VOLUME 1

Setup, processors and discrete I/O

VOLUME 2

Setup

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Setup

VOLUME 4

Setup

VOLUME 1

1 General

This manual is intended for personnel technically qualified to install, operate and maintain the products which are described herein. It contains all the necessary information for correct use of the products. However, for advanced use of our products please contact your nearest sales office for additional information.

The contents of this manual are not contractual and cannot under any circumstance extend or restrict contract warranty clauses.

2 Qualification of personnel

Only **qualified personnel** are authorized to install, operate or maintain the products. Any work performed by unqualified personnel or non-observance of the safety instructions in this document or attached to the equipment may risk the safety of personnel and/or cause irreparable damage to equipment. The following personnel may be regarded as being **"Qualified"** :

- those involved with application design. Design office personnel familiar with control system safety concepts (for example, design engineers, etc),
- those involved with equipment installation. Individuals who are familiar with the installation, connection and startup of control system equipment (for example installers or wiring technicians working during the installation phase, technicians setting up the equipment, etc),
- those involved with operation. Personnel trained to operate and manage control system equipment (for example, operators, etc),
- those performing preventive or corrective maintenance. Personnel who are trained and experienced in the adjustment and repair of control system equipment (for example, installation engineers, after sales service engineers, etc).

3 Warnings

Warnings serve to prevent specific risks encountered by personnel and/or equipment. They are indicated in the documentation and on the products by different warning symbols, according to the severity of the risk :

Danger or **Caution**

Indicates that not following instructions or ignoring the warning may cause serious personal injury, death and/or serious damage to equipment.

Warning or **Important** or ⚠

Indicates that not following a specific instruction may lead to minor injury and/or damage to equipment.

Note or **Comment**

Highlights important information relating to the product, its operation or its accompanying documentation.

4 Conformity of use

The products described in this manual **conform to the European Directives** (*) to which they are subject (CE marking). However, they can only be used correctly in the context of the applications for which they are intended (described in the various documents) and when connected to approved third party products.

As a general rule, if all handling, transport and storage specifications are observed, and all instructions for installation, operation and maintenance are followed, the products will be used correctly, with no danger to personnel or equipment.

(*) EMC and LV Directives, concerning Electromagnetic Compatibility and Low Voltage.

5 Installing and setting up equipment

It is important to observe the following rules when installing and starting up equipment. In addition, if the installation includes digital links, it is essential to follow the basic wiring rules given in the manual "Electromagnetic Compatibility of industrial Networks and Fielbuses"**, reference TSX DG KBLE,** or in manual **TSX DR NET**, part C.

- safety instructions must be followed meticulously. These instructions are in the documentation or on the equipment being installed and set up.
- the type of equipment defines the way in which it should be installed :
  - a flush-mountable device (for example, an operator terminal or a cell controller) must be flush-mounted,
  - a device which is to be built in (for example, PLC) must be placed in a cabinet or enclosure,
  - the casing of a laptop or portable device (for example, a programming terminal or a notebook) must remain closed,
- if the device is permanently connected,
  - the upstream installation must conform to standard IEC 1131-2 **overvoltage category 2**,
  - in addition, its electrical installation must include a device to isolate it from the power supply and a circuit-breaker to protect it against overcurrents and isolation faults. If this is not the case, the power socket must be grounded and be easily accessed. **In all cases, the device must be connected to the protective mechanical ground PG using green/yellow wires (NFC 15 100 - IEC 60 364-5-51) .**
- low voltage circuits (even though they are low voltage) must be connected to the protective ground so that dangerous voltages can be detected.
- before a device is powered up, its nominal voltage must be checked to ensure that it has been adjusted to conform with the supply voltage.
- if the device is supplied with 24 or 48 VDC, the low voltage circuits must be protected. Only use power supplies which conform to the standards currently in force.
- check that the supply voltages remain within the tolerance ranges defined in the technical characteristics of the devices.
- all measures must be taken to ensure that any power return (immediate, warm or cold) does not lead to a dangerous state which may risk personnel or the installation.
- emergency stop devices must remain effective in all the device's operating modes, even those which are abnormal (for example, when a wire becomes disconnected). Resetting these devices must not cause uncontrolled or improper restarts.
- cables which carry signals must be located where they do not cause interference with the control system functions by capacitive, inductive or electromagnetic interference.

- control system equipment and their control devices must be installed in such a way as to ensure that they are protected against unintentional operation.
- appropriate safety measures must be taken for the inputs and outputs, to prevent improper states in the control system device, if no signal is received.

6 Equipment operation

The operational safety and availability of a device is its ability to avoid the appearance of faults and to minimize their effects if they occur.

A system is said to be fail-safe if the appearance of faults **never** causes a dangerous situation.

A fault inside the control system is known as :

- passive, if it results in an open output circuit (no command is sent to the actuators).
- active, if it results in a closed output circuit (a command is sent to the actuators).

From the safety point of view, a given fault is dangerous or not depending on the type of command given during normal operation. A passive fault is dangerous if the normal command is the operation of an alarm. An active fault is dangerous if it maintains or activates an undesirable command.

It is important to note the basic difference between the behavior of an electromechanical relay and an electronic component (for example a transistor) :

- there is a high probability, approximately 90%, that the failure of a relay will cause an open circuit (control circuit powered off).
- there is a 50% probability that the failure of a transistor will cause either an open circuit or a closed circuit.

This is why it is important to correctly estimate the types and consequences of faults when automating a system using electronic products such as PLCs, including when relay output modules are used on PLCs.

The system designer must **use devices external to the PLC** to protect against active faults inside the PLC, which are not indicated and are judged to be dangerous to the application. This may require solutions from various different technologies such as mechanical, electromechanical, pneumatic or hydraulic devices (for example, directly wiring a limit switch and emergency stop switches to the coil of a movement control contactor).

To protect against dangerous faults which may occur on output circuits or preactuators, it is sometimes beneficial to resort to general principles and use the large processing capacity of PLCs, for example by using inputs to check the correct execution of commands requested by the program.

7 Electrical and thermal characteristics

Details of the electrical and thermal characteristics of devices are given in the associated technical documents (installation manuals, quick reference guides).

8 Environmental conditions

In industry, the micro-environmental conditions of electronic devices can vary greatly. For this reason, programmable controllers and associated modules must conform to the following two types of installation :

- installation in an enclosure with IP54 protection for protecting devices from metallic dust amongst other things. Two guidelines are associated with this type of installation :
  - direct access to electronic modules should be strictly reserved to maintenance staff (see section 2), with access keys,
  - the selection of a metal enclosure must be considered, since it serves as extra shielding against the latent risk of electromagnetic interference.
- direct installation without protection for Premium PLCs and associated systems (power supply modules, etc) which themselves have IP20 protection.
  This type of installation applies to areas with restricted access and low pollution levels (not exceeding 2), for example stations or control rooms which have neither machines nor any activity generating metallic dust or other metallic particles. The external walls hence serve as the PLC enclosure.

9 Preventive or corrective maintenance

Availability

The availability of a system is its ability, in terms of its combined reliability, maintainability and maintenance logistics, to be in a state to perform a required function, at a given moment and within a defined time period.

Availability is therefore specific to each application, since it is a combination of :

- the architecture of the automatic system,
- the reliability and maintainability : intrinsic characteristics of the equipment (PLCs, sensors, machine, etc),
- maintenance logistics : characteristic intrinsic to the user of the control system (software structure, fault indication, process, on-site replacement parts, training of personnel).

Troubleshooting procedure

- control system equipment should only be repaired by qualified personnel (after sales service engineer, or technician approved by Schneider Automation). Only certified replacement parts or components should be used.
- before performing any operation on equipment (for example opening an enclosure), always cut the power supply off (disconnect the power plug or open the power isolation switch).
- before performing any "mechanical" operation on equipment on site, cut the power supply off and mechanically lock any moving parts.
- before removing a module, a memory cartridge, a PCMCIA card, etc, check in the manual whether this should be done with the power off or if it is possible with the device powered up. Follow the instructions given in the manual carefully.
- on positive logic outputs or negative logic inputs, take all necessary precautions to prevent a disconnected wire coming into contact with the mechanical ground (risk of undesirable control action).

Replacement and recycling of used batteries

- if these are replaced, use batteries of the same type and dispose of defective batteries in the same way as toxic waste.
  Do not throw lithium or mercury batteries into a fire, open or recharge them, or attempt to solder them.

1.1 Main component parts

Premium PLCs are entirely modular. A PLC station is made up of racks, power supply modules, processor modules, discrete I/O modules, analog I/O modules, etc.

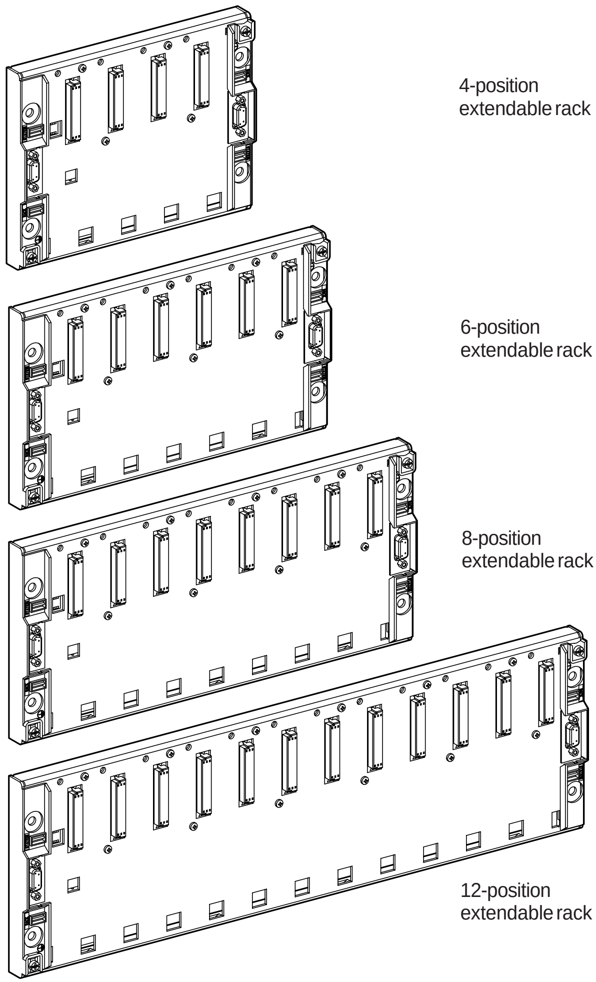
1.1-1 Racks

(see part A - section 2 in this manual)

Two types of rack are available :

- **Standard racks** with 6, 8 and 12 positions :
  They can make up a PLC station **limited to a single rack**.
- **Extendable racks** with 4, 6, 8 and 12 positions :
  They can make up a PLC station **which can have up to :**
  - **16 racks maximum** if the station is made up of racks with 4, 6 or 8 positions.
  - **8 racks maximum** if the station is made up of racks with 12 positions.

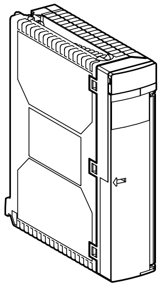
  These racks are distributed on a bus (known as Bus X) whose maximum length should not exceed 100 meters. For applications which require a longer length, a Bus X remote rackmaster module can be used. This enables 2 Bus X segments to be remotely located at a maximum distance of 250 meters from the rack supporting the processor.



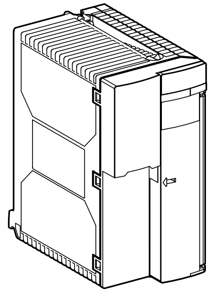
1.1-2 Rack power supplies

(see part A - section 4 in this manual)

Each rack requires a power supply module determined according to the distributed line supply (AC or DC) and the power required at rack level (standard format module or double format module).



standard format power supply module for ∼ or ⎓ supply



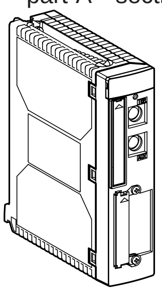
double format power supply module for ∼ or ⎓ supply

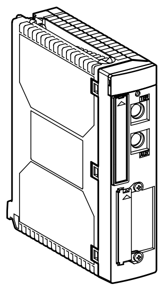
1.1-3 Processors

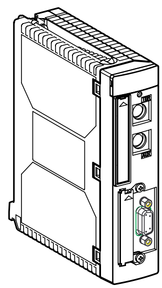
Each station has a processor which is selected according to :

- its type of integration : integrated in a rack or integrated in a PC
- the processing power required : number of discrete/analog I/O, etc
- the type of processing : sequential or sequential + process control

• **Sequential processors, which can be integrated on TSX RKY ••• racks** (see part A - section 3 in this manual)







TSX P 57 102

This is used to :

• control a PLC station comprising a maximum of :
  - 1 standard rack or
  - 2 x 12-position extendable racks or
  - 4 x 4, 6 or 8-position extendable racks
  - 512 in-rack discrete I/O
  - 24 analog I/O
  - 8 application-specific channels (counter, axis control, etc)

• integrate the PLC station in a single network structure

TSX P 57 202 **TSX P 57 252**

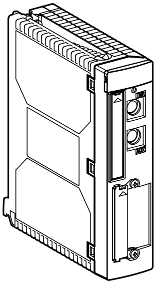
These are used to :

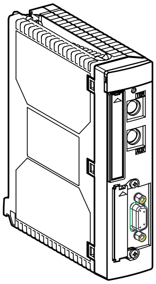
• control a PLC station comprising a maximum of :
  - 1 standard rack or
  - 8 x 12-position extendable racks or
  - 16 x 4, 6 or 8-position extendable racks
  - 1024 in-rack discrete I/O
  - 80 analog I/O
  - 24 application-specific channels (counter, axis control, etc)

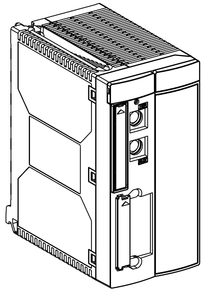
• integrate the PLC station in a multinetwork structure.

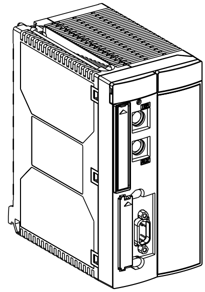
The TSX P 57 252 processor also has an integrated FIPIO master link.

Sequential processors which can be integrated in TSX RKY ••• racks (cont.)


TSX P 57 302


TSX P 57 352


TSX P 57 402


TSX P 57 452

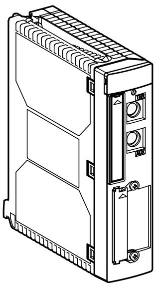
These are used to :
- control a PLC station comprising a maximum of :
  - 1 standard rack or
  - 8 x 12-position extendable racks or
  - 16 x 4, 6 or 8-position extendable racks
  - 1024 in-rack discrete I/O
  - 128 analog I/O
  - 32 application-specific channels (counter, axis control, etc)
- integrate the PLC station in a multinetwork structure

The TSX P 57 352 processor also has an integrated FIPIO master link.

These are used to :
- control a PLC station comprising a maximum of :
  - 1 standard rack or
  - 8 x 12-position extendable racks or
  - 16 x 4, 6 or 8-position extendable racks
  - 2040 in-rack discrete I/O
  - 256 analog I/O
  - 64 application-specific channels (counter, axis control, etc)
- integrate the PLC station in a multinetwork structure

The TSX P 57 452 processor also has an integrated FIPIO master link.

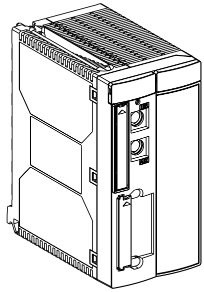
- **Process control processors which can be integrated in TSX RKY ••• racks** (see part A - section 3 in this manual)



TPMX P 57 102

This has the same capacity as a TSX P57 102 and performance levels which are equivalent to a TSX P57 2•2. It is used to :

- control a PLC station comprising a maximum of :
  - 1 standard rack or
  - 2 x 12-position extendable racks or
  - 4 x 4, 6 or 8-position extendable racks
  - 512 in-rack discrete I/O
  - 24 analog I/O
  - 8 application-specific channels (counter, axis control, etc)
  - etc
  - manage 10 process control channels
- integrate the PLC station in a single network structure

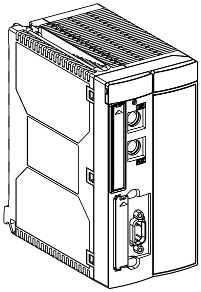


TPMX P57 202

This has the same capacity as a TSX P57 202 and performance levels which are equivalent to a TSX P57 4•2. It is used to :

- control a PLC station comprising a maximum of :
  - 1 standard rack or
  - 8 x 12-position extendable racks or
  - 16 x 4, 6 or 8-position extendable racks
  - 1024 in-rack discrete I/O
  - 80 analog I/O
  - 24 application-specific channels (counter, axis control, etc)
  - etc
  - manage 10 process control channels
- integrate the PLC station in a multinetwork structure

Process control processors which can be integrated in TSX RKY ●●● racks

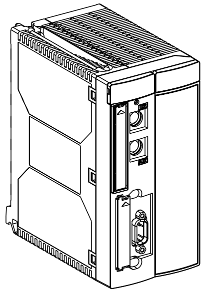


TPMX P57 352

This has the same capacity as a TSX P57 352 and performance levels which are equivalent to a TSX P57 4●2. It is used to :

- control a PLC station comprising a maximum of :
  - 1 standard rack or
  - 8 x 12-position extendable racks or
  - 16 x 4, 6 or 8-position extendable racks
  - 1024 in-rack discrete I/O
  - 128 analog I/O
  - 32 application-specific channels (counter, axis control, etc)
  - etc
  - manage 10 process control channels
- integrate the PLC station in a multinetwork structure

It has an integrated FIPIO master link.



TPMX P57 452

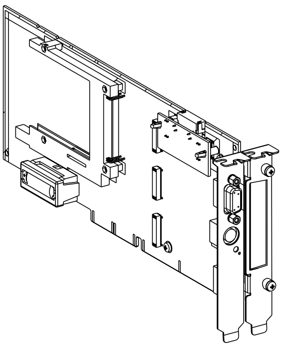
This has the same capacity as a TSX P57 452 and performance levels which are equivalent to a TSX P57 4●2. It is used to :

- control a PLC station comprising a maximum of :
  - 1 standard rack or
  - 8 x 12-position extendable racks or
  - 16 x 4, 6 or 8-position extendable racks
  - 2040 in-rack discrete I/O
  - 255 analog I/O
  - 64 application-specific channels (counter, axis control, etc)
  - etc
  - manage 10 process control channels
- integrate the PLC station in a multinetwork structure

It has an integrated FIPIO master link.

- **Sequential processors, which can be integrated in a PC** (see part A - section 3 in this manual)

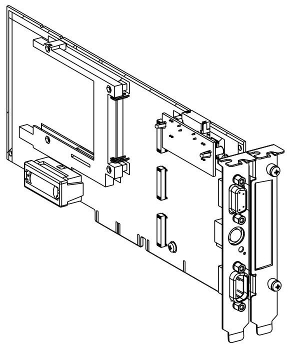
  Installed on the ISA bus of an industrial or office PC operating in a Windows 95 or Windows NT environment, these are used to control a PLC station. In addition, the installation of a communication driver enables transparent communication between the host PC and the processor, thus overcoming the need for another programming terminal.



TPCX 57 1012

This is used to :

- control a PLC station comprising a maximum of :
  - 1 standard rack or
  - 2 x 12-position extendable racks or
  - 4 x 4, 6 or 8-position extendable racks
  - 512 in-rack discrete I/O
  - 24 analog I/O
  - 8 application-specific channels (counter, axis control, etc)
- integrate the PLC station in a single network structure



TPCX 57 3512

These are used to :

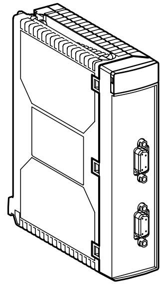
- control a PLC station comprising a maximum of :
  - 1 standard rack or
  - 8 x 12-position extendable racks or
  - 16 x 4, 6 or 8-position extendable racks
  - 1024 in-rack discrete I/O
  - 128 analog I/O
  - 32 application-specific channels (counter, axis control, etc)
- integrate the PLC station in a multinetwork structure.

It has an integrated FIPIO master link.

1.1-4 Bus X remote rackmaster module

(see section 5 of part A)

This module enables 2 bus segments to be remotely located at a maximum distance of 250 meters from the rack supporting the processor. Each remote segment can support a number of racks, distributed on the Bus X over a maximum length of 100 meters.



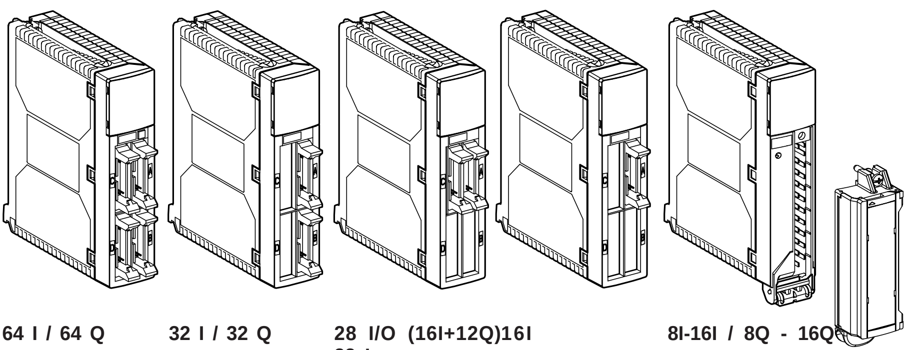
1.1-5 In-rack discrete I/O

(see part B1 in this manual)

A wide range of discrete I/O modules enables users to match their particular requirements. These modules vary in :

- Modularity : 8, 16, 28, 32 or 64 channels
- Type of inputs :
  - modules with DC inputs (24VDC, 48VDC)
  - modules with AC inputs (24VAC, 48VAC, 110VAC, 240VAC)
- Type of outputs :
  - modules with relay outputs
  - modules with DC solid state outputs (24VDC / 0.1A - 0.5A - 2A, 48VDC/ 0.25A - 1A)
  - modules with AC solid state outputs (24VAC / 130VAC / 1A, 48VAC / 240VAC / 2A)
- Type of connections : screw terminal block connections and HE10 type connectors, for connection to sensors and preactuators by means of the TELEFAST 2 pre-wired system

HE10 connections	Screw terminal block connections



64 I / 64 Q **32 I / 32 Q** **28 I/O (16I+12Q)16I** **32 I** **8I-16I / 8Q - 16Q**

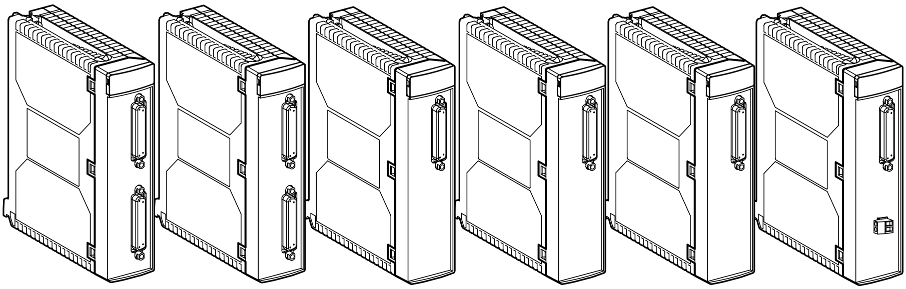
1.1-6 Analog I/O

(see the "Analog and Weighing Installation Manual - Volume 4")

The range of analog I/O modules covers the majority of requirements. These modules vary in :

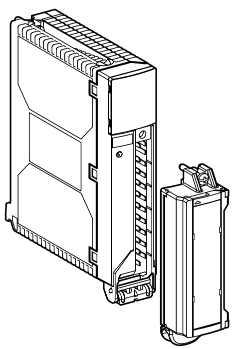
- Modularity : 4, 8, 16 channels
- Performance and signal ranges on offer : voltage/current, thermocouple, multirange (thermocouple, temperature probe, voltage/current)
- Type of connections : 25-pin SUB D type connectors, for connection to sensors by means of the TELEFAST 2 pre-wired system

25-pin SUB D connections					



16 I not isolated betw. channels	**16 I isolated betw. channels**	**8 I not isolated betw. channels**	**8 I isolated betw. channels**	**4 I, fast isolated betw. channels**	**8 Q not isolated betw. channels**
Voltage/Current 0...10 V ± 10 V 1...5V 0...5V 0...20 mA 4...20 mA	Thermocouple - 80 + 80 mV	Voltage/Current 0...10 V, ± 10 V 1...5V 0...5V 0...20 mA 4...20 mA	Voltage/Current 0...10 V ± 10 V 1...5V 0...5V 0...20 mA 4...20 mA	Voltage/Current 0...10 V ± 10 V 1...5V 0...5V 0...20 mA 4...20 mA	Voltage/Current ± 10 V 0...20 mA 4...20 mA
12 bits	16 bits	12 bits	16 bits/Voltage 14 bits/Current	16 bits/Voltage 14 bits/Current	16 bits/Voltage 14 bits/Current

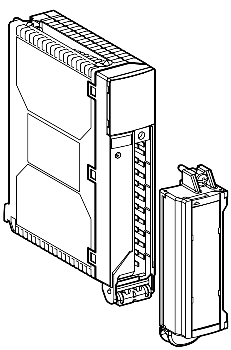
Screw terminal block connections	



4 I
isolated
between channels

Multi-range
0...10 V, ± 10 V
0...5V, 1...5V
0...20 mA, 4...20 mA
- 13 + 63 mV
0..400 Ω
0..3850 Ω
Temperature probe
Thermocouple

16 bits



4 Q
isolated
between channels

Voltage / Current
± 10 V
0...20 mA
4...20 mA

11 bits + sign

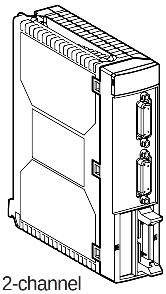
1.1-7 Counting

(see the "Counting and Motion Control Installation Manual - Volume 2")

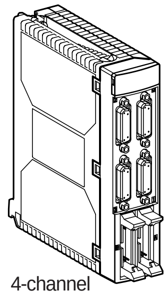
Premium PLCs offer the main counting functions (downcounting, upcounting, up/down counting) using "counter" modules.

Three modules are available :

- One module with 2 channels and one module with 4 channels for incremental encoder, with a maximum read frequency of 40 kHz

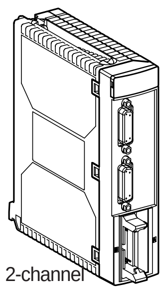


2-channel module



4-channel module

- One module with 2 channels for :
  - incremental encoder, with a maximum read frequency of 500 kHz
  - SSI serial absolute encoder, with a maximum read frequency of 2 MHz



2-channel module

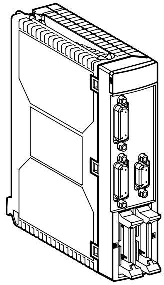
1.1-8 Axis control

(see the "Counting and Motion Control Installation Manual - Volume 2")

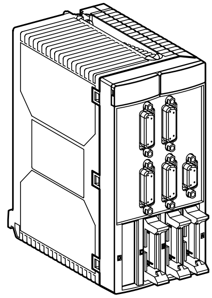
By means of "axis control" modules, Premium PLCs can be used to manage motion control applications, controlled by servomotors where the speed reference is an analog value (± 10 V).

There are five modules :

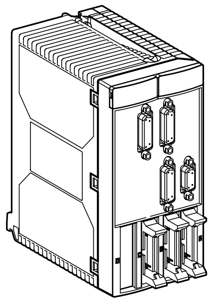
- A 2-channel module which can be used for servo loop positioning with two independent, linear and limited axes.
- A 2-channel module which can be used for servo loop positioning with two independent, circular and infinite axes.
- A 4-channel module which can be used for servo loop positioning with four independent, linear and limited axes.
- A 4-channel module which can be used for servo loop positioning with four independent, circular axes.
- A 3-channel module which can be used for positioning on 2 or 3 synchronized axes (linear interpolation).



2-channel modules



4-channel modules



3-channel modules

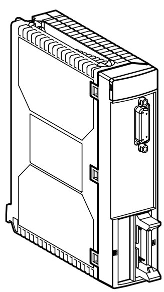
1.1-9 Stepper motor control

(see the "Counting and Motion Control Installation Manual - Volume 2")

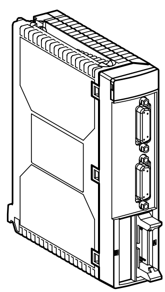
By means of "stepper motor control" modules, Premium PLCs can be used to manage motion control applications, controlled by translators where the speed reference is a frequency.

Two modules are available :

- A 1-channel module used to control one translator
- A 2-channel module used to control two translators



Single channel module



2-channel module

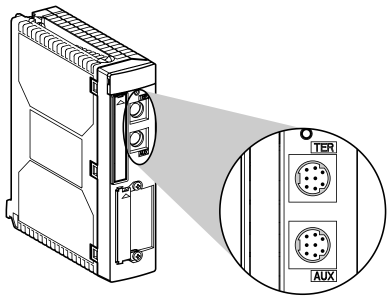
1.1-10 Communication

Premium PLCs can be used for various methods of communication :

- **Communication on terminal port** (see the "Communication, Bus and Network Interfaces Installation Manual - Volume 3")

TSX and PMX processors

TSX and PMX processors have two terminal ports (TER) and (AUX), a non-isolated RS 485 serial link, and UNI-TELWAY or character mode protocol. These terminal ports can be used for connecting :

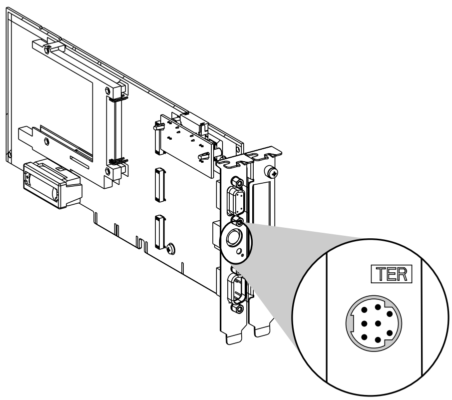


- a programming terminal and/or a man-machine interface terminal (UNI-TELWAY master mode)
- the station to a UNI-TELWAY multidrop link (UNI-TELWAY master or slave mode)
- a printer or a terminal in character mode

Note : The user-defined communication protocol is the same for both ports.

PCX processor

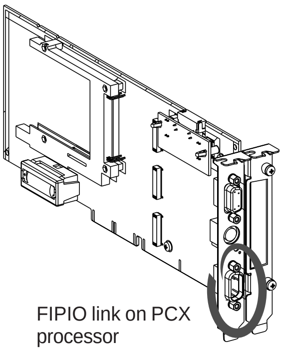
PCX processors have a terminal port (TER), a non-isolated RS 485 serial link, and UNI-TELWAY or character mode protocol.
As with TSX and PMX processors, they are used to connect :



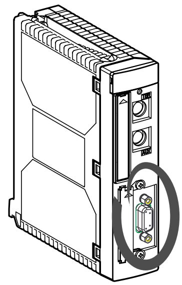
- a programming terminal and/or a man-machine interface terminal (UNI-TELWAY master mode)
- the station to a UNI-TELWAY multidrop link (UNI-TELWAY master or slave mode)
- a printer or a terminal in character mode.

- **FIPIO master communication, integrated on certain processors.**
  (see the "Communication, Bus and Network Interfaces Installation Manual - Volume 3")

  TSX P57•52 / TPMX P57 •52 and PCX P57 3512 processors integrate as standard a FIPIO master link, which enables the following types of equipment to be located remotely (15 km maximum) :
  - discrete I/O modules (TBX, Momentum)
  - analog I/O modules (TBX, Momentum)
  - variable speed controllers (ATV16)
  - operator control panels (CCX 17)
  - etc.



FIPIO link on PCX processor



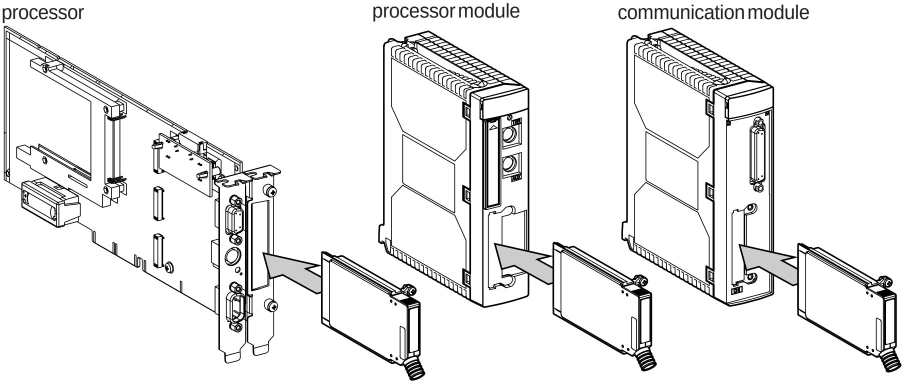
FIPIO link on TSX / PMX processor

- **Communication via PCMCIA cards which can be integrated into the processor or the TSX SCY 21601 communication module** (see the "Communication, Bus and Network Interfaces Installation Manual - Volume 3")
  The processors and the TSX SCY 21 communication module both have a slot which can take a type III extended PCMCIA format communication card :

PCX processor

TSX / PMX processor module

TSX SCY 21 communication module



PCMCIA card

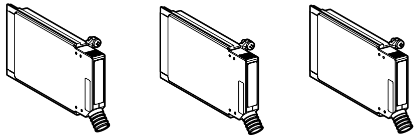
PCMCIA card

PCMCIA card

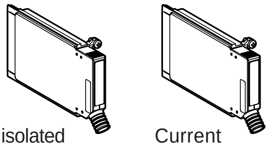
The various types of PCMCIA type III communication cards

(see the "Communication, Bus and Network Interfaces Installation Manual - Volume 3")

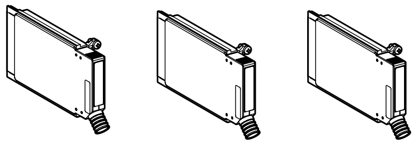
- multiprotocol cards (UNI-TELWAY, MODBUS/JBUS, character mode) (1) :
  non isolated RS 232 D serial link
  isolated RS 485 serial link
  current loop link



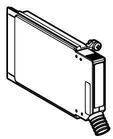
- JNET single protocol cards (2) :
  isolated RS 485 serial link
  current loop link



- Modbus+ network card (3)
- FIPWAY network card (1)
- FIPIO Agent bus card (3)



- Modem cards (3)



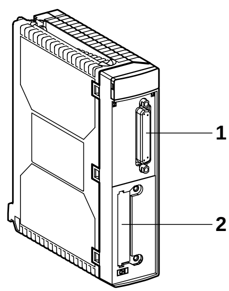
(1) can be integrated on a TSX SCY 21601 communication module and/or TSX/PMX/PCX processors.
(2) can only be integrated on a TSX SCY 21601 communication module
(3) can only be integrated on TSX/PMX/PCX processors

- **Communication via application-specific module**

TSX SCY 21 module (see the "Communication, Bus and Network Interfaces Installation Manual - Volume 3")

This module, which can be integrated in all TSX/PMX/PCX Premium PLC station racks, has :

- an integrated communication channel (1), multiprotocol (UNI-TELWAY, Modbus/Jbus, character mode), isolated RS 485 serial link
- a slot (2), which can take a type III extended PCMCIA communication card (see above)

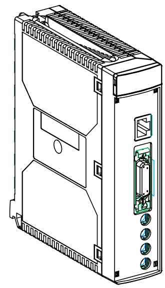


Communication via application-specific module (continued)

TSX ETY 110 module (see the "Communication, Bus and Network Interfaces Installation Manual - Volume 3")

This module allows communication in an Ethernet multinetwork architecture and has a communication channel offering two types of connection :

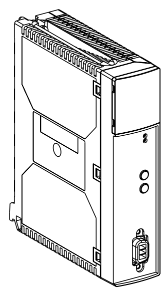
- connection to an ETHWAY network
- connection to a TCP_IP network



1.1-11 Bus interfaces

- **AS-i bus interface module : TSX SAY100** (see the "Communication, Bus and Network Interfaces Installation Manual - Volume 3")

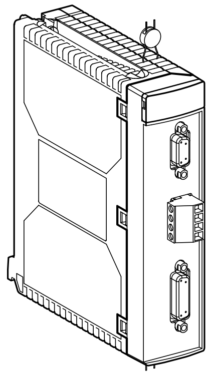
  This module provides the connection to an AS-i bus on a TSX/PMX/PCX Premium PLC station.
  It is a bus master module, managing and coordinating access to the bus, which sends data to all the slaves and receives data from them.



1.1-12 Weighing

(see the "Analog and Weighing Installation Manual - Volume 4")

By means of the "weighing" module, TSX Premium PLCs can be used to manage weighing applications : batching, multiproduct batching, sorting by weight, flow control, weight totalizing, etc.
This module has a measurement input for 8 sensors maximum, 2 fast discrete outputs and a serial link for an extension display.

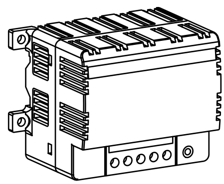


1.1-13 Process and AS-i power supplies

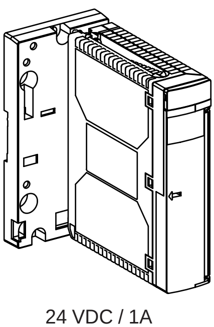
(see part E in this manual)

- **Process power supplies**

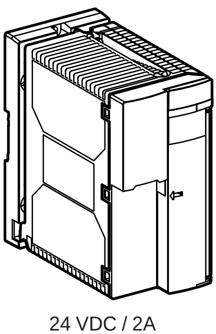
  A wide range of power supply units and modules enables users to match their particular requirements. Designed to provide the 24 VDC power supply to the peripherals in an automated system, controlled by TSX/PMX/PCX Premium PLCs, they can all be mounted on a Telequick plate, AM1-PA, and some can be mounted on a central DIN rail, AM1-DP200 / DE 200.



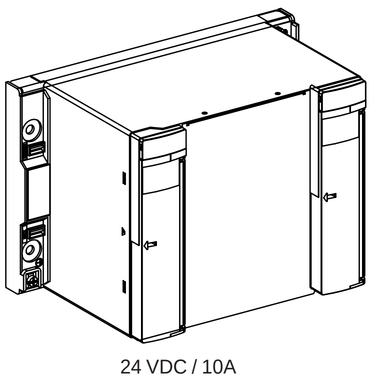
24 VDC / 1A



24 VDC / 1A



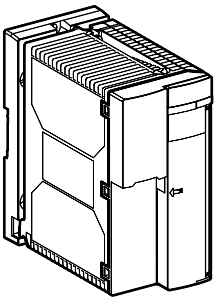
24 VDC / 2A
24 VDC / 5A



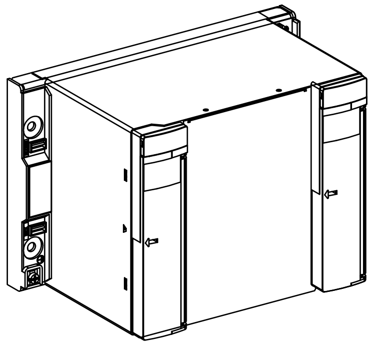
24 VDC / 10A

- **AS-i power supplies**

  These are designed to provide the 30 VDC power supply to the components connected on the AS-i fieldbus.



AS-i 30 VDC / 2.4A

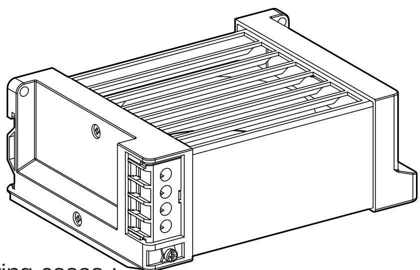


AS-i 30 VDC / 5A & 24 VDC

1.1-14 Fan modules

(see part A - section 9 in this manual)

Depending on the rack modularity (4, 6, 8 or 12 positions), one, two or three fan modules can be installed on top of each rack in order to help cool the various modules by forced convection.



These fan units should be used in the following cases :

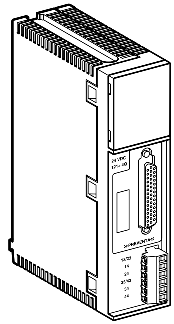
- **Ambient temperature in the range 25°C...60°C** : Forced ventilation increases the lifetime of the various TSX Premium PLC components (25% increase in MTBF).
- **Ambient temperature in the range 60°C...70°C :** Since the ambient temperature is limited to 60°C without ventilation, forced ventilation is used to decrease the temperature inside the modules by 10°C, bringing the internal module temperature to the equivalent of an ambient temperature of 60°C.

There are three types of fan module :

- fan module with 110 VAC power supply
- fan module with 220 VAC power supply
- fan module with 24 VDC power supply

1.1-15 Emergency stop monitoring modules

(see part B2 of this manual)



Modules with an integrated safety circuit, designed for totally safe control of machine emergency stop circuits. These modules cover all safety functions up to category 4 in accordance with standard EN 954-1.
There are two modules :

- 1 module with 12 inputs and 2 outputs
- 1 module with 12 inputs and 4 outputs

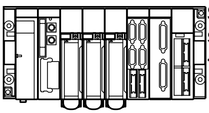
1.2 The various types of station

1.2-1 PLC stations with processor integrated on TSX RKY •• rack

The maximum capacities of a TSX / PMX Premium PLC station are defined according to the type of rack (standard or extendable) and the type of processor (TSX / T PMX P 57 1••, TSX / T PMX P 57 2••, TSX / T PMX P 57 3••, TSX / T PMX P 57 4••) selected.

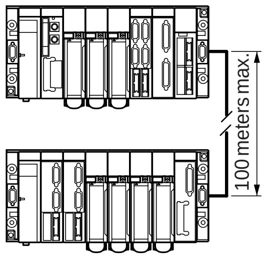
- **TSX 57 10 or PMX 57 10 stations :** based on a TSX P57 102 or T PMX P57 102 processor

  - With no Bus X remote rackmaster module

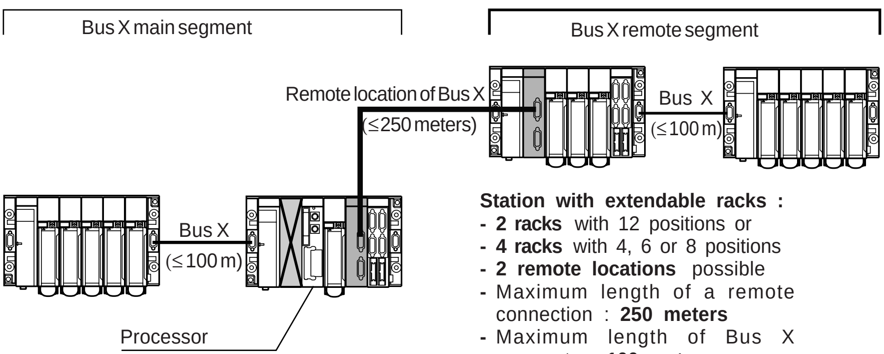


Station with standard rack :
- **1 rack** with 6, 8 or 12 positions

Station with extendable racks:
- **2 racks with** 12 positions or
- **4 racks with** 4, 6 or 8 positions
- maximum length of Bus X : **100 meters**



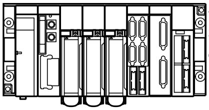
  - With Bus X remote rackmaster module (station example)



Station with extendable racks :
- **2 racks** with 12 positions or
- **4 racks** with 4, 6 or 8 positions
- **2 remote locations** possible
- Maximum length of a remote connection : **250 meters**
- Maximum length of Bus X segments : **100 meters**

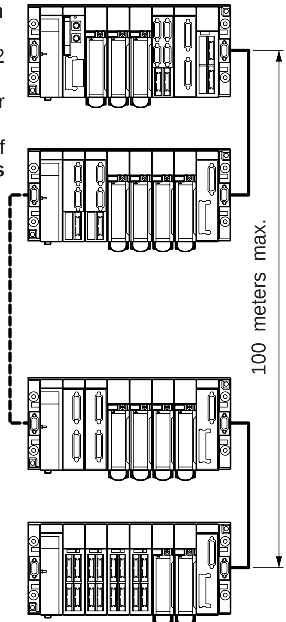
- **TSX 57 20 or PMX 57 20 stations :** based on a TSX P 57 202/252 or T PMX P57 202 processor
- **TSX 57 30 or PMX 57 30 stations :** based on a TSX P 57 302/352 or T PMX P57 352 processor
- **TSX 57 40 or PMX 57 40 stations :** based on a TSX P 57 402/452 or T PMX P57 452 processor

- With no Bus X remote rackmaster module

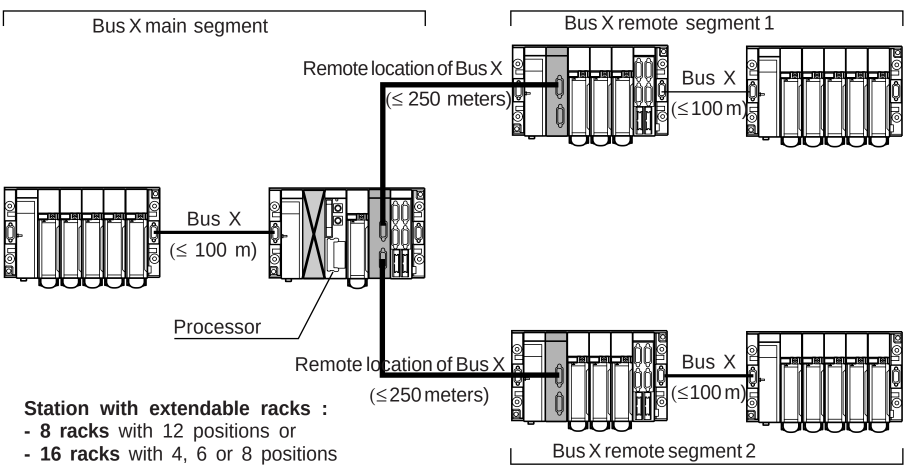


Station with standard rack :
- **1 rack** with 6, 8 or 12 positions

Station with extendable racks:
- **8 racks** with 12 positions or
- **16 racks** with 4, 6 or 8 positions
- maximum length of Bus X : **100 meters**



- With Bus X remote rackmaster module (station example)



Station with extendable racks :
- **8 racks** with 12 positions or
- **16 racks** with 4, 6 or 8 positions
- **2 remote locations** possible
- Maximum length of a remote connection : **250 meters**
- Maximum length of Bus X segments : **100 meters**

Maximum configurations

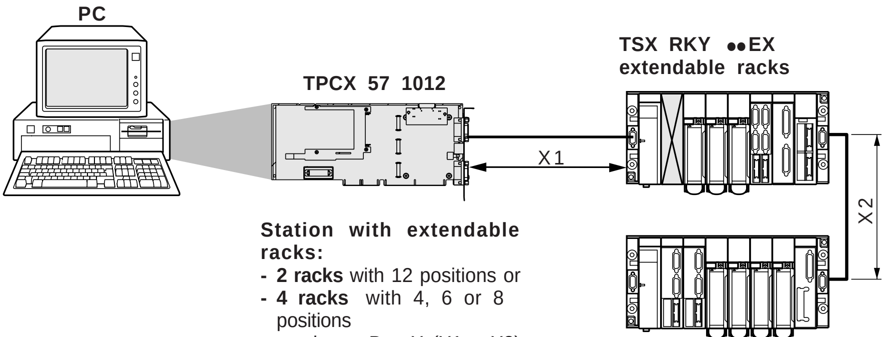
Type of station			TSX/PMX 5710	TSX/PMX 57 20		TSX/PMX		TSX/PMX 5730	5740
Processors	TSX/TPMX P57→		102	202	252	302	352	402	452
No. of racks	standard	TSX RKY 6/8/12	1	1	1	1	1	1	1
	extendable	TSX RKY 12EX	2	8	8	8	8	8	8
		TSX RKY 4EX TSX RKY 6EX TSX RKY 8EX	4	16	16	16	16	16	16
Processor	In-rack discrete I/O (1)		512	1024	1024	1024	1024	2040	2040
processing	Analog I/O (1)		24	80	80	128	128	255	255
capacity	App-spec. channels (1) (2)		8	24	24	32	32	48	48
	Network connections (3)		1	1	1	3	3	4	4
	Third party fieldbus connections (4)		–	1	1	2	2	2	2
	AS-i sensor/ actuator bus connections		2	4	4	8	8	8	8
	FIPIO master connections		–	–	1	–	1	–	1
	Process control channels (5)		10	10	–	–	10	–	10
Total length of Bus X extension cables on one segment			100 meters maximum with TSX CBY •• cables (ii ≥ 02)						
Maximum remote connection distance of a Bus X segment			250 meters maximum						

(1) On a TSX/PMX 5740 station, the number of in-rack discrete I/O, analog I/O and application-specific channels is not cumulative (see section 3.5-4 in this part).
(2) Application-specific channels = counter, axis control, stepper motor control, communication, etc, channels (see section 3.5-3 in this part - definition and number of application-specific channels).
(3) FIPWAY, Modbus +, Ethernet TCP_IP network
(4) INTERBUS-S, PROFIBUS-DP
(5) Only on TPMX P57 102/202/352/452 process control processors.

1.2-2 PLC stations with processor integrated in a PC

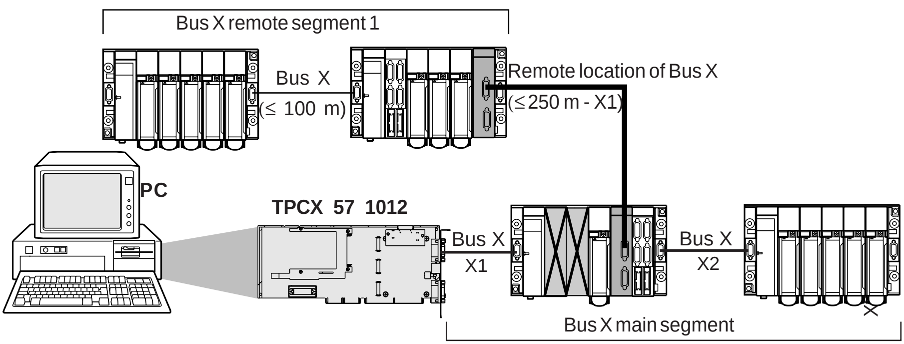
The maximum capacities of a TSX Premium PLC station are defined according to the type of processor (TPCX 57 1012 or TPCX 57 3512). In this type of station, where the processor is integrated in a PC, the station is made up of extendable racks.

- **PCX 57 10 station :** based on a TPCX P57 1012 processor
  - Without Bus X remote rackmaster module



Station with extendable racks:
- **2 racks** with 12 positions or
- **4 racks** with 4, 6 or 8 positions
- maximum Bus X (X1 + X2) length : **100 meters**

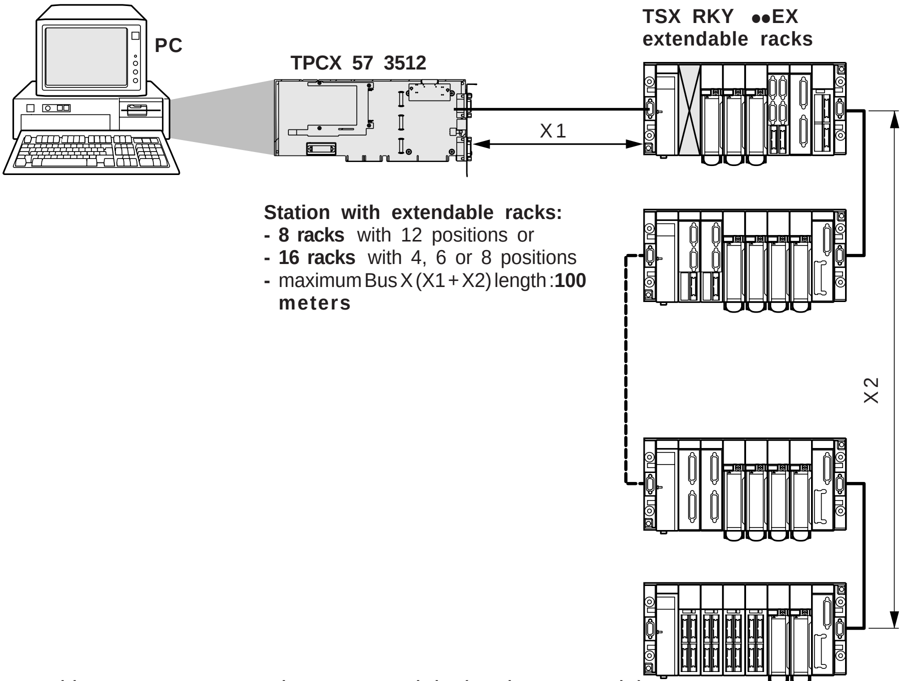
  - With Bus X remote rackmaster module (station example)



Station with extendable racks :
- **2 racks** with 12 positions or
- **4 racks** with 4, 6 or 8 positions
- **2 remote locations** possible
- Maximum length of a remote connection : **250 meters - X1**
- Maximum length of Bus X segments : **100 meters**

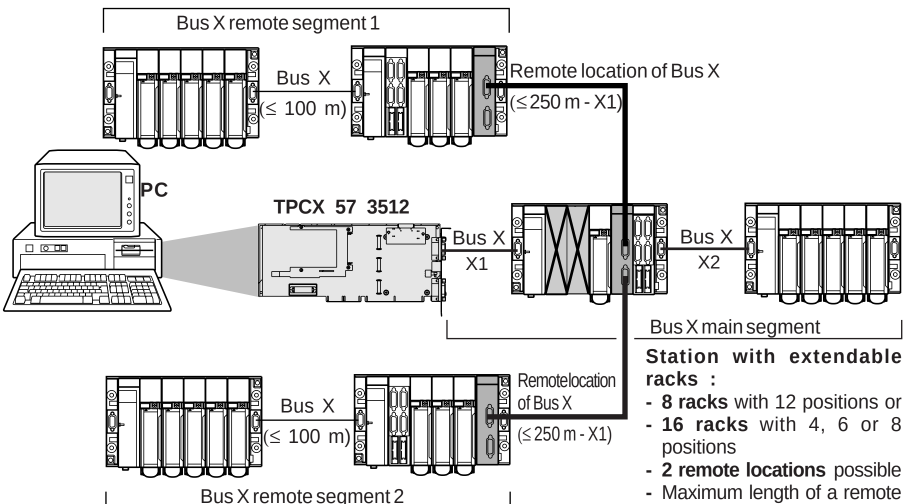
- **PCX 57 30 station :** based on a TPCX 57 3512 processor

  - Without Bus X remote rackmaster module



Station with extendable racks:
- **8 racks** with 12 positions or
- **16 racks** with 4, 6 or 8 positions
- maximum Bus X (X1 + X2) length : **100 meters**

  - With Bus X remote rackmaster module (station example)



Station with extendable racks :
- **8 racks** with 12 positions or
- **16 racks** with 4, 6 or 8 positions
- **2 remote locations** possible
- Maximum length of a remote connection : **250 meters - X1**
- Maximum length of Bus X segments : **100 meters**

Maximum configurations

Type of station			**PCX 57 10**	**PCX 5730**
Processors	TPCX P57	➜	1012	3512
No. of racks	extendable	TSX RKY 12EX	2	8
		TSX RKY 4EX TSX RKY 6EX TSX RKY 8EX	4	16
Processor processing capacity	In-rack discrete I/O		512	1024
	Analog I/O		24	128
	App-spec. channels (1)		8	32
	Network connections (2)		1	3
	Third party fieldbus connections (3)		–	2
	AS-i sensor/ actuator bus connections		2	8
	FIPIO master connections		–	1
Total length of bus extension cables (X1 + X2)			100 meters maximum with with TSX CBY ●● cables (ii ≥ 02)	
Maximum remote connection distance of a Bus X segment			250 meters minus the distance between the processor and the rack at address 0 (X1)	

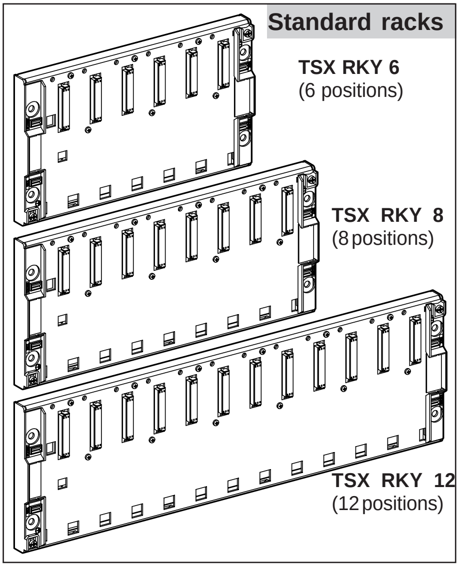
(1) Application-specific channels = counter, axis control, stepper motor control, communication, etc, channels (see section 3.5-3 in this part - definition and number of application-specific channels).
(2) FIPWAY, Modbus +, Ethernet TCP_IP network
(3) INTERBUS-S, PROFIBUS-DP

2.1 Presentation

2.1-1 General

TSX RKY ••• racks are the basic element of Premium PLCs.
These racks provide the following functions :

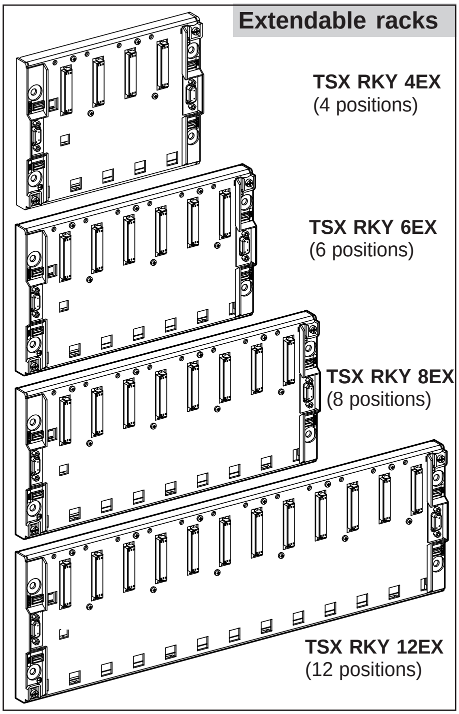
- Mechanical function :
  They are used for fitting all PLC station modules (power supply modules, TSX/PMX processor, discrete/analog I/O, application-specific modules).
  They can be fitted in enclosures, on the machine frame or on panels.
- Electrical function :
  The racks have an integral bus, called Bus X, which distributes :
  - the power supplies required for each module in the same rack,
  - the service signals and data for the whole PLC station if it comprises a number of racks.



So as to match user requirements more closely, there are two families of racks, each available in several versions (4, 6, 8 and 12 positions) :

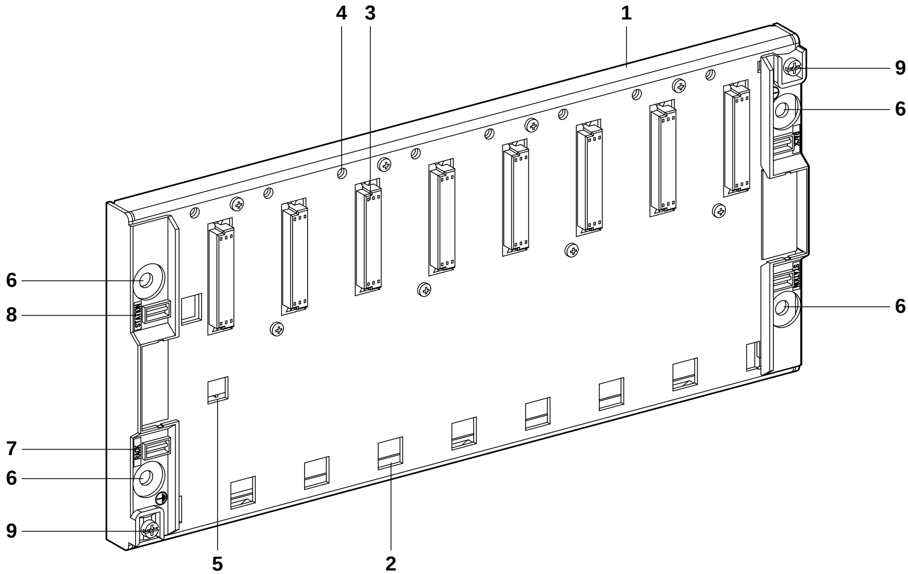
- **Standard racks** : These are used to make up a PLC station limited to a single rack.
- **Extendable racks :** These are used to make up a PLC station containing :
  - Up to 8 RKY 12 EX racks
  - Up to 16 RKY 4EX/6EX/8EX racks

  These racks are distributed on a bus known as Bus X, whose maximum length is limited to 100 meters.
  Bus continuity from one rack to another is provided by a bus extension cable.

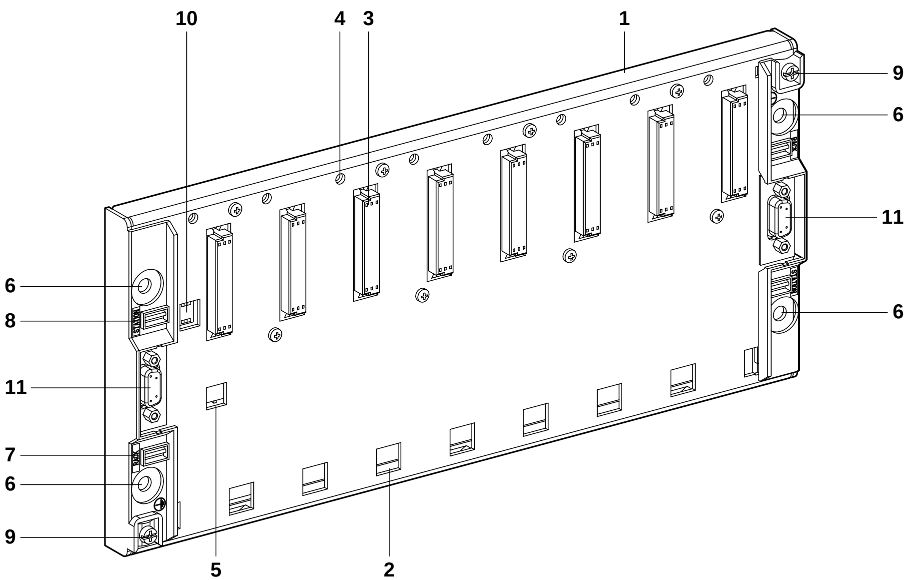


2.1-2 Physical description

- **Standard racks**



- **Extendable racks**



1 Metal plate acting as :
- support for the Bus X electronic card and protection for the bus against EMI and ESD interference,
- module support,
- mechanical reinforcement for the rack.

2 Apertures for anchoring the module pins,

3 48-pin female 1/2 DIN connectors for connecting the rack to each module. When the rack is supplied these connectors are protected by covers which should be removed before the modules are installed. The connector located furthest to the left marked PS is always dedicated to the rack power supply module; the other connectors marked 00 to •• can take all the other types of module.

4 Tapped holes for the module fixing screw.

5 Aperture which ensures correct location when a power supply module is fitted. Since the power supply modules have a boss on the rear panel, it is impossible to mount this module in any other position.

6 Holes large enough to take M6 screws for fitting the rack on a support.

7 Location for marking the rack address.

8 Location for marking the station network address.

9 Ground terminals for grounding the rack.

10 Micro-switches for encoding the rack address (on extendable racks only).

11 9-pin female SUB D connectors for connecting Bus X to another rack (on extendable racks only).

2.2 Installation/Mounting

The procedure for installing and mounting racks is explained in section 6 of this part.

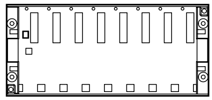
- Installation : section 6.1
- Mounting : section 6.3

2.3 Functions

2.3-1 Composition of a PLC station with TSX/PMX 57 processors, which can be integrated on TSX RKY ●● ▲⎓∿❑⏚

- **Based on standard racks : TSX RKY 6/8/12**

  Standard racks are used to make up a TSX/PMX 57 10, 57 20, 57 30 or 57 40 PLC station limited to a single rack.



- **Based on extendable racks : TSX RKY 4EX/6EX/8EX/12EX**

  By using extendable racks, it is possible to make up a PLC station containing a maximum of :

  TSX/PMX 57 10 station :

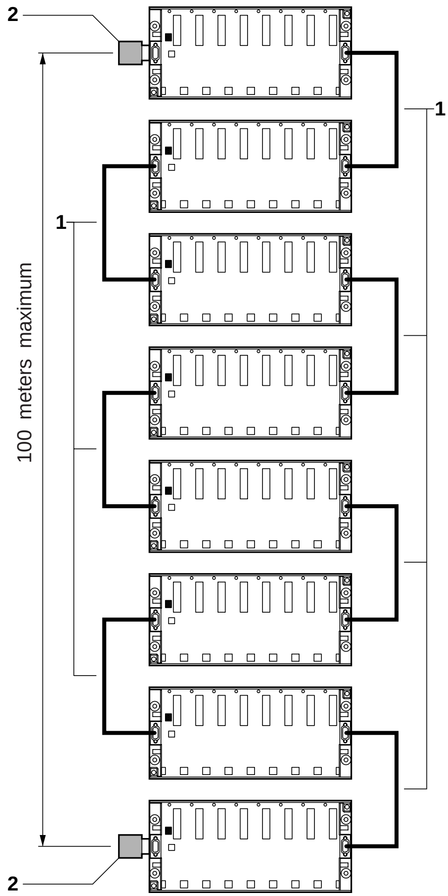
  - 2 TSX RKY 12EX racks or
  - 4 TSX RKY 4EX/6EX/8EX racks

  TSX/PMX 57 20, 57 30 or 57 40 station:

  - 8 TSX RKY 12EX racks or
  - 16 TSX RKY 4EX/6EX/8EX racks

  A single station may comprise racks with 4, 6, 8 and 12 positions which are connected by Bus X extension cables (1). Bus X should have a line terminator (2) fitted at each end.

  - Bus X extension cables
    The racks are interconnected by TSX CBY ●●0K Bus X extension cables connected to the 9-pin SUB D connector on the right and left-hand side of each extendable rack.
    As the concept of inlet and outlet does not apply to 9-pin SUB D connectors, it does not matter whether the cable coming in from a rack or the cable going out to another rack is connected to the right or left connector.



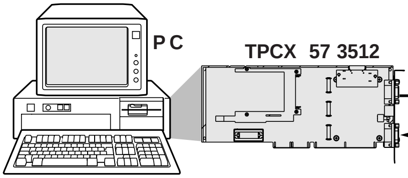
- Line terminator
  The two extendable racks located at either end of the daisy chain **must** be fitted with a TSX TLYEX line terminator (marked A/ and /B) on the unused 9-pin SUB D connector.
- Maximum cable length : The total length of all the TSX CBY ●●0K cables used in a PLC station must never exceed 100 meters

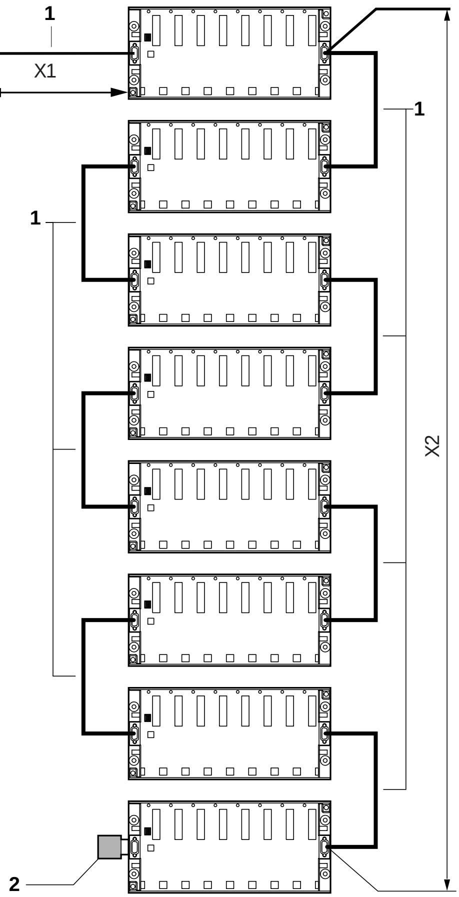
Note:

For applications which require distances of more than 100 meters between racks, a remote rackmaster module can be used. This enables 2 Bus X segments to be remotely located at a maximum distance of 250 meters from the rack supporting the processor. The maximum distance of each Bus X segment is 100 meters. (See section 5 - Bus X remote rackmaster module)

2.3-2 Composition of a PLC station with PCX 57 processors, which can be integrated in a PC

In this case, the PLC station is made up of extendable racks : TSX RKY 4EX/6EX/8EX/12EX





By using extendable racks, it is possible to make up a PLC station containing a maximum of :

- **PCX 57 10 station :**
  - 2 TSX RKY 12EX racks or
  - 4 TSX RKY 4EX/6EX/8EX racks
- **PCX 57 30 station :**
  - 8 TSX RKY 12EX racks or
  - 16 TSX RKY 4EX/6EX/8EX racks

A single station may comprise racks with 4, 6, 8 and 12 positions which are connected to each other and to the processor by Bus X extension cables (1). Bus X should have a line terminator (2) fitted at the end.

- Bus X extension cables
  Connections between racks and between the racks and the processor are made using TSX CBY ••0K Bus X extension cables connected to the 9-pin SUB D connector on the right and left-hand side of each extendable rack and at the top of the front panel of the processor.
  As the concept of inlet and outlet does not apply to 9-pin SUB D connectors, it does not matter whether the cable coming in from a rack or the cable going out to another rack is connected to the right or left connector.

- Line terminator
  The equivalent of line terminator /A is integrated in the processor as standard, and thus the processor is located at the head of the Bus X line. The extendable rack located at the end of the daisy chain **must** be fitted with a **TSX TLY EX** line terminator (**marked /B**) on the unused 9-pin SUB D connector.

- Maximum cable length
  The total length (X1 + X2) of all the TSX CBY ●●0K cables used in a PLC station must never exceed 100 meters.

Note 1:

For applications which require distances of more than 100 meters between racks, a remote rackmaster module can be used. This enables 2 Bus X segments to be remotely located at a maximum distance of 250 meters from the rack virtually supporting the processor. The maximum distance of each Bus X segment is 100 meters. (See section 5 - Bus X remote rackmaster module).

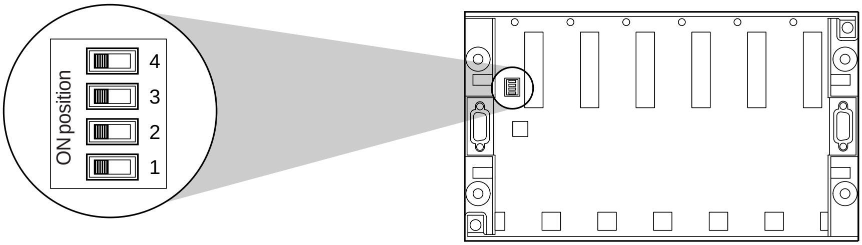
Note 2:

By default, the PCX 57 processor is equipped to be installed at the head of the Bus X line. Line terminator A/ is therefore integrated in the processor in the form of a plug-in daughter board.
If an application requires the integration of the processor inside a Bus X segment, a mechanical assembly is supplied with the processor so that this can be done. This mechanical assembly is supplied in the form of :
- a daughter board which is installed in the place of line terminator A/
- a mounting plate with a 9-pin SUB D connector for connecting a TSX CBY ●●0K Bus X cable and a ribbon cable for connection to the daughter board.

(See section 6.5-6 for the installation of this interface).

2.3-3 Addressing racks in a PLC station

- **Station made up of a standard rack**
  The station is always limited to a single rack; the rack address is therefore implicit and has the value 0 (no micro-switches).
- **Station made up of extendable racks**
  Each station rack must have an address assigned to it. This address is coded via 4 micro-switches located on the rack.
  Micro-switches 1 to 3 are used for coding the rack address on Bus X (0 to 7), micro-switch 4 is used for coding two racks (4, 6 or 8 positions) on the same address. This latter function is handled by PL7 Junior or PL7 Pro software, version V3.3 or later.



Rack addresses		0	1	2	3	4	5	6	7
Position of micro-switches	4	ON	ON	ON	ON	ON	ON	ON	ON
	3	ON	ON	ON	ON	OFF	OFF	OFF	OFF
	2	ON	ON	OFF	OFF	ON	ON	OFF	OFF
	1	ON	OFF	ON	OFF	ON	OFF	ON	OFF
		ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF	ON OFF

Note : At the time of supply, micro-switches 1, 2 and 3 are in the ON position (address 0).

Assigning addresses to the various racks

Address 0 : This address is always assigned to the rack which supports :
- the TSX/PMX 57 processor physically
- the PCX 57 processor virtually

This rack can be located in any position in the chain.

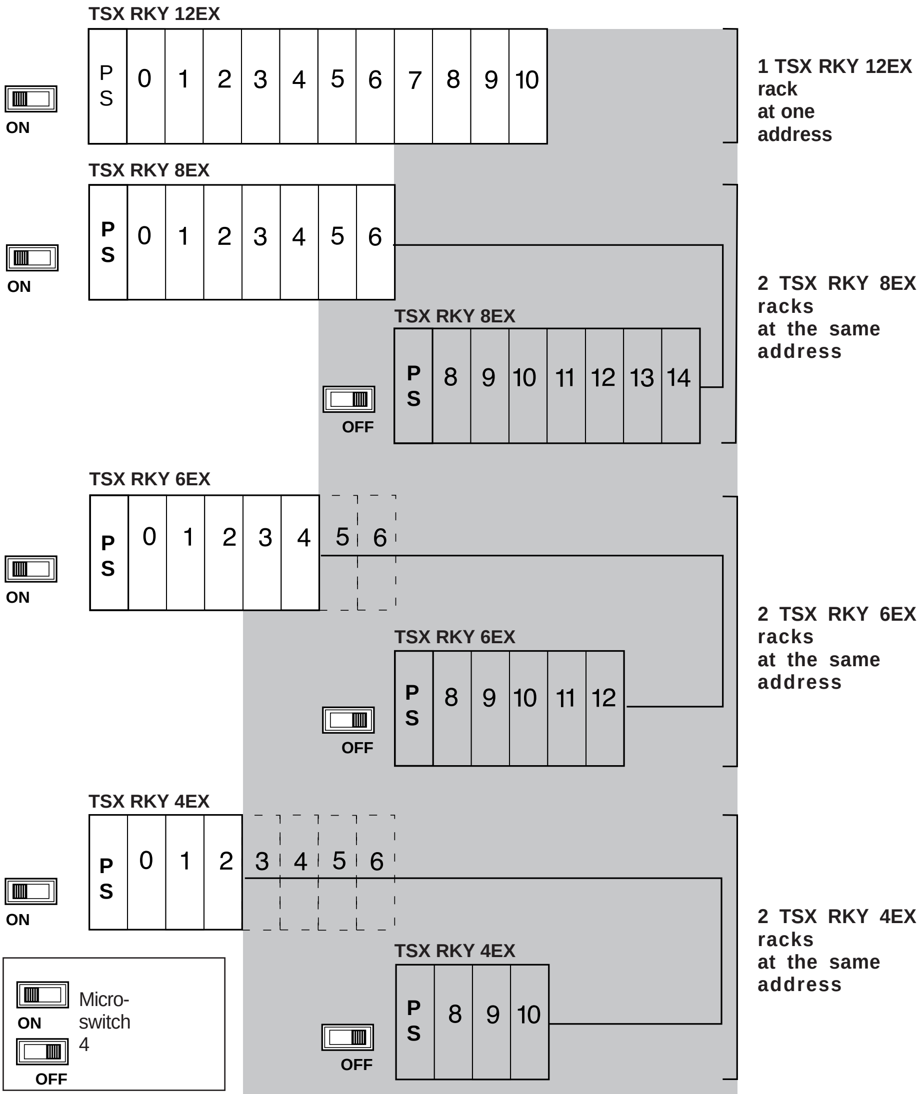
Addresses 1 to 7 : These can be assigned in any order to all the other extendable racks in the station.

Note : The rack address must be coded before the power supply module is mounted.

⚠ **If two or more racks are accidentally positioned at the same address (other than address 0), the racks concerned change to fault mode as do all their modules. Having corrected the rack addressing, the racks concerned should be switched off/on.**

Note : 1 This comment only concerns racks, reference TSX RKY ••EX.
2 If two or more racks are at address 0, the rack supporting the processor does not change to fault mode.

Principle of addressing 2 racks at the same address



Notes :

- TSX RKY 12EX racks cannot receive a second rack at the same address.
- It is possible to mix TSX RKY 8EX/6EX/4EX racks.
- Two TSX RKY 8EX/6EX/4EX racks with the same address will not be necessarily be daisy-chained one after the other. The physical order of distribution is not important.

2.3-4 Module addresses

For all standard and extendable racks, a module address is geographical and will depend on the position of the module on the rack. The address of each position is indicated below each connector; the connector marked PS is always dedicated to the rack power supply.

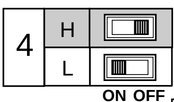
Module addresses according to the type of rack

- **Standard racks**
  - TSX RKY6 : addresses 00 to 02
  - TSX RKY8 : addresses 00 to 04
  - TSX RKY12 : addresses 00 to 10
- **Extendable racks**

  The address of a module depends on the position of micro-switch 4 (see table below).
  - micro-switch 4 in the ON position, the modules will have addresses (00 to x) depending on the type of rack
  - micro-switch 4 in the OFF position, the modules will have addresses (08 to y) depending on the type of rack. This function is only handled by PL7 Junior or PL7 Pro software, version V 3.3 or later.

	Module addresses	
Position of micro-switch 4	**ON**	**OFF**
TSX RKY 4EX racks	00 to 02	08 to 10
TSX RKY 6EX racks	00 to 04	08 to 12
TSX RKY 8EX racks	00 to 06	08 to 14
TSX RKY 12EX racks	00 to 10	cannot be used

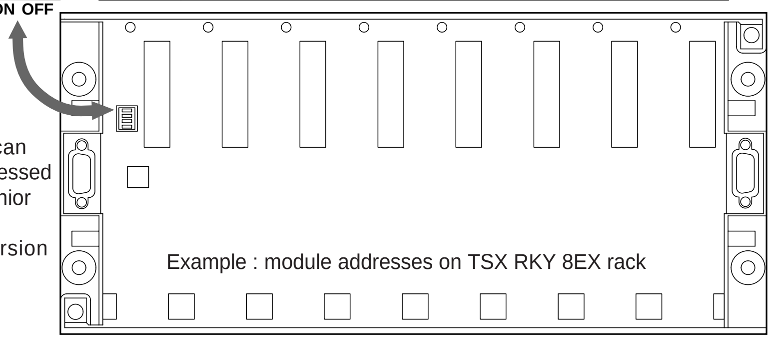
Micro-switch 4



Module addresses

PS	08	09	10	11	12	13	14
PS	00	01	02	03	04	05	06

Note :
The shaded addresses can only be accessed from PL7 Junior or PL7 Pro software version 3.3 or later



Example : module addresses on TSX RKY 8EX rack

PS = Marks the power supply module connector

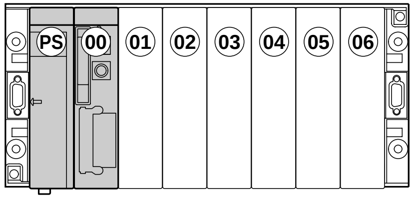
2.3-5 Installing power supplies, processors and other modules

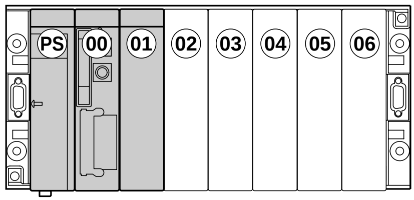
- **On a standard or extendable rack at address 0 with a TSX 57 or PMX 57 processor, which can be integrated on the rack**

  The rack with address 0 must receive a power supply module and the processor module. Since TSX Premium PLCs can have two types of power supply (standard format or double format), the position of the processor will depend on the type of power supply being used.

  Using a standard format power supply module :

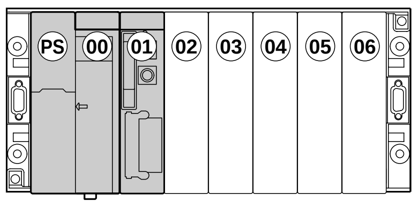
  - The power supply module always occupies position PS.
  - The single format processor module is installed in position 00 (preferred position) or position 01 if position 00 is not available.
  - The double format processor module is installed in positions 00 and 01 (preferred positions) or positions 01 and 02 if position 00 is not available.
  - The other modules should be installed from position 01, 02 or 03 onwards, depending on the location of the processor.

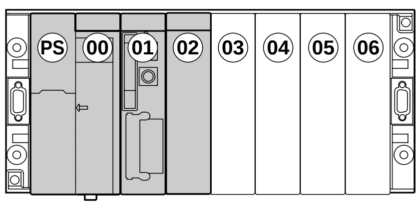




  Using a double format power supply module :

  - The power supply module always occupies positions PS and 00.
  - The single format processor module must be installed in position 01.
  - The double format processor module is installed in positions 01 and 02.
  - The other modules should be installed from position 02 or 03 onwards, depending on the type of processor.

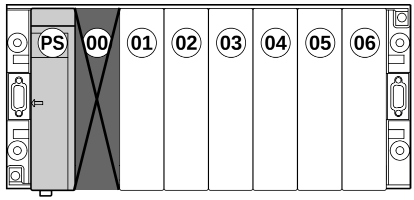




- **On an extendable rack at address 0 with a PCX 57 processor, which can be integrated in the PC**
  The PCX 57 processor, integrated in the PC, occupies one position virtually on the rack at address 0; this virtual position must be empty. Since TSX Premium PLCs can have two types of power supply (standard format or double format), the empty position will depend on the type of power supply being used.

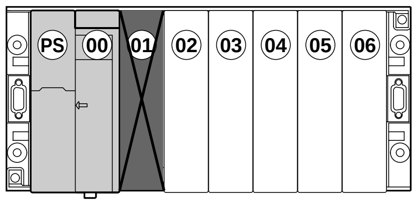
  Using a standard format power supply module :

  - The power supply module always occupies position PS.
  - Position 00, virtual slot for the processor, must be empty.
  - The other modules should be installed from position 01 onwards.



  Using a double format power supply module :

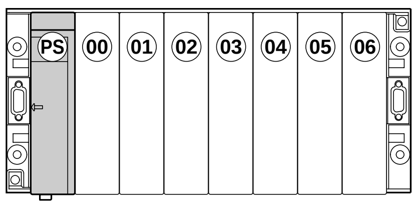
  - The power supply module always occupies positions PS and 00.
  - Position 01, virtual slot for the processor, must be empty.
  - The other modules should be installed from position 02 onwards.



- **On an extendable rack at address 1 to 7 regardless of the type of processor**
  Each rack must have a power supply module, whether standard or double format.

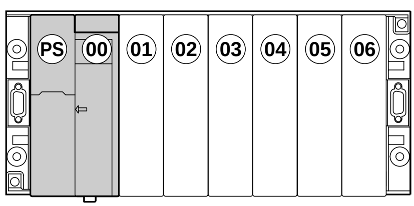
  Using a standard format power supply module :

  - The power supply module always occupies position PS.
  - The other modules should be installed from position 00 onwards.



  Using a double format power supply module :

  - The power supply module always occupies positions PS and 00.
  - The other modules should be installed from position 01 onwards.



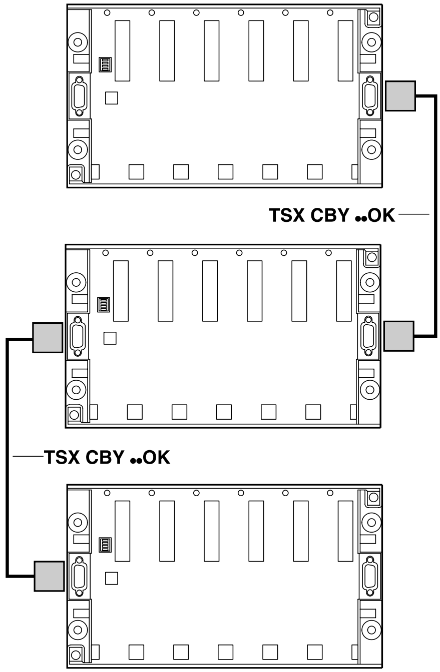
2.4 Accessories

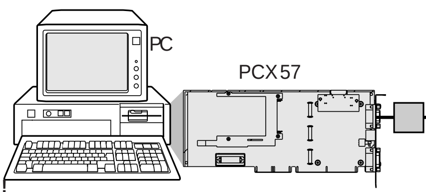
2.4-1 Bus X extension cables

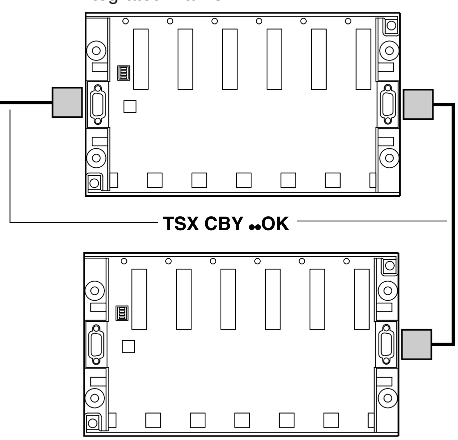
- **TSX CBY ••0K cables (II ≥ 02)**

  These fixed-length cables are used to daisy-chain TSX RKY ••EX extendable racks and carry the various Bus X signals. When used with a PCX 57 processor, they also provide the connection between the processor integrated in the PC and the first rack in the station. They are fitted with 9-pin male SUB D connectors at each end, which connect to the 9-pin female SUB D connectors on the extendable rack or the PCX 57 processor.

  Several different lengths of cable are available to meet the various application requirements (see table below).







⚠ **The total length of all the cables used in a PLC station is limited to 100 meters.**

⚠ **All the station elements (racks, PC, etc) must be powered down prior to inserting or removing a TSX CBY •••0K cable.**

The different types of cable available

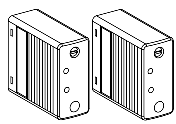
References	Lengths
TSX CBY 010K (II ≥ 02)	1 meter
TSX CBY 030K (II ≥ 02)	3 meters
TSX CBY 050K (II ≥ 02)	5 meters
TSX CBY 120K (II ≥ 02)	12 meters
TSX CBY 180K (II ≥ 02)	18 meters
TSX CBY 280K (II ≥ 02)	28 meters
TSX CBY 380K (II ≥ 02)	38 meters
TSX CBY 500K (II ≥ 02)	50 meters
TSX CBY 720K (II ≥ 02)	72 meters
TSX CBY 1000K (II ≥ 02)	100 meters

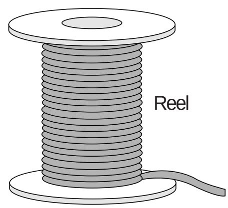
- **TSX CBY 1000 cables (reel with 100 meters)**

  For Bus X lengths which are less than 100 meters but not those offered already equipped with connectors, the TSX CBY 1000 cable **must** be used. This cable must be equipped at each end with TSX CBY K9 connectors to be fitted by the user. The procedure for this is described in the quick reference guide included with the cable and the connectors.

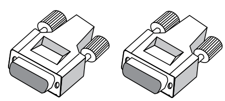
  The following equipment is required to make up this cable :

  - 1 TSX CBY 1000 cable including 1 reel of 100 meters and two testers for checking the cable once the connections have been made

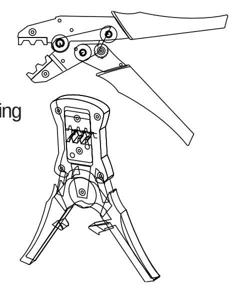




  - 1 set of two TSX CBY K9 9-pin connectors including for each connector :
    1 connector body,
    1 set of contacts,
    1 internal shielding cover,
    1 external shielding cover,
    1 ferrule,
    1 plastic cover with 2 fixing screws,



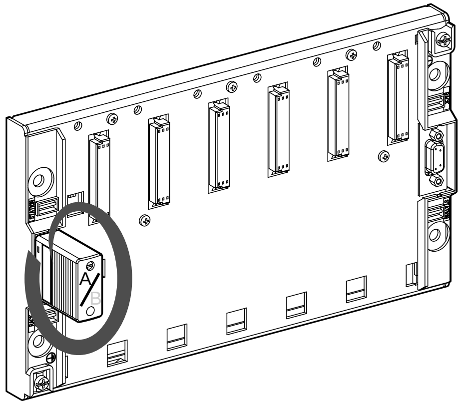
  - 1 TSX CBY ACC10 kit including 2 crimping pliers and a tool for extracting contacts to be used in case of error,



  - 1 digital ohmmeter,
  - 1 wire stripper,
  - 1 pair of scissors.

2.4-2 TSX TLYEX line terminator

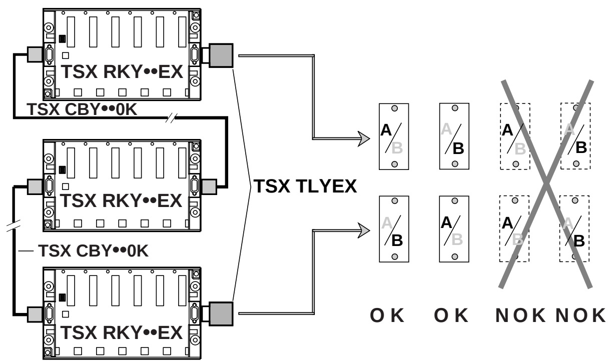
When using extendable racks, Bus X must be fitted with a line terminator at each end (see outline diagram in section 2.3-1).
A line terminator is made up of a 9-pin SUB D connector and a cover containing the matching elements. It fits onto the 9-pin SUB D connectors on the extendable racks located at the end of the line.



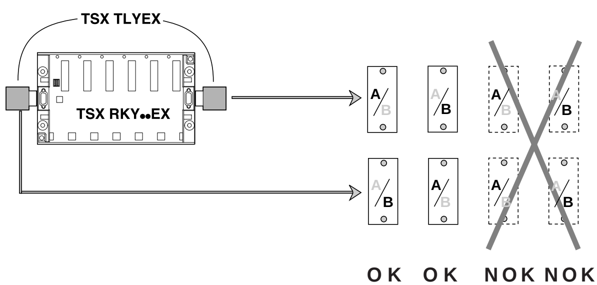
TSX TLYEX line terminators are sold in lots of 2 and marked A/ and /B. **The bus must have an A/ terminator at one end and a /B terminator at the other end in no specific order** (see diagrams below).

⚠ **All the station racks must be powered down prior to inserting or removing a line terminator.**

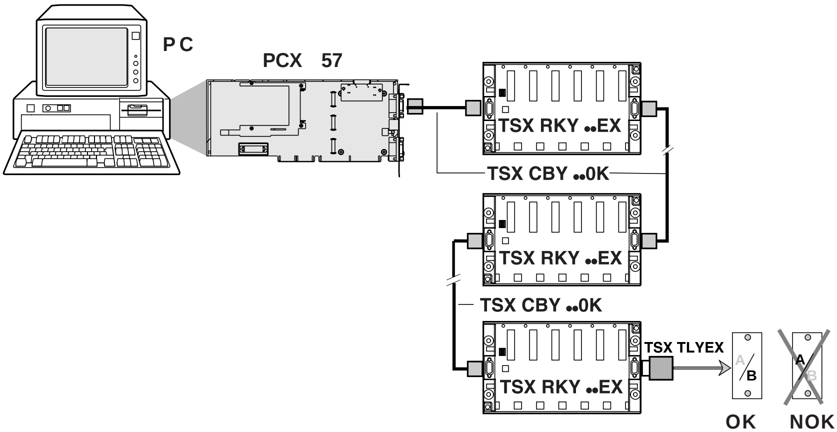
- **Positioning line terminators on a station with a TSX or PMX processor integrated on a TSX RKY••EX rack**
  - On a PLC station comprising several TSX RKY••EX extendable racks



  - On a PLC station comprising one TSX RKY••EX extendable rack
    Note :
    When using a single extendable rack, a line terminator must be fitted on each 9-pin SUB D connector on the rack.



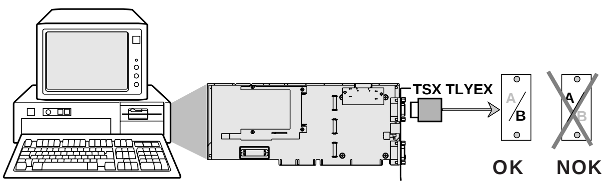
- **Positioning line terminators on a station with a PCX 57 processor integrated in a PC**



The equivalent of line terminator /A is integrated in the processor as standard, and thus the processor is located at the head of the Bus X line. The extendable rack located at the end of the daisy chain **must** be fitted with a **TSX TLY EX** line terminator (**marked /B**) on the unused 9-pin SUB D connector.

Special case

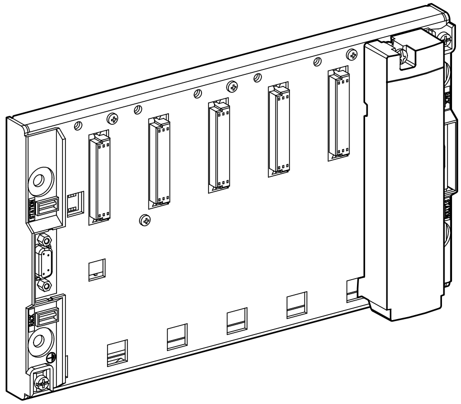
If no element is connected on Bus X, a TSX TLYEX line terminator, /B, must be installed on the Bus X connector on the PCX 57 processor.



2.4-3 TSX RKA 02 protective cover for an empty slot

If there are any unoccupied positions on a rack, it is advisable to fit a TSX RKA 02 cover in this position, which is designed for this purpose.
This cover fits on the rack in the same way as a shallow version of a module.

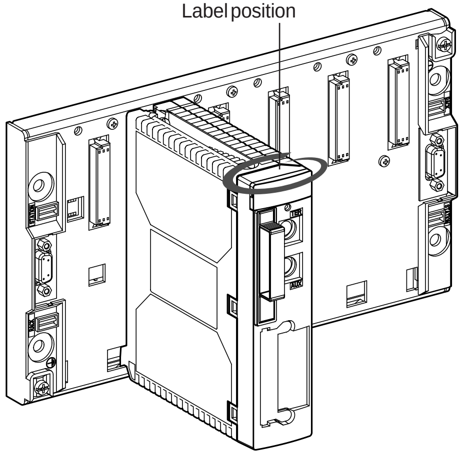
TSX RKA 02 covers are sold in lots of 5.



2.4-4 Marking

- **Marking module positions on the rack**

  When the module is in place on the rack, it hides the position marker which is screen-printed on the rack. So that a module position can still be identified quickly, each rack comes with a sheet of self-adhesive labels which can be used to mark the position of each module. These self-adhesive labels can be stuck on top of the module when it is in place on the rack.



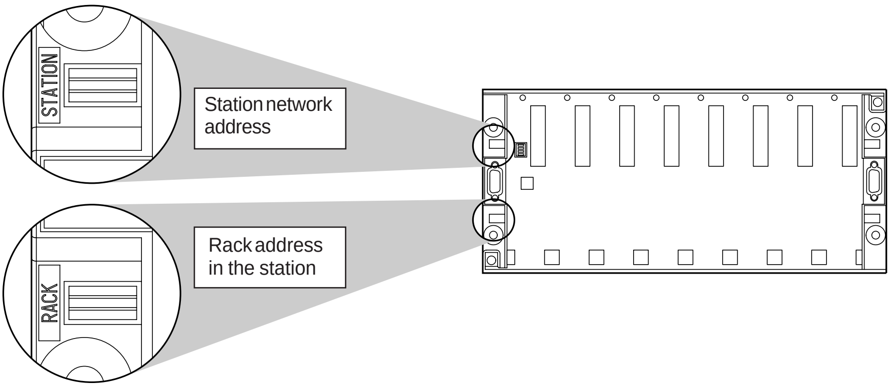
Example : processor module marking

Sheet of labels

PS	00	01	02	03	04	05	06
07	08	09	10	11	12	13	14

- **Marking racks**

  Each rack is supplied with a pack of clip-on markers on a strip. These can be used to mark each rack with :
  - the address of the rack in the station
  - the network address of the station, if this is connected to a communication network.
  Each rack therefore has two locations to take these markers.



2.5 Compatibility with the existing installed base

		Existing configuration with			
		Old references			New references
		TSX RKY••E TSX CBY••0K (ii 01) TSX TLY (ii 01)	TSX RKY••E TSX CBY••0K (ii 01) TSX TLY A+B (ii 03)	TSX RKY••E TSX CBY••0K (ii 02) or TSX CBY 1000 TSX TLY A+B (ii 03)	TSX RKY••EX TSX CBY••0K (ii 02) or TSX CBY 1000 TSX TLYEX A/+/B
Configuration enhanced with – Old references	2 TSX TLY (ii 01) line terminators	Yes	No	No	No
	TSX CBY••0K (ii 01) cables	Yes	Yes	No	No
	TSX TLY A+B line terminators (ii 03)	Yes	Yes	Yes	No
	TSX racks TSX RKY••E	Yes	Yes	Yes	No
Configuration enhanced with – New references	TSX cable(s) CBY••0K (ii 02) or CBY 1000	Yes	Yes	Yes	Yes
	TSX racks RKY••EX	Yes	Yes	Yes	Yes
	TSX TLYEX line terminators A/+/B	Yes	Yes	Yes	Yes

Note :
On a PLC station, the TSX TLY line terminator coupling must be the same version.

3.1 General presentation

A wide range of processors is available, increasing in capacity and performance levels to best meet the differing needs of users :

- **TSX 57 sequential processors, which can be integrated in TSX RKY •• racks :**
  - TSX P57 102 processor,
  - TSX P57 202, TSX P57 252 processors,
  - TSX P57 302, TSX P57 352 processors,
  - TSX P57 402, TSX P57 452 processors,

- **PMX 57 process control processors, which can be integrated in TSX RKY •• racks :**
  - TPMX P57 102 processor : processor with the same capacity as aTSX P57 102 processor and performance levels which are equivalent to TSX P57 2•2 processors. It can also be used to manage 10 process control channels.
  - TPMX P57 202 processor : processor with the same capacity as a TSX P57 57 202 processor and performance levels which are equivalent to TSX P57 4•2 processors. It can also be used to manage 10 process control channels.
  - TPMX P57 352 processor : processor with the same capacity as a TSX P57 57 352 processor and performance levels which are equivalent to TSX P57 4•2 processors. It can also be used to manage 10 process control channels.
  - TPMX P57 452 processor : processor with the same capacity as a TSX P57 57 452 processor and performance levels which are equivalent to TSX P57 4•2 processors. It can also be used to manage 10 process control channels.

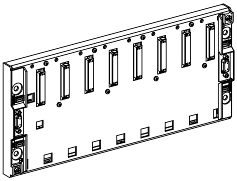
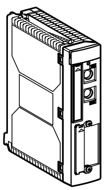
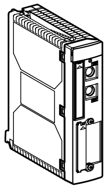
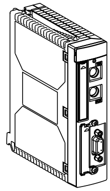
- **PCX 57 sequential processors, which can be integrated in a PC :**
  - TPCX 57 1012 processors : processor with the same capacity as a TSX P57 102 processor.
  - TPCX 57 3512 processors : processor with the same capacity as a TSX P57 352 processor.

TSX 57 / PMX 57 and PCX 57 processors manage an entire PLC station comprising discrete I/O modules, analog I/O modules and application-specific modules (counter, axis control, stepper motor control, communication) which can be distributed over one or more racks connected on Bus X.
The application is designed using PL7 Junior or PL7 Pro software under Windows, which offers :

- Four programming languages : Grafcet, Ladder, Structured Text and List languages,
- A multitask software structure : master task, fast task, event processing,
- Modification of currently running programs,
- etc

3.2 TSX / PMX 57 processors, which can be integrated in TSX RKY •• racks

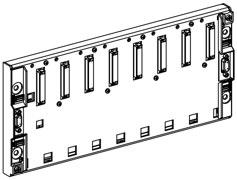
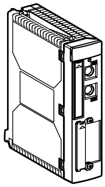
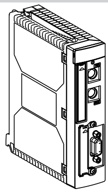
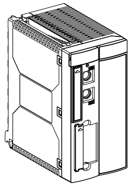
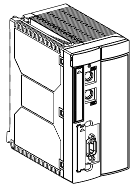
3.2-1 Catalog

Type of processor	TSX processors which can be integrated in TSX RKY •• racks		
			
Station characteristics (1)			
TSX RKY..EX racks	2	8	
TSX RKY 4EX/6EX/8EX racks	4	16	
Module slots (2)	21 [27]	87 [111]	
I/O profile (3)	Fixed		
No. of in-rack discrete I/O (4)	512	1024	
No. of analog I/O channels	24	80	
No. of app-specific chans (5)	8	24	
Network connection	1 (FIPWAY, ETHWAY/TCP_IP, Modbus +)		
FIPIO master connection			1 (integrated)
Third party fieldbus connection		1 (6)	
AS-i sensor/actuator bus connection	2	4	
Memory characteristics			
Internal memory	32 K16	48 K16	64 K16
Memory extension	64 K16	128 K16	
References	**TSX P 57 102**	**TSX P 57 202**	**TSX P 57 252**

(1) Maximum characteristics for the station managed by the processor
(2) 21 or 87 slots with 2 or 8 TSX RKY 12EX racks, [27] or [111] slots with 4 or 16 TSX RKY 8EX racks. For standard format modules, except power supply modules and processor.
(3) Fixed I/O profile : the number of discrete I/O, analog and application-specific channels is cumulative
(4) In-rack discrete I/O. Discrete I/O on FIPIO bus, third party fieldbus, AS-i sensor/actuator bus are to be counted additionally.
(5) Counter, axis control, etc, channels (see section 3.5-3 : definition and number of application-specific channels)
(6) INTERBUS-S, PROFIBUS-DP

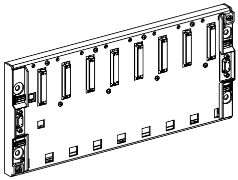
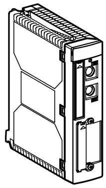
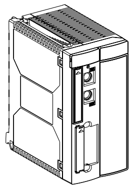
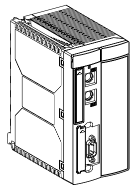
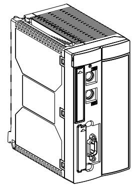
A

Catalog (continued)

Type of processor	TSX processors which can be integrated in TSX RKY •• racks			
				
Station characteristics (1) TSX RKY..EX racks TSX RKY 4EX/6EX/8EX racks	8 16			
Module slots (2)	87 [111]			
I/O profile (3)	Fixed		Flexible	
No. of discrete I/O (4)	1024		2040 maximum	
No. of analog channels	128		255 maximum	
No. of app.-spec. chans (5)	32		48 maximum	
FIPIO master connection		1 (integrated)		1 (integrated)
Network connection	3 (FIPWAY, ETHWAY/TCP_IP Modbus +)		4 (FIPWAY, ETHWAY/TCP_IP Modbus +)	
Third party fieldbus connection	2 (6)			
AS-i sensor/actuator bus connection	8			
Memory characteristics Internal memory	64 K16	80 K16	96 K16	96/112 K16(7)
Memory extension	256 K16			
References	**TSX P57 302**	**TSX P57 352**	**TSX P57 402**	**TSX P57 452**

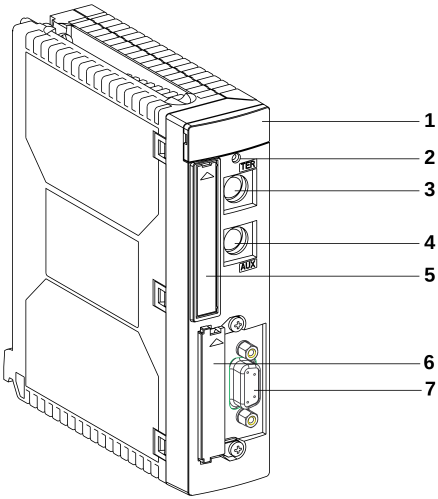
(1) Maximum characteristics for the station managed by the processor
(2) 87 slots with 8 TSX RKY 12EX racks, [111] slots with 16 TSX RKY 8EX racks. For standard format modules, except power supply modules and processor.
(3) Fixed I/O profile : the number of discrete I/O, analog and application-specific channels is cumulative
Flexible I/O profile : the number of discrete I/O, analog and application-specific channels is not cumulative (see section 3.5-4 of this manual).
(4) In-rack discrete I/O. Discrete I/O on FIPIO bus, third party fieldbus, AS-i sensor/actuator bus are to be counted additionally.
(5) Counter, axis control, etc, channels (see section 3.5-3 : number of app-specific channels)
(6) INTERBUS-S, PROFIBUS-DP.
(7) See section 3.4-3

Catalog (continued)

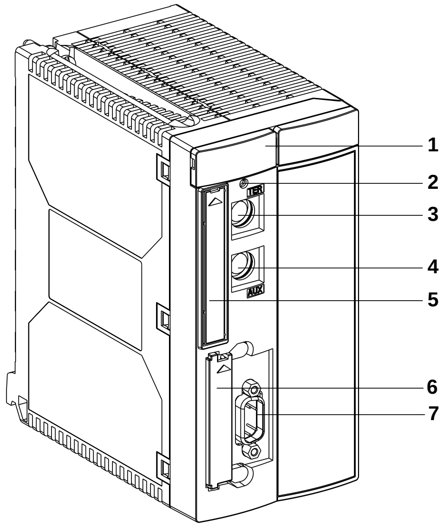
Type of processor	PMX processors which can be integrated in TSX RKY •• racks			
				
Station characteristics (1)				
TSX RKY..EX racks	2	8		
TSX RKY 4EX/6EX/8EX racks	4	16		
Module slots (2)	21 [27]	87 [111]		
I/O profile (3)	Fixed			Flexible
No. of discrete I/O (4)	512	1024		2040 max.
No. of analog I/O chan.	24	80	128	255 max.
No.of app-spec.chan.(5)	8	24	32	48 max.
Control loops	10			
Network connection	1 (FIPWAY, ETHWAY/TCP_IP, Modbus +)		3 (FIPWAY, ETHWAY/TCP_IP, Modbus+)	4
FIPIO master connection			1 (integrated)	
Third party fieldbus connection		1 (6)	2 (6)	
AS-i sensor/actuator bus connection	2	4	8	
Memory characteristics				
Internal memory	48 K16	48 K16	80 K16	96/112 K16(7)
Memory extension	64 K16	128 K16	256 K16	
References	**TPMX P57 102**	**TPMX P57 202**	**TPMX P57 352**	**T PMX P57 452**

(1) Maximum characteristics for the station managed by the processor
(2) 21 or 87 slots with 2 or 8 TSX RKY 12EX racks, [27] or [111] slots with 4 or 16 TSX RKY 8EX racks. For standard format modules, except power supply modules and processor
(3) Fixed I/O profile : the number of discrete I/O, analog and application-specific channels is cumulative
Flexible I/O profile : the number of discrete I/O, analog and application-specific channels is not cumulative (see section 3.5-4 in this part).
(4) In-rack discrete I/O. Discrete I/O on FIPIO bus, third party fieldbus, AS-i sensor/actuator bus are to be counted additionally.
(5) Counter, axis control, etc, channels (see section 3.5-3 : number of app-specific channels)
(6) INTERBUS-S, PROFIBUS-DP.
(7) See section 3.4-3.

3.2-2 Physical description



Standard format processors :
- TSX P57 102/202/252/302/352
- T PMX P57 102



Double format processors :
- TSX P57 402/452
- T PMX P57 202/352/452

1 Display block comprising 4 or 5 indicator lamps :
- RUN indicator lamp (green) :
  on if the processor is operating (program running),
- ERR indicator lamp (red) :
  when on, this indicates faults relating to the processor and its installed devices (PCMCIA memory card and PCMCIA communication card)
- I/O indicator lamp (red) :
  when on, this indicates faults originating from another station module or a configuration fault,
- TER indicator lamp (yellow) :
  when flashing, this indicates activity on the terminal port. The frequency of flashing depends on the amount of traffic.
- FIP indicator lamp (yellow):
  when flashing, this indicates activity on the FIPIO bus (only on TSX / TPMX P57 •52 processors). The frequency of flashing depends on the amount of traffic.

2 Pencil-point RESET button which causes the PLC to perform a cold start when pressed.

3 Terminal port (TER connector) : enables a peripheral device (with or without its own power supply) to be connected : programming or adjustment terminal, man-machine interface terminal, printer, etc.

4 Terminal port (AUX connector) : enables a peripheral device (with or without its own power supply) to be connected : programming or adjustment terminal, man-machine interface terminal, printer, etc.

5 Slot for a type 1 PCMCIA format memory extension card.

⚠ **If no card is present, this slot is fitted with a cover which MUST remain in place; if removed, the processor will stop.**

6 Slot for a type 3 PCMCIA format communication card which enables a FIPWAY, FIPIO Agent, UNI-TELWAY, or serial link communication channel to be connected to the processor.
If no communication card is present, this slot is fitted with a cover.

7 9-pin SUB D connector for connection to the FIPIO master bus. This connector is only available on TSX P57 •52 or T PMX P57 •52 processors.

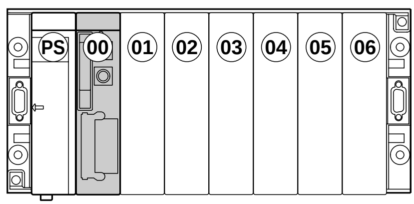
3.2-3 Installation/mounting

- **Installing a standard format processor module**

A standard format processor module is always installed on the **TSX RKY ●● rack at address 0** and in **position 00 or 01** depending on whether the rack is equipped with a standard format or double format power supply module.

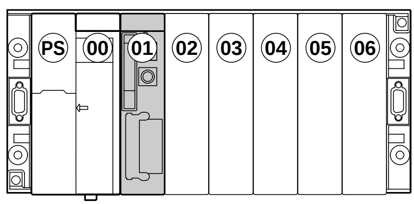
- Rack with TSX PSY 2600/1610 standard format power supply module :

  In this instance, the processor module will be installed in position 00 (preferred position) or position 01 (in which case, position 00 must be empty).



- Rack with TSX PSY 3610/5500/5520/8500 double format power supply module :

  In this instance, since the power supply module takes up two positions (PS and 00), the processor has to be installed in position 01.

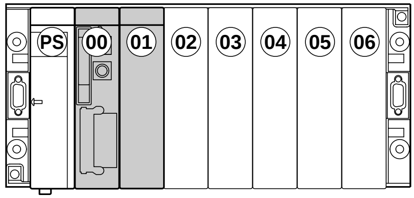


- **Installing a double format processor module**

  A double format processor module is always installed on the **TSX RKY •• rack at address 0 and in positions 00 and 01 or 01** and 02 depending on whether the rack is equipped with a standard format or double format power supply module.

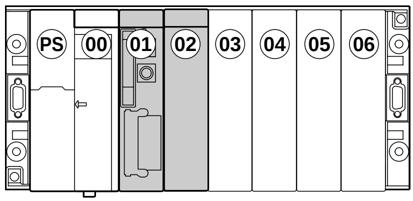
- Rack with TSX PSY 2600/1610 double format power supply module :

  In this instance, the processor module will be installed in positions 00 and 01 (preferred position) or in positions 01 and 02, in which case position 00 must be empty.



- Rack with TSX PSY 3610/5500/5520/ 8500 double format power supply module :

  In this instance, since the power supply module takes up two positions (PS and 00), the processor has to be installed in positions 01 and 02.



Note : The rack where the processor is installed is always address 0

- **Mounting :**

  The procedure for mounting modules is defined in section 6.4-1.

  ⚠ **The rack power supply must always be powered down prior to mounting a processor module.**

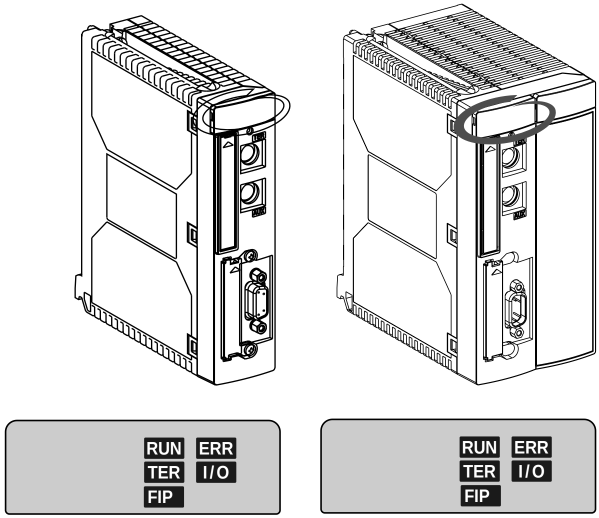
  Precautions to be taken when replacing a processor

  ⚠ **If a TSX / PMX 57 processor is being replaced by another processor which has already been programmed and contains an application, the power must be cut to all the PLC station control devices.**

  Before restoring the power to the control devices, check that the processor actually contains the required application.

3.2-4 Display

Five indicator lamps on the processor front panel enable rapid diagnostics of the PLC status :



RUN indicator lamp green) : shows the application status

• On : PLC running normally, program execution,

• Flashing : PLC stopped or affected by software blocking fault,

• Off : the PLC is not configured : application missing, invalid or incompatible.
PLC in error mode : processor or system fault.

ERR indicator lamp (red) : signals faults relating to the processor and its ancillary equipment (memory card and PCMCIA communication card)

- On : PLC in error mode : processor or system fault,
- Flashing :
  - PLC not configured (application missing, invalid or incompatible).
  - PLC affected by software blocking fault,
  - memory card battery fault
  - Bus X fault (1)
- Off : normal status, no internal fault.

I/O indicator lamp (red) : signals configuration faults and faults arising from other station modules :

- On : I/O fault originating from another module or channel, or a configuration fault
- Flashing : Bus X fault (1),
- Off : normal status, no internal fault.

TER indicator lamp (yellow) : signals activity on the TER terminal port

- Flashing : link active. The frequency of flashing depends on the amount of traffic
- Off : link inactive

FIP indicator lamp (yellow), only on TSX/TPMX P57 •52 processors : this indicates activity on the FIPIO bus

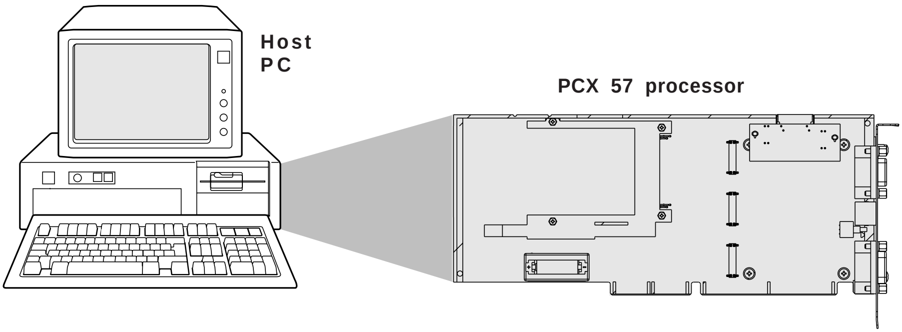
- Flashing : link active. The frequency of flashing depends on the amount of traffic
- Off : link inactive

(1) A Bus X fault is indicated by the ERR and I/O indicator lamps flashing simultaneously.

3.3 PCX 57 processors, which can be integrated in a PC

3.3-1 Presentation

Integrated in a host PC (1) which is running under Windows 95/98 or Windows NT and has a 16-bit ISA bus, PCX 57 processors, using PL7 Junior or PL7 Pro software, manage an entire PLC station made up of racks, discrete I/O modules, analog I/O modules and application-specific modules which can be distributed over one or more racks connected on Bus X. The PCX 57 processor communicates with the PC on which it is installed via the 16-bit ISA bus. To do this, a communication driver (ISAWAY 95/98 or ISAWAY NT) must be installed.



Two types of processor are available to meet the differing needs of users :

- TPCX 57 1012 processors : processor with the same capacity as a TSX P57 102 processor.
- TPCX 57 3512 processors : processor with the same capacity as a TSX P57 352 processor.

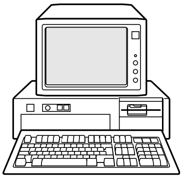
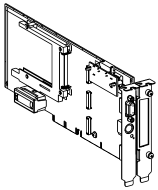
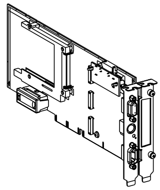
Characteristics of the host PC

To receive a PCX 57 processor, the host PC must :

- operate under Windows 95/98 or Windows NT,
- have an 8 MHz 16-bit ISA bus,
- have two standard slots available on the ISA bus (consecutive and 20.32 mm apart), with sufficient space in terms of height and width. The format of the PCX 57 processor card is identical to that of a 16-bit ISA PC card,
- comply with the ISA standards (signals, power supply, etc)

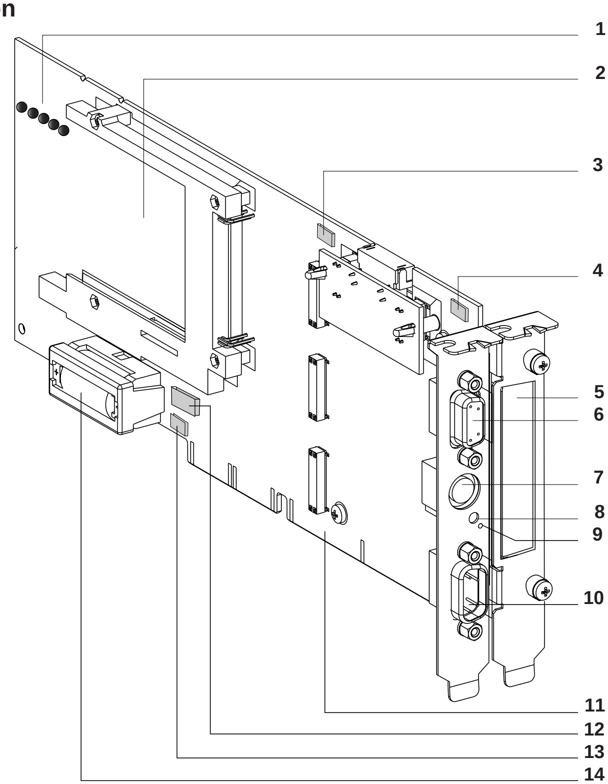
(1) In the remainder of this document, the term host PC covers a Groupe Schneider industrial PC type device or any other commercially available PC which has the characteristics defined above.

3.3-2 Catalog

Type of module	Processors which can be integrated in a PC	
		
Station characteristics (1)		
TSX RKY..EX racks	2	8
TSX RKY 4EX/6EX/8EX racks	4	16
Module slots (2)	21 [27]	87 [111]
I/O profile (3)	Fixed	
No. of discrete I/O (4)	512	1024
No. of analog I/O chan.	24	128
No. of app-spe. chan (5)	8	32
FIPIO master conn.		1 (integrated)
Network connection	1(FIPWAY, ETHWAY/TCP_IP Modbus +)	3(FIPWAY, ETHWAY/TCP_IP Modbus +)
Third party fieldbus connection		2 (6)
AS-i sensor/actuator bus connection	2	8
Memory characteristics		
Internal memory	32 K16	80 K16
Memory extension	64 K16	256 K16
References	**TPCX 57 1012**	**TPCX 57 3512**

(1) Maximum characteristics for the station managed by the processor
(2) 21 or 87 slots with 2 or 8 TSX RKY 12EX racks, [27] or [111] slots with 4 or 16 TSX RKY 8EX racks. For standard format modules, except power supply modules and processor
(3) Fixed I/O profile : the number of discrete I/O, analog and application-specific channels is cumulative
(4) In-rack discrete I/O. Discrete I/O on FIPIO bus, third party fieldbus, AS-i sensor/actuator bus are to be counted additionally.
(5) Counter, axis control, etc, channels (see section 3.5-3 : number of application-specific channels)
(6) INTERBUS-S, PROFIBUS-DP.

3.3-3 Physical description



1 BAT, RUN, TER, I/O and FIP indicator lamps (the FIP lamp is only present on the TPCX 57 3512 model).

2 Slot for a type 1 PCMCIA format memory extension card.

3 Micro-switches for coding the position of the module on the rack.

4 Micro-switches for coding the rack address on Bus X.

5 Slot for a type 3 PCMCIA format memory extension card.

6 9-pin female SUB D connector for remote connection of Bus X to an extendable rack.

7 Terminal port (TER connector) : enables a peripheral device (with or without its own power supply) to be connected : programming or adjustment terminal, man-machine interface terminal, printer, etc.

8 Pencil-point RESET button which causes the PLC to perform a cold start when pressed.

9 ERR indicator lamp.

10 9-pin male SUB D connector for connection to the FIPIO master bus. This connector is only present on the PCX P57 3512 processor.

11 16-bit ISA connector for connection to the host PC.

12 Micro-switches for coding the address of the PCX 57 processor on the ISA bus (I/O space).

13 Coding devices for selecting the interrupt (IRQ ii), used by the processor on the ISA bus.

14 Slot which takes a battery for backing up the processor internal RAM memory.

3.3-4 Mounting / installation

- **Mounting** (see section 6.5)

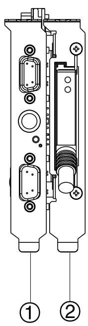
Precautions to be taken when replacing a processor

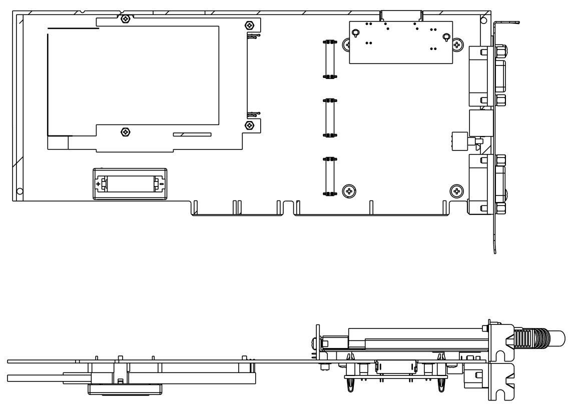
⚠ **If a PCX 57 processor is being replaced by another processor which has already been programmed and contains an application, the power must be cut to all the PLC station control devices.**

Before restoring the power to the control devices, check that the processor actually contains the required application.

- **Physical installation in the PC**

The PCX 57 processor mechanically occupies two consecutive slots① and② on the ISA bus but electrically only uses one①. The second slot② is used by the mechanical part of the PCMCIA communication card.
The size and dimensions of the PCX 57 processor card are given in section 6 in this part.





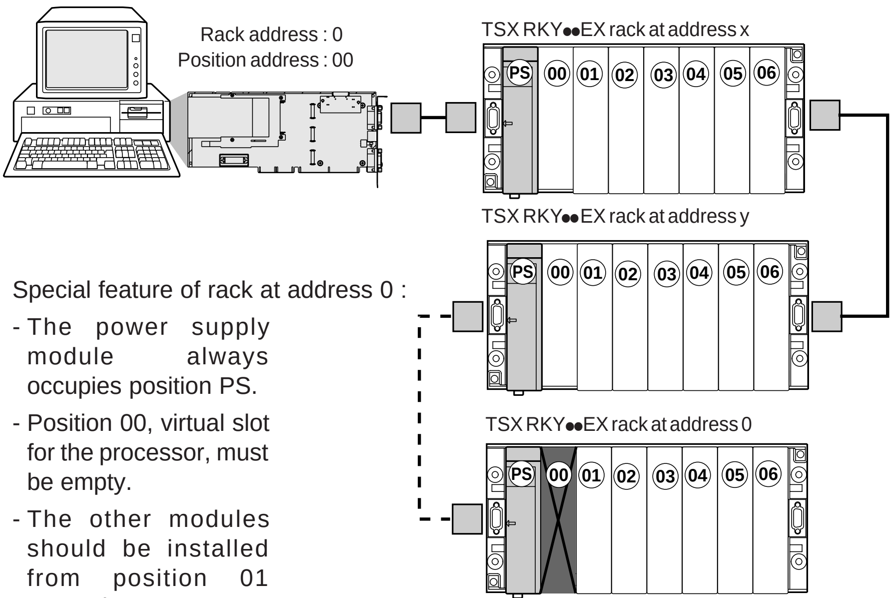
Note : It is possible to install 2 PCX 57 processors in one PC.

- **Logical installation on Bus X**
  The PCX 57 processor logically occupies the same slot as a TSX/PMX 57 processor (rack address 0, position 00 or 01).

  The TSX RKY ••EX rack at address 0 must receive a power supply module and the position normally occupied by a TSX 57 or PMX 57 processor will be empty (virtual slot of PCX 57 processor). For Premium PLCs with two types of power supply (standard format or double format), the empty position at rack address 0 will depend on the type of power supply used.

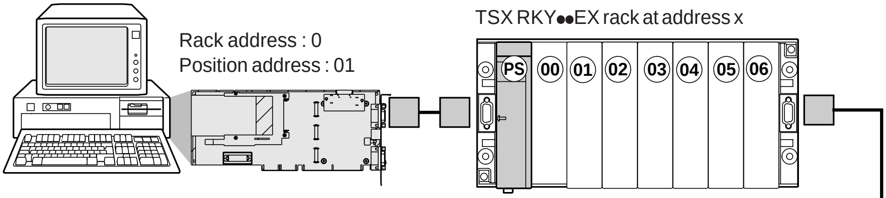
  Note : The racks can be addressed in any order on Bus X.

Using a standard format power supply module :



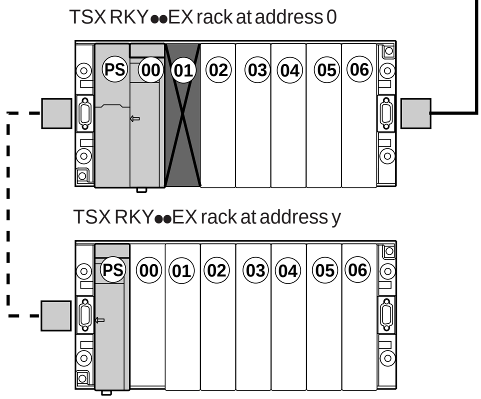
Special feature of rack at address 0 :
- The power supply module always occupies position PS.
- Position 00, virtual slot for the processor, must be empty.
- The other modules should be installed from position 01 onwards.

Using a double format power supply module :



Special feature of rack at address 0 :

- The power supply module always occupies positions PS and 00.
- Position 01, the virtual slot for the processor, must be empty.
- The other modules should be installed from position 02 onwards.

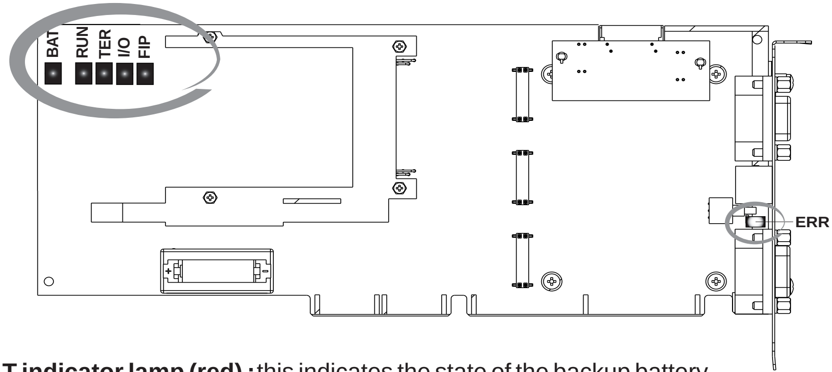


⚠ **The slot corresponding to the address of the PCX 57 processor (physically free on the rack) should not be used by another module.**

⚠ **For the PCX 57 processor to read its address on Bus X, the Bus X address must be configured using the micro-switches on the processor card.** (See section 6.5-4 : preliminary operations before installing the processor in the PC).

3.3-5 Display

Six indicator lamps (BAT, RUN, TER, I/O, FIP and ERR) on the processor card enable rapid diagnostics of the PLC status.
Because of the lack of space available on the front cover, only the ERR indicator lamp is visible when the PC receiving the processor is closed. In order to assist the user, the state of the RUN, I/O and ERR and FIP indicator lamps is displayed via a utility in the Windows 95 or Windows NT system taskbar on the PC in which the processor card is installed. This function is only available when the host PC is operational (ISAWAY driver installed).



BAT indicator lamp (red) : this indicates the state of the backup battery for the processor internal RAM memory.

- on if battery missing, run down, wrong way round, or incompatible type
- off during normal operation,

RUN indicator lamp (green) : shows the application status

- On : PLC running normally, program execution,
- Flashing : PLC stopped or affected by software blocking fault,
- Off : the PLC is not configured : application missing, invalid or incompatible. PLC in error mode : processor or system fault.

TER indicator lamp (yellow) : signals activity on the TER terminal port

- Flashing : link active. The frequency of flashing depends on the amount of traffic
- Off : link inactive

I/O indicator lamp (red) : signals configuration faults and faults arising from other station modules :

- On : I/O fault originating from another module or channel, or a configuration fault
- Flashing : Bus X fault (1),
- Off : normal status, no internal fault.

FIP indicator lamp (yellow), only on TPCX 57 3512 processors : this indicates activity on the FIPIO bus

- Flashing : link active. The frequency of flashing depends on the amount of traffic
- Off : link inactive

ERR indicator lamp (red) : signals faults relating to the processor and its ancillary equipment (memory card and PCMCIA communication card)

- On : PLC in error mode : processor or system fault,
- Flashing :
  - PLC not configured (application missing, invalid or incompatible).
  - PLC affected by software blocking fault,
  - memory card battery fault
  - Bus X fault (1)
- Off : normal status, no internal fault.

(1) A Bus X fault is indicated by the ERR and I/O indicator lamps flashing simultaneously.

3.4 Auxiliary functions common to all processors

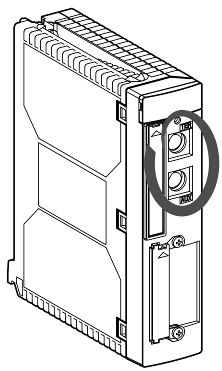
3.4-1 Terminal port

- **On TSX 57 and PMX 57 processors**

Each processor has a terminal port (non-isolated RS 485 link), with two 8-pin mini-DIN connectors, used to physically connect two devices on the processor front panel :

- **TER connector :**

This is used to connect an FTX type or PC compatible terminal, or to connect the PLC to the UNI-TELWAY bus by means of the TSX P ACC 01 isolator box. This port enables power of 5V to be supplied to the connected accessory (within the limits of the current available from the power supply unit).

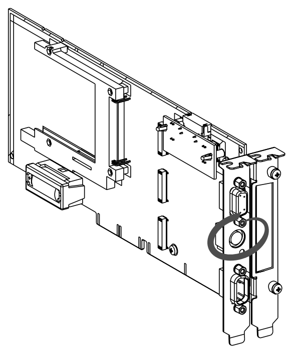


- **AUX connector :**
This is used to connect a peripheral device with its own power supply, (terminal, man-machine interface terminal or printer) (no voltage supplied to this connector).

The default communication mode for the TER and AUX connectors is UNI-TELWAY master at 19200 bauds and, by configuration, UNI-TELWAY slave mode or ASCII character mode.

- **On PCX 57 processors**

Each processor has a terminal port (non-isolated RS 485 link), with two 8-pin mini-DIN connectors, used to physically connect a device to the processor :



- **TER connector :**
This is used to connect an FTX type or PC compatible terminal, or to connect the PLC to the UNI-TELWAY bus by means of the TSX P ACC 01 isolator box. This port enables power of 5V to be supplied to the connected accessory (within the limits of the current available from the PC power supply).

The default communication mode for the terminal port is UNI-TELWAY master at 19200 bauds and, by configuration, UNI-TELWAY slave mode or ASCII character mode.

Note :
The various connection possibilities and the different operating modes for these terminal ports are explained in the "Communication, Bus and Network Interfaces Installation Manual - Volume 3".

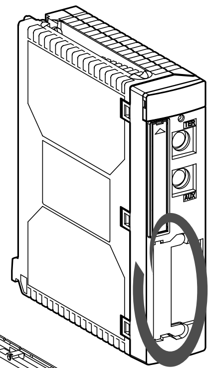
3.4-2 Slot for PCMCIA communication card

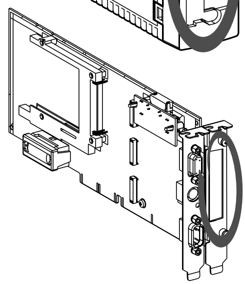
Each processor has a slot for inserting a type 3 PCMCIA format communication card.
This slot can take any card which conforms to the internal interface standard.

⚠ **Do not insert or remove a communication card when the processor is powered up.**

Note : Further information on how to install the various communication cards is provided in the "Communication, Bus and Network Interfaces Installation Manual - Volume 3"

Processors :
TSX P57
TPMX P57

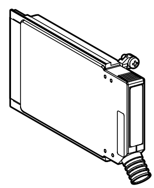




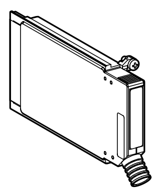
Processor :
PCX 57

The various types of communication card, which can be integrated in the following processors :

- **TSX SCP111** : multiprotocol card (UNI-TELWAY, Modbus/Jbus, character mode), RS 232 D, 9 signals, non-isolated,
- **TSX SCP112 :** multiprotocol card (UNI-TELWAY, Modbus/Jbus, character mode), current loop (20mA CL),
- **TSX SCP114 :** multiprotocol card (UNI-TELWAY, Modbus/Jbus, character mode), RS 485, compatible with isolated RS 422,
- **TSX FPP 10 :** FIPIO Agent bus card,
- **TSX FPP 20 :** FIPWAY network card,
- **TSX MBP 100 :** Modbus+ network card,
- **TSX MDM 10 :** Modem cards.



Type 3 PCMCIA communication cards



3.4-3 Memories

- **Internal RAM memory**

  Each processor has an internal RAM memory. This memory can receive the whole application. If this is too large, the memory can be extended by a PCMCIA memory card.

Processors	Internal RAM memory capacity
TSX P 57 102 - TPCX 57 1012	32 K16
TSX P57 202 - T PMX P57 102/202	48 K16
TSX P57 252/302	64 K16
TSX P57 352 - T PMX P57 352 - TPCX 57 3512	80 K16
TSX P57 402	96 K16
TSX P57 452 - TPMX P57 452	96/112 K16(1)

(1) When the application is stored in the internal RAM, memory capacity is limited to 96 K16.
When the application is in the PCMCIA card, the internal memory capacity is 112 K16.

Note : Organization of the application memory (internal RAM + PCMCIA memory card) is described in this part - section 8.4.

Internal RAM memory backup :

- On TSX 57 and PMX 57 processors

The processor internal RAM memory can be protected by an optional battery located in the power supply module. This protection is obviously only effective if the power supply and processor modules are in place on the rack.

- **On PCX 57 processors**

The processor internal RAM memory can be protected by an optional battery located on the processor card.

Backup period

The backup period depends on two factors :

- the percentage of time for which the PLC is powered down and thus the time for which the battery is used,
- the ambient temperature when the PLC is powered down

Ambient temperature when powered down		≤30°C	40°C	50°C	60°C
Backup period	PLC powered down 12 hours/day	5 years	3 years	2 years	1 year
	PLC powered down 1 hour/day	5 years	5 years	4.5 years	4 years

The processors have their own local backup facility which is effective when removing :

- the battery from the TSX PSY power supply (backup on TSX/PMX 57 processors),
- the battery from the PCX 57 processor card.

The backup period depends on the ambient temperature. If the processor was previously powered up, the guaranteed time varies as follows :

Ambient temperature during power down	20°C	30°C	40°C	50°C
Backup period	2 h	45 min	20 min	8 min

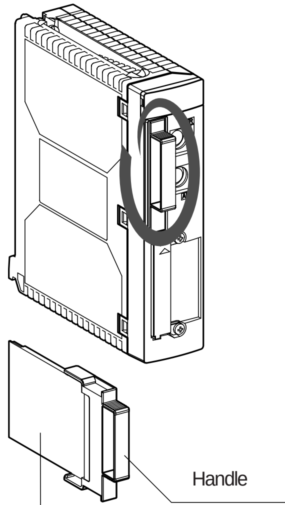
- **PCMCIA memory extension card on TSX 57 / PMX 57 processor**

The slot located on the processor front panel, protected by a cover, can be used to insert an optional type 1 PCMCIA format memory card. This card can be used to extend the processor internal memory in order to store the application program and the constants.

Note : before inserting a PCMCIA memory card, the protective cover must first be removed.

Handling PCMCIA memory cards with the power on
A PCMCIA memory card can be inserted or removed with the power on. To become operational, the memory card handle must be fitted; if this is missing, the processor will not start (processor faulty, ERR indicator lamp on). When a memory card complete with handle is inserted, this causes the processor to cold-start.

⚠ **If the program contained in the PCMCIA memory card has the RUN AUTO option, the processor automatically starts in RUN once the card has been inserted.**

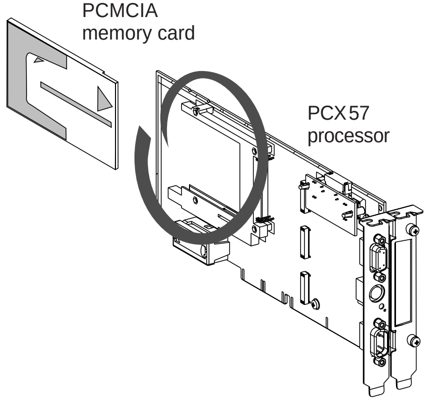


- **PCMCIA memory extension card on PCX 57 processor**

PCX 57 processors have a slot which can take a type 1 PCMCIA format memory extension communication card.

⚠ **The memory cards inserted in a PCX 57 processor do not have a handle, thus they must be inserted or removed with the PC powered down.**

PCMCIA memory cards do not have a location coding device, so should be inserted in the direction shown in the diagram opposite.



⚠ **If the program contained in the PCMCIA memory card has the RUN AUTO option, the processor automatically starts in RUN once the card has been inserted and the PC started.**

Three types of memory card are available :

- **Standard memory cards :**
  - protected RAM type memory extension card :
    used predominantly during creation and debugging of the application program, this can be used for all online functions for transferring and modifying the application. The memory is protected by a removable battery integrated in the memory card.
  - Flash Eprom type memory extension card :
    used once the application program has been debugged, this can only be used to perform a global transfer of the application and to overcome the problems of battery backup.
- **BACKUP type memory card :**
  Already loaded with the application program, this can be used to reload the application program into the processor internal RAM memory without needing to use a programming terminal.
  This card cannot be used unless the application is only in the processor internal RAM memory and the total size (program + constants) is less than 32 Kwords.

References of standard and Backup type memory extension cards

References	Type/Capacity	Processor compatibility		
		TSX P57 102 **TPMX P57 102** **TPCX 57 1012**	**TSX P57 2•2** **TPMX P57 202**	**TSX P57 3•2** **TSX P57 4•2** **TPMX P57 352** **TPMX P57 452** **TPCX 57 3512**
TSX MRP 032P	RAM/32 K16	Yes	Yes	Yes
TSX MRP 064P	RAM/64 K16	Yes	Yes	Yes
TSX MRP 0128P	RAM/128 K16	No	Yes	Yes
TSX MRP 0256P	RAM/256 K16	No	No	Yes
TSX MFP 032P	Flash Eprom/32 K16	Yes	Yes	Yes
TSX MFP 064P	Flash Eprom/64 K16	Yes	Yes	Yes
TSX MFP 0128P	Flash Eprom/128 K16	No	Yes	Yes
TSX MFP BAK032P	BACKUP/32 K16	Yes	Yes	Yes

Note:

- Memory capacity : K16 = Kwords (word of 16 bits)
- Organization of the application memory (internal RAM + PCMCIA memory card) is described in this part - section 8.4

- **Application + files memory cards**

  In addition to the traditional application storage zone, these memory cards have :
  - for all cards, a file area for archiving data by program.
    Application examples :
    - automatic storage of application data and remote viewing via modem link
    - storage of manufacturing recipes
    - etc
  - for some cards, an area for archiving the client application symbol database. This symbol database is compressed to that it does not cause any space problems in the zone allocated to it (128 K16).

  There are two types of memory card :
  - application + files protected RAM type memory extension card . The memory is protected by a removable battery integrated in the memory card.
  - application + files Flash Eprom memory extension card . In this case, the data storage area is protected RAM, which means that this type of card must have a backup battery.

References of application + files memory extension cards

References	**Type/Capacity**			**Compatibility with processors**		
	Application area	File area (type RAM)	Symb. area (RAM type)	**TSXP57102 TPMXP57102 TPCX571012**	**TSXP572•2 TPMX P57202**	**TSXP573•2 TSXP574•2 TPMXP57452 TPCX573512**
TSX MRP 232P	RAM/32 K16	128 K16	–	Yes	Yes	Yes
TSX MRP 264P	RAM/64 K16	128 K16	–	Yes	Yes	Yes
TSX MRP 2128P	RAM/128 K16	128 K16	128 K16	No	Yes	Yes
TSX MRP 3256P	RAM/256 K16	640 K16 (5x128K16)	128 K16	No	No	Yes
TSX MFP 232P	Flash Eprom/ 32 K16	128 K16	–	Yes	Yes	Yes
TSX MFP 264P	Flash Eprom/ 64 K16	128 K16	–	Yes	Yes	Yes

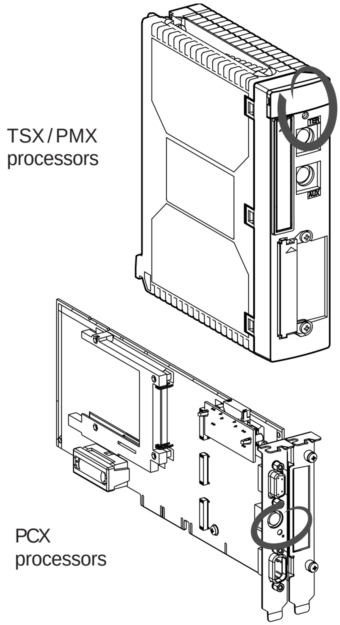
3.4-4 Processor RESET pushbutton

Using a pencil to push this button on the processor front panel causes the application to cold-start :

- Processor in normal operation :
  cold start in STOP or in RUN, according to procedure defined at the time of configuration,
- Processor faulty :
  forced start in STOP.

Note :
The operating modes which are effective after a cold start are described in this part - section 9

⚠ **On PCX 57 processors the RESET button should be pressed with an insulated object.**



3.4-5 Realtime clock

Each processor has a battery-backed realtime clock which manages :

- the current date and time,
- the date and time of the last application stop

The date and time are still managed when the processor is powered down (see the backup period, section 3.4-3) provided that :

- The TSX/PMX 57 processor is mounted on the rack with its power supply module in place, and fitted with a backup battery,
- The PCX 57 processor is fitted with a backup battery.

- **Current date and time**

  The processor updates the current date and time in system words %SW49 to %SW53. This data is encoded in BCD format.

System words	High order byte	Low order byte
%SW49	00	Days of the week (1 to 7)
%SW50	Seconds (0 to 59)	00
%SW51	Hours (0 to 23)	Minutes (0 to 59)
%SW52	Month (1 to 12)	Days of the month (1 to 31)
%SW53	Century (0 to 99)	Year (0 to 99)

- **Access to the date and time :**

  - via the processor debug screen,
  - via the program :

  reads : system words %SW49 to %SW53 if system bit %S50 = 0

  immediate updating : writes system words %SW49 to %SW53 if system bit %S50 = 1

  incremental updating : system word %SW59 is used to set the date and time field by field starting from the current value if system bit %S59 = 1

bit 0 = 1 increments the day of the week	bit 8 =1 decrements the day of the week
bit 1 = 1 increments the seconds	bit 9 =1 decrements the seconds
bit 2 = 1 increments the minutes	bit 10 =1 decrements the minutes
bit 3 = 1 increments the hours	bit 11 = 1 decrements the hours
bit 4 = 1 increments the days	bit 12 = 1 decrements the days
bit 5 = 1 increments the months	bit 13 = 1 decrements the months
bit 6 = 1 increments the years	bit 14 = 1 decrements the years
bit 7 = 1 increments the centuries	bit 15 = 1 decrements the centuries

Note : the processor does not manage the changeover from winter to summer time automatically.

- **Date and time of the last application stop**

The date and time of the last application stop are stored in BCD format in system words %SW54 to %SW58.

System words	High order byte	Low order byte
%SW54	Seconds (0 to 59)	00
%SW55	Hours (0 to 23)	Minutes (0 to 59)
%SW56	Month (1 to 12)	Days of the month (1 to 31)
%SW57	Century (0 to 99)	Year (0 to 99)
%SW58	Day of the week (1 to 7)	Cause of the last application stop

- access to the date and time of the last application stop :
  By reading system words %SW54 to %SW58
- cause of the last application stop :
  By reading the low order byte of system word %SW58 (value stored in BCD format)
  %SW58 = 1 application changes to STOP mode,
  %SW58 = 2 stops the application after a software fault,
  %SW58 = 4 power break or the power supply RESET button pressed
  %SW58 = 5 stop due to hardware fault
  %SW58 = 6 application stop after HALT instruction

3.5 Characteristics

3.5-1 General characteristics

TSX 57 processors		TSX P ➜	57 102	57 202	57 252
Maximum configuration	Max. no. of TSX RKY12EX racks		2	8	8
	Max. no. of TSX RKY 4EX/4EX/8EX racks		4	16	16
	Max. no. of slots (1)		21/27	87/111	87/111
Functions	I/O profile (2)		fixed	fixed	fixed
	Maximum number of channels	In-rack discrete I/O	512	1024	1024
		In-rack analog I/O	24	80	80
		Application-specific (3)	8	24	24
	Maximum number of connections	Integrated UNI-TELWAY (terminal port)	1	1	1
		Network (ETHWAY, FIPWAY, Modbus +)	1	1	1
		FIPIO master (integrated)	-	-	1
		Third party fieldbus	-	1	1
		AS-i fieldbus	2	4	4
	Realtime clock can be backed up		Yes	Yes	Yes
Memory	Internal protected RAM		32K16	48K16	64K16
	PCMCIA memory card (maximum capacity)		64K16	128K16	128K16
	Max. memory size		96K16	176K16	192K16
Application structure	Master task		1	1	1
	Fast task		1	1	1
	Event processing (1 event has priority)		32	64	64
Application code execution time for 1K instructions	Internal RAM	100% Boolean	0.72 ms	0.31 ms	0.31ms
		65% Boolean+35% numerical	1.39 ms	0.78 ms	0.78 ms
	PCMCIA card	100% Boolean	0.72 ms	0.47 ms	0.47 ms
		65% Boolean+35% numerical	1.39 ms	0.98 ms	0.98 ms
System overhead	MAST task	no FIPIO bus used	2.9 ms	2 ms	2 ms
		FIPIO bus used	–	–	3.8 ms
	FAST task		0.8 ms	0.6 ms	0.6 ms

(1) 21 or 87 slots with 2 or 8 TSX RKY 12EX, 27 and 111 slots with 4 or 16 TSX RKT 8EX. For standard format modules, except power supply modules and processor.

(2) Fixed I/O profile : the number of discrete I/O, analog and application-specific channels is cumulative.

(3) Counter, axis control, etc, channels (see section 3.5-3 : number of app.-specific channels).

General characteristics (continued)

TSX 57 processors			TSX P ➜	57 302	57 352	57 402	57 452
Maximum	No. of TSX RKY 12EX racks			8	8	8	8
config.	No. of TSX RKY 4EX/4EX/8EX racks		16	16	16	16	
	Max. no. of slots (1)			87/111	87/111	87/111	87/111
Functions	I/O profile (2)			fixed	fixed	flexible	flexible
	Maximum	In-rack discrete I/O		1024	1024	2040	2040max
	number	In-rack analog I/O		128	128	255	255 max
	of channels	Application-specific (3)		32	32	48	48 max
	Maximum number	Integrated UNI-TELWAY (terminal port)		1	1	1	1
	of connections	Network (ETHWAY, FIPWAY, Modbus +)		3	3	4	4
		FIPIO master (integrated)		-	1	-	1
		Third party fieldbus (4)		2	2	2	2
		AS-i fieldbus		8	8	8	8
	Realtime clock can be backed up			Yes	Yes	Yes	Yes
Memory	Internal protected RAM		(K16)	64	80	96	96/112 (5)
	PCMCIA mem. card (max. capacity)		(K16)	256	256	256	256
	Max. memory size		(K16)	320	336	352	368
Application	Master task			1	1	1	1
structure	Fast task			1	1	1	1
	Event processing (1 event has priority)			64	64	64	64
Application code execution time for 1K instructions	Internal RAM	100% Boolean		0.31 ms	0.31 ms	0.31 ms	0.31 ms
		65% Boolean+35% num.		0.78 ms	0.78 ms	0.5 ms	0.5 ms
	PCMCIA card	100% Boolean		0.47 ms	0.47 ms	0.47 ms	0.47 ms
		65% Boolean+35% num.		0.98 ms	0.98 ms	0.68 ms	0.68 ms
System	MAST task	no FIPIO bus used		2 ms	2 ms	0.6 ms	0.6 ms
overhead		FIPIO bus used		–	3.8 ms	–	1.1 ms
	FAST task			0.6 ms	0.6 ms	0.2 ms	0.2 ms

(1) 87 slots with 8 TSX RKY 12EX racks, 111 slots with 16 TSX RKY 8EX racks. For standard format modules, except power supply modules and processor.
(2) Fixed I/O profile : the number of discrete I/O, analog and app.-specific channels is cumulative. Flexible I/O profile : the number of discrete I/O, analog and application-specific channels is not cumulative, distribution is defined by a formula (see section 3.5-4).
(3) Counter, axis control, etc, channels (see section 3.5-3 : number of app-specific channels).
(4) INTERBUS-S, PROFIBUS-DP. (5) See section 3.4-3

General characteristics (continued)

PMX 57 processors			**TPMX P ➜**	**57 102**	**57 202**	**57 352**	**57 452**
Maximum configuration	No. of TSX RKY 12EX racks			2	8	8	8
	No. of TSX RKY 4EX/6EX/8EX racks			4	16	16	16
	Max. no. of slots (1)			21/27	87/111	87/111	87/111
Functions	I/O profile (2)			fixed	fixed	fixed	flexible
	Maximum number of channels	In-rack discrete I/O		512	1024	1024	2040max
		In-rack analog I/O		24	80	128	255 max
		Application-specific (3)		8	24	32	48 max
	No. of control loops managed			10	10	10	10
	Maximum number of connections	Integrated UNI-TELWAY (terminal port)		1	1	1	1
		Network (ETHWAY, FIPWAY, Modbus +)		1	1	3	4
		FIPIO master (integrated)		-	1	-	1
		Third party fieldbus (4)		-	1	2	2
		AS-i fieldbus		2	4	8	8
	Realtime clock can be backed up			Yes	Yes	Yes	Yes
Memory	Internal protected RAM		(K16)	48	48	80	96/112 (5)
	PCMCIA mem. card (max. capacity)		(K16)	64	128	256	256
	Max. memory size		(K16)	112	176	336	368
Application structure	Master task			1	1	1	1
	Fast task			1	1	1	1
	Event processing (1 event has priority)			32	64	64	64
Application code execution time for 1K instr.	Internal RAM	100% Boolean		0.31 ms	0.31 ms	0.31 ms	0.31 ms
		65% Boolean+35% numerical		0.78 ms	0.78 ms	0.5 ms	0.5 ms
	PCMCIA card	100% Boolean		0.47 ms	0.47 ms	0.47 ms	0.47 ms
		65% Boolean+35% numerical		0.98 ms	0.68 ms	0.68 ms	0.68 ms
Processing time	Process loop		(ms)	4 to 9.5	0.4 to 1	0.4 to 1	0.4 to 1
	Cascaded loop		(ms)	8 to 16	0.8 to 1.6	0.8 to 1.6	0.8 to 16
System overhead	MAST task	no FIPIO bus used		2 ms	0.6 ms	0.6 ms	0.6 ms
		FIPIO bus used		–	1.1 ms	–	1.1 ms
	FAST task			0.6 ms	0.2 ms	0.2 ms	0.2 ms

(1) 21 or 87 slots with 2 or 8 TSX RKY 12EX racks, 27 or 111 slots with 4 or 16 TSX RKY 8EX racks. For standard format modules, except power supply modules and processor.

(2), (3), (4), (5) : See definition on previous page.

General characteristics (continued)

PCX 57 processors			**TPCX →**	**57 1012**	**57 3512**
Maximum configuration	Max. no. of TSX RKY ••EX racks			2	8
	No. of TSX RKY 4 EX/6EX/8EX racks			4	16
	Max. no. of slots (1)			21/27	87/111
Functions	I/O profile (2)			fixed	fixed
	Maximum number of channels	In-rack discrete I/O		512	1024
		In-rack analog I/O		24	128
		Application-specific (3)		8	32
	Maximum number of connections	Integrated UNI-TELWAY (terminal port)		1	1
		Network (ETHWAY, FIPWAY, Modbus +)		1	3
		FIPIO master (integrated)		-	1
		Third party fieldbus (4)		-	2
		AS-i fieldbus		2	8
	Realtime clock can be backed up			Yes	Yes
Memory	Internal protected RAM			32K16	80K16
	PCMCIA memory card (maximum capacity)			64K16	256K16
	Max. memory size			96K16	336K16
Application structure	Master task			1	1
	Fast task			1	1
	Event processing (1 event has priority)			32	64
Application code execution time for 1K inst.	Internal RAM	100% Boolean		0.72 ms	0.31 ms
		65% Boolean+35% numerical		1.39 ms	0.78 ms
	PCMCIA card	100% Boolean		0.72 ms	0.47 ms
		65% Boolean+35% numerical		1.39 ms	0.98 ms
System overhead	MAST task	no FIPIO bus used		2.9 ms	2 ms
		FIPIO bus used		–	3.8 ms
	FAST task			0.8 ms	0.6 ms

(1) 21 or 87 slots with 2 or 8 TSX RKY 12EX racks, 27 or 111 slots with 4 or 16 TSX RKY 8EX racks. For standard format modules, except power supply modules and processor.

(2) Fixed I/O profile : the number of discrete I/O, analog and application-specific channels is cumulative.

(3) Counter, axis control, etc, channels (see section 3.5-3 : number of application-specific channels).

(4) INTERBUS-S, PROFIBUS-DP.

General characteristics (continued)

Programming software	PL7 Junior under Windows 95/98 or NT
Programming languages	Ladder language, Grafcet language, Structured Text language, List language

3.5-2 Electrical characteristics

Since the processors can accept certain devices which do not have their own power supply, the power consumption of these devices must be taken into account when calculating the overall power consumption.

- Devices without their own power supply which can be connected to the terminal port
  - Adjustment terminal : T FTX 117 ADJUST,
  - TSX P ACC01 box for connection to the UNI-TELWAY bus.
- Devices without their own power supply which can be integrated in the processor :
  - TSX FPP 10/20 PCMCIA communication cards
  - TSX SCP 111/112/114 PCMCIA communication card
  - TSX MBP 100 PCMCIA communication card
  - TSX MDM 10 modem card

TSX 57 and PMX 57 processors

Consumption of TSX PSY ●●● power supply module at 5VDC		Typical	Maximum
Processors +	TSX P 57 102	440 mA	600 mA
PCMCIA memory card	TSX P 57 202/302 TPMX P57 102	450 mA	650 mA
	TSX P 57 252/352	500 mA	750 mA
	TSX P 57 402 TPMX P57 202	1300 mA	1700 mA
	TSX P57 452 TPMX P57 352/452	1350 mA	1750 mA
Dissipated power		**Typical**	**Maximum**
Processors +	TSX P 57 102	2.2 W	3 W
PCMCIA memory card	TSX P 57 202/302 TPMX P57 102	2.25 W	3.25 W
	TSX P 57 252/352	2.5 W	3.75W
	TSX P 57 402 TPMX P57 202	6.5 W	8.5W
	TSX P57 452 TPMX P57 352/452	6.75 W	8.75 W

PCX 57 processors

PCX 57 processors have their own 5 VDC power supply, generated from the 12 VDC power supply of the host PC. The 12 VDC power supply of the host PC must therefore have sufficient power to take a PCX 57 processor.

Consumption of host PC at 12 VDC		Typical	Maximum
Processors + PCMCIA memory card	TPCX 57 1012	550 mA	800 mA
	TPCX 57 3512	600 mA	900 mA
Dissipated power		**Typical**	**Maximum**
Processors + PCMCIA memory card	TPCX 57 1012	6.6 W	9.6W
	TPCX 57 3512	7.2 W	10.8 W

Limit voltage of host PC at 12 VDC		≥11.4 V	≤12.6 V

Devices which can be connected to or integrated in the processor

TSX PSY ••• power supply module consumption at 5 VDC		Typical	Maximum
Devices without their own power supply which connect to the terminal port (TER)	T FTX 117 ADJUST	310 mA	340 mA
	TSX P ACC01	150 mA	250 mA
PCMCIA communication cards which can be integrated in the processor	TSX FPP 10	330 mA	360 mA
	TSX FPP 20	330 mA	360 mA
	TSX SCP 111	140 mA	300 mA
	TSX SCP 112	120 mA	300 mA
	TSX SCP 114	150 mA	300 mA
	TSX MBP 100	220 mA	310 mA
	TSX MDM 10	195 mA	-
Dissipated power		**Typical**	**Maximum**
Devices without their own power supply which connect to the terminal port (TER)	T FTX 117 ADJUST	1.5 W	1.7 W
	TSX P ACC01	0.5 W	1.25 W
PCMCIA communication cards which can be integrated in the processor	TSX FPP 10	1.65 W	1.8 W
	TSX FPP 20	1.65 W	1.8 W
	TSX SCP 111	0.7 W	1.5 W
	TSX SCP 112	0.6 W	1.5 W
	TSX SCP 114	0.75 W	1.5 W
	TSX MBP 100	1.1 W	1.55 W
	TSX MDM 10	0.975 W	-

3.5-3 Definition and number of application-specific channels

App.-specific function		Module/card	App.-specific channels	No.
Counting		TSX CTY 2A	Yes	2
		TSX CTY 2C	Yes	2
		TSX CTY 4A	Yes	4
Motion control		TSX CAY 21	Yes	2
		TSX CAY 41	Yes	4
		TSX CAY 22	Yes	2
		TSX CAY 42	Yes	4
		TSX CAY 33	Yes	3
Stepper motor control			TSX CFY 11	Yes 1
		TSX CFY 21	Yes	2
Weighing		TSX ISP Y100	Yes	2
Communication	Serial links	TSX SCP11● (in the processor)	No	0 (*)
		TSX SCP11● (in the TSX SCY 21●)	Yes	1
		TSX JNP11● (in the TSX SCY 21●)	Yes	1
		TSX SCY 21 (integrated channel)	Yes	1
	Modem	TSX MDM10	Yes	1
	FIPIO agent	TSX FPP10 in the processor	No	0 (*)
	FIPIO master	integrated in the processor	No	0 (*)

(*) Although these channels are application-specific channels, they are not to be taken into account when calculating the maximum number of application-specific channels supported by the processor.

Note : only those channels configured using PL7 Junior or PL7 Pro software are counted.

3.5-4 I/O profile

- **Fixed I/O profile :**
  The maximum number of in-rack discrete I/O, analog I/O and application-specific channels indicated in the various characteristics tables is cumulative.
- **Flexible I/O profile :**
  The maximum number of in-rack discrete I/O, analog I/O and application-specific channels indicated in the various characteristics tables of the TSX/PMX P57 4•2 processors is not cumulative.

  Each channel and group of channels (discrete, analog, application-specific) occupies space in the internal RAM and the system RAM. Since the system RAM is limited to **8800 bytes**, the user must calculate the **system RAM** usage of the various modules and application-specific channels used in his terminal so that the system RAM occupation is less than 8800 bytes.

  Note : If the system RAM occupation is greater than 8800 bytes, this will lead to a NON CONFIGURED state of the processor when the application has been loaded.

  The table on the next page gives the system RAM usage level for each type of module.

Type of module		System RAM usage in bytes	
		Per module	**Per channel**
8 or 16-channel discrete I/O : TSX DEY• / TSX DSY•		40	–
28-channel discrete I/O : TSX DMY•		120	–
32 & 64-channel discrete I/O (1) : TSX DEY• / TSX DSY•		80	–
Safety : TSX PAY•		40	–
Bus X rackmaster : TSX REY 200		–	–
4, 8 or 16-channel analog : TSX AEY• / TSX ASY•		–	21
1, 2 or 4-channel counter : TSX CTY•		–	85
2, 3 or 4-channel axis control : TSX CAY•		–	30
1 or 2-channel stepper motor : TSX CFY•		–	30
Weighing : TSX ISP Y100		–	95
Serial link : TSX SCP 11•		–	25
Serial link : TSX SCY 2160•		–	25
Modem : TSX MDM 10		–	–
AS-i fieldbus : TSX SAY 100		60	–
FIPIO bus agent : TSX FPP10		–	–
Third party fieldbus	INTERBUS-S: TSX IBY 100	25	–
	PROFIBUS-DP: TSX PBY 100	25	–
Network	ETHWAY: TSX ETY 110/120/210,	25	–
	Modbus +: TSX MBP 100,	–	–
	FIPWAY:TSXFPP20	–	–

(1) Mixing tasks (MAST, FAST) in channel groups of a 64-channel discrete I/O module generates a system RAM memory usage equivalent to 20 additional bytes per channel group.

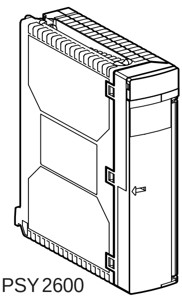
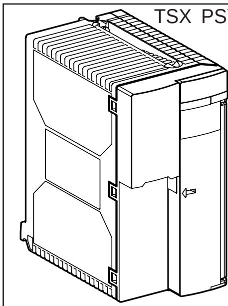
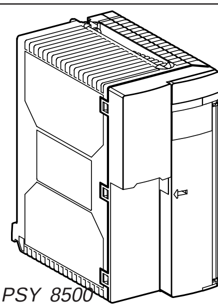
4.1 Presentation

4.1-1 General

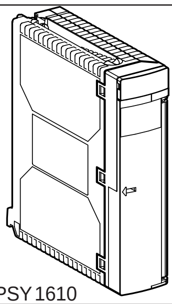
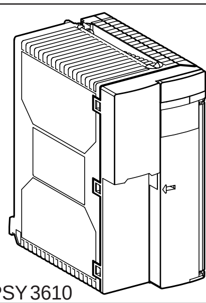
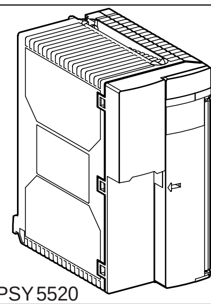
TSX PSY ●●●● power supply modules are designed to supply power to each TSX RKY ●●● rack and its modules. The power supply module is selected according to the distributed supply (DC or AC) and the required power (standard format or double format version).
Moreover, each power supply module has auxiliary functions such as :

- a display block, an alarm relay,
- a slot which takes a battery for backing up the data in the processor RAM memory,
- a pencil-point type pushbutton which, when pressed, simulates a power break, causing a warm restart of the application,
- a 24 VDC sensor power supply (only on versions powered by an AC supply).

Power supply modules for AC supply

Standard format model	Double format model	
 TSX PSY 2600	TSX PSY 5500 	 *TSX PSY 8500*
100...240 VAC	100...120 / 200...240 VAC	

Power supply modules for DC supply

Standard format model	Double format model	
 TSX PSY 1610	 TSX PSY 3610	 TSX PSY 5520
24 VDC, non-isolated		24...48 VDC, isolated

4.1-2 Physical description

Power supplies take the form of the following modules :
- standard format, for TSX PSY 2600 and TSX PSY 1610 modules,
- double format, for TSX PSY 5500/3610/5520/8500 modules.

1 Display block comprising :
  - an OK indicator lamp (green), on if the voltages are present and correct,
  - a BAT indicator lamp (red), on when the battery is defective or missing,
  - a 24V indicator lamp (green), on when the sensor voltage is present. This indicator lamp is only found on TSX PSY 2600/5500/8500 AC power supplies.

2 Pencil-point RESET button which, when pressed, causes a warm restart of the application.

3 Slot which takes a battery for backing up the processor internal RAM memory.

4 Cover which protects the module front panel.

5 Screw terminals for connection :
  - to the power supply network,
  - of the alarm relay contact,
  - of the sensor power supply for TSX PSY 2600/5500/8500 AC supplies.

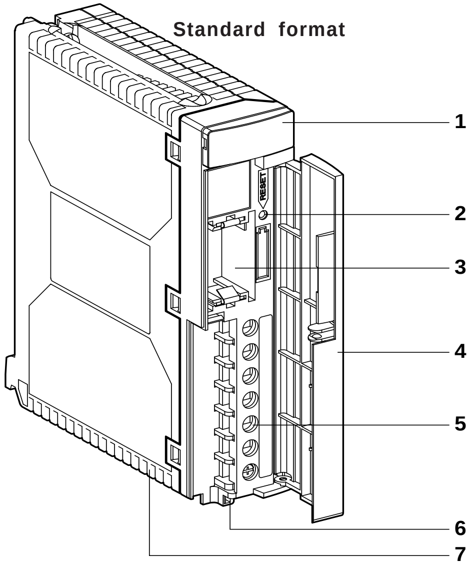
6 Hole for a cable clamp,

7 Fuse located under the module which protects :
  - the 24 VR voltage on the TSX PSY 3610 DC power supply,
  - the primary voltage on the TSX PSY 1610 DC power supply.

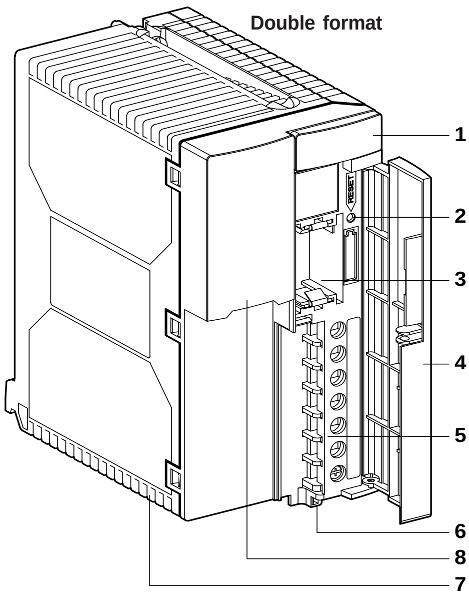
  Note : On the TSX PSY 2600/5500/5520/8500 power supplies, the protective fuse on the primary voltage is inside the module and cannot be accessed.

8 110/220 voltage selector, present only on the TSX PSY 5500/8500 AC power supplies. When delivered, the selector is set to 220.

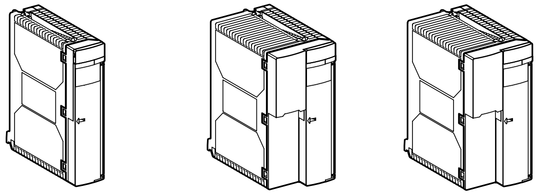
Standard format



Double format



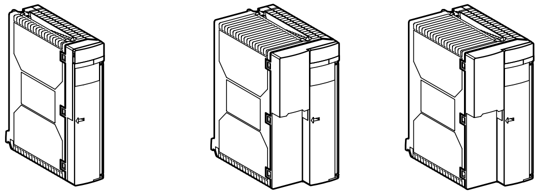
4.2 Catalog

Module type	Power supplies for AC supply		
			
Input characteristics			
Nominal voltages	100...240 VAC	100...120VAC / 200...240VAC	
Limit values	85...264 VAC	85...140VAC / 190...264VAC	
Limit frequency	47...63 Hz		
Accepted duration of AC supply micro-cuts	≤ 10 ms		
Apparent power	50 VA	150 VA	
Nominal input current	0.5A to 100V 0.3A to 240V	1.7A to 100V / 0.5A to 240V	
Output characteristics			
Total useful power	26 W	50 W	80 W
Output voltages ⎓	5V, 24VR (1), 24VC (2)		5V, 24VC (2)
Nominal current 5V ⎓	5 A	7 A	15 A
24VR ⎓	0.6 A	0.8 A	not supplied
24VC ⎓	0.5 A	0.8 A	1.6 A
Auxiliary functions			
Alarm relay	yes (1 N/O volt-free contact on terminal block)		
Display	yes, via indicator lamps on the front panel		
Backup battery	yes (status monitoring via indicator lamp on module front panel)		
Conformity to standards	IEC 1131-2		
References	**TSX PSY 2600**	**TSX PSY 5500**	**TSX PSY 8500**

(1) 24V ⎓ voltage for supplying power to the relays, installed on "relay output" modules.
(2) 24 V ⎓ voltage for supplying power to the sensors.

Catalog

Module type	Power supplies for DC supply		



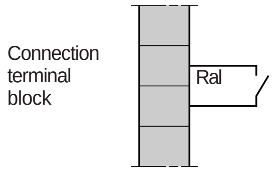
Input characteristics Nominal voltages	24 VDC non-isolated		24...48 VDC isolated
Limit values	19.2 ... 30 VDC		19.2...60 VDC
Accepted duration of AC supply micro-cuts	≤ 1ms		
Nominal input current	≤ 1.5 A	≤ 2.7A	≤ 3 A /24V ≤ 1.5A/48V
Output characteristics Total useful power	26 W	50 W	50 W
Output voltages ⎓	5V, 24VR (1)		
Nominal current 5V ⎓	3 A	7A	7 A
24VR ⎓	0.6 A	0.8 A	0.8 A
Auxiliary functions Alarm relay	yes (1 N/O volt-free contact on terminal block)		
Display	yes, via indicator lamps on the front panel		
Backup battery	yes (status monitoring via indicator lamp on module front panel)		
Conformity to standards	IEC 1131-2		
References	**TSX PSY 1610**	**TSX PSY 3610**	**TSX PSY 5520**

(1) 24V ⎓ voltage for supplying power to the relays, installed on "relay output" modules.

4.3 Auxiliary functions

- **Alarm relay**

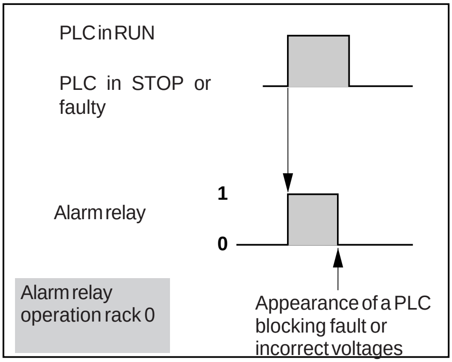
This relay, which is included in every power supply module, has a volt-free contact which can be accessed on the module screw connection terminals.



Principle

- **Alarm relay of the module located on the rack supporting the processor** (rack 0)

During normal operation, with the PLC running, the alarm relay is activated and its contact is closed (state 1). If the application stops, even partially, such as when a "blocking" fault appears, the output voltages are incorrect, or the supply voltage disappears, this relay is de-energized and its associated contact opens (state 0).



Note :
If using a PCX 57 type processor which can be integrated in a PC, the power supply alarm relay is not managed and thus is always open.

If this function is absolutely essential to correct operation of the installation, the power supply module alarm relay function may be replaced by using a relay output from a module on Bus X or the FIPIO bus. To do this, this output must be :
- a relay output,
- configured with a fallback to 0 (default configuration),
- initialized at state 1 before execution of the application program.

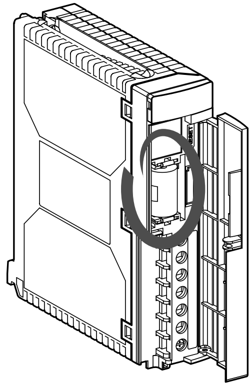
When configured in this way, the relay output will behave in the same way as the alarm relay controlled by a TSX 57 processor.

- **Alarm relay of modules located on the other racks** (racks 1 to 7)

Once the module is powered up and the output voltages are correct, the alarm relay is activated and its contact is closed (state 1).
If the supply voltage disappears or the output voltages are incorrect, the relay is de-energized (state 0).

These operating modes enable these contacts to be used in external failsafe safety circuits such as, for example, interlocking of preactuator power supplies, data feedback.

- **Backup battery**



Each power supply module has a slot to take a battery which supplies power to the internal RAM memory located in the processors, and therefore protects the data when the PLC is powered down. This battery, supplied in the same packaging as the power supply module, should be installed by the user, taking care to respect the polarity.

Note :
If using a PCX 57 type processor which can be integrated in a PC, the backup battery is built into the processor and its characteristics are the same as those described below.

- **Battery characteristics :** thionyl lithium chloride battery, 3.6 V / 0.8 Ah, size 1 / 2AA.
- **Replacement part reference :** TSX PLP 01
- **Data backup period :**
  The data backup period depends on two factors :
  - the percentage of time for which the PLC is powered down and thus the time for which the battery is used,
  - the ambient temperature when the PLC is powered down.

Ambient temperature when powered down		≤ 30°C	40°C	50°C	60°C
Backup period	PLC powered down 12 hours/day	5 years	3 years	2 years	1 year
	PLC powered down 1 hour/day	5 years	5 years	4.5 years	4 years

- **Monitoring the state of the battery :** When powered up, the power supply module monitors the state of the battery. In the event of a problem, the user receives a visual warning from the BAT indicator lamp (red), which comes on; if this happens, the battery must be changed immediately.
- **Changing the battery :** The battery can be changed with the power supply module powered up or immediately after it is powered down. In the latter instance, the user intervention time available is limited.

  The backup period depends on the ambient temperature. If the processor was previously powered up, the guaranteed time varies as follows :

Ambient temperature during power-down	20°C	30°C	40°C	50°C
Backup period	2 hrs	45 min	20 min	8 min

- **Display**

  Every power supply module has a display block comprising :

  - Three indicator lamps (OK, BAT, 24V) for TSX PSY 2600/ 5500/8500 AC power supplies,
  - Two indicator lamps (OK, BAT) for TSX PSY 1610/ 3610 / 5520 DC power supplies,

  OK indicator lamp (green) :
  - on during normal operation,
  - off when the output voltages are below the thresholds.

  BAT indicator lamp (red) :
  - off during normal operation,
  - on if battery missing, run down, wrong way round, or incompatible type.

  24V indicator lamp (green) :
  - on during normal operation,
  - off if the 24V sensor voltage delivered by the power supply is no longer present.

- **RESET pushbutton**

  Action on this pushbutton results in a sequence of service signals identical to that for :
  - a power break when pressed,
  - a power-up when released.

    These actions (press and release) effect a warm restart of the application (see section 8.5-2 - Part A).

- **Sensor power supply**

  TSX PSY 2600/5500/8500 AC power supplies have an integrated power supply which delivers a 24 VDC voltage to supply the sensors.

  This sensor power supply is accessible on the module screw terminal block.

  ⚠ **This power supply cannot be wired in parallel with an external power supply.**

  Note :

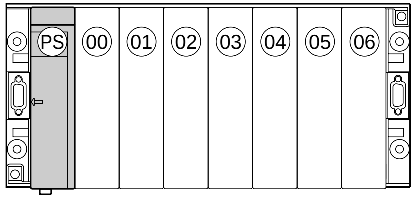
  The "24 VDC sensor supply" output on the TSX PSY 8500 module is SELV (safety extra low voltage) type. It therefore ensures the safety of the user.

4.4 Installation / insertion

4.4-1 Installation

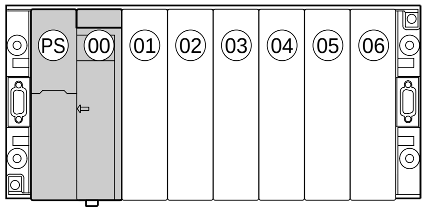
- TSX PSY 2600/1610 standard format power supply modules :

  These are installed in the first slot of each TSX RKY ... rack and occupy position PS.



- TSX PSY 3610/5500/5520/8500 double format power supply modules :

  These are installed in the first two slots of each TSX RKY ... rack and occupy positions PS and 00.



Note :
Every power supply module has a locating system which ensures that it can only be installed in the slots designated above.

Important

The TSX PSY 8500 power supply module does not supply a 24 VR voltage. Thus a rack which is fitted with this module will not be able to take some modules, such as relay output and weighing modules (see section 4.6).

4.4-2 Insertion / connections

Inserting modules : see section 6.4-1 of this part.

Connections : see section 7.2 of this part.

⚠ **When inserting or removing a TSX PSY .... power supply module, the external power supplies must be powered down.**

Important:

The PLC internal 0V is connected to the machine ground. The machine ground itself must be connected to the earth ground.

4.5 Characteristics

4.5-1 Characteristics of AC power supplies

References			**TSX PSY 2600**	**TSX PSY 5500**	**TSX PSY 8500**
Primary	Nominal voltages (V) ∿		100…240	100..120/200..240	100..120/200..240
	Limit voltages (V) ∿		85..264	85..140/ 190..264	85..140/ 170..264
	Nominal/limit frequencies		50 -60 / 47-63 Hz	50 -60 / 47-63 Hz	50 -60 / 47-63 Hz
	Apparent power		50 VA	150 VA	150 VA
	Nominal current drawn : Irms		≤ 0.5 A at 100 V ≤ 0.3 A at 240 V	≤ 1.7 A at 100 V ≤ 0.5 A at 240 V	≤ 1.4 A at 100 V ≤ 0.5 A at 240 V
	Initial power-up	I inrush	≤ 37 A at 100 V ≤ 75 A at 240 V	≤ 38 A at 100 V ≤ 38 A at 240 V	≤ 30 A at 100 V ≤ 60 A at 240 V
	at 25°C	I^2t on activation	0.63 A^2s at 100 V 2.6 A^2s at 240 V	4 A^2s at 100 V 2 A^2s at 240 V	15 A^2s at 100 V 8 A^2s at 240 V
	(1)	It on activation	0.034 As at 100V 0.067 As at 240V	0.11 As at 100V 0.11 As at 240V	0.15 As at 100V 0.15 As at 240V
	Accepted duration of micro-cuts		≤ 10 ms	≤ 10 ms	≤ 10 ms
	Integrated phase protection		by fuse inside module (cannot be accessed)		
Secondary	Total useful power		26 W	50 W	77/85/100 W (2)
	5VDC output	Nominal voltage	5.1 V	5.1 V	5.1 V
		Nominal current	5 A	7 A	15 A
		Power (typical)	25 W	35 W	75 W
	24VR output	Nominal voltage	24 VDC	24 VDC	not supplied
	(24V relay)	Nominal current	0.6 A	0.8A	not supplied
	(3)	Power (typical)	15 W	19 W	not supplied
	24VC output	Nominal voltage	24 VDC	24 VDC	24 VDC
	(24V sensor)	Nominal current	0.5 A	0.8 A	1.6 A
		Power (typical)	12 W	19 W	38 W
	Outputs protected against		overloads/short-circuits/overvoltages		
Dissipated power		10 W	20 W	20 W	
Conformity to standards			IEC 1131-2	IEC 1131-2	IEC 1131-2
Isolation	Dielectric withstand (50/60 Hz-1min)	primary/secondary primary/ground 24VDC output/ground	2000 Vrms 2000 Vrms	2000 Vrms 2000 Vrms –	3000 Vrms 3000 Vrms – 500 Vrms
	Insulation resistance	primary/secondary primary/ground	≥ 100 MΩ ≥ 100 MΩ	≥ 100 MΩ ≥ 100 MΩ	≥ 100 MΩ ≥ 100 MΩ

(1) These values should be taken into account when starting several devices simultaneously or when calculating the size of protection devices.
(2) 77 W at 60°C, 85 W at 55°C, 100 W at 55°C if the rack is fitted with fan modules.
(3) 24V ⎓ output for supplying power to "relay output" module relays.

4.5-2 Characteristics of DC power supplies

- **Non-isolated power supplies**

References			**TSX PSY 1610**	**TSX PSY 3610**
Primary	Nominal voltages		24 VDC	24 VDC
	Limit voltages (including ripple) (1)		19.2...30 VDC (possible up to 34V for 1 hour in 24 hours)	19.2...30 VDC
	Nominal input current : I rms at 24VDC		≤ 1.5 A	≤ 2.7 A
	Initial power-up	I inrush	≤ 100 A at 24 VDC	≤ 150 A at 24 VDC
	at	I^2t on activation	12.5 A^2s	20 A^2s
	25°C (2)	It on activation	0.2 As	0.5 As
	Accepted duration of AC supply micro-cuts		≤ 1 ms	≤ 1 ms
	Integrated protection on + input (fuse located under the module)		by 5x20 fuse, time-delay, 3.5 A	no
Secondary	Total useful power (typical)		30 W	50 W
	5VDC output	Nominal voltage	5 V	5.1 V
		Nominal current	3 A	7 A
		Power (typical)	15 W	35 W
	24VR output (3)	Nominal voltage	U supply — 0.6V	U supply — 0.6V
	(24 VDC relay)	Nominal current	0.6 A	0.8A
		Power (typical)	15 W	19 W
	Integrated protection	Overloads	yes	yes
	on outputs against	Short-circuits	yes	yes
	(4)	Overvoltages	yes	yes
Dissipated power			10 W	15 W
Conformity to standards			IEC 1131-2	IEC 1131-2

(1) When supplying power to modules with "relay outputs", the limit range is reduced to 21.6V...26.4V.

(2) These values should be taken into account when starting several devices simultaneously or when calculating the size of protection devices.

(3) 24 V ⎓ output for supplying power to the "relay output" module relays.

(4) The 24VR output voltage cannot be accessed by the user and is protected by a fuse located under the module (5x20, 4A, Medium).

- **Isolated power supply**

References			**TSX PSY 5520**
Primary	Nominal voltages		24...48 VDC
	Limit voltages (including ripple)		19.2...60 VDC
	Nominal input current : I rms		≤ 3 A at 24 VDC ≤ 1.5 A at 48 VDC
	Initial power-up	I inrush	≤ 15 A at 24 VDC ≤ 15 A at 48 VDC
	at 25°C	I^2t on activation	50 A^2s at 24 VDC 55 A^2s at 48 VDC
	(1)	It on activation	7 As at 24 VDC 6 As at 48 VDC
	Accepted duration of AC supply micro-cuts		≤ 1 ms
	Integrated protection on + input		by fuse inside the module (cannot be accessed)
Secondary	Total useful power (typical)		50 W
	5 VDC output	Nominal voltage	5.1 V
		Nominal current	7 A
		Power (typical)	35 W
	24 VR output (2)	Nominal voltage	24 V
	(24 VDC relay)	Nominal current	0.8 A
		Power (typical)	19 W
	Integrated protection	Overloads	yes
	on outputs against	Short-circuits	yes
		Overvoltages	yes
Dissipated power			20 W
Conformity to standards			IEC 1131-2
Isolation	Dielectric withstand	primary / secondary primary / ground	2000 Vrms - 50/60 Hz - 1 min 2000 Vrms - 50/60 Hz - 1 min
	Insulation resistance	primary / secondary primary / ground	≥ 10 MΩ ≥ 10 MΩ

(1) These values should be taken into account when starting several devices simultaneously or when calculating the size of protection devices.

(2) 24V ⎓ output for supplying power to the "relay output" module relays.

4.5-3 Characteristics of the alarm relay contact

Characteristics			Alarm relay contact			
Limit operating voltage	AC		19...264 V			
	DC		10...30 V (possible up to 34V for 1 hour in 24 hours)			
Thermal current			3 A			
AC load	Resistive AC12 duty	Voltage	∿ 24 V	∿ 48 V	∿ 110 V	∿ 220 V
		Power	50 VA (5)	50 VA (6) 110 VA (4)	110 VA (6) 220 VA (4)	220 VA (6)
	Inductive AC14 and AC15 duty	Voltage	∿ 24 V	∿ 48 V	∿ 110 V	∿ 220 V
		Power	24 VA (4)	10VA (10) 24 VA (8)	10 VA (11) 50 VA (7) 110 VA (2)	10 VA (11) 50 VA (9) 110 VA (6) 220 VA (1)
DC load	Resistive	Voltage	⎓ 24 V			
			40 W (3)			
	Inductive DC13 duty (L/R = 60 ms)	Voltage	⎓ 24 V			
		Power	10 W (8) 24 W (6)			
	Min. switchable load		1 mA / 5 V			
Response time	Activation		< 10 ms			
	Deactivation		< 10 ms			
Type of contact			Normally open			
Integrated protection	Against overloads and short-circuits		None, a quick-blow fuse must be fitted			
	Against inductive overvoltages in ∿		None, an RC circuit or MOV peak limiter (ZNO) suitable for the voltage must be fitted in parallel across the terminals of each preactuator			
	Against inductive overvoltages in ⎓		None, a discharge diode must be fitted across the terminals of each preactuator			
Isolation (test voltage)	Contact/ground		2000 Vrms - 50/60 Hz - 1 min (on TSX PSY 2600/ 5500/1610/3610/5520 modules). 3000Vrms - 50/60 Hz - 1 min (on TSX PSY 8500 module)			
	Insulation resistance		> 10 MΩ at 500 VDC			

(1) 0.1 x 10^6 operations
(2) 0.15 x 10^6 operations
(3) 0.3 x 10^6 operations
(4) 0.5 x 10^6 operations
(5) 0.7 x 10^6 operations.
(6) 1 x 10^6 operations.
(7) 1.5 x 10^6 operations.
(8) 2 x 10^6 operations.
(9) 3 x 10^6 operations.
(10) 5 x 10^6 operations.
(11) 10 x 10^6 operations.

4.6 Power consumption table for selecting a power supply module

The power required to supply a rack depends on the types of module installed on it. It is therefore necessary to draw up a power consumption table in order to define which power supply module should be inserted on the rack (standard or double format module).

The tables on the following pages show the typical consumption of each module and can be used to calculate the consumption of each rack and on each output according to which modules have been installed.

Power available on each power supply module

Power supply modules / Power (typical)	Standard format		Double format			
	TSX PSY 1610	**TSX PSY 2600**	**TSX PSY 3610**	**TSX PSY 5520**	**TSX PSY 5500**	**TSX PSY 8500**
Total useful power (all outputs included) (1)	30W (30 W)	26W (30W)	50W (55W)	50W (55W)	50W (55W)	77W at 60°C 85W at 55°C 100W with TSX FAN •
Power available on 5 VDC output	15 W	25 W	35 W	35 W	35 W	75 W
Power available on 24 VR output	15 W	15 W	19 W	19 W	19 W	not supplied
Power available on 24 VC output (sensor power supply on front panel term. blk)	not supplied	12 W	not supplied	not supplied	19 W	38 W

(1) The values in brackets are the maximum values which can be tolerated for 1 out of every 10 minutes. These values must not be included when calculating the consumption requirement.

Caution:

When defining the power requirements, the total power drawn on each output (5 VDC, 24 VR and 24 VC) must not exceed the total useful power of the module.

Important:

The TSX PSY 8500 power supply module has no 24 VR output for supplying certain modules with 24 VDC.
Thus, for all racks which have this type of power supply, the following measures should be taken :

- TSX DSY 08R• / 16R• relay output modules and the TSX ISP Y100 weighing module should not be installed on these racks.
- TSX ASY 800 analog output modules should be configured for an external power supply (3 modules maximum per rack).

Power consumption table

Rack number :								
Module type	**References**	**No.**	**Consumption in mA** (typical value) (1)					
			On 5 VDC		**On 24 VR**		**On 24 VC** (2)	
			Module	Total	Module	Total	Module	Total
Processor + PCMCIA memory card	TSX P57 102		440					
	TSX P57 202/302		450					
	TSX P57 252/352		500					
	TSX P57 402		1300					
	TSX P57 452		1350					
	T PMX P57 102		450					
	TPMX P57 202		1300					
	TPMX P57 352		1350					
	TPMX P57 452		1350					
Discrete inputs	TSX DEY 08D2		55				80	
	TSX DEY 16A2		80					
	TSX DEY 16A3		80					
	TSX DEY 16A4		80					
	TSX DEY 16A5		80					
	TSX DEY 16D2		80				135	
	TSX DEY 16D3		80				135	
	TSX DEY 16FK		250				75	
	TSX DEY 32D2K		135				160	
	TSX DEY 32D3K		140				275	
	TSX DEY 64D2K		155				315	
Total								

(1) The module consumption is given for 100% of inputs or outputs at state 1.
(2) If using an external ⎓ 24 V sensor power supply, do not take the consumption on this output into account when selecting the rack power supply.

Power consumption table (continued)

Rack number:								
Module type	**References**	**No.**	**Consumption in mA** (typical value) (1)					
			On 5VDC		**On 24VR**		**On 24VC** (2)	
			Module	Total	Module	Total	Module	Total
Report								
Discrete output	TSX DSY 08R4D		55		80			
	TSX DSY 08R5		55		70			
	TSX DSY 08R5A		55		80			
	TSX DSY 08S5		125					
	TSX DSY 08T2		55					
	TSX DSY 08T22		55					
	TSX DSY 08T31		55					
	TSX DSY 16R5		80		135			
	TSX DSY 16S4		220					
	TSX DSY 16S5		220					
	TSX DSY 16T2		80					
	TSX DSY 16T3		80					
	TSX DSY 32T2K		140					
	TSX DSY 64T2K		155					
Discrete I/O	TSX DMY 28FK		300				75	
	TSX DMY 28RFK		300				75	
Emergency stop safety	TSX PAY 262		150					
	TSX PAY 282		150					
Bus X remote location	TSX REY 200		500					
Total								

(1) The module consumption is given for 100% of inputs or outputs at state 1.
(2) If using an external ⎓ 24 V sensor power supply, do not take the consumption on this output into account when selecting the rack power supply.

Power consumption table (continued)

Rack number:								
Module type	References	No.	Consumption in mA (typical value) (1)					
			On 5VDC		On 24VR		On 24VC (2)	
			Module	Total	Module	Total	Module	Total
Report								
Analog	TSX AEY 414		660					
	TSX AEY 420		500					
	TSX AEY 800		270					
	TSX AEY 810		475					
	TSX AEY 1600		270					
	TSX AEY 1614		300					
	TSX ASY 410		990					
	TSX ASY 800 (3)		200		300			
Counter	TSX CTY 2A		280				30	
	TSX CTY 2C		850				15	
	TSX CTY 4A		330				36	
Axis control	TSX CAY 21		1100				15	
	TSX CAY 22		1100				15	
	TSX CAY 41		1500				30	
	TSX CAY 42		1500				30	
	TSX CAY 33		1500				30	
Stepper motor control	TSX CFY 11		510				50	
	TSX CFY 21		650				100	
Weighing	TSX ISP Y100		150		145			
Grand total								

(1) The module consumption is given for 100% of inputs or outputs at state 1.
(2) If using an external ⎓ 24 V sensor power supply, do not take the consumption on this output into account when selecting the rack power supply.
(3) If using an external ⎓ 24 VR power supply, do not take the 300 mA consumption on the internal 24 VR into account when selecting the rack power supply.

Power consumption table (continued)

Rack number:								
Module type	**References**	**No.**	**Consumption in mA** (typical value) (1)					
			On 5VDC		**On 24VR**		**On 24VC** (2)	
			Module	Total	Module	Total	Module	Total
Report								
Communication	TSX ETY 110 (3)		800					
	(4)		1200					
	TSX ETY 120 (3)		800					
	(4)		1200					
	TSX ETY 210 (3)		800					
	(4)		1200					
	TSX IBY 100		500					
	TSX PBY 100		400					
	TSX SAY 100		110					
	TSX SCY 21601		350					
	TSX SCP 111		140					
	TSX SCP 112		120					
	TSX SCP 114		150					
	TSX FPP 10		330					
	TSX FPP 20		330					
	TSX JNP 112		120					
	TSX JNP 114		150					
	TSX MBP 100		220					
	TSX MDM 10		195					
Grand total								

(1) The module consumption is given for 100% of inputs or outputs at state 1.
(2) If using an external ⎓ 24 V sensor power supply, do not take the consumption on this output into account when selecting the rack power supply.
(3) Without remote power supply (RJ45)
(4) With remote power supply (AUI)

Power consumption table (continued)

Rack number :								
Module type	**References**	**No.**	**Consumption in mA** (typical value) (1)					
			On 5V DC		**On 24 VR**		**On 24 VC** (2)	
			Module	Total	Module	Total	Module	Total
Report								
Other (devices without their own power supply which can be connected on the term. port)	TSX P ACC01		150					
	T FTX 117		310					
Grand total								

(1) The module consumption is given for 100% of inputs or outputs at state 1.
(2) If using an external ⎓ 24 V sensor power supply, do not take the consumption on this output into account when selecting the rack power supply.

Power requirement

The power requirement for a rack should be calculated on the basis of the consumption table drawn up using the tables defined on the preceding pages. The currents which apply to each output (5 VDC, 24 VR and 24 VC) are those which appear on the grand total line of the preceding table.

Rack number :			
1	Power required on 5 VDC output :	.... $x10^{-3}$A x 5 V	= .... W
2	Power required on 24 VR output :	.... $x10^{-3}$ A x 24 V	= .... W
3	Power required on 24 VC output :	..................$x10^{-3}$ A x 24 V	= .... W
4	Total power required :		= .... W

Caution : The power calculated should be compared to the power supplies in the table below.
- Power required on each output - power available on each output :
  1 - 1a, 2 - 2a, 3 - 3a
- Sum of the power required on each output - total power available :
  4 - 4a

Power available (at each output and total)

Power available / Modules	On 5 VDC output	On 24 VR output	On 24 VC output	Total
	1a	**2a**	**3a**	**4a**
TSX PSY 1610	15 W	15 W	—	30 W
TSX PSY 2600	25 W	15 W	12 W	26 W
TSX PSY 3610	35 W	19 W	—	50 W
TSX PSY 5520	35 W	19 W	—	50 W
TSX PSY 5500	35 W	19 W	19 W	50 W
TSX PSY 8500	75 W	—	38 W	77/85/100 W (1)

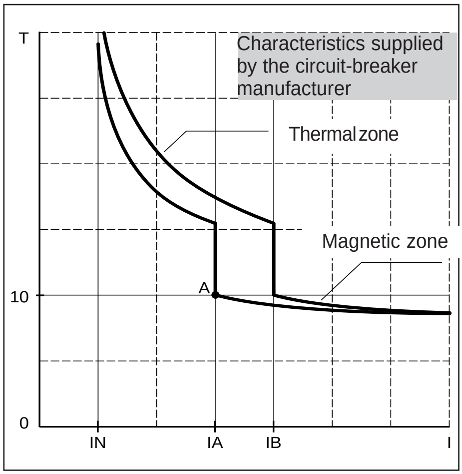
(1) 77 W at 60°C, 85 W at 55°C, 100 W at 55°C if the rack is fitted with fan modules.

4.7 Definition of protection devices at the head of the line

It is recommended that a protection device such as a circuit-breaker or a fuse be installed on the power supply at the head of the line.
The information below shows the minimum rating for the circuit-breaker and line fuse for a given power supply module.

- **Selecting a line circuit-breaker**
  When selecting the rating for the circuit-breaker, the following three characteristics, which are given for each power supply, should be taken into account :
  - nominal input current : Irms,
  - inrush current : I,
  - It.

  The minimum rating for the circuit breaker is selected as follows :
  - circuit-breaker rating IN > Irms power supply,
  - I max. circuit-breaker > I inrush power supply,
  - It circuit-breaker at point A on the curve
  > It power supply.



- **Selecting the line fuse**
  When selecting the rating for the line fuse, the following two characteristics, which are given for each power supply, should be taken into account :
  - nominal input current : Irms,
  - I^2t.

  The minimum rating for the fuse is selected as follows :
  - fuse rating IN > 3 x Irms power supply,
  - I^2t of the fuse > 3 x I^2t power supply

Note :
A summary of the characteristics of power supplies (I rms, I inrush, It I^2t) is given on the next page.

Reminder of the Irms, I inrush, It and I²t characteristics of each supply module

Modules	**TSX**	**PSY 2600**	**PSY 5500**	**PSY 8500**	**PSY 1610**	**PSY 3610**	**PSY 5520**
I rms	at 24 VDC	–	–	–	1.5 A	2.7 A	3 A
	at 48 VDC	–	–	–	–	–	1.5 A
	at 100 VAC	0.5 A	1.7 A	1.4A	–	–	–
	at 240 VAC	0.3 A	0.5 A	0.5 A	–	–	–
I inrush	at 24 VDC	–	–	–	100 A	150 A	15 A
(1)	at 48 VDC	–	–	–	–	–	15 A
	at 100 VAC	37 A	38 A	30 A	–	–	–
	at 240 VAC	75 A	38 A	60 A	–	–	–
It	at 24 VDC	–	–	–	0.2 As	0.5 As	7 As
(1)	at 48 VDC		–	–	–	–	– 6 As
	at 100 VAC	0.034 As	0.11 As	0.15 As	–	–	–
	at 240 VAC	0.067 As	0.11 As	0.15 As	–	–	–
I²t	at 24 VDC	–	–	–	12.5 A^2s	20 A^2s	50 A^2s
(1)	at 48 VDC	–	–	–	–	–	55 A^2s
	at 100 VAC	0.63 A^2s	4 A^2s	15A^2s	–	–	–
	at 240 VAC	2.6 A^2s	2 A^2s	8 A^2s	–	–	–

(1) Values on initial power-up and at 25°C.

5.1 Presentation

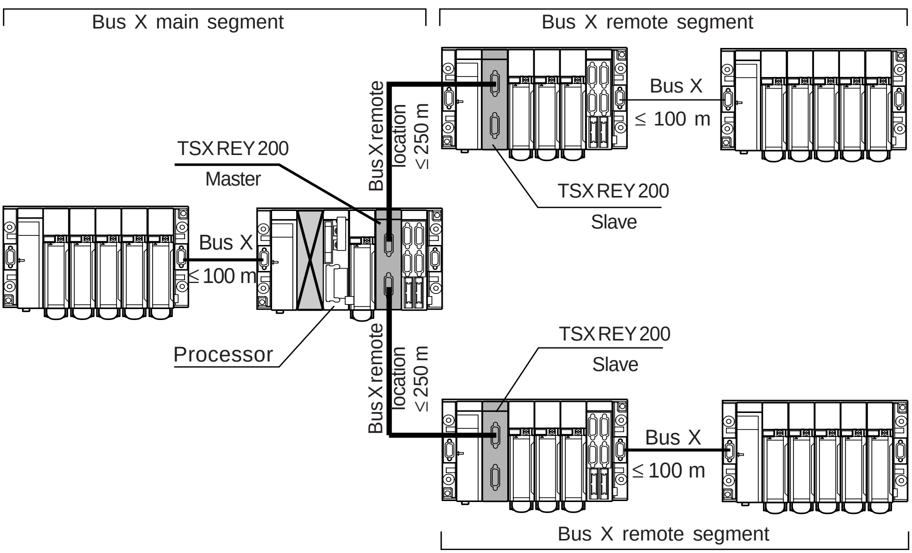
5.1-1 General

Bus X for Premium PLCs is used for connecting eight 12-position racks (TSX RKY12EX) or sixteen 4, 6 or 8-position racks (TSX RKY 4EX/6EX/8EX) distributed over a maximum length of 100 meters.
For applications which require a greater distance between racks, the Bus X distributed remote rackmaster module (TSX REY 200) can be used to significantly increase the distance while retaining all the features and performance capabilities inherent in a PLC station which consists of a single Bus X segment without a remote rackmaster module.

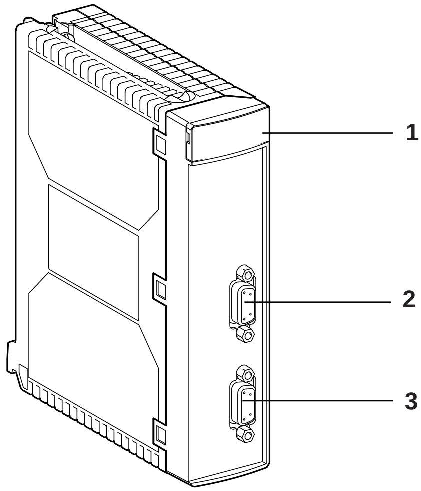
The system consists of :

- A Bus X remote rackmaster module (TSX REY 200) called the "Master", located on the rack at address 0 (rack containing the processor) which is on the main Bus X segment. This module has 2 channels used to locate 2 Bus X segments remotely at a maximum distance of 250 meters.
- 1 or 2 TSX REY 200 modules called "Slaves", each located on a rack on the remote bus segments.
- Each slave module is connected to the master module using a TSX CBRY 2500 / TSX CBRY K5 kit (cable + connectors).

Topology example



5.1-2 Physical description of the module



1 Display block with 6 indicator lamps :

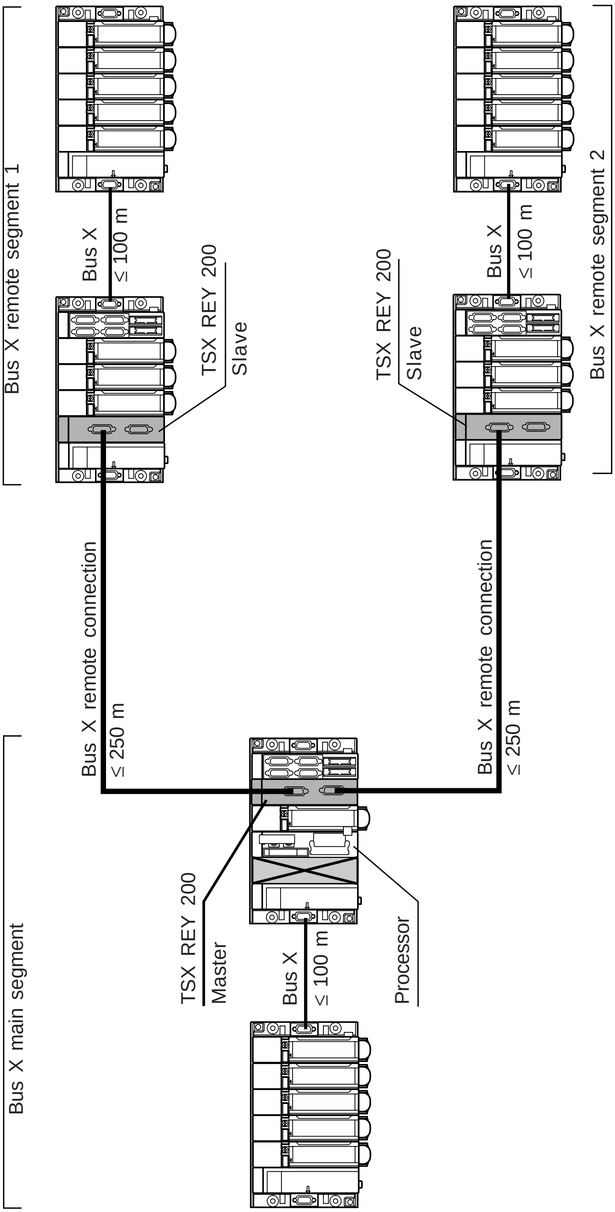
- **RUN** indicator : indicates the operating status of the module
- **ERR** indicator : indicates a module internal fault
- **I/O** indicator : indicates a fault external to the module
- **MST** indicator : indicates whether the module is acting as master or slave
- **CH0** indicator : indicates the operating status of channel 0
- **CH1** indicator : indicates the operating status of channel 1.

2 Connector for connecting channel 0 of the module

3 Connector for connecting channel 1 of the module

5.2 Topology of a PLC station with remote rackmaster modules

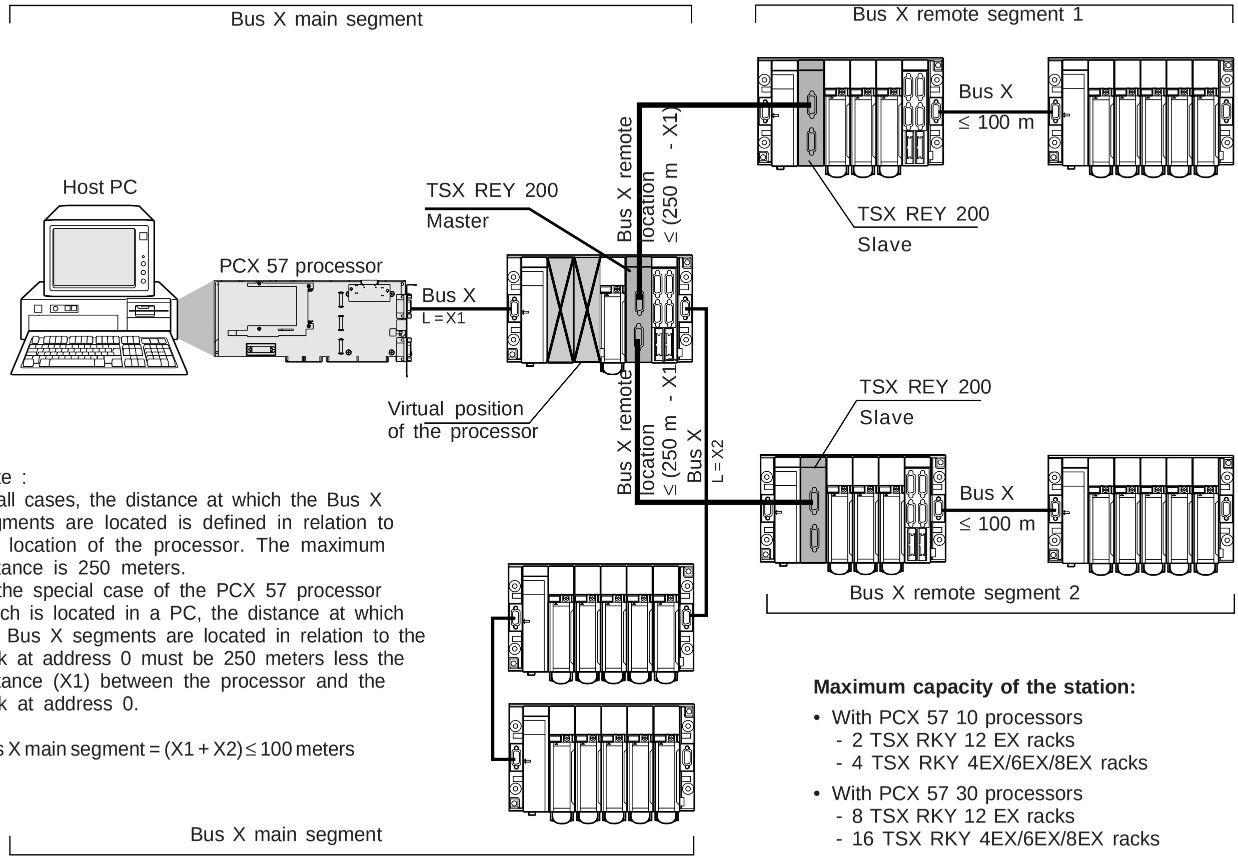
5.2-1 TSX/PMX 57 station



Maximum capacity of the station :

- With TSX/PMX 57 10 processors
  - 2 TSX RKY 12 EX racks
  - 4 TSX RKY 4EX/6EX/8EX racks
- With TSX/PMX 57 20/30/40 processors
  - 8 TSX RKY 12 EX racks
  - 16 TSX RKY 4EX/6EX/8EX racks

5.2-2 Station PCX 57



Note :
In all cases, the distance at which the Bus X segments are located is defined in relation to the location of the processor. The maximum distance is 250 meters.
In the special case of the PCX 57 processor which is located in a PC, the distance at which the Bus X segments are located in relation to the rack at address 0 must be 250 meters less the distance (X1) between the processor and the rack at address 0.

Bus X main segment = (X1 + X2) ≤ 100 meters

Maximum capacity of the station:

- With PCX 57 10 processors
  - 2 TSX RKY 12 EX racks
  - 4 TSX RKY 4EX/6EX/8EX racks
- With PCX 57 30 processors
  - 8 TSX RKY 12 EX racks
  - 16 TSX RKY 4EX/6EX/8EX racks

5.3 Installing the module

5.3-1 Master module

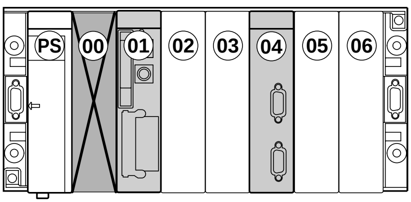
- **On a TSX/PMX 57 station**

The master module must be installed :
- on the rack which contains the processor (rack at address 00). This rack is on the Bus X main segment
- in any position on this rack other than those positions specifically for the power supply module and the processor module.

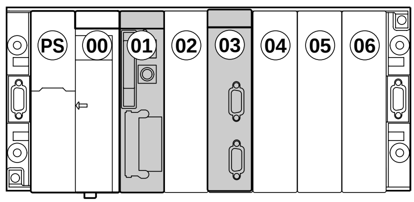
Restrictions :
- position 00 of the rack at address 0 is prohibited for any module (including the processor module). This position can only be occupied by a double format power supply module.

The diagrams below indicate the various possible situations, depending on the format of the power supply and the processor.

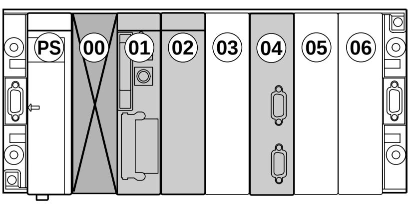
Rack at address 0 with single format power supply and processor :
- Power supply in position PS
- Processor must be in position 01
- Position 00 always empty
- TSX REY 200 module in one of the available positions on the rack



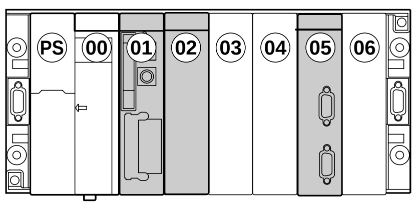
Rack at address 0 with double format power supply and single format processor :
- Power supply in positions PS and 00
- Processor must be in position 01
- TSX REY 200 module in one of the available positions on the rack



Rack at address 0 with single format power supply and double format processor :
- Power supply in position PS
- Processor must be in positions 01 and 02
- Position 00 always empty
- TSX REY 200 module in one of the available positions on the rack



Rack at address 0 with double format power supply and processor :
- Power supply in positions PS and 00
- Processor must be in positions 01 and 02
- TSX REY 200 module in one of the available positions on the rack



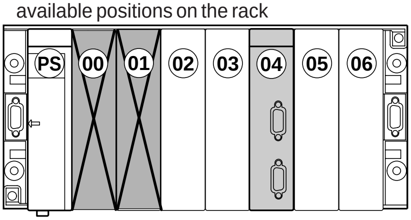
- **On PCX 57 station**

  In the same way as on a TSX/PMX 57 station, the master module must be installed:
  - on the rack which virtually supports the processor (rack at address 0). This rack is located on the main Bus X segment
  - in any position on this rack other than the position specifically for the power supply module and that occupied by the processor module.

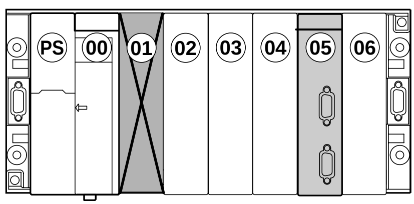
  Restrictions:
  - position 00 of the rack at address 0 is prohibited for any module. Only a double format power supply can occupy this position. The virtual position of the processor (unoccupied position) must be position 01.

  The diagrams below indicate the various possible situations, depending on the format of the power supply

Rack at address 0 with single format power supply :
- Power supply in position PS
- Virtual position of the processor must be position 01 (position always empty)
- Position 00 always empty
- TSX REY 200 module in one of the available positions on the rack

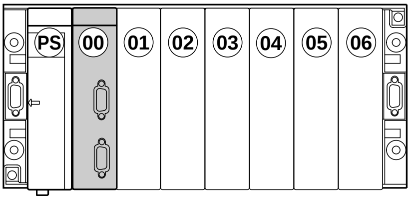
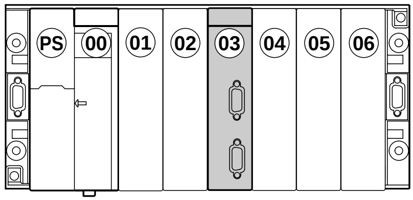


Rack at address 0 with double format power supply :
- Power supply in position PS
- Virtual position of the processor must be position 01 (position always empty)
- TSX REY 200 module in one of the available positions on the rack



5.3-2 Slave module

The slave module is installed in one of the racks of the remote bus segment, in any position on this rack other than the position specifically for the power supply module.

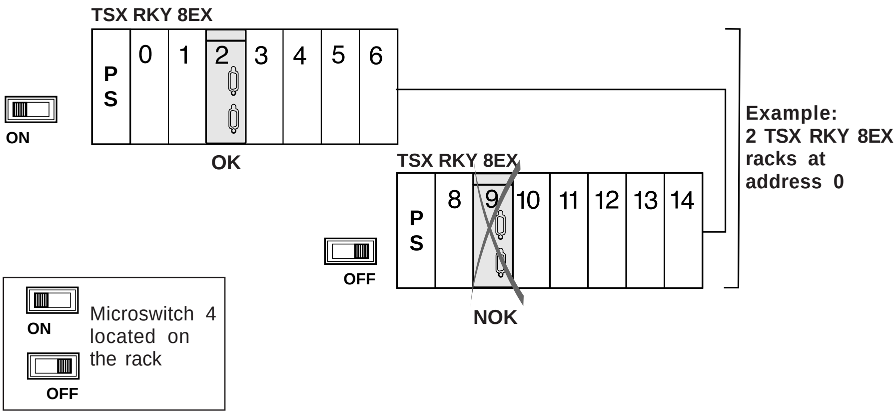
<table>
<tr>
<td>Rack with single format power supply module :
• Power supply in position PS
• TSX REY 200 module in one of the available positions on the rack

</td>
<td>Rack with double format power supply module :
• Power supply in positions PS and 00
• TSX REY 200 module in one of the available positions on the rack

</td>
</tr>
</table>

5.4 Configuring the module

The module is configured for the master or slave function automatically :

- if the module is installed on the rack at address 0, it will automatically be declared as the master
- if the module is installed on a rack at an address other than 0, it will automatically be declared as a slave

Note 1 :
If 2 racks are declared at address 0, the master module **must** be located on the rack supporting "low" module addresses as shown in the diagram below.
"Low" module addresses :
• addresses 0 to 6 on TSX RKY8EX rack
• addresses 0 to 4 on TSX RKY6EX rack
• addresses 0 to 2 on TSX RKY4EX rack

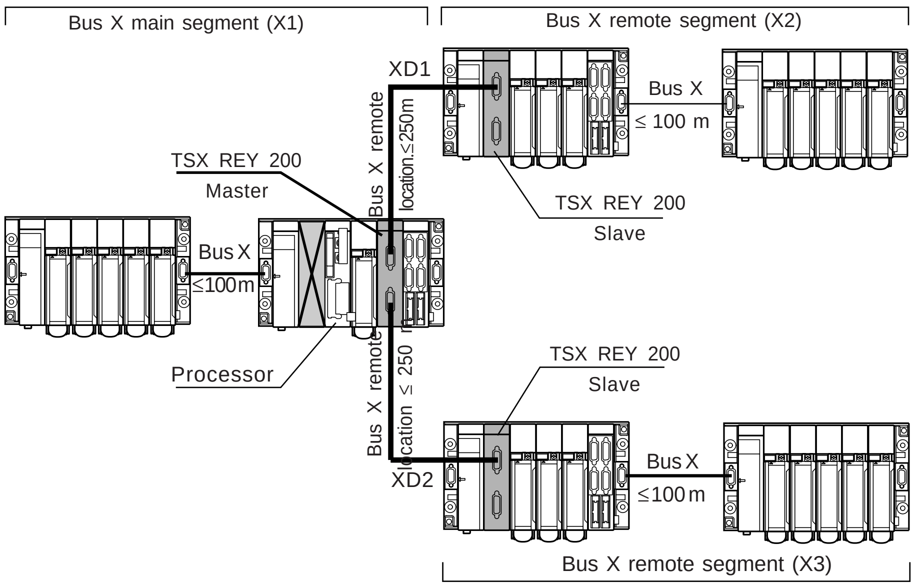


Note 2 :
If 2 racks are declared at address 0, the rack supporting the "high" module addresses cannot take a slave remote rackmaster module.
"High" module addresses :
• addresses 8 to 14 on TSX RKY8EX rack
• addresses 8 to 12 on TSX RKY6EX rack
• addresses 8 to 10 on TSX RKY4EX rack

5.5 Maximum distances according to the type of module

The diagram below shows the maximum permitted distances for the various Bus X segments and Bus X remote locations:

- Each Bus X segment (X1, X2 or X3) : maximum length 100
- Each Bus X remote connection (XD1 or XD2) : maximum length 250 meters.

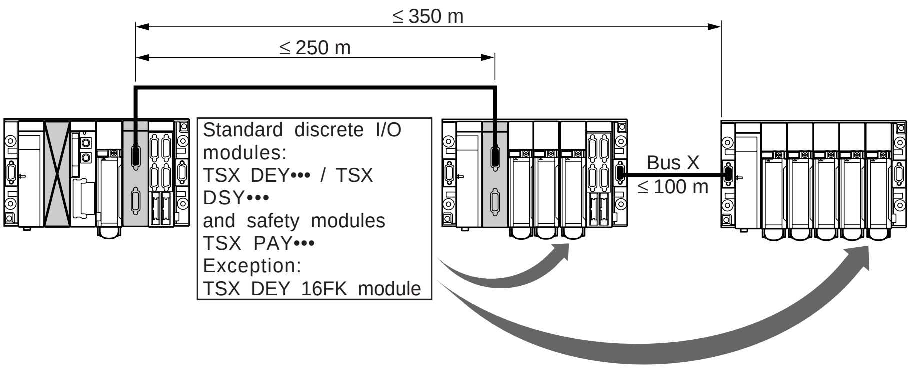


Taking these elements into account, the maximum distance between the processor and the furthest modules can be 350 meters.

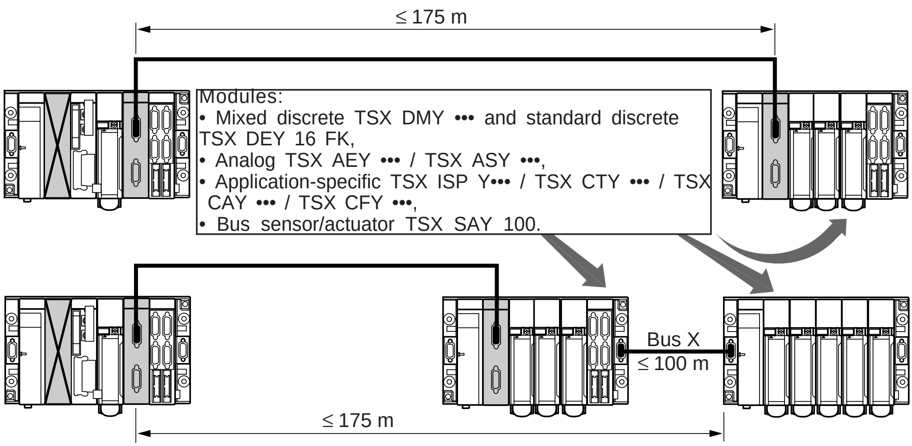
This distance of 350 meters is only possible for standard discrete I/O modules. The following pages give restrictions for each type of module.

Note:
The remote location is not permitted for TSX SCY •••/TSX ETY •••/ TSX IBY •••/TSX PBY ••• communication modules. These modules must be located on the main X1 segment on Bus X.

- **Standard and safety discrete I/O modules**



- **Mixed, analog, application-specific, bus sensor/actuator discrete I/O modules**



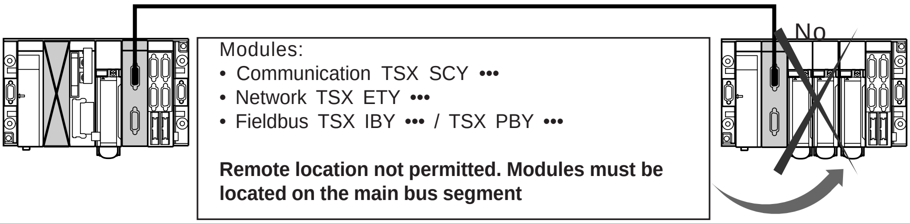
Note: For the following modules:

- TSX DEY 16 FK index PV ≥ 06,
- TSX DMY 28FK / 28 RFK,
- TSX AEY 810 / 1614,
- TSX ASY 410 index PV ≥ 11,
- TSX ASY 800,
- TSX CTY 2C,
- TSX CAY 22 / 42 / 33,

the maximum distance permitted (remote cable length + Bus X cable) is 225 m

- **Communication modules**

⚠	**Remote location not permitted. Modules must be located on the main Bus X segment.**



5.6 Connections

5.6-1 Connection accessories

The locate Bus X remotely, the following must be used:

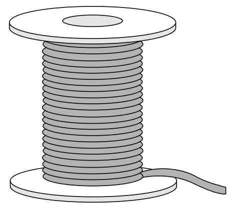
- the TSX CBRY 2500 kit comprising one 250 m cable on a drum,
- 1 set of TSX CBRY K5 connectors.

The user must fit connectors at both ends of the cable. The procedure for fitting the connectors on the cable is described in the quick reference guide supplied with the TSX CBRY 2500 kit.

The following items are therefore required for setting up a remote Bus X connection:

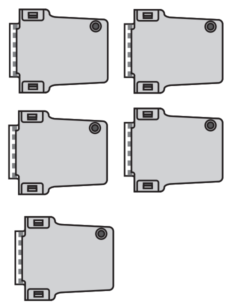
1 TSX CBRY 2500 kit comprising :
one 250 meter cable on a drum

Drum

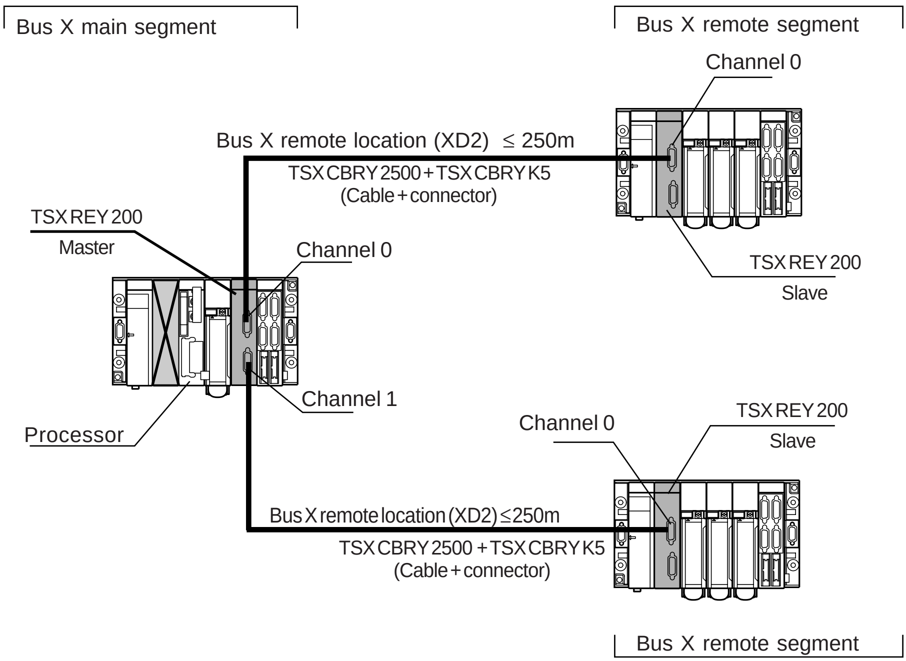


1 set of 5 TSX CBRY K5 connectors for connecting 2 remote cables, plus one as a spare.

Connectors



5.6-2 Connection principle



Note:
Each Bus X segment is installed according to the rules defined in part A - section 2.4.

Reminder
Each Bus X segment must have a line terminator A/ and /B at either end.

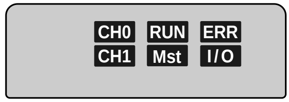
5.7 Module consumption

Consumption on 5 VDC power supply : 500 mA
Dissipated power : 2.5 W

5.8 Diagnostics

5.8-1 Using indicator lamps

The display block on the front panel of the TSX REY 200 module is used for diagnosing the remote location system according to the following tables.



Module acting as master (positioned on rack at address 00)

Status of indicator lamps						Module status	Comments
ERR	RUN	Mst	I/O	CH0	CH1		
⊗	×	×	×	×	×	Fault	No communication with the processor
○	●	●	○	●	○	OK	Channel 0 active, Channel 1 inactive
○	●	●	○	○	●	OK	Channel 0 inactive, Channel 1 active
○	●	●	○	●	●	OK	Channel 0 active, Channel 1 active
○	●	●	●	○	○	Fault	Channel 0 inactive, Channel 1 inactive

Module acting as slave function (positioned on rack at address other than 00)

Status of indicator lamps						Module status	Comments
ERR	RUN	Mst	I/O	CH0	CH1		
⊗	×	×	×	×	×	Fault	No communication with the processor
○	●	○	○	●	○	OK	Channel 0 active,
○	●	○	●	○	○	Fault	Channel 0 inactive,

Key : indicator lamp status

● On ○ Off ⊗ Flashing × Indeterminate

5.9 Managing an installation equipped with a Bus X remote rackmaster module

⚠ **Any use of a Bus X remote rackmaster module (TSX REY 200) in an installation requires the management of the installation or machine to be subject to the presence of all the racks configured in the application.**
To do this, an application program check tests whether all the racks in the application are present by testing bit %MWxy.Mod.2:X6 on at least one module in each rack (explicit exchange).
This test prevents any incorrect declaration in the addressing of the racks, and in particular if two racks accidentally have the same address.

This test is only of use if the installation is restarted (power-up, modification of the installation, processor RESET, configuration change).

6.1 Rack installation rules

6.1-1 Positioning the racks

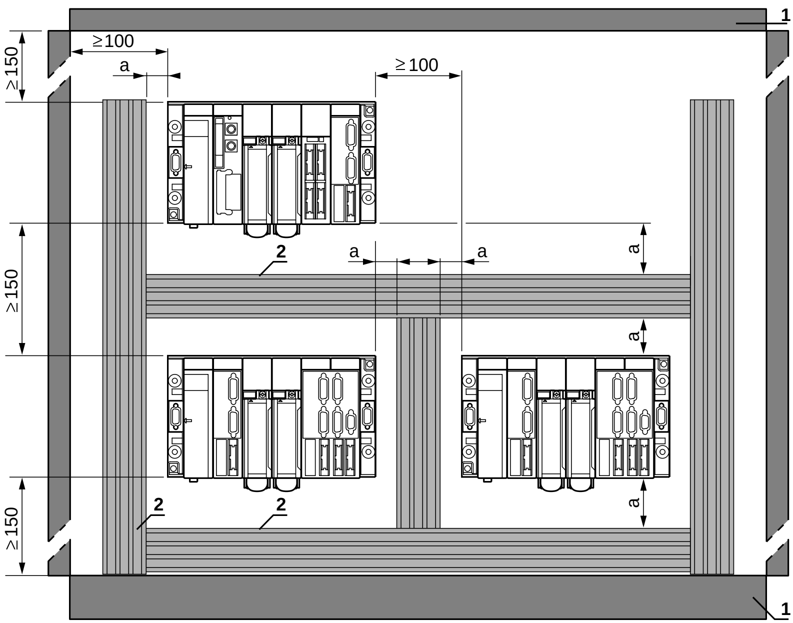
When mounting TSX RKY••• racks certain installation rules must be respected :

1 As the various modules (power supply, processors, discrete I/O, etc) are cooled by natural convection, **the various racks must be installed horizontally and on a vertical plane** to assist ventilation.

Note :
If using fan modules, see section 10 of this part.

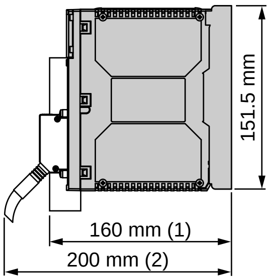
2 If several racks are installed in the same enclosure, it is recommended that the following positioning guidelines are respected :

- leave a space of at least 150 mm between two superposed racks, to allow for the cable ducts and to facilitate air circulation.
- it is advisable to install equipment which generates heat (transformers, process power supplies, power contactors, etc) above the racks.
- leave a space of at least 100 mm on each side of a rack to allow room for the cables and to facilitate air circulation.



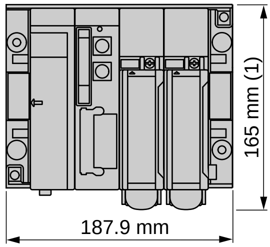
a ≥50 mm
1 Equipment or enclosure.
2 Cable duct or clip.

6.2 Rack dimensions

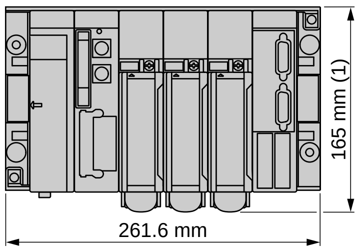


(1) Modules with screw terminal block
(2) Maximum depth with all types of module and associated connections

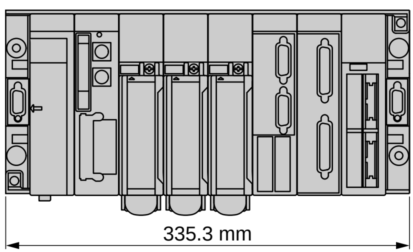
TSX RKY 4EX



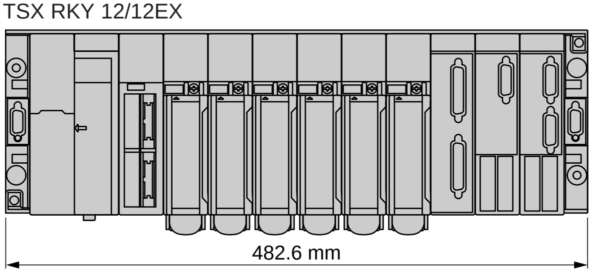
TSX RKY 6/6EX



TSX RKY 8/8EX



TSX RKY 12/12EX



Note :
If using fan modules, see section 10 of this part.

6.3 Mounting/fixing racks

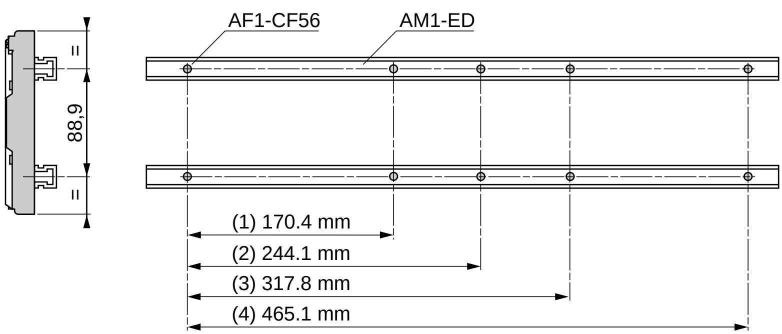
TSX RKY●● and TSX RKY●●EX racks can be mounted :
- on a 35 mm wide DIN rail fixed with M6x25 screws
- on a Telequick pre-slotted mounting plate or on a panel,

The installation rules described in section 6.1 should be respected, regardless of the type of mounting.

Note :
If using fan modules, see section 10 of this part.

6.3-1 Mounting on a 35 mm wide DIN rail

Fix with 4 M6x25 screws + washers and AF1-CF56 1/4 turn sliding nuts.



(1) TSX RKY 4EX

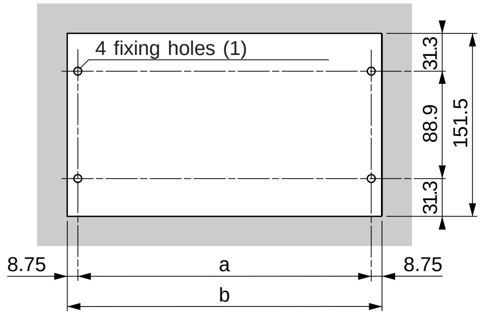
(2) TSX RKY6 and TSX RKY 6EX

(3) TSX RKY8 and TSX RKY 8EX

(4) TSX RKY 12 and TSX RKY 12EX

6.3-2 Mounting on panel or Telequick pre-slotted mounting plate

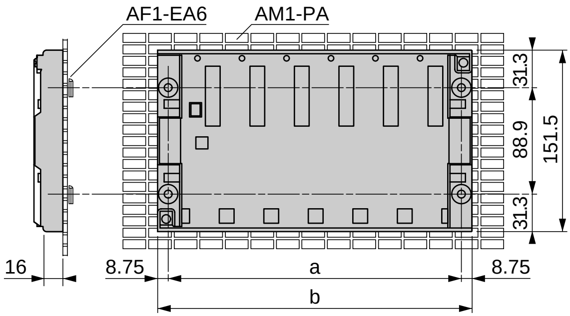
• **Mounting on panel : cut-out** (dimensions in mm)



(1) The fixing hole diameter must be large enough for M6 screws.

• **Mounting on AM1-PA Telequick pre-slotted mounting plate** (dimensions in mm)

Fix the rack with 4 M6x25 screws + washers and AF1-EA6 clip nuts



Racks	a	b	Thickness
TSX RKY 4EX	170.4 mm	187.9 mm	16 mm
TSX RKY 6/6EX	244.1 mm	261.6 mm	16 mm
TSX RKY 8/8EX	317.8 mm	335.3 mm	16 mm
TSX RKY 12/12EX	465.1 mm	482.6 mm	16 mm

• **Maximum tightening torque for fixing screws :** 2.0 N.m

6.4 Mounting modules and terminal blocks

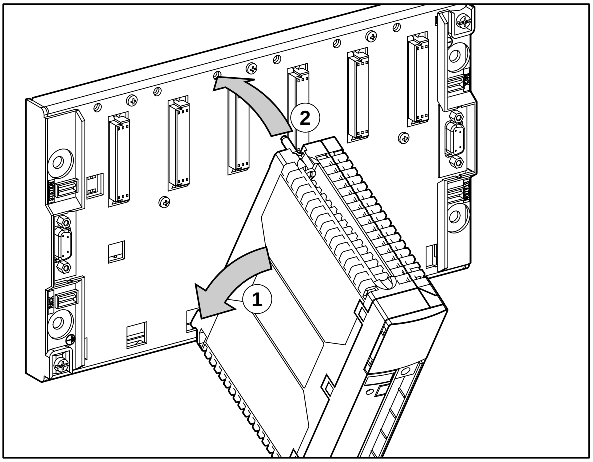
Modules can be inserted and removed while powered up **with the exception of the processor module and PCMCIA communication cards.**
To insert/remove powered-up modules, they must be manually screwed and unscrewed to ensure that the signals on Bus X are connected/disconnected in the correct sequence. This sequence is not necessarily respected if an electric screwdriver is used.

⚠ Powered-up modules must be removed/installed with the terminal block or HE10 connector disconnected, having taken care to cut the sensor/preactuator power supply if it is greater than 48V.

6.4-1 Inserting a module in a rack

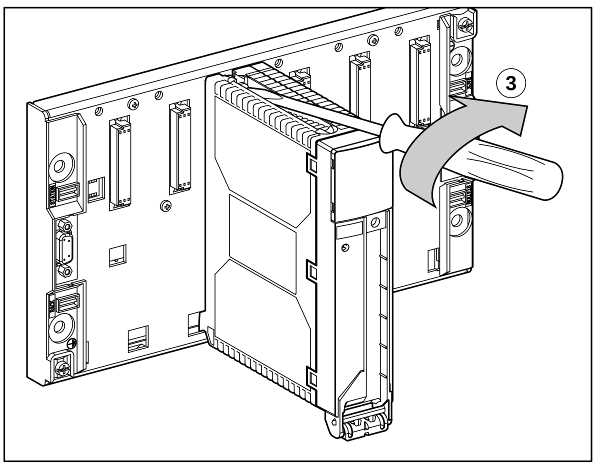
1 Locate the pins on the rear of the module in the centering holes at the bottom of the rack (①).

2 Swivel the module, bringing it into contact with the rack (②).



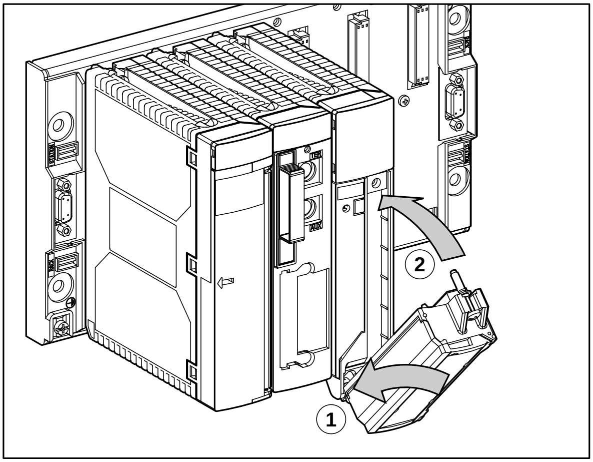
3 Fix the module firmly onto the rack by tightening the screw at the top of the module (③).

Maximum tightening torque : 2.0 N.m



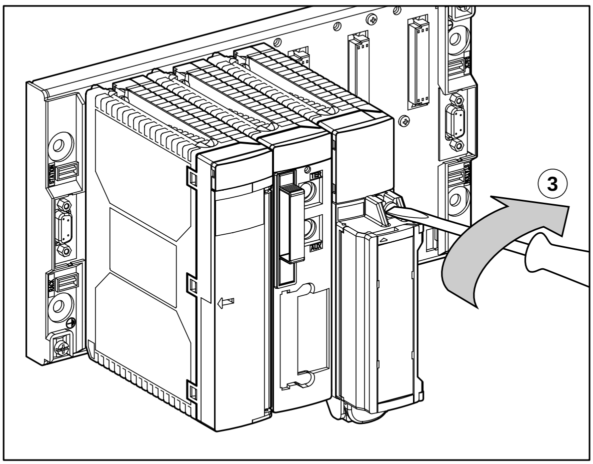
6.4-2 Fitting a screw terminal block on a module

The first time a screw terminal block is mounted on a module which takes this type of connection, the terminal block has to be coded with the type of module on which it is mounted. This is done by transferring 2 physical coding devices from the module onto the screw terminal block. This mechanical code prohibits any subsequent mounting of the terminal block with this code on any other type of module.



1 With the module already in place on the rack, mount the terminal block as shown opposite (①). The code is transferred automatically during this initial operation.

2 Swivel the terminal block into position to plug onto the module (②).



3 Lock the terminal block onto the module by tightening the appropriate screw (③).

Maximum tightening torque : 2.0 N.m

Note :
When replacing a module in position on the rack with another module, the screw terminal block on the old module already has physical coding devices which relate to that module.
There are two possible options :

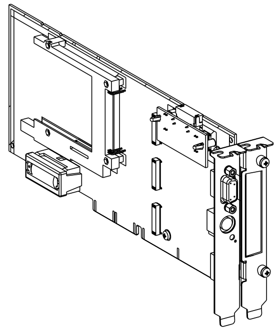
- Replace the module with a module of the same type : in order to install the coded terminal block on the new module, it will first be necessary to remove the physical coding devices on the new module before installing the terminal block,
- Replace the module with another type of module : it will first be necessary to remove the old physical coding devices on the terminal block before mounting it as described above.

6.5 Mounting a PCX 57 processor in a PC

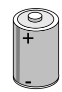
6.5-1 The various components

On delivery, the PCX 57 processor includes several component parts :

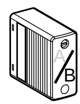
- A processor card and a mechanical subassembly for receiving a type 3 PCMCIA communication card.



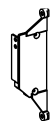
- A battery for backing up the processor RAM memory, to be inserted in the appropriate slot on the processor card (see section 6.6.2 in this part).



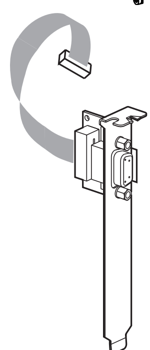
- a **TSX TLYEX /B** line terminator.
  (see section 2.4-2 in this part).



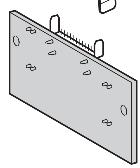
- A removable cover for a PCMCIA communication card dedicated to the PCX 57 processor (see part D in the "Communication, Bus and Network Interfaces" manual).



- Front plate equipped with a 9-pin SUB D connector for connecting a TSX CBY •• 0K Bus X extension cable and a ribbon cable for connection to the PCX 57 processor. This accessory is to be used for incorporating the PCX 57 processor inside a Bus X segment. (See the installation in the quick reference guide included with the processor).

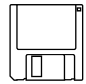


- Daughter board which provides the interface between the above front plate and the PCX 57 processor card. This accessory for use with the above front plate.
  It is installed in the place of the line terminator A/ incorporated as standard in the processor. (See the installation in the quick reference guide included with the processor).

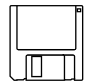


The various components (continued)

- An installable disk containing the Windows 95 version of the ISAWAY driver (see the quick reference guide included with the processor).



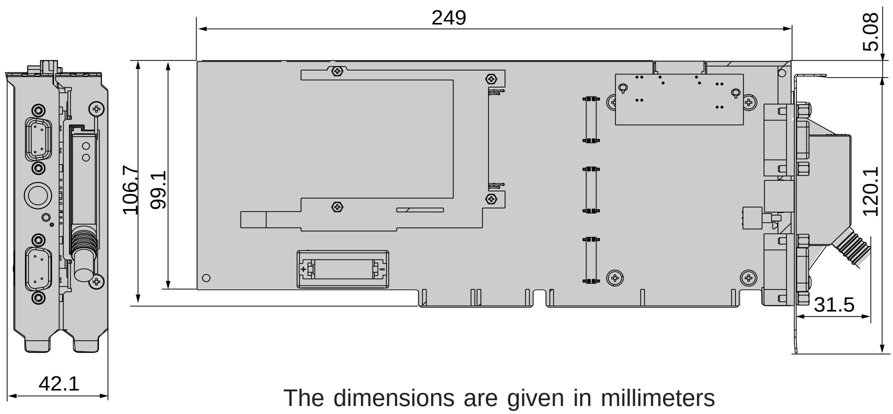
- An installable disk containing the Windows NT version of the ISAWAY driver (see the quick reference guide included with the processor).



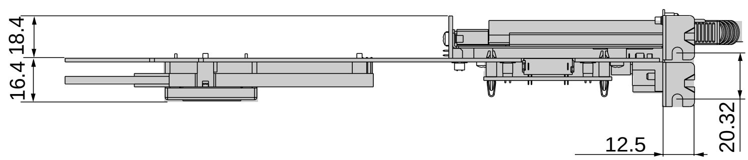
- OFS data server software

- A quick reference guide for setting up the PCX 57 processor.

6.5-2 Dimensions



The dimensions are given in millimeters



Note : A PCX processor occupies two slots on the PC ISA bus. These slots must be consecutive and 20.32 mm apart.

6.5-3 Installation precautions

It is advisable to limit the static electricity charges, which could cause significant damage to the electronic circuits. To do this, proceed as follows :

- Hold the card by the edges, without touching the connectors or the visible circuits.
- Do not remove the card from its antistatic protective packaging until you are ready to install it in the PC.
- If possible, connect yourself to ground during these operations.
- Do not place the card on a metal surface.
- Avoid unnecessary movement as static electricity is produced by clothing, carpets and furniture.

6.5-4 Preliminary operations before installation in the PC

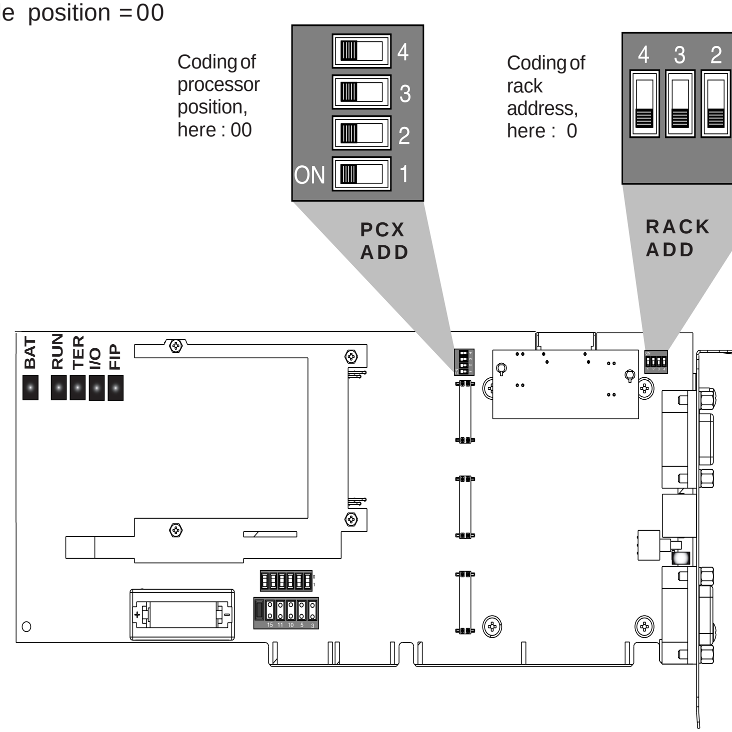
Before installing the processor card in the PC, certain operations must be performed :

- Insert the battery in the appropriate slot if necessary (see section 6.6-2),
- Insert the PCMCIA memory card if necessary (see section 5.7-2),
- **Configure the address of the processor on Bus X** (rack address, module position). This address should be the same as that defined in the configuration screen in PL7 Junior or PL7 Pro. The address is configured using the micro-switches on the processor card.

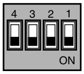
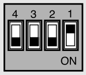
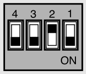
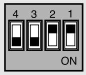
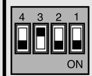
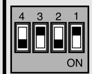
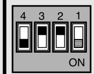
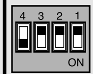
  Rack address : the virtual slot of the processor is always at rack address 0

  Processor position : the virtual position of the processor will depend on the type of power supply installed on the rack.
  single format power supply :
  virtual position of the processor = 00
  double format power supply :
  virtual position of the processor = 01

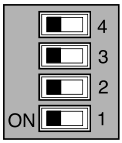
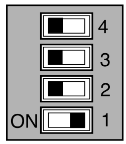
  Default configuration :
  - rack address = 0
  - module position = 00



Positioning the RACK ADD micro-switches according to the rack address

Rack address	0	1	2	3	4	5	6	7
Position of the RACK ADD micro-switches								
		Unused addresses						

Positioning the PCX ADD micro-switches according to the position of the processor on the rack

Processor position	00	01
Position of the PCX ADD micro-switches		

- **Configuring the base I/O address of the processor on the ISA bus**

  The PCX 57 processor uses :

  - eight consecutive addresses in the I/O space of the ISA bus,
  - one interrupt (IRQ ••).

  Before configuring the PCX 57 processor, it is advisable to define an I/O space and an IT available in the PC using the standard utilities under Windows 95/98 or Windows NT.

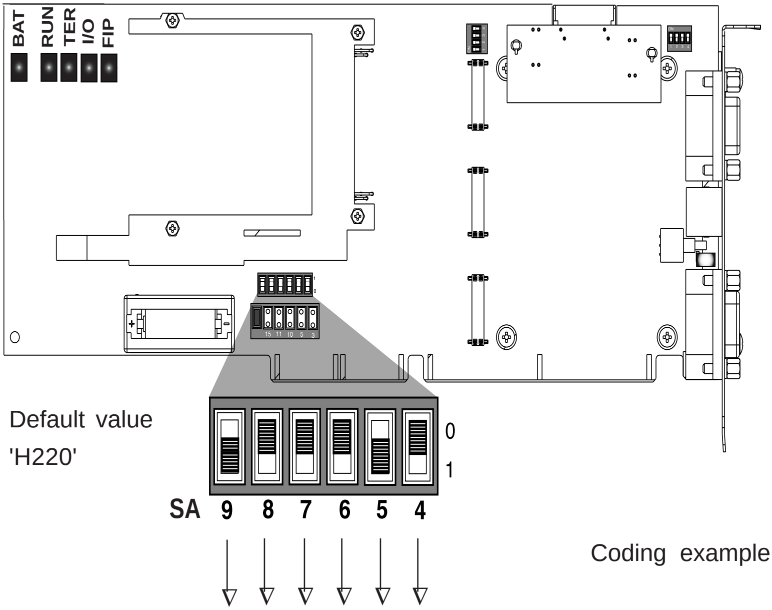
  ⚠ An incorrect configuration may cause the PC to malfunction.

  When the available resources have been determined, the PCX 57 is configured as follows :

  - Configure the base address of the PCX 57 processor on the ISA bus.

    This address is configured using the 6 micro-switches near the PCX 57 ISA connector. They represent from left to right address bits SA9 to SA4 (see the diagram and examples opposite).
    By default, address H '220' is configured.

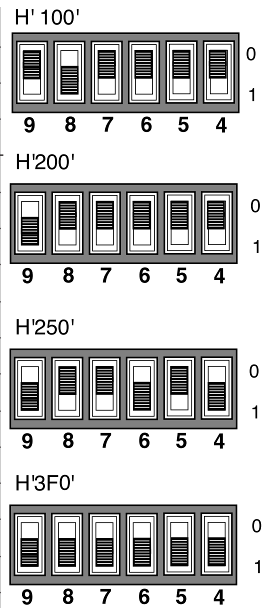
    Note : This address should be the same as that defined in the ISAWAY driver configuration screen.



Default value
'H220'

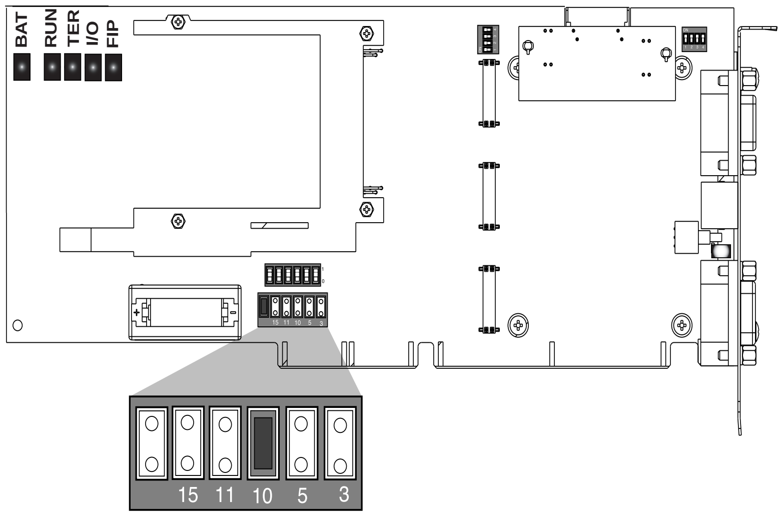
Switch		9	8	7	6	5	4	3	2	1	0
H'000'	0	0	0	0	0	0	0	0	0	0	0
H'110'	1	0	1	0	0	0	1	0	0	0	0
H'220'	2	1	0	0	0	1	0	0	0	0	0
H'330'	3	1	1	0	0	1	1	0	0	0	0
	4			0	1	0	0	0	0	0	0
	5			0	1	0	1	0	0	0	0
	6			0	1	1	0	0	0	0	0
	7			0	1	1	1	0	0	0	0
	8			1	0	0	0	0	0	0	0
	9			1	0	0	1	0	0	0	0
	A			1	0	1	0	0	0	0	0
	B			1	0	1	1	0	0	0	0
	C			1	1	0	0	0	0	0	0
	D			1	1	0	1	0	0	0	0
	E			1	1	1	0	0	0	0	0
	F			1	1	1	1	0	0	0	0

Coding example



- Next, configure the interrupt used by the processor on the ISA bus (IRQ ●●)

This is configured using a jumper which must be placed according to the interrupt to be selected. The default selection is IRQ 10.



6.5-5 Installing the processor card in the PC

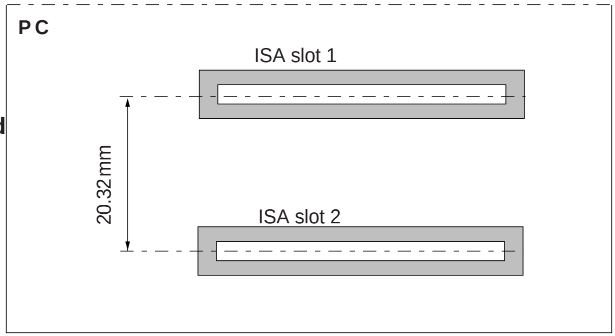
⚠ **The PC must be powered down during installation of the processor.**

Procedure :
When the preliminary operations described earlier have been completed, proceed as follows :

- With the electricity supply to the PC switched off, remove the cover of the computer and locate two free consecutive ISA slots,

⚠ **Installation restriction :**

The PC must respect the following standard



- Remove the covers and fixing screws already in place which correspond to the available slots,
- Install the card in the appropriate slots,
- Fix the card firmly onto the PC by replacing and tightening the fixing screws,
- Close the computer and connect all the cables and accessories which must be added with the PC powered down :
  - Bus X cable and TSX TLYEX /B line terminator,

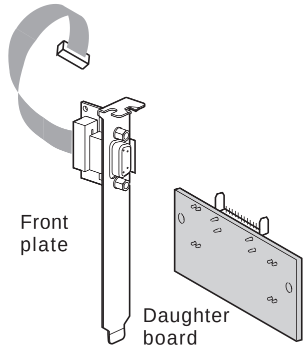
  ⚠ **The processor changes to blocking fault if line terminator /B is not installed :**
  - on the PCX 57 processor, if this is not connected to a rack by a TSX CBY●● X Bus cable. In this case, the /B line terminator must be installed on the processor Bus X output (see section 2.4-2),
  - on the connector available on the last rack of the station if the PCX 57 processor is connected to a rack by a TSX CBY ●● Bus X cable. In this case, the /B line terminator must be installed (see section 2.4-2).

  This mechanism enables the user to see whether Bus X has been terminated.
  - FIPIO bus cable and PCMCIA communication card if required,
- Power up the PC and start installing the software :
  - ISAWAY driver corresponding to the OS installed : WINDOWS 95/98 or Windows NT, (see the quick reference guide included with the processor),
  - OFS data server if used, (see the OFS software installation manual),
  - PL7 Junior or PL7 Pro software if used (see the operating modes manual).

6.5-6 Integrating a PCX 57 processor inside a Bus X segment

The PCX 57 processor is equipped as standard to be integrated at the head of the Bus X line. It therefore has an integrated line terminator A/.
If the user wishes to integrate the processor inside a Bus X segment, two accessories which are supplied with the module are used :

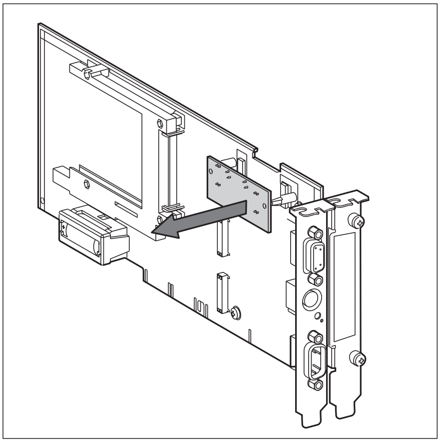
- A front plate equipped with :
  - a 9-pin SUB D connector for connecting a TSX CBY• Bus X cable,
  - a ribbon cable for connecting the 9-pin SUB D connector to the processor card.
- A daughter board equipped with two connectors which performs the interface function between the PCX 57 card and the 9-pin SUB D connector on the front plate described above. This daughter board is installed in the place of line terminator A/, which is fitted as standard on the PCX 57 card.



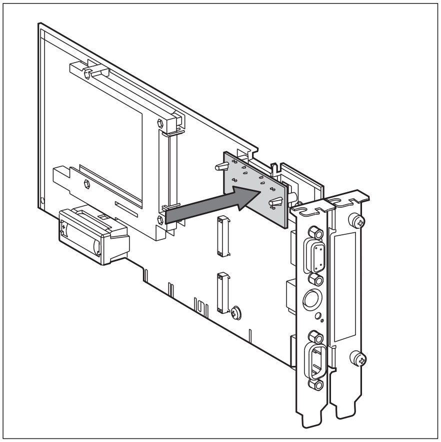
Installation procedure

⚠ The PCX 57 processor card, and thus the PC, must be powered down when installing these accessories.

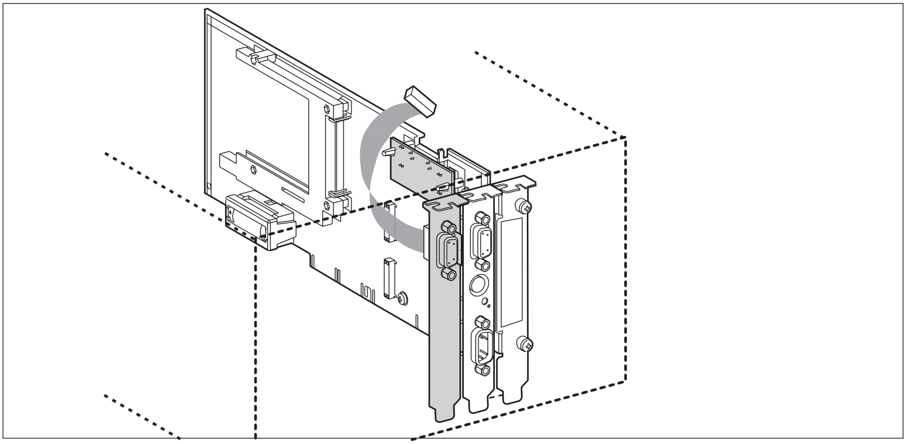
1 Remove line terminator A/ from its slot on the processor.



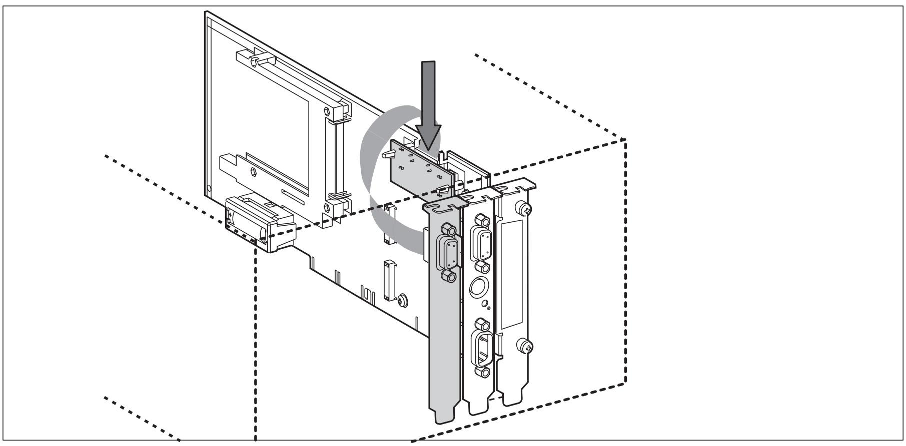
2 Fit the daughter board in place of line terminator A/.



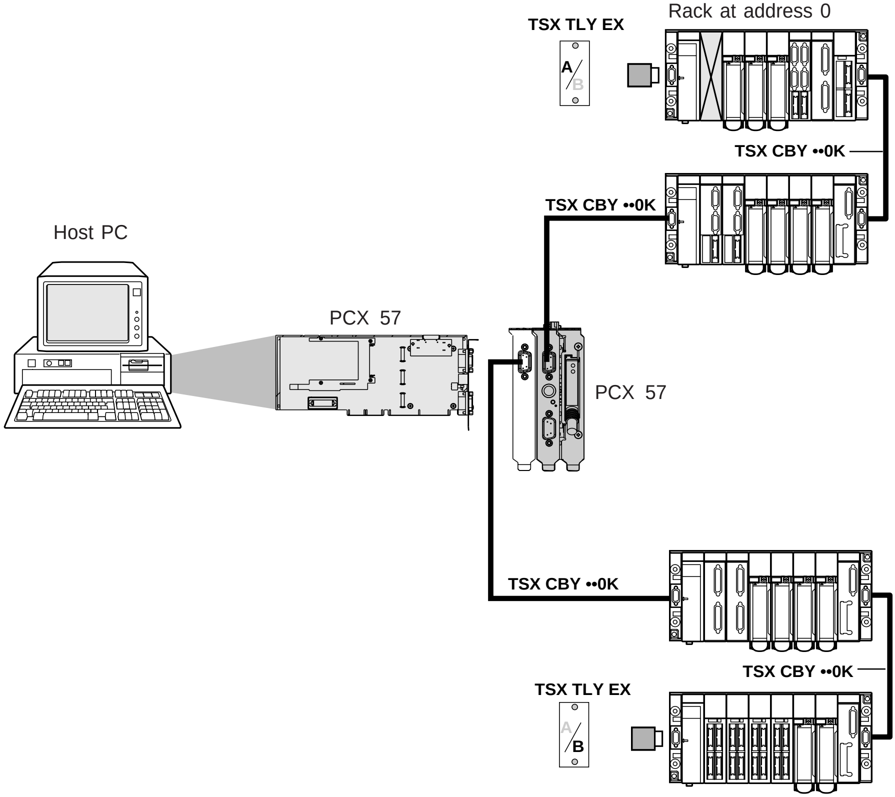
3 With the processor card installed in the PC, fit the front plate in the available slot, to the immediate left of the processor card as shown in the diagram below.



4 Connect the ribbon cable to the connector on the daughter board installed in step 2.



Example of the topology of a PCX 57 station with the processor integrated inside a Bus X segment



Important

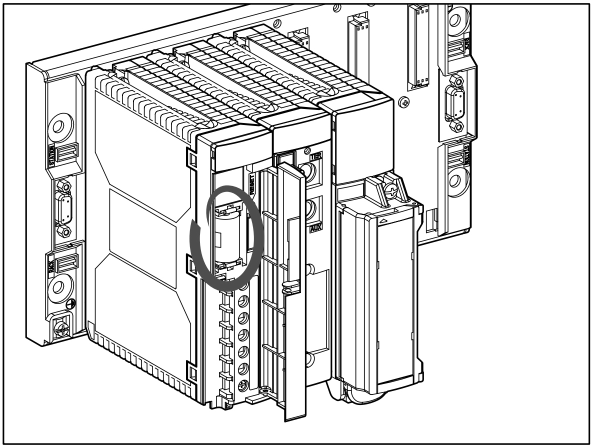
In this situation, as the PCX 57 processor is no longer integrated at the head of the line, the TSX TLY EX line terminators (A/ and /B) must be installed on each of the racks located at the end of the line.

6.6 Fitting/removing the RAM memory backup battery

6.6-1 With a TSX 57 / PMX 57 processor

This battery, located on the TSX PSY **....** power supply module, backs up the processor internal RAM memory and the realtime clock in the event of a mains power supply failure. Supplied in the same packaging as the power supply module, it should be installed by the user.

Fitting the battery

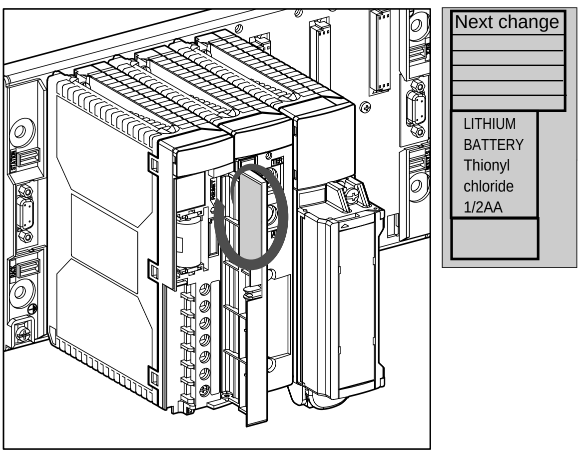


1 Open the access cover located on the front panel of the power supply module,
2 Position the battery in its compartment, taking care to respect the polarity, as shown on the plate,
3 Close the access cover.

Changing the battery

The battery may be changed **once a year**, as a preventative measure, or when the BAT indicator lamp lights up (see section 6.6-3 : frequency of changing the battery). Follow the same procedure as for installation :

1 Open the battery access cover,
2 Take the defective battery out of its compartment,
3 Insert the new battery, taking care to respect the polarity,
4 Close and lock the access cover.



If there is a loss of power supply when changing the battery, the RAM memory is backed up by the processor which has its own local backup facility (see section 6.6-3).

Important : So as not to forget to change the battery every year, it is advisable to note the date of the next change due where indicated inside the access cover.

6.6-2 With a PCX 57 processor

This battery, located on the TPCX P57 •••• processor module, backs up the processor internal RAM memory and the realtime clock in the event of a mains power supply failure. Supplied in the same packaging as the processor, it should be installed by the user.

Note : With a PCX 57 processor, there is no need to put a battery in the power supply of the rack which usually receives the processor (rack at address 0).

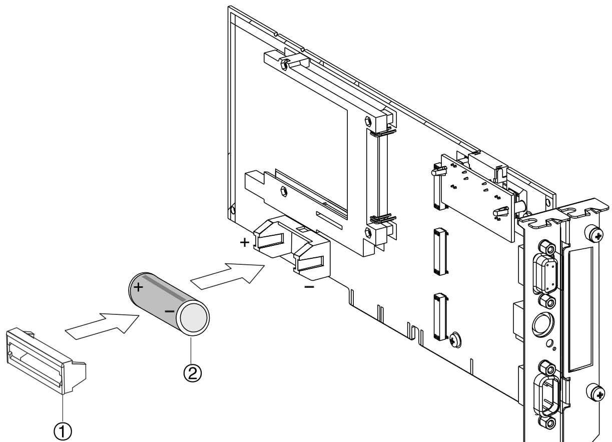
Fitting the battery for the first time

This operation must be performed before inserting the card in the PC.

1 Remove the cover① by squeezing the sides,

2 Position the battery ② in its compartment, taking care to respect the polarity, as shown on the plate,

3 Replace the cover ① which holds the battery in its slot.



Changing the battery

The battery may be changed **once a year**, as a preventative measure, or when the BAT indicator lamp lights up (see section 6.6-3 : frequency of changing the battery). However, since this indicator lamp is not visible when the PC is closed, system bit %S68 can be used by the application program to create an alarm to indicate that the battery needs changing.

Procedure

1 Switch the PC off,
2 Disconnect the cables connected to the processor,
3 Open the PC,
4 Remove the card from its slot,
5 Remove the cover ①,
6 Remove the defective battery from its slot,
7 Insert the new battery, taking care to respect the polarity,
8 Replace the cover ①,
9 Replace the card in its slot, close the PC, connect the external elements and switch on.

⚠ **The operation to change the battery should not exceed a certain length of time when the PC is switched off as the data in the RAM memory may be lost** (see section 6.6-3).

6.6-3 Frequency of changing the battery

Battery backup period

The time for which the battery provides its backup function for the processor internal RAM memory and the realtime clock depends on two factors :

- the percentage of time for which the PLC is powered down and thus the time for which the battery is used,
- the ambient temperature when the PLC is powered down.

Ambient temperature when powered down		≤ 30°C	40°C	50°C	60°C
Backup period	PLC powered down 12 hours/day	5 years	3 years	2 years	1 year
	PLC powered down 1 hour/day	5 years	5 years	4.5 years	4 years

Processor backup facility

The processors have their own local backup facility for the processor internal RAM memory and the realtime clock which is effective when removing :

- the battery, the power supply or the TSX/PMX 57 processor,
- the battery from the PCX 57 processor.

The backup period depends on the ambient temperature. If the processor was previously powered up, the guaranteed time varies as follows :

Ambient temperature during power-down	20°C	30°C	40°C	50°C
Backup period	2 hrs	45 min	20 min	8 min

6.7 Inserting/removing the PCMCIA memory extension card

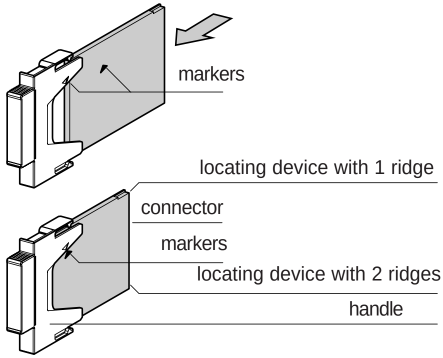
6.7-1 On a TSX 57 / PMX 57 processor

A handle is required to insert the memory card in its slot.

Fitting the handle onto the card

1 Position the end of the memory card (opposite end from the connector) at the handle opening.
The triangular-shaped markers on both the handle and the label of the card should be on the same side.

2 Slide the memory card into the handle until it stops. It then forms an integral part of the handle.

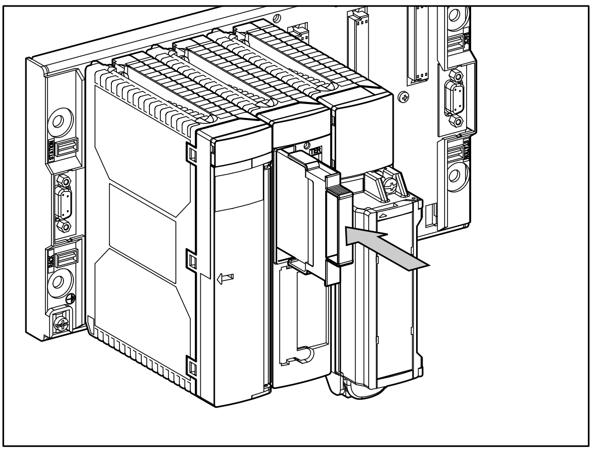


Inserting the memory card

To install the memory card in the processor, proceed as follows :

1 Remove the protective cover by unlocking and then pulling it towards the front of the PLC,

2 Position the PCMCIA card with its handle into the slot which is now vacant. Slide in until the card stops, then push the handle to connect the card.



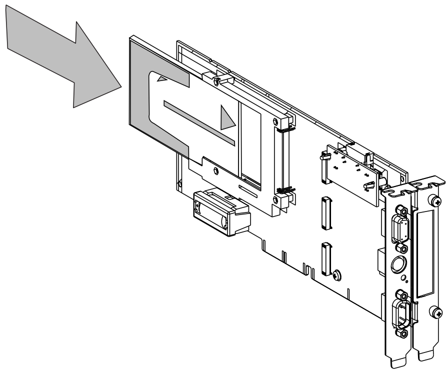
Note :
When installing the PCMCIA card in its slot, make sure that the physical locating devices are correctly positioned :
• 1 ridge towards the top,
• 2 ridges towards the bottom

Note 2 :
If the program contained in the PCMCIA memory card has the **RUN AUTO** option, the processor automatically starts in RUN once the card has been inserted.

6.7-2 On a PCX 57 processor

⚠ **The memory extension card must be installed on the processor card with the power off and before it is inserted in the PC.**

To install the memory card in the PCX 57 processor, proceed as follows :



1 Position the PCMCIA card in the appropriate slot.

2 Slide it as far as it will go into the slot.

3 Position the card in the PC with the power off.

Note :
If the program contained in the PCMCIA memory card has the **RUN AUTO** option, the processor automatically starts in RUN once the card has been inserted and the PC has been powered up.

6.8 Changing the battery on a RAM type PCMCIA memory card

RAM type PCMCIA memory cards (TSX MRP••••) must be fitted with a battery (reference TSX BAT M01), which has to be changed at certain intervals (see the table below).

- **On a TSX 57 / PMX 57 processor**

1 Remove the card from its slot by pulling the handle towards the front of the PLC.

2 Separate the PCMCIA card from its handle by pulling them apart.

3 Hold the PCMCIA card so as to allow access to the battery slot at the non-connector end of the card.

4 Unlock the battery holder, located at the non-connector end of the card. To do this, press the clip towards the bottom of the card (in the opposite direction to the write-protect micro-switch) while pulling it back.

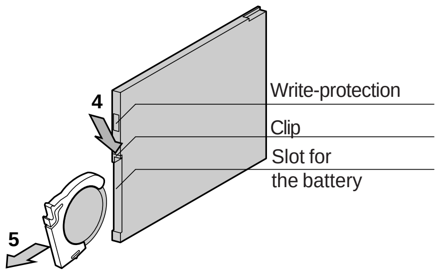
5 Remove the battery with holder from its slot.

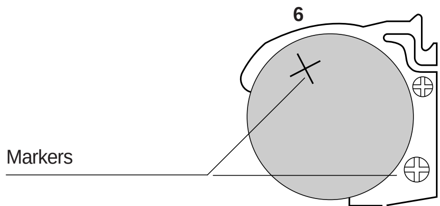
6 Replace the defective battery with a new 3 V battery. The polarity must be respected by placing the + markers on the holder and the battery on the same side.

7 Put the battery with holder back in its slot and lock it in place. To do this, simply reverse the removal procedure.

8 Fix the PCMCIA card in its handle.

9 Replace the card with its handle in the PLC.





- **On a PCX 57 processor**

  Having removed the card from its slot, follow steps **3 to 7** described above, then replace the card.

Battery service life

PCMCIA card stored in normal conditions (-20 °C to 70 °C)	12 months
PCMCIA card installed in an operating PLC or PC (0 °C to 60 °C)	36 months

Note : During operation, when the PCMCIA card battery is faulty, the processor ERR indicator lamp flashes.

6.9 Precautions to be taken when replacing a processor

If a TSX / PMX / PCX 57 processor is being replaced by another processor which has already been programmed and contains an application, the power must be cut to all the PLC station control devices.
Before restoring the power to the control devices, check that the processor actually contains the required application.

6.10 Screw tightening torques

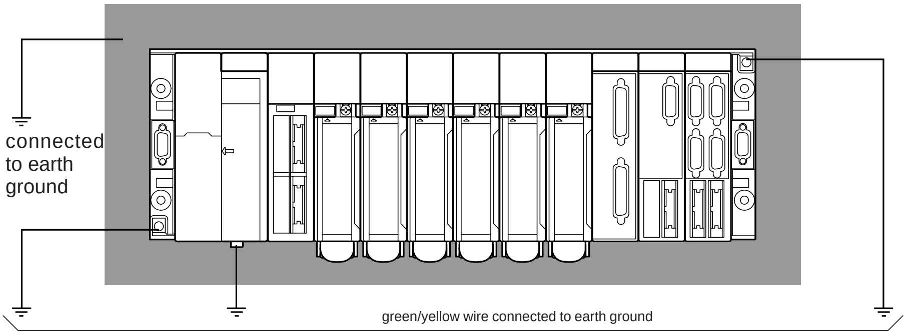
Technical components	Maximum tightening torques
Fixing screws for PLCs, modules and terminals Ground connection screws	2.0 N.m
Screws for discrete I/O module terminals Screws for power supply terminals Screws for SUB D connectors Screws for various wire and cable connectors	0.8 N.m
Screws for TSX PAY/REY/SAY/••• module enclosed terminal blocks	0.5 N.m

7.1 Ground connections

7.1-1 Grounding the racks

The functional grounding of racks is provided by the rear panel, which is metal. This ensures that PLCs meet environmental standards, provided that the racks are fixed to a metal support which is correctly grounded. The various racks which may constitute a TSX 57 PLC station must be fitted either on the same support or on different supports which must however be correctly interconnected.

To protect personnel, the ⏚ terminals of each rack **must, without exception,** be connected to the protective earth ground. To do this, use a green/yellow wire with a cross-section of at least 2.5 mm and as short as possible.



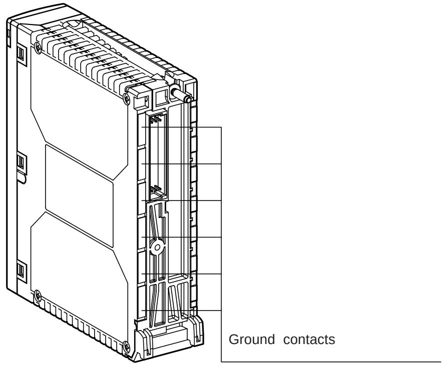
Important

The PLC internal 0V is connected to the machine ground. The machine ground itself must be connected to the earth ground.

Maximum tightening torque on ground connection screw : 2.0 N.m

7.1-2 Grounding the modules

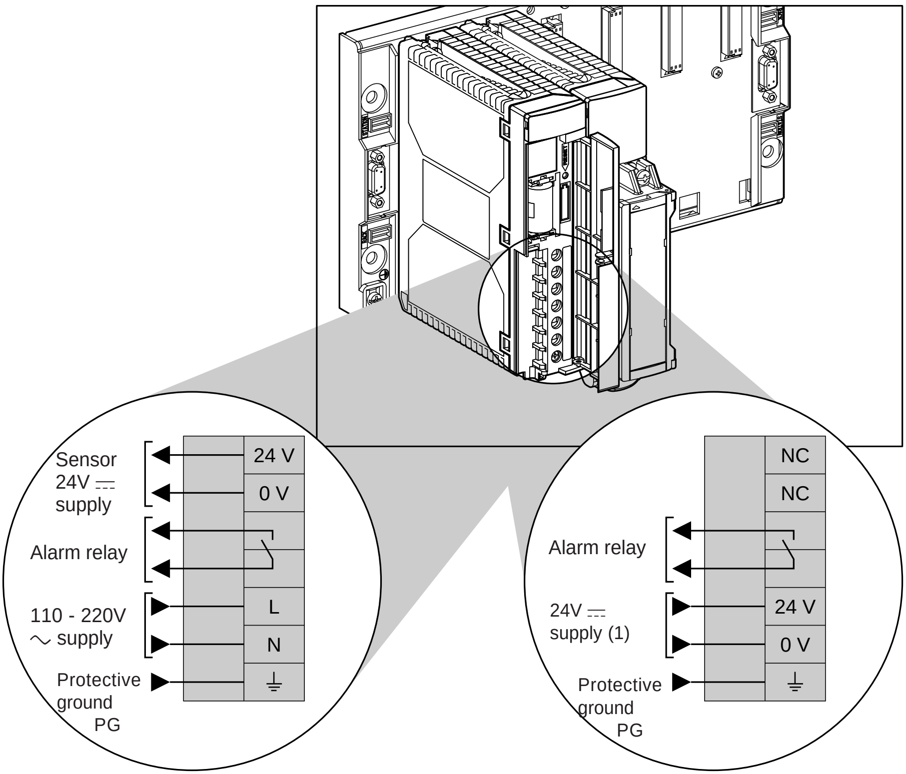
The modules are grounded by metal plates located on the module rear panel. When the module is in position, these metal plates are in contact with the rack metal-work, thus providing the connection to ground.



7.2 Connection of power supplies

7.2-1 Rules for connection

The TSX PSY.... power supply modules on each rack have a non-removable terminal block, protected by a cover, which is used to connect the mains supply, the alarm relay, the protective ground and, for AC power supplies, the power supply for the 24 VDC sensors.
This terminal block is fitted with captive screw clamp terminals with a maximum connection capacity of 2 x 1.5 mm^2 cross-section wires with cable ends, or 1 x 2.5 mm^2 cross-section wire (maximum tightening torque on screw terminals : 0.8 N.m). The wires exit vertically downwards, and can be secured by a cable clamp.



AC power supply
TSX PSY 2600/5500/8500

DC power supplies
TSX PSY 1610/3610/5520

⚠ For TSX PSY 5500/8500 power supply modules, set the voltage selector position according to the mains voltage being used (110 or 220VAC).

(1) 24V...48V for the TSX PSY 5520 power supply

Be sure to install a device for protecting and breaking the power supply upstream of the PLC station.
When choosing protection devices, the user should take account of the inrush currents defined in the table of characteristics for each power supply (see section 4.5).

Note :
Given that the TSX PSY 1610/2610/5520 DC power supplies have a very strong inrush current, it is not advisable to use them on DC supplies with return current protection (fold back).

When a power supply module is connected on a DC supply, in order to avoid line losses, it is essential to limit the length of the power supply cable :

- TSX PSY 1610 power supply module :
  - length limited to 30 meters each way (60 meters in total) with copper wires, cross-section 2.5mm^2
  - length limited to 20 meters each way (40 meters in total) with copper wires, cross-section 1.5mm^2
- TSX PSY 3610 and TSX PSY 5520 power supply modules :
  - length limited to 15 meters each way (30 meters in total) with copper wires, cross-section 2.5mm^2
  - length limited to 10 meters each way (20 meters in total) with copper wires, cross-section 1.5mm^2

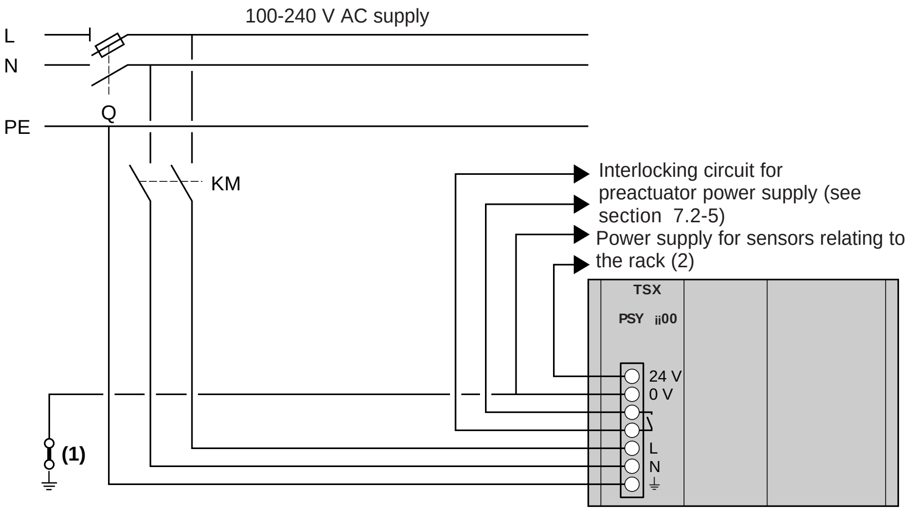
Warning :

Interconnection of several PLCs which are powered by a secure DC supply not connected to ground.

The 0V and the mechanical ground are connected inside PLCs, line supply wiring accessories and some operator panels.
Special connection arrangements must be made for specific applications which use a free-floating mounting. These depend on the installation method used. In this case, it is essential to use an isolated DC supply. Please contact us when defining the electrical installation.

7.2-2 Connecting AC power supply modules

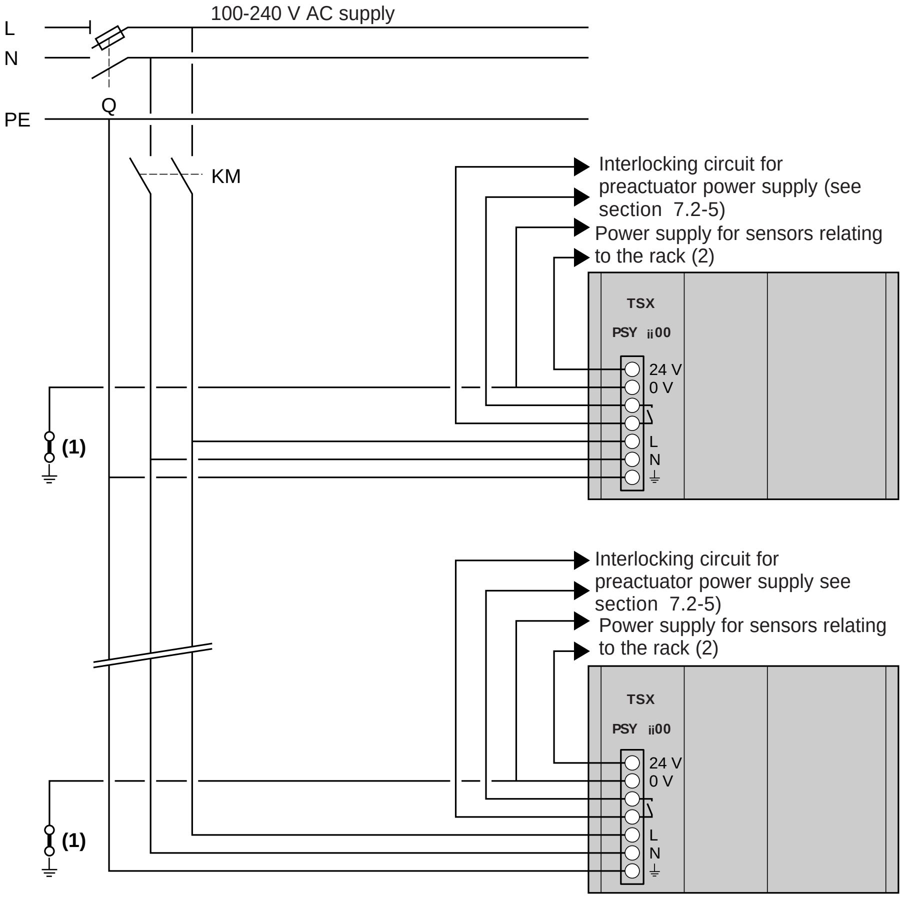
Connecting a PLC station comprising a single rack



Q : general isolator,
KM : line contactor or circuit-breaker,
Protective fuse :
TSX PSY 2600/5500/8500 AC power supply modules are fitted as standard with a protective fuse. This fuse, wired in series with input L, is located inside the module and cannot be accessed.

(1) isolation strip for locating ground fault.
(2) available current :
- 0.6 A with TSX PSY 2600 power supply module (see characteristics section 4.5-1)
- 0.8 A with TSX PSY 5500 power supply module (see characteristics section 4.5-1)
- 1.6 A with TSX PSY 8500 power supply module (see characteristics section 4.5-1)

Connecting a PLC station comprising a number of racks



Note :

When there are a number of PLC stations, all powered from a single supply, the connection principle is identical.

Q : general isolator,

KM : line contactor or circuit-breaker,

Protective fuse :

TSX PSY 2600/5500/8500 AC power supply modules are fitted as standard with a protective fuse. This fuse, wired in series with input L, is located inside the module and cannot be accessed.

(1) isolation strip for locating ground fault.

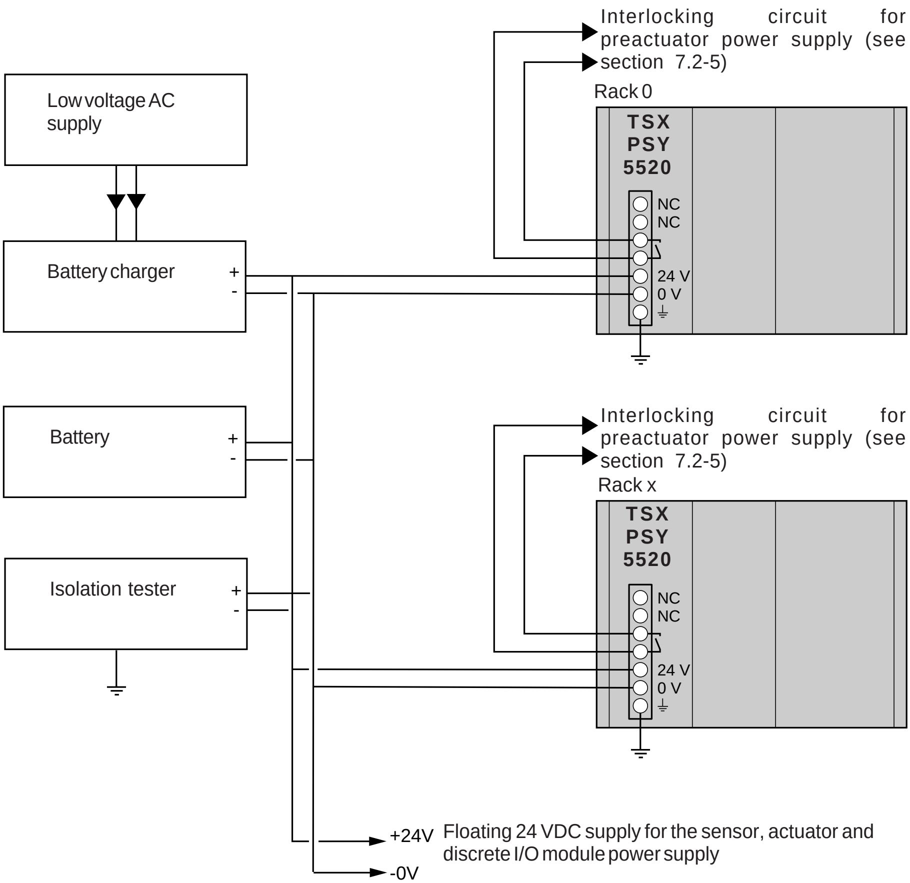
(2) available current :

- 0.6 A with TSX PSY 2600 power supply module, (see characteristics section 4.5-1)
- 0.8 A with TSX PSY 5500 power supply module, (see characteristics section 4.5-1)
- 1.6 A with TSX PSY 8500 power supply module (see characteristics section 4.5-1)

7.2-3 Connecting DC power supply modules via a floating 24 VDC or 48 VDC supply

Warning :

For a free-floating mounting (not connected to ground) used in specific applications and in particular in **M**arine **A**pplications, a **TSX PSY 5520** (24 / 48 VDC) isolated power supply must be used.

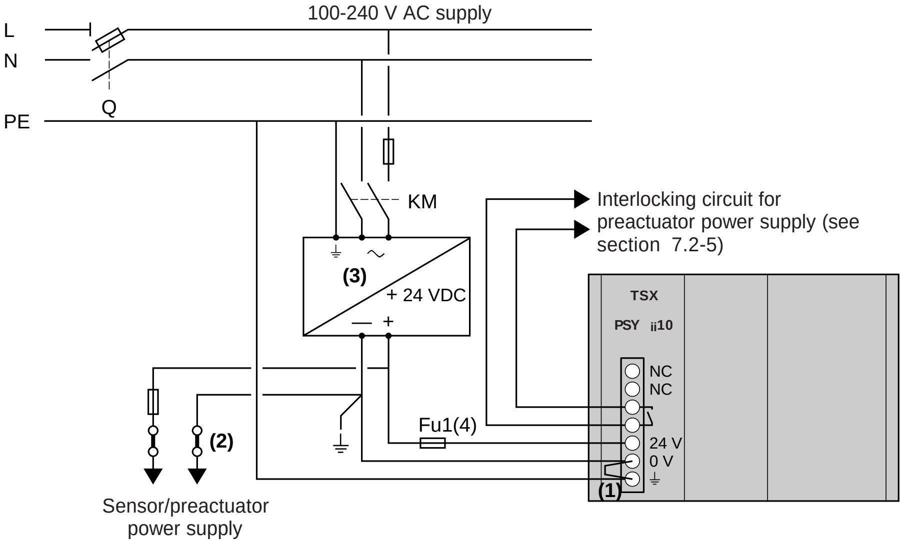


Notes :

- A device can be used to measure the degree of isolation of the 24 VDC (or 48VDC) continuously in relation to ground and to sound an alert if the degree of isolation is abnormally low.
- I/O modules in the Premium range are isolated.

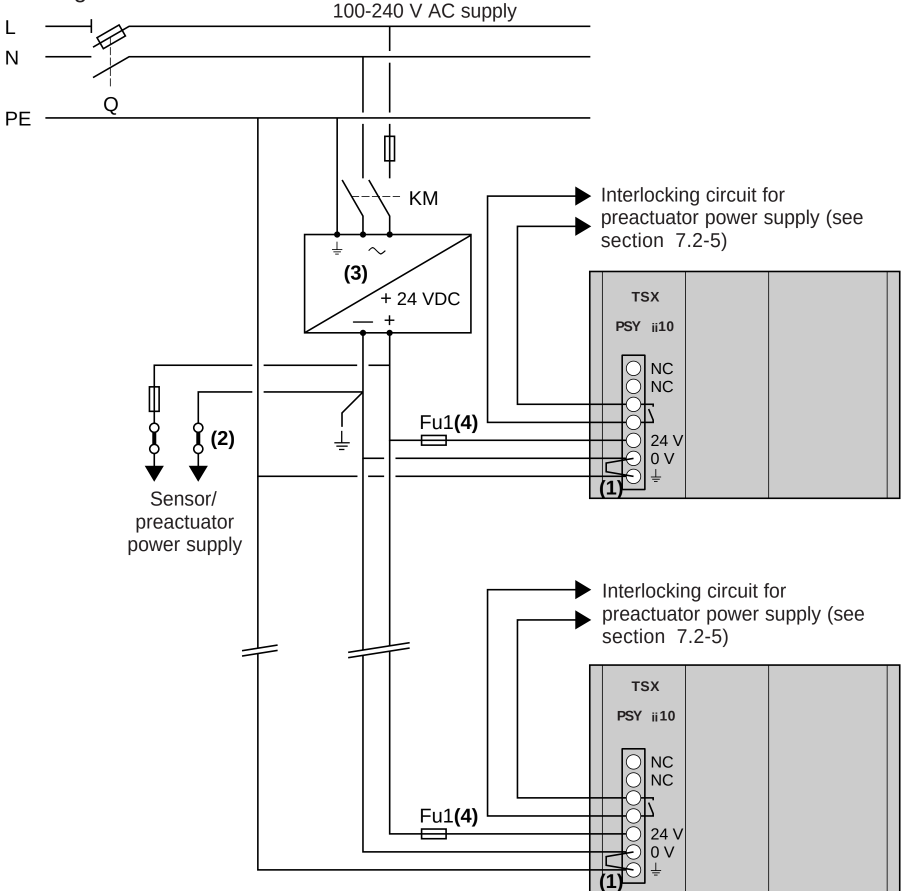
7.2-4 Connecting DC power supply modules via an AC supply

- **TSX PSY 1610/3610 non-isolated power supply modules**
  - Connecting a PLC station comprising a single rack, with AC supply referenced to ground



Q : general isolator,
KM : line contactor or circuit-breaker,
(1) : external shunt supplied with the power supply module
(2) : isolation strip for locating ground fault. In this instance the power supply needs to be unplugged in order to disconnect the AC supply from the ground.
(3) : it is possible to use a process power supply (to be defined according to the power required, see part E).
(4) : protective fuse, (4 A, time-delayed) which is only necessary with a TSX PSY 3610 power supply module.
The TSX PSY 1610 power supply module is fitted as standard with a protective fuse located under the module and in series on the 24V input (3.5 A fuse, 5x20, time-delayed).

- Connecting a PLC station comprising a number of racks, with AC supply referenced to ground

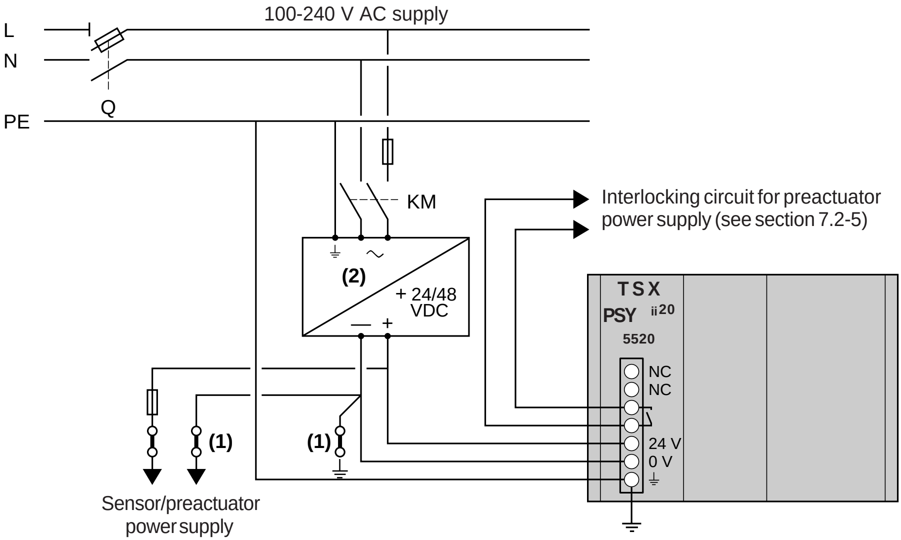


Q : general isolator,
KM : line contactor or circuit-breaker,
(1) : external shunt supplied with the power supply module,
(2) : isolation strip for locating ground fault. In this instance the power supply needs to be unplugged in order to disconnect the AC supply from the ground.
(3) : it is possible to use a process power supply (to be defined according to the power required, see part E).
(4) : protective fuse, (4A, time-delayed) which is only necessary with a TSX PSY 3610 power supply module.
The TSX PSY 1610 power supply module is fitted as standard with a protective fuse located under the module and in series on the 24V input (3.5 A fuse, 5x20, time-delayed).

Note :

- When there are a number of PLC stations, all powered from a single supply, the connection principle is identical.

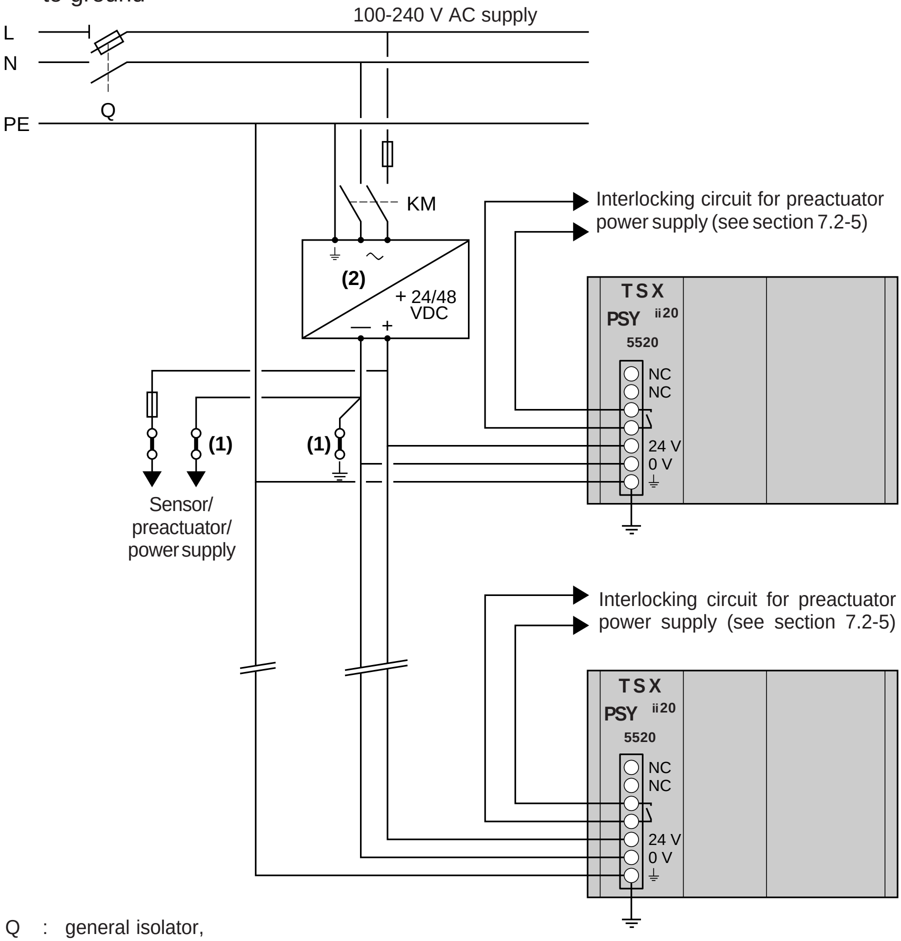
- **TSX PSY 5520 isolated power supply**
  - Connecting a PLC station comprising a single rack, with AC supply referenced to ground



Q : general isolator,
KM : line contactor or circuit-breaker,
Protective fuse :
The TSX PSY 5520 power supply module is fitted as standard with a protective fuse. This fuse, wired in series with the 24/48V input, is located inside the module and cannot be accessed.

(1) : isolation strip for locating ground fault.
(2) : it is possible to use a process power supply (to be defined according to the power required, see part E).

- Connecting a PLC station comprising a number of racks, with AC supply referenced to ground



Q : general isolator,
KM : line contactor or circuit-breaker,
Protective fuse :
The TSX PSY 5520 power supply module is fitted as standard with a protective fuse located under the module and in series on the 24V input : 5 A fuse, 5x20, time-delayed,

(1) : isolation strip for locating ground fault.
(2) : it is possible to use a process power supply (to be defined according to the power required, see part E).

Note :
- Where there are a number of PLC stations, all powered from a single supply, the connection principle is identical.

7.2-5 Sensor and preactuator power supply interlocking

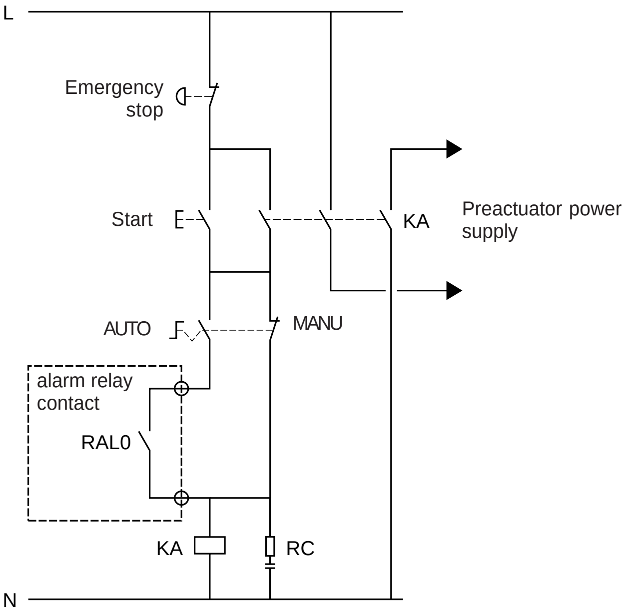
It is advisable to interlock the various power supplies in the following sequence :

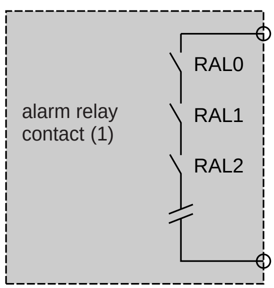
1 Power up the PLC and input (sensor) power supply via the KM contactor (see previous circuit diagrams),

2 If the PLC is running in AUTO mode, power up the output (preactuator) power supply via the KA contactor. This is interlocked with the alarm relay contact of each power supply.

In addition, safety standards require authorization to be given by an operator before restarting the installation after a stop (caused by a power failure or use of the emergency stop button). The following interlocking circuit diagrams take account of these standards. The MANU/AUTO switch gives the option of forcing the outputs from a programming terminal, when the PLC is stopped.

Example 1 : PLC station supplied with AC

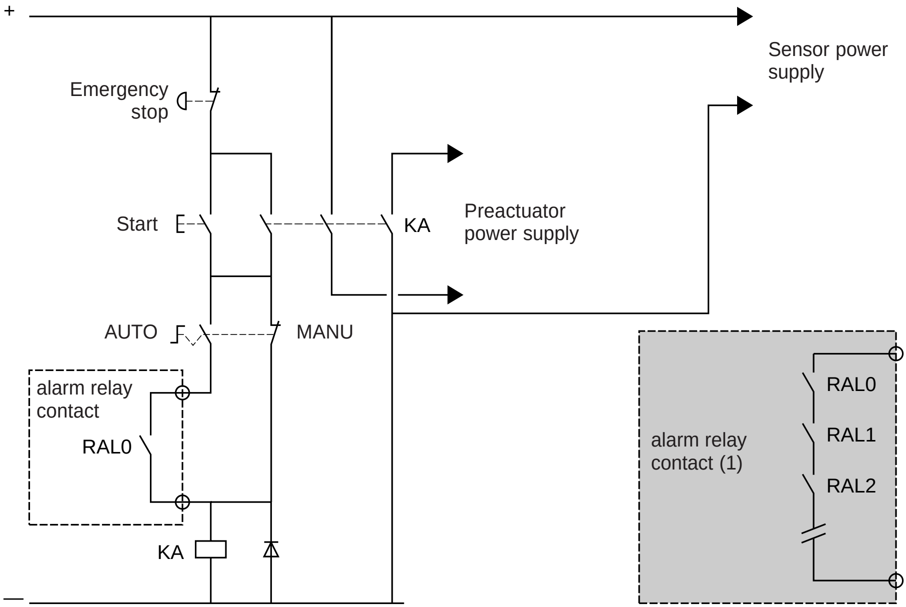




KA : contactor interlocked with the alarm relay of the power supply in AUTO operation.

(1) If the PLC station comprises a number of racks : connect all the power supply "alarm relay" contacts (RAL0, RAL1, RAL2, etc) in series.

Example 2 : PLC station supplied with DC



KA : contactor interlocked with the alarm relay of the power supply in AUTO operation.

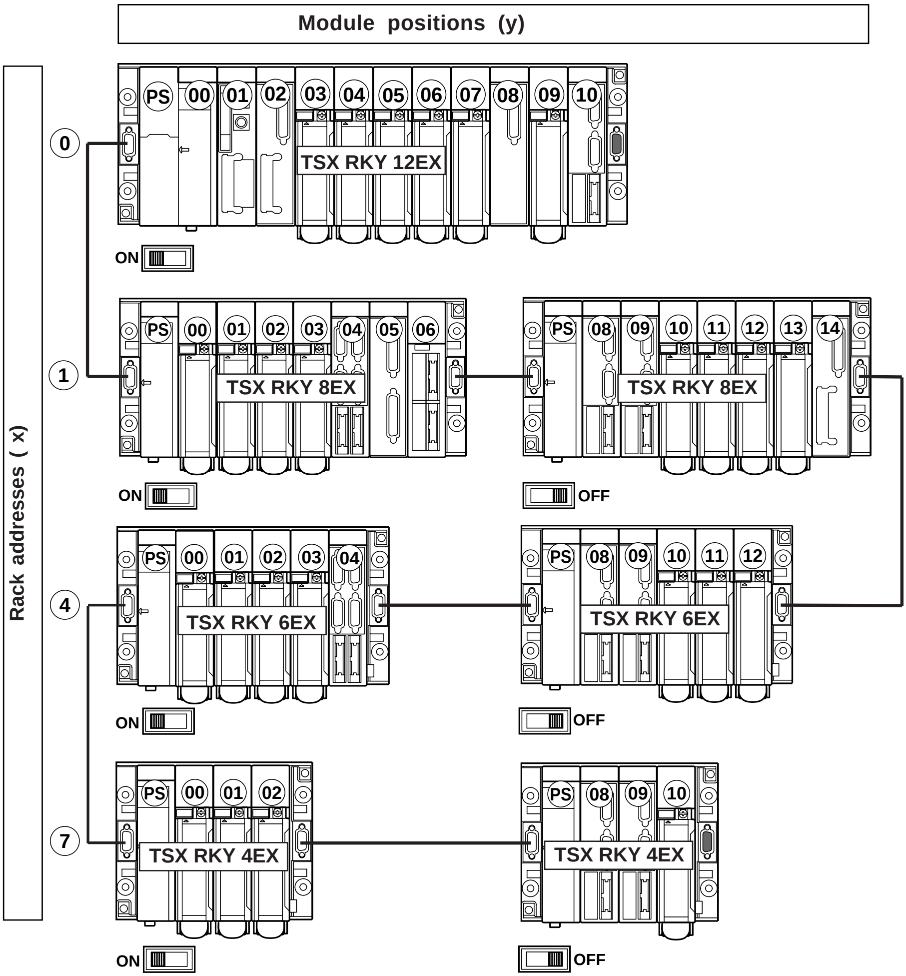
(1) If the PLC station comprises a number of racks : connect all the power supply "alarm relay" contacts (RAL0, RAL1, RAL2, etc) in series.

8.1 Addressing discrete I/O channels

The addressing for all TSX/PMX/PCX 57 PLC bit and word objects is defined in the PL7 reference manual. This section only covers the addressing principle for discrete I/O.

Channel addressing is **geographical**; ie. it depends on :

- the **rack address**,
- the **physical position of the module** on the rack,
- the extendable rack when 2 racks are used on the same address



Note : When using 2 extendable racks on the same address, the position of the modules is defined by the setting of microswitch 4 on the rack (see section 2.3-3 - part A) :

- ON : module position y (y = 00 to 06 depending on the type of rack)
- OFF : module position y (y = 08 to 14 depending on the type of rack).

- **Rack addresses**

Rack references TSX →	RKY 6	RKY 8	RKY 12	RKY4EX	RKY 6EX	RKY 8EX	RKY 12EX
Rack address (x)	0	0	0	0 to 7	0 to 7	0 to 7	0 to 7

- **Module positions using standard racks**

Rack references TSX →	RKY 6	RKY 8	RKY 12
Module position (y)	00 to 04	00 to 06	00 to 10

- **Module positions using extendable racks**

Rack references TSX →		RKY 4EX	RKY 6EX	RKY 8EX	RKY 12EX
micro	ON Module position (y)	00 to 02	00 to 04	00 to 06	00 to 10
switch 4	OFF Module position (y)	08 to 10	08 to 12	08 to 14	not usable

Note:
One rack address can contain up to 2 TSX RKY 4EX/6EX/8EX extendable racks. In this case, the position of the modules is defined by the position (ON or OFF) of microswitch 4 which is located on the rack (see section 2.3-3 : principle for addressing 2 racks at the same address).

- **Channel numbers (i)**

TSX DEY •/ DSY•/DMY • modules	64 I/O	32 I/O	28 I/O	16 I/O	8 I/O
Channel number (i)	0 to 63	0 to 31	I=0-15, O=16-27	0 to 15	0 to 7

The syntax of a discrete I/O address is as follows :

%	**I or Q**	**rack x address**	**module y position**	**•**	**channel i number**
Symbol	I = input Q = output	x = 0 to 7	y = 00 to 14	Point	i = 0 to 63

- **Examples**

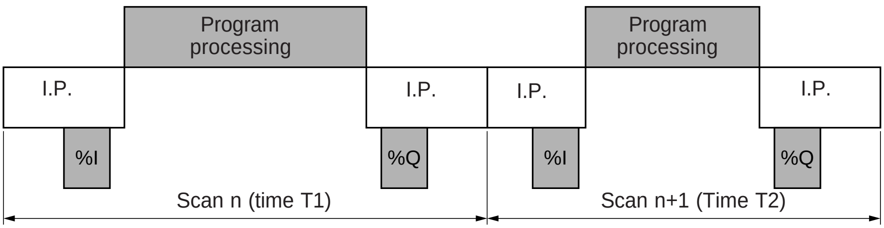
%Q7.3 means : output 3 of the module in position 07 in rack 0.
%I102.5 means : input 5 of the module in position 02 in rack 1

8.2 Single task application structure

The application comprises only the master (MAST) task, which may be executed either cyclically or periodically, depending on the selection at the time of configuration.

8.2-1 Cyclic execution

This type of operation corresponds to the normal execution of the PLC scan (default selection). It consists of sequencing the scans of the main task (MAST), one after another.



I.P. (internal processing) : the system implicitly monitors the PLC (managing the system bits and words, updating the realtime clock current values, updating the status indicator lamps, detecting changes to RUN/STOP, etc) and processing requests originating from the programming terminal or the communication system,

%I (reading the inputs) : writing the status of information on the inputs to the memory,

Program processing: execution of the application program, written by the user,

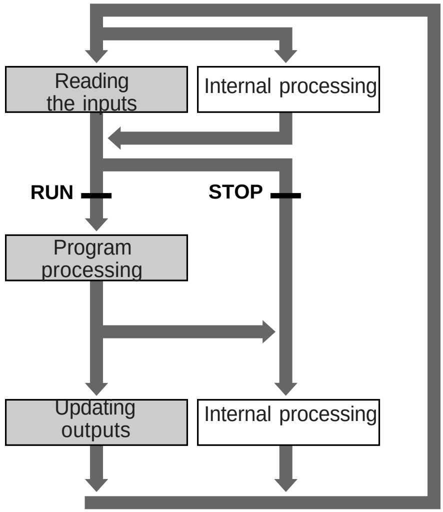
%Q (updating outputs) : assigning physical outputs of discrete, analog and application-specific modules according to the status calculated by the application program.

Operating cycle

PLC running : the processor performs internal processing, reading of inputs, application program processing and updating of outputs. Reading of inputs and updating of outputs occur in parallel with the internal processing.

PLC stopped : the processor only performs internal processing and reading of inputs. The output values are handled by the module according to the fallback mode configured for each channel or group of channels.

- fallback to 0 or 1: the physical outputs are forced to the fallback value (the image memory is not changed),
- maintain state : the module physical outputs are maintained at their last value.



Watchdog overrun

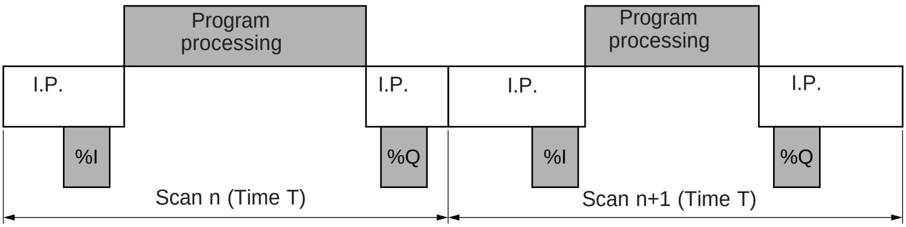
The application scan time is monitored by the PLC (watchdog) and must not exceed the value defined at the time of configuration.
In the event of an overrun, system bit %S11 is set to 1 and the application is declared to be faulty, which causes the PLC to stop immediately (the processor ERR and RUN indicator lamps flash).

Comment

> To avoid tripping the watchdog when making a modification in RUN mode, it is necessary to leave approximately 50 ms time available between the maximum duration of the MAST task and duration of the watchdog.

8.2-2 Periodic execution

In this operating mode, the internal processing, reading of inputs, application program processing and updating of outputs are performed periodically according to a time defined during configuration (from 1 to 255 ms) which can be adjusted by system word %SW0. At the start of a PLC scan, a timer, initialized with the current configured value, starts to count down. The PLC scan must finish before expiry of this downcount, which at 0 starts a new scan.



I.P. (internal processing) : the system implicitly monitors the PLC (managing the system bits and words, updating the realtime clock current values, updating the status indicator lamps, detecting changes to RUN/STOP, etc) and processing requests originating from the programming terminal or the communication system,

%I (reading the inputs) : writing the status of information on the inputs to the memory,

Program processing: execution of the application program, written by the user,

%Q (updating of outputs) : assigning the physical outputs of discrete, analog and application-specific modules according to the status calculated by the application program.

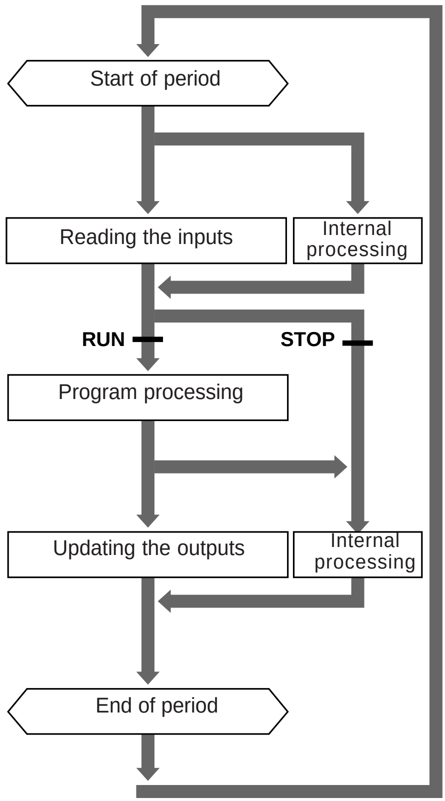
Operating cycle

PLC running : the processor performs internal processing, reading of inputs, application program processing and updating of outputs. Reading of inputs and updating of outputs occur in parallel with the internal processing.
If the period is not yet over, the processor completes its operating cycle with "system" tasks or background tasks until the end of the period.

PLC stopped : the processor only performs internal processing and reading of inputs. The output values are handled by the module according to the fallback mode configured for each channel or group of channels.

- fallback to 0 or 1: the physical outputs are forced to the fallback value (the image memory is not changed),
- maintain state : the module physical outputs are maintained at their last value.

Period overrun : if the operating time exceeds that assigned to the period, the PLC indicates a period overrun by setting task system bit %S19 to 1; processing continues and is executed in its entirety (it should not exceed the watchdog time limit). The next scan is sequenced after implicit writing of the outputs of the current scan.



Watchdog overrun

The application scan time is monitored by the PLC (watchdog) and must not exceed the value defined at the time of configuration.
In the event of an overrun, system bit %S11 is set to 1 and the application is declared to be faulty, which causes the PLC to stop immediately (the processor ERR and RUN indicator lamps flash). The duration of the watchdog must, without exception, be longer than the duration of the period.

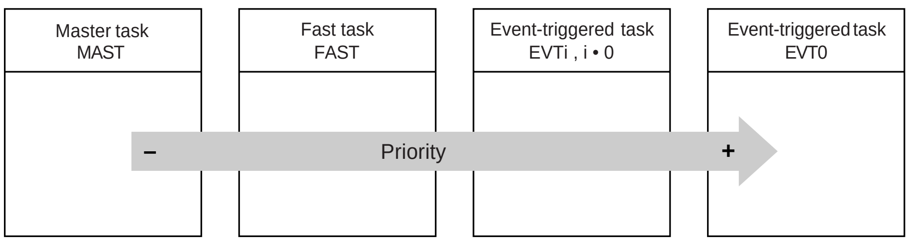
Comment

To avoid tripping the watchdog when making a modification in RUN mode, it is necessary to leave approximately 50 ms time available between the maximum duration of the period and the duration of the watchdog.

8.3 Multitask application structure

The application structure of a TSX/PMX/PCX 57 PLC can be single task or multitask. In a single task structure, only the main MAST task is used in cyclic or periodic operation (see previous section). In a multitask structure, 2 control tasks (MAST and FAST) and event-triggered tasks are offered and executed according to their priority. The triggering of one of these tasks (occurrence of an event or start of scan) interrupts the execution of less important tasks in progress. The interrupted task recommences when the priority task is complete. The structure of this kind of application is as follows :

- the main MAST task, low priority, is always present. It can be cyclic or periodic,
- the FAST task, medium priority, is optional. It is always periodic,
- the event-triggered tasks EVTi, highest priority, are called by the system when an event occurs. These tasks are optional and are useful for applications requiring short software response times. There can be no more than 32 on a TSX/PMX/PCX 5710 PLC and 64 on a TSX /PMX/PCX 57 20, 57 30 and 5740 PLC.
  In all TSX/PMX/PCX 57 PLCs, the event-triggered task EVT0 has higher priority than the other event-triggered tasks (EVT1 to EVT63).



Example of multitask processing :

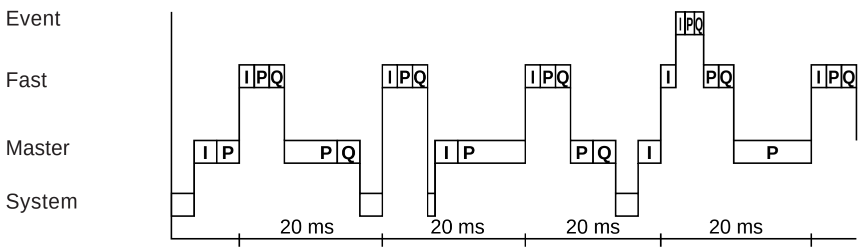
- cyclic master task (MAST),
- fast task with 20 ms period (FAST),
- event-triggered task.

Key

I : reading of inputs

P : program processing

Q : updating outputs



8.3-1 Control tasks

- **MAST master task**

  This task has the lowest priority and controls the majority of the application program. It can be configured to execute cyclically (default mode) or periodically. With periodic execution, the period duration can be configured in the PL7 Junior program and can be adjusted by system word %SW0 (%SW0 = 0 : cyclic execution).
  The MAST task is organized according to the model described in the previous section : implicit reading of inputs, execution of the application program and implicit writing of outputs.

- **FAST task**

  This task has a higher priority than the MAST task and is periodic in order to allow the lower priority time to be executed.
  The period duration can be configured in the PL7 Junior program and adjusted by system word %SW1. This can be higher than that of the MAST task in order to adapt to slow periodic processing. The program executed must nevertheless remain short in order not to penalize the main task (MAST).

  Note

  When the FAST task is empty (no program), it does not exist in the PLC and the system bits and words associated with it are not significant. Hence the channels associated with the task are not exchanged.

- **Period overrun**

  With periodic execution (MAST and FAST task), if the operating time exceeds that assigned to the period, the PLC signals a period overrun by setting system bit %S19 of the task to state 1; processing continues and is executed in its entirety (it must not exceed the watchdog time limit). The next scan is sequenced after implicit writing of the outputs of the current scan.

- **Watchdog overrun**

  With cyclic or periodic execution, the application scan time is monitored by the PLC (watchdog) and must not exceed the value defined during configuration. In the event of an overrun, system bit %S11 is set to 1 and the application is declared to be faulty, which causes the PLC to stop immediately (the processor ERR and RUN indicator lamps flash). The duration of the watchdog must, without exception, be longer than the duration of the period.

- **Assigning channels to control tasks**

  In addition to the application program, the tasks execute "system" functions related to managing their associated implicit I/O. Associating a channel or group of channels with a task is defined in the configuration screen of the corresponding module; the task associated by default is the MAST task.

Discrete I/O module channels :
The modularity of the discrete I/O modules being 8 successive channels (channels 0 to 7, channels 8 to 15, etc), the I/O can be assigned in groups of 8 channels, to either the MAST or FAST task. For example, it is possible to assign the channels of a 32-input module as follows :

- inputs 0 to 7 assigned to the MAST task,
- inputs 8 to 15 assigned to the FAST task,
- inputs 16 to 23 assigned to the MAST task,
- inputs 24 to 31 assigned to the FAST task.

Counter and axis control module channels :
Each channel of a counter or axis control module can be assigned to either the MAST or FAST task. For example, for a 2-channel counter module, it is possible to assign : channel 0 to the MAST task and channel 1 to the FAST task.

Analog module channels :
Each channel (TSX AEY 414 and TSX ASY 410 modules) or group of 4 channels (TSX AEY 800 and TSX AEY 1600 modules) can be assigned to either the MAST or FAST task (MAST task by default).

Note

In order to maximize performance, the module channels should ideally be grouped in a single task.

- **Task monitoring**

  In RUN mode, tasks can be enabled or inhibited by writing a system bit. When a task is inhibited, it exchanges its I/O but does not execute its application program.

  MAST task monitoring : system bit %S30 (0 = task inhibited, 1 = task enabled).
  FAST task monitoring : system bit %S31 (0 = task inhibited, 1 = task enabled).

  By default, the MAST and FAST tasks are active.

8.3-2 Event-triggered tasks

Event-triggered tasks allow control events to be taken into account and processed as quickly as possible (for example, the event inputs of the TSX DEY 16FK and TSX DMY 28 FK discrete modules, threshold reached on a counter module, etc).

Control events

These are **external events** which can be triggered by, for example :

- the event inputs of TSX DEY 16FK and TSX DMY 28 FK discrete modules, on a rising or falling edge,
- the counter channel(s) on counter modules,
- the reception of telegrams in a PLC equipped with a TSX FPP 20 or TSX SCY 2160● module.
- etc.

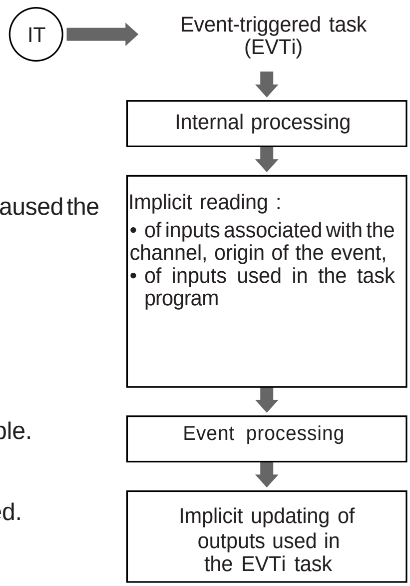
It is possible to configure up to :

- 32 events in TSX/PMX/PCX 5710 PLCs,
- 64 events in TSX/PMX/PCX 57 20, 57 30 and 57 40 PLCs.

The association between a channel and an event number is made in the channel configuration screen.

The appearance of a control event diverts the application program towards the processing which is associated with the I/O channel or with the reception of a telegram, which caused the event :

External event



All the inputs associated with the channel which caused the event are read automatically. (*)

The processing time must be as short as possible.

All the outputs used in the EVTi task are updated.

Notes :

The EVTi task I/O are also exchanged in the MAST or FAST task (in each period or scan), which can cause inconsistencies linked to the input chronology (loss of edge, for example).

(*) In the case of telegrams, data is read by the RCV_TLG function (refer to the "Communication" manual).

Enabling and inhibiting event-triggered tasks

Event-triggered tasks can be globally enabled or inhibited by the application program, via system bit %S38. If one or more events take place while the event-triggered tasks are inhibited, the associated processing is lost.

Masking and unmasking control events

Two PL7 language instructions, available to the application program, allow both global masking and unmasking of control events. If one or more events take place during masking, they are memorized by the system and the associated processing in the event-triggered tasks will only be performed after unmasking; the order of appearance is maintained.
The masking of event-triggered tasks must be short so that :

- there is not too long a delay in taking account of events,
- events are not lost (memorization capacity overrun).

Priority of control events

In a TSX/PMX/PCX 57 PLC, there are 2 levels of priority for control events : event 0 (EVT0) has higher priority than the other events (EVT1 to EVT31 or EVT63 depending on the processor).
When an event occurs, if an event-triggered task of the same or higher priority level is being executed, it is memorized in a stack and the processing associated with this new event will only be performed after the processing in progress. If the stack overflows, events will be lost; an error is indicated by system bit %S39 being set to 1.

Maximum number of channels used in event-triggered tasks

The number of channels associated with the total number of control events is limited (see table below).

Type of channel	**Type of processor**	
	TSX/TPMX P57 1•2 **TPCX 57 1012** (32 EVT)	**TSX/TPMX P57 2•2** **TSX/TPMX P57 3•2** (64 EVT) **TSX/TPMX P57 4•2** **TPCX 57 3512**
Discrete I/O channels	32	128
Analog channels	8	16
App.-specific channels	4	16

Notes

- I/O exchanges of the EVTi task are performed by channel (for some analog and application-specific modules) or by group of channels (for discrete modules and some analog modules). For this reason, if the processing modifies, for example, outputs 2 and 3 of a discrete module, it is the image (PLC memory) of outputs 0 to 7 which will be transferred to the module.
- any exchange of an input/output in an event-triggered task can cause loss of rising edge information, concerning processing performed on this channel (or group of channels), in the task where it has been declared : MAST or FAST.

8.4 User memory structure

The memory space of TSX/PMX/PCX 57 PLCs consists of an internal RAM memory designed to receive the application program. It varies in capacity according to the type of processor :

- 32 Kwords for a TSX P 57 102 or TPCX 571012 processor,
- 48 Kwords for a TPMX P57 102 or TSX/TPMX P 57 202 processor,
- 64 Kwords for a TSX P 57 252/TPMX P 57 302 processor,
- 80 Kwords for a TSX/TPMX P 57 352 or TPCX 573512 processor,
- 96 Kwords for a TSX P 57 402 processor,
- 112 Kwords (1) for a TSX/TPMX P 57 452 processor.

(1) When the application is in the internal RAM, the memory capacity is limited to 96 Kwords, When the application is in the PCMCIA memory card, the memory capacity is 112 Kwords.

Furthermore, this internal RAM memory can be extended with a PCMCIA memory card with a capacity of :

- 32 or 64 Kwords, RAM or FLASH EPROM type for a TSX/TPMX P 57 102 or TPCX 571012 processor,
- 32, 64 or 128 Kwords, RAM or FLASH EPROM type for a TSX/TPMX P 57 2•2 processor,
- 32, 64, 128 or 256 Kwords, RAM or FLASH EPROM (1) type for a TSX/TPMX P 57 3•2, TSX/TPMX P 57 4•2, TPCX 57 3512 processor,

(1) FLASH EPROM memory card, limited to 128 Kwords

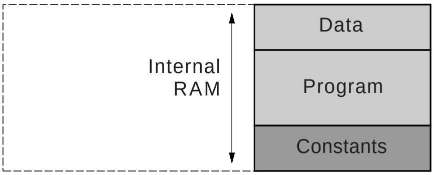
8.4-1 Application memory

The application memory can be divided into memory zones, physically shared between the internal RAM memory and the PCMCIA memory card (if the TSX/PMX/PCX 57 processor is equipped with a memory card) :

- the application data zone is always in internal RAM,
- the application program zone (application descriptor and executable task code) is in internal RAM or in the PCMCIA memory card
- the constants, initial values and configuration zone is in internal RAM or in the PCMCIA card.

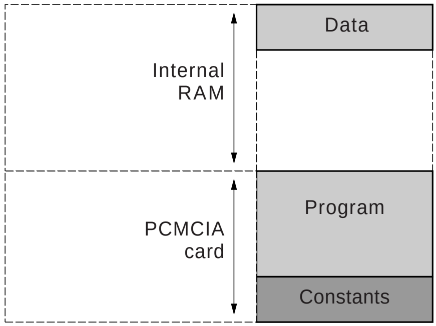
With respect to these zones, 2 types of application memory organization are possible depending on whether or not the PLC is equipped with a PCMCIA memory card.

TSX /PMX/PCX 57 (with no PCMCIA card)



Data : application data,
Program : descriptor and executable task code,
Constants : constant words, initial values and configuration

TSX /PMX/PCX 57 (with PCMCIA card)



Application in internal RAM

So that the application is loaded entirely in the protected internal RAM (*) of the PLC without PCMCIA memory extension card, its size must be compatible with that of the RAM memory :

- 32 Kwords (TSX P57 102/TPCX 57 1012), split for example into 7.5 Kwords of application data and 24.5 Kwords of program and constants.
- 48 Kwords (TPMX P57 102 and TSX/TPMX P 57 202), split for example into 10 Kwords of application data and 38 Kwords of program and constants.
- 64 Kwords (TSX P 57 252/TPMX P 57 302), split for example into 15 Kwords of application data and 49 Kwords of program and constants.
- 80 Kwords (TSX/TPMX P 57 352 et TPCX 573512), split for example into 20 Kwords of application data and 60 Kwords of program and constants.
- 96 Kwords (TSX P 57 402, TSX/TPMX P 57 452), split for example into 25 Kwords of application data and 71 Kwords of program and constants.

  Note :If the PLC station has a TSX/TPMX P57 452 processor, the capacity of the internal RAM is limited to 96 Kwords.

(*) The internal RAM is protected by an optional 3.6 V battery located on the power supply module which has an autonomy of at least 1 year (see section 6 of this part).

Application in the PCMCIA card

In this case, the memory card contains the executable program, the constants, the configuration, etc; the internal RAM is reserved exclusively for data.

In the creation and debugging phases of the program, it is necessary to use a protected RAM type PCMCIA card. Once the program is operational, it will be able to be executed in this memory card or transferred to a FLASH EPROM type PCMCIA card, to ensure protection in the event of failure of the RAM type memory card battery.

Comment

> When an application has been configured for execution in the internal RAM memory of a PLC (no PCMCIA memory card defined in the processor configuration screen), the presence of this card must first be declared (in the processor configuration screen) before transferring this application to a PLC equipped with a PCMCIA memory card.

Application protection

Whatever the structure of the PLC memory : whether the application is situated in the internal RAM or in the PCMCIA card, the application can be protected in order to inhibit access in online mode under PL7 Junior / PL7 Pro (program reading and debugging).

To "remove" the protection from such an application, it must be transferred again, without protection, from the terminal to the PLC. This operation requires the source program of the application to have been previously loaded into the terminal.

A protected application in a PCMCIA card can be executed by another PLC, but never duplicated. In addition to the protection offered by PL7 Junior, PCMCIA cards have a lock which inhibits any write access (program loading or modification).

Application backup

With Premium PLCs, it is possible to back up the application (program and constants) on a Backup memory card (reference TSX MFP BAK 032P). The internal RAM memory can thus be reloaded with the contents of this Backup memory card.

Note : This Backup function is not available when the application is being executed on a RAM or FLASH EPROM PCMCIA memory card.

- **Loading an application "backup" from the PLC internal RAM memory.**

  This operation consists of transferring the application program from the PLC internal RAM memory to a Backup PCMCIA memory card (reference TSX MFP BAK 032P). To do this, perform the following steps.

  1 insert the Backup memory card into its slot with the write-protection tab WP in the OFF position,
  2 transfer the application from the PLC internal RAM to the Backup card (PLC/Backup menu, RAM ➜ Backup zone option),
  3 at the end of this operation, remove the Backup card and set the WP switch to ON (backup protected).

⚠ **If the application in the PLC is protected, inserting the Backup memory card reinitializes the PLC internal RAM memory. In this case, the procedure for loading the Backup memory card is as follows :**

1 ensure that the application program to be saved is available in the terminal. If it is not, transfer this program to the terminal,

2 insert the Backup memory card into its slot with the write-protection tab WP in the OFF position,
3 transfer the application from the terminal to the PLC internal RAM (PLC/Transfer program menu, : PC ➜ PLC option),
4 transfer the application from the PLC internal RAM to the Backup card (PLC/Backup menu, RAM ➜ Backup zone option),
5 at the end of this operation, remove the Backup card and set the WP switch to ON (backup protected).

Note :
These various transfers are executed from a terminal equipped with PL7 Junior/PL7 Pro software.

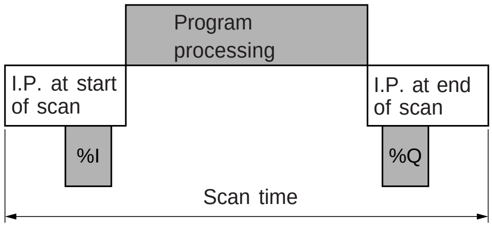
- **Retrieving an application "backup" from a preloaded memory card**

  This operation, using a preloaded memory card (reference TSX MFP BAK 032P), enables the application program to be updated without using a terminal. The write-protection tab on this memory card must be in the ON position. When this type of card is inserted in a TSX/PMX/PCX 57 PLC, its contents are **automatically** transferred to the internal RAM memory of this PLC. At the end of the transfer, the PLC is placed in forced STOP (whatever the configured RUN AUTO option).
  As long as the "backup" card is in the PLC, a power break / power return always causes its start-up in forced STOP.
  Removal of the card causes the PLC to cold start, in RUN or STOP according to the RUN AUTO configuration.

8.5 Performance

8.5-1 MAST task scan time

IP = internal processing



MAST scan time	**=**	**Program processing time (Ttp)** **+** **Internal processing time at start and end of scan (Tti)**

- **Definition of the program processing time Ttp**

Ttp	**=**	Application code execution time (Texca) + Grafcet overhead time (ToG7)

- Application code execution time (Texca)

Texca= Σ of the time of each instruction executed by the application program on each scan

The execution time of each instruction as well as the typical application used to verify these are given in the manual TLX DR PL7 33E - part B - section 8.

By way of indication, the table below gives the execution time in milliseconds (ms), for 1K instruction (1).

(1) 1K instruction = 1024 instructions

Processors	Application code execution time Texca (1)			
	Internal RAM		PCMCIA card	
	100% Boolean	65% Boolean + 35% numerical	100% Boolean	65% Boolean + 35% numerical
TSX P57 102 **TPCX 57 1012**	0.72 ms	1.39 ms	0.72 ms	1.39 ms
TSX P57 202 / 252 **TSX P57 302 / 352** **TPMX P57 102** **T PCX 57 3512**	0.31 ms	0.78 ms	0.47 ms	0.98 ms
TSX P57 402 / 452 **TPMX P57 202** **TPMX P57 352 / 452**	0.31 ms	0.5 ms	0.47 ms	0.68 ms

Note : not all the application program instructions need to be executed on each PLC scan.

(1) with all instructions executed on each PLC scan

- Grafcet overhead time (ToG7)

ToG7 = TGF **+** (TEA x number of steps active at the same time) **+** (TTP x number of transitions which are true at the same time).

Processors	TGF	TEA	TTP
TSX P57 102 **TPCX 57 1012**	0.332 ms	0.121 ms	0.491 ms
TSX P57 202 / 252 **TSX P57 302 / 352** **TPMX P57 102** **T PCX 57 3512**	0,291 ms	0.106 ms	0.431 ms
TSX P57 402 / 452 **TPMX P57 202 / 352 / 452**	0.13 ms	0.05 ms	0.19 ms

• Definition of the internal processing time at the start and end of the scan (Tti)

Tti = MAST task system overhead time (TosM)
\+
max [System time for communication in reception (Tcomr); management time at start of scan for implicit I/O %I (Tge%I)]
\+
max [System time for communication in transmission (Tcome); management time at end of scan for implicit I/O %Q (Tgs%Q)]

- MAST task system overhead time (TosM)

Processors	Time without FIPIO application	Time with FIPIO application
TSX P57 102 **TPCX 57 1012**	2.9 ms	–
TSX P57 202 / 302 **TPMX P57 102**	2 ms	–
TSX P57 252 / 352 **TPCX 57 3512**	2 ms	3.8 ms
TSX P57 402 **TPMX P57 202**	0.6 ms	–
TSX P57 452 **TPMX P57 352 / 452**	0.6 ms	1.1 ms

- Management time of implicit I/O (%I and %Q) at the start and end of the scan

Tge%I = $60\ \mu s + \Sigma$ of IN times for each module (see below)

Tgs%Q = $60\ \mu s + \Sigma$ of OUT times for each module (see below)

Input (IN) and output (OUT) management times for each module :
Discrete I/O, analog, counter, axis control and stepper motor control modules.

Type of module	Management times		
	Input (IN)	Output (OUT)	Total (IN + OUT)
8-channel discrete inputs	27 µs	–	27 µs
16-channel discrete inputs (all modules except TSX DEY 16FK)	27 µs	–	27 µs
32-channel discrete inputs	48 µs	–	48 µs
64-channel discrete inputs	96 µs	–	96 µs
Fast discrete inputs (8 channels used) (TSX DEY 16FK/TSX DMY 28FK module)	29 µs	16 µs	45 µs
Fast discrete inputs (16 channels used) (TSX DEY 16FK/TSX DMY 28FK/28RFK module)	37 µs	22 µs	59 µs
8-channel discrete outputs	26 µs	15 µs	41 µs
16-channel discrete outputs	33 µs	20 µs	53 µs
32-channel discrete outputs	47 µs	30 µs	77 µs
64-channel discrete outputs	94 µs	60 µs	154 µs
Analog inputs (per group of 4 channels)	84 µs	–	84 µs
Analog outputs (4 channels)	59 µs	59 µs	118 µs
Counter (TSX CTY 2A/4A), per channel	55 µs	20 µs	75 µs
Counter (TSX CTY 2C), per channel	65 µs	21 µs	86 µs
Stepper motor control (TSX CFY ••), per channel	75 µs	20 µs	95 µs
Axis control (TSX CAY ••), per channel	85 µs	22 µs	107 µs

Note:
The times given for discrete I/O modules assume that all the module channels are assigned to the same task.
Example: using a TSX DEY 32 D2 K module
- if the 32 channels are assigned to the same task, take the "32-channel discrete inputs" time.
- if only 16 channels are assigned to the same task, take the "16-channel discrete inputs" time, not the "32-channel discrete inputs" time divided by 2.

- Communication system time

  Communication (excluding telegram) is managed during the MAST task "Internal Processing" phases :
  - at the start of the scan for message reception (Tcomr)
  - at the end of the scan for message transmission (Tcome)

  The MAST task scan time is therefore affected by communication traffic. The communication time per scan varies considerably depending on :
  - the traffic generated by the processor : number of communication EFs which are active simultaneously,
  - the traffic generated by other devices in the direction of the processor or devices for which the processor, as master, acts as a router.

  This time is only spent in scans where there is a new message to be managed.

Examples of communication system times :

- PL7 Junior software with terminal online and animation table open

Processors	Average time per scan	Maximum scan time
TSX P57 102 **TPCX 57 1012**	2.5 ms	3.4 ms
TSX P57 202 / 252 **TSX P57 302 / 352** **TPMX P57 102** **T PCX 57 3512**	1.8 ms	2.4 ms
TSX P57 402 / 452 **TPMX P57 202** **TPMX P57 352 / 452**	0.8 ms	1 ms

- 1 SEND_RQ OF (mirror request, 100 characters)

Instruction execution time : 2 ms (for a TSX P 57 202 processor) to be included in the application code execution time for scans where the EF is actually executed.

Communication system time

Processors	Transmission time	Reception time
TSX P57 102 **TPCX 57 1012**	1.4 ms	1.4 ms
TSX P57 202 / 252 **TSX P57 302 / 352** **TPMX P57 102** **T PCX 57 3512**	1 ms	1 ms
TSX P57 402 / 452 **TPMX P57 202** **TPMX P57 352 / 452**	0.4 ms	0.4 ms

These times cannot all occur in the same scan. Transmission occurs in the same scan as execution of the instruction as long as the communication traffic is low, but not in the same scan as reception of the response.

Example of calculating MAST task scan times in the following conditions :

For an application with the following characteristics :

- TSX P 57 202 processor,
- Program execution in PLC internal RAM,
- 10 K instructions, 65% Boolean + 35 % numeric,
- 1 communication OF of the SEND_REQ type,
- 128 discrete inputs distributed on : seven TSX DEY 16D2 modules + one TSX DEY 16FK module
- 80 discrete outputs, distributed on : five TSX DSY 16T2 modules,
- 32 analog inputs distributed on : two TSX AEY 1600 modules,
- 16 analog outputs distributed on : four TSX ASY 410 modules,
- 2 counter channels distributed on : 1 TSX CTY 2A module,

Application code execution time (Texca) :

- Without communication OF : 10x 0.78 = 7.8 ms
- With 1 communication OF of the SEND_REQ type = (10x0.78) + 2 = 9.8 ms

System overhead time (TosM) = 2 ms

Management time for implicit I/O (%I and %Q) at the start and end of the scan :

Module reference	Type of module	Number of modules	Management time at start (IN)	at end (OUT)
TSX DEY 16 D2	16-channel discrete inputs	7	238 µs	–
TSX DEY 16 FK	16-channel discrete inputs (fast inputs)	1	37 µs	22 µs
TSX DSY 16T2	16-channel discrete outputs	5	165 µs	100 µs
TSX AEY 1600	Analog inputs	2 (32 channels)	672 µs	–
TSX ASY 410	Analog outputs	4 (16 channels)	236 µs	236 µs
TSX CTY 2A	Counter	1 (2 channels)	110 µs	40 µs
Total management time			1458 µs	398 µs

- Management time at start of scan : Tge%I = 60µs + 1458 µs = 1518 µs = 1.52 ms
- Management time at end of scan : Tgs%Q = 60µs + 398 µs = 458 µs = 0.46 ms

Communication system time :

- Sending the request : Tcome = 1 ms
- Receiving the response : Tcomr = 1 ms

Scan time without execution of the communication OF

TcyM = Texca + TosM + Tge%I + Tgs%Q
= 7.8 ms + 2 ms + 1.52 ms + 0.46 ms = **11.78 ms**

Scan time with execution of the communication OF and transmission of the request

TcyM = Texca + TosM + Tge%I + max [request transmission time (Tcome), Tgs%Q]

= 9.8 ms + 2 ms + 1.52 ms + max [1ms; 0.46 ms] = **14.32 ms**

Scan time with reception of the response

TcyM = Texca + TosM + max [response reception time (Tcomr), Tge%I] + Tgs%Q

= 7.8 ms + 2 ms + max [1 ms; 1.52 ms] + 0.46 ms = **11.78 ms**

8.5-2 FAST task scan time

FAST scan time	**=**	**Program processing time (Ttp)** **+** **Internal processing time at start and end of scan (Tti)**

- **Definition of the program processing time Ttp**

Ttp **=** Execution time of application code with respect to the FAST task (Texca)

- Application code execution time (Texca) : see the definition in section 8.5-1

- **Definition of the internal processing time at the start and end of the scan (Tti)**

Tti	**=**	FAST task system overhead time (TsoF) + Management time for implicit I/O (%I and %Q) at start and end of scan

- FAST task system overhead time (TosF)

Processors	FAST task system overhead time
TSX P57 102 **TPCX 57 1012**	0.8 ms
TSX P57 202 / 252 **TSX P57 302 / 352** **TPMX P57 102** **TPCX 57 3512**	0.6 ms
TSX P57 402 / 452 **TPMX P57 202** **TPMX P57 352 / 452**	0.2 ms

- Management time for implicit I/O (%I and %Q) : see section 8.5-1

8.5-3 Response time on an event

Time between a rising edge on an event-triggered input and the corresponding edge on an output set by the event-triggered task program.
Example : program with 100 Boolean instructions and input module TSX DEY 16 FK

Processors	Response time					
	TSX DSY 08T22 module			TSX DSY 32T2K module		
	Minimum	Typical	Maximum	Minimum	Typical	Maximum
TSX P57 102 **TPCX 57 1012**	1.2ms	1.3ms	2.8ms	1.9ms	2.4ms	4.2ms
TSX P57 202 / 252 **TSX P57 302 / 352** **TPMX P57 102**	1ms	1.1ms	2.2ms	1.8ms	2.2ms	3.7ms
TPCX 57 3512 **TSX P57 402 / 452** **TPMX P57 202** **TPMX P57 352 / 452**	0.7ms	0.8ms	0.8ms	1.5ms	1.9ms	2.1ms

8.5-4 Precision of the internal time bases

For time management, Premium PLCs have :

- a time/date clock (10^{-5} precision) from which system words %SW49 to %SW58 are refreshed.
- a realtime clock with a theoretical period of 1 ms but whose actual period is 0.99973 ms (10^{-5} precision) which controls :
  - the task periods,
  - the timers, monostables, GRAFCET step activity times, etc,
  - periodic system bits %S4 to %S7,
  - system word %SD18.

  This difference (0.027%) between the theoretical value and the actual value is completely acceptable for the above uses. However any timestamping operation performed using this clock will result in a gain of around 24 seconds per 24 hour period, which will not occur if the same operation is performed using the time/date clock.

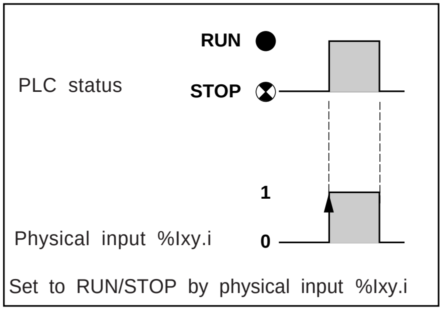
9.1 Setting the PLC to RUN/STOP

Principle

The RUN/STOP function is used to start (RUN) or stop (STOP) execution of the application program.
This function can be performed from :

- A programming or adjustment terminal,
- A discrete physical input which will previously have been dedicated to this function during the application configuration stage.

  Setting the PLC to STOP using this physical input has priority over setting it to RUN from a terminal or network.



Operating modes of the physical RUN/STOP input

- Operation of the physical RUN/STOP input (%Ixy.i)
  - At state 0, this input forces the application to stop (STOP state),
  - A rising edge on this input causes the application to start up (RUN state),
  - At state 1, the application can be controlled freely from a terminal,
  - If there is a fault on the RUN/STOP input, the application stops. Once the fault has disappeared, and if the input is at state 1, the application restarts in RUN mode.
- Processing on a restart
  - the cold start is performed in RUN if :
    - the RUN/STOP input is at state 1,
    - there is no fault on this input at the time of the start.
  - the warm restart is performed in RUN if :
    - the RUN/STOP input is at state 1,
    - there is no fault on this input at the time of the start,
    - the PLC has not received a STOP command before the break.

Summary of the PLC status during a warm restart
(depending on the state of the RUN/STOP input before the break and on return of power)

RUN/STOP input state on return of power / **RUN/STOP input state before power break**	State 1	State 0 or faulty
State 1, PLC in RUN mode	PLC in **RUN** mode	PLC in **STOP** mode
State 1, PLC in STOP mode	PLC in **STOP** mode	PLC in **STOP** mode
State 0	PLC in **RUN** mode	PLC in **STOP** mode
Faulty	PLC in **RUN** mode	PLC in **STOP** mode

9.2 Processing on power break and power return

9.2-1 Break in the power supply on the rack supporting the TSX/PMX 57 processor (rack 0) or on the PC supporting the PCX 57 processor

On a power break, the system memorizes the application context. When the power supply returns, the saved context is compared to the current one, which defines the type of start which will be executed :

- If the application context has changed (loss of system context or new application), the PLC performs a **cold start** and initializes the application,
- If the application context is identical, the PLC performs a **warm restart** without initializing the data.

Cold start

Cold starting is performed in RUN or in STOP depending on the state of the "automatic start-up in RUN" bit defined during configuration, or on the state of the RUN/STOP input.

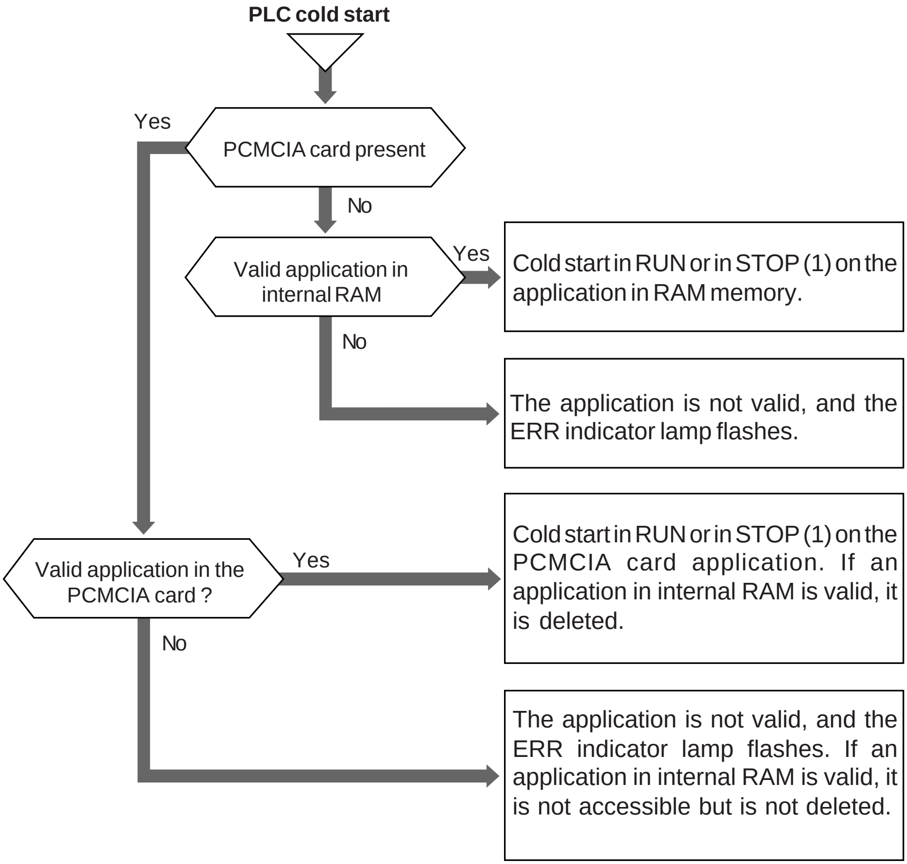
- **PLC response :**

  Initialization of the application data :
  - Setting of the internal bits and I/O image to 0.
  - Initialization of the system bits and words.
  - Initialization of the function blocks from the configuration data.
  - Canceling of any forcing.
  - Setting of the internal words (%MWi) to 0 if no save was requested during configuration, otherwise they are left in their current state.
  - Initialization of the data declared in the DFBs : either to 0, or to the initial value declared in the code, or with the value saved during the SAVE function.

  Other initializations :
  - Initialization of the message and event stacks.
  - Transmission of the configuration parameters to all the discrete I/O modules and application-specific modules (analog, counter, axis control, communication, etc).

  Start-up of the application, if start-up in RUN is requested :
  - Restart of the first scan in the MAST task.
  - Setting of system bits %S0 (cold start) and %S13 (first scan in RUN) to 1 at the start of the first MAST task scan.
  - Setting of system bits %S0 and %S13 to 0 at the end of the first MAST task scan.
  - Activation of other tasks.

The PLC will respond differently on a cold start depending on whether it is equipped with a PCMCIA memory card (see diagram below).



(1) Starting in RUN or in STOP is defined during configuration

- **Processing of the application program on a cold start**

  If the user requires specific processing of the application in the event of a cold start, the state of system bit %S0, which remains at 1 during the first MAST task scan, must be tested at the start of the MAST task.

- **Actions causing a cold start**

Actions	Characteristics of the start
Loading an application	Forced cold start in STOP
Action on the processor RESET button	Cold start in STOP or in RUN according to the configuration
Action on the processor RESET button following a blocking fault	Forced cold start in STOP
Manipulation of the handle or Inserting/removing a PCMCIA memory card	Cold start in STOP or in RUN according to the configuration
Initialization from PL7 Junior or PL7 Pro Forcing system bit %S0	Cold start in STOP or in RUN according to the configuration, without initialization of the discrete I/O and application-specific modules.
Restart after a power break with loss of context	Cold start in STOP or in RUN according to the configuration

Warm restart

A restart after a power break is treated as a warm restart if the application context has not changed.

- **PLC response :**

  Restart of program execution
  program execution restarts from the line at which the power break occurred, without updating the outputs at the end of the restart cycle.

  Initialization at the end of the restart cycle
  - of the message and event stacks.
  - transmission of the configuration parameters to all the discrete I/O modules and application-specific modules (analog, counter, axis control, communication, etc).
  - deactivation of event-triggered and FAST tasks until the end of the first MAST task scan.

  Restart
  - Restart of the first scan in the MAST task.
  - Setting of system bits %S1 (warm restart) and %S13 (first scan in RUN) to 1 at the start of the first MAST task scan.
  - Setting of system bits %S1 and %S13 to 0 at the end of the first MAST task scan.
  - Activation of other tasks.

- **Processing the warm restart**

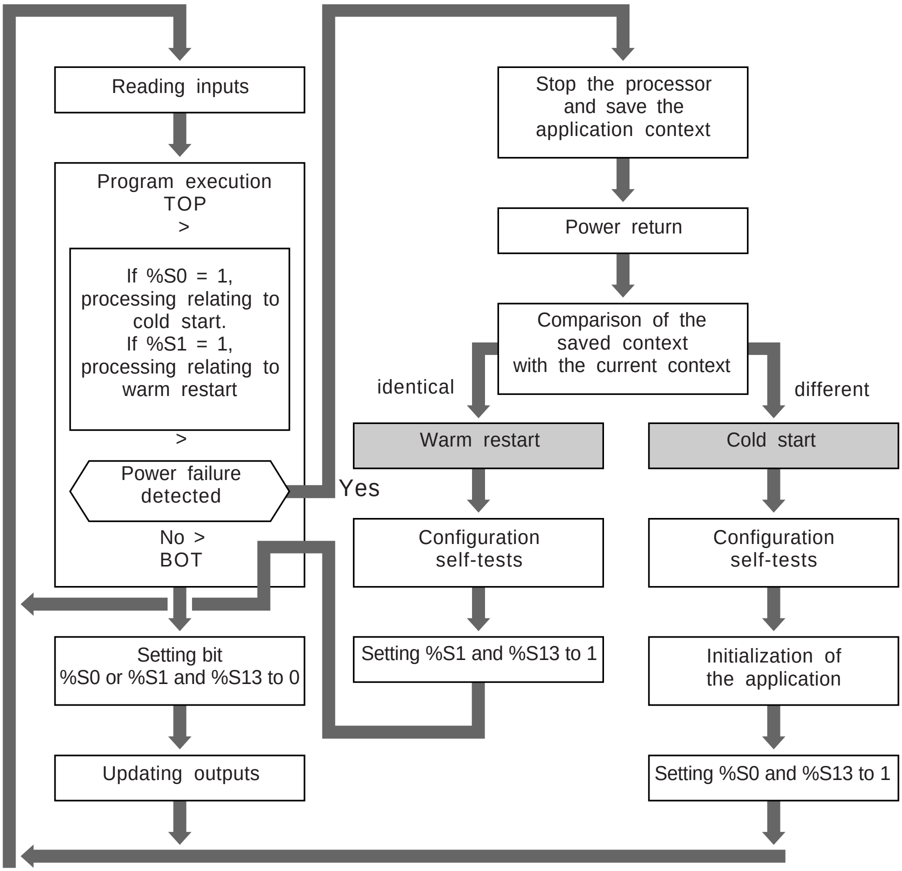
  If the user requires specific processing of the application in the event of a warm restart, the state of system bit %S1, which remains at 1 during the first MAST task scan, must be tested at the start of the MAST task.

- **Actions causing a warm restart**

Actions	Characteristics of the restart
Action on the RESET button of the power supply module in rack 0	Warm restart
Forcing system bit %S1	Warm restart
Restart after a power break without loss of context	Warm restart

(1) except on a station with a PCX 57 processor

Diagram of a cold start / warm restart



9.2-2 Break in the power supply on a rack other than rack 0

All the channels on this rack are seen as faulty by the processor but the other racks are not affected, and the values of the faulty inputs cease to be updated in the application memory. In the case of a discrete input module they are set to 0, unless they have been forced, in which case they keep their forced value.

If the duration of the failure is less than 10 ms for AC power supplies or 1 ms for DC power supplies, it is not seen by the program which runs normally.

9.3 Processing on insertion/removal of a PCMCIA memory card

9.3-1 On TSX/PMX 57 PLCs

TSX/PMX 57 PLC processors are equipped with a cover on the front panel which must be removed in order to insert a PCMCIA memory card. Removing the cover causes the PLC to stop without saving the application context. The module outputs change to fallback mode.
Insertion of the memory card fitted with its handle causes the PLC to cold start. Similarly, removing the memory card causes the PLC to stop without saving the application context.

⚠ If the program contained in the PCMCIA memory card has the RUN AUTO option, the processor automatically starts in RUN once the card has been inserted.

9.3-2 On PCX 57 PLCs

⚠ The PCMCIA memory card must not be inserted in or removed from a PCX 57 processor which is powered up. Such intervention, although not destructive for the processor or any other device, will cause random behavior of the processor, and operation cannot therefore be guaranteed.

⚠ If the program contained in the PCMCIA memory card has the RUN AUTO option, the processor automatically starts in RUN once the card has been inserted and the PC has been powered up.

9.4 Processing after action on the processor RESET button

All the processors have a RESET button on the front panel which, when pressed, causes the PLC to cold start in RUN or in STOP (1), on the application contained in the memory card (or in the internal RAM).

RESET following a processor fault

When a processor fault appears, the rack 0 (2) alarm relay is deactivated (open contact) and the module outputs change to the fallback position or their state is maintained, according to the choice made at the time of configuration. Pressing the RESET button causes the PLC to cold start, forced into STOP.

(1) Starting in RUN or in STOP is defined during configuration

(2) With a TSX/PMX 57 processor. This relay is not controlled in the case of a PCX 57 processor.

Note :

When the RESET button is used, and during the PLC cold start, the terminal link ceases to be active.

9.5 Processing after action on the power supply RESET button

The power supply module in each rack has a RESET button on the front panel, which can be activated to trigger an initialization sequence for the modules on the rack it is supplying.

If this button is activated on the power supply module on the rack containing the TSX/PMX 57 processor (rack 0), it causes a warm start.

Special case of a PCX 57 processor

In this case, since the processor is not physically present on the rack at address 0, activation of the RESET button on the rack power supply does not cause a warm restart of the application. However, the modules on this rack are reinitialized.

9.6 Response of the PCX 57 to an action on the PC

Note

The PCX 57 processor operating modes are identical to those of TSX / PMX 57 processors.

- **Power up / down of the PC receiving the PCX 57 processor :**

  Warm restart of the PCX 57 if the application context has not changed.

- **Micro-cuts on the AC supply powering the PC :**

  Since the PCX 57 does not have a mechanism for filtering micro-cuts, any micro-cut which is not filtered by the PC internal power supply causes the PCX 57 to warm restart if the application context has not changed.

- **Pressing the PC RESET button :**

  As a general rule, and provided that the RESET button on the PC activates the RSTDRV signal on the ISA bus, pressing the RESET button on the PC causes the PCX 57 to warm restart if the application context has not changed,

- **Software RESET of the PC (CTRL ALT DEL),**

  These actions have no effect on the current status of the PCX 57 processor (if the PCX 57 processor is in RUN, it stays in RUN, etc). They do not cause a warm restart or a cold start.

  Comment :

  A software blocking fault on the PC has no effect on the current status of the PCX 57 processor (same response as to that for a PC software RESET).

- **Software commands (Shutdown or Restart)**

  On some PCs (a small minority), the Shutdown or Restart software commands cause a warm restart of the PCX 57.
  This behavior of the PCX 57 has been observed on certain PCs where the mother board manages the RSTDRV signal in a particular way during the PC RESET phases.
  On the majority of PCs, these software commands do not affect the behavior of the PCX 57.

9.7 Behavior on insertion/removal of a module when powered-up

All modules can be inserted when powered-up, with the exception of the processor module and PCMCIA communication cards.
Insertion and removal of modules when powered-up means that a module can be replaced without stopping the application.
The removal of a module activates system bits associated with the I/O, and the faults associated with the module and its channels. Inputs are no longer updated in the application memory and are set to 0 in the case of a discrete input module, unless they have been forced, in which case they keep their forced value while the module is missing. The processor I//O indicator lamp comes on.
When the new module is inserted, the system tries to configure it with the configuration of the module it is replacing.
If this configuration is successful (module with the same reference), the channels are once again taken into account by the application, and the faults caused by the absence of the module disappear. The processor I/O indicator lamp goes off.
If this reconfiguration fails (module with a different reference), the channels are not taken into account by the application, the system bits associated with the I/O and the faults associated with the module and its channels remain active, and the processor I/O indicator lamp stays on.

9.8 Behavior of the I/O on downgraded operating mode

9.8-1 Safety value of discrete and analog outputs

- **Situations :**
  - the PLC is not configured
  - the PLC is in STOP mode without previously having been in RUN mode (for example after loading the application, or on a cold start in STOP mode),
  - the PLC is in RUN mode but the task which manages the output module is in STOP mode and has never been in RUN mode,
  - power break on the rack where the output module is positioned,
  - output module does not conform to the configuration.

- **Behavior :**
  Outputs are set to the safety value : 0 for discrete and analog outputs.

9.8-2 Discrete and analog outputs switching to fallback mode

- **Situations :**
  These occur as soon as the application ceases to function normally
  - the PLC switches to STOP mode,
  - the PLC switches to "error" (processor fault) or to "HALT or software fault" (application blocking fault),
  - the task which manages these outputs switches to STOP mode,
  - insertion of a breakpoint in the task which manages these outputs,
  - command to switch outputs to fallback mode by system bit %S9 or the debug screen,
  - communication fault detected by the output module (output not updated by the processor).

- **Behavior :**
  The output values are managed by the module depending on the fallback mode for each channel or group of channels :
  - fallback : the module physical outputs are forced to the fallback value configured (0 or 1). (The image memory is not modified),
  - maintain state: the module physical outputs are maintained at their last value.

  The default operating mode is fallback to 0.

9.8-3 I/O faults

- **Situations :**
  - channel fault,
  - module fault,
  - module missing or does not conform to the configuration,
  - communication fault detected by the processor.

- **Behavior :**
  - faulty discrete input channel : the value in the application memory is set to 0, unless it is forced, in which case it is maintained at the forced value,
  - other types of faulty input : in the case of a communication fault, the value in the application memory is not updated (the value is maintained),
  - faulty output channel : the value of the output continues to be managed by the application and is only sent to the module if the latter conforms to the configuration.

  The fault is indicated by the system bits associated with the I/O and the fault information associated with the module and its channels. The processor I/O indicator lamp is lit.

9.9 Alarm relay management

9.9-1 On TSX/PMX 57 PLCs

Only the alarm relay on the power supply module in rack 0 is managed according to the state of the application. It opens for the duration of a stop, even a partial stop, of the application, and in particular on the occurrence of a blocking fault. However, the alarm relay in the power supply module for the other racks remains closed.
The relay on the power supply module for a rack other than that of rack 0, is only significant of the state of the power supply for this rack. It opens when this power supply is no longer operating.

9.9-2 On PCX 57 PLCs

If using a PCX 57 type processor which can be integrated in a PC, the alarm relay on the power supply for rack 0 is not managed and thus is always open.
If this function is absolutely essential to the correct operation of the installation, the power supply module alarm relay may be replaced by using a relay output from a module on the Bus X or FIPIO bus. To do this, this output must be :

- a relay output,
- configured with a fallback to 0 (default configuration),
- initialized at state 1 before executing the application program.

When configured in this way, the relay output will behave in the same way as the alarm relay on the power supply module in rack 0 controlled by a TSX / PMX57 processor.

9.10 Loading the operating system (OS)

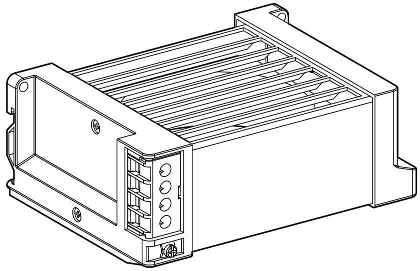
The operating system for TSX/PMX/PCX 57 PLCs can be updated from the programming terminal by downloading via the processor terminal port.
For a PCX 57 PLC, downloading can be performed from the PC which supports the PCX 57 processor. In this case, the PC serial output should be connected on the PCX 57 processor terminal port by a TSX PCU 1030 cable.

The operating system updating procedure is explained in the manual
"PL7 Junior and PL7 Pro Software Operating Modes".

10.1 Fan modules

10.1-1 General presentation

The fan modules installed above TSX/PMX/PCX 57 PLC station racks provide forced air convection to ensure an even ambient temperature inside the unit and thus eliminate any hot spots which may exist.



A temperature probe integrated into every fan module indicates to the user that the ambient temperature has reached its maximum value.

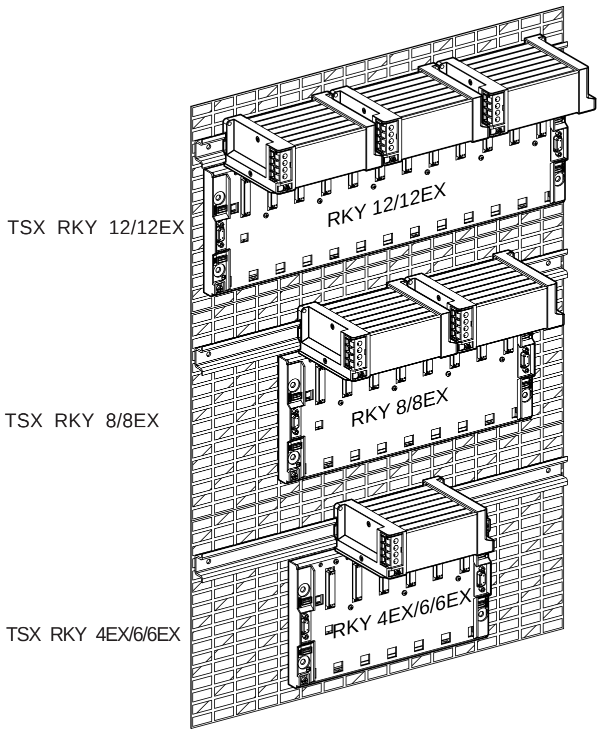
The use of fan modules is advised in the following cases :

- **Ambient temperature in the range 25°C...60°C** : this increases the lifetime of the various TSX Premium PLC components (25% increase in MTBF).
- **Ambient temperature in the range 60°C...70°C** : since the ambient temperature is limited to 60°C without ventilation, forced ventilation is used to decrease the temperature inside the modules by 10°C, bringing the internal module temperature to the equivalent of an ambient temperature of 60°C.

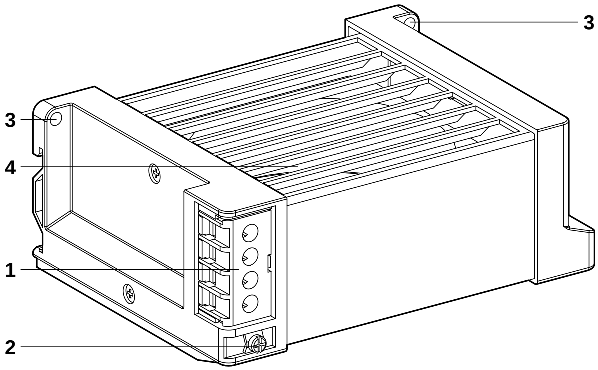
Three fan modules are available for adaptation to the main power supplies : fan module with 24 VDC, 110 VAC or 220 VAC supply voltage.

Depending on the rack modularity (4, 6, 8 or 12 positions), 1, 2 or 3 fan modules must be installed above each rack :

- TSX RKY 12 / 12EX racks with 12 positions : 3 fan modules,
- TSX RKY 8 / 8EX racks with 8 positions : 2 fan modules,
- TSX RKY 4EX/6 / 6EX racks with 4 and 6 positions : 1 fan module



10.1-2 Physical presentation



1 Terminal block for connecting :
- the module power supply voltage,
- the power supply for the temperature probe and the associated indicator lamp or preactuator.

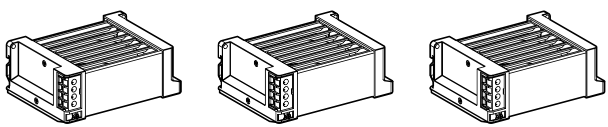
Each terminal can receive one 1.5 mm² wire without a cable end or two 1 mm² wires with cable ends.

2 Terminal for grounding the module.

3 Holes for fixing the module (M4 x 12 screws). When using these modules with TSX Premium PLCs, the fan modules must be fixed on a 35 x 15 AM1-ED••• type rail

4 Tilted shutters which enable the air to be directed to the front.

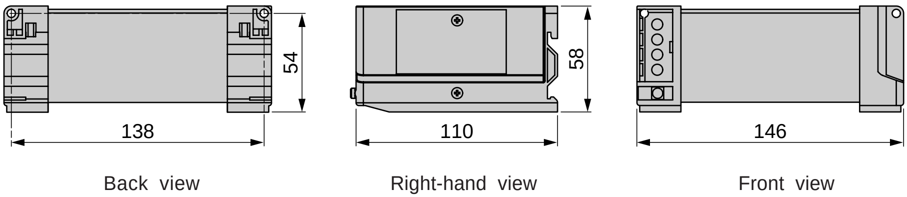
10.1-3 Catalog



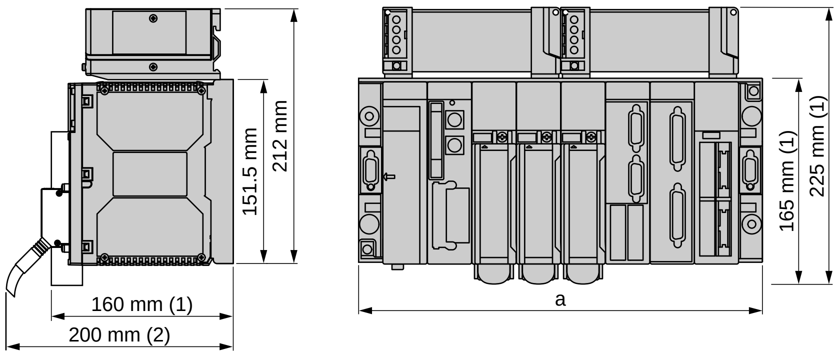
Type of module	Fan		
Characteristics Power supply voltage	24 VDC	110 VAC	220 VAC
Temperature probe	Yes (temperature detection • 80°C ± 5°C), open on alarm		
No. of modules per rack	1 module on a rack with 4 and 6 positions (TSX RKY 4EX/6/6EX) 2 modules on a rack with 8 positions (TSX RKY 8/8EX) 3 modules on a rack with 12 positions (TSX RKY 12/12EX)		
References	**TSX FAN D2 P**	**TSX FAN A4 P**	**TSX FAN A5 P**

10.1-4 Dimensions

- **Single fan module** (measurements in millimeters)



- **Fan module + rack** (measurements in millimeters)



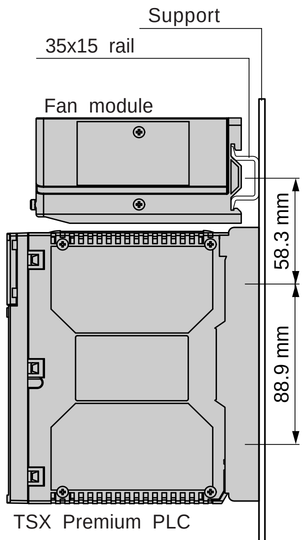
(1) with screw terminal module
(2) Maximum depth associated with all types of modules and their connectors

Racks	Number of positions	a
TSX RKY 4EX	4	187.9 mm
TSX RKY 6/6EX	6	261.6 mm
TSX RKY 8/8EX	8	335.3 mm
TSX RKY 12/12EX	12	482.6 mm

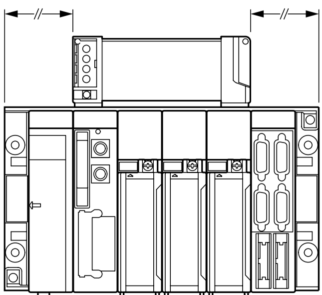
10.1-5 Mounting

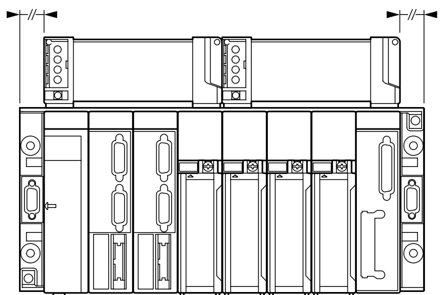
The fan modules associated with TSX/PMX/PCX Premium PLCs must be mounted on 35 mm x 15 mm rails (type AM1-ED•••) to compensate for the thickness of the rack.

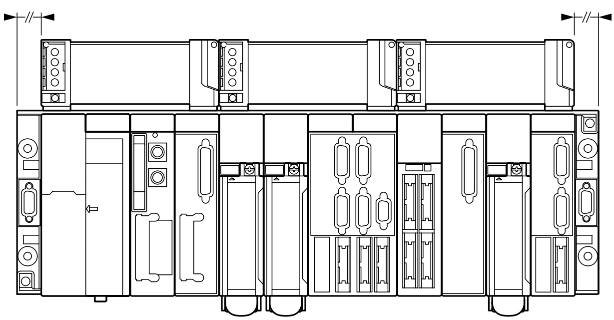
Note :
The fixing distances for TSX RKY •• racks are defined in part A - section 6.3.

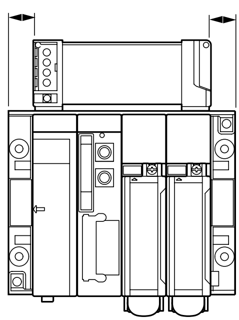


Mounting positions for the fan modules depending on the type of rack


Racks with 6 positions (TSX RKY 6/6EX)

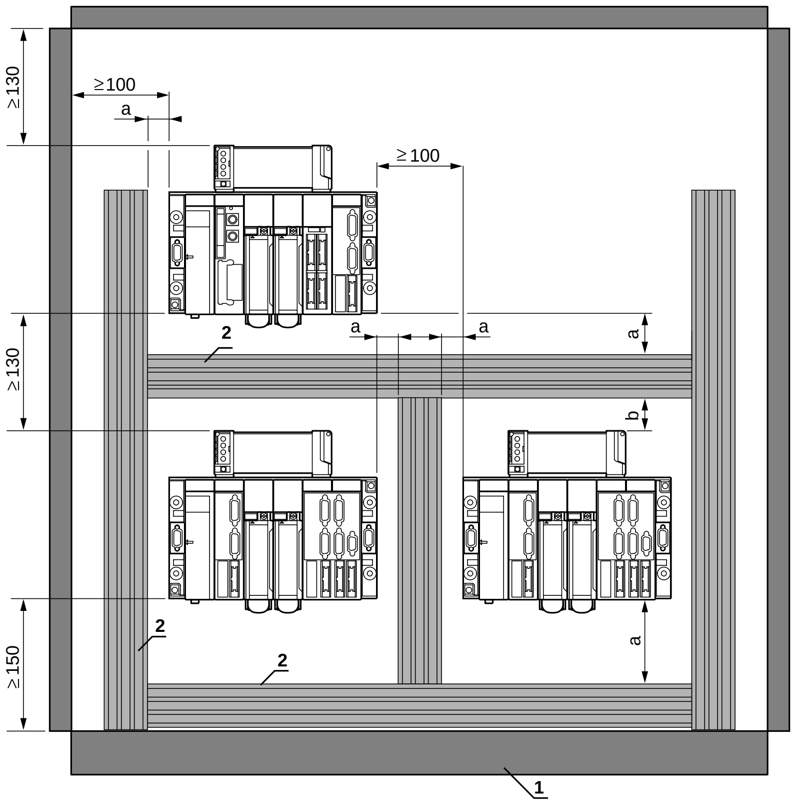

Racks with 8 positions (TSX RKY 8/8EX)


Racks with 12 positions (TSX RKY 12/12EX)


Racks with 4 positions (TSX RKY 4EX)

10.1-6 Installation rules for racks with fan modules

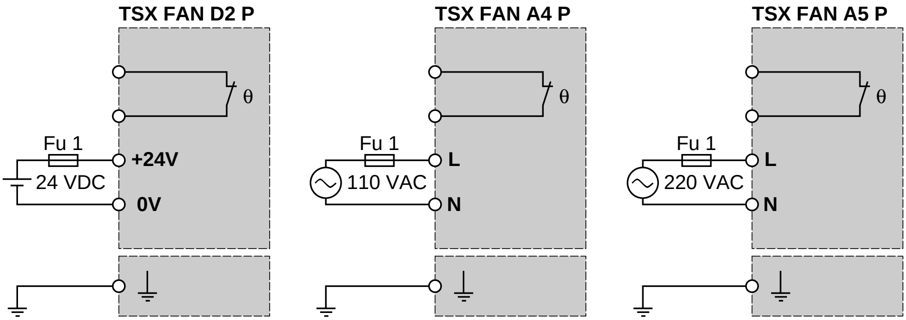
(See general rules on positioning racks which are not fan-cooled, section 6.1 in this part).



a ≥ 50 mm   b ≥ 30 mm
1 Equipment or enclosure.
2 Cable duct or clip.

10.1-7 Connections

- **Connecting the fan module power supply**



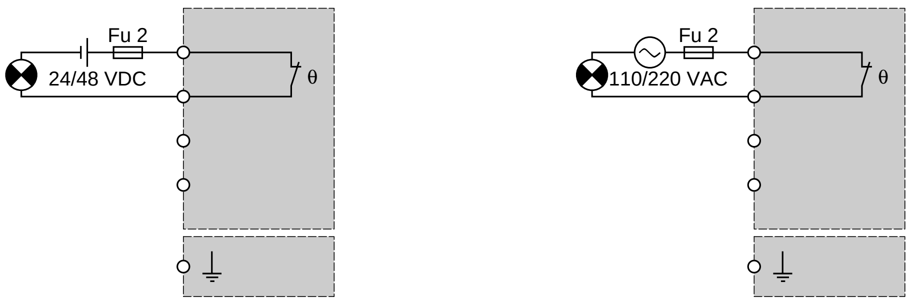
Note : when using several fan modules of the same type, use one common power supply for all the fan modules.

- **Connecting the temperature probe power supply**

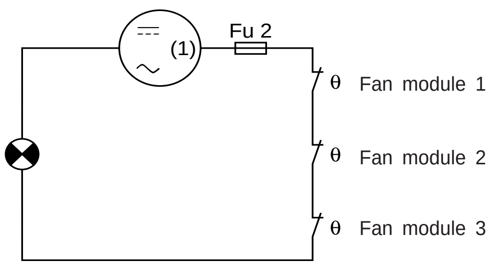
The temperature probe can be power supplied either in AC or DC and connected to an indicator lamp, a PLC input, etc.

DC power supply

AC power supply



Note : when using several fan modules, the probe contacts will be placed in series.



(1) ⎓ 24 / 48 V or ∼ 110 / 220 V

10.1-8 Characteristics

Type of module		**TSX FAN D2 P**	**TSX FAN A4 P**	**TSX FAN A5 P**
Power supply voltage	Nominal	24 VDC	110 VAC	220 VAC
	Limit	20...27.6 VDC	90...120 VAC	180...260 VAC
Current drawn at nominal voltage		180 mA	180 mA	100 mA
Temperature probe	Power supply voltage :	⎓ 24 / 48 VDC or ∿ 110 / 220 VAC		
	Breaking capacity (on resistive load)	1 A at 24 VDC / 10 000 operations 1 A at 48 VDC / 30 000 operations 1 A at 110 VAC / 30 000 operations 0.5 A at 220 VAC / 10 000 operations		
	Activation	Temperature ≥ 75 °C ± 5°C		
	Status	closed if temperature ≤ 75°C ± 5°C open if temperature ≥ 75°C ± 5°C		

Section **Page**

1.1 Description

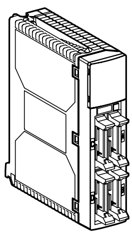
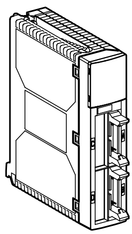
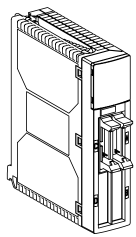
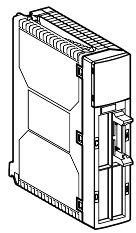
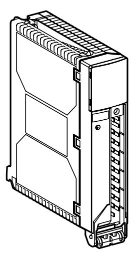
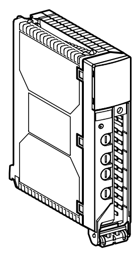
1.1-1 General description

Inputs : these receive signals from sensors and perform the acquisition, adaptation, electrical isolation and filtering functions and protect against interference signals.

Outputs :these store instructions given by the processor in order to control preactuators via decoupling and amplifying circuits.

A wide range of discrete inputs and outputs meet requirements encountered on the following levels :

- functional : AC or DC I/O, positive or negative logic,
- connection via screw terminal blocks or HE 10 connectors,
- modularity : 8, 16, 32 or 64 channels/module.

Modularity / Connection	64 I or 64 Q	32 I or 32 Q	32 I 28 I/O (16 I+12 Q)	16 I
HE10 connectors				
Modularity / Connection	**64 I or 64 Q**	**32 I or 32 Q**	**8/16 I or 8/16 Q**	**16 Q or 8 Q**
Screw terminal blocks (Terminal blocks not shown)				

1.1-2 Physical description

I/O modules are standard format (1 slot), and are incorporated in a plastic case which provides IP20 protection for all the electronics.
The internal shielding elements are connected to the protective ground for the rack via contacts located at the back of the modules (see part A section 7.1-2).

Modules with connection via screw terminal block

1 Module display and diagnostics block.

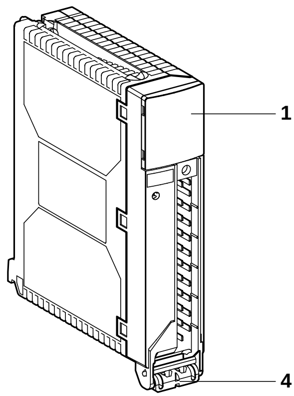
2 Removable screw terminal block for direct connection of the I/O to sensors and preactuators.
Reference : **TSX BLY 01**.

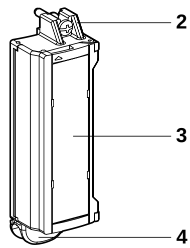
3 Pivoting door providing access to terminal block screws and also acting as a reference label holder.

4 Rotating support containing the locating device.

Notes :

- The terminal blocks are supplied separately.
- Some output modules have integrated fuses, which can be accessed from the front when the terminal block, 2, is removed.



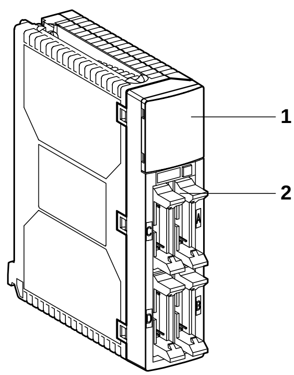


Modules with connection via HE10 connectors

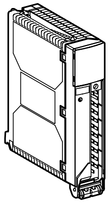
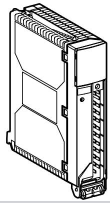
Each module is composed of the following elements :

1 Module display and diagnostics block.

2 HE10 connectors, protected by a cover. They enable connection of the I/O to sensors and preactuators either directly or via TELEFAST 2 connection sub-bases.

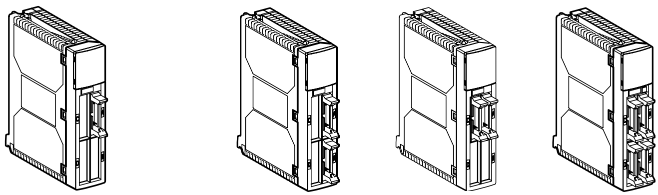


1.2 Catalog

Module type	Inputs with screw terminal block						
							
Modularity	8 inputs	16 inputs					
Voltage	24 VDC		48 VDC	24 VAC 24 VDC	48 VAC	100..120 VAC	200..240 VAC
Isolation	Isolated inputs						
IEC 1131-2 conformity	Type 2			(1)			
Logic	Positive			Negative			
Proximity sensor compatibility	2-wire DC and 3-wire PNP proximity sensors, IEC 947-5-2			2-wire DC & 3-wire NPN proximity sensor, IEC 947-5-2			
				2-wire AC proximity sensor (IEC 947-5-2)			
Filtering	Integrated 4 ms			Integrated, 50 or 60 Hz supply			
Connection	Screw terminal block						
References	**TSX DEY 08D2**	**TSX DEY 16D2**	**TSX DEY 16D3**	**TSX DEY 16A2**	**TSX DEY 16A3**	**TSX DEY 16A4**	**TSX DEY 16A5**

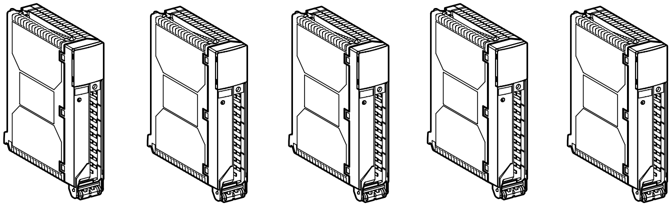
(1) For module TSX DEY 16A2, type 2 conformity only applies to the 24 VAC version

Catalog (continued)

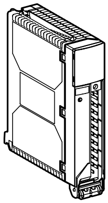
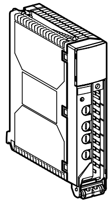
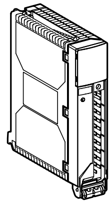


Module type	Inputs with HE10 connectors			
Modularity	16 fast inputs	32 inputs		64 inputs
Voltage	24 VDC		48 VDC	24 VDC
Isolation	Isolated inputs			
IEC 1131-2 conformity	Type 1		Type 2	Type 1
Logic	Positive			
Proximity sensor compatibility	2-wire proximity sensor, see characteristics section 3.3-1 3-wire PNP proximity sensor			
Filtering **Programmable filter** **Latching** **Event**	(0.1.. 7.5 ms in steps of 0.5) Yes Yes Yes	fixed 4 ms		
Connection	HE 10 connectors			
References	**TSX DEY 16FK**	**TSX DEY 32D2K**	**TSX DEY 32D3K**	**TSX DEY 64D2K**

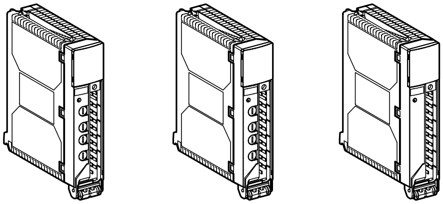
Catalog (continued)

Module type	Transistor outputs with screw terminal block				
					
Modularity	8 outputs			16 outputs	
Voltage	24 VDC		48 VDC	24 VDC	48 VDC
Isolation	Isolated outputs				
Current	0.5 A	2 A	1 A	0.5 A	0.25 A
IEC 1131-2 conformity	Yes				
Protection	Outputs protected against short-circuits and overloads with automatic or controlled reactivation with a rapid electromagnet demagnetization circuit				
Fallback	Configurable fallback mode for outputs. Continuous monitoring of output control and outputs set to 0 if an internal fault is detected				
Logic	Positive				
Response time	1 ms	0.2 ms	0.3 ms	1 ms	1 ms
Connection	Screw terminal block				
References	**TSX DSY 08T2**	**TSX DSY 08T22**	**TSX DSY 08T31**	**TSX DSY 16T2**	**TSX DSY 16T3**

Catalog (continued)

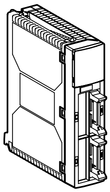
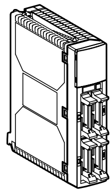
Module type	Relay outputs with screw terminal block			
				
Modularity	8 outputs			16 outputs
Voltage	12..24 VDC or 24..240 VAC	24..130 VDC	24..48 VDC or 24..240 VAC	12..24 VDC or 24..240 VAC
Isolation	Outputs isolated between contact and ground			
Current	3 A	5 A		3 A
IEC 1131-2 conformity	Yes			
Protection	No protection	Protection by interchangeable fuses Outputs set to 0 on detection of a fault, reactivated after fuse replacement		No protection
Fallback	Configurable fallback mode for outputs.			
Unlocking terminal block	Automatic output cut-off facility when the terminal block is unlocked			
Logic	Positive/negative			
Connection	Screw terminal block			
References	**TSX DSY 08R5**	**TSX DSY 08R4D**	**TSX DSY 08R5A**	**TSX DSY 16R5**

Catalog (continued)

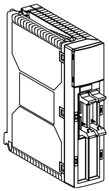
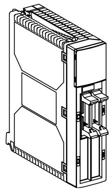


Module type	Triac outputs with screw terminal block		
Modularity	8 outputs	16 outputs	
Voltage	48..240 VAC		24..120 VAC
Isolation	Isolated outputs		
Current	2 A	1 A	
IEC 1131-2 conformity	Yes		
Protection	Protection by interchangeable fuses		Outputs not protected against short-circuits or overloads. Flameproof protection by non-interchangeable fuses.
Fallback	Configurable fallback mode for outputs.		
Unlocking terminal block	Automatic output cut-off facility when the terminal block is unlocked		
Connection	Screw terminal block		
References	**TSX DSY 08S5**	**TSX DSY 16S5**	**TSX DSY 16S4**

Catalog (continued)

Module type	Solid state outputs with connectors	
		
Modularity	32 outputs	64 outputs
Voltage	24 VDC	
Isolation	Isolated outputs	
Current	0.1 A	
IEC 1131-2 conformity	Yes	
Protection	Outputs protected against short-circuits and overload with automatic or controlled reactivation	
Fallback	Configurable fallback mode for outputs. Continuous monitoring of output control and outputs set to 0 if an internal fault is detected	
Logic	Positive	
Connection	HE 10 connectors	
References	**TSX DSY 32T2K**	**TSX DSY 64T2K**

Catalog (continued)

Module type	Mixed I/O with connectors	
		
Modularity 12 outputs	16 fast inputs	16 fast inputs 12 reflex outputs
Inputs		
Voltage	24 VDC	
Isolation	Isolated inputs	
IEC 1131-2 conformity	Type 1	
Logic	Positive	
Prox. sensor compatibility	2-wire proximity sensor, see characteristics section 4.2, 3-wire proximity sensor	
Programmable filtering	(0.1.. 7.5 ms in steps of 0.5)	
Latching	Yes	
Event	Yes	
Outputs		
Voltage	24 VDC	
Isolation	Isolated outputs	
Current	0.5 A	
IEC 1131-2 conformity	Yes	
Protection	Outputs protected against short-circuits and overloads with automatic or controlled reset with a fast demagnetization circuit for electromagnets	
Fallback	Configurable fallback mode for outputs. Continuous monitoring of output control and outputs set to 0 if an internal fault is detected	
Logic	Positive	
Response time	0.6 ms	
Connection	HE 10 connectors	
References	**TSX DMY 28FK**	**TSX DMY 28RFK**

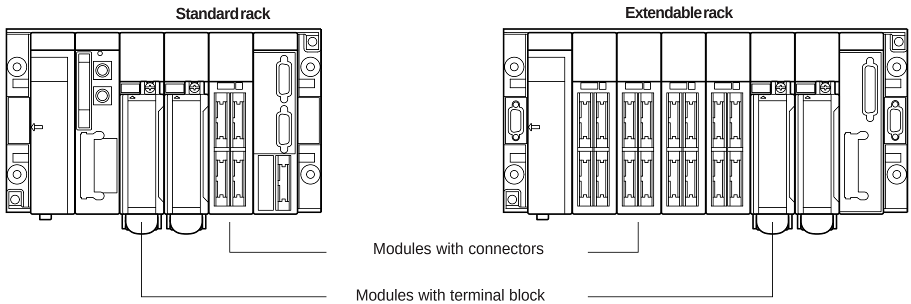
1.3 Installing, inserting and removing modules

1.3-1 Installation

All TSX Premium discrete I/O modules are standard format.

They are supplied with power by the backplane bus and include a display on the front panel (see section 3.5).

The modules can be placed in either a standard rack or an extendable rack. They can be moved safely without switching off the power supply to the rack.



1.3-2 Inserting/removing modules

Discrete I/O modules should be inserted in the rack as follows :

- Position the two pins at the bottom of the card in the corresponding slots in the rack.
- Tilt the module upwards and plug in the backplane connector.
- Tighten the fixing screw at the top of the module (see part A, section 6.4, Mounting modules).

Warning

If this screw is not tightened, the module will not stay in position in the rack.

⚠ **Reminder :**

Modules must be inserted and removed with the sensor and preactuator supply off and **the terminal block disconnected**.

1.4 Labeling

1.4-1 Modules with screw terminal block

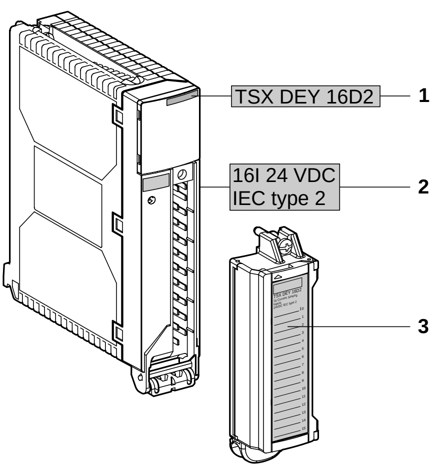
The module has three-fold labeling :

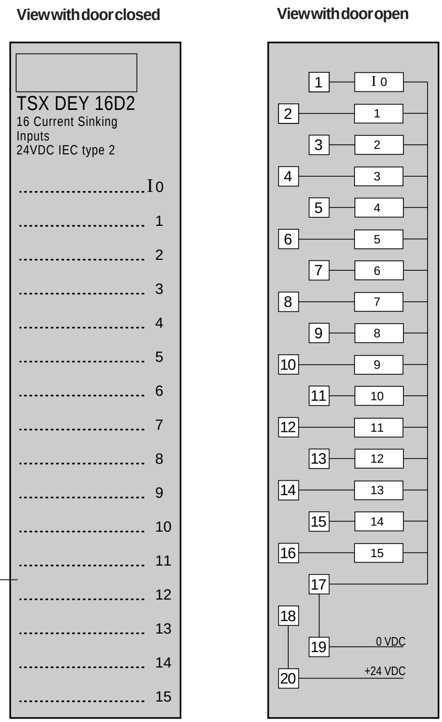
1 on the display block,
the module reference,

2 under the display block,
the module characteristics

3 on the terminal block, a removable label, to be placed inside the door, printed on both sides with the following information :
external view (door closed) :
- module reference,
- type of channels,
- a box for writing in the module position number (address),
- designation of each channel (symbol),

internal view (door open) :
- I/O wiring diagram with channel numbers and connection terminal numbers.



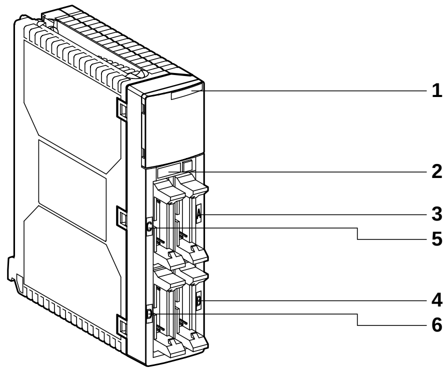


Note :
The terminal block labels are included with the module.

1.4-2 Module with HE10 connectors

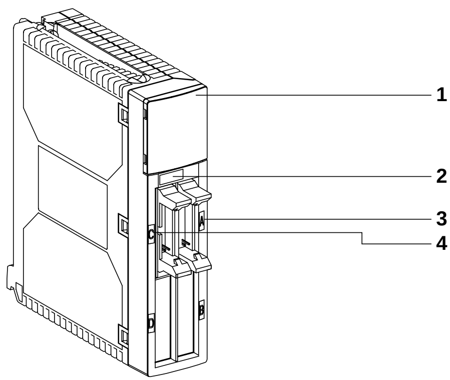
The module labeling is laser-engraved :

- **TSX DEY•• / DSY •• input or output modules**



1 **Marking** on the display block shows :
  - the module reference,
2 **Marking of module characteristics**
3 **Marking** of addresses of corresponding channels :
  - module channels 0 to 15 (I or Q),
4 **Marking** of addresses of corresponding channels :
  - module channels 16 to 31 (I or Q),
5 **Marking** of addresses of corresponding channels :
  - module channels 32 to 47 (I or Q),
6 **Marking** of addresses of corresponding channels :
  - module channels 48 to 63 (I or Q),

- **TSX DEY 32D3K input modules and TSX DMY 28FK/28RFK mixed I/O modules**



1 **Marking** on the display block shows :
  - the module reference,
2 **Marking of module characteristics**
3 **Marking** of addresses of corresponding input channels :
  - input channels 0 to 15 of the TSX DEY 32D3K or TSX DMY 28FK/ 28RFK (I) modules,
4 **Marking** of addresses of corresponding channels :
  - input channels 16 to 31 of the TSX DEY 32D3K (I) module,
  - output channels 16 to 27 of the TSX DMY 28FK/28RFK (Q) modules.

1.5 Channel addressing

Channel addressing is geographical; in other words it depends on :
- the rack address (0 to 7),
- the physical position of the module in the rack :
  - 00 to 02 for a rack with 4 slots,
  - 00 to 04 for a rack with 6 slots,
  - 00 to 06 for a rack with 8 slots,
  - 00 to 10 for a rack with 12 slots.

The syntax for a discrete I/O address is as follows :

%	I or Q	Rack address	Module position	.	channel number
Symbol	I = Input Q = Output	0 to 7	00 to 14	Point	0 to 63

Example :
%I102.5 indicates : input bit 5 of the module in position 2 of rack 1.

For more information, see :
- in this manual - part A - section 7.1,
- in the application-specific manual TLX DS 57 PL7 33E - Volume 1 - part B.

2.1 General functions

2.1-1 Constant current inputs

24 and 48 VDC inputs are "constant current" type. Although the input voltage may be greater than 11 V (for 24 VDC inputs) or 20 V (for 48 VDC inputs), the input current is constant.

This characteristic has the following advantages :

- it ensures minimum current when energized conforming to the IEC standard,
- it limits the current drawn when the input voltage increases, thus avoiding unnecessary temperature rise in the module,
- it reduces the current drawn on the sensor power supply, whether provided by the PLC power supply or a process power supply.

2.1-2 Protecting DC transistor outputs

All transistor outputs (except those which are specifically marked "Unprotected"), have a protective device which detects the appearance of an overload or short-circuit when an output is active. Any such fault deactivates the output (tripping) and the fault is signaled on the front panel display. The indicator lamp for the faulty channel flashes, and the I//O fault lamp lights up.

The fault is also fed back to the system. Language interface objects and debug screens are used to display the fault.

To use an output after tripping, it must be reactivated (see section 2.1-3).

2.1-3 Reactivating outputs

When an output is tripped following a fault, it can be reactivated so that it is active again. Reactivation may be either automatic or controlled, depending on the option selected during configuration. This applies to modules with **DC transistor outputs** and to **modules with relay and triac outputs** protected by interchangeable fuses. (See application-specific manual TLX DS 57 PL7 33E - Volume 1 - part B "Discrete functions")

- If the automatic option has been selected, reactivation is executed by the module. There is a delay of about 10 seconds, and if the fault persists, the reactivation is repeated every 10 seconds until the fault disappears.
- If the controlled option has been selected, reactivation is executed after a command from the application program or from the terminal, via the debug screen. The minimum time between two reactivations is 10 seconds, and the module incorporates a delay to prevent repeated reactivations occurring very close together.

Reactivation affects one group of 8 channels at a time, but has no effect on channels which are not active or faulty.

2.1-4 Output fallback

All TSX Premium discrete module outputs can be placed in a state determined by the user when there is a fault on the PLC bus (base rack or extension rack), or if the processor stops. This state, known as the fallback position, is selected during configuration.

Several options are available :

- Fallback strategy configured per group of 8 channels with one of the following options :
  - maintain channel states (last state given by the module),
  - switch to fallback position.
- Fallback value : if switching to fallback position is requested, all 8 channels in the same group will take the fallback value (0 or 1) set during configuration. The fallback value is determined channel by channel.

2.1-5 Sharing the I/O

Each module is split functionally into groups of 8 channels. Each group of channels can be assigned to a specific application task. This is most useful for modules with a large number of channels (eg : TSX DEY 64D2K) where, for example, 48 channels could be assigned to the Master task (Mast), 8 channels to a Fast task (Fast) and 8 channels would not be used for any task.

This property can be accessed in the PL7 Junior / PL7 Pro software in configuration mode.

Note :
Inputs belonging to a single group (of channels) can easily be used by different tasks. When sharing the output channels of the same group, it is wise to take a certain number of precautions.

The channels of a single group have consecutive numbers, the first channel of each group always being a multiple of 8, (eg channels 0 to 7, 8 to 15, ... 24 to 31, ... 56 to 63).

Operating modes are common to channels in a group, and some functions are handled in common for all the channels in a group.

Example :

- Fallback strategy.
- Reactivation of outputs after tripping.

2.2 Specific functions for certain modules

2.2-1 Programmable input filtering for TSX DEY 16 FK and TSX DMY 28FK/ DMY 28RFK modules

The input filter time for **TSX DEY 16FK, TSX DMY 28FK and TSX DMY 28RFK** modules can be modified in configuration mode.

Input filtering is performed by :

- a fixed analog filter which provides maximum immunity for 0.1 ms to filter out line interference,
- a digital filter which can be configured in increments of 0.5 ms. This filtering can be modified in configuration mode via the terminal.

Configurable filter times (in ms)															
0.1	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5

The default filter time is 4 ms.

Note

- To avoid signals due to contact bounce when mechanical contacts are closed, it is advisable to use filter times of more than 3ms.
- In order to comply with standard IEC 1131-2, the filter time must be set to ≥ 3.5 ms.

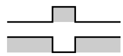
2.2-2 Latching inputs on TSX DEY 16 FK and DMY 28FK modules

Principle

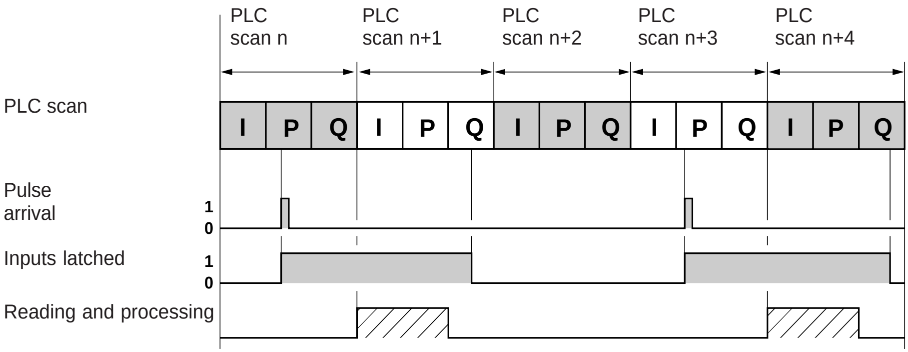
Use the latching function to take account of particularly short pulses and those which are shorter than the PLC scan time.
This function takes the pulse into account so that it may be processed in the master (MAST) or fast (FAST) task during the next scan without interrupting the PLC scan.

The pulse is taken into account when the input changes state. This may be either :

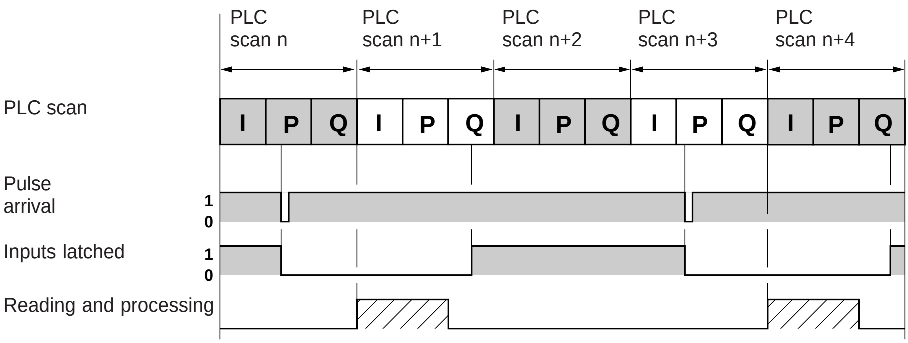
- change from state 0 → to state 1,
- change from state 1 → to state 0,



Example of processing a latch on pulse 0 → 1



Example of processing a latch on pulse 1 → 0



Key

I = read inputs, **P** = process program, **Q** = update outputs

Note

The time which separates the arrival of two pulses on the same input must be greater than or equal to the time of two PLC scans. The minimum duration of the pulse should be greater than the filter time selected.

2.2-3 Event management on inputs for TSX DEY 16 FK and TSX DMY 28 FK modules

Principle

TSX DEY 16FK and **TSX DMY 28FK** modules can be used to configure up to 16 event-triggered inputs. These inputs enable acceptance of events and ensure their immediate processing (interrupt processing). Event-triggered processing is assigned **priority 0**. Event 0 is only associated with channel 0.

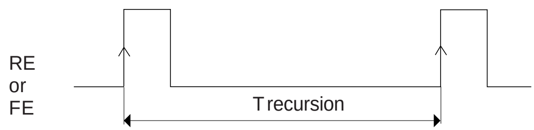
These inputs can be associated with event-triggered processing (Evti) and are defined in configuration mode by :

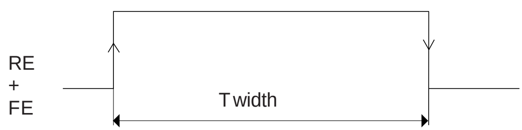
- i = 0 to 31 for TSX/TPMX P57102 and TPCX 57 1012 processors
- i = 0 to 63 for TSX/TPMX P57 2•2 processors
- i = 0 to 63 for TSX/TPMX P57 3•2 and TPCX 57 3512 processors
- i = 0 to 63 for TSX/TPMX P57 4•2 processors

Event-triggered processing is initiated on a rising edge (0 →1) or falling edge (1→ 0) of the associated input or simply on an edge : an EVT state (see Language interface) enables it to be differentiated during processing.
When two edges are detected on a module simultaneously, the events are processed in ascending order of channel number.

The principle of event-triggered processing is defined in part A, section 1.6-5 of the reference manual.

The recursion time of the edges on each input or the pulse width on an input programmed as RE + FE must correspond to the following diagram :





T recursion or T width > 0.25 ms + 0.25 X module event number

- Max. frequency of Evt = 1kHz / module Evt number
- Max number of events in bursts : 100 Evt per 100 ms

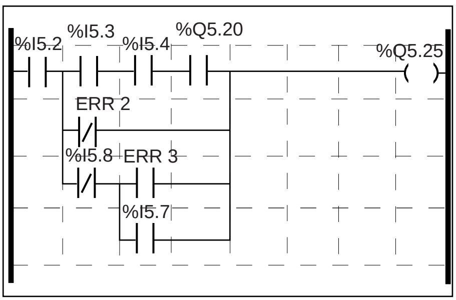
2.2-4 Reflex and timer functions on the TSX DMY 28RFK module

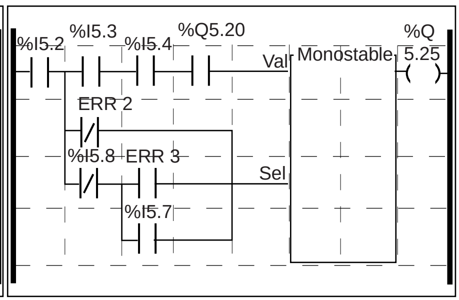
This module is used for applications which require a response time faster than the FAST task or only event processing (< 500 µs).
It is used for control system functions executed at module level and independently of the PLC task, using the following as input variables :

- the physical inputs (%I) of the module
- the output commands (%Q) of the module
- the channel or module fault data
- the states of the module physical outputs

These functions are programmed using PL7 software in configuration mode. The configuration screen for each output comprises two main parts :

- one part representing a simplified ladder rung layout with 4 lines of 4 contacts to achieve a combinational logic function of the input variables listed above,
- the other part representing the function used which can be either direct control of the output using the configured combinational logic, or a function block.





List of main function blocks :

- on-delay timer function block
- off-delay timer function block
- on-delay/off-delay timer function block
- 2-value timer function block
- selectable on-delay/off-delay timer function block
- retriggerable monostable function block
- time-delayed non-retriggerable monostable function block
- 2-value monostable function block
- oscillator function block
- dual threshold counter function block
- single threshold counter with monostable function block
- interval counter function block used to measure time or length
- Burst function block used to generate a defined number of oscillator periods
- PWM function block used to generate continuous oscillation with a fixed frequency but variable cyclic ratio
- slow speed detection function block
- speed monitoring function block
- command / control function block used to control an action and to check that it has been executed within a given time :

  - type 1 command / control function block : (1 single command),
  - type 2 command / control function block : (2 commands, FWD and REV),
- function block command during a number of counting points (standard positioning),
- fault indication function block,
- D latch function block, memorization of edge,
- T latch function block, division by 2.

A further description of these various function blocks and their software setup can be found in the application-specific manual TLX DS 57 PL7 33E - Volume 1 - part B.

2.3 Diagnostic functions

2.3-1 Module diagnostics

Dialog fault

Any communication fault, hindering normal operation of an output module or the fast input module, is indicated on the front panel by the red module "ERR" lamp flashing, and by the %@ module.ERR fault bit.

A communication fault can be caused by a hardware fault on the backplane bus, by a processor fault or by a faulty extension cable.

Internal module fault

Any internal fault which the module is able to detect is indicated on the front panel by the red "ERR" lamp coming on and the green "RUN" lamp going off.

Some instances of total module failure cannot be detected but are characterized by all lamps going off (as with a power supply fault).

2.3-2 Process diagnostics

Monitoring sensor/preactuator voltage

All input modules and transistor output modules have a device for monitoring the sensor and preactuator voltage.
When the sensor or preactuator voltage is below a certain threshold at which correct module operation cannot be ensured, the red I/O lamp lights up, and the "External voltage" fault is also indicated in the language objects.

- For an input module, when the sensor voltage is correct, the state perceived by the input is indeed that of the sensor, whatever type of sensor is being used (within the recommended range).
- For an output module, when the preactuator voltage is correct, the state determined for the preactuator is the state determined by the application. **However, it is up to the user to check that the preactuator supply voltage is within the range accepted by the preactuators being used** (bear in mind the residual output voltage).

This monitoring is unique to modules with terminal blocks. On 32 or 64-channel modules with connectors, there is one monitoring device per connector (or one for every 16 channels).

A sensor or actuator voltage fault causes all inputs and outputs affected by the fault to switch to fault mode, that is all channels for a module with terminal block, and the group(s) of 16 channels, on a 32 or 64-channel module with connectors.

Note :
Relay and triac output modules do not monitor preactuator voltage.

Monitoring the presence of the terminal block

All modules with connection via terminal block include a facility for checking that the terminal block is on the module. If the terminal block is missing or if it is not properly attached to the module, the "I/O" lamp flashes and a "Terminal block" fault is indicated in the language interface.

Module with connectors do not have a facility for monitoring the **presence** of connectors. The module **power supply monitoring performs** this **function**.

Monitoring short-circuit and overload

Transistor output modules include a load state monitoring facility. If there is a short-circuit or an overload on one or more outputs, they trip. The faults are indicated on the front panel by the lamps of the faulty channels flashing, and by the red "I/O" lamp lighting up.

The faults are indicated in the language interface by the "Short-circuit fault" bit on each channel and by the "Trip" bit of channel groups per module.

The tripping of a channel is indicated by :

- I/O indicator lamp on (I/O fault),
- channel lamp flashing,
- channel fault bit being set to 1 (%Ix.i.ERR =1),
- a fault bit in the module status word.

Monitoring sensor voltage

All input modules include a facility for monitoring the sensor voltage for all module channels. This facility checks that the supply voltage for the sensors and the module is at a sufficient level to ensure correct operation of the module input channels (see section 4 for the various characteristics of each module).

If the sensor voltage is lower than or equal to a defined threshold, it is signaled by :

- I/O indicator lamp on (I/O fault),
- channel fault bit %Ix.i.ERR =1,
- a fault bit in the module status word and in the channel status word.

Note : The sensor supply should be protected by a fast blow fuse.

Monitoring preactuator voltage

All modules with 24/48 VDC transistor outputs include a facility for monitoring the preactuator supply voltage for all module channels. This facility checks that the supply voltage for the preactuator and the module is at a sufficient level to ensure correct operation of the module output channels.

This voltage should be greater than 18V (24 VDC power supply), 36 V (48 VDC power supply) for modules with DC transistor outputs. If the preactuator voltage is less than or equal to this threshold, the outputs change to state 0 and the fault is indicated by :

- I/O indicator lamp ON (I/O fault),
- channel fault bit %Ix.i.ERR =1,
- a fault bit in the module status word and in the channel status word.

2.4 Protection

2.4-1 Built-in protection for 24 VDC transistor output modules

Protection of each channel against short-circuits and overload
All channels incorporate a protection device providing protection against this type of fault.

Protection against polarity reversal
Modules have a device which causes the power supply to short-circuit, without damaging the module, to protect against polarity reversal.

In order for this protection to function in optimum conditions, it is essential to place a fast blow fuse on the power supply upstream of the preactuators.

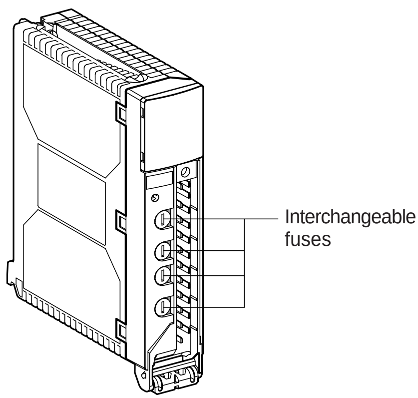
Note :

> As a general rule it is advisable to fit one fuse for all the module output channels; see section 4.3 for a table of characteristics.

Protection against inductive overvoltages
Each output is individually protected against inductive overvoltages and is equipped with a zener diode fast demagnetization circuit for electromagnets which enables a reduction in the mechanical cycle time of certain fast machines.

2.4-2 Fuse protection

TSX DSY 08R5A/08R4D modules and **TSX DSY 08S5/16S5** output modules are equipped with interchangeable fuses which can be accessed on the front panel of the modules when the terminal block is removed.
If there is a fault, the front panel displays the module diagnostics.
The I/O indicator lamp is on; the channel fault bit %Ix.i.ERR =1.

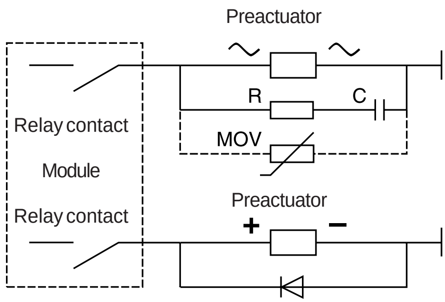


The fuses can be accessed once the terminal block has been removed.

2.4-3 Protection of relay output contacts (TSX DSY 08R5/16R5)

These relay outputs do not include a protection device for the contacts so as to enable control of :

- electrically isolated inputs, with a low energy level which require zero leakage current,
- power circuits, by eliminating induced overvoltages at source.
  For this reason, it is imperative to connect the following to the terminals of the preactuator coils :
  - an RC circuit or an MOV (ZNO) peak limiter, for use with AC supply,
  - a discharge diode for use with DC supply.



Note : A relay output used on an AC load must not then be used on a DC load and vice versa.

3.1 Recommendations for use

Installation/removal of screw terminal blocks or HE10 connectors

Screw terminal blocks or HE10 connectors are installed or removed with the power supply to the preactuators and sensors off.

Inserting and removing modules

The terminal block must be disconnected when modules are inserted and removed, however, this can be done while the PLC is powered up.

Locking modules into their slot

In order to ensure that the contacts and electrical ground are securely connected, the fixing lock on the modules should be pushed in as far as possible.

Choice of DC power supplies for sensors and preactuators

Regulated or rectified power supplies with filtering

When using external 24 VDC power supplies, it is advisable to use :

- either regulated power supplies,
- or non regulated power supplies with filtering of :
  - 1000 µF/A for full wave single rectification and 500 µF/A for 3-phase rectification,
  - Maximum ripple (peak to peak) : 5%
  - Maximum voltage variation : - 20% to + 25% of the nominal voltage (ripple included)

Note :
Unfiltered rectified power supplies must not be used.

Cadmium/nickel battery power supply

This type of power supply may be used for the sensors and preactuators as well as the associated I/O. In normal operation, the latter tolerate a maximum voltage of 30 VDC. When this type of battery is being charged, the battery voltage may reach 34 VDC for a duration of 1 hour. For this reason, all I/O modules operating on 24 VDC tolerate a voltage of 34 VDC, limited to 1 hour in 24 hours.

This type of operation has the following restrictions :

- the maximum current at 34 VDC tolerated by the outputs must never exceed the current defined for a voltage of 30 VDC,
- a derating in temperature which limits to :
  - 80% of the I/O at state 1 up to 30°C,
  - 50% of the I/O at state 1 at 60°C.

3.2 General wiring rules and recommendations

Discrete I/O contain protection circuits ensuring excellent immunity to industrial conditions. However, certain rules must be observed :

External power supplies for sensors and preactuators
These power supplies must be protected against short-circuits and overloads by fast blow fuses.

Caution

> If the 24 VDC installation does not conform to SELV standards (safety extra low voltage), the 0V of the 24 VDC power supplies must be connected to the mechanical ground, which itself must be taken to ground as near to the power supply unit as possible. This is necessary for the safety of personnel in the event of one of the AC supply phases coming into contact with the 24 VDC.

Note :
If an I/O module with a screw terminal block or HE10 connector is present in the PLC, the sensor or preactuator voltage must be connected to it, otherwise an "external power supply" fault will be displayed with the I/O LED on.

For module with connectors, the sensor/preactuator power supply must be connected to each connector, except if the corresponding channels are not used and have not been assigned to **any** task (See the "Discrete functions" section in the application-specific installation manual).

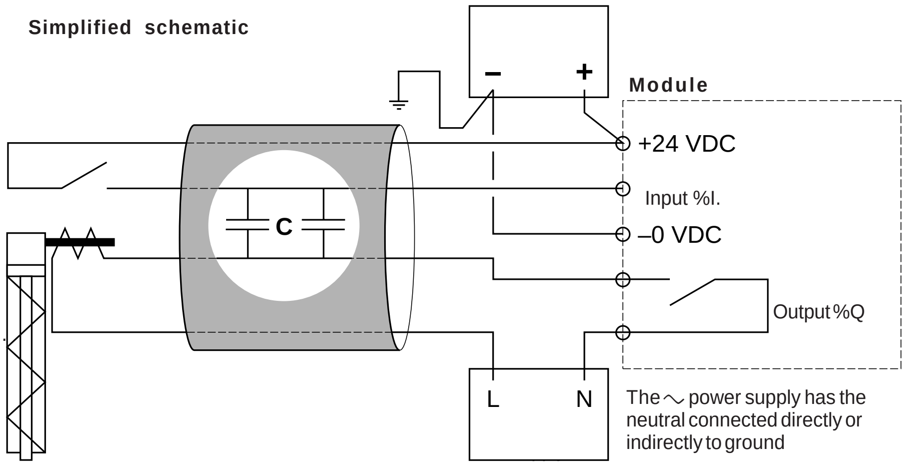
Inputs

- Usage recommendations for fast input modules (TSX DEY 16 FK/DMY 28FK/DMY 28RFK)
  - when using 24 VDC inputs, it is advisable to set the filter time for the required function.
  - if the filter time is reduced to less than 3 ms, use of sensors with mechanical contact outputs is not recommended in order to avoid the effect of contact bounce when the contact is closed.
  - in order to achieve optimal operation, the use of DC inputs and sensors is recommended as AC inputs have a much longer response time.
- 24 VDC inputs and line coupling with AC supply
  Close coupling between cables carrying AC and cables carrying DC input signals may interfere with operation.

  (see simplified schematic on the next page)

24 VDC inputs and line coupling with an AC supply (continued)

Simplified schematic



When the contact at the input is open, AC crossing the parasitic capacitance of the cable may generate a current in the input which may cause it to change to state 1.

Line capacitance not to be exceeded.

The following values are given for coupling with a 240 VAC/50 Hz line.
For coupling with a different voltage, apply the following formula :

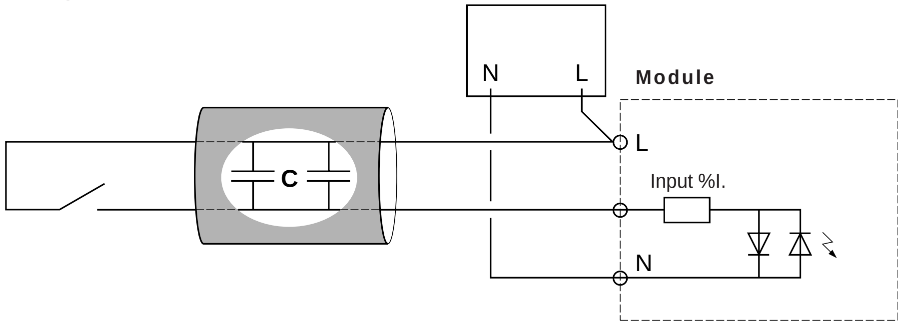
$$\text{Permissible capacitance} = \frac{\text{Capacitance at 240 VAC} \times 240}{\text{line voltage}}$$

Modules		Max. permissible coupling capacitance with 240 VAC/50 Hz line		
TSX DEY 32/64D2K		25 nF		
TSX DEY 16D2		45 nF		
TSX DEY 16FK/DMY 28FK	Filtering	1.1 ms	3.5 ms	7.5 ms
TSX DMY 28RFK	Capacity	10 nF	30 nF	60 nF

Note :
By way of an example, a standard 1 meter cable has a coupling capacitance of 100 to 150 pF.

- 24 to 240 VAC inputs and line coupling
  In this case, when the line controlling the input is open, current circulates due to the capacitance of the cable coupling.

Simplified schematic



Line capacitance not to be exceeded :

Module	Maximum coupling capacitance
TSX DEY 16A2	50 nF
TSX DEY 16A3	60 nF
TSX DEY 16A4	70 nF
TSX DEY 16A5	85 nF

Outputs

- for high currents, it is advisable to segment the terminal connections by protecting each one with a fast blow fuse,
- use wire of sufficient cross-section to avoid voltage drops and temperature rises.

Cable routing

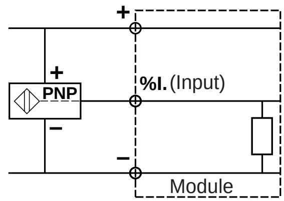
- inside and outside the equipment,
  In order to limit the AC coupling, power circuit cables (power supply, power contactors, etc) must be separated from the input cables (sensors) and the output cables (preactuators).
- outside the equipment,
  I/O cables must be placed in a sheath separate to that used for power cables and placed in separate metal ducting, which must be connected to ground. These cables must be separated by a minimum distance of 100 mm.

3.3 Compatibility of sensors ➜ inputs and preactuators ➜ outputs

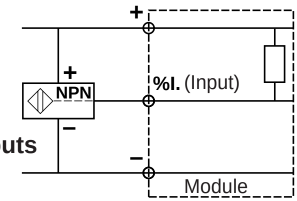
3.3-1 Compatibility of sensors with inputs

Compatibility between 3-wire sensors and 24 and 48 VDC inputs

- 3-wire sensors and positive logic inputs (sink) IEC 1131-2 type 1 and type 2,
  All inductive or capacitive proximity sensors, 3-wire PNP type photoelectric detectors, operating at 24 and 48 VDC, are compatible with all positive logic inputs.

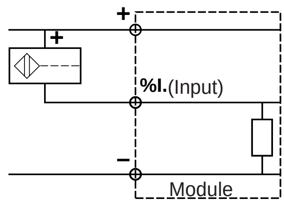


- 3-wire sensors and negative logic inputs (source)
  All inductive or capacitive proximity sensors and 3-wire NPN type photoelectric detectors, operating at 24 VDC, are compatible with negative logic inputs from the Premium range.

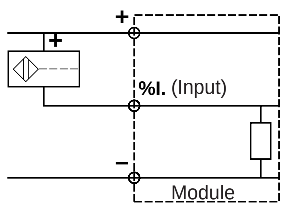


Compatibility between 2-wire sensors and 24 VDC inputs

- 2-wire sensors and positive logic inputs (sink) IEC 1131-2 type 1.
  All proximity sensors or other 2-wire sensors, operating at 24 VDC and having the characteristics listed below, are compatible with all 24 VDC positive logic type 1 inputs from the Premium range.
  Residual voltage at closed state : ≤ 7 V
  Minimum switching current : ≤ 2.5 mA
  Residual current at open state : ≤ 1.5 mA.

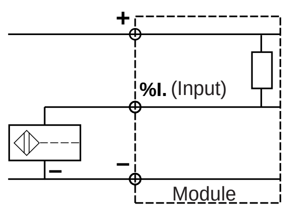


- 2-wire sensors and positive logic inputs (sink) IEC 1131-2 type 2.
  All 2-wire proximity sensors, operating at 24 and 48 VDC and conforming to standard IEC 947-5-2, are compatible with all 24 and 48 VDC positive logic type 2 inputs.



- 2-wire sensors and negative logic inputs (source)
  All proximity sensors or other 2-wire sensors, operating at 24 VDC and having the characteristics listed below, are compatible with all 24 VDC negative logic type inputs from the Premium range.

  Residual voltage at closed state : ≤ 7 V
  Minimum switching current : ≤ 2.5 mA
  Residual current at open state : ≤ 1.5 mA.



Compatibility between 2-wire sensors and 24/48/100...120/200...240 VAC inputs

All 2-wire AC proximity sensors conforming to standard IEC 947-5-2 and other 100...120 VAC sensors are compatible with all 110...120 VAC IEC 1131-2 type 2 inputs.
All 2-wire AC proximity sensors conforming to standard IEC 947-5-2 and other 200...240 VAC sensors are compatible with all 200...240 VAC IEC 1131-2 type 2 inputs from the Premium range in the 220...240 VAC range.

Summary table

Type of input / Type of proximity sensor	24 VDC Type 1 positive logic	24/48 VDC Type 2 positive logic	24 VDC negative logic	24/48 VAC 100..120 VAC Type 2	200...240 VAC Type 2
All 3-wire prox. sensors (DC), PNP					
All 3-wire prox. sensors (DC), NPN					
Telemecanique or other 2-wire Proximity sensors (DC) with the following characteristics: **Residual voltage at closed state ≤7V** **Minimum switching current ≤ 2.5 mA** **Residual current at open state ≤ 1.5 mA**					
2-wire proximity sensor (AC/DC)					(1)
2-wire proximity sensor (AC)					(1)

(1) in nominal voltage range 220...240 VAC

Key

DC : operates at ⎓ voltage
AC : operates at ∿ voltage
AC/DC : operates at ∿ or ⎓ voltage

Compatibility

3.3-2 Compatibility of preactuators with outputs

Compatibility between DC preactuators and outputs

- Respect the maximum current and output switching frequency specified in the characteristics tables.
- In the case of low consumption preactuators, the output leakage current at rest state must be taken into account such that :
  I nominal • 50 x I leakage,
  I nominal = current drawn by the preactuator,
  I leakage = leakage current in the output at rest state.

Compatibility between tungsten filament lamps and transistor outputs (constant current)

- For outputs with protection against short-circuits, respect the maximum power of the tungsten filament lamps specified in the characteristics tables, otherwise there is the risk of tripping the outputs due to the lamp pull-in current at the moment of illumination.

Compatibility between AC preactuators and relay outputs

- Preactuators with inductive AC have a pull-in current which may exceed the holding current by ten times during a maximum time of 2/F seconds (F= AC frequency). For this reason, the relay outputs are designed to withstand this duty cycle (AC14 and AC15). The characteristics table for relay outputs specifies the maximum permitted holding power (in VA) as a function of the number of operations.

Reminder of the definition of thermal current

The current which may continuously flow through a closed relay, with an acceptable rise in temperature. **Under no circumstances should this current be switched by the relay.**

Compatibility between filament lamp and triac outputs

- respect the maximum power equal to U x I max.

Compatibility between AC preactuators and triac outputs

- respect the maximum specified current,
- In the case of low consumption preactuators, the output leakage current at rest state must be taken into account such that :
  I nominal • 50 x I leakage,
  I nominal = current drawn by the preactuator,
  I leakage = leakage current in the output at rest state.

3.3-3 Using negative logic (24 VDC)

Negative logic (Source inputs / Sink outputs) can be used with the following modules :

- for the inputs :
  - TSX DEY16A2 (this module intended for use with AC, can also be used with DC : negative logic).

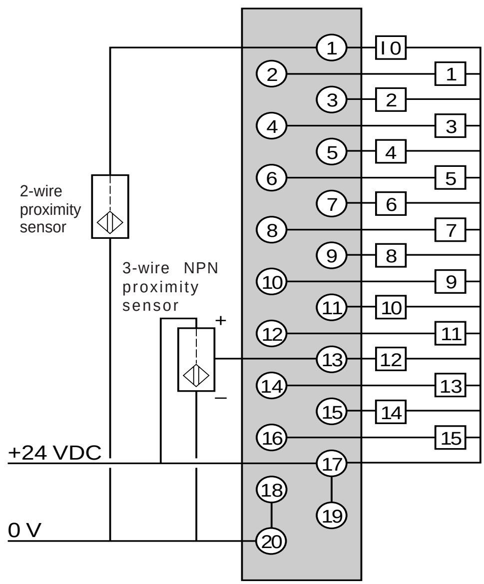
Caution :

The filter time for the inputs of the TSX DEY 16A2 module is between 10 and 20 ms.

- for the outputs :
  - relay outputs modules : TSX DSY 16R5 or TSX DSY 08R4D.

Wiring diagram :

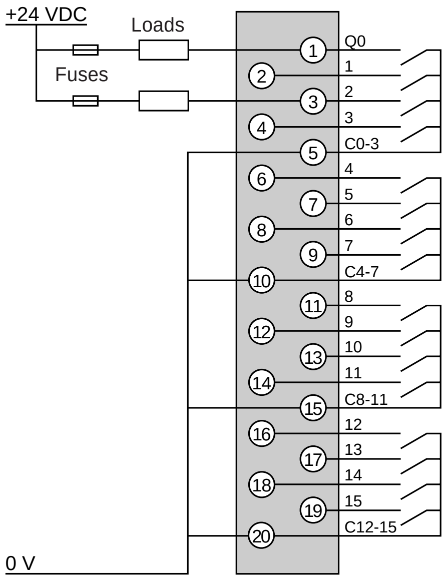
Input module : **TSX DEY 16A2**



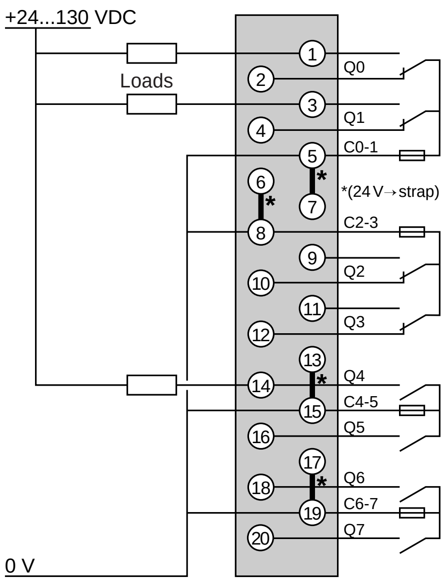
Comment :

The use of negative logic is not recommended when the sensor 0V is connected to ground. This is because if one of the wires were to be accidentally disconnected and come into contact with the mechanical ground, the input might be set to state 1. This would cause an undesirable control action.

Relay output module : TSX DSY 16R5



Relay output module : TSX DSY 08R4D



(*) : Strap required for the 24 V

3.4 Software installation and associated language objects

Discrete I/O used in the application program should be software configured using a configuration editor :

- declaration of the various modules in their respective position (in the rack),
- definition of the channel parameters for each module :
  - filter time for fast inputs,
  - assignment of channels to a task,
  - type of output reactivation,
  - fallback mode for output channels,
  - etc.

The software installation and the language objects associated with discrete I/O are described in the PL7 Junior / PL7 Pro software installation manual TLX DS 57 PL7 33E, Volume 1.

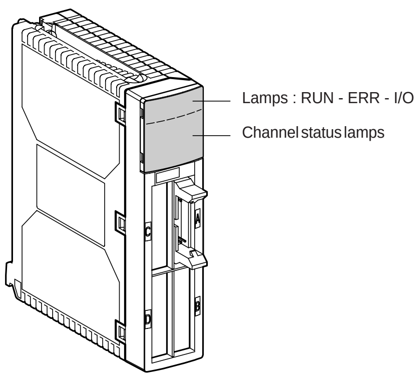
3.5 Discrete I/O display and diagnostics

The use and operation of display blocks is described in this manual in part C, "Maintenance/Diagnostics".

The discrete I/O diagnostics are based on 3 indicator lamps :

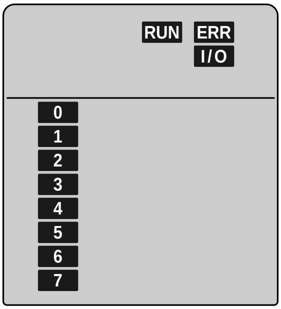
- RUN green,
- ERR red,
- I/O red,

on the front panel of each module as shown in the diagram opposite.
The zone below the diagnostic indicator lamps contains the lamps which relate to the input or output channels.
The channel is active when the corresponding lamp is on.
64-channel modules also have a +32 indicator lamp.

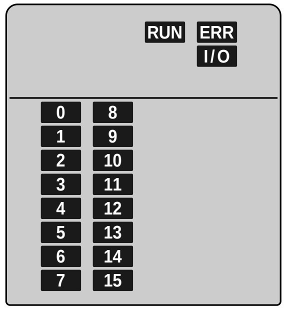


There are several different display blocks depending on the module :

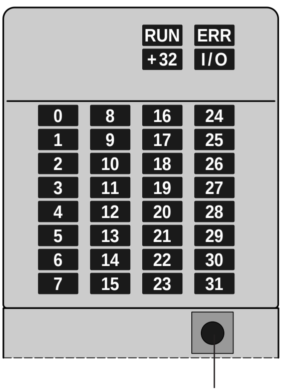
- **8-channel modules** have :
  - 3 module status lamps,
  - 8 channel status lamps,



- **16-channel modules** have :
  - 3 module status lamps,
  - 16 channel status lamps,



- **28, 32 and 64-channel modules** have :
  - 3 module status lamps,
  - 1 + 32 lamp, displaying channels 32 to 63 for the 64 channel module,
  - 32 channel status lamps.



Switch for displaying channels higher than 31. Only on 64-channel modules.
Example : displaying channel 41, lamps 9 and +32 lit if the channel is at state 1

Note :
for mixed I/O modules with 28 I/O, TSX DMY 28FK/28RFK :

- lamps 0 to 15 display the state of the inputs,
- lamps 16 to 27 display the state of the outputs,

4.1 Characteristics of input modules with terminal block

4.1-1 24 - 48 VDC positive logic input modules

Module reference			**TSX DEY 08D2 / 16D2**	**TSX DEY 16D3**
Nominal input values		Voltage	24 VDC	48 VDC
		Current	7 mA	7 mA
Input limit values	at state 1	Voltage	≥ 11 V	≥ 30 V
		Current	≥ 6.5 mA (for U = 11V)	≥ 6.5 mA (for U = 30V)
	at state 0	Voltage	≤ 5 V	≤ 10 V
		Current	≤ 2 mA	≤ 2 mA
	Sensor supply (ripple included)		19...30 V (possible up to 34 V, limited to 1 hour per 24 hours)	38...60 V
Input impedance	(at U nominal)		4 kΩ	7 kΩ
Response time	typical/maximum		4 ms / 7 ms	4 ms / 7 ms
IEC 1131-2 conformity			type 2	type 2
Compatibility	2-wire/3-wire prox. sensors (1)		IEC 947-5-2	IEC 947-5-2
Dielectric strength			1 500 V rms, 50/60 Hz for 1 min	
Insulation resistance			10 MΩ (at 500 VDC)	
Type of input			current sink	current sink
Paralleling of inputs (1)			Yes	Yes
Sensor voltage monitoring threshold		OK	> 18 V	> 36 V
		Fault	< 14 V	< 24 V
Monitoring response time	on appearance		1 ms < T < 3 ms	1 ms < T < 3 ms
	on disappearance		8 ms < T < 30 ms	8 ms < T < 30 ms
Consumption 5V	typical		55/80 mA	80 mA
	maximum		65/90 mA	90 mA
Sensor supply consumption (3)	typical		25 mA + (7 x N) mA	25 mA+(7 x N) mA
	maximum		33 mA + (7 x N) mA	33 mA+(7 x N) mA
Dissipated power (3)			1W + (0.15 x N) W	1W + (0.3 x N) W
Temperature derating (3)	The characteristics at 60°C are ensured for 60% of the inputs at state 1 (this characteristic is not relevant to module TSX DEY 08D2).			

(1) See section 3.3-1
(2) This characteristic enables several inputs to be wired in parallel on the same module, or on different modules if redundant inputs are required.
(3) N = Number of channels at 1
(4) See section 4.2-4.

4.1-2 24 VDC negative logic input module

Module reference			**TSX DEY 16A2**
Nominal input values		Voltage	24 VDC
		Current	16 mA (outgoing)
Input limit values	at state 1	Voltage	≤ Usup — 14V
		Current	≥ 6.5 mA (outgoing)
	at state 0	Voltage	≥ Usup — 5 V
		Current	≤ 2 mA (outgoing)
	Sensor supply (ripple included)		19...30 V (possible up to 34 V, limited to 1 hour per 24 hours)
Input impedance	at U nominal		1.6 kΩ
Response time	typical		10 ms
	maximum		20 ms
IEC 1131-2 conformity			Negative logic not considered in the standard
Compatibility	2-wire/3-wire prox. sensors (1)		IEC 947-5-2
Dielectric strength			1500 V rms, 50/60 Hz for 1 min
Insulation resistance			10 MΩ (at 500 VDC)
Type of input			resistive
Paralleling of inputs			No
Sensor voltage monitoring threshold		OK	> 18 V
		Fault	< 14 V
Monitoring response time		on appearance	20 ms < T < 40 ms
		on disappearance	5 ms < T < 10 ms
Consumption 5V	typical		80 mA
	maximum		90 mA
Sensor supply consumption	typical		15 mA + (15 x No. of channels at 1) mA
	maximum		19 mA + (15 x No. of channels at 1) mA
Dissipated power			1W + (0.4 x No. of channels at 1) W
Temperature derating (2)	The characteristics at 60°C are ensured for 60% of the inputs at state 1		

(1) See section 3.3-1
(2) See section 4.2-4.

4.1-3 AC voltage input modules

Module reference			TSX DEY 16A2	TSX DEY 16A3	TSX DEY 16A4	TSX DEY 16A5
Nominal input values	Voltage		24 VAC	48 VAC	100..120 VAC	200..240 VAC
	Current		15 mA	16 mA	12 mA	15 mA
	Frequency		50 / 60 Hz			
Input limit values	at state 1	Voltage	≥ 10 V	≥ 29 V	≥ 74 V	≥ 159 V
		Current	≥ 6 mA (U=10V)	≥ 6 mA (U=29V)	≥ 6 mA (U=74V)	≥ 6 mA (U=159V)
	at state 0	Voltage	≤ 5 V	≤ 10 V	≤ 20 V	≤ 40 V
		Current	≤ 4 mA	≤ 4 mA	≤ 4 mA	≤ 4 mA
	Frequency		47...63 Hz			
	Sensor supply		20...26 V	40...52 V	85..132 V	170…264V
	Peak current on activation (at U nominal)		15 mA	80 mA	160 mA	300 mA
Input impedance at U nominal			1.6 kΩ	3.2 kΩ	9.2 kΩ	20 kΩ
Type of input			Resistive	Capacitive	Capacitive	Capacitive
Response time	Activation		15 ms	10 ms	10 ms	10 ms
	Deactivation		20 ms	20 ms	20 ms	20 ms
IEC 1131-2 conformity			type 2	type 2	type 2	type 1
Compatibility	2-wire prox. sensors (1)		IEC 947-5-2			
Sensor voltage monitoring threshold	O K		> 18 V	> 36 V	> 82 V	> 164 V
	Fault		< 14 V	< 24 V	< 40 V	< 80 V
Monitoring response time	on appearance			20 ms < T < 50 ms		
	on disappearance			5 ms < T < 15 ms		
Consumption 5V	typical/maximum		80/90 mA	80/90 mA	80/90 mA	80/90 mA
Consumption sensor supply	typical/maximum		15/19 mA +(15xN) mA	16/20 mA +(16xN) mA	15/19 mA +(15xN) mA	12/16 mA +(12xN) mA
Power dissipated (2)			1 W+ (0.35xN)W	1 W (0.35xN)W	1 W (0.35xN)W	1 W (0.4xN)W
Dielectric strength	Input / ground or Input/internal logic		1500 Vrms	1500 Vrms (50/60 Hz for 1 minute)	1500 Vrms	2000 Vrms
Insulation resistance			> 10 MΩ at 500 VDC			
Temperature derating (2)			The characteristics at 60°C are ensured for 60% of the inputs at state 1			

(1) See section 3.3-1 (2) N = Number of channels at 1 (3) See section 4.2-4.

4.2 Characteristics of input modules with connectors

4.2-1 24 VDC positive logic fast input module

Reference			TSX DEY 16FK
Nominal input values	Voltage		24 VDC
	Current		3.5 mA
Input limit values	at state 1	Voltage	≥ 11 V
		Current	≥ 3 mA
	at state 0	Voltage	≤ 5 V
		Current	≤ 1.5 mA
	Sensor supply (ripple included)		19...30 V (possible up to 34 V, limited to 1 hour per 24 hours)
Input impedance at U nominal			6.3 kΩ
Response time	Default		4 ms
	Configurable filtering		0.1...7.5 ms (in increments of 0.5)
Type of input			current sink
Paralleling of inputs (1)			Yes
IEC 1131-2 conformity			Type 1
Compatibility	2-wire proximity sensor (2)		Yes
	3-wire proximity sensor (2)		Yes
Sensor voltage monitoring threshold	OK		> 18 V
	Fault		< 14 V
Monitoring response time	on appearance on disappearance		8 ms < T < 30 ms 1 ms < T < 3 ms
Consumption 5V	typical		250 mA
	maximum		300 mA
Sensor supply consumption	typical		20 mA + (3.5 mA per input at 1)
	maximum		30 mA + (3.5 mA per input at 1)
Dissipated power			1.2 W + (0.1 W x No. of channels at 1)
Dielectric strength Input / ground or internal logic			1 500 V rms, 50/60 Hz for 1 minute
Insulation resistance			> 10 MΩ at 500 VDC
Temperature derating (3)			The characteristics at 60°C are ensured for 60 % of inputs at state 1

(1) This characteristic enables several inputs to be wired in parallel on the same module, or on different modules if redundant inputs are required.
(2) See section 3.3-1
(3) See section 4.2-4.

4.2-2 24 VDC and 48 VDC 32-channel positive logic input modules

Reference			**TSX DEY 32D2K**	**TSX DEY 32D3K**
Nominal input values	Voltage		24 VDC	48 VDC
	Current		3.5 mA	7 mA
Input limit values	at state 1	Voltage	≥ 11 V	≥ 30 V
		Current	≥ 3 mA	≥ 6.5 mA (for U=30V)
	at state 0	Voltage	≤ 5 V	≤ 10 V
		Current	≤ 1.5 mA	≤ 2 mA
	Sensor supply (ripple included)		19...30 V (possible up to 34 V, limited to 1 hour per 24 hours)	38...60 V
Input impedance at U nominal			6.3 kΩ	6.3 kΩ
Response time			4 ms	4 ms
IEC 1131-2 conformity			Type 1	Type 2
Compatibility 2-wire and 3-wire proximity sensor			Yes (1)	Yes
Type of input			current sink	current sink
Paralleling of inputs			No	Yes
Sensor voltage monitoring threshold	OK		> 18 V	> 36 V
	Fault		< 14 V	< 24 V
Monitoring response time	on appearance		8 ms < T < 30 ms	
	on disappearance		1 ms < T < 3 ms	
Consumption 5V	Typical		135 mA	300 mA
	Maximum		155 mA	350 mA
Sensor supply consumption	Typical		30 mA + (3.5xN) mA	50 mA + (7xN) mA
	Maximum		40 mA + (3.5xN) mA	66 mA + (7xN) mA
Dissipated power			1 W + (0.1 W x No. of channels at 1)	2.5 W + (0.34 W x No. of channels at 1)
Dielectric strength Input / ground or internal logic			1 500 Vrms, 50/60 Hz for 1 min	
Insulation resistance			> 10 MΩ at 500 VDC	
Temperature derating (2)			The characteristics at 60°C are ensured for 60 % of inputs at state 1 at nominal voltage	

N = Number of channels at 1
(1) See section 3.3-1
(2) See section 4.2-4.

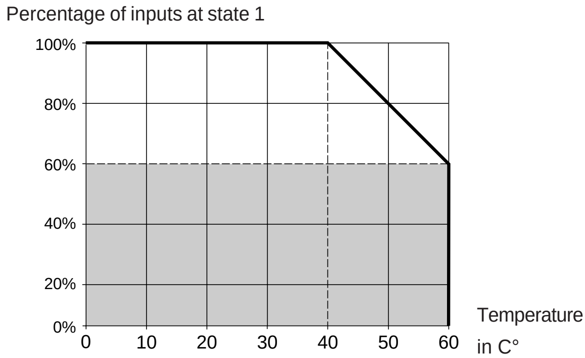
4.2-3 24 VDC 64-channel positive logic input module

Reference			**TSX DEY 64D2K**
Nominal input values	Voltage		24 VDC
	Current		3.5 mA
Input limit values	at state 1	Voltage	≥ 11 V
		Current	≥ 3 mA
	at state 0	Voltage	≤ 5 V
		Current	≤ 1.5 mA
	Sensor supply (ripple included)		19...30 V (possible up to 34 V, limited to 1 hour per 24 hours)
Input impedance at U nominal			6.3 kΩ
Response time			4 ms
IEC 1131-2 conformity			Type 1
Compatibility 2-wire and 3-wire prox. sensor (1)			Yes
Type of input			current sink
Paralleling of inputs			No
Sensor voltage monitoring threshold	OK		> 18 V
	Fault		< 14 V
Monitoring response time	on appearance		8 ms < T < 30 ms
	on disappearance		1 ms < T < 3 ms
Consumption 5V	Typical		135 mA
	Maximum		175 mA
Sensor supply consumption	Typical		60 mA + (3.5xN) mA
	Maximum		80 mA + (3.5xN) mA
Dissipated power			1.5W + (0.1 W x No. of channels at 1)
Dielectric strength Input / ground or internal logic			1 500 Vrms, 50/60 Hz for 1 min
Insulation resistance			> 10 MΩ at 500 VDC
Temperature derating (2)			The characteristics at 60°C are ensured for 60 % of inputs at state 1

N = Number of channels at 1
(1) See section 3.3-1
(2) See section 4.2-4.

4.2-4 Temperature derating

All the characteristics of the various discrete modules are given for a simultaneous loading of 60% of the channels at state 1. For operation with a higher loading, see the derating curve opposite.



Note 1

There is no derating for relay output modules, the user must check that the overall consumption on the 24 V relay power supply is sufficient.

For transistor outputs, temperature derating is on the maximum current used by the active outputs.

Example 1 : a module with sixteen 24 VDC/0.5 A transistor outputs, each switching 0.5 A. At 60°C, the maximum permitted current at the outputs is 16 x 0.5 x 60% = 4.8 which corresponds to about 10 outputs active simultaneously.

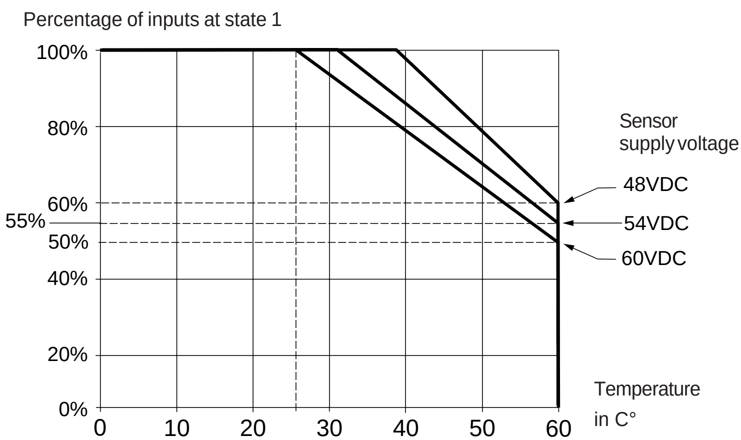
Example 2 : the same module (sixteen 24 VDC/0.5 A transistor outputs) each switching 0.3 A. At 60°C, the maximum permitted current at the outputs is 16 x 0.3 x 60% = 2.9 A, which corresponds to 16 outputs active simultaneously. In this case, there is no derating on the outputs; the maximum permitted current of the module is not exceeded.

Note 2 : special case for the TSX DEY 32D3K module with 32 inputs

For extreme uses of this module (in terms of sensor voltage and temperature), the derating conditions defined below must be met.

The following curves indicate the percentage of inputs simultaneously at state 1, depending on the :

- operating temperature,
- sensor supply voltage.



4.3 Characteristics of outputs with terminal block

4.3-1 DC transistor output modules (positive logic)

Module reference	TSX DSY →	08T2/16T2	08T22	08T31	16T3
Nominal values	Voltage / Current	24V/0.5A	24V/2A	48V/1A	48V/0.25A
Limit values	Voltage	19...30 V	(1)	38...60 V	38...60 V
(for U ≤ 30 V or 34 V,	Current / channel	0.625 A	2.5 A	1.25 A	0.31 A
ripple included)	Current / module	4 A / 7 A	14 A	7 A	4 A
Tungsten filament lamp power	(max.)	6 W	10 W	10 W	6 W
Leakage current	at state 0	< 0.5 mA	< 1 mA	< 1 mA	< 0.5 mA
Residual voltage	at state 1	< 1.2 V	< 0.5 V	< 1 V	< 1.5 V
Min. load impedance		48 Ω	12 Ω	48 Ω	192 Ω
Response time (2)		1.2 ms	200 µs	200 µs	1.2 ms
Switching frequency on inductive load		0.5 / LI^2 Hz			
Paralleling of outputs		Yes (2 maximum)			
Compatibility with DC inputs, IEC 1131-2		Yes (type 1 and type 2)			
Built-in protection	Against overvoltages	Yes, by transil diode			
	Against reverse polarity	Yes, by reverse-mounted diode. Provide a fuse on the + 24 V or + 48 V of the preactuators.			
	Against short-circuits and overloads	Yes, by current limiter and electronic circuit-breaker 1.5 In < Id < 2 In			
Preactuator voltage monitoring threshold	O K	> 18 V	> 18 V	> 36 V	> 36 V
	Fault	< 14 V	< 14 V	< 24 V	< 24 V
Monitoring response time	on appearance	T < 4 ms	T < 4 ms		
	on disappearance	T < 30 ms	T < 30 ms		
Consumption 5V	typical	55/80 mA	55 mA	55 mA	80 mA
	maximum	65/90 mA	65 mA	65 mA	90 mA
Consumption 24V preactuator	typical	30/40 mA	30 mA	30 mA	40 mA
(without load current)	maximum	40/60 mA	50 mA	50mA	60 mA
Dissipated power (N = number of outputs at 1)		1 / 1.1 W + 0.75WxN	1.3 W + 0.2WxN	2.2 W + 0.55WxN	2.4 W + 0.85WxN
Dielectric strength	output/ground or internal logic	1 500 Vrms, 50/60 Hz for 1 min			
Insulation resistance		> 10 MΩ at 500 VDC			
Temperature derating		The characteristics at 60°C are ensured for 60% of the max. module current			

(1) 34 V permissible for 1 hour per 24 hours.
(2) All outputs have fast demagnetization circuits for electromagnets. Electromagnet discharge time < L/R.

4.3-2 Relay output modules, thermal current 3 A

Modules			**TSX DSY 08R5 / 16R5**			
Operating voltage limit	DC/AC		10...34 VDC / 19...264 VAC			
Thermal current			3 A			
Maximum current per common			3 A (must not exceed this value)			
AC load	Resistive	Voltage	∼ 24 V	∼ 48 V	∼100..120V	∼200..240V
	AC12 duty	Power	50 VA (5)	50 VA (6) 110 VA (4)	110 VA (6) 220 VA (4)	220 VA (6)
	Inductive	Voltage	∼ 24 V	∼ 48 V	∼100..120V	∼200..240V
	AC14 and AC15 duty	Power	24 VA (4)	10VA (10) 24 VA (8)	10VA (11) 50 VA (7) 110 VA (2)	10 VA (11) 50 VA (9) 110 VA (6) 220 VA (1)
DC load	Resistive	Voltage	⎓ 24 V			
	DC12 duty	Power	24 W (6) 40 W (3)			
	Inductive	Voltage	⎓ 24 V			
	DC13 duty (L/R = 60 ms)	Power	10 W (8) 24 W (6)			
	Min switchable load		1 mA / 5 V			
Response time	Activation		< 8 ms			
	Deactivation		< 10 ms			
Type of contact			Normally open			
Built-in protection	Against overloads and short-circuits		None, a fast blow fuse must be fitted to each channel or group of channels			
	Against inductive overvoltages in ∼		None, an RC circuit or MOV peak limiter (ZNO) suitable for the voltage must be fitted in parallel across the terminals of each preactuator			
	Against inductive overvoltages in ⎓		None, a discharge diode must be fitted across the terminals of each preactuator			
Dielectric strength	Outputs/ground Outputs/internal logic		2000 V rms 50/60 Hz for 1 min			
Insulation resistance			> 10 MΩ at 500 VDC			
Power consumption	5 V internal		Typical 55/80 mA		Maximum 65/90 mA	
	24 V relay (per channel at 1)		Typical 8.5 mA		Maximum 10 mA	
Dissipated power			0.25 W + (0.2 W x No. of outputs at 1)			

(1) 0.1 x 10^6 operations
(2) 0.15 x 10^6 operations
(3) 0.3 x 10^6 operations
(4) 0.5 x 10^6 operations
(5) 0.7 x 10^6 operations.
(6) 1 x 10^6 operations.
(7) 1.5 x 10^6 operations.
(8) 2 x 10^6 operations.
(9) 3 x 10^6 operations.
(10) 5 x 10^6 operations.
(11) 10 x 10^6 operations.

4.3-3 DC relay output module

Module reference			**TSX DSY 08R4D**		
Limit operating voltage	DC		19...143 V		
	AC		not allowed		
Thermal current			5 A		
Maximum current per common			6 A (must not exceed this value)		
DC load	Resistive	Voltage	⎓ 24 V	⎓ 48 V	⎓ 100...130 V
	DC12 duty	Power	50 W (6) 100 W (3)	100 W (6) 200 W (3)	220 W (6) 440 W (3)
	Inductive	Voltage	⎓ 24 V	⎓ 48 V	⎓ 100...130 V
	DC13 duty (L/R = 60 ms)	Power	20 W (8) 50 W (6)	50 W (8) 100 W (6)	110 W (8) 220 W (6)
Response time	Activation		< 10 ms		
	Deactivation		< 15 ms		
Type of contact			2x2 C/O (1) (on-delay/off-delay) 2x2 N/O (on-delay)		
Built-in protection	against overvoltages		R-C and Ge-Mov circuit		
common	against overloads		Interchangeable 6.3 A fast blow fuse per and short-circuits		
Dielectric strength	Outputs/ground Outputs/internal logic		2000 V rms 50/60 Hz for 1 min		
Insulation resistance			> 10 MΩ at 500 VDC		
Power consumption	5 V	Typical	55 mA		
		Maximum	65 mA		
	24 V	Typical	10 mA per channel at 1		
	Relay	Maximum	12 mA per channel at 1		
Dissipated power (2)			0.25 W + (0.24 W x No. of outputs at 1)		

(1) N/C = normally closed - N/O = Normally open

(3) 0.3×10^6 operations
(6) 1×10^6 operations.
(8) 2×10^6 operations.

4.3-4 Relay output module, thermal current 5 A

Module reference			**TSX DSY 08R5A**			
Limit operating voltage	DC		19...60 V			
	AC		19…264V			
Thermal current			5 A			
Maximum current per common			6 A (must not exceed this value)			
AC load	Resistive	Voltage	~ 24 V	~ 48 V	~100..120V	~200..240V
	AC12 duty	Power	100 VA(5)	100 VA(6) 200 VA(4)	220 VA(6) 440 VA(4)	440 VA(6)
	Inductive	Voltage	~ 24 V	~ 48 V	~100..120V	~200..240V
	AC14 and AC15 duty	Power	50 VA (4)	20VA (10) 50 VA (8)	20 VA (11) 110 VA (7) 220 VA(2)	20 VA (11) 110 VA (9) 220 VA(6) 440 VA (1)
DC load	Resistive	Voltage	⎓ 24 V	⎓ 48 V		
	DC12 duty	Power	24 W (6) 50 W (3)	50 W (6) 100 W (3)		
	Inductive	Voltage	⎓ 24 V	⎓ 48 V		
	DC13 duty (L/R = 60 ms)	Power	10 W (8) 24 W (6)	24 W (8) 50 W (6)		
Response time	Activation		< 10 ms			
	Deactivation		< 15 ms			
Type of contact			2x2 C/O (1) (on-delay/off-dlay) 2x2 N/O (on-delay)			
Built-in protection common	against overvoltages		R-C and Ge-Mov circuit			
	against overloads		Interchangeable 6.3 A fast blow fuse per and short-circuits			
Dielectric strength	Outputs/ground Outputs/internal logic		2000 V rms 50/60 Hz for 1 min			
Insulation resistance			> 10 MΩ at 500 VDC			
Power consumption	5 V	Typical	55 mA			
		Maximum	65 mA			
	24 V	Typical	10 mA	per channel at 1		
	Relay	Maximum	12 mA	per channel at 1		
Dissipated power			0.25 W + (0.24 W x No. of outputs at 1)			

(1) 0.1 x 10^6 operations
(2) 0.15 x 10^6 operations
(3) 0.3 x 10^6 operations
(4) 0.5 x 10^6 operations
(5) 0.7 x 10^6 operations.
(6) 1 x 10^6 operations.
(7) 1.5 x 10^6 operations.
(8) 2 x 10^6 operations.
(9) 3 x 10^6 operations.
(10) 5 x 10^6 operations.
(11) 10 x 10^6 operations.

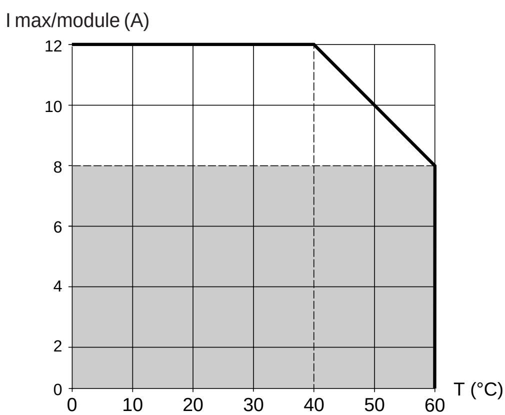
4.3-5 Triac output modules

Module reference		TSX DSY 08S5/16S5	TSX DSY 16S4
Limit operating	DC	not allowed	not allowed
voltage	AC	41..264V	20..132V
Permissible current (1)	TSX DSY 08S5 TSX DSY 16S5	2 A / chan. - 12A/module 1 A / chan. - 12A/module	1 A / chan. - 12A/module
Leakage current	TSX DSY 08S5 TSX DSY 16S5	≤ 2 mA ≤ 1.5 mA	≤ 1.5 mA
Response	Activation	≤ 10 ms	
time	Deactivation	≤ 10 ms	
Built-in	against overvoltages	Ge-Mov	
protection	against overloads and short-circuits	Interchangeable fast blow fuse per common - 5 A	Flameproof protection non interchangeable per common of 10 A
Dielectric strength	Outputs/ground Outputs/internal logic	2000 V rms 50/60 Hz for 1 min	
Insulation resistance		> 10 MΩ at 500 VDC	
Consumption on	Typical TSX DSY 08S5 TSX DSY 16S5	125 mA 220 mA	220 mA
5V supply	Maximum TSX DSY 08S5 TSX DSY 16S5	135 mA 230 mA	230 mA
Dissipated power	TSX DSY 08S5 TSX DSY 16S5	0.5 W + 1 W/A per output 0.85 W + 1 W/A per output	0.85 W+1 W/A per output

(1) temperature derating is as shown on graph below

Important :

When using TSX DSY 08S5 modules at 220 VAC, it is essential not to use different phases between groups of channels on the same module.



4.4 Characteristics of transistor output modules with connector

4.4-1 DC transistor output modules (positive logic)

Module reference		**TSX DSY 32T2K**	**TSX DSY 64T2K**
Nominal values	Voltage / current	24V / 0.1A	24V / 0.1A
Limit values (for U ≤ 30V or 34V,	Voltage	19...30 V, possible up to 34 V, limited to 1 hour per 24 hours).	
ripple included)	Current / channel	0.125 A	0.125 A
	Current / module	3.2 A	5 A
Tungsten filament lamp power		1.2 W (maximum)	1.2 W (maximum)
Leakage current	at state 0	< 0.1 mA for U = 30 V	< 0.1 mA for U = 30 V
Residual voltage	at state 1	< 1.5 V for I = 0.1 A	< 1.5 V for I = 0.1 A
Min load impedance		220 Ω	220 Ω
Response time (1)		1.2 ms	1.2 ms
Switching frequency on inductive load		0.5 / LI^2 Hz	0.5 / LI^2 Hz
Paralleling of outputs		Yes : 3 max.	Yes : 3 max.
Compatibility of DC inputs with IEC 1131-2		Yes (type 1 and type 2)	Yes (type 1 and type 2)
Built-in	Against overvoltages	Yes, by transil diode	
protection	Against reverse polarity	Yes, by reverse-mounted diode - provide a 2 A fuse on the + 24 V of the preactuators (1 per connector).	
	Against short-circuits and overloads	Yes, by current limiter and electronic circuit-breaker 0.125 A < Id < 0.185 A	
Preactuator voltage	O K	> 18 V	> 18 V
monitoring threshold	Fault	< 14 V	< 14 V
Monitoring	on appearance	T < 4 ms	T < 4 ms
response time	on disappearance	T < 30 ms	T < 30 ms
Consumption 5V	typical/maximum	135 mA / 155 mA	135 mA / 175 mA
Consumption 24V preactuator (without load current)	typical/maximum	30 mA / 40 mA	60 mA / 80 mA
Dissipated power		1.6 W + 0.1 W / output	2.4 W + 0.1 W / output
Dielectric strength output/ground or internal logic		1 500 V rms, 50/60 Hz for 1 min	
Insulation resistance		> 10 MΩ at 500 VDC	
Temperature derating		The characteristics at 60°C are ensured for 60% of the max. module current	

(1) All outputs have fast demagnetization circuits for electromagnets. Electromagnet discharge time < L/R.

4.5 Characteristics of mixed I/O modules with connectors

4.5-1 24 VDC positive logic fast inputs

Module references			**TSX DMY 28FK/28RFK**
Nominal input values	Voltage		24 VDC
	Current		3.5 mA
Input limit values	at state 1	Voltage	≥ 11 V
		Current	≥ 3 mA
	at state 0	Voltage	≤ 5 V
		Current	≤ 1.5 mA
	Sensor supply (ripple included)		19...30 V (possible up to 34 V, limited to 1 hour per 24 hours)
Input impedance at U nominal			6.3 kΩ
Response time	Default		4 ms
	Configurable filtering		0.1...7.5 ms (in increments of 0.5)
Type of input			current sink
Paralleling of inputs (1)			Yes
IEC 1131-2 conformity			Type 1
Compatibility	2-wire proximity sensor (2)		Yes
	3-wire proximity sensor (2)		Yes
Sensor voltage monitoring threshold	OK		> 18 V
	Fault		< 14 V
Monitoring response time	on appearance		8 ms < T < 30 ms
	on disappearance		1 ms < T < 3 ms
Consumption 5V	typical		300 mA
	maximum		350 mA
Sensor supply consumption	typical		20 mA + (3.5 mA per input at 1)
	maximum		30 mA + (3.5 mA per input at 1)
Dissipated power			1.2 W + (0.1 W x Number of inputs at 1)
Dielectric strength Input / ground or internal logic			1 500 V rms, 50/60 Hz for 1 minute
Insulation resistance			> 10 MΩ at 500 VDC
Temperature derating (3)			The characteristics at 60°C are ensured for 60 % of inputs at state 1

(1) This characteristic enables several inputs to be wired in parallel on the same module, or on different modules if redundant inputs are required.
(2) See section 3.3-1
(3) See section 4.2-4.

4.5-2 DC transistor outputs (positive logic)

Module references			**TSX DMY 28FK/28RFK**
Nominal values	Voltage / current		24VDC/0.5A
Limit values	Voltage		19...30 V (1)
(for U ≤ 30 V or 34 V,	Current / channel		0.625 A
ripple included)	Current / module		4 A
Tungsten filament lamp power (max.)			6 W
Leakage current	at state 0		< 1 mA
Residual voltage	at state 1		< 1.2 V
Min load impedance			48 Ω
Response time (2)			0.6 ms
Switching frequency on inductive load			0.5 / LI² Hz
Paralleling of outputs			Yes (2 maximum)
Compatibility with IEC 1131-2 DC inputs			Yes (type 1 and type 2)
Built-in	Against overvoltages		Yes, by transil diode
protection	Against reverse polarity		Yes, by reverse-mounted diode - Provide a fuse on the + 24 V of the preactuators.
	Against short-circuits and overloads		Yes, by current limiter and electronic circuit-breaker 1.5 In < Id < 2 In
Sensor voltage	O K		> 18 V
monitoring threshold	Fault		< 14 V
Monitoring	on appearance		T < 4 ms
response time	on disappearance		T < 30 ms
Consumption 24V preactuator		typical	30/40 mA
(without load current)		maximum	40/60 mA
Dissipated power			1 W + (0.75 W) / output
Dielectric strength Input/ground or Input/internal logic			1500 V rms, 50/60 Hz for 1 min
Insulation resistance			> 10 MΩ at 500 VDC
Temperature derating			The characteristics at 60°C are ensured for 60% of the max. module current

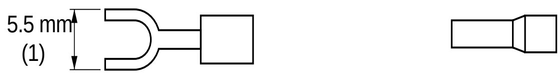
(1) 34 V permissible for 1 hour per 24 hours.
(2) All outputs have fast demagnetization circuits for electromagnets. Electromagnet discharge time < L/R.

5.1 Connection methods

5.1-1 Connection to modules with screw terminal block

The terminal blocks of the I/O modules have an automatic transfer coding device for when they are first used. This avoids handling errors while a module is being replaced. The coding ensures electrical compatibility for each type of module. See part A, section 5.4.

Each terminal can accept bare wires or wires fitted with cable ends or open lugs.
The capacity of each terminal is :
- minimum : 1 wire, 0.2 mm^2 (AWG 24) without cable end,
- maximum : 1 wire, 2 mm^2 without cable end or,
  1 wire, 1.5 mm^2 with cable end.



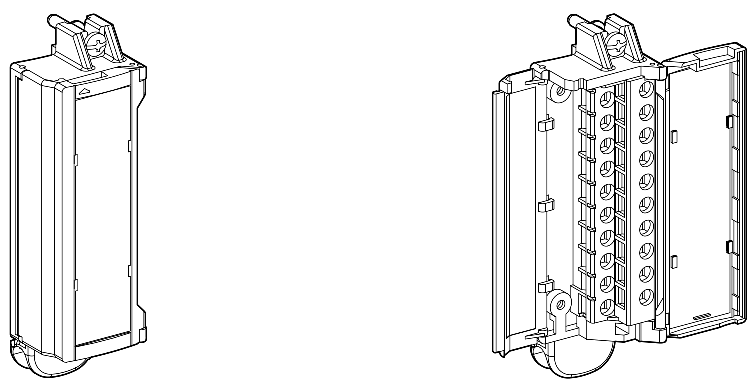
(1) 5.5 mm maximum

The screw clamps have a recess for screwdrivers with the following heads :
- Pozidrive N°1 cruciform,
- flat, Ø 5 mm diameter

The screw terminal connection blocks are fitted with captive screws. They are supplied unscrewed. The maximum capacity of the terminal block is 16 wires, 1 mm^2 (AWG) + 4 wires, 1.5 mm^2 (AWG).

Maximum tightening torque on connection terminal screw : 0.8 N.m

Opening the cover



5.1-2 Connection to modules with HE10 connectors

20-wire preformed cable, 22 gauge (0.34 mm^2),

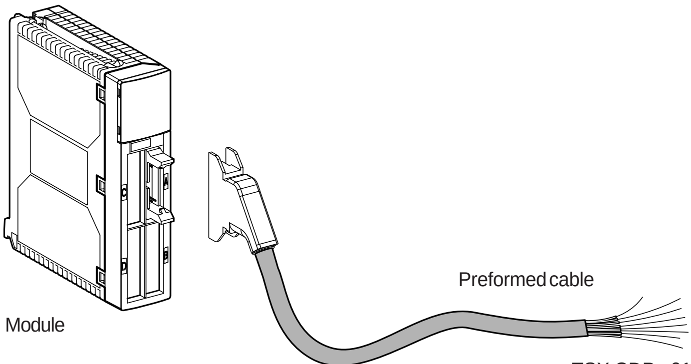
Used for simple and direct wire-to-wire connection of the I/O on modules with HE10 connectors to sensors, preactuators or terminals.

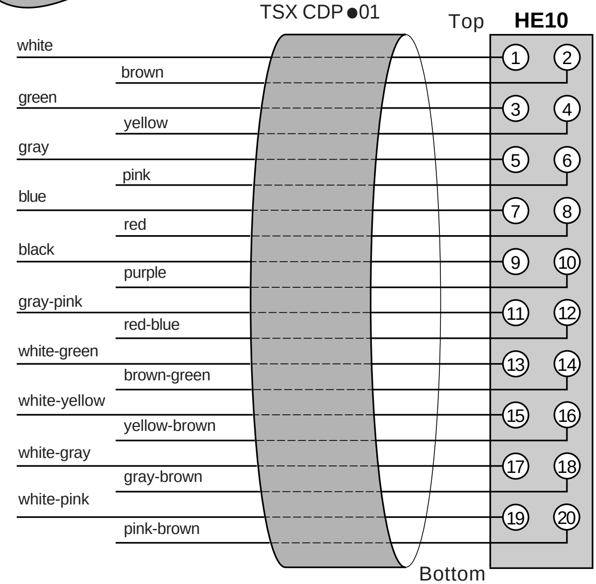
This preformed cable comprises :

- at one end, an HE10 moulded connector carrying 20 wires, 0.34 mm^2 cross-section within a sheath,
- at the other end, flying leads color-coded conforming to standard DIN 47100.

Note : A nylon cord inside the cable enables the sheath to be stripped easily.

There are two product references : **TSX CDP 301** : 3 meters.
TSX CDP 501 : 5 meters.





Correspondence between wire color and the HE10 connector pin number

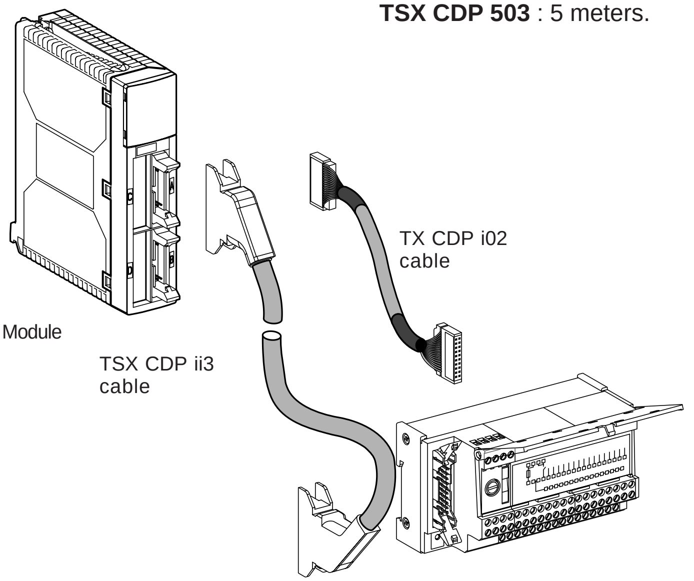
Sheathed rolled ribbon cable 28 gauge (0.08 mm²)
Used to connect the I/O from modules with HE10 connectors to TELEFAST 2 rapid connection and wiring interfaces. This cable comprises 2 HE10 connectors and a sheathed rolled ribbon cable with 0.08 mm² cross-section wires.
Given the small cross-section of the wires, it is recommended that they be used only for low current inputs or outputs (< 100 mA per input or output).

There are three product references : **TSX CDP 102** : length 1 meter
TSX CDP 202 : length 2 meters
TSX CDP 302 : length 3 meters

Connection cable 22 gauge (0.34 mm²)
Used to connect the I/O of modules with HE10 connectors to TELEFAST 2 rapid connection and wiring interfaces. This preformed cable comprises 2 HE10 moulded connectors and a cable with 0.34 mm² cross-section wires used for carrying higher currents (> 500 mA).

There are five product references : **TSX CDP 053** : length 0.50 meters.

TSX CDP 103 : length 1 meter.
TSX CDP 203 : length 2 meters.
TSX CDP 303 : length 3 meters.
TSX CDP 503 : 5 meters.



Maximum tightening torque on TSX CDP• cable connector screw : 0.5 N.m

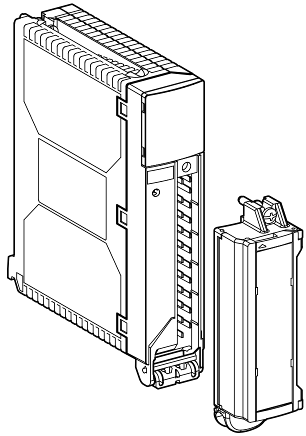
5.2 Module connections

5.2-1 TSX DEY 08D2 / 16D2 modules

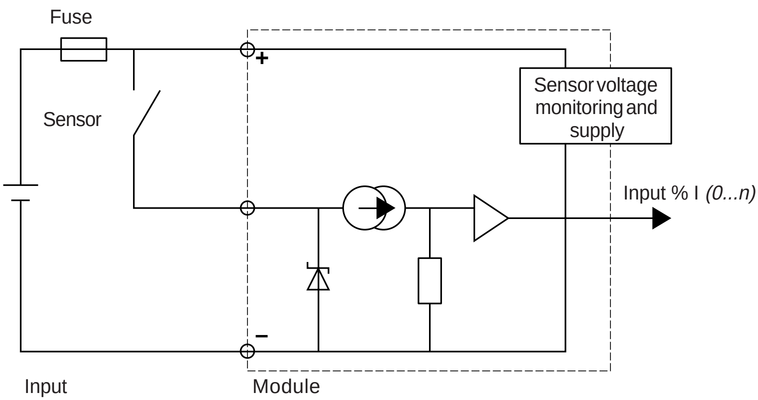
Presentation

TSX DEY 08D2 / 16D2 modules comprise :
• 8 inputs 24 VDC, positive logic type 2 for TSX DEY 08D2 modules,
• 16 inputs 24 VDC, positive logic type 2 for TSX DEY 16D2 module,

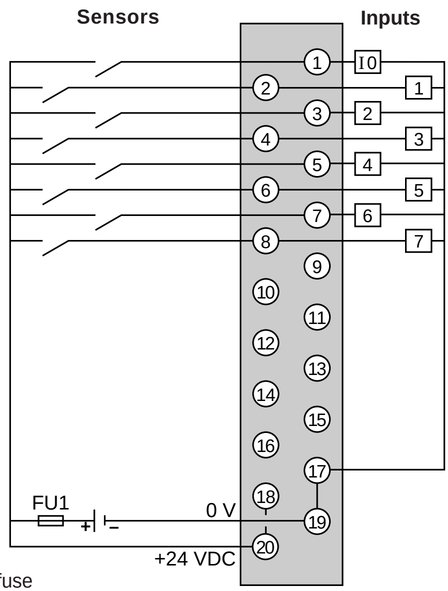
The inputs are connected via a removable screw terminal block on the module.



Simplified input schematic

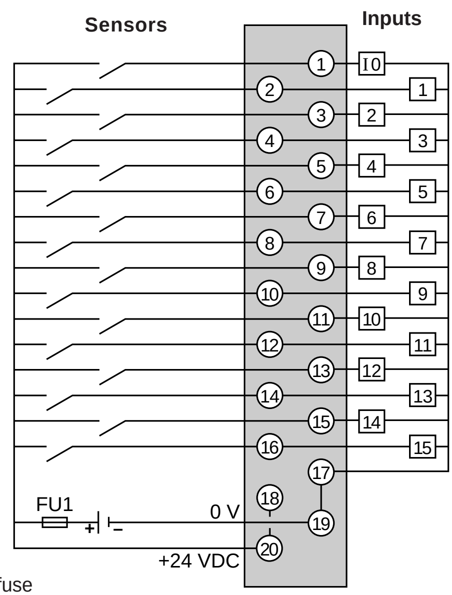


TSX DEY 08D2 module connections



FU1 = 0.5 A fast blow fuse

TSX DEY 16D2 module connections



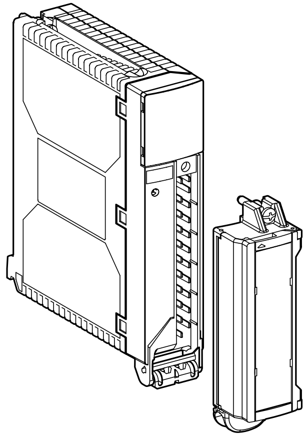
FU1 = 0.5 A fast blow fuse

5.2-2 TSX DEY 16D3 module

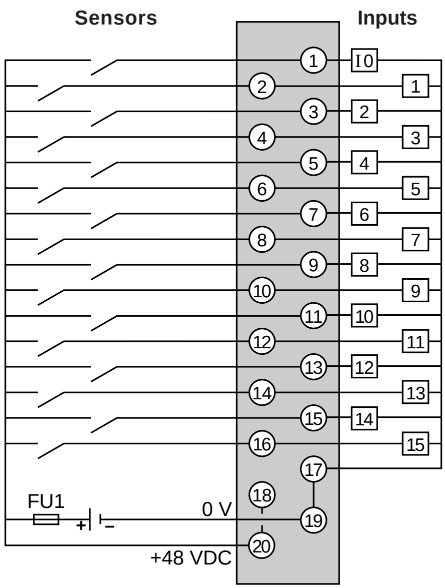
Presentation

The TSX DEY 16D3 module has 16 inputs, 48 VDC.

This module is connected to a 20-pin screw terminal block. Inputs are type 2, positive logic.



TSX DEY 16D3 module connections



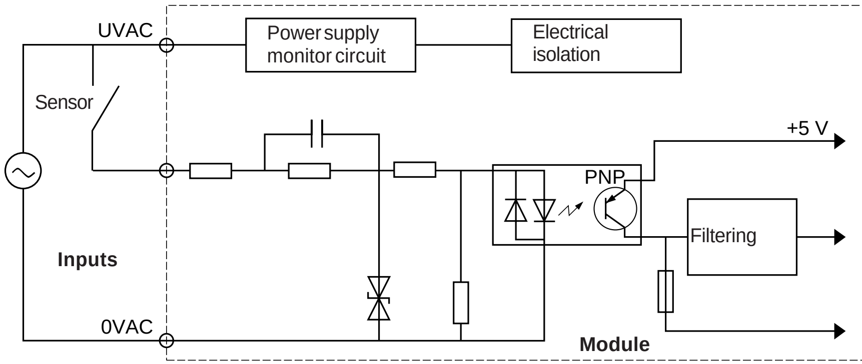
FU1 = 0.5 A fast blow fuse

5.2-3 TSX DEY 16A2 / 16A3 / 16A4 / 16A5 modules

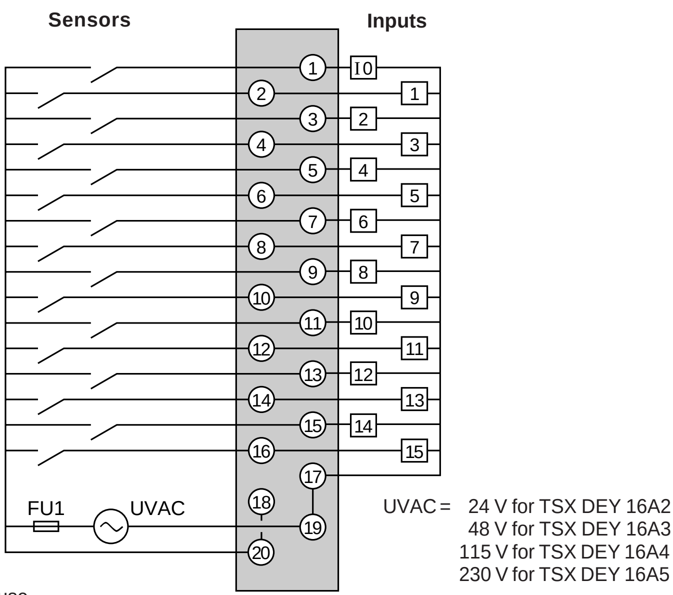
Presentation

TSX DEY 16A2 / 16A3 / 16A4 and 16A5 modules have AC inputs, type 2. They are connected to 20-pin screw terminal blocks.

Simplified input schematic

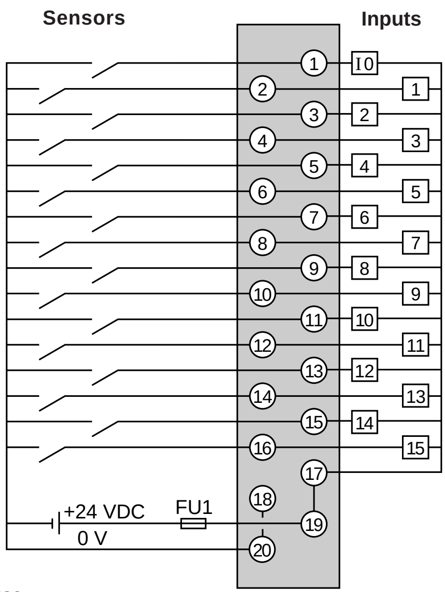


TSX DEY 16A2 / 16A3 / 16A4 / 16A5 module connections



FU1 = 0.5 A fast blow fuse

TSX DEY 16A2 module connections with negative logic DC inputs



FU1 = 0.5 A fast blow fuse

⚠ The use of negative logic is not recommended when the sensor 0V is connected to ground. This is because if one of the wires were to be accidentally disconnected and come into contact with the mechanical ground, the input might be set to state 1. This would cause an undesriable control action.

5.2-4 TSX DEY 16FK module

Presentation

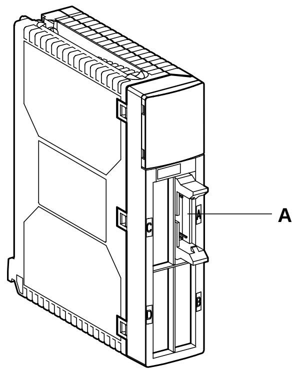
This module has 16 fast input channels, 24 VDC. They are type 1 inputs, proximity sensor compatible conforming to the characteristics in section 4.

The module is fitted with an HE10 male connector :

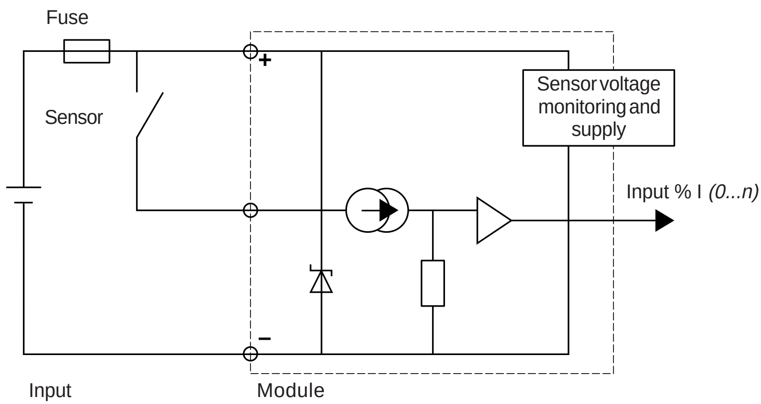
- connector A addresses 0 to 15

The connector can accept :

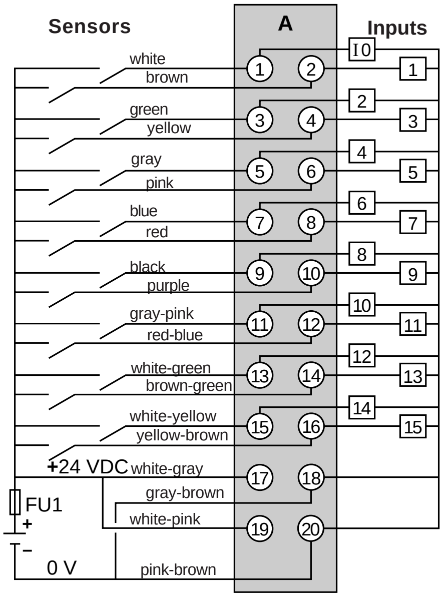
- either a TSX CDP•01 preformed cable for direct connection to the sensor terminal,
- or a TSX CDP•02 ribbon cable or a TSX CDP••3 cable for connection to a TELEFAST 2 interface.



Simplified schematic



TSX DEY 16FK module connections



FU1 = 0.5 A fast blow fuse

Note :
The colors are used to show the correspondence between the HE10 connector pins and the wires of a TSX CDP•01 preformed cable.

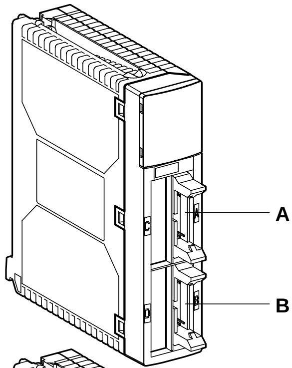
5.2-5 TSX DEY 32D2K / 64D2K modules

Presentation

TSX DEY 32D2K and 64D2K modules have 24 VDC inputs. These are type 1 proximity sensor compatible inputs conforming to the characteristics in section 4.

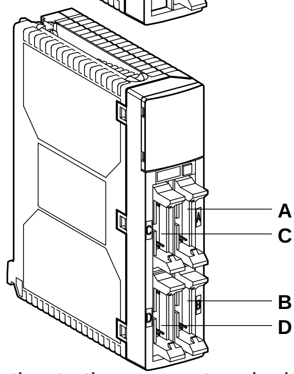
The TSX DEY 32D2K module is fitted with 2 HE10 male connectors :

- connectors A and B are used to connect inputs :
  - A (0 to 15)
  - B (16 to 31)



The TSX DEY 64D2K module is fitted with 4 HE10 male connectors :

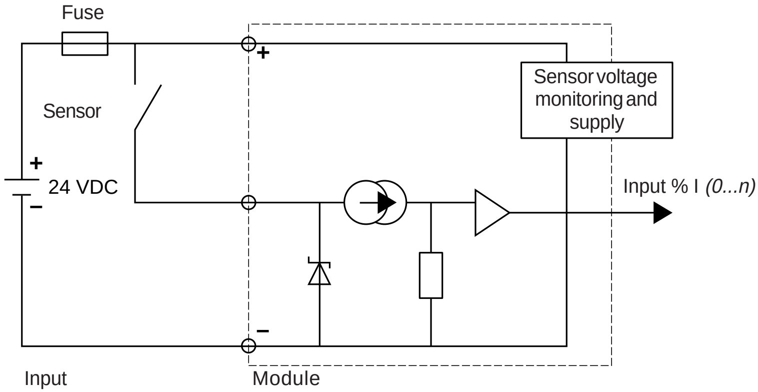
- connectors A and B for connecting channels :
  - A (0 to 15)
  - B (16 to 31)
- connectors C and D for connecting channels :
  - C (32 to 47)
  - D (48 to 63)



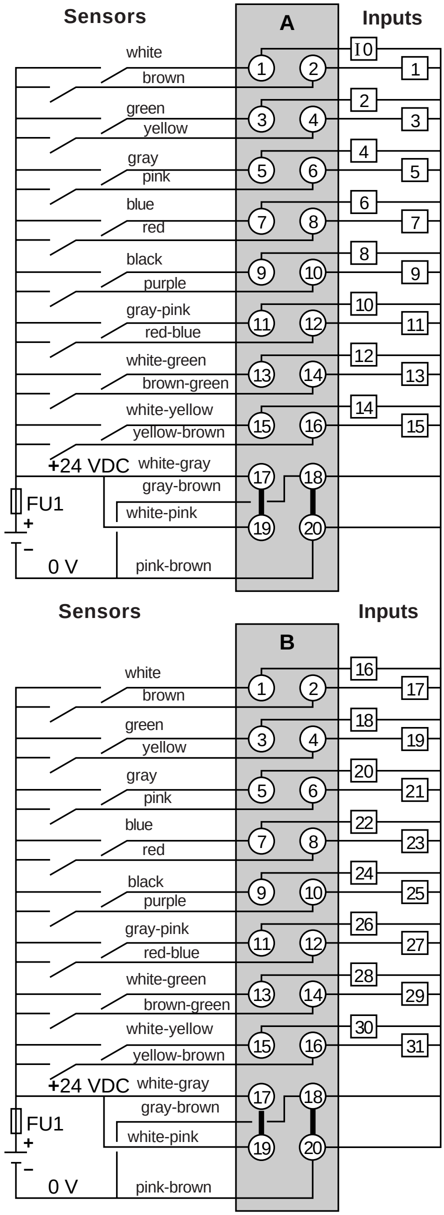
Each connector can accept :

- either a TSX CDP•01 preformed cable for direct connection to the sensor terminal,
- or a TSX CDP•02 ribbon cable or a TSX CDP••3 cable for connecting to a TELEFAST 2 interface.

Simplified input schematic

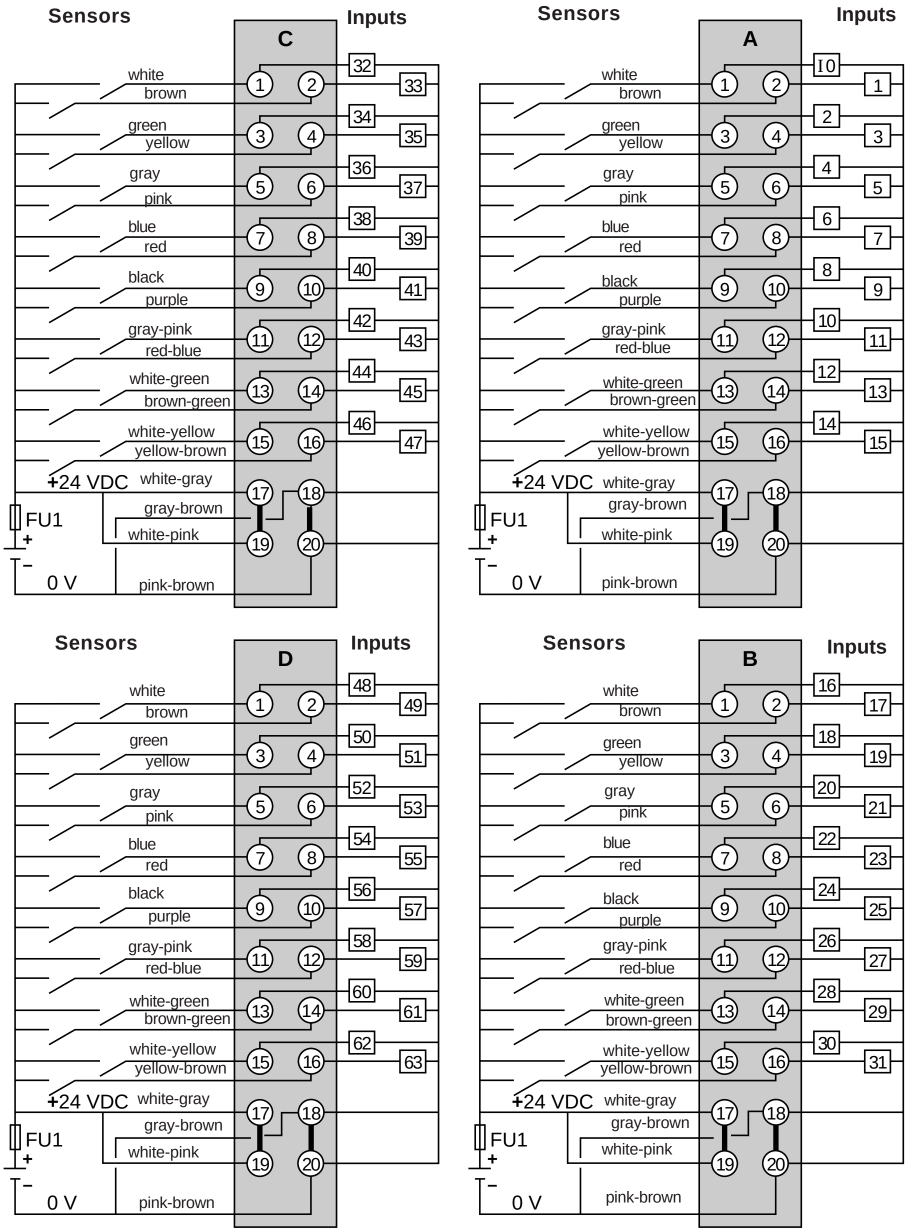


TSX DEY 32D2K module connections



FU1 = 0.5 A fast blow fuse

TSX DEY 64D2K module connections



FU1 = 0.5 A fast blow fuse

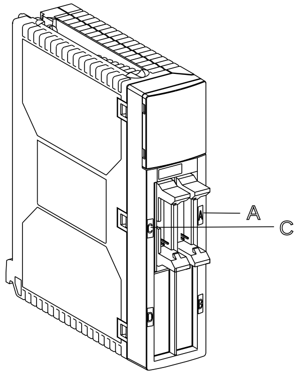
5.2-6 TSX DEY 32D3K module

Presentation

The TSX DEY 32D3K has 48 VDC inputs. These are type 2 proximity sensor compatible inputs conforming to the characteristics in section 4.

The TSX DEY 32D3K module is fitted with 2 HE10 male connectors :

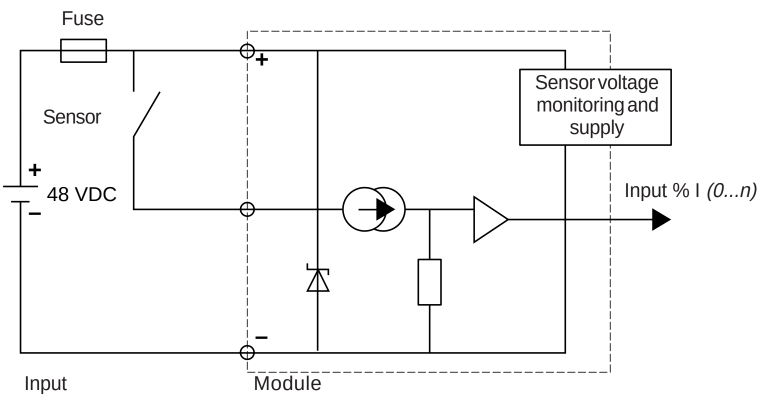
- connectors A and C are used to connect inputs :
  - A (0 to 15)
  - C (16 to 31)



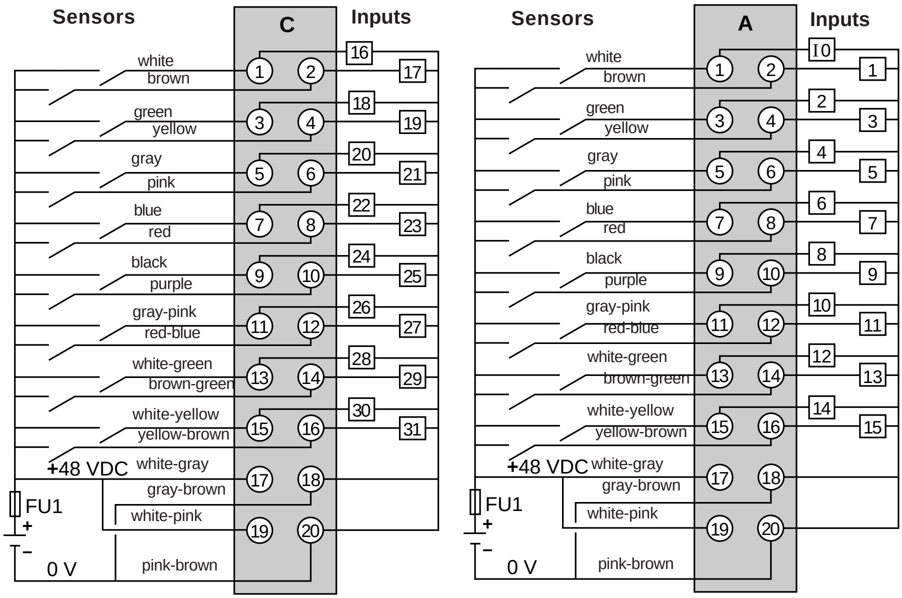
Each connector can accept :

- either a TSX CDP•01 preformed cable for direct connection to the sensor terminal,
- or a TSX CDP•02 ribbon cable or a TSX CDP••3 cable for connecting to a TELEFAST 2 interface.

Simplified input schematic



TSX DEY 32D3K module connections



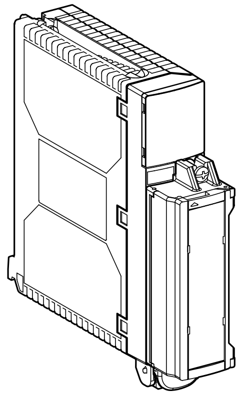
FU1 = 0.5 A fast
blow fuse

5.2-7 TSX DSY 08T2 / 16T2 / 16T3 / 08T22 / 08T31 modules

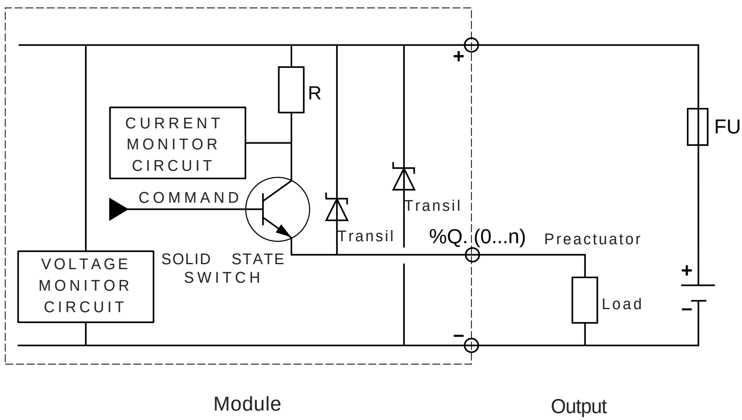
Presentation

TSX DSY 08T2 / 16T2 and 08T22 modules have protected 24 VDC transistor outputs, TSX DSY 16T3 /08T31 modules have 48 VDC protected transistor outputs.

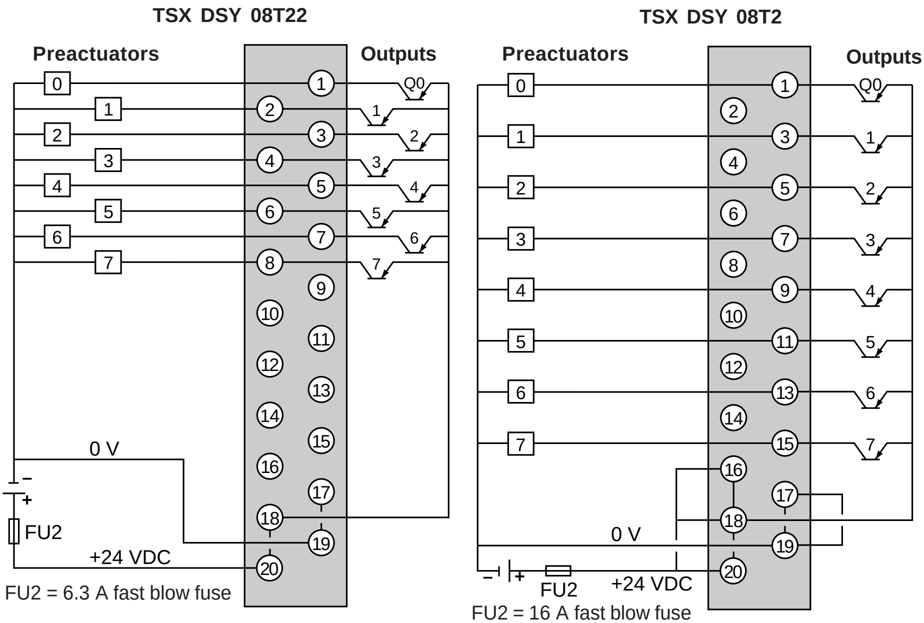
These five modules are fitted with a 20-pin screw terminal block, which can be removed in order to connect the outputs.



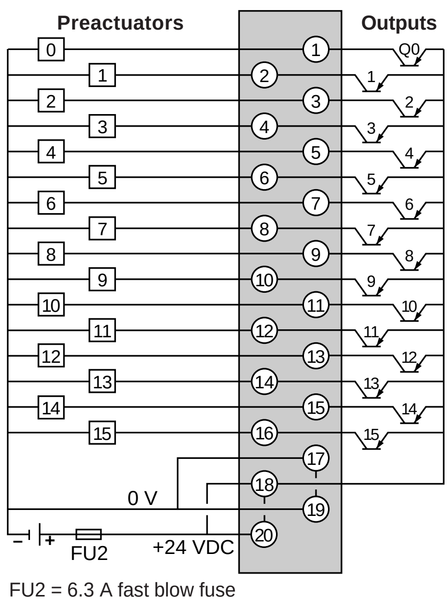
Simplified output schematic



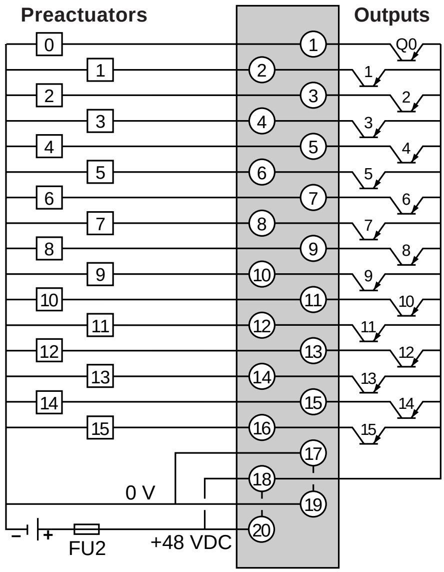
TSX DSY 08T2/08T22 module connections



TSX DSY 16T2 module connections

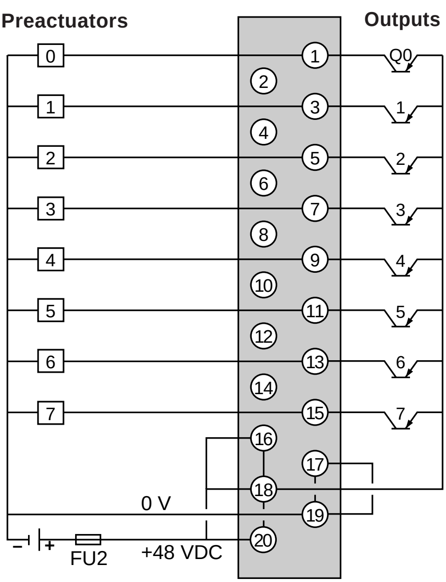


TSX DSY 16T3 module connections : 48 VDC supply



FU2 = 10 A fast blow fuse

TSX DSY 08T31 module connections



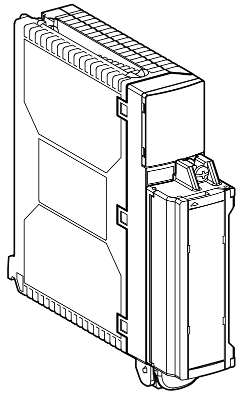
FU2 = 10 A fast blow fuse

5.2-8 Relay modules 50 VA : TSX DSY 08R5 / 16R5

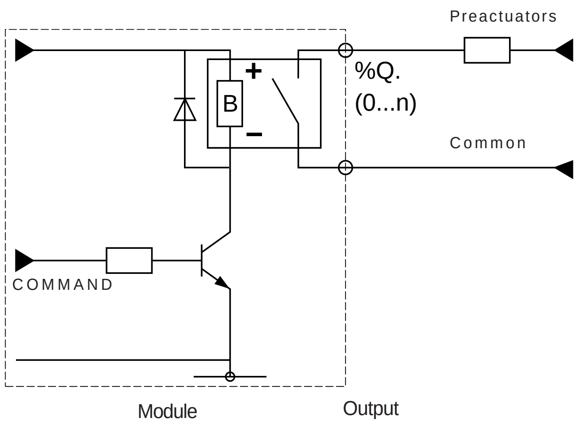
Presentation

TSX DSY 08R5 and 16R5 modules have 8 relay outputs and 16 relay outputs respectively.

They are fitted with a 20-pin screw terminal block, which can be removed in order to connect the outputs.



Simplified output schematic

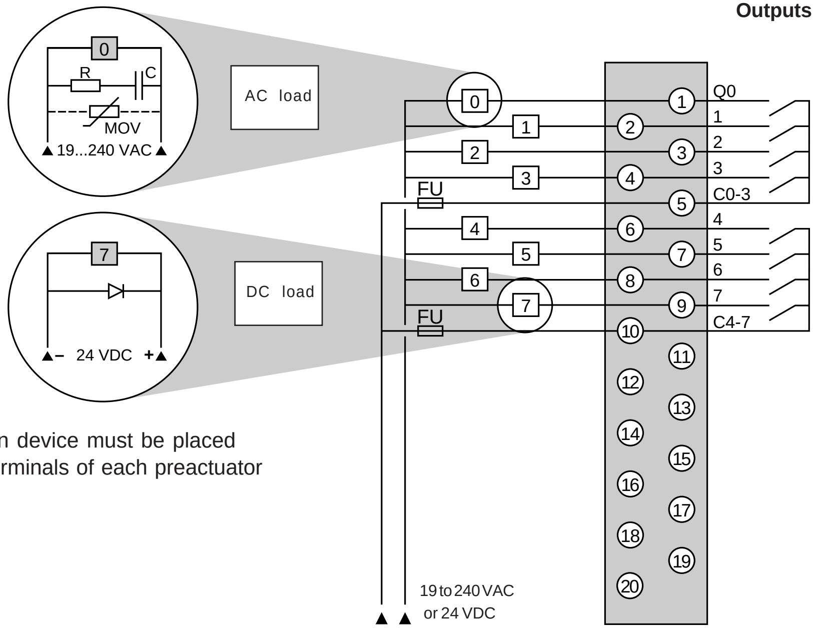


Warning :

The relay contact must be protected by placing across the preactuator terminals :

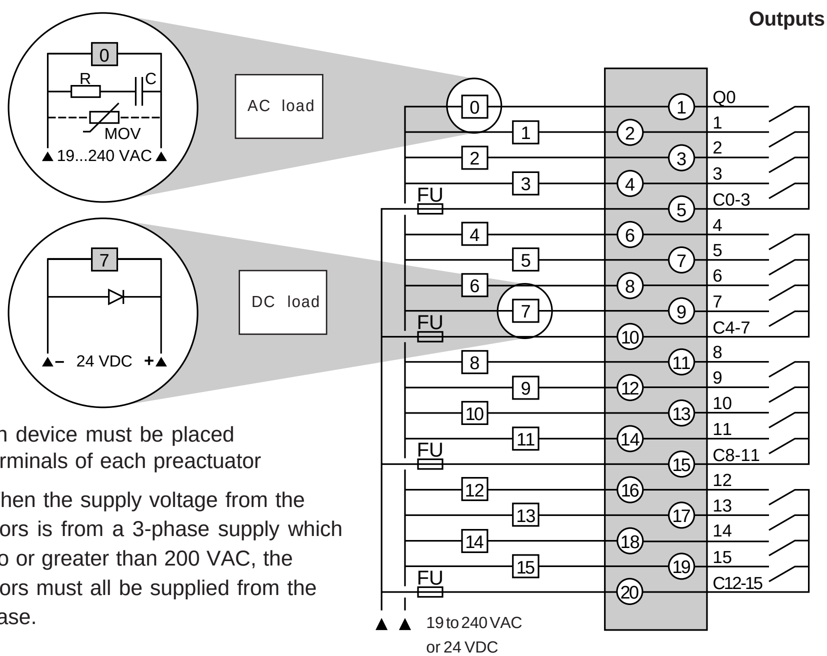
- either an RC circuit or MOV (ZNO) peak limiter when using AC,
- or a discharge diode when using DC.

TSX DSY 08R5 module connections



Protection device must be placed across terminals of each preactuator

TSX DSY 16R5 module connections



Protection device must be placed across terminals of each preactuator

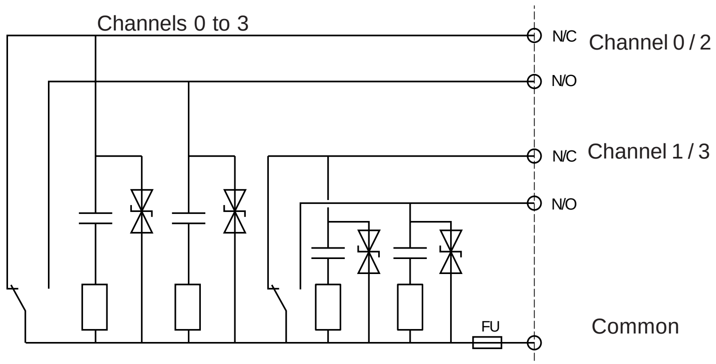
Note : When the supply voltage from the preactuators is from a 3-phase supply which is equal to or greater than 200 VAC, the preactuators must all be supplied from the same phase.

5.2-9 Relay modules 100 VA : TSX DSY 08R5A / 08R4D

Presentation

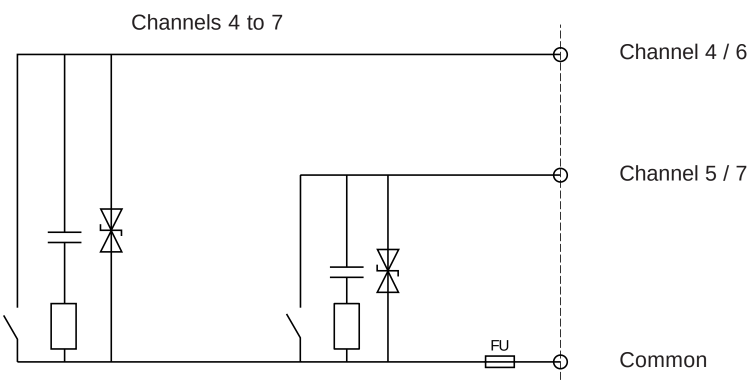
TSX DSY 08R5A and 08R4D modules each have 8 protected relay outputs. They are fitted with a 20-pin screw terminal block, which can be removed in order to connect the outputs.

Simplified C/O output schematic



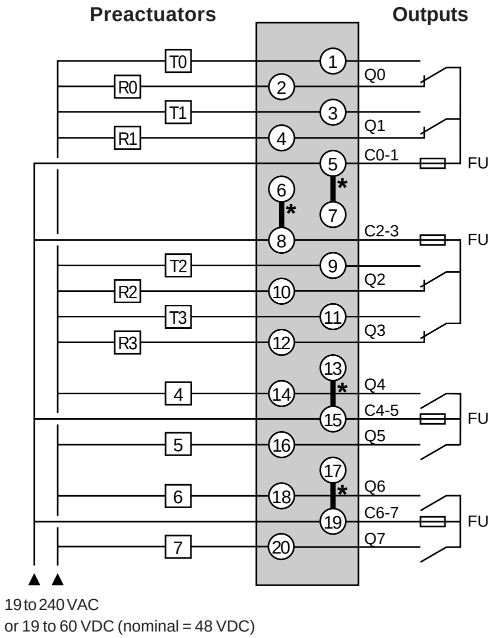
N/C : Normally closed - N/O : Normally open
FU = interchangeable 6.3 A fast blow fuse. 1 fuse per common

Simplified N/O output schematic



FU = 6.3 A - interchangeable fast blow fuse. 1 fuse per common.

TSX DSY 08R5A module connections

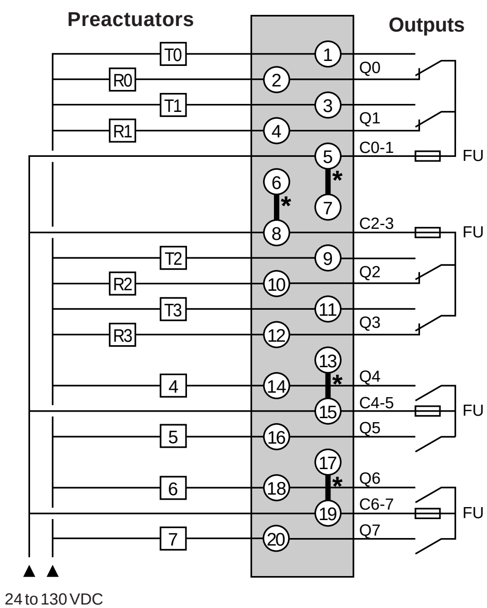


* = strap 24 V

must be connected when using 24 V AC or DC.

FU = 6.3 A fast blow fuse

TSX DSY 08R4D module connections



* = strap 24 V

must be connected when using 24 V AC or DC.

FU = 6.3 A fast blow fuse

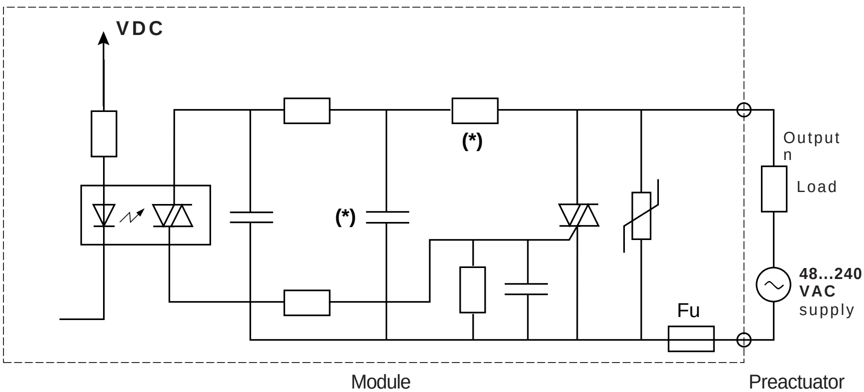
5.2-10 TSX DSY 08S5 / 16S5 / 16S4 modules

Presentation

Each module comprises :
- 8 triac outputs for the TSX DSY 08S5 module,
- 16 triac outputs for TSX DSY 16S4/16S5 modules,

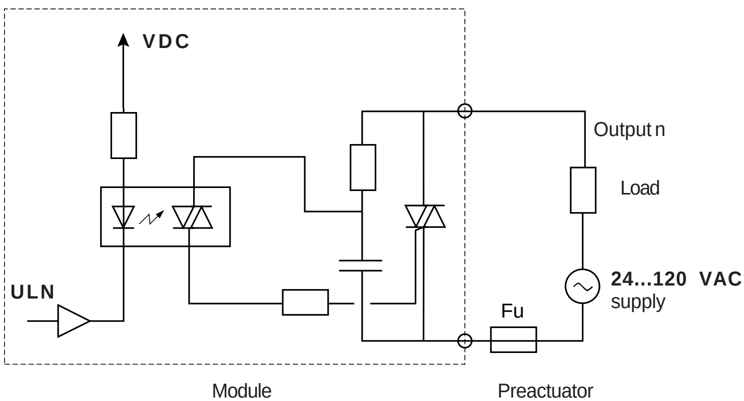
The modules must be fitted with a removable 20-pin screw terminal block.

Simplified output schematic for a TSX DSY 08S5/16S5 module



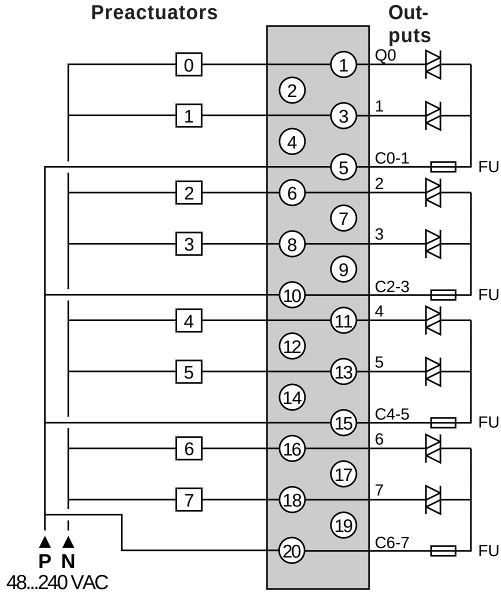
(*) RC not present on TSX DSY 16S5 module

Simplified output schematic for a TSX DSY 16S4 module



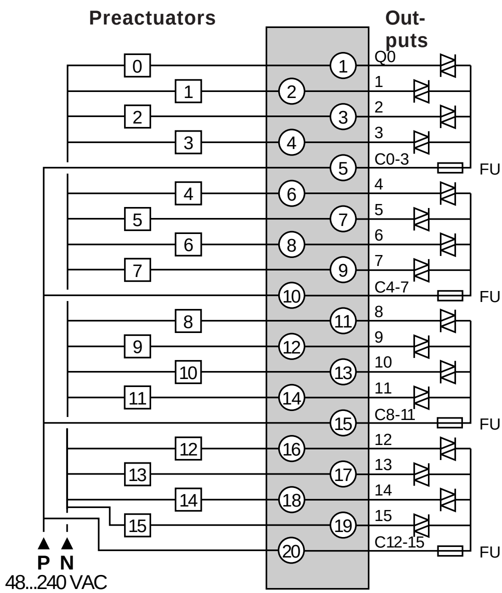
Note :
Protect the module outputs against short-circuits at the load, by means of a 5 A ultra fast blow and high breaking capacity fuse.

TSX DSY 08S5 module connections



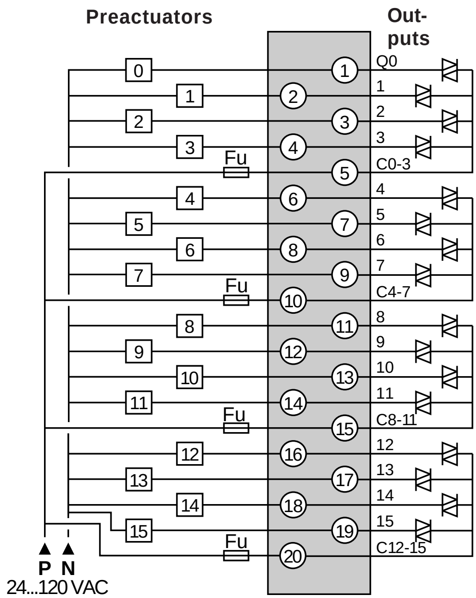
FU = interchangeable 5 A ultra fast blow fuse

TSX DSY 16S5 module connections



FU = interchangeable 5 A ultra fast blow fuse

TSX DSY 16S4 module connections



Note :
Protect the module outputs against short-circuits at the load, by means of a 5 A ultra fast blow and high breaking capacity fuse.

5.2-11 TSX DSY 32T2K / 64T2K modules

Presentation

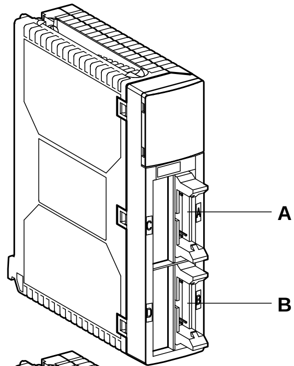
TSX DSY 32T2K and 64T2K modules have positive logic source type transistor outputs.

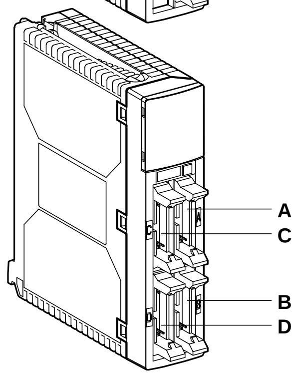
These modules are fitted with male HE10 connectors :

- 2 connectors A and B for TSX DSY 32T2K modules
  - connector A for outputs 0 to 15
  - connector B for outputs 16 to 31
- 4 connectors A, B, C and D for TSX DSY 64T2K modules
  - connector A for outputs 0 to 15
  - connector B for outputs 16 to 31
  - connector C for outputs 32 to 47
  - connector D for outputs 48 to 63

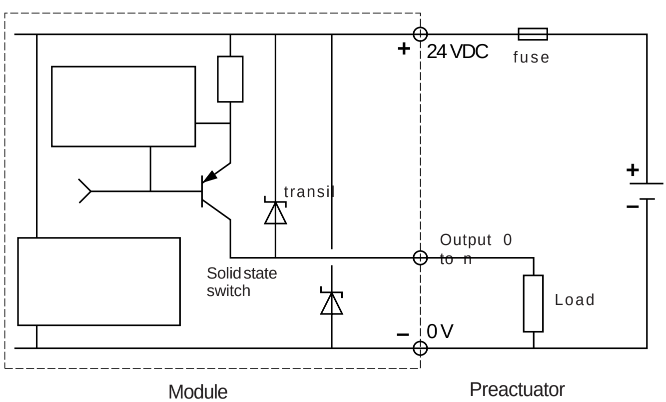
The connectors can accept :

- either a TSX CDP•01 preformed cable for direct connection to the preactuator terminal,
- or a TSX CDP••3 cable or TSX CDP•02 ribbon cable for connection to a TELEFAST 2 wiring interface.

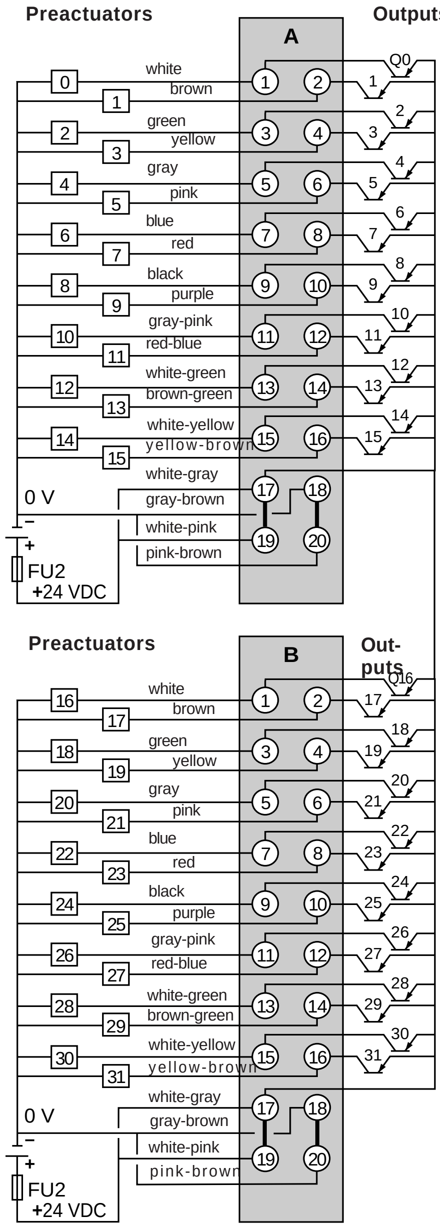




Simplified output schematic



TSX DSY 32T2K module connections



FU2 = 2 A fast blow fuse

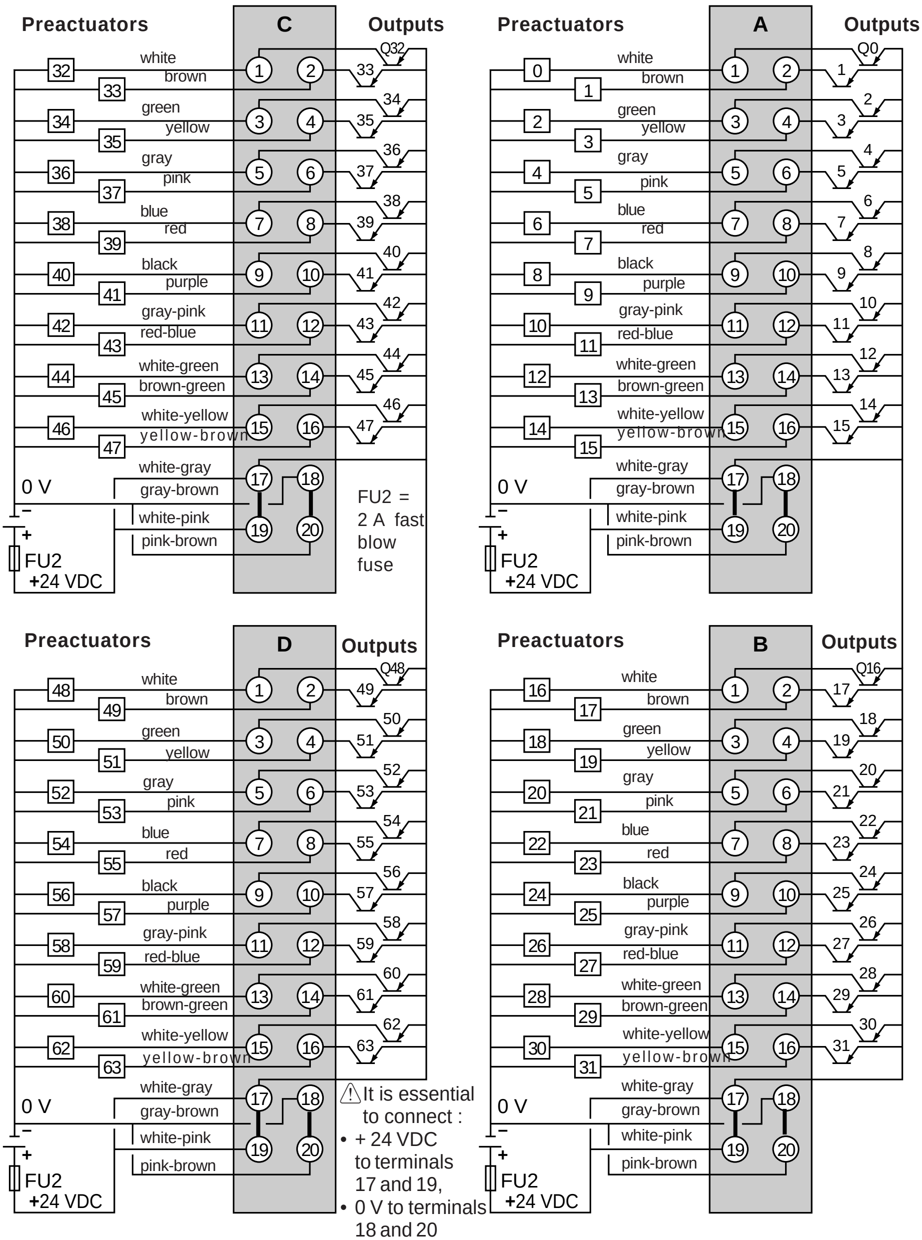
⚠ It is essential to connect :

- + 24 VDC to terminals 17 and 19,
- 0 V to terminals 18 and 20

FU2 = 2 A fast blow fuse

Note :
The colors show the correspondence between the HE10 connector pins and the flying leads of a TSX CDP•01 preformed cable.

TSX DSY 64T2K module connections



FU2 = 2 A fast blow fuse

FU2 = 2 A fast blow fuse

Note : The colors show the correspondence between the HE10 connector pins and the flying leads of a TSX CDP• preformed cable.

5.2-12 TSX DMY 28FK/DMY 28RFK modules

Presentation

This mixed I/O module comprises :

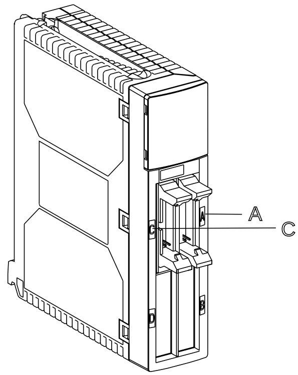
- 16 fast input channels, 24 VDC. They are type 1 inputs, proximity sensor compatible conforming to the characteristics in section 4.
- 12 output channels, 24 VDC / 0.5A

The module is fitted with two male HE10 connectors :

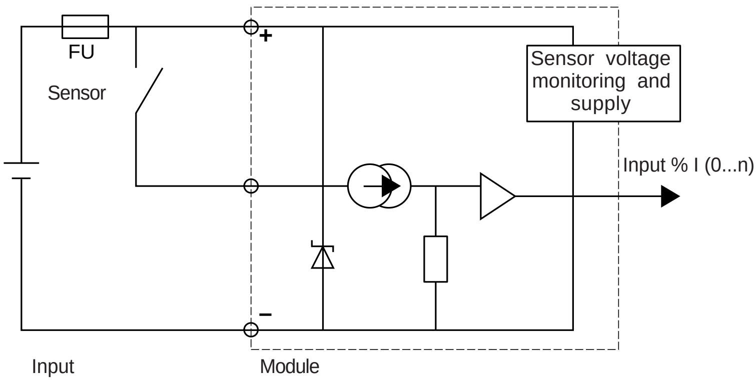
- connector A for inputs : addresses 0 to 15
- connector C for outputs : addresses 16 to 27

The connector can accept :

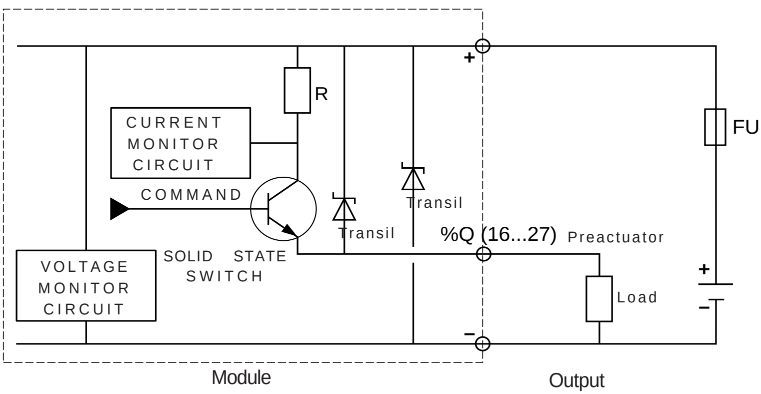
- either a TSX CDP•01 preformed cable for direct connection to the sensor terminal,
- or a TSX CDP•02 ribbon cable or a TSX CDP••3 cable for connection to a TELEFAST 2 interface.



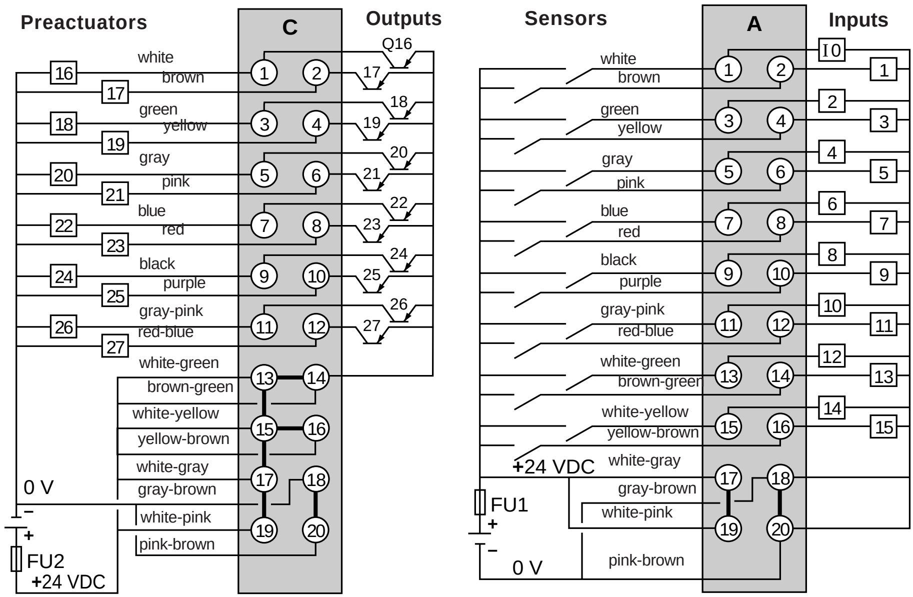
Simplified input schematic



Simplified output schematic



TSX DMY 28FK and TSX DMY 28RFK module connections



FU2 = 10 A fast
blow fuse

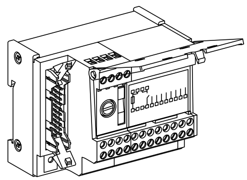
FU1 = 0.5 A
fast blow fuse

Note :
The colors show the correspondence between the HE10 connector pins and the flying leads of a TSX CDP•01 preformed cable.

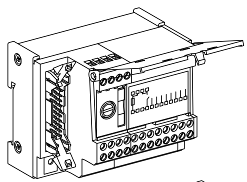
6.1 Presentation

The TELEFAST 2 system is a range of products for rapid connection of discrete I/O modules to the application. It replaces screw terminal blocks, and provides remote location of single-wire termination.
The TELEFAST 2 system can only be connected to modules equipped with HE10 connectors. It is composed of interface sub-bases and connecting cables. Several types of sub-base exist :

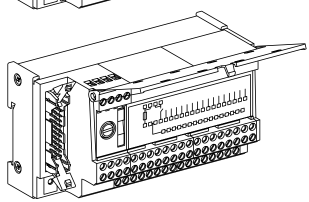
- **Connection interface sub-bases for discrete I/O, 8/12/16 channels :**
  - **8-channel sub-base :**
    ABE-7H08R10, ABE-7H08R11,
    ABE-7H08R21
    • with 1 isolator/channel
    ABE-7H08S21



  - **12 and 16-channel compact sub-bases :**
    ABE-7H12R50*,
    ABE-7H16R50.



  - **12 and 16-channel sub-bases :**
    ABE-7H12R10 (1), ABE-7H12R11 (1),
    ABE-7H12R20 (1), ABE-7H12R21 (1),
    ABE-7H16R10, ABE-7H16R11,
    ABE-7H16R20, ABE-7H16R21/23,
    ABE-7H16R30, ABE-7H16R31,
    • with 1 isolator/channel
    ABE-7H12S21 (1), ABE7-H16S21
    • with 1 fuse + 1 isolator/channel
    ABE-7H16S43 (for Inputs)
    ABE-7H16F43 (for Outputs)



Method of identifying the various discrete I/O connection sub-bases

ABE-7H ●● ● ● ●

Last character:
0 or even number = without LED per channel
odd number = with LED per channel

Third character:
1 = 1 screw terminal per channel on 1 row
2 = 2 screw terminals per channel on 2 rows
3 = 3 screw terminals per channel on 3 rows
4 = 2 screw terminals per channel on 1 row
5 = 1 screw terminal per channel on 2 rows (compact version)

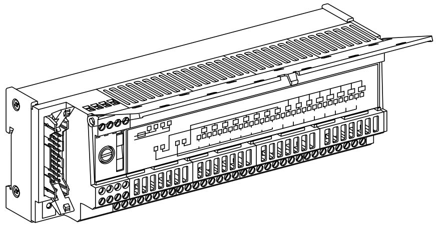
Second character:
Primary function :
R = Direct connection
S = Isolator/channel
F = Fuse/channel

First two characters:
08 = 8-channel sub-base
12 = 12-channel sub-base
16 = 16-channel sub-base

(1) none of the 12-channel sub-bases are compatible with TSX Premium discrete I/O modules.

- **Input connection interface and adaptor sub-bases, 16 isolated channels**

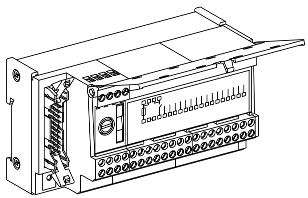
  - ABE-7S16E2B1: 16 inputs 24 VDC,
  - ABE-7S16E2E1: 16 inputs 48 VDC,
  - ABE-7S16E2E0: 16 inputs 48 VAC,
  - ABE-7S16E2F0: 16 inputs 110/120 VAC,
    : 16 inputs 220/240 VAC.



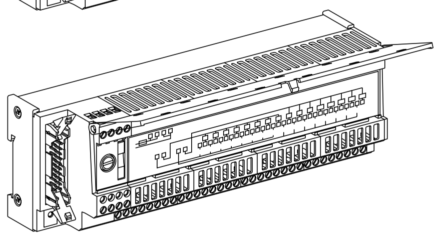
- **Solid state output connection interface and adaptor sub-bases, 8 and 16 channels :**

8 channel sub-bases

- ABE-7S08S2B0: 8 solid state outputs 24VDC/0.5 A, with fault detection feedback to the PLC.

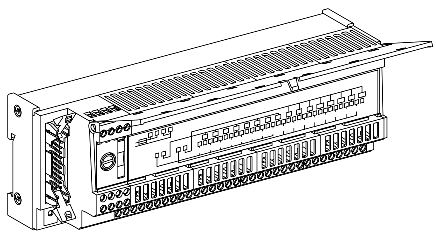


- ABE-7S08S2B1: 8 solid state outputs 24VDC/2A, with fault detection feedback to the PLC.



16 channel sub-base

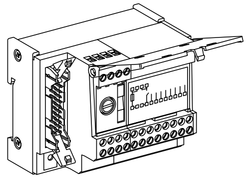
- ABE-7S16S2B0: 16 solid state outputs 24VDC/ 0.5A, with fault detection feedback to the PLC,
- ABE-7S16S2B2: 16 solid state outputs 24VDC/ 0.5A, without fault detection feedback to the PLC.



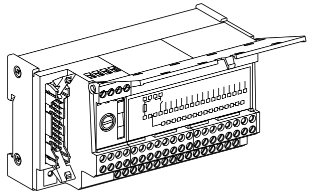
- **Relay output connection interface and adaptor sub-bases, 8 and 16 channels :**

8-channel sub-bases

- ABE-7R08S111 : 8 relay outputs, 1 "N/O" with distribution of "+ or ∼" poles.

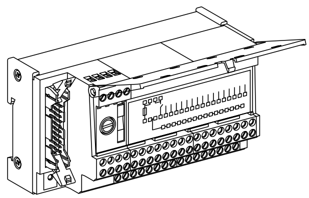


- ABE-7R08S210 : 8 relay outputs, 1 "N/O", volt-free contact.

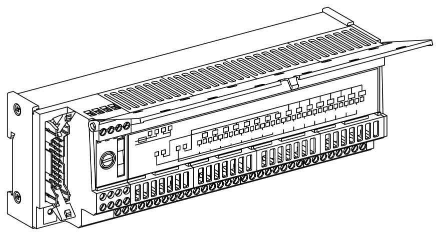


16-channel sub-base

- ABE-7R16S111 : 16 relay outputs, 1"N/O", 2x8 commons "+ or ∼".

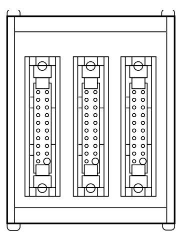


- ABE-7R16S210 : 16 relay outputs, 1 "N/O", volt-free contact,
- ABE-7R16S212 : 16 relay outputs, 1 "N/O" with distribution of both poles per group of 8 channels.



• 16 channels ➜ 2 x 8 channels adaptor sub-base

- ABE-7ACC02 : outputs can be split :
  - 16 channels in 2 blocks of 8,
  - 12 channels in 1 block of 8 + 1 block of 4.

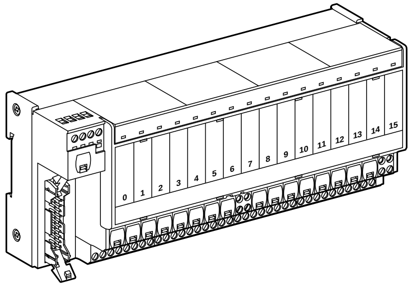


- **Input or output adaptor interface sub-bases, with or without removable electromechanical or solid state relays, 16 channels**

Output sub-bases

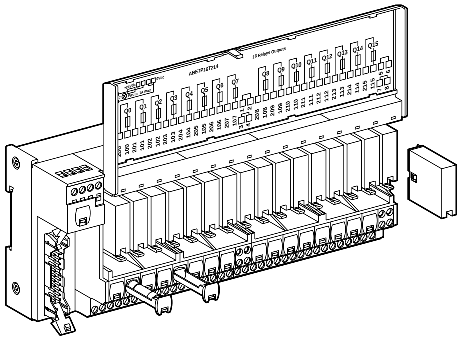
1"N/O", volt-free contact

- ABE-7R16T210 : with 10 mm wide electromechanical relay,
- ABE-7P16T210 : 10 mm wide relay, not supplied,
- ABE-7P16T214 : as above but with 1 fuse per channel.



1"N/O", with distribution of both poles per group of 8 channels

- ABE-7R16T212 : with 10 mm wide electromechanical relay,
- ABE-7P16T212 : 10 mm wide relay, not supplied,
- ABE-7P16T215 : as above but with 1 fuse per channel.

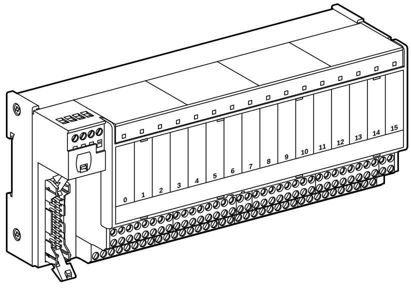


1"N/O", with distribution of both poles per group of 4 channels

- ABE-7P16T318 : without 12.5 mm wide electro-mechanical relay, 1 fuse + 1 isolator/channel

1"C/O", volt-free contact

- ABE-7R16T230 : with 10 mm wide electromechanical relay,
- ABE-7R16T330 : with 12.5 mm wide electromechanical relay,
- ABE-7P16T330 : 12.5 mm wide relay, not supplied,
- ABE-7P16T334 : as above but with 1 fuse per channel.

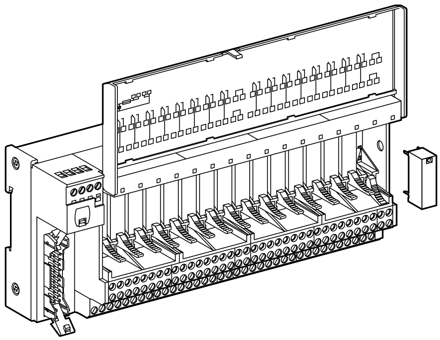


1"C/O", common per group of 8 channels

- ABE-7R16T231 : with 10 mm wide electromechanical relay.

1"C/O", with distribution of both poles per group of 8 channels

- ABE-7R16T332 : with 12.5 mm wide electromechanical relay,
- ABE-7P16T332 : 12.5 mm wide relay, not supplied.



2 "C/O", volt-free contact

- ABE-7R16T370 : with 12.5 mm wide electromechanical relay.

- **Input sub-bases for 12.5 mm wide solid state relay**
  - ABE-7P16F310 : volt-free,
  - ABE-7P16F312 : distribution of both poles per group of 8 channels.

6.2 TSX Micro I/O module and sub-base compatibility

Discrete I/O modules TSX	**DMZ 28DTK**		**DMZ64DTK**		**DEZ 12D2K**	**DSZ 08T2K**
Modularity	1x16I	1x12Q	2x16I	2x16Q	1x12I	1X8Q
Connection sub-bases						
8 channels						
ABE-7H08R••	(1)		(1)	(1)		
ABE-7H08S21	(1)		(1)	(1)		
12 channels						
ABE-7H12R••						
ABE-7H12S21						
16 channels						
ABE-7H16R••						
ABE-7H16S21						
ABE-7H16R23						
ABE-7H16F43						
ABE-7H16S43						
Input adaptor sub-bases						
16 channels						
ABE-7S16S2••						
ABE-7P16F3••						
Output adaptor sub-bases						
8 channels						
ABE-7S08S2••				(1)		(2)
ABE-7R08S•••				(1)		
16 channels						
ABE-7R16S•••		(3)				
ABE-7R16T•••		(3)				
ABE-7P16T•••		(3)				

(1) with adaptator 16 ➜ 2x8 channels ABE-7ACC02
(2) except ABE-7S08S2B0
(3) caution : the 4 unused outputs are at state 1

Combination possible

B1

6.3 TSX Premium I/O module and sub-base compatibility

<table>
<tr><th>Discrete I/O modules TSX</th><th>DEY 16FK</th><th colspan="2">DEY : 32D2K 64D2K</th><th>DEY 32D3K</th><th colspan="2">DMY 28FK/28RFK</th><th colspan="2">DSY : 32T2K 64T2K</th></tr>
<tr><td>Modularity</td><td>1x16I</td><td>2x16I</td><td>4x16I</td><td>2x16I</td><td>1x16I</td><td>1x12Q</td><td>2x16Q</td><td>4x16Q</td></tr>
<tr><td colspan="9">Connection sub-bases</td></tr>
<tr><td colspan="9">8 channels</td></tr>
<tr><td>ABE-7H08R●●</td><td style="background:#d3d3d3">(1)</td><td style="background:#d3d3d3">(1)</td><td style="background:#d3d3d3">(1)</td><td></td><td style="background:#d3d3d3">(1)</td><td></td><td style="background:#d3d3d3">(1)</td><td style="background:#d3d3d3">(1)</td></tr>
<tr><td>ABE-7H08S21</td><td style="background:#d3d3d3">(1)</td><td style="background:#d3d3d3">(1)</td><td style="background:#d3d3d3">(1)</td><td></td><td style="background:#d3d3d3">(1)</td><td></td><td style="background:#d3d3d3">(1)</td><td style="background:#d3d3d3">(1)</td></tr>
<tr><td colspan="9">12 channels</td></tr>
<tr><td>ABE-7H12R●●</td><td></td><td></td><td></td><td></td><td></td><td style="background:#d3d3d3"></td><td></td><td></td></tr>
<tr><td>ABE-7H12S21</td><td></td><td></td><td></td><td></td><td></td><td style="background:#d3d3d3"></td><td></td><td></td></tr>
<tr><td colspan="9">16 channels</td></tr>
<tr><td>ABE-7H16R●●</td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3">(2)</td><td style="background:#d3d3d3"></td><td></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td></tr>
<tr><td>ABE-7H16S21</td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td></td><td style="background:#d3d3d3"></td><td></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td></tr>
<tr><td>ABE-7H16R23</td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td></td><td style="background:#d3d3d3"></td><td></td><td></td><td></td></tr>
<tr><td>ABE-7H16F43</td><td></td><td></td><td></td><td></td><td></td><td></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td></tr>
<tr><td>ABE-7H16S43</td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td></td><td style="background:#d3d3d3"></td><td></td><td></td><td></td></tr>
<tr><td colspan="9">Input adaptor sub-bases</td></tr>
<tr><td colspan="9">16 channels</td></tr>
<tr><td>ABE-7S16E2●●</td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td></td><td style="background:#d3d3d3"></td><td></td><td></td><td></td></tr>
<tr><td>ABE-7P16F3●●</td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td><td></td><td style="background:#d3d3d3"></td><td></td><td></td><td></td></tr>
<tr><td colspan="9">Output adaptor sub-bases</td></tr>
<tr><td colspan="9">8 channels</td></tr>
<tr><td>ABE-7S08S2●●</td><td></td><td></td><td></td><td></td><td></td><td></td><td style="background:#d3d3d3">(1)</td><td style="background:#d3d3d3">(1)</td></tr>
<tr><td>ABE-7R08S●●●</td><td></td><td></td><td></td><td></td><td></td><td></td><td style="background:#d3d3d3">(1)</td><td style="background:#d3d3d3">(1)</td></tr>
<tr><td colspan="9">16 channels</td></tr>
<tr><td>ABE-7R16S●●●</td><td></td><td></td><td></td><td></td><td></td><td></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td></tr>
<tr><td>ABE-7R16T●●●</td><td></td><td></td><td></td><td></td><td></td><td></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td></tr>
<tr><td>ABE-7P16T●●●</td><td></td><td></td><td></td><td></td><td></td><td></td><td style="background:#d3d3d3"></td><td style="background:#d3d3d3"></td></tr>
</table>

(1) with adaptator 16 ➜ 2x8 channels ABE-7ACC02
(2) only with sub-base ABE-7H16R20

<table><tr><td style="background:#d3d3d3">   </td><td>Combination possible</td></tr></table>

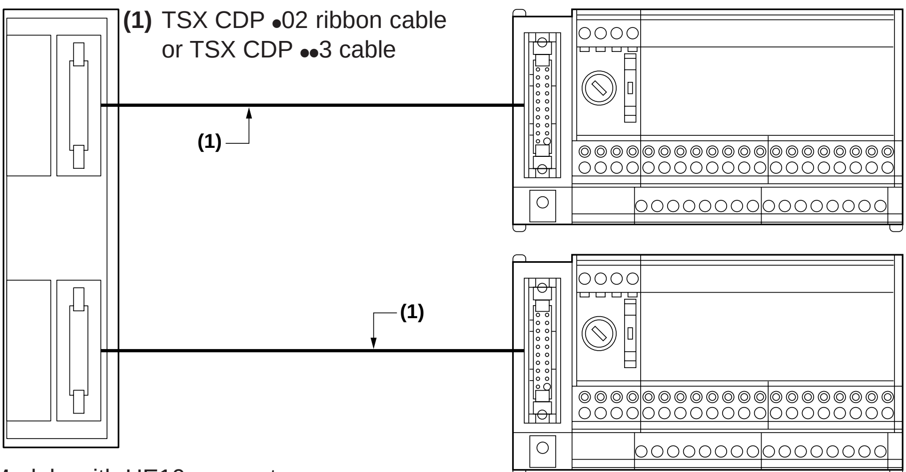
6.4 Module ➜ interface sub-base connection principle

The connection between an HE 10 connector located on a discrete I/O module and a connection sub-base is made using a sheathed rolled ribbon cable (TSX CDP •02) or a connection cable (TSX CDP ••3) equipped with 20-pin HE10 connectors at each end.

- Sheathed rolled ribbon cables, 28 gauge : 0.08 mm^2 (see description section 5.1-2). Given the small cross section of the wires, it is recommended that they be used for the connection of low current I/O (< 100 mA per channel).
  There are three product references :
  - TSX CDP 102 : 1 meter long,
  - TSX CDP 202 : 2 meters long,
  - TSX CDP 302 : 3 meters long.

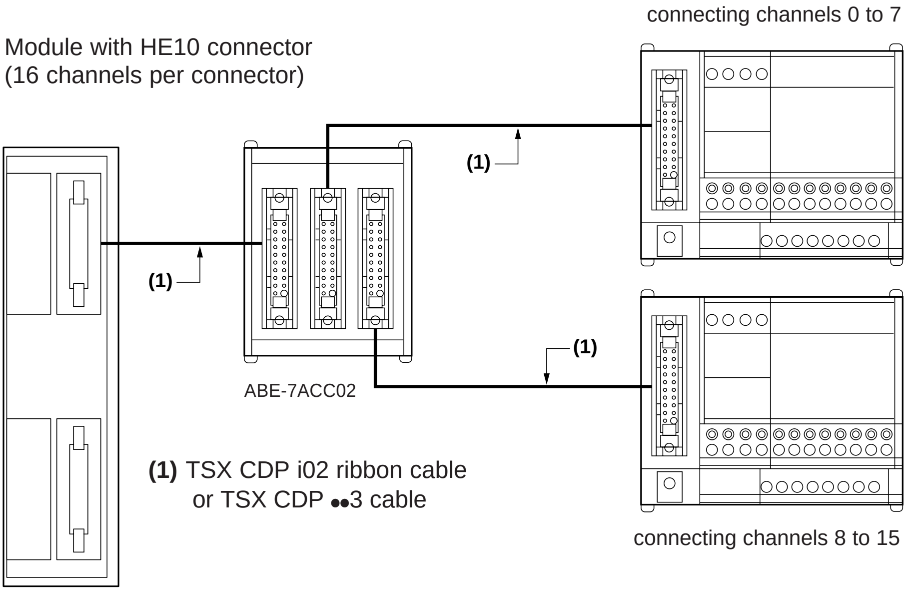
- Connection cables, 22 gauge : 0.34 mm^2 (see description section 5.1-2)
  Used to connect any I/O with a current of > 500 mA per channel.
  There are five product references :

- TSX CDP 053 : 0.5 meters long,
- TSX CDP 103 : 1 meter long,
- TSX CDP 203 : 2 meters long,
- TSX CDP 303 : 3 meters long,
- TSX CDP 503 : 5 meters long,



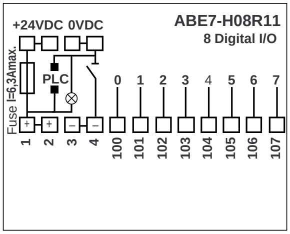
Module with HE10 connector
(16 channels per connector)

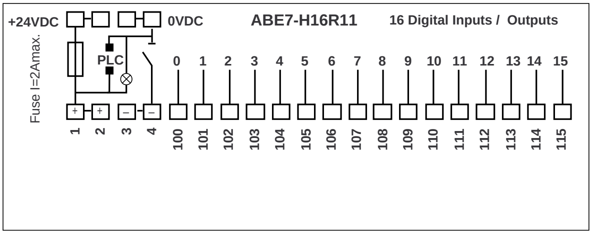
Connection of 16 channels (2 x 8) using an ABE-7ACC02 adaptor sub-base.
Example 1 : Connection of 16 channels (2 x 8)

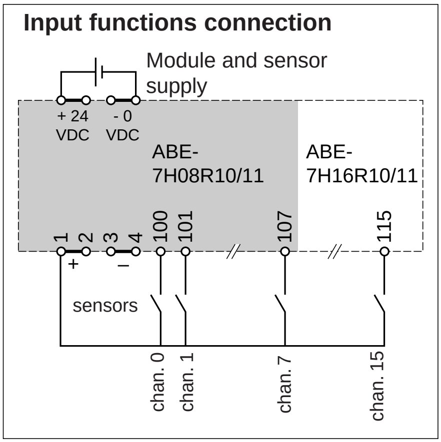


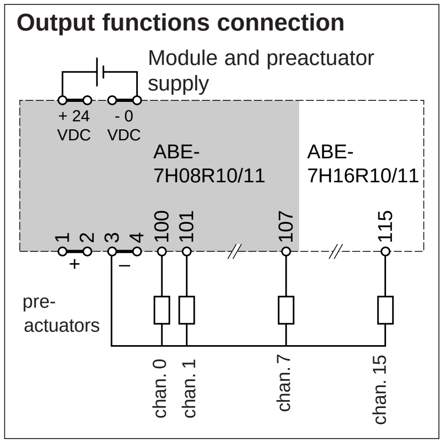
6.5 Sensor or preactuator connection to sub-bases

6.5-1 ABE-7H08R10, ABE-7H08R11, ABE-7H16R10, ABE-7H16R11 sub-bases









Connection of sensor common :

- on terminals 1 or 2 : sensors connected to supply "+" (positive logic inputs),

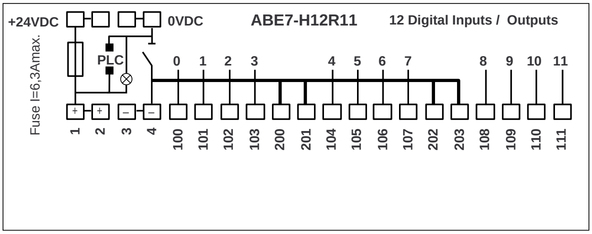
Connection of preactuator common :

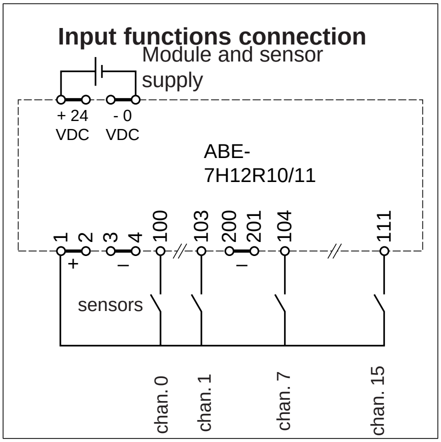
- on terminals 3 or 4 : preactuators connected to supply "–" (positive logic outputs).

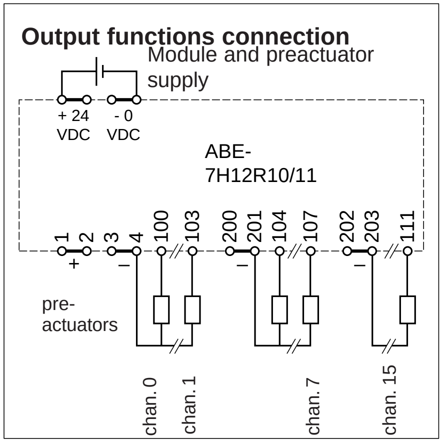
⚠ Sub-bases are supplied with a general purpose 2 A fast blow fuse. In order to ensure optimum protection, this fuse should be rated according to the application (connection to input or output functions) and the maximum permissible current in the sub-base. Type and rating of fuse to be used :

- input functions : 0.5 A fast blow fuse,
- for output functions :
  - 2 A fast blow fuse on ABE-7H16R●● sub-base
  - 6.3 A fast blow fuse on ABE-7H08R●● sub-base

6.5-2 ABE-7H12R10, ABE-7H12R11 sub-bases







Connection of sensor common :

- on terminals 1 or 2 : sensors connected to the supply "+" (positive logic inputs).

⚠ Terminals 200/201/202 and 203 are connected to the "–" pole.

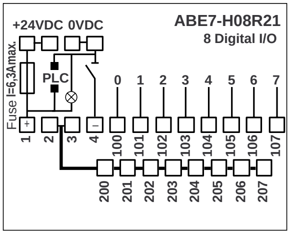
Connection of preactuator common :

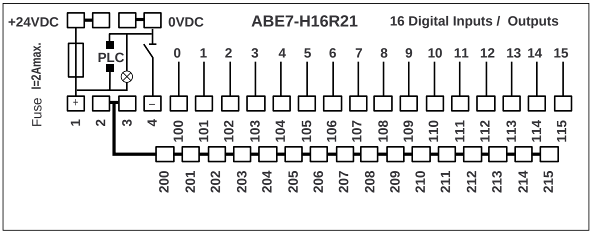
The use of a number of terminals connected to the "–" pole (3, 4, 200, 201, 202 and 203) creates commons for each group of 4 or 2 channels (positive logic outputs)

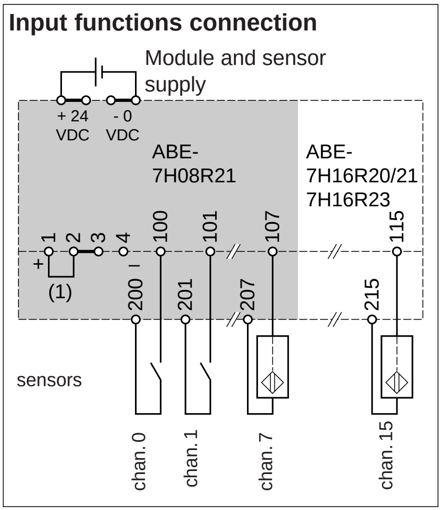
⚠ Sub-bases are supplied with a general purpose 6.3 A fast blow fuse. In order to ensure optimum protection, this fuse should be rated according to the application (connection to input or output functions) and the maximum permissible current in the sub-base. Type and rating of fuse to be used :

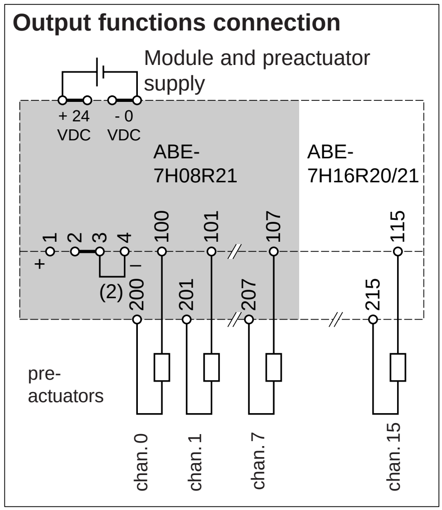
- input functions : 0.5 A fast blow fuse,
- for output functions :
  - 6.3 A fast blow fuse on ABE-7H12R●● sub-base

6.5-3 ABE-7H08R21, ABE-7H16R20, ABE-7H16R21, ABE-7H16R23 sub-bases for type 2 inputs









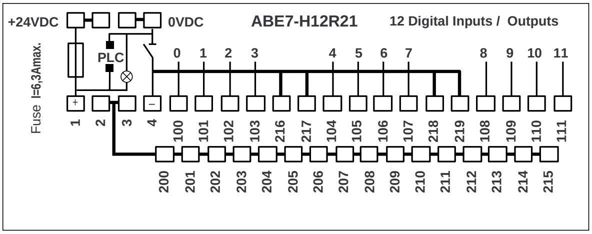
Connection of sensor common :
In order to create the sensor supply common, place the jumper (1) across terminals 1 & 2 : terminals 200 to 215 should be connected to the supply "+" (positive logic input).

Connection of preactuator common :
In order to create the preactuator supply common, place the jumper (2) across terminals 3 & 4 : terminals 200 to 215 should be connected to the supply "+" (positive logic outputs).

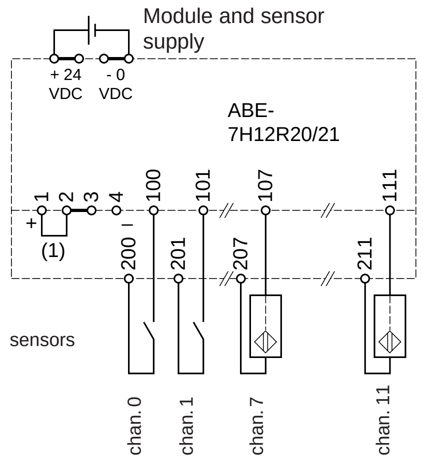
⚠ Sub-bases are supplied with a general purpose 2 A fast blow fuse. In order to ensure optimum protection, this fuse should be rated according to the application (connection to input or output functions) and the maximum permissible current in the sub-base. Type and rating of fuse to be used :

- input functions : 0.5 A fast blow fuse,
- for output functions :
  - 2 A fast blow fuse on ABE-7H16R●● sub-base
  - 6.3 A fast blow fuse on ABE-7H08R●● sub-base

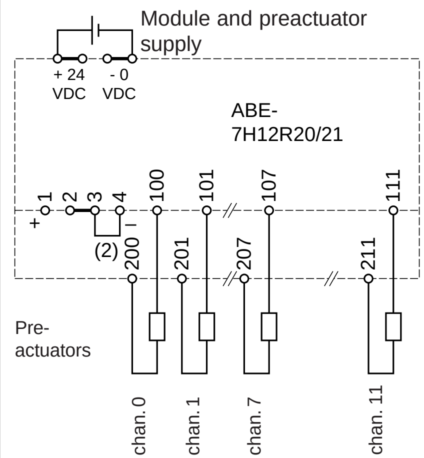
6.5-4 ABE-7H12R20, ABE-H12R21 sub-bases



Input functions connection



Output functions connection



Connection of sensor common :
In order to create the sensor supply common, place the jumper (1) across terminals 1 & 2 : terminals 200 to 215 should be connected to the supply "+" (positive logic input).

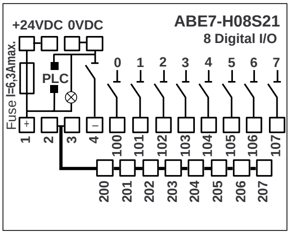
⚠ Terminals 216, 217, 218 and 219 are connected to the "–"pole.

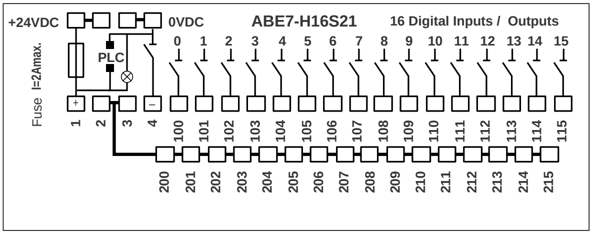
Connection of preactuator common :
In order to create the preactuator supply common, place the jumper (2) across terminals 3 & 4 : terminals 200 to 215 should be connected to the supply "–" (positive logic outputs).

⚠ Terminals 216, 217, 218 and 219 are connected to the "–"pole.

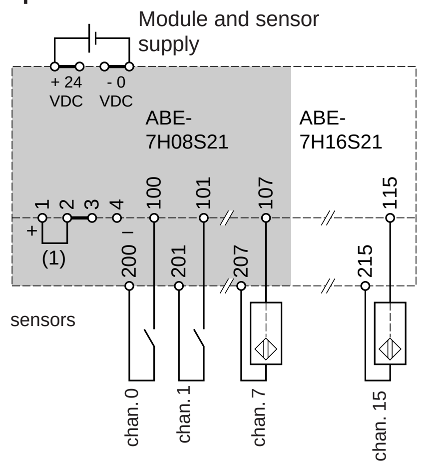
⚠ The sub-base is supplied with a general purpose 6.3 A fast blow fuse. In order to ensure optimum protection, this fuse should be rated according to the application (connection to input or output functions) and the maximum permissible current in the sub-base. Type and rating of fuse to be used :
- input functions : 0.5 A fast blow fuse,
- output functions :
  - 6.3 A fast blow fuse on ABE-7H12R●● sub-base

6.5-5 ABE-7H08S21, ABE-7H16S21 sub-bases with 1 isolator per channel

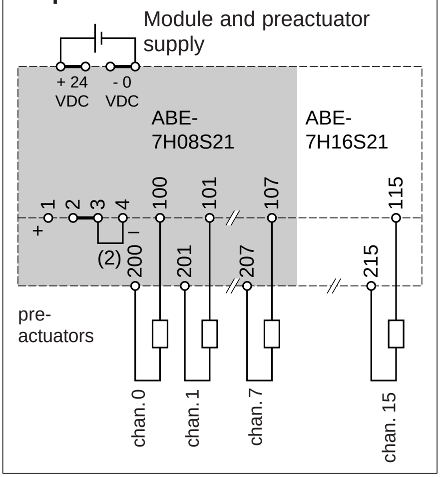




Input functions connection



Output functions connection



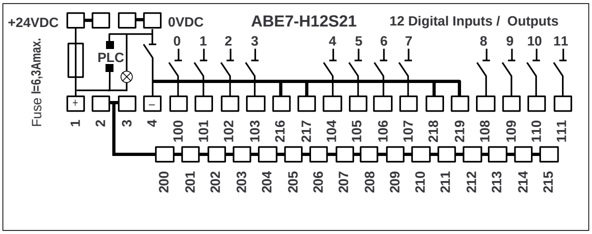
Connection of sensor common :
In order to create the sensor supply common, place the jumper (1) across terminals 1 & 2 : terminals 200 to 215 should be connected to the supply "+" (positive logic input).

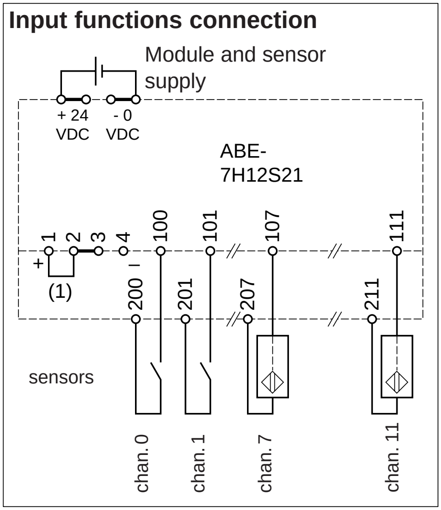
Connection of preactuator common :
In order to create the preactuator supply common, place the jumper (2) across terminals 3 & 4 : terminals 200 to 215 should be connected to the supply "–" (positive logic outputs).

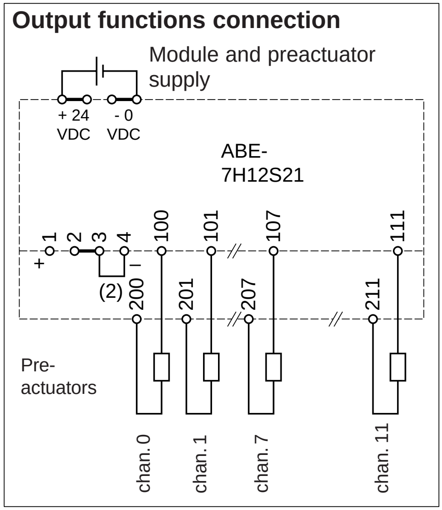
⚠ Sub-bases are supplied with a general purpose 2A fast blow fuse. In order to ensure optimum protection, this fuse should be rated according to the application (connection to input or output functions) and the maximum permissible current in the sub-base. Type and rating of fuse to be used :

- input functions : 0.5 A fast blow fuse,
- output functions :
  - 2 A fast blow fuse on ABE-7H16S21 sub-base
  - 6.3 A fast blow fuse on ABE-7H08S21 sub-base

6.5-6 ABE-7H12S21 sub-base with 1 isolator per channel







Connection of sensor common :
In order to create the sensor supply common, place the jumper (1) across terminals 1 & 2 : terminals 200 to 215 should be connected to the supply "+" (positive logic input).

⚠ Terminals 216, 217, 218 and 219 are connected to the "–"pole.

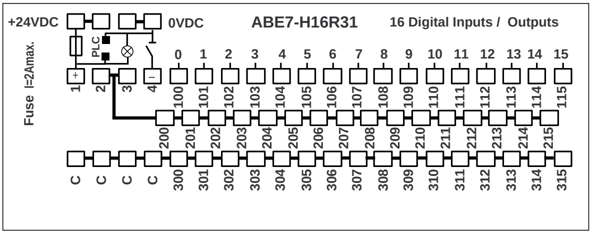
Connection of preactuator common :
In order to create the preactuator supply common, place the jumper (2) across terminals 3 & 4 : terminals 200 to 215 should be connected to the supply "–" (positive logic outputs).

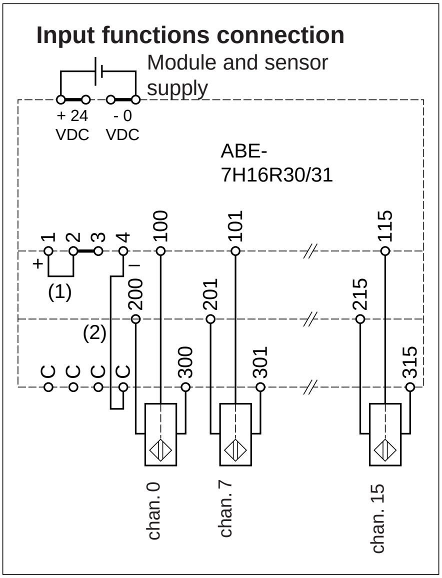
⚠ Terminals 216, 217, 218 and 219 are connected to the "–"pole.

⚠ The sub-base is supplied with a general purpose 6.3 A fast blow fuse. In order to ensure optimum protection, this fuse should be rated according to the application (connection to input or output functions) and the maximum permissible current in the sub-base. Type and rating of fuse to be used :

- input functions : 0.5 A fast blow fuse,
- output functions :
  - 6.3 A fast blow fuse on ABE-7H12S21 sub-base

6.5-7 ABE-7H16R30, ABE-7H16R31 sub-bases

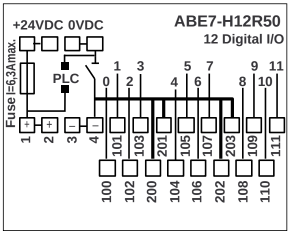




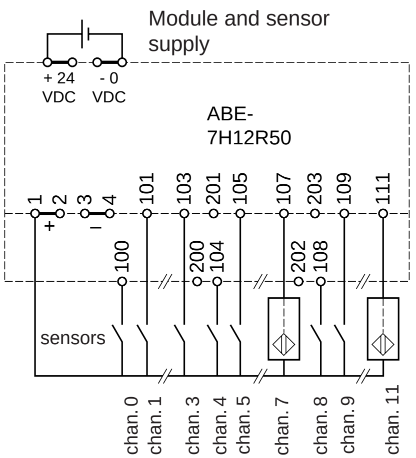
Connection of sensor common :
In order to create the sensor supply common :
- place the jumper (1) across terminals 1 & 2 : terminals 200 to 215 should be connected to the supply "+",
- connect terminal 4 to one of the "C" terminals on the third row (2) : terminals 300 to 315 should be connected to the supply **"–".**

Sub-bases are supplied with a general purpose 2 A fast blow fuse. In order to ensure optimum protection, this fuse should be rated according to the application (connection to input or output functions) and the maximum permissible current in the sub-base. Type and rating of fuse to be used :
- input functions : 0.5 A fast blow fuse.

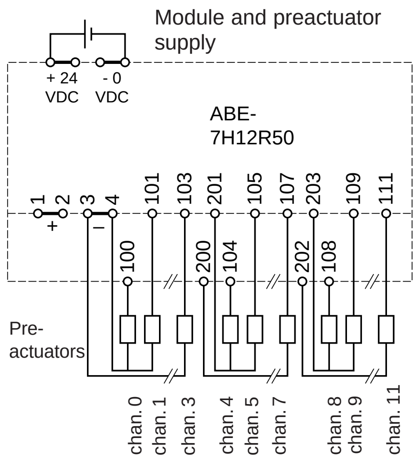
6.5-8 ABE-7H12R50 sub-base



Input functions connection



Output functions connection



Connection of sensor common :
• on terminals 1 or 2 : sensors connected to the supply "+" (positive logic input).

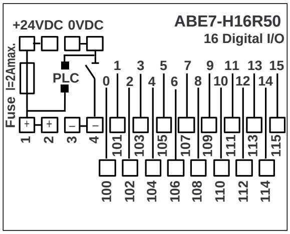
⚠ Terminals 200/201/202 and 203 are connected to the "–" pole.

Connection of preactuator common :
The use of a number of terminals connected to the "–" pole (3, 4, 200, 201, 202 and 203) creates commons for each group of 4 or 2 channels (positive logic outputs).

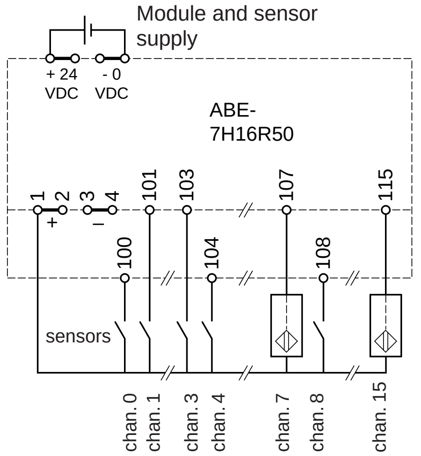
⚠ The sub-base is supplied with a general purpose 6.3 A fast blow fuse. In order to ensure optimum protection, this fuse should be rated according to the application (connection to input or output functions) and the maximum permissible current in the sub-base. Type and rating of fuse to be used :

• input functions : 0.5 A fast blow fuse,
• output functions :
  - 6.3 A fast blow fuse on ABE-7H12R50 sub-base

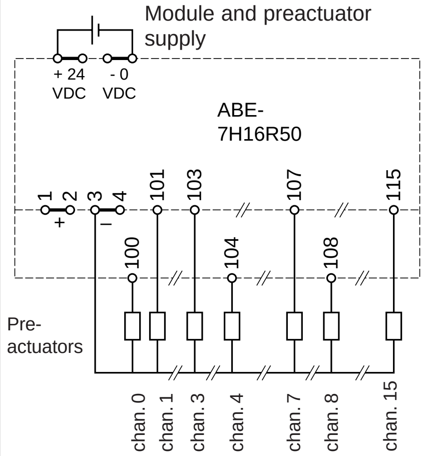
6.5-9 ABE-7H116R50 sub-base



Input functions connection



Output functions connnection



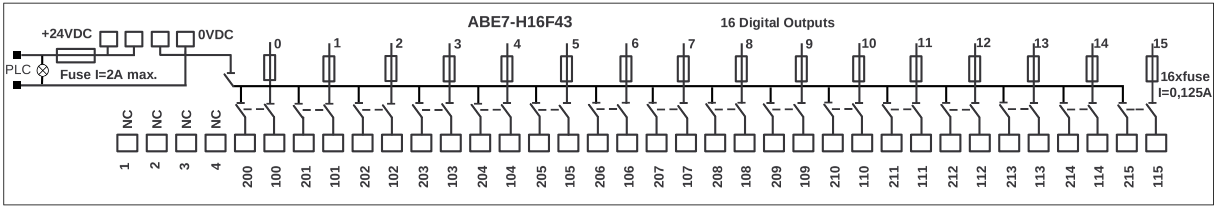
Connection of sensor common :
• on terminals 1 or 2 : sensors connected to the supply "+" (positive logic input).

Connection of preactuator common :
• on terminals 3 or 4 : preactuators connected to supply "–" (positive logic output).

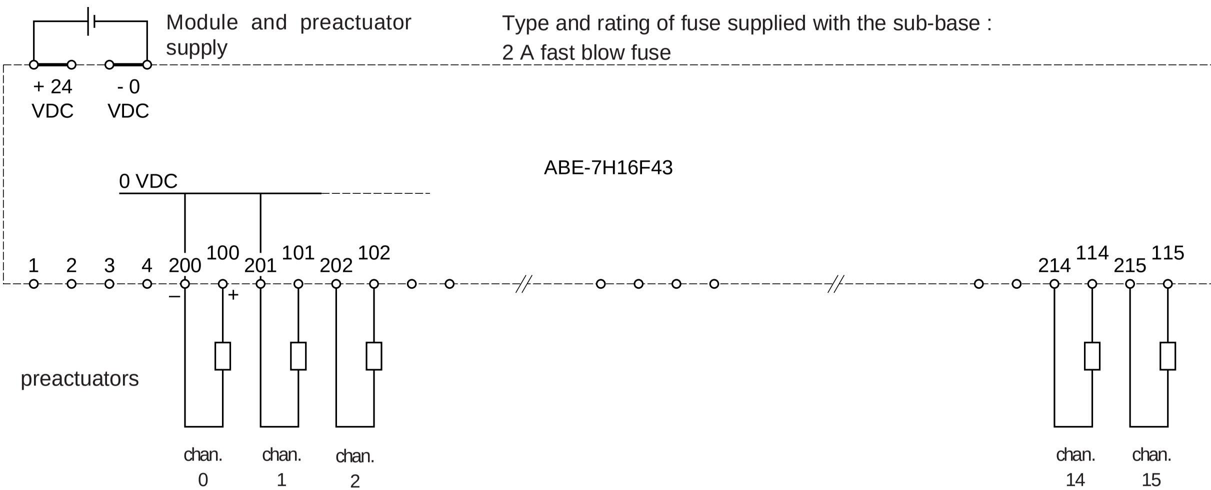
The sub-base is supplied with a general purpose 6.3 A fast blow fuse. In order to ensure optimum protection, this fuse should be rated according to the application (connection to input or output functions) and the maximum permissible current in the sub-base. Type and rating of fuse to be used :

- input functions : 0.5 A fast blow fuse,
- output functions :
  - 2 A fast blow fuse on ABE-7H12R50 sub-base

6.5-10 ABE-7H16F43 output sub-base with 1 fuse and 1 isolator per channel



Output function connection

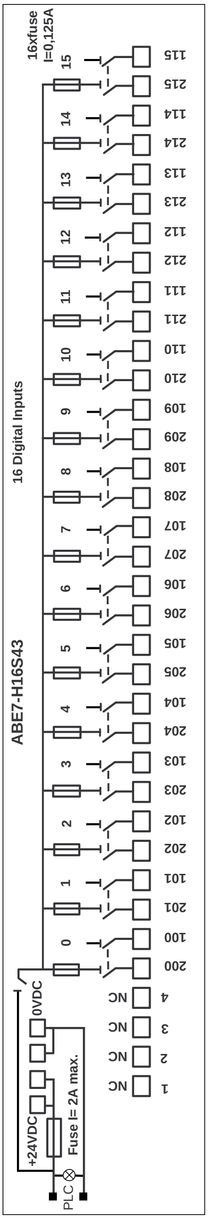


Type and rating of fuse supplied with the sub-base :
2 A fast blow fuse

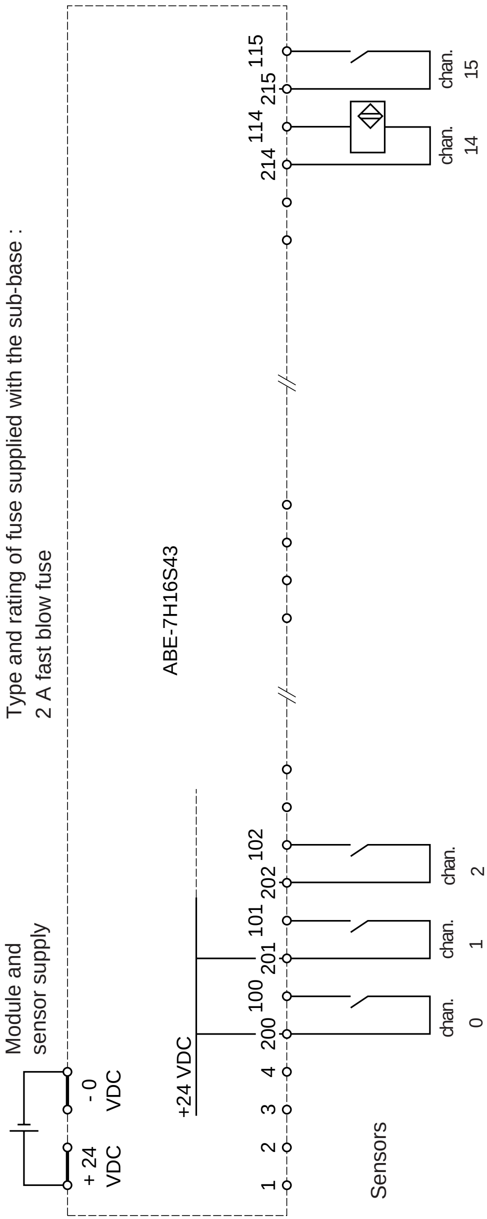
Each channel has :
- a 0.125 A fuse fitted as standard
- an isolator which breaks the "–" and the channel signal simultaneously

⚠ Terminals 200, 201, 202, ..., 214, 215 are connected to the supply "–"

6.5-11 ABE-7H16S43 input sub-base with 1 fuse and 1 isolator per channel



Input function connection



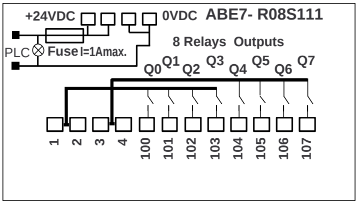
Terminals 200, 201, 202, ..., 214, 215 are connected to the supply "+"

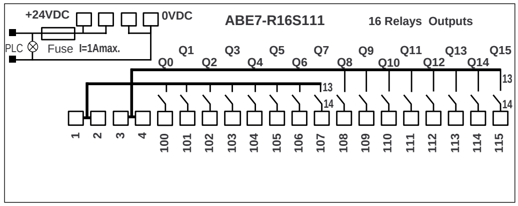
Each channel has :

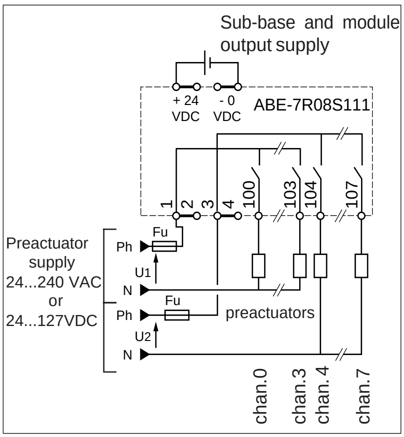
- a 0.125 A fuse fitted as standard
- an isolator which breaks the "+" and the channel signal simultaneously

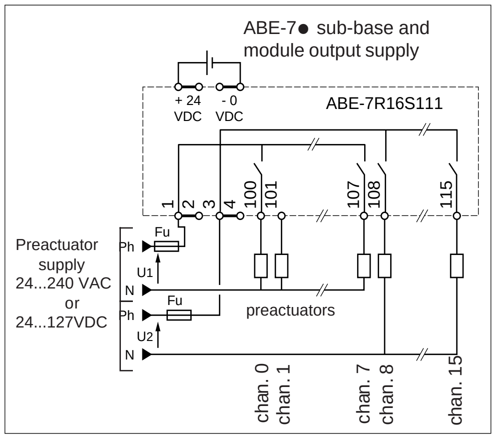
6.5-12 Fixed relay output adaptor sub-bases : ABE-7R08S111, ABE-7R16S111, ABE-7R16S210, ABE-7R16S212

- **ABE-7R08S111 sub-bases :** 8 relay outputs, 1"N/O" 2 x 4 commons "+ or ∿"
  ABE-7R16S111 : 16 relay outputs, 1"N/O" 2 x 8 commons "+ or ∿"









Type and rating of fuse supplied with the sub-base :
1 A fast blow fuse.

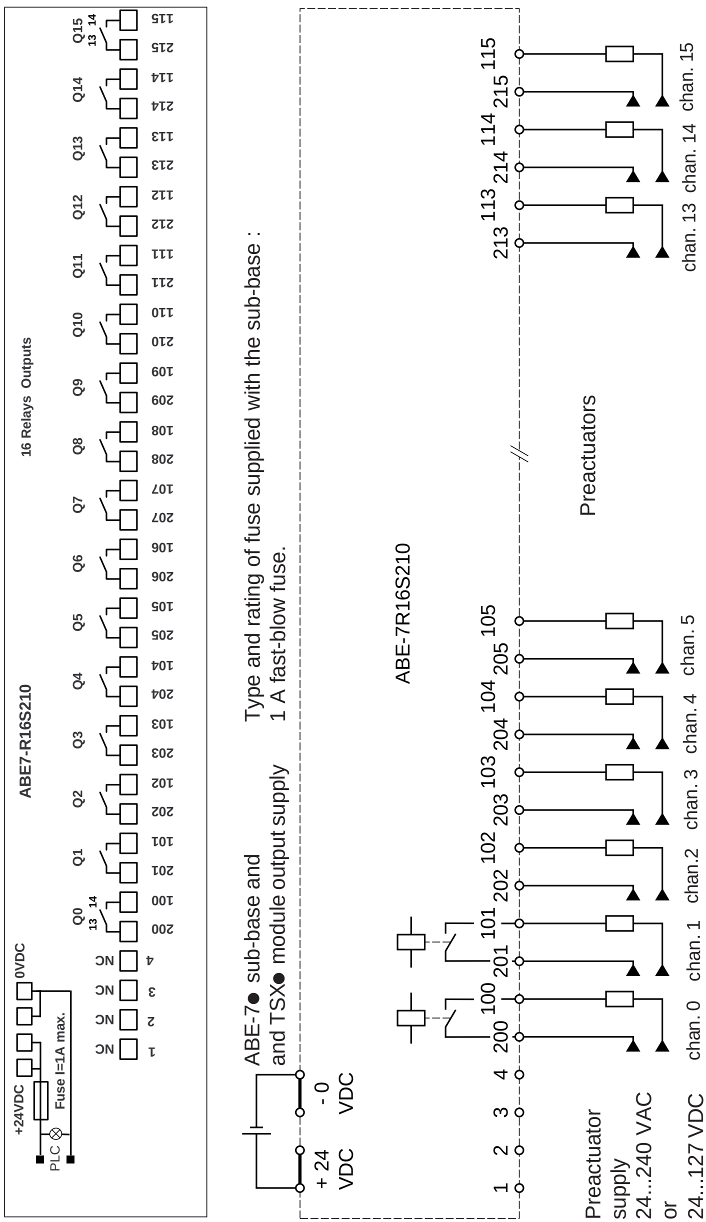
Fu : fuse to be rated according to the load

⚠ **Protection of relay contacts :**

Protection circuit must be placed across the preactuator terminals :

- RC or MOV circuit for AC,
- discharge diode for DC

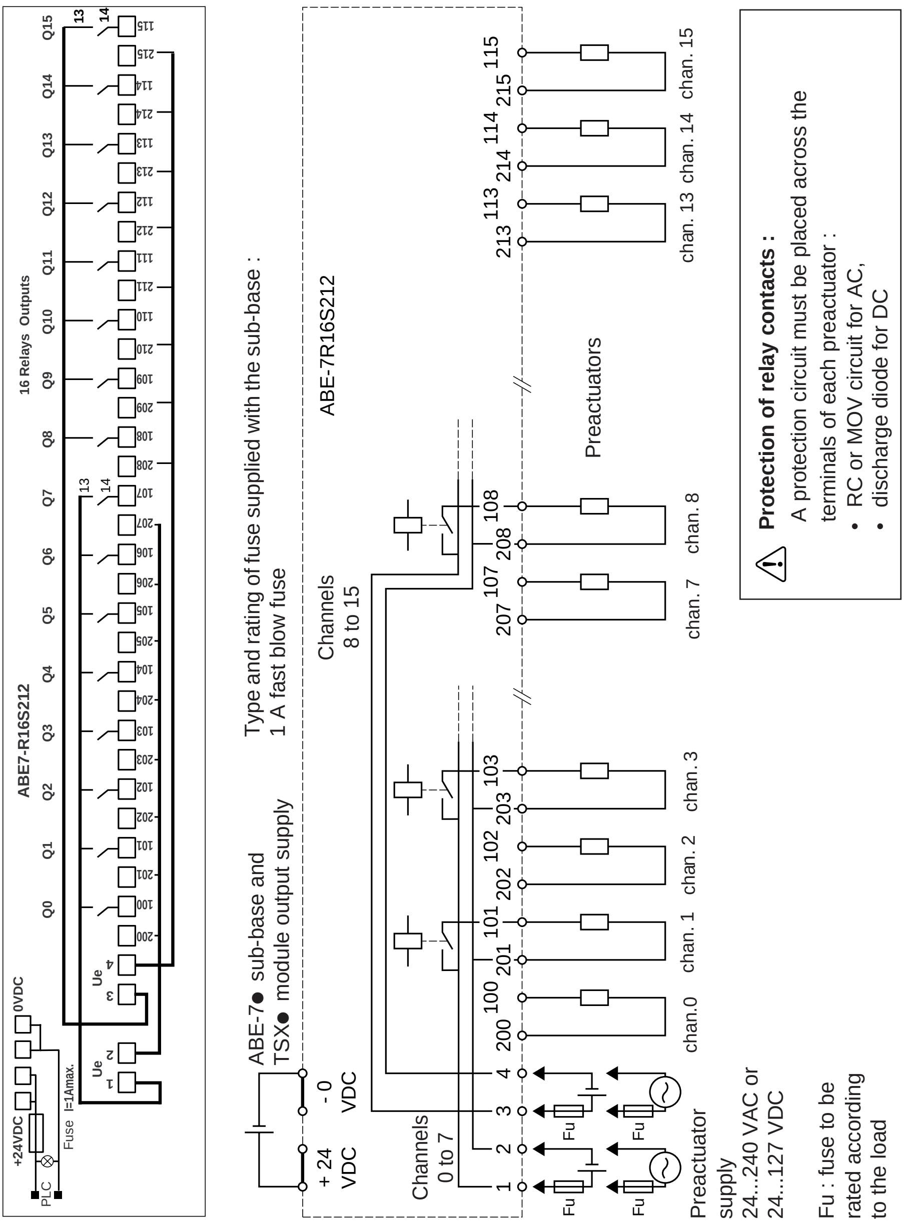
- **ABE-7R16S210 sub-base :** 16 relay outputs, 1 "N/O", volt-free contacts



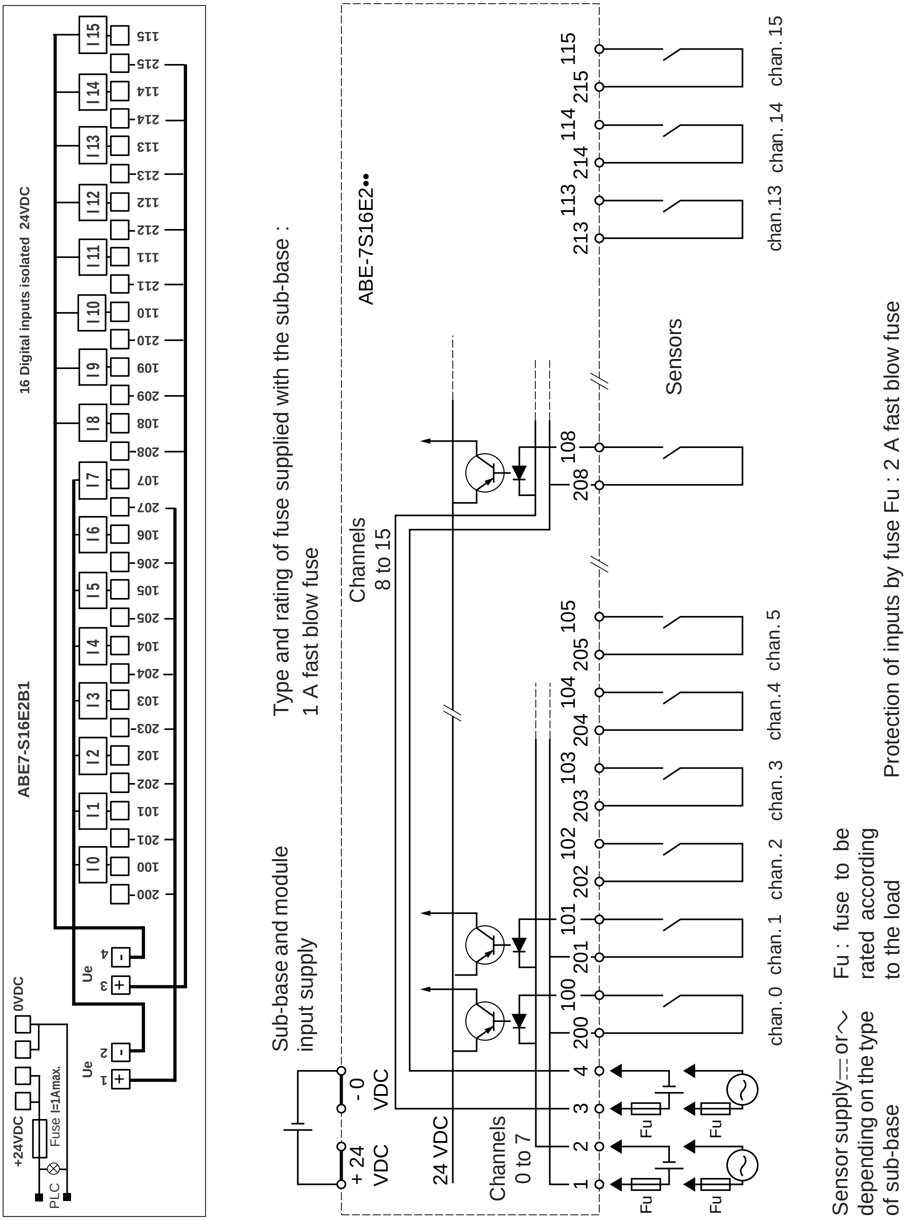
Protection of relay contacts :
A protection circuit must be placed across the terminals of each preactuator :
- RC or MOV circuit for AC,
- discharge diode for DC

Provide one protection fuse per preactuator or per group if they are supplied with the same voltage.

- **ABE-7R16S212 sub-base :** 16 relay outputs, 1 "N/O", with distribution of both poles per group of 8 channels

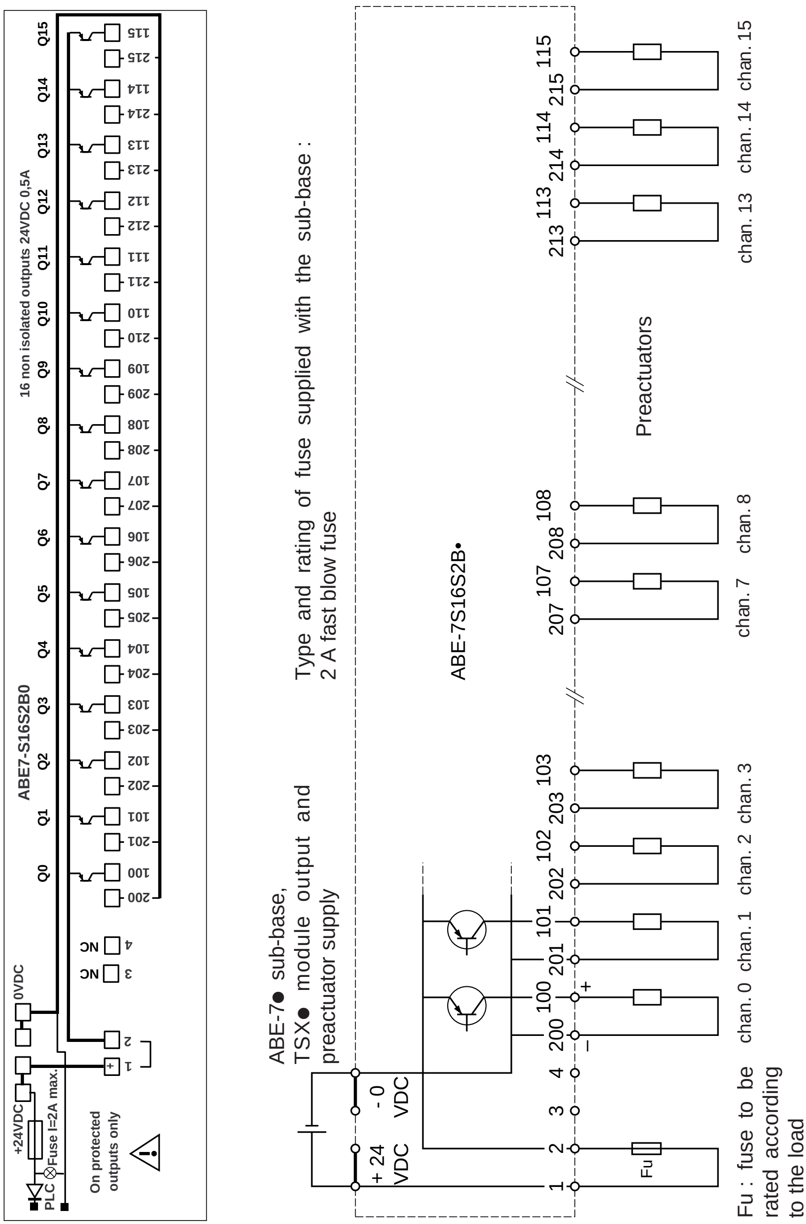


6.5-13 Fixed solid state relay input adaptor sub-bases : ABE-7S16E2B1, ABE-7S16E2E1, ABE-7S16E2E0, ABE-7S16E2F0, ABE-7S16E2M0

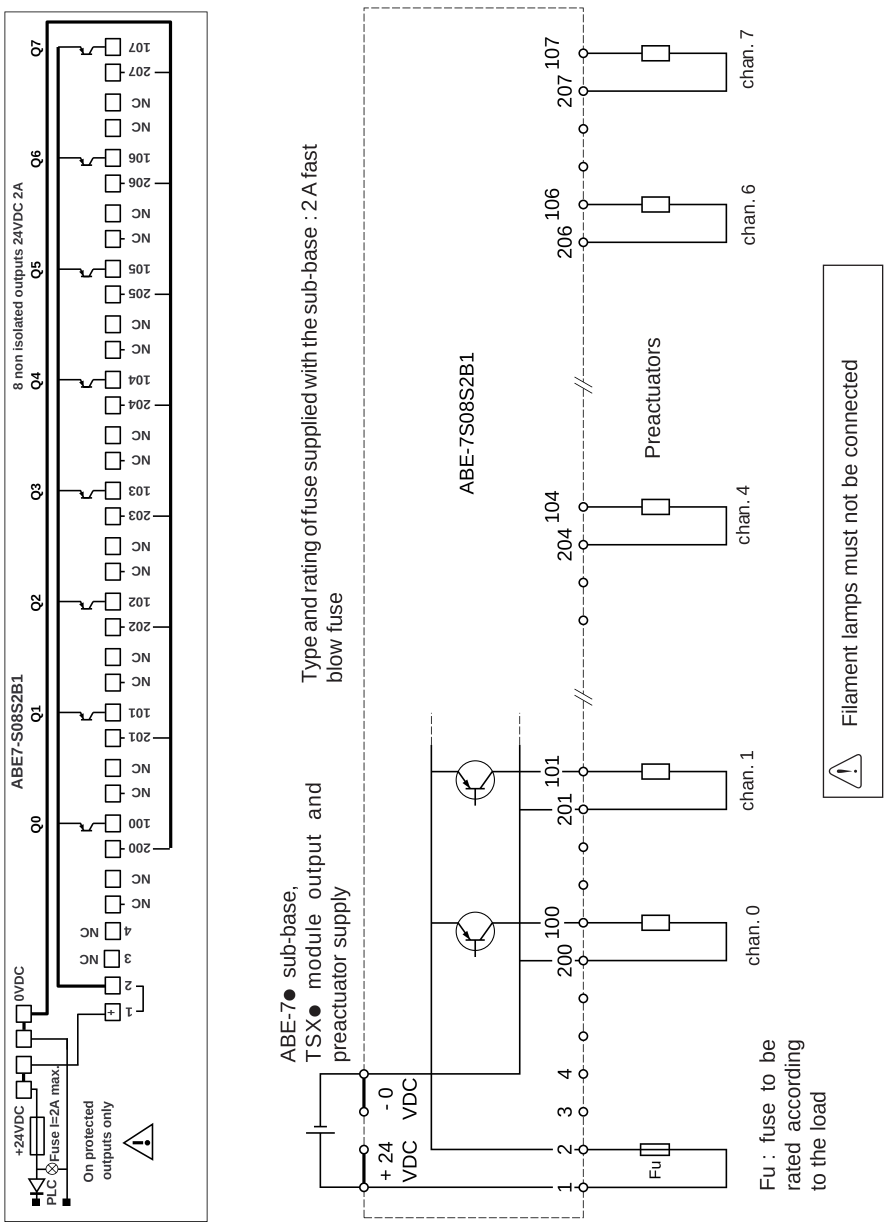


6.5-14 Solid state output adaptor sub-bases : ABE-7S16S2B0, ABE-7S16S2B2 and ABE-7S08S2B0, ABE-7S08S2B1

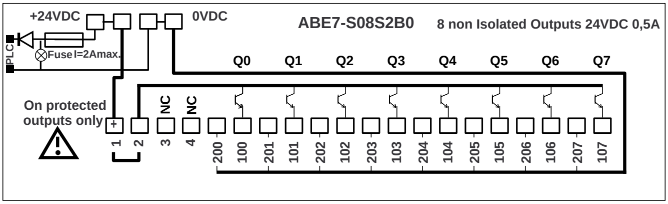
- **ABE-7S16S2B0 and ABE-7S16S2B2 sub-bases :** 16 solid state outputs/ 24VDC / 0.5A

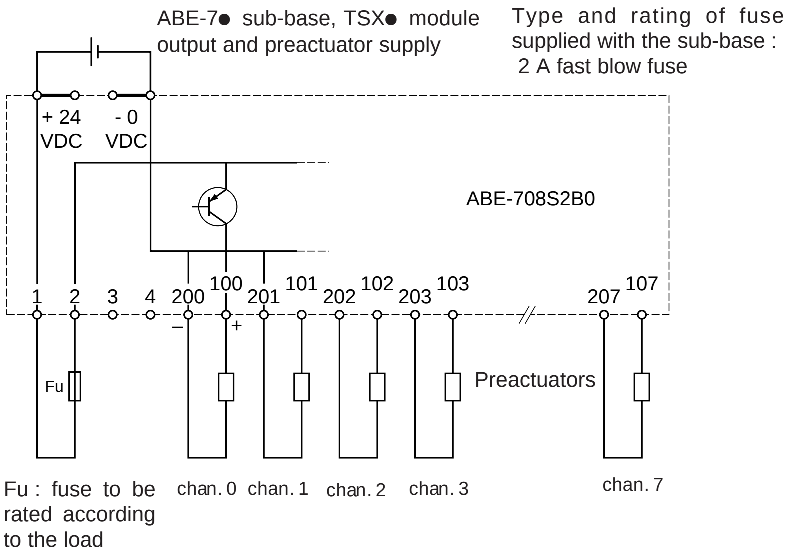


- **ABE-7S08S2B1 sub-base :** 8 solid state outputs / 24 VDC / 2A



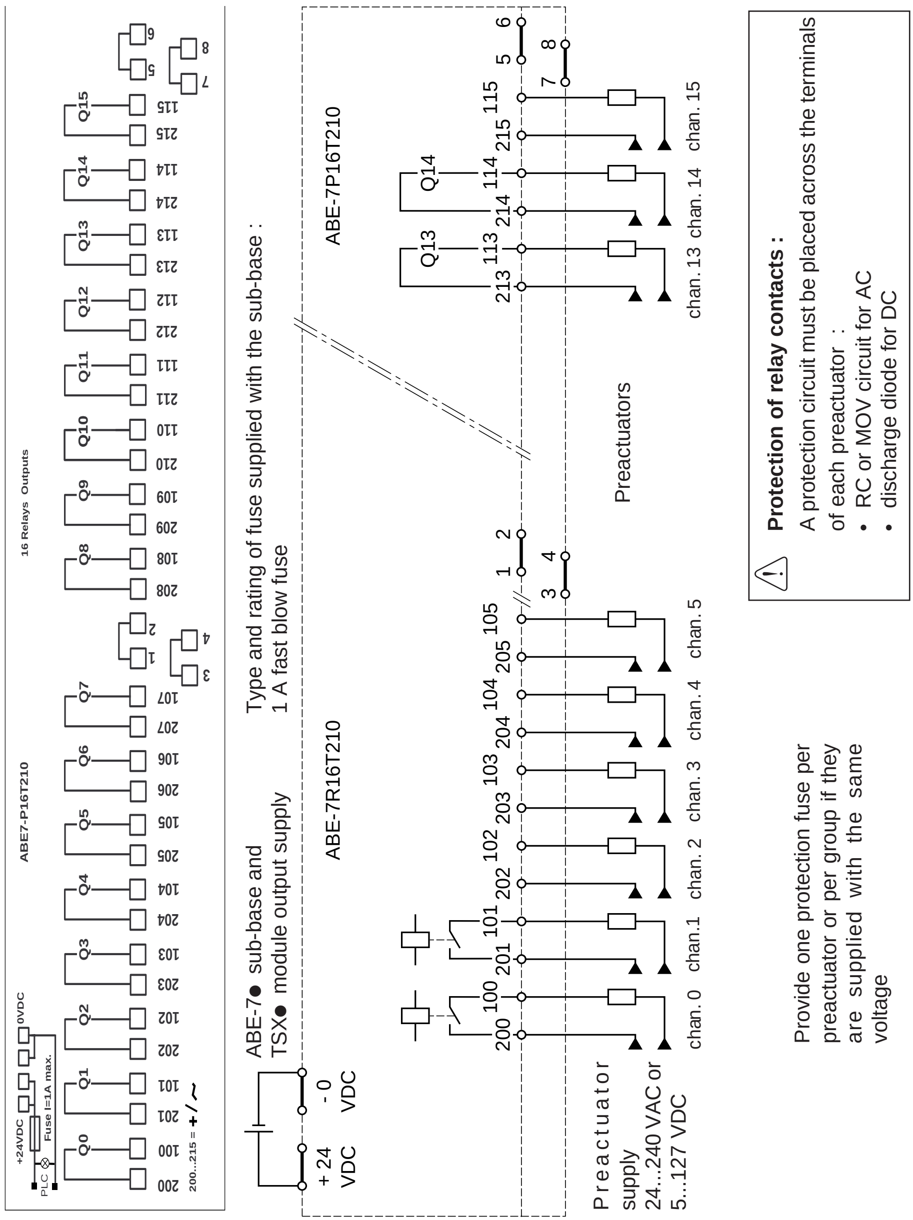
- **ABE-7S08S2B0 sub-base :** 8 solid state outputs / 24 VDC / 0.5A



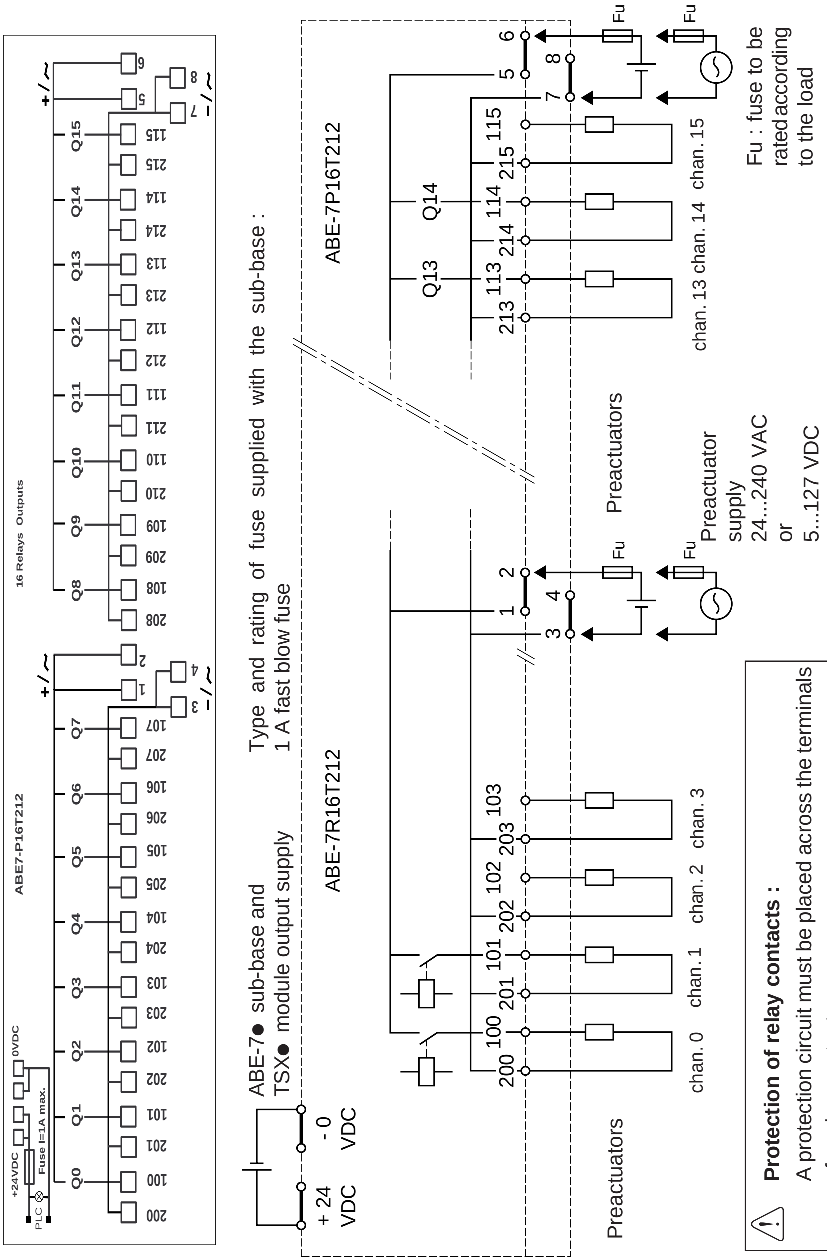


6.5-15 Solid state or electromechanical relay output sub-bases, relay 10mm wide

- **1"N/O" sub-bases, volt-free contact**
  - **- ABE-7R16T210** with electromechanical relays
  - **- ABE-7P16T210** relay not supplied



- **1"N/O" sub-bases, with distribution of both poles per group of 8 channels**
  - **ABE-7R16T212** with electromechanical relays
  - **ABE-7P16T212** relay not supplied

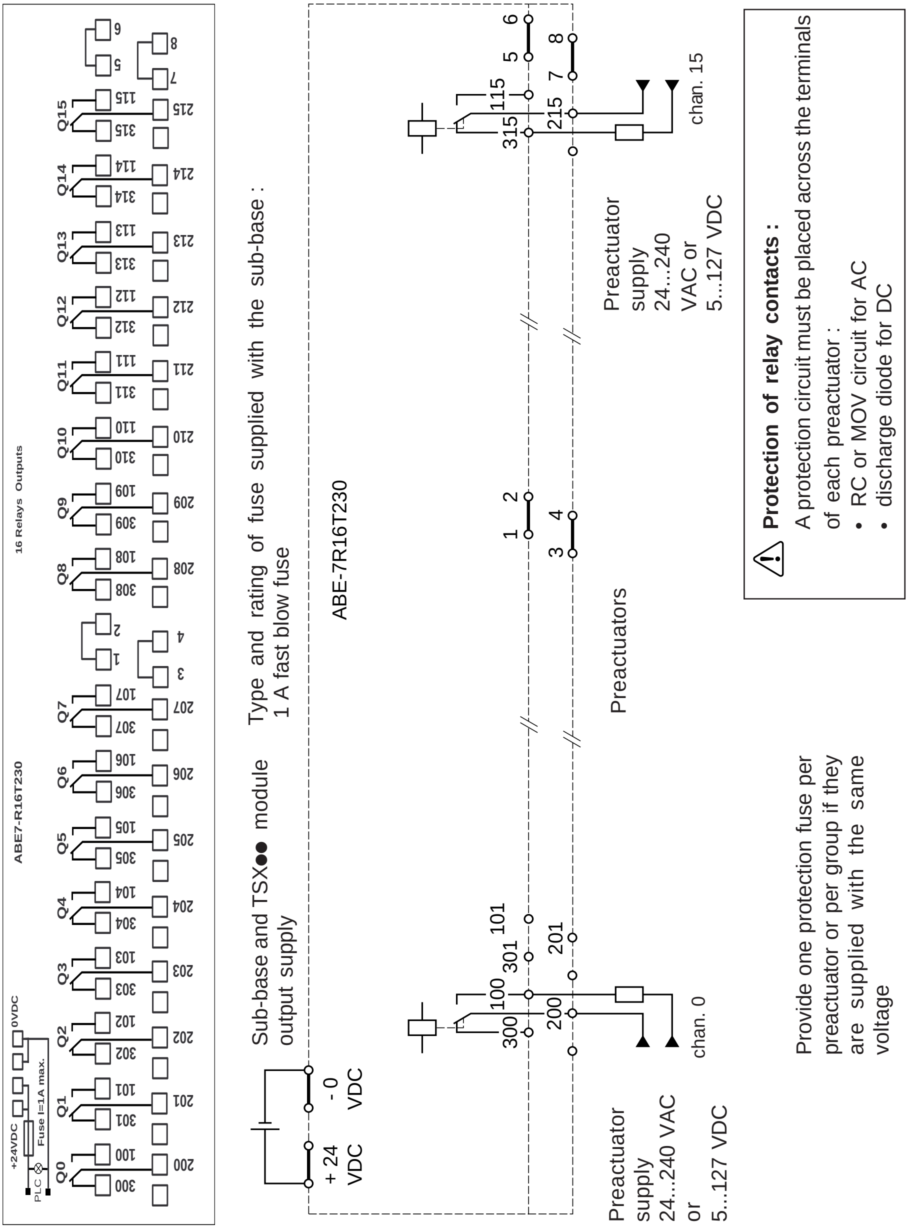


Protection of relay contacts :

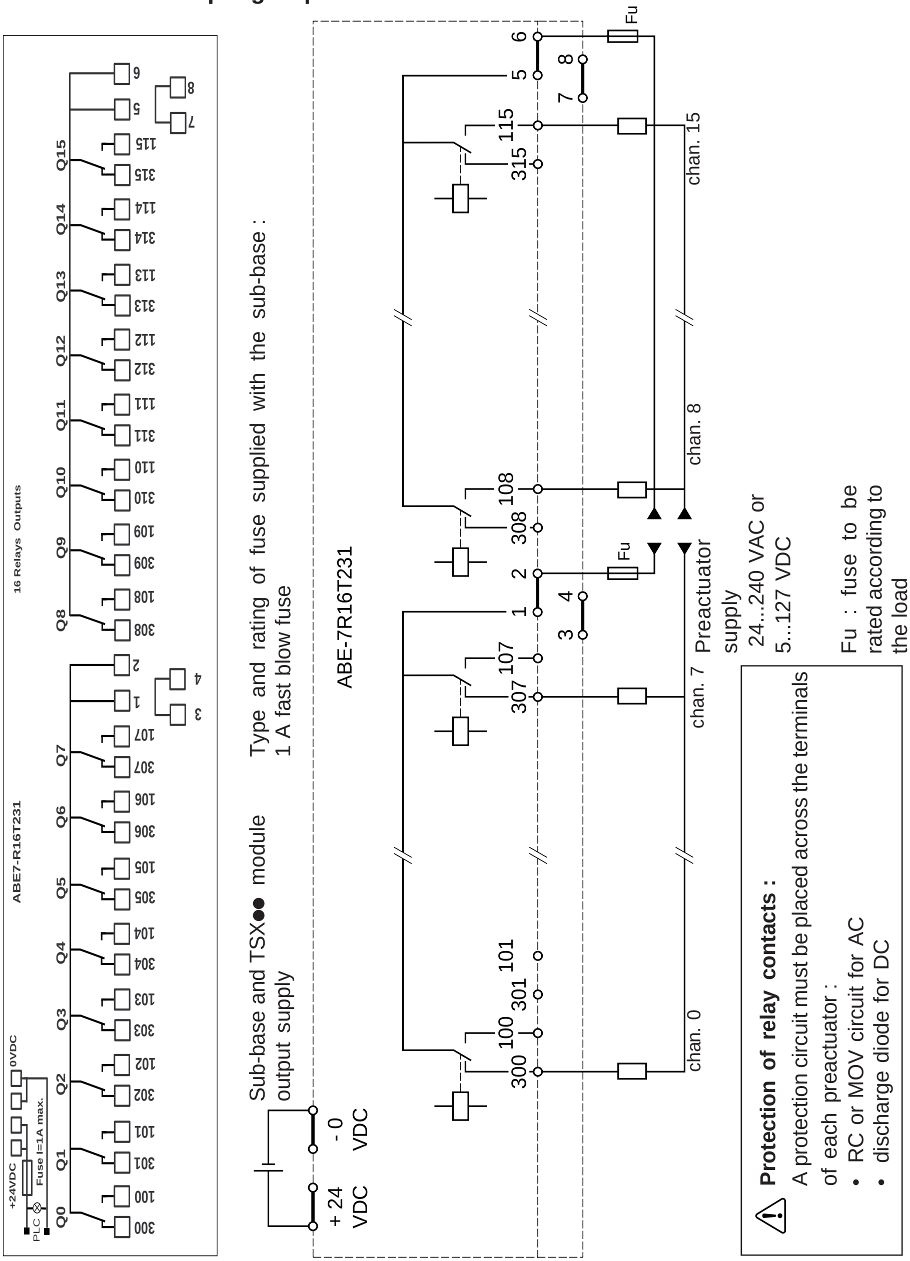
A protection circuit must be placed across the terminals of each preactuator :

- RC or MOV circuit for AC
- discharge diode for DC

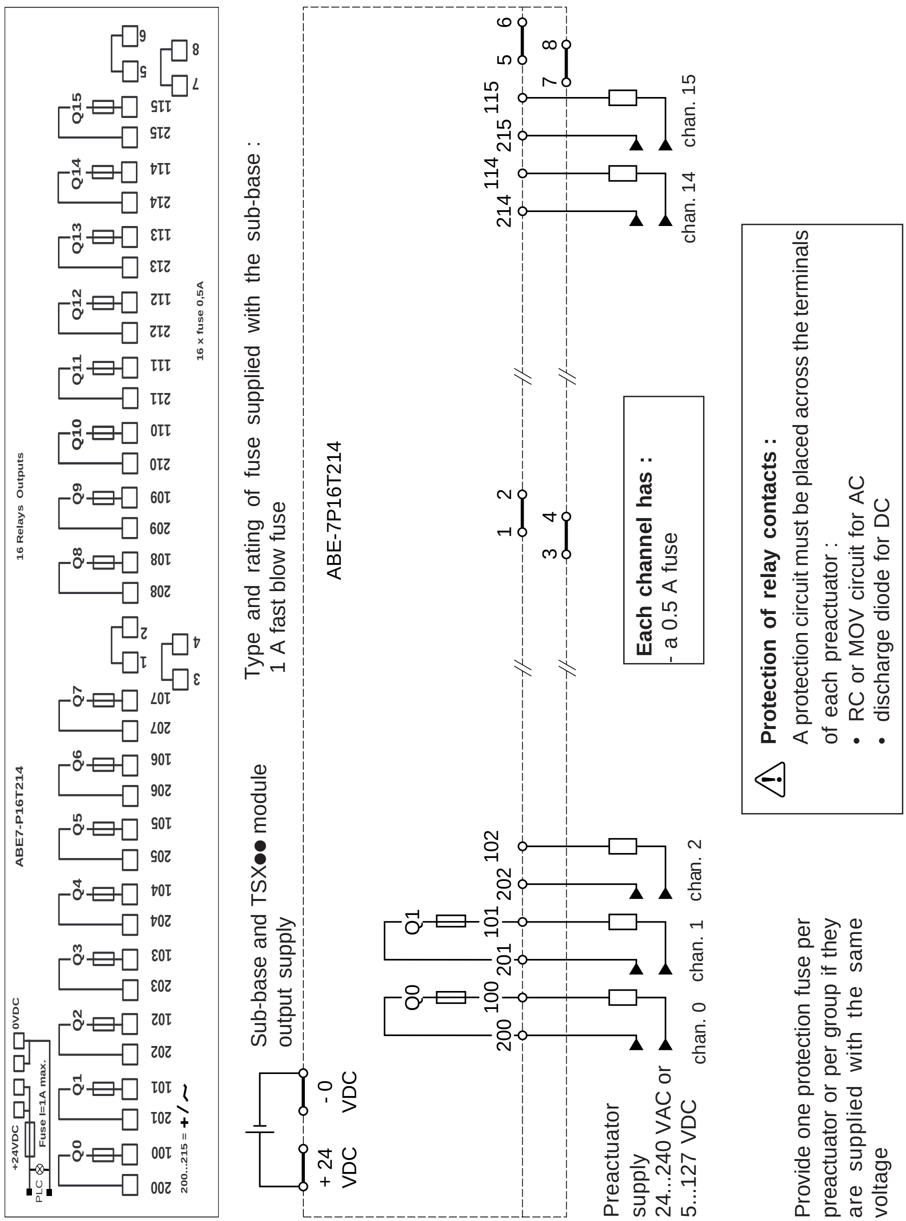
- **ABE-7R16T230 sub-base with electromechanical relays (1 "C/O"), volt-free contact**



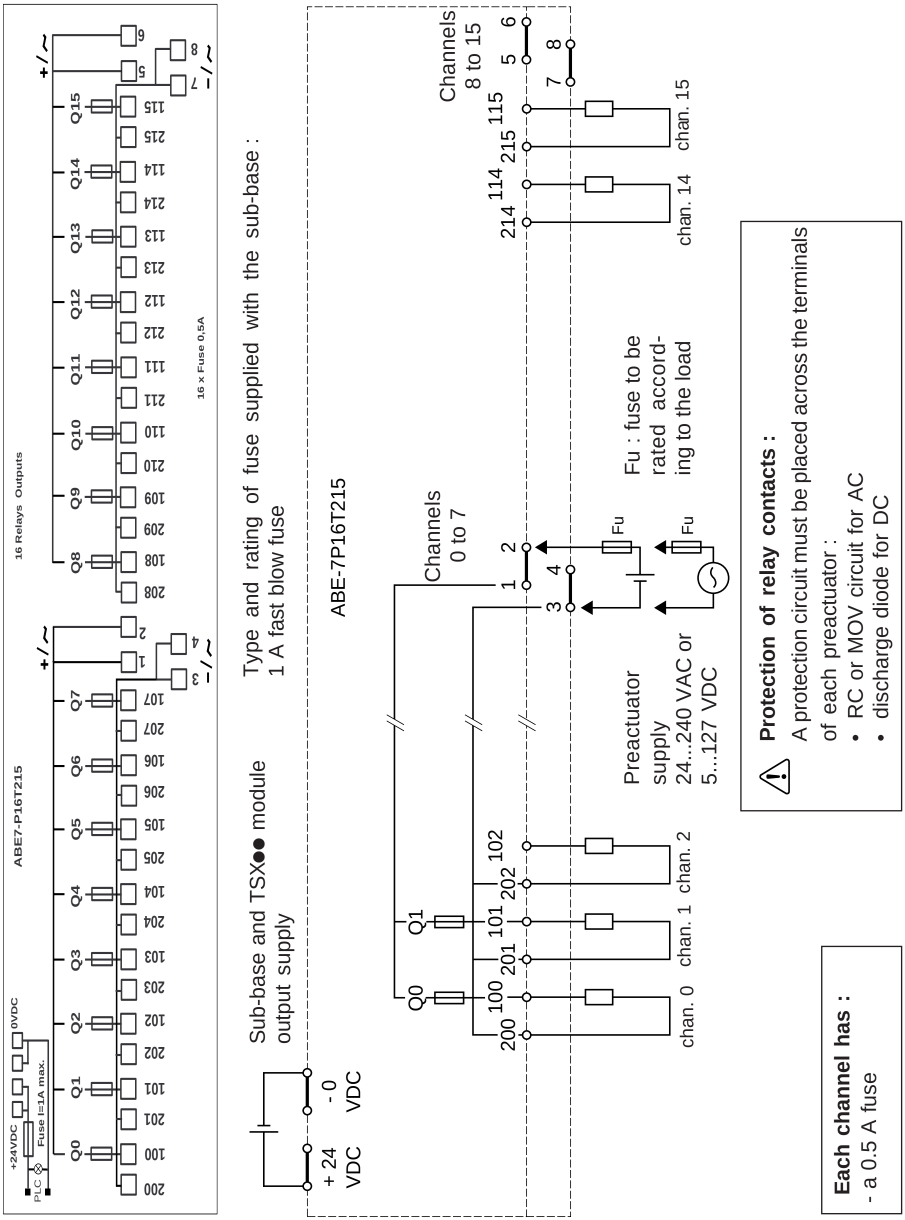
- **ABE-7R16T231 sub-base, with electromechanical relays (1"C/O"), distribution of one common per group of 8 channels**



- **ABE-7P16T214 sub-base relays not supplied**
  1"N/O", volt-free contact
  1 fuse per channel



- **ABE-7P16T215 sub-base relays not supplied**
  1"N/O", distribution of both poles per group of 8 channels
  1 fuse per channel

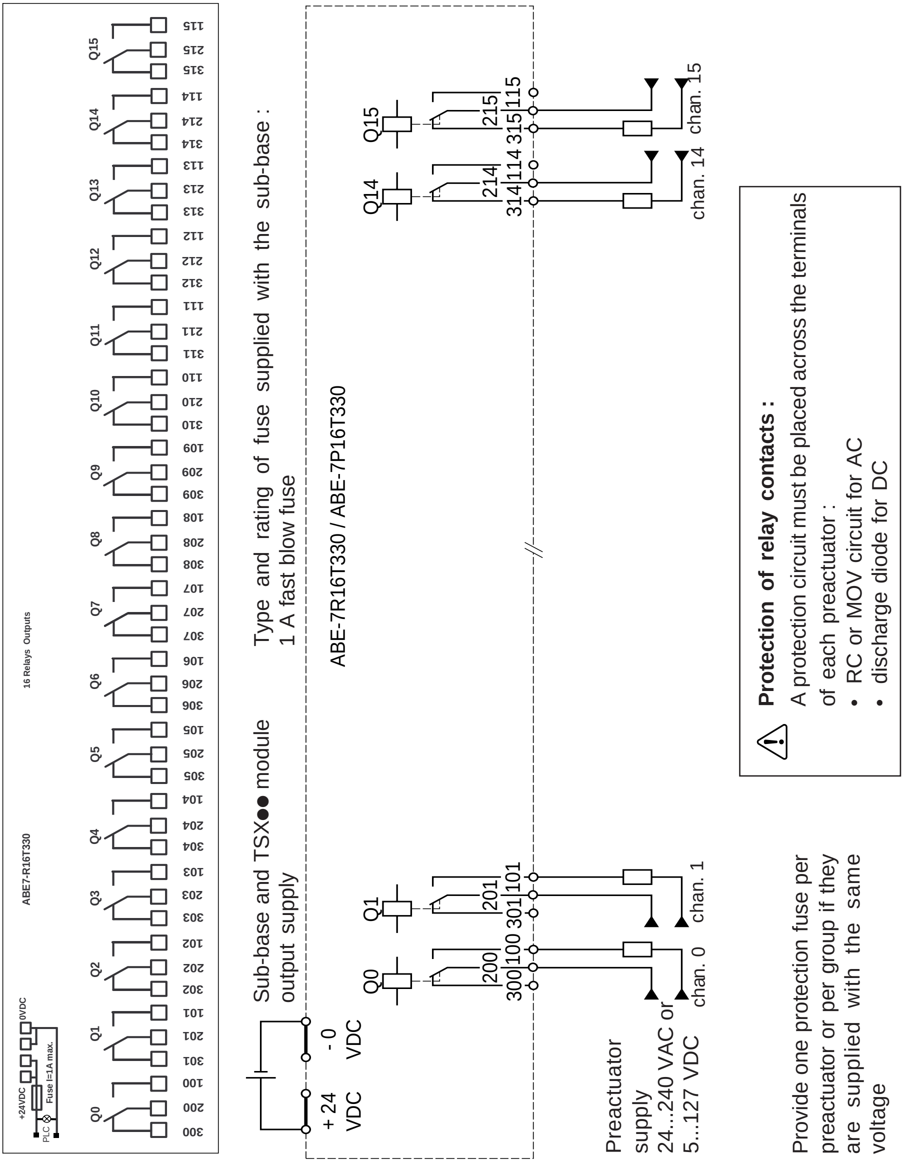


Protection of relay contacts :
A protection circuit must be placed across the terminals of each preactuator :
- RC or MOV circuit for AC
- discharge diode for DC

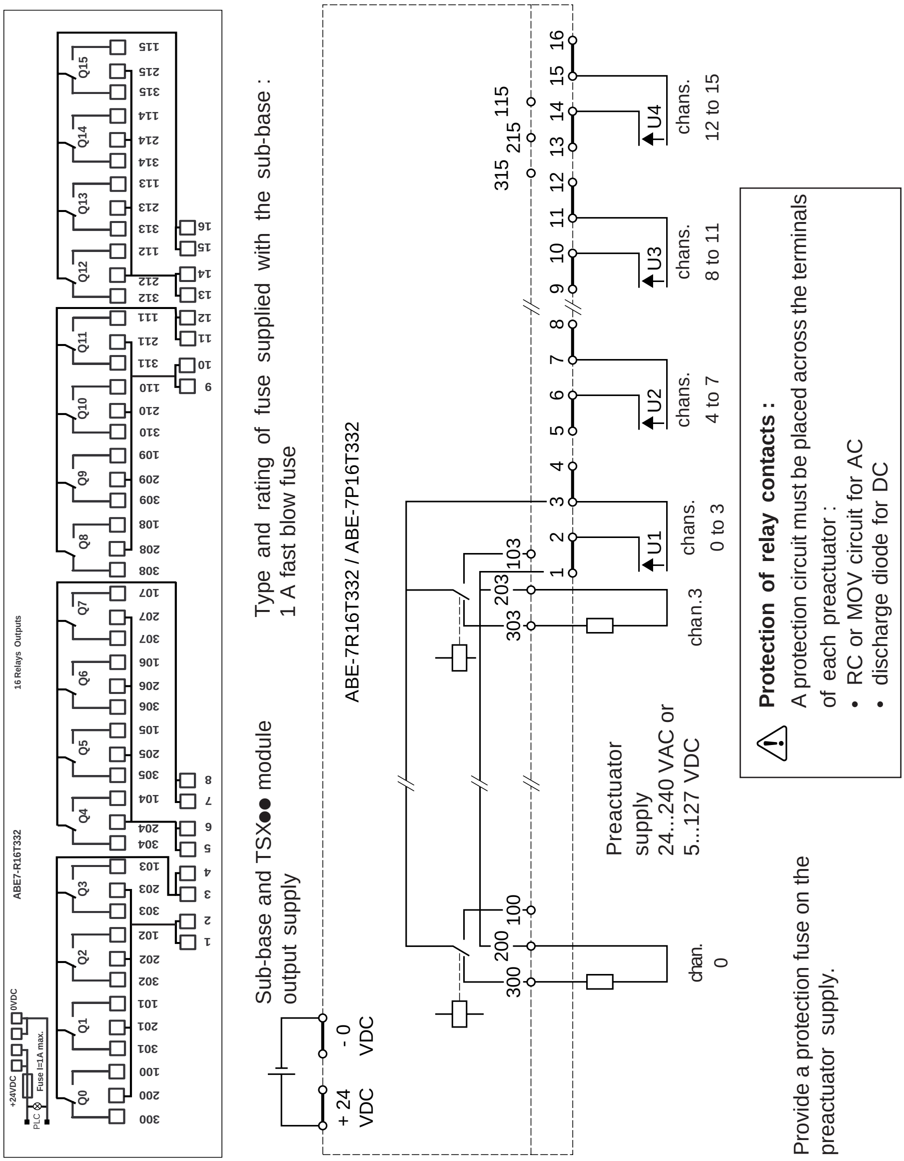
Each channel has :
- a 0.5 A fuse

6.5-16 Electromechanical or solid state relay input or output sub-bases, relay 12.5 mm wide

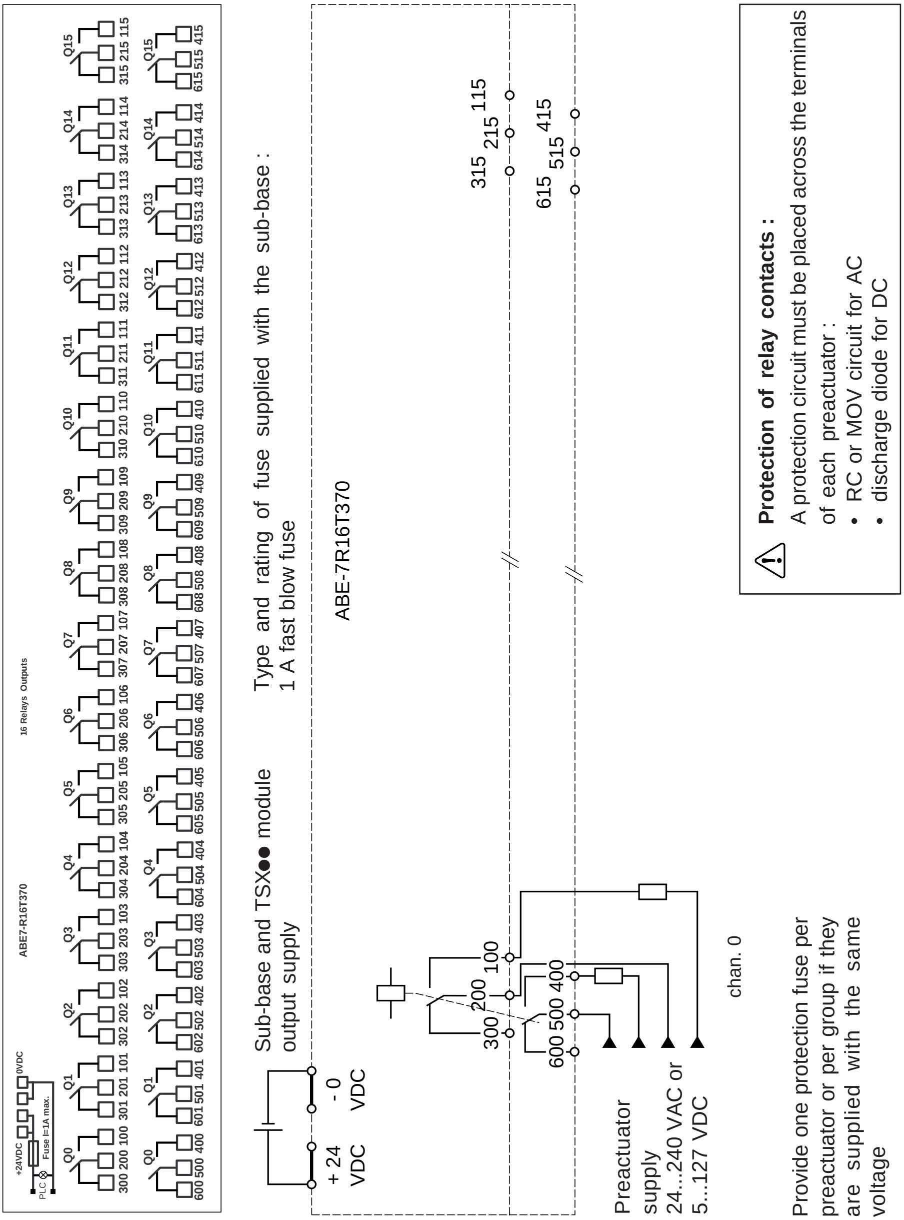
- **1"C/O" sub-bases, volt-free contact**
  - **ABE-7R16T330 with electromechanical relays**
  - **ABE-7P16T330 relays not supplied**



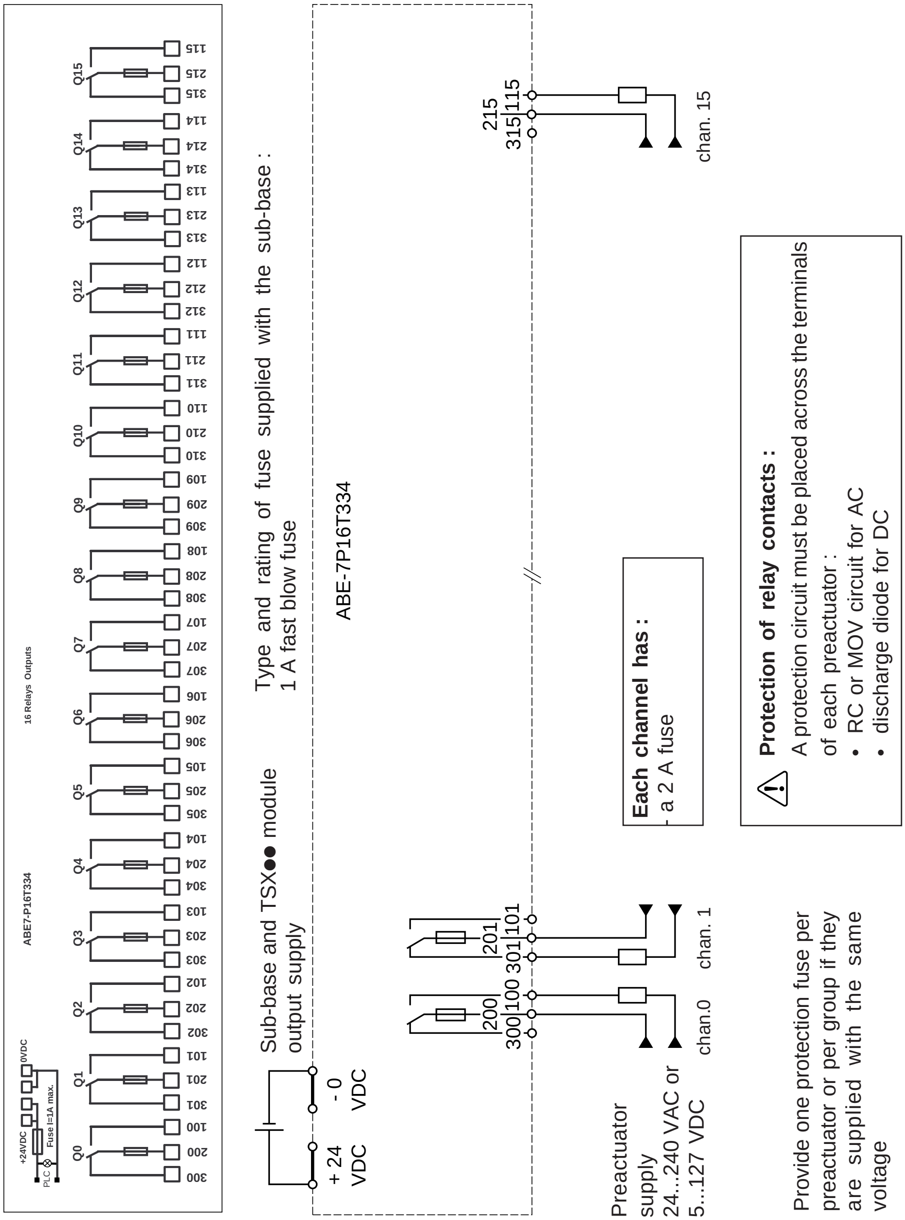
- **1"C/O" sub-bases, distribution of both poles per group of 4 channels**
  - **- ABE-7R16T332 with electromechanical relays**
  - **- ABE-7P16T332 relays not supplied**



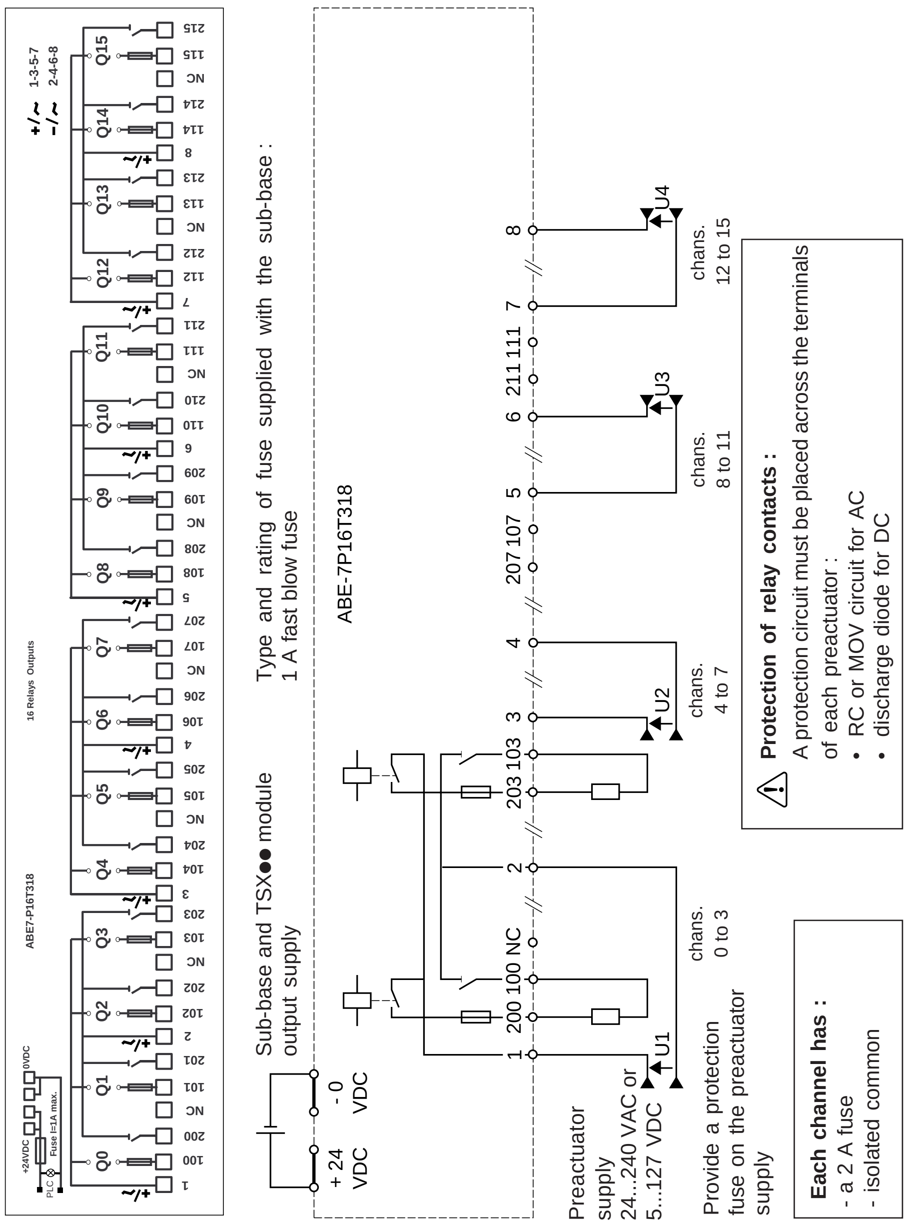
- **ABE-7R16T370 sub-bases, with electromechanical relay (2 "C/O"), volt-free contact**



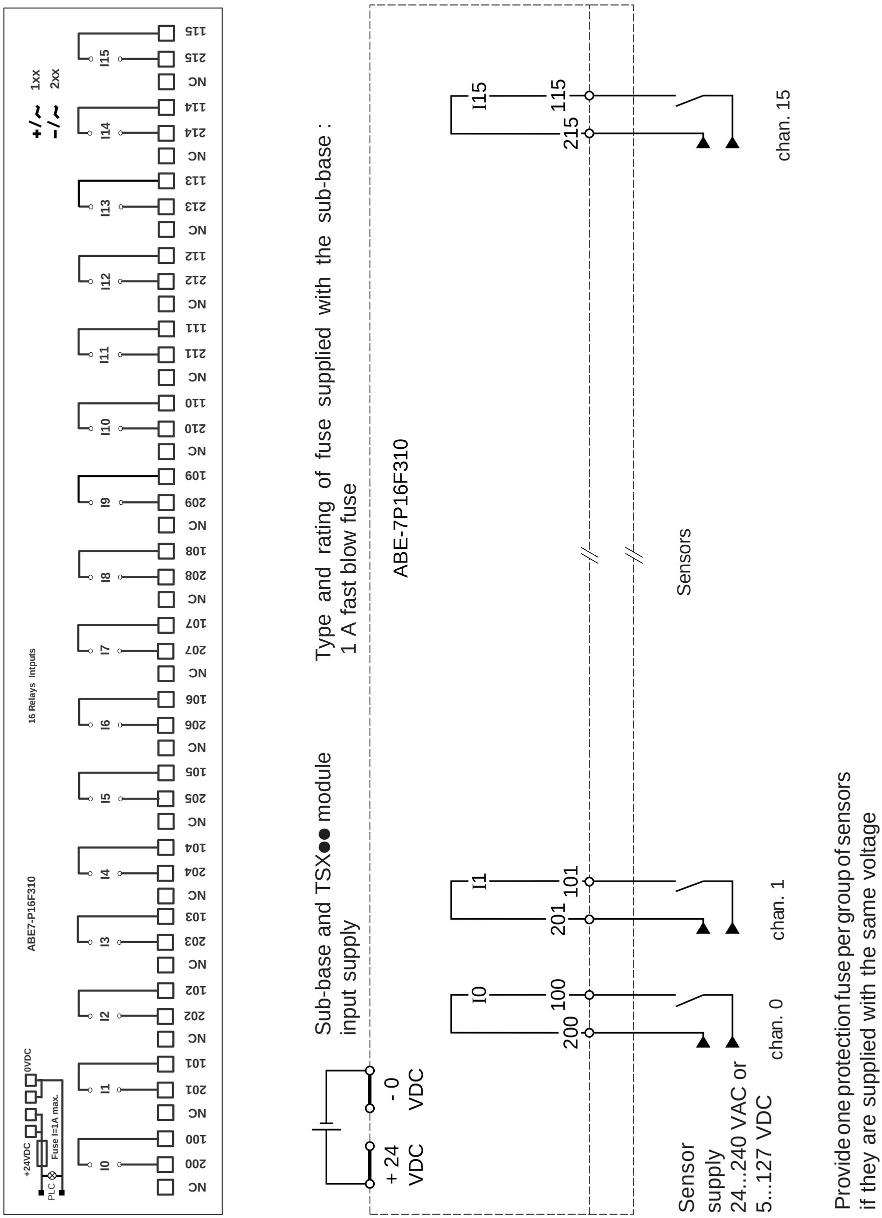
• ABE-7P16T334 sub-base, relays not supplied (1"C/O"), volt-free contact



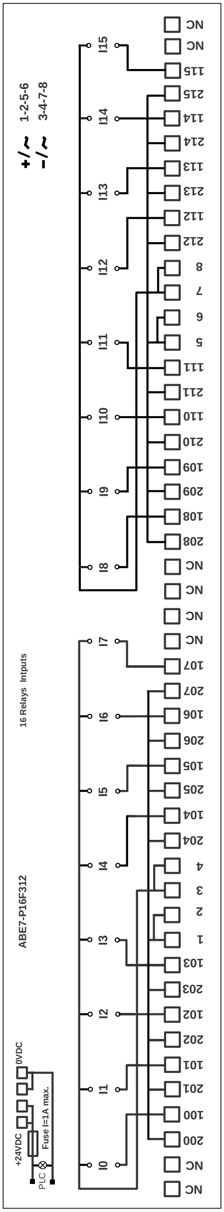
• **ABE-7P16T318 sub-base, relays not supplied**
1"C/O" distribution of both poles per group of 4 channels
1 fuse and 1 isolator per channel

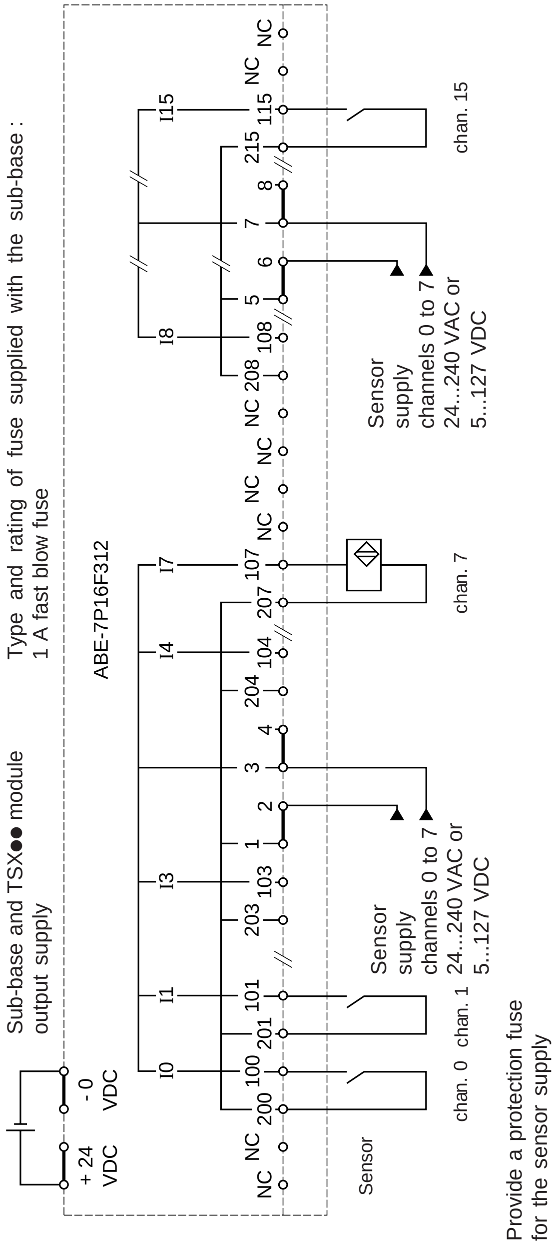


• ABE-7P16F310 solid state relay input sub-base (relays not supplied), volt-free



- **ABE-7P16F312 solid state relay input sub-base (relays not supplied), distribution of both poles per group of 8 channels**



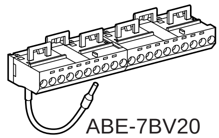


6.6 Compatibility table for relays and ABE-7R16T•••, ABE-7P16T•••, ABE-7P16F••• sub-bases

Sub-base ABE-7		Equipped with electromechanical relays R16T21●	R16T23●	R16T33●	R16T370	Not equipped with relays P16T21●	P16T33●	P16T318	P16F31●
Electromechanical relay (output)		(1) compatible relays			(2) except ABE-7P16T334				
10mm	ABR-7S21 1"N/O"	■				■			
	ABR-7S23 1"C/O"	(1)	■						
12.5mm	ABR-7S33 1"C/O"			■			■	■	
	ABR-7S37 2"C/O"				■				
Solid state relay (output)									
10mm	ABS-7SC2E	■ (1)				■			
	ABS-7SA2M	■ (1)				■			
12.5mm	ABS-7SC3BA			■ (1)			■ (2)	■	
	ABS-7SC3E			■ (1)			■	■	
	ABS-7SA3M			■ (1)			■	■	
Solid state relay (input)									
12.5mm	ABS-7EC3AL								■
	ABS-7EC3B2								■
	ABS-7EC3E2								■
	ABS-7EA3E5								■
	ABS-7EA3F5								■
	ABS-7EA3F6								■
	ABS-7EA3M5								■
	ABS-7EA3M6								■
Continuity block									
10 mm	ABE-7ACC20	■				■			
12.5 mm	ABE-7ACC21			■			■	■	

6.7 Accessories

- **Add-on shunt terminal block :**
  ABE-7BV10 : terminal block with 10 screw terminals
  ABE-7BV20 : terminal block with 20 screw terminals



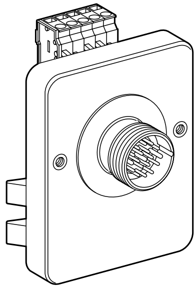
ABE-7BV20

- **Adaptor sub-base :**
  ABE-7ACC02 : used to switch from 16 channels to 2x8 channels

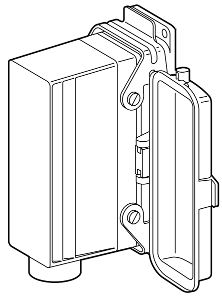
- **Mounting kit :**
  ABE-7ACC01 : is used to fix sub-bases to solid plates

- **Dust and damp-proof cable bushing :**
  ABE-7ACC84 : is used to feed through the enclosure without isolating the leads

- **Enclosure feed through :**
  ABE-7ACC83 : HE10 connectors for 8/12 channels ➜ M23 cylindrical connector.
  ABE-7ACC82 : HE10 connector for 16 channels ➜ M23 cylindrical connector.
  ABE-7ACC80 : HE10 connectors for 32 channels ➜ "HARTING" type connector.
  ABE-7ACC81 : plug-in connector for ABE-7ACC80



ABE-7ACC82



ABE-7ACC80

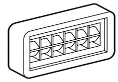
- **Removable continuity module :**
  ABE-7ACC20 : 10 mm wide
  ABE-7ACC21 : 12.5 mm wide

- **Software for marking customer labels :**
  ABE-7LOGV10

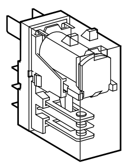
- **Glass 5 x 20 fast blow fuse :**

ABE-7FU012	0.125 A		ABE-7FU200	2 A
ABE-7F7050	0.5 A		ABE-7FU630	6.3 A
ABE-7FU100	1 A			

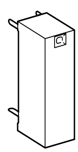
- **Self-adhesive label holder :**
  AR1-SB3 for AB1-R. / AB1-G. type labels



- **Relays for ABE-7R16T●●●, ABE-7P16T●●● and ABE-7P16F●●● sub-bases :**
  ABR-7S●●● : electromechanical output relays (see page 6/41)
  ABS-7S●●● : solid state output relays (see page 6/41)
  ABS-7E●●● : solid state input relays (see page 6/41)



ABR-7S3●●



ABR-7S2●●

6.8 Sub-base electrical characteristics

6.8-1 Fixed input adaptor sub-bases

Types of sub-base			ABE-7 S16E2B1	ABE-7 S16E2E1	ABE-7 S16E2E0	ABE-7 S16E2F0	ABE-7 S16E2M0
Number of channels			16	16	16	16	16
Control circuit characteristics (application inputs)							
Nominal values	Voltage		24VDC	48VDC	48VAC	110/ 130VAC	230/ 240VAC
	Current		12 mA	13 mA	12 mA	8.3 mA	8 mA
	Frequency		-	-	50/60 Hz	50/60 Hz	50/60 Hz
Input limit values	At state 1	Voltage	≥ 13.7 V	≥ 30 V	≥ 32 V	≥ 79 V	≥ 164 V
		Current	≥ 5 mA	≥ 6 mA	≥ 5 mA	≥ 5 mA	≥ 4.5 mA
	At state 0	Voltage	≤ 5 V	≤ 10 V	≤ 10 V	≤ 30 V	≤ 40 V
		Current	≤ 2 mA	≤ 2 mA	≤ 1.5 mA	≤ 2 mA	≤ 2 mA
	Frequency		-	-	47...63 Hz	47...63 Hz	47...63 Hz
	Sensor supply (ripple included)		19..30 V	38.4...60 V	38.4...53 V	96...143 V	184...264 V
IEC 1131-2 conformity			type 1	type 2	type 1	type 1	type 1
Response time		State 0 to 1	0.05 ms	0.05 ms	20 ms	20 ms	20 ms
		State 1 to 0	0.4 ms	0.4 ms	20 ms	20 ms	20 ms
Maximum switching frequency			1000 Hz	1000 Hz	25 Hz	25 Hz	25 Hz
Rated insulation voltage		I/O	300 V				
Rated impulse withstand voltage (1.2 / 50)		I/O	2.5 kV				

6.8-2 Fixed solid state output adaptor sub-bases

Types of sub-base			ABE-7 S●●S2B0	ABE-7 S16S2B2	ABE-7 S08S2B1
Number of channels			8 / 16	16	8
Output circuit characteristics					
DC load	Resistive, DC12 duty	Voltage	24 VDC	24 VDC	24 VDC
		Current	0.5 A	0.5 A	2 A (1)
	Inductive, DC13 duty	Voltage	24 VDC	24 VDC	24 VDC
		Current	0.25 A	0.25 A	0.5 A (1)
	Filament lamp		10 W	10 W	no
Limit values		Voltage	19...30 VDC	19...30 VDC	19...30 VDC
Leakage current at state 0			≤ 0.3 mA	≤ 0.3 mA	≤ 0.5 mA
Residual voltage at state 1			≤ 0.6 V	≤ 0.6 V	≤ 0.5 V
Minimum current per channel			1 mA	1 mA	1 mA
Response time		State 0 to 1	0.1 ms	0.1 ms	0.1 ms
		State 1 to 0	0.02 ms	0.02 ms	0.02 ms
Built-in protection	Against overloads and short-circuits		Yes by current limiter and circuit-breaker Id > 0.75 A	Id > 0.75 A	Id > 2.6 A
	Against inductive overvoltages		Yes by integrated zener diode		
	Against reverse polarity		Yes by peak limiter		
Switching frequency on inductive load			< 0.6 LI^2	< 0.6 LI^2	< 0.5 LI^2
Fault detection feedback			Yes	No	Yes
Rated insulation voltage	I/O		300 V		
Rated impulse withstand voltage (1.2 / 50)	I/O		2.5 kV		

(1) from 50°C to + 60°C alternating between channels

6.8-3 Fixed relay output adaptor sub-bases

Types of sub-base			**ABE-7 R●●S111**	**ABE-7 R●●S210**	**ABE-7 R16S212**
Number of channels			8 / 16	8 / 16	16
Contact characteristics					
Limit operating voltage	AC ∼		250 V	250 V	250 V
	DC ⎓		30 V	125 V	125 V
Thermal current			3 A	5A	5A
AC load	Resistive, AC12 duty	Voltage	230 VAC	230 VAC	230 VAC
		Current (1)	0.6 A	1.5 A	1.5 A
	Inductive, AC15 duty	Voltage	230 VAC	230 VAC	230 VAC
		Current (1)	0.4 A	0.9 A	0.9 A
DC load	Resistive, DC12 duty	Voltage	24 VDC	24 VDC	24 VDC
		Current (1)	0.6 A	1.5 A	1.5 A
	Inductive, DC13 duty	Voltage	24 VDC	24 VDC	24 VDC
	L/R = 10 ms	Current (1)	0.2A	0.6 A	0.6 A
Minimum switching		Current	1 mA	10 mA	10 mA
		Voltage	5 V	5 V	5 V
Response time	State 0 to 1		10 ms	10 ms	10 ms
	State 1 to 0		6 ms	5 ms	5 ms
Maximum rate of on-load operation			0.5 Hz	0.5 Hz	0.5 Hz
Built-in protection	Against overloads and short-circuits		None, fit a fast blow fuse per channel or group of channels		
	Against inductive overvoltages in AC		None, an RC circuit or an MOV (ZNO) peak limiter appropriate to the voltage must be placed across the terminals of each preactuator		
	Against inductive overvoltages in DC		None, a discharge diode must be placed across the terminals of each preactuator		
Rated insulation voltage	Coil/contact		300 V		
Rated impulse withstand voltage (1.2 / 50)	Coil/contact		2.5 kV		

(1) for 0.5 x10^6 operations

6.8-4 Removable output electromechanical relays

			S21	S23	S33	S37
Relay references / **Relay width**	**ABR-7**	➜	**S21** **10 mm**	**S23** **10 mm**	**S33** **12.5 mm**	**S37** **12.5 mm**
Contact characteristics						
Contact type			**1"N/O"**	**1"C/O"**	**1"C/O"**	**2"C/O"**
Max operating voltage	AC ~		250 V	250 V	264 V	264 V
(in line with IEC 947-5-1)	DC ⎓		125 V	125 V	125 V	125 V
Thermal current			4 A	4 A	5 A	5 A
Frequency of the operating current				50/60 Hz		
AC load	Resistive,	Voltage	230 VAC	230 VAC	230 VAC	230 VAC
	AC12 duty	Current (1)	1.5 A	1.2 A	3 A	2.5 A
	Inductive,	Voltage	230 VAC	230 VAC	230 VAC	230 VAC
	AC15 duty	Current (1)	0.9 A	0.7 A	1.7 A	1.3 A
DC load	Resistive,	Voltage	24 VDC	24 VDC	24 VDC	24 VDC
	DC12 duty	Current (1)	1.5 A	1.2 A	3 A	2.5 A
	Inductive, DC13 duty	Voltage	24 VDC	24 VDC	24 VDC	24 VDC
	L/R = 10 ms	Current (1)	0.6 A	0.45 A	1.4 A	1 A
Minimum switching		Current	10 mA	10 mA	100 mA	100 mA
		Voltage	5 V	5 V	5 V	5 V
Response time		State 0 to 1	10 ms	10 ms	13 ms	15 ms
		State 1 to 0	5 ms	5 ms	13 ms	20 ms
Maximum rate of on-load operation			0.5 Hz	0.5 Hz	0.5 Hz	0.5 Hz
Rated insulation voltage	Coil/contact				300 V	
Rated impulse withstand voltage (1.2 / 50)	Coil/contact				2.5 kV	

(1) for 0.5 x10^6 operations

6.8-5 Removable input solid state relays

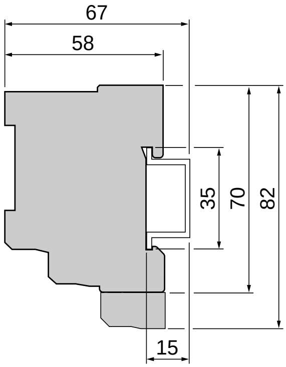
References **Relay width**	**ABS-7**	**➜**	**EC3AL** **12.5mm**	**EC3B2** **12.5mm**	**EC3E2** **12.5mm**	**EA3E5** **12.5mm**	**EA3F5** **12.5mm**	**EA3M5** **12.5mm**
Control characteristics								
Rated operating	DC	⎓	5V	24V	48V	—	—	—
voltage (Us)	AC	∿				48V	110/130V	230/240V
Maximum operating voltage (ripple included)			6V	30 V	60 V	53 V	143 V	264 V
Max Us current			13.6 mA	15 mA	15 mA	12 mA	8.3 mA	8 mA
State 1 guaranteed	Voltage		3.75 V	11 V	30 V	32 V	79 V	164 V
	Current		4.5 mA	6 mA	6 mA	5 mA	5 mA	4.5 mA
State 0 guaranteed	Voltage		2 V	5 V	10 V	10 V	30 V	40 V
	Current		0.09 mA	2 mA	2 mA	1.5 mA	2 mA	2 mA
Maximum switching frequency (cyclic ratio 50%)			1000 Hz	1000 Hz	1000 Hz	25 Hz	25 Hz	25 Hz
IEC 1131-2 conformity			—	Type 2	Type 2	Type 1	Type 1	Type 1
Response time	State 0 to 1		0.05 ms	0.05 ms	0.05 ms	20 ms	20 ms	20 ms
	State 1 to 0		0.4 ms	0.4 ms	0.4 ms	20 ms	20 ms	20 ms
Rated insulation voltage	I/O			300 V				
Rated impulse withstand voltage (1.2 / 50)	I/O			2.5 kV				

6.8-6 Fixed output solid state relays

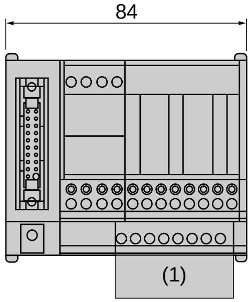
References ABS-7 → Relay width			SC2E 10mm	SA2M 10mm	SC3BA 12.5mm	SC3E 12.5mm	SA3M 12.5mm
Output circuit characteristics							
Rated operating voltage	DC	⎓	5..48V	—	24V	5..48V	—
	AC	∼	—	24..240V	—	—	24..240V
Maximum voltage			57.6VDC	264 VAC	30 VDC	60 VDC	264 VAC
AC load	Resistive, Current AC12 duty		—	0.5 A	—	—	2 A
DC load	Resistive, Current DC12 duty		0.5 A	—	2 A	1.5 A	—
	Inductive, Current DC13 duty		—	—	—	0.3 A	—
	Filament lamp DC6 duty		—	—	—	10 W	—
Leakage current at state 0			≤ 0.5 mA	≤ 2 mA	≤ 0.3 mA	≤ 0.3 mA	≤ 2 mA
Residual voltage at state 1			≤ 1 V	≤ 1.1 V	≤ 0.3 V	≤ 1.3 V	≤ 1.3 V
Minimum current per channel			1 mA	10 mA	1 mA	1 mA	10 mA
Response time	State 0 to 1		0.1 ms	10 ms	0.1 ms	0.1 ms	10 ms
	State 1 to 0		0.6 ms	10 ms	0.02 ms	0.6 ms	10 ms
Switching frequency on inductive load			—	—	< 0.5 LI^2	—	—
Rated insulation voltage	I/O		300 V				
Rated impulse withstand voltage (1.2 / 50)	I/O		2.5 kV				

6.9 Dimensions and mounting

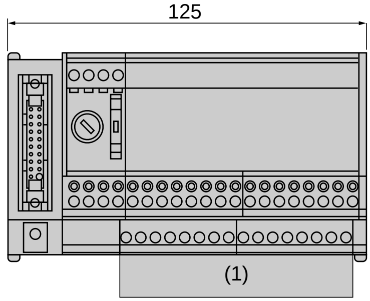
- **Dimensions**



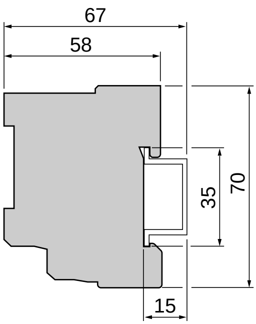
(1) Dimension with add-on shunt terminal block ABE-7BV20 or ABE-7BV10

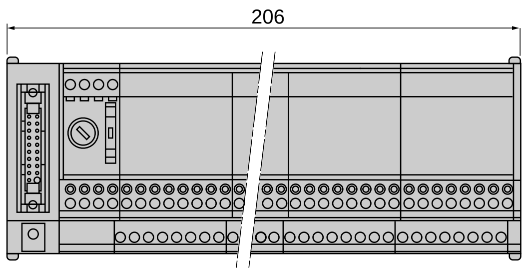


ABE-7H08R1●
ABE-7H08R2●
ABE-7H12R50
ABE-7H16R50
ABE-7R08S111
ABE-7H08S21



ABE-7H12R1● , ABE-7H12R2●
ABE-7H12S21 , ABE-7H16R1●
ABE-7H16R2● , ABE-7H16R3●
ABE-7H16S21 , ABE-7R16S111
ABE-7R08S210 , ABE-7S08S2B0

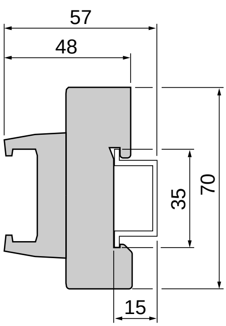


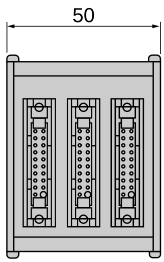


ABE-7H16F43
ABE-7H16S43

ABE-7S16E2B1
ABE-7S16E2E1
ABE-7S16E2E0
ABE-7S16E2F0
ABE-7S16E2M0

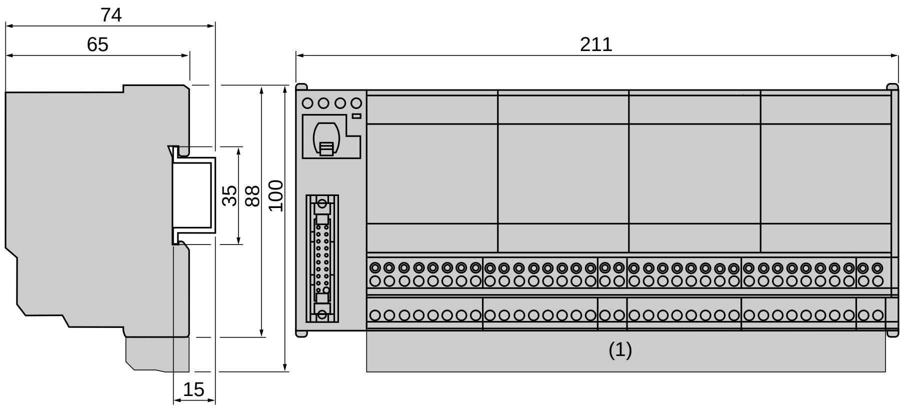
ABE-7S08S2B1
ABE-7S16S2B0
ABE-7S16S2B2
ABE-7R16S210
ABE-7R16S212





ABE-7ACC02

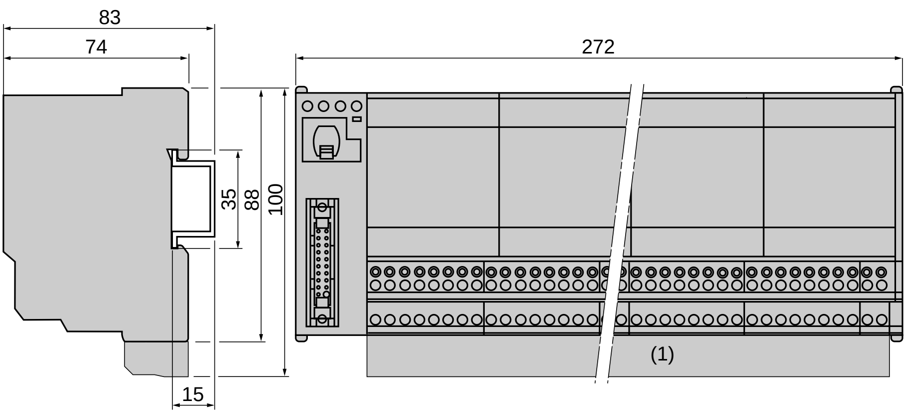
- **Dimensions (cont)**



Reference with dimensions of 211x88 mm
(product pictured with removable relays and screws not mounted)

ABE-7R16T210
ABE-7R16T212
ABE-7R16T231
ABE-7R16T230

ABE-7P16T210
ABE-7P16T212
ABE-7P16T214
ABE-7P16T215



Reference with dimensions of 272x88 mm
(product pictured with removable relays and screws not mounted)

ABE-7R16T330
ABE-7R16T332
ABE-7R16T370

ABE-7P16T330
ABE-7P16T332
ABE-7P16T334
ABE-7P16T318

(1) Dimension with add-on shunt terminal block ABE-7BV20 or ABE-7BV10

- **Mounting**
  TELEFAST 2 connection sub-bases are mounted on 35 mm DIN rails.

⚠ **Special mounting requirements for certain sub-bases**

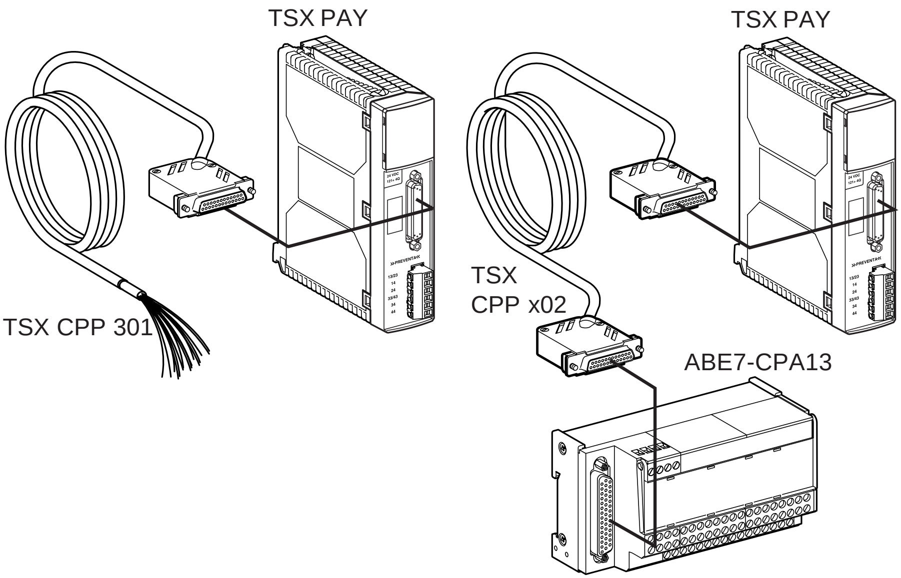
The following sub-bases must be mounted on a vertical plane and in a horizontal position :

- input adaptor sub-bases : ABE-7S16E2E1
- solid state output adaptor sub-bases : ABE-7S●●S2B●

Section	Page

1.1 General description

TSX PAY safety modules and TSX CPP ... and ABE-7CPA13 accessories are used to interrupt one or more category 0 emergency stop (ES) or safety stop control circuits (safety components). The complete safety system satisfies the requirements of European standards EN418 for emergency stops and EN60204-1 for safety circuits.
The modules also meet the safety requirements for the electrical monitoring of limit switches (LS) activated by protection devices.



TSX PAY 262 and TSX PAY 282 safety modules offer :

- A safety system designed to safely control the emergency stop (ES) circuits on machines. The modules are equipped with a safety block in hard-wired logic for emergency stop monitoring.
- Complete diagnostics of the safety system by reading the state of the pushbuttons or limit switches for the emergency stop input circuit, the reset input, the feedback loop, the control bit of the two output circuits and the supply state of the safety system. This data is transmitted to the TSX Premium CPU in the form of 28 discrete input bits.

The PLC has no effect on the safety modules, and the safety system part is connected to an external power supply.

1.2 Physical description

TSX PAY modules have the same format as Premium PLC interfaces.
They occupy a single slot.

1 IP20 rigid housing to support and protect the electronic card

2 Block for displaying the operating modes, any errors and state of the safety system

3 Module reference label (right side)

4 Laser marking of the module external power supply

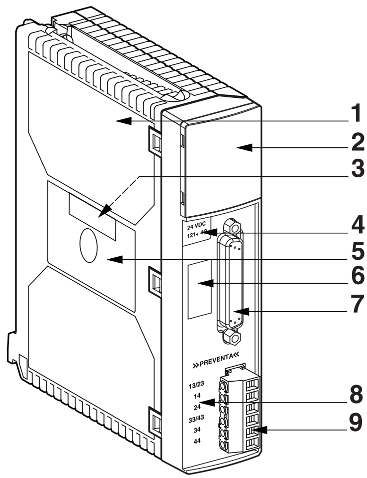
5 Label marking the characteristics of the safety outputs (left side)

6 Free zone for user referencing

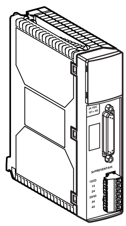
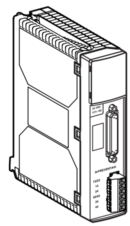
7 High-density 44-pin SUB-D connector for connecting the safety system

8 Front panel label for identifying the safety outputs

9 Removable screw terminal block for connecting the safety outputs



1.3 Module range

Modules	For emergency stop and limit switch monitoring	
Target applications	From 1 to 12 double-contact PB/LS. Break per relay : 2 safety outputs Power supply : 24VDC	1 to 12 double-contact PB/LS. Break per relay : 4 safety outputs Power supply : 24VDC
		
Category	4	
Number of outputs	2F (Immediate stop)	4F (Immediate stop)
Number of inputs	12 double or single contacts	12 double or single contacts
Connection **Input string** **Outputs**	 By 44-pin HD SUB-D connectors By 6-pin screw terminal block	 By 44-pin HD SUB-D connectors By 6-pin screw terminal block
Power supply	24VDC	24VDC
Output string voltage	24VDC	24VDC
PLC diagnostics	Reading the state of the input contacts (PB or LS) Reading the reset input Reading the output control bit Reading the feedback loop Presence of safety system power supply / monitoring (see section 2.2)	
Reset monitoring	Yes, by means of a strap	Yes, by means of a strap
Standards	EN 60204-1, EN 292, EN 418, prEN 1921, BS 2771-1, DIN VDE 0113-1, EN 954, EN 1088, EN 574 type III A, NF C 79-130, NF E 09-053	
Display	28 LEDs + 3 Premium standard state LEDs	
Synchronism of inputs	approx. 400ms (<1s, automatic start)	
Module ref.	**TSX PAY 262**	**TSX PAY 282**

TSX CPP X02 connection cables and ABE 7CPA13 terminal blocks must be ordered separately.

1.4 Installing TSX PAY modules

TSX PAY 262 and TSX PAY 282 modules have a standard format.
They can be installed in any of the positions of a TSX RKY ... rack, with the exception of positions dedicated to the power supply and processor modules.

The I/O of PAY ... modules must be counted as discrete in-rack I/O, respecting the limits defined for each type of processor.

1.5 Software setup

Software setup (configuration, debugging, etc) is performed using PL7 Premium / PL7 PRO software (see the Premium PLC application-specific manual "Basic Functions").

2.1 Description

2.1-1 User functions of the product

TSX PAY modules provide the following functions :

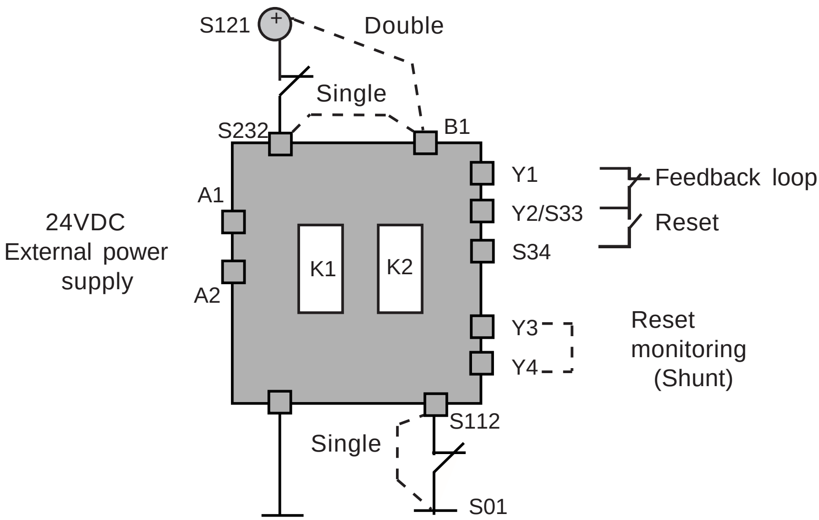
- Monitoring of the emergency stop PBs and limit switches (LS) of moving guards for immediate stop (Emergency stop category 0 according to standard EN 418)
- Detection of desynchronism between the channels (>400ms) in automatic start-up mode
- Hard-wired safety block independent of the operating mode of the Premium PLC
- Regardless of the failures in the safety system components, the safety function is guaranteed by :
  - 2 safety output circuits
  - double-contact inputs for the emergency stop PB or LS
- Wiring of one (+) channel on an input (x) and the (-) channel on another input (x+12) in the case of a double contact
- Self-checking redundancy concept (similar to the PREVENTA XPS-ASF range, see the Telemecanique catalogue "Components for safety applications")
- Restart control via action on an auxiliary input : reset input
- Possibility of monitoring the reset input via action on a falling edge
- Selection of start-up mode via external wiring : manual, automatic or on a falling edge
- Self-testing of outputs by reading their state in the feedback loop
- Self-testing of input channels by means of the continuous comparison of their respective states
- Complete diagnostics of the safety system by :
  - reading the state of the emergency stop PB or LS inputs
  - reading the reset input
  - reading the feedback loop
  - reading the safety output control bit
  - reading the state of the safety system power supply
  - monitoring the module external power supply
- Possibility of selecting external power supply monitoring by PL7

Note :

PB (pushbutton)
ES (emergency stop)
LS (limit switch)

2.1-2 Operating modes

- **Diagram of the product**



- **External power supply**

The 24 VDC external power supply is wired between terminals A1 and A2. It must be protected by an external fuse.

- **Use of single/double contact ES PB and LS**

The wiring of terminal B1 makes it possible to choose the type of ES PB, single or double :

- B1 connected to S121, the module will be wired with double contacts between terminals S121 to S232 for positive polarity and between terminals S01 to S112 for negative polarity
- B1 connected to S232, the module will be wired with single contacts between terminal S121 and S232 for positive polarity, a global shunt between terminals S01 and S112 having been produced for negative polarity

- **Use of ES PB and LS contact**

- Pressing one of the emergency stop buttons, or a break in the external power supply, will directly cause the safety output circuits K1 and K2 to open.
- After unlocking the emergency stop PBs or closing the limit switches of the input circuit, the safety output contacts (terminals 13-14, 23-24, 33-34, 43-44) are closed by sending a pulse to the enable input (terminals S33-S34).

- **Reset**

  The resetting of the safety system is active when the feedback loop between terminals Y1 and Y2 is closed AND when there is a reset request (S24) between terminals S33 and S34.

  Terminals Y3/Y4 are used to choose whether or not this reset input is monitored :

  - Y3/Y4 open means activation of the outputs (recommended use) when the PB is pressed and then released (falling edge on S34).
  - Y3/Y4 closed means immediate activation of the outputs when the PB is interrogated.

  Notes :

  . The shunt between terminals Y3-Y4 must be as short as possible.
  . No other connections may be made to these terminals.

  A shunt performed on terminals Y3-Y4 on the one hand and S33-S34 on the other hand makes it possible to automatically activate the outputs as soon as the two input channels are closed. A desynchronization time of 400 ms is permissible.

- **Safety outputs**

  The PAY 262 module has two outputs wired between terminals 13-14 and 23-24; these two outputs may have their own power supply.
  The PAY 282 module has four outputs wired between terminals 13-14, 23-24, 33-34, 43-44; these outputs are grouped into blocks of two, and each block may have its own power supply.
  The relays (with guided contacts) or contactors connected downstream of the outputs must be inserted in the feedback loop between terminals Y1 and Y2. It is only possible to start the unit if the relays with safety functions have become inactive after receiving the stop command. The feedback loop must be closed for each new start-up operation.
  An additional external condition, managed by the PLC, may be inserted in the feedback loop in order to prevent a reset if a fault is detected in the safety system.

- **Diagnostics**

  The PLC always knows the state of the safety system, by means of the input data.

2.2 Operating modes

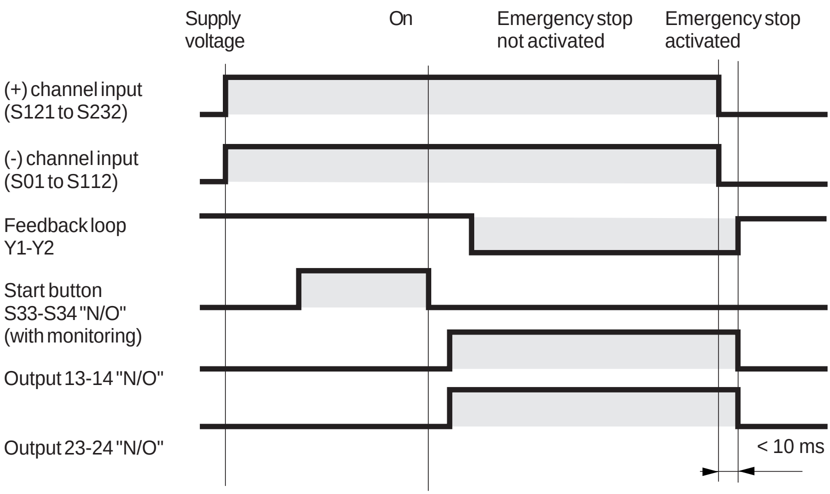
The safety function is autonomous in respect of the operation of the PLC. It does not follow the PLC operating modes and is capable of cutting off the power even when the PLC is powered off or in Stop or if the CPU is absent : **it is not a safety PLC**.

The only exchanges between the CPU and the module are diagnostic data sent from the module to the CPU; **no output is controlled by the PLC**.

The module can be connected or disconnected with the power on; however, it is necessary to disconnect the HD SUB-D and the screw terminal block.

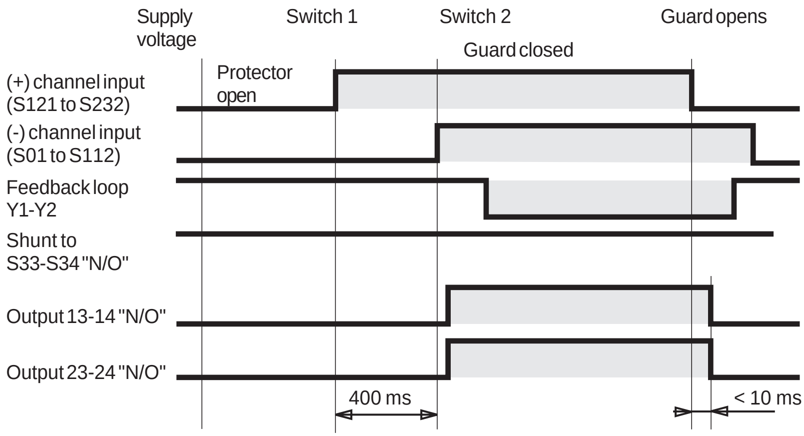
2.3 Functional diagrams

2.3-1 Emergency stop function



Depending on the wiring of Y3-Y4, the reset is performed on an edge or a state.
A single open ES PB contact opens the safety outputs.
It is necessary to open the two channels to enable a reset : this is the input self-test.
The reset is only possible if loop Y1-Y2 is closed : this is the output self-test.

2.3-2 Protective guard function with automatic start



The use of the 2 separate limit switches (switches 1 and 2) means that the mechanism respects a time delay on closing of the 2 switches of less than 400ms.
The manufacturer characteristics guarantee the absence of control if the time is greater than 1s. In this configuration, automatic reset is selected.

2.4 Fault processing

2.4-1 Detection of faults on the inputs

The module is capable of detecting a short-circuit between the two ES PB or LS channels; in this case, bit Ix.27 indicates a fault in the safety system.
The module also carries out an input self-test, in the case of use with double contacts : if there is an inconsistency in the state of the ES PB or LS when interrogated, the safety outputs open but a reset is no longer possible.
To memorize a fault, it is essential to :
- maintain a permanent power supply
- activate a single ES PB at a time (detection of a short-circuiting ES)

Application solutions using a PLC output in the feedback loop and fault detection by means of the module diagnostic data can be used to improve the memorization of a fault.

2.4-2 Detection of faults on the outputs

Detection of a fault on the outputs requires the use of mechanically linked auxiliary contact relays (see the Telemecanique catalogue "Components for safety applications") : this is the output self-test. The "N/C" contacts on relays K3 and K4 must be looped back in series on the feedback loop, between terminals Y1 and Y2. This wiring prevents the resetting of the safety system if one of the two control relays (K3 or K4) sticks.

2.4-3 Detection of internal module faults

In the event of the failure of an internal component, the TSX PAY modules ensure the safety function by opening the output contacts (K1, K2) immediately or at the next interrogation (when an ES PB or LS is opened or the power is switched off). Once this happens, the output contacts (K1, K2) can no longer be closed and the module should be changed.
If such a fault causes over-consumption on the 24VDC, the current is limited to 750mA. In this case, bit Ix.27, the state of the safety system power supply, changes to 0.

2.4-4 Detection of ground faults

The TSX PAY modules have been designed to meet the requirements of standard EN60204-1, which deals in particular with cases of short-circuits to ground. As the 0VDC is connected to ground, the consequences of one or several short-circuits to ground may be :

- a short-circuit of one or several ES PB or LS on negative polarity, if double contacts are used. The outputs open when an ES PB or LS is interrogated, by means of the opening of the contact on positive polarity, as a reset is no longer possible because of the self-test performed on the inputs,
- a short-circuit of the 24VDC external power supply, whether the wiring uses single or double contacts. Immediate opening of the safety outputs because of the absence of a power supply in the safety system. External power supply A1-A2 is protected by the current limitation to 750mA, and bit Ix.27=0 indicates a fault in the safety system.

2.4-5 Limitations

The interrogation of a short-circuited ES PB or LS opens the safety outputs and the self-test does not permit a reset. However, the opening of a second ES PB or LS before the reset also renders this self-test ineffective, as in this case the two channels reach a consistent state (see section 2.4-1).
In the same way, the input self-test is rendered ineffective if a break in the external power supply occurs (or is triggered) after the interrogation of a faulty ES PB or LS, as the power-up reinitializes the module and makes a reset possible once again.

3.1 Safety system

Wiring is via :

- a TSX CPP 301 cable, of which the ends of the strands are free
- a TSX CPP x02 cable with the Telefast ABE-7CPA13 connection sub-base (see section 3.2-2)

The connection diagrams below indicate the connections of the Telefast sub-base; they have been checked and tested with the greatest of care.

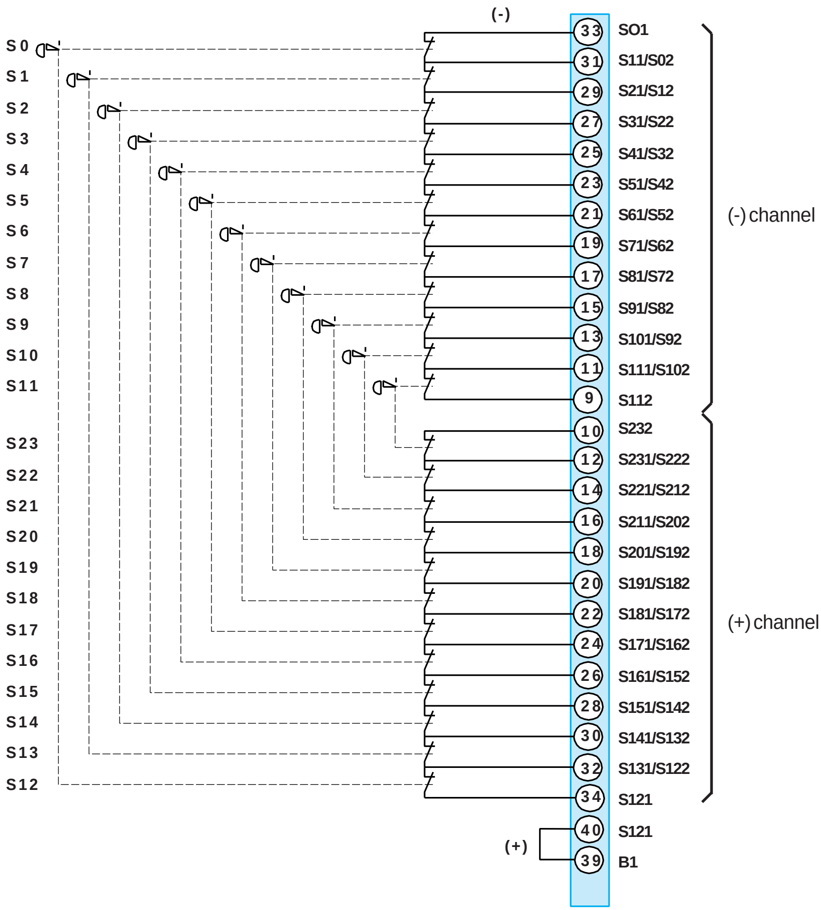
Risks may arise if :

- the wiring diagrams are modified by changing connections or adding components if the latter are not integrated (or are insufficiently integrated) into the safety circuit.
- the user does not respect the requirements of the safety standards for the installation, use, adjustment and maintenance of the machine. It is important to strictly respect **an inspection and maintenance interval of 1 year.**
- the module is manipulated when the supply voltages have not been cut off

3.1-1 ES PB or LS connections

• Double contacts (recommended use)

This double contact wiring of the inputs is suitable for applications requiring a safety level of category 3 or 4.
Short-circuits between channels are detected.
Short-circuits of an ES PB or LS are detected and located.



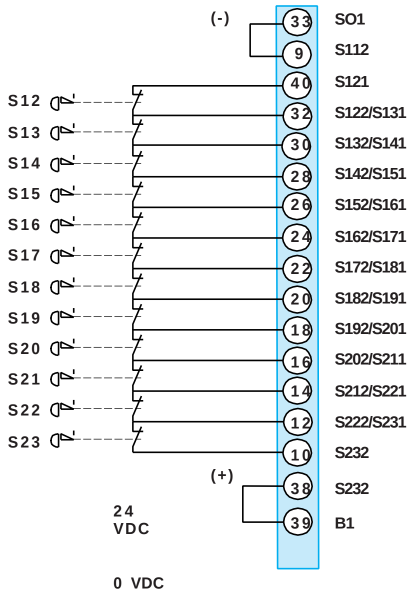
If using less than 12 double contacts, the unused input terminals must be bridged.

Example : Contacts S7 to S11 and S19 to S23 not used.
A bridge is required between terminals S71/S62 and S112 and terminals S191/S182

• **Single contact**

This wiring is not suitable for applications requiring a safety level of category 3 or 4.

All the faults are not detected; a short-circuit on an ES PB or LS is not detected. In this case, the interrogation of this PB does not cause the fault relays to open (loss of the safety function).



If using less than 12 double contacts, the unused input terminals must be bridged.

Example : Contact S18 not used.
A bridge is required between terminals S172/S181 and S182/S191.

3.1-2 Feedback loop connection

The design of a category 4 immediate stop circuit requires redundancy and a check on interrogation of the power break devices.

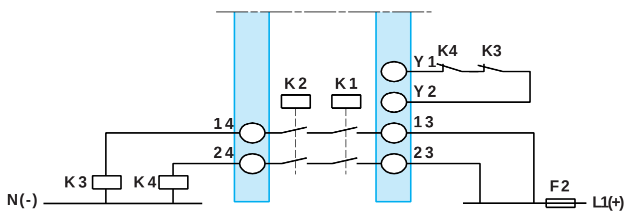
The wiring of the "N/C" contacts (K3, K4) or (K3, K4, K5, K6) makes a check possible upon each interrogation.

The relays (K3, K4) or (K3, K4, K5, K6) must have mechanically linked contacts.

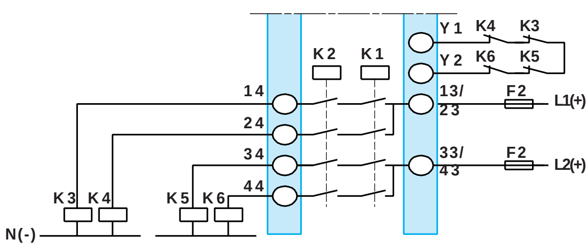
Category three wiring corresponds to :

- no wiring of the auxiliary contacts in the feedback loop (a strap connects terminals Y1 and Y2/S33)
- conventional contactors, with unguided contacts being sufficient

• Use of 2 contactors (category 4)

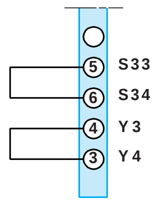


• Use of 4 contactors (category 4)



3.1-3 Reset connection

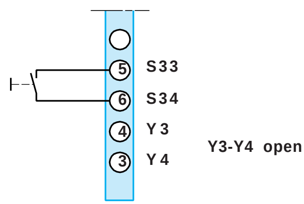
• Automatic reset (protective guard)



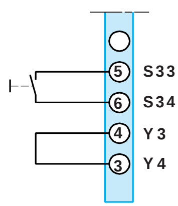
• Manual reset

When all the ES PB or LS are unlocked, manual resetting of the safety system may be monitored if required.

With monitoring of the power on button (recommended use)

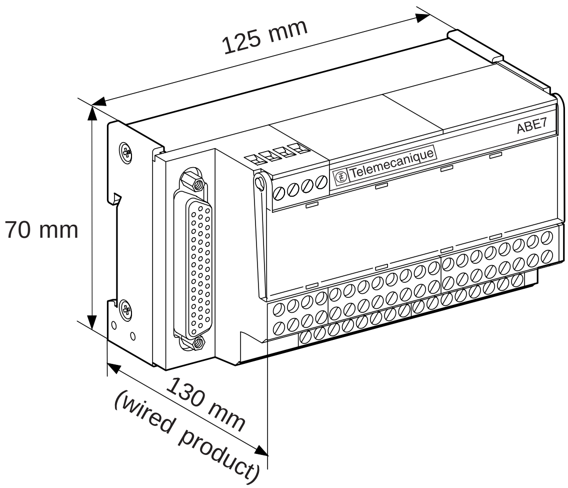


Without monitoring of the power on button



3.2 Telefast ABE-7CPA13 sub-base

The Telefast sub-base described below is of the "wire to wire" type without electronic components and is specific to the PAY safety modules on PREMIUM.
It is used to simplify the installation and wiring of the safety system on a machine. It transforms a SUB-D connector into a terminal block connector.
The Telefast is not supplied with the module.



3.2-1 Connectors

• The TSX CPP x02 cables for connection to the module form part of the safety system. They must not be modified by the user.

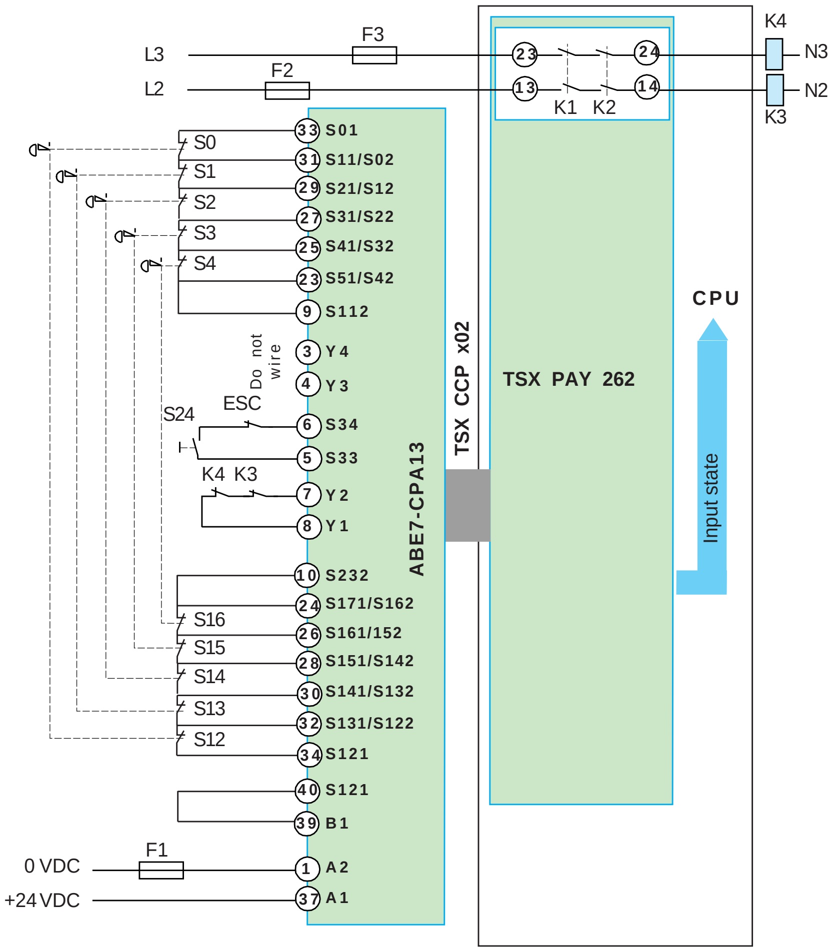
• The maximum capacity of the screw terminals of the Telefast terminal block is :
  - with cable end : 2 x 1mm² wires or 1 x 1.5mm² wire
  - without cable end : 1 x 2.5mm² wire

3.2-2 Marking of the TSX CPP x02 cable

Marker	Telefast screw terminal block	Marker	Telefast screw terminal block
A1	37	S122/S131	32
A2/Y4	1-3	S132/S141	30
B1	39	S142/S151	28
S01	33	S152/S161	26
S02/S11	31	S162/S171	24
S12/S21	29	S172/S181	22
S22/S31	27	S182/S191	20
S32/S41	25	S192/S201	18
S42/S51	23	S202/S211	16
S52/S61	21	S212/S221	14
S62/S71	19	S222/S231	12
S72/S81	17	S232	10-38
S82/S91	15	S33/Y2	5-7
S92/S101	13	S34	6
S102/S111	11	Y1	8
S112	9	Y3	4
S121	34-40	GND	2-35-36

3.3 Wiring example

• Wiring of 5 emergency stops with reset monitoring



Y1-Y2	Feedback loop
S33-S34	Enable operation
Y3-Y4	Selection of reset monitoring mode
S121 to S232	Contact of (+) input channel
S01 to S112	Contact of (-) input channel
A1-A2	External 24VDC power supply
B1	Selection of double or single contact wiring
13-14, 23-24	Safety outputs (common on the PAY 282 module)
F1	1A gl fuse
F2, F3	4A gl fuses

3.4 TSX CPP 301 cable

The cable described in section 5 is not supplied with the module; it is identified by a product reference of the type TSX CPP 301.
The wiring procedure is indicated in the module quick reference guide.
Each strand is marked by a color code, taken from standard EN47100.

• Marking of the TSX CPP 301 cable

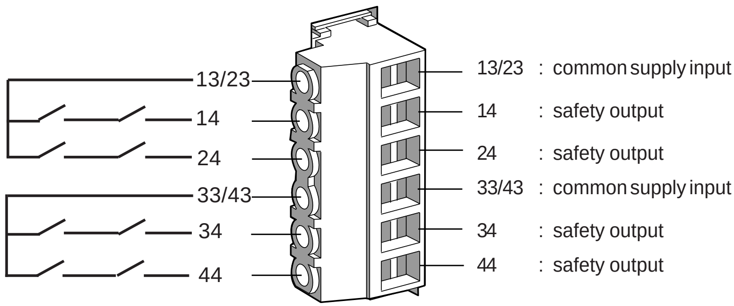
Marker	Color DIN 47100	Marker	Color DIN 47100
A1	Yellow/Brown	S122/S131	White/Blue
A2/Y4	White/Pink	S132/S141	Green
B1	White/Pink	S142/S151	White/Red
S01	Pink/Brown	S152/S161	Gray
S02/S11	Brown	S162/S171	White/Black
S12/S21	Brown/Blue	S172/S181	Blue
S22/S31	Yellow	S182/S191	Gray/Green
S32/S41	Brown/Red	S192/S201	Black
S42/S51	Pink	S202/S211	Pink/Green
S52/S61	Brown/Black	S212/S221	Gray/Pink
S62/S71	Red	S222/S231	Green/Blue
S72/S81	Yellow/Gray	S232	White/Green
S82/S91	Purple	S33/Y2	White/Yellow
S92/S101	Yellow/Pink	S34	Gray/Brown
S102/S111	Red/Blue	Y1	White
S112	Yellow/Blue	Y3	Brown/Green
S121	White	GND	Yellow/Green

The first color indicates the base color of the conductor insulation, and the second indicates the color of the printed band.

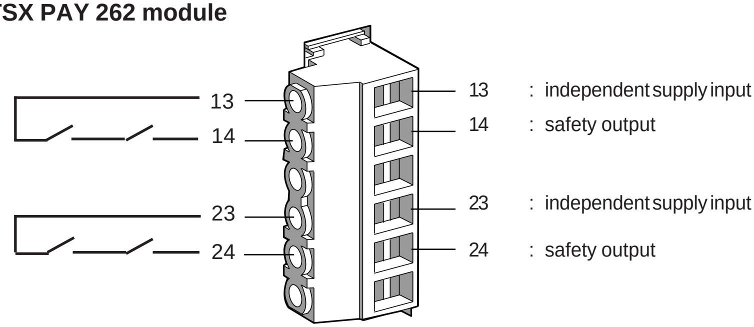
3.5 Safety outputs

For both types of module, the outputs are wired to a 6-pin screw terminal block. The removable part is supplied with the module.

• **TSX PAY 282 module**



• **TSX PAY 262 module**



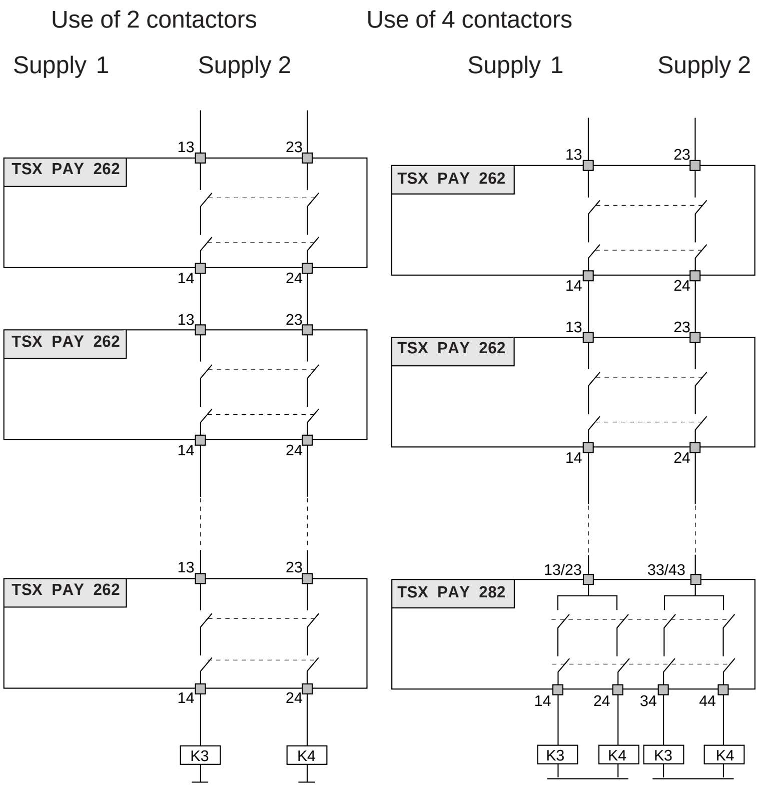
• **Wire cross-section** :

- with cable end : 2 x 1mm² wires or 1 x 1.5mm² wire
- without cable end : 1 x 2.5mm² wire

3.6 Connecting modules in series

For applications with more than 12 single contact or double contact inputs, it is possible to use several TSX PAY modules.

However the safety system is wired, it is necessary to wire :
- the safety module outputs in series
- the same number of S33/S34 reset contacts in series as there are modules (contacts isolated electrically)
- the feedback loop K3/K4 on one of the modules and a bridge between terminals Y1/Y2 on the other modules
- the safety system inputs independently on each module (no connection in series)

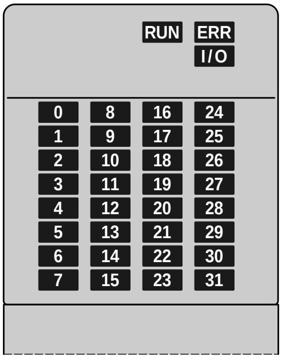


Note :

It is however necessary to note the global voltage drop on the output circuit, due to the resistance of the 0.1Ω contacts of the fault relays, which depends on the current conveyed.
For a max. thermal current of 2.5A, this voltage drop will be 4V with 16 PAY modules connected in series, and 16V with 32 PAY modules connected in series.

4.1 Display LEDs

Like the discrete input modules, the TSX PAY 262 and TSX PAY 282 modules have a 32-LED display block.
Three RUN, ERR and I/O LEDs indicate the module status. LEDs 0 to 27 indicate the safety system status (see section 4.3).



LEDs 0 to 11	State of the ES PB and LS contacts, (+) circuit
LEDs 12 to 23	State of the ES PB and LS contacts, (-) circuit
LED 24	State of reset input
LED 25	State of feedback loop
LED 26	Fault relay control state
LED 27	Presence of a power supply on the safety system, safety system diagnostics
LEDs 28 to 31	Not used

4.2 Language interfaces

4.2-1 Input data

The modules are similar to discrete modules as regards the 28 diagnostic inputs of the emergency stop circuit.

- The states of the ES PB or LS contacts of the emergency stop circuit can be accessed via bits %Ix.0 to %Ix.23, **with the value 0 for an open contact and 1 for a closed contact**.
- The state of the reset input can be accessed via bit %Ix.24, **with the value 0 for an open contact and 1 for a closed contact; if feedback loop %Ix.25 is closed.**
- The state of the feedback loop can be accessed via bit %Ix.25, **with the value 0 for an open loop and 1 for a closed loop**.
- The control state of fault relays K1 and K2 can be accessed via bit %Ix.26, **with the value 0 for de-energized relays and the value 1 for controlled relays**.
- The presence of a power supply to the safety system can be accessed via bit %Ix.27, **with the value 0 for insufficient voltage (<15VDC)**.
- Bits %Ix.28 to %Ix.31 are not used.

4.2-2 Diagnostic data

The table below provides the diagnostic data managed by the PAY and shows the tree structure of the diagnostic data which is user-definable.

ERR module Implicit %Ixy.MOD.ERR	**ERR channel Implicit** %Ixy.i.ERR	**Module status Explicit** Links with %MWxy.MOD.2	**Channel status Explicit** Address	**Meaning**
---	---	%MWxy.MOD.2:x1	%MWxy.i.2:x0	Not significant at %MWxy.i.2:x2
1 (1)	1 (1)	%MWxy.MOD.2:x1 (1)	%MWxy.i.2:x3 (1)	Ext. supplyfault For this module, the absence of the terminal block results in an external supply fault
1	1	%MWxy.MOD.2:x0	%MWxy.i.2:x4	Int. fault : Module out of order
---	---	---	%MWxy.i.2:x5 at %MWxy.i.2:x15	Not significant

Note : (1) The feedback of this fault is associated with the parameter definition.

4.3 Display block diagnostics

4.3-1 Module status

RUN LED	ERR LED	I/O LED	Meaning
Off	Off	Off	Rack powered-off or module fault
Off	Off	On	External power supply fault
Off	On	Off	Module fault
Off	On	On	Module fault and external power supply
On	Off	Off	Module operating : no int./ext. fault OR Module not recognized if external power supply is absent
On	Off	On	External fault = 24VDC ext. power supply fault (<19VDC)
On	On	Off	Internal fault
On	On	On	General fault (short-circuit, etc)

4.3-2 Safety system status

LEDs	State	Meaning
0 to 23	Off On	ES PB or LS contact open ES PB or LS contact closed
24	Off On	Reset input open or feedback loop open Reset input closed AND feedback loop closed
25	Off On	Feedback loop open Feedback loop closed
26	Off On	Safety system relays K1 and K2 not controlled Safety system relays K1 and K2 controlled
27	Off On	Safety system power supply fault or fault creating a short-circuit between the safety system channels Safety system power supply present
28 to 31	Off	Not used

An external power supply fault causes the I/O LED of the module to light up. The LEDs of the display block always display the state of the channels, even if they change to an error state (all equal to 0) in PL7.

It is possible to define parameters for monitoring the external power supply. In this case, the LEDs of the display block reflect the real state of the Emergency Stops.

4.4 Maintenance table

FAULTS	POSSIBLE CAUSES	CHECK
Inappropriate opening of the safety outputs	No external power supply or fuse F1 burnt out	Read %Ix.MOD.ERR = external fault Display I/O LED on PAY module Voltage between terminals A1-A2 >19.2VDC If %Ix.27=0, then SC on safety system
	ES PB or LS open	Read %Ix.0 to %Ix.23 Check the consistency of the state of the contacts
	B1 disconnected	Check B1 is connected to S232 (single cont.) Check B1 is connected to S121 (double cont.)
	Relays no longer controlled Fuse F2 destroyed	Read %Ix.26 Check the state and characteristics of F2
Cannot start up	No external power supply or fuse F1 destroyed	Read %Ix.MOD.ERR = external fault Display I/O LED on PAY module Voltage between terminals A1-A2 >19.2VDC
	Emergency stop still open	Read %Ix.0 to %Ix.23 Check the consistency of the state of the contacts
	Conflict on the inputs (wires cut or faulty ES PB), use of double contacts : self-test	Read %Ix.0 to %Ix.23 Check the consistency of the state of the contacts
	No PB action with feedback loop closed	%Ix.24=%Ix.25=1 when PB pressed Check PB contacts Check the state of shunt Y3-Y4
	Feedback loop still open No control possible	Read %Ix.25 Check contacts on the auxiliary relays Read %Ix.26 when PB is pressed
	Fuse F2 destroyed	Check the state and characteristics of F2
	Output power supply not working	Check the reset wiring
Automatic start-up	PB continuously enabled with loop closed	%Ix.24=%Ix.25=1 without PB being pressed. Check PB contacts
Incorrect input data	Voltage drop on the cables	Voltage between terminals S01-S112 and S121-S232 > 18.2VDC all ES PBs closed

If the fault persists once the wiring has been checked, change the module.

To avoid errors when replacing a product, it is advisable to mark the slot on the module label on the front panel and on the label of the TSX CPP... cable. The specific red color of the front panel of PAY modules helps to avoid errors during PLC maintenance operations.

note : SC : Short-circuit
Cont. : Contact
ES PB : Emergency Stop Pushbutton

4.5 Test procedures

Before installation or during a periodic check (cyclic test), it may be useful to test the module and its functions. This procedure may be as follows.

4.5-1 External power supply

The module integrates an external power supply voltage check. A voltage less than 19VDC causes a fault on the module (%Ix.@MOD.ERR = 1). The input bits are no longer significant (%Ix.0 to 31 = 0).

The power supply fault is signaled as follows :

- The I/O indicator lamp lights up, as does that of the CPU
- Module fault bit %Ix.@MOD.ERR changes to 1
- Module fault bit %MWx.MOD.2:X9 changes to 1
- Channel fault bits %Ix.i.ERR all change to 1

In this state, the safety system remains operational : a voltage drop of up to 10VDC will still set the module to the safety position by opening the safety outputs.

The module is protected against polarity inversions and has a current limit set at 750mA.

If the external power supply check is not activated (parameter setting), power supply faults are not indicated and the bits represent the process.

4.5-2 Emergency stop inputs

With the outputs closed, interrogate all the emergency stops one by one to check that the outputs change to the safety position : %Ix.26 should change from 1 to 0.
Check the triggering of the safety system and the consistency of the diagnostic data.

4.5-3 Feedback loop input

The feedback loop is used to indicate to the module the real image of the safety outputs. It is open when the outputs are active. The device used is a relay with guided contacts for controlling the outputs.

Loop open Bit %Ix.25 = 0 Loop closed Bit %Ix.25 = 1

Check the state of the feedback loop depending on the output control bit.

4.5-4 Activation of the Reset input

The activation of the reset input between terminals S33 and S34 makes it possible to reset the system when no ES has been interrogated AND if the feedback loop is closed; the device used is a pushbutton (activation on a state or a falling edge).
It is only possible to read the state of the reset input if the feedback loop is also closed.

Contact open Bit %Ix.24 = 0 Contact closed Bit %Ix.24 = 1 and Bit %Ix.25 = 1

Depending on the reset option chosen, check correct functioning and the diagnostic indicators.

4.5-5 State of the output control bit

Depending on the module, TSX PAY 262 or TSX PAY 282, two or four outputs are available between terminals 13-14, 23-24, 33-34, 43-44; they are used to control the contactors or preactuators. This part is isolated from the control (reset) part.
When the reset conditions are met (feedback loop closed AND activation of the reset input), the outputs are controlled.

Outputs off Bit %Ix.26 = 0 Outputs active Bit %Ix.26 = 1

5.1 Characteristics of TSX PAY modules

• General characteristics

Safety functions emergency stop and LS monitoring	Yes (from 1 to 12 single or double contacts)
checking of moving guards	Yes (desynchronism > 400ms)
monitoring of pressure sensitive mats	No
two-handed control	No
Category according to EN 954-1	4
Module external power supply voltage	terminals A1 and A2 24VDC
residual ripple	5%
voltage limits	-15% +20%
protection of external supply fuse F1 (according to IEC 947-5-1)	< 1A gl
max. consumption	200mA
monitoring threshold	< 19VDC
max. current inrush	0.5A / 5ms
safety circuit voltage 24VDC	
module protection	Electronic internal fuse > 250mA and < 1A
isolation	Overvoltage category II (2kV), degree of pollution 2
PLC power supply current consumption on internal 5V	< 150mA
Power power dissipated in the module	< 5W
Display	28 LEDs for discrete inputs + Diag 3 module status LEDs
Mounting	In Premium rack
Dimensions H x L x D	150 x 36 x 120 mm
Weight	PAY 262 = 0.43 Kg PAY 282 = 0.49 Kg
Module MTBF	3×10^{-6} failures / hour (relay board = 0.5×10^{-6}, mother board = 2.4×10^{-6})
Connection safety system safety outputs	 44-pin HD SUB-D 6-pin screw terminal block
Max. length of safety system for module external supply = 24V	depending on the wire resistance (see section 6.3)

• Input characteristics

Inputs	
number of safety channels	12 single or double contact ES PBs
reset / power on button	Yes (S33-S34)
selection of single or double ES PBs	Yes = external shunt (B1)
feedback loop	Yes (Y1-Y2)
monitoring of reset input	Yes = external shunt (Y3-Y4)
inrush current	0.5A / 1ms
isolation Inputs / ground	500 Vrms 50/60Hz - 1 min

• Output characteristics

Safety outputs		
voltage reference		Volt-free
number and type of circuits		2F (AgCdo, 2µ gold plated) with independent power supply for the TSX PAY 262 2*2F (AgCdo, 2µ gold plated) with independent power supply for the TSX PAY 282
DIN EN 60947-5-1 breaking capacity		AC15 / C300 : Inrush 1800VA, Holding 180VA DC13 : 24V / 2.5A L/R =100ms
voltage		19 ... 250 VAC / 17 ... 127 VDC
protection of outputs by fuse (according to DIN VDE 0660 part 200 and IEC 947-5-1)		4 A gl
max. thermal current Ithe		2.5A
minimum current and voltage		30mA and 24VDC
response time on ES interrogation		< 10 ms
isolation	Output / ground Test voltage	Insulation voltage 300V according to VDE0110 / part 1 2000Vrms 50/60 Hz - 1 min
isolation of safety system / Ground		300Vrms
Mechanical life		10^6 operations
Electrical life		1 x 10^6 operations (depends on the power)

The module is capable of switching low loads (24 V / 30 mA). This is possible provided that the contact has never previously switched any high loads, as this may have impaired the gold plating on the contact.

• Conditions of use

Operating temperature	0...+60°C for the PLC -10...+60°C for the safety function
Humidity without condensation	5 to 95%
Storage temperature	-25 to 70°C
Isolation resistance	> 10MW at 500VDC
Dielectric strength on SUB-D acc. to IEC1131	500Vrms, 50/60Hz, 1min
Operating altitude	0...2000m
Degrees of protection according to IP IEC 529 terminals / connection box installation area	 IP20 IP54
Maximum capacity of screw terminals	2 x 1mm² wires with cable end

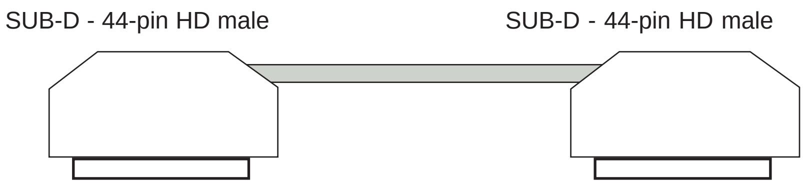
• Terminal marking (according to DIN EN 50005, DIN EN 50042)

Module external power supply	A1 - A2
Contacts on the (+) circuit	S01-S02, S11-S12, S21-S22, S31-S32, S51-S52, S61-S62, S71-S72, S81-S82, S91-S92, S101-S102, S112
Contacts on the (-) circuit	S121-S122, S131-S132, S141-S142, S152, S161-S162, S171-S172, S181-S182, S191-S192, S201-S202, S211-S212, S221-S222, S231-S232
Selection of single or double contacts	B1
Reset	S33 - S34
Feedback loop	Y1 - Y2
Monitoring of reset input	Y3 - Y4
Safety outputs TSX PAY 262 module, independent power supply: TSX PAY 282 module, common power supply:	 13 - 14, 23 - 24 13/23 - 14, 13/23 - 24, 33/43 - 34, 33/43 - 44

5.2 Characteristics of TSX CPP x02 and TSX CPP 301 cables

- **TSX CPP x02 cable**

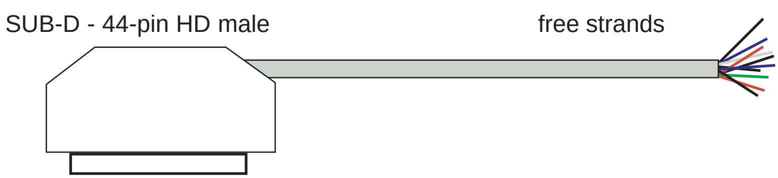
SUB-D / SUB-D version



Cable	Unshielded multiconductors (32 conductors used) According to EN47100 (conductor color)
Connector	SUB-D 44-pin HD male, SUB-D 44-pin HD male The connector cannot be removed
Lengths	1m, 2m and 3m

- **TSX CPP 301 cable**

SUB-D / free strands version



Cable	Unshielded multiconductors (32 conductors used) Gauge 22, 7 strands per conductor According to EN47100 (conductor color)
Connector side	SUB-D 44-pin HD male The connector cannot be removed
Preparation of the ends	Semi-stripped (the sheath has been cut but the conductor is not stripped)
Length	3m

5.3 Standards

TSX PAY modules have been designed to meet the requirements of European and international standards concerning electronic industrial control system equipment and safety circuits.

Specific PLC requirements	EN61131-2 (IEC 1131-2), CSA 22-2 no.142, UL508
Electrical qualities	UL746L, UL94
Electrical machine equipment	EN60204-1 (IEC204-1)
Emergency stop equipment	EN418
Machine safety - Parts of the control system concerned with safety	EN954-1 PR EN954-2
	EN953
	EN1088
	DIN VDE 0110
	DIN VDE 0660
	EN60947-5-1
	VDE 57100
	NF C63-850
	IEC 664

6.1 General wiring rules and recommendations

The safety system should be wired in accordance with the specifications given in section 15 of standard EN60204-1. This section describes the regulations concerning wiring and the mechanical protection of cables.

The entire safety system, the ES PB or LS, the TSX PAY modules, the protective fuses and the auxiliary relays must be housed in an enclosure providing IP54 protection minimum as specified in standard EN954-1.

The modules can be mounted / removed with the PLC energized (without the risk of damaging the module or disturbing the PLC. It is essential to disconnect the module cable in order to deactivate the safety outputs before removing the output terminal block).

6.2 Cable length and dimensions

The length of the safety system wires can cause a voltage drop in the power supply which depends on the circulating current. This voltage drop results from the sum of the currents circulating in the 0Vdc return path of the electrical circuit. A common practice is to double or triple the 0Vdc wires.
To ensure the correct functioning of the safety system (resetting of the relays) and the correct reading of the diagnostic data, it is important that the voltage measured between terminals A1 and A2 is greater than 19.2V.

• Cross-section of wires with the Telefast ABE-7CPA13 sub-base

Each terminal can receive bare wires or wires fitted with cable ends, or open or closed tag connectors.
The capacity of each terminal is :

- minimum : 1 x 0.28mm wire^2 without cable end
- maximum : 2 x 1mm wires^2 or 1 x 1.5mm wire^2 with cable end

The maximum cross-section of the wires on the terminal block is : 1 x 2.5mm^2 wire without cable end.

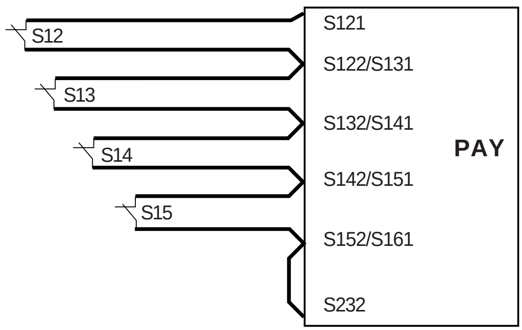
• Calculation of the maximum cable length

The resistance of each safety system (plus circuit and minus circuit) must not exceed 75 Ohms. The resistance can be calculated from the length and cross-section of the cable :

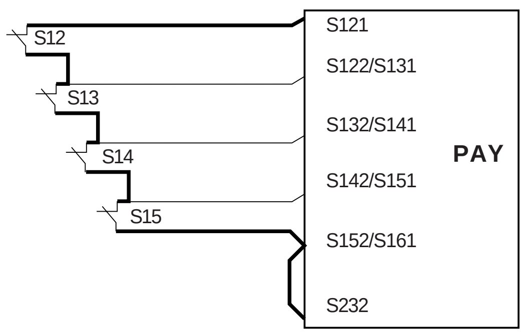
$R = \rho\, l / S$ where ρ = 1.78 for copper
l = the length in meters
S = the cross-section in mm²

It is possible for the wiring to allow a greater distance between the ES PB or LS and the module :

Conventional wiring :



Wiring with optimized length :



Length to be taken into account when calculating the resistance

6.3 Ground connection

The module does not have a ground connection terminal on the front panel. Depending on the TSX CPP cable used, the 0Vdc can be connected to ground (see EN60204-1) via the intermediate connection block or directly on the Telefast ABE-CPA13 sub-base.

6.4 Protection of the safety system

Faults within the PAY safety modules can be propagated outside the module, and particularly to the external power supply used : module internal short-circuits can cause an avalanche of the supply voltage or a malfunction if the latter is not protected. For this reason, a 1A fast-blow fuse (gL) is placed in the control part of the relays, as the maximum power consumption is 200mA :**this fuse, known as F1, is an active element of the safety system**.

The module also has a current-limiting device set at 750mA in order to detect short-circuits between channels on the ES PB or LS : in this case, the external power supply is protected, with bits Ix.27=0 indicating a safety system fault.

To ensure the safety function, the following must be used :

- As inputs : ES PB or LS with double contacts
  N/C contacts of the auxiliary relays with guided contacts in the feedback loop,
- As outputs : two or four auxiliary relays with guided contacts
  an F2 fuse for protecting the 4A gl outputs
- On the external power supply of the module : an F1 1A gl protective fuse

6.5 Protection of the safety outputs

The output voltages may be up to 230VAC or 127VDC.

The outputs are not protected inside the module; GMOV type protections (for a continuous load), or an RC cell (for an AC load) are placed directly at the terminals of the load used. These protections must be adapted to the load.

The use of auxiliary relays with guided contacts and the wiring of the feedback loop thus makes it possible to detect a short-circuit on the safety outputs.

A 4A fast-blow fuse (gL) is placed on the auxiliary supply circuit to protect the fault relay contacts of the module and the connected loads : this is identical to the PREVENTA modules.

The F2 fuse placed on the safety outputs provides protection against short-circuits or overloads. This protection prevents the fusing of the fault relay contacts internal to the TSX PAY modules.

C

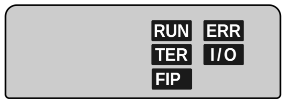
1.1 Introduction

Every module has indicator lights which assist setup, operation, diagnostics and maintenance of the PLC :

- display the PLC status on the processor module
- display the status of each module (discrete I/O, application-specific module, power supply)
- display the channels for each discrete I/O module and some of the application-specific modules
- I/O channel diagnostics

1.2 Display of PLC status

The 5 indicator lamps RUN, TER, I/O, ERR, FIP situated on the processor provide information, depending on their state (off, flashing or on), on the PLC operating mode :



RUN : PLC Run/Stop
ERR : Processor or application fault
I/O : I/O fault (channel or module)
TER : Traffic on the terminal port
FIP: Traffic on the FIPIO bus (TSX/PMX/PCX 57 ●52 processors)

Status / Indicator	On ●	Flashing ⊗	Off ○
RUN (green)	PLC running normally	PLC in Stop or PLC faulty, blocking software (1)	PLC not configured : application absent, invalid or incompatible with the type of processor PLC : processor or system fault
ERR (red)	PLC error : processor fault or system fault	•PLC not configured : application absent, invalid or incompatible with the type of processor •PLC faulty, blocking software •Memory card battery fault. •Fault on X Bus	No fault
I/O (Red)	I/O fault from a module, channel or configuration fault.	Fault on X Bus : (the X bus fault is detected on simultaneous flashing of I/O and ERR indicator lamps)	No fault
TER (Yellow)	—	Exchange in progress on terminal port	No exchanges in progress
FIP (Yellow)	—	FIPIO Bus active, Exchange in progress	No exchanges in progress

(1) For more information on blocking or non-blocking faults, refer to section 3.1

1.3 Display of module status

1.3-1 Discrete I/O modules

- Module status indicator lamps : (RUN, ERR, I/O)

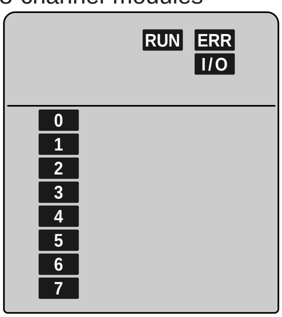
  Three or four indicator lamps situated on each module provide information, depending on their state (off, flashing or on), about the module operating mode :
  - RUN indicator : signals the module operating status,
  - ERR indicator : signals an internal module fault,
  - I/O indicator : signals an external fault,
  - indicator + 32 : signals the display of channels 32 to 63 on modules with 64 channels.

- Channel status indicator lamps : (0 to i)
  Depending on the type of module, 8, 16, 28 or 32 indicator lamps display and provide diagnostics on the status of each module channel.

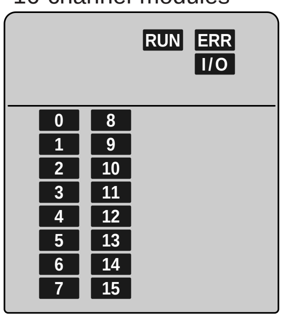
Status / Indicator	On ●	Flashing ⊗	Off ○
RUN	Normal operation	—	Module faulty or powered off
ERR	Internal fault : module failure	Communication fault if RUN indicator lamp is on Module not configured if RUN indicator lamp off (1)	No module fault
I/O	External fault : overload, short-circuit, sensor/preactuator voltage fault	Terminal block fault	No external fault
0...i	Channel at state 1	Channel faulty due to overload or short-circuit	Channel at state 0

Note : during the self-tests, the RUN, ERR, and I/0 indicator lamps flash.

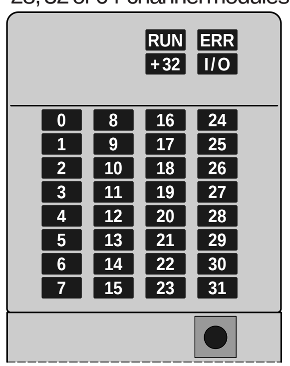
8-channel modules



16-channel modules



28, 32 or 64-channel modules



(2)

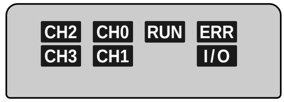
(1) This state is available on module versions ≥ V2.0.
(2) Pushbutton enabling the display of channels 32 to 63 on modules with 64 channels

1.3-2 Analog and application-specific modules

Like discrete I/O modules, analog and application-specific modules (counter, axis control, etc) have indicator lamps which display the module status and channel status (on certain modules).

- Module status indicator lamps (RUN, ERR, I/O)

  Three indicator lamps situated on each module give information, depending on their status (indicator off, flashing or on), about the module operating mode :
  - RUN indicator : signals the module operating status,
  - ERR indicator : signals an internal module fault,
  - I/O indicator : signals an external fault,



- Channel status indicator lamps (CH•)
  Certain application-specific modules have 1, 2 or 4 indicator lamps which display and provide diagnostics for the status of each module channel.

TSX AEY / TSX ASY analog modules and TSX ISP Y100 weighing modules

Status / Indicator	On ●	Flashing ⊗	Off ○
RUN	Normal operation	—	Module faulty or powered off
ERR	Internal fault module failure	Communication fault on TSX ASY analog output module and TSX ISP Y100 weighing module	No module fault
I/O	External fault • range overshoot • sensor link fault (TSX AEY 414 module)	Terminal block fault	No external fault
CHi	No channel status indicator lamps		

TSX CTY 2A/4A/2C counter modules

Status / Indicator	On ●	Flashing ⊗	Off ○
RUN	Normal operation	—	Module faulty or powered off
ERR	Internal fault module failure	Communication fault	No module fault
I/O	External fault • wiring fault • encoder supply fault • measurement overrun Application fault (1).	—	No external fault
CH• **TSX CTY 2A :** CH0 and CH1 **TSX CTY 4A :** CH0, CH1, CH2, CH3	Channel is operational	Channel is not operating correctly due to : • an internal fault, (module absent or failed), • an external fault, (application fault), • communication fault.	Channel is not Iin service, No configuration or incorrect configuration.

TSX CAY 21/22/33/41/42 axis control modules

Status / Indicator	On ●	Flashing ⊗	Off ○
RUN	Normal operation	—	Module faulty or powered off
ERR	Internal fault module failure	Communication fault	No module fault
I/O	External fault • wiring fault, • encoder/24 V supply fault, • absolute encoder fault, • speed drive fault, Application fault (1).	—	No external fault
CH• **TSX CAY 21/22 :** CH0 and CH1 **TSX CAY 21 :** CH0, CH1, CH2 **TSX CAY 41/42 :** CH0, CH1, CH2, CH3	Channel is operational	Channel is not operating correctly due to : • an internal fault, (module absent or failed), • an external fault, (application fault), • communication fault.	Channel is not operational, No configuration or incorrect configuration.

(1) configuration, adjustment, OF control problems

C

TSX CTY 11/21 stepper motor control module

Status / Indicator	On ●	Flashing ⊗	Off ○
RUN	Normal operation	—	Module faulty or powered off
ERR	Internal fault module failure	Communication fault	No module fault
I/O	External fault • wiring fault • 24 V supply fault • transporter fault, Application fault (1)	—	No external fault
CH• **TSX CFY 11 :** CH0 **TSX CFY 21 :** CH0, CH1	Channel is operational	Channel is not operating correctly due to : • an internal fault, (module absent or failed), • an external fault, (application fault), • communication fault.	Channel is not operational, No configuration or incorrect configuration.

TSX SCY 21601 communication module

Status / Indicator	On ●	Flashing ⊗	Off ○
RUN	Normal operation	—	Module faulty or powered off
ERR	Internal fault module failure	Communication fault with the connected device, configuration fault	No module fault
CH0	Channel is operational	Channel is not operating correctly due to : • an internal fault, (module absent or failed), • an external fault, (application fault) • communication fault.	Channel is not operational

(1) configuration, adjustment, OF control problems

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TSX SAY 100 AS-i bus interface module

Status / Indicator	On ●	Flashing ⊗	Off ○
RUN (Green)	Normal operation	Module self-tests (1)	Module faulty , or module powered off
ERR (Red)	Serious internal fault, module failure	Module self-tests (1) Fault : system OK but • application program faulty • fault on AS-i bus	No internal fault
COM (Yellow)	—	Module self-tests (1) Communication on the AS-i bus	No communication on the AS-i bus
I/0 (Red)	I/O fault	Module self-tests (1)	Module in normal operation

(1) 4 indicator lamps flashing simultaneously during self-tests when module is powered up.

TSX ISP Y100 weighing module

Status / Indicator	On ●	Flashing ⊗	Off ○
RUN	Normal operation		Module faulty or powered off
ERR	Internal fault, module failure	Communication fault, Application absent, invalid or faulty	No fault
I/O	External faults : • Overload or underload fault during calibration, • Range overshoot fault, • Measurement fault, • Module sealed (configuration refused)		No fault
CH	No channel status indicator lamp		

1.3-3 Power supply modules

Each power supply module has a display block comprising :

- 3 indicator lamps (OK, BAT, 24V) on TSX PSY 2600/5500/8500 power supply modules for an AC supply,
- 2 indicator lamps (OK, BAT) on TSX PSY 1610/3610/5520 power supply modules for a DC supply.

Status / Indicator	On ●	Flashing ⊗	Off ○
OK	Normal operation	—	Module powered off or output voltage outside monitoring range
BAT	Battery fault : battery absent, spent, incorrectly fitted, incompatible.	—	Normal operation
24V (only on modules for ∼ supply)	Normal operation	—	24V sensor voltage outside monitoring range.

C

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2.1 Checking discrete I/O connections

- **Principle**
  This check consists of ensuring that :
  - data originating from the sensor is taken into account by the corresponding inputs and the processor,
  - commands from the processor are taken into account by the outputs and transmitted to the corresponding preactuators.

⚠ **Activated outputs may cause machine movements. As a result, it is advisable to disconnect the power part before carrying out this check :**
- **remove the motor control power fuses,**
- **disconnect the hydraulic and pneumatic power generators**
- **then power up the PLC equipped with its discrete I/O modules**

- **Checking input connections without a terminal**
  This check is carried out by activating each sensor and checking that the corresponding input indicator lamp changes state. If it does not, check the wiring and that the sensor is operating normally.

- **Checking I/O connections using a terminal**

  The use of a terminal enables I/O connections to be checked more thoroughly. To this end, an application (1) should first be loaded to the PLC from a programming terminal, even if it contains only the I/O configuration.

  This check can be carried out with the PLC in RUN :
  - either from an "ADJUST 117" adjustment terminal
  - or from an FTX 417/507 terminal or PC equipped with PL7 Junior or PL7 Pro software which gives access to the debug functions.

  Note :
  This check can also be carried out with the complete application loaded in the memory. In this case, inhibit the MAST, FAST and event tasks to prevent the program from being processed, by setting system bits %S30, %S31, %S38 to 0.

  - **Checking inputs**:
    1 - activate each sensor and check that the corresponding input indicator changes state,
    2 - check on the terminal screen that the corresponding input bit (%I•) also changes state.
  - **Checking outputs**:
    from the terminal, set each corresponding output bit (%Q•) to 1 then to 0 and check that the corresponding output indicator lamp switches on and off and that the associated preactuator is activated and deactivated.

(1) no module must be declared in FAST task if the application is empty.

2.2 PLC and module states on initial power-up

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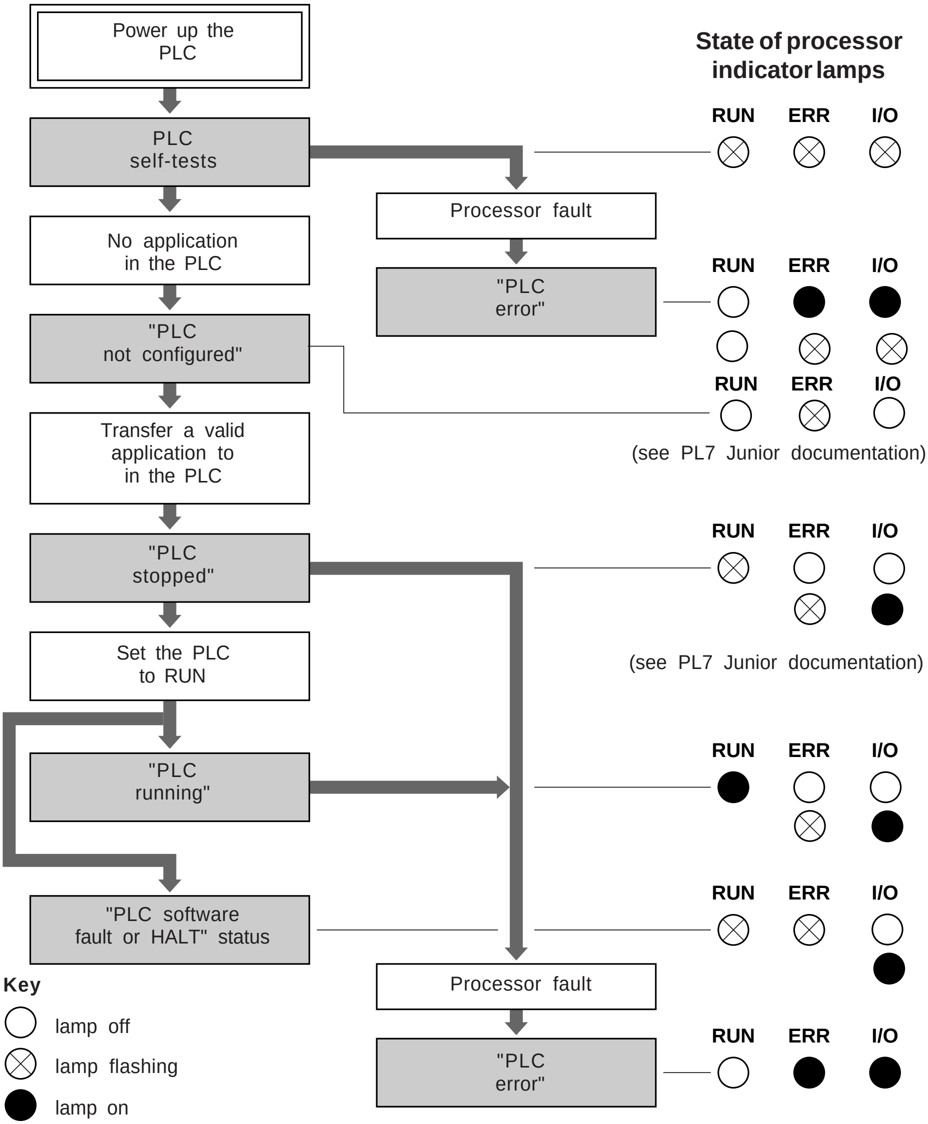
PLC status : on power-up, the processor executes its self-tests then waits for an application transfer. The various processor states are indicated on the display block by the RUN, ERR, I/O, etc indicator lamps. The following diagram shows the procedure to be followed on initial start-up, depending on the state of the indicator lamps.



Description of the PLC states

PLC self-tests

The PLC processor executes its self-tests internally. The PLC does not control the process and cannot communicate via its terminal port (or networks). This state is signaled by all 3 indicator lamps RUN, ERR and I/O flashing.

"PLC error"

The processor is stopped after :

- a hardware failure or system fault. The process is no longer controlled, communication is impossible and only a cold restart is possible (press the processor RESET button, move the memory card handle, etc). This state is signaled when the RUN indicator lamp is off and the ERR and I/O indicator lamps are on.
- a wiring fault on X Bus :
  - the fault is detected by the processor during the self-tests if a fault occurs during start-up. It is signaled when the RUN indicator lamp is off and the ERR and I/O indicator lamps are flashing. Be prepared for a break in communication if the wiring fault persists.
  - if a fault occurs during program execution (a cable break, for example), it will be detected as soon as it occurs if the application uses the X Bus I/O. In this case, the processor will trigger a switch to "processor error" state. Be prepared for a break in communication if the wiring fault persists. To identify if the fault is a processor fault or an X Bus wiring fault, press the RESET button on the processor. If the fault is an X Bus wiring fault, it will be detected during the self-tests and indicated by the indicator lamps : RUN off, ERR and I/O flashing.

"PLC not configured"

The processor has started but does not contain any valid applications. It does not control the process but can communicate via its terminal port (or networks). This state is signaled when the RUN indicator lamp is off and the ERR indicator lamp is flashing.

"PLC software fault or HALT"

The application has changed to "watchdog timer overrun" or performed an unresolved JUMP, a HALT instruction or a blocking fault has appeared. This state is signaled when the RUN and ERR indicator lamps are flashing and, in the case of an I/O fault, the I/O indicator lamp is on.

"PLC stopped"

The PLC has a valid application which is stopped (the application is in an initial state when first powered up, tasks are stopped at the end of a cycle). The process commands are in fallback state. This state is signaled by the RUN indicator lamp flashing. I/O faults : I/O indicator lamp on, battery fault on PCMCIA memory card : ERR indicator lamp flashing.

"PLC running"

The application operates normally in order to control the process. An application non-blocking fault (I/O fault or software fault) may also be present. This state is signaled when the RUN indicator lamp is on.
I/O faults : I/O indicator lamp on.
Battery fault on PCMCIA memory card :ERR indicator lamp flashing.

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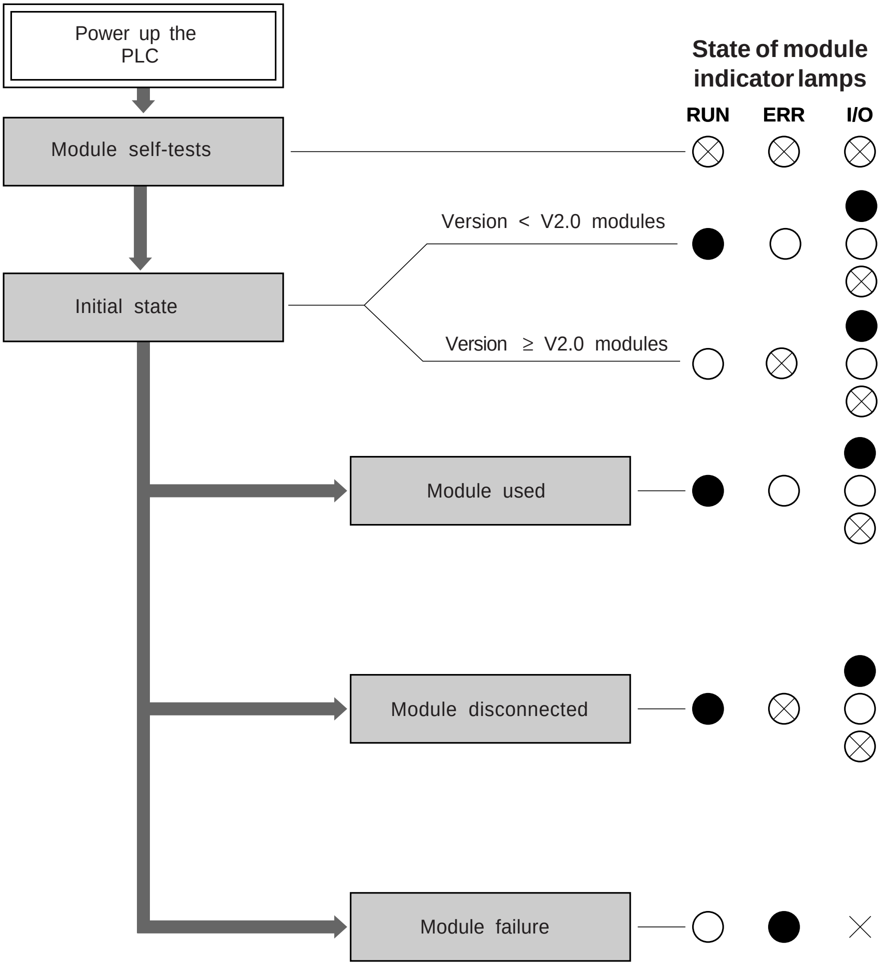
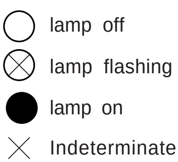
Module states : During the module power-up phase, modules can be in one of the following five states :



Key



Description of module states

Self-tests

On power-up, or reinitialization of the processor, the module runs its self-tests. This state is signaled by the RUN, ERR and I/O indicator lamps flashing.
Output state : safety value (state 0 for discrete I/O).

Initial state :

This is the normal state of the module after the self-test phase if it is not controlled by the application. Depending on the module software version, this state is signaled when :

- the RUN indicator lamp is on, the ERR indicator lamp is off and the I/O indicator lamp is on, flashing or off, depending on the presence or not of an I/O fault for version < V2.0 modules,
- the RUN indicator lamp is off, the ERR indicator lamp is flashing and the I/O indicator lamp is on, flashing or off, depending on the presence or not of an I/O fault for version ≥ V2.0 modules,

Output state : safety value (state 0 for discrete I/O).

Module used

The module is used in the application, and its channels are controlled by control tasks (MAST, FAST, event). This state is signaled when the RUN indicator lamp is on, the ERR indicator lamp is off and the I/O indicator lamp is on, flashing or off depending on the presence or not of an I/O fault.
The state of the outputs depends on the state of the task which controls them :

- state 0 if the controlling task has not been started,
- state 0 or 1 (value given by the application if the controlling task is in RUN),
- state at fallback value (configurable) if the controlling task is stopped in STOP, on a breakpoint (BKPT), on a HALT instruction or if system bit %S9=1.

Module disconnected

No more communication between the module and the processor (processor error or powered off, rack disconnected, etc). This state is signaled when the RUN indicator lamp is on, the ERR indicator lamp is flashing and the I/O indicator lamp is on, flashing or off depending on the presence or not of an I/O fault.
This state is only controlled by the modules controlling the outputs. The other modules remain in the "module used" state in the event of a communication stop (discrete input modules for example).

Module failure

The module has an internal fault and has to be replaced. This state is signaled when the RUN indicator lamp is off, when the ERR indicator lamp is on and the I/O indicator lamp is in any state.

3.1 Troubleshooting using the processor status indicator lamps

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The status indicator lamps situated on the processor inform the user about the PLC operating mode and also about any possible faults. Faults detected by the PLC concern :
- circuits in the PLC and/or its modules : internal faults,
- the process controlled by the PLC or the wiring to the process : external faults,
- the operation of the application executed by the PLC : internal or external faults.

Faults are detected during start-up (self-tests) or during operation (this is the case for the majority of hardware faults), during exchanges with the modules or upon the execution of a program instruction.
Certain "serious" faults require a PLC restart, with others, the user uses his discretion to decide on appropriate action, depending on the level of application required.
3 types of faults can be identified : non-blocking, blocking or processor faults.

3.1-1 Non-blocking faults

This is an anomaly caused by an I/O fault on the X Bus, the FIPIO bus or by the execution of an instruction. It may be processed by the user program and does not change the PLC status.

- **Non-blocking faults linked to the I/O**
  A non-blocking fault linked to the I/O is signaled by :
  - the I/O status indicator lamp of the processor being on,
  - the I/O status indicator lamps of the faulty modules being on, (on X Bus and FIPIO bus)
  - the fault bits and words associated with the channel :
    I/O on X Bus :
    %Ixy.i.ERR bit = 1 indicates faulty channel (implicit exchanges),
    %MWxy.i.2 words indicate the type of channel faults (explicit exchanges),
    I/O on FIPIO bus :
    %I\p.2.c\m.v.ERR bit = 1 indicates faulty channel (implicit exchanges),
    %MW\p.2.c\m.v.2 words indicate the type of channel faults (explicit exchanges),
  - the fault bits and words associated with the module :
    Module on X Bus :
    %Ixy.MOD.ERR bit = 1 indicates a module fault (implicit exchanges),
    %MWxy.MOD.2 words indicate the type of module fault (explicit exchanges),
    Module on FIPIO bus :
    %I\p.2.c\0.MOD.ERR bit = 1 indicates a module fault (implicit exchanges),
    %MW\p.2.c\0.MOD.2 words indicate the type of module fault (explicit exchanges),
  - system bits
    %S10 : I/O fault (on X Bus and on FIPIO bus),
    %S16 : I/O fault (on X Bus and FIPIO bus) in the task in progress
    %S40 to %S47 : I/O fault in racks with addresses 0 to 7 on X bus (see section 3.2).

Note : the use of these bits and words is explained in the TLX DS 57 PL7 30E application-specific manuals.

Status indicator lamps RUN	ERR	I/O	System bits	Faults
×	×	●	%S10 %S16 %S40 to %S47	I/O faults : channel supply fault, channel tripped, module not conforming to configuration, out of order, module supply fault I/O fault in a task Rack I/O fault (%S40: rack 0,.... %S47: rack 7)

Key ● Indicator lamp on × Indeterminate state

- **Non-blocking faults linked to program execution**
  A non-blocking fault linked to the program execution is signaled by setting to 1 any of the system bits %S15, %S18 and %S20.
  Testing and setting these system bits to 0 is the responsibility of the user.

Status indicator lamps RUN	ERR	I/O	System bits	Faults
●	×	×	%S15 = 1 %S18 = 1 %S20 = 1	Character string manipulation error. Capacity overflow, error on floating point or division by 0. Index overflow

Note : The program diagnostics function, which can be accessed via PL7 Junior/PL7 Pro software enables certain non-blocking faults linked to the execution of the program to be rendered blocking. The type of fault is indicated in system word %SW 125.

3.1-2 Blocking faults

These faults, caused by the application program, prevent the program from continuing to operate, but do not cause a system fault. When such a fault appears, the application stops immediately and changes to the HALT state (all tasks are stopped on the current instruction).

There are 2 ways of restarting the application :
- via the INIT command using PL7 Junior or PL7 Pro software,
- via the processor RESET pushbutton.

The application is then at its initial state : the data has its initial values, tasks are stopped at the end of the scan, the input image bits are updated and the outputs are set to fallback position ; the RUN command enables the application to be restarted.

A non-blocking fault is indicated by status indicator lamps (ERR and RUN) flashing and, depending on the type of fault, by the setting to 1 of one or both system bits %S11 and %S26. The type of fault is indicated in system word %SW 125.

Status indicator lamps			System bits	Faults
RUN	**ERR**	**I/O**		
⊗	⊗	×	%S11 = 1	Watchdog overrun
			%S26 = 1	Overrun of grafcet activity table Unresolved Grafcet step
				Execution of HALT instruction
				Execution of unresolved JUMP

Key ● Indicator lamp on ⊗ Indicator lamp flashing × Indeterminate state

Diagnostic tools under PL7 Junior/PL7 Pro

The program diagnostics tool for PL7 Junior/PL7 Pro software shows "in plain language" the cause and origin of the change to a PLC blocking fault : watchdog overrun, character string fault, etc.

The type of fault is indicated in system word %SW 125.

Fault type	Meaning	System bits	System word %SW125
Blocking	Watchdog overrun	%S11 = 1	H'DEB0'
	Grafcet activity table overrun	%S26 = 1	H'DEF7'
	Unresolved Grafcet step	% S26 = 1	H'DEFE'
	Execution of HALT instruction		H'2258'
	Execution of unresolved JUMP		H'DEF8'
Non-blocking, rendered	Manipulation error on a character string	%S15 = 1	H'DEF1'
blocking	Division by 0	%S18 = 1	H'DEF0'
during program	Capacity overflow	%S18 = 1	H'DEF2'
diagnostics	Operation on floating point error	%S18 = 1	H'DE87'
	Index overflow	%S20 = 1	H'DEF3'

3.1-3 Processor or system faults

These serious **processor** (hardware or software), or **X Bus wiring** faults mean that correct operation of the system is no longer assured. They cause a PLC to stop in ERROR which requires a cold restart. To prevent a PLC fault occurring again, the next cold start will be forced to STOP mode.

Status indicator lamps RUN	ERR	I/O	System word %SW124	Faults
×	●	●	H'80'	System watchdog fault or wiring fault on X Bus
			H'81'	Wiring fault on X bus
				System code fault, interruption not expected, System task stack overflow PL7 Junior task stack overflow

Key ● Indicator lamp on × Indeterminate state

Processor fault diagnostics :
When the PLC has stopped due to a fault, it can no longer communicate with a diagnostic device. Data relating to faults can only be accessed after a cold start (see system word %SW124). In general this data cannot used by the operator. Only H'80' and H'81' data can be used to diagnose a wiring fault on X Bus.

C

3.2 Reminder of system bits and system words

System bits %Si and system words %SWi provide information about the PLC status and can be used to control its operation. Some of these objects are managed entirely by the system, others are the user's responsibility. For more information on system bits and words refer to the PL7 Junior documentation (TLX DR PL7 30 E - section 3 of part B).

3.2-1 System bits

Bits	Function	Description
%S0	Cold start	Normally at state 0, this bit is set to 1 : • on power return with loss of data, • by the user program, • by the terminal, • on changing the PCMCIA memory card, • by pressing the processor RESET button, • by manipulating the memory slot cover or the handle of the PCMCIA memory card. This bit is reset to 0 by the system after a normal program execution scan. To process an application program after a cold PLC start, it is also possible to test bit %SW10:X0 (if %SW10:X0 = 0, there has been a cold restart).
%S1	Warm restart	Normally at state 0, this bit is set to 1 : • on power return with data save, • by the user program, • by the terminal. This bit is reset to 0 by the system at the end of the first complete scan and before the outputs are updated.
%S4 to **%S7**	Time bases	%S4 changes state every 5 ms (Time base = 10 ms), %S5 changes state every 50 ms (TB = 100 ms), %S6 changes state every 500 ms (TB = 1 s), %S7 changes state every 30 s (TB = 1 min). These bits are not synchronized with the PLC scan.
%S9	Change to output fallback state on all buses (X Bus, FIPIO, AS-i, etc)	Normally at state 0, this bit can be set to 1 via the program or the terminal. %S9 = 1 : change to fallback state (0 or 1) depending on choice made in configuration of all discrete and analog outputs, %S9 = 0 : normal output update.
%S10	I/O fault on X Bus and FIPIO bus	Normally at state 1, this bit is set to 0 by the system during an I/O fault on one of the station racks. This bit is reset to 1 by the system when the fault disappears.
%S11	Watchdog overrun	Normally at state 0, this bit is set to 1 by the system if the program execution time exceeds the maximum execution time (watchdog) declared during configuration. Such a fault causes the PLC to change to HALT (software fault).

C

System bits (continued)

Bits	Function	Description
%S13	First scan	Normally at state 0, this bit is set to 1 by the system during the first scan after setting the PLC to RUN. In the case of a cold restart, %S13 can only change to 1 after the RESET button on the processor has been pressed or after manipulation of the PCMCIA memory card handle or slot cover.
%S15	Character string fault	Normally at state 0, this bit is set to 1 by the system when the size of the destination zone for the transfer of a character string is insufficient. This bit must be reset to 0 by the user.
%S16	I/O task fault X Bus and FIPIO	Normally at state 1, this bit is set to 0 by the system during a fault on an X Bus I/O module or a FIPIO device configured in the task. This bit must be reset to 1 by the user. Each task manages its own bit %S16.
%S17	Exit bit on a shift operation or arithmetic report	Normally at state 0, this bit is set to 1 by the system : • during a shift operation, contains the state of the last bit, • when an overrun occurs with unsigned arithmetic. This bit is reset to 0 by the user.
%S18	Arithmetic overflow or error	Normally at state 0, this bit is set to 1 by the system in the event of a capacity overflow during operation on a word : • result greater than +32767 or less than -32768 (single word), • result greater than +2147483647 or less than -2147483648 (double word), • overflow or error during operation on a floating point. The type of fault is given by system word %SW17. • division by 0, • square root of a negative number, • forcing a DRUM to a non-existent step, • stacking a full register or unstacking an empty register. This bit must be reset to 0 by the user.
%S19	Task period overrun (periodical scan)	Normally at state 0, this bit is set to 1 by the system in the event of an overrun of the time defined for the task during configuration or programmed in %SW0 /%SW1. This bit is reset to 0 by the user. Each periodic task (MAST, FAST) controls its own bit %S19. Note : while the cause of the task time overrun persists, the task operates cyclically.
%S20	Index overrun	Normally at state 0, this bit is set to 1 by the system when the address of the indexed object becomes less than 0 or exceeds the number of objects declared during configuration. This bit is reset to 0 by the user.

C

System bits (continued)

Bits	Function	Description
%S21	Grafcet initialization	Normally at state 0, this bit is set to 1 by : • a cold restart (%S0 = 1) • the user program exclusively in preprocessing, • the terminal At state 1, it causes the Grafcet to be initialized. The active steps are deactivated and the initial steps are activated. It is reset to state 0 by the system at the end of preprocessing.
%S22	Grafcet reset to zero	Normally at state 0, this bit is managed by the user and can only be set to state 1 via the program during preprocessing. At state 1, all active steps are deactivated. It is reset to state 0 by the system at the end of preprocessing.
%S23	Grafcet freeze	Normally at state 0, this bit is managed by the user and can only be set to state 1 via the program during preprocessing. Maintained at state 1 by the application program, it enables the Grafcet to remain in a given state (without changing). It must be reset to 0 only by program during preprocessing so that the Grafcet can change from the freeze situation.
%S24	Resetting macro-steps to 0	Normally at state 0, setting %S24 to 1 resets the selected macro-steps in a table of 4 system words %SW22 to %SW25. It is reset to 0 by the system after acceptance at the end of preprocessing.
%S26	Table overflow (steps/ transitions)	Normally at state 0, this bit is set to state 1 when the number of possible steps or transitions has been exceeded. An overflow causes the PLC to change to STOP. Starting execution (RUN) via the terminal must be preceded by an initialization (setting %S21 to 1) by the same terminal. It is thus reset to 0 on initialization of the terminal. System words %SW20 and %SW21 contain the number of positions occupied in the Grafcet activity tables (%SW20 step positions, %SW21 transition positions). In the event of an overflow, the words %SW20 and %SW21 contain the number of positions corresponding to the scan before the overflow.
%S30	Activation/ deactivation of master task (MAST)	Normally at state 1, this bit is managed by the user : %S30 = 1, activation of master task, %S30 = 0, deactivation of master task.
%S31	Activation/ deactivation of fast task (FAST)	Normally at state 1, this bit is managed by the user : %S31 = 1, activation of the fast task, %S31 = 0, deactivation of the fast task. This bit is inactive if the fast task is not programmed.

System bits (continued)

Bits	Function	Description
%S38	Activation/ deactivation of events	Normally at state 1, this bit is managed by the user : %S38 = 1, activation of event-triggered processing, %S38 = 0, deactivation of event-triggered processing. This bit is inactive if no event is programmed as an event task.
%S39	Loss of events	This bit is set to 1 by the system to advise the application that one or more events have been lost following stack overflow. This bit should be reset to 0 by the application.
%S14 to **%S47**	I/O faults (racks)	Normally at state 1, each of these bits is set to state 0 on an I/O fault of the corresponding rack : %S40 for 0, %S41 for rack 1, ..., %S47 for rack 7. Setting one of these bits to 0 causes : • the %S10 general bit to be set to 0, • the I/O indicator lamp of the corresponding rack and processor to light up, • status module bit %Ixy.ERR to be set to 1. They are reset to 1 when the fault disappears. These various bits are used by the program to draw up the fault processing structure.
%S50	Updating of date and time by %SW50 to %SW53	Normally at state 0, this bit is managed by the user : %S50 = 0, access to date/time by reading words %SW50 to %SW53, %S50 = 1, updating of date/time by writing words %SW50 to %SW53.
%S51	Loss of time on the real-time clock	This bit managed by the system indicates at state 1 either the absence of the real-time clock, or that the system words relating to the real-time clock have no significance; in this case the real-time clock must be reset. This automatically resets the bit to 0.
%S59	Updating date / time by %SW59	Normally at state 0, this bit is managed by the user : %S59 = 0, the system does not manage word %SW59, %S59 = 1, the system manages word %SW59,
%S60	Redundant architecture control	System bit used when redundant architecture is used. (see description and usage in "Premium Redundant Architecture" manual).
%S67	PMCIA memory card battery status	This bit, managed by the system, is used to check the backup battery for the PMCIA memory card (RAM type) : %S67 = 0, battery present and operative, %S67 = 1, battery missing or inoperative.

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System bits (continued)

Bits	Function	Description
%S68	Processor internal RAM backup battery status	This bit, managed by the system, is used to check the backup battery for the data and the program in the processor internal RAM memory : %S68 = 0, battery present and operative, %S68 = 1, battery missing or inoperative.
%S70	Updating of data on the AS-i bus	This bit is set to 1 by the system at the end of each AS-i bus scan. During start-up, it indicates that all data has been refreshed at least once and is significant. This bit is reset to 0 by the user.
%S73	Change to protected mode on the AS-i bus	Normally at state 0, this bit is set to 1 by the user to switch to protected mode on the AS-i bus. Initially, bit %S74 must be set to state 1. This bit is only used for wiring checks. It is not used in the PLC.
%S74	Saving current configuration on the AS-i bus	Normally at state 0, this bit is set to 1 by the user to save the current configuration on the AS-i bus. This bit is only used for wiring checks. It is not used in the PLC.
%S80	Reset message counters	Normally at state 0, this bit is set to 1 by the user to reset the message counters %SW80 to %SW86.
%S90	Updating the common words	Normally at state 0, this bit is set to 1 by the system on receipt of common words from another station. This bit is reset to 0 by the user.
%S92	Switch to communication function measurement mode	Normally at state 0, this bit can be set to 1 by the user to set the communication functions in performance measurement mode. The communication function Time-out parameter then displays the exchange loop-back time in tenths of ms (if this time <10s, otherwise insignificant).
%S94	Save DFB adjustments	Normally at state 0, this bit can be set to 1 by the user to save the adjustment values of user function blocks.
%S95	Restore DFB adjustments	Normally at state 0, this bit can be set to 1 by the user to restore the adjustment values of user function blocks.
%S100	Protocol on terminal port	This bit, managed by the system, takes the value 0 or 1 depending on the type of device connected to the terminal port : %S100 = 0, UNI-TELWAY master protocol, %S100 = 1, UNI-TELWAY slave or ASCII protocol (character mode).

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System bits (continued)

Bits	Function	Description
%S101	Diagnostic buffer configured	This bit is set to 1 by the system when the diagnostic option is configured, and a diagnostic buffer designed to store errors sent by diagnostic DFBs is then reserved.
%S102	Diagnostic buffer full	This bit is set to 1 by the system when the buffer receiving errors from diagnostic function blocks is full.
%S118	General I/O fault on FIPIO bus	Normally at state 1, this bit is set to 0 by the system if a fault occurs on a connected device on the FIPIO bus. When the fault disappears, this bit is set to 1 by the system.
%S119	General I/O fault on X Bus	Normally at state 1, this bit is set to 0 by the system if a fault occurs on a connected device on the X Bus. When the fault disappears, this bit is set to 1 by the system.

3.2-2 System words

Words	Function	Description
%SW0	Master task scan time (MAST)	Used to modify the master task time, defined during configuration, via the program or the terminal. Time is expressed in ms (1 to 255 ms). During cyclic operation %SW0 = 0.
%SW1	Fast task scan time (FAST)	Used to modify the fast task time, defined during configuration, via the program or the terminal. Time is expressed in ms (1 to 255 ms). This system word is not significant if the fast task is not programmed.
%SW8	Control of reading inputs for each task	Used to inhibit reading the inputs for each task : %SW8:X0 = 1 inhibit in the master task (MAST) %SW8:X1 = 1 inhibit in fast task (FAST)
%SW9	Control of updating outputs for each task	Used to inhibit updating the outputs of each task : %SW9:X0 = 1 inhibit in the master task (MAST) %SW9:X1 = 1 inhibit in fast task (FAST)
%SW10	Detection of a cold restart at the end of the first scan of a task	This word indicates a change to RUN after a cold start Bit %SW10:X0 is associated with the MAST task, Bit %SW10:X1 is associated with the FAST task (if it is programmed). The value 0 of the current task bit means that it is executing its first scan after a cold start. Each bit is set to 1 after the associated task has been executed.
%SW11	Watchdog duration	Contains the duration of the watchdog defined during configuration. It is expressed in ms (10 to 500 ms).
%SW12	Terminal port UNI-TELWAY address	UNI-TELWAY address of the terminal port defined during configuration and loaded in this word on a cold start. This word is updated by the system.
%SW13	Main station address	Indicates for the main network : • the station number (low order byte) : 0 to 127, • the network number (high order byte) : 0 to 63.
%SW17	Fault status of operations on floating points	Indicates the type of fault on a floating point operation: %SW17:X0 = 1 invalid operation %SW17:X1 = 1 non-standard operand %SW17:X2 = 1 division by 0 / the result is ± × %SW17:X3 = 1 overflow / the result is ± × %SW17:X4 = 1 underflow / the result is 0 %SW17:X5 to X15: unused, always at 0
%SD18 (%SW18 + %SW19)	Absolute time counter	This double word is used to calculate the duration. It is incremented by the system every 1/10th of a second (even when the PLC is in STOP). %SW18 the least significant and %SW19 the most significant bits of word %SD18.

System words (continued)

Words	Function	Description
%SW20	Grafcet activity level	This word contains the number of active steps to be activated and deactivated for the current scan.
%SW21	Validity table for Grafcet transitions	This word contains the number of enabled transitions and transitions to be enabled and disabled for the current scan.
%SW22 to **%SW25**	Macro-step reset to 0 table	A macro-step corresponds to each bit in this table with %SW22:X0 for XM0 ....%SW25:X16 for XM63. Macro-steps whose associated bit in the table is at 0 will be reset when bit %S24 is set to 1.
%SW30	Master task execution time	Shows, for the master task (MAST), the execution time of the last PLC scan (in ms).
%SW31	Max execution time for master task	Shows, for the master task (MAST), the longest execution time since the last cold start (in ms).
%SW32	Min execution time for master task	Shows, for the master task (MAST), the shortest execution time since the last cold start (in ms).
%SW33	Fast task execution time	Shows, for the fast task (FAST), the execution time of the last PLC scan (in ms).
%SW34	Max execution time for fast task	Shows, for the fast task (FAST), the longest execution time since the last cold start (in ms).
%SW35	Min execution time for fast task	Shows, for the fast task (FAST), the shortest execution time since the last cold start (in ms).
%SW48	Number of events	Indicates the number of events processed since the last cold start.
%SW49 to **%SW53**	Real-time clock function	Contains, in BCD, the current date / time value : %SW49 : day of the week, 1 to 7 (00DD) (1 = Monday, ..., 7 = Sunday) %SW50 : Seconds, 0 to 59 (SS00), %SW51 : Hours, 0 to 23 / Minutes, 0 to 59 (HHMM), %SW52 : Month, 1 to 12 / day of month, 1 to 31 (MMDD), %SW53 : Century, 0 to 99 / Year, 0 to 99 (CCYY). These words are managed by the system when %S50 = 0. They can be accessed by the user in write mode when %S50 = 1.

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System words (continued)

Words	Function	Description
%SW54 to **%SW58**	Real-time clock function	Contains, in BCD, the date / hour of the last power supply fault or PLC stop : %SW54 : Seconds, 0 to 59 (00SS) %SW55 : Hours, 0 to 23 / Minutes, 0 to 59 (HHMM), %SW56 : Month, 1 to 12 / day of month, 1 to 31 (MMDD), %SW57 : Century, 0 to 99 / Year, 0 to 99 (CCYY). %SW58 : day of the week on MSB, (1 to 7 (DD00) 1 = Monday, ..., 7 = Sunday)
%SW58	Code of last stop	Contains the code of the cause of the last stop on the low order byte (00CC) : %SW58 = 1, change from RUN to STOP by the terminal, %SW58 = 2, stop on software fault (task overflow), %SW58 = 4, power fault or power supply RESET button pressed, %SW58 = 5, stop on hardware fault, %SW58 = 6, stop on HALT instruction.
%SW59	Adjustment of current date/time	Contains 2 series of 8 bits for adjusting the current date/time. The adjustment is made on the rising edge of a bit. The adjustment word is validated by %S59. Incrementation / Decrementation / Parameter bit %SW59:X0 / bit %SW59:X8 / day of the week bit %SW59:X1 / bit %SW59:X9 / seconds bit %SW59:X3 / bit %SW59:X11 / hours bit %SW59:X4 / bit %SW59:X12 / day of month bit %SW59:X5 / bit %SW59:X13 / month bit %SW59:X6 / bit %SW59:X14 / year bit %SW59:X7 / bit %SW59:X15 / century
%SW60 to **%SW69**	Redundant PLC diagnostics	System words used when redundant architecture is used. (see description and usage in "Premium Redundant Architecture" manual).
%SW80 to **%SW86**	Message counters	%SW80 : number of messages transmitted by the system to the terminal port. %SW81 : number of messages received by the system from the terminal port. %SW82 : number of messages transmitted by the system to the PCMCIA communication card. %SW83 : number of messages received by the system from the PCMCIA communication card. %SW84 : number of telegrams transmitted by the system. %SW85 : number of telegrams received by the system. %SW86 : number of telegrams refused by the system.

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System words (continued)

Words	Function	Description
%SW87	Management of communication flow (1)	Number of requests processed by the synchronous server per master task cycle (MAST).
%SW88		Number of requests processed by the asynchronous server per master task cycle (MAST).
%SW89		Number of requests processed by the server functions (immediate) per master task cycle (MAST).
%SW108	Number of forced bits	Indicates the number of forced bits in the application. Normally set to 0, it is updated by the system when forcing and unforcing bits in the application memory.
%SW109	Forced analog channel counter	Counts the number of analog channels forced to 0.
%SW116	FIPIO I/O fault in the task	Normally at 0, each bit of this word represents a FIPIO exchange state in the task in which it is tested. This word is reset to 0 by the user. bit %SW116:X0 = 1 explicit exchange error (the variable is not exchanged on the bus), bit %SW116:X1 = 1 time out on an explicit exchange (no response at the end of the time out), bit %SW116:X2 = 1 number of explicit exchanges carried out simultaneously, bit %SW116:X3 = 1 incorrect MPS status (the contents of the variable are invalid), bit %SW116:X4 = 1 the length of a received variable is greater than the declared length, bit %SW116:X5 = 0 reserved at 0, bit %SW116:X6 = 1 invalid PDU code (the variable must be ignored by the channel manager), bit %SW116:X7 = 1 asynchronous promptness time out : the time taken by the agent to produce the variable has not been respected. Signals absence of configured devices on the FIPIO bus, bit %SW116:X8 = 1 channel fault bit %SW116:X9 = 0 reserved at 0, bit %SW116:X10 = 0 reserved at 0, bit %SW116:X11 = 0 reserved at 0, bit %SW116:X12 = 0 reserved at 0, bit %SW116:X13 = 0 reserved at 0, bit %SW116:X14 = 0 reserved at 0, bit %SW116:X15 = 1 global fault (or fault on bits 3, 4, 6, 7).

(1) words only available on TSX/PCX/PMX 57, version V3.3 or later.

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System words (continued)

Words	Function	Description
%SW118 to **%SW121**	Not significant	Not significant for TSX/PMX/PCX Premium processors. These words are at state 0
%SW124	Type of processor fault	Contains the last type of processor fault encountered. At values H'80' and H'81', it is used to diagnose a wiring fault on X Bus. Read after PLC cold restart.
%SW125	Type of blocking fault	Contains the last type of blocking fault encountered (see section 3.1).
%SW126 and **%SW127**	Address of the blocking fault instruction	Contains the address of the instruction which generated the blocking fault. %SW126 contains the offset of this address %SW127 contains the base of this address
%SW128 to **%SW143**	Connection point fault on device on the FIPIO bus	Each bit in this group of words represents the state of a connected device on the FIPIO bus. Normally at state 1, if one of these bit is at state 0, a connection point fault has occurred. When the fault disappears, this bit is set to 0 by the system. %SW128 represents addresses 0 to 15 bit %SW128:X0 = @ 0 bit %SW128:X1 = @ 1 ... bit %SW128:X15 = @ 15 %SW129 represents addresses 16 to 31 %SW130 represents addresses 32 to 47 %SW131 represents addresses 48 to 63 %SW132 represents addresses 64 to 79 %SW133 represents addresses 80 to 95 %SW134 represents addresses 96 to 111 %SW135 represents addresses 112 to 127 %SW136 represents addresses 128 to 143 %SW137 represents addresses 144 to 159 %SW138 represents addresses 160 to 175 %SW139 represents addresses 176 to 191 %SW140 represents addresses 192 to 207 %SW141 represents addresses 208 to 223 %SW142 represents addresses 224 to 239 %SW143 represents addresses 240 to 255

System words (continued)

Words	Function	Description
%SW144	Operating mode of bus arbitrator, producer/ consumer functions on FIPIO bus	Used to stop or start the bus arbitrator and the producer/consumer functions on the bus. It is used to modify the starting, automatic and manual modes of the bus if it is stopped. bit %SW144:X0 = 1 producer/consumer function in RUN bit %SW144:X0 = 0 producer/consumer function in STOP (no variables are exchanged on the bus). bit %SW144:X1 = 1 the bus arbitrator is in RUN, bit %SW144:X1 = 0 the bus arbitrator is in STOP (no variables or messages are scanned on the bus). bit %SW144:X2 = 1 automatic start if the bus has been stopped automatically. bit %SW144:X2 = 0 manual start if the bus has been stopped automatically. bit %SW144:X3 = 1 reserved at 1 bit %SW144:X4 to bit %SW144:X15 = 0 reserved at 0 ⚠ **Modifying this system word may stop the PLC station**
%SW145	Modification of FIPIO bus arbitrator parameters	The bits are set to state 1 by the user and reset to 0 by the system when initialization is performed. bit %SW145:X0 = 1 modification of bus arbitrator priority : the high order byte of this system word contains the value of the bus arbitrator priority which will be applied on the bus. bit %SW145:X1 = 1 modification of the slot time value (Tr): the high order byte of this word contains the slot time value Tr (in µs) which will be applied on the bus, bit %SW145:X2 = 1 modification of silence time (T0): the high order byte of this word contains the silence time value T0 (in µs) which will be applied on the bus, bit %SW145:X3 to bit %SW145:X7 = 0 reserved at 0. bit %SW145:X8 to bit %SW145:X15 = bus arbitrator priority value (if bit %SW145:X0 = 1). These parameters can be modified when in RUN, but the application must be stopped and then restarted. ⚠ **Modifying this system word may stop the PLC station**

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System words (continued)

Words	Function	Description
%SW146	Display of the bus arbitrator and producer/ consumer function on the FIPIO bus	The low order byte shows the state of the producer/ consumer function on the FIPIO bus. The low order byte shows the state of the producer/ consumer function. The high order byte shows the state of the bus arbitrator function. Byte value H'00' : the function does not exist. H'70' : the function is loaded but is not operational. H'F0' : the function is currently being executed.
%SW147	Network cycle time for the MAST task	A value not equal to 0 (in ms), showing the network cycle time for the MAST task (NCT-MAST).
%SW148	Network cycle time for the FAST task	A value not equal to 0 (in ms), showing the network cycle time for the FAST task (NCT-FAST).
%SW149		Reserved
%SW150	Number of frames transmitted	This word shows the number of frames transmitted by the FIPIO channel manager.
%SW151	Number of frames received	This word shows the number of frames received by the FIPIO channel manager.
%SW152	Number of message resend attempts	This word shows the number of message resend attempts by the FIPIO channel manager.

System words (continued)

Words	Function	Description
%SW153 and **%SW154**	List of FIPIO channel manager faults	Each bit is set to state 1 by the system and reset to 0 by the user. **%SW153** bit %SW153:X0 = 1 station overrun fault bit %SW153:X1 = 1 message refusal fault bit %SW153:X2 = 1 interrupt variable refusal fault bit %SW153:X3 = 1 station underrun fault bit %SW153:X4 = 1 physical layer fault bit %SW153:X5 = 1 non echo fault bit %SW153:X6 = 1 chatter fault bit %SW153:X7 = 1 hypocurrent fault bit %SW153:X8 = 1 pierced frame fault bit %SW153:X9 = 1 frame reception CRC fault bit %SW153:X10 = 1 frame reception coding fault bit %SW153:X11 = 1 received frame length fault bit %SW153:X12 = 1 unknown frame type received bit %SW153:X13 = 1 truncated frame received bit %SW153:X14 not used, value not significant bit %SW153:X15 not used, value not significant **%SW154** bit %SW154:X0 = 1 aperiodic Time Out sequence bit %SW154:X1 = 1 message handling request refused bit %SW154:X2 = 1 urgent update command refused bit %SW154:X3 = 1 non-urgent update command refused bit %SW154:X4 = 1 silence fault bit %SW154:X5 = 1 network collision on transmission of identifier bit %SW154:X6 = 1 bus arbitrator overrun fault bit %SW154:X7 not used, value not significant bit %SW154:X8 = 0 reserved at 0 bit %SW154:X9 = 0 reserved at 0 bit %SW154:X10 = 0 reserved at 0 bit %SW154:X11 = 0 reserved at 0 bit %SW154:X12 = 0 reserved at 0 bit %SW154:X13 = 0 reserved at 0 bit %SW154:X14 = 0 reserved at 0 bit %SW154:X15 = 0 reserved at 0
%SW155	Number of explicit exchanges	This word indicates the number of explicit exchanges during processing.
%SW162	Number of errors in diagnostic buffer	Number of current errors in the diagnostic buffer.

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D

1.1 Standards

TSX/PMX/PCX Premium PLCs have been developed to conform to the main national and international standards regarding electronic industrial control system products :

- Specific PLC requirements : operational characteristics, immunity, ruggedness, safety, etc.
  EN61131-2 (IEC1131-2), CSA 22.2, UL 508
- Merchant navy requirements of principal European bodies :
  BV, DNV, GL, LROS, RINA, etc.
- Compliance with European Directives (low voltage, Electromagnetic Compatibility), CE Marking.
- Electrical and self-extinguishing qualities of insulating materials :
  UL 746C, UL 94, etc.

1.2 Service conditions and requirements linked to the environment

1.2-1 Normal service conditions

- **Operating temperature/Humidity/Altitude**

Ambient operating temperature	0°C to +60°C (IEC 1131-2 = +5°C to +55°C)
Relative humidity	10% to 95% (without condensation)
Altitude	0 to 2000 meters

- **Supply voltages**

Voltage	nominal	24VDC	48VDC	100...240VAC	100-120/200-240VAC
	limit	19..30VDC (1)	19..60VDC	90...264VAC	90..140/190..264VAC
Frequency	nominal	-	-	50/60 Hz	50/60 Hz
	limit	-	-	47/63 Hz	47/63 Hz
Micro-breaks	duration	≤ 1 ms	≤ 1 ms	≤ 1/2 period	≤ 1/2 period
	repetition	≥ 1s	≥ 1s	≥ 1s	≥ 1s
Total harmonic distortion		-	-	10%	10%
Residual ripple included		5%	5%	-	-

(1) Possible up to 34 VDC, limited to 1 hour per 24 hours.
With TSX PSY 1610 and TSX PSY 3610 power supplies, and if relay output modules are used, this range is reduced to 21.6V...26.4V

D

- **Mechanical withstand**
  - Immunity to vibrations :
    Complies with IEC 68-2-6, Fc test.
  - Immunity to shocks:
    Conforming to standard IEC 68-2-27, Ea test.

- **Electrostatic discharge withstand**
  - Immunity to electrostatic discharges :
    Conforming to standard IEC 1000-4-2, level 3 (1)

- **HF interference withstand**
  - Immunity to electromagnetic radiation :
    Conforming to standard IEC 1000-4-3, level 3 (1)
  - Immunity to conducted interference induced by RF fields :
    Conforming to standard IEC 1000-4-6, level 3 (1)
  - Immunity to bursts of rapid transients :
    Conforming to standard IEC 1000-4-4, level 3 (1)
  - Immunity to shock waves :
    Conforming to standard IEC 1000-4-5, level 3 (1)
  - Immunity to damped oscillatory waves :
    Conforming to standard IEC 1000-4-12, level 3 (1)

(1) minimum level in the test conditions laid down in the standards

- **LF interference withstand**

  Conforming to standard IEC 1131-2.

- **TSX Premium PLC protective treatment**

  TSX/PMX/PCX Premium PLCs meet the "TC" treatment (1) requirements.
  For installing in an industrial production workshop or in an atmosphere corresponding to "TH" treatment (2), TSX Premium PLCs must be installed in at least IP54 protection enclosures as defined by the IEC 664 and NF C 20 040 standards.
  TSX/PMX/PCX Premium PLCs offer their own protection index IP20 (3). They can therefore be installed without enclosures in reserved access premises which do not exceed pollution level 2 (control room with neither machines nor dust-producing activity).

(1) "TC" treatment : all-atmosphere treatment.
(2) "TH" treatment : treatment for warm or humid atmospheres.
(3) When a position is not occupied by a module, a TSX RKA 02 protective cover must be placed over the position.

1.2-2 Transport and storage requirements

Conforming to the IEC 1131-2 requirements

Storage temperature	- 25°C to +70°C
Relative humidity	5% to 95% (without condensation)

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1.1 General

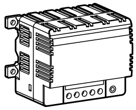
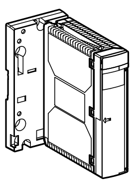
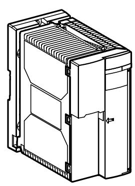
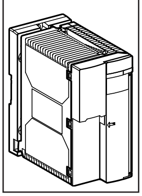
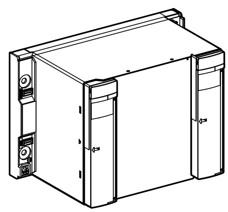
A wide range of power supply units and modules are available providing the user with the best possible solution for his requirements :

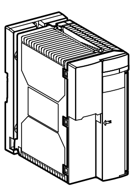
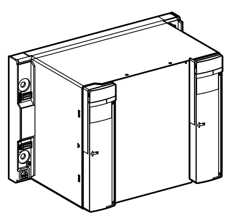
- TBX SUP 10 and TSX SUP 1••1 process power supply units and modules supply 24 VDC to the peripherals of an application controlled by PLCs (TSX Micro and Premium). These peripherals include sensors, preactuators, encoders, operator terminals, loop controllers, indicator lamps, pushbuttons, pneumatic cylinders, etc. The 24 V supply can be provided by a 100/240 V, 50/60 Hz AC supply.
  TBX SUP 10 and TSX SUP 1011 power supply modules can also be connected to 125 VDC supply.
- AS-i TSX SUP A02 and A05 process power supply units and modules supply components connected on an AS-i fieldbus with 30 VDC. This power supply is distributed via the same conductors as those used for data exchanges.

The mounting arrangements for these products have been specially designed to meet the specific distance and mounting requirements for TSX Micro and Premium PLCs and TBX products.

All the products can be mounted :

- on a Telequick AM1-PA mounting plate,
- on an AM1-DP200 / DE200 central DIN rail, with the exception of TSX SUP 1101 and TSX SUP A05 high power supply units.

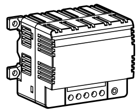
Process power supply				
Supply voltage 100..240VAC or 125VDC		Supply voltage 100...120/200...240 VAC		
				
24VDC / 1A	**24VDC / 1A**	**24VDC / 2A**	**24VDC / 5A**	**24VDC / 10A**

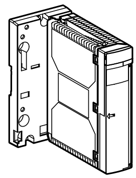
AS-i bus power supplies	
Supply voltage 100...120 or 200...240 VAC	
	
AS-i 30 VDC / 2.4 A	**AS-i 30 VDC / 5 A & 24 VDC**

1-2 24 VDC process power supplies

1.2-1 Catalog

Selection table





Input characteristics Nominal voltage	100...240 VAC or 125 VDC	
Limit values	90...264VAC or 88...156 VDC	85...264VAC or 105...150 VDC
Limit frequency	47...63 Hz	47...63 Hz or 360...440 Hz
Nominal input current	0.4A	0.4 A
Output characteristics Useful power	24 W	26 W
⎓ output voltage	24 VDC	
Nominal current	**1 A**	**1.1 A**
Auxiliary functions SELV (1)	No	Yes
Paralleling (2)	No	Yes, with power optimization (3)
Redundancy (4)	No	Yes
References	**TSX SUP 10**	**TSX SUP 1011**

(1) Construction characteristics conforming to standards IEC 950, IEC 1131-2, ensuring the safety of the user at the 24 V output, in terms of isolation between primary and secondary, maximum overvoltage on the output wiring and protection via the grounding circuit.

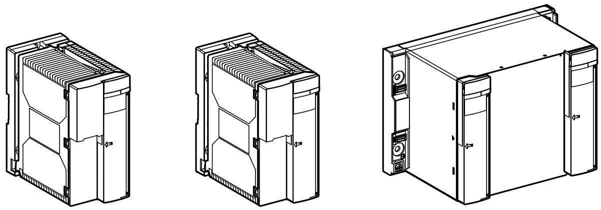
(2) Option of paralleling 2 power supply outputs of the same type, to provide an output current greater than the maximum authorized by a single supply.

(3) For 2 modules providing a total current of 100 %, each module supplies 50 % of the total. This improves the lifetime of the products.

(4) Option of paralleling 2 power supply outputs of the same type, to provide an output current less than the maximum authorized by a single supply but ensuring availability of the output voltage even if one of the two modules becomes faulty.

Catalog (continued)

Selection table (continued)



Input characteristics Nominal voltage	100...120 VAC or 200...240 VAC		
Limit values	85...132VAC or 170..264 VAC		
Limit frequency	47...63 Hz or 360...440 Hz		
Nominal input current	0.8 A	2.4 A	5 A
Output characteristics Useful power	53 W	120 W	240 W
⎓ output voltage	24VDC		
Nominal current	**2.2 A**	**5 A**	**10 A**
Auxiliary functions SELV (1)	Yes		
Paralleling (2)	Yes, with power optimization (3)		
Redundancy (4)	Yes	No	
References	**TSX SUP 1021**	**TSX SUP 1051**	**TSX SUP 1101**

(1) Construction characteristics conforming to standards IEC 950, IEC 1131-2, ensuring the safety of the user at the 24 V output, in terms of isolation between primary and secondary, maximum overvoltage on the output wiring and protection via the grounding circuit.

(2) Option of paralleling 2 power supply outputs of the same type, to provide an output current greater than the maximum authorized by a single supply.

(3) For 2 modules providing a total current of 100 %, each module supplies 50 % of the total. This improves the lifetime of the products.

(4) Option of paralleling 2 power supply outputs of the same type, to provide an output current less than the maximum authorized by a single supply but ensuring availability of the output voltage even if one of the two modules becomes faulty.

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1.2-2 Auxiliary functions

- **Parallel operation with power optimization mode**

  The aim of paralleling is to use **two modules with the same reference** to provide an output current greater than the maximum authorized by a single power supply. The total current is the sum of the currents supplied by all the power supplies.

  Power optimization is an internal power supply system used to distribute currents equally between power supplies connected in parallel. The benefit obtained is a significant increase in the service life due to the distribution of power consumed.

  - On TSX SUP 1011 / 1021 power supplies

    Power optimization mode is obtained by setting the NOR/LSH switch located at the rear of the modules to the LSH position. The support must be dismantled in order to reach this switch. When the orange (LSH) indicator lamp is on, the mode is operational. (See section 2.3-1 for required connections).

    The current supplied with two power supplies connected in parallel is limited to :
    - 2 A with 2 TSX SUP 1011 power supply modules,
    - 4 A with 2 TSX SUP 1021 power supply modules.

    Using this mode reduces the precision of the output voltage: 24% ± 5% instead of 24 V ± 3% in normal mode.

    The phase imbalance of the powers on load sharing can be a maximum of 25%.

  - On TSX SUP 1051 / 1101 power supplies

    Power optimization mode does not require a switch on these power supplies. The connections specified in the following sections must be made :

    - 2.3-2 for the TSX SUP 1051 power supply module,
    - 2.3-3 for the TSX SUP 1101 power supply unit,

    The maximum current supplied with two power supplies connected in parallel is limited to :
    - 10 A with 2 TSX SUP 1051 power supply modules,
    - 20 A with 2 TSX SUP 1101 power supply units.

    Using this mode does not affect the precision of the output voltage.

    The phase imbalance of the powers on load sharing can be a maximum of 15%.

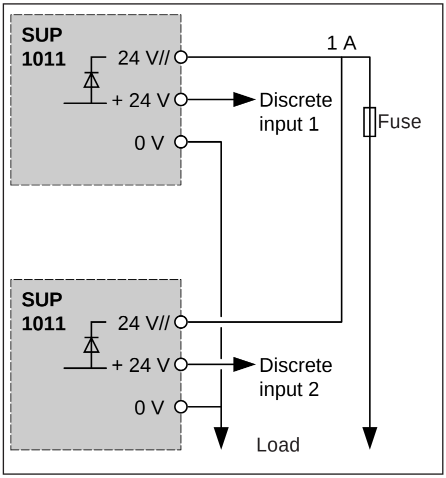
- **Redundancy / safety on TSX SUP 1101 / 1021 power supplies**

  Principle :

  To ensure availability of the currents required for the application, even if one of the power supplies becomes faulty.
  In this case the two power supplies are connected in parallel, using the connections specified in section 2.3-1.
  The power supplies are configured in power optimization mode.

  Example : supply 1A with redundancy from the 2 TSX SUP 1011 power supplies.

  Discrete inputs 1 and 2 of the PLC indicate the failure of one or other of the power supplies.



Note :
TSX SUP 1051 and 1101 power supplies are not fitted with the diode in series, required for the redundancy function.

1-3 AS-i power supplies

Special features :

As data and power are transmitted simultaneously on the same cable, data transmission must be filtered in relation to the power supply. For this reason the AS-i power supply integrates a decoupling filter which supports the maximum direct current provided by the power supply. The power supply gives a standardized impedance in relation to data transmission frequencies.

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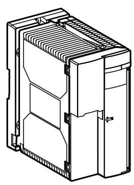
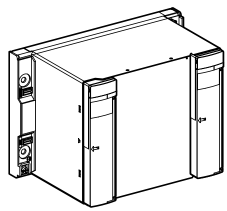
1.3-1 Catalog

Selection table





Input characteristics Nominal voltage	100...120 VAC or 200...240 VAC		
Limit values	85...132 VAC or 170...264 VAC		
Limit frequency	47...63 Hz or 360...440 Hz		
Nominal input current	1.3 A	5 A	
Output characteristics Useful power	72 W	230 W	
⎓ output voltages	AS-i 30 VDC	AS-i 30 VDC	24 VDC
Nominal current	**2.4 A**	**5 A** (1)	**7 A** (1)
Auxiliary functions SELV safety (2)	Yes		
Paralleling	No		
Redundancy	No		
References	**TSX SUP A02**	**TSX SUP A05**	

(1) Maximum current for each output, the sum of the powers is limited to 230 W

(2) Construction characteristics conforming to standards IEC 950, IEC 1131-2, ensuring the safety of the user at the 24 V output, in terms of isolation between primary and secondary, maximum overvoltage on the output wiring and protection via the grounding circuit.

1.4 Physical description

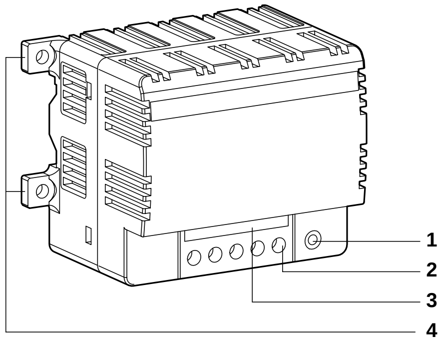
1.4-1 TBX SUP 10 power supply unit

1 Lamp indicating module power-up.

2 Screw terminal block for wiring the power supply voltages.

3 Identification label for the wiring terminals.

4 Module mounting lugs.



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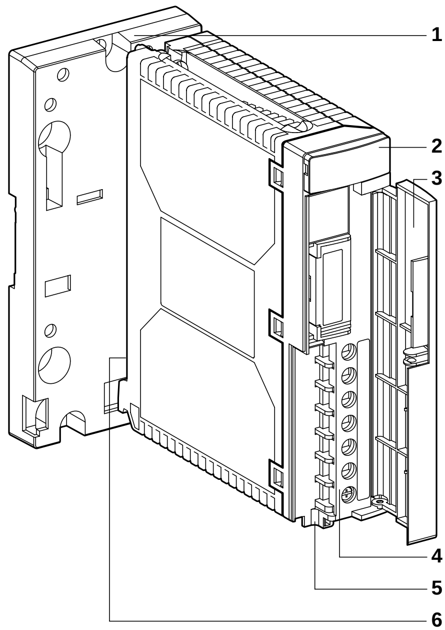
1.4-2 TSX SUP 1011/ 1021/ 1051/ A02 power supply modules

- **TSX SUP 1011 module**



1 Support plate for mounting the supply module directly on an AM1-DE200/ DP200 rail or an AM1-PA Telequick pre-slotted plate.

2 Display block comprising :

- A 24V indicator lamp (green) : lit if the internal and output voltages are established and correct.
- An LSH indicator lamp (orange) "power optimization mode" : lit if the supply is operating in parallel mode with power optimization.

3 Cover to protect the terminal block

4 Screw terminal block for connection to the :

- AC or DC supply,
- 24VDC output.

5 Slots for cable clamp.

6 "NOR / LSH" switch on the rear of the module to control the power optimization device.

  • NOR position : normal operation without power optimization (default position),
  • LSH position : operation with power optimization with power supplies in parallel.

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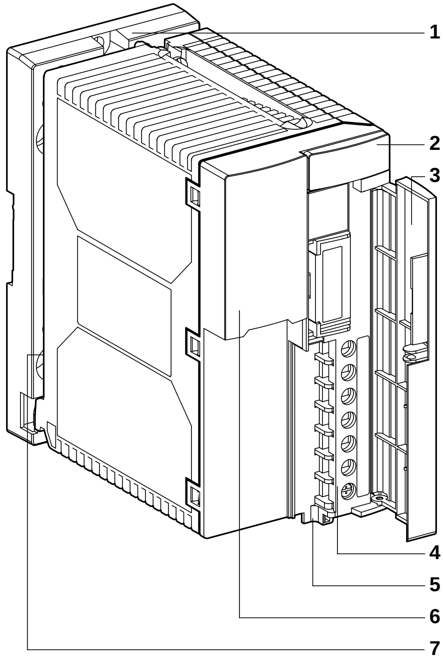
- **TSX SUP 1021 / 1051 modules**



1 Support plate for mounting the supply module directly on an AM1-DE200/ DP200 rail or an AM1-PA Telequick pre-slotted plate.

2 Display block comprising :
- A 24V indicator lamp (green) : lit if the internal and output voltages are correct.
- An LSH "power optimization mode" indicator lamp (orange), only on TSX SUP 1021 : lit if the supply is operating in parallel mode with power optimization.

3 Cover to protect the terminal block

4 Screw terminal block for connection to the :
- AC or DC supply,
- 24VDC output.

5 Slots for cable clamp.

6 110/220 V voltage selector. On delivery, the selector is set to 220.

7 "NOR / LSH" switch on the rear of the module to control the power optimization device. This switch is only present on the TSX SUP 1021 module
- NOR position : normal operation without power optimization (default position),
- LSH position : operation with power optimization with power supplies in parallel.

- **TSX SUP A02 module**

1 Support plate for mounting the supply module directly on an AM1-DE200/ DP200 rail or an AM1-PA Telequick pre-slotted plate.

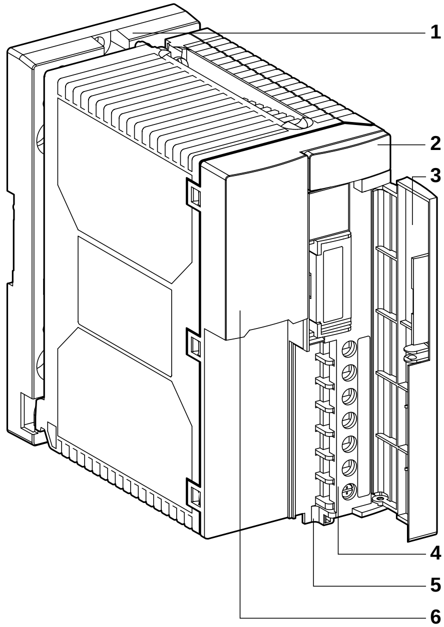
2 Display block comprising :
- An AS-i indicator lamp (green) : lit if the internal and output voltages are correct.

3 Cover to protect the terminal block

4 Screw terminal block for connection to the :
- AC supply
- AS-i 30 VDC output.

5 Slot for cable clamp.

6 110/220 V voltage selector. On delivery, the selector is set to 220.



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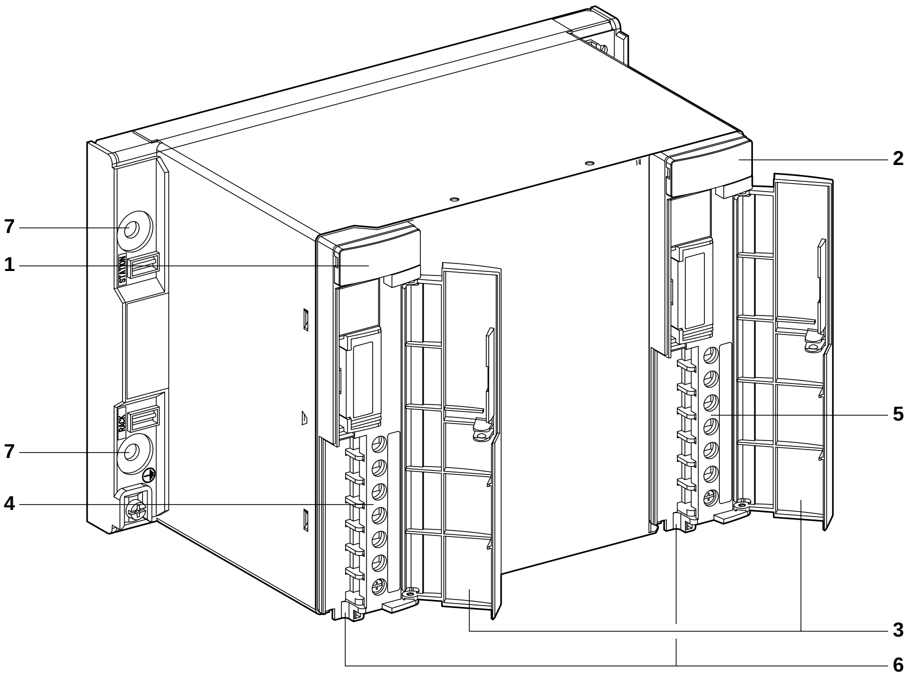
1.4-3 TSX SUP 1101 and TSX SUP A05 power supply unit



1 Display block comprising an ON indicator lamp (orange) : lit if the power supply is on.

2 Display block comprising :
- a 24V indicator lamp (green) : lit if the 24 VDC output voltage is present and correct,
- an AS-i indicator lamp (green : lit if the AS-i 30 VDC output voltage is present and correct. Indicator lamp present only on the TSX SUP A05 unit.

3 Cover to protect the terminal blocks

4 Screw terminal block for connection to the AC supply

5 Screw terminal block for connection of the 24 VDC and AS-i 30 VDC output voltage to TSX SUP A05

6 Slots for cable clamp

7 Four fixing holes for M6 screws.

1.4-4 Support plate

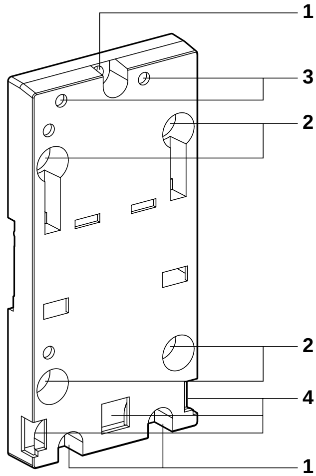
Each TSX SUP 10•1 and TSX SUP A02 power supply module comes with a support plate for fixing the power supply : either on an AM1-DE200 or AM1-DP200 rail, or an AM1-PA Telequick pre-slotted plate.
Each support plate can take : one TSX SUP 1021, TSX SUP 1051 or TSX SUP A02 module, or one or two TSX SUP 1011 modules.

1 Three Ø 5.5 holes for mounting the support plate on a panel or AM1-PA pre-slotted plate at 140 mm centers (fixing center for TSX 37 PLCs).

2 Four Ø 6.5 holes for mounting the support plate on a panel or AM1-PA pre-slotted plate at 88.9 mm centers (fixing center for TSX 57 PLCs).

3 Two M4 holes for fixing one or more TSX SUP 1011/1021/1051/A02 power supply modules.

4 Slots for anchoring pins located at the bottom and rear of the module.



Notes :

- Each of these power supply modules can also be mounted on a TSX RKY ••• rack replacing another module, with the exception of position PS, which must be used by a TSX PSY ••• power supply module supplying power to the rack modules.
- The following operations require the module to be removed from the support plate :
  - setting the "NOR/LSH" switch to LSH,
  - mounting the plate on a panel or a pre-slotted AM1-PA plate,
  - mounting the module on a TSX RKY ••• rack.

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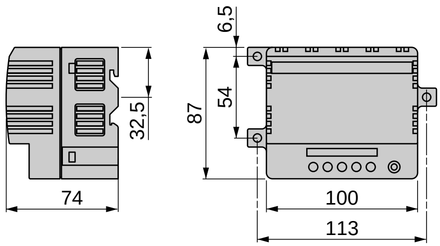
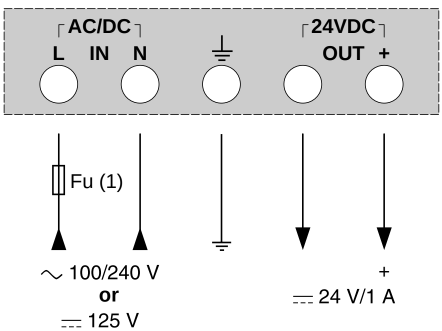
2.1 TBX SUP 10 dimensions/mounting/connections

- **Dimensions / mounting**



The TBX SUP 10 power supply unit should be mounted vertically to ensure optimal air flow within the unit.
It can be mounted on a panel, on an AM1-PA Telequick pre-slotted plate or AM1-DE200 / DP200 rail.

- **Connections**



Note

> **Primary** : if the module is supplied with 100/240 V∼, the phase and the neutral must be respected when wiring. Conversely, if the module is supplied with 125 V ⎓ , it is not necessary to respect the polarities.
>
> **Secondary** : the - 0 V terminal must be connected to the ground at the output of the power supply module.

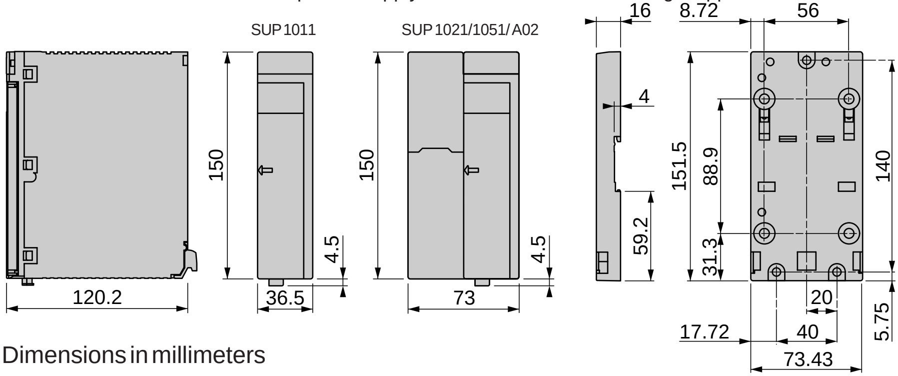
⚠ To ensure the safety of personnel, connect the ground terminal of the module to the protective ground with a green/yellow wire.

(1) External protection fuse on phase : 1A time-delayed 250 V for a single power supply.

2.2 Dimensions/mounting of process and AS-i power supplies

2.2-1 TSX SUP 1011 / 1021 / 1051 / A02 power supply

TSX SUP 1011/1021/1051/A02 power supply modules | Mounting support

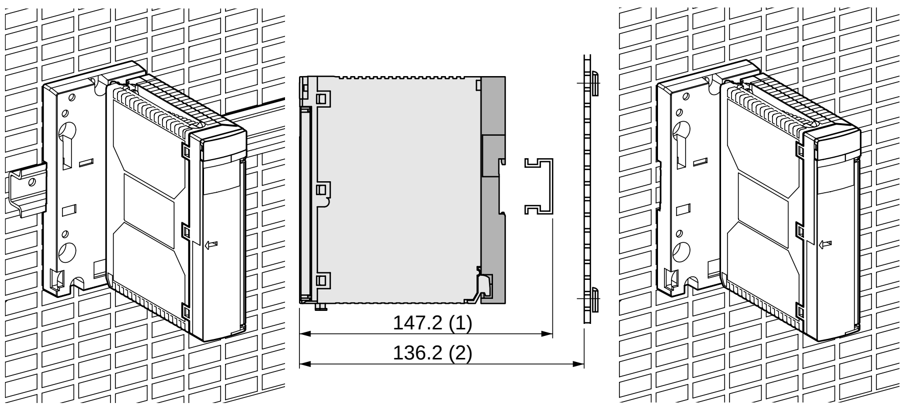


Dimensions in millimeters

TSX SUP 1011/1021/1051/A02 power supply modules can be mounted in the following ways :

Mounting on AM1-DE200 or AM1-DP200 rail or AM1-PA plate

Each power supply module comes mounted on a support for this type of mounting.



(1) 147.2 mm (AM1-DE200)
139.7 mm (AM1-DP200)

(2) 136.7 mm (AM1-PA)

Mounting on an AM1-D.... rail

1 Check that the module is mounted on the support

2 Mount the module + support on the rail

Mounting on an AM1-PA plate

1 Dismantle the module from the support

2 Mount the support on the AM1-PA plate

3 Mount the module on the support

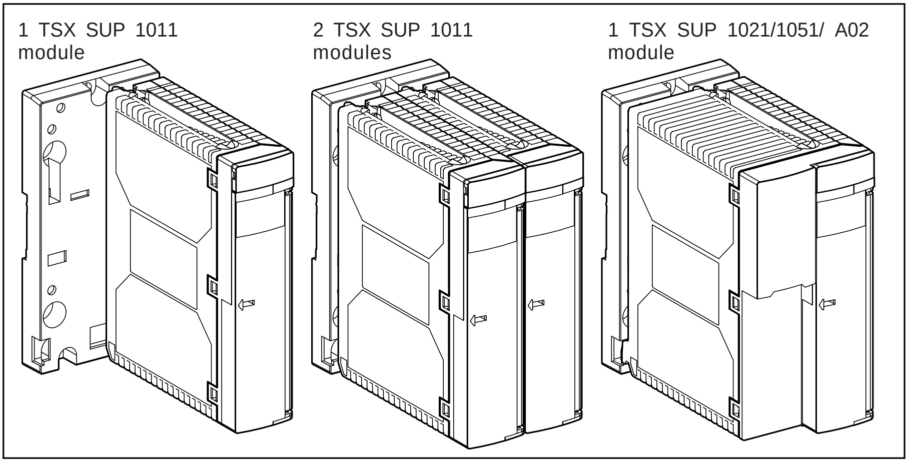
Mounting the module on the support

Each power supply module has an integral support for mounting it directly on a DIN rail. The support can take 1 or 2 TSX SUP 1011 power supply modules or 1 TSX SUP 1021/ 1051/A02 power supply module.

1 Fix the module pins in the slots on the lower part of the support.

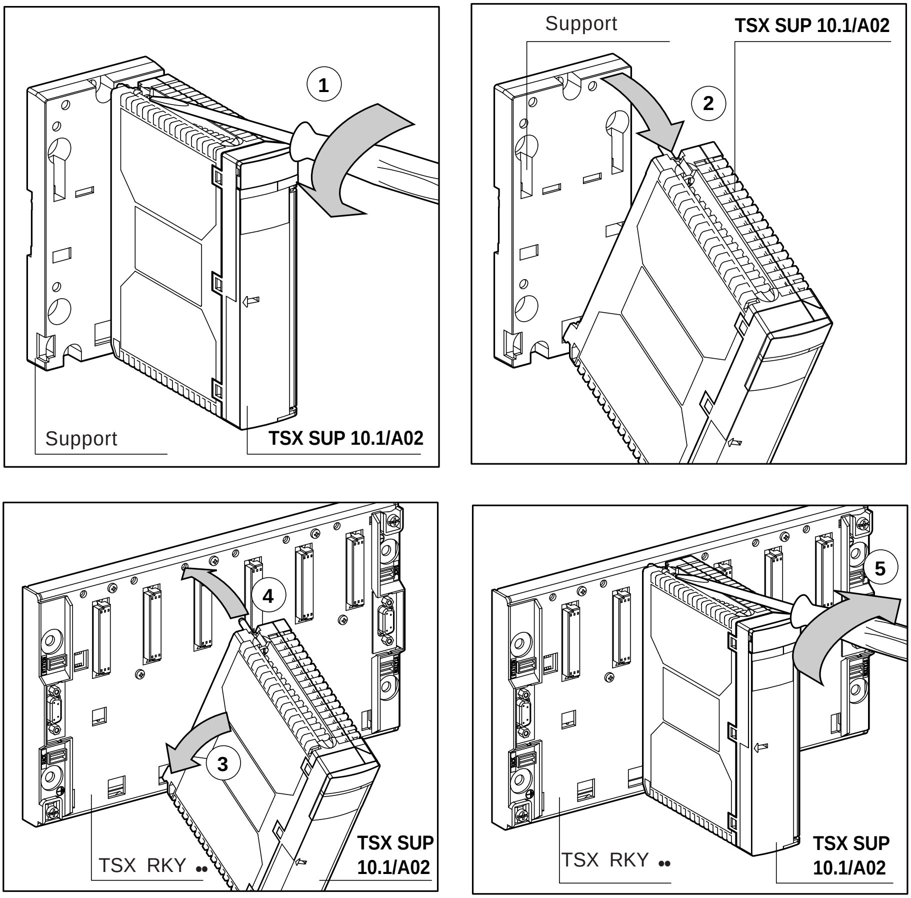
2 Tilt the module until it touches the support.

3 Tighten the screw on the upper part of the module to secure it to the support.



Mounting on TSX RKY •• rack

TSX SUP 1011/1021/1051/A02 power supply modules can be mounted in any of the positions on a TSX RKY•• rack with the exception of position PS which is reserved for the rack power supply module. If this is the case, the support is not used and must be removed.

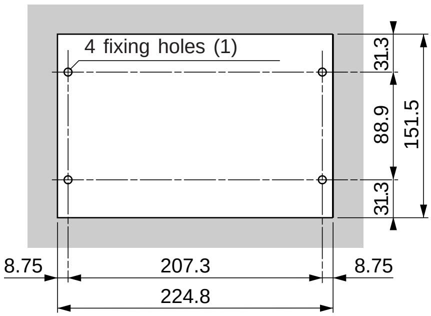


Note:
The TSX PSY ••• rack power supply module must be in position PS in order to supply power to the rack modules.

2.2-2 TSX SUP 1101 / A05 power supplies

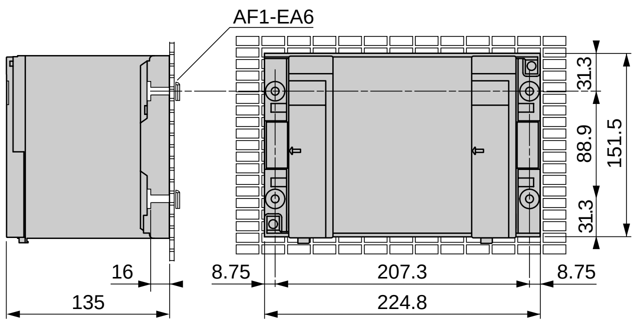
TSX SUP 1101 and TSX SUP A05 power supply units can be mounted on a panel, an AM1 - PA plate or a DIN rail.

- **Mounting on a panel : drilling plan** (dimensions in millimeters)

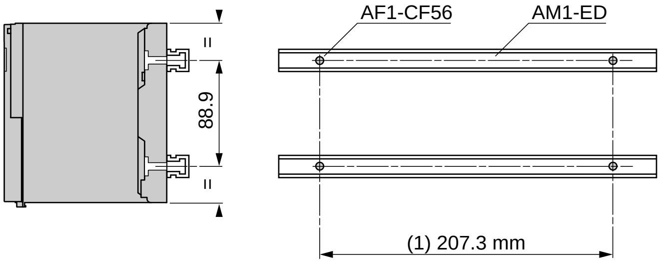


(1) The diameter of the fixing holes must be large enough to take M6 screws.

- **Mounting on a Telequick AM1-PA pre-slotted plate** (dimensions in millimeters)
  Fix the power supply unit using four M6x25 screws + washers and AF1-EA6 clip nuts



- **Mounting on a DIN rail, width 35 mm** (dimensions in millimeters)
  Fix the power supply unit using four M6x25 screws + washers and AF1-CF56 1/4 turn sliding nuts



2.2-3 Summary of mounting options

Power supply references	TBX SUP 10	TSX SUP 1011	TSX SUP 1021	TSX SUP 1051	TSX SUP 1101	TSX SUP A02	TSX SUP A05
Telequick AM1-PA plate	●	●	●	●	●	●	●
AM1-DE200/DP200 central DIN rail	●	●	●	●		●	
AM1-ED DIN rail 140 mm center (TSX 37 PLC)		●	●	●		●	
AM1-ED DIN rail 88.9 mm center (TSX 57 PLC)		●	●	●	●	●	●
TSX RKY●● TSX 57 rack		●	●	●		●	

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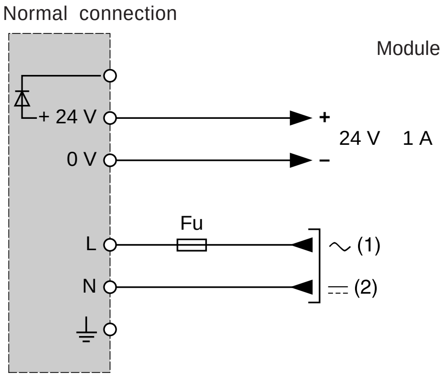
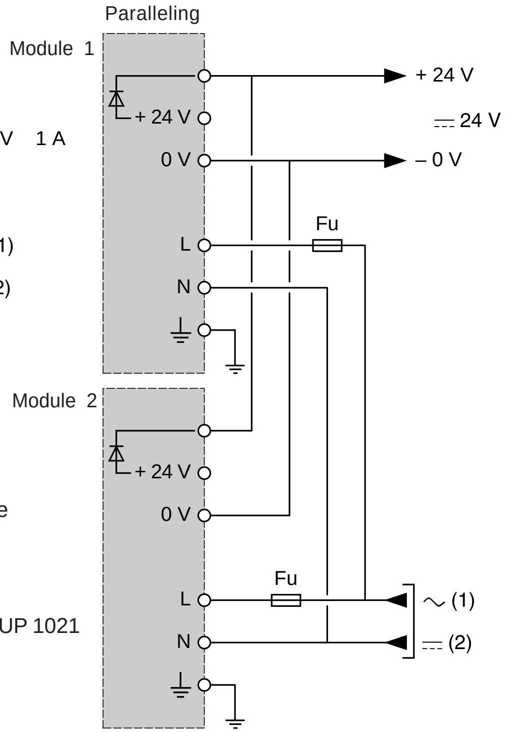
2.3 Connections for 24 VDC process power supplies

2.3-1 TSX SUP 1011/1021 power supplies





Fu = External protection fuse on phase (Fu) : 4A time-delayed 250 V.

(1) 100...240VAC on TSX SUP 1011
100...120 / 200..240VAC on TSX SUP 1021

(2) 125 VDC, only on TSX SUP 1011

Connection rules

Primary : if the module is supplied with 100/240 V∿, it is necessary to respect the phase and the neutral when wiring. Conversely, if the module is supplied with 125 V⎓ , it is not necessary to respect the polarities.

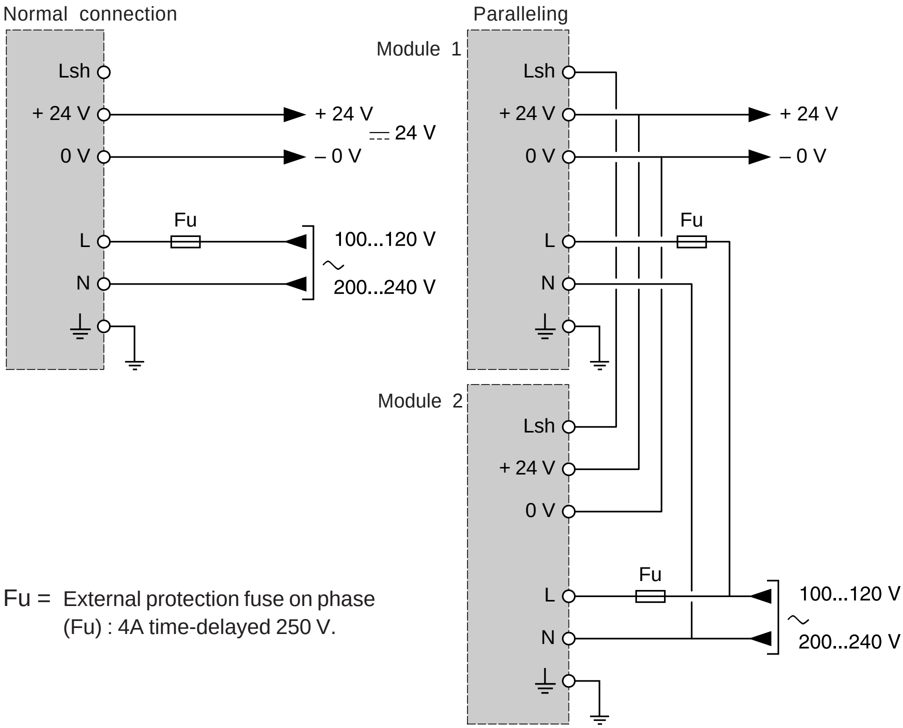
⚠ To ensure the safety of personnel, connect the ground terminal of the module to the protective ground with a green/yellow wire.

The power supply terminal block is protected by a cover which allows access to the wiring terminals. Wires exit vertically downwards. The wires can be held by a cable clamp.

In order to ensure 24 V SELV isolation, use wires with :

- An operating voltage ≥ 600 VAC and a cross-section of 1.5 mm² for connecting to the AC supply,
- An operating voltage ≥ 300 VAC and a cross-section of 2.5 mm² for 24 V outputs and the ground.

2.3-2 TSX SUP 1051 power supply



Fu = External protection fuse on phase (Fu) : 4A time-delayed 250 V.

Connection rules

Primary : respect the phase and the neutral when wiring.

⚠ To ensure the safety of personnel, connect the ground terminal of the module to the protective ground with a green/yellow wire.

The power supply terminal block is protected by a cover which allows access to the wiring terminals. Wires exit vertically downwards. The wires can be held by a cable clamp.

In order to ensure 24 V SELV isolation, use wires with :

- An operating voltage ≥ 600 VAC and a cross-section of 1.5 mm² for connecting to the AC supply,
- An operating voltage ≥ 300 VAC and a cross-section of 2.5 mm² for 24 V outputs and the ground.

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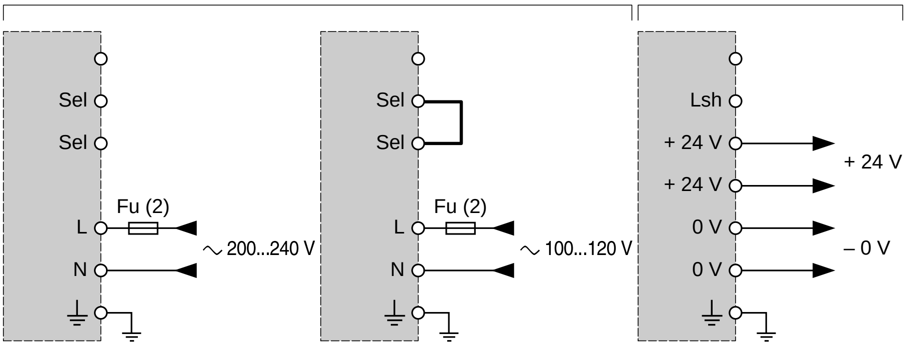
2.3-3 TSX SUP 1101 power supply

Normal connection

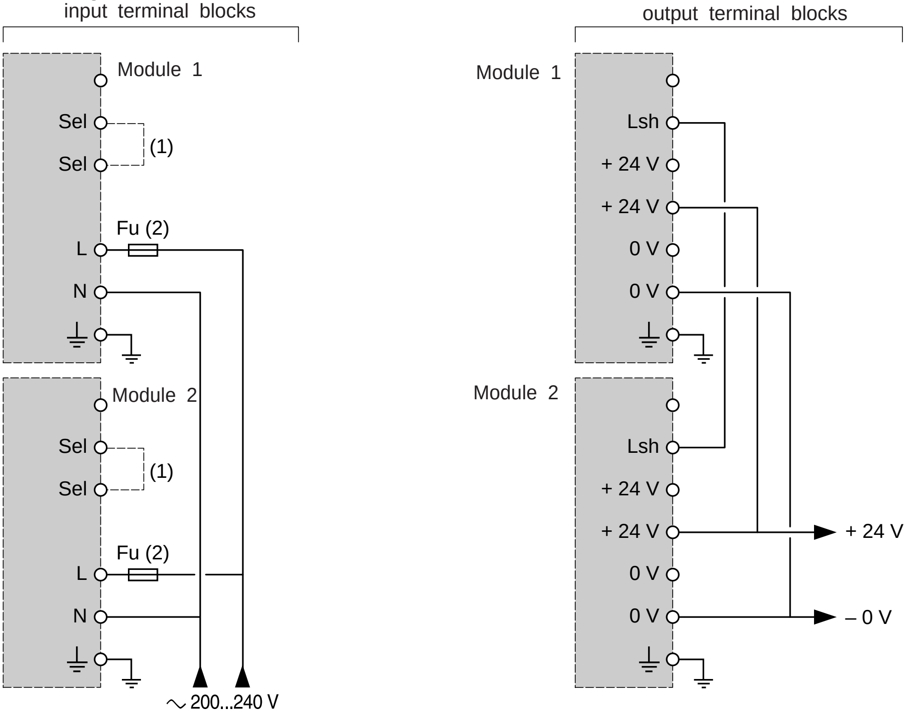


Connection to a ~ 200..240 V supply

Connection to a ~ 100..120 V supply

Connection to a ⎓ 24V output

Paralleling



(1) Connection to be performed if the power supply is provided by ~ 100...120 V
(2) External protection fuse on phase (Fu) : 6.3A time-delayed 250 V.

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Connection rules

Primary : respect the phase and the neutral when wiring.

⚠ To ensure the safety of personnel, connect the ground terminal of the module to the protective ground with a green/yellow wire.

The power supply terminal block is protected by a cover which allows access to the wiring terminals. Wires exit vertically downwards. The wires can be held by a cable clamp.

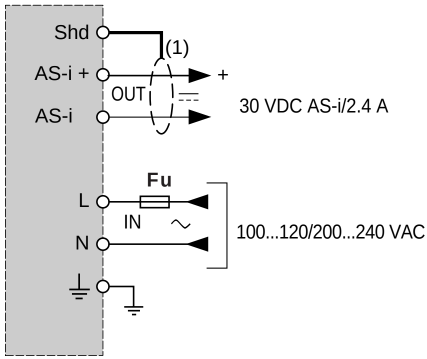
Secondary :

In order to ensure 24 V SELV isolation, use wires with :

- An operating voltage ≥ 300 VAC and a cross-section of 1.5 mm^2 or 2.5 mm^2 for connecting to the AC supply,
- An operating voltage ≥ 300 VAC and a cross-section of 2.5 mm^2 for 24 V outputs and the ground.
- Wire the two 24V terminals in parallel or share the load on the two 24V outputs if the total current supplied is greater than 5A.

2.4 Connections for AS-i power supplies

2.4-1 TSX SUP A02 power supply

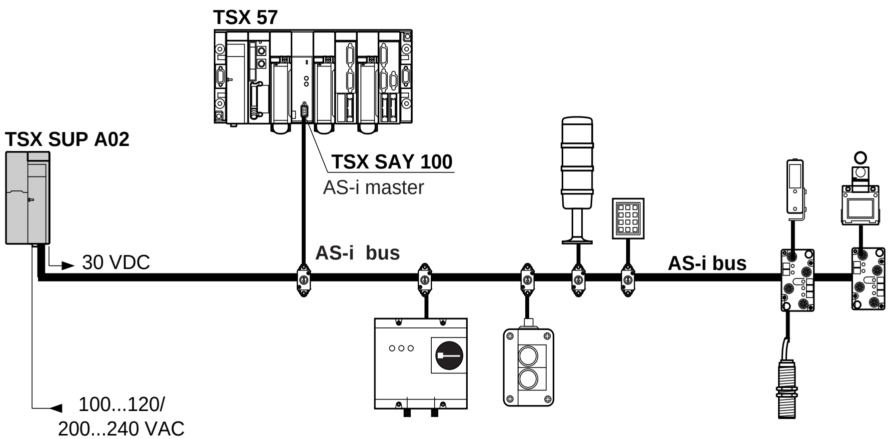


(1) Shielded AS-i cable screen for atmospheres subject to interference

Fu = External protection fuse on phase (Fu) : 4A time-delayed 250 V.

Connection diagram

The TSX SUP A02 power supply module is used to supply power to the AS-i bus and the slaves connected to it (30 VDC/2.4A output).



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Connection rules

Primary : respect the phase and the neutral when wiring.

⚠ To ensure the safety of personnel, connect the ground terminal of the module to the protective ground with a green/yellow wire.

The power supply terminal block is protected by a cover which allows access to the wiring terminals. Wires exit vertically downwards. The wires can be held by a cable clamp.

In order to ensure 24 V SELV isolation, use wires with :

- An operating voltage ≥ 600 VAC and a cross-section of 1.5 mm^2 for connecting to the AC supply,
- An operating voltage ≥ 300 VAC and a cross-section of 2.5 mm^2 for 24 V outputs and the ground.

A shielded cable is only required for the AS-i bus if the installation is subject to high EMC (Electromagnetic Compatibility) interference.

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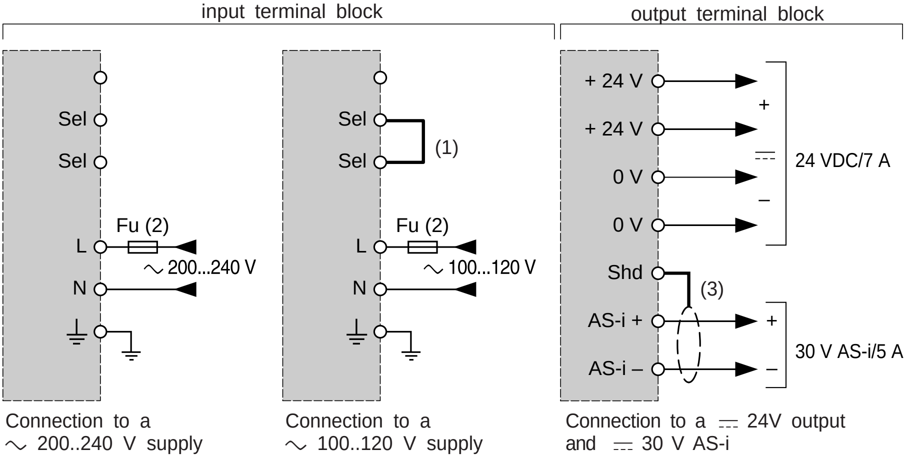
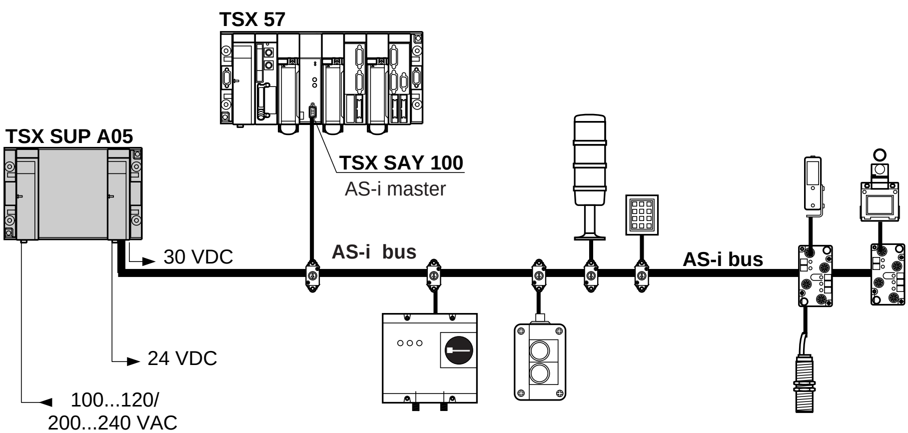
2.4-2 TSX SUP A05 power supply



(1) Connection to be performed if the power supply is provided by ~ 100...120 V
(2) External protection fuse on phase (Fu) : 6.3A time-delayed 250 V.
(3) Shielded AS-i cable screen for atmospheres subject to interference

Connection diagram

The TSX SUP A05 power supply unit is used to supply power to the AS-i bus and the slaves connected to it (30 V/5A output). It also has an auxiliary power supply (24 VDC/7A) for sensors /actuators which are high current consumers; a black AS-i ribbon cable is used for this purpose.



Connection rules

Primary : respect the phase and the neutral when wiring.

⚠ To ensure the safety of personnel, connect the ground terminal of the module to the protective ground with a green/yellow wire.

The "∿ power supply" and "⎓ 24V and AS-i 30 VDC output voltage" terminal blocks are protected by a cover which allows access to the wiring terminals. Wires exit vertically downwards. The wires can be held by a cable clamp.

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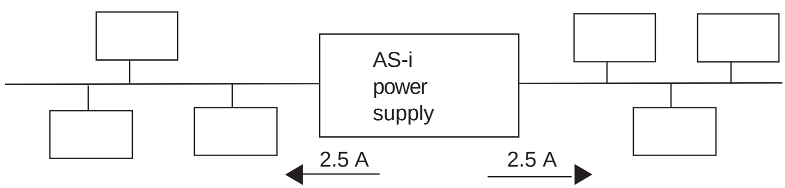
In order to ensure 24 V SELV isolation, use wires with :

- An operating voltage ≥ 300 VAC and a cross-section of 1.5 mm² or 2.5 mm² for connecting to the AC supply,
- An operating voltage≥ 300 VAC and a cross-section of 2.5 mm² for 24V outputs and the ground.
- Wire the two 24V terminals in parallel or share the load on the two 24V outputs if the total current supplied is greater than 5A.

A shielded cable is only required for the AS-i bus if the installation is subject to high EMC (Electromagnetic Compatibility) interference.

As this power supply can supply a very large current, its positioning on the bus is very important. If the power supply if positioned at one end of the bus, it provides its nominal current (for example 5A) for the whole bus, and the voltage drop at the end of the bus is thus proportional to this 5A. If it is positioned halfway along the bus, the voltage drop at the end of the bus is only proportional to 2.5A, if consumption on each of the sections of the bus is equal.



If none of the slaves use a large amount of energy, it is preferable to position the power supply in the center of the installation. Conversely, if the installation has one or more slaves which use a large amount of energy, it is advisable to position the power supply near to these slaves.

Note : If actuators which use a large amount of energy are present (contactors, solenoid valve coils, etc), the TSX SUP A05 power supply can provide the auxiliary 24 VDC, isolated from the AS-i line.

2.4-3 General recommendations

When the AS-i yellow cable is installed, it must be placed in a cable ducting which is separate from the power cable ducting. It is also advisable to lay it flat and not to twist it in order to optimize the symmetry between the two wires of the AS-i cable. The installation of the AS-i cable in a plan connected to the electrical potential of the machine (for example the frame), meets the requirements of the EMC (Electromagnetic Compatibility) directive.

The end of the cable, or ends for a star connection, must be protected by :
- connecting them to a tap link tee,
- not allowing them to exit the last connection point.

Important

The energy on the AS-i bus must be properly distributed so that each product on the bus is supplied with sufficient voltage to ensure correct operation. To do this, the following rules must be respected :

- Rule 1

Select the power supply rating suitable for the total consumption of the AS-i segment. The ratings available are 2.4 A (TSX SUP A02) and 5 A (TSX SUP A05). A rating of 2.4 A is usually sufficient for an average consumption of 65 mA per slave for a segment comprising a maximum of 31 slaves.

- Rule 2

To minimize voltage drops and reduce the cost of the cable, it is necessary to determine the optimum position for the power supply on the bus, as well as the minimum cross-section suitable for distributing the power.
The voltage drop should not exceed 3V between the master and the last slave on the bus. To this end, the table below gives the information required to select the cross-section of the AS-i cable.

AS-i cable cross-section	**0.75 mm^2**	**1.5 mm^2**	**2.5 mm^2**
Linear resistance	52 mΩ / meter	27 mΩ / meter	16 mΩ / meter
Voltage drop for 1 A on 100 meters	5.2 V	2.7 V	1.6 V

The 1.5 mm^2 cable is suitable for the majority of applications, this is the AS-i bus standard model (cable offered in the SCHNEIDER catalog). Cables with a smaller cross-section may be used if the sensors use very little energy.

Note :
The maximum length without a repeater for all the segments of the AS-i bus is 100 meters. The length of cable connecting a slave to a passive splitter block must be taken into account.

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3.1 Electrical characteristics

3.1-1 Process power supplies : TBX SUP 10 and TSX SUP 1011

Process power supplies			**TBX SUP 10** 24 V / 1A	**TSX SUP 1011** 24V / 1A
Primary				
Nominal input voltage		V	∼ 100... 240 ⎓ 125	∼ 100... 240 ⎓ 125
Input limit voltage		V	∼ 90...264 ⎓ 88...156	∼ 85...264 ⎓ 105...150
Line frequency		Hz	47... 63	47...63/360...440
Nominal input current (U = 100V)		A	0.4	0.4
Max inrush current	at 100 V	A	3	37
(1)	at 240 V	A	30	75
It max	at 100 V	As	0.03	0.034
on activation (1)	at 240 V	As	0.07	0.067
I^2t max	at 100 V	A^2s	2	0.63
on activation (1)	at 240 V	A^2s	2	2.6
Power factor			0.6	0.6
Harmonic 3			10% (φ = 0° and 180°)	10% (φ = 0° and 180°)
Full load efficiency		%	> 75	> 75
Secondary				
Useful power (2)		W	24	26 (30)
Nominal output current (2)		A	1	1.1
Output voltage / specified at 25°C		V	24 ± 5 %	24 ± 3 %
Residual ripple (peak to peak) Max HF noise (peak to peak)		mV mV	240 240	150 240
Permitted duration of AC supply micro-break (3)		ms	≤ 10 in ∼ ≤ 1 in ⎓	≤ 10 in ∼ ≤ 1 in ⎓
Protection against	Short-circuits and overloads		continuous - automatic reactivation	fallback to 0 and automatic re-activation when error disappears
	Overvoltages	V	peak limiting U > 36	peak limiting U > 36
Paralleling			no	yes with power optimization
Serial connection			no	yes
Dissipated power		W	8	9

(1) Values on initial activation, at 25°C. These elements should be taken into account when starting up for sizing protection devices.
(2) Useful power and output current at an ambient temperature of 60°C. Value between () = useful power in a ventilated enclosure or within a temperature range of 0...+40°C.
(3) Nominal voltage for a repetition frequency of 1 Hz.

3.1-2 Process power supplies : TSX SUP 1021/1051/1101

Process power supplies			TSX SUP 1021 24 V / 2A	TSX SUP 1051 24 V / 5A	TSX SUP 1101 24 V / 10A
Primary					
Nominal input voltage		V	~ 100...120/200...240		
Input limit voltage		V	~ 85...132/170...264		
Line frequency		Hz	47...63 / 360...440		
Nominal input current (U=100V)		A	0.8	2.4	5
Max inrush current	at 100 V	A	< 30	51	75
(1)	at 240 V	A	< 30	51	51
It max	at 100 V	As	0.06	0.17	0.17
on activation (1)	at 240 V	As	0.03	0.17	0.17
I^2t max	at 100 V	A^2s	4	8.6	8.5
on activation (1)	at 240 V	A^2s	4	8.6	8.5
Power factor			0.6	0.52	0.5
Harmonic 3			10% (φ = 0° and 180°)		
Full load efficiency		%	> 75	> 80	
Secondary					
Useful power (2)		W	53(60)	120	240
Nominal output current (2) A		2.2	5	10	
Output voltage (0°C - 60°C)		V	24 ± 3 %		24 ± 1 %
Residual ripple (peak to peak)		mV	150	200	
Max HF noise (peak to peak)		mV	240		
Permitted duration of AC supply micro-break (3)		ms	≤ 10		
Start time on resistive load s		< 1			
Protection against	Short-circuits and overloads		fallback to 0 and automatic reactivation when error disappears	current limit	
	Internal overvoltages	V	peak limiting U > 36	peak limiting U > 32	
Paralleling			yes, with power optimization		
Serial connection			yes		
Dissipated power		W	18	30	60

(1) Values on initial activation, at 25°C. These elements should be taken into account when starting up for sizing protection devices.
(2) Useful power and output current at an ambient temperature of 60°C. Value between () = useful power in a ventilated enclosure or within a temperature range of 0...+40°C.
(3) Permitted duration at nominal voltage for a repetition frequency of 1 Hz.

3.1-3 AS-i power supplies : TSX SUP A02 /A05

AS-i power supplies			**TSX SUP A02** 30V AS-i / 2.4A	**TSX SUP A05** 24V / 7A & 30V AS-i/5A	
Primary					
Nominal input voltage		V	∼ 100...120/200...240	∼ 100...120/200...240	
Input limit voltage		V	∼ 85...132/170...264	∼ 85...132/170...264	
Line frequency		Hz	47...63/360...440	47...63/360...440	
Nominal input current (U = 100V)		A	1.3	5	
Max inrush current	at 100 V	A	30	50	
(1)	at 240 V	A	30	50	
It max	at 100 V	As	0.06	0.17	
on activation (1)	at 240 V	As	0.03	0.17	
I^2t max	at 100 V	A^2s	4	8.5	
on activation (1)	at 240 V	A^2s	4	8.5	
Power factor			0.6	0.51	
Harmonic 3			10% (φ = 0° and 180°)	10% (φ = 0° and 180°)	
Full load efficiency		%	> 75	> 80	
Secondary					
Useful peak power		W	72 (84) (2)	230 (3)	
Nominal peak	AS-i 30 V output	A	2.4 (2.8) (2)	5 (3) (4)	
current	24V output	A	—	7 (3) (4)	
Output voltage Global variation (-10°C to + 60°C)		V V	30 (AS-i) 29.5 to 31.6	24 ±3%	30 (AS-i) 29.5 to 31.6
Ripple (from 10 to 500 kHz) Ripple (from 0 to 10 kHz)		mV mV	50 300	200 240	50 300
Start time on resistive load		s	< 2 (with C = 15000 µF)	< 2 (with C = 15000 µF)	
Permitted duration of AC supply micro-break (5)		ms	≤ 10	≤ 10	
Protection against	Short-circuits and overloads		fallback to 0 and automatic reactivation when error disappears	current limit on each output	
	Overvoltages	V	peak limiting U > 36	peak limiting U > 36	
Dissipated power		W	24	60	

(1) Values on initial activation, at 25°C. These elements should be taken into account when starting up for sizing protection devices.
(2) Useful power and output current at an ambient temperature of 60°C. Value between () = transitory useful power.
(3) Useful power and output current for a maximum ambient temperature of 55°C, if product index II = 01. (60°C if product index II > 01).
(4) See the distribution diagram for current on each output on the next page.
(5) Permitted duration at nominal voltage for a repetition frequency of 1 Hz.

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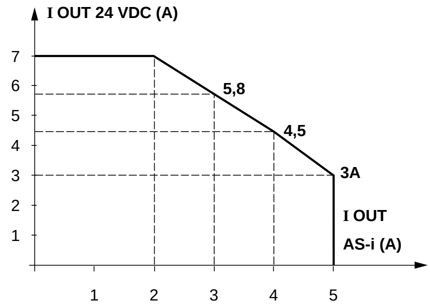
Diagram of currents available on AS-i 30 V and 24V outputs of the TSX SUP A05 power supply unit

The maximum power delivered by the power supply is 230 W. If the consumption is 5 A on the AS-i 30 V, the possible flow on the 24 V output is then only 3 A (see diagram opposite).



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3.2 Physical and environmental characteristics

Process and AS-i power supply modules / units		**TBX SUP 10**	**TSX SUP 1011 / 1021 TSX SUP 1051 / 1101 TSX SUP A02/A05**
Connection to screw terminals Max. capacity / terminal	mm²	1 terminal per output 1 x 2.5	1011/1021/1051/A02: 1 terminal/output 1101: 2 terminals/output A05: 2 terminals/output (24 VDC) 1 terminal/output (AS-i 30 VDC) 2x1.5 with cable end or 1 x 2.5
Temperatures : Storage Operation	 ° C ° C	 -25 to +70 +5 to +55	 -25 to +70 0 to +60 (TSX SUP 1011/1021/1051/1101) -10 to + 60 (TSX SUP A02/A05) (1)
Relative humidity	%	5-95	
Cooling	%	By natural convection	
User safety		_	SELV (EN 60950 and IEC1131-2)
Dielectric strength : Primary / secondary Primary / ground Secondary / Ground	 V rms V rms V rms	50/60Hz- 1min 1500 1500 500	 3500 2200 500
Insulation resistance: Primary / secondary Primary / ground	 MΩ MΩ	 ≥ 100 ≥ 100	
Leakage current		I ≤ 3.5 mA (EN 60950)	
Electrostatic discharge immunity		6 KV per contact / 8 KV in the air (conforms to IEC 1000-4-2)	
Fast electrical transients		2 KV (serial mode and common mode on input and output)	
Electromagnetic field influence		10 V/m (80 MHz to 1 GHz)	
Electromagnetic interference rejection		(conforms to FCC 15-A and EN 55022 class A) Test conditions : U and I nominal, resistive load, cables: 1 meter horizontal, 0.8 meter vertical	
Shock wave		Input : 4 kV MC, 2 KV MS Outputs : 2 kV MF, 0.5 kV MS (conforms to IEC 1000-4-5)	
Vibrations (2)		1 mm 3 Hz to 13.2 Hz 1 g 57 Hz to 150 Hz (2g TSX SUP A02/A05) (conforms to IEC 68-2-6, FC test)	
Degree of protection		IP 20.5	IP 20.5, terminal block IP 21.5
MTBF at 40°C	H	100 000	
Service life at 50°C	H	30 000 (at nominal voltage and at 80% of the nominal power)	

(1) -10°C to + 55°C for the TSX SUP A05 power supply unit with product index II = 01
-10°C to + 60°C for the TSX SUP A05 power supply unit with product index II > 01

(2) conforms to IEC 68-2-6, FC test with module or unit mounted on plate or panel

E

Symbols

A

B

C

D

E

F

G

I

R

S

T

U

W

1 General

This manual is intended for personnel technically qualified to install, operate and maintain the products which are described herein. It contains all the necessary information for correct use of the products. However, for advanced use of our products please contact your nearest sales office for additional information.

The contents of this manual are not contractual and cannot under any circumstance extend or restrict contract warranty clauses.

2 Qualification of personnel

Only **qualified personnel** are authorized to install, operate or maintain the products. Any work performed by unqualified personnel or non-observance of the safety instructions in this document or attached to the equipment may risk the safety of personnel and/or cause irreparable damage to equipment. The following personnel may be regarded as being **"Qualified"** :

- those involved with application design. Design office personnel familiar with control system safety concepts (for example, design engineers, etc),
- those involved with equipment installation. Individuals who are familiar with the installation, connection and startup of control system equipment (for example installers or wiring technicians working during the installation phase, technicians setting up the equipment, etc),
- those involved with operation. Personnel trained to operate and manage control system equipment (for example, operators, etc),
- those performing preventive or corrective maintenance. Personnel who are trained and experienced in the adjustment and repair of control system equipment (for example, installation engineers, after sales service engineers, etc).

3 Warnings

Warnings serve to prevent specific risks encountered by personnel and/or equipment. They are indicated in the documentation and on the products by different warning symbols, according to the severity of the risk :

Danger or **Caution**

Indicates that not following instructions or ignoring the warning may cause serious personal injury, death and/or serious damage to equipment.

Warning or **Important** or 

Indicates that not following a specific instruction may lead to minor injury and/or damage to equipment.

Note or **Comment**

Highlights important information relating to the product, its operation or its accompanying documentation.

4 Conformity of use

The products described in this manual **conform to the European Directives** (*) to which they are subject (CE marking). However, they can only be used correctly in the context of the applications for which they are intended (described in the various documents) and when connected to approved third party products.
As a general rule, if all handling, transport and storage specifications are observed, and all instructions for installation, operation and maintenance are followed, the products will be used correctly, with no danger to personnel or equipment.

(*) EMC and LV Directives, concerning Electromagnetic Compatibility and Low Voltage.

5 Installing and setting up equipment

It is important to observe the following rules when installing and starting up equipment. In addition, if the installation includes digital links, it is essential to follow the basic wiring rules given in the manual "Electromagnetic Compatibility of industrial Networks and Fielbuses"**, reference TSX DG KBLE,** or in manual **TSX DR NET**, part C.

- safety instructions must be followed meticulously. These instructions are in the documentation or on the equipment being installed and set up.
- the type of equipment defines the way in which it should be installed :
  - a flush-mountable device (for example, an operator terminal or a cell controller) must be flush-mounted,
  - a device which is to be built in (for example, PLC) must be placed in a cabinet or enclosure,
  - the casing of a laptop or portable device (for example, a programming terminal or a notebook) must remain closed,
- if the device is permanently connected,
  - the upstream installation must conform to standard IEC 1131-2 **overvoltage category 2**,
  - in addition, its electrical installation must include a device to isolate it from the power supply and a circuit-breaker to protect it against overcurrents and isolation faults. If this is not the case, the power socket must be grounded and be easily accessed. **In all cases, the device must be connected to the protective mechanical ground PG using green/yellow wires (NFC 15 100 - IEC 60 364-5-51) .**
- low voltage circuits (even though they are low voltage) must be connected to the protective ground so that dangerous voltages can be detected.
- before a device is powered up, its nominal voltage must be checked to ensure that it has been adjusted to conform with the supply voltage.
- if the device is supplied with 24 or 48 VDC, the low voltage circuits must be protected. Only use power supplies which conform to the standards currently in force.
- check that the supply voltages remain within the tolerance ranges defined in the technical characteristics of the devices.
- all measures must be taken to ensure that any power return (immediate, warm or cold) does not lead to a dangerous state which may risk personnel or the installation.
- emergency stop devices must remain effective in all the device's operating modes, even those which are abnormal (for example, when a wire becomes disconnected). Resetting these devices must not cause uncontrolled or improper restarts.
- cables which carry signals must be located where they do not cause interference with the control system functions by capacitive, inductive or electromagnetic interference.

- control system equipment and their control devices must be installed in such a way as to ensure that they are protected against unintentional operation.
- appropriate safety measures must be taken for the inputs and outputs, to prevent improper states in the control system device, if no signal is received.

6 Equipment operation

The operational safety and availability of a device is its ability to avoid the appearance of faults and to minimize their effects if they occur.

A system is said to be fail-safe if the appearance of faults **never** causes a dangerous situation.

A fault inside the control system is known as :

- passive, if it results in an open output circuit (no command is sent to the actuators).
- active, if it results in a closed output circuit (a command is sent to the actuators).

From the safety point of view, a given fault is dangerous or not depending on the type of command given during normal operation. A passive fault is dangerous if the normal command is the operation of an alarm. An active fault is dangerous if it maintains or activates an undesirable command.

It is important to note the basic difference between the behavior of an electromechanical relay and an electronic component (for example a transistor) :

- there is a high probability, approximately 90%, that the failure of a relay will cause an open circuit (control circuit powered off).
- there is a 50% probability that the failure of a transistor will cause either an open circuit or a closed circuit.

This is why it is important to correctly estimate the types and consequences of faults when automating a system using electronic products such as PLCs, including when relay output modules are used on PLCs.

The system designer must **use devices external to the PLC** to protect against active faults inside the PLC, which are not indicated and are judged to be dangerous to the application. This may require solutions from various different technologies such as mechanical, electromechanical, pneumatic or hydraulic devices (for example, directly wiring a limit switch and emergency stop switches to the coil of a movement control contactor).

To protect against dangerous faults which may occur on output circuits or preactuators, it is sometimes beneficial to resort to general principles and use the large processing capacity of PLCs, for example by using inputs to check the correct execution of commands requested by the program.

7 Electrical and thermal characteristics

Details of the electrical and thermal characteristics of devices are given in the associated technical documents (installation manuals, quick reference guides).

8 Environmental conditions

In industry, the micro-environmental conditions of electronic devices can vary greatly. For this reason, programmable controllers and associated modules must conform to the following two types of installation :

- installation in an enclosure with IP54 protection for protecting devices from metallic dust amongst other things. Two guidelines are associated with this type of installation :
  - direct access to electronic modules should be strictly reserved to maintenance staff (see section 2), with access keys,
  - the selection of a metal enclosure must be considered, since it serves as extra shielding against the latent risk of electromagnetic interference.
- direct installation without protection for Premium PLCs and associated systems (power supply modules, etc) which themselves have IP20 protection.
  This type of installation applies to areas with restricted access and low pollution levels (not exceeding 2), for example stations or control rooms which have neither machines nor any activity generating metallic dust or other metallic particles. The external walls hence serve as the PLC enclosure.

9 Preventive or corrective maintenance

Availability

The availability of a system is its ability, in terms of its combined reliability, maintainability and maintenance logistics, to be in a state to perform a required function, at a given moment and within a defined time period.

Availability is therefore specific to each application, since it is a combination of :

- the architecture of the automatic system,
- the reliability and maintainability : intrinsic characteristics of the equipment (PLCs, sensors, machine, etc),
- maintenance logistics : characteristic intrinsic to the user of the control system (software structure, fault indication, process, on-site replacement parts, training of personnel).

Troubleshooting procedure

- control system equipment should only be repaired by qualified personnel (after sales service engineer, or technician approved by Schneider Automation). Only certified replacement parts or components should be used.
- before performing any operation on equipment (for example opening an enclosure), always cut the power supply off (disconnect the power plug or open the power isolation switch).
- before performing any "mechanical" operation on equipment on site, cut the power supply off and mechanically lock any moving parts.
- before removing a module, a memory cartridge, a PCMCIA card, etc, check in the manual whether this should be done with the power off or if it is possible with the device powered up. Follow the instructions given in the manual carefully.
- on positive logic outputs or negative logic inputs, take all necessary precautions to prevent a disconnected wire coming into contact with the mechanical ground (risk of undesirable control action).

Replacement and recycling of used batteries

- if these are replaced, use batteries of the same type and dispose of defective batteries in the same way as toxic waste.
  Do not throw lithium or mercury batteries into a fire, open or recharge them, or attempt to solder them.

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1.1 Description

1.1-1 General

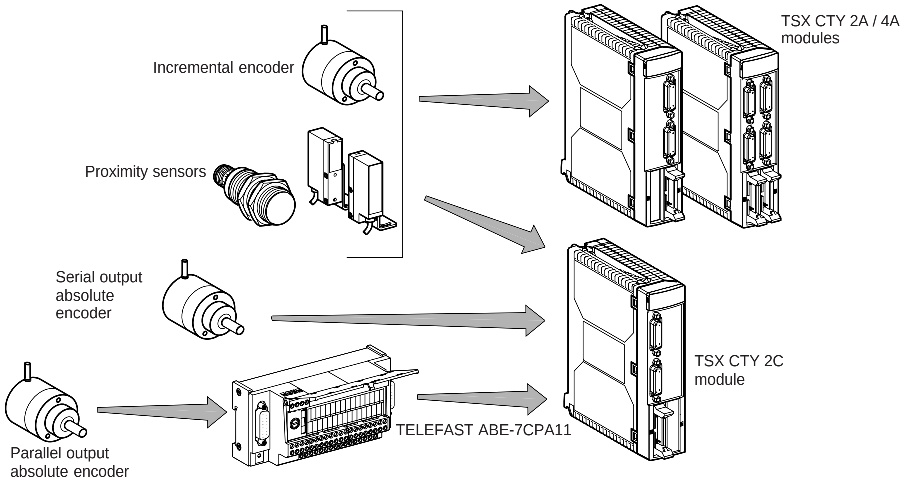
TSX CTY 2A, TSX CTY 4A and TSX CTY 2C modules are standard format counter modules. They are used to count pulses from a sensor, at a maximum frequency of 40 kHz (CTY 2A / 4A) or 1 MHz (CTY 2C).
Counter modules can be installed in any available slot in a Premium (TSX, PMX or PCX) PLC configuration, provided it uses no more than :

- 8 "app.-specific" channels in a TSX P57 102/TPMX P57 102/TPCX 57 1012 configuration
- 24 "app.-specific" channels in a TSX P57 2•2/TPMX P57 202 configuration
- 32 "app.-specific" channels in a TSX P57 3•2/TPMX P57 352/TPCX 57 3512 configuration
- 48 "app.-specific" channels in a TSX P57 4•2/TPMX P57 452 configuration

TSX CTY 2A and TSX CTY 4A modules only differ in the number of channels they have (2 channels for the TSX CTY 2A module and 4 channels for the TSX CTY 4A module) and are used to perform upcounting, downcounting and up/down counting functions for each channel.
The TSX CTY 2C module (2 channels) is used to perform up/down counting and measurement functions in normal mode or modulo mode.

The sensor used on each channel can be :

- A 2- or 3-wire proximity sensor, type PNP or NPN. If an output with mechanical contacts is used, the channel immunity must be increased, in order to reduce bounce when the contact is closed.
- An incremental encoder with 5 VDC differential output signals (encoder with RS 422/ 485 line driver)
- An incremental encoder with 10-30 VDC output signals (Totem Pole encoder)
- A serial output absolute encoder, RS 485 standard interface (TSX CTY 2C only)
- A parallel output absolute encoder, via the TELEFAST adaptor : ABE-7CPA11 (TSX CTY 2C only).



1.1-2 Physical description

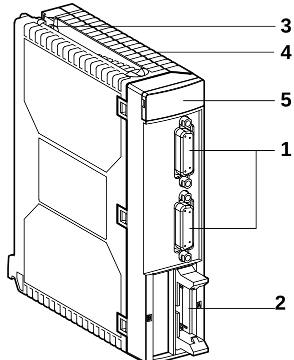
1 Standard 15-pin SUB-D connector for connecting :
- the counting sensor(s) corresponding to channels 0 and 1 for TSX CTY 2A / 2C modules, and channels 0, 1, 2, and 3 for the TSX CTY 4A module,
- the encoder power supply if this type of sensor is used,
- the encoder power supply return which confirms that this is correctly supplied.

2 20-pin HE10 connector for connecting (for each channel) :
- the auxiliary inputs :
  - reset or set to preset value,
  - counter enable,
  - read,
- the auxiliary outputs,
- the external power supplies :
  - power supply for the auxiliary inputs and outputs,
  - power supply for other sensors.

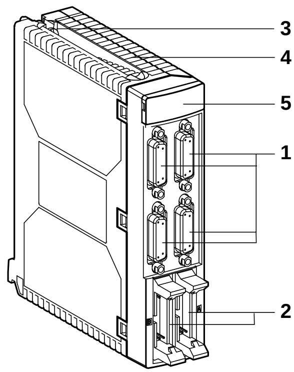
3 Screw for fixing the module in its position.

4 Rigid casing providing :
- support for the electronic card,
- guidance of module into its slot.

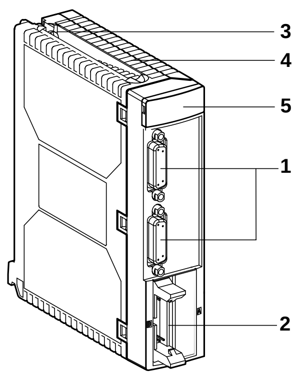
5 Module diagnostics indicator lamps :
- module level diagnostics :
  - green RUN indicator lamp : indicates the module operating mode (module operative),
  - red ERR indicator lamp : indicates the internal status of the module (internal fault, module failure),
  - red I/O indicator lamp : indicates an external module fault or an application fault.
- channel level diagnostics :
  - green CHx indicator lamp : indicates channel diagnostics :
    . indicator lamp on : channel operating,
    . indicator lamp flashing : channel not operating,
    . indicator lamp off : channel faulty, not configured or incorrectly configured.



TSX CTY 2A



TSX CTY 4A

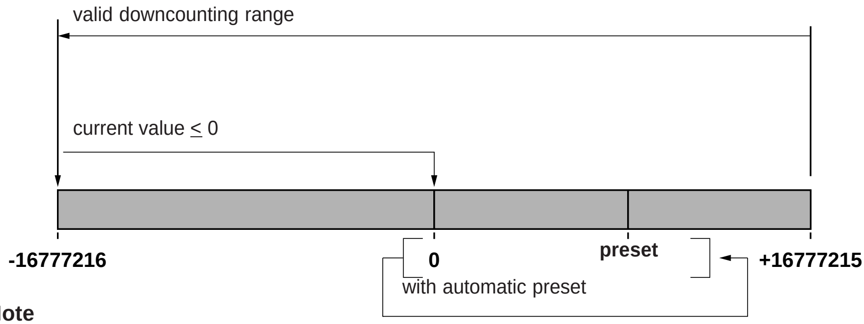


TSX CTY 2C

2.1 Presentation of the various counting functions

2.1-1 Downcounting function (TSX CTY 2A / 4A modules)

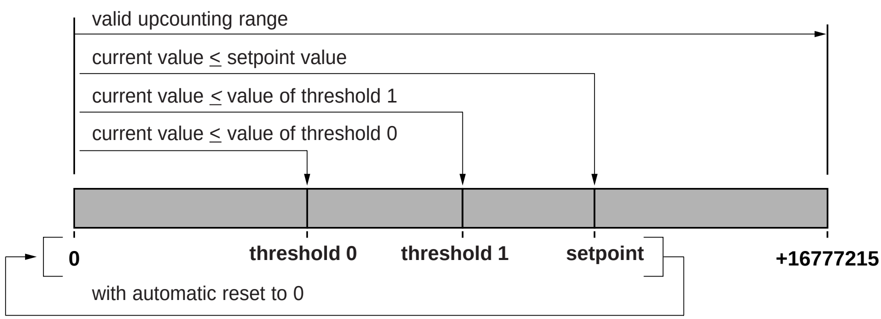
The downcounting function is used to downcount pulses (on 24 bits + sign) from a preset value from 0 to +16777215 and indicates if the current value is less than or equal to 0. The downcounting range is between -16777216 and +16777215.



Note
The operation of the downcounting function, associated language objects and software installation are described in the application-specific manual.

2.1-2 Upcounting function (TSX CTY 2A / 4 A modules)

The upcounting function is used to upcount pulses (on 24 bits + sign) from 0 to a preset value called the setpoint value and indicates passage through the setpoint value. The upcounting range is from 0 to + 16777215.
The current value of the counter is continuously compared with two adjustable thresholds (threshold 0 and threshold 1).

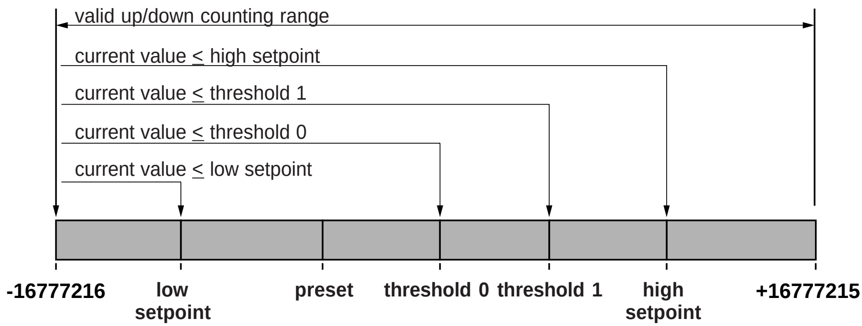


Note
The operation of the upcounting function, associated language objects and software installation are described in the application-specific manual.

2.1-3 Up/down counting function (TSX CTY 2A / 4A modules)

The up/down counting function is used to upcount and downcount pulses (on 24 bits + sign) from a preset value between -16777216 and +16777215 on the same module. This function also offers the option of defining several values the crossing of which by the current value will be signaled and may trigger event processing :

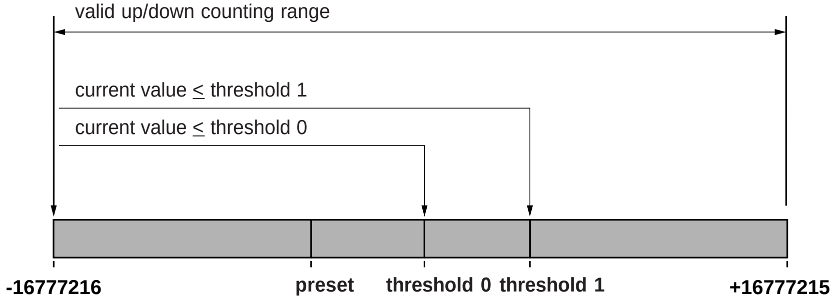
- a low setpoint and a high setpoint
- 2 adjustable thresholds (thresholds 0 and 1)



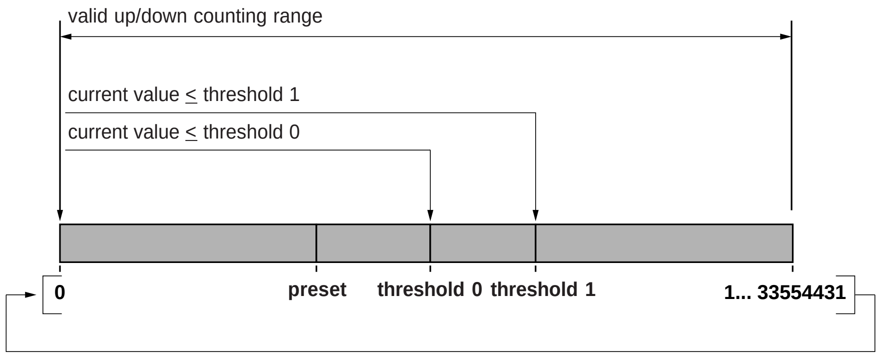
Note
The operation of the up/down counting function, associated language objects and software installation are described in the application-specific manual.

2.1-4 Up/down counting and measurement function (TSX CTY 2C module)

The up/down counting function is used to upcount and downcount pulses (on 24 bits + sign) on the same counter from a preset value from -16777216 to +16777215.
The measurement function is used to read a serial frame from a serial output absolute encoder.
The up/down counting and measurement function also offers the option of defining 2 thresholds (thresholds 0 and 1), the crossing of which by the current value will be signaled and may trigger event processing.



Modulo mode is used for up/down counting (on 25 bits) in the range 0 to +33554431.



Note
The operation of the up/down counting and measurement function, associated language objects and software installation are described in the application-specific manual.

2.2 Up or down counting with a TSX CTY 2A / 4A module

The TSX CTY 2A/4A counter modules provide :

- 2 independent upcounting or downcounting channels (TSX CTY 2A module)
- 4 independent upcounting or downcounting channels (TSX CTY 4A module)

The maximum counting frequency on each channel is 40 kHz.

Upcounting or downcounting signals
The upcounting or downcounting signals relating to a channel, as well as the encoder power supply (if the sensor is an incremental encoder) are grouped together on a standard 15-pin SUB-D connector. Each upcounter or downcounter channel can receive 5 VDC or 24 VDC signals. Pulses are received on input **IA**.

Auxiliary inputs
The 24 VDC auxiliary inputs (reset to 0 for upcounting, set to the preset value for downcounting and enable for upcounting or downcounting) and the external power supplies are grouped together on an HE10 connector, common to channels 0 and 1 or 2 and 3 (TSX CTY 4A only).

- **Reset to 0** (upcounting) **or preset** (downcounting)
  The reset to 0 (upcounting) or set to the preset value (downcounting) can be performed as follows :
  - changing the state (rising or falling edge) of input IPres (downcounting) or **IReset** (upcounting), depending on the selection made during configuration,
  - crossing the setpoint value (upcounting) or value 0 (downcounting),
  - by the program,
- **Enable upcounting or downcounting**
  Upcounting or downcounting is enabled as follows :
  - set input **IEna** to 1,
  - by the program.

Note
For further information on these functions, refer to the application-specific manual.

Line check input : EPSR
This input is connected to the power supply return output of an incremental encoder, in order to check that the encoder power supply is correct.
If there is a line break on the cable carrying the encoder power supply, a fault is generated which can be used by the application program.

See the following pages for the EPSR input wiring.

Counter outputs
Upcounting or downcounting functions have counter outputs which can be associated with 2 reflex physical outputs (Q0 and Q1) on the counter module :

- downcounting function : this offers one counter output with predefined activation and deactivation conditions :

  - activation when the current value passes through 0,
  - deactivation on downcounter preset.

- upcounting function : this offers two counter outputs, with activation and deactivation conditions which are predefined for counter output 0, and which can be set for counter output 1 :

  Counter output 0
  - activation on passage through the setpoint value,
  - deactivation upon counter reset.

  Counter output 1
  - activation and deactivation can be set in the adjustment screen.

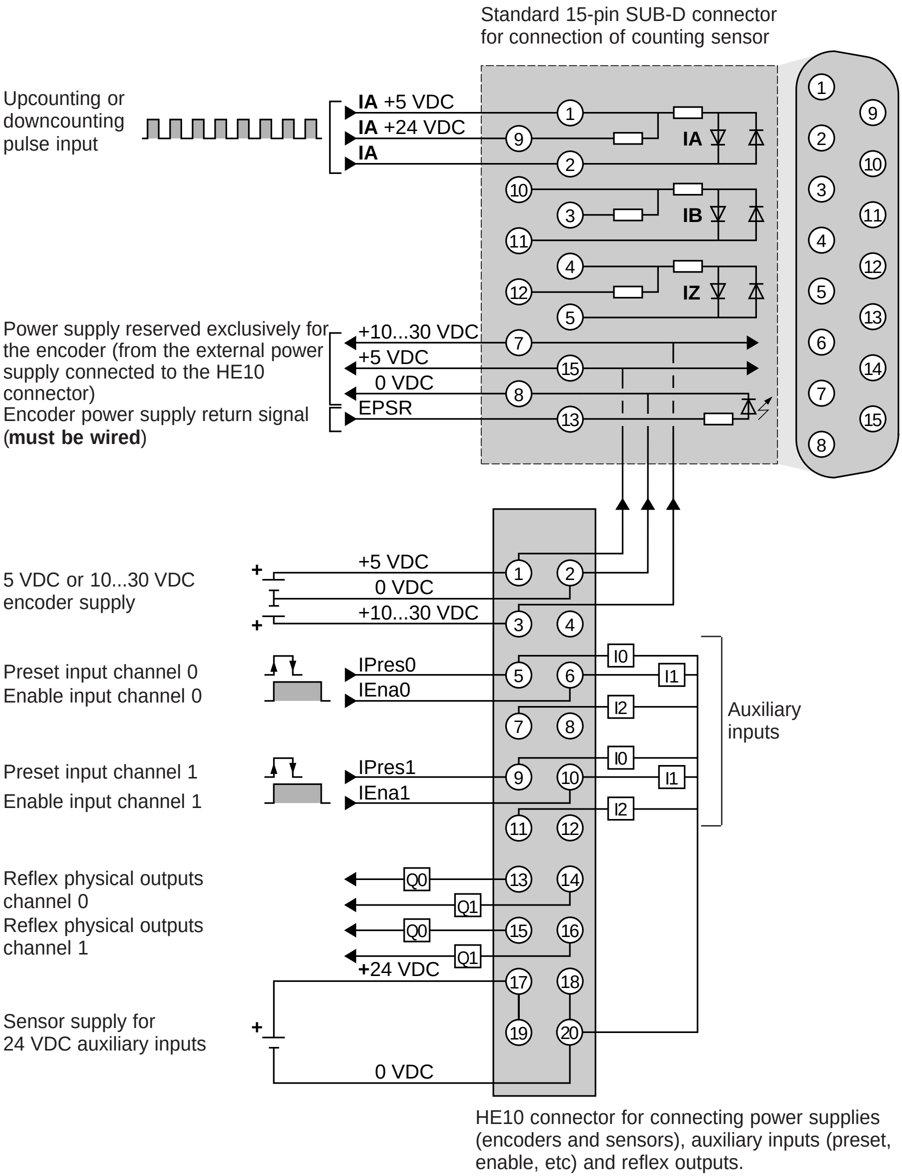
Physical outputs
Physical outputs Q0 and Q1 can be controlled as follows :

- in automatic mode : if the physical output is enabled, the state of the counter output is applied to the output (counter output 0 controls output Q0 and counter output 1 controls output Q1). If the physical output is not enabled, it is at 0,
- in manual mode : the state of the physical output is controlled manually.

For further information on setting up counter outputs and physical outputs, refer to the application-specific manual.

Simplified schematic

The 15-pin SUB-D connector is used to wire a single counter channel (for example, channel 0), while the HE10 connector is common to 2 channels (for example, channels 0 and 1). The wiring of the other channels or pairs of channels is identical.



HE10 connector for connecting power supplies (encoders and sensors), auxiliary inputs (preset, enable, etc) and reflex outputs.

2.3 Up/down counting with a TSX CTY 2A / 4A module

TSX CTY 2A/4A counter modules provide :

- 2 independent up/down counting channels (TSX CTY 2A module),
- 4 independent up/down counting channels (TSX CTY 4A module).

The maximum up/down counting frequency on each channel is 40 kHz.

Up/down counting signals

Up/down counting on a channel can be performed in several ways :

- use of a physical input for upcounting and a physical input for downcounting. Upcounting pulses are received on input **IA** and downcounting pulses on input **IB**.

  Note
  All pulses on inputs IA and IB are taken into account, whatever the synchronism of the signals.

- use of a physical input for up/down counting and a physical input for direction (upcounting or downcounting). Up/down counting pulses are received on input**IA** and the direction (upcounting or downcounting) is defined by the state of input **IB** (upcounting at state 1 and downcounting at state 0).

  Note
  In upcounting, pulses on input IA are taken into account if input IB is at 1 for more than 3 µs.
  In downcounting, pulses on input IA are not taken into account if input IB is at 0 for more than 3 µs.

- use of an up/down counting physical input and definition of direction by the application (setting a bit to 0 or 1). The up/down counting pulses are received on input **IA**.

- Use of two physical inputs with signals phase-shifted by $\pi/2$ (incremental encoder signals). Counting signal A is received on input **IA** and counting signal B on input **IB**.

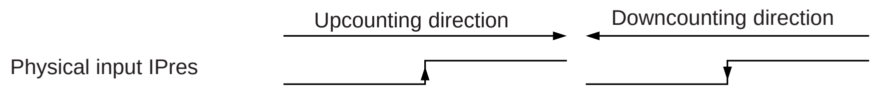
Auxiliary inputs

The 24 VDC auxiliary inputs and the external power supplies are grouped together on an HE10 connector, common to 2 channels : channels 0 and 1 or channels 2 and 3 (TSX CTY 4A only). The connector comprises the following signals : set to preset value **IPres**, enable up/down counting **IEna**, capture current value **IRead**.

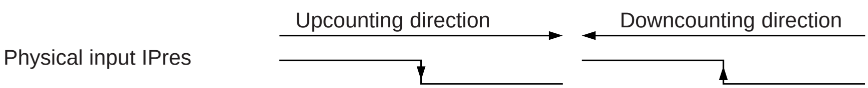
- **Preset**

  Setting to the preset value can be performed as follows :

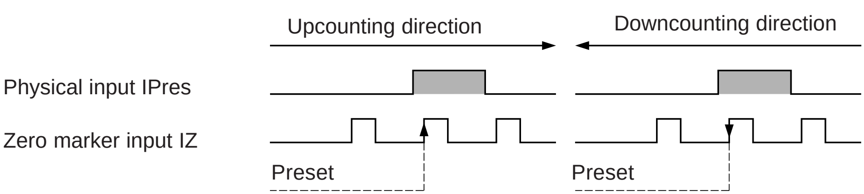
  - on a change of state (rising or falling edge) of input **IPres** and enable by program,
  - on a rising edge of input **IPres**, if the direction is + (upcounting) or on a falling edge of input **IPres**, if the direction is - (downcounting), and enable by program.



  - on a rising edge of input **IPres**, if the direction is - (downcounting) or on a falling edge of input **IPres**, if the direction is + (upcounting), and enable by program.



  - on state 1 of input **IPres** and enable by program. The current value does not change while the input is at 1.
  - on short cam reference point : the preset is taken into account :
    . if the direction is + (upcounting) : input **IPres** at state 1, rising edge of zero marker input **IZ**, and enable by program,
    . if the direction is - (downcounting) : input **IPres** at state 1, falling edge of zero marker input **IZ**, and enable by program.

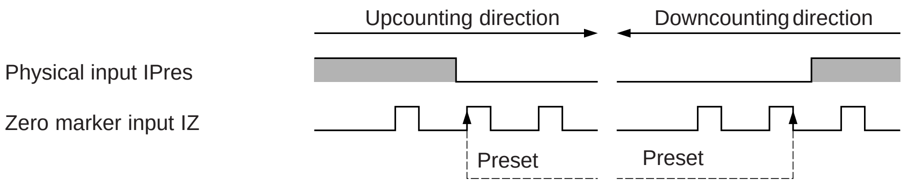


Note

In theory, as the short cam is less than one revolution of the incremental encoder, the zero marker only appears once in the cam.

If, however, there are several revolutions of the incremental encoder in the cam, the last active edge of the zero marker signal triggers a preset.

- on long cam reference point : the preset is taken into account on the first rising edge of the zero marker input **IZ** after input **IPres** has passed through state 0 in both the upward and downward directions, and enable by program.



- directly by program.

- **Enable up/down counting**
  Up/down counting is enabled as follows :
  - on setting to 1 of input **IEna** and enable by program**,**
  - by the program.

- **Capture**
  The current value is captured in the following way :
  - on change of state (rising or falling edge) of input **IRead** and enable by program,
  - by the program.

Note
For further information on these functions, refer to the application-specific manual.

Line check input : EPSR
This input is connected to the power supply return output of an incremental encoder, in order to check that the encoder power supply is correct.
If there is a line break on the cable carrying the encoder power supply, a fault is generated which can be used by the application program.

See the following pages for the EPSR input wiring.

Counter outputs
The up/down counting function has 2 counter outputs which can be associated with 2 reflex physical outputs (Q0 and Q1) on the counter module.
These two counter outputs have activation and deactivation conditions defined by the user in a coding matrix which can be accessed via the adjustment function.

Physical outputs
Physical outputs Q0 and Q1 can be controlled as follows :

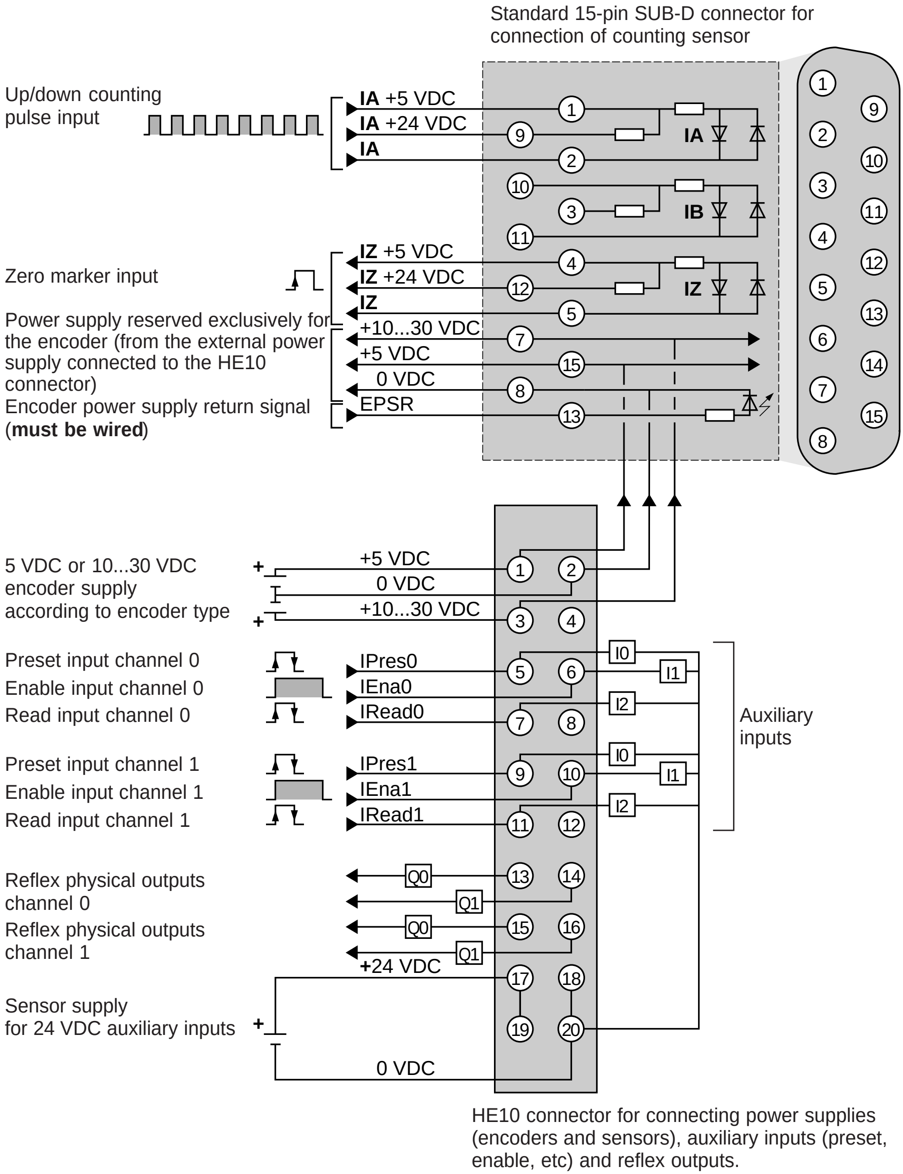
- in automatic mode : if the physical output is enabled, the state of the counter output is applied to the output (counter output 0 controls output Q0 and counter output 1 controls output Q1). If the physical output is not enabled, it is at 0.
- in manual mode : the state of the physical output is controlled manually.

For further information on setting up counter outputs and physical outputs, refer to the application-specific manual.

Notes :
The following schematics show the principle for wiring a 15-pin SUB-D connector (1 channel only). The wiring of the other channels is identical.
On schematics 2 to 4, the HE10 connector is not shown, as its wiring is identical to that of schematic 1.

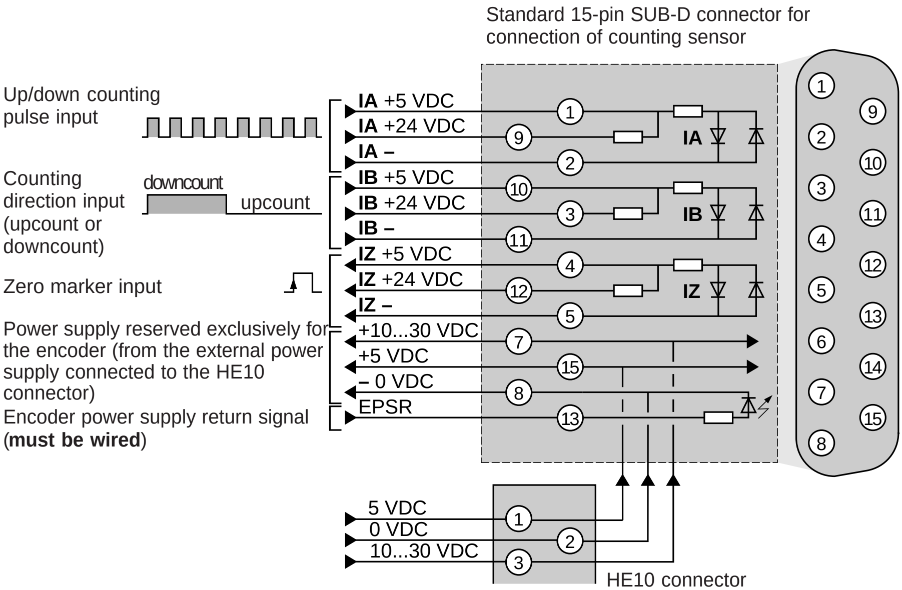
Simplified schematic 1

Use of an up/down counter physical input and definition of direction (upcounting or downcounting) by the application.



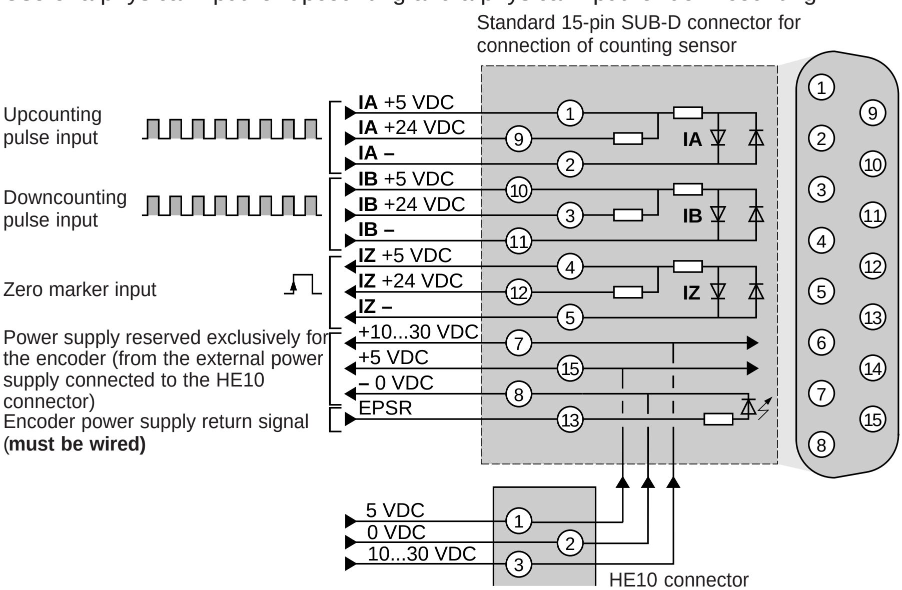
Simplified schematic 2

Use of a physical up/down counting input and a physical input for direction (upcounting or downcounting).



Simplified schematic 3

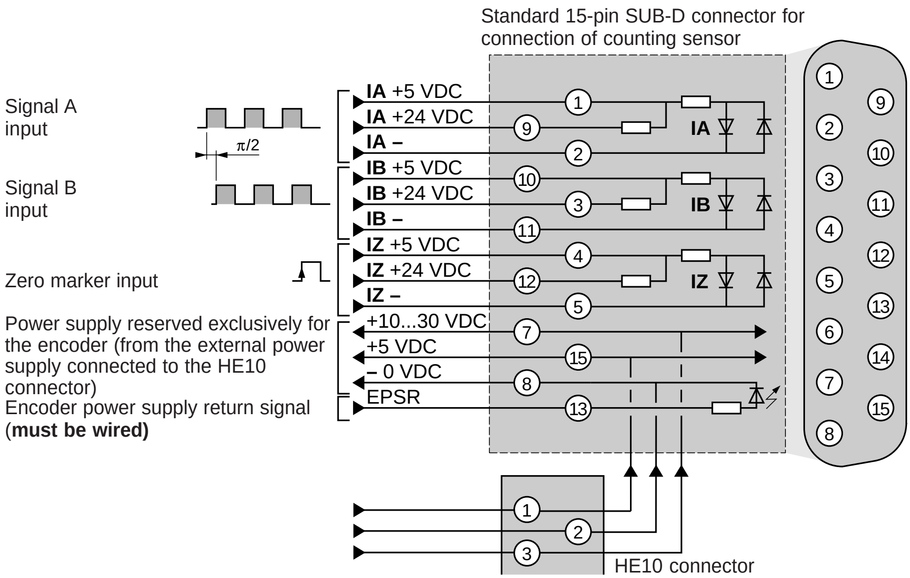
Use of a physical input for upcounting and a physical input for downcounting.



Simplified schematic 4

Use of two physical inputs for wiring an incremental encoder with signals phase-shifted by π/2. The multiplication by 4 option can be used to increase encoder resolution :

- multiplication by 1 : up/down counting is performed on the rising edges of input IB,
- multiplication by 4 : up/down counting is performed on all the rising and falling edges of inputs IA and IB.



2.4 Up/down counting and measurement with a TSX CTY 2C module

The TSX CTY 2C counter module can be used for 2 independent up/down counting and measurement channels (absolute encoder interface).

- **up/down counting (mechanical contacts, proximity sensor, pulse generators, incremental encoders)**

  Up/down counting on a channel can be performed in several ways :

  - use of a physical input for upcounting and a physical input for downcounting. Upcounting pulses are received on input **IA** and downcounting pulses on input **IB**.

  - use of a physical input for up/down counting and a physical input for direction (upcounting or downcounting). Up/down counting pulses are received on input **IA** and the direction (upcounting or downcounting) is defined by the state of input **IB** (upcounting at state 1 and downcounting at state 0).

  - use of an up/down counting physical input and definition of direction by the application (setting a bit to 0 or 1). The up/down counting pulses are received on input **IA**.
    The maximum up/down counting frequency on each channel is 1 MHz.

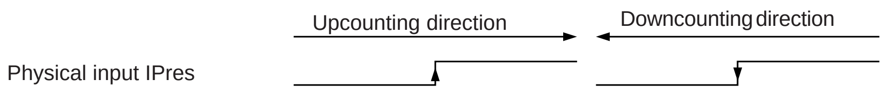
  - use of two physical inputs with signals phase-shifted by $\pi/2$ (incremental encoder signals). Counting signal A is received on input **IA** and counting signal B on input **IB**.
    The maximum frequency of phase-shifted signals is 500 kHz (in multiplication by 1) or 250 kHz (in multiplication by 4).

- **measurement (absolute encoders)**

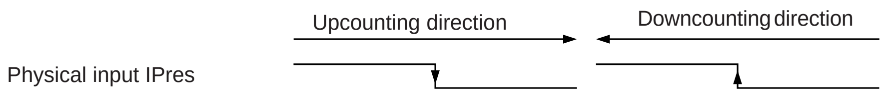
  - use of a physical input to receive serial data (signals from a serial output absolute encoder) and use of a physical output to send the transmission clock to the encoder.
    TELEFAST adaptor TSX ABE-7CPA11 allows a parallel output absolute encoder to be used.

Auxiliary inputs
The 24 VDC auxiliary inputs and the external power supplies are grouped together on an HE10 connector, common to 2 channels. The connector comprises the following signals : set to preset value **IPres**, enable up/down counting **IEna**, capture current value **IRead**.

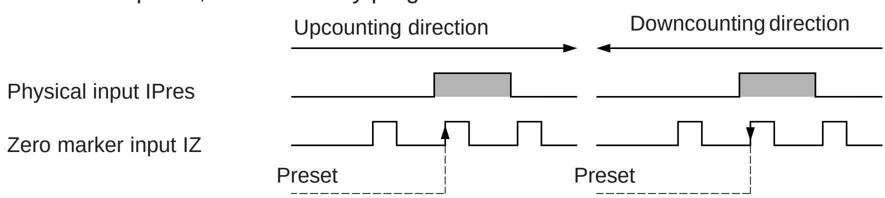
- **Preset**
  Setting to the preset value can be performed as follows :
  - on a change of state (rising or falling edge) of input **IPres** and enable by program,
  - on a rising edge of input **IPres**, if the direction is + (upcounting) or on a falling edge of input **IPres**, if the direction is - (downcounting), and enable by program.



  - on rising edge of input **IPres**, if the direction is - (downcounting) or on a falling edge of input **IPres**, if the direction is + (upcounting), and enable by program.

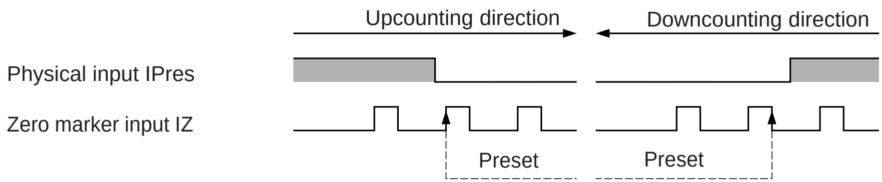


  - on state 1 of input **IPres** and enable by program. The current value does not change while the input is at 1.
  - on short cam reference point : the preset is taken into account :
    . if the direction is + (upcounting) : input **IPres** at state 1, rising edge of zero marker input **IZ**, and enable by program,
    . if the direction is - (downcounting) : input **IPres** at state 1, falling edge of zero marker input **IZ**, and enable by program.



Note
In theory, as the short cam is less than one revolution of the incremental encoder, the zero marker only appears once in the cam.
If, however, there are several revolutions of the incremental encoder in the cam, the last active edge of the zero marker signal triggers a preset.

- on long cam reference point : preset is taken into account on the first rising edge of the zero marker input **IZ** after input **IPres** has passed through state 0 in both the upward and downward directions, and enable by program.



- directly by program.

- **Enable up/down counting**
  Up/down counting is enabled as follows :
  - on setting to 1 of input **IEna** and enable by program**,**
  - by the program.

- **Capture**
  The current value is captured in the following way :
  - on change of state (rising edge, falling edge or rising and falling edges) of input **IRead** and enable by program,
  - by the program.

Note
For further information on these functions, refer to the application-specific manual.

Line check input : EPSR
This input is connected to the power supply return output of an incremental or absolute encoder, in order to check that the encoder power supply is correct.
If there is a short-circuit or line break on the cable carrying the power supply voltage to the encoder, a fault is generated which can be used by the application program.

See the following pages for the EPSR input wiring.

Counter outputs
The up/down counting function has 2 counter outputs which can be associated with 2 reflex physical outputs (Q0 and Q1) on the counter module.
These two counter outputs have activation and deactivation conditions defined by the user in a coding matrix (30 possible combinations), which can be accessed via the adjustment function.

Physical outputs
Each channel of the TSX CTY 2C module has 4 physical outputs, Q0 to Q3.

Physical outputs Q0 and Q1 are identical to those of a TSX CTY 2A or TSX CTY 4A module. They can be controlled :

- in automatic mode : if the physical output is enabled, the state of the counter output is applied to the output (counter output 0 controls output Q0 and counter output 1 controls output Q1). If the physical output is not enabled, it is at 0.
- in manual mode : the state of the physical output is controlled manually.

Output Q2 can only be controlled in manual mode.

Output Q3 is in fact, a configurable input/output. It can be used in **programmable frequency** mode to give an external synchronization marker on several channels in several counter modules.

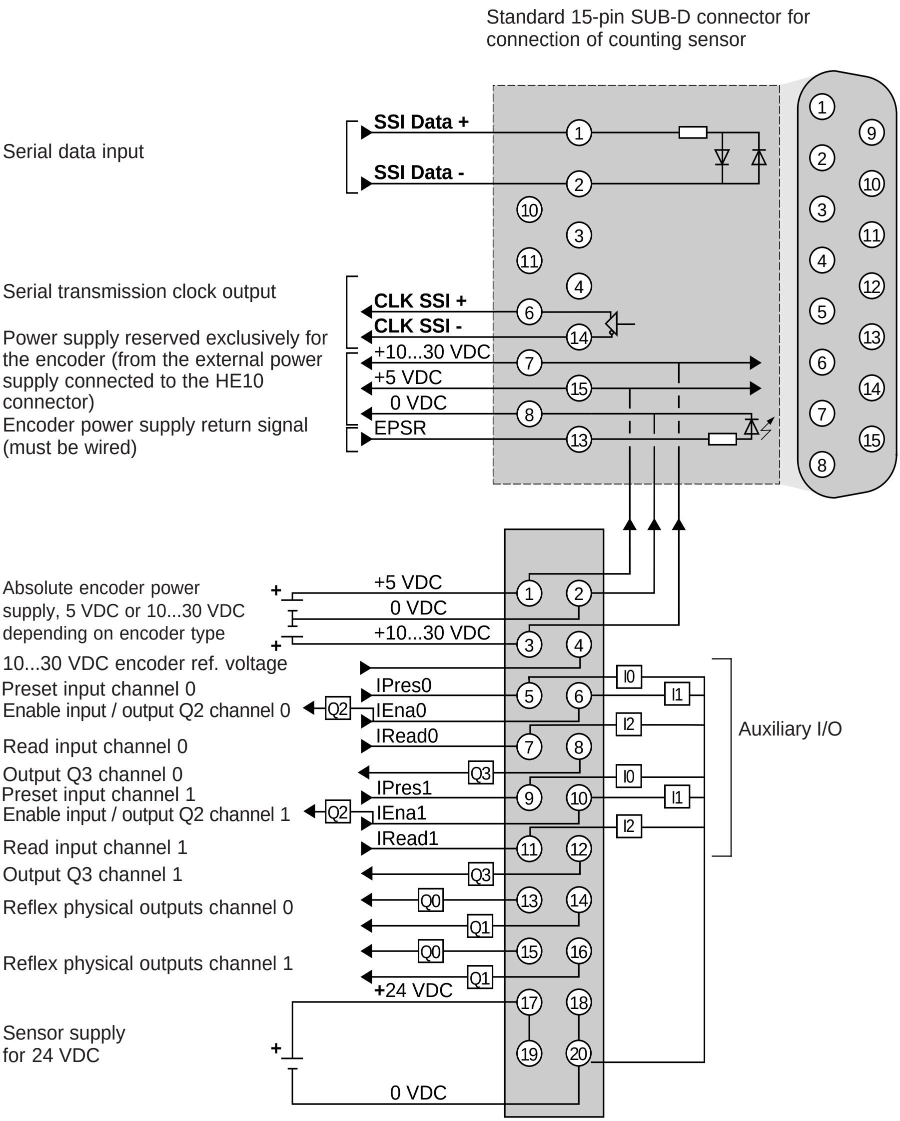
When using parallel outputs absolute encoder(s), with a TELEFAST adaptor, ABE-7CPA11, outputs Q2 and Q3 can be used as discrete outputs to address these encoder(s).

For further information on setting up counter outputs and physical outputs, refer to the application-specific manual.

Note
The schematics showing the principle for wiring a 15-pin SUB-D connector (1 channel only) are identical to those for up/down counting with a TSX CTY 2A / 4A module (schematics 1 to 4). These schematics are complemented by schematic 5 on the next page, which takes account of the wiring of a serial output absolute encoder or a parallel output absolute encoder, via TELEFAST adaptor ABE-7CPA11.

Simplified schematic 5

Use of a physical input to receive serial data and use of a physical output to send the transmission clock to the SSI absolute encoder.



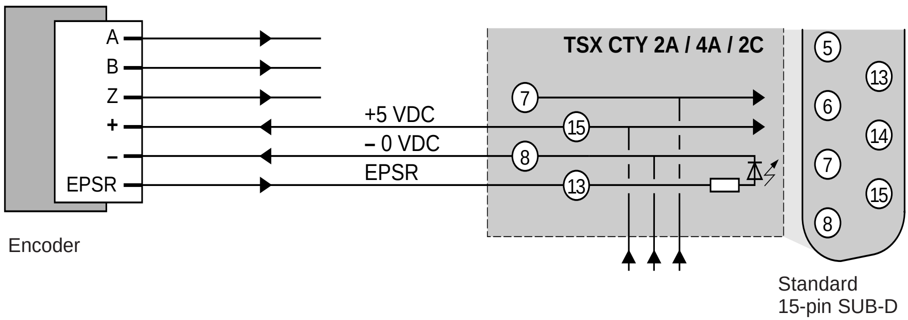
HE10 connector for connecting power supplies (encoders and sensors), auxiliary inputs (preset, enable, etc) and reflex outputs.

2.5 Principle of connecting the EPSR input "power supply return"

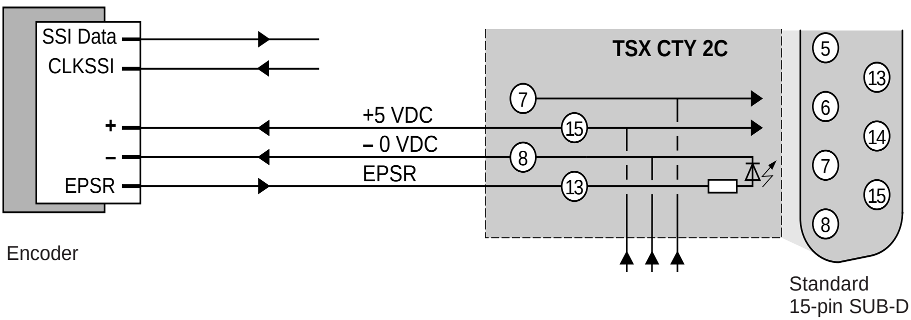
This input must be wired.

The connection of this input depends on the type of sensor used :

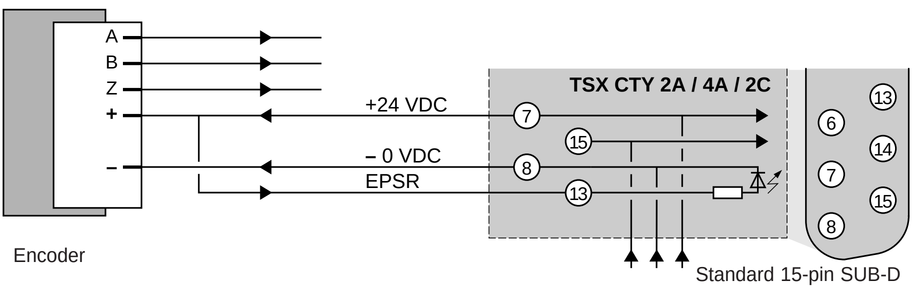
- **incremental encoder with power supply return output**
  - the EPSR input is connected to the encoder power supply return output



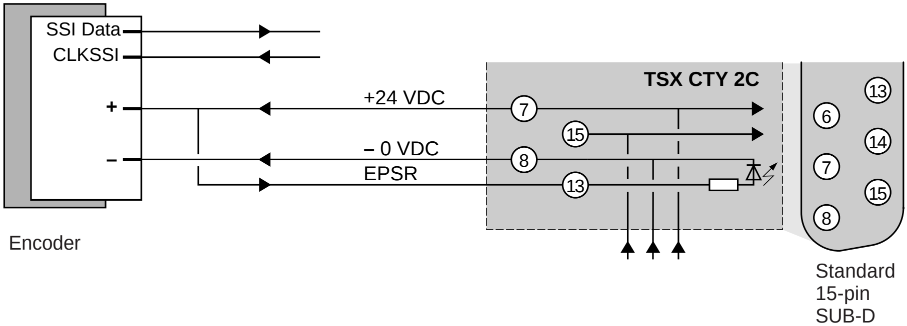
- **serial output absolute encoder with power supply return output**
  - the EPSR input is connected to the encoder power supply return output



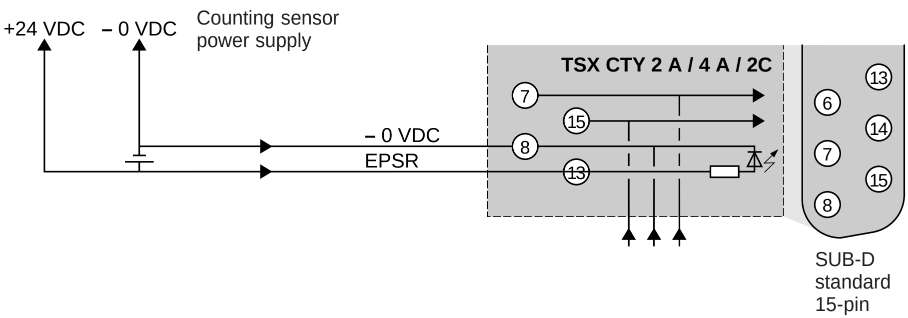
- **incremental encoder without power supply return output**
  - the EPSR input is connected to the positive of the encoder power supply, encoder side.



- **serial output absolute encoder without power supply return output**
  - the EPSR input is connected to the positive of the encoder power supply, encoder side.



- **inductive proximity sensors**
  - the EPSR input is connected to the positive of the counting sensor power supply,
  - the - 0 VDC output is connected to the negative of the counting sensor power supply.



Note

> If the sensor does not have a power supply return output, the EPSR input of a TSX CTY 2C module does not need to be wired. In this case, it is advisable to mask the "encoder or proximity sensor power supply" fault.

Note

For further information on these functions, refer to the application-specific manual.

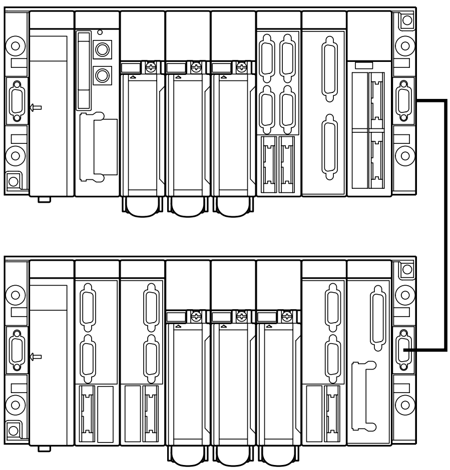
3.1 Maximum number of counter modules

TSX CTY 2A / 4A / 2C counter modules can be installed in any available slot in a Premium (TSX, PMX or PCX) PLC configuration, provided they use no more than :

Processors	No. of "app.-specific" channels managed
TSX P57 102 / TPMX P57 102 / TPCX 57 1012	8
TSX P57 202 / TPMX P57 202	24
TSX P57 252	24
TSX P57 302	32
TSX P 57 352 / TPMX P57 352 / TPCX 57 3512	32
TSX P57 402	48
TSX P57 452 / TPMX P57 452	48

All the channels of an application-specific module (counter module, axis control module, etc) are called "application-specific" channels. TSX CTY 2A / 2C modules comprise 2 "application-specific" channels and the TSX CTY 4A module comprises 4 "application-specific" channels. Only configured channels are counted.

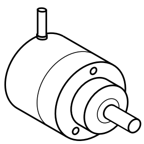
For example, in a configuration with a TSX P57 202 processor, it is possible to install 12 TSX CTY 2A / 2C modules or 6 TSX CTY 4A modules, where all the channels are configured.
These modules can be installed in all the positions of the main rack and in all the positions of the 7 extension racks.



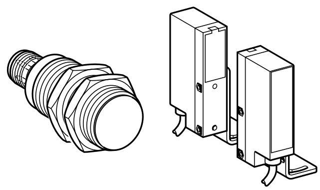
3.2 Types of sensor which can be used on counter inputs

Counter inputs on TSX CTY 2A / 4A / 2C modules can receive pulses generated by :

- 2- or 3-wire proximity sensors, type PNP or NPN,
- incremental encoders with 5 VDC differential output signals, line driver RS 422 / 485, supplied at 10-30 V,
- incremental encoders with 5 V differential output signals, RS 422 / 485 line driver, supplied at 5 V,
- incremental encoders with 10-30 V differential output signals, Totem pole, supplied at 10-30 V,
- SSI serial output absolute encoders, RS 485 standard interface (TSX CTY 2C only),
- parallel output absolute encoders and TELEFAST adaptor ABE-7CPA11 (TSX CTY 2C only).



Incremental or absolute encoder



Proximity sensors

3.3 Electrical characteristics of TSX CTY 2A / 4A / 2C modules

3.3-1 General module characteristics

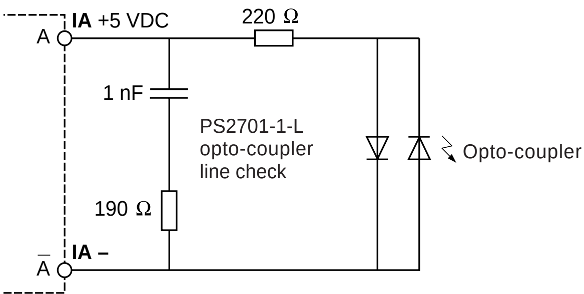
Modules			TSX CTY 2A	TSX CTY 4A	TSX CTY 2C
Maximum frequency at counter inputs			40 kHz	40 kHz	1 MHz
Current consumed by the module	5 V internal	Typical Maximum	280 mA 330 mA	330 mA 470 mA	850 mA (*) 1 A (*)
	24 V sensor / preactuator	Typical Maximum	30 mA 60 mA	36 mA 72 mA	15 mA 18 mA
Power dissipated in the module		Typical Maximum	4.5 W 6 W	8 W 11.5 W	7 W 10 W
Power supply monitoring for sensors / preactuators			Yes	Yes	Yes
Operating temperature			0 to 60 °C	0 to 60 °C	0 to 60 °C
Dielectric strength inputs/ground or inputs and internal logic			1000 V rms - 50/60 Hz - 1 min		
Insulation resistance			> 10 M Ω at 500 VDC		
Relative humidity			5% to 95% without condensation		
Storage temperature			- 25 ° to + 70 °C		
Operating altitude			0 to 2000 m		

(*) with fan operating

3.3-2 Characteristics of the counter inputs (TSX CTY 2A / 4A)

Characteristics for use in RS 422 C

Example schematic for each counter input IA, IB, IZ.



Inputs IA, IB and IZ used in RS 422 are totally compatible with incremental encoder line drivers with RS 422 outputs and also with encoders with push-pull complementary outputs with a 5 V power supply. Line monitoring is performed on each output.

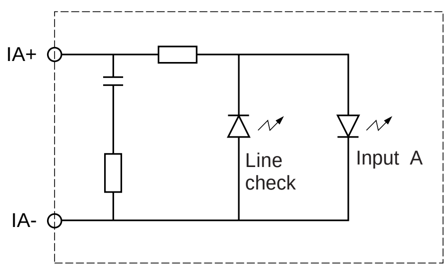
TSX CTY 2A / 4A : characteristics for use at 5 VDC / 24 VDC

Inputs			5 VDC counter (IA/IB/IZ)	24 VDC counter (IA/IB/IZ)
Logic			Positive	Positive or Negative
Nominal values	Voltage		5 V	24 V
	Current		18 mA	18 mA
	Sensor supply (ripple included)		–	19…30 V (possible up to 34 V, limited to 1hr per 24hrs)
Limit values	Voltage		≤ 5.5 V	34 V (1hr per 24hrs)
	At state 1	Voltage	≥ 2.4 V	≥ 11 V
		Current	> 3.7 mA (1)	> 6 mA (2)
	At state 0	Voltage	≤ 1.2 V	≤ 5 V
		Current	< 1 mA (3)	< 2 mA (4)
Input impedance for U nominal			400 Ω	1.4 kΩ
Input impedance for U = 2.4 V (RS 422 compatibility)			> 270 Ω	–
Response time			Maximum permissible frequency 40 kHz	
Input type			Resistive	Resistive
IEC 1131 conformity			–	Type 2
2-wire prox. sensor compatibility (5)			–	Yes
3-wire prox. sensor compatibility (5)			–	Yes

(1) for U = 2.4 V, (2) for U = 11 V, (3) for U = 1.2 V, (4) for U = 5 V
(5) see compatibility of sensors with type 1 and type 2 inputs

3.3-3 Characteristics of the counter inputs (TSX CTY 2C)

Example schematic for input IA



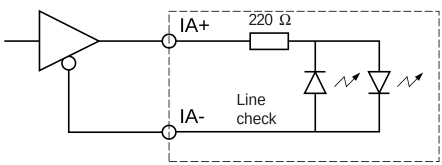
TSX CTY 2C : characteristics for use at 5 VDC / 24 VDC

Inputs			**5 VDC counter (IA/IB/IZ) or measurement (SSI Data)**	**24 VDC counter (IA/IB/IZ)**
Logic			Positive	Positive or Negative
Nominal values	Voltage		5 V	24 V
	Current		18 mA	16 mA
	Sensor supply (ripple included)		–	19…30 V (possible up to 34 V, limited to 1hr per 24hrs)
Limit values	Voltage		≤ 5.5 V	34 V (1hr per 24hrs)
	At state 1	Voltage	≥ 2.4 V	≥ 11 V
		Current	> 3.6 mA (1)	> 6 mA (2)
	At state 0	Voltage	≤ 1.2 V	≤ 5 V
		Current	< 1 mA	< 2 mA
Input impedance	for U nominal		270 Ω	1.5 kΩ
Response time Maximum permissible frequency for : • counting pulses • incremental encoders • SSI and parallel output absolute encoders (with TELEFAST adaptor ABE-7CPA11)			 1 MHz 500 kHz in multiplication by 1 250 kHz in multiplication by 4 SSICLK transmission clock : 150 kHz...1 MHz	
Input type			Resistive	Resistive
IEC 1131 conformity			–	Type 2
2-wire prox. sensor compatibility (3)			–	Yes
3-wire prox. sensor compatibility (3)			–	Yes

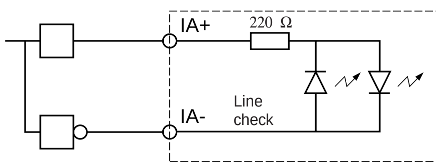
(1) for U = 2.4 V, (2) for U = 11 V
(3) see compatibility of sensors with type 1 and type 2 inputs

Compatibility of inputs IA, IB, IZ :

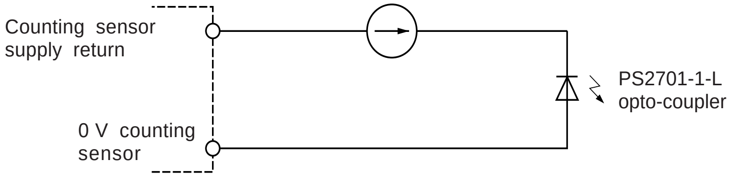
RS 422 / RS 485 / 7mA current loop line driver outputs. Differential line check on each input.



Totem pole complementary outputs, 5 V supply. Differential line check on each input.



Characteristics of power supply monitor circuit for counting sensors (encoder or proximity sensor)



Modules		TSX CTY 2A / 4A	TSX CTY 2C
Voltage **with no** encoder or proximity sensor supply fault :			
• 5 V power supply		> 2.5 V	> 3.75 V
• 10...30 V power supply		> 2.5 V	> 3.75 V if the 10...30 V encoder reference voltage input is **not wired** (pin 4 of the HE10 connector).
			> 80% of the supply voltage of the encoder or proximity sensor, if the 10...30 V encoder reference voltage input is **wired** (pin 4 of the HE10 connector).
Current **with** detection of a fault on the proximity sensor or encoder supply		< 0.5 mA	/
Limit values	Voltage	30 V (possible up to 34 V, limited to 1 hour per 24 hours)	
	Current	< 3 mA	< 3 mA

Note

> If the sensor does not have a power supply return output, the EPSR input of a TSX CTY 2C module does not need to be wired. In this case, it is advisable to mask the "encoder or proximity sensor power supply" fault.

Note :
For further information on these functions, refer to the application-specific manual.

3.3-4 Characteristics of the auxiliary inputs (preset, enable, read)

Modules			TSX CTY 2A / 4A	TSX CTY 2C
Logic			Positive	Positive
Nominal values	Voltage		24 VDC	24 VDC
	Current		7 mA	8 mA
	Sensor power supply (ripple included)		19…30 V (possible up to 34 V, limited to 1 hr per 24 hrs)	
Limit values	At state 1	Voltage	≥ 11 V	≥ 11 V
		Current	> 6 mA (1)	> 6 mA (1)
	At state 0	Voltage	≤ 5 V	≤ 5 V
		Current	< 2 mA	< 2 mA
Sensor / preactuator voltage monitoring thresholds		OK	> 18 V	> 18 V
		Fault	< 14 V	< 14 V
Response time of sensor / preactuator voltage monitoring		On disappearance of 24 V	< 2.5 ms (4)	< 2.5 ms (4)
		On appearance of 24 V	< 10 ms (4)	< 10 ms (4)
Input impedance			3.4 kΩ	3.4 kΩ
Response time		State 0 to 1	< 250 µs (3)	< 25 µs (3)
		State 1 to 0	< 250 µs (3)	< 50 µs (3)
Input type			Current sink	Resistive
IEC 1131 conformity			Type 2	Type 2
2-wire proximity sensor compatibility (2)			Yes (all 24 VDC 2-wire proximity sensors)	
3-wire proximity sensor compatibility (2)			Yes (all 24 VDC 3-wire proximity sensors)	

(1) for U = 11 V
(2) see compatibility of sensors with type 1 and type 2 inputs
(3) auxiliary inputs are fast inputs (response time < 50 µs or < 250 µs) in accordance with the maximum permissible frequency (1 MHz or 40 KHz) of the counter inputs.
(4) when the sensor supply voltage disappears, the fast auxiliary inputs can be taken into account.

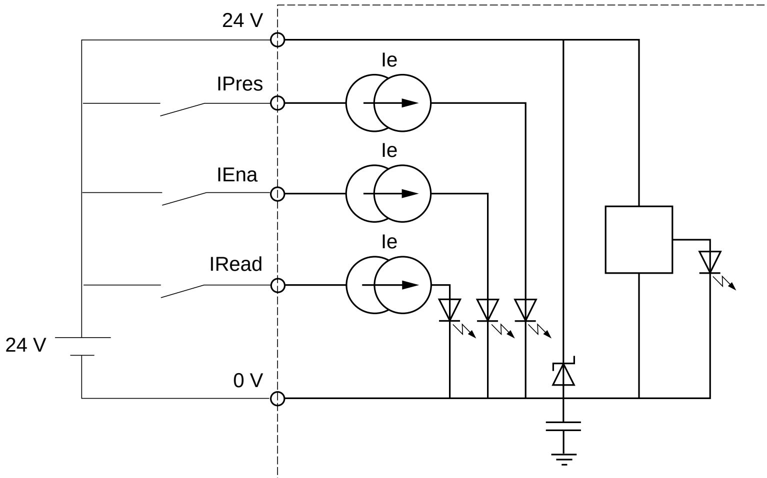
Note

If auxiliary I/O are not used on a TSX CTY 2C module, the auxiliary power supply does not need to be wired. In this case, it is advisable to mask the "auxiliary I/O power supply" fault.

Note :
For further information on these functions, refer to the application-specific manual.

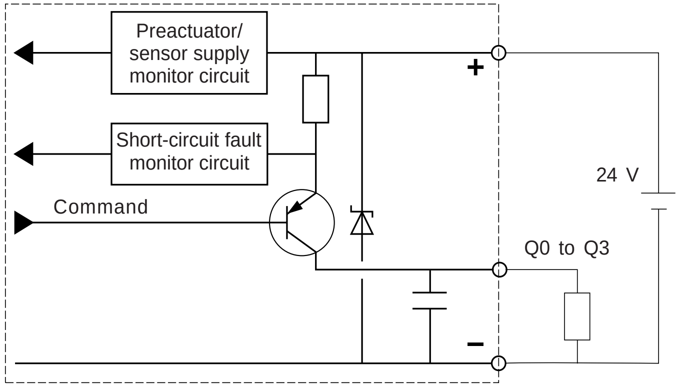
The **auxiliary inputs** are supplied with 24 V from a power supply on the connector.

Equivalent schematic for TSX CTY 2A / 4A :



3.3-5 Characteristics of the auxiliary outputs

Equivalent schematic :



Modules	TSX CTY 2A / 4A	TSX CTY 2C
Nominal voltage	24 VDC	24 VDC
Voltage limits	19…30 V (possible up to 34 V,	limited to 1 hour per 24 hours)
Nominal current	500 mA	500 mA
Voltage drop	< 0.5 V	< 0.5 V
Leakage current	< 0.1 mA	< 0.1 mA
Max current at 30 V and at 34 V	625 mA	625 mA
Switching time	< 250 µs	< 250 µs
Dielectric strength with the ground	1500 V rms. 50 / 60 Hz for 1 min	
Compatibility with DC inputs	All positive logic inputs whose input resistance is < 15 KΩ	
IEC 1131-2 conformity	Yes	Yes
Protections against overloads and short-circuits	By current limiter and and thermal tripping (0.7 < Id < 2 A)	
Short-circuit monitoring of outputs of each channel	One signalling bit per channel	
Reactivation can be configured • **manual (by application program)** • **automatic**	One configuration bit per channel	
Protection against overvoltage on channels	via zener diode between outputs and + 24 V	
Protection against reverse polarity	by reverse-mounted diode on supply	
Power of one filament lamp	8 W (max.)	8 W (max.)

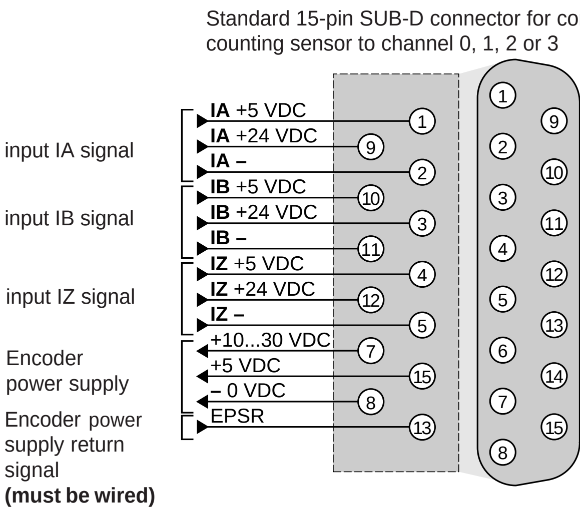
3.4 15-pin SUB-D and HE10 connector pinout

3.4-1 Standard 15-pin SUB-D connectors for a TSX CTY 2A / 4A module

These connectors are used for connecting counting sensors and the encoder power supply :

- TSX CTY 2A modules : two 15-pin SUB-D connectors (channels 0 and 1),
- TSX CTY 4A module : four 15-pin SUB-D connectors (channels 0,1, 2 and 3).

Note
the pinouts of the various connectors are strictly identical.



5 VDC signals	Pins
Input IA +	1
Input IA -	2
Input IB +	10
Input IB -	11
Input IZ +	4
Input IZ -	5
Encoder supply :	
+ 5 VDC	15
- 0 VDC	8
Encoder power supply return	13

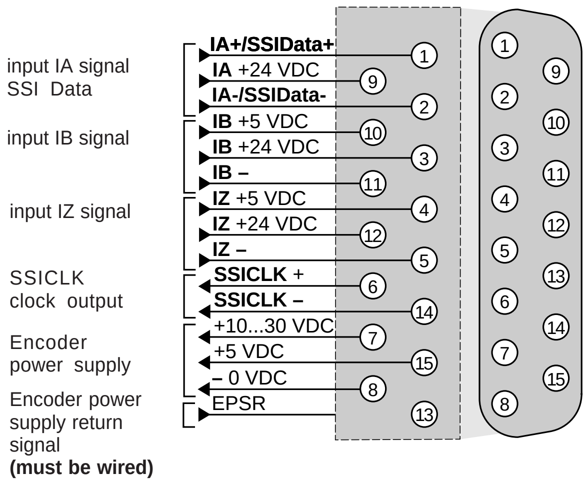
10...30 VDC signals	Pins
Input IA +	9
Input IA -	2
Input IB +	3
Input IB -	11
Input IZ +	12
Input IZ -	5
Encoder supply :	
+ 10...30V	7
- 0 VDC	8
Encoder power supply return	13

3.4-2 Standard 15-pin SUB-D connectors for a TSX CTY 2C module

These connectors are used for connecting counting sensors and the encoder power supply :

- TSX CTY 2C modules : two 15-pin SUB-D connectors (channels 0 and 1).

Note :
the pinouts of the various connectors are strictly identical.



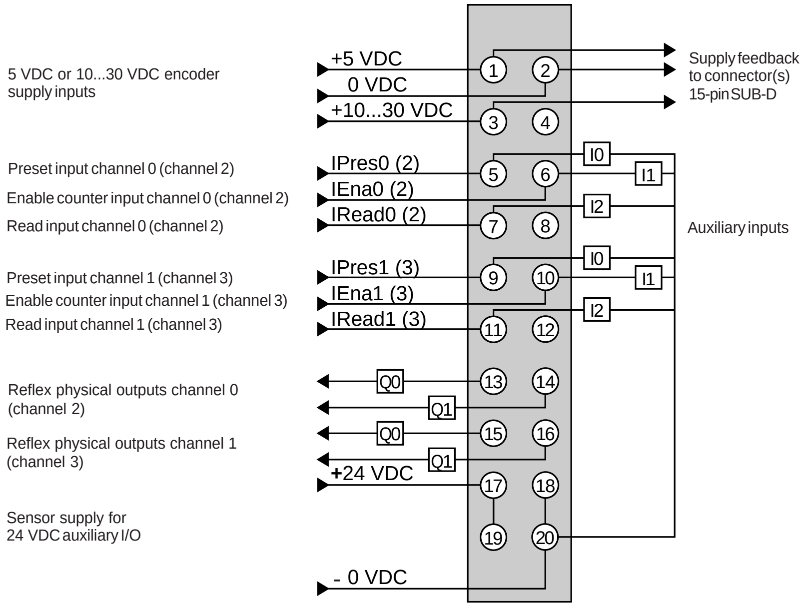
5 VDC signals	Pins
Input IA +	1
Input IA -	2
Input IB +	10
Input IB -	11
Input IZ +	4
Input IZ -	5
Encoder supply :	
+ 5 VDC	15
- 0 VDC	8
Encoder power supply return	13

10...30 VDC signals	Pins
Input IA +	9
Input IA -	2
Input IB +	3
Input IB -	11
Input IZ +	12
Input IZ -	5
Encoder supply :	
+ 10...30V	7
- 0 VDC	8
Encoder power supply return	13

Serial signals (absolute encoder with serial or parallel outputs, via TELEFAST adaptor ABE-7CPA11)	Pins
Input SSI Data +	1
Input SSI Data -	2
Input SSICLK+	6
Input SSICLK -	14
Encoder supply :	
+ 5	
- 0 VDC	8
Encoder power supply return	13

3.4-3 20-pin HE10 type connector for a TSX CTY 2A / 4A module

This connector is used for connecting auxiliary inputs, outputs, encoder power supplies and other sensors.
The TSX CTY 2A module has a single HE10 connector for channels 0 and 1.
The TSX CTY 4A module has 2 HE10 connectors, for channels 0,1 and 2,3 respectively.

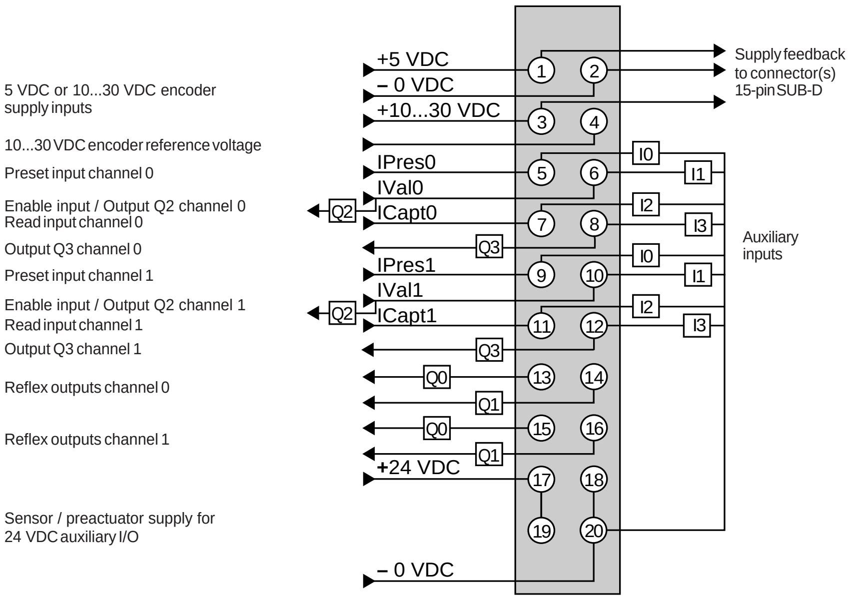


24 VDC signals	Pins
Auxiliary inputs channel 0 (channel 2) :	
Preset IPres 0/2	5
Enable IEna 0/2	6
Read IRead 0/2	7
Auxiliary inputs channel 1 (channel 3) :	
Preset IPres 1/3	9
Enable IEna 1/3	10
Read IRead 1/3	11
Reflex output channel 0 (channel 2) :	
Output Q0	13
Output Q1	14
Reflex output channel 1 (channel 3) :	
Output Q0	15
Output Q1	16

Power supplies	Pins
Encoder supply :	
+ 5 VDC	1
- 0 VDC	2
- +10...30 VDC	3
Sensor supply :	
+ 24 VDC	17 or 19
- 0 VDC	18 or 20

3.4-4 20-pin HE10 type connector for a TSX CTY 2C module

This connector is used for connecting auxiliary inputs, outputs, encoder power supplies and other sensors.
The TSX CTY 2C module has a single HE10 connector for channels 0 and 1.

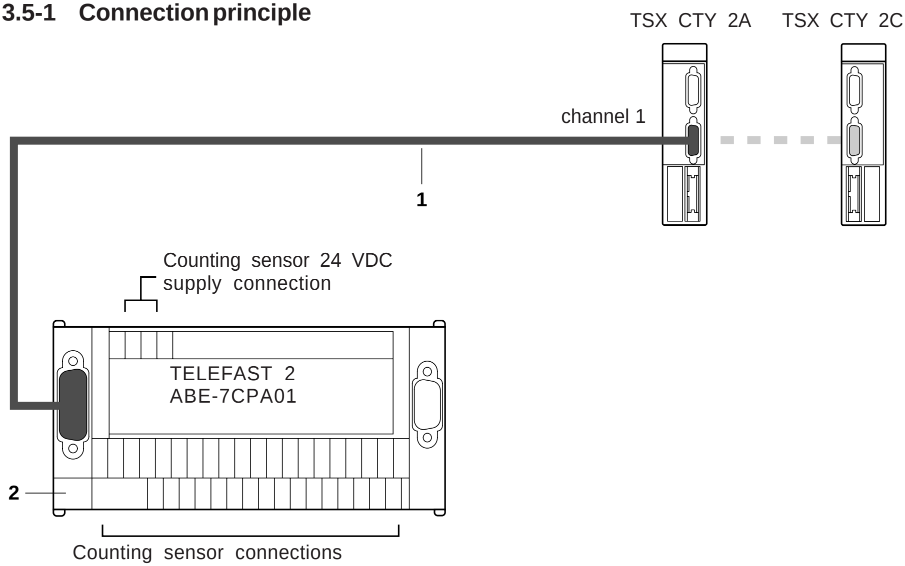


24 VDC signals	Pins
Auxiliary inputs channel 0 :	
Preset IPres0	5
Enable IEna0 / Output Q2	6
Read IRead0	7
Output Q3	8
Auxiliary inputs channel 1 :	
Preset IPres1	9
Enable IEna1 / Output Q2	10
Read IRead1	11
Output Q3	12
Reflex output channel 0 :	
Output Q0	13
Output Q1	14
Reflex output channel 1 :	
Output Q0	15
Output Q1	16

Power supplies	Pins
Encoder supply :	
+ 5 VDC	1
- 0 VDC	2
+10...30 VDC	3
Encoder reference voltage 10...30 VDC	4
Sensor supply :	
+ 24 VDC	17 or 19
- 0 VDC	18 or 20

3.5 Connection of proximity type counting sensors

3.5-1 Connection principle

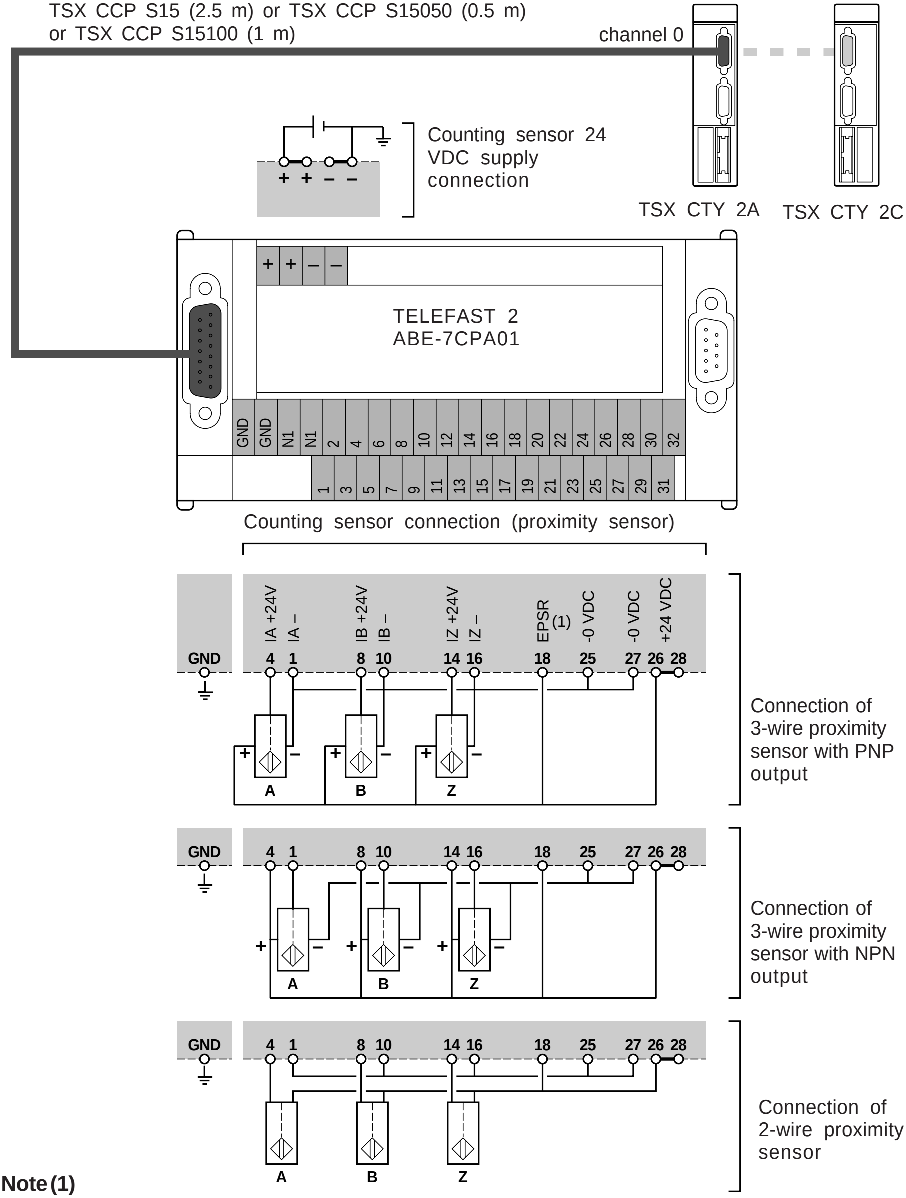


1 TSX CCP S15 (2.5 m long) or TSX CCP S15050 (0.5 m long) or TSX CCP S15100 (1 m long) cable, with high density 15-pin SUB-D connector and standard 15-pin SUB-D connector. This cable is used to connect the counter channel to the TELEFAST 2 connection sub-base (ABE-7CPA01). It carries the various counter channel signals.

2 TELEFAST 2 connection sub-base, reference ABE-7CPA01 :
This is used to connect the counting sensors and their power supply for the relevant channel.

Note
The connection of channels 2 and 3 of a TSX CTY 4A module is identical to that of channels 0 and 1.

3.5-2 Connection of counting sensors and their power supply



Note (1)

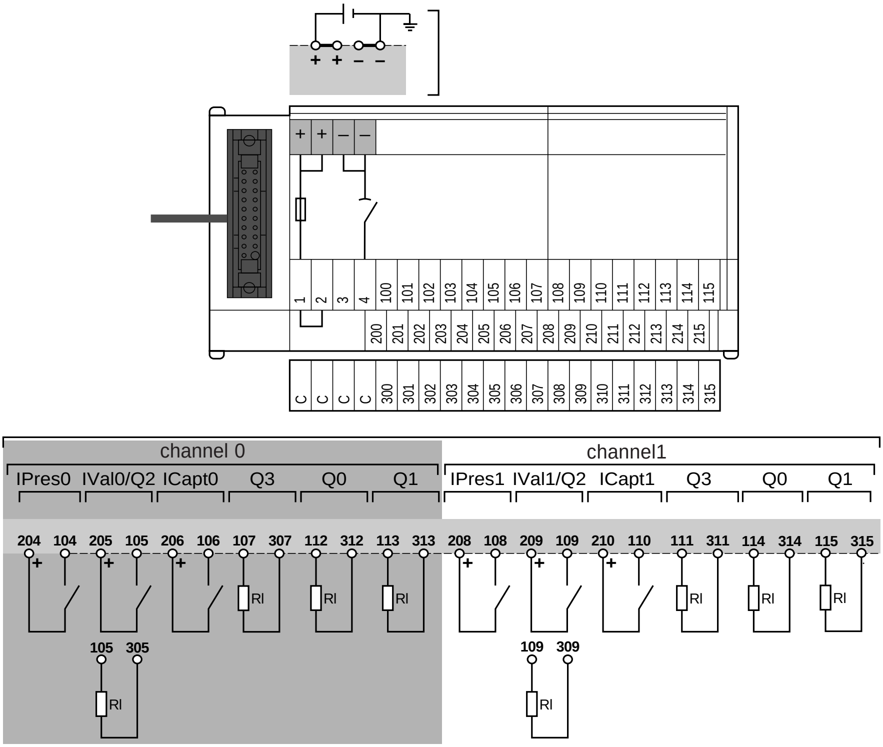
If proximity type counting sensors are used, the EPSR input (encoder power supply return) must respect polarity. To do this, connect :

- EPSR (terminal 18) to the 24VDC positive of the sensor power supply (terminal 26 or 28),
- - 0VDC of the sensor power supply (terminal 27) to - 0VDC encoder power supply (terminal 25).

3.5-3 Wiring recommendations

Inputs IPres, IEna and IRead are fast inputs which should be connected to the sensor by twisted pair if it is a volt-free contact, or by shielded cables if it is a 2 or 3-wire proximity sensor.
This module is fitted as standard with devices to protect against short-circuits or polarity inversions. **Power supplies must**, however, be protected by **fuses in series**. These fuses must be "fast blow" type with 1A maximum rating.

Important : wiring solid state outputs Q0 to Q3
The actuator connected to outputs Q0 to Q3 has its common point at the 0V of the power supply. If, due to a poor contact or accidental disconnection, there is a break in the 0V supply of the output amplifier, while the common point of the actuators remains connected to the 0V supply; there may be an output current from the amplifier of a few mA which is sufficient to keep certain low-power actuators energized.

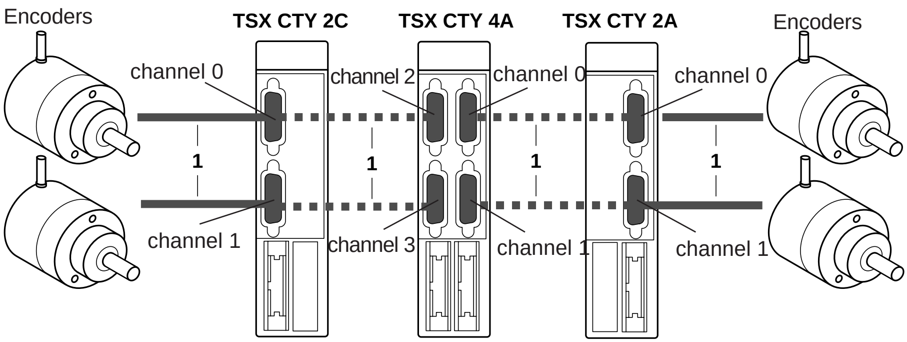


Connecting using TELEFAST :
This is the most reliable type of connection provided the actuator common is connected to the bar of the 2•• common points (jumper in position 1-2). In this case there can be no break in the module common without breaking the actuator common.

3.6 Connection of encoder type counting sensors

3.6-1 Connection principle

A TSX CTY 4A module is wired as follows. For a TSX CTY 2A or TSX CTY 2C module, only the elements relating to channels 0 and 1 should be connected.



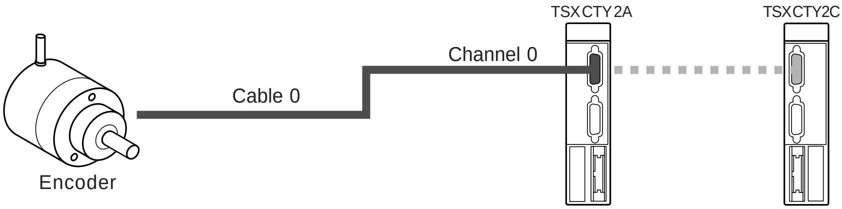
Description of the various connection elements

1 Equipment for connecting the encoder to the standard 15-pin SUB-D connector, located on the TSX CTY 2A / 4A / 2C module. In view of the different types of encoder, the connection equipment is the user's responsibility and consists of :

- a connector for the encoder connection (depends on the encoder used; generally a 12-pin female DIN connector),
- a standard 15-pin male SUB-D connector for connection to the 15-pin female SUB-D connector on the TSX CTY 2A / 4A / 2C module. This connector is available with the reference TSX CAP S15,
- a cable :
  - twisted pairs (26 gauge) with shielding for an incremental encoder with RS 422 standard line driver outputs or absolute encoder,
  - multicore (24 gauge) with shielding for an incremental encoder with Totem Pole outputs.

  The cable shielding is of the "braid + strip" type. Contact between the "braid + strip", and the ground for each connector must be secured by clamping around the whole circumference of the cable.
  The connection of this cable to the two connectors varies depending on the type of power supply used by the encoder (5 VDC or 10...30 VDC) and the type of outputs (RS 422, Totem Pole). Different types of connection are used as examples on the following pages.

3.6-2 Connection of an encoder to a TSX CTY 2A / 4A / 2C module

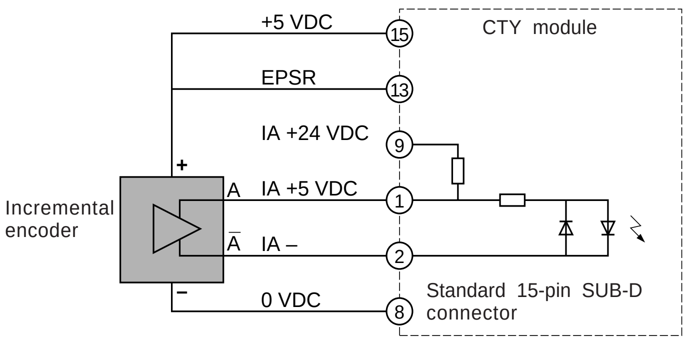


Connection example for incremental encoder with RS 422 / RS 485 line driver outputs

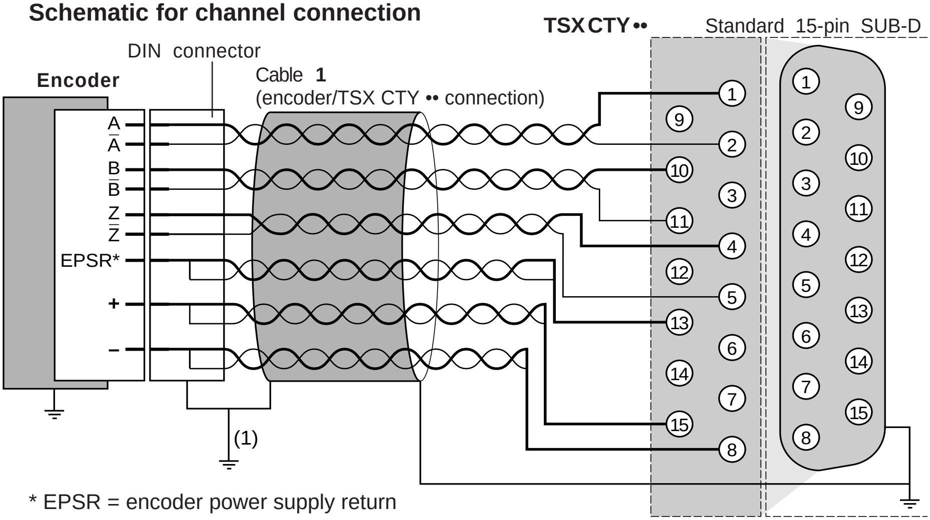
Encoder characteristics

- supply voltage : 5 VDC,
- output voltage : 5 VDC differential,
- output stage : RS 422/485 standard line driver.

Simplified schematic



Schematic for channel connection



* EPSR = encoder power supply return

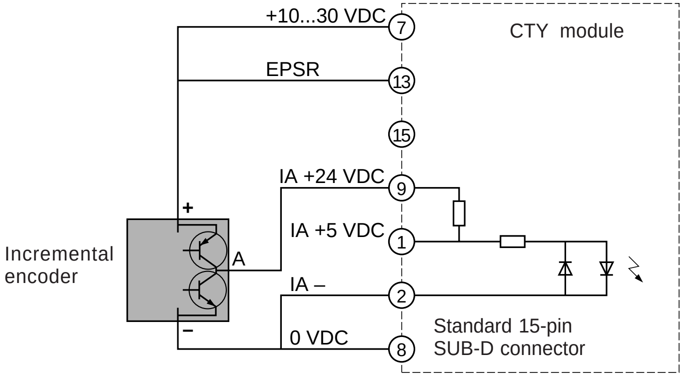
(1) This link should be made directly if the encoder is isolated from ground.

Connection example for incremental encoder with Totem Pole outputs

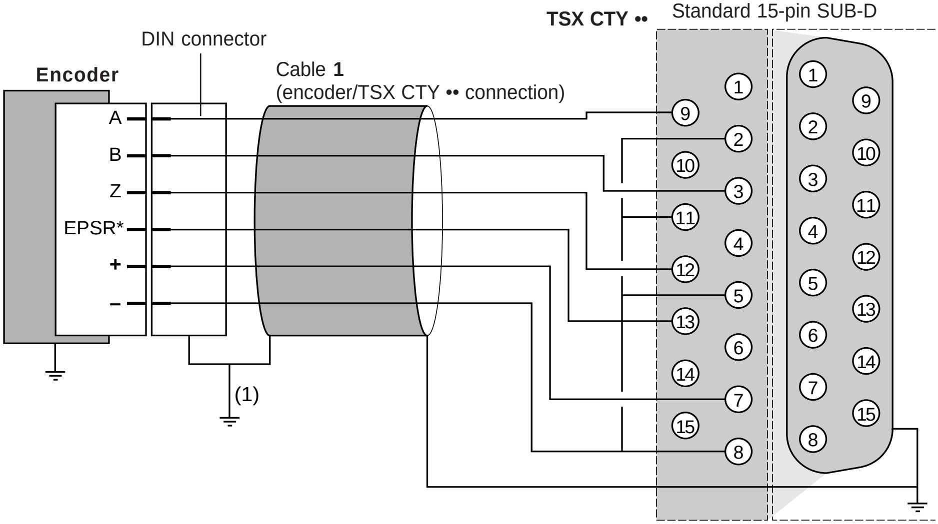
Encoder characteristics

- supply voltage : 10...30 VDC,
- output voltage : 10...30 VDC,
- output stage : Totem Pole.

Simplified schematic



Schematic for channel connection



* EPSR = encoder power supply return
If the encoder does not have a power supply return, the EPSR input should be linked on the encoder side to the positive of the power supply.

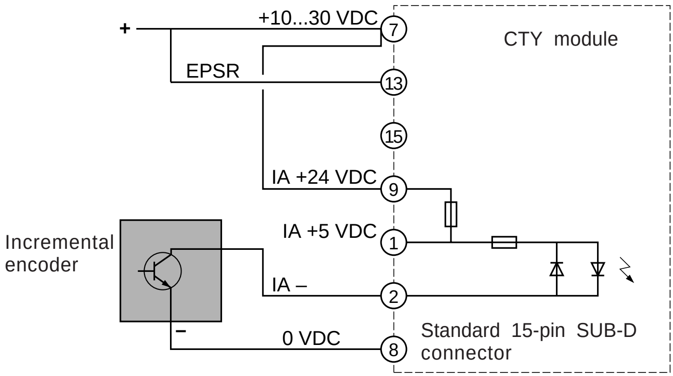
(1) This link should be made directly if the encoder is isolated from ground.

Connection example for incremental encoder with NPN open collector outputs

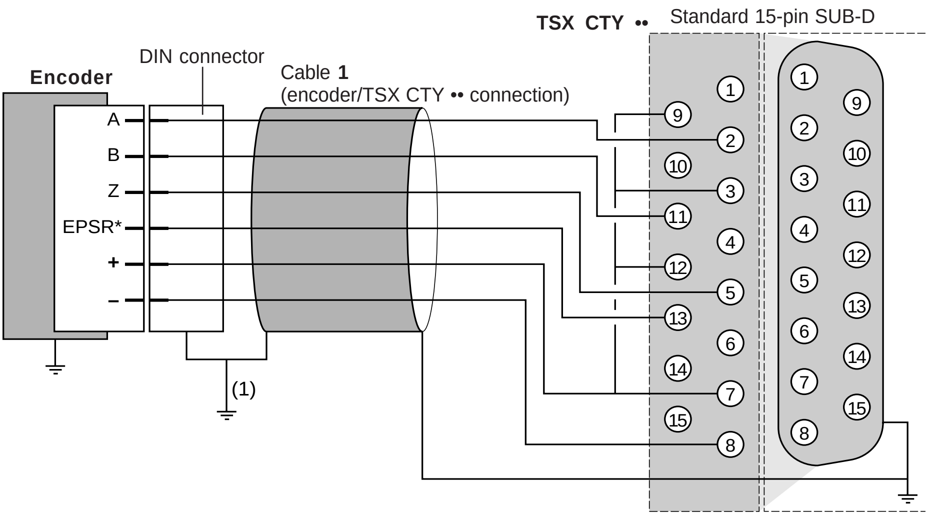
Encoder characteristics

- supply voltage : 24 VDC
- output voltage : 24 VDC,
- output stage : NPN open collector.

Simplified schematic



Schematic for channel connection



* EPSR = encoder power supply return
If the encoder does not have a power supply return, the EPSR input should be linked on the encoder side to the positive of the power supply.

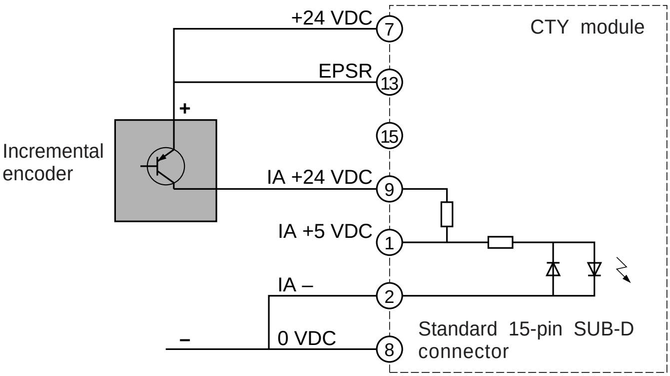
(1) This link should be made directly if the encoder is isolated from ground.

Connection example for incremental encoder with PNP open collector outputs

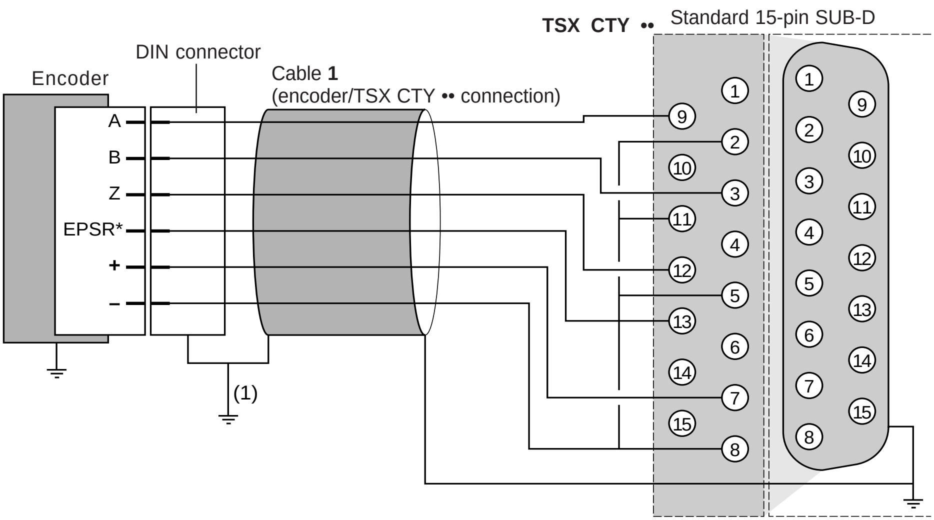
Encoder characteristics

- supply voltage : 24 VDC
- output voltage : 24 VDC,
- output stage : PNP open collector.

Simplified schematic



Schematic for channel connection



* EPSR = encoder power supply return
If the encoder does not have a power supply return, the EPSR input should be linked on the encoder side to the positive of the power supply.

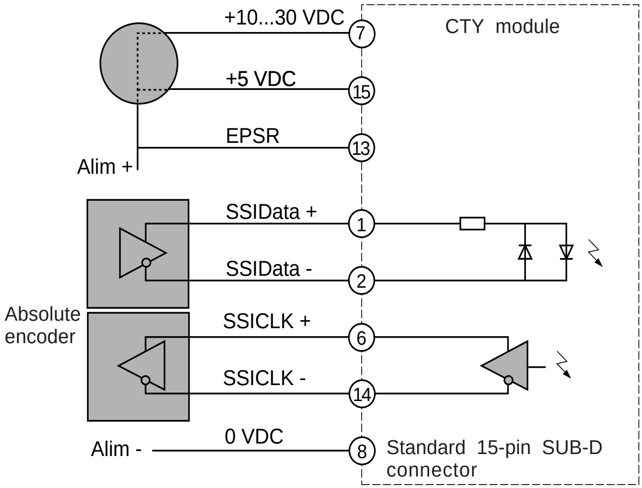
(1) This link should be made directly if the encoder is isolated from ground.

Connection example for serial output or parallel output absolute encoder, via TELEFAST adaptor ABE-7CPA11 (TSX CTY 2C module only)

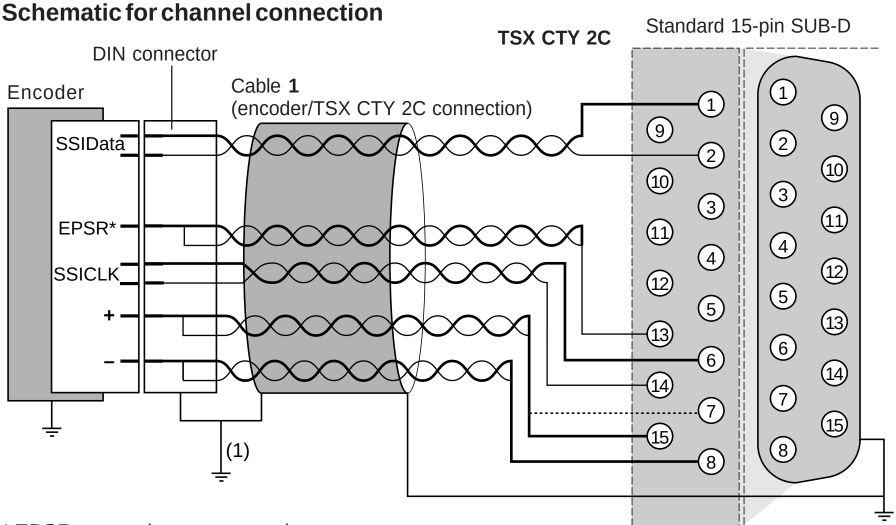
Encoder characteristics

- supply voltage : 5 VDC or 10...30 VDC
- output stages : differential line driver.

Simplified schematic



Schematic for channel connection



* EPSR = encoder power supply return

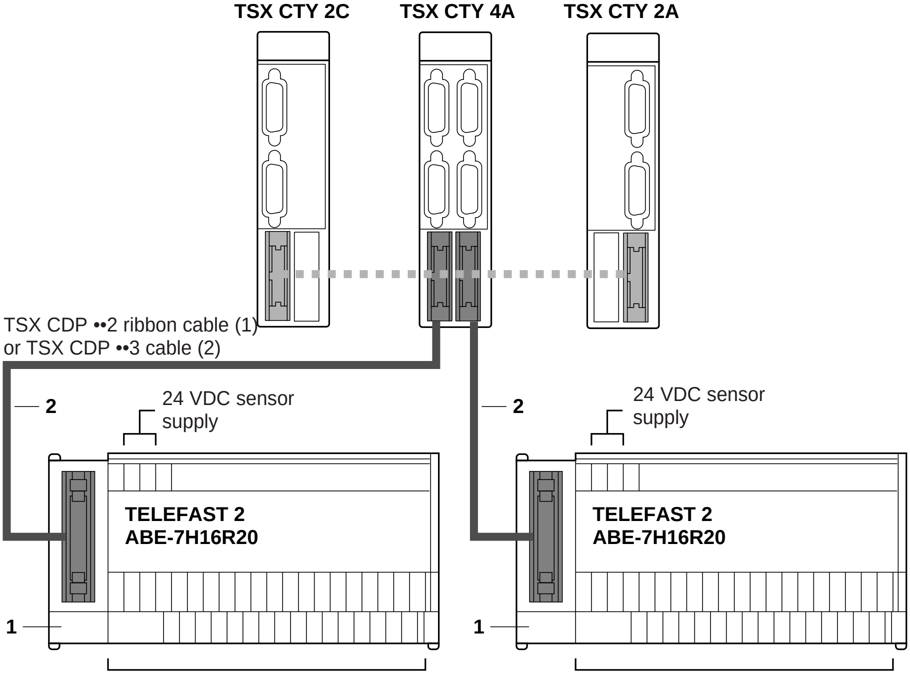
If the encoder does not have a power supply return, the EPSR input should be linked on the encoder side to the positive of the power supply.

(1) This link should be made directly if the encoder is isolated from ground.

3.7 Connection of the sensors to auxiliary inputs and outputs

3.7-1 Connection principle

A TSX CTY 4A module is wired as follows. For a TSX CTY 2A or TSX CTY 2C module, a single TELEFAST sub-base is connected (channel 0 and 1).



Connection :
- encoder power supply (5 VDC or 10...30 VDC)
- preset sensor channels 2 and 3
- counter enable sensor channels 2 and 3
- read sensor channels 2 and 3
- reflex outputs channels 2 and 3

Connection
- encoder power supply (5 VDC or 10...30 VDC)
- preset sensor channels 0 and 1
- counter enable sensor channels 0 and 1
- read sensor channels 0 and 1
- reflex outputs channels 0 and 1

Notes
- It is not essential but it is advisable to use a discrete TELEFAST connection sub-base in order to facilitate connection of the power supplies, sensors and preactuators to the auxiliary inputs and outputs.

(1) TSX CDP 102 : 1 m long,
TSX CDP 202 : 2 m long,
TSX CDP 302 : 3 m long.

(2) TSX CDP 053 : 0.5 m long,
TSX CDP 103 : 1 m long,
TSX CDP 203 : 2 m long,
TSX CDP 303 : 3 m long,
TSX CDP 503 : 5 m long.

Description of the various connection elements

1 TELEFAST 2 connection sub-base : ABE-7H16R20. It is used for rapid connection of the :

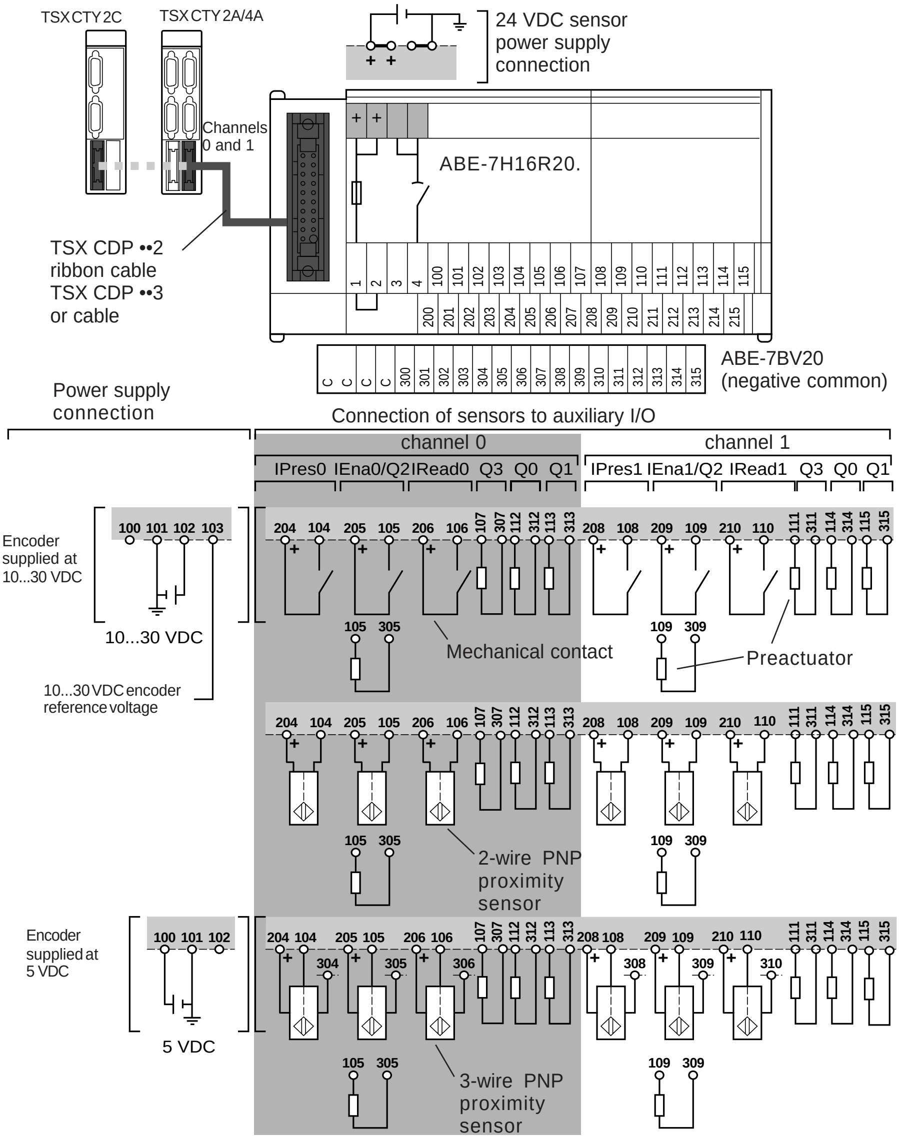
- 24 VDC supply for the sensors connected to the auxiliary I/O,
- encoder power supply (for encoder type counting sensors),
- sensors to the auxiliary I/O (preset, enable, read),
- preactuators.

Note :accessory ABE-7BV20 (sold in lots of 5) is used for connecting the commons.

2 TSX CDP ••2 sheathed rolled ribbon cable or TSX CDP ••3 connection cable.

3.7-2 Connection of sensors and their power supply

These are connected using a TELEFAST 2 connection sub-base, reference ABE-7H16R20 :



Note

The connection of channels 2 and 3 of a TSX CTY 4A module is identical to that of channels 0 and 1.

3.8 General installation rules

3.8-1 Installation

It is not advisable to connect or disconnect the standard 15-pin SUB-D connectors of TSX CTY 2A / 4A / 2C modules with the encoder and sensor supplies present, as this could damage the encoder. Certain encoders cannot withstand a sudden power-up or simultaneous disconnection of the signals and power supplies.

3.8-2 General wiring instructions

Cross section of wires

Wires of a sufficient cross sectional area must be used in order to avoid voltage drops (mainly at 5 V) and temperature rises.

Example of voltage drops for encoders with a 5 V power supply and a 100 meter length of cable.

Wire cross section	Encoder consumption			
	50 mA	100 mA	150 mA	200 mA
0.08 mm^2 (28 gauge)	1.1 V	2.2 V	3.3 V	4.4 V
0.12 mm2 (26 gauge)	-	1.4 V	-	-
0.22 mm2 (24 gauge)	-	0.8 V	-	-
0.34 mm^2 (22 gauge)	0.25 V	0.5 V	0.75 V	1 V
0.5 mm^2	0.17 V	0.34 V	0.51 V	0.68 V
1 mm^2	0.09 V	0.17 V	0.24 V	0.34 V

Connection cables

All cables carrying power supplies to the counting sensors (encoders, proximity sensors, etc) and signals must :

- be kept apart from power cables,
- be shielded with the shielding connected to the mechanical ground on both the PLC and the encoder,
- never carry signals other than counting signals and power supplies relating to the counting sensors.

The module/encoder connecting cable should be as short as possible in order to avoid creating loops causing coupling capacitances which can interfere with operation.

Note :

Position the outward and return lines for a signal in the same cable as the power supplies if necessary. In order to do this, it is preferable to use twisted pair cables.

3.8-3 Encoder and auxiliary sensor supplies

Encoder supply

This must be :

- reserved exclusively for supplying the encoder, to avoid interference pulses which could disrupt encoders with sensitive electronics,
- as near to the TELEFAST 2 sub-base as possible in order to reduce voltage drops and coupling with other cables,
- protected against short-circuits and overloads by fast blow fuses,
- have sufficient endurance to micro-cuts.

Auxiliary sensor supply

See the general installation rules for discrete modules.

Important

> The - 0VDC polarity of the encoder and auxiliary sensor power supplies must be connected to ground (⏚) as close as possible to the power supplies.
> Cables carrying supply voltages should have their shielding connected to ground (⏚).

3.8-4 Software installation

Software installation and the language objects associated with the various counting functions are described in the counting manual.

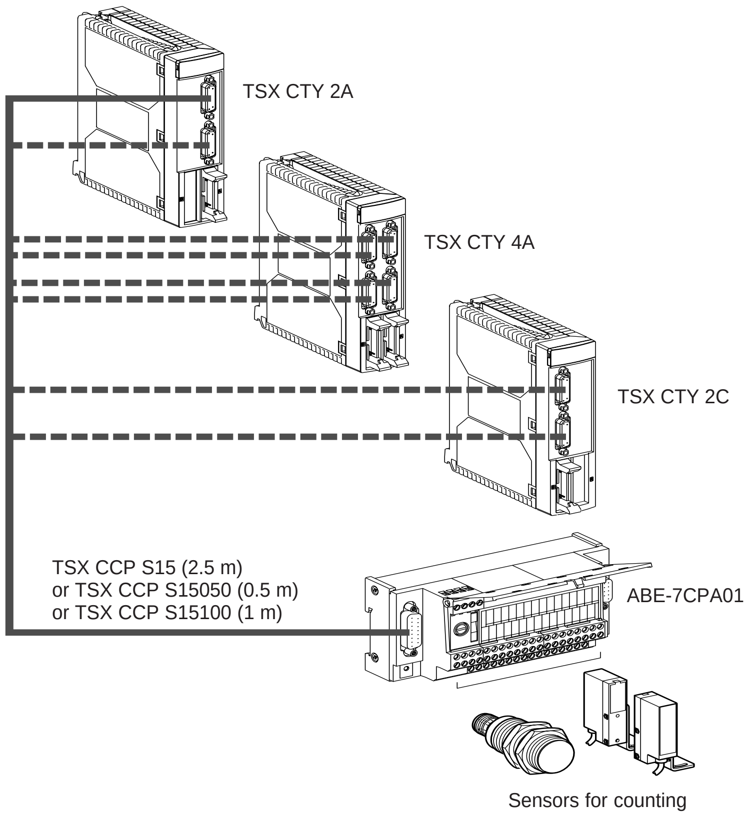
4.1 TELEFAST 2 connections : ABE-7CPA01

4.1-1 Presentation

The TELEFAST 2 connection sub-base (ABE-7CPA01) transforms a standard 15-pin female SUB-D connector to a screw terminal block connector with :

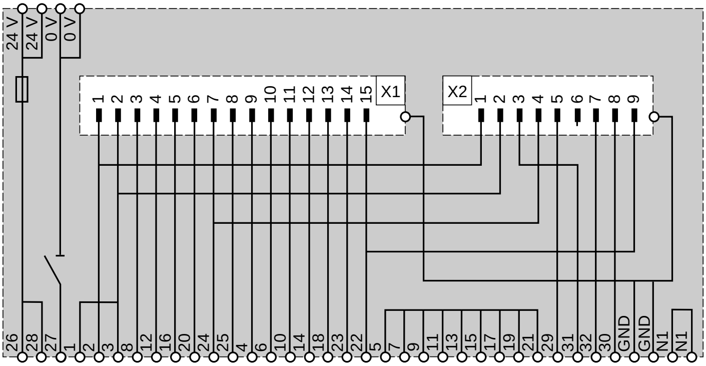
- 32 terminals on two rows for connecting the various sensors and their power supply,
- 4 terminals for onward connection (2 GND terminals + 2 N1 terminals for special connections),
- 4 terminals for connecting the sensor power supply.

This enables rapid connection of the proximity type sensors to a counter channel on TSX CTY 2A, TSX CTY 4A and TSX CTY 2C modules.



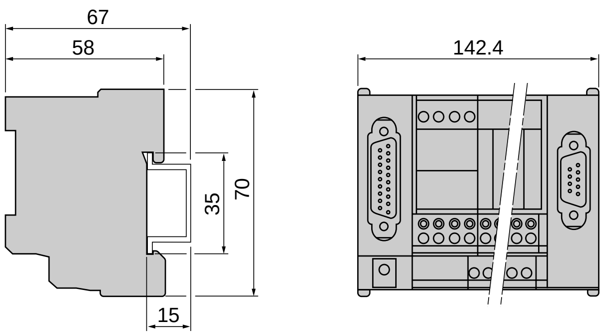
A 9-pin SUB-D connector is used to transfer information to an Altivar drive when using this sub-base with analog I/O.

4.1-2 Wiring diagram



4.1-3 Dimensions and mounting

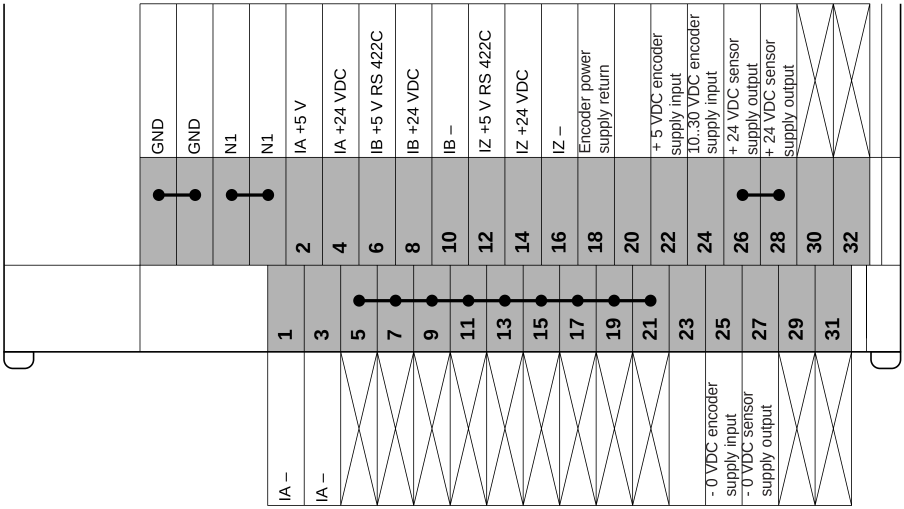
- **Dimensions**



- **Mounting**
  The ABE-7CPA01 connection sub-base is mounted on 35 mm DIN rails.

4.1-4 Availability of counting signals on the TELEFAST screw terminal block

Counter channel used with proximity type sensors



Notes

- Each TELEFAST 2 ABE-7CPA01 connection sub-base is supplied with 6 labels which enable each sub-base to be identified individually according to its intended use.
- It is possible to add an optional bar, to provide, for example, a GND common.

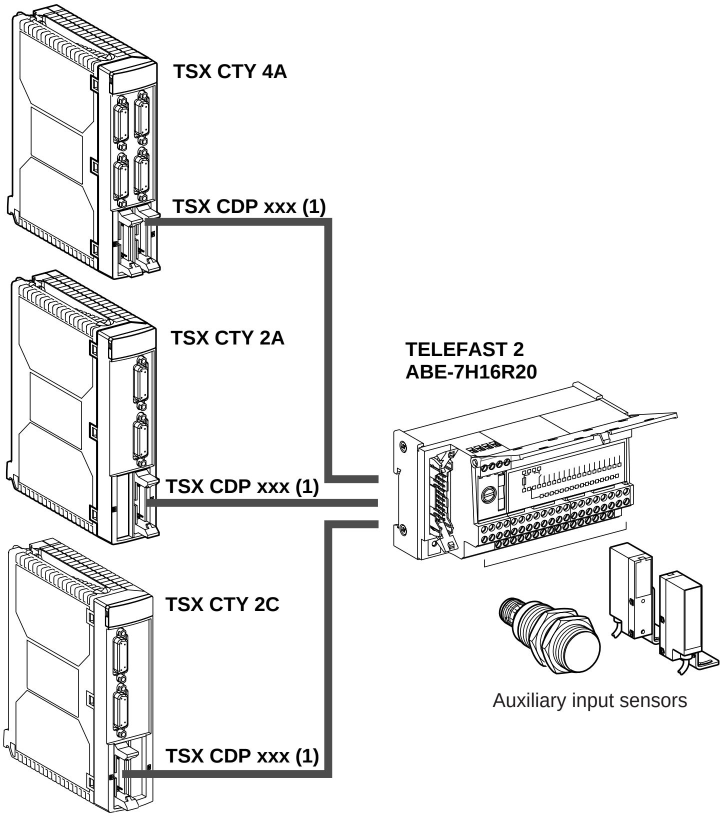
4.1-5 Correspondence between TELEFAST ABE-7CPA01 terminal blocks and 15-pin SUB-D connectors

TELEFAST screw term. block (Terminal no.)	Standard 15-pin SUB-D connector (Pin no.)	Type of signals	
		TSX CTY 2A / 4A	TSX CTY 2C
1	2	IA -	IA -
2	1	IA + 5 V RS 422C	IA + 5 V RS 422C
3	2	IA -	IA -
4	9	IA + 24 VDC	IA + 24 VDC
5			
6	10	IB + 5 V RS 422C	IB + 5 V RS 422C
7			
8	3	IB + 24 VDC	IB + 24 VDC
9			
10	11	IB -	IB -
11			
12	4	IZ + 5 V RS 422C	IZ + 5 V RS 422C
13			
14	12	IZ + 24 VDC	IZ + 24 VDC
15			
16	5	IZ -	IZ -
17			
18	13	Encoder power supply return (EPSR)	
19			
20	6		Reserved
21			
22	15	+5VDC encoder supply input	
23	14		Reserved
24	7	+ 10...30 VDC encoder supply input	
25	8	- 0 VDC encoder supply input	
26		+ 24 V DC sensor supply output	
27		- 0 V DC sensor supply output	
28		+ 24 V DC sensor supply output	
29			
30			
31			
32			

4.2 TELEFAST 2 connection sub-base : ABE-7H16R20

4.2-1 Presentation

The TELEFAST 2 connection sub-base (ABE-7H16R20) transforms a 20-pin HE10 connector to a screw terminal block connector for the rapid connection of the sensors and power supplies relating to the auxiliary inputs of TSX CTY 2A / 4A / 2C counter modules.



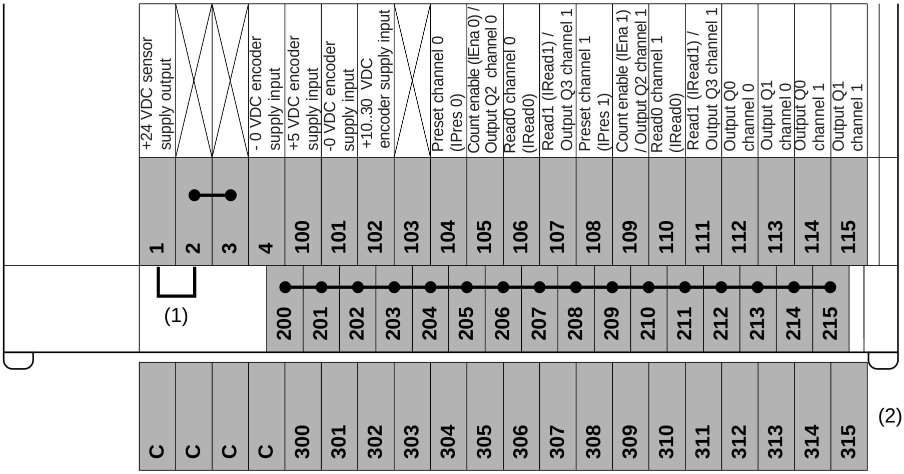
(1) TSX CDP ••2 ribbon cable or TSX CDP ••3 cable.

Note :

TELEFAST 2 connection sub-bases for discrete I/O are described in the discrete I/O installation manual.

4.2-2 Availability of signals on the TELEFAST screw terminal block

The terminal block below represents the terminal block of the ABE-7H16R20 sub-base.



(1) On the ABE-7H16R20 sub-base, the position of the jumper defines the polarity of all the 2•• terminals :
- Jumper in position 1 and 2 : terminals 200 to 215 have positive polarity,
- Jumper in position 3 and 4 : terminals 200 to 215 have negative polarity,

(2) On the ABE-7H16R20 sub-base it is possible to add an optional ABE-7BV20 bar to create a second sensor common (+ or - selected by the user).

Note :
Connection of sensors and power supply on ABE-7H16R20 sub-base is described in the discrete I/O installation manual.

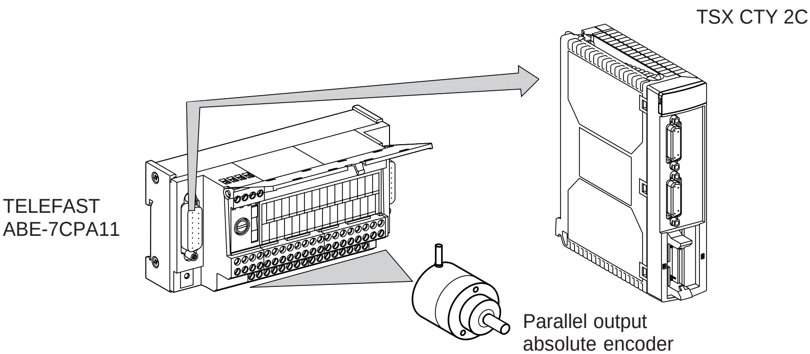
4.2-3 Correspondence between TELEFAST ABE-7H16R20 terminal blocks and HE10 connector

TELEFAST screw term. blk (Terminal no.)	20-pin HE10 connector (Terminal no.)	Type of signals		
		TSX CTY 2A /A	TSX CTY 2C	Type of signal
100	1	+ 5 VDC	+ 5 VDC	Encoder power supply
101	2	- 0 VDC	- 0 VDC	
102	3	+ 10…30 VDC	+ 10…30 VDC	
103	4		10...30 VDC encoder reference voltage	
104	5	IPres 0/2	IPres 0	Auxiliary inputs channs 0 / 2
105	6	IEna 0/2	IEna 0 / output Q2 channel 0	
106	7	IRead 0/2	IRead 0	
107	8		Output Q3 chan. 0	
108	9	IPres 1/3	IPres1	Auxiliary I/O channels 1 / 3
109	10	IEna 1/3	IEna1 / output Q2 channel 1	
110	11	IRead 1/3	IRead 1	
111	12		Output Q3 chann. 1	
112	13	Output Q0 chann. 0/2	Output Q0 chann. 0	Reflex outputs channels 0 / 2
113	14	Output Q1 chann. 0/2	Output Q1 chann. 0	
114	15	Output Q0 chann. 1/3	Output Q0 chann. 1	Reflex outputs channels 1 / 3
115	16	Output Q1 chann. 1/3	Output Q1 chann. 1	
+ 24 VDC	17	Auxiliary I/O supply		
- 0 VDC	18			
+ 24 VDC	19			
- 0 VDC	20			
1		Terminals 200 to 215 at + 24 VDC		
2				
3		Terminals 200 to 215 at - 0 VDC		
4				
200...215		Connecting sensor commons to : + 24 VDC if terminals 1 & 2 are linked - 0 VDC if terminals 3 & 4 are linked		
300...315		Terminals may be used as a sensor common on optional ABE-7BV20 bar		

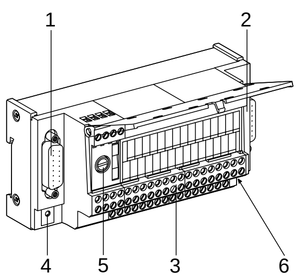
4.3 TELEFAST 2 connection and adaptor sub-base : ABE-7CPA11

4.3-1 Presentation

The TELEFAST 2 connection and adaptor sub-base ABE-7CPA11 is used to connect parallel output absolute encoders to the TSX CTY 2C counter module. It converts the position value given by the parallel output absolute encoder to serial data. The absolute encoder must be coded in pure binary or Gray with a maximum of 24 data bits.
It is possible to connect 2 parallel output absolute encoders to the same TELEFAST adaptor. Moreover, connecting several ABE-7CPA11 sub-bases (maximum 4) in series can be used to multiplex up to 4 parallel output absolute encoders on the same counter channel (position acquisition).



4.3-2 Physical description



1 Standard 15-pin SUB-D connector for connecting the TELEFAST sub-base to the TSX CTY 2C module.

2 Standard 15-pin SUB-D connector for connecting several TELEFAST sub-bases (maximum 4) in series.

3 Screw terminal block for connecting parallel output absolute encoder(s) (maximum 2).

It is possible to distribute power supplies using additional snap on terminal blocks : ABE-7BV10 (10 terminals) or ABE-7BV20 (20 terminals).

4 TELEFAST diagnostics indicator lamp. This green indicator lamp is on when the TELEFAST is supplied with power.

5 Protective fuse (1A fast-blow type) for the 10...30 V supply.

6 Micro-switches for configuring the encoder(s) (number / type, etc).

4.3-3 Characteristics of the TELEFAST sub-base

- **General characteristics**

Parameters	Values
Permissible voltage at 10-30 VDC	11...30 V
Permissible voltage at 5 VDC	5...6 V
Maximum frequency of change of state of least significant bit	75 kHz
Frequency for reading the serial frame	150 kHz ... 1 MHz
Current consumption (excluding encoders)	typically : 90 mA max. : 130 mA
Power dissipation	typically : 450 mW max. : 1.5 W
Encoder power supply return monitoring : • on + supply • on - supply	 -15 % Vsupply +15 % Vsupply
Insulation resistance	> 10 MΩ at 500 VDC
Dielectric strength	1000 Vrms. 50 / 60 Hz for 1 min
Operating temperature	0...60 °C
Relative humidity	5%...95% without condensation
Storage temperature	-25 °C...+70 °C
Operating altitude	0...2000 m

- **Characteristics of encoder read inputs (in0 to in23)**

Parameters	Values
Logic	positive or negative (1)
Compatibility with encoder outputs	11-30 V Totem-pole outputs 5V TTL outputs 11-30 V NPN open collector transistor outputs
Maximum permissible voltage on inputs	+30 V
Max. length of cable between encoder and TELEFAST	200 m (2)
VIL input voltage	0 V < VIL < 2.5 V
VIH input voltage	3.9 V < VIH < 30 V

(1) **Positive logic** : voltage < 2.5 V -> state 0,
voltage > 3.9 V -> state 1,

Negative logic : voltage < 2.5 V -> state 1,
voltage > 3.9 V -> state 0.

(2) 50 m max. with encoders with pure binary coding and NPN open collector outputs and derating depending on the length.

- **Characteristics of discrete address inputs (AD0, AD1)**

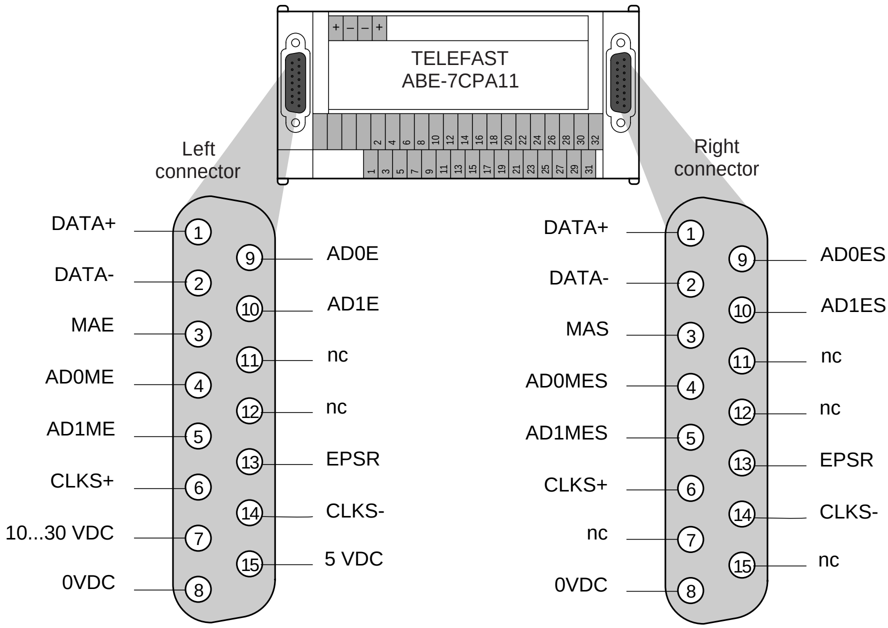
Parameters	Values
Logic	Positive
Voltage limit • max. permissible voltage limit	30 V 34 V (1 hr per 24 hrs)
Nominal values • voltage • current	 24 V 7 mA
Voltage at ON state Current at ON state at 11 V Voltage at OFF state Current at OFF state	≥ 11 V ≥ 3 mA ≤ 5 V ≤ 2 mA
Input impedance for U nominal	3.6 kΩ
Response time	25 µs...50 µs
Type of inputs	resistive
IEC 1131 conformity	type 1

- **Characteristics of encoder 3-state control outputs (3ST0, 3ST1)**

Parameters	Values
Output voltage	encoder supply
Nominal current	encoder supply / 3 kΩ
Max. voltage drop	< 0.5 V
Max. current	10 mA
Protection against overvoltages and short-circuits	no

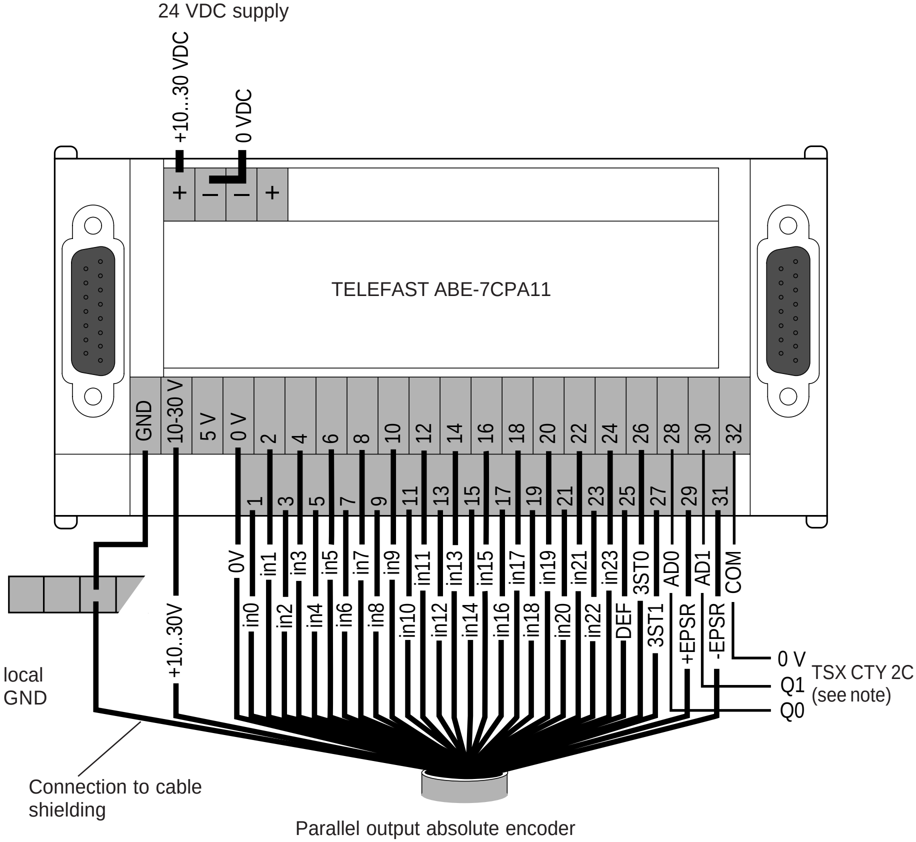
4.3-4 Connecting the TELEFAST sub-base

- **Pinout of 15-pin SUB-D connectors**



Supply		**Supply**	
0 VDC	8		
10...30 VDC	7		
0 VDC	15	0 VDC	8
Addressing encoders		**Addressing encoders**	
• inter-TELEFAST bus (Input) :		• inter-TELEFAST bus (Output) :	
AD0E	9	AD0ES	9
AD1E	10	AD1ES	10
AD0ME	4	AD0MES	4
AD1ME	5	AD1MES	5
MAE	3	MAS	3
Encoder power supply return		**Encoder power supply return**	
EPSR	13	EPSR	13
Serial link		**Serial link**	
• data outputs :		• data outputs :	
DATA+	1	DATA+	1
DATA-	2	DATA-	2
• clock inputs :		• clock inputs :	
CLKS+	6	CLKS+	6
CLKS-	14	CLKS-	14

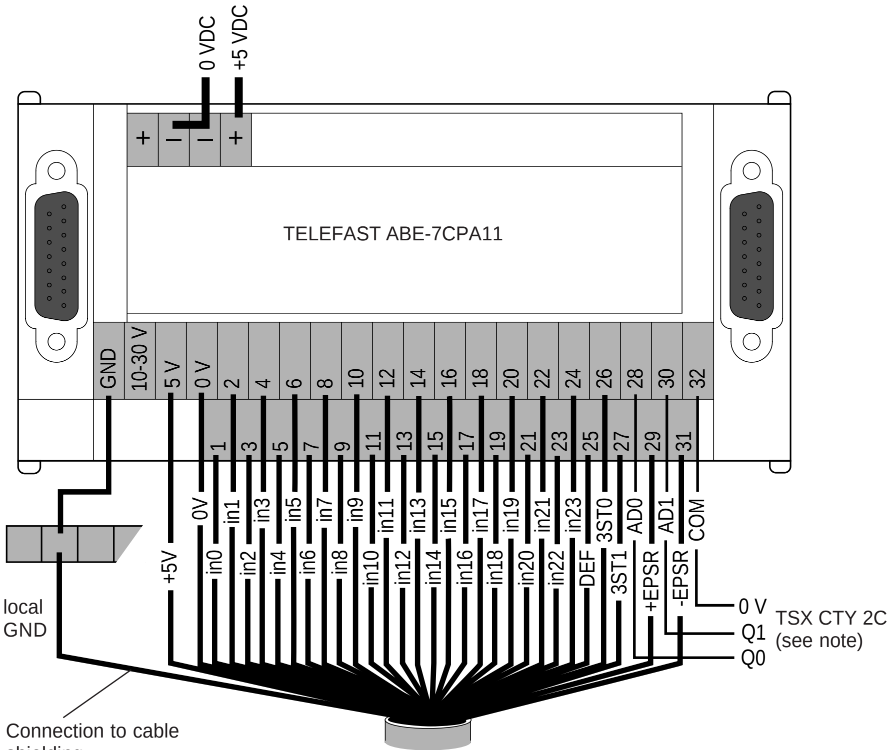
• **Connecting encoders supplied at 10...30 V**



Signals	Meaning	Terminal no.
GND	encoder ground	
+10...30V	+ terminal of encoder supply	
0V	- terminal of encoder supply	
in0 to in 23	encoder outputs	1...24
DEF	encoder fault output	25
3ST0	encoder 0 output inhibit command (for multiplexing)	26
3ST1	encoder 1 output inhibit command (for multiplexing)	27
AD0, AD1	encoder multiplexing command	28, 30
COM	common of signals AD0 and AD1	32
+EPSR	encoder power supply return + (connect to +10...30 V if no monitor circuit)	29
+EPSR	encoder power supply return - (connect to 0 V if no monitor circuit)	31

Note : refer to the wiring instructions and recommendations for encoder inputs (section 4.3-5).

• **Connecting encoders supplied at 5 V**

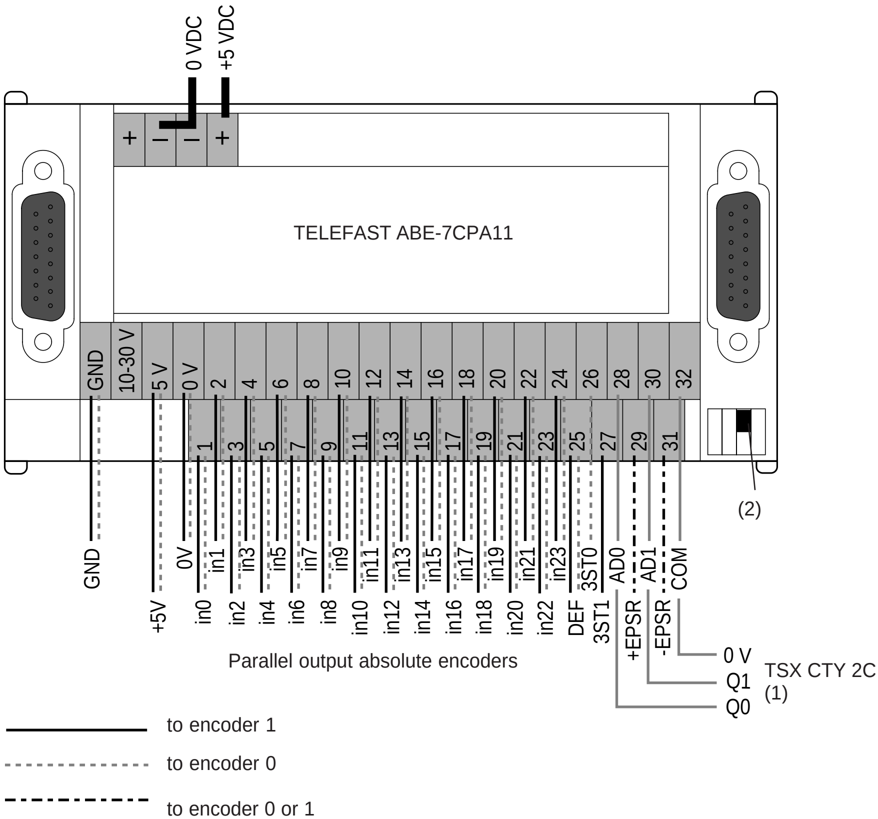


Parallel output absolute encoder

Signals	Meaning	Terminal no.
GND	encoder ground	
+5V	+ terminal of encoder supply	
0V	- terminal of encoder supply	
in0 to in 23	encoder outputs	1...24
DEF	encoder fault output	25
3ST0	encoder 0 output inhibit command (for multiplexing)	26
3ST1	encoder 1 output inhibit command (for multiplexing)	27
AD0, AD1	encoder multiplexing command	28, 30
COM	common of signals AD0 and AD1	32
+EPSR	encoder power supply return + (connect to +5 V if no monitor circuit)	29
+EPSR	encoder power supply return - (connect to 0 V if no monitor circuit)	31

Note : refer to the wiring instructions and recommendations for encoder outputs (section 4.3-5).

• **Example of multiplexing of encoders supplied at 5 V**



IMPORTANT

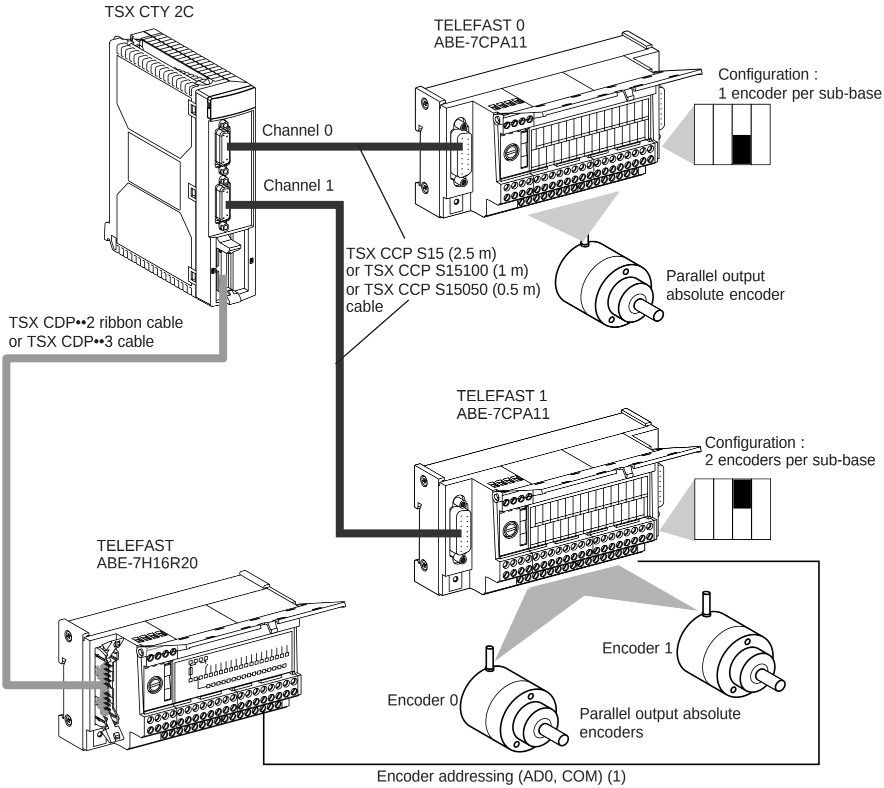
> **For multiplexing, the same type of parallel output encoders must be used :**
> **- same number of data bits,**
> **- same supply (encoders are supplied at either 10...30 VDC, or 5 VDC).**

Note : if the encoder supply monitor circuit is not used, the +EPSR terminal (+ encoder power supply return) must be connected to the +10...30 V or +5 V and the -EPSR terminal (- encoder power supply return) must be connected to the 0 V.

(1) It is not essential to use reflex outputs Q0 and Q1 of the TSX CTY 2C module to address the encoders; this operation can be performed by 2 outputs of a discrete module. In this case, the output common must be connected to the COM input of the TELEFAST ABE-7CPA11.

(2) The configuration micro-switch must be positioned according to the number of encoders connected to the sub-base (OFF for 1 encoder or ON for 2 encoders).

- **Connection example : each TSX CTY 2C module channel is connected to a single TELEFAST sub-base**

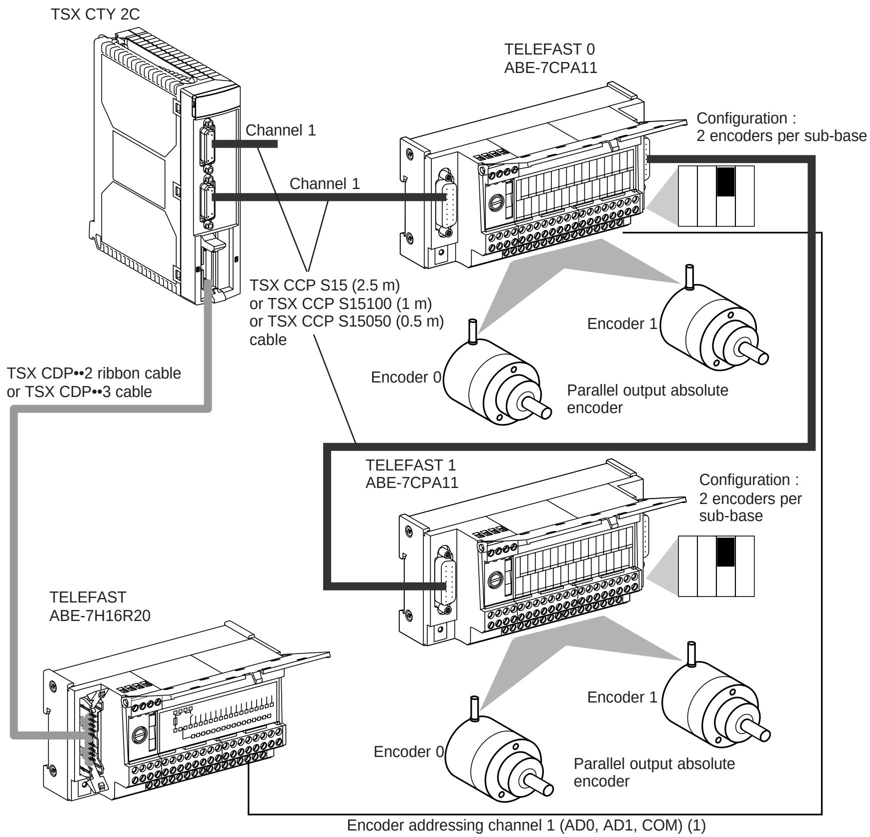


Note

(1) It is not necessary to wire the encoder addressing for the TELEFAST 0 sub-base (channel 0), as it has a default address of 00. Encoder addressing for the TELEFAST 1 sub-base (channel 1) is as follows :

AD1	AD0	Action
0	0	read encoder 0
0	1	read encoder 1
1	0	no read operation
1	1	no read operation

• **Connection example : 2 TELEFAST sub-bases are connected on a single channel**

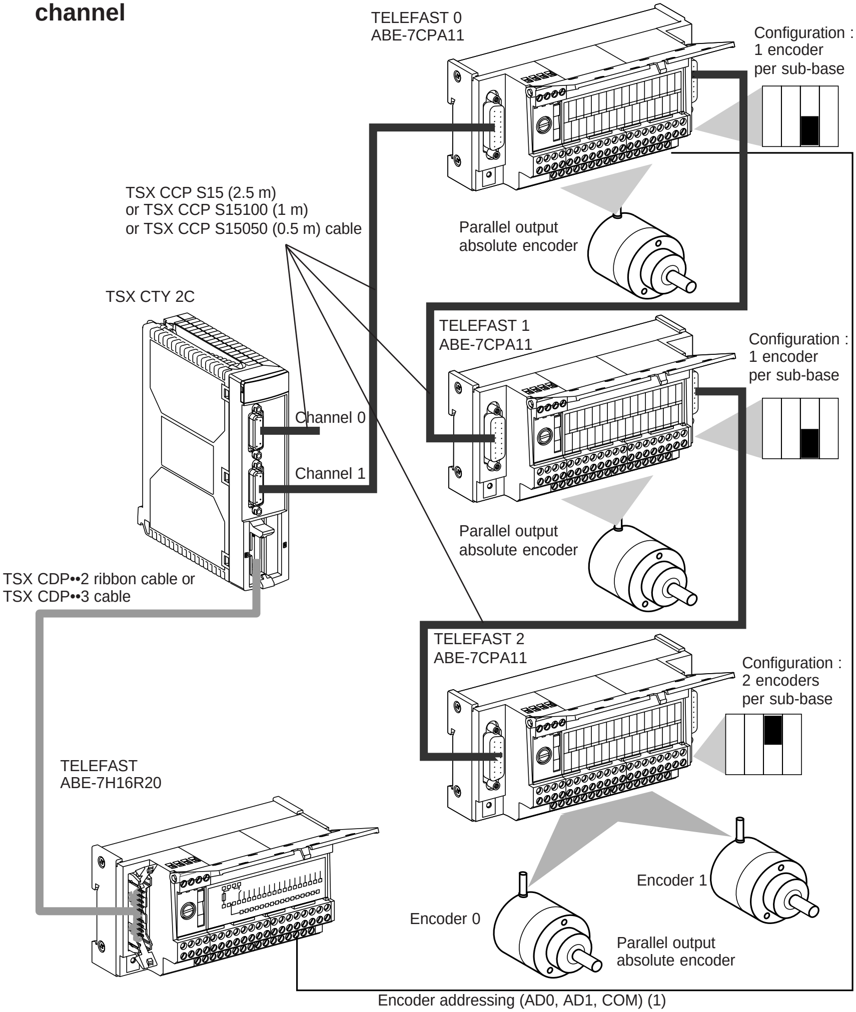


Note

(1) Encoder addressing is as follows :

AD1	**AD0**	**Action**
0	0	read encoder 0 of TELEFAST 0
0	1	read encoder 1 of TELEFAST 0
1	0	read encoder 0 of TELEFAST 1
1	1	read encoder 1 of TELEFAST 1

- **Connection example : 3 TELEFAST sub-bases are connected on a single channel**



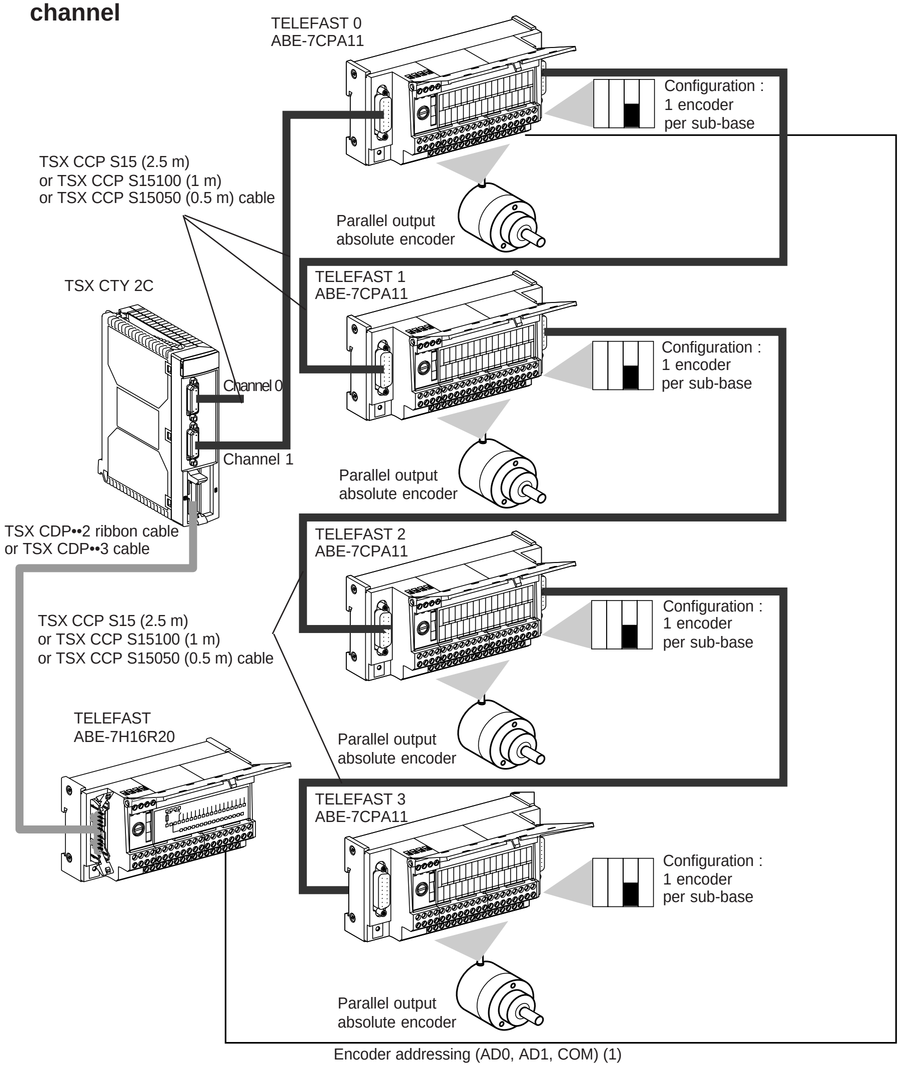
Note

(1) Encoder addressing is as follows :

AD1	**AD0**	**Action**
0	0	read encoder of TELEFAST 0
0	1	read encoder of TELEFAST 1
1	0	read encoder 0 of TELEFAST 2
1	1	read encoder 1 of TELEFAST 2

If, for example, 2 encoders are wired on TELEFAST 0 and one encoder is wired on TELEFAST 2, the addressing becomes : 00-read encoder 0 of TELEFAST 0, 01-read encoder 1 of TELEFAST 0, 10-read encoder of TELEFAST 1 and 11-read encoder of TELEFAST 2.

- **Connection example : 4 TELEFAST sub-bases are connected on a single channel**



Note

(1) Encoder addressing is as follows :

AD1	**AD0**	**Action**
0	0	read encoder of TELEFAST 0
0	1	read encoder of TELEFAST 1
1	0	read encoder of TELEFAST 2
1	1	read encoder of TELEFAST 3

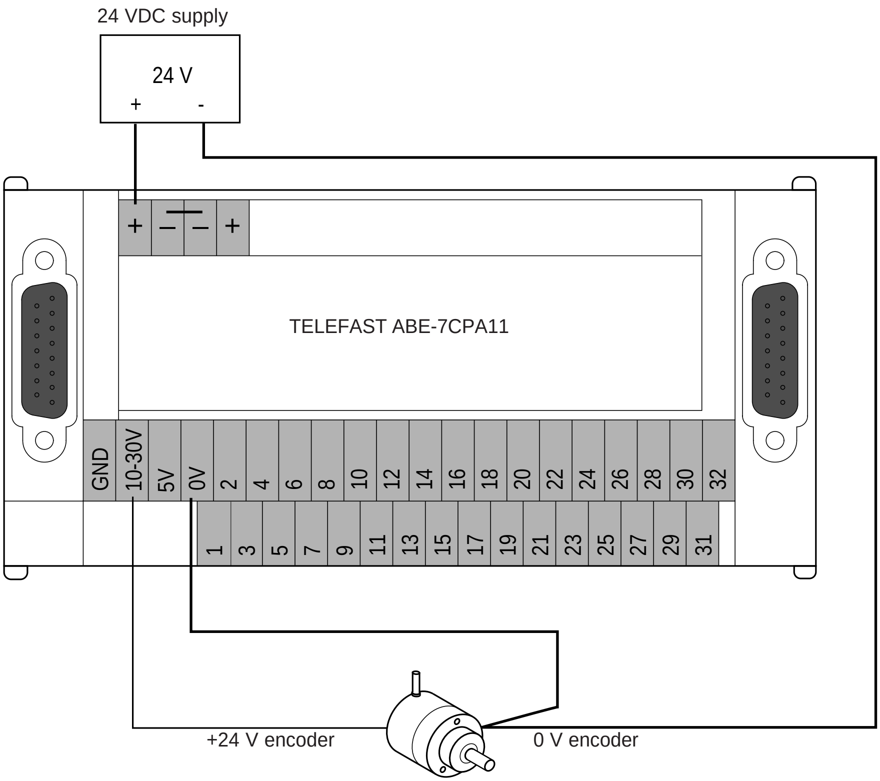
4.3-5 Wiring instructions and recommendations

IMPORTANT

All connections or disconnections on the TELEFAST must be performed WITH THE POWER OFF (encoders, connection to the counter module, connections between TELEFAST sub-bases).

- **Connecting TELEFAST 0 to the counter module and daisy-chaining TELEFAST sub-bases**

  TSX CCP S15 (2.5 m), TSX CCP S15100 (1 m) and TSX CCP S15050 (0.5 m) cables are offered for connecting TELEFAST sub-bases to each other or for connecting TELEFAST 0 to the TSX CTY 2C module. The user can, however, use longer connections by using the wiring kit, reference TSX CAP S15••, and respecting the following rule if encoders are supplied at 5 V : if the connection between the counter module and the TELEFAST 0 is no longer than 100 m, use a 28-gauge wire (0.08 mm²). If it is > 100 m, use a 22-gauge wire minimum (0.34 mm²). However, to limit the voltage drop in the 0 V, due to the encoder supply current, it is advisable to wire the 0 V in the following way :



- **Length of cables between counter module and TELEFAST**

  The total length of the connection between the counter module and the TELEFAST sub-bases (sum of lengths between the counter channel and the first TELEFAST sub-base and between the various TELEFAST sub-bases) must not exceed 200 m, with a maximum cable length between 2 TELEFAST sub-bases of 50 m.

  If the total distance between the first and last TELEFAST sub-base exceeds 20 m, a line terminator must be installed on the right-hand connector of the last TELEFAST sub-base, by inserting an end of line plug (resistance of 220 Ω between pins 1 and 2 of the connector).

  The following table indicates the clock frequencies for the serial transmission, depending on the total length of the connection :

Cable length	Clock frequency for the serial transmission
< 10 m	1 MHz
< 20 m	750 kHz
< 50 m	500 kHz
< 99 m	375 kHz
< 150 m	200 kHz (By default)
< 200 m	150 kHz

- **Protection of encoder supply**

  The operating voltage of the encoder(s) connected to the TELEFAST determines whether it must be supplied at 10...30 VDC or 5 VDC. For a 10...30 VDC supply, the protective fuse is integrated in the TELEFAST sub-base (fast-blow type 1 A fuse). However, if the TELEFAST sub-base is supplied at 5 VDC, the user should provide, in series with the + terminal of the power supply, a fast-blow fuse suitable for the consumption of the TELEFAST sub-base and the encoders connected to it.

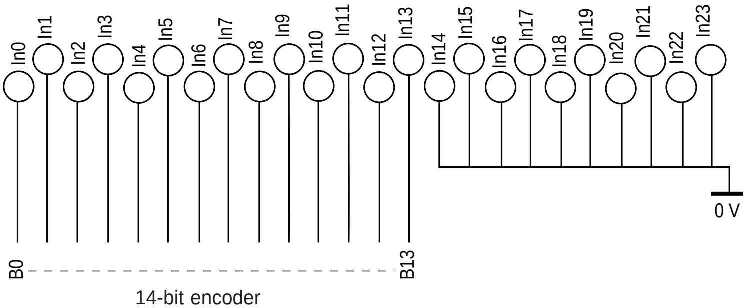
- **Encoder supply voltage monitoring**

  This function is only valid if a single encoder is connected to the TELEFAST sub-base. If the encoder supply voltage decreases by more than 15%, the EPSR fault is fed back to the module.

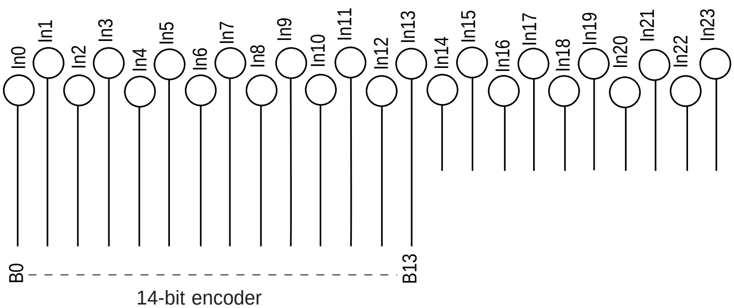
  If the encoder does not have an encoder power supply return, the following must be wired :
  - the +EPSR terminal of the TELEFAST sub-base to the + terminal of the encoder power supply,
  - the -EPSR terminal of the TELEFAST sub-base to the - terminal of the encoder power supply.

- **Wiring of encoder outputs**

  If the encoder has positive logic outputs and if there are less than 24, the following rules must be respected :
  - wire the encoder outputs on the TELEFAST inputs, from the least significant to the most significant,
  - wire the TELEFAST inputs which are not used to the 0 V terminal.

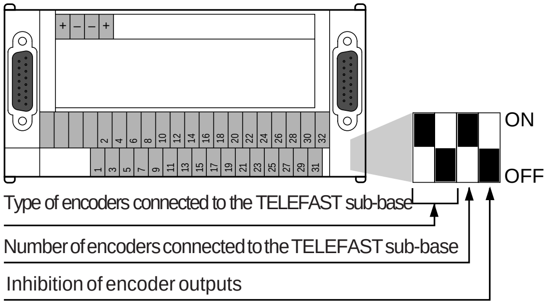


  If the encoder has negative logic outputs and if there are less than 24, the following rules must be respected :
  - wire the encoder outputs on the TELEFAST inputs, from the least significant to the most significant,
  - do not wire the TELEFAST inputs which are not used.



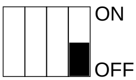
4.3-6 Configuring the TELEFAST sub-base

The sub-base is configured by positioning the 4 micro-switches, located under the right-hand connector of the sub-base. They are used to inhibit the encoder outputs and to define the number and type of encoders connected to the TELEFAST sub-base.

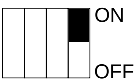


Inhibition of encoder outputs

This micro-switch is used to select the active state of the 2 inhibit commands (3ST0 and 3ST1) for the encoder outputs.



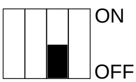
The encoder outputs are high impedance with a 3ST0 or 3ST1 command active at 0.



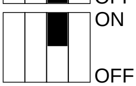
The encoder outputs are high impedance with a 3ST0 or 3ST1 command active at 1.

Number of encoders connected to the TELEFAST

This micro-switch is used to define the number of encoders connected to the TELEFAST sub-base (1 or 2 parallel output absolute encoders).



One encoder is connected to the sub-base.



Two encoders are connected to the sub-base.

If, for a counter channel, there is an odd number of encoders connected and there are 2 or 3 TELEFAST sub-bases connected in series, **the TELEFAST sub-bases must be configured so that the total number of encoders is 4**.

- **For 2 TELEFAST sub-bases**

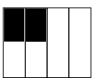
Hardware configuration (number of encoders per TELEFAST sub-base)	**TELEFAST micro-switch**		**Address**		**Action**
	0	**1**	**AD0**	**AD1**	
2 encoders on TELEFAST 0 and 1 encoder on TELEFAST 1	ON	ON	0 0 1 1	0 1 0 1	Read encoder 0 of TELEFAST 0 Read encoder 1 of TELEFAST 0 Read encoder of TELEFAST 1 Read encoder of TELEFAST 1
1 encoder on TELEFAST 0 and 2 encoders on TELEFAST 1	ON	ON	0 0 1 1	0 1 0 1	Read encoder of TELEFAST 0 Read encoder of TELEFAST 0 Read encoder 0 of TELEFAST 1 Read encoder 1 of TELEFAST 1

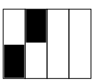
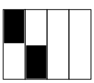
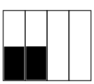
- **Case of 3 TELEFAST sub-bases**

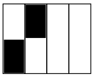
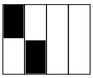
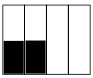
Hardware configuration (number of encoders per TELEFAST sub-base)	TELEFAST micro-switch 0	1	2	Address AD0	AD1	Action
1 encoder on TELEFAST 0 1 encoder on TELEFAST 1 and 1 encoder on TELEFAST 2	ON	OFF	OFF	0 0 1 1	0 1 0 1	Read encoder of TELEFAST 0 Read encoder of TELEFAST 0 Read encoder of TELEFAST 1 Read encoder of TELEFAST 2
1 encoder on TELEFAST 0 1 encoder on TELEFAST 1 and 1 encoder on TELEFAST 2	OFF	ON	OFF	0 0 1 1	0 1 0 1	Read encoder of TELEFAST 0 Read encoder of TELEFAST 1 Read encoder of TELEFAST 1 Read encoder of TELEFAST 2
1 encoder on TELEFAST 0 1 encoder on TELEFAST 1 and 1 encoder on TELEFAST 2	OFF	OFF	ON	0 0 1 1	0 1 0 1	Read encoder of TELEFAST 0 Read encoder of TELEFAST 1 Read encoder of TELEFAST 2 Read encoder of TELEFAST 2

Type of encoders connected to TELEFAST

These micro-switches are used to define the type of encoders connected to the TELEFAST sub-base. The following tables indicate the performance of the encoder / TELEFAST connection, depending on the code selected using the micro-switches :

Encoders with positive logic outputs, Totem-pole, TTL and NPN open collector, Gray code	Max. length encoder / TELEFAST	Max. frequency of change of least significant bit
 ON OFF	50 m	75 kHz

Encoders with negative logic outputs, Totem-pole, TTL and NPN open collector, Gray code	Max. length encoder / TELEFAST	Max. frequency of change of least significant bit
 ON OFF	50 m	75 kHz
 ON OFF	100 m	40 kHz
 ON OFF	200 m	5 kHz

Encoders with positive or negative logic outputs, NPN open collector, binary coded	Max. length encoder / TELEFAST	Max. frequency of change of least significant bit
 ON OFF	10 m	40 kHz
 ON OFF	30 m	20 kHz
 ON OFF	50 m	5 kHz

Note

For encoders with positive logic, TTL and Totem-pole outputs, it is possible to improve these performance levels, without exceeding the recommendations of encoder manufacturers.

4.4 TSX TAP S15•• wiring accessories

4.4-1 Presentation

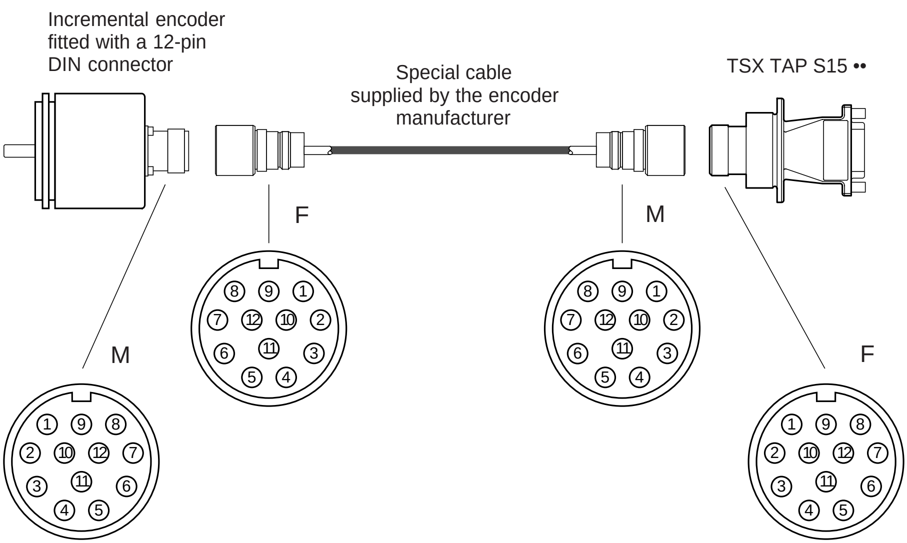
TSX TAP S15•• wiring accessories are used to connect an incremental encoder to the counter module, using a special cable (supplied by the encoder manufacturer).

- the TSX TAP S1505 accessory is used to connect an incremental encoder supplied at 5 VDC : encoder with RS 422 line driver outputs,
- the TSX TAP S1524 accessory is used to connect an incremental encoder supplied at 24 VDC : encoder with Totem Pole or open collector PNP outputs.

The TSX TAP S15•• is fitted with 2 connectors :

- a 12-pin female DIN connector, numbered in an anti-clockwise direction. This connector is used to connect the encoder, via a cable supplied by the encoder manufacturer,
- a standard 15-pin DIN connector for connecting to the counter module, via a TSX CCP S15 cable.

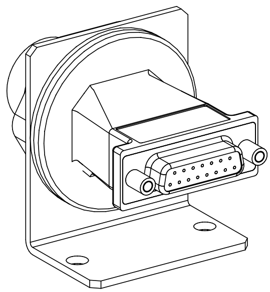
The TSX TAP S15•• can be mounted on a DIN rail, using the bracket supplied with the product, or fitted through an enclosure wall (in the second case, a seal supplied with the product ensures the cabinet is dust and damp-proof).

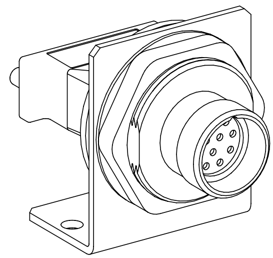


4.4-2 Mounting the TSX TAP S15••

Mounting on Telequick plate

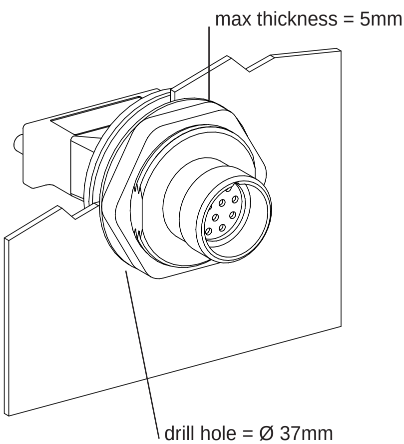
The bracket supplied is used to fix the TSX TAP S15•• to an AM1-PA••• type pre-slotted plate or to any other support.

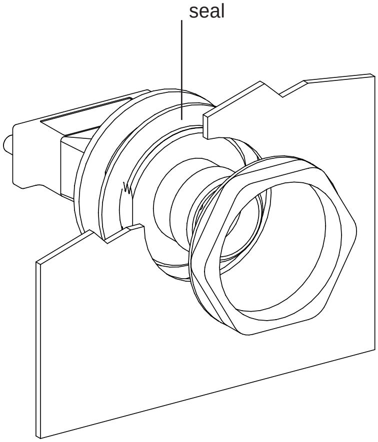




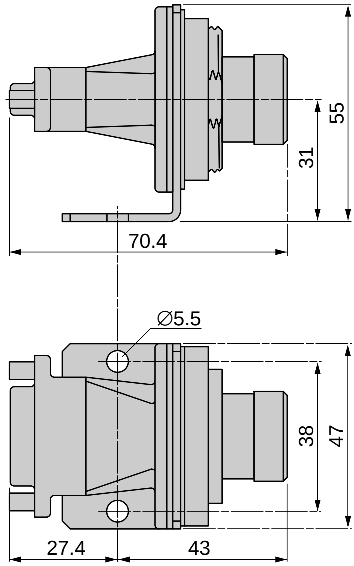
Mounting into an enclosure wall

The TSX TAP S15•• can be mounted into an enclosure wall using its fixing nut. The seal supplied with this accessory ensures the enclosure is dust and damp-proof.



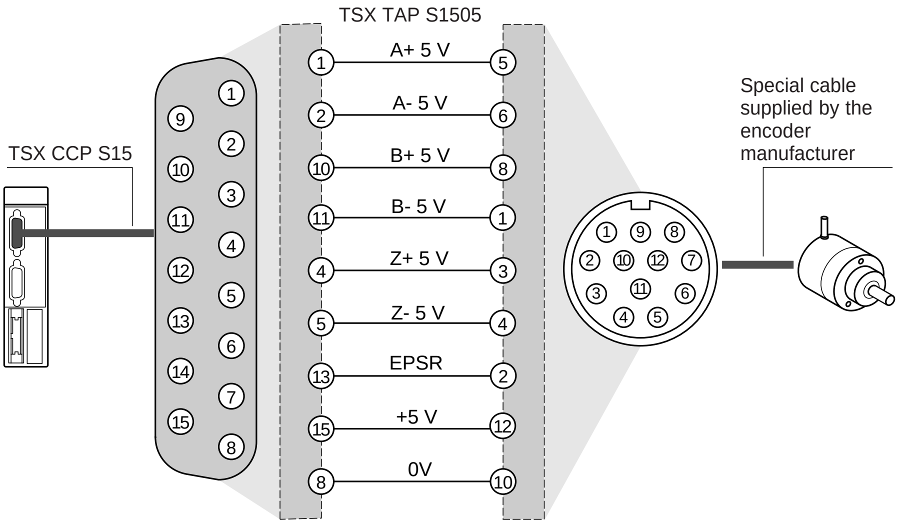


Dimensions



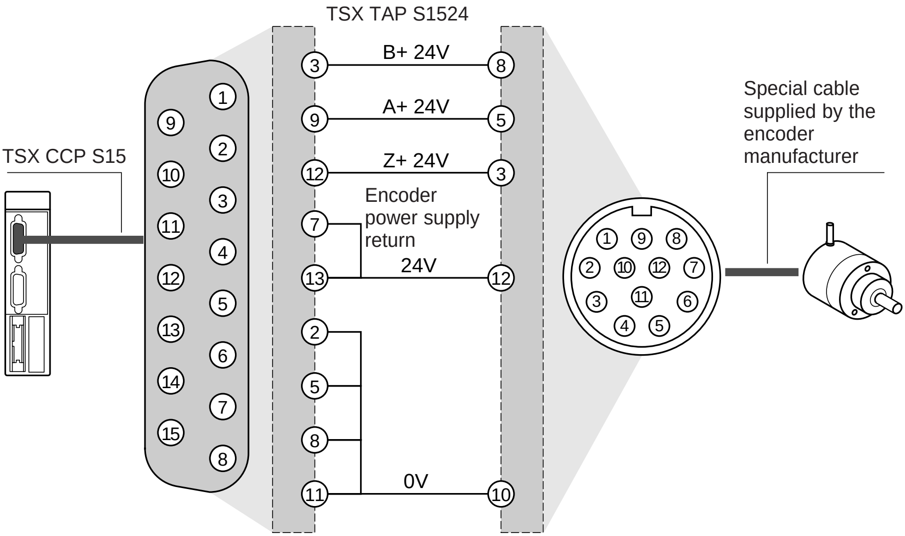
4.4-3 Connection of an encoder using the TSX TAP S1505 accessory

Connecting the encoder via a TSX TAP S1505 accessory requires a special cable (supplied by the encoder manufacturer).
The TSX TAP S1505 pinout is as follows :



4.4-4 Connection of an encoder using the TSX TAP S1524 accessory

Connecting the encoder via a TSX TAP S1524 accessory requires a special cable (supplied by the encoder manufacturer).
The TSX TAP S1524 pinout is as follows :



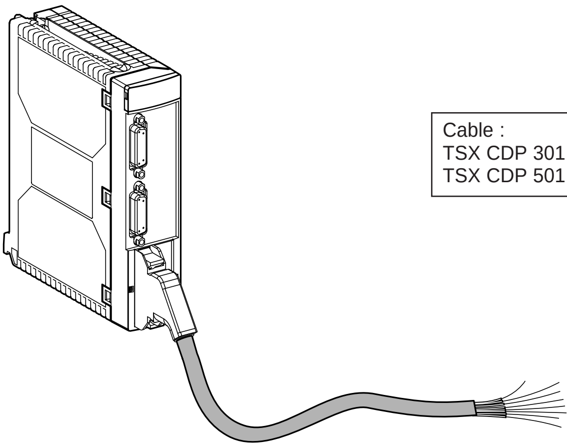
This type of connection is compatible with encoders supplied at 24V (Heidenheim, Hengstler, Codéchamp, Ivo, Ideacod, etc).

4.5 Cables

4.5-1 TSX CDP 301 and TSX CDP 501 preformed cables

Preformed cables (or ribbon cables) are used to connect sensors, preactuators or terminals directly to counter modules. They consist of 20 wires, 22 gauge (0.34 mm^2) and are fitted with an HE10 connector at one end. The flying leads at the other end are color-coded according to DIN 47100 standard.

The correspondence between the wire color and the pin number of the HE10 connector is as follows :



Cable :	length :
TSX CDP 301	3 m
TSX CDP 501	5 m

HE10		TSX CTY 2A/4A	TSX CTY 2C	
1	white	+5 VDC	+5 VDC	
2	brown	0 VDC	0 VDC	
3	green	+10...30 VDC	+10...30 VDC	
4	yellow	nc	nc	
5	gray	IPres0	IPres0	chann.0 (or 2)
6	pink	IEna0	IEna0 / Q2	
7	blue	IRead0	Iread0	
8	red	nc	Q3	
9	black	IPres1	IPres1	chann.1 (or 3)
10	purple	IEna1	IEna1 / Q2	
11	gray-pink	IRead1	IRead1	
12	red-blue	nc	Q3	
13	white-green	Q0	Q0	chann.0 (or 2)
14	brown-green	Q1	Q1	
15	white-yellow	Q0	Q0	chann.1 (or 3)
16	yellow-brown	Q1	Q1	
17	white-gray	+24 VDC	+24 VDC	
18	gray-brown	0 VDC	0 VDC	
19	white-pink	+24 VDC	+24 VDC	
20	pink-brown	0 VDC	0 VDC	

4.5-2 TSX CDP 102, TSX CDP 202 and TSX CDP 302 ribbon cables

These sheathed, rolled ribbon cables are used to connect the HE10 connector of a counter module to a TELEFAST 2 connection interface (1). They consist of a rolled and sheathed ribbon cable with 28-gauge wires (0.08 mm^2), fitted at each end with a HE10 connector.
Given the small wire cross-section, it is recommended to use these preformed connection cables only for low current inputs or outputs (<100 mA per input or output).

3 lengths of preformed connection cable are offered :

TSX CDP 102 : length 1 meter,
TSX CDP 202 : length 2 meters,
TSX CDP 302 : length 3 meters.

4.5-3 TSX CDP 053 / 103 / 203 / 303 / 503 connection cable

These connection cables are used to connect the HE10 connector of a counter module to a TELEFAST 2 connection interface (1). They consist of a cable with 22-gauge wires (0.34 mm^2), fitted at each end with a moulded HE10 connector.
These cables can be used for higher currents (< 500 mA) than the ribbon cables.

5 lengths of connection cable are offered :

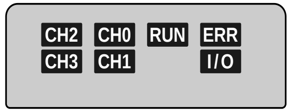
TSX CDP 053 : length 0.5 meter,
TSX CDP 103 : length 1 meter,
TSX CDP 203 : length 2 meters,
TSX CDP 303 : length 3 meters,
TSX CDP 503 : length 5 meters.

(1) see sections 3.7 and 4.2

4.6 Module display

TSX CTY 2A / 4A / 2C modules have indicator lamps on the front panel which display the status of the module and the counter channels :

- Module status lamps (RUN, ERR, I/O)
  These 3 indicator lamps give information on the module operating mode :
  - RUN indicates the module is operating,
  - ERR signals an internal module fault,
  - I/O signals an external module fault or application fault,

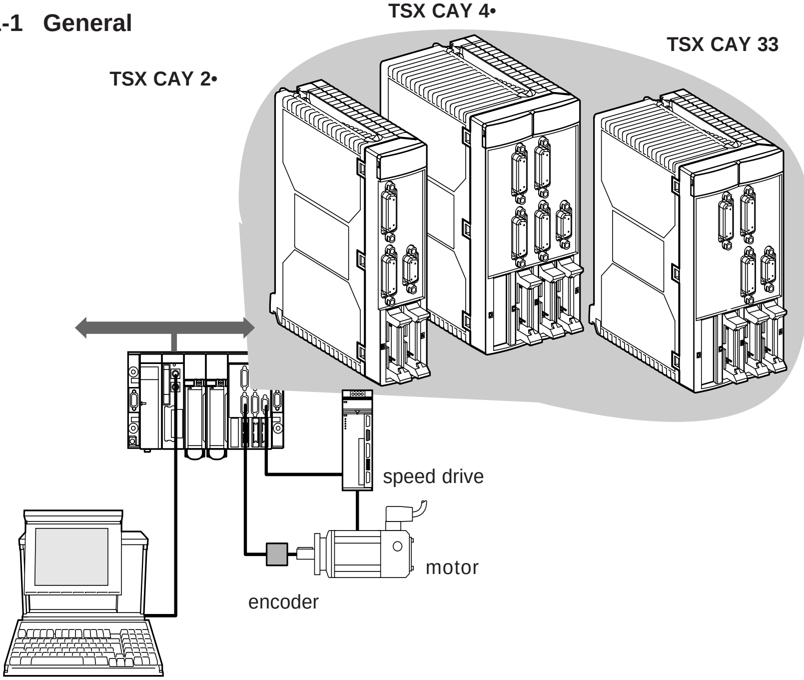


- Channel status lamps (CH.)
  2 or 4 indicator lamps to display and diagnose the status of each module channel.

Status / Indic. lamps	On ●	Flashing ⊗	Off ○
RUN	Module running.	/	Module faulty or off.
ERR	Internal module fault : . module failure.	Communication fault or waiting for configuration.	No fault.
I/O	External fault : . wiring fault, . encoder supply fault, . measurement overrun. Application fault.	/	No fault.
CH. ***TSX CTY 2A / 2C*** **:** CH0 and CH1 **TSX CTY 4A :** CH0, CH1, CH2, CH3	The channel is operating	The channel is not operating correctly due to . an internal fault . an external fault, . a communication fault . an application fault.	The channel is faulty The channel is not configured or is incorrectly configured.

1.1 Description

1.1-1 General



The axis control and servo-loop positioning range for TSX Premium PLC is designed for machines which require high-performance motion control together with simultaneous sequential control via a PLC.
TSX CAY 21 (2 axes) and TSX CAY 41 (4 axes) modules are multiaxis control modules which are used to control movements on an independent, linear and limited axis.
TSX CAY 22 (2 axes)and TSX CAY 42 (4 axes) modules are multiaxis control modules which are used to control movements on an independent, circular and infinite axis.
TSX CAY 33 (3 axes) modules are multiaxis control modules which are used to control movements on on 2 or 3 synchronized axes (linear interpolation).

Terminology :

- The term TSX CAY covers the axis control range
- The reference TSX CAY2• refers to all TSX CAY 21 and 22 modules
- The reference TSX CAY4• refers to TSX CAY 41 and 42 modules

These standard (TSX CAY2•) or double (TSX CAY 4• and TSX CAY 33) format modules can be inserted in all the available slots of a PLC configuration (TSX, PMX or PCX).

To ensure position measurement, an encoder, which may be one of several types, is wired on each of the channels :

- incremental encoder, type RS 422/485
- incremental encoder, type 5V totem pole
- SSI serial absolute encoder
- parallel output absolute encoder (with ABE 7CPA11 interface)

1.1-2 Physical description

1 15-pin SUB-D connector for connecting the axis 0 encoder.

2 15-pin SUB-D connector for connecting the axis 1 encoder.

3 15-pin SUB-D connector for connecting the axis 2 encoder.

4 15-pin SUB-D connector for connecting the axis 3 encoder.

5 9-pin SUB-D connector for connecting the speed references :

6 HE10 connector(s) for connecting :
- auxiliary inputs :
  reference point cam
  emergency stop
  recalibration
- auxiliary outputs,
- external power supplies (encoders and sensors).

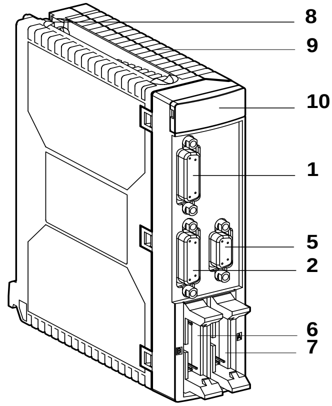
7 HE10 connector for connecting speed controller control I/O.

8 Screw for fixing the module in its position.

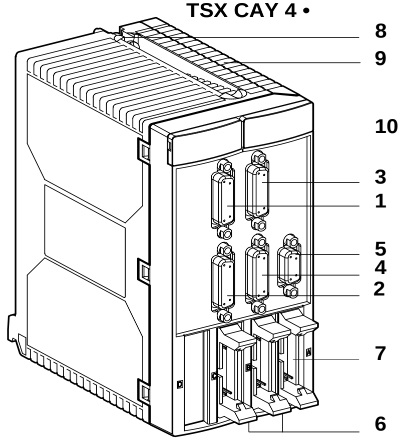
9 Rigid casing to locate the module into its slot.

10 Module diagnostics indicator lamps :
- module diagnostics :
  - green RUN indicator lamp : indicates module operating mode
  - red ERR indicator lamp : indicates internal fault
  - red I/O indicator lamp : indicates external fault or application fault.
- channel diagnostics :
  - green CHx indicator lamp : indicates channel diagnostics

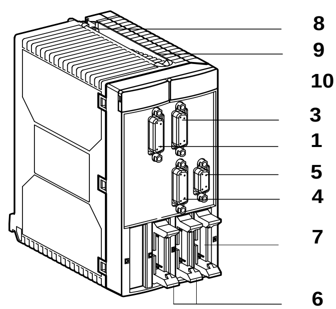
TSX CAY 2 •



TSX CAY 4 •

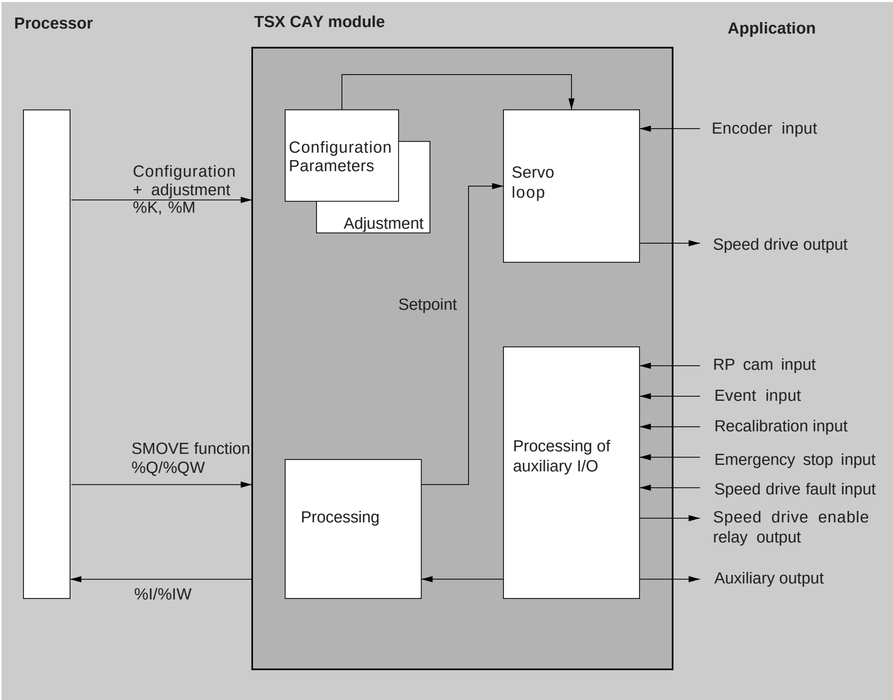


TSX CAY 33



2.1 Functions

Block diagram of an axis control system



Axis control modules provide the following functions for each axis :

- Inputs
  - input for reading position measurements :
    incremental encoder, type RS 485 or 5V totem pole
    absolute encoder, type SSI serial interface, 16 to 25 data bits
  - machine reference point input
  - event input
  - speed drive fault input
  - recalibration input
  - emergency stop input
- Outputs
  - isolated analog output ± 10V, resolution 13 bits + sign, to control the speed drives
  - speed drive enable relay output
  - auxiliary solid state output

Processing commands :

Each movement, controlled by the PLC sequential program, is described by an SMOVE movement command function in PL7 language. The TSX CAY 21/41 module uses this SMOVE command to calculate a position / speed trajectory.

PL7 screens make it easy to configure, adjust and debug the axes.

- **Configuring the axes**
  The configuration screen is used to enter the parameters required to adapt the module operation to the machine characteristics. These parameters are : type of encoder, position limits, maximum speed, etc. They cannot be modified by the program. There is no default configuration.

- **Adjusting the axes**
  The parameters offered in the adjustment screen are associated with operation of the axes. The parameters are adjusted online or offline.

  The operating parameters are :
  - corrected resolution
  - motion control : deviation, recalibration, overspeed, etc.
  - stop control : time, speed, target window
  - position loop : position gain, feedforward cœfficient, offset
  - command : soft limits, acceleration, acceleration profile
  - manual mode parameter : speed, reference point value, etc.

  These parameters can be modified by the program.

- **Debugging**
  The debug screen can only be accessed online. It is used to control and observe axis behavior.
  The data and commands differ depending on the operating mode selected :
  - automatic mode :
    Manual mode
  - direct drive mode
  - measurement mode (Off)

  The upper area of the screen gives information about the module operating status and its diagnostics. The lower area of the screen gives access to the commands and information about the operation of movements, I/O, faults, etc.

3.1 Setup

3.1-1 Basic configuration required

Servomotor axis control modules can be installed in any available slot in a Premium (TSX, PMX or PCX) PLC configuration, provided they use no more than :

Processors	No. of "app-specific" chans managed
TSX P57 102 / TPMX P57 102 / TPCX 57 1012	8
TSX P57 202 / TPMX P57 202	24
TSX P57 252	24
TSX P57 302	32
TSX P57 352 / TPMX P57 352 / TPCX 57 3512	32
TSX P57 402	48
TSX P57 452 / TPMX P57 452	48

(*) All the channels of an application-specific module are called "application-specific" channels (counter module, axis control module, etc). TSX CAY 2 modules comprise 2 "application-specific" channels, TSX CAY 4 modules comprise 4 "application-specific" channels and TSX CAY 33 modules comprise 3 "application-specific" channels.

Note: TSX CAY 22/42 and 33 modules are **not compatible** with the former TSX P57 10 and TSX P57 20 processors.

The power supply for a rack must be chosen according to the number of modules installed.

3.1-2 Installation procedure

It is possible to install or remove a module without switching off the supply voltage to the rack. The module design enables this operation to be executed while powered up to ensure that another device remains available for use.

> Connection or disconnection of connectors with sensor supplies is, however, not recommended, as certain encoders cannot tolerate such handling. The auxiliary I/O connectors can be disconnected while powered up without damaging the module. Nevertheless, for the safety of personnel it is recommended that auxiliary supplies are switched off before any disconnection.

The module and connector fixing screws must be tightened correctly in order to obtain good electrical contacts, thus ensuring good protection against electrostatic and electromagnetic interference.

3.1-3 General wiring instructions

The sensor and actuator supplies must be protected against overloads or overvoltages by fast-blow fuses.
Use wires with an adequate cross-section to avoid line voltage drops or overheating.
Keep sensor and actuator cables away from any source of radiation caused by high-power electrical circuit switching.
All cables connecting absolute or incremental encoders must be shielded. Shielding must be of high quality and connected to the machine ground at both the module and encoder ends. There must be continuity along the entire length of the connections. Only encoder signals should be carried on the cable.
For performance reasons, module auxiliary inputs have short response times and it is thus important that these inputs have an adequate independent supply to ensure that the module continues to operate correctly in the event of brief power outage. It is recommended that regulated supplies are used as they ensure the consistency of actuator and sensor response times. The 0V supply must be connected to the machine ground as near as possible to the supply output.

3.2 Choice of encoders

3.2-1 Output interface

The output interfaces of incremental encoders or pulse generators are :

- RS 422/485 standard output, two push-pull complementary outputs per signal
- 5V Totem Pole output, two push-pull complementary outputs.

The SSI-type serial absolute encoders have a standard RS485 interface for clock and data signals.
We recommend using an encoder with an opto type "CLOCK" signal input stage.
It is possible to connect encoders of different types to the same module. For example, an incremental encoder on channel 0 and an SSI absolute encoder on channel 1.

3.2-2 Encoder power supply

The module is designed to supply either 5V or 24V to the encoders. It is possible to supply a mix of supply voltages to the module channels.
Incremental encoders generally have a 5V supply.
SSI-type absolute encoders often have a 24V supply (10/30V).

5V encoder supply : maximum voltage drop
It is necessary in this case to take into account the line voltage drop, which depends on the cable length and the encoder consumption for a given wire gauge.
Example for a 100m cable :

Wire cross-section	Voltage drop for a 100m cable			
Encoder consumption	50mA	100mA	150mA	200mA
28-gauge = 0.08mm^2	1.1V	2.2V	3.3V	4.4V
22-gauge = 0.34 mm^2	0.25V	0.5V	0.75V	1V
0.5 mm^2	0.17V	0.34V	0.51V	0.68V
1 mm^2	0.09V	0.17V	0.24V	0.34V

24V encoder supply
This type of encoder is recommended as there is no need for a precise supply (10V/30V). With a 24V power supply these encoders can use a very long cable, and the voltage drop along the cable is very small. This is the case with SSI-type serial link encoders.

If an SSI-type 24V serial absolute encoder is used it is not necessary to connect it to the 5V supply.

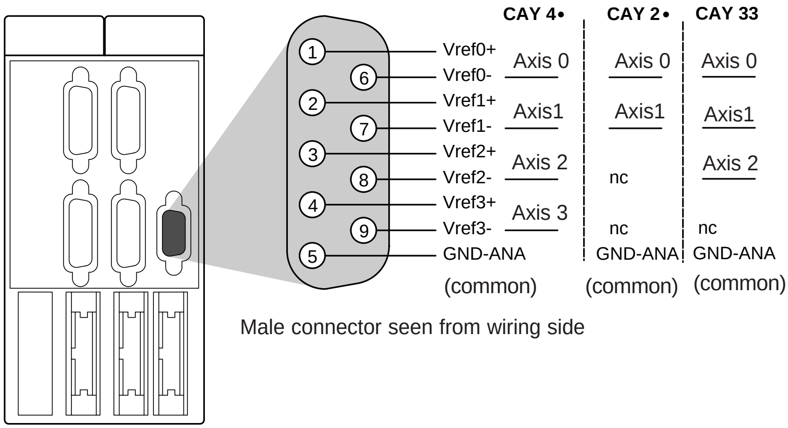
The 24V supply must be reserved for the encoders. The supplies must be able to operate independently for a sufficient length of time to power the encoder during microbreaks (•10ms).

3.2-3 Shielding

To ensure correct operation when the environment is subject to interference, it is necessary to choose an encoder with a metal casing referenced to machine ground of the connected equipment. The encoder must provide ground connection to the connection cable shielding.

3.3 Connecting the speed reference signals

3.3-1 Signal referencing



Male connector seen from wiring side

Connection of speed references :

There are four types of connection

- wiring with TSX CAP S9 connector and cover
- using a TSX CDP 611 cable
- wiring with output on terminals with TELEFAST ABE-7CPA01
- wiring with output to TAP MAS (distribution box)

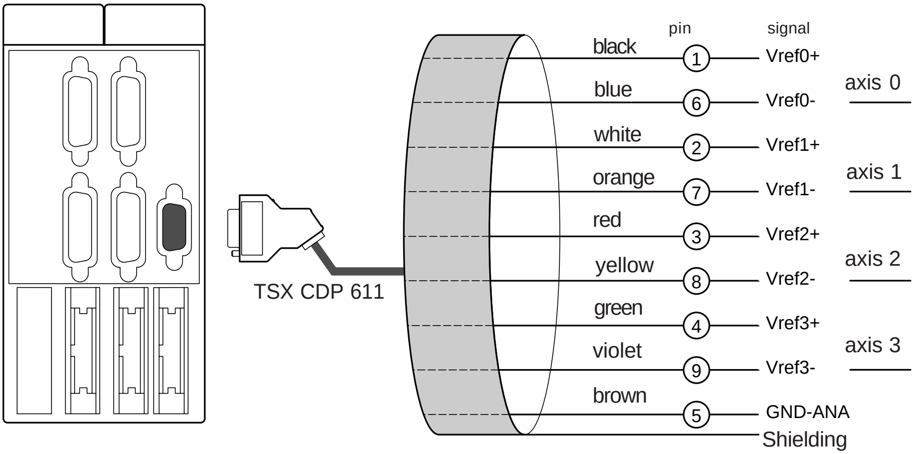
3.3-2 Connecting using a TSX CAP S9

The user makes the connection by soldering directly onto the 9-pin Sub-D connector as shown in 3.3-1. Ensure that the cable shielding is correctly tightened onto the connector cover.

3.3-3 Connecting using a TSX CDP 611 cable

This preformed cable consists of a 9-pin Sub-D connector for connection to the TSX CAY 21/41 module end with flying leads at the other end. 6m long, it consists of 24-gauge wires which correspond to the pins on the Sub-D connector. It is used to connect devices directly to the module. The various signals are identified using a color code.

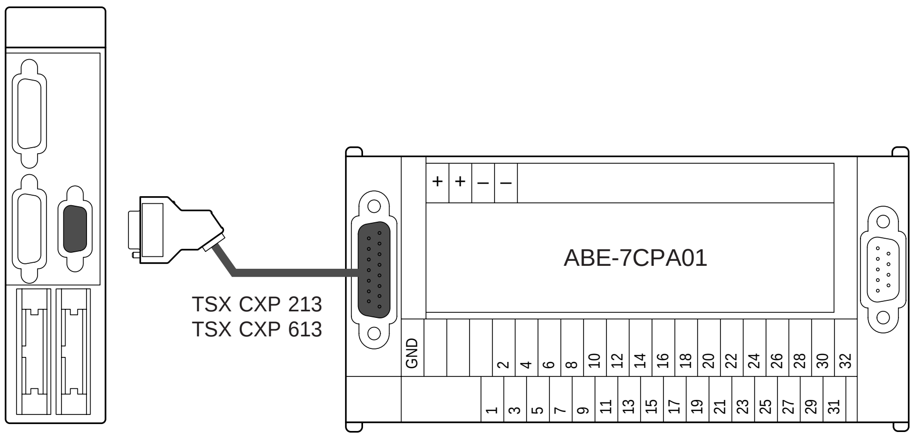
The shielding must be connected to the machine ground of the connected device.

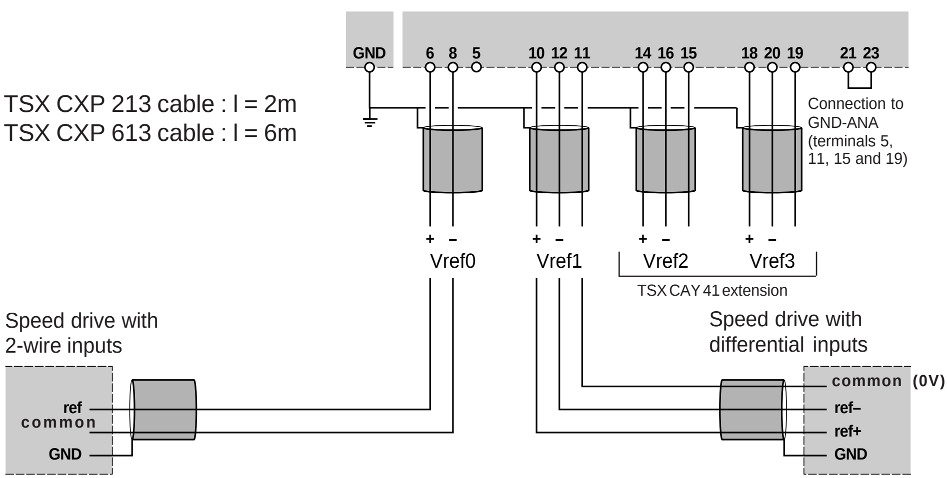


The TSX CDP 611 cable is 6m long.

3.3-4 Connecting to terminals with the TELEFAST pre-wired system

The TELEFAST 2 system is a range of products used for rapid connection of modules in the TSX Micro and TSX Premium ranges. This system replaces screw terminals and provides a single-wire remote connection.
It is necessary to connect speed references to terminals when the speed drives are not close to each other. The TELEFAST pre-wired system simplifies setup by giving access to signals via screw terminals. The module is connected to the TELEFAST (reference ABE-7CPA01) via a cable fitted with a 9-pin Sub-D connector at the module end and a 15-pin Sub-D connector at the TELEFAST end. This cable may either be : TSX CXP213 or TSX CXP 613.





Correspondence between Sub-D connector pins and TELEFAST terminals

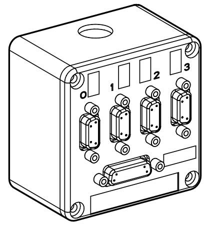
TELEFAST screw terminal (Terminal no.)	15-pin Sub-D connector (Pin no.)	9-pin Sub-D connector for the TSX CAY module	Type of signal
2	1		
4	2		
5			
6	10	1	Vref0+
8	3	6	Vref0-
10	11	2	Vref1+
11			
12	4	7	Vref1-
14	12	3	Vref2+
15			
16	5	8	Vref2-
18	13	4	Vref3+
19			
20	6	9	Vref3-
21			connect to terminal 23
22	nc		
23	14	5	GND-ANA
24	nc		
26	nc		
28	nc		
30	nc		
32	nc		

Note : nc = not connected

Terminal 23 of the lower TELEFAST terminal block (GND-ANA) must be connected to terminal 21 in order to distribute the GND-ANA to terminals 5, 11, 15 and 19.

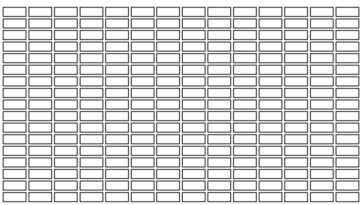
3.3-5 TAP MAS connection box

The connection box is used to assign the speed references from each speed drive to particular port, enabling simple connection of several speed drives while ensuring good ground continuity.

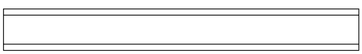


Dimensions and fixing :

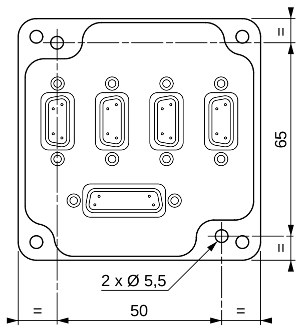
The TSX TAP MAS box is installed on an AM1 PA-type pre-slotted plate or on a DIN rail with an LA9 D09976 fixing plate using two M3x8 or M3x10 screws.



AM1-PA...

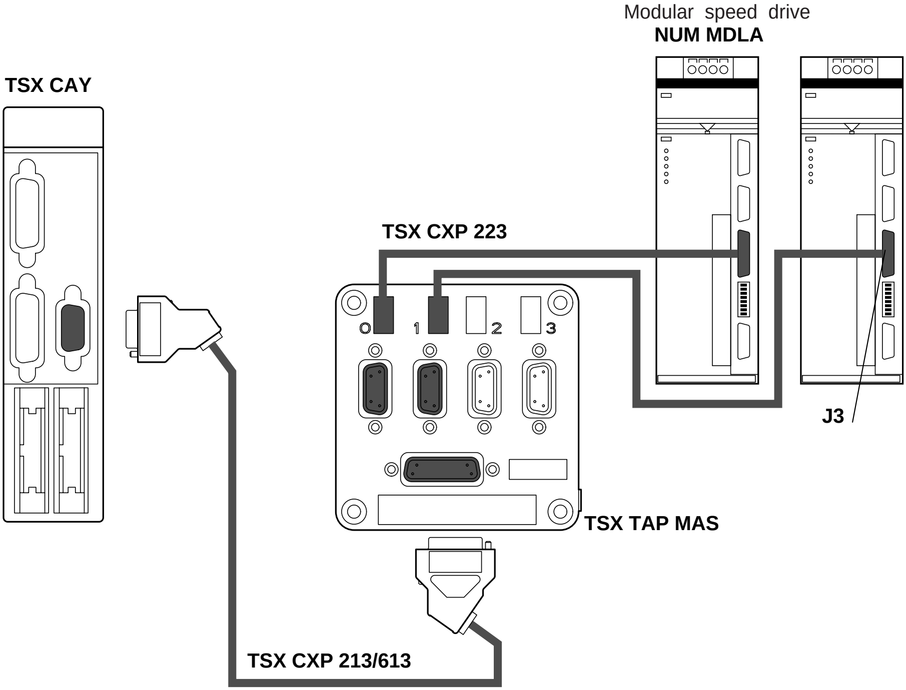


AM1-DE/ED

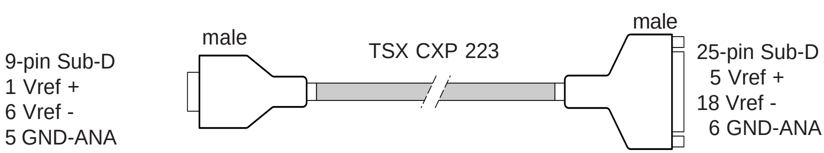


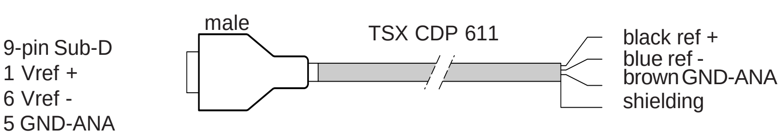
3.3-6 Connecting speed drives using the TAP MAS connection box

NUM MDLA modular speed drives can be connected to the TSX CAY module using a TSX TAP MAS connection box. Setup is simplified by the use of predefined cables and the connection box which directs the voltage references of the different axes in a simple manner.



Cables :
TSX CXP 223 : length = 2.5m
TSX CXP 213 : length = 2.5m
TSX CXP 613 : length = 6m





3.4 Connecting counter signals

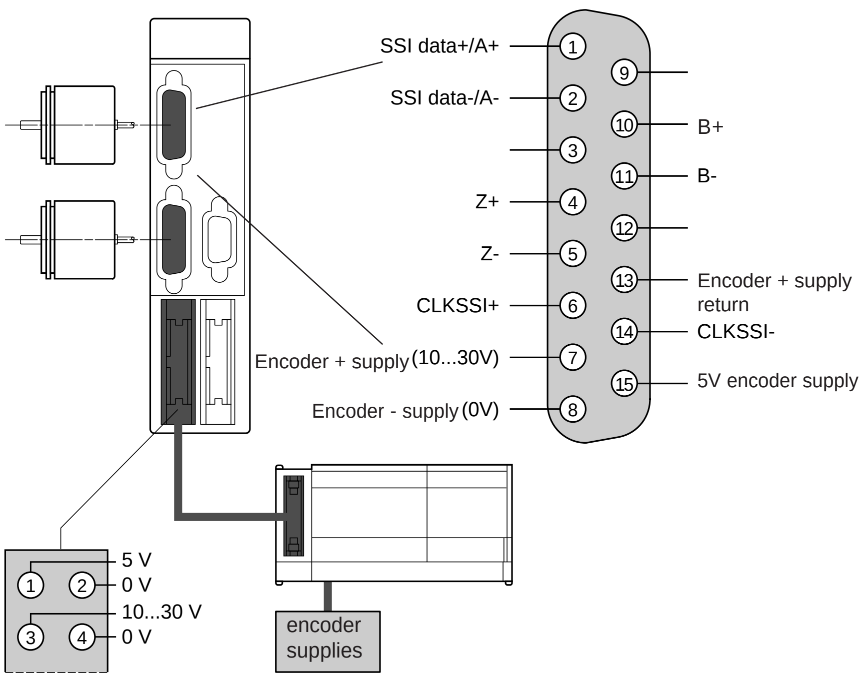
To ensure position measurement, TSX CAY modules are fitted with connectors which enable an incremental encoder or SSI absolute encoder to be directly connected to each channel. Each channel may be fitted with an encoder of a different type.

3.4-1 Signal referencing

TSX CAY modules can be connected either to incremental encoders or to absolute encoders with SSI-type serial link. In configuration mode the following functions are available.

- Two types of interface can be used for incremental encoders :
  - RS 422/RS485 outputs with two complementary outputs per signal,
  - 5V Totem Pole outputs,
- SSI absolute encoder with RS 485 standard interface.

A 15-pin Sub-D connector is assigned to each channel. It is also used to supply power to the encoder. These supplies are generated via the HE10 connector discrete + supply. The encoder + supply return signal from the encoder enables accidental disconnection of the encoder to be detected.



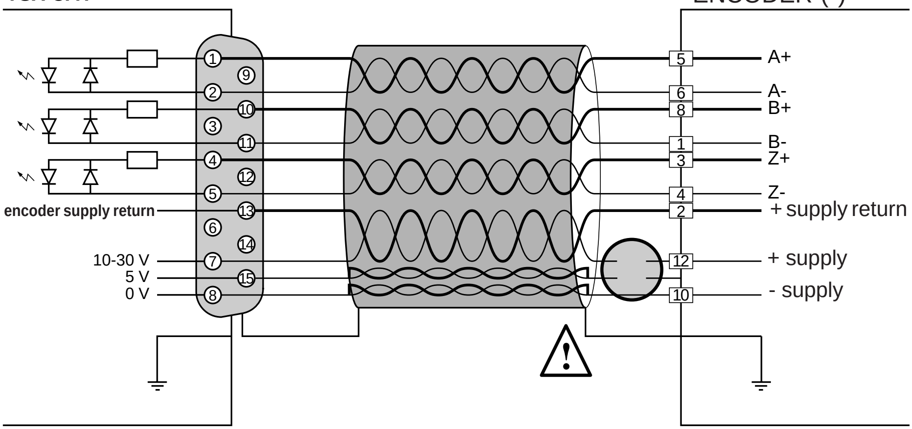
Connections :

Incremental encoder	input A+	1	input B+	10
	input A-	2	input B-	11
	input Z+	4	encoder	13
	input Z-	5	supply return	
SSI absolute encoder	SSI data+	1	CLKSSI+	6
	SSI data-	2	CLKSSI-	14
5V encoder supply				
	+ supply (5V)	15	- supply (0V)	8
Encoder supply (10-30V)				
	+ supply (10-30V)	7	- supply (0V)	8

3.4-2 Connecting an incremental encoder

The interface is RS 422 / RS 485 or totem pole type

TSX CAY ENCODER (*)

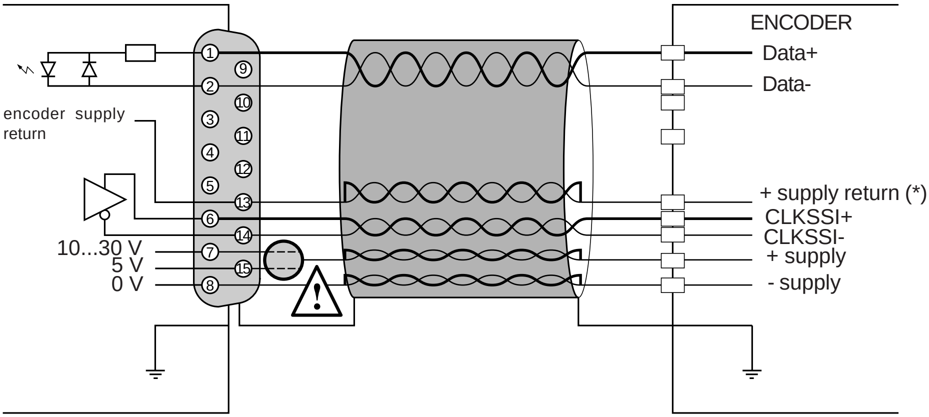


(*) standard pin-out of an encoder with a 12-pin DIN connector.

Each signal (A+,A- for example) must be connected by a twisted pair. To reduce line voltage drops, it is recommended that each supply point is connected through a pair. The cable shielding must be connected to the machine ground at each end.

⚠ The DIN connector encoder + supply input must be connected to the 10-30V supply wire or to the 5V wire depending on the type of encoder used.

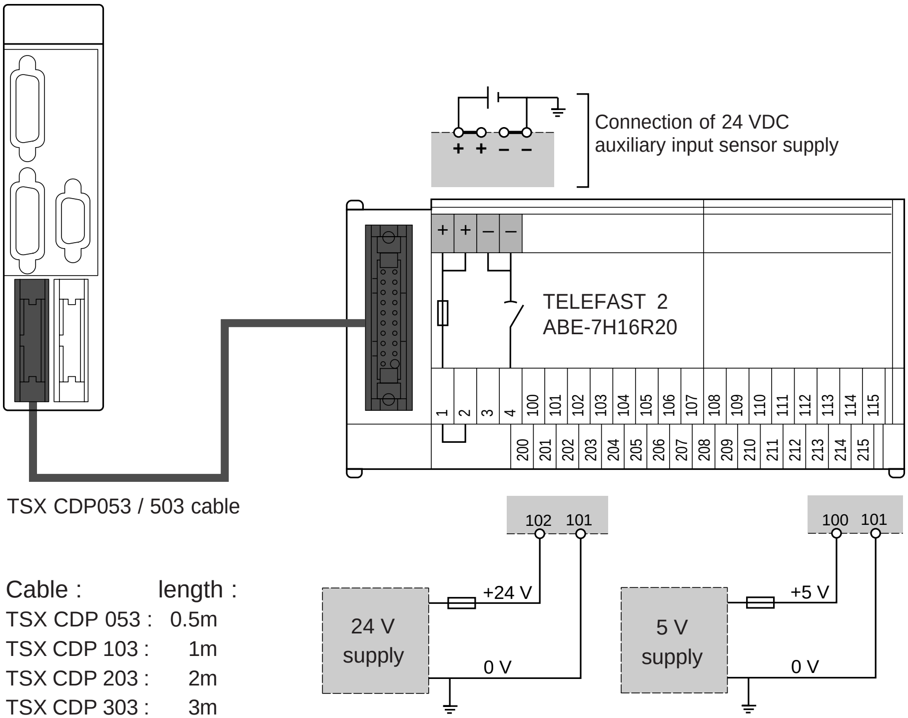
3.4-3 Connecting an SSI absolute encoder



⚠ The encoder supply must be connected to pin number 15 or 7 of the Sub-D connector depending on the encoder supply voltage.

(*) + supply return : encoder output which sends the supply voltage to the module enabling the module to detect the presence of the encoder.

3.4-4 Connecting encoder supplies



Cable :	length :
TSX CDP 053 :	0.5m
TSX CDP 103 :	1m
TSX CDP 203 :	2m
TSX CDP 303 :	3m
TSX CDP 503 :	5m

> **Important :** the maximum length of the wires between the supply outputs and the TELEFAST connecting pins must be less than 0.5m.

Only one supply is necessary if the same type of encoder is used on both channels.

Fuses :
This module has as standard several systems to protect against wiring errors and accidental short-circuits on the cable, such as :

• inversion of supply polarity,
• inversion of 5V <- -> 10/30V supplies,
• 10/30V short-circuit on the CLOCK signal of the serial link.

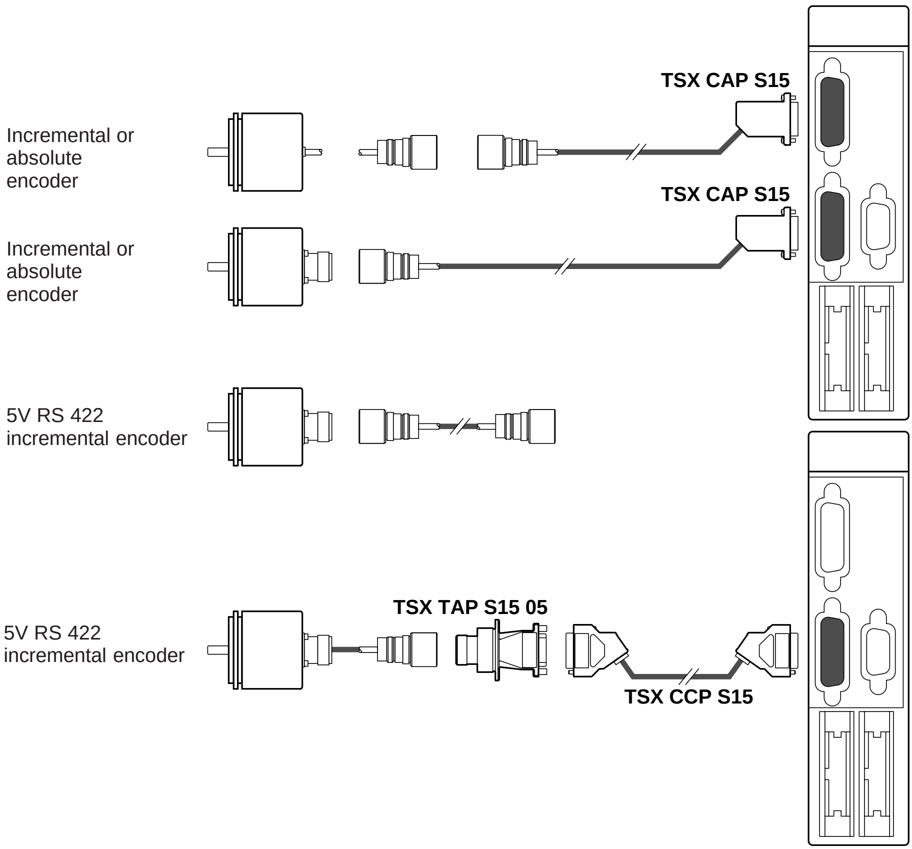
As the module cannot withstand for any length of time, the fuses must blow very quickly. The fuses must therefore be "fast blow" type with 1A maximum rating. Supplies must have a limit current at such a level that the fuse can blow at the correct point.

3.5 Wiring accessories

3.5-1 Encoder connection accessories

A number of accessories are available to simplify setup and installation. These accessories are used for prewiring the installation.
TSX CAP S15 cover kits with a 15-pin Sub-D connector enable the user to make a direct link to the installation. To simplify installation, the TSX TAP S15 05 provides an interface between the Sub-D connector and the 12-pin DIN connector. This accessory can be fitted on a DIN rail using clips, or in the wall of an enclosure with a seal and locknut. A 2.5m TSX CCP S15 cable is used for connection to the module.

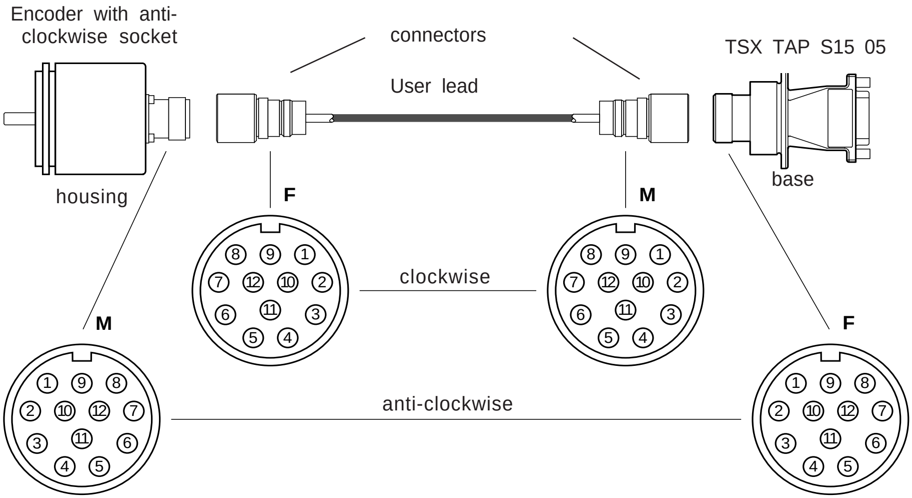
Examples :



These accessories provide good signal and shielding continuity in adverse conditions. The encoder connection cables are generally offered by the encoder suppliers.

Precision with regard to FRB type 12-pin connectors

The pins on these connectors are numbered in two different ways. Most encoders have an integrated 12-pin base which is numbered in an anti-clockwise direction. The TSX TAP S15 has a 12-pin female connector numbered in an anti-clockwise direction. All user leads must be fitted with connectors numbered in a clockwise direction, in order that the pin numbers correspond exactly during wiring.



Pinout of the DIN and 15-pin Sub-D connectors on the TSX TAP S15 05

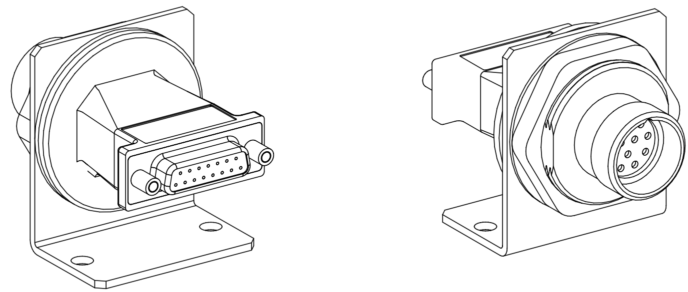
DIN		SUB-D
Pin	Signal	Pin
1	B-	11
2	Supply return	13
3	Z+	4
4	Z-	5
5	A+	1
6	A-	2
7	nc	
8	B+	10
9	nc	
10	0V	8
11	nc	
12	5V	15

Shielding must be continuous along the entire length of the connections, which must be connected to the machine ground at both ends.

3.5-2 Mounting the TSX TAP S15 05

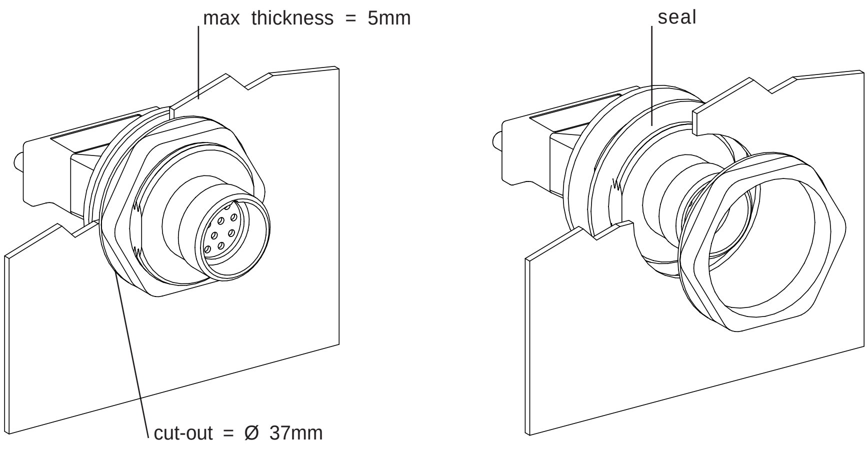
Mounting on Telequick plate

The bracket supplied is used to fix the TSX TAP S15 05 to an AM1-PA ... type pre-slotted plate or to any other support.

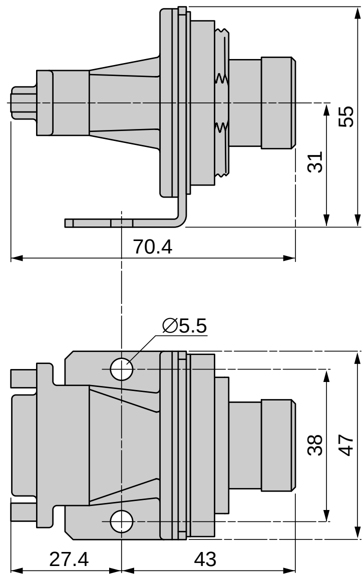


Mounting through the wall of an enclosure

The TSX TAP S15 05 can be fitted through the wall of an enclosure using its fixing nut. The seal ensures dust and damp protection between the inside and the outside.

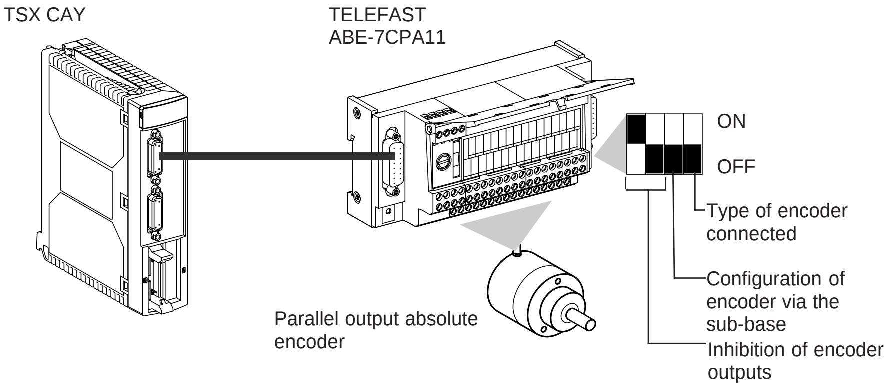


Dimensions



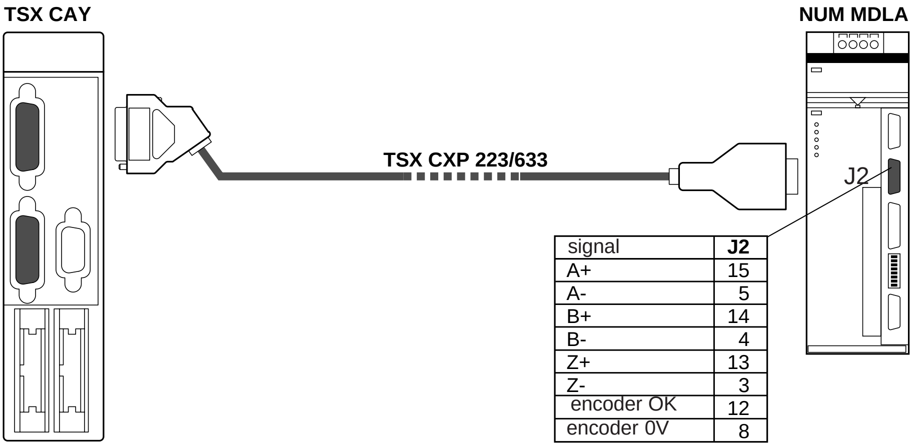
Connecting an // absolute encoder via an ABE-7CPA11 Telefast adaptor sub-base

- the multiplexing function should not be used : each channel uses a sub-base, to which a single parallel output absolute encoder is connected,
- the encoder frame should be configured as follows :
  - code : binary or Gray (depending on the type of encoder),
  - header bits : 0,
  - data bits : 24 (regardless of the number of encoder data bits),
  - status bits : 3,
  - significance of error bit : 1 (optional),
  - parity : even.



Connecting to a NUM MDLA speed drive

The NUM 400 V speed drive integrates all of the elements necessary for its operation. To indicate position it has an output whose signals simulate the operation of an incremental encoder. The TSX CXP 233 / 633 cable accessory (2.5m or 6m) is used for direct connection.



signal	**J2**
A+	15
A-	5
B+	14
B-	4
Z+	13
Z-	3
encoder OK	12
encoder 0V	8

Cable : length :

TSX CXP 213 : 2.5m

TSX CXP 633 : 6m

Note : in this case no encoder supply is necessary.

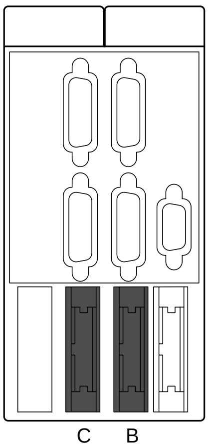
B

3.6 Connecting sensors, preactuators and supplies without a speed drive

The TSX CAY 21 / 41 module is fitted with dedicated I/O as standard to ensure full operation of the motion control system, as well as providing the encoder supply.

3.6-1 Signal referencing

The connector is a high density HE 10 type

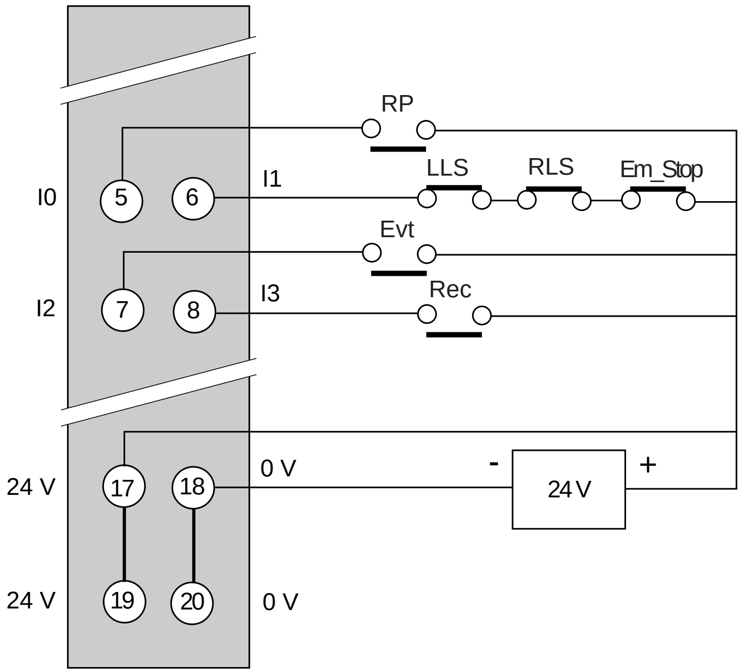


					CAY 21/41 B	CAY 41 C
5 V	1	2	0 V	Encoder supply input	chan. 0.1	chan. 2.3
10...30 V	3	4	nc			
I0	5	6	I1	Auxiliary inputs	chan. 0	chan. 2
I2	7	8	I3			
I0	9	10	I1	Auxiliary inputs	chan. 1	chan. 3
I2	11	12	I3			
Q0	13	14	nc	Reflex output	chan. 0	chan. 2
Q0	15	16	nc	Reflex output	chan. 1	chan. 3
24 V	17	18	0 V	Sensor supply input	chan. 0.1	chan. 2.3
24 V	19	20	0 V			

TSX CAY 2• module : channels 0 and 1
TSX CAY 4• module : channels o, 1, 2 and 3
TSX CAY 33 module : channels 0, 1 and 2
The auxiliary I/O are assigned to the following functions :

- I0 = reference point cam input,
- I1 = emergency stop input (stop if no current at input),
- I2 = event input,
- I3 = recalibration input,
- Q0 = reflex output (solid state output).
- 0 V = auxiliary inputs and reflex outputs common.

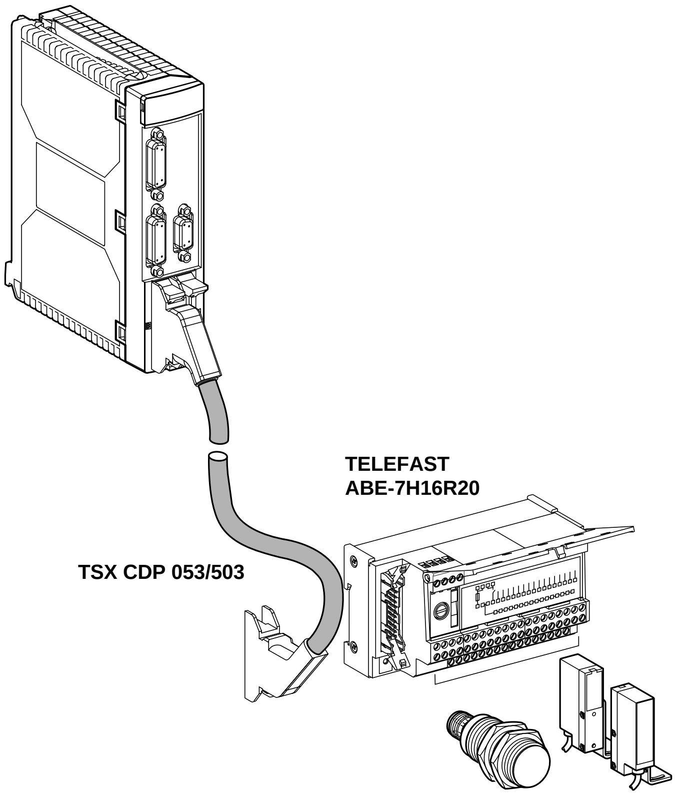
Connection principle for I/O associated with channel 0



3.6-2 TELEFAST connection and wiring accessories

To connect this high-density connector, it is recommended to use the discrete TELEFAST ABE 7H16R20 prewiring accessory together with the TSX CDP 053 / 503 cable, or the TSX CDP 301 20-wire 3m cable or the TSX CDP 501 5m cable, with an HE10 connector at one end and flying leads at the other.

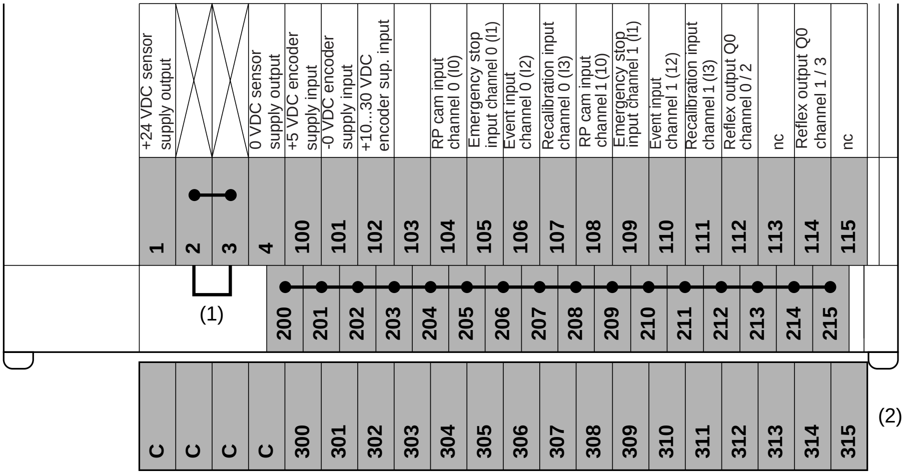
Wiring using discrete TELEFAST



Cable :	length :
TSX CDP 053 :	0.5m
TSX CDP 103 :	1m
TSX CDP 203 :	2m
TSX CDP 303 :	3m
TSX CDP 503 :	5m

3.6-3 Signal availability on the TELEFAST screw terminal block

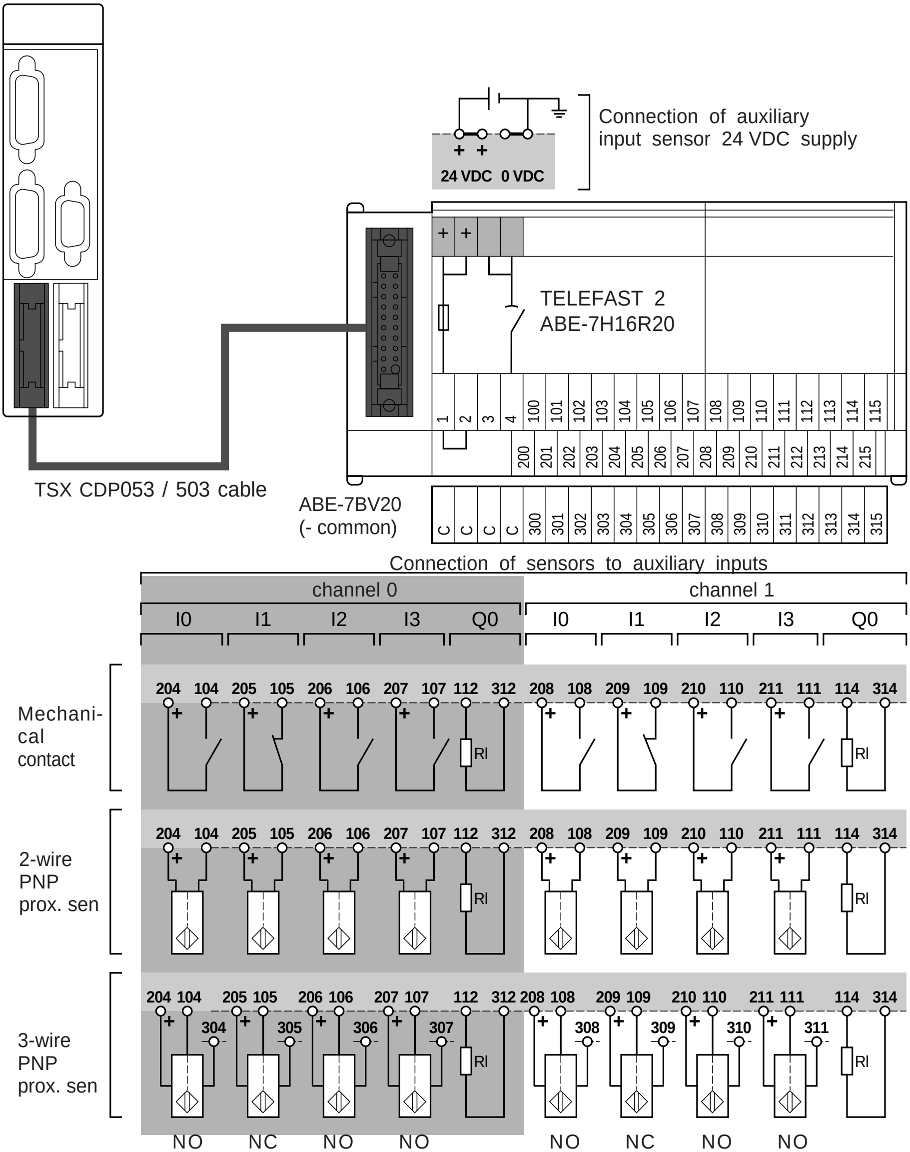
The terminal block below represents that of the ABE-7H16R20. sub-base. The signals are referenced using the TSX CDP 053 / 503 cable.



(1) On the ABE-7H16R20 sub-base, the position of the jumper defines the polarity of terminals 200 to 215 :
- Jumper in position 1 and 2 : terminals 200 to 215 have positive polarity,
- Jumper in position 3 and 4 : terminals 200 to 215 have negative polarity.

(2) On the ABE-7H16R20 sub-base it is possible to add an optional ABE-7BV20 bar to create a second sensor common (+ or - selected by the user).

Example of connecting sensors on auxiliary inputs and their supply
This connection is made using a TELEFAST 2
ABE-7H16R20 connection sub-base



N/O : normally open
NC : Normally Closed (Conductor)

Correspondence between TELEFAST terminal blocks and HE10 connector on module

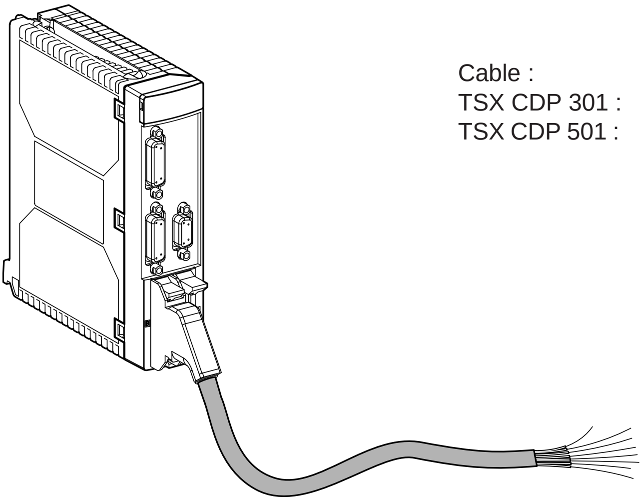
TELEFAST screw term. blk. (Terminal no.)	20-pin HE10 connector (Pin no.)	Signal type	
100	1	+ 5 VDC	Encoder supply
101	2	- 0 VDC	
102	3	+ 10…30 VDC	
103	4	nc	
104	5	reference point cam input I0 (chan. 0)	Channel 0 auxiliary inputs
105	6	emergency stop input I1 (channel 0)	
106	7	event input I2 (channel 0)	
107	8	recalibration input I3 (channel 0)	
108	9	reference point cam input I0 (chan.1)	Channel 1 auxiliary inputs
109	10	emergency stop input I1 (channel 1)	
110	11	event input I2 (channel 1)	
111	12	recalibration input I3 (channel 1)	
112	13	Reflex output Q 0 (channel 0)	
113	14	nc	
114	15	Reflex output Q0 (channel 1)	
115	16	nc (1)	
+ 24 VDC	17	Auxiliary input sensor supply	
- 0 VDC	18		
+ 24 VDC	19		
- 0 VDC	20		
1 [		Terminals 200 to 215 at + 24 VDC	
2			
3 [		Terminals 200 to 215 at - 0 VDC	
4			
200...215		Connection of sensor commons to : + 24 VDC if terminals 1 & 2 linked - 0 VDC if terminals 3 & 4 linked	
300...315		Terminals on the optional ABE-7BV20 bar may be used as sensor common, to be wired to the common voltage.	

Note (1) nc = not connected

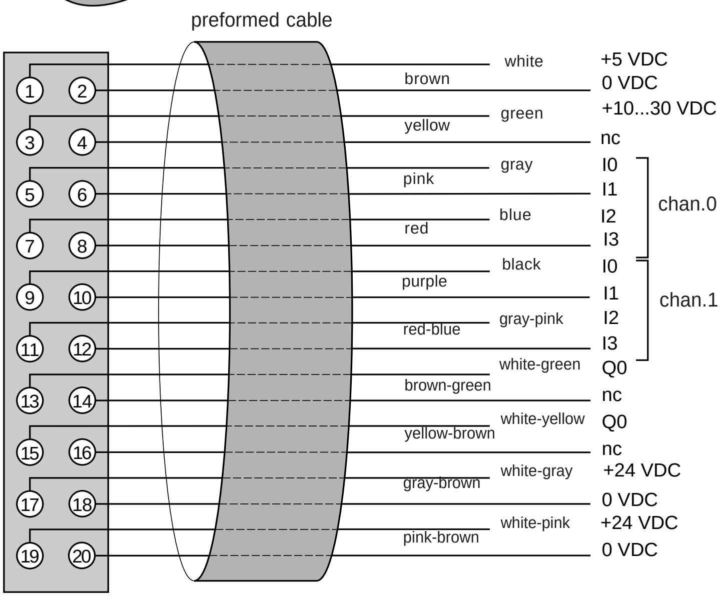
The same wiring is used in the CAY 4• modules for channels 2 and 3 as well as for channel 2 on module CAY 33.

3.6-4 Connecting via TSX CDP 301 or 501 cable

The use of these cables gives a direct connection to the actuators, preactuators or terminals. The cable consists of twenty 22-gauge (0.34 mm^2) wires, and has an HE10 connector at one end and color-coded flying leads at the other.



Cable :	length :
TSX CDP 301 :	3m
TSX CDP 501 :	5m



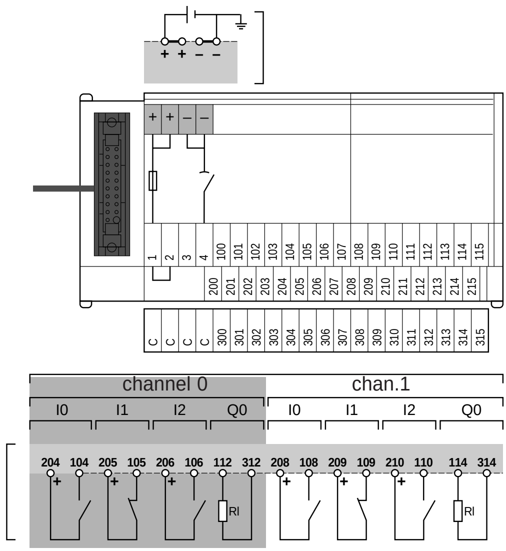
Correspondance between the wire color and the pin number of the HE10 connector.

3.6-5 Wiring recommendations

Inputs I0, I1, I2 and I3 are fast inputs and must be connected to the sensor by twisted wire if it is a volt-free contact, or by shielded cables if it is a 2 or 3-wire proximity sensor. This module is fitted as standard with devices to protect against short-circuits or voltage inversions. The module cannot, however, withstand a fault for any length of time and the fuses connected in series with the supplies must give effective protection. The fuses must, therefore, be of the fast blow type with a maximum rating of 1A. The supplies must provide sufficient power to blow the fuses.

Important note : wiring solid state outputs Q0

The actuator connected to output Q0 has its common point at the 0V of the power supply. If for any reason (poor contact or accidental disconnection) there is a break in the 0V supply to the output amplifier while the 0V of the actuators remains connected to the 0V supply, there may be an output current from the amplifier of a few mA which is sufficient to keep certain low-power actuators energized.



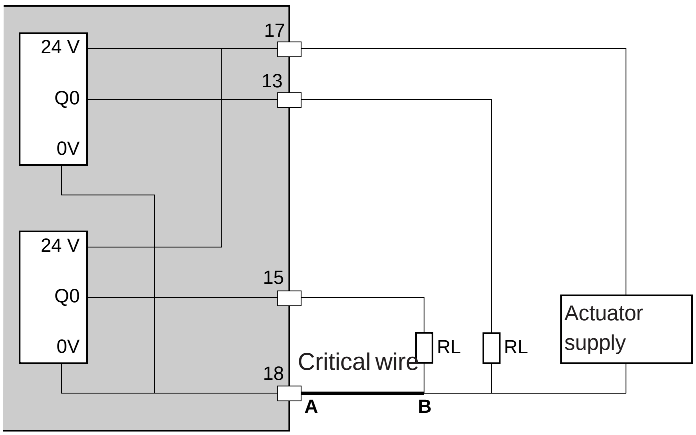
Connecting using TELEFAST :

This is the most reliable type of connection provided the actuator common is connected to the bar of common points 200 to 215 (jumper in position 1-2). In this case there can be no break in the module common without breaking the actuator common.

Connecting via cable

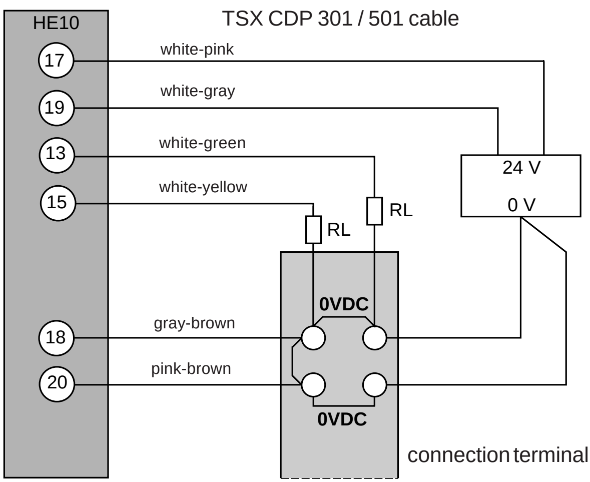
This type of connection requires very careful attention. Great care must be exercised during wiring, for example, using cable ends at the screw terminals. If required it will be necessary to double up the connections to ensure permanent contacts. When the actuator supply is some distance from the modules and near to the actuator common, the connection between the common and 0V terminal of the module(s) may be accidentally broken.

TSX CAY 21/41



If there is a break in the supply cable segment between A and B, there is a risk of the RL actuators remaining energized. If possible, double up the 0V power supply connections for the modules.

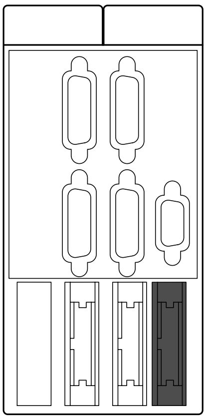
Using the TSX CDP 301/501 cable :

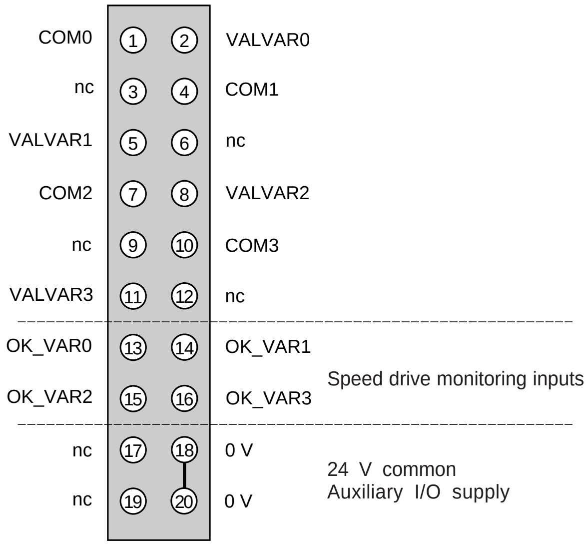


3.7 Connecting speed drive monitoring signals

3.7-1 Signal referencing

TSX CAY modules integrate standard management of the signals necessary for correct operation of the speed drives. This connector is always used whatever the number of channels on the TSX CAY modules.

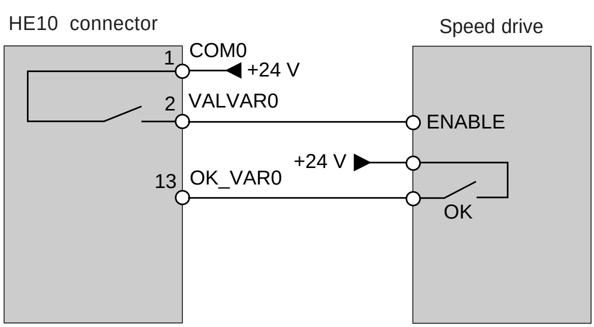




COMx - VALVARx : volt-free contact to enable the speed drive
OK_VARx : speed drive monitoring input
24V - 0V sensor supply

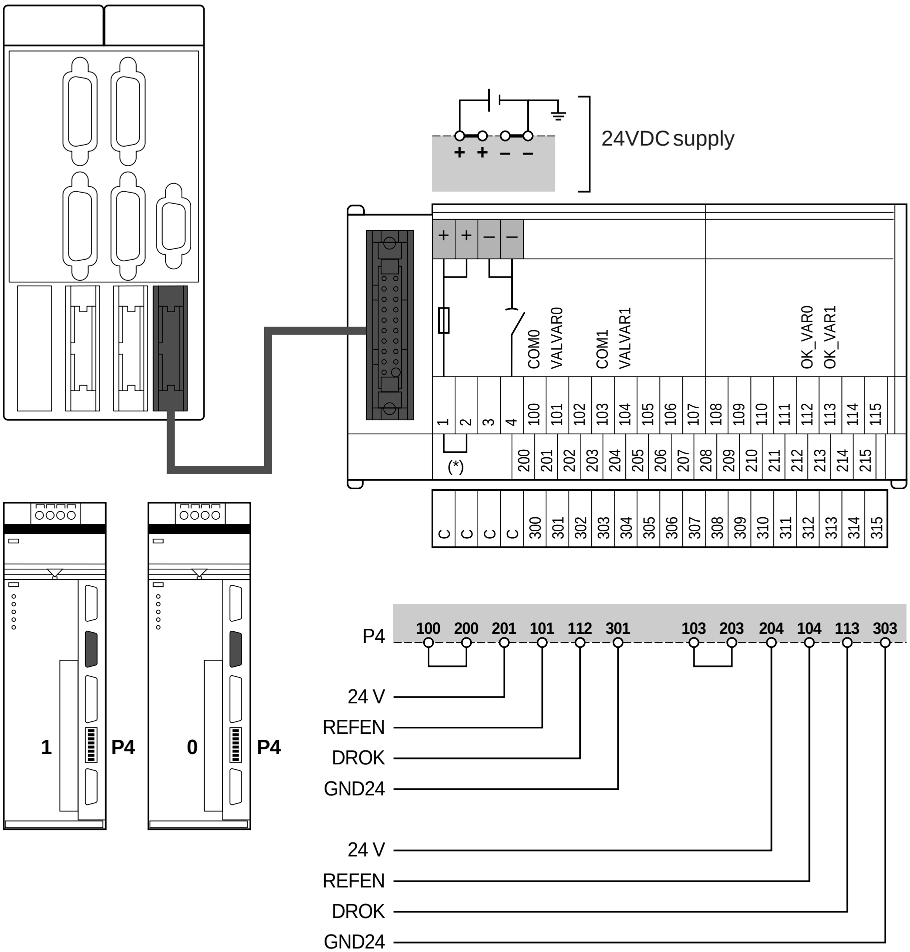
Each channel has a volt-free N/O contact.

Connection principle for speed drive I/O associated with channel 0



To connect the HE10 connector, use the following wiring accessories : discrete TELEFAST discrete ABE-7H16R20 with TSX CDP 303 or TSX CDP 503 cable.

3.7-2 Connecting using the TELEFAST pre-wired system



For direct connection use a TSX CDP 301 or 501 cable.
See section 3.6-3.

(*) Strap between 1 and 2 : terminals 200 to 215 are at +24 VDC.

3.7-3 Correspondence between TELEFAST terminal blocks and HE10 connector

TELEFAST screw term. blk. (Terminal no.)	20-pin HE10 connector (Pin no.)	Signal type	
100	1	COM0	contact closed = speed drive enabled
101	2	VALR0	
102	3	nc	
103	4	COM1	
104	5	VALR1	
105	6	nc	
106	7	COM2	
107	8	VALR2	
108	9	nc	
109	10	COM3	
110	11	VALR3	
111	12	nc	
112	13	OK_VAR0	ENCoder OK = encoder supply voltage present
113	14	OK_VAR1	
114	15	OK_VAR2	
115	16	OK_VAR3	
+ 24 VDC	17	Auxiliary input sensor supply	
- 0 VDC	18		
+ 24 VDC	19		
- 0 VDC	20		
1 [		Terminals 200 to 215 at + 24 VDC	
2			
3 [		Terminals 200 to 215 at - 0 VDC	
4			
200...215		Connection of sensor commons to : + 24 VDC if terminals 1 & 2 are linked - 0 VDC if terminals 3 & 4 are linked	
300...315		Terminals on the optional ABE-7BV20 bar may be used as sensor common	

Note (1) nc = not connected

3.8 Electrical characteristics of the module

3.8-1 General characteristics

Maximum counting frequency :			
SSI absolute encoder : CLK transmission frequency			200KHz
incremental encoder :			500 kHz x 1 250 kHz x 4
Current drawn on internal 5V (fan running)		typical	max
	CAY 2•	1.1A	1.4A
	CAY 4• /33	1.5A	1.8A
Current drawn on sensor/ preactuator 24V, outputs OFF		typical	max
	CAY 2•	15mA	18mA
	CAY 4• /33	30mA	36mA
Current drawn by module on 10/30V encoder at 24V (1)		typical	max
	CAY 2•	11 mA	20 mA
	CAY 4• /33	22mA	40mA
Power dissipated in module		typical (2)	max (3)
	CAY 2•	7.2W	11.5W
	CAY 4• /33	10 W	17 W
Insulation resistance	> 10 MOhms at 500 VDC		
Dielectric strength with ground or PLC logic 0V	1000 V rms 50 / 60 Hz for 1 min		
Operating temperature	0 to 60°C		
Storage temperature	-25°C to 70°C		
Relative humidity (without condensation)	5% to 95%		
Operating altitude	< 2000 m		

Note (1) : Use of an absolute encoder and a single supply at 24V
Note (2) : normal operating conditions : one auxiliary input active per channel (at 24 V)
Note (3) : the "worst possibility" and extreme conditions : all auxiliary inputs active (at 30 V).

The module has a small internal fan to ensure correct operation across the entire temperature range. The fan is activated as necessary by a temperature sensor inside the module (triggered at 45 °C external temperature).
It is possible to use TSX FAN•• external ventilation units if the temperature conditions around the module exceed the parameters above.

3.8-2 Characteristics of the analog outputs

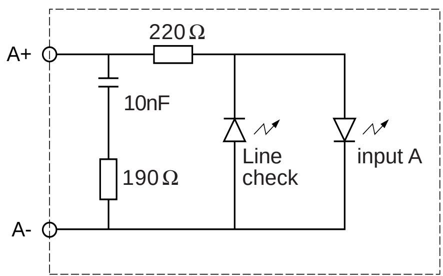
Parameters	Value	Unit
Range	±10.24	V
Actual range	±10.24	V
Resolution	13 bits + sign	
Value of LSB	1.25	mV
Max. current from one output	1.5	mA
Fallback value	max ±1	LSB
Monotonicity	100	%
Differential linearity	±2	LSB
Accuracy	0.5	% F.S.
Dielectric strength between channels and machine ground	1000VAC	

Each output is protected against short-circuits and overloads. If a fault occurs a signal is sent to the CPU via a status word. A short-circuit on these outputs will not damage the module.

The absence of the connector on the analog output is not checked.

3.8-3 Characteristics of the counter inputs

Equivalent circuit diagram :
example of input A

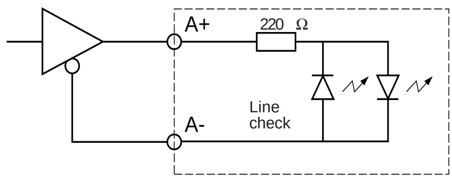


Characteristics

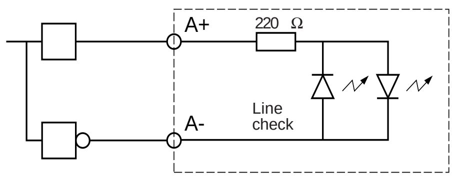
Electrical characteristics	Symbol	Value	Unit
Nominal voltage	Un	±5	V
Voltage limits	U1	±5.5	V
Nominal current	In	±18	mA
Input impedance (at 5 V)	Re	270	Ohms
Voltage at "On" state	Uon	>=+2.4	V
Current at "On" state	Ion	> +3.7	mA
Voltage at "Off" state	Uoff	<1,2	V
Current at "Off" state	Ioff	<1	mA
Encoder / sensor voltage return check		Presence check	

Compatibility of inputs A, B and Z :

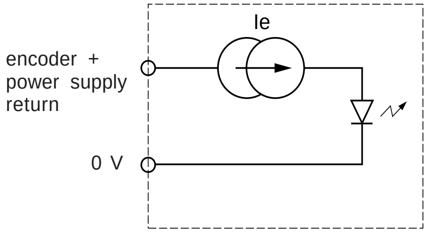
RS 422 / RS 485 / 7 mA current loop line driver outputs. Differential line check on each input.



Totem pole complementary outputs, 5V supply. Differential line check on each input.



Encoder + power supply return input characteristics :

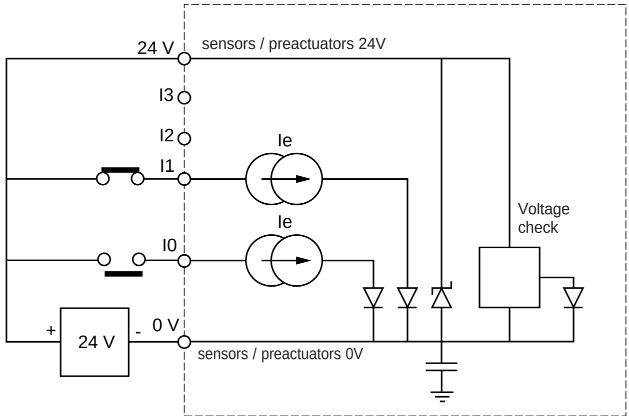


Electrical characteristics	Symbol	Value	Unit
Voltage at "On" state (OK)	Uok	> 2.5	V
Voltage limits	Umax	30	V
Input current (2.5 < Uok < 30)	Imax	3	mA

The presence of the encoder will be detected as long as the input is active.

3.8-4 Characteristics of auxiliary inputs

The auxiliary inputs are supplied at 24V from a supply provided via the connector. Equivalent circuit diagram :

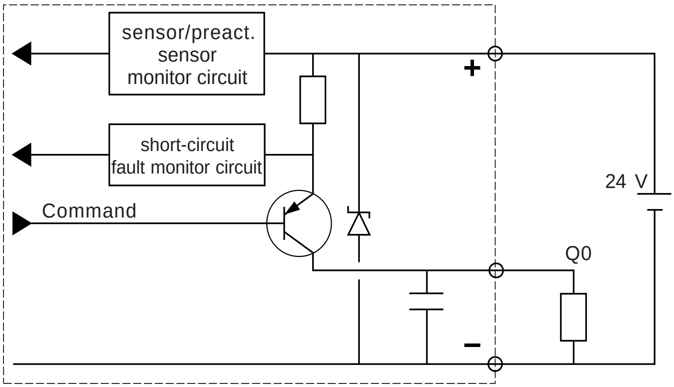


Electrical characteristics	Symbol	Value	Unit
Nominal voltage	Un	24	V
Voltage limits (1) (ripple included)	U1 Utemp (*)	19 to 30 34	V V
Nominal current	In	8	mA
Input impedance (at Unom)	Re	3	KOhms
Voltage at "On" state	Uon	>=11	V
Current at Uon (11V)	Ion	>6	mA
Voltage at "Off" state	Uoff	<5	V
Current at "Off" state	Ioff	<2	mA
Immunity Off --> On (for I0, I2 and I3) (for I1)	ton	0.1 to 0.2 1 to 4	ms ms
Immunity Off --> On (for I0, I2 and I3) (for I1)	ton	0.1 to 0.2 1 to 4	ms ms
EVT input (on G07)	incremental encoder : 1 µs absolute encoder : ≤ 400 µs		
Dielectric strength with ground	1500V rms 50 / 60 Hz for 1min		
IEC compatibility with sensors	type 2		
3-wire / 2-wire proximity sensor compatibility	all proximity sensors operating at 24VDC		
Input type	Current sink		
Logic type	Positive (sink)		

(*) Utemp : maximum permitted voltage for 1 hour in any 24-hour period.

3.8-5 Characteristics of the reflex outputs Q0

Each position control channel has an output controlled by the processor which is used for the integrated control of one function of the axis being controlled. For example, control of braking between two movements, safety, etc. This is a solid state output with the load common at the sensor / preactuator 0V voltage. It is protected against overloads and short-circuits, and fault information is provided to the processor if a fault occurs.



Electrical characteristics	Value	Unit
Nominal voltage	24	V
Voltage limits Max for 1 hour / 24 hrs (Utemp)*	19 to 30 34	V V
Nominal current	500	mA
Max voltage drop when "On"	< 1	V
Leakage current	< 0.3	mA
Max current at 30V and at 34V	625	mA
Switching time	<500	µs
Dielectric strength with ground	1500V rms 50 / 60 Hz for 1min	
Compatible with DC inputs	All positive logic inputs where input resistance is less than 15KOhms	
IEC 1131 compatibility	yes	
Short-circuit monitoring on each channel	One signalling bit per channel	

Electrical characteristics	Value
Reactivation : • by application program • automatic	One bit per channel written by program
Protection against overloads and short-circuits	By current limiter and thermal tripping (0.7 < Id < 2 A)
Protection against channel overvoltages	Zener diode between outputs and +24V
Protection against reverse polarity	By reverse-mounted diode on the supply
Power of filament lamp	10 W (max)

Note
Utemp is the maximum voltage which can be applied to the module for 1 hour in any 24-hour period.

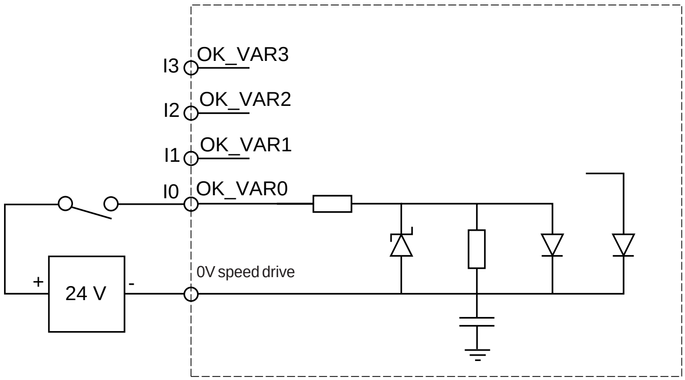
3.8-6 Monitoring the sensor / preactuator voltage

The module monitors the supply to the actuators / preactuators so that it can signal to the processor any malfunction which may cause incorrect operation.

Electrical characteristics	Symbol	Value	Unit
Voltage at OK state	Uok	>18	V
Voltage at fault state	Udef	<14	V
Immunity OK ---> Fault	Im.off	>1	ms
Immunity Fault---> OK	Im.on	>1	ms
Accept fault	Toff	<10	ms
Accept no fault	Ton	<10	ms

3.8-7 Characteristics of the speed drive monitoring inputs

The speed drive monitoring auxiliary inputs have the same supply as the auxiliary I/O. The module does not monitor this supply, but any voltage drop below 5V on a CTRL_VAR input may signal a speed drive fault to the processor.

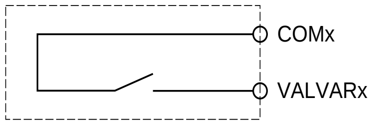


Electrical characteristics	Symbol	Value	Unit
Nominal voltage	Un	24	V
Voltage limits (1) (ripple included)	U1 Utemp (*)	19 to 30 34	V V
Nominal current	In	8	mA
Input impedance (at Un)	Re	3	KOhms
Voltage at OK state	Uon	>=11	V
Current at Uon (11V)	Ion	>3,5	mA
Voltage at "Fault" state	Uoff	<5	V
Current at "Fault" state	Ioff	<1.5	mA
Immunity OK --> Fault	toff	1 to 4	ms
Immunity Fault-->OK	ton	1 to 4	ms
Dielectric strength with ground	1500V rms 50 / 60 Hz for 1min		
IEC 1131 compatibility with sensors	type 1		
Logic type	Positive (sink)		

(*) Utemp : maximum permitted voltage for 1 hour in any 24-hour period.

3.8-8 Characteristics of the relay outputs

Each channel has one relay output.



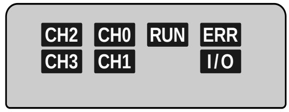
Electrical characteristics	Value	Unit
DC operating voltage	5 to 30	V
Permissible DC switching current 30V on resistive load	200	mA
Permissible minimum load	1V / 1mA	
Switching time	<5	ms
Dielectric strength : • between contacts and between channels • between contacts and ground	 300VAC for 1min 1000VAC for 1 min	

3.9 Module display

TSX CAY 21/41 modules have indicator lamps displaying the status of the module and the channels.

- Module status lamps (RUN, ERR, I/O)

  The state of the three lamps on the front panel (off, flashing or on) indicates the module operating mode :
  - RUN lamp : signals module operating state
  - ERR lamp : signals an internal module fault
  - I/O lamp : signals an external fault



- Channel status lamps (CH•)
  TSX CAY 21/41 modules have 2 or 4 indicator lamps to display and diagnose the state of each channel.
  These lamps are green.

State / Lamps	On ●	Flashing ⊗	Off ○
RUN	Normal operation	—	Module faulty or off
ERR	Internal fault module failure	Communication fault Application absent, invalid or execution fault	No fault
I/O	External fault • wiring fault • encoder power supply and 10 / 30V power supply fault • absolute encoder fault (*)	—	No fault
CHi **TSX CAY 4• /33 :** CH0 and CH1 **TSX CAY 41 :** CH0, CH1, CH2, CH3	Channel is operational	Channel is operating incorrectly because of : • external fault, • communication fault, • a process fault.	Channel not operating. No configuration or incorrect configuration.

Application fault
- configuration refused
- SMOVE function refused

4.1 Appendix

All SSI absolute encoders, 16 $\leq$ Number of data bits $\leq$ 25, Gray or binary code are compatible with TSX CAY modules. For example :

IVO brandname

- GM 400 0 10 11 01

  24 Volts, Gray, 0 header bit, 25 data bits, 0 status bit, no parity.
- GM 401 1 30 R20 20 00

  24 Volts, Gray, 0 header bit, 25 data bits, 1 status bit, even parity.

Hengstler brandname

- RA58-M/1212

  24 Volts, Gray, 0 header bit, 24 data bits, 1 status bit, no parity.

Stegmann brandname

- AG 661 01

  24 Volts, Gray, 0 header bit, 24 data bits, 0 status bit, no parity.

IDEACOD brandname

- SHM506S 428R / 4096 / 8192 / 26

  11-30 Volts, Gray, 0 header bit, 25 data bits, 0 status bit, no parity.

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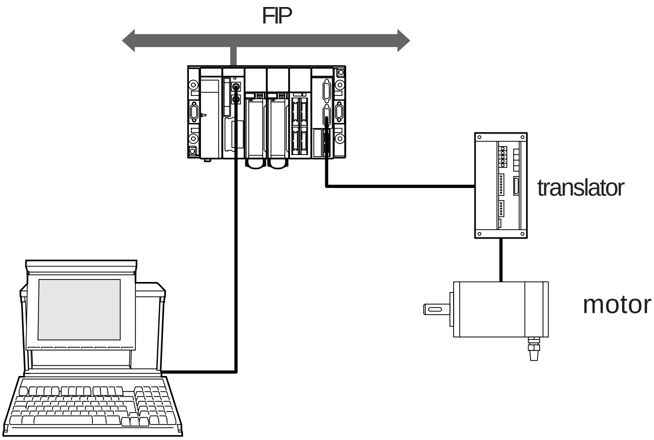
1.1 Introduction

1.1-1 Stepper motor axis control range

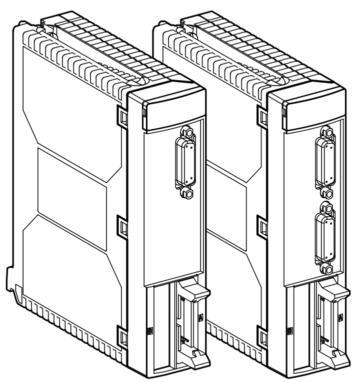


The CFY 11/21 stepper motor axis control range for Premium PLCs is designed to meet the requirements of machine manufacturers.
It is designed for machines which require motion control using a stepper motor together with simultaneous sequential control via a PLC.

1.1-2 Presentation

There are two modules :

- **TSX CFY 11 module :** a single-axis module with one translator control output
- **TSX CFY 21 module :** a 2-axis module with two translator control outputs



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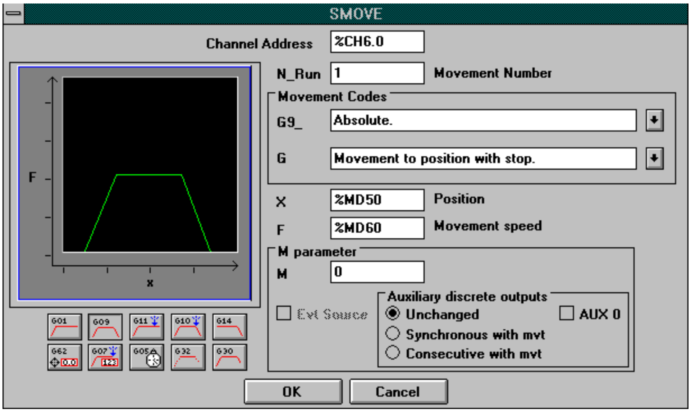
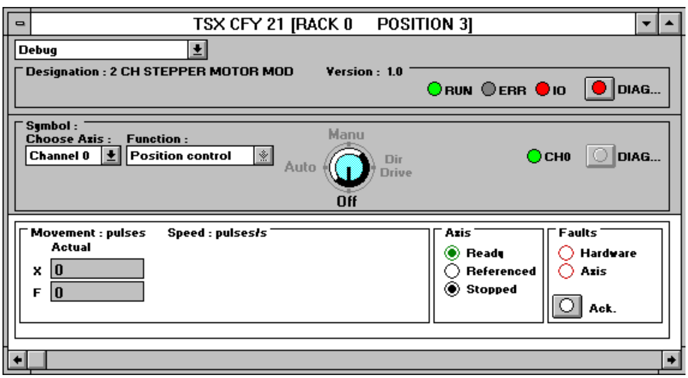
1.1-3 Setup software

PL7 Junior or PL7 Pro software can access screens to configure each axis and define elementary movements using its function library.



Screens for adjusting the axis parameters and setting up movements can also be accessed from PL7 Junior or PL7 Pro.



1.2 Physical description

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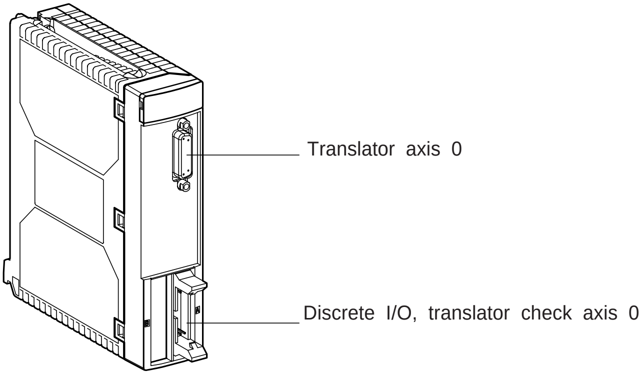
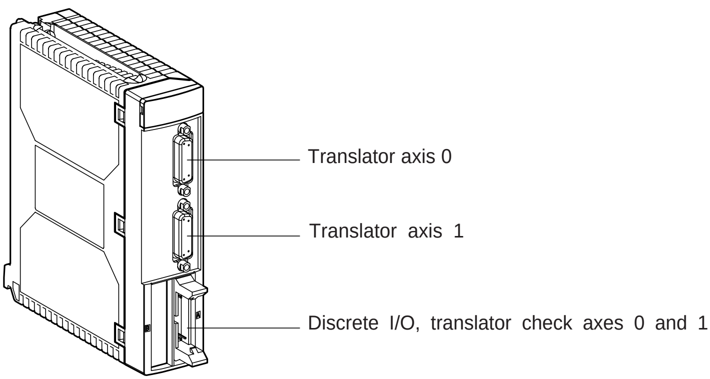
Description of TSX CFY 11 and TSX CFY 21 stepper motor axis control modules

TSX CFY 11



TSX CFY 21



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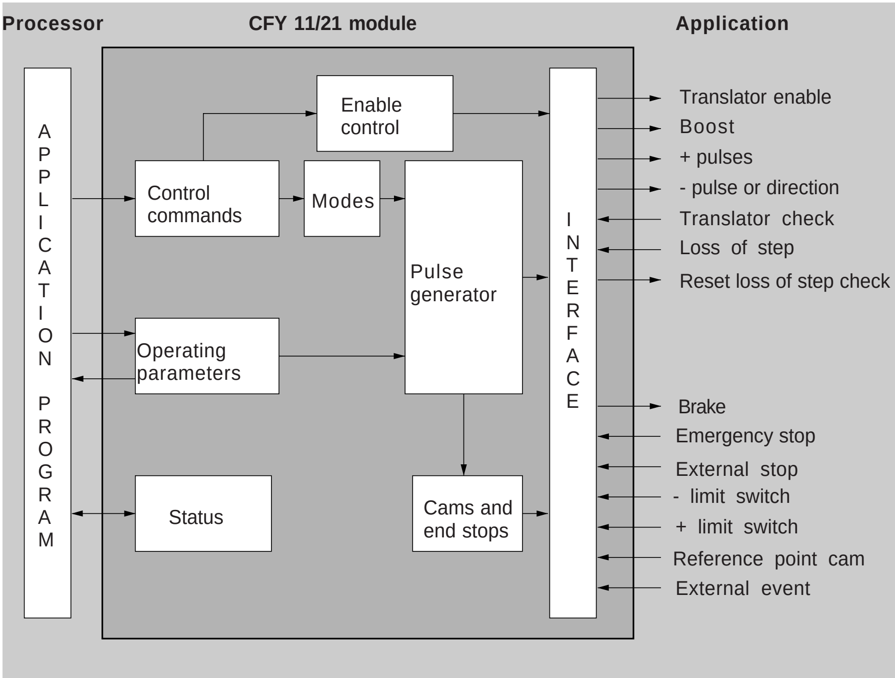
2.1 Functions

Block diagram of a stepper motor axis control system :



CFY 11/21 stepper motor axis control modules provide for each axis :

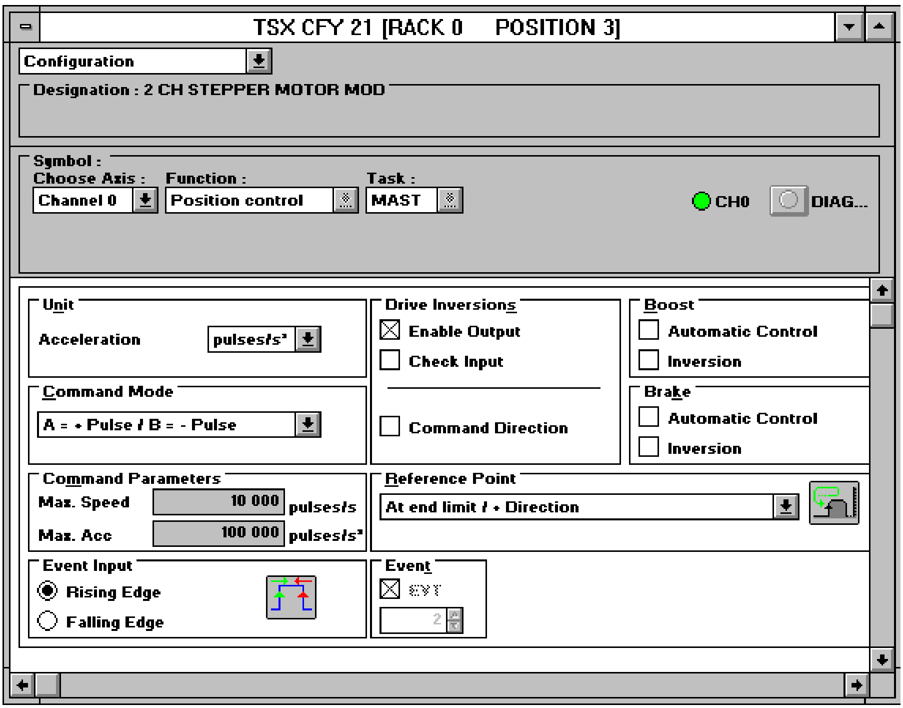
- inputs
  - translator check input
  - loss of step check input
  - + limit switch input
  - - limit switch input
  - reference point cam input
  - event input
  - emergency stop input
  - external stop input
- outputs
  - brake output
  - + pulse output
  - - pulse or direction output
  - reset loss of step check output
  - boost output
  - translator enable output

Processing commands

Each movement, controlled by the PLC sequential program, is described by an SMOVE movement function in PL7 language. The CFY 11/12 module uses this SMOVE command to calculate a position setpoint / speed reference and generates movement pulses. PL7 screens make it easy to adjust, debug and clearly display the status of the axes.

2.1-1 Configuring the axes

This screen is used to enter the parameters required to adapt the module operation to the machine axis characteristics and the technical characteristics of the power translators controlling the motor.
There is no default configuration for this screen. The configuration parameters cannot be modified by the program. Access is only possible via the programming terminal.



Note: For an MSD or SP type Phytron translator, use the following configuration :
- **Command mode** : A=Pulse / B=Direction
- **Translator (drive) inversions** : Enable output (box checked)

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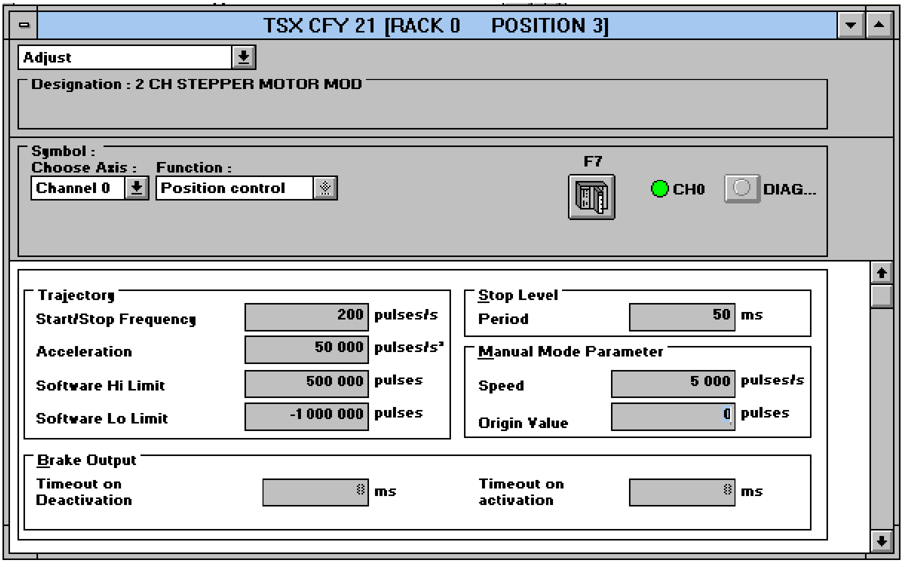
2.1-2 Adjusting the axes

Adjustment parameters may be modified, either via the terminal (online or offline), or directly via the application program.
The operating parameters are :

- trajectory parameters : stop/start frequency, acceleration, soft stops (software Hi and Lo limits), stop plateau (level) duration,
- manual mode parameters : speed, reference point (origin point),
- brake output activation and deactivation delay times.

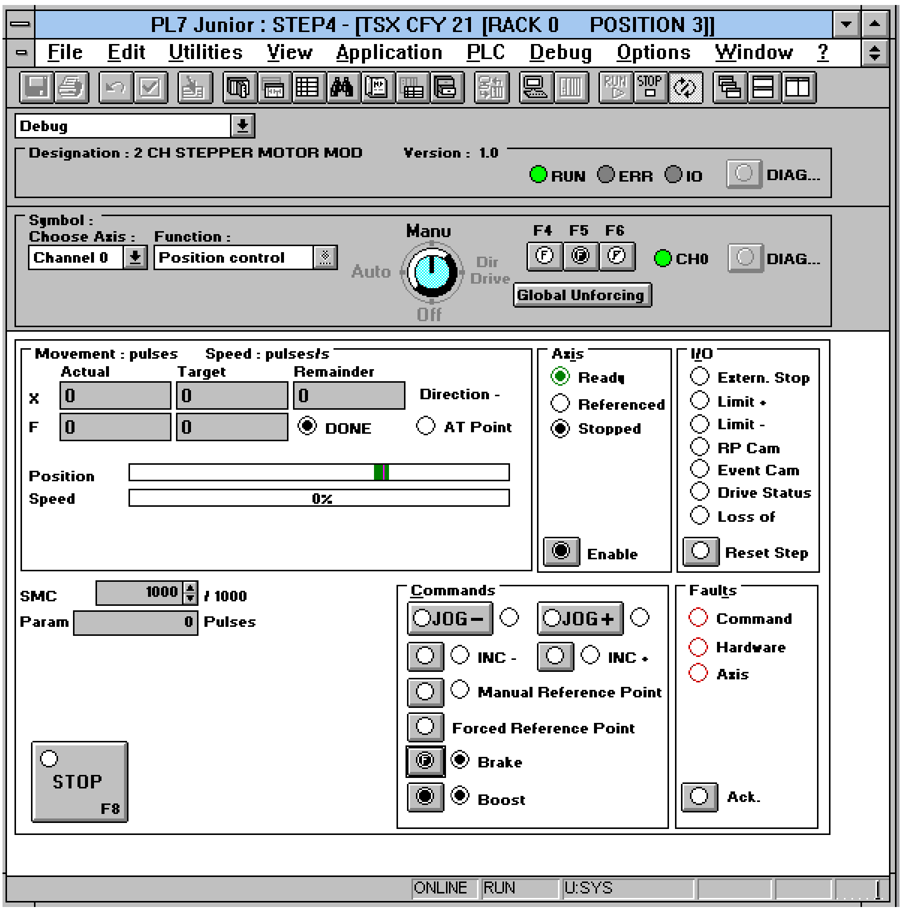


2.1-3 Debugging

Debug mode can be accessed online and is used to control and observe axis behavior. The information shown differs depending on the operating mode selected :

- Off mode
- Dir Drive mode
- Manual mode
- Automatic mode

The upper part of the screen gives information about the module and axis operating status : the lower part of the screen gives information about the state of the module inputs and the position of the axis with respect to the programmed target position. Various manual movement modes are available, including a command for creating a machine reference point.



3.1 Setup

3.1-1 Basic configuration required

Stepper motor axis control modules can be installed in any slot of a TSX RKY•• rack. The power supply to the rack must be chosen according to the number of modules installed.

Maximum number of TSX CFY modules •1 per station

Each stepper motor axis control module supports :

- 1 application-specific channel for the TSX CFY 11 module,
- 2 application-specific channels for the TSX CFY 21 module,

The number of application-specific channels managed by a PLC station depends on the type of processor installed. The maximum number of TSX CFY •1 modules in a PLC station thus depends on :

- the type of processor installed,
- the number of application-specific channels already used apart from the stepper motor control channels.

The user should therefore perform a review at station level to determine the number of application-specific channels already used, in order to define the number of TSX CFY•1 modules which can be used.

Note : The definition and number of application-specific channels is given in the manual TSX DM57 2 E "Volume 1 - part A - section 3.5-3).

Number of application-specific channels managed by each type of processor

Processors	No. of app.-spec. channels managed
TSX P57 102/TPMX P57 102/TPCX 571012	8
TSX P57 2•2/TPMX P57 202	24
TSX P57 3•2/TPMX P57 352/TPCX 57 3512	32
TSX P57 4•2/TPMX P57 452	48

3.1-2 Installation procedure

It is possible to install or remove a module without switching off the rack supply voltage to ensure that another device remains available for use.

However, connection or disconnection of connectors to the translator power supplies is not recommended, as certain translators cannot tolerate such handling. The auxiliary I/O connector can be disconnected while powered up without damaging the module. Nevertheless, for the safety of personnel it is recommended that auxiliary supplies are switched off before any disconnection.

The module and connector fixing screws must be tightened correctly in order to obtain good protection against electrostatic and electromagnetic interference.

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3.1-3 General wiring instructions

The sensor and actuator power supplies must be protected against overloads or overvoltages by fast-blow fuses.
Use wires with an adequate cross-section to avoid line voltage drops or overheating.
Keep sensor and actuator cables away from any source of radiation caused by high-power electrical circuit switching.
All cables connecting translators must be shielded. Shielding must be of high quality and connected to the machine ground at both the module and translator ends. There must be continuity along the entire length of the connections. Only translator signals should be carried on the cable.
For performance reasons, module auxiliary inputs have short response times and it is thus important that these inputs have an adequate independent supply to ensure that the module continues to operate correctly in the event of brief power outage. It is recommended that regulated supplies are used as they ensure the consistency of actuator and sensor response times. The 0V supply must be connected to the machine ground as near as possible to the supply output.

3.2 Choice of translator

3.2-1 I/O interfaces

TSX CFY 11 and TSX CFY 21 stepper motor axis control modules can be connected to translators which have the following I/O characteristics :

- RS422 / RS485 differential inputs or TTL/5V "source" compatible inputs,
- RS422 / RS485 differential outputs or NPN open collector outputs.

3.2-2 Translator interface power supply

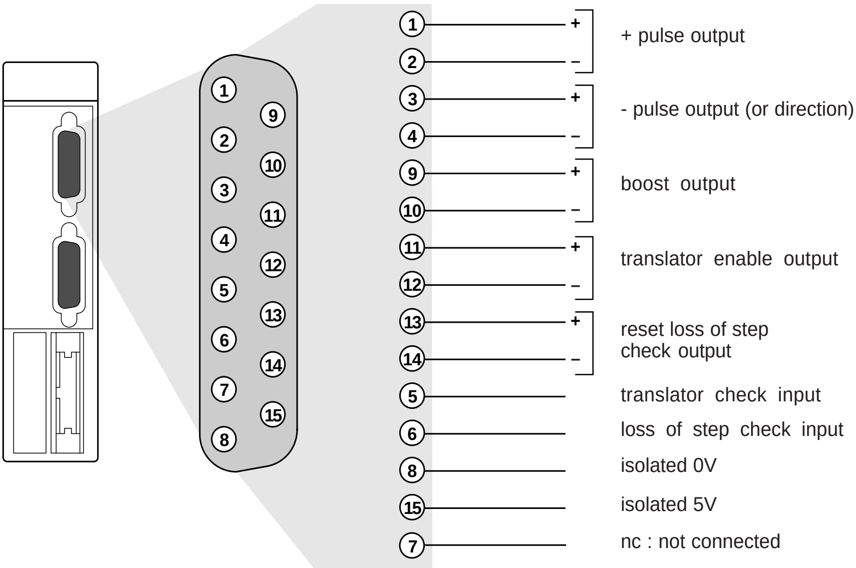
The modules have an isolated 5V power supply which can power the translator interfaces if the translator does not provide power. This is the case for interfaces with open collector outputs or TTL inputs. The 0V is common to both the inputs and the outputs, and must in all cases be wired between the module and the translator.

3.2-3 Shielding

To ensure correct operation of the module when the environment is subject to interference, shielding must be continuous along the entire length of the connector cables, and must be connected to machine ground at both ends of the cable.

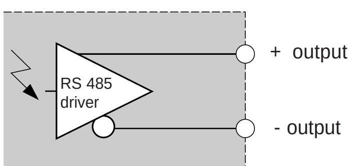
3.3 Connecting translator signals

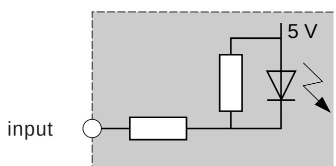
3.3-1 Signal referencing



Each module output transmits an RS 485-type signal, and for each output there is thus a direct (+) signal and its complement (-). The inputs are TTL-compatible current sinking inputs. The 5V isolated supply is only available (if necessary) for the translator I/O interface. The 0V supply is common to both inputs and outputs. The 5V supply may only be used for translators with open collector outputs and TTL-type inputs (the 5V isolated supply is not supplied by the translator).

Physical interfaces of the module :





The type of connection suggested is to solder the wires directly onto the connector : the TSX CAP S15 kit comprises a Sub-D connector and its protective cover.

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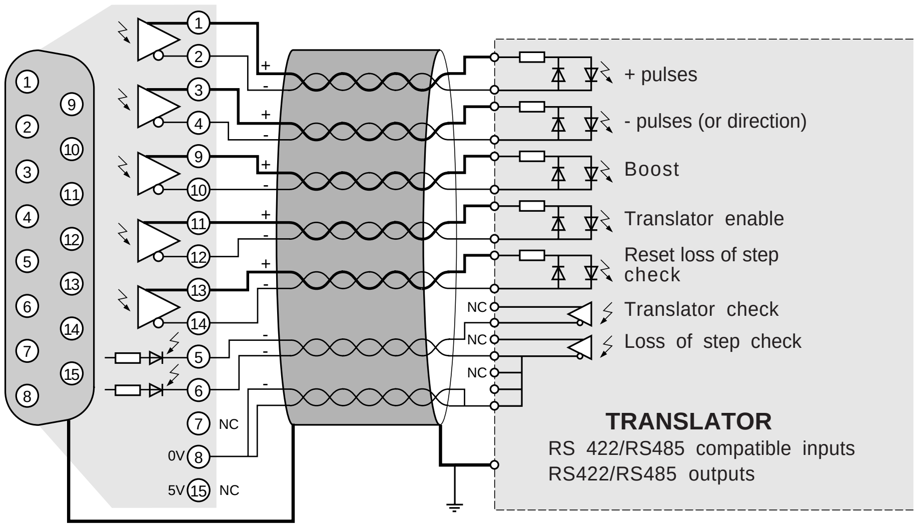
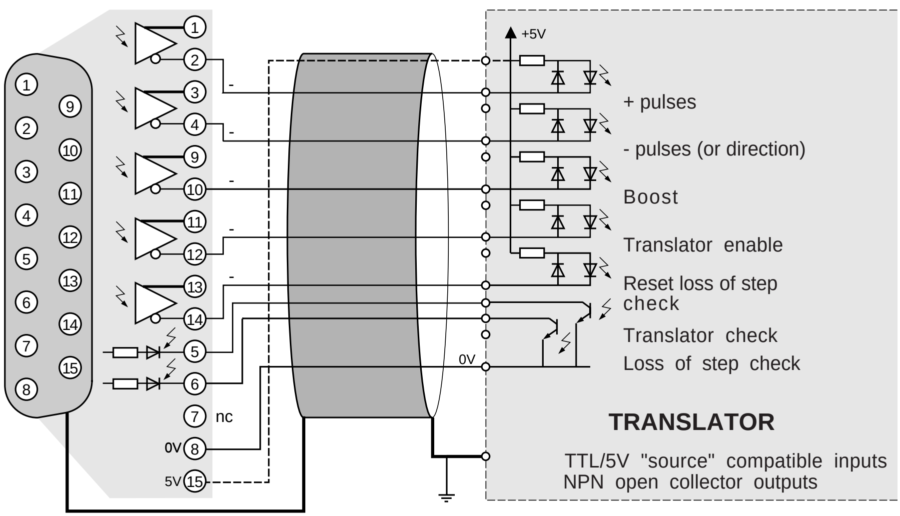
3.3-2 Connecting a translator using an RS 422/485 interface

A shielded cable containing 7 twisted pairs is recommended for connection. The + and - wires for each module output signal must be connected on the same pair.



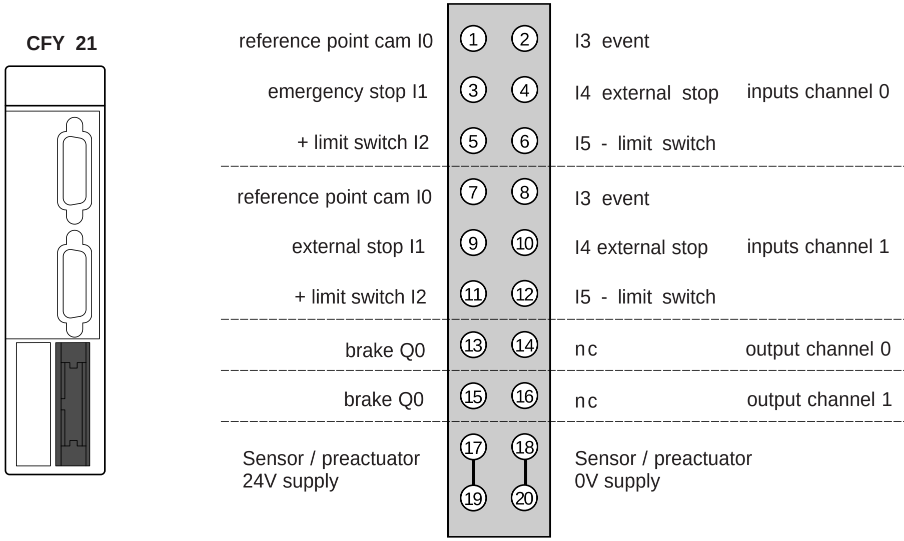
3.3-3 Connecting a translator using an NPN open collector interface

A single wire is used for each I/O signal. If the isolated 5V supply is not provided by the translator, the isolated 5V supply from the module must be used to supply the interface.



3.4 Connecting sensors / preactuators and power supplies

3.4-1 Signal referencing



The 0V for sensors / preactuators should be connected within the module to machine ground by an R/C circuit with value : R = 10MΩ / C = 4.7nF.

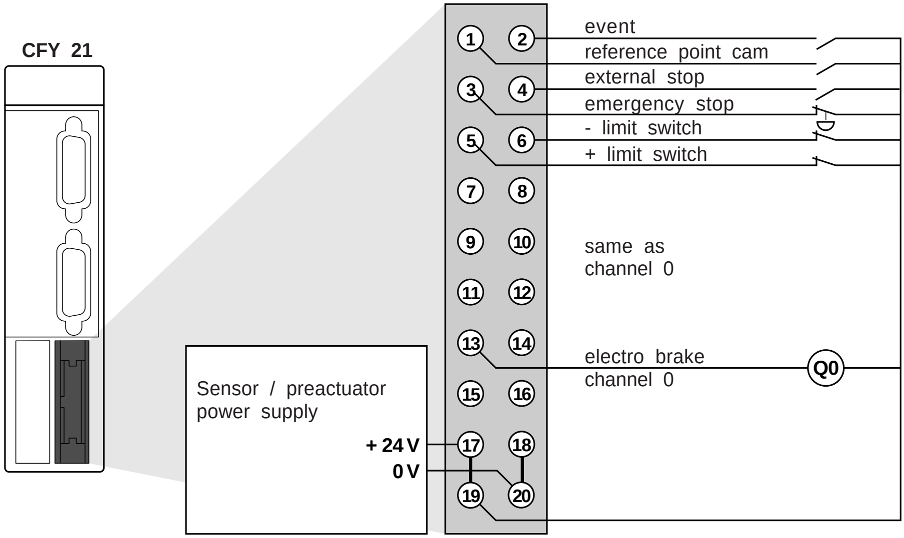
3.4-2 Connections

There are several possible solutions for connecting CFY 11 / 21 module sensors / preactuators. They must be connected directly via a TSX CDP 301 / 501 flat cable or via the discrete TELEFAST pre-wired system.

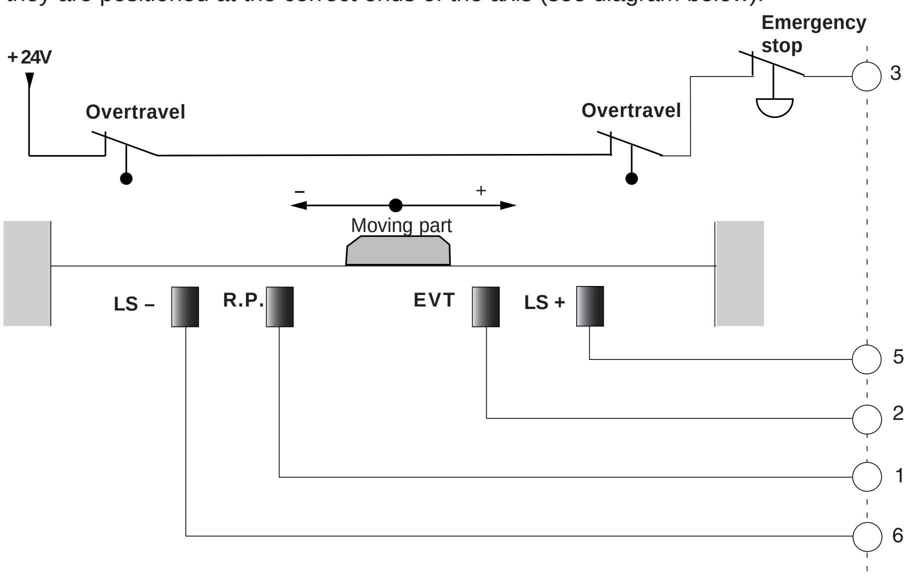
3.4-3 Connecting auxiliary I/O to the process

For optimum performance, the event and reference point inputs have low immunity. The use of bounce-free contacts (proximity sensor for example) is recommended.

Connection principle for the I/O of channel 0

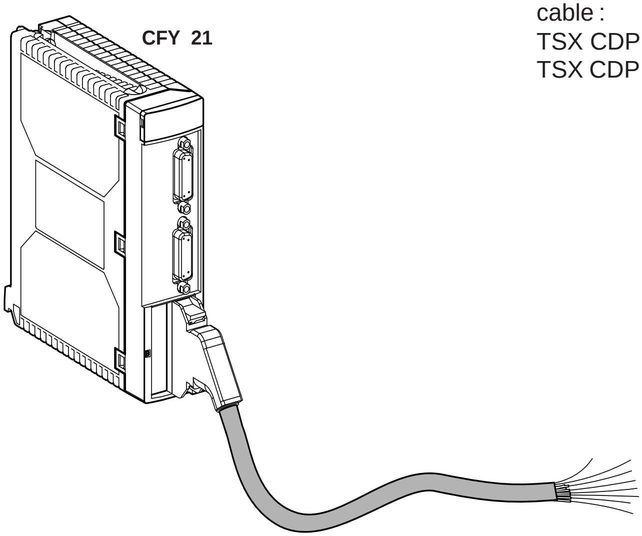


The emergency stop or limit switch contacts are N/C.
The limit switch contacts are not overtravel contacts which must be wired in series with the emergency stop input. The role of the limit switch contacts is to control the stopping of a movement with deceleration. Limit switch (LS +) stops the movement in the + direction, limit switch (LS –) stops the movement in the – direction. It is therefore important that they are positioned at the correct ends of the axis (see diagram below).

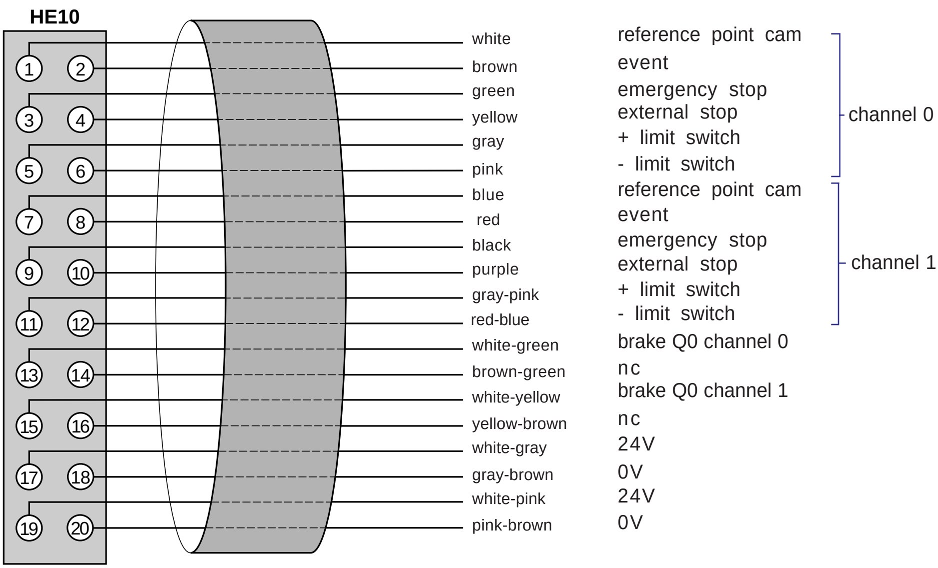


3.4-4 Connecting using a TSX CDP 301/ 501 preformed cable

This preformed cable enables direct connection to actuators, preactuators or any system with terminals. The cable consists of twenty 22-gauge wires (0.34 mm²) with a connector at one end and color-coded flying leads at the other.

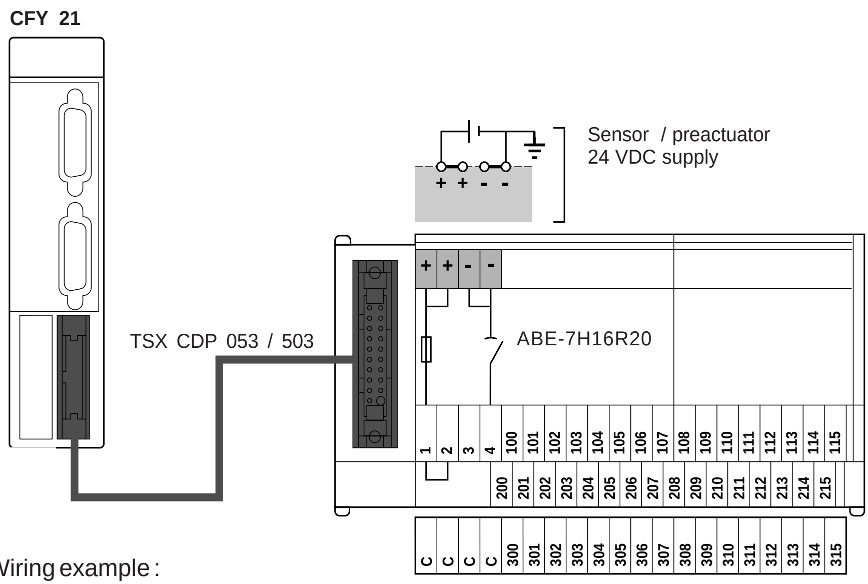


cable :	length :
TSX CDP 301	3m
TSX CDP 501	5m

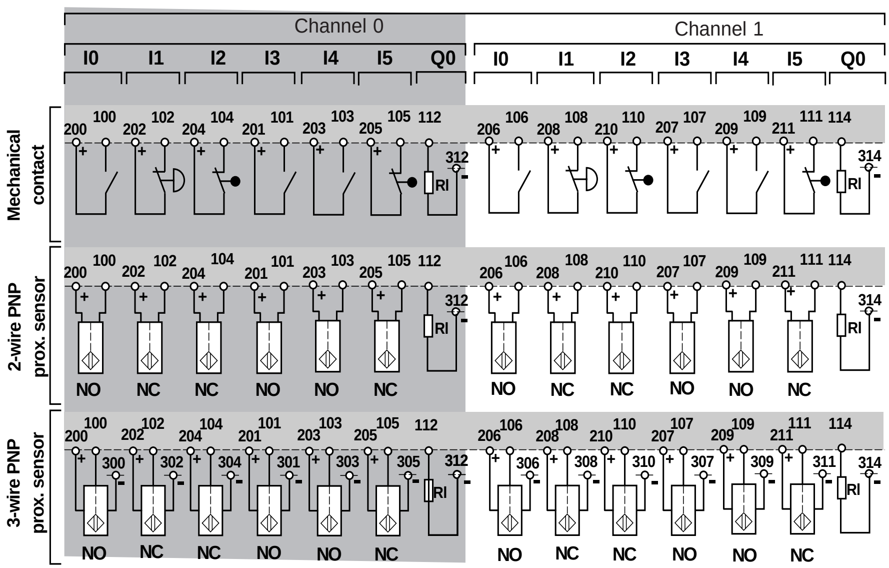


3.4-5 Connecting using the TELEFAST pre-wired system

Connection is made by means of a TELEFAST 2 sub-base : ABE-7H16R20.



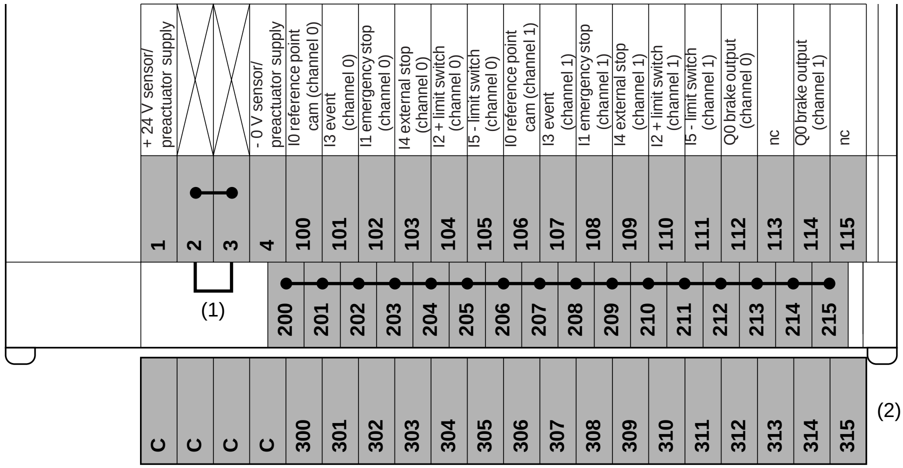
Wiring example :



NO : normally open
NC : normally closed

3.4-6 Signal availability on the TELEFAST terminal block

The terminal block below represents that of the ABE-7H16R20 sub-base. The signals are referenced using the TSX CDP 053 / 503 direct connecting cable.



(1) On the ABE-7H16R20 sub-base, the position of the jumper defines the polarity of terminals 200 to 215 :
- Jumper in position 1 and 2 : terminals 200 to 215 have positive polarity,
- Jumper in position 3 and 4 : terminals 200 to 215 have negative polarity.

(2) On the ABE-7H16R20 sub-base it is possible to add an optional ABE-7BV20 bar to create a second sensor common (+ or - selected by the user).

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3.4-7 Correspondence between TELEFAST terminal blocks and HE10 connector

TELEFAST screw term. blk. (Terminal no.)	20-pin HE10 connector (Pin no.)	Signal type	
100	1	I0 reference point cam	channel 0
101	2	I3 event	
102	3	I1 emergency stop	
103	4	I4 external stop	
104	5	I2 + limit switch	
105	6	I5 - limit switch	
106	7	I0 reference point cam	channel 1
107	8	I3 event	
108	9	I1 emergency stop	
109	10	I4 external stop	
110	11	I2 + limit switch	
111	12	I5 - limit switch	
112	13	Brake output Q 0	channel 0
113	14	nc	
114	15	Brake output Q0	channel 1
115	16	nc (1)	
+ 24 VDC	17	Sensor / actuator supply	
- 0 VDC	18		
+ 24 VDC	19		
- 0 VDC	20		
1 [		Terminals 200 to 215 at + 24 VDC	
2			
3 [		Terminals 200 to 215 at - 0 VDC	
4			
200...215		Connection of sensor commons to : + 24 VDC if terminals 1 & 2 linked - 0 VDC if terminals 3 & 4 linked	
300...315		On the optional ABE-7BV20 bar, terminals may be used as sensor common, wired to the common voltage.	

note (1) nc = not connected

Signals corresponding to channel 1 are not connected for a CFY 11 module.

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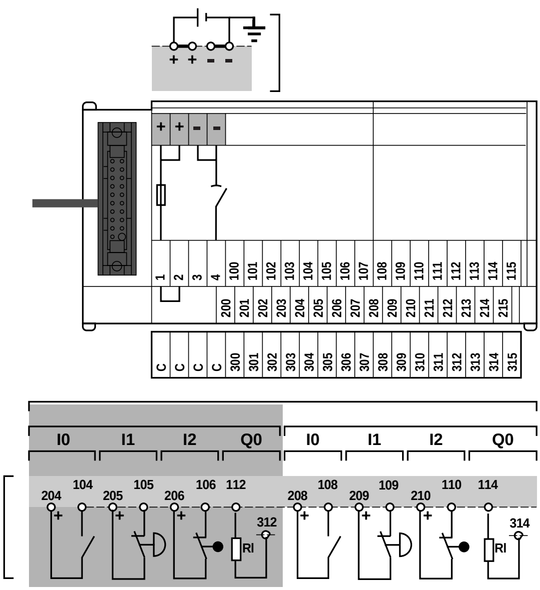
3.4-8 Wiring recommendations

To ensure optimum performance, inputs I0 to I5 are fast inputs. If the actuator is a volt-free contact type, the inputs must be connected using a twisted pair, or a shielded cable if the sensor is a two or three-wire proximity sensor.

This module is fitted as standard with devices to protect against short-circuits or voltage inversions. However, the module cannot withstand a fault for any length of time and the fuses connected in series with the supplies give effective protection. The fuses must therefore be of the fast blow type with a maximum rating of 1A. The supplies must provide sufficient power to blow the fuses.

Important note : wiring of solid state outputs Q0

The actuator is connected to output Q0 at its common point at the 0V of the power supply. If for any reason (poor contact or accidental disconnection) there is a break in the 0V supply of the output amplifier while the 0V of the actuators remains connected to the 0V supply, there may be an output current from the amplifier of a few mA which is sufficient to keep certain low-power actuators energized.

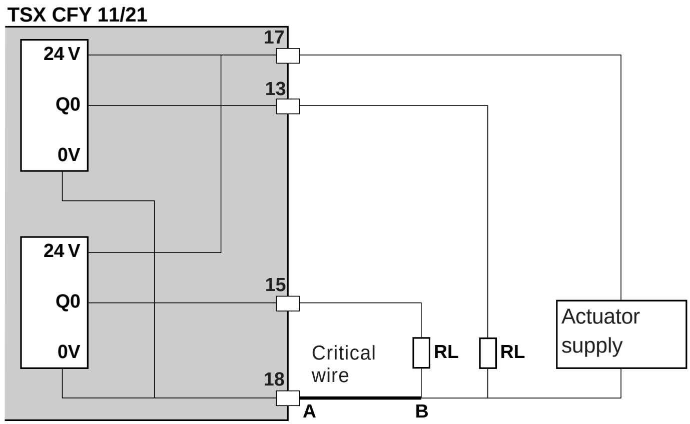


Connecting using TELEFAST :

This is the most reliable type of connection provided the actuator common is connected to the bar of common points 200 to 215 (jumper in position 1-2). In this case there can be no break in the module common without breaking the actuator common.

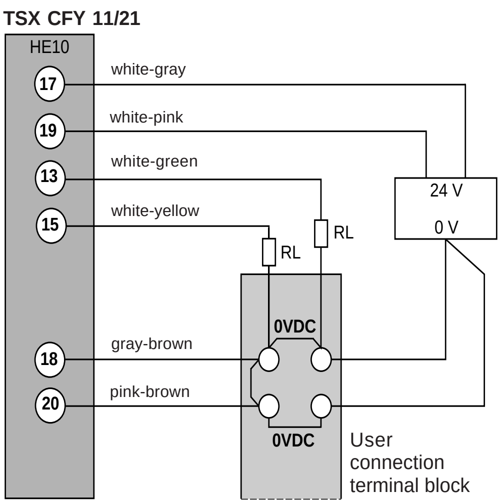
3.4-9 Connecting using a TSX CDP 301 / 501 preformed cable

This type of connection requires very careful attention. Great care must be exercised during wiring, for example using cable ends at the screw terminals. In certain circumstances, it is necessary to double up the connections to ensure permanent contacts. When the actuator supply is some distance from the modules and near to the actuator common, the connection between the common and 0V terminal of the module(s) may be accidentally broken.



If there is a break in the supply cable segment between A and B, it is possible that the RL actuators may remain energized. If possible, double up the 0V supply connections for the module(s).

Connecting using a TSX CDP 301 / 501 preformed cable :



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3.5 Electrical characteristics of the module

3.5-1 General characteristics

Electrical characteristics		Values
Maximum pulse frequency		187.316 KHz
Current drawn on internal 5V	TSX CFY 11	510 mA
	TSX CFY 21	650 mA
Current drawn by module	TSX CFY 11	50 mA
on 24V sensor / preactuator excluding sensor / preactuator current	TSX CFY 21	100 mA
Power dissipated in module	TSX CFY 11	3.8 W
	TSX CFY 21	5.6 W
Insulation resistance		> 10 MΩ at 500VDC
Dielectric strength between "translator" I/O and protected ground or PLC logic		1000Vrms 50 / 60 Hz for 1minute
Operating temperature		0 to 60°C
Storage temperature		-25°C to 70°C
Relative humidity (without condensation)		5% to 95%
Operating altitude		< 2000 m

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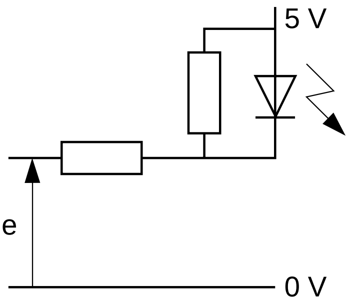
3.5-2 Characteristics of the translator inputs (Sub-D connector)

These are current sinking inputs with negative logic.

diagram :



Characteristics	Symbol	Value	Unit
Nominal current (Ue = 0V)	Ie	4.5	mA
Voltage at ON state	Uon	2	V
Voltage at OFF state	Uoff	3.6	V
Immunity of loss of step input		15 to 30	µs
Immunity of translator fault input		3 to 10	ms

3.5-3 Characteristics of the translator outputs (Sub-D connector)

These are isolated RS 422 / 485 type. There are two complementary outputs per signal.

Characteristics	Values	Units
Differential output voltage at R load <= 100Ω	±2	V
Short-circuit current	< 150	mA
Permissible common mode voltage	≤ 7	V
Permissible differential voltage	≤ 12	V

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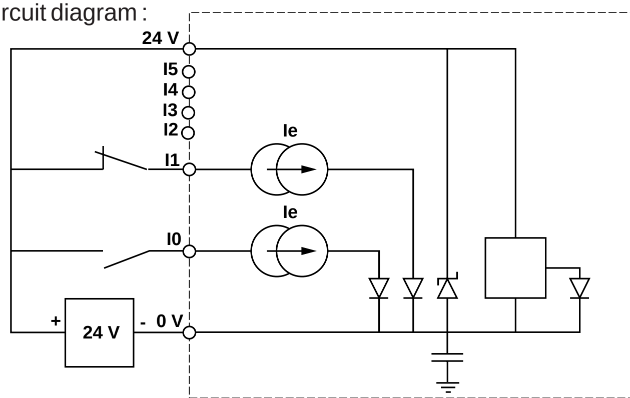
3.5-4 Characteristics of the auxiliary inputs (HE10 connector)

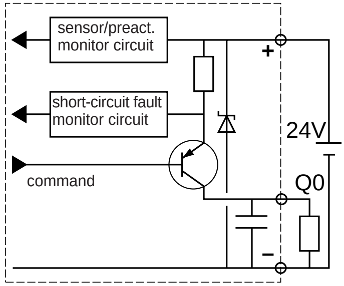
Equivalent circuit diagram :



Characteristics		Symbol	Value	Unit
Nominal voltage		Un	24	V
Nominal voltage limits (including ripple)		U1 Utemp (1)	19 to 30 34	V V
Nominal current		In	7	mA
Input impedance (at Unom)		Re	3.4	KΩ
Voltage at ON state		Uon	>=11	V
Current at Uon (11V)		Ion	> 6	mA
Voltage at OFF state		Uoff	< 5	V
Current at OFF state		Ioff	< 2	mA
Input immunity : Reference point cam and event Other inputs		 ton/ toff (2) ton / toff	 < 250 3 to 10	 µs ms
IEC 1131 compatibility with sensors			type 2	
2 and 3-wire proximity sensor compatibility			all proximity sensors at 24 VDC	
Input type			current sink	
Logic type			positive (sink)	
Preactuator	supply threshold OK		> 18	V
voltage monitoring	supply threshold faulty		< 14	V
Power supply	supply OK		<30	ms
detection time	supply faulty		> 1	ms

(1) Utemp : maximum permissible voltage for 1 hour in any 24-hour period.
(2) Inputs : reference point cam and event are fast inputs (response time < 250µs) in accordance with the maximum frequency of 187.316 KHz for translator check outputs.

3.5-5 Characteristics of brake output Q0 characteristics



Electrical characteristics	Value	Unit
Nominal voltage	24	V
Voltage limits Temporary voltage	19 to 30 34 (1)	V V
Nominal current	500	mA
Maximum voltage drop at ON state	< 1	V
Leakage current at OFF state	< 0.3	mA
Load impedance	80 < Zon <15000	Ω
Maximum current at 30V and 34V	625	mA
Switching time	< 250	µs
Electro discharge time	< L/R	s
Maximum switching frequency (on inductive load)	F < 0.6 /(LI2)	Hz
Inductive input compatibility	All inputs with Re less than 15 KΩ and positive logic	
IEC 1131 conformity	yes	
Protection against overloads and short-circuits	via current limiter and tripping	
Short-circuit check on each channel	thermal with signaling : 1 bit per channel	
Reset : (by program or automatic)	 1 bit per module	
Protection against channel overvoltages	Zener diode (55V) between outputs and +24V	
Protection against polarity inversions	via reverse-mounted diode on supply	
Permissible power of filament lamp	8	W
Preactuator voltage check	OK if supply > 18 (rising) not OK if supply < 14 (falling)	V V
Voltage monitoring response time	NOK--> OK < 30 OK --> NOK > 1	ms ms

(1) : maximum permissible voltage for 1hr in any 24hrs.

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4.1 Translators compatible with TSX CFY 11 / 21

4.1-1 Phytron translators

Manufacturer	Reference
Phytron Elektronik	MSD MINI 172/140 (17 A : 140 V) MSD MINI 172/70 (17 A : 70 V) SP MINI 92/70 (9 A : 70 V) SP MINI 72/70 (7 A : 70 V) SP MINI 52/70 (5 A : 70 V)

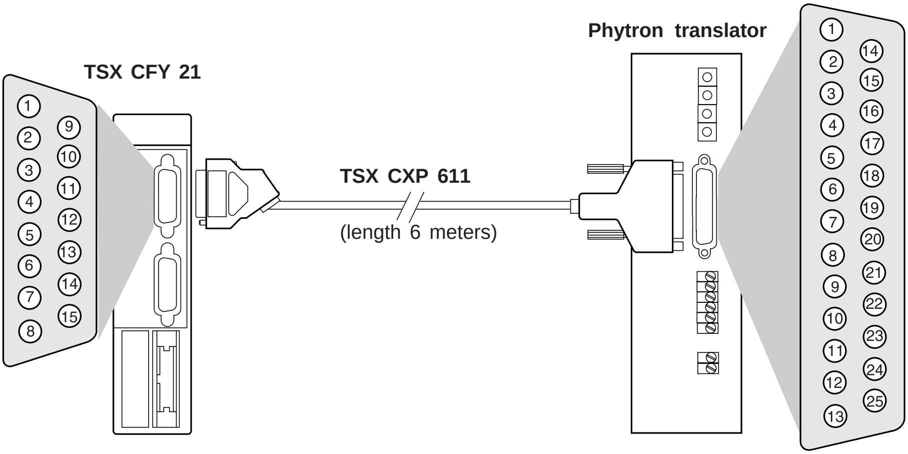
4.1-2 Other translators

Manufacturer	Reference
Other	All RS422 / RS485 type translators : • RS422 / RS485 differential inputs or TTL 5V "source" compatible inputs, • RS422 / RS485 differential outputs or NPN open collector outputs.

4.2 Installing TSX CFY 11/21 with Phytron translators

4.2-1 Connections

The TSX CXP 611 cable is used to simplify the connection between the TSX CFY 11/21 modules and the Phytron Elektronik range of translators, series MSD MINI and SP MINI :



TSX CFY 11/21	TSX CXP 611 cable	Phytron translator
1	+ pulses	1
2	– pulses	14
3	+ direction	2
4	– direction	15
9	+ boost	3
10	– boost	16
11	+ enable	4
12	– enable	17
13	+ reset fault	5
14	– reset fault	18
5	Translator ready	9
6	Fault	11
8	0V isolated	22, 24

4.2-2 Special notes on use

- **"Translator check" signal**

  The "Translator check" input of TSX CFY 11/21 modules is connected to the "Ready/ Module ready" translator output signal.

  If the translator is not powered-up, or if the cable connection is broken, or if the module does not deliver the "Translator enable" output signal, the "Translator check" fault signal becomes active, causing a fault at TSX CFY11/21 module level :

  - in the debug screen :
    Transl Chk indicator lamp and **DIAG** indicator lamp in module zone both on,
  - in the application program interface :
    ST_DRIVE (%Ixy.i.35) at 1, HD_ERR (%Ixy.i.4) at 1 and DRV_FLT (%MWxy.i.3:X2, explicit reading) at 1.

  To resolve this fault, simply :

  1- Ensure that :
  - the translator is switched on and connected correctly,
  - in the TSX CFY 11/21 Configuration Editor : the "**Drive Inversions : Enable output**" box is checked. Also select **Command mode : "A=Pulse / B=Direction".**
  - the "Translator enable" output is activated, either :
  - in the debug mode screen when online : by activating the **Enable** button.
  - via the application program : ENABLE (%Qxy.i.10) set to 1.

  2- Acknowledge the fault :
  - In the debug mode screen when online : by pressing the **Ack** button.
  - Via the application program : Rising edge on ACK_DEF object (%Qxy.i.9)

  If the fault persists, check that there are no other reasons for the error.
  In particular, check the presence of the 24 V supply on the auxiliary I/O connector, and check that no emergency stop signal is present (presence of the 24 V supply on the emergency stop input, EMG_STOP: %Ixy.i.29 is at 0)

- **"Loss of step" signal.**

  The TSX CFY 11/21 "Loss of step" input is connected to the "Fault" output signal of the translator.
  If the translator is powered up, if the cable connection is broken, or if the "Fault" output signal of the translator is confirmed, the "Loss of step" signal becomes active :
  - in the debug screen : **Loss of step** indicator lamp on.
  - in the application program interface: STEP_FLT (%Ixy.i.28) at 1.

  The documentation for the Phytron MSD MINI and SP MINI translators lists the internal translator conditions which activate this signal.

  Note : the appearance of the "Loss of step" signal does not cause a fault at TSX CFY11/21 module level.

C

- **"Reset loss of step check" command**

  This TSX CFY 11/21 command output is connected to the "Reset" input of the translators.
  The command can be activated :
  - in the debug screen : by pressing the **Reset step** button.
  - Via the application program : ACK_STEPFLT (%Qxy.i.15) set to 1.

  The activation of this command causes a translator Reset and as long as this command is active, the translator signals that it is not ready and the "Translator fault" signal appears : ST_DRIVE (%Ixy.i.35) at 1, HD_ERR (%Ixy.i.4) at 1

  To resolve this common fault, simply :

  1 Deactivate the "Reset loss of step check" command :
  - in the debug screen : release the **Reset step** button.
  - Via the application program : ACK_STEPFLT (%Qxy.i.15) to 1.0

  2 Acknowledge the fault :
  - In the debug mode screen when online : by pressing the **Ack** button.
  - Via the application program : Rising edge on ACK_DEF object (%Qxy.i.9)

4.2-3 Recommendations for initial adjustments

- **Configuration of enable and command outputs.**

  In TSX CFY configuration editor:
  - Check the "Drive Inversions : Enable output" box,
  - Select the control mode : "A=Pulse / B=Direction".

- **Start and stop frequency**

  This parameter can be adjusted:
  - In the adjustment parameters editor,
  - Via the application program : assignment of SS_FREQ %MDxy.i.18, followed by WRITE_PARAM %CHxy.i.

  The start and stop frequency is the frequency at which the motor can start and stop without a ramp and without loss of step. Its maximum limit value depends on the external inertia exerted on the motor axis. For Phytron MSD/SP systems, a start/stop frequency value which is generally suitable, whatever the external inertia exerted on the motor, is 400 Hz (in ½ step mode), corresponding to 1 revolution/s. This value may become critical above 600/800 Hz (1.5 to 2 revolution/s).

Symbols

A

B

C

D

E

F

G

H

I

L

M

N

U

W

1 General

This manual is intended for personnel technically qualified to install, operate and maintain the products which are described herein. It contains all the necessary information for correct use of the products. However, for advanced use of our products please contact your nearest sales office for additional information.

The contents of this manual are not contractual and cannot under any circumstance extend or restrict contract warranty clauses.

2 Qualification of personnel

Only **qualified personnel** are authorized to install, operate or maintain the products. Any work performed by unqualified personnel or non-observance of the safety instructions in this document or attached to the equipment may risk the safety of personnel and/or cause irreparable damage to equipment. The following personnel may be regarded as being **"Qualified"** :

- those involved with application design. Design office personnel familiar with control system safety concepts (for example, design engineers, etc),
- those involved with equipment installation. Individuals who are familiar with the installation, connection and startup of control system equipment (for example installers or wiring technicians working during the installation phase, technicians setting up the equipment, etc),
- those involved with operation. Personnel trained to operate and manage control system equipment (for example, operators, etc),
- those performing preventive or corrective maintenance. Personnel who are trained and experienced in the adjustment and repair of control system equipment (for example, installation engineers, after sales service engineers, etc).

3 Warnings

Warnings serve to prevent specific risks encountered by personnel and/or equipment. They are indicated in the documentation and on the products by different warning symbols, according to the severity of the risk :

Danger or **Caution**

Indicates that not following instructions or ignoring the warning may cause serious personal injury, death and/or serious damage to equipment.

Warning or **Important** or ⚠

Indicates that not following a specific instruction may lead to minor injury and/or damage to equipment.

Note or **Comment**

Highlights important information relating to the product, its operation or its accompanying documentation.

4 Conformity of use

The products described in this manual **conform to the European Directives** (*) to which they are subject (CE marking). However, they can only be used correctly in the context of the applications for which they are intended (described in the various documents) and when connected to approved third party products.
As a general rule, if all handling, transport and storage specifications are observed, and all instructions for installation, operation and maintenance are followed, the products will be used correctly, with no danger to personnel or equipment.

(*) EMC and LV Directives, concerning Electromagnetic Compatibility and Low Voltage.

5 Installing and setting up equipment

It is important to observe the following rules when installing and starting up equipment. In addition, if the installation includes digital links, it is essential to follow the basic wiring rules given in the manual "Electromagnetic Compatibility of industrial Networks and Fielbuses"**, reference TSX DG KBLE,** or in manual **TSX DR NET**, part C.

- safety instructions must be followed meticulously. These instructions are in the documentation or on the equipment being installed and set up.
- the type of equipment defines the way in which it should be installed :
  - a flush-mountable device (for example, an operator terminal or a cell controller) must be flush-mounted,
  - a device which is to be built in (for example, PLC) must be placed in a cabinet or enclosure,
  - the casing of a laptop or portable device (for example, a programming terminal or a notebook) must remain closed,
- if the device is permanently connected,
  - the upstream installation must conform to standard IEC 1131-2 **overvoltage category 2**,
  - in addition, its electrical installation must include a device to isolate it from the power supply and a circuit-breaker to protect it against overcurrents and isolation faults. If this is not the case, the power socket must be grounded and be easily accessed. **In all cases, the device must be connected to the protective mechanical ground PG using green/yellow wires (NFC 15 100 - IEC 60 364-5-51) .**
- low voltage circuits (even though they are low voltage) must be connected to the protective ground so that dangerous voltages can be detected.
- before a device is powered up, its nominal voltage must be checked to ensure that it has been adjusted to conform with the supply voltage.
- if the device is supplied with 24 or 48 VDC, the low voltage circuits must be protected. Only use power supplies which conform to the standards currently in force.
- check that the supply voltages remain within the tolerance ranges defined in the technical characteristics of the devices.
- all measures must be taken to ensure that any power return (immediate, warm or cold) does not lead to a dangerous state which may risk personnel or the installation.
- emergency stop devices must remain effective in all the device's operating modes, even those which are abnormal (for example, when a wire becomes disconnected). Resetting these devices must not cause uncontrolled or improper restarts.
- cables which carry signals must be located where they do not cause interference with the control system functions by capacitive, inductive or electromagnetic interference.

- control system equipment and their control devices must be installed in such a way as to ensure that they are protected against unintentional operation.
- appropriate safety measures must be taken for the inputs and outputs, to prevent improper states in the control system device, if no signal is received.

6 Equipment operation

The operational safety and availability of a device is its ability to avoid the appearance of faults and to minimize their effects if they occur.

A system is said to be fail-safe if the appearance of faults **never** causes a dangerous situation.

A fault inside the control system is known as :

- passive, if it results in an open output circuit (no command is sent to the actuators).
- active, if it results in a closed output circuit (a command is sent to the actuators).

From the safety point of view, a given fault is dangerous or not depending on the type of command given during normal operation. A passive fault is dangerous if the normal command is the operation of an alarm. An active fault is dangerous if it maintains or activates an undesirable command.

It is important to note the basic difference between the behavior of an electromechanical relay and an electronic component (for example a transistor) :

- there is a high probability, approximately 90%, that the failure of a relay will cause an open circuit (control circuit powered off).
- there is a 50% probability that the failure of a transistor will cause either an open circuit or a closed circuit.

This is why it is important to correctly estimate the types and consequences of faults when automating a system using electronic products such as PLCs, including when relay output modules are used on PLCs.

The system designer must **use devices external to the PLC** to protect against active faults inside the PLC, which are not indicated and are judged to be dangerous to the application. This may require solutions from various different technologies such as mechanical, electromechanical, pneumatic or hydraulic devices (for example, directly wiring a limit switch and emergency stop switches to the coil of a movement control contactor).

To protect against dangerous faults which may occur on output circuits or preactuators, it is sometimes beneficial to resort to general principles and use the large processing capacity of PLCs, for example by using inputs to check the correct execution of commands requested by the program.

7 Electrical and thermal characteristics

Details of the electrical and thermal characteristics of devices are given in the associated technical documents (installation manuals, quick reference guides).

8 Environmental conditions

In industry, the micro-environmental conditions of electronic devices can vary greatly. For this reason, programmable controllers and associated modules must conform to the following two types of installation :

- installation in an enclosure with IP54 protection for protecting devices from metallic dust amongst other things. Two guidelines are associated with this type of installation :
  - direct access to electronic modules should be strictly reserved to maintenance staff (see section 2), with access keys,
  - the selection of a metal enclosure must be considered, since it serves as extra shielding against the latent risk of electromagnetic interference.
- direct installation without protection for Premium PLCs and associated systems (power supply modules, etc) which themselves have IP20 protection.
  This type of installation applies to areas with restricted access and low pollution levels (not exceeding 2), for example stations or control rooms which have neither machines nor any activity generating metallic dust or other metallic particles. The external walls hence serve as the PLC enclosure.

9 Preventive or corrective maintenance

Availability

The availability of a system is its ability, in terms of its combined reliability, maintainability and maintenance logistics, to be in a state to perform a required function, at a given moment and within a defined time period.

Availability is therefore specific to each application, since it is a combination of :

- the architecture of the automatic system,
- the reliability and maintainability : intrinsic characteristics of the equipment (PLCs, sensors, machine, etc),
- maintenance logistics : characteristic intrinsic to the user of the control system (software structure, fault indication, process, on-site replacement parts, training of personnel).

Troubleshooting procedure

- control system equipment should only be repaired by qualified personnel (after sales service engineer, or technician approved by Schneider Automation). Only certified replacement parts or components should be used.
- before performing any operation on equipment (for example opening an enclosure), always cut the power supply off (disconnect the power plug or open the power isolation switch).
- before performing any "mechanical" operation on equipment on site, cut the power supply off and mechanically lock any moving parts.
- before removing a module, a memory cartridge, a PCMCIA card, etc, check in the manual whether this should be done with the power off or if it is possible with the device powered up. Follow the instructions given in the manual carefully.
- on positive logic outputs or negative logic inputs, take all necessary precautions to prevent a disconnected wire coming into contact with the mechanical ground (risk of undesirable control action).

Replacement and recycling of used batteries

- if these are replaced, use batteries of the same type and dispose of defective batteries in the same way as toxic waste.
  Do not throw lithium or mercury batteries into a fire, open or recharge them, or attempt to solder them.

1.1 Preface

Since the terminal port refers to the UNI-TELWAY master, UNI-TELWAY slave and character string communication modes it will be necessary to refer to the following documentation for the installation (hardware and software) of these communication modes.

- TSX DG UTW E : UNI-TELWAY bus communication (User guide),
- TSX DR NET E : X-WAY communication (Reference manual),
- TLX DS COM PL7 30E : TSX Micro / Premium PLC communication (software installation manual)

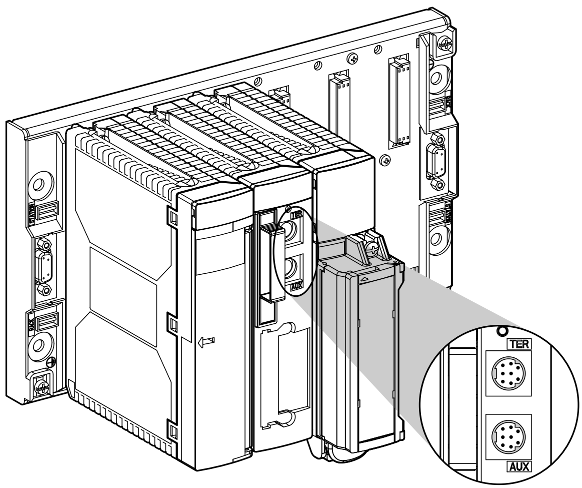
1.2 Presentation

- **On TSX / PMX 57 PLCs**

The terminal port on TSX/PMX 57 processors is an RS 485 non-isolated link consisting of two 8-pin mini DIN connectors. These two connectors, which are functionally identical, located on the processor and marked TER and AUX, enable physical and simultaneous connection of two devices such as a programming/adjustment terminal and an operator panel.

The TER connector is also able to supply power to a device which does not have its own power supply (RS 485/RS 232 converter cable, TSX P ACC 01 isolation box, etc).

The terminal port functions in UNI-TELWAY master mode by default. By configuration, it is possible to switch to UNI-TELWAY slave or character mode.



Note :

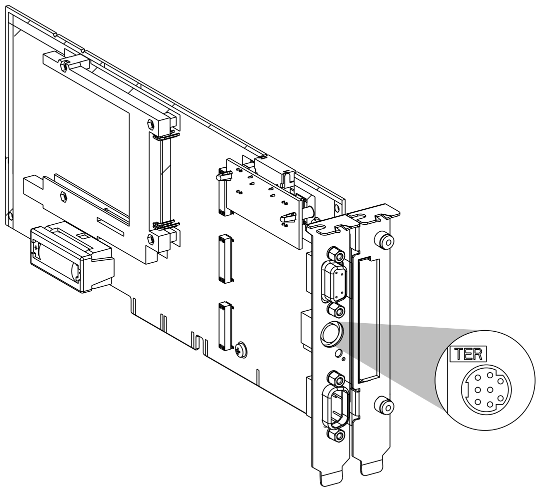
The communication mode (UNI-TELWAY master, UNI-TELWAY slave or character mode) is identical on the two connectors TER and AUX.

• **On PCX 57 PLCs**

PCX 57 processors have a single terminal port, TER, which is exactly the same as the TER terminal port on TSX/PMX 57 PLC processors. It is an RS 485 non-isolated link, consisting of an 8-pin mini DIN connector for physically connecting a device such as a programming/adjustment terminal or an operator panel.

This connector is also used to supply power to a device which does not have its own power supply (RS 485/ RS 232 converter cable, TSX P ACC 01 isolation box, etc).

The terminal port functions in UNI-TELWAY master mode by default. By configuration, it is possible to switch to UNI-TELWAY slave or character mode.

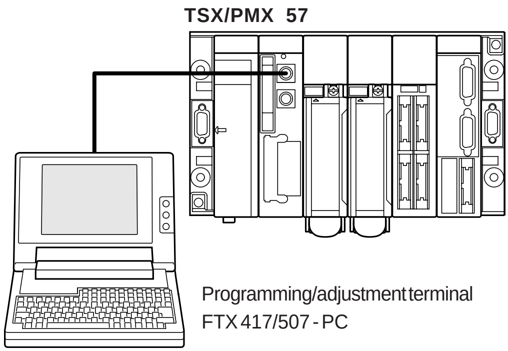


Note :
Using a TSX P ACC01 isolation box doubles the terminal port in order to provide the two ports, TER and AUX, as on a TSX/PMX 57 PLC processor.

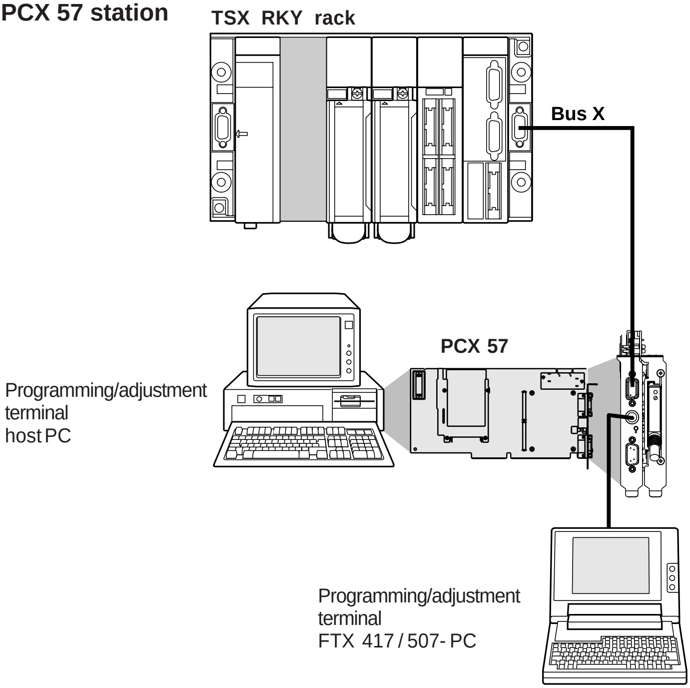
1.2-1 Communication with a programming or adjustment terminal

Configured in UNI-TELWAY master mode (default function), the terminal port is used to connect a programming or adjustment terminal.

- **TSX/PMX 57 station**



- **PCX 57 station**

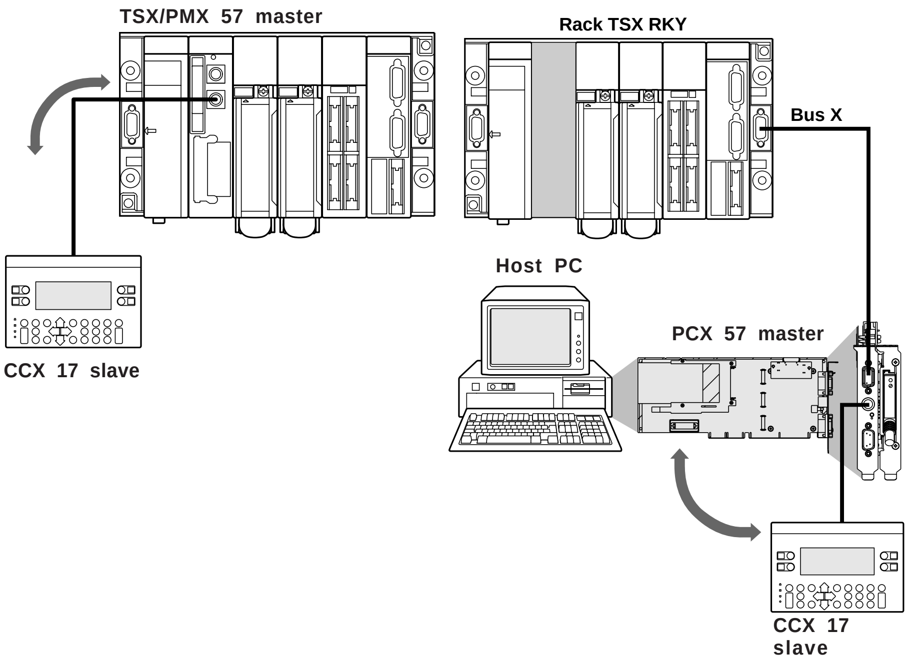


Note :
For a PCX 57 PLC station, the programming terminal is generally the PC which supports the PCX 57 processor. However, as with a TSX/PMX 57 PLC station, the programming terminal may also be a PC type terminal, connected to the processor terminal port.

1.2-2 Communication with an operator panel

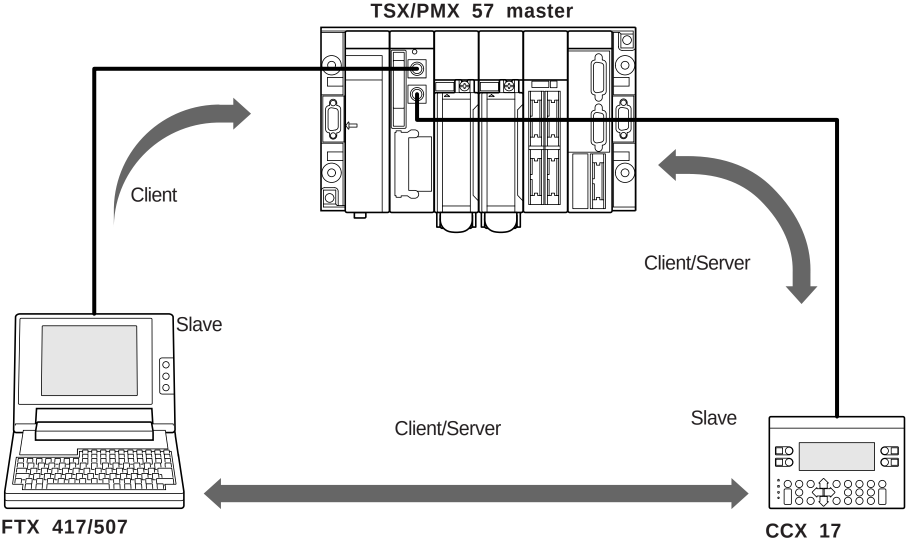
Configured in UNI-TELWAY master mode (default function), the terminal port is used to manage an operator panel.
The operator terminal uses UNI-TE protocol to communicate with the local PLC and other stations on the network.

For a TSX / PMX 57 PLC, in order to free the TER connector for possible connection of a programming or adjustment terminal, the operator panel will be connected to the AUX connector.



1.2-3 UNI-TELWAY master / slave communication

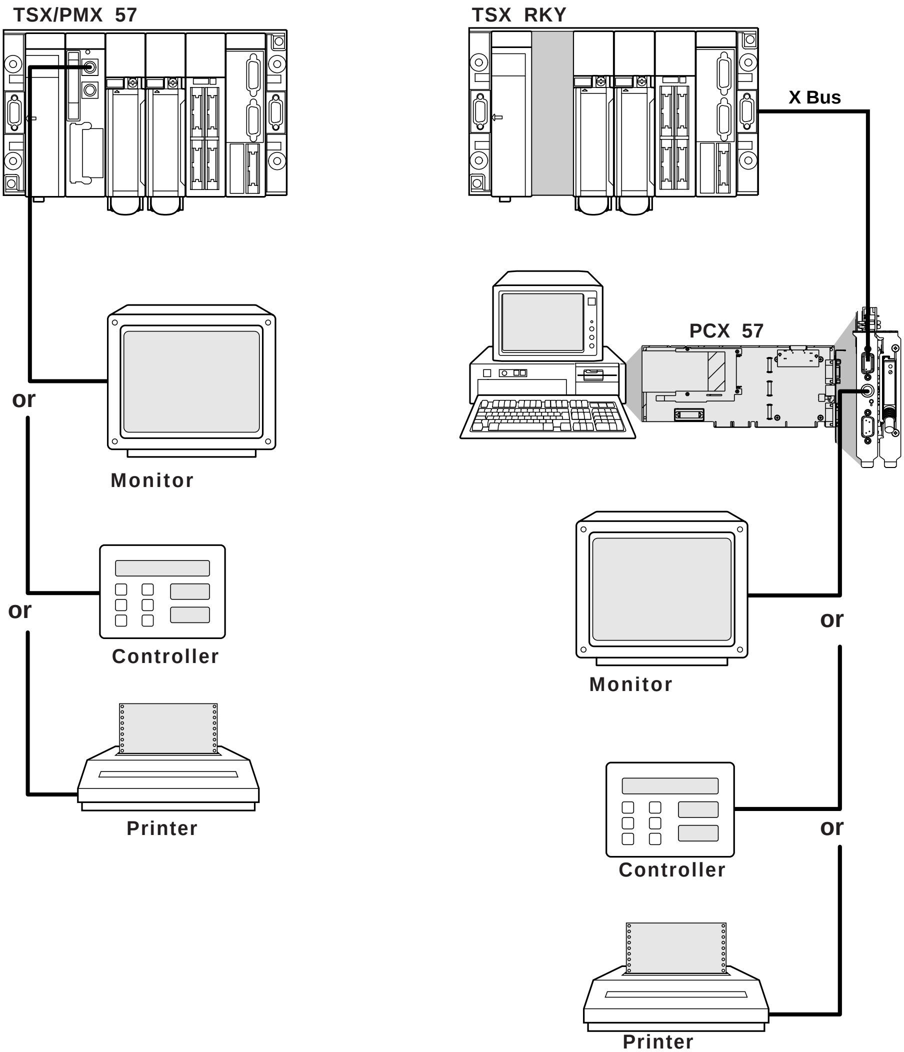
The default communication mode of the terminal port is UNI-TELWAY master. It is mainly used for the connection of a slave programming terminal and operator panel.



Note :
For a PCX 57 PLC, whose processor only has one terminal port, this type of connection is only possible using a TSX P ACC01 box.

1.2-4 Character string communication

This mode is used for connecting a printer or specialized panel (monitor, panel mounted controller, etc) to the terminal port of the TSX/PMX/PCX 57 PLC.



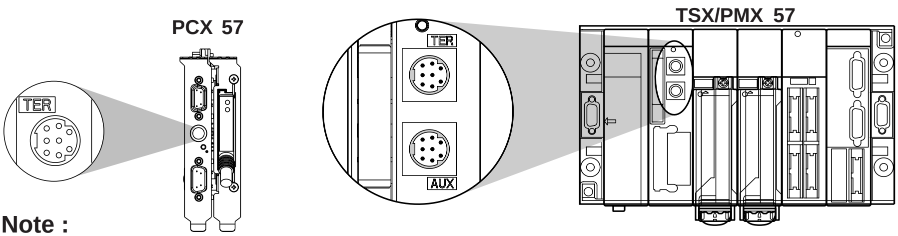
1.3 Connections

The connector marked TER can be used to connect any device supporting the UNI-TELWAY protocol, and in particular devices which do not have their own power supply (RS 485/RS 232 converter cable, TSX P ACC 01 isolation box, etc).

The connector marked AUX (only on TSX/PMX 57 PLCs) can only be used to connect devices which have their own power supply (operator panel, third-party equipment, etc).

The terminal port enables three operating modes :

- UNI-TELWAY master (default configuration),
- UNI-TELWAY slave,
- Character string.



Note :

> For TSX/PMX 57 PLCs, which have two connectors (TER and AUX), the operating mode defined during configuration (UNI-TELWAY master, UNI-TELWAY slave, character mode) is identical for both connectors.

Depending on the operating mode selected during configuration, the terminal port can be used to connect :

- A programming and adjustment terminal on TSX/PMX 57 PLCs,
- An operator terminal,
- Another PLC, via the TSX P ACC01 isolation box,
- UNI-TELWAY devices (sensor / actuator, variable speed drive, etc),
- A printer or monitor (character string mode link),
- A modem.

The use of an isolation box, reference TSX P ACC 01, provides 2 connectors, enabling, for example, a programming terminal and two slave devices to be connected simultaneously. This box is also necessary for connecting a TSX 57 •• PLC on a UNI-TELWAY link when the distance between the devices is greater than 10 meters. Slave mode can be forced by using this box, which is described in section 2.

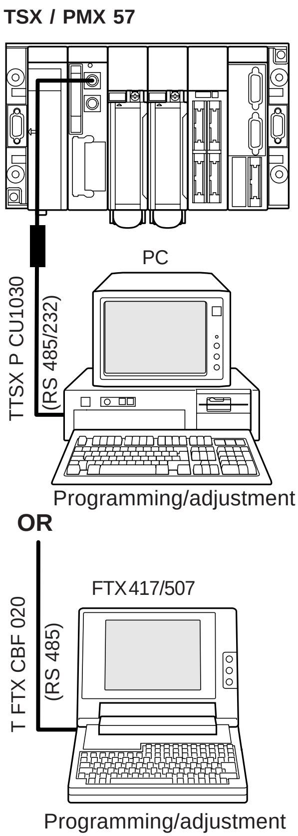
Note :

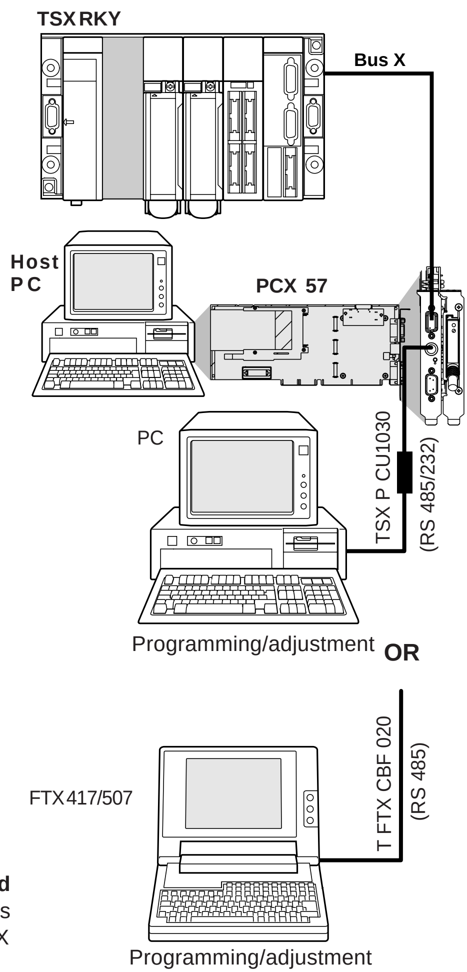
> A TSX P ACC 01 box must be used to connect a TSX/PMX/PCX 57 slave PLC on a UNI-TELWAY bus.

1.3-1 Programming / adjustment terminal

Terminals which have their own power supply (FTX 417, FTX 507) can be connected to either the TER or the AUX connector on TSX / PMX 57 processors.
If a terminal does not have its own power supply, it must be connected to the TER connector on the processor.
The programming terminal uses the UNI-TE protocol for programming, adjusting or performing diagnostics on the local PLC and all the station devices.
If the PLC is connected on a network architecture, network transparency enables the programming terminal to reach all the devices on the network.
The references for the various connection cables are given in the diagram below.

Connection examples





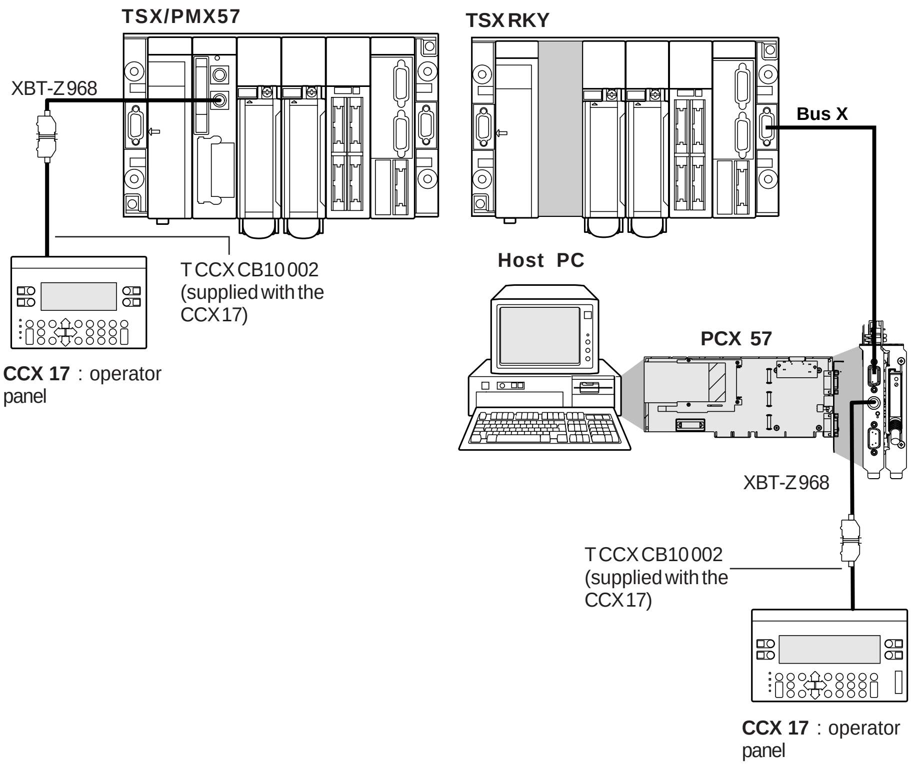
Note :
The TSX P CU1030 cable **must be connected** to the **TER** terminal port on TSX/PMX 57 PLCs (it will not operate if it is connected to the AUX terminal port).

1.3-2 Operator panel

An operator terminal uses the UNI-TE protocol to communicate with the local PLC and other stations on the network.
In the case of a TSX 57 PLC, the operator panel has its own power supply and must be connected to the AUX terminal port in order to leave the TER port available for a terminal which requires a power supply (FTX 117 Adjust for example).

Connection example

The references of the connection cables between the terminal port and a CCX 17 operator panel are shown below.

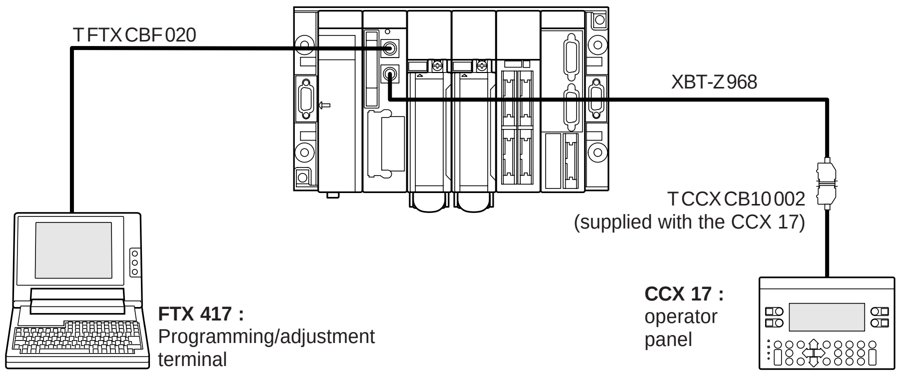


1.3-3 Programming / adjustment terminal and operator panel

The terminal port on a TSX / PMX 57 processor can handle two devices in multidrop mode : the programming / adjustment terminal and an operator panel.

TSX/PMX 57 processors have two connectors, therefore each connector can take one of these devices.

Connection example



Note :
Either connected device can be removed without disturbing the operation of the other.
For a PCX 57 PLC, whose processor only has one terminal port, this type of connection is only possible using a TSX P ACC01 box.

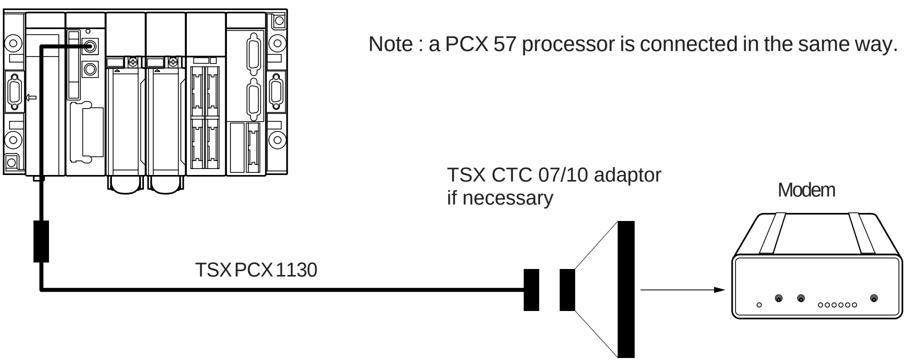
1.3-4 Modem on terminal port

The terminal port on TSX Micro PLCs version V1.5 and later and on TSX/PMX/PCX 57 processors of Premium PLCs is compatible with a modem connection in all the protocols : UNI-TELWAY master, UNI-TELWAY slave, and character string.
The modem to be connected must have the following characteristics :

1- Support a 10 or 11 bits per character format if the terminal port is used in UNI-TELWAY mode : 1 Start, 8 Data, 1 Stop, Odd, or No Parity,
2- operate without any data compression if the terminal port is used in UNI-TELWAY mode,
3- be able to be configured with "DTR signal forced" at the RS 232 serial port end (in cases where the modem is used in response mode), since this signal is not connected by the cable,
4- operate without flow control (no -RTS/CTS- hardware or -XON/XOFF- software) at the RS 232 serial port end, since the cable to be used at the terminal port end can only carry TX, RX and GND signals.
5- operate without carrier control. Warning : this operating mode also uses RTS and CTS control signals,
6- accept an incoming telephone call while characters arrive on the RS 232 serial port (in cases where a modem/telephone network is used in response mode on a terminal port configured in UNI-TELWAY master mode).

Warning : it is strongly recommended to check with the modem supplier that the above characteristics are available on the selected modem.

Example : diagram showing connection to a TSX/PMX 57 processor



Example 1 : for a terminal port in UNI-TELWAY master mode connected to a modem/telephone network in response mode, numbers 1 to 6 of the above characteristics are required.

Example 2 : for a terminal port in character string mode connected to a modem via a dedicated line, numbers 3 to 5 of the above characteristics are required.

Configuration of the terminal port in UNI-TELWAY mode :

The waiting time is between 100 and 250 ms.
In master mode, the number of slaves configured must correspond to the real number of slaves on the bus.
In slave mode, the number of addresses must correspond to those used.

The terminal port on TSX/PMX/PCX 57 PLCs is configured using PL7 Junior or PL7 Pro software.

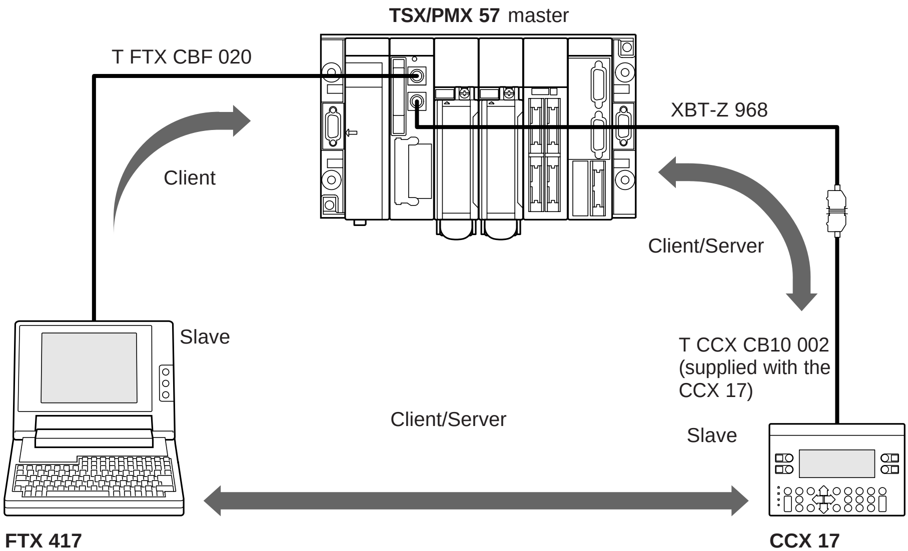
For further details refer to the TLX DS COM PL7 30E communication manual.

1.3-5 UNI-TELWAY Master

This is the default operating mode of the terminal port. It is mainly used for :

- the connection of a programming/adjustment terminal and an operator panel in the case of a TSX/PMX 57 PLC.
- the connection of a programming/adjustment terminal or an operator panel in the case of a PCX 57 PLC which only has one terminal port.

Connection example



Note :
For a PCX 57 PLC station where the processor only has one terminal port, this type of connection may be made using a TSX P ACC01 box.

Important

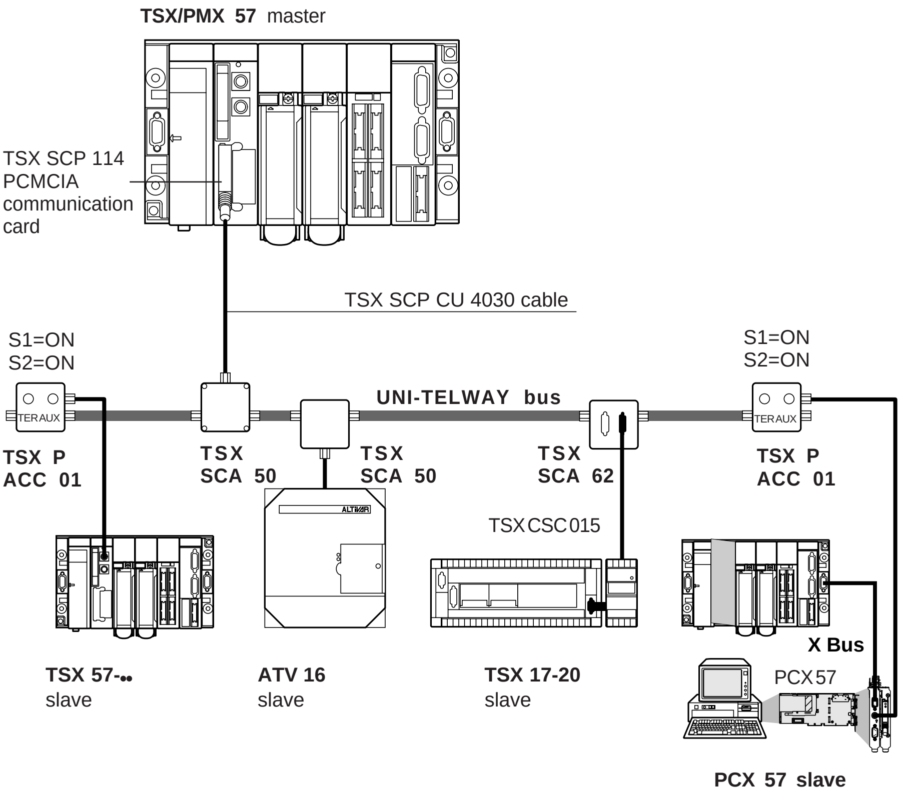
The master can scan up to eight link addresses. Link addresses 1, 2 and 3 are reserved for the programming terminal, the five other addresses can be used to connect a man-machine interface, slave PLC, sensors/actuators or any other slave device which supports the UNI-TE protocol. If a CCX 17 operator panel is used, addresses 4 and 5 are reserved (addresses forced by using XBT-Z 968 cables).

This operating mode is operational immediately, and consequently, within the limits of the default configuration, no other installation phase is necessary to connect a device on this type of link.

1.3-6 UNI-TELWAY slave

The terminal port UNI-TELWAY slave protocol enables, for example, a slave TSX/PMX/PCX 57 PLC to be integrated on a UNI-TELWAY bus managed by a TSX/PMX/PCX 57 master PLC (PCMCIA communication card or terminal port) or a TSX/PMX model 40 PLC.
For this connection to be possible, a TSX P ACC 01 connection box must be used. The various ways of connecting this box are shown in section 2.

Connection example



A slave PLC manages up to three consecutive link addresses :

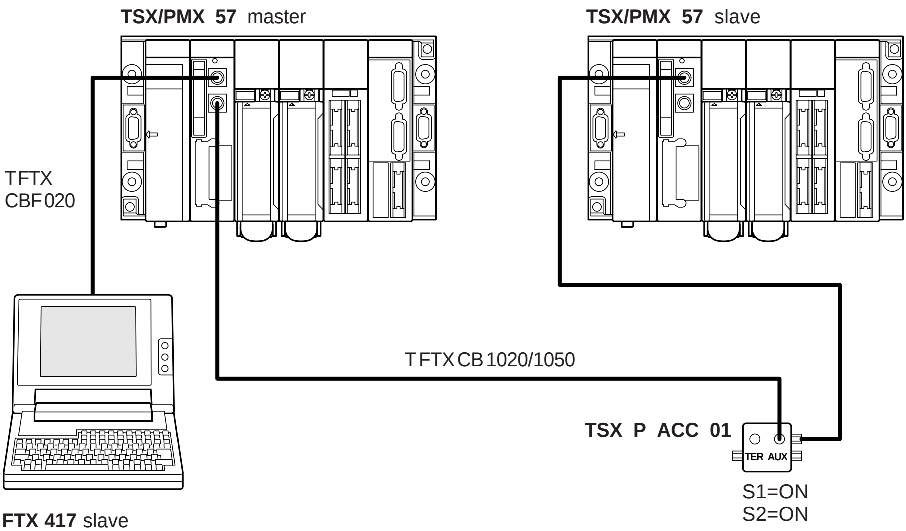
- Ad0 (system address),
- Ad1 (application address - client),
- Ad2 (application address - listen only mode).

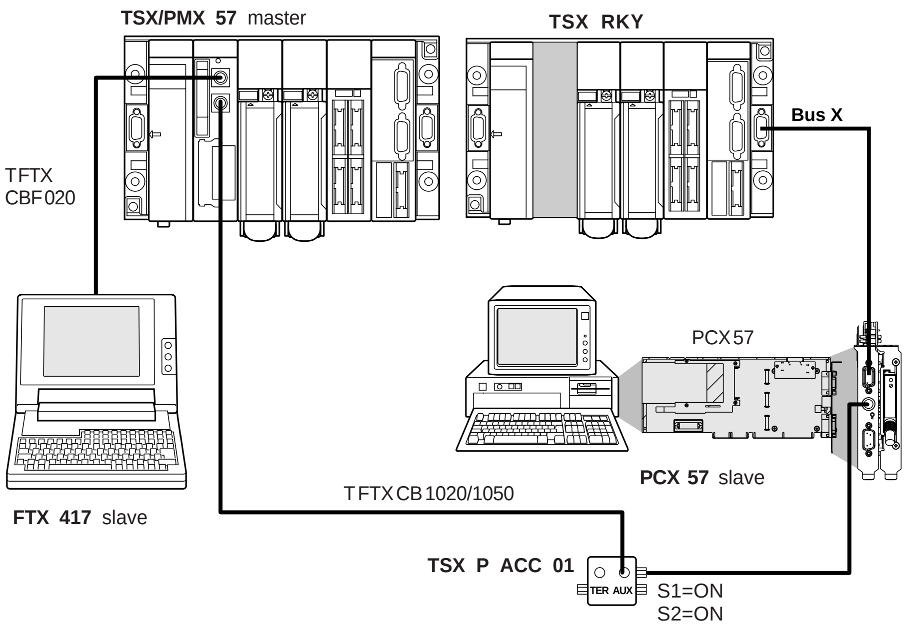
Note :
For the installation of TSX SCA 50 and TSX SCA 62 junction boxes, refer to the TSX DG UTW manual : UNI-TELWAY bus communication (User Guide),

1.3-7 UNI-TELWAY inter-PLC

The terminal port on TSX/PMX 57 processors permits the connection of two PLCs, one of which is the master and the other the slave.

A TSX P ACC 01 box is essential for this type of connection. The various ways of connecting this box are given in section 2.



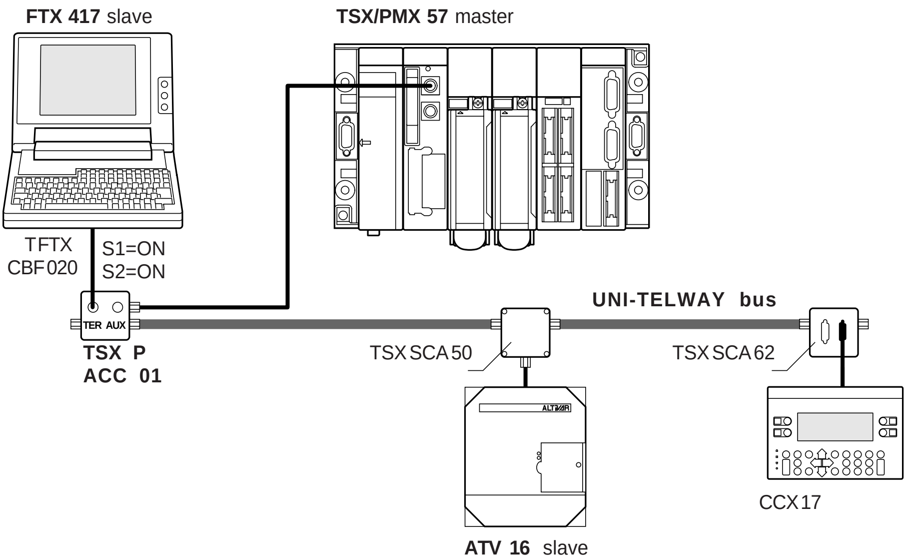


1.3-8 UNI-TELWAY inter-device

The terminal port on TSX/PMX/PCX 57 PLCs provides a means of connection to a UNI-TELWAY bus for communication with devices such as variable speed drives, sensors/actuators or other PLCs.

When connecting a TSX/PMX/PCX 57 PLC (master or slave) to a UNI-TELWAY bus it is essential to use a TSX P ACC 01 box. For further details, see section 2.

Connection example



The connected devices communicate with the PLC using the UNI-TE protocol.

The various devices can also communicate between themselves.

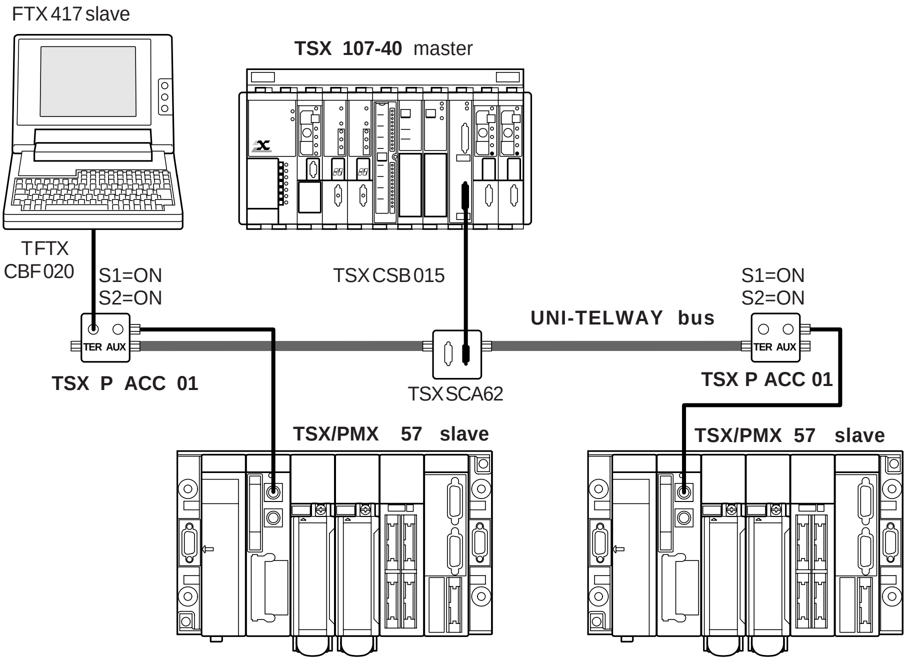
The programming terminal can access all devices directly to perform adjustment and diagnostic functions.

Note :
For the installation of TSX SCA 50 and TSX SCA 62 junction boxes, refer to the TSX DG UTW manual : UNI-TELWAY bus communication (User guide),

1.3-9 TSX model 40 master PLC

A TSX/PMX model 40 PLC can also be configured in UNI-TELWAY bus master mode and can control TSX/PMX/PCX 57 slave PLCs.

Connection example

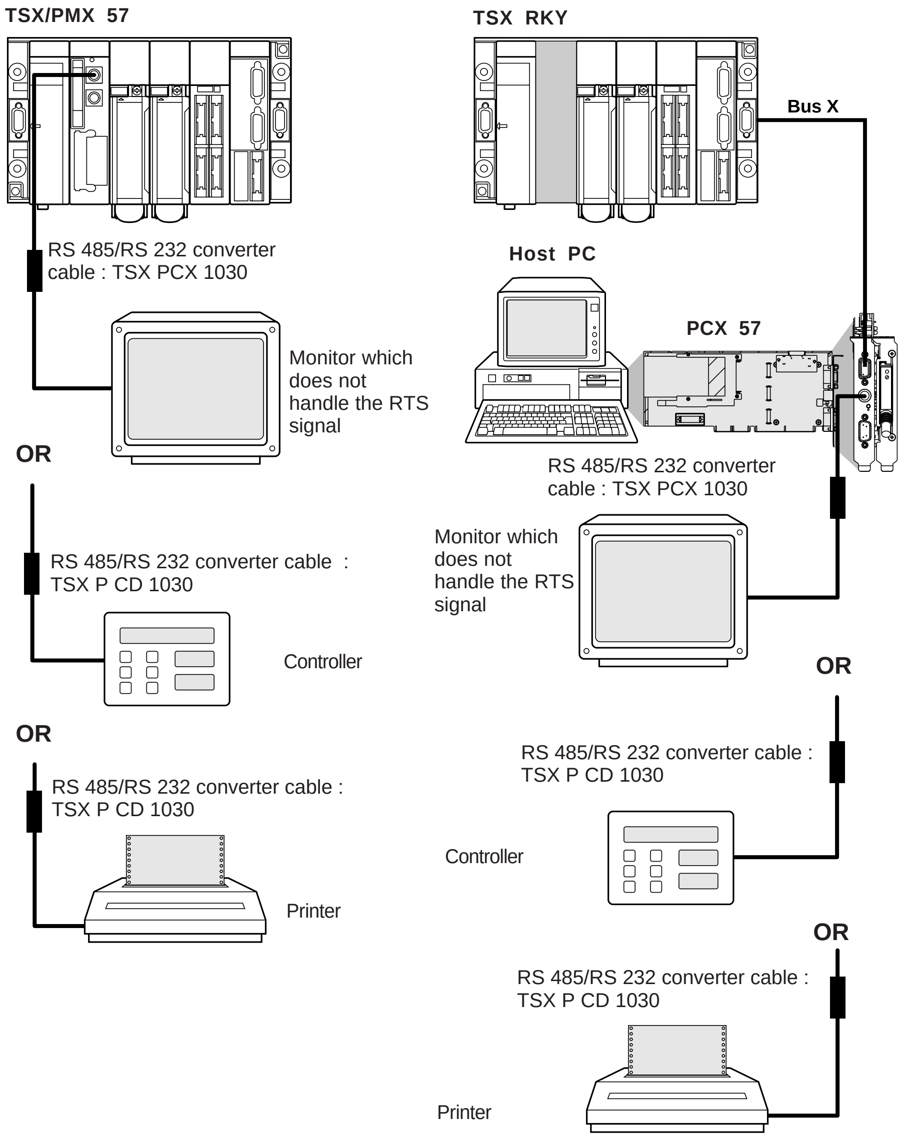


Note :
For the installation of TSX SCA 50 and TSX SCA 62 junction boxes, refer to the TSX DG UTW manual : UNI-TELWAY bus communication (User guide),

1.3-10 Character string

When configured in character mode, the terminal port can be used to connect a device such as a printer, monitor, or specialized panel (panel mounted controller for example, etc).

Connection examples



Note :
The TSX P CD 1030 cable provides the RS485 / RS232 conversion, and supplies "slave peripheral" information to the printer. It does not operate on the AUX terminal port and **the connected device must handle the RTS signal.**

Warning :

The TSX PCX 1030 and TSX PCX 1130 cables should only be connected to the PLC TER port to supply the RS485 / RS 232 conversion electronics. To avoid conflicting signals, devices should not be connected to the PLC AUX port.
To ensure all types of connection, cables are provided with adaptors.
The TSX PCX 1030 cable is provided with two adaptors / converters :
TSX CTC 07 : 9-pin male to 25-pin female,
TSX CTC 10 : 9-pin male to 25-pin male.
The TSX PCX 1130 cable is provided with one adaptor / converter :
TSX CTC 09 : 9-pin male to 25-pin male.

1.3-11 Terminal port connection summary table

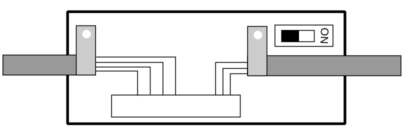
The table below defines the cable linking the terminal port connectors on a TSX/PMX/PCX 57 PLC to peripheral equipment.

Connection cable	PLC terminal ports		Example of connected devices
	TER	AUX	
T FTX CB 1020 T FTX CB 1050		X	TSX P ACC 01
T FTX CBF 020	X	X	FTX 507, FTX 417
TSX P CU 1030	X		RS 232 programming and adjustment terminals
TSX P CD 1030	X		Graphic terminals, printers, managing the RTS signal
XBT-Z 968	X	X	CCX 17, XBT
TSX P ACC 01	X		UNI-TELWAY connection
TSX PCX 1030	X		Devices which do not manage the RTS signal, type DTE <--> DTE : programming terminals, RS 232 printers
TSX PCX 1130	X		Devices which do not manage the RTS signal, type DTE <--> DCE : Modem

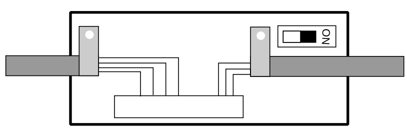
TSX PCX 1030 and TSX PCX 1130 cables convert RS 485 signals to RS 232. They permit connection of the terminal port to RS 232 devices which do not manage the RTS signal.
They are both fitted with a switch for setting the PLC to Master or slave mode. The switch can be accessed internally by removing the metal cover containing the electronics. The switch is managed as follows :

	PL7 configuration UTW master	PL7 configuration UTW slave	PL7 configuration Character mode
Switch position M	UTW master with PL7 conf	UTW master with default conf	UTW master with default conf
Switch position S	UTW slave with default conf.	UTW slave with PL7 conf.	Character mode with PL7 conf.

Switch setting :



Master mode M



Slave mode S

1.4 Appendix

1.4-1 Characteristics

The characteristics of the terminal port are given in the table below :

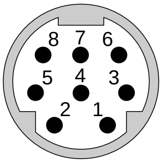
		UNI-TELWAY mode master or slave	**Character mode**
Structure	Physical interface	RS 485 non isolated.	RS 485 non isolated.
Transmission	Protocol	Multidrop master/slave.	No protocol.
	Bit rate	19200 bits/s by default modifiable from 1200 to 1 start bit, 8 data bits, even, odd or no parity, 1 stop bit	9600 bits/s by default modifiable from 1200 to 19200 bits/s. 7 or 8 data bits, even, odd or no parity, with or without echo.
Configuration	Number of devices	Eight maximum (eight addresses managed by the master). In slave mode addresses 4,5,6 are selected by default. In master mode, the reserved addresses are : 1,2,3 for the programming terminal, 4,5 if CCX 17 present, the others are available.	One device (point-to-point).
	Length	10 m maximum.	10 m maximum.
Services	UNI-TE	Requests in point to point with confirmation of 128 bytes maximum initiated by any connected device. No broadcasting initiated by the master.	Character strings of 20 bytes max. The messages must end with $0D (carriage return)
	Other functions	Transparency of communication with any device in a network architecture via the master.	
	Safety	One control character on each frame, acknowledgment and repetition possible.	No error feedback.
	Monitoring	Bus status table, status of devices, error counters are accessible on the slaves.	No flow control.

Note :
Use of a TSX P ACC 01 isolation box enables the RS485 link to be used in isolated mode. See section 2.

1.4-2 Pinout of the terminal port connectors

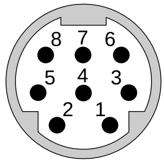
The terminal port has 8-pin mini-DIN lockable connectors marked TER and AUX.

The signals are given below :



TER

1 D (B)
2 D (A)
3 not connected
4 /DE
5 /DPT (1 = master)
6 not connected
7 0 volt
8 5 volts



AUX

1 D (B)
2 D (A)
3 not connected
4 /DE
5 /DPT (1 = master)
6 not connected
7 0 volt
8 not connected

Note :

The operation of the terminal port is dependent on two parameters :

- the state of the /DPT signal (0 or 1), set by the wiring accessory (cable, TSX P ACC 01),
- the software configuration of the terminal port defined under PL7 Junior/Pro.

The table below defines the operating mode of the terminal port according to these two parameters.

/DPT signal value / **Configuration under PL7 Junior/Pro**	**0**	**1**
UNI-TELWAY master	Terminal port in UTW slave mode (by default)	Terminal port in UTW master mode
UNI-TELWAY slave	Terminal port in UTW slave mode	Terminal port in UTW master mode (by default)
Character mode	Terminal port in character mode	Terminal port in UTW master mode (by default)

2.1 Presentation

2.1-1 Functions

The TSX P ACC 01 box is a wiring accessory which connects to the TER connector on the processor of TSX/PMX/PCX 57 PLCs via an integral cable with a mini-DIN connector at one end.

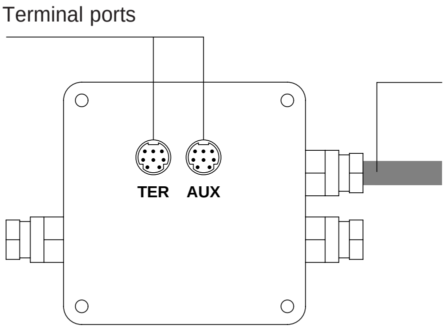
It is used to :

- connect several devices to the terminal port on TSX/PMX/PCX 57 PLCs. For this purpose, it has two mini-DIN connectors, marked TER and AUX, which are functionally identical to the TER and AUX connectors on TSX/PMX 57 •• PLC processors,
- isolate UNI-TELWAY signals so that the Premium terminal port link can be extended to more than 10 meters when connecting the PLC to a UNI-TELWAY bus,
- provide line termination when the box is connected to one end of the UNI-TELWAY bus,
- set the operating mode of the terminal port :
  - UTW master,
  - UTW slave or character mode.

Note :
The two terminal ports of the TSX P ACC01 box, TER and AUX, are not isolated from each other nor from the TER port of the PLC which supplies power to the box.

2.1-2 External appearance

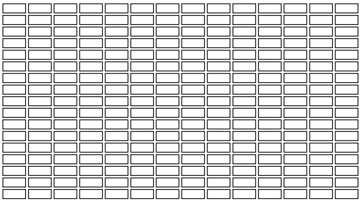
The box is made of zamak, the same as for the UNI-TELWAY T-junction or Y-junction box (TSX SCA 50 and TSX SCA 62). It is designed to be mounted in a cabinet (see dimensions section 2.2-1). Its index of protection is IP 20.



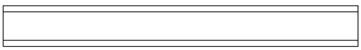
2.2 Hardware installation

2.2-1 Dimensions and fixing

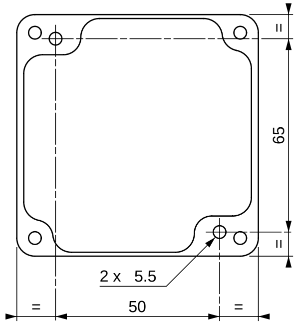
The TSX P ACC 01 box is installed on an AM1-PA ... pre-slotted plate or an AM1-E/DP DIN rail with an LA9 D09976 fixing plate.



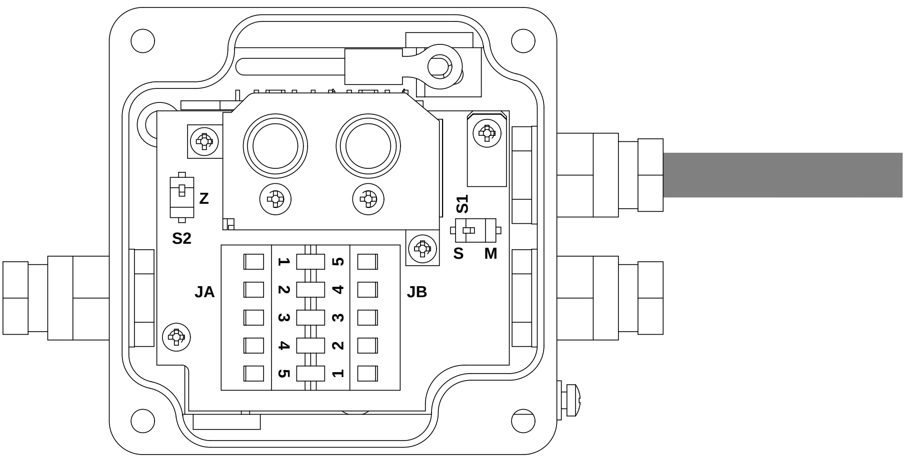
AM1-PA...



AM1 DE/EP



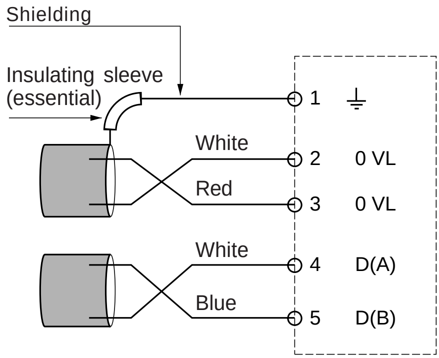
2.2-2 Internal view



S1 Selection of operating mode (master or slave),
S2 Line terminator,
JA and JB UNI-TELWAY bus connection terminals.

2.2-3 Connection to the UNI-TELWAY bus

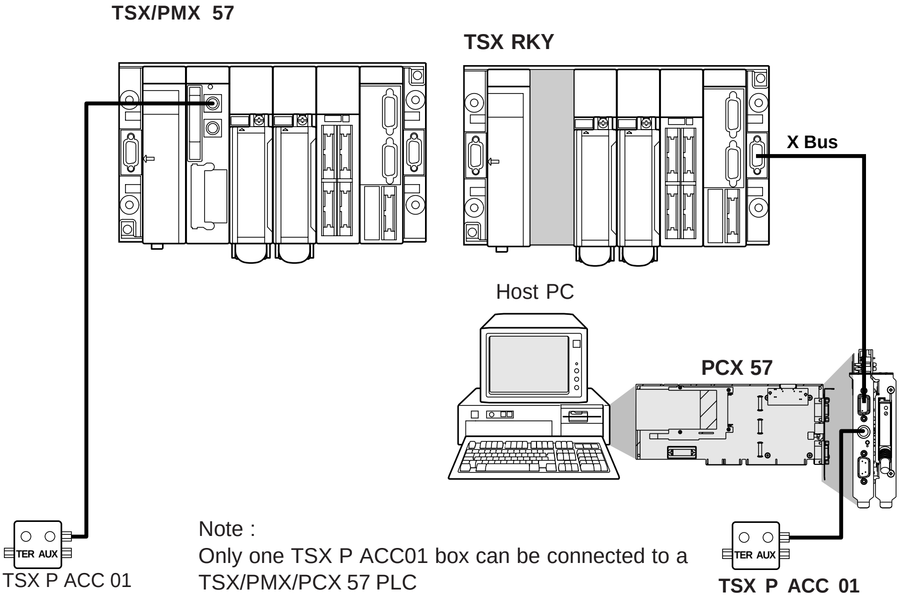
The TSX P ACC 01 box is connected to the UNI-TELWAY bus via connection terminals JA and JB as shown opposite.



2.2-4 Connection to TSX/PMX/PCX 57 PLCs

As the TSX P ACC 01 box has to be supplied, it must be connected by its integral cable to the TER connector on the PLC processor.

The box can be connected or disconnected while the PLC is powered up.



Note :
Only one TSX P ACC01 box can be connected to a TSX/PMX/PCX 57 PLC

2.2-5 Configuring the switches

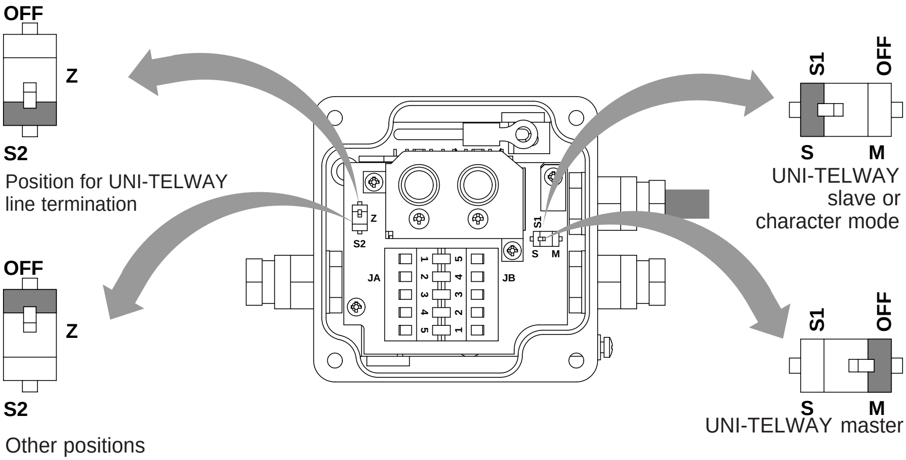
Configuring the line terminator

Switch S2 provides line termination as indicated below :

Configuring the operating mode

The choice of operating mode is determined via switch S1 as indicated below :

Note : The selected operating mode only concerns the cable for connecting the TER connector on the PLC processor



2.3 Examples of topology

2.3-1 Connectable devices

The functions of the TER and AUX connectors on the TSX P ACC 01 box are identical to those of the TER and AUX connectors on the processors of TSX/PMX 57 PLC stations.

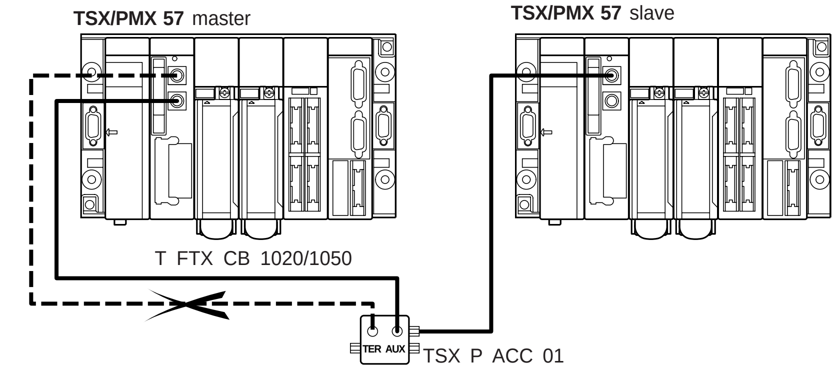
- the TER connector on the box can be used to connect any device supporting the UNI-TELWAY protocol, and in particular devices which do not have their own power supply (RS 485/RS 232 converter cable, etc),
- the AUX connector on the box can only be used to connect devices which have their own power supply (operator panel, third party equipment, etc).

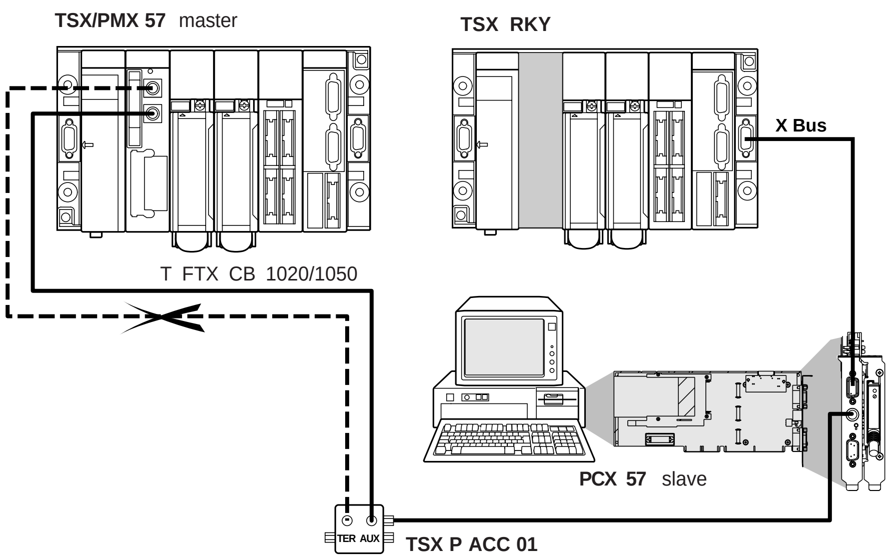
Important

The TSX P ACC 01 box is supplied by the TER connector of the PLC to which it is connected. The TER connector on the box can therefore supply devices which have their own power supply (CCX 17, etc) or those which do not (RS 485/RS 232 converter cable, etc).

If the user wishes to connect the terminal port of a second PLC to one of the connectors on the TSX P ACC 01 box, it is essential that the AUX connector (on the box and the PLC) is used in order to avoid conflict between the two PLC power supplies.

Examples



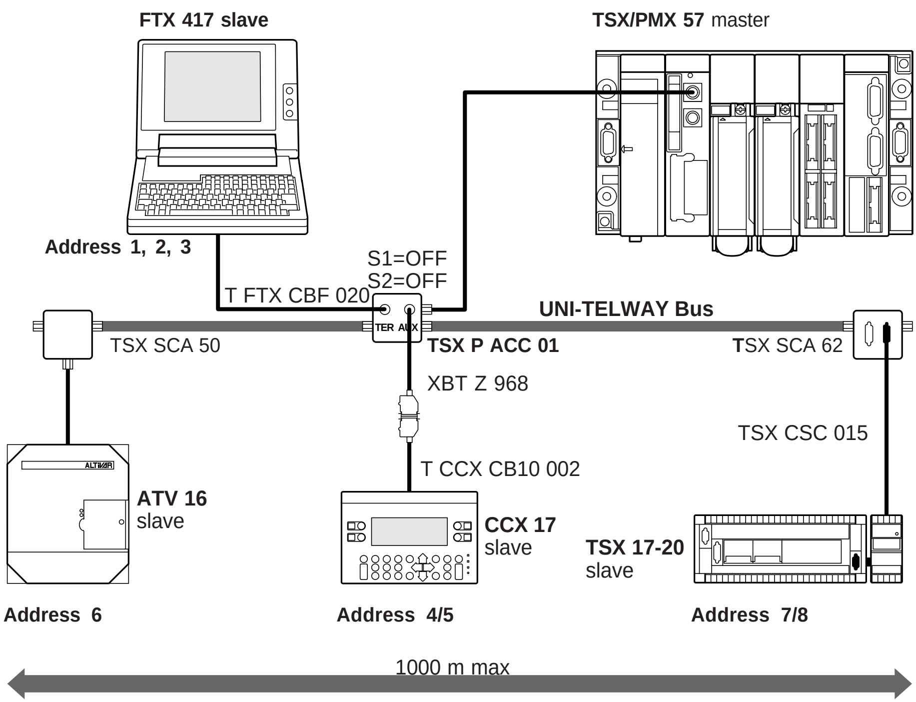


2.3-2 Master mode

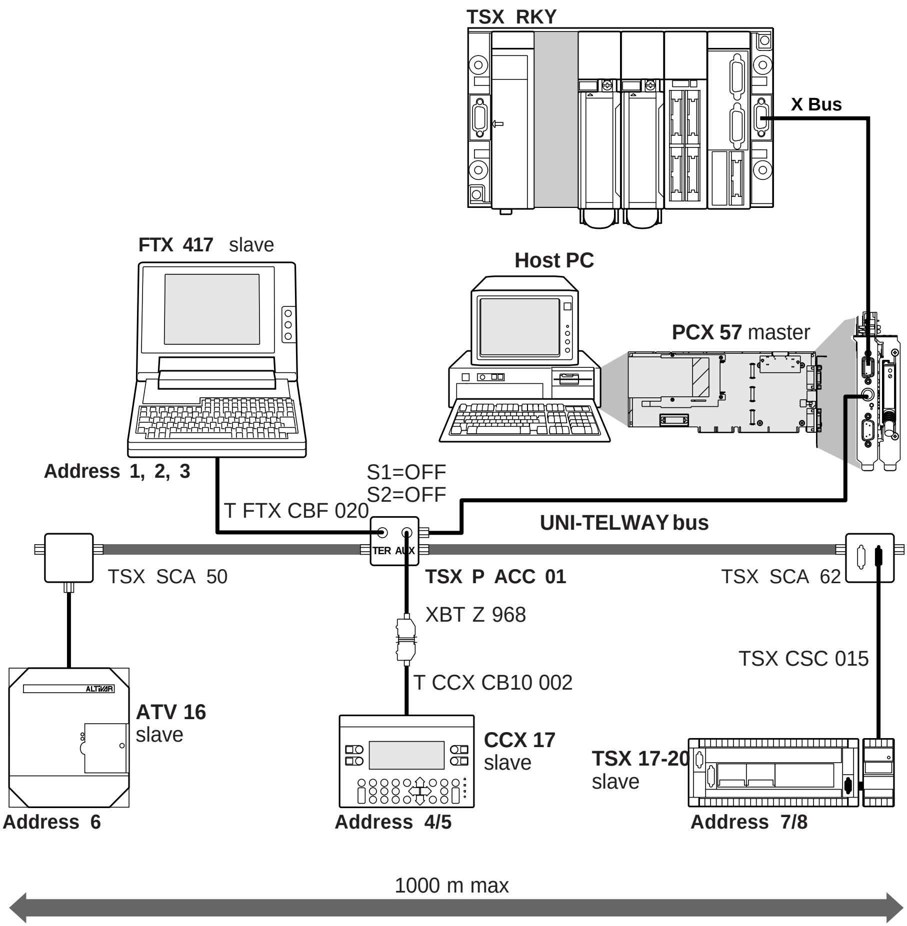
A TSX P ACC 01 box is connected to a master PLC on the UNI-TELWAY link as shown in the example below.

Switches S1 and S2 must be set to OFF (master mode).

- **TSX / PMX 57 station**



- **PCX 57 station**



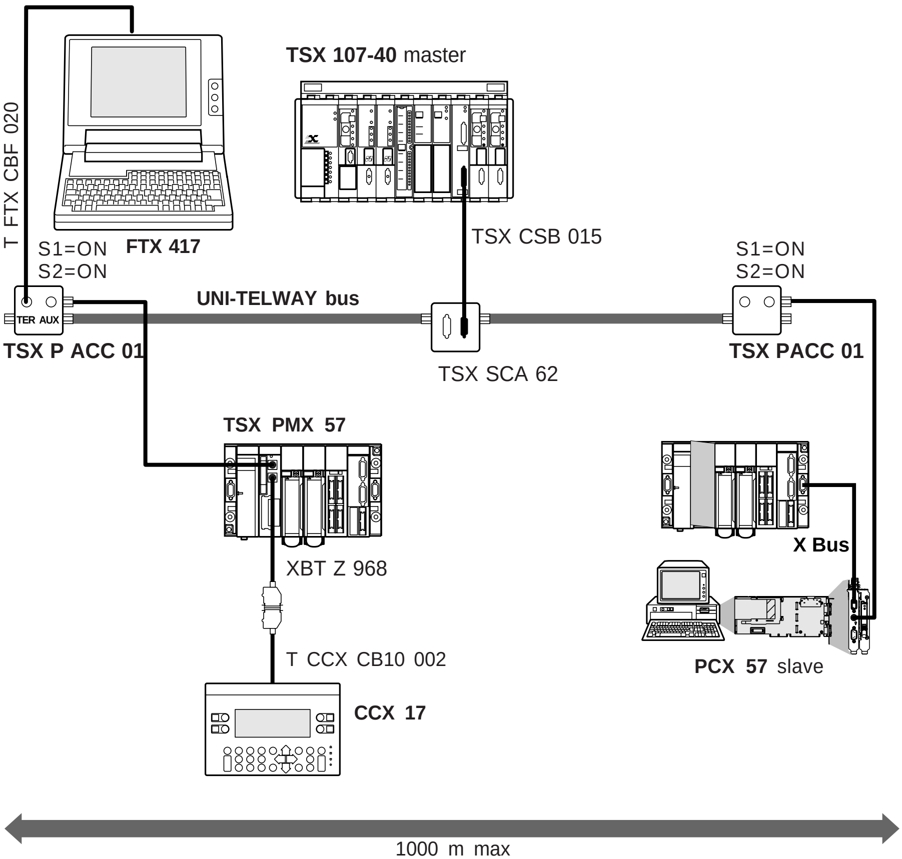
2.3-3 Slave mode

A TSX P ACC 01 box is connected to a slave PLC on the UNI-TELWAY link as shown in the example below.

In this example, switches S1 and S2 on both boxes must be set to ON (slave mode and line termination boxes).

Important

For a PLC to operate in slave mode, it must be connected to a TSX P ACC 01 box by the box integral cable.



2.3-4 Connection between two PLC stations

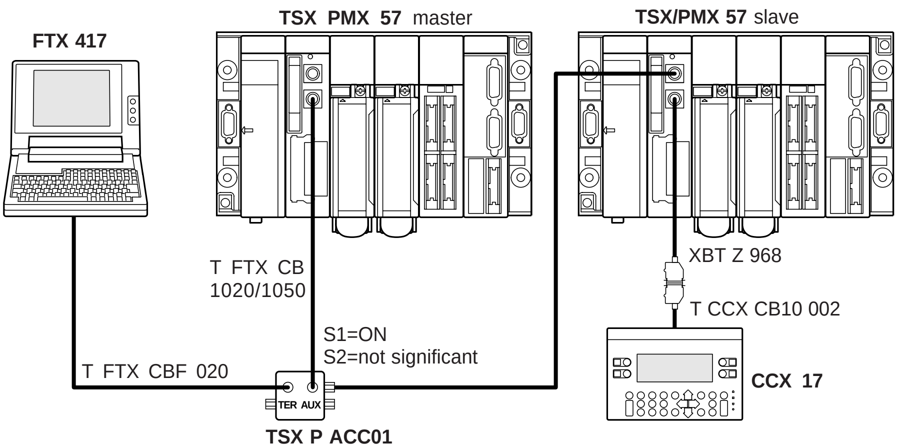
Reminder

If the user wishes to connect the terminal port of a second PLC to one of the TSX P ACC 01 box ports, the AUX port must be used in order to avoid conflict between the power supplies of the two PLCs.

For a PLC to operate in slave mode, it must be connected to a TSX P ACC 01 box by the box integral cable.

In the example below, the TSX P ACC 01 box must be connected to the UNI-TELWAY slave PLC by the box integral cable. Switch S1 must be set to ON.

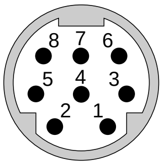
As the box is not situated on a UNI-TELWAY bus, the position of switch S2 is not important.



2.4 TSX P ACC01 box connectors

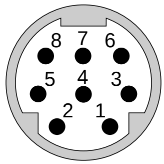
The TSX P ACC 01 box has two parallel connectors, marked TER and AUX.

The signals are given below :



TER

1 D (B)
2 D (A)
3 not connected
4 not connected
5 not connected
6 not connected
7 0 volt
8 5 volts



AUX

1 D (B)
2 D (A)
3 not connected
4 not connected
5 not connected
6 not connected
7 not connected
8 not connected

1.1 Summary of the FIPIO bus

FIPIO is a fieldbus used for remote location of the I/O of a PLC station and its industrial peripheral equipment as close as possible to the operative part.
From a PLC station whose processor has an integrated FIPIO link, the FIPIO bus can be used to connect between 1 and 127 devices, such as :

- Momentum remote I/O modules (discrete and analog),
- TBX remote I/O modules (discrete and analog),
- CCX 17 operator panels,
- ATV16 variable speed drives,
- devices which comply with standard profiles,
- agent PLCs, PCs,
- etc.

The FIPIO fieldbus can be used in a simple architecture (single station) or in a more complex architecture (multiple stations) where several FIPIO segments can be governed by a higher level local area network, FIPWAY or Ethernet TCP_IP for example.

Main characteristics

- **Structure**

- Type	:	open fieldbus, conforming to the WorldFIP standards,
- Topology	:	linking of devices by daisy-chaining or tap link connection,
- Method of access	:	management by a bus arbitrator,
- Communication	:	by exchanging variables which can be accessed by the user in the form of PL7 objects and by X-WAY datagrams.
- Priority exchanges	:	cyclical exchange of status variables and remote I/O commands.

- **Transmission**

- Data rate	:	1 Mb/s
- Medium	:	shielded twisted pair (150 Ohms characteristic impedance).

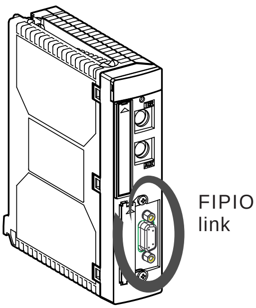
- **Configuration**

- Number of connection points	:	128 logical connection points for the whole architecture,
- Number of segments	:	15 maximum (in cascade) using electrical or optical repeaters (14 maximum in cascade),
- PLC	:	one PLC (connection point address 0),
- Programming terminal	:	one programming terminal (must be connected at connection point 63).
- Length	:	the length of a segment depends on the type of tap links. 1000 meters maximum for one segment without repeaters. 15000 meters maximum between the devices which are furthest apart.

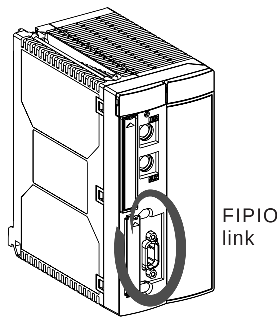
1.2 Integrated FIPIO link on TSX/PMX/PCX 57 processors

Some processors have an integrated master FIPIO link as standard, which can be used to connect the PLC station to a FIPIO bus.

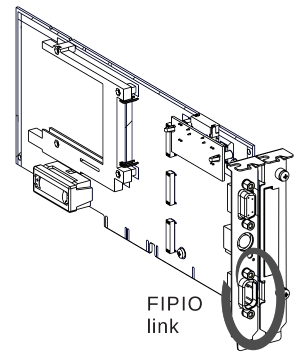
Processors concerned :



TSX P 57 252
TSX P57 352



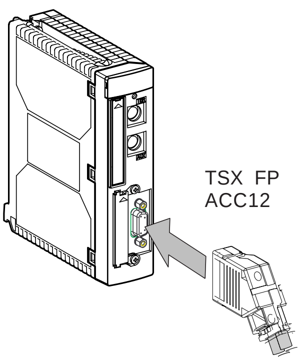
TSX P57 452
PMX P57 352
PMX P57 452

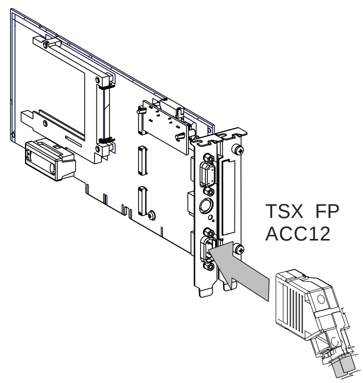


TPCX P57 3512

Connection to the FIPIO bus

The processor has a 9-pin SUB D connector which is used for connection to the FIPIO bus via a TSX FP ACC12 connector.



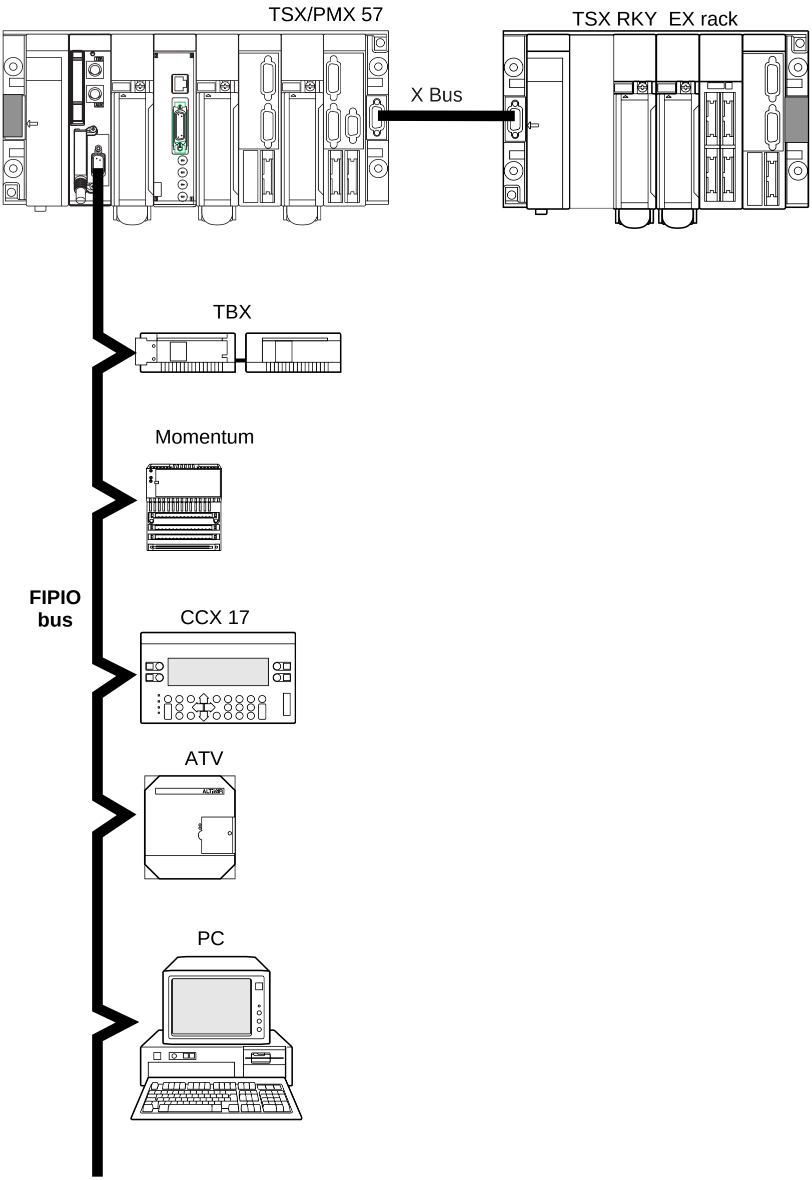


The complete installation of a FIPIO bus (type of architecture, type of cables to use, wiring accessories, etc) is described in detail in the FIPIO bus reference manual.

Note: The master FIPIO link integrated in the processors should not be included when calculating the number of application-specific channels for the station.

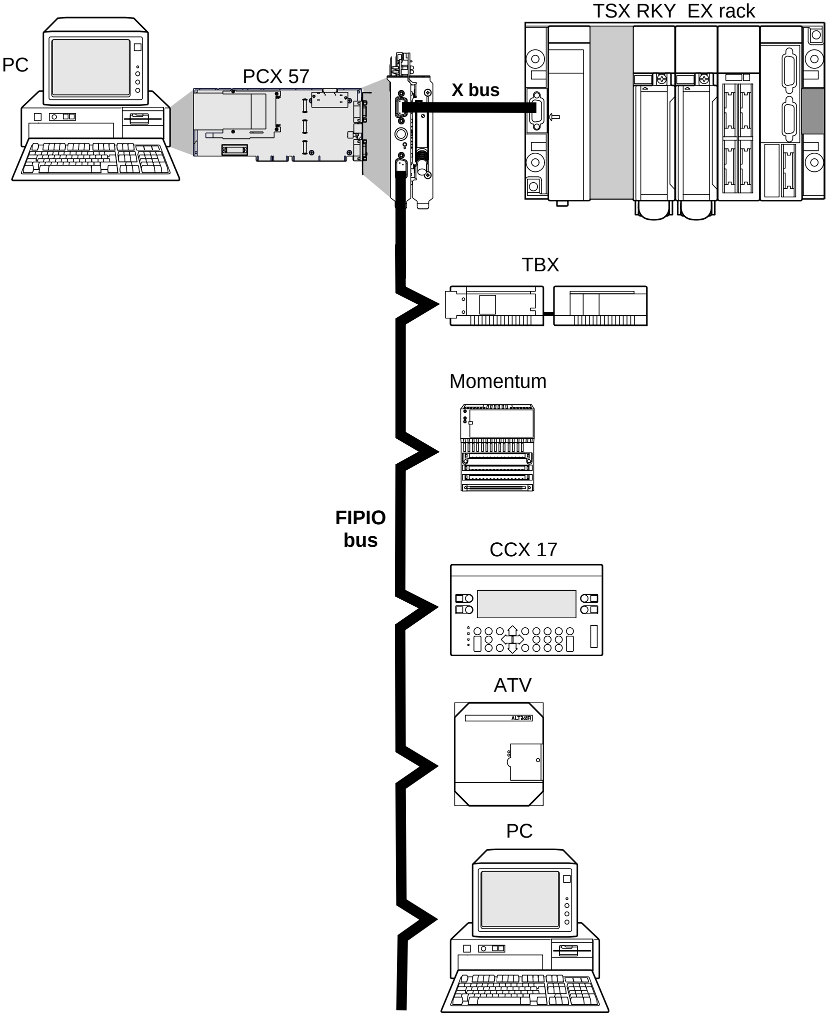
1.3 Examples of architectures

- **TSX / PMX 57 station**



Examples of architectures (continued)

- **PCX 57 station**



C

C

1.1 Preface

This section only covers the hardware installation of the TSX SAY 100 interface module which controls the AS-i bus from a TSX /PMX/PCX 57 PLC. For the complete installation of an AS-i bus, the following manuals should be consulted :

- the AS-i bus reference manual (reference XD0C 5511E) which explains the design and installation of the bus.
- the AS-i section in the application-specific functions installation manual which covers the software setup of an AS-i bus using PL7 Junior and PL7 Pro software.

1.2 Summary of the AS-i bus

The AS-i bus is a fieldbus (level 0), which can be used to connect sensors/actuators. It is used to route discrete data between a bus "master" and sensor/actuator "slaves".

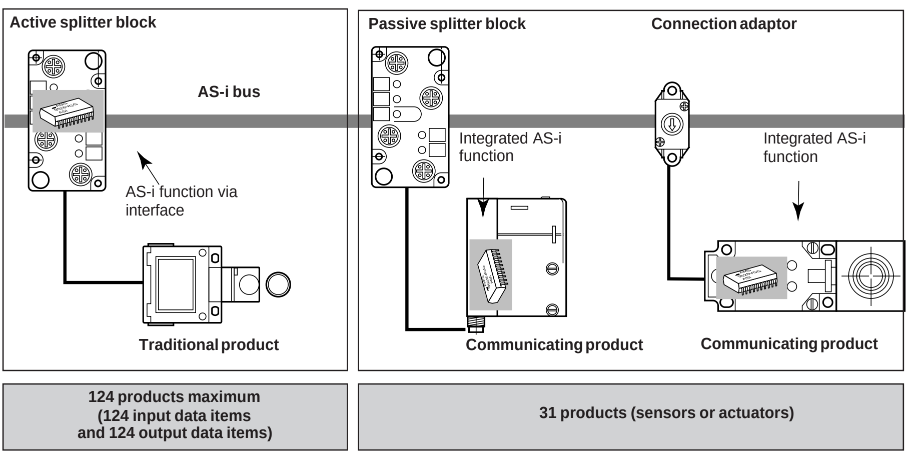
AS-i comprises three main elements :

- a specific power supply providing a voltage of 30 VDC,
- a bus master,
- slaves (sensors and actuators).

The main types of sensor/actuator

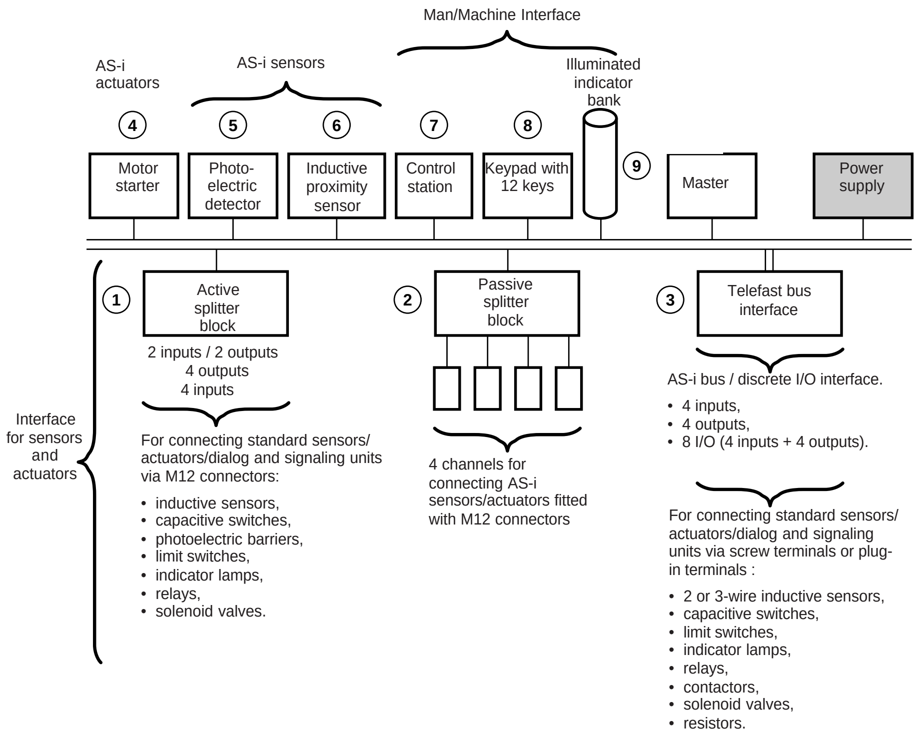
1 Communicating sensors/actuators :
These have the AS-i function built in, and are connected directly to the AS-i bus via a passive splitter block or a connection adaptor.

2 Traditional IP 65 sensors/actuators
These are connected to the bus via an AS-i interface (active splitter block or IP20 Telefast discrete I/O bus interface). These interfaces connect traditional sensors and actuators to the AS-i bus and enable them to communicate on the bus.



1.2-1 Range of AS-i products in the Schneider catalog

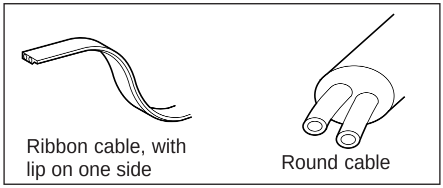
(non-exhaustive list)



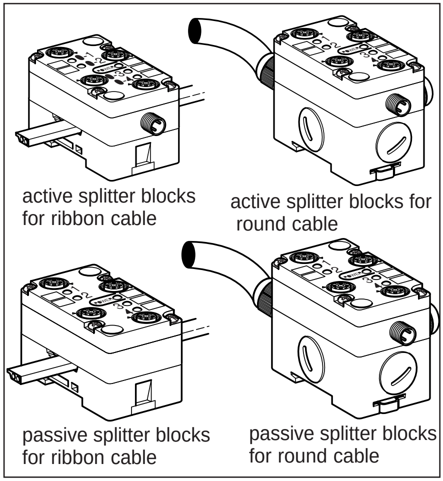
C

1.2-2 Presentation of the main components

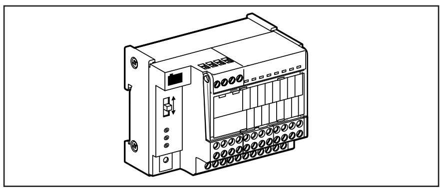
- **The cable**
  This transmits data and carries energy.
  It can consist of :
  - either a two-wire ribbon AS-i cable, which is not shielded and has a lip on one side to prevent incorrect insertion,
  - or a standard two-wire round cable, which may optionally be shielded,



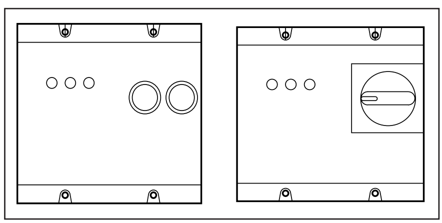
- **Active① and passive② splitter blocks**
  IP67 dust and damp proof interfaces for connecting sensors/actuators using M12 connectors :
  - Active splitter blocks, with the AS-i function built in, are used for connecting "traditional" non-communicating sensors/actuators.
  - Passive splitter blocks do not have any electronics and are used for connecting "communicating" sensors/actuators.



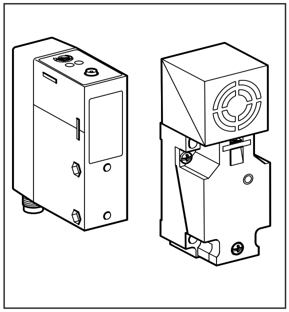
- **The Telefast SB2 bus/discrete I/O interface** ③
  IP20 dust and damp proof interface with the AS-i function built in. They are used for connecting all types of "traditional" non-communicating sensors/actuators via screw terminals.



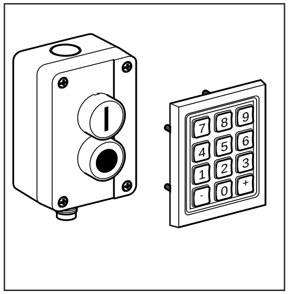
- **AS-i actuators** ④
  D.O.L. motor starters and reversers in dust and damp proof enclosures (IP54 and IP65), are used for the control and protection of electrical motors up to 4 KW at 400VAC.



- **AS-i sensors**
  - Photoelectric detectors⑤ :
    These detect all types of object (opaque, reflective, etc) using 5 basic systems (thru-beam, reflex, polarized reflex, diffuse and diffuse with background suppression). They have IP67 protection.
  - Inductive proximity sensors ⑥:
    These detect any metal object and supply information to the object presence/absence checking functions. They have IP67 protection.

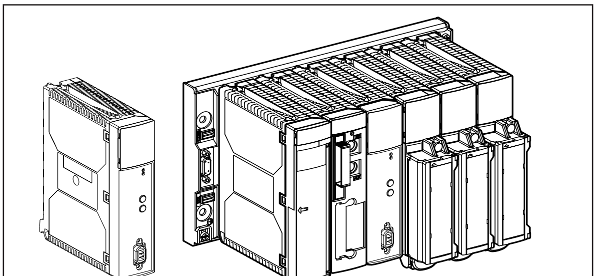


- **Man/machine interface products**
  - Control stations⑦ :
    These are man/machine interface tools which are ideally suited to exchange data between operator and machine. They have IP65 protection.
  - Keypads⑧ :
    Man/machine interface tools with 12 tactile feedback keys. The data supplied is BCD encoded on 4 bits. They have IP65 protection.

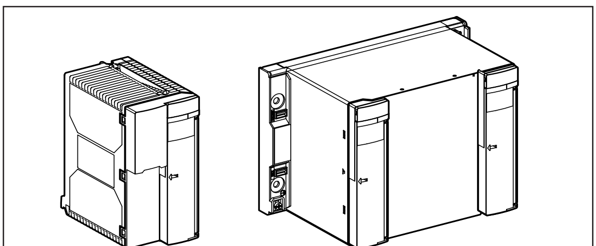


- **Signaling elements :**
  - Illuminated indicator banks ⑨ :
    optical or audible signaling elements.

- **The bus master**
  Integrated in a TSX/PMX/PCX 57 PLC station, the TSX SAY 100 module (AS-i bus master) manages all the data exchanges on the AS-i bus.

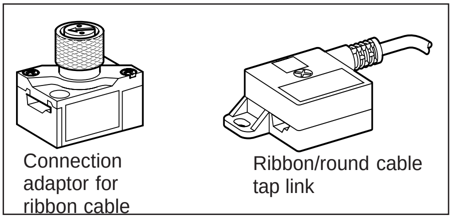

TSX SAY 100 TSX/PMX/PCX 57 station

- **AS-i power supplies**
  Specific AS-i power supplies, for supplying components connected to the AS-i bus.
  This power supply is distributed via the same medium as that used for data exchanges.

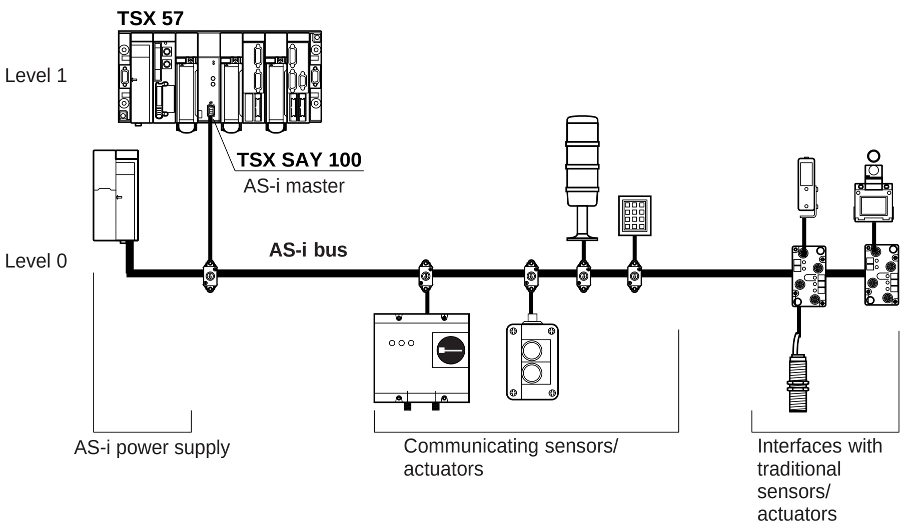

TSX SUP A02 TSX SUP A05

- **Connection and tap-link accessories**

  Connection to the AS-i bus is via connection adaptors designed for connecting to AS-i ribbon cable or ribbon/ round cable tap links.



1.2-3 Example of an AS-i bus topology



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1.2-4 Main characteristics of the AS-i bus

AS-i is a system on which data exchanges are managed by a single master which calls each detected slave one after the other by scanning the bus and waits for its answer.
The serial communication frame carries :

- 4 data bits (D0 to D3), which are the image of the inputs or the outputs, depending on the type of interface,
- 4 parameter bits (P0 to P3), which are used to define the operating modes of the interface.
  Bits P0 to P3 are used for "intelligent" devices which have an AS-i ASIC. Operation can be modified while running.

The address of the slave concerned is coded on 5 bits.
In the AS-i master request, the outputs are set and the AS-i device inputs are fed back in the answer from the slave.

Addressing of slaves :

Each slave connected to the AS-i bus must have an address between 1 and 31 (coded on 5 bits). When delivered from the factory, slaves have address 0 (the address of the slave is stored in non-volatile memory). The address is programmed using an XZMC11 special addressing terminal.

Note: If a faulty slave, whose address has been defined, is replaced, the address of the replacement slave can be updated automatically.

Identification of slaves :

All slave devices connected to the AS-i bus are identified by:

- an I/O Code (I/O distribution code),
- an identification code, which completes the functional identification of the slave.

These identifications enable the AS-i master to recognize the configuration on the bus.
The various profiles have been produced by the AS-i bus association, and are used to distinguish input and output modules, mixed modules, families of "intelligent" devices, etc.

Maximum number of I/O :

An AS-i bus can take up to 31 slaves. Each slave can have up to 4 inputs and/or 4 outputs.
Thus up to 124 inputs + 124 outputs, that is 248 discrete I/O, can be managed, where all the active devices have 4 inputs and 4 outputs.

AS-i cable :

The AS-i cable is a two-wire link on which communication and power are transmitted to the connected devices. It is not necessary for the link to be twisted, and the wire cross-section can be 2 x 0.75 mm^2 , 2 x 1.5 mm^2 or 2 x 2.5 mm^2, depending on the current consumption of the devices.

Topology and maximum length of the AS-i bus :

The topology of the AS-i bus is totally flexible and can be adapted to users' requirements (point-to-point, line, tree-structure topology). In all cases, the total length of all the branches of the bus must not exceed 100 meters without using a repeater.

AS-i bus cycle time (slave - TSX SAY 100) :

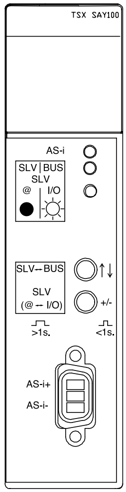
The AS-i system always transmits data of an identical length to each slave on the bus. The AS-i cycle time depends on the number of slaves connected on the bus (with 31 slaves present, all operating, this time will be 5 ms maximum).

Reliability, flexibility :

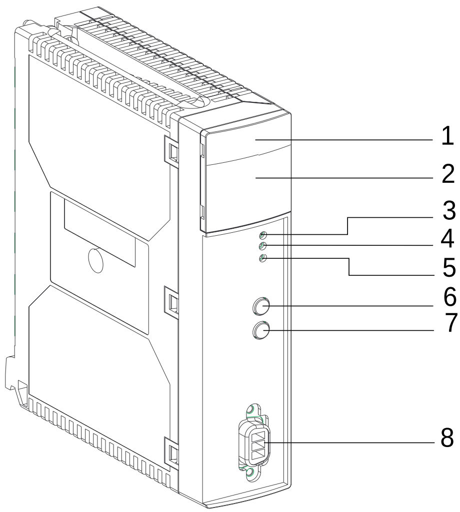
The transmission procedure used (current modulation and Manchester code) ensures reliable operation. The master monitors the line supply voltage and the data transmitted. It detects transmission errors and slave failures and transmits the information to the PLC.
Exchanging or connecting a new slave during operation does not disturb the communication by the master with the other slaves.

1.3 Description of the TSX SAY 100 module

1.3-1 Physical presentation



Front panel



The TSX SAY 100 is a standard format module.
It consists of the following components :

1 Display block comprising 4 status indicator lamps for displaying the module operating modes :

- Green RUN indicator lamp : on during normal module operation,
- Red ERR indicator lamp : when on, it indicates a module fault,
- Green COM indicator lamp : when on, it indicates data exchanges on the AS-i medium,
- Red I/O indicator lamp : when on, it indicates an external I/O fault on the AS-i bus.

2 Display block comprising 32 indicator lamps (0 to 31) for diagnostics of the AS-i bus and display of the state of each slave connected on the bus.

3 Red AS-i indicator lamp : when on, it indicates a fault on the AS-i power supply,

4 Green BUS indicator lamp : when on, it indicates that display block **2** is in Bus display mode (displaying the slaves on the bus).

5 Green I/O indicator lamp : when on, it indicates that display block **2** is in slave "SLV" display mode (displaying the state of the I/O bits of a selected slave).

6 Pushbutton "↑↓" dedicated to local diagnostics of the AS-i bus. Pressing this pushbutton (long or short presses), combined with the "**+ / -**" pushbutton enables the user to move between the various AS-i bus diagnostic modes.

7 Pushbutton "**+ / -**" dedicated to local diagnostics of the AS-i bus. Pressing this pushbutton (long or short presses), combined with the "↑↓" pushbutton enables the user to move between the various AS-i bus diagnostic modes.

8 CANNON SUB D connector for connection to the AS-i bus.

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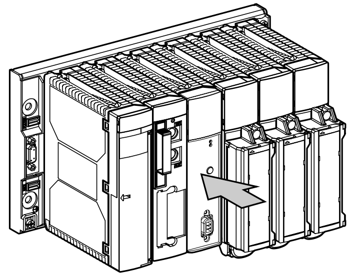
1.3-2 Mounting/installation

The TSX SAY 100 module can be mounted in any position in a TSX RKY rack, except the positions specifically for the processor and the power supply.

Insertion and removal of this module follows the general procedure for inserting and removing modules on TSX/PMX/PCX 57 PLCs (see installation manual for TSX/PMX/PCX 57 PLCs).

Reminder :
The module can be inserted and removed with the PLC power supply and the AS-i bus power supply on.



Example of mounting a TSX SAY 100 module

The maximum number of modules per station depends on the type of processor installed :

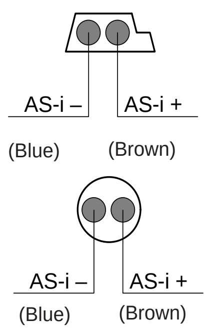
Processor	**Maximum number per station**	
	of AS-i bus connections	**of SAY 100 modules**
TSX / TPMX P57 102 **TPCX 57 1012**	2	2
TSX / TPMX P57 2•2	4	4
TSX P57 3•• / TSX P57 4•• **TPMX P57 352 / 452** **TPCX 57 3512**	8	8

1.3-3 Connections

- **AS-i bus cables**

  These carry the signals and provide the sensors and actuators connected on the bus with a 30 VDC supply.

  - AS-i ribbon cable, with a lip on one side : yellow, wire cross-section 1.5 mm^2.
  - standard round cable with 1.5 mm^2 or 2.5 mm^2 cross-section wires.
    Recommended cable : reference H05VV-F2x1.5, complying with standard DIN VDE 0281. Wire cross-section 1.5 mm^2.



Cable routing

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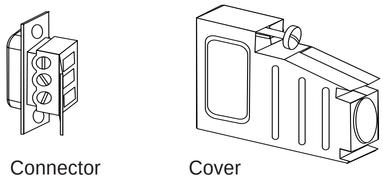
The AS-i cable and high energy power cables must be in separate ducting, and protected by a metal screen,

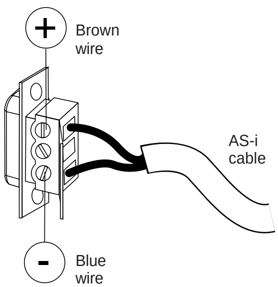
When the AS-i cable is routed together with the control cables, it is essential that the connections on these control links are made in accordance with standard practice (discharge diode or peak limiters on the terminals of inductive elements, etc).

- **Connection of the module to the AS-i bus**

A kit (connector + cover) is supplied with the module for connecting it to the AS-i bus. This connector must be connected to the AS-i bus cable and assembled by the user in accordance with the steps described below.

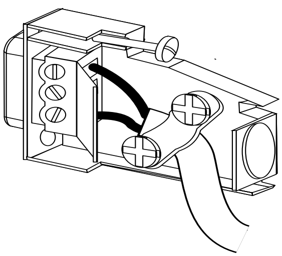


1 Connect the 2 wires of the AS-i cable to the connector observing the correct polarity.

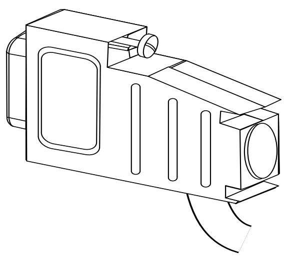


If in exceptional circumstances a shielded cable is used, this should be connected to the central terminal.

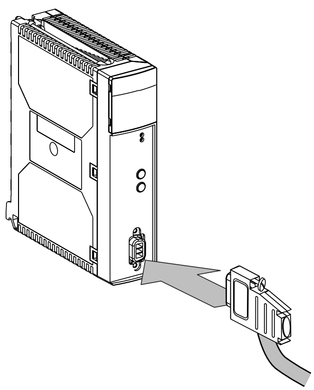
2 Insert the connector in its cover and secure the cable to the cover.



3 Close the cover by snapping it shut.



4 Mount the assembled unit on the module.



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1.3-4 Displaying the module status

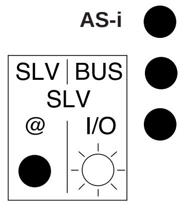
This is performed by 4 indicator lamps (RUN, ERR, COM, I/O) located on the module which inform the user by their state (indicator lamp off, flashing or on) of the operating mode of the module :

State / Indic.	On	Flashing	Off
RUN (green)	Module operating normally	Module self-tests (1)	Module faulty, or module off
ERR (red)	Serious internal fault, module failure	Module self-tests (1) Fault : system OK but • application faulty or, • fault on AS-i bus	No internal fault
COM (green)	—	Module self-tests (1) Communication on the AS-i bus	No communication on the AS-i bus
I/0 (red)	I/O fault	Module self-tests (1)	Module operating normally

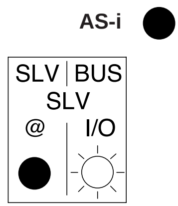
(1) all 4 indicator lamps flash simultaneously during the self-tests when the module is powered up.

1.3-5 Special displays of the TSX SAY 100 module

3 indicator lamps, AS-i, Bus and I/O display data specific to the TSX SAY 100 module :



- **AS-i indicator lamp (red)**

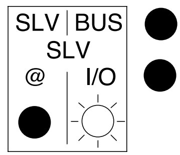


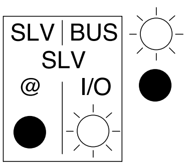
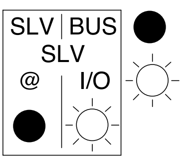
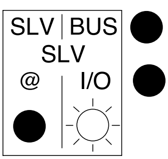
Indicator lamp off : module operating normally

Indicator lamp on : power supply fault on the AS-i bus

Indicator lamp flashing : automatic addressing initialized

- **BUS and I/O indicator lamps**
  These two indicator lamps show the selected display mode :
  - Bus display mode or
  - slave display mode.



Module display	SLV Bus indic.	@I/O indic.	Diagnostics
	On	Off	The 32 indicator lamp display block on the front panel of the module is in BUS display mode which shows the slaves present on the bus.
	Off	On	The 32 indicator lamp display block on the front panel of the module is in slave (SLV) display mode with the state of the I/O bits of the selected slave displayed.
	Off	Off	The 32 indicator lamp display block on the front panel of the module is in slave (SLV) display mode with the address of the selected slave displayed.

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1.3-6 Technical characteristics

AS-i bus	AS-i bus maximum cycle time	5 ms
	Maximum number of slaves on the AS-i bus	31
	Maximum length of the AS-i bus (including all branches without repeater)	100 meters
	Maximum number of I/O	124 inputs + 124 outputs
	AS-i bus nominal supply voltage	30 VDC
TSX SAY 100 module	Programming the TSX SAY 100 module	using the PL7 Junior or PL7 Pro software
	Response time with 31 slaves (1) for a PLC scan time of 10 ms	typically 27 ms maximum 37 ms
	Calculation of the AS-i scan time for n slaves (normal operation)	156 ms x (n+2) if n < 31 156 ms x (n+1) if n = 31
	Current consumption on the PLC 5V	110 mA typical/ 150 mA max.
	Current consumption on the AS-i 30V	50mA typical/ 60 mA max.
	Dissipated power	2.5 W max.
	Protection against polarity reversal on AS-i bus inputs	Yes
	Degree of protection	IP20
	Operating temperature	0 to 60°C
	AS-i master profile	M2
	Standards and operating conditions	in accordance with those for Premium PLCs. (see Volume 1 - part D)

(1) Program response time = time between an AS-i input activated on the bus, processed in the PLC application and applied to an AS-i output.

1.3-7 Safety of personnel

To ensure the safety of personnel, it is essential to :

- connect the PLC ground terminal to earth,
- use a SELV (safety extra low voltage) AS-i power supply, with 30 VDC nominal voltage,
- for PLCs connected to an AC supply, place a residual current device upstream of this supply which will disconnect the PLC power supply source if an earth leakage is detected,
- for PLCs connected to a DC power supply source, ensure that the power supply placed upstream of the PLC is SELV,
- use AS-i certified products on the bus.

Because of its technology and connections, the TSX SAY 100 AS-i module only takes 5 VDC, and its electrical 0 V is connected to the PLC ground.

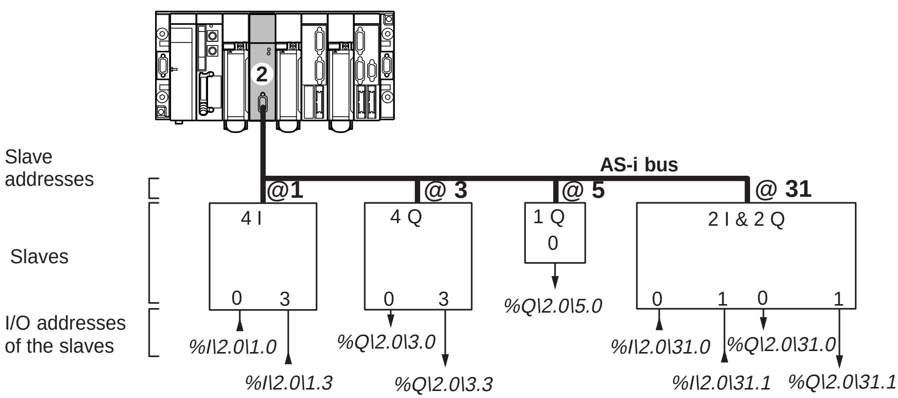
1.4 Addressing I/O objects

Reading the inputs and updating the outputs of the slave devices connected to the AS-i bus are performed automatically, at the beginning and end respectively of each scan of the task in which the TSX SAY 100 module is configured.

The user program can access these inputs and outputs using language objects whose syntax is as follows :

%	I or Q	\	xy.0	\	n	.	i
Symbol	Type of object **I** = input **Q** = output		Module/channel address of the TSX SAY 100 **x** = number of the rack **y**= position number **0**= channel 0 of module		Slave number **0 to 31**		Rank of the bit **0 to 3**

Examples : special case of rack 0
%I\2.0\1.3 indicates : input 3 of slave 1, channel 0 of the TSX SAY 100 module, located in slot 2 of rack 0.
%Q\2.0\31.0 indicates : input 0 of slave 31, channel 0 of the TSX SAY 100 module, located in slot 2 of rack 0.



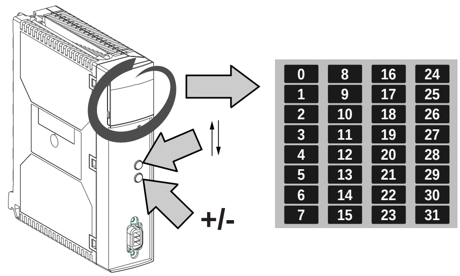
Reminder : the physical address of an AS-i slave is programmed using the XZM C11 portable terminal.

1.5 AS-i bus diagnostics

The module display block is used to :

- display the presence of each slave on the AS-i bus, (Bus mode),
- display the state of the I/O bits of each slave on the bus (Slave mode "SLV").

These modes are accessed by pressing combinations of the (↑↓ and +/-) pushbuttons on the TSX SAY100 module.



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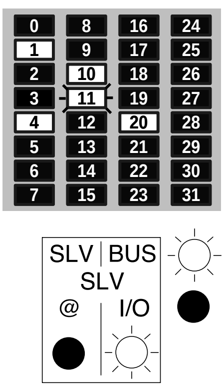
Bus mode

Display of the image of the AS-i bus, each indicator lamp, 1 to 31, corresponds to a slave address on the bus :

- indicator lamp on : slave present,
- indicator lamp flashing : slave projected and not detected, or detected and not projected,
- indicator lamp off : slave neither projected nor detected.

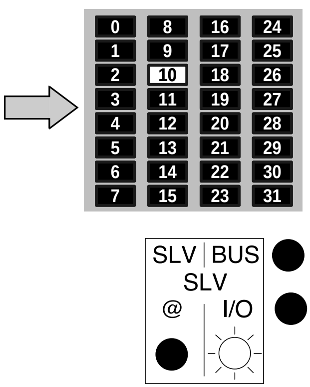


The display mode is indicated when the BUS indicator lamp is on and the I/O indicator lamp is off.

Slave mode (SLV)

Display of the address of the selected slave :

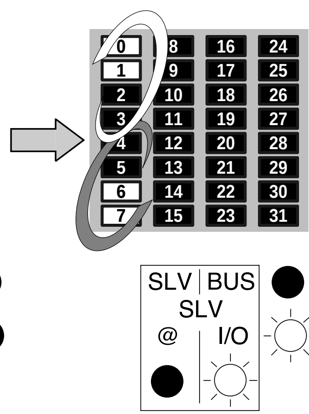
- indicator lamp on: number of the selected slave



The display mode is indicated when both the BUS and I/O indicator lamps are off.

Display of the state of the I/O bits of the selected slave :

- indicator lamps 0 to 3 display the state of the input bits,
- indicator lamps 4 to 7 display the state of the output bits,
- indicator lamp on: bit at state 1,
- indicator lamp off: bit at state 0 or not significant.



The display mode is indicated when the I/O indicator lamp is on and the BUS indicator lamp is off.

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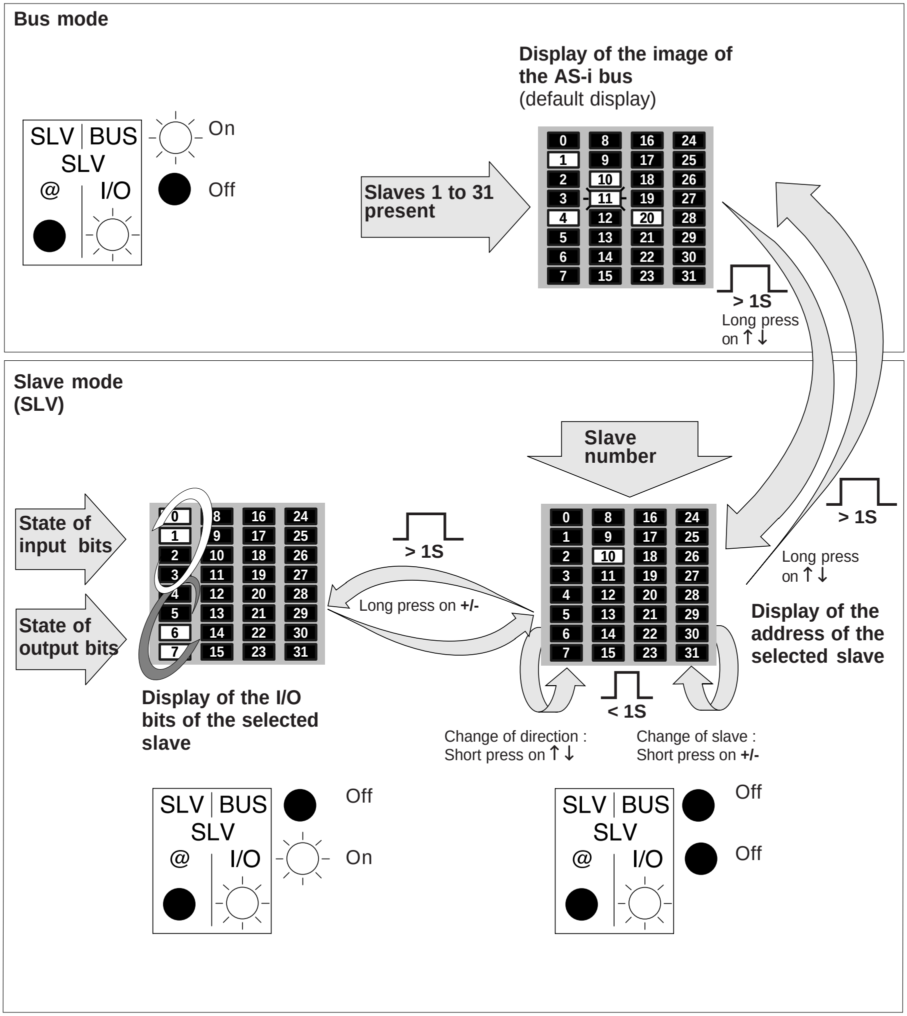
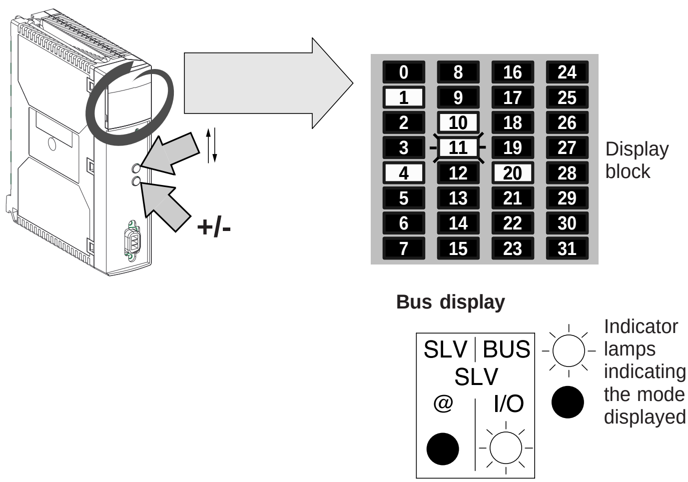
Moving between the various display modes



- **Display of slaves on the AS-i bus (Bus mode)**

  This mode is displayed by default on power-up and shows :
  - slaves which are projected and detected (indicator lamps on, steady),
  - slaves which are neither projected nor detected (indicator lamps off),
  - slaves which are projected and not detected, or which are detected and not projected (indicator lamps flashing).



The image of the AS-i network is displayed on the whole of the display block, with each indicator lamp representing a slave address on the AS-i bus. The user can move between the various modes by pressing combinations of the ↑↓ and +/- pushbuttons (see previous diagram).

Two indicator lamps, "BUS" and "I/O", indicate the current display mode. In this example, the "BUS" indicator lamp is on and the I/O indicator lamp is off indicating that the display is in Bus mode.

In the above example the display block indicates that:
- slaves 1, 4, 10 and 20 (indicator lamps on) are present,
- slave 11 (indicator lamp flashing) is present and not projected, or projected and absent.

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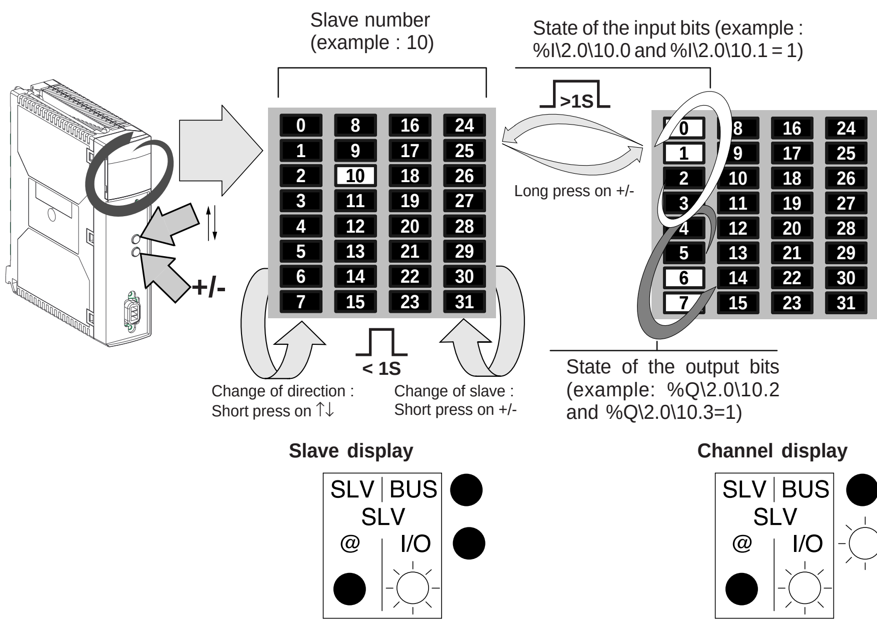
- **Display of the state of the I/O bits of each slave (Slave mode "SLV")**

  The module display block indicates the state of the I/O bits of each slave present on the bus.

  From the Bus mode display :
  - a **long press** on the **(↑↓)** pushbutton on the TSX SAY 100 module changes it to slave "SLV" mode with the display of a slave address (1 to 31) which may be incremented (1 ➔ 31) or decremented (31 ➔ 1), using short presses on the **(+/-)** pushbutton.
    In this case, the "BUS" and "I/O" indicator on the module front panel are off.

  From the display of the selected slave :
  - a **long press** on the **(+/-)** pushbutton on the TSX SAY 100 module displays the state of the I/O bits relating to the selected slave, (indicator lamp on = bit at state 1, indicator lamp off = bit at state 0 or no inputs or outputs). The indicator lamps (0 to 3) in the upper part show the state of the input bits of slave (4 input bits maximum per slave). The indicator lamps (4 to 7) in the lower part show the state of the output bits of slave (4 output bits maximum per slave) .
    In this example, the I/O indicator lamp is on and the BUS indicator lamp is off.



Incrementing or decrementing the slave number

When the PLC display block is in Slave mode (SLV), with a slave number displayed, the user can scan the slaves in an upward (1 ➔ 31) or downward (31 ➔ 1) direction. A short press on the (↑↓) pushbutton on the TSX SAY 100 module changes the direction.

C

1.6 Operating modes of the TSX SAY 100 module

- **Output fallback position**

  The fallback mode is defined in the configuration screen (general parameters) and can be read in word %KW4.0.19 (%KWxy.0.19:X0 = 1 : fallback to 0, %KWxy.0.19:X0 = 0, maintain state).
  See the AS-i section in the application-specific functions installation manual.

  x = rack address
  y = module address

  When the AS-i channel changes to STOP:

  - with the reset to 0 option : the outputs are forced to 0, then communication on the medium stops,
  - with the maintain state option: the state of the outputs is maintained, then communication on the medium stops.

- **Automatic addressing of slaves**

  When this function is validated in the module configuration, a faulty slave can be replaced by a slave of the same type without stopping the AS-i bus and without the necessity for any special operation.
  If the replacement slave is programmed with the same address and it has the same profile, it will be automatically inserted in the list of slaves detected and activated. If this is not the case, the ERR and AS-i indicator lamps flash simultaneously.
  If the new slave is unformatted (address 0, new slave) and it has the same profile, the slave will automatically take the address of the slave which it replaces and will therefore appear in the list of slaves which are detected and in the list of slaves which are active. If this is not the case, the ERR and AS-i indicator lamps flash simultaneously.
  These operations are only possible if a single slave in the configuration is faulty.

- **Processor fault**

  If communication with the processor is broken, the module switches to SAFETY position.
  Causes of the communication break :
  - tripping of the processor watchdog if the TSX SAY 100 module is located in the rack containing the processor,
  - disconnection of the X Bus cable if the TSX SAY 100 module is located in an extension rack.

- **Module fault**
  If there is a serious TSX SAY 100 module fault (faulty component, etc), the module stops communication with the X Bus and with the AS-i bus. The same behavior occurs as when a module is removed while powered up.

- **Removing the module while it is powered up**

  When the module is removed while it is powered up, communication with the X Bus stops, and the processor indicates a module fault.
  Communication on the AS-i bus is also interrupted without warning. In this case, the slaves which have a watchdog set their outputs to the required state and the others remain in the same position and cannot be set to 0 because the module can no longer provide communication.

- **Inserting the module while it is powered up**

  After the TSX SAY 100 module is powered up, it waits to receive the configuration from the processor or for one of the "↑↓"or "+ / " pushbuttons to be pressed, otherwise it remains stopped.

- **Fault on the AS-i power supply**

  When there is a fault on the AS-i power supply module, communication stops and :
  - the outputs of the slaves which have a watchdog are set to the required state, unless the slave draws its power from the AS-i medium.
  - the commands of the slaves change to 0 as a result of loss of power.

  This fault is shown by the AS-i indicator lamp being on.

- **Breaking of the AS-i medium**

  If the medium is broken, there are several possibilities :
  - the medium is cut at the module output : the behavior is the same as when there is a power break, with disappearance of all the slaves and indication of a power supply fault.
  - the medium is cut beyond the TSX SAY 100 module and AS-i power supply assembly : disappearance of all the slaves and no indication of a power supply fault,
  - the medium is cut beyond the TSX SAY 100 module and AS-i power supply assembly and a number of slaves : disappearance of the slaves located beyond the break and no indication of a power supply fault.

1.7 Recommendations for use

1.7-1 24 V auxiliary power supply

If slaves are using a 24 V auxiliary power supply, the disappearance of this power supply is not managed by the TSX SAY 100 module.
Data on the disappearance of this power supply can be fed back using a 24 V input.

1.7-2 Multiple addressing

When connecting one or more slaves, care should be taken not to give them an address which is already in use by a slave on the bus.
If double addressing of slaves occurs, there are two possibilities :

- The two slaves which have the same address also have the same profile and manage identical I/O : the AS-i bus master does not detect any error,
- The two slaves which have the same address manage different I/O : the AS-i bus master may then detect transmission errors when accessing the I/O of one of the two slaves.

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Section **Page**

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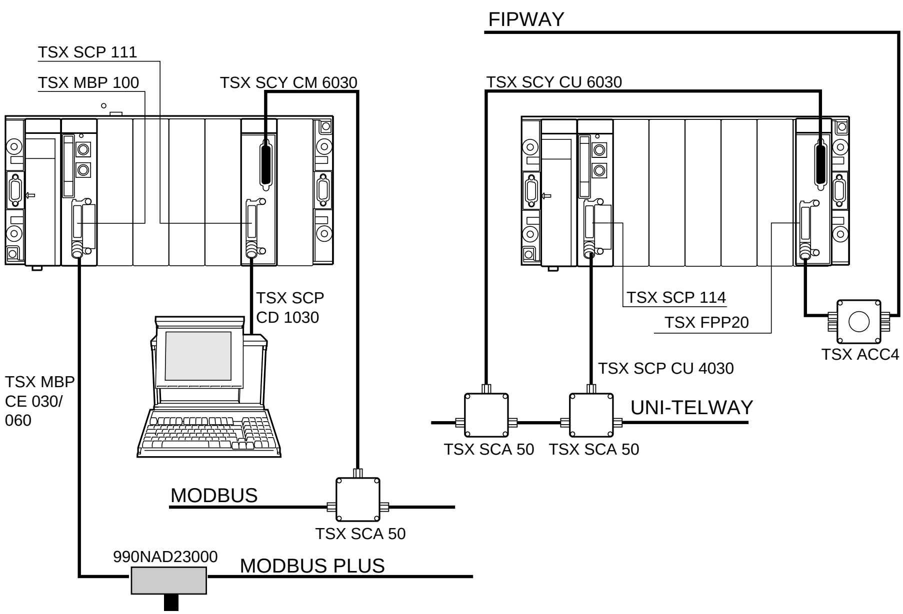
1.1 Structure of network documentation

This manual is aimed at users wishing to install a device with one or more communication networks.
Manuals :
TSX DM57 33E Volume 3: (this document) part D, provides general information regarding hardware aspects of the installation of the various communication cards.
TSX DRNET E : X-WAY reference manual provides an outline of the world of X-WAY communication, an overview of the various networks, and the X-WAY protocols.
Information on the individual networks is given in the following manuals :
TSX DR FPW E : FIPWAY network
TSX DG UTW E : UNI-TELWAY network
TSX DG MDB E : Modbus network
890 USE 100 01 : Modbus + network
TLX DS COM PL7 33E : PL7 communication manual, providing general information on software installation of the various networks.

1.2 General communication architecture



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1.3 Operating standards

The **TSX SCY 21601** module and the **PCMCIA** communication cards comply with the following international standards :

- US standards : UL508, IEC 1131-2
- CANADA standards : CSA C22.2 / 142
- Conforming to regulations : FCC-B
- CE marking
- type III E mechanical PCMCIA standard
- PCMCIA 2.01.

The integrated link of the TSX SCY 21601 module complies with the following communication standards :

- UNI-TELWAY,
- Modbus,
- XWAY.

The TSX FPP 20 FIPWAY and TSX FPP10 FIPIO agent PCMCIA cards comply with the following communication standards :

- FIP protocol (link, network management),
- PCMCIA,
- XWAY.

The TSX SCP 111, 112, 114 PCMCIA cards comply with the following communication standards :

- UNI-TELWAY, Modbus protocols
- PCMCIA,
- XWAY.

2.1 Presentation

The TSX SCY 21601 communication module will take PCMCIA communication cards. It has two communication channels :

- One multiprotocol integrated channel (channel 0), isolated RS485 asynchronous serial link, for UNI-TELWAY, Jbus/Modbus, or Character Mode protocols,
- One PCMCIA host channel (channel 1) which supports the following protocols :
  - UNI-TELWAY, Jbus/Modbus, and Character Mode on an RS232-D, current loop or RS485 link corresponding to the TSX SCP 111, 112 and 114 cards.
  - FIPWAY cell network corresponding to the TSX FPP 20 card,

Important : the TSX SCY21601 module integrated channel is only compatible with a 2-wire RS485 link.

The installation of new functions on the TSX SCY 21601 module means that TSX SCY 21600 communication modules will not be compatible with certain processors in the Premium range :

Processors	**version**	**Communication module**	
		TSX SCY 21600	**TSX SCY 21601**
TSX P57-••	≤ V2	compatible	incompatible
TSX P57-•• TPMX P57-•• TPCX 57-••	≥ V3	incompatible	compatible

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2.2 Description

The TSX SCY 21601 module is a single format module which can be inserted in one of the slots of a TSX/PMX/PCX Premium PLC station rack.

This module comprises the following components :

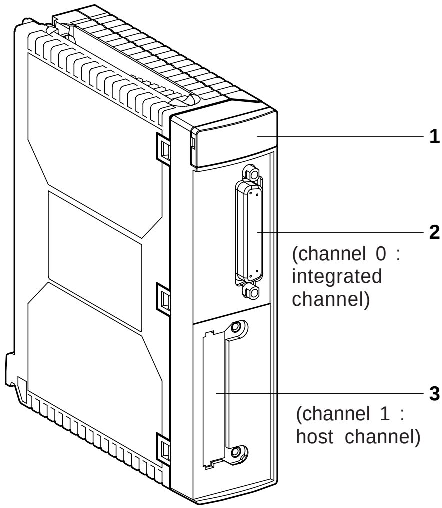
1 Three indicator lamps on the front panel of the module :

- RUN and ERR indicate the module status,
- CH0 displays the communication status of the integrated serial link channel (channel 0),

2 Integrated channel with a 25-pin female SUB-D connector, standard RS485 link in half duplex mode (channel 0) :

- UNI-TELWAY
- Jbus/Modbus
- Character mode

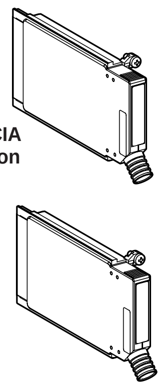
3 Host channel for type III PCMCIA cards (channel 1) :



The various types of communication card which can be integrated in the host channel of the TSX SCY 21601 module

- **TSX SCP111** : multiprotocol card (UNI-TELWAY, Modbus/Jbus, character mode), RS 232 D, 9 non-isolated signals,
- **TSX SCP112 :** multiprotocol card (UNI-TELWAY, Modbus/Jbus, character mode), current loop (20 mA CL),
- **TSX SCP114 :** multiprotocol card (UNI-TELWAY, Modbus/Jbus, character mode), RS 485, compatible with isolated RS 422,
- **TSX FPP 20 :** FIPWAY network cards,

Type 3 PCMCIA communication cards



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2.3 Characteristics of the integrated channel

The integrated channel of the TSX SCY 21601 module comprises :

- an RS485 physical interface,
- a baseband asynchronous mode,
- a double twisted pair medium,
- UNITELWAY, Modbus and Character Mode protocols.

Protocol	UNI-TELWAY	Modbus	Character Mode
Type	Master-slave	Master-slave	Half duplex
Speed	9,600 bits/sec. Can be configured from 1,200 to 19,200 bits/sec	9,600 bits/sec. Can be configured from 1,200 to 19,200 bits/sec	9,600 bits/sec. Can be configured from 1,200 to 19,200 bits/sec
Number of devices	28	28	-
Number of slave addresses	98	98	-
Length of bus excluding tap-links	1000 m.	1000 m.	1000 m.
Size of messages	240 bytes	256 bytes	4 Kb
Service	Message handling Master-slave Slave-slave UNI-TE requests	Read Words/bits Write Words/bits Diagnostics	Transmission of character strings Reception of character strings

2.4 Compatibility of the host channel

The cards accepted by the host channel are :

- TSX SCP 111,112,114 PCMCIA cards which are used for communication with TSX 7, series 1000, Modicon PLCs and other products compatible with UNITELWAY, Jbus/ Modbus and Character mode. PCMCIA cards are also Jbus/Modbus compatible with series 1000 PLCs.

- The TSX FPP 20 card is compatible with FIPWAY devices :
  - model 40 PLCs (TSX 47-455, TSX 67-455 etc) later than version 5.0,
  - TSX 17 PLCs,
  - connected PC compatibles with TSX FPC10 and TSX FPC 20 cards.

Note : the host channel does not accept the TSX FPP 10 card.

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2.5 Installation

The TSX SCY 21601 module is installed in a TSX/PMX/PCX Premium PLC station rack.

It is included in X-WAY network architectures based on TSX series 7, TSX Micro and TSX/PMX/PCX Premium PLCs.

This communication module provides the PLC station with :
- an isolated multiprotocol RS485 communication channel,
- a slot for a PCMCIA standard communication card.

The TSX SCY 21601 module can be installed in any available slot in a TSX/PMX/PCX Premium PLC station.

Maximum number of TSX SCY 21601 modules per station

A TSX 21601 module supports a maximum of 2 communication channels; an RS 485 channel integrated in the module and a channel from the PCMCIA card which can be integrated in the module.
As the number of application-specific channels managed by a PLC station depends on the type of processor installed, the maximum number of TSX SCY 21601 modules in a PLC station thus depends on :
- the type of processor installed,
- the number of application-specific channels already used apart from those used for communication.

The user should therefore review the overall total at station level to determine the number of application-specific channels already used, in order to define the number of TSX 21 601 modules which can be used.

Note :
The calculation of the number of application-specific channels is defined in the manual TSX DM57 2, Volume 1 - part A - section 3.5-3).

Summary of the number of application-specific channels managed by each type of processor

Processors	No. of app.-spec. channels managed
TSX P57 102/TPMX P57 102/TPCX 571012	8
TSX P57 2•2/TPMX P57 202	24
TSX P57 3•2/TPMX P57 352/TPCX 57 3512	32
TSX P57 4•2/TPMX P57 452	48

Insertion / removal :

The TSX SCY 21601 module can be **inserted or removed with the power on**. This device **does not have** memory **protection**. When the module is disconnected from the rack, its internal memory is erased. The module goes through an initialization phase when it is reinserted.

A TSX SCY 21601 module with a PCMCIA card can be removed with the power on.

⚠ PCMCIA cards, however, **cannot be removed** with the power on.

2.6 Operation

The TSX SCY 21601 module is a two-channel communication module from the Premium range which can be installed on TSX RKY racks of a TSX / PMX / PCX 57 PLC station.

It is used for communication between the PLC station and devices with an X-WAY architecture via UNI-TELWAY or Jbus/Modbus fieldbuses or the FIPWAY network.

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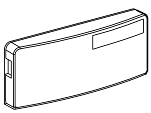
The TSX SCY 21601 module manages two independent communication channels with their own functions :

- Channel 0 handles UNI-TELWAY, Jbus/Modbus, and Character mode protocols on a half duplex RS485 standard isolated physical link, with a speed restricted to 19200 bits per second,
- Channel 1 can take one of the following PCMCIA communication cards :
  - Fieldbus : TSX SCP111 (RS232), TSX SCP112 (current loop), TSX SCP114 (RS 422/ RS485) cards, UNI-TELWAY, Jbus/Modbus and Character Mode,
  - Cell network : TSX FPP 20 FIPWAY card.

The PCMCIA card and protocol can be selected during configuration of the TSX SCY 21601 communication channels using PL7 Junior or PL7 Pro software.

2.7 Module visual diagnostics

There are three indicator lamps on the front panel of TSX SCY 21601 modules. These provide information on the **operating status of the module** and the **communication status** of the **integrated** serial link channel :



RUN (Green)
ERR (Red)
CH0 (Yellow)

The communication status of the **host channel** is indicated by the ERR and COM indicator lamps on the serial link or FIPWAY PCMCIA cards, see section 3.3-5.

The indicator lamps on the TSX SCY 21601 module indicate the operating mode of the integrated channel. These indicator lamps can be : on, off or flashing.

State of indicator lamps

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RUN	ERR	CHO	Comments
○	(1)	(1)	Module powered down, or not operating
●	○	○	No communication on the integrated channel
●	○	●(2)	Communication on the integrated channel
●	●	(1)	Serious fault on the integrated channel
●	◍	○	Fault on the integrated channel, configuration fault, no device OK on the channel
●	◍	◍	Faulty device on the integrated channel
◍	◍	◍	Self-tests

Key :

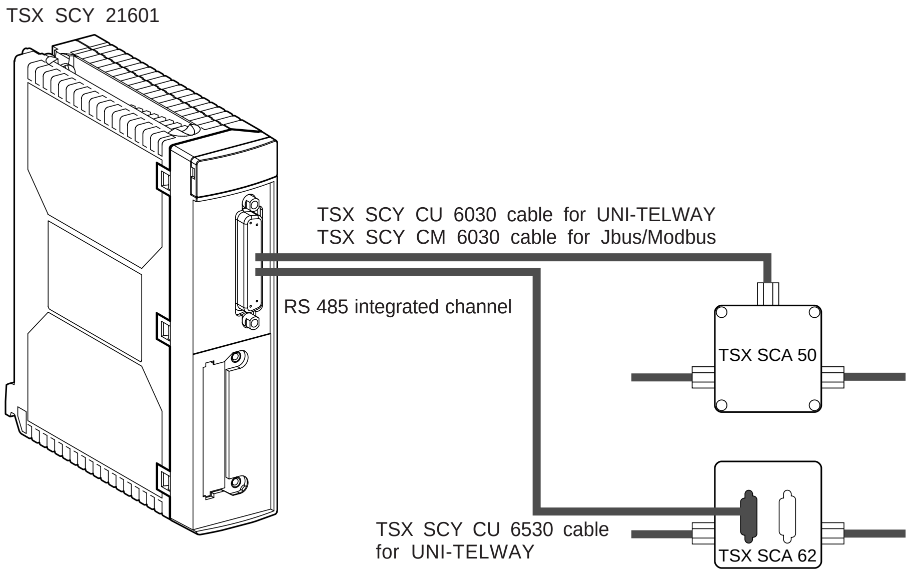
● On
○ Off
◍ Flashing
(1) = state not significant
(2) = line activity display.

2.8 Connection of the integrated channel

2.8-1 Presentation

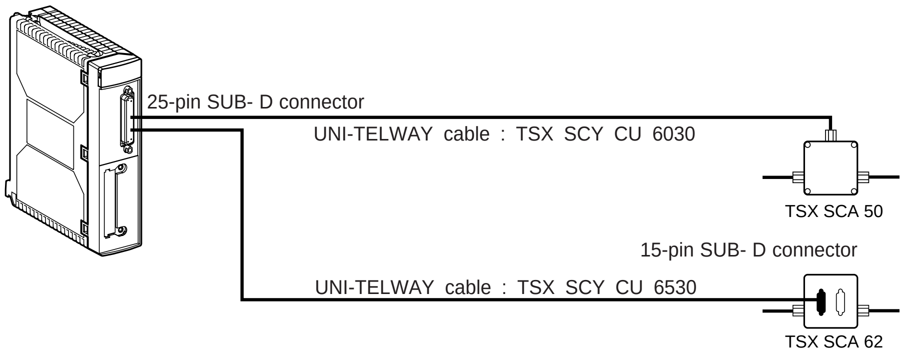
The wiring accessories for connecting the standard RS485 link of the TSX SCY 21601 module enable the following connections :

- connection to the UNI-TELWAY network via a TSX SCA 50 T-junction box with the TSX SCY CU 6030 cable, or via a TSX SCA62 Y-junction box with the TSX SCY CU 6530 cable,
- connection to the Jbus/Modbus network via a TSX SCA 50 T-junction box with the TSX SCY 6030 cable,
- connection to RS485 standard devices using a connector suitable for the link with the TSX SCY CU 6030 or TSX SCY CM 6030 cable.

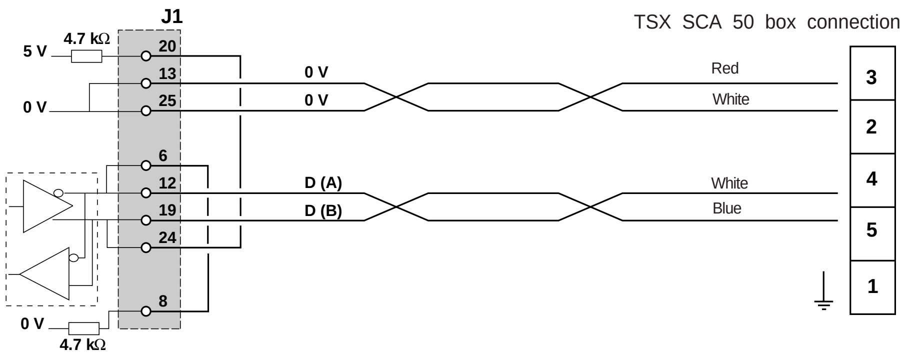


2.8-2 Connection to the UNI-TELWAY fieldbus

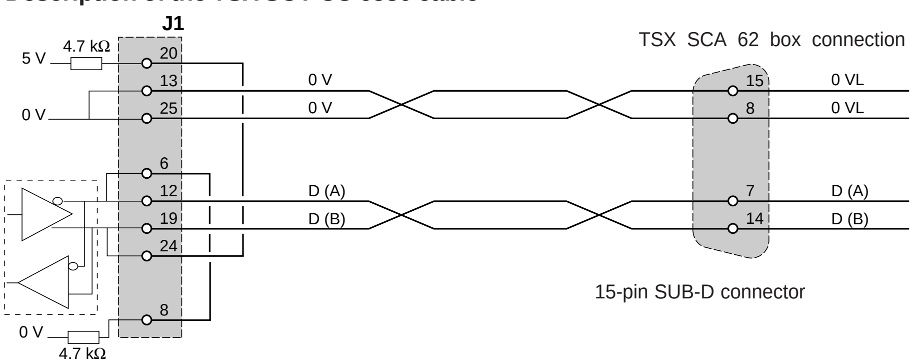
The communication channel integrated in the module is connected to the UNI-TELWAY fieldbus with the **TSX SCY CU 6030** connection cable, via the TSX SCA50 T-junction box.



Description of the TSX SCY CU 6030 cable



Description of the TSX SCY CU 6530 cable



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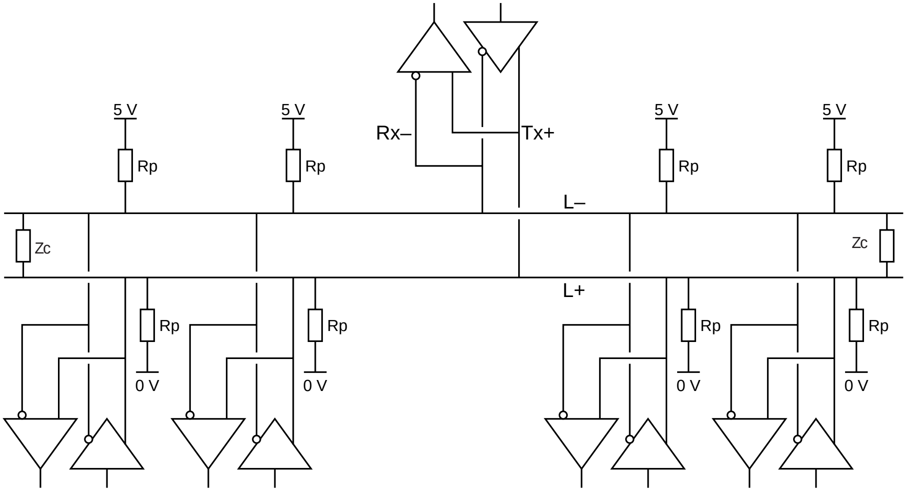
2.8-3 Principle of distributed impedance matching for an RS485 line

This is the type of impedance matching used for UNI-TELWAY networks



The above diagram shows the general architecture of a UNI-TELWAY network.

The network consists of a single shielded twisted pair. The various network stations are connected simply by linking :

- all the outputs marked + (Tx+, Rx+) on the + wire of the network marked (L+),
- all the outputs marked - (Tx-, Rx-) on the - wire of the network marked (L-).

The network impedance is matched by means of two line termination resistors (Zc) located on the stations at both ends of the network.

Distributed polarization of the network is achieved by connecting the L+ wire to the 5 V and the L- wire to the 0 V by means of two polarization resistors (R = 4.7KΩ). This polarization keeps the network stable when it is de-energized. This must be performed for each network station.
The essential features are :

- up to 32 stations,
- maximum length : approximately 1,300 m,
- bus topology,
- tap link ≤ 15 m,
- half duplex on 2 wires,
- line termination on the end stations.
- distributed line impedance matching Rp = 4.7KΩ

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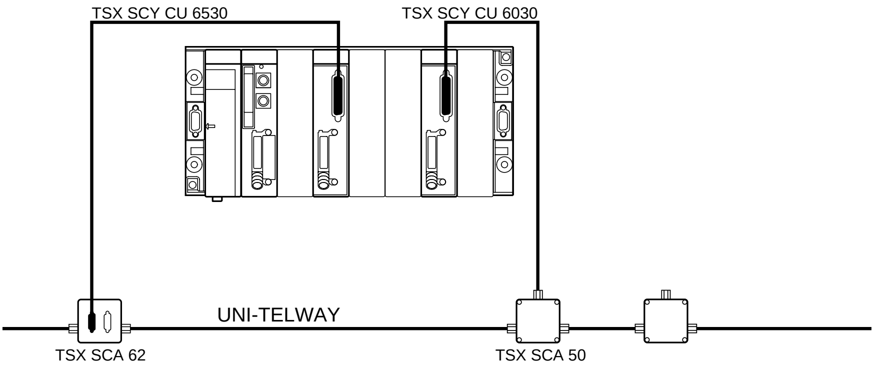
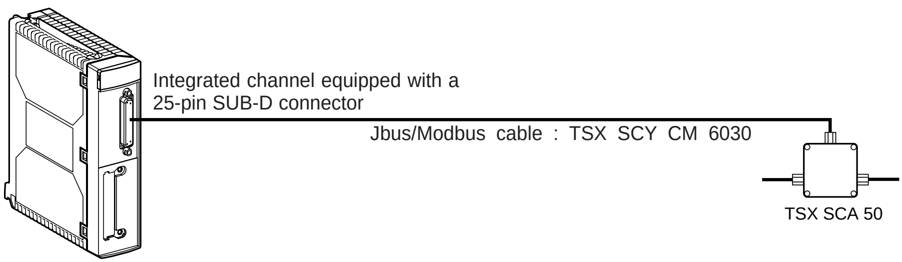
2.8-4 Example of a UNI-TELWAY architecture

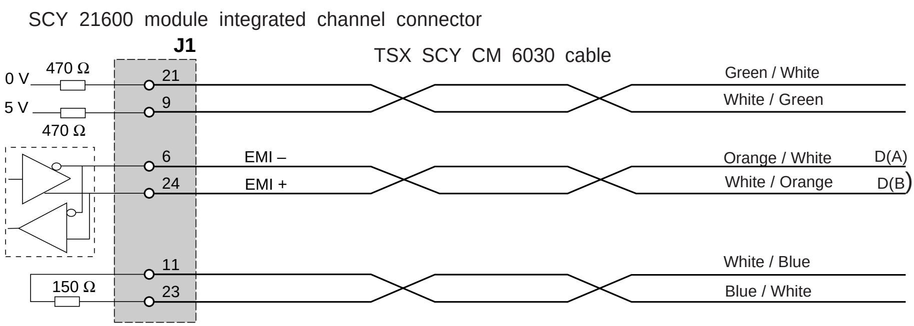


2.8-5 Connection to the Jbus/Modbus fieldbus

The integrated channel is connected to the bus via the TSC SCA 50 T-junction box with the TSX SCY CM 6030 connection cable.

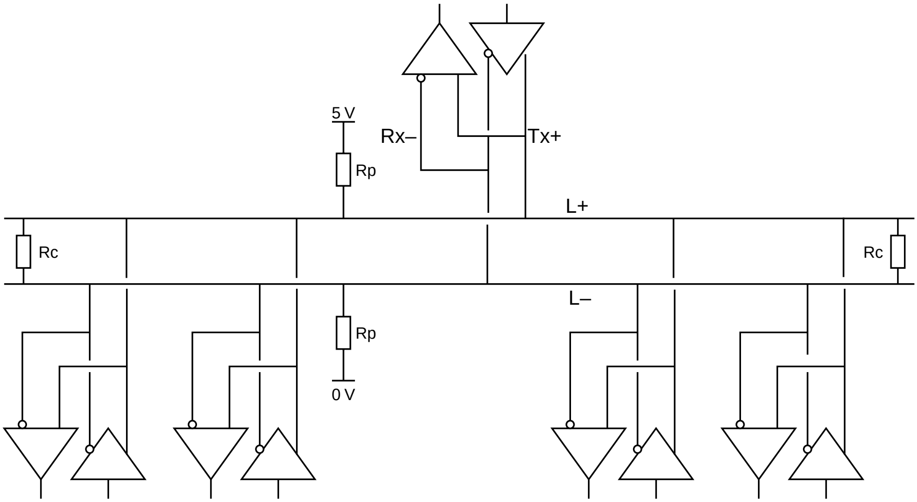


Description of the TSX SCY CM 6030 cable



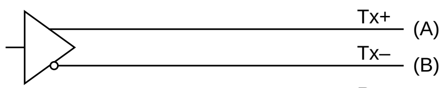
2.8-6 Principle of polarization for an RS485 line

This is the type of polarization used for Modbus networks.

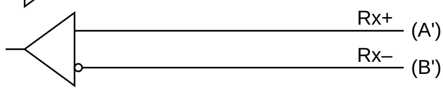


The above diagram shows the general architecture of an RS 485 network.

The transmitters are shown as :



The receivers are shown as :



The network consists of a single shielded twisted pair. The various network stations are connected simply by linking :

- all the outputs marked + (Tx+, Rx+) on the + wire of the network marked (L+),
- all the outputs marked - (Tx-, Rx-) on the - wire of the network marked (L-).

The network impedance is matched by means of two line termination resistors (Rc) located on the stations at both ends of the network.

Polarization of the network is achieved by connecting the L+ wire to the 5 V and the L- wire to the 0 V by means of two polarization resistors (R = 470Ω). This polarization ensures there is always a current flowing through the network, and can be located at any point along the network (in practice it is generally at the level of the master).

It must be the only one on the network, whatever the network length.

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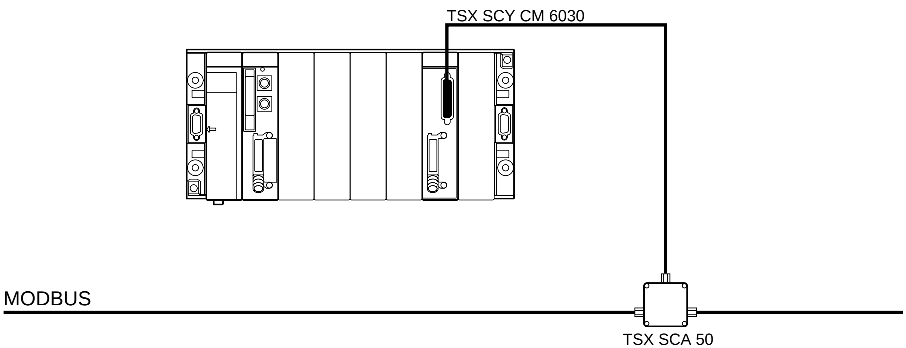
The essential characteristics are :

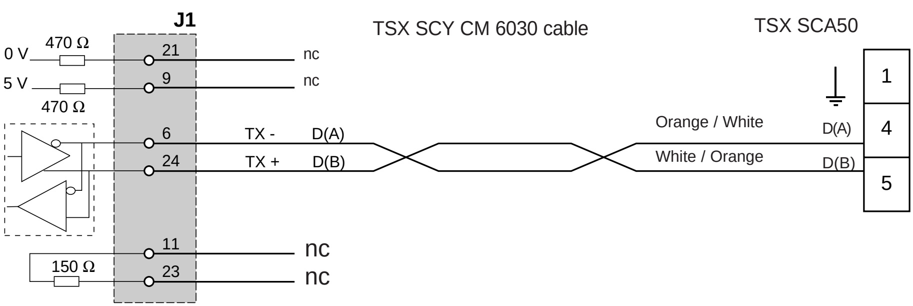
- up to 32 stations,
- maximum length : approximately 1,300 m,
- bus topology,
- tap link ≤ 15 m,
- half duplex on 2 wires,
- line termination on the end stations,
- single line impedance matching Rp = 470Ω.

2.8-7 Example of a Modbus architecture

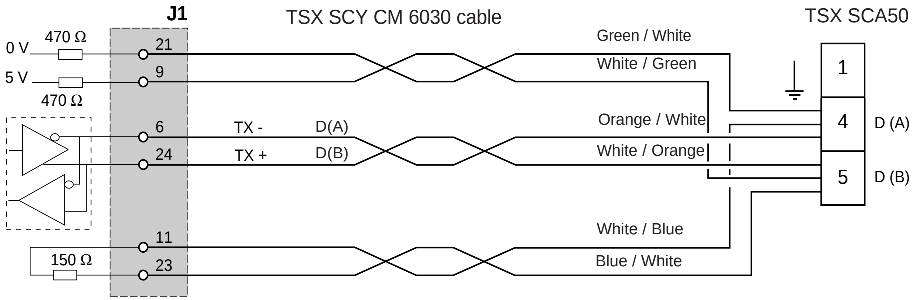


2.8-8 Connection of the TSX SCA50 T-junction box

- **Modbus connection without line matching**



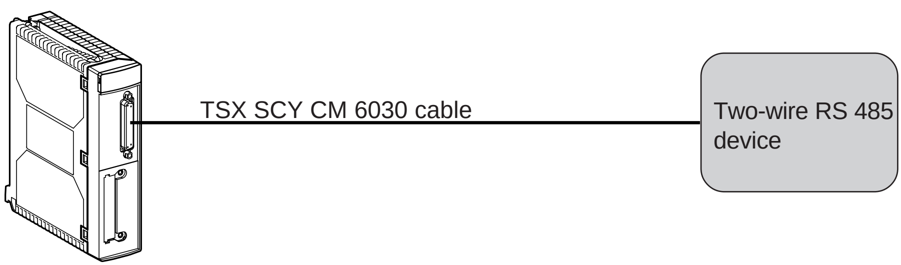
- **Modbus connection with line matching**



2.8-9 Connection in Character mode

The cable for connecting the TSX SCY 21601 module to an RS 485 standard device is the TSX SCY CM 6030 cable.

When connecting the TSX SCY 21601 integrated channel to a Half duplex standard RS 485 device in Character mode, the user makes the connection using the TSX SCY CM 6030 connection cable, **adding a connector suitable for the device to be connected to the free end of the cable, and linking the required signals.**



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2.8-10 TSX SCY 21601 module consumption

This table shows the **consumption** of a TSX SCY 21601 communication module **without** a PCMCIA card **or** connection to the integrated channel :

Voltage	Typical current	Maximum current	Dissipated power
5 Volts	350 mA	420 mA	2.1 W max.

3.1 Presentation

TSX/PMX/PCX 57 PLC stations connect to networks, buses and communication links via PCMCIA communication cards.
The card comprises a metal case whose size conforms to the type III extended PCMCIA format.
These cards are inserted in the appropriate slot in the processor and/or TSX SCY 21601 module of Premium PLCs.

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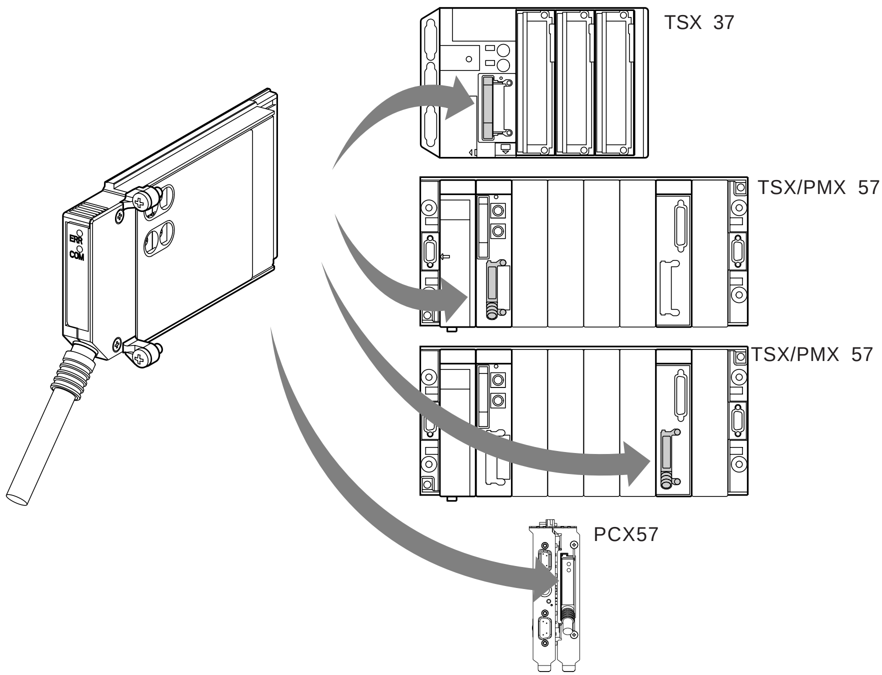
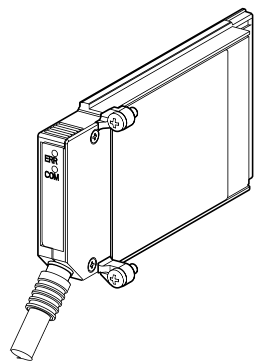
⚠ PCMCIA cards must not be connected with the power on.



- **Serial link PCMCIA cards, TSX SCP 11●**

  Each TSX SCP 11● PCMCIA card supports a different physical layer. This card family comprises three products.

  - the RS 232-D link, reference TSX SCP 111,
  - the current loop link (20 mA), reference TSX SCP 112,
  - the RS 485 link (compatible with the RS 422), reference TSX SCP 114,



Each card in the TSX SCP 111, 112, 114 family offers all the communication protocols.

The protocols which can be used for each PCMCIA card are as follows :

- Modbus/Jbus protocol,
- UNI-TELWAY protocol,
- Character mode (asynchronous link).

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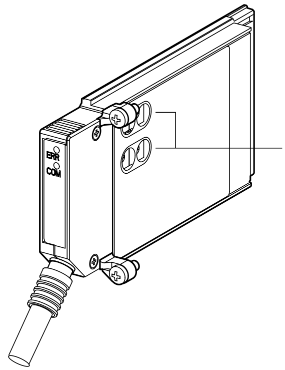
PCMCIA cards may also be used on devices with a type III slot, such as the CCX 17, FTX 417-40 terminals or third-party devices, for example PC compatibles.

- **FIPWAY network PCMCIA card, TSX FPP 20**

  The TSX FPP 20 PCMCIA card supports the FIP physical layer. The card is used to connect a TSXPMX/ PCX 57 PLC station to a FIPWAY network, and is also suitable for devices made by manufacturers who wish to connect their products to the FIPWAY network.

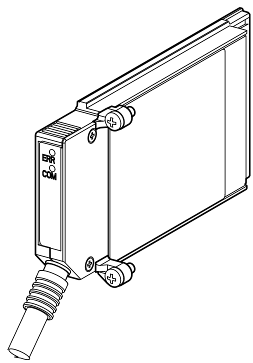
  The card has four rotary switches **labeled "1"** used to set the code for the network and station number.



- **Modbus + network PCMCIA card, TSX MBP 100**
  The TSX MBP 100 PCMCIA card is used to connect a TSXPMX/PCX 57 PLC station to a Modbus + network.

- **FIPIO agent bus PCMCIA card, TSX FPP 10**

  The TSX FPP 10 PCMCIA card is used to connect a TSXPMX/PCX 57 PLC station to a FIPIO bus which is a FIPIO agent. It is used to connect to TSX 47-107 and April 5000 PLCs.



Setup, use and maintenance of PCMCIA cards is performed using PL7 Junior / PL7 Pro programming and operating software for all Premium PLCs.

3.2 Description

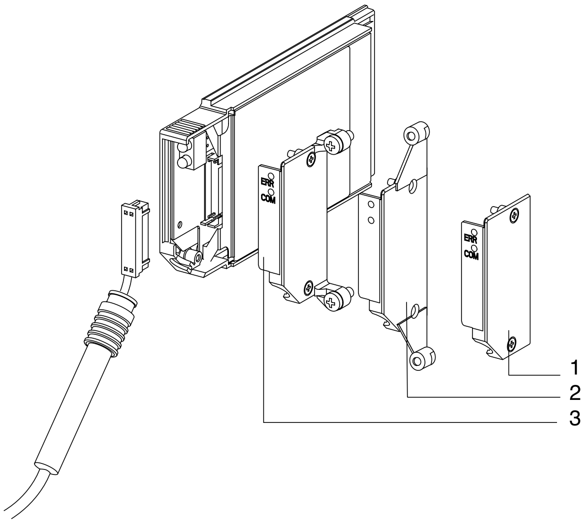
Type III E (extended) PCMCIA communication cards are incorporated in a metal case with the following dimensions :

- length 85.6 mm,
- width 51 mm,
- height 10 mm.

The front of the card displays the communication operating status and is the point of physical connection to the network.

The mechanical configuration of the card should be adapted according to the type of installation required by fitting a removable cover :

- installation on TSX P57● or TPMX P57● type processor or on a TSX SCY21601 communication module : Use the removable cover with lugs (3), supplied with screws for fixing the cover to the host module,
- installation on a TPCX 57● type processor : Use the removable cover with lugs (2), supplied with screws for fixing the cover to the TPCX 57 processor,
- installation on a PC compatible type device : Use the removable cover (1)



Note : Covers (1) and (3) are supplied with the PCMCIA card.
Cover 2 is supplied with the TPCX 57● processor.

Connection to the network is obtained by connecting the cable to the front of the card. A locating device prevents incorrect mounting. The product reference label informs the user of the type of physical layer supported by the card.

Note

The use of covers with lugs, mounted on PCMCIA cards, prevents unintentional removal while powered up and ensures correct card operation.

D

3.3 Connection of the PCMCIA card host channel

3.3-1 Precautions relating to PCMCIA connections

⚠ The PCMCIA card must only be handled **when the power is off**. When removing or inserting it, the unit may not operate. There are no warm restart procedures between the PCMCIA card and the TSX SCY 21601 host device.

If the operating environment makes it impossible to stop the application by switching the PLC processor off, it is advisable to remove both the TSX SCY 21601 module and the PCMCIA card.

The PCMCIA card must be fitted with its appropriate cover and must be screwed into the TSX SCY 21601 host module, before the unit is powered up (see section 3.2).

3.3-2 Connecting PCMCIA cards

The connection of PCMCIA cards on a UNI-TELWAY or Modbus/Jbus fieldbus or in Character mode to a standard device is described in sections 3.4, 3.5 and 3.6 of this document.

List of connection equipment required to use a specific protocol from a PCMCIA card :

PCMCIA cards	UNI-TELWAY	JBUS/MODBUS	Character mode
TSX SCP 111 (RS232)	(1)	(1)	TXS SCP CD 1030/1130
TSX SCP 112 (CL)	TSX SCP CX 2030	TSX SCP CX 2030	TSX SCP CX 2030
TSX SCP 114 (RS422/RS485)	TSX SCP CU 4030 and TSX SCA 50	TSX SCP CM 4030 and TSX SCA 50	TSX SCP CU 4030 TSX SCP CM 4030

(1) : with point-to-point : TSX SCP CD 1030/1130 cables, with multidrop via a modem : TSX SCP CC 1030 cable.

Connection of the TSX FPP 20 FIPWAY card via the host channel is performed using the TSX FPCG 10 or TSX FPCG 30 cable.
Connection of the TSX MBP 100 Modbus+ card via the host channel is performed using the TSX MBP CE 030 (3m) or TSX MBP CE 060 (6m) cable.

D

3.3-3 PCMCIA card references and installation

References

PCMCIA card references are as follows :

- **TSX SCP 111** : multiprotocol card, RS 232 D, 9 signals, not isolated,
- **TSX SCP 112** : multiprotocol card, 20 mA current loop,
- **TSX SCP 114** : multiprotocol card, RS 485, compatible with RS 422, isolated,
- **TSX FPP 20** : FIPWAY card
- **TSX FPP 10** : FIPIO Agent card
- **TSX MBP 100** : Modbus+ card

Installation

References	Installation	
PCMCIA cards	Processor host channel	TSX SCM 21601 host channel
TSX SCP 111	Yes	Yes
TSX SCP 112	Yes	Yes
TSX SCP 114	Yes	Yes
TSX FPP 10	Yes	No
TSX FPP 20	Yes	Yes
TSX MBP 100	Yes	No

Number of application-specific channels and network connections

PCMCIA	Number of app.-spec. channels		Number of
cards	Card integrated in the processor	Card integrated in TSX SCY 21601 module	network connections
TSX SCP 111	0	1	
TSX SCP 112	0	1	
TSX SCP 114	0	1	
TSX FPP 10	0		
TSX FPP 20			1
TSX MBP 100			1

Number of application-specific channels and network connections managed by each type of processor

Processors	App-specific chans	Network connections
TSX P57 102/TPMX P57 102/TPCX 571012	8	2
TSX P57 2•2/TPMX P57 202	24	4
TSX P57 3•2/TPMX P57 352/TPCX 57 3512	32	8
TSX P57 4•2/TPMX P57 452	48	8

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3.3-4 Mounting cards and cables

PCMCIA cards consist of the following components :

1 Ready-assembled card.

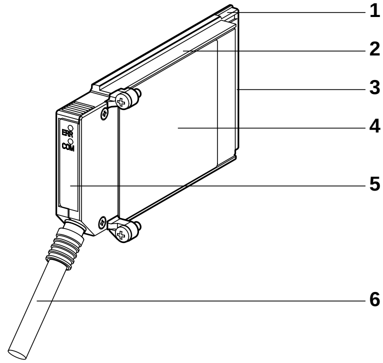
2 Body, made of Zamak.

3 PCMCIA connector.

4 Upper cover.

5 Removable cover.

6 Connection cable with ferrule.



The removable cover (**5**) displays the operating status of the card in its environment. The function of the two indicator lamps is printed on the front of the removable cover.

The product reference label indicates the type of PCMCIA card. It is located on the upper cover (**4**).

The metal ferrule (**6**), located at the PCMCIA card end of the cable, prevents the cable being trapped by the removable cover. The ferrule eliminates the risk of the cable being subjected to a bending radius, which could have a detrimental effect on the quality of the connection.

PCMCIA cards are fitted by assembling the connection accessory (a cable which varies according to the type of transmission support chosen), and then screwing the appropriate removable cover onto the unit. This cover can be used to fix the PCMCIA card onto the processor or the TSX SCY 21601 module.

A 20-pin connector is used on the PCMCIA card end.

To fit the transmission support to the card, first unscrew the cover from the unit, then assemble as described below :

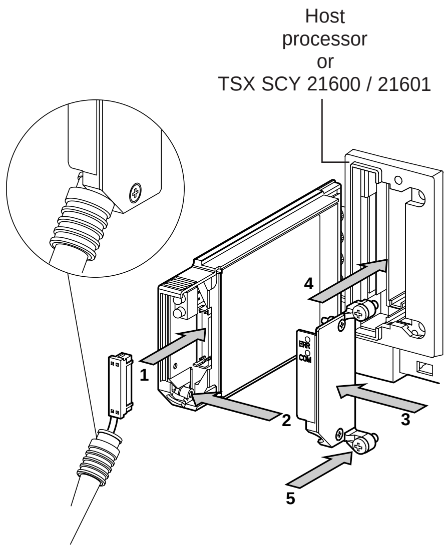
1 Connect the cable.

2 Place the appropriate cover on the unit, taking care to insert the ferrule in the recess designed for this purpose so that the cable is held firmly in place on the card.

3 Screw on the cover.

4 Next, insert the card in the appropriate slot in the host device.

5 Screw the card into position to prevent it being removed while powered up and to ensure correct operation.



3.3-5 Displaying the operating status of PCMCIA cards

There are two diagnostic indicator lamps on the front of the card. They provide the user with information on the operating status of exchanges between the device supporting the PCMCIA card and the connected device.

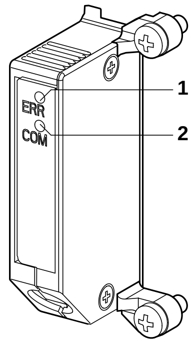
"ERR" error indicator lamp (**1**) (normally off) displays faults.

The "ERR" indicator lamp is red.

"COM" communication indicator lamp (**2**) displays line activity.

The "COM" indicator lamp is :

- yellow on TSX SCP 11•, TSX FPP 10 and TSX FPP 20 cards.
- green on the TSX MBP 100 card



3.3-6 PCMCIA card visual diagnostics

The PCMCIA card indicator lamps show the communication operating mode and provide card diagnostics.

- **TSX SCP 11•, TSX FPP 10/FPP 20 cards**

Indicator lamp state

ERR	COM	Meaning	Corrective action
○	○	Device not powered up No dialog	Check power supply and connection Card not operating
○	◍	Normal operation	–
●	(1)	Serious fault	Change card
◍	○	Operational fault	Check configuration and connection to communication bus
◍	◍	Operational fault	Check configuration

● Indicator on ○ Indicator off ◍ Indicator flashing.

(1) : state of the indicator lamp not significant.

When the "ERR" indicator lamp on the TSX FPP 20 card flashes, this indicates that an external fault has occurred. External faults include :

- line fault,
- station already present on the network,
- incorrect coding of the network-station address (coding using the rotary switches).

- **TSX MBP 100 card**

Indicator lamp state

ERR	COM	Meaning	Corrective action
○	○	Device not powered up No dialog	Check power supply and connection Card not operating
○	◍ (1)	Normal operation	–
●	(2)	Serious fault	Change card
◍	○	Operational fault : card not configured, communication on the network cannot start	Configure the card from : PL7 Micro (TSX Micro PLCs) PL7 Junior or PL7 Pro (Premium PLCs)
◍	◍ (1)	Operational fault	Check configuration and connection to the Modbus + network. The way the COM indicator is flashing indicates the nature of the problem (see description below).

● Indicator on ○ Indicator off ◍ Indicator flashing.

(1) The way the COM indicator is flashing indicates the operating status of the network (normal operation, faults, etc). The various patterns of flashing and their meaning are shown below.

(2) state of the indicator lamp not significant.

Meaning of COM indicator patterns of flashing

COM indicator state	Meaning
6 flashes / second	Normal operating status for the node. It is receiving and passing the network token. All nodes on a healthy network flash this pattern.
1 flash / second	The node is offline just after power-up or after exiting the 4 flashes / second mode. In this state, the node monitors the network and builds a table of active nodes. After being in this state for 5 seconds, the node attempts to go to its normal operating status, indicated by 6 flashes / second.
2 flashes, then off for 2 seconds	The node hears the token being passed among the other nodes but it never receives the token itself. Check the network for an open circuit or defective termination.
3 flashes, then off for 1.7 seconds	The node does not hear the token being passed among the other nodes. It periodically claims the token but cannot find another node to which to pass it. Check the network for an open circuit or defective termination.
4 flashes, then off for 1.4 seconds	The node has heard a valid message from a node using a network address identical to its own address. The node remains in this state for as long as it continues to hear the duplicate address. If the duplicate address is not heard for 5 seconds, the node changes mode and flashes once per second.

3.4 Connection of the TSX SCP 111 card

3.4-1 Point-to-point connection in character mode (DTE <==> DTE)

The TSX SCP 111 card, with RS 232 D as the physical support, is inserted either in the processor or in the TSX SCY 21601 module. It is connected via the TSX SCP CD 1030/ 1100 cable to the connected device.

DTE to DTE type devices such as terminals or printers can be connected (DTE means : Data Terminal Equipment).
The cable required for this connection is reference TSX SCP CD 1030/1100.

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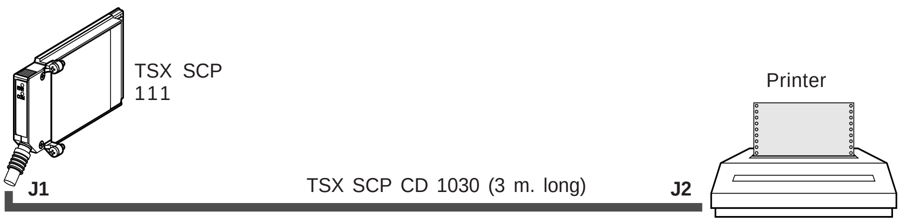
Type of connection

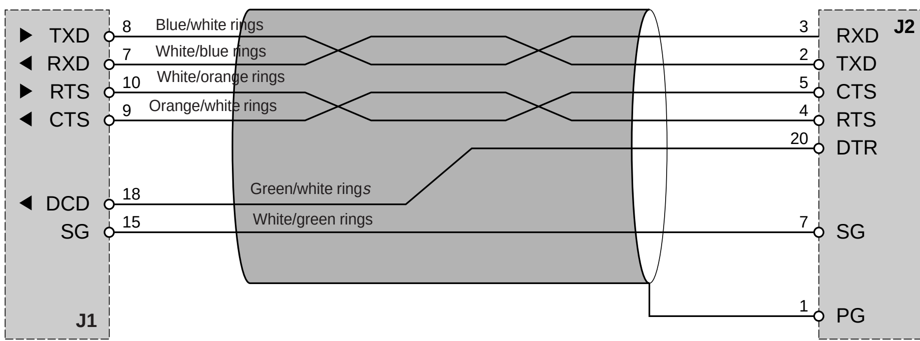
The TSX SCP 111 PCMCIA card is connected directly to the device via the TSX SCP CD 1030 cable.
The two connected devices are DTE.



Description of the TSX SCP CD 1030 cable

The 20-pin miniature PCMCIA connector supports the following signals :

25 M SUB-D connector

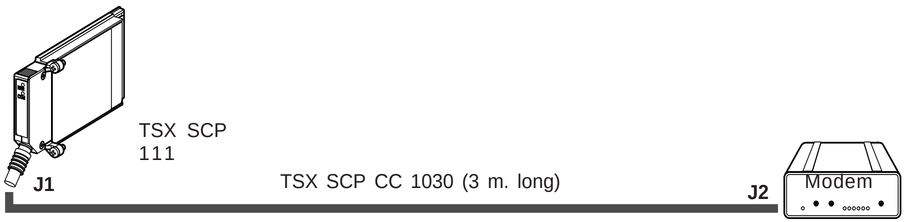


3.4-2 UNI-TELWAY, Modbus or Character mode connection via Modem

Connection of the PCMCIA card to the UNI-TELWAY, Modbus or Character mode bus via a Modem and a telephone link (DTE/DCE type), can be achieved using the TSX SCP CC 1030 cable. The card is inserted either into the processor or into the SCY 21601 module (DCE means : data communications equipment).

Type of connection

The TSX SCP 111 PCMCIA card is linked to the connected device via the TSX SCP CC 1030 cable.
The connected devices are DCE type; for example a MODEM or converters.



Description of the TSX SCP CC 1030 cable

The 20-pin miniature PCMCIA connector supports the following signals :

25 M SUB-D connector

3.5 Connection of the TSX SCP 112 card

The TSX SCP 112 PCMCIA card is used to connect a TSX/PMX/PCX 57 PLC station to a 20mA current loop link in point-to-point (pp) or multidrop (md) connection.

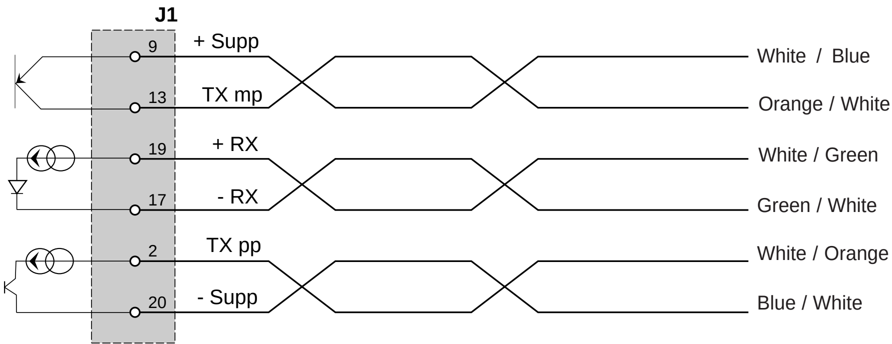
In all cases a 24V ± 20% supply, external to the TSX SCP 112 card should be used to provide the necessary current to power the current loop.

D

The TSX SCP CX 2030 cable is used to perform this type of connection (3m long).

Description of the TSX SCP CX 2030 cable

The 20-pin miniature PCMCIA connector supports the following signals :

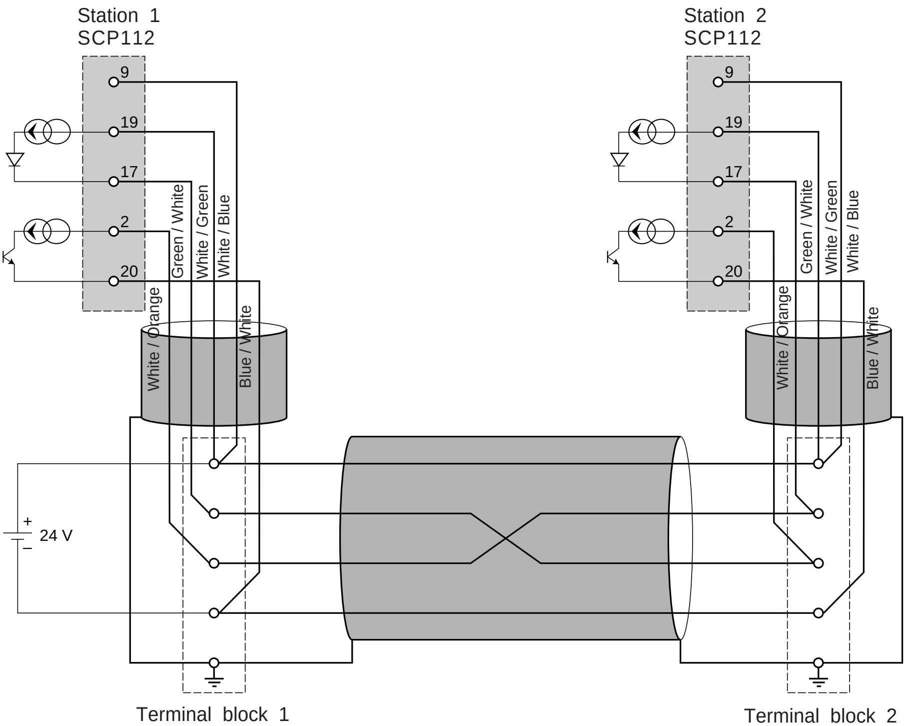


Notes

To connect the TSX SCP 112 card, a screw terminal block must be used.

3.5-1 Point-to-point connection

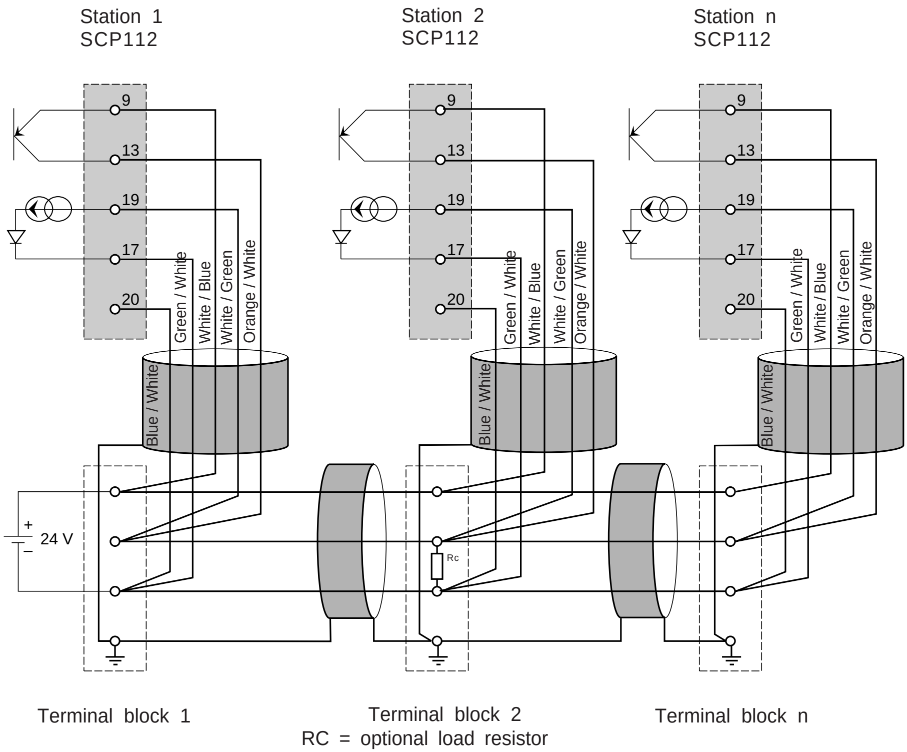
Wiring principle for TSX SCP112 current loop PCMCIA cards in point-to-point. Point-to-point connection is only possible in 20mA inactive mode.



Important : the cable shielding must be connected as closely as possible to the terminal blocks.

3.5-2 Multidrop connection

Multidrop connection is only possible in 0mA inactive mode. Transmissions and receptions are wired in parallel. The master is defined by the program.
Example of connection of n TSX SCP 112 cards :



Important : the cable shielding must be connected as closely as possible to the terminal blocks.

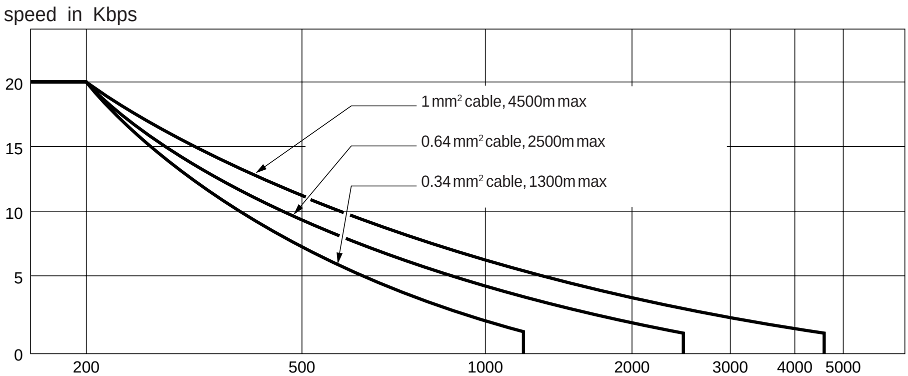
D

3.5-3 Dynamic performance

The flow rate of a current loop link is limited by the cross-section and length of the cable used.
The user should refer to the two diagrams below to get an idea of the performance that can be achieved for his application.

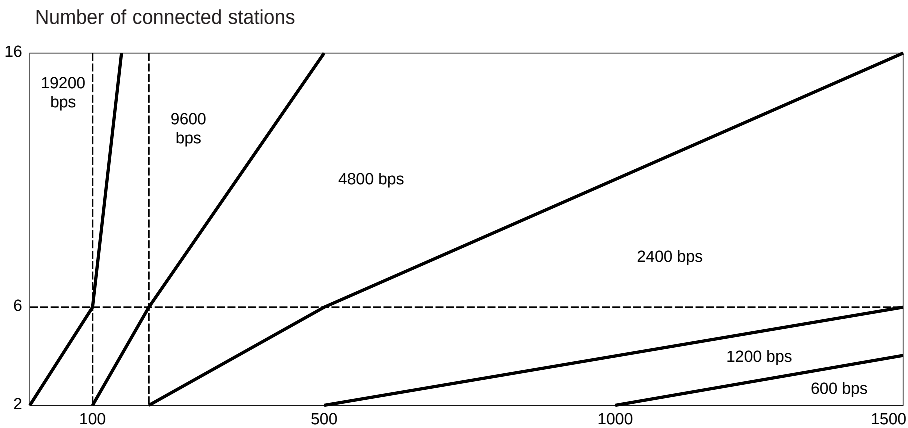
Point-to-point

These curves are for a shielded two-pair cable (transmission in one pair, reception in the other). All precautions for use are adhered to.



Multidrop

The graph below is for a shielded cable where the conductor cross-section is 0.34 mm^2, connected in accordance with the parallel multidrop diagram above. The use of conductors with a larger cross-section will improve the quality of the transmitted signals.



The performance of a multidrop link is much improved when a large number of stations is connected. The load on the line is greater, which improves the quality of the transmitted signal.
When connection is performed according to the preceding diagram, the number of stations can be artificially increased (up to a maximum of 16 stations) by loading the line at one end. This can be performed by incorporating a load resistor. This load resistor can be connected on any terminal block as long as it is between pins 17 and 19 of the SCP112 cards.

The value of resistor R, which simulates the load of "N" stations is determined by the formula :

$$R = \frac{U}{N \times 20}$$

R in KΩ
U = external power supply voltage
N = Number of stations to be simulated

Example :
An installation has 6 physically connected stations in multidrop in accordance with the preceding diagram, with a 24V external power supply.
The line performance will be the same as for 10 stations, with the load of 4 additional stations simulated by a resistor :

$$R = \frac{24}{4 \times 20} = 0.3K\Omega$$

Note : The load resistor should not produce any inductive effect, otherwise operation may be affected. Use thick film type resistors.

D

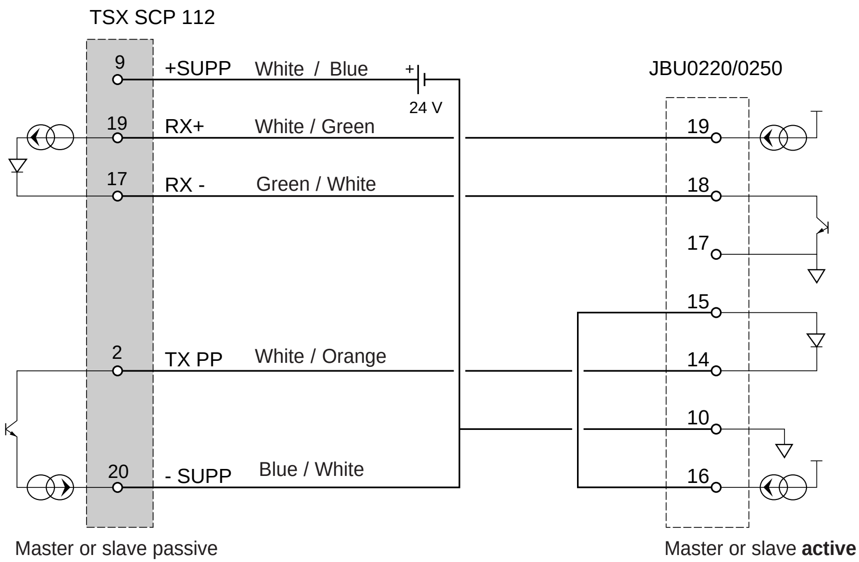
3.5-4 TSX SCP 112 connection to April 5000/7000 PLCs

The 20 mA current loop TSX SCP 112 PCMCIA card is used to connect April communication modules, type JBU0220 and JBU0250. **Multidrop connection** of the TSX SCP 112 PCMCIA card to JBU0220 and JBU0250 modules is performed in **serial mode**. For connection of April modules refer to the TEM60000E reference manual.

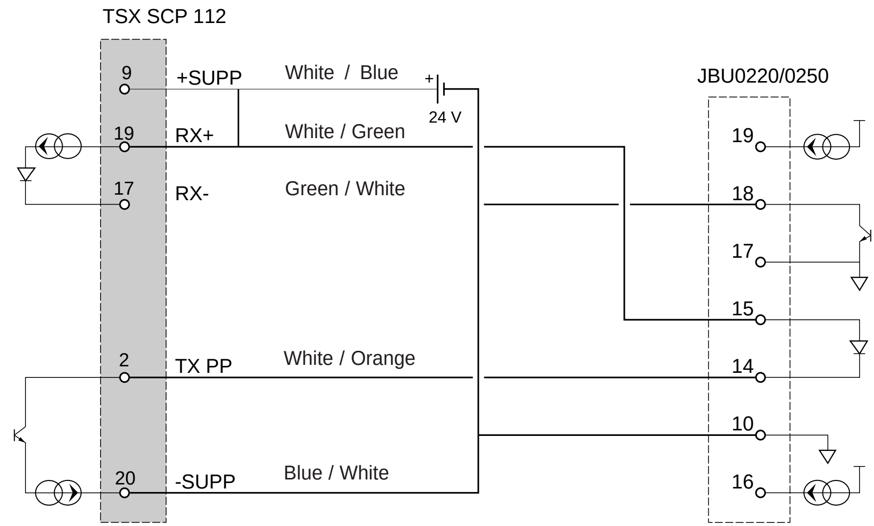
Important : The TSX SCP 112 must be configured in **point-to-point** mode in the PL7 configuration screen, regardless of whether a point-to-point or a serial multidrop link is used.

Notes :
The current loop permits a current of 20 mA when the PLC is inactive in both point-to-point and multidrop mode.
If a slave is powered down, the transmitter of this slave becomes conducting, the line is available.
If the loop power supply is located remotely, on one of the slaves, the powering down of this slave interrupts communication.

Point-to-point type link : JBU0220 or JBU0250 module active



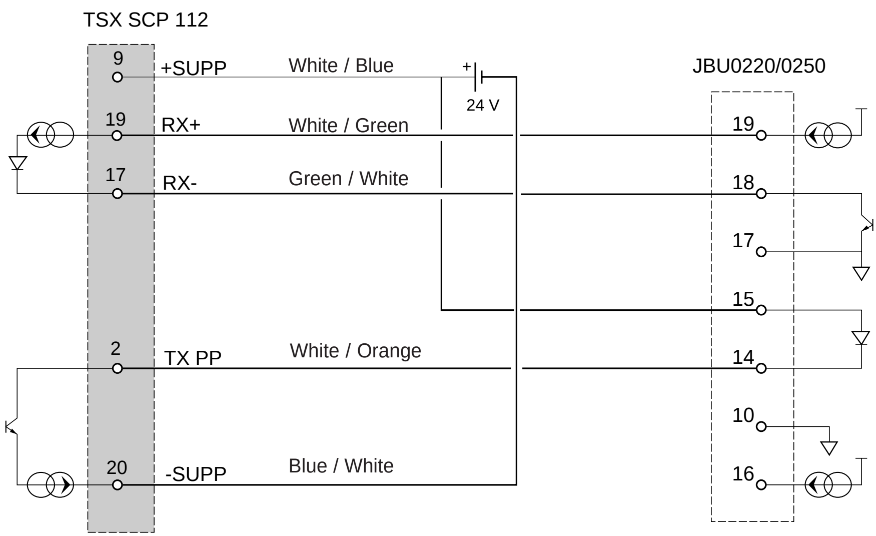
Point-to-point type link : TSX SCP 112 card active



Master or slave **active**

Master or slave passive

Mixed stations link



Master or slave :
passive on reception
active in transmission

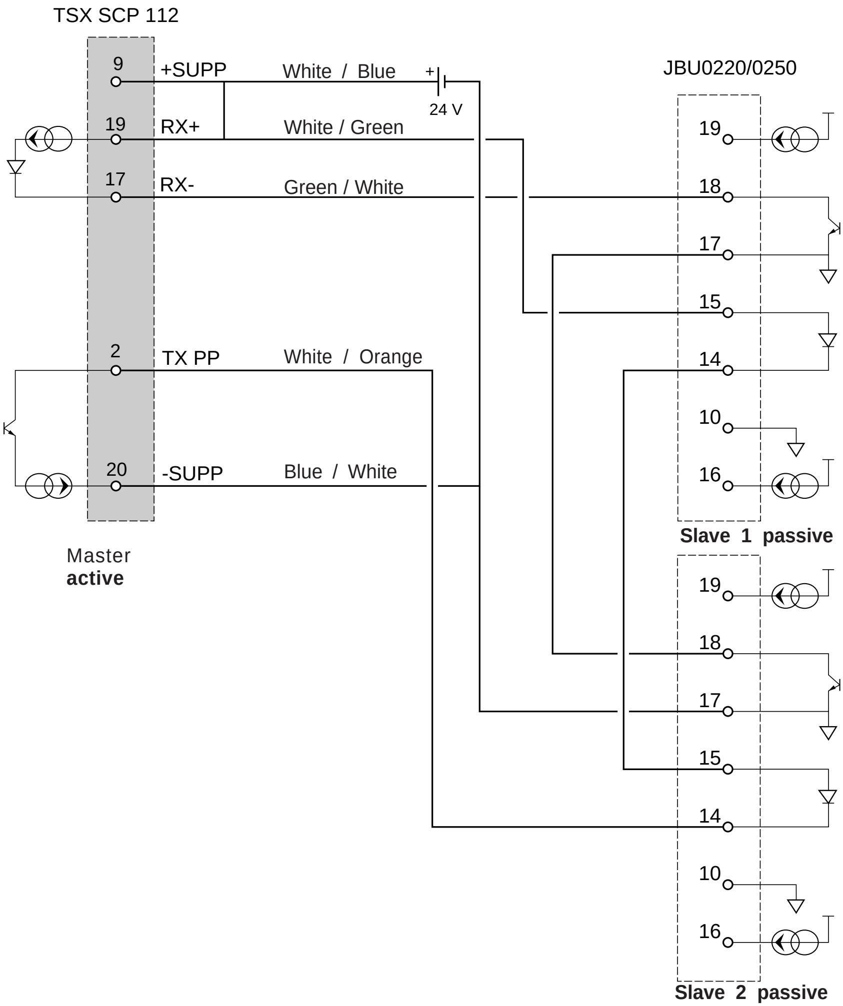
Master or slave :
passive on reception
active in transmission

Multidrop type link

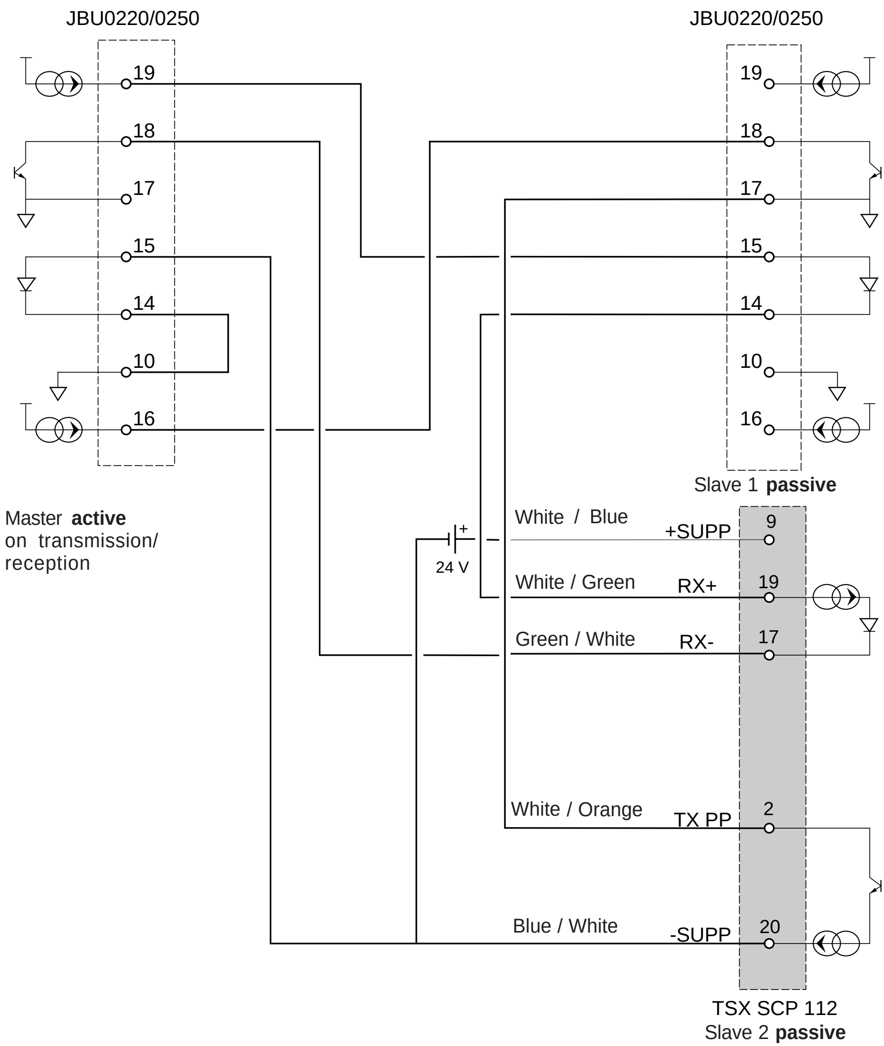
The following examples describe the various wiring possibilities for the TSX SCP 112 card with JBU0220/0250 modules.

Important : always connect the 24 V supply of each TSX SCP 112 in the loop, whether active or passive, otherwise the link may not operate.
These supplies must not have any common point (voltage).
Do not connect the -24 V of the supplies to ground.

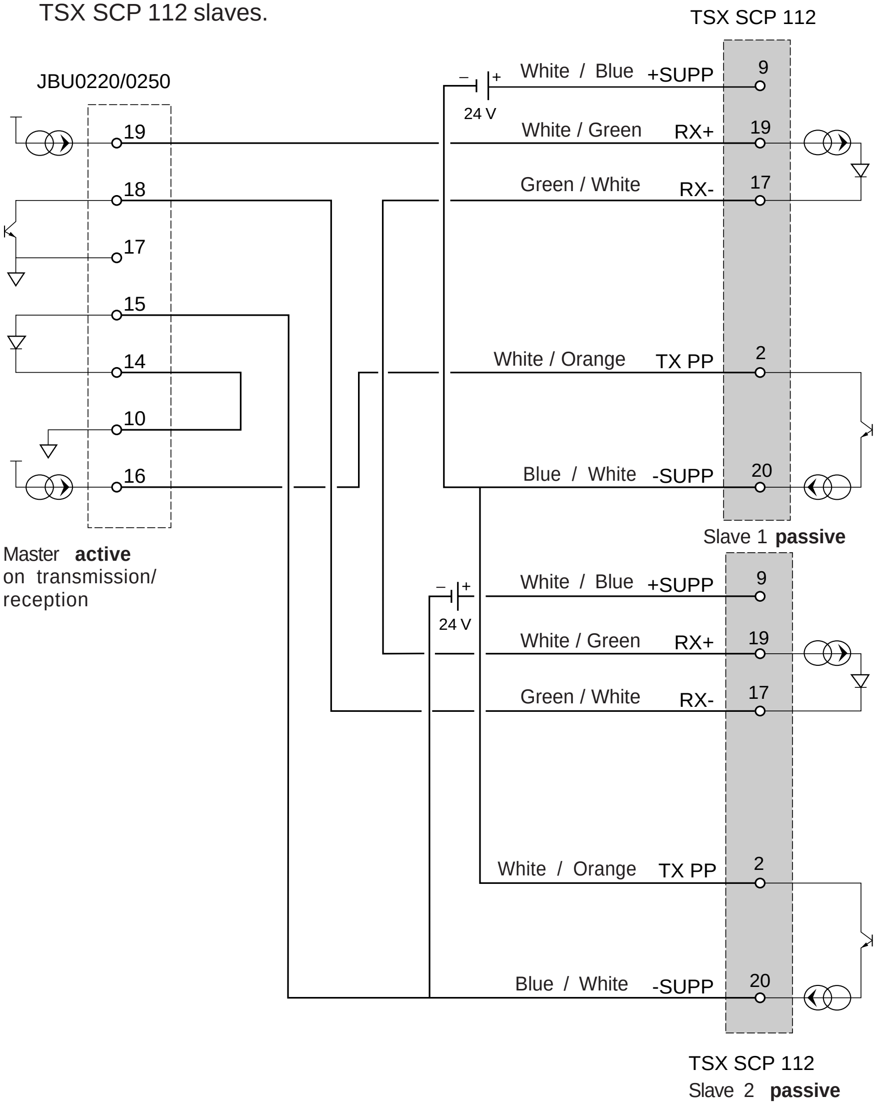
Example 1 : Multidrop TSX SCP 112 master active



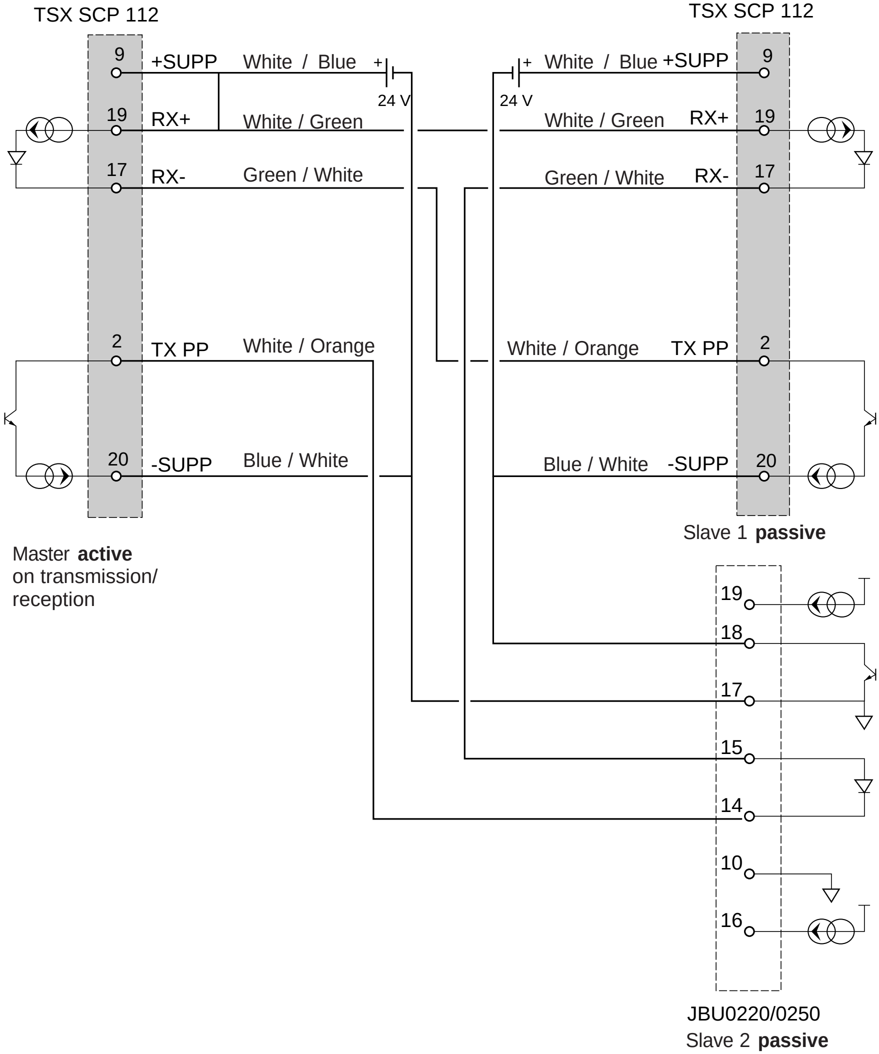
Example 2 : Multidrop master JBU0220/0250 active on transmission / reception



Example 3 : Multidrop master JBU0220/0250 active on transmission/reception - TSX SCP 112 slaves.



Example 4 : Multidrop master active TSX SCP 112.



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3.6 Connection of the TSX SCP 114 card

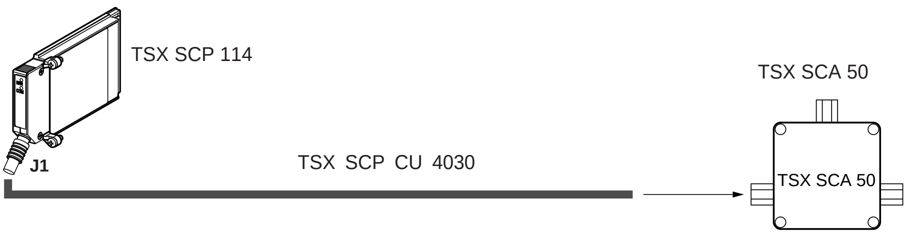
3.6-1 Connection to the UNI-TELWAY network

The TSX SCP 114 card, with RS 485 as the physical support, is connected to the UNI-TELWAY network using cable **TSX SCP CU 4030** via the TSX SCA 50 T-junction box, or using cable **TSX SCP CU 4530** (fitted with a 15-pin SUB-D connector) via the TSX SCA62 Y-junction box.
The card is inserted into the processor or into the SCY 21601 module.

The TSX SCA50 is passive, comprising a printed circuit with 3 sets of screw terminals. It is used for connecting a station, via tap link, to the trunk cable segment of a UNI-TELWAY bus.
Electrical continuity of the signals, shielding and end of line termination are thus provided.

Type of connection

The cable of the PCMCIA card has flying leads for connection to the terminal block located inside the T-junction box.

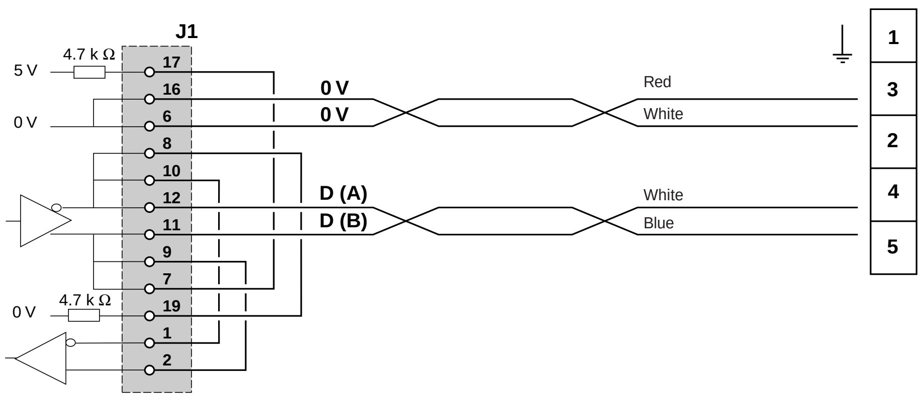


Note
Using the T-junction box configures the wiring system for the card as a tap-link type connection system.

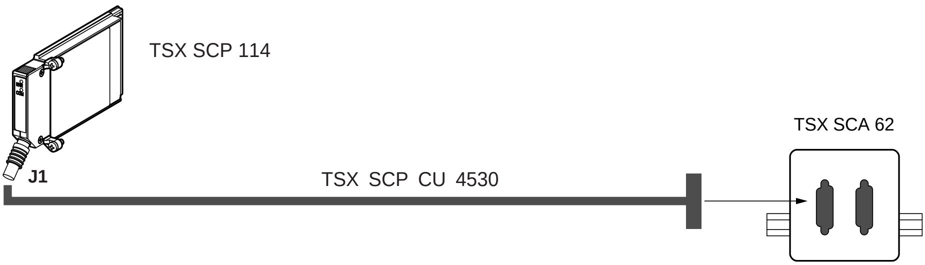
Description of the TSX SCP CU 4030 cable

The 20-pin miniature PCMCIA connector supports the following signals :

TSX SCA 50 T-junction box

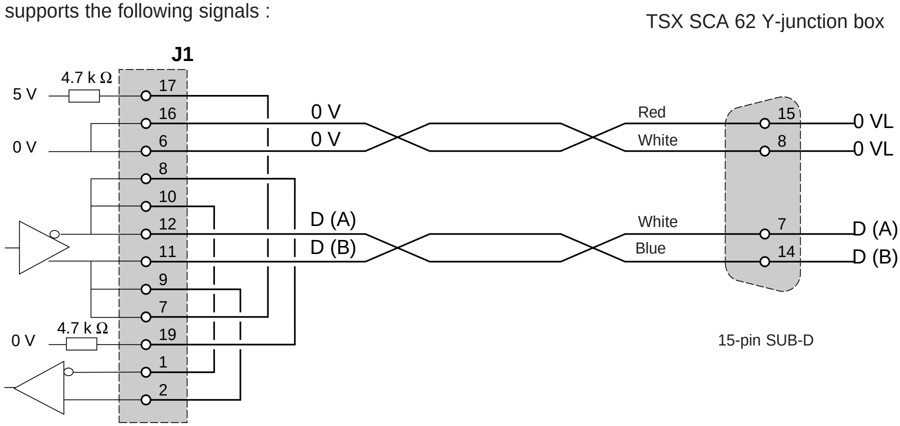


Connection via a TSX SCA 62 Y-junction box



Description of the TSX SCP CU 4530 cable

The 20-pin miniature PCMCIA connector supports the following signals :



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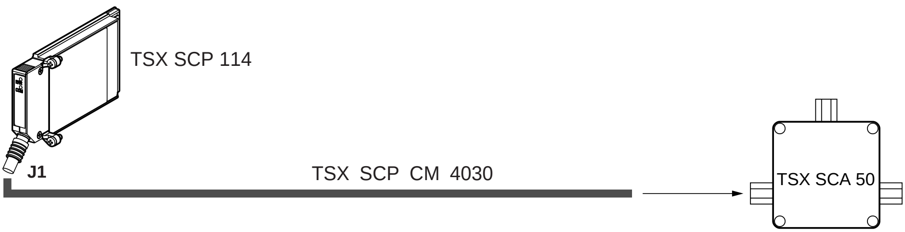
3.6-2 Connection to the Modbus/Jbus bus

The TSX SCP 114 PCMCIA card is connected to the Modbus bus via the TSX SCP CM 4030 serial link cable. This cable is connected to the TSX SCA 50 T-junction box.

D

Type of connection

The cable of the PCMCIA card has flying leads for connection to the terminal block located inside the junction box.

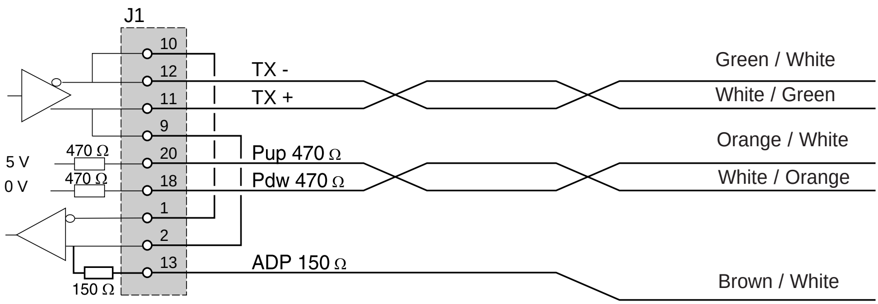


Comment :

The user cable (3 m) allows a device to be connected to a TSX SCA 50 T-junction box located at up to 3 meters from the card. This length ensures that connection is possible within a standard enclosure.

Description of the TSX SCP CM 4030 cable

The 20-pin miniature PCMCIA connector supports the following signals :



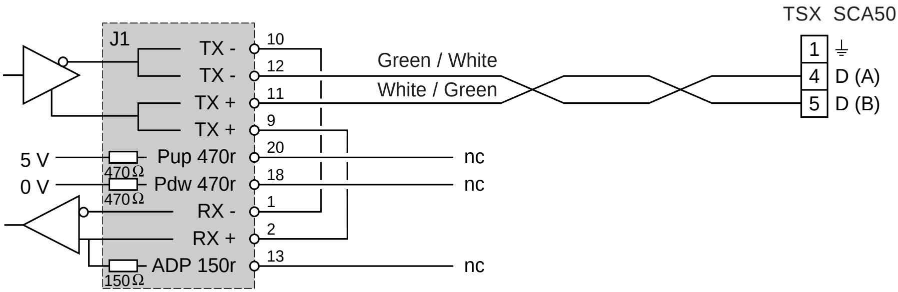
Important : on a Modbus / Jbus bus it is necessary to :

- Polarize the line, usually in one place only, (generally on the master device) using pull-down and pull-up resistors of 470Ω available on the PCMCIA card. Connect pull-down R to TX- (D(A)) and pull-up R to TX+ (D(B)).
- Match the line on the two end devices by a 150Ω resistor between TX+ and TX- (connection on TX- is already internally performed by the card).

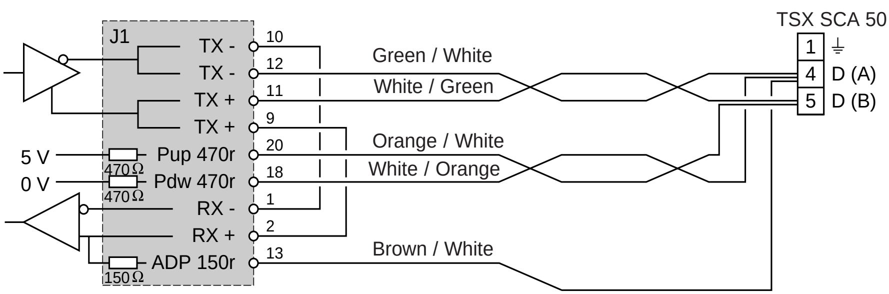
Important : to connect a TSX SCP114 card to a Series 1000 (S1000) PLC, it is essential to connect TX+ to L-.

Modbus connection to TSX SCA 50 box

Connection without line terminator



Connection of SCA 50 with line terminator

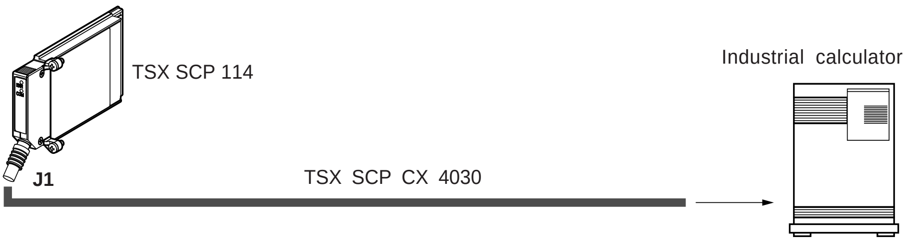


3.6-3 Multi-protocol asynchronous link connection, RS 422

No special accessories are required for connecting the TSX SCP 114 card in Character mode.
The reference of the connection cable for the RS 485/RS 422 PCMCIA card is TSX SCP CX 4030. The cable is 3 meters long.

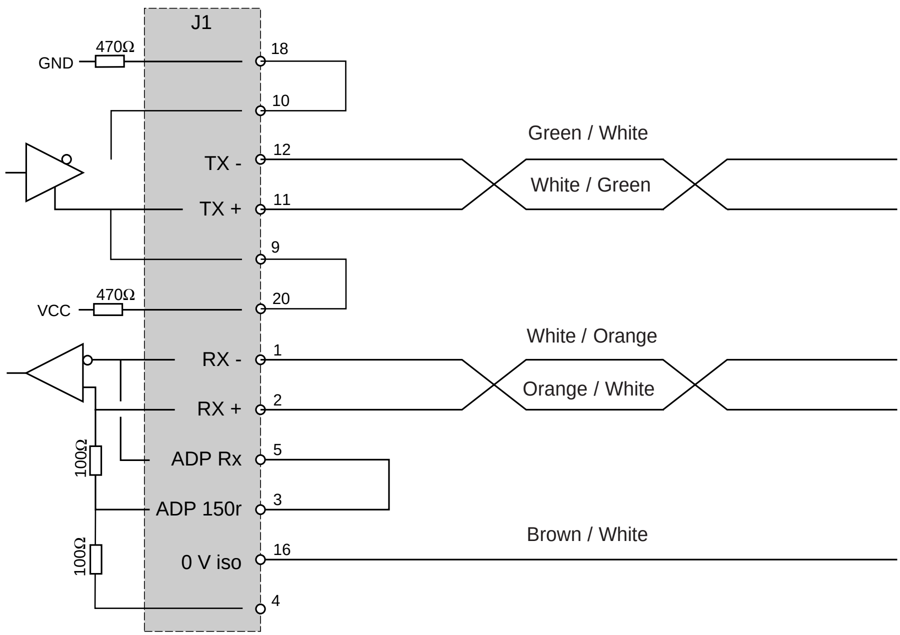
Type of connection

The TSX SCP 114 PCMCIA card is connected in point-to-point mode to a standard RS 422A VAX station type device.



Description of the TSX SCP CX 4030 cable

The 20-pin miniature PCMCIA connector supports the following signals :



Also see section 3.4-1 : for connection of the TSX SCY 21601 integrated link in character mode.

D

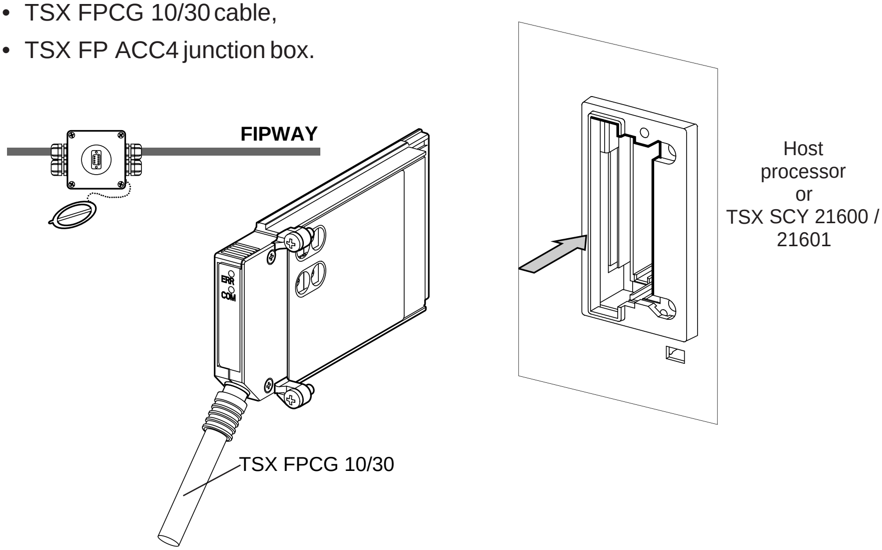
3.7 Connection of TSX FPP 20 cards

TSX FPP 20 PCMCIA cards are connected to the FIPWAY network using a TSX FP ACC4 or a TSX FP ACC12 type connector.
To connect the PCMCIA card to the ACC4/ACC12 connector, the user may select either :

- a 1 m cable, reference TSX FPCG 010,
- a 3 m cable, reference TSX FPCG 030.

The figure below shows the components needed to connect the TSX/PMX/PCX 57 PLC to the FIPWAY network :

- TSX P57● /TPMX P57 ● /TPCX 57● processors or SCY 21601 module,
- TSX FPP 20 PCMCIA card,
- TSX FPCG 10/30 cable,
- TSX FP ACC4 junction box.



Important

The cables (TSX FPCG 10 and 30) may be connected to and disconnected from the PCMCIA card only when it is **powered down**.

D

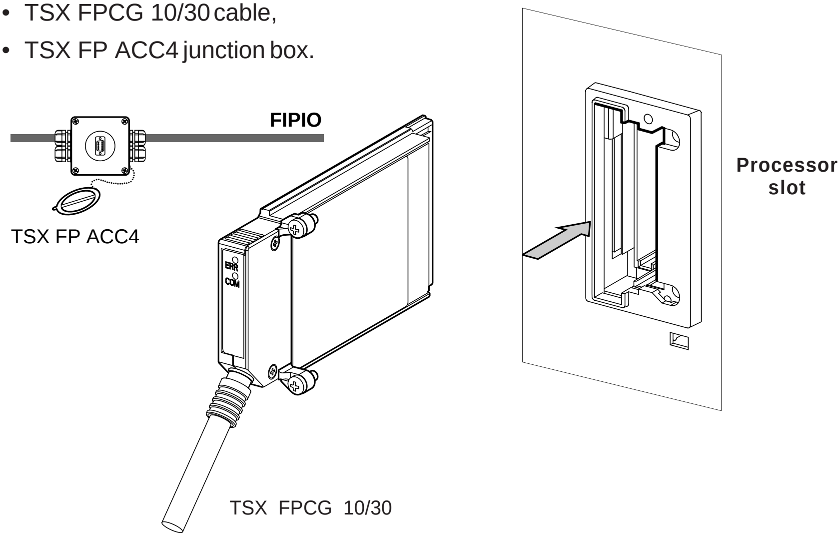
3.8 Connection of TSX FPP 10 cards

TSX FPP 10 PCMCIA cards are connected to the FIPIO bus using a TSX FP ACC4 or TSX FP ACC12 type connector.
To connect the PCMCIA card to the ACC4/ACC12 connector, the user may select either :

- a 1 m cable, reference TSX FPCG 010,
- a 3 m cable, reference TSX FPCG 030.

The figure below shows the components needed to connect the TSX/PMX/PCX 57 PLC to the FIPIO remote I/O bus :

- TSX P57• /TPMX P57 • /TPCX 57• processor,
- TSX FPP 10 PCMCIA card,
- TSX FPCG 10/30 cable,
- TSX FP ACC4 junction box.



Important

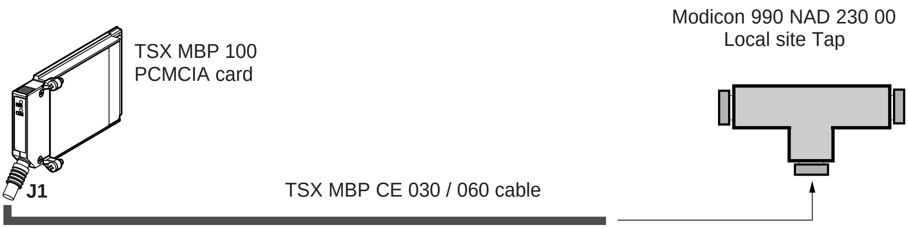
> The cables (TSX FPCG 10 and 30) may be connected to and disconnected from the PCMCIA card only when it is **powered down**.

3.9 Connection of TSX MBP 100 cards

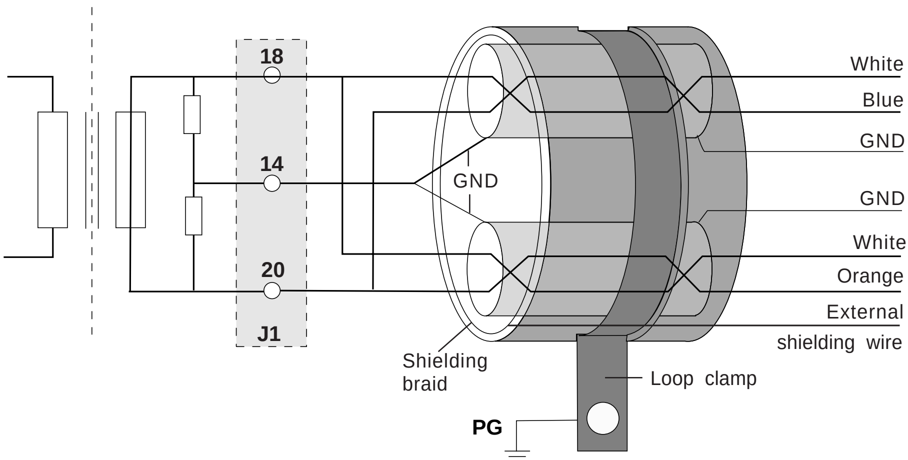
The TSX MBP 100 PCMCIA card is connected to the Modbus + network using the TSX MBP CE 030 (3m) or TSX MBP CE 060 (6m) tap link cable. This cable is connected to the Modicon 990NAD23000 local site tap. For installation of a Modbus Plus network, see the Modicon "Modbus Plus Network - Installation and Planning Manual", reference 890 USE 100 01.

D

- **Connection principle, PCMCIA card end**



Description of TSX MBP CE 030 / 060 cable



Important :
The main cable shielding is grounded via a metal loop clamp in contact with the shielding braid, which itself is fixed to the chassis supporting the rack. See mounting principle on the next page.
This grounding connection must be made even if the PCMCIA card is not in place.

D

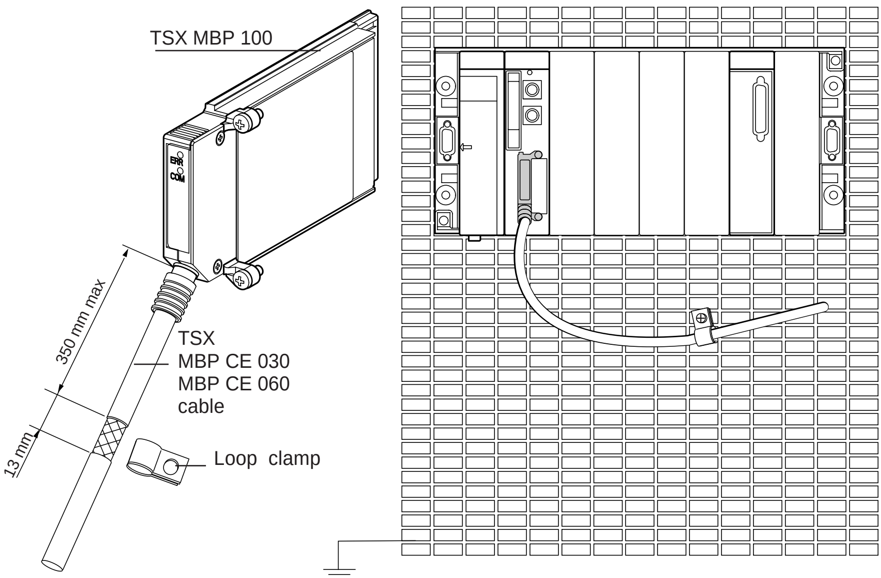
Grounding the TSX MBP CE 030 / 060 cable

The cable for connecting the PCMCIA card to the Modicon local site tap must be grounded as described below.

Procedure :

1 Place the loop clamp around the cable. The loop clamp is supplied with the Modicon local site tap, reference 990 NAD 230 00.

2 Fix the clamp + cable to the chassis, which is also connected to ground.



D

- **Connecting the TSX MBP CE 030/060 cable, Modicon 990 NAD 230 00 tap end**

The TSX MBP CE 030/060 cable comprises two distinct sets of shielded twisted pairs and one external shielding ground wire, making a total of seven conductors.

Procedure :

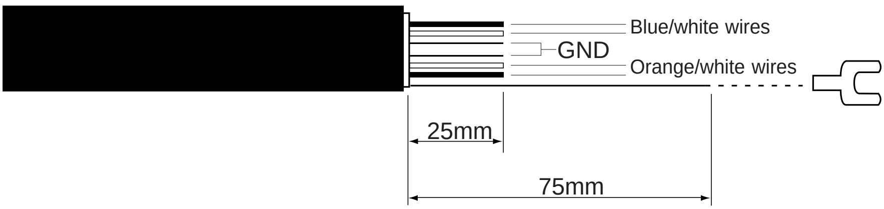
1 Identify the sets of wires and preparing the cable

Identifying the wires :

- one set of wires is identified by the colors white and orange, with a stripped shielded wire,
- the other set of wires is identified by the colors white and blue, with a stripped shielded wire,
- an external shielding wire.

Before connecting the wires to the appropriate terminals, ensure that the two sets of twisted pairs are correctly identified, since the two white wires are not interchangeable.

Preparing the cable :

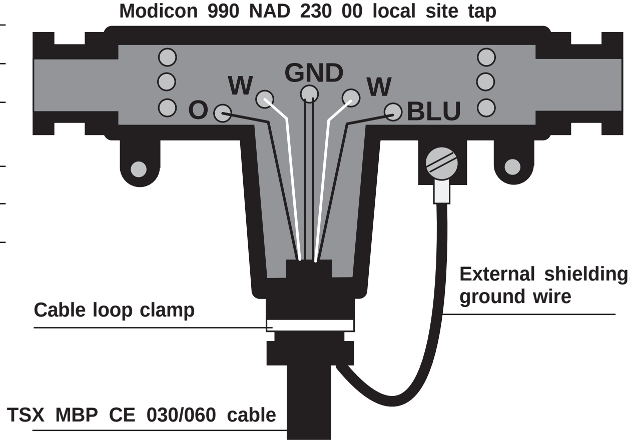


2 Connecting the wires to the Modicon tap

- insert the cable into the tap and hold it in place with a clamp,
- connect the wires following the directions in the diagrams below.

The terminals are identified as follows :

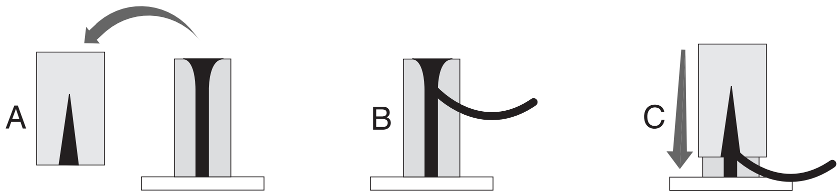
Terminal	Color of wire
O	Orange
W	White
GND	Shielding for both sets
W	White
BLU	Blue



D

3 Principle for connecting the wires to the tap terminals

- to connect each wire, remove the plastic cap from the terminal (figure **A**),
- place the wire in the slot in the terminal (figure **B**),
- replace the cap and push the wire into the slot using a screwdriver (figure **C**).
  A special tool has been designed for this purpose (reference AMP 552714-3).
  The diagrams below illustrate the connection procedure.



4 Connecting the external shielding wire

Fix an open tag on the external shielding wire either by soldering or crimping and connect this to the ground screw of the tap as shown in the diagram above.

3.10 Summary of connection cables

3.10-1 TSX SCP 111 card

Type of cable	Reference	Description
Modem cable	TSX SCP CC 1030	Cable for connection via Modem DTE/DCE, 9 signals, RS 232D, l = 3 m
Standard cable	TSX SCP CD 1030 TSX SCP CD 1100	Cable for DTE/DTE connection RS 232D, l = 3 m or 10 m

3.10-2 TSX SCP 112 card

Type of cable	Reference	Description
Current loop cable	TSX SCP CX 2030	20 mA CL cable, l = 3m.

3.10-3 TSX SCP 114 card

Type of cable	Reference	Description
Universal cable	TSX SCP CX 4030	Universal cable, RS 485 and RS 422A type, l = 3 m
UNI-TELWAY cable	TSX SCP CU 4030	RS 485 2-wire cable, l = 3 m
Modbus cable	TSX SCP CM 4030	RS 485 2-wire cable, l = 3 m
T-junction box	TSX SCA 50	Box for screw connection to bus for RS 485 serial link
Y-junction box	TSX SCA 62	Box for connection via connector to bus for RS 485 serial link
Converter box	TSX SCA72	RS 232D / RS 485 converter box

D

3.10-4 TSX FPP 10 and TSX FPP 20 cards

Type of cable	Reference	Description
FIPWAY/FIPIO cable	TSX FPCG 010	Connection cable, l = 1 m
FIPWAY/FIPIO cable	TSX FPPCG 030	Connection cable, l = 3 m
Junction box	TSX FP ACC4	FIPWAY/FIPIO junction box
Junction box	TSX FP ACC12	Low-cost FIPWAY/FIPIO junction box

3.10-5 TSX MBP 100 card

Type of cable	Reference	Description
Modbus+ cable	TSX MBP CE 030	Connection cable, l = 3 m
Modbus+ cable	TSX MBP CE 060	Connection cable, l = 6 m

3.11 Precautions for connecting PCMCIA cards

Important:

PCMCIA cards must be connected to and disconnected from the host device (processor or TSX SCY 21601) with the device **powered down**.

The ferrule placed in direct contact with the PCMCIA card unit serves to discharge electrical interference carried by the connection cable braid.

D

3.12 Current consumption of PCMCIA cards

3.12-1 Current consumption of TSX SCP 111 card

Voltage	Typical current	Maximum current	Dissipated power
5 volts	140 mA	300 mA	1.5 W max.

3.12-2 Current consumption of TSX SCP 112 card

Voltage	Typical current	Maximum current	Dissipated power
5 volts	120 mA	300 mA	1.5 W max.

3.12-3 Current consumption of TSX SCP 114 card

Voltage	Typical current	Maximum current	Dissipated power
5 volts	150 mA	300 mA	1.5 W max.

3.12-4 Current consumption of TSX FPP 10 and TSX FPP20 cards

Voltage	Typical current	Maximum current	Dissipated power
5 volts	280 mA	330 mA	1.65 W max.

3.12-5 Current consumption of TSX MBP 100 card

Voltage	Typical current	Maximum current	Dissipated power
5 volts	220 mA	310 mA	1.55 W max.

D

E

1.1 Presentation

The TSX ETY 110 communication module is used for communication in an Ethernet architecture. It consists of a communication channel which provides two types of connection :

- connection to an ETHWAY network supporting the common words service and X-WAY UNITE message handling service on an ETHWAY profile,
- connection to a TCP_IP network supporting the X-WAY UNITE message handling service.
- this module is also used for transparent routing of X-WAY UNI-TE messages from a TCP-IP network to an X-WAY network and vice versa.

Please refer to the Ethernet reference manual, **TSX DR ETH**, for the wiring of an ETHWAY architecture.

1.2 Description

The TSX ETY 110 is a single format module for insertion in a slot on a Premium PLC station rack.

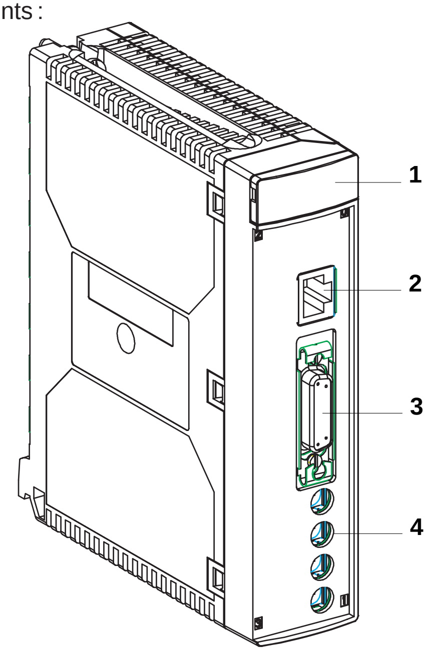
This module comprises the following components :

1 a display block indicating the status of the module,

2 a standard connector for 10baseT (RJ45) interface,

3 a standard connector for 10base5 (AUI) interface,

4 thumbwheels for defining the station number and the network number.



E

1.3 Characteristics of the Ethernet channel

The module has two standard interfaces for connection to a network.

- a 10baseT interface on the front panel of the module consisting of an RJ45 connector for point-to-point connection via a connection cable made up of two twisted pairs with an impedance of 100Ω, ± 15Ω.
- a 10base5, or AUI, interface on the front panel of the module consisting of a 15-pin Sub-D connector for connection to the network by tap-offs. This interface is also used for supplying power to active taps. It complies with standard IEC 802.3, and can be used to connect any device which complies with this standard.

The type of connection is recognized automatically as soon as the device is connected to the network.

Services and functions supported by the module

TCP-IP services	UNI-TE	- client / server mode - 256 byte synchronous requests - 1 Kbyte asynchronous requests
Ethway services	UNI-TE	- client / server mode - 256 byte synchronous requests - 1 Kbyte asynchronous requests
	common words	- 256 word shared database
	application to application	- point-to-point exchange of messages of up to 256 bytes
Common services		- routing between X-WAY networks - X-WAY / UNI-TE routing - module diagnostics

Note : The Ethernet driver supports the Ethernet II and (LLC + SNAP) 802.3 formats on TCP-IP, and LLC 802.3 on Ethway.

1.4 Installing the TSX ETY 110 module

The TSX ETY 110 communication module is inserted in a slot on a TSX/PMX/PCX 57 PLC station rack. It can be located in any available slot as long as the rack power supply requirements are observed (see section 1.8, electrical characteristics).

E

1.4-1 Selecting the type of processor

The choice of the processor which controls the PLC station will depend on the number of network connections required.

Processor	No. of network connections	No. of ETY 110 modules/station (*)
TSX P57 1••/2•• TPMX P57 1••/2•• TPCX 57 1012	1	1
TSX P57 3•• TPMX P57 352 TPCX 57 3512	3	3
TSX P57 4•• TPMX P57 452	4	4

(*) as long as the power consumption on the 5V is compatible with the selected power supply.

1.4-2 Insertion / removal while powered up

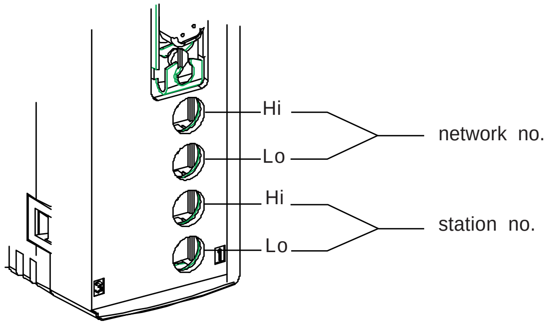
Module :
The TSX ETY 110 module can be inserted or removed while it is powered up without disturbing the operation of the station. As it has no function for backing up the internal RAM memory, the memory will be cleared when the module is switched off. The module performs an initialization phase when it is powered up. Be prepared for loss of communication during these operations.

Link :
The 15-pin Sub-D connectors of the AUI interface and the RJ45 connector of the 10baseT interface can be connected or disconnected while powered up. Be prepared for loss of communication in the current application.

1.4-3 Coding the station address

Four thumbwheels which can be accessed via the front panel are used to code the network number and the station number.
The coding is hexadecimal :
- the network number can take values from 0 to 7F,
- the station number can take values from 0 to 3F.

E



Lo = low order Hi = high order

The address can be coded while the module is powered up.
Modules are supplied with network number and station number = 0

Example of coding :		thumbwheels :	
network 3	: 16#03	0	Hi
		3	Lo
station 27	: 16#1B	1	Hi
		B	Lo

Warning : In an Ethernet network, the MAC address must be unique for each station. Before changing these addresses, check that they comply with the company addressing system.

E

1.5 Connection via the AUI interface

This interface can be used to connect any type of device which complies with the physical layer defined in ISO standard 802.3 (10base5, 10base2, FOIRL, etc) via a transceiver. The TSX ETY 110 module can provide a remote power supply for the transceiver via the Sub-D connector : Imax = 0.5A, 12V -6% < Usupply < 15V +5%.

Reminder of the pinout of the 15-pin Sub-D connector in accordance with standard ISO 802.3

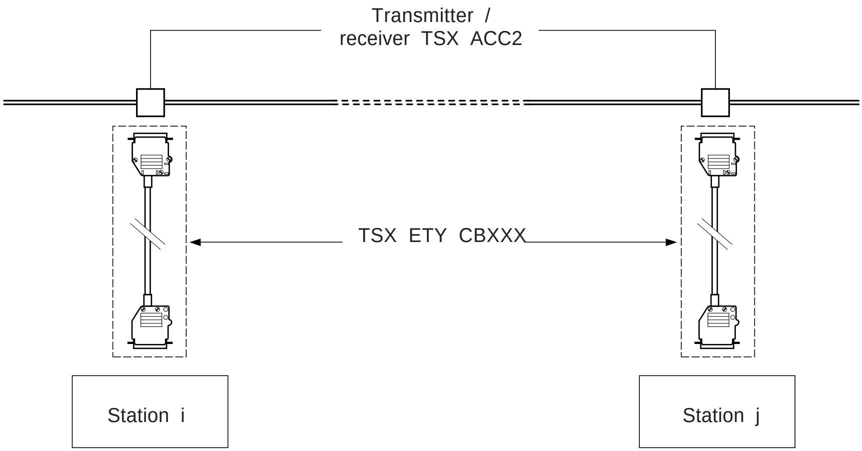
Pin no.	Name according to ISO 802.3		Use
1	CI-S	(Control in shield)	GND
2	CI-A	(control in A)	COLL+
3	DO-A	(Data Out A)	TD+
4	DI-S	(Data in shield)	GND
5	DI-A	(Data in A)	RD+
6	VC	(Voltage Common)	GND
7	not used		
8	not used		
9	CI-B	(control in B)	COLL-
10	DO-B	(Data Out B)	TD-
11	DO-S	(Data Out shield)	GND
12	DI-B	(Data in B)	RD-
13	VP	Voltage Plus	12V
14	VS	Voltage Shield	GND
15	not used		
Sub-D body	PG	Protective Ground	Machine ground

The module will be connected to the trunk cable via a transceiver and tap-off cables :
TSX ETY CB 005 length 5m
TSX ETY CB 010 length 10m
TSX ETY CB 020 length 20m
The maximum length of a tap-off is 50 m. This can be achieved by connecting several tap-off cables end to end.

Transceivers (TSX ETH ACC2) must be used to connect two modules together in point-to-point mode.

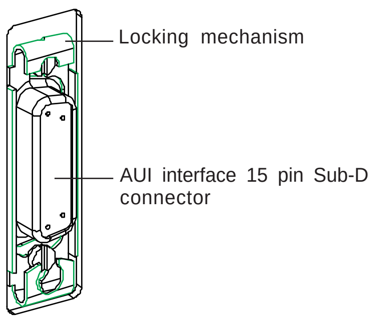
E

Topology :



Locking :

The Sub-D connector on the front panel of the module has a slide locking system. The connector is locked by sliding the mechanism downwards. To ensure correct operation of the module in noisy environments, the connector must be locked.



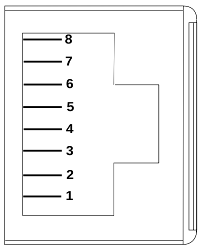
1.6 10baseT interface

This interface has a standard RJ45 connector. The connection cables are widely available commercially.

In industrial environments, it is essential to use a double twisted pair shielded cable, with an impedance of 100 Ω ± 15 Ω. (1 to 16 MHz), maximum attenuation of 11.5 dB / 100 meters, and a maximum length of 100 meters.

E

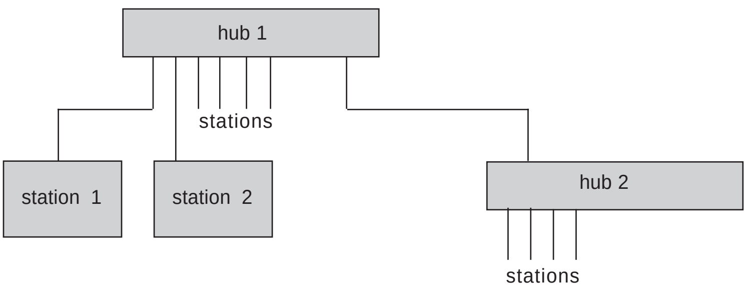
Reminder of the pinout of the 10BaseT (RJ45) connector :



Pin :	signal :
1	TD +
2	TD –
3	RD+
4	not connected
5	not connected
6	RD –
7	not connected
8	not connected

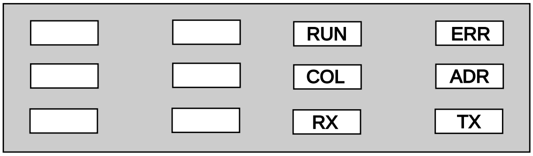
The 10baseT connection is a point-to-point connection forming a star network. The stations are connected to hubs or switches.

Topology :
This link is used to create a star network with point-to-point connections. The stations are connected to a hub. The hubs can also be cascaded to increase the size of the network.



1.7 Display block, diagnostics

The display block conforms to the Premium standard.



Visual diagnostics of the module :

RUN	ERR	COL	ADR	TX	RX	comments
E	A	ns	ns	ns	ns	module off
E	C	E	E	E	E	module not configured or configuration fault
C	C	E	E	E	E	module performing self-tests
A	E	E	E	C	E	transmitting Ethernet communication
A	E	E	E	E	C	receiving Ethernet communication
A	E	E	E	C	C	transmitting/receiving Ethernet communication
A	E	C	E	C	E	collision detection by the module
A	E	E	A	E	E	duplicate MAC address
E	E	E	A	E	E	network address or station out of range

A = on, C = flashing, E = off, ns = not significant

1.8 Electrical characteristics

The TSX ETY 110 module can be inserted in any slot on TSX/PMX/PCX 57 PLC station racks. The consumption of the module on the rack power supply depends on whether there is a remote power supply to the transceiver.

Voltage	current drawn		power dissipated	
5 V	typical	maximum	typical	maximum
no remote power supply (RJ45)	0.8 A	1.2 A	4 W	6 W
with remote power supply (AUI)	1.2 A	2.5 A	6 W	12.5 W

E

Warning :
The consumption of ETY 110 modules on the 5 Volts is high when the AUI connection is used. Special attention must therefore be given to the power consumption of the devices in the rack before deciding on the choice of power supply.
Maximum number of TSX ETY 110 modules which may be connected in one rack :
- 2 TSX ETY 110 modules with AUI connection,
- 4 TSX ETY 110 modules with RJ45 connection.

E

F

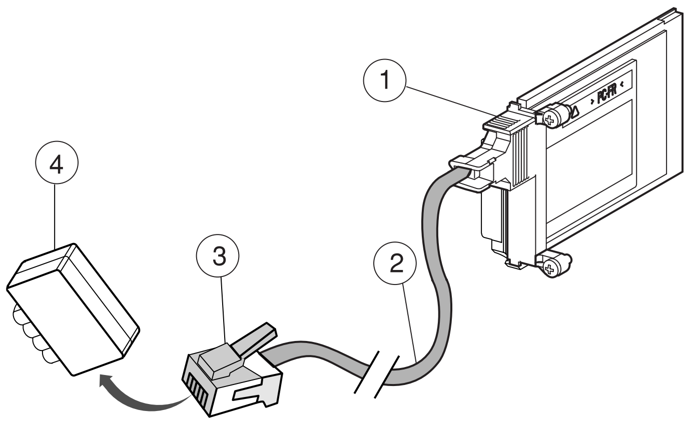
1.1 Introduction

The TSX MDM 10 card is used to connect to the switched telephone network (PSTN) and access remote stations according to UNI-TELWAY or character mode protocols.

This type of communication is available via the PCMCIA modem card. It can only be installed in the PCMCIA host slot of a TSX/TPMX P57 • processor version V ≥ 3.3 .

1.2 Description

The TSX MDM 10 comprises the following elements :



1 PCMCIA modem card

2 Cable for connection to the switched telephone network

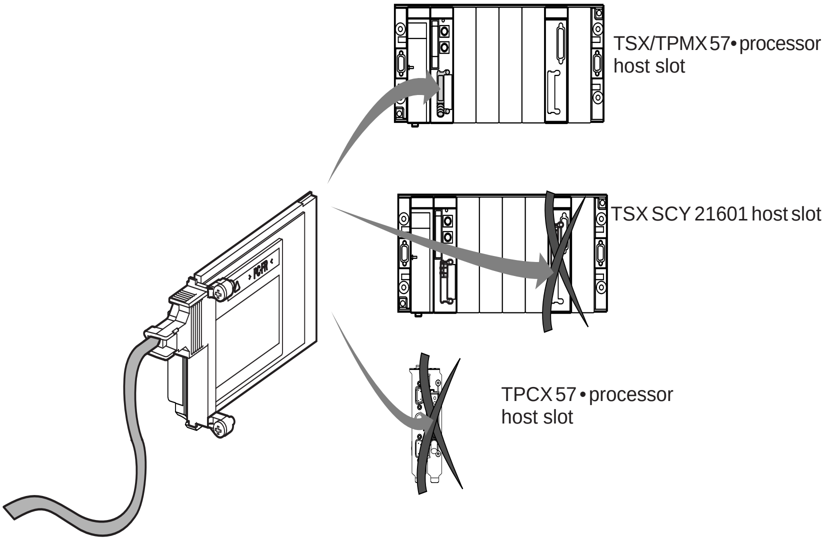
3 RJ 11 socket for connection to a telephone adapter (4) or direct connection to a telephone socket

4 Telephone adapter for connection to the telephone network

1.3 Installing the TSX MDM 10 card

1.3-1 Selecting the type of processor and the slot

The TSX MDM 10 card can only be located in the processor PCMCIA host slot.



The TSX MDM 10 card is compatible with all TSX P57 • and TPMX P57 • processors version V ≥ 3.3.

> ⚠ **Neither TPCX 57 • processors nor TSX SCY 21601 communication modules accept TSX MDM 10 modem cards.**

1.3-2 Inserting / removing when powered up

TSX MDM 10 communication cards must not be inserted or removed when the host module (processor) is powered up.

1.3-3 Connecting to the telephone network

To connect to the switched telephone network, follow the assembly instructions below:

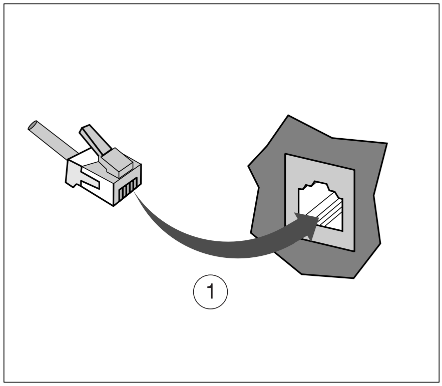
1 Connect the RJ 11 socket to the telephone adapter if required.

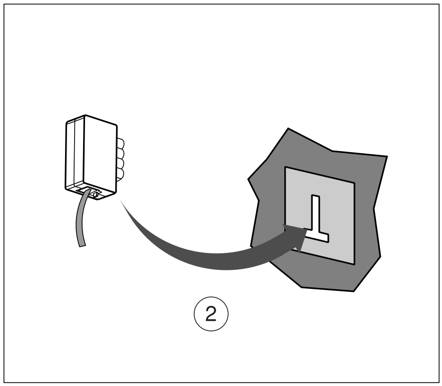
2 Plug the RJ 11 socket or the telephone adapter into a socket for your telephone line.
If a device is already connected to this socket, unplug it, then plug in the telephone adapter in its place and plug the device back in behind the telephone adapter.

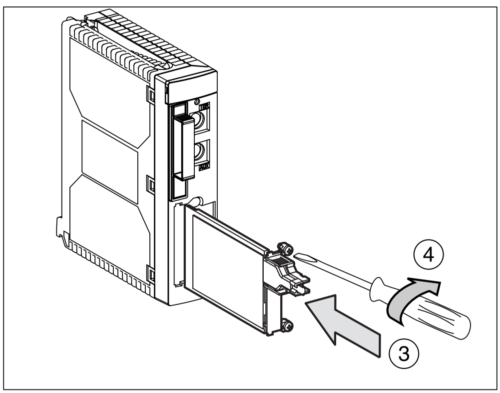
3 Inset the PCMCIA card in the designated slot on the processor.

⚠ **The card should only be inserted or removed when the host device is powered down.**

4 Screw the card into the host device to prevent it from being moved when the device is powered up.







F

1.4 Connecting the adapters

1.4-1 The various adapters

Telephone adapters, conforming to the country of purchase, can be used to connect the RJ 11 socket on the PCMCIA TSX MDM 10 card to the wall socket for the telephone network.

To use the TSX MDM 10 card in different countries, simply change the telephone adapter.

They are available under the following references :

F

- TSX MDM ADT F : adapter for French telephone networks
- TSX MDM ADT G : adapter for German telephone networks
- TSX MDM ADT B : adapter for Belgian telephone networks
- TSX MDM ADT S : adapter for Spanish telephone networks
- TSX MDM ADT T : adapter for Italian telephone networks

1.5 Electrical characteristics

This table indicates the consumption for a PCMCIA modem card :

Voltage	Typical current
5 V	195 mA

1.6 Technical specifications

F

1.6-1 Communication protocols

The TSX MDM 10 card supports the various ITU-T V.32 communication protocols.

1.6-2 Operating characteristics

The TSX MDM 10 supports the following characteristics :

- transmission of AT commands
- half and full duplex communication
- automatic calling and answering
- pulse or tone calls

1.6-3 Maximum operating temperature

- without fan module TSX FAN •• : max. 50°C
- with fan module TSX FAN •• : max. 60°C

1.6-4 CE mark

The TSX MDM 10 card conforms to European Telecommunications Directive DTTC 98/13/EC.
The level of immunity to electromagnetic fields ensured by the card is 3V/m. Communication faults may appear above this threshold. This conforms to EMC Directive 89/336/EEC which applies to residential, commercial and light industrial sites.
The TSX MDM 10 card also conforms to Low Voltage Directive 73/23 EEC, modified by 93/68/EEC.

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1 General

This manual is intended for personnel technically qualified to install, operate and maintain the products which are described herein. It contains all the necessary information for correct use of the products. However, for advanced use of our products please contact your nearest sales office for additional information.

The contents of this manual are not contractual and cannot under any circumstance extend or restrict contract warranty clauses.

2 Qualification of personnel

Only **qualified personnel** are authorized to install, operate or maintain the products. Any work performed by unqualified personnel or non-observance of the safety instructions in this document or attached to the equipment may risk the safety of personnel and/or cause irreparable damage to equipment. The following personnel may be regarded as being **"Qualified"** :

- those involved with application design. Design office personnel familiar with control system safety concepts (for example, design engineers, etc),
- those involved with equipment installation. Individuals who are familiar with the installation, connection and startup of control system equipment (for example installers or wiring technicians working during the installation phase, technicians setting up the equipment, etc),
- those involved with operation. Personnel trained to operate and manage control system equipment (for example, operators, etc),
- those performing preventive or corrective maintenance. Personnel who are trained and experienced in the adjustment and repair of control system equipment (for example, installation engineers, after sales service engineers, etc).

3 Warnings

Warnings serve to prevent specific risks encountered by personnel and/or equipment. They are indicated in the documentation and on the products by different warning symbols, according to the severity of the risk :

Danger or **Caution**

Indicates that not following instructions or ignoring the warning may cause serious personal injury, death and/or serious damage to equipment.

Warning or **Important** or ⚠

Indicates that not following a specific instruction may lead to minor injury and/or damage to equipment.

Note or **Comment**

Highlights important information relating to the product, its operation or its accompanying documentation.

4 Conformity of use

The products described in this manual **conform to the European Directives** (*) to which they are subject (CE marking). However, they can only be used correctly in the context of the applications for which they are intended (described in the various documents) and when connected to approved third party products.
As a general rule, if all handling, transport and storage specifications are observed, and all instructions for installation, operation and maintenance are followed, the products will be used correctly, with no danger to personnel or equipment.

(*) EMC and LV Directives, concerning Electromagnetic Compatibility and Low Voltage.

5 Installing and setting up equipment

It is important to observe the following rules when installing and starting up equipment. In addition, if the installation includes digital links, it is essential to follow the basic wiring rules given in the manual "Electromagnetic Compatibility of industrial Networks and Fielbuses"**, reference TSX DG KBLE,** or in manual **TSX DR NET**, part C.

- safety instructions must be followed meticulously. These instructions are in the documentation or on the equipment being installed and set up.
- the type of equipment defines the way in which it should be installed :
  - a flush-mountable device (for example, an operator terminal or a cell controller) must be flush-mounted,
  - a device which is to be built in (for example, PLC) must be placed in a cabinet or enclosure,
  - the casing of a laptop or portable device (for example, a programming terminal or a notebook) must remain closed,
- if the device is permanently connected,
  - the upstream installation must conform to standard IEC 1131-2 **overvoltage category 2**,
  - in addition, its electrical installation must include a device to isolate it from the power supply and a circuit-breaker to protect it against overcurrents and isolation faults. If this is not the case, the power socket must be grounded and be easily accessed. **In all cases, the device must be connected to the protective mechanical ground PG using green/yellow wires (NFC 15 100 - IEC 60 364-5-51) .**
- low voltage circuits (even though they are low voltage) must be connected to the protective ground so that dangerous voltages can be detected.
- before a device is powered up, its nominal voltage must be checked to ensure that it has been adjusted to conform with the supply voltage.
- if the device is supplied with 24 or 48 VDC, the low voltage circuits must be protected. Only use power supplies which conform to the standards currently in force.
- check that the supply voltages remain within the tolerance ranges defined in the technical characteristics of the devices.
- all measures must be taken to ensure that any power return (immediate, warm or cold) does not lead to a dangerous state which may risk personnel or the installation.
- emergency stop devices must remain effective in all the device's operating modes, even those which are abnormal (for example, when a wire becomes disconnected). Resetting these devices must not cause uncontrolled or improper restarts.
- cables which carry signals must be located where they do not cause interference with the control system functions by capacitive, inductive or electromagnetic interference.

- control system equipment and their control devices must be installed in such a way as to ensure that they are protected against unintentional operation.
- appropriate safety measures must be taken for the inputs and outputs, to prevent improper states in the control system device, if no signal is received.

6 Equipment operation

The operational safety and availability of a device is its ability to avoid the appearance of faults and to minimize their effects if they occur.

A system is said to be fail-safe if the appearance of faults **never** causes a dangerous situation.

A fault inside the control system is known as :

- passive, if it results in an open output circuit (no command is sent to the actuators).
- active, if it results in a closed output circuit (a command is sent to the actuators).

From the safety point of view, a given fault is dangerous or not depending on the type of command given during normal operation. A passive fault is dangerous if the normal command is the operation of an alarm. An active fault is dangerous if it maintains or activates an undesirable command.

It is important to note the basic difference between the behavior of an electromechanical relay and an electronic component (for example a transistor) :

- there is a high probability, approximately 90%, that the failure of a relay will cause an open circuit (control circuit powered off).
- there is a 50% probability that the failure of a transistor will cause either an open circuit or a closed circuit.

This is why it is important to correctly estimate the types and consequences of faults when automating a system using electronic products such as PLCs, including when relay output modules are used on PLCs.

The system designer must **use devices external to the PLC** to protect against active faults inside the PLC, which are not indicated and are judged to be dangerous to the application. This may require solutions from various different technologies such as mechanical, electromechanical, pneumatic or hydraulic devices (for example, directly wiring a limit switch and emergency stop switches to the coil of a movement control contactor).

To protect against dangerous faults which may occur on output circuits or preactuators, it is sometimes beneficial to resort to general principles and use the large processing capacity of PLCs, for example by using inputs to check the correct execution of commands requested by the program.

7 Electrical and thermal characteristics

Details of the electrical and thermal characteristics of devices are given in the associated technical documents (installation manuals, quick reference guides).

8 Environmental conditions

In industry, the micro-environmental conditions of electronic devices can vary greatly. For this reason, programmable controllers and associated modules must conform to the following two types of installation :

- installation in an enclosure with IP54 protection for protecting devices from metallic dust amongst other things. Two guidelines are associated with this type of installation :
  - direct access to electronic modules should be strictly reserved to maintenance staff (see section 2), with access keys,
  - the selection of a metal enclosure must be considered, since it serves as extra shielding against the latent risk of electromagnetic interference.
- direct installation without protection for Premium PLCs and associated systems (power supply modules, etc) which themselves have IP20 protection.
  This type of installation applies to areas with restricted access and low pollution levels (not exceeding 2), for example stations or control rooms which have neither machines nor any activity generating metallic dust or other metallic particles. The external walls hence serve as the PLC enclosure.

9 Preventive or corrective maintenance

Availability

The availability of a system is its ability, in terms of its combined reliability, maintainability and maintenance logistics, to be in a state to perform a required function, at a given moment and within a defined time period.

Availability is therefore specific to each application, since it is a combination of :

- the architecture of the automatic system,
- the reliability and maintainability : intrinsic characteristics of the equipment (PLCs, sensors, machine, etc),
- maintenance logistics : characteristic intrinsic to the user of the control system (software structure, fault indication, process, on-site replacement parts, training of personnel).

Troubleshooting procedure

- control system equipment should only be repaired by qualified personnel (after sales service engineer, or technician approved by Schneider Automation). Only certified replacement parts or components should be used.
- before performing any operation on equipment (for example opening an enclosure), always cut the power supply off (disconnect the power plug or open the power isolation switch).
- before performing any "mechanical" operation on equipment on site, cut the power supply off and mechanically lock any moving parts.
- before removing a module, a memory cartridge, a PCMCIA card, etc, check in the manual whether this should be done with the power off or if it is possible with the device powered up. Follow the instructions given in the manual carefully.
- on positive logic outputs or negative logic inputs, take all necessary precautions to prevent a disconnected wire coming into contact with the mechanical ground (risk of undesirable control action).

Replacement and recycling of used batteries

- if these are replaced, use batteries of the same type and dispose of defective batteries in the same way as toxic waste.
  Do not throw lithium or mercury batteries into a fire, open or recharge them, or attempt to solder them.

1.1 Description

1.1-1 General

The analog I/O modules in the Premium range are standard format modules (occupying a single position), equipped with one 25-pin SubD connector (TSX AEY 420/800/810 and TSX ASY 800), two 25-pin SubD connectors (TSX AEY 1600/1614), or a screw terminal block (TSX AEY 414 and TSX ASY 410). They can be installed in any position in TSX RKY.. racks, except for the first position which is reserved for the rack power supply.
The maximum number of analog modules which can be used in a TSX/TPMX/PCX 57 configuration is shown in the following table :

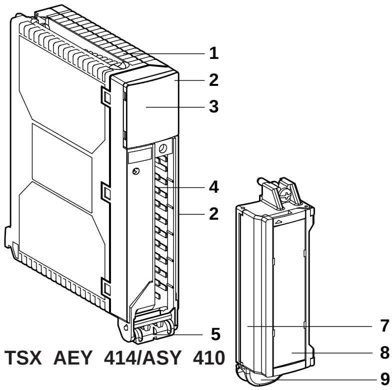
Module	**57-1•**	**57-2•**	**57-3•**	**57-4•**
Analog channels	24 (1)	80 (1)	128	256

(1) TSX AEY 420/800/810 and TSX ASY 800 modules are not compatible with TSX 57-10/20 processors, version $\leq$ V2.

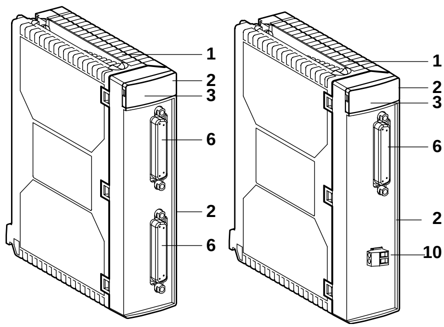
Note : if the TSX ASY 800 modules are powered by the internal 24V supply, the number of modules is reduced to 2 per rack (with double format power supply) or 1 per rack (with single format power supply.

1.1-2 Physical description

1 Rigid casing which provides support and protection for the electronic card.
2 Module reference markings (visible on the right side of the module).
3 Display block showing operating modes and errors.
4 Connector for the screw terminal block.
5 Module encoder.
6 25-pin SubD connector(s), for connecting sensors or preactuators.
7 Removable screw terminal block, for connecting sensors or preactuators. This terminal block is supplied separately under reference TSX BLY 01.
8 Cover providing access to the screw terminals. Also holds the terminal wiring and channel identification label.
9 Terminal encoder.
10 External power supply terminal.

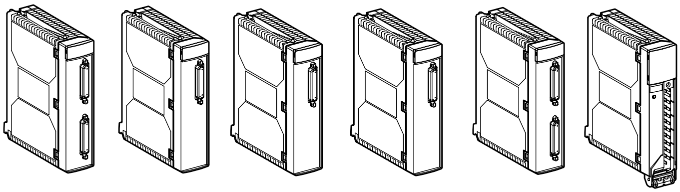


TSX AEY 414/ASY 410

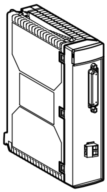
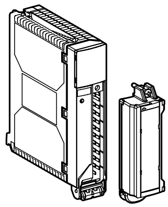


TSX AEY 16../8../420 TSX ASY 800

1.2 Input catalog

Module type	Input					
						
Number of channels	16	8		4	16	4
Range	± 10 V 0..10 V 0..5V 1..5V 0..20mA 4..20mA				-80..+80mV Thermocouple	± 10 V 0..10 V ± 5 V 0..5V 1..5V 0..20mA 4..20mA -13..+63mV 0..400Ω 0..3850Ω Temp. probe Thermocouple
Current consumed on 24 VR	0mA					
Current consumed on 5 V	270mA (typ.) 380mA (max)		475mA (typ.) 630mA (max)	500mA (typ.) 800mA (max)	300mA (typ.) 400mA (max)	660mA (typ.) 940mA (max)
Voltage common mode between channels	Common point		±200VDC	Common point	±100VDC	±200VDC
Resolution	12 bits		16 bits			
Connections	2 x 25-pin SubD	1 x 25-pin SubD			2 x25-pin SubD	20-pin screw terminal block
TSX reference	**AEY 1600**	**AEY 800**	**AEY 810**	**AEY 420**	**AEY 1614**	**AEY 414**

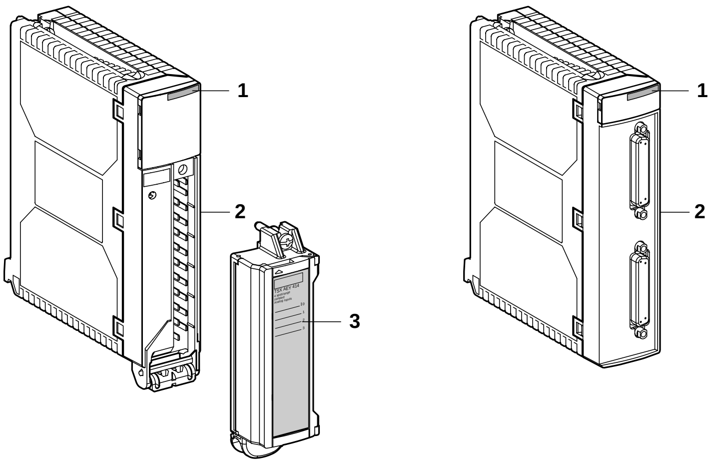
1.3 Output catalog

Module type	Output	
		
Number of channels	8	4
Range	± 10 V 0..20 mA 4..20 mA	
Current consumed on 24 VR	300 mA (typ.) (1) 455 mA (max)	0 mA
Current consumed on 5 V	200 mA (typ.) 300 mA (max)	990 mA (typ.) (2) 1220 mA (max) (2)
Channel isolation	Common point	1500 Vrms isolation
Resolution	14 bits for voltage/13 bits for current	11 bits + sign
Connections	1 x 25-pin SubD, 2-pin screw terminal block	20-pin screw terminal block
TSX reference	**ASY 800**	**ASY 410**

(1) If a 24 V internal power supply is used (0 mA if external power supply is used)
(2) + 20 mA per active channel

1.4 Labeling

The module is identified by laser-engraved markings on the cover, accessible on the front panel and the right-hand side of the module :



- module marking **1**, which indicates the module reference,
- module marking **2**, which indicates the module reference and type,
- removable terminal block label **3**, located inside the cover, displaying the module reference and type and the terminal wiring. Additional information may be added to this double-sided label by the user.

2.1 Installation recommendations

2.1-1 Module and terminal block installation

Inserting/removing modules

Analog modules and terminal blocks can be inserted and removed when the PLC is **powered up** (without risk of damage to the modules or interference to the PLC).

The presence of the terminal block is detected using a shunt positioned in the upper part of the terminal block, which should **always be tightened to its maximum**.

The terminal block should always be removed before removing the module. This avoids leading voltage on to the terminal block inputs (up to 1700 V) in the event of a module isolation fault.
With the TSX ASY 800 module, the external 24V terminal block should also be removed before removing the module.

Encoding the screw terminal block

The first time a screw terminal block is fitted onto a module, the coding is transferred from the module to the terminal block which then becomes specific to the module type (for more information about encoding the terminal block, please refer to section 5 in part A1).

2.2 Wiring recommendations

To protect the signal against external noise in series mode and common mode noise, it is advisable to take the following precautions :

Conductor type
Use shielded twisted pairs with a minimum cross-section of 0.28 mm^2 (AWG24 gauge).

Cable shielding

- **for modules fitted with a screw terminal block (TSX AEY 414 / TSX ASY 410)**

  Connect the shielding at each end of the cable to the shielding connection terminals (ground terminals). See the paragraph on the following page concerning referencing of sensors and preactuators to ground.

- **for modules fitted with SubD connector(s) (TSX AEY 420/800/810/1600/1614 and TSX ASY800)**

  As there is a large number of channels, a minimum 13-pair twisted cable will be used with general shielding (external diameter 15 mm maximum), fitted with a 25-pin male SubD connector for linking with the module.
  Connect the shielding of the cable to the cover of the male SubD connector. It is connected to the PLC ground via the SubD connector retention screws (for this reason, it is therefore essential to screw the male SubD connector onto its female base).

Grouping of conductors in cables
Signals of the same type with the same reference to ground can be grouped together in multipair cables.

Cable routing
Keep the discrete I/O cables (especially those for relay outputs) as far away as possible from the power cables.

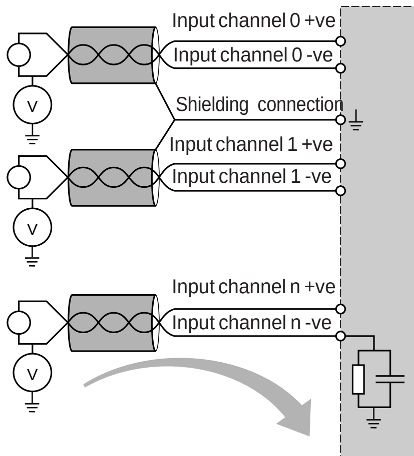
Sensors referenced to ground
For modules with non-isolated channels (TSX AEY 800, TSX AEY 420 and TSX AEY 1600), sensors **which are not referenced to ground** are preferred.

To ensure correct operation of the measurement system, the following precautions are advised :

- sensors should be located near to each other (few meters),
- all the sensors should be referenced to the same point, which is connected to the module ground.

Use of sensors referenced to ground
If the sensors are referenced to ground, this can, in certain cases, lead to a ground voltage at the terminal block or SubD connector(s) due to a distant earth ground connection. It is therefore **essential** that the following rules are observed :

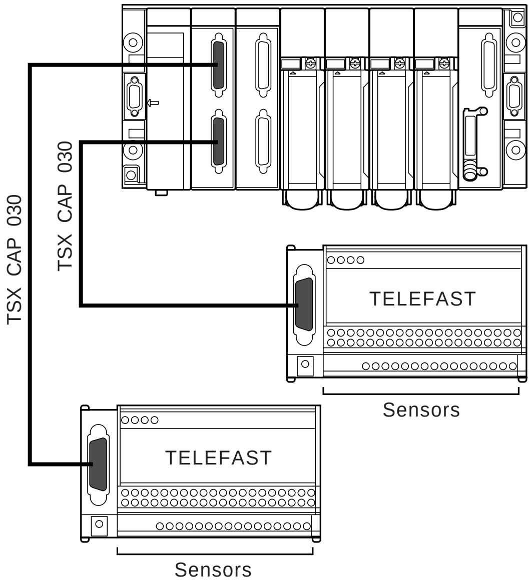
- this voltage must be less than the safety voltage,
- when a reference voltage is taken to a sensor it can cause leakage current. It should therefore be checked that any leakage current generated does not interfere with the system.



Use of preactuators referenced to ground
There is no technical restriction for referencing preactuators to ground. For safety reasons, however, it is preferable to avoid the introduction of a ground voltage at the terminal block due to a distant earth ground connection, as this may vary significantly from the ground voltage due to a local earth ground connection.

2.3 TELEFAST wiring accessories

Using TELEFAST wiring accessories facilitates the installation of TSX AEY 420/800/810/1600/1614 and TSX ASY800 analog modules, by giving access to the inputs (or outputs) via screw terminals.
The analog module is connected to the TELEFAST accessories via a 3 meter shielded cable, reference TSX CAP 030 which has 25-pin SubD connectors fitted at both ends.



There are 5 types of analog TELEFAST wiring accessory :

- TELEFAST accessory, reference ABE 7 CP A02, distributes the 8 channels from a 25-pin SubD connector, to the screw terminals,
- TELEFAST accessory, reference ABE 7 CP A03, distributes the 8 channels from a 25-pin SubD connector, to the screw terminals; but also :
  - supplies, channel by channel, the 2 and 4-wire sensors with a 24 V supply protected and current-limited (30 mA),
  - maintains the continuity of the current loops when the 25-pin SubD connector is removed,
  - protects the current shunt contained in the modules against overvoltages.
- TELEFAST accessory, reference ABE 7 CP A31, distributes the 8 channels from a 25-pin SubD connector, to the screw terminals; but also :
  - supplies, channel by channel, the 2 and 4-wire sensors with an IEC 24 V supply protected and current-limited (25 mA), maintaining the isolation between the module channels.
  - protects the current shunt (250 Ω) contained in the modules against overvoltages.

- TELEFAST accessory, reference ABE 7 CP A12, distributes the 8 channels from a 25-pin SubD connector, to the screw terminals for connecting thermocouples. It is a junction box, fitted with an integral temperature probe, which also performs cold junction compensation at the connection terminal block.

Number of channels which can be connected :
  - 16 thermocouple channels in TELEFAST internal cold junction compensation mode
  - 14 thermocouple channels in external cold junction compensation mode with a 4-wire Pt100 probe on channels 0 and 8

- TELEFAST accessory, reference ABE 7CPA21, distributes the 4 channels from a 25-pin SubD connector, to the screw terminals.
- The TSX ASY 410 analog module is connected to the TELEFAST accessory using one of the following cables :
  - ABF-Y25S150 : length 1.5m
  - ABF-Y25S200 : length 2m
  - ABF-Y25S300 : length 3m
  - ABF-Y25S500 : length 5m

  These cables are part of the TSX BLY 01 terminal block.

The following table shows the TELEFAST accessories which can be used with each module :

Module	**ABE 7 CPA02**	**ABE 7 CPA03**	**ABE 7 CPA31**	**ABE 7 CPA12**	**ABE 7 CPA21**
TSX AEY 420	X	X			X
TSX AEY 800	X	X			
TSX AEY 810	X		X		
TSX AEY 1600	X	X			
TSX AEY 1614				X	
TSX ASY 410					X
TSX ASY 800	X				

Note

The TELEFAST wiring accessory, reference ABE 6 SD 2520, can be used instead of the TELEFAST ABE 7 CP A02, as it has the same functions (the only difference between the 2 wiring accessories is that the TELEFAST ABE 6 SD 2520 belongs to the TELEFAST first-generation range).

3.1 External faults

3.1-1 Range overshoot

At the time of measurement range overshoot, the following bits are set to 1 :

- fault bit **%Ixy.i.ERR**, associated with the channel
- bit 1 (range overshoot) of "status" word **%MWxy.i.2** associated with channel i for TSX AEY 414/800/1600 and TSX ASY 410 modules (version : II >10).
- bit 14 or 15 (range overshoot : lower or upper overshoot zone) of "status" word **%MWxy.i.2** associated with the channel for TSX AEY 420/810/1614 modules.
- bit 1 (indicates range overshoot), and bit 3 (if set to 0, indicates a lower limit range overshoot, if set to 1, indicates an upper limit range overshoot) of "status" word **%MWxy.i.2** associated with the channel for TSX ASY 800 and TSX ASY 410 modules (version : II > 10).

The **I/O indicator lamp is permanently on** during the fault.

Note :
Overshoot monitoring parameters can be configured for TSX AEY 420/810/1614 and TSX ASY 800 modules (see the overshoot monitoring section for each module).

3.1-2 Sensor link fault (TSX AEY 414/1614)

When a sensor link fault occurs (refer to section 4.2-3, sensor link monitoring in part B), the following bits are set to 1 :

- fault bit **%Ixy.i.ERR**, associated with the channel,
- bit 0 (sensor link fault) of "status" word **%MWxy.i.2** associated with the channel (for example, %MW2.0.2:X0 for channel 0 of the module located in slot 2).

The **I/O indicator lamp is permanently on** during the fault.

Note :
Sensor link fault monitoring can be activated and deactivated via the configuration.

3.2 Internal faults

Each module carries out a series of self-tests (watchdog, memory, analog/digital conversion circuit).

When an error occurs during these tests, an internal fault is signalled. The channels change to 0 and the **ERR indicator lamp is permanently on**.

If a module is inoperative and can no longer communicate with the processor, the latter will still be informed as it detects a module which is absent or inoperative.

Self-test performed	Status of ERR indicator lamp during a fault	Feedback of fault to the processor
Watchdog test	Permanently on	no
Checksum of REPROM memory	Permanently on	no
Test of X Bus interface	Permanently on	no
Test of external RAM	Permanently on	no
Test of EEPROM memory	Permanently on	no
Test of converters (1)	Permanently on	yes
Test of internal references (2)	Permanently on	yes

(1) TSX AEY 414/1614 modules
(2) TSX AEY 800/810/1600 modules

3-3 Other faults

3.3-1 Communication fault

When a fault of communication with the processor occurs, the images of the channel values (at PLC processor level) are frozen at the last value before the fault.

3.3-2 Terminal block fault

If the terminal block fault is configured, it occurs when at least one channel is used, while the corresponding SubD connector or terminal block is absent. When such a fault occurs, the following bits are set to 1 :

- fault bit **%Ixy.i.ERR**, associated with the channel,
- bit 2 (terminal block fault) of "status" word **%MWxy.i.2** associated with the channel (for example, %MW2.0.2:X2 for channel 0 of the module located in slot 2) for TSX AEY420/810/1614 and ASY 800 modules.

The **I/O indicator lamp flashes** during the fault.

Note : Terminal block monitoring can be activated and deactivated via the configuration.

3.3-3 Output power supply (TSX ASY 800)

If the output power supply fault is configured, it occurs when an external power supply is used to supply the module and the absence of this power supply is detected. When such a fault occurs, the following bits are set to 1 :

- fault bit **%Ixy.i.ERR**, associated with the channel,
- bit 1 (power supply fault) of "status" word **%MWxy.mod.2** associated with the module (for example, %MW2.mod.2:X1 for the module located in slot 2).

The **I/O indicator lamp is permanently on** during the fault.

Note :
The selection of internal or external power supply and fault monitoring can be activated and deactivated via the configuration.

3.4 Fault display

Analog modules are fitted with a display block comprising 3 indicator lamps which display the module operating modes and possible faults : RUN, ERR and I/O indicator lamps.

Module status	Status indicator lamps		
	RUN	ERR	I/O
Normal operation	●	○	○
Module not configured	○	⊗	○
External fault (range overshoot or external 24 V power supply fault)	●	○	●
Internal fault (module failure)			
• communication with CPU possible	●	●	○
• communication with CPU not possible	○	●	○
Other fault (communication fault)	●	○	○
Other fault (terminal block fault)	●	○	⊗

Note
If a range overshoot occurs at the same time as a terminal block fault, the indicator lamps will indicate a range overshoot (I/O on).

○ Indicator lamp off

⊗ Indicator lamp flashing

● Indicator lamp on

Section **Page**

Section			Page

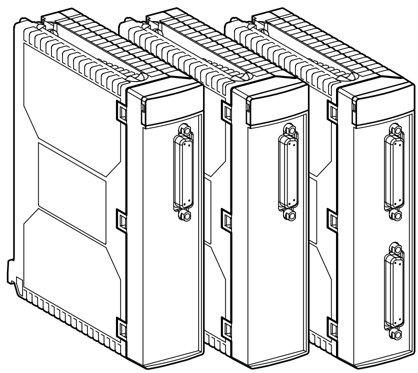
1.1 Presentation

General

TSX AEY 800, TSX AEY 810 and TSX AEY 1600 modules are analog input modules with 8 /16 high level inputs. Linked to sensors or transmitters, they perform monitoring, measurement and continuous process control functions.

The TSX AEY 800, TSX AEY 810 or TSX AEY 1600 module offers the range ± 10 V, 0..10 V, 0..5 V, 1..5 V, 0..20 mA or 4..20 mA for each of its inputs, depending on the choice made during configuration.

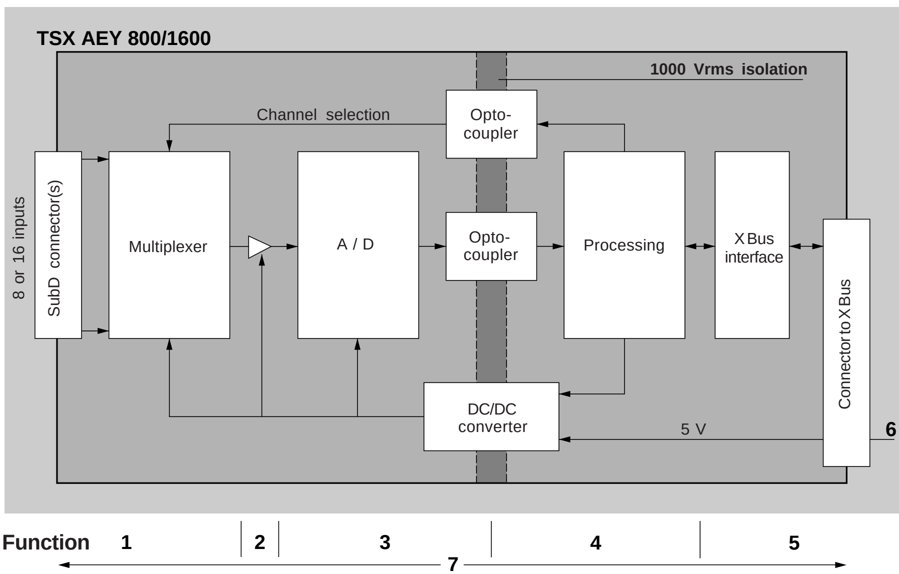
TSX AEY 800 / TSX AEY 810 / AEY 1600



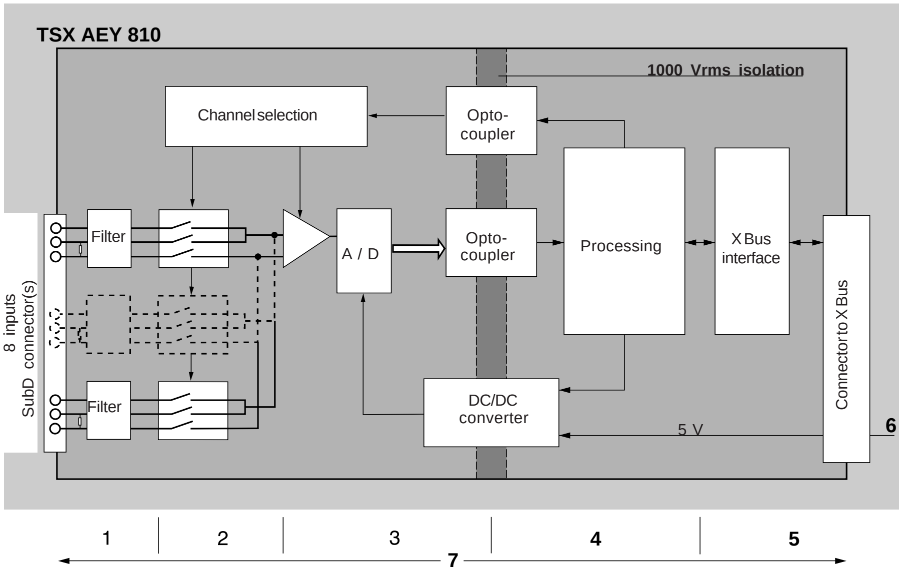
Functions

TSX AEY 800, TSX AEY 810 and TSX AEY 1600 input modules perform the following functions :

TSX AEY 800 and TSX AEY 1600



TSX AEY 810



1 Connection to the process and scanning of input channels

- physical connection to the process, via SubD connector(s),
- protection of the module against overvoltages (peak limiting diodes),
- adaptation of input signals by analog filtering,
- scanning of input channels, by solid state multiplexing (it is possible to scan only those channels defined as being used : **fast cycle**).
  For the TSX AEY 810, multiplexing is performed by optical switches which isolate the channels.

2 Adaptation to input signals

- gain selection, according to the characteristics of the input signals, defined during configuration (unipolar or bipolar voltage or current range),
- compensation for drift in the amplifier circuits.

3 Digitalization of input measurement analog signals

- 12-bit analog / digital converter for TSX AEY 800/1600,
- 16-bit analog / digital converter for TSX AEY 810,

4 Converting input measurements to a unit which can be handled by the user

- acceptance of recalibration and alignment coefficients to be applied to the measurements, as well as the autocalibration coefficients of the module,
- measurement filtering (digital filter), according to the configuration parameters,
- measurement scaling, according to the parameters set during configuration.

5 Interface and communication with the application

- management of exchanges via X bus,
- geographical addressing,
- reception of module and channel configuration parameters,
- transmission of measured values, as well as the module status, to the application.

6 Module power supply

7 Monitoring the module and indicating possible faults to the application

- test for the conversion circuit,
- test for range overshoot on the channels,
- test for the presence of the terminal block,
- test of watchdog.

1.2 Input processing

1.2-1 Measurement sampling

Measurement sampling depends on the cycle used, defined during configuration : normal cycle or fast cycle.

In **normal cycle**, the input scan cycle is fixed, irrespective of the number of inputs used : 27 ms for a TSX AEY 800 module, 29.7 ms for a TSX AEY 810 module, 51 ms for a TSX AEY 1600 module.

In **fast cycle**, only the channels defined as used are scanned, even if they are not consecutive. This improves the module scan time. The module scan time is represented by the following formula :

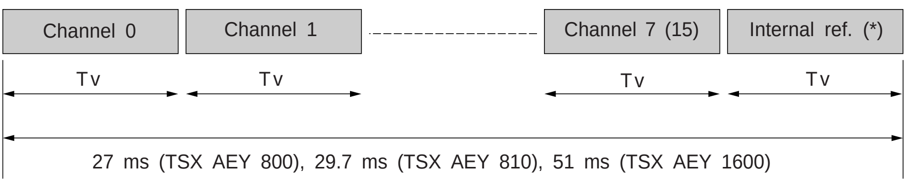
Tc (ms) = (N+1) x Tv

where N = number of channels used, Tv = channel scan time :
- 3 ms for a TSX AEY 800 module.
- 3.3 ms for a TSX AEY 810 module.
- 3 ms for a TSX AEY 1600 module.

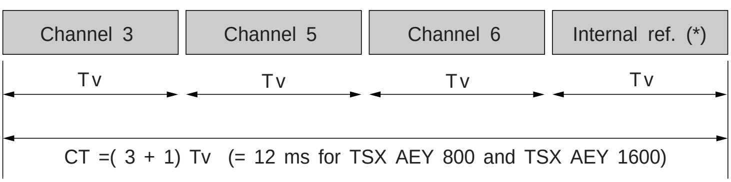
For example, if 6 channels are used on a TSX AEY 800 module, the cycle time is (6 +1)x 3 = 21 ms

Filtering is inhibited in fast mode.
The scan cycle of the channels used is as follows :

- **normal cycle**



- **fast cycle** (for example, channels 3, 5 and 6 used)



(*) corresponds to the acquisition of voltage references integrated in the module, to enable its periodic autocalibration.

Note
The module scan is not synchronous with the PLC scan (application). At the start of each PLC cycle, the channel values are taken into account, which means that some values will not have changed if the scan of the MAST task is shorter than that of the module.

B

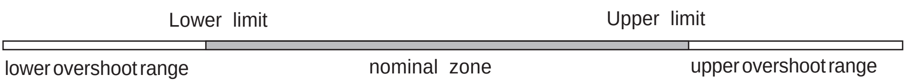
1.2-2 Range selection and overshoot monitoring

Each module has the choice of 6 ranges for each of its inputs : ± 10 V, 0..10 V, 0..5 V, 1..5 V, 0..20 mA and 4..20 mA.
The module monitors the overshoot for the chosen range, ie. it checks that the measurement is between the upper and lower limits.

TSX AEY 800 and TSX AEY 1600 modules

Overshoot monitoring is always enabled. The measurement range is divided into three zones :

- **the nominal zone,** corresponding to the selected range,
- **the upper overshoot zone**, located above the upper limit,
- **the lower overshoot zone**, located below the lower limit.



Outside these limits (upper or lower overshoot zone), the analog measurement circuit risks saturation and an overshoot fault is signaled by a bit which can be used by the program (error bit **%Imodule.channel.ERR** = 1 indicates a channel fault, and status word bit **%MWmodule.channel.2:X1** = 1 indicates a range overshoot on the channel).

Modules generally allow a 5% range overshoot of the positive electrical range (for example, 5% of 10V for the range ± 10 V). The 0-5 V and 0-20 mA ranges will not tolerate a negative overshoot. As soon as the measured value becomes negative, a range overshoot fault is signaled.

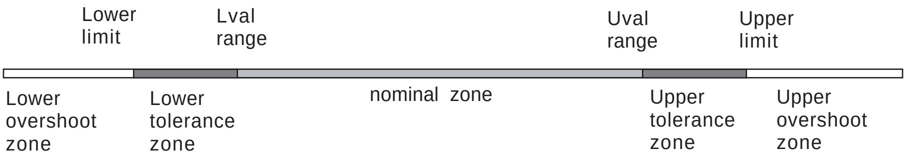
AEY 800 AEY 1600 Range	**Lower limit**	**Upper limit**	**Default values Standard format**	**Min. limit in User (1) format**	**Max. limit in User (1) format**
± 10 V	- 10.5 V	+ 10.5 V	±10500	Min - 5% (max-min)/2	Max + 5% (max-min)/2
0..10 V	- 0.5 V	+ 10.5 V	-500..10500	Min - 5% (max-min)	Max + 5% (max-min)
0..5 V	0 V	+ 5.25 V	0..10500	Min (2)	Max + 5% (max-min)
1..5 V	0.8 V	+ 5.2 V	-500..10500	Min - 5% (max-min)	Max + 5% (max-min)
0..20 mA	0 mA	+ 21 mA	0..10500	Min (2)	Max + 5% (max-min)
4..20 mA	+ 3.2 mA	+ 20.8 mA	-500..10500	Min - 5% (max-min)	Max + 5% (max-min)

Min / Max : minimum / maximum values entered in USER format configuration.
(1) See section 1.2-4
(2) Range overshoot is signaled for an overshoot of approximately :
-10 mV for the range 0..5 V,
-40 µA for the range 0..20 mA.

TSX AEY 810 module

Overshoot monitoring is optional. The measurement range is divided into 5 zones :

- **the nominal zone,** corresponding to the selected range,
- **the upper tolerance zone,** with values between the upper value of the range (eg : +10V for a range +10V/-10V) and the upper limit,
- **the lower tolerance zone**, with values between the lower value of the range (eg : -10V for a range +10V/-10V) and the lower limit,
- **the upper overshoot zone**, located above the upper limit,
- **the lower overshoot zone**, located below the lower limit.



When the value read is in one of the 2 tolerance zones, warning bit %IWxy.i.1:X5 (for the lower zone) or %IWxy.i.1:X6 (for the upper zone) is set to 1.
When the value read is in one of the 2 overshoot zones (and overshoot monitoring is required), error bit %Ixy.ERR is set to 1, and the overshoot type (overshoot of lower or upper value) is indicated in bit %MWxy.i.2:X1 (range overshoot) and %MWxy.i.2:X4 (for the lower zone) or %MWxy.i.2:X5 (for the upper zone). The measured value is then limited.

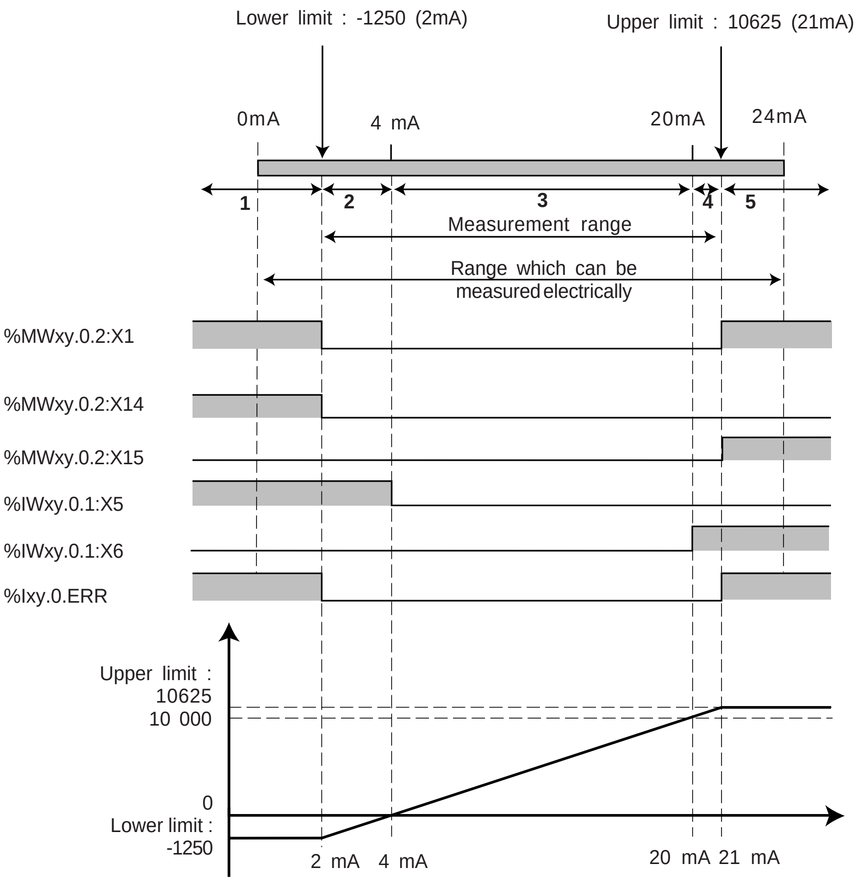
The upper and lower limits can be configured separately. They can have whole values between the following values :
Lower limit = Lval range + lower tolerance zone
Upper limit = Uval range + upper tolerance zone

Range	Lower tolerance zone			Upper tolerance zone		
	Default value	**Max value**	**Min value**	**Default value**	**Min value**	**Max value**
Bipolar	-0.125 x FS/2	0	-0.25 x FS/2	0.125 x FS/2	0	0.25 x FS/2
Unipolar	-0.125 x FS	0	-0.25 x FS	0.125 x FS	0	0.25 x FS
Standardized Bipolar	-1250	0	-2500	1250	0	2500
Standardized Unipolar	-1250	0	-2500	1250	0	2500
User Bipolar	-0.125 x Δ range/2	0	-0.25 x Δ range/2	0.125 x Δ range/2	0	0.25 x Δ range/2
User Unipolar	-0.125 x Δ range	0	-0.25 x Δ range	0.125 x Δ range	0	0.25 x Δ range

where FS = 20 (range ± 10V and 0..20mA), = 10 (range ± 5V and 0..10V), = 5 (range 0..5V), = 4 (range 1..5V),= 16 (range 4..20mA),
Δ range = upper value range - lower value range.

Notes :
- the bipolar range is the range ± 10V, the unipolar ranges are ranges 0..20mA, 0..10V, 0..5V, 1..5V, 4..20mA.
- by default, overshoot monitoring is active. It can be partially activated (only for lower or upper overshoots) and deactivated.

Example of overshoot in the range 4..20mA in standardized mode, on channel 0.



where **1** = lower overshoot zone, **2** = lower tolerance zone, **3** = nominal zone, **4** = upper tolerance zone, **5** = upper tolerance zone,

1.2-3 Measurement filtering

First order filtering is performed with a filtering coefficient which can be modified from a programming terminal or by the program. The mathematical formula used is as follows :

$$\mathbf{Mes_{fn} = \alpha \times Mes_{fn-1} + (1-\alpha) \times Val_{bn}}$$

where : α = filter efficiency, **Mes_{fn}** = filtered measurement at moment n,
Mes_{fn-1} = filtered measurement at moment n-1, **Val_{bn}** = "raw" value measured at moment n.
During configuration the user selects a filter value from 7 possible values (0 to 6).
This value may be modified, even when the application is in RUN.
Reminder : Filtering is inhibited in the fast cycle

TSX AEY 800

Efficiency required	Value to select	Corresponding α	Filter response time at 63%	Cut off frequency (Hz)
No filter	0	0	0	-
Low level of filtering	1 2	0.750 0.875	100 ms 202 ms	1.591 0.788
Medium level of filtering	3 4	0.937 0.969	419 ms 851 ms	0.379 0.187
High level of filtering	5 6	0.984 0.992	1.714 s 3.442 s	0.093 0.046

TSX AEY 810

Efficiency required	Value to select	Corresponding α	Filter response time at 63%	Cut off frequency (Hz)
No filter	0	0	0	-
Low level of filtering	1 2	0.750 0.875	104.3 ms 224.7 ms	1.526 0.708
Medium level of filtering	3 4	0.937 0.969	464.8 ms 944.9 ms	0.342 0.168
High level of filtering	5 6	0.984 0.992	1.905 s 3.825 s	0.084 0.042

TSX AEY 1600

Efficiency required	Value to select	Corresponding α	Filter response time at 63%	Cut off frequency (Hz)
No filter	0	0	0	-
Low level of filtering	1 2	0.750 0.875	178 ms 382 ms	0.894 0.416
Medium level of filtering	3 4	0.937 0.969	791 ms 1.607 s	0.201 0.099
High level of filtering	5 6	0.984 0.992	3.239 s 6.502 s	0.049 0.024

1.2-4 Measurement display

The measurement supplied to the application can be used directly by the operator, who can choose between :

- using the 0..10000 standard display (or ±10000 for the range ±10 V),
- setting his own display format parameters by indicating his required minimum and maximum values.

Standardized display. Values are displayed in standard units :

- for a unipolar range of 0-10 V, 0-5 V, 0-20 mA or 4-20 mA, they are displayed from 0 to 10000 (0 $^{0}/_{000}$ to 10000 $^{0}/_{000}$),
- for the bipolar range of ± 10 V, they are displayed from - 10000 to + 10000 (-10000$^{0}/_{000}$ to +10000$^{0}/_{000}$).

User display. The user can choose the range of values in which the measurements are expressed, by choosing :

- the lower limit corresponding to the minimum of the range 0 $^{0}/_{000}$ (or - 10000 $^{0}/_{000}$),
- the upper limit corresponding to the maximum of the range + 10000 $^{0}/_{000}$.

These upper and lower limits are integers between -30000 and +30000.

For example, suppose a conditioning unit indicates information about pressure on a 4-20 mA loop, with 4 mA corresponding to 3200 mB and 20 mA corresponding to 9600 mB. The user can then select the User format, by defining the following upper and lower limits :

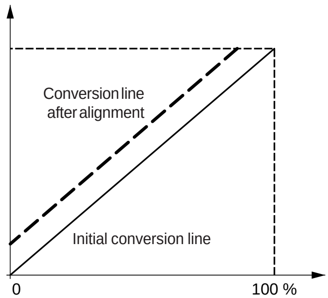
- 0 $^{0}/_{000}$ <=> 3200 as lower limit,
- 10000 $^{0}/_{000}$ <=> 9600 as upper limit.

The values transmitted to the program will vary between 3200 (= 4 mA) and 9600 (= 20 mA).

For more information about the standardized or user display, refer to the installation manual for application-specific functions, reference TLX DS 57 PL7 33E.

1.2-5 Sensor alignment

Alignment consists of eliminating a systematic shift observed by a given sensor, around a given operating point. An error linked to the process will be compensated but not an error linked to the control system. For this reason, replacing a module does not require a new alignment. On the other hand, replacing the sensor or changing the operating point of that sensor will require a new alignment.



For example, suppose that a pressure sensor, linked to a conditioning unit (1mV/mB), indicates 3200 mB, while the actual pressure is 3210 mB. The value measured by the module in standardized scale will be 3200 (3.20 V). The user can align the measurement to the value 3210 (required value). After this alignment procedure, the measurement channel will apply a systematic offset of +10 to any new measurement.

The alignment value which should be entered is 3210.

The alignment value can be modified via a programming terminal, even if the program is in RUN. For each input channel, the user can :

- display and modify the required measurement value,
- save the alignment value,
- know if the channel already has an alignment.

The alignment offset can also be modified via the program.
Alignment is performed when the channel is in normal operation, without affecting the operating modes of the module channel.

The maximum deviation between the measured value and the required value (aligned value) should not exceed ± 1000.

The alignment offset is saved in the word %MWxy.i.8.

Note : for TSX AEY 810, bit %IWxy.i.1:X0 = 1 indicates that the channel is aligned.

1.2-6 Recalibration

For TSX AEY 800, TSX AEY 810 and TSX AEY 1600 modules, it is only necessary to recalibrate channel 0 in order to recalibrate the whole module.
It is recommended that the module should be recalibrated outside the application.
Recalibration can be performed with the PLC task linked to the channel, in RUN or in STOP.

In recalibration mode, the measurements of all the module channels are declared invalid (bit %Ixy.i.ERR = 1 for TSX AEY 800 and TSX AEY 1600 modules, bit %IWxy.i.1:X2= 1 for the TSX AEY 810 module), filtering and alignment are inhibited, the acquisition cycles of the channels can be extended.
As inputs other than channel 0 are not read during recalibration, the value transmitted to the application for these other channels is the last value measured before recalibration.

Recalibration is performed from the calibration screen and is performed for the whole module only on channel 0. To do this :

- click on a channel to go to recalibration mode (a confirmation message signals the change to this mode),
- connect a voltage reference to **the voltage input** of channel 0, according to the range to be recalibrated :
  - reference = 10 V ± 20 ppm, to recalibrate the module for the ranges ± 10 V and 0..10 V,
  - reference = 5 V ± 20 ppm, to recalibrate the module for the ranges 0..5 V, 1..5 V, 0..20 mA and 4..20 mA.
    Warning : the 5 V reference recalibrates the whole **measurement circuit** or the ranges 0..20 mA and 4..20 mA, but does not take into account the **250 Ω current shunt** integrated in the module and located on the current input,
- select in the calibration screen the connected reference (for example 10 V). Wait the necessary time for the voltage reference to stabilize, then confirm the selection. Recalibration of the ranges linked to this reference (for example, ± 10 V and 0..10 V) is performed automatically. The displayed value of channel 0 should therefore be 10000 ± 10.
- the user can then connect another external voltage reference (for example 5 V), then repeat the previous procedure up to the automatic recalibration of the ranges linked to that reference (0..5 V, 1..5 V, 0..20 mA and 4..20 mA).

Recalibration is not accepted until it has been saved in the module ("**save**" button). The "**Return to Factory Parameters**" button cancels all recalibrations and reverts to the initial recalibration (performed in the factory). Pressing the "Return to Factory Parameters" button triggers a confirmation message. However, after confirmation, it is immediately accepted and does not require saving.
If the user exits the screen without saving, a message is displayed which reminds the user that it has not been saved. If the user still chooses to exit the screen, the new calibration coefficients will be lost (it will revert to the old coefficients).

1.3 Characteristics

1.3-1 Input characteristics

Module	TSX AEY 800	TSX AEY 1600	TSX AEY 810
Number of channels	8	16	8
Analog / digital conversion	12 bits (3719 points for voltage / 3836 points for current)		16 bits (49090 points for voltage /24545 points for current)
Configuration of acquisition scan	Fast : periodic acquisition of channels used Normal : periodic acquisition of all channels		
Conversion time	3 ms / channel		3.3 ms / channel
Dielectric voltage channels / ground	1000 V rms		1000 V rms
Isolation between channels	Common point		± 200 VDC
Isolation betw. bus and channs.	1000 V rms		1000 V rms.
Max. permissible overvoltage on inputs	± 30 V for voltage ± 30 mA for current		± 30 V for voltage ± 30 mA for current
Input impedance • for voltage • for current	10 MΩ 250 Ω		10 MΩ 250 Ω
Max. dissipated power	1.9 W		3.15 W
Standards	IEC 1131		IEC 1131, CSA22.2, UL508
Electrical range	± 10 V and 0..10 V	0..5 V and 1..5 V	0..20 mA and 4..20 mA
Full scale (FS)	10 V	5 V	20 mA
Resolution (1)	5.38 mV	1.34V	5.1 µA
Maximum error at 25 °C (1) **Max error from 0 to 60 °C** (1)	0.19% FS 0.22% FS	0.15% FS 0.22% FS	0.25% FS 0.41% FS
Temperature drift (1)	20 ppm / °C	20 ppm / °C	45 ppm / °C
Range overshoot (2)	± 10.5 V (± 12.5 V) in range ± 10 V -0.5..10.5V (-2.5..12.5V) in range 0..10 V	0..5.25 V(0..6.25 V) in range 0.. 5 V 0.8..5.2 V (0..6V) in range 1..5 V	0..21 mA(0..25 mA) in range 0.. 20 mA 3.2..20.8 mA (0..24 mA) in range 4..20 mA
Precision of internal conversion resistance	/	/	0.1% - 25 ppm / °C (0.01% - 25 ppm / °C)

(1) these values do not apply to the TSX AEY 810 module. Its characteristics are shown in the table below,
(2) the TSX AEY 810 module overshoot limits can be configured (see section 3.2-2)

TSX AEY 810 module

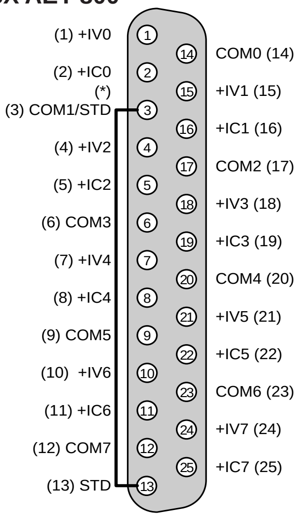
Electrical range	± 10 V and 0..10 V	0..5 V and 1..5 V	0..20 mA and 4..20 mA
Full scale (FS)	10 V	5 V	20 mA
Resolution	406 µV	203 µV	812 nA
Maximum error at 25 °C **Max. error from 0 to 60 °C**	0.244% 0.305%	0.13% 0.191%	0.142% 0.212%
Temperature drift	15.3ppm / °C	15.3 ppm / °C	17.5 ppm / °C

B

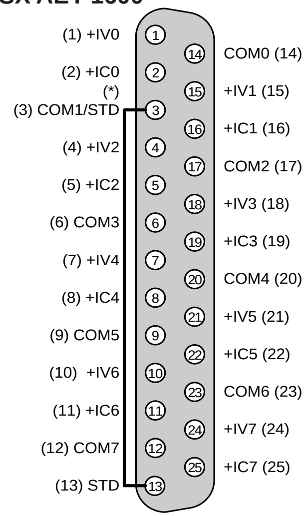
1.4 Connections

1.4-1 Connector pinout

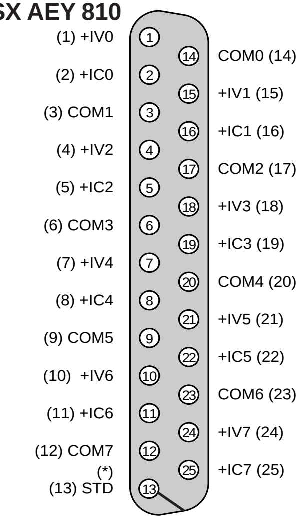
TSX AEY 800

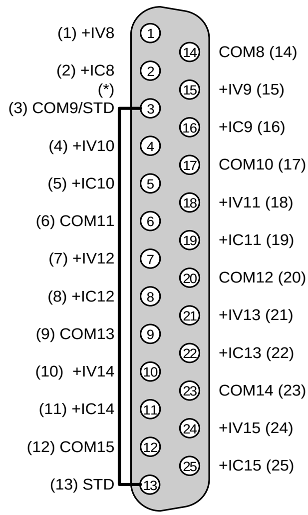


TSX AEY 1600



TSX AEY 810





+IVx : +ve voltage input of channel x	+ICx: +ve current input of channel x
COMx: -ve input of channel x (voltage or current)	STD : "Strap" (*) to detect removal.

For the TSX AEY 810 : to detect removal of the terminal block, connect pin 13 to ground via the SubD cover.

1.4-2 TELEFAST pinout

After connecting the analog module to a TELEFAST accessory, via cable TSX CAP 030, the distribution of the analog channels on the TELEFAST terminals is as follows :

TELEFAST, reference ABE 7 CP A02

TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal	TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal
1	/	Ground	Supp1	/	Ground
2	/	STD (1)	Supp2	/	Ground
3	/	STD (1)	Supp3	/	Ground
4	/	STD (2)	Supp4	/	Ground
100	1	+IV0 or +IV8	200	14	COM0 or COM8
101	2	+IC0 or +IC8	201	/	Ground
102	15	+IV1 or +IV9	202	3	COM1 or COM9
103	16	+IC1 or +IC9	203	/	Ground
104	4	+IV2 or +IV10	204	17	COM2 or COM10
105	5	+IC2 or +IC10	205	/	Ground
106	18	+IV3 or +IV11	206	6	COM3 or COM11
107	19	+IC3 or +IC11	207	/	Ground
108	7	+IV4 or +IV12	208	20	COM4 or COM12
109	8	+IC4 or +IC12	209	/	Ground
110	21	+IV5 or +IV13	210	9	COM5 or COM13
111	22	+IC5 or +IC13	211	/	Ground
112	10	+IV6 or +IV14	212	23	COM6 or COM14
113	11	+IC6 or +IC14	213	/	Ground
114	24	+IV7 or +IV15	214	12	COM7 or COM15
115	25	+IC7 or +IC15	215	/	Ground

Terminal detection :

- TSX AEY 1600/800 modules : connect terminals STD (1) and STD (2) using a "strap",
- TSX AEY 810 modules : connect terminals STD (1) and ground (pin no. 1) using a "strap".

TELEFAST, reference ABE 7 CP A03

TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal	TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal
1	/	0 V	Supp1	/	24 V (sensor supp.)
2	/	0 V	Supp2	/	24 V (sensor supp.)
3	/	0 V	Supp3	/	0 V (sensor supp.)
4	/	0 V	Supp4	/	0 V (sensor supp.)
100	/	IS1 or IS9 (*)	200	/	IS0 or IS8 (*)
101	15	+IV1 or +IV9	201	1	+IV0 or +IV8
102	16	+IC1 or +IC9	202	2	+IC0 or +IC8
103	/	Ground	203	14 / 3	COM0 / COM1 or COM8 / COM9
104	/	IS3 or IS11 (*)	204	/	IS2 or IS10 (*)
105	18	+IV3 or +IV11	205	4	+IV2 or +IV10
106	19	+IC3 or +IC11	206	5	+IC2 or +IC10
107	/	Ground	207	17 / 6	COM2 / COM3 or COM10 / COM11
108	/	IS5 or IS13 (*)	208	/	IS4 or IS12 (*)
109	21	+IV5 or +IV13	209	7	+IV4 or +IV12
110	22	+IC5 or +IC13	210	8	+IC4 or +IC12
111	/	Ground	211	20 / 9	COM4 / COM5 or COM12 / COM13
112	/	IS7 or IS15	212	/	IS6 or IS14 (*)
113	24	+IV7 or +IV15	213	10	+IV6 or +IV14
114	25	+IC7 or +IC15	214	11	+IC6 or +IC14
115	/	Ground	215	23 /12	COM6 / COM7 or COM14 / COM15

(*) ISx : 24 V supply on channel x

TELEFAST, reference ABE 7 CP A31

TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal	TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal
1	/	Ground	Supp1	/	24 V (sensor supp.)
2	/	Ground	Supp2	/	24 V (sensor supp.)
3	/	Ground	Supp3	/	0 V (sensor supp.)
4	/	Ground	Supp4	/	0 V (sensor supp.)
100	/	IS0	116	/	IS4
101	1	IV0	117	7	IV4
102	2	IC0	118	8	IC4
103	14	0 V0	119	20	0 V4
104	/	IS1	120	/	IS5
105	15	IV1	121	21	IV5
106	16	IC1	122	22	IC5
107	3	0 V1	123	9	0 V5
108	/	IS2	124	/	IS6
109	4	IV2	125	10	IV6
110	5	IC2	126	11	IC6
111	17	0 V2	127	23	0 V6
112	/	IS3	128	/	IS7
113	18	IV3	129	24	IV7
114	19	IC3	130	25	IC7
115	6	0 V3	131	12	0 V7

(*) ISx : 24 V supply on channel x

For connections to ground, use the additional terminal block ABE 7 BV20.

Terminal block detection :
The TELEFAST ABE 7CP A31 is fitted with the strap required for the presence check.

2.1 Presentation

General

The TSX AEY 1614 is an analog input module with 16 thermocouple inputs.

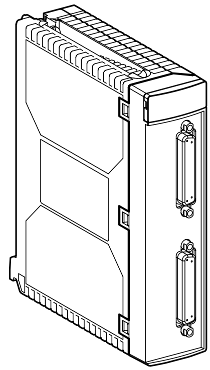
This module provides the following ranges for each of its inputs :

- thermocouple : B,E,J,K,L,N,R,S,T or U.
- voltage : -80..+80mV.

according to the selection made during configuration.

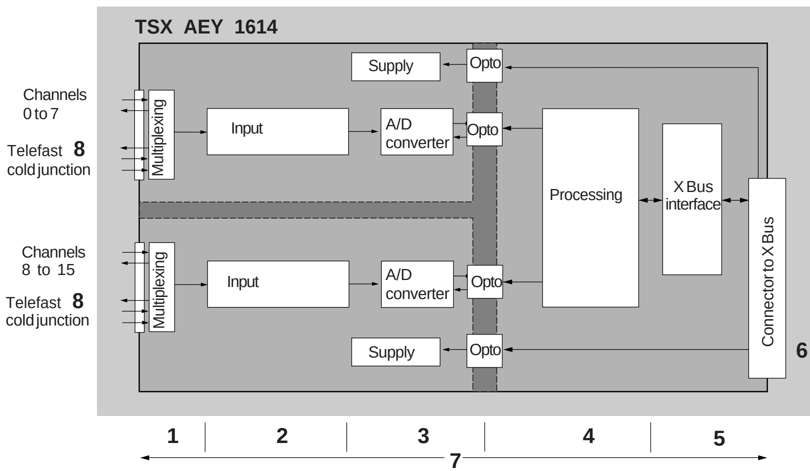
The TELEFAST ABE 7 CP 412 connection accessory provides easy connection and integrated cold junction compensation.

TSX AEY 1614



TSX AEY 1614 module functions

The TSX AEY 1614 input module performs the following functions :



1 **Adaptation and multiplexing**
Adaptation consists of a common mode and a differential mode filter. It is followed by channel multiplexing which is performed by optical switches in order to enable common mode voltage between channels (up to 400V). A second stage of multiplexing autocalibrates the input offset closest to the input terminal and selects the cold junction compensation sensor included in the telefast terminal.

2 **Amplification**
This is constructed around a low level offset amplifier. The amplifier input peak limiter can withstand an overload of 30V.

3 **Conversion**
The converter receives the signal emitted by an input channel or the cold junction compensation. Conversion is based on a 16-bit $\Sigma\Delta$ converter.

4 **Converting input measurements to a unit which can be handled by the user**
- acceptance of recalibration and alignment coefficients to be applied to the measurements, as well as the autocalibration coefficients of the module,
- measurement filtering (digital filter), according to the configuration parameters,
- measurement scaling, according to the parameters set during configuration.

5 **Interface and communication with the application**
- management of exchanges via X Bus,
- geographical addressing,
- reception of module and channel configuration parameters,
- transmission of measured values, as well as the module status, to the application.

6 **Module power supply**

7 **Monitoring the module and indicating possible faults to the application**
- test for the conversion circuit,
- test for range overshoot on the channels,
- test for the presence of the terminal block,
- test of watchdog.

8 **Cold junction compensation**
- integrated in TELEFAST ABE 7CP A12,
- to be provided by the user if TELEFAST is not used.

2.2 Input processing

2.2-1 Measurement sampling

The TSX AEY 1614 module cycle time (T) depends on the configuration options (wiring check, cold junction compensation, high precision mode). In addition, the channels are read simultaneously in pairs (channel 0 and channel 8; channel 1 and channel 9;...; channel 7 and channel 15).

Normal cycle

SubD0	Wc0	V0	Wc1	V1	Wc2	V2	...	Wc7	V7	TCJC	Hi prec.	...
	8ms	70ms	8ms	70ms	8ms	70ms	...	8ms	70ms	70ms	70ms	

SubD1	Wc8	V8	Wc9	V9	Wc10	V10	...	Wc14	V14	TCJC	Hi prec.	...
	8ms	70ms	8ms	70ms	8ms	70ms	...	8ms	70ms	70ms	70ms	

where :
- Wc : wiring check (8ms per channel to be tested)
- TCJC : Telefast cold junction compensation
- Hi prec. : high precision mode (corresponding to module autocalibration).

Fast cycle

Only the channels defined as used are scanned, even if they are not consecutive. To reduce the scan time to a minimum, the fact that the channels are read simultaneously in pairs must be taken into account.

Example of optimum wiring for 3 channels used with wiring check, Telefast cold junction compensation and high precision :

If only 3 channels are to be used and the minimum scan time is required, it is advisable to wire channels 0, 8 (dual channels) and 1.

The scan is then as follows :

SubD0	Wc0	V0	Wc1	V1	TCJC	Hi prec.
	8ms	70ms	8ms	70ms	70ms	70ms

SubD1	Wc8	V8	Wc9	V9	TCJC	Hi prec.
	8ms	70ms	8ms	70ms	70ms	70ms

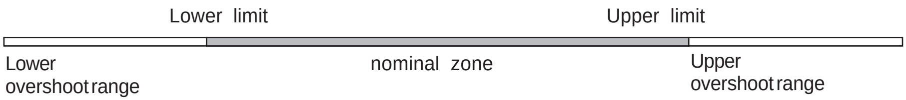
T = 2 x 70ms + 2 x 8ms + 70ms + 70ms = 296ms

2.2-2 Range selection and overshoot monitoring

This module offers a choice between a voltage range and 6 thermocouple ranges for each of its inputs.

Overshoot monitoring for each of the channels can be selected during configuration.

The measurement range is divided into three zones :
- **the nominal zone,** corresponding to the selected range,
- **the upper overshoot zone**, located above the upper limit,
- **the lower overshoot zone**, located below the lower limit.



Outside these limits (upper and lower overshoot zone), which correspond to the nominal values of the selected range (thermocouple limit values or -80mV and +80mV for the electrical range), the measurement circuit will be saturated, even if overshoot monitoring has not been selected.

If overshoot monitoring is activated, an overshoot error is indicated as follows :
- error bit **%Imodule.channel.ERR** = 1 indicates a channel fault,
- status word bit **%MWmodule.channel.2:X1** = 1 indicates a range overshoot on the channel,
- status word bit **%MWmodule.channel.2:X14** = 1 indicates a lower limit overshoot on the channel,
- status word bit **%MWmodule.channel.2:X15** = 1 1 indicates an upper limit overshoot on the channel,

If overshoot monitoring is not activated, all the bits above remain at zero, irrespective of the measurement value.

For temperature ranges :
the range overshoot corresponds to an overshoot of the input range, an overshoot of the standard sensor measurement zone or an overshoot of the compensation temperature range (-5 °C to +85 °C).

2.2-3 Measurement filtering

First order filtering is performed with a filtering coefficient which can be modified from a programming terminal or by the program. The mathematical formula used is as follows :

$$\mathbf{Mes_{fn} = \alpha \times Mes_{fn-1} + (1-\alpha) \times Val_{bn}}$$

where : α = filter efficiency,
Mes_{fn} = filtered measurement at moment n,
Mes_{fn-1} = filtered measurement at moment n-1,
Val_{bn} = "raw" value measured at moment n.

During configuration the user selects a filter value from 7 possible values (0 to 6).

This value may be modified, even when the application is in RUN.

Filtering is a function of the cycle time T (see section 2.2-1).

Efficiency required	Value to select	Corresponding α	Filter response time at 63%	Cut off frequency (Hz)
No filter	0	0	0	-
Low level of filtering	1 2	0.750 0.875	4 T 8 T	0.040/T 0.020/T
Medium level of filtering	3 4	0.937 0.969	16 T 32 T	0.010/T 0.005/T
High level of filtering	5 6	0.984 0.992	64 T 128 T	0.025/T 0.012/T

2.2-4 Measurement display

This processing is used to select the display format in which the measurements are supplied to the user program. It is necessary to differentiate between electrical ranges and thermocouple or temperature probe ranges.

Electrical ranges -80..80mV
The measurement supplied to the application can be used directly by the operator who can choose between :

- using the standard display ±10000,
- setting his own display format parameters by indicating his required minimum and maximum values.

Standardized display (default). The values are displayed in a standard unit of -10000 to 10000 (-10000$^0/_{000}$ to 10000$^0/_{000}$),

User display. The user can choose the range of values in which the measurements are expressed, by choosing :
- the lower limit corresponding to the minimum of the range : -10000$^0/_{000}$,
- the upper limit corresponding to the maximum of the range : +10000$^0/_{000}$.

These upper and lower limits are integers between -30000 and +30000.

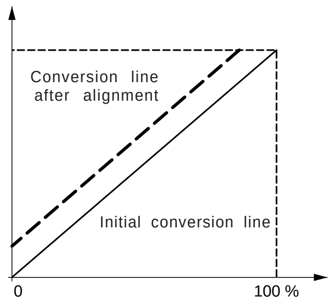
Thermocouple ranges
The user can choose between two types of display :

- **Temperature display**. Values are supplied by default in tenths of a degree :
  - tenths of a degree Celsius, if the unit chosen during configuration is °C,
  - tenths of a degree Fahrenheit, if the unit chosen during configuration is °F.

- **Standardized display**. The user can choose a 0..10000 standard display (0 to 10000$^0/_{000}$), by specifying the minimum and maximum temperatures corresponding to 0 and 10000.

2.2-5 Sensor alignment

Alignment consists of eliminating a systematic shift observed by a given sensor, around a given operating point. An error linked to the process will be compensated but not an error linked to the control system. For this reason, replacing a module does not require a new alignment. On the other hand, replacing the sensor or changing the operating point of that sensor will require a new alignment.



The alignment value can be modified via a programming terminal, even if the program is in RUN. For each input channel, the user can :

- display and modify the required measurement value,
- save the alignment value,
- know if the channel already has an alignment.

The alignment offset can also be modified via the program.
Alignment is performed when the channel is in normal operation, without affecting the operating modes of the module channel.

The maximum deviation between the measured value and the required value (aligned value) should not exceed 1500.

Note : bit %IWxy.i.1:X0 = 1 indicates that the channel is aligned.

2.2-6 Recalibration

For TSX AEY 1614 modules, it is only necessary to recalibrate channels 0 to 8 in order to recalibrate the whole module.

Recalibration is performed from the recalibration screen in the configuration editor.

- select a channel and switch to recalibration mode
- connect a voltage reference to the voltage input of the channel to be recalibrated (channel 0 to 8), according to the range to be recalibrated.

Voltage reference	**Ranges to be recalibrated**
+25.000 mV ± 0.039%	B, R, S, T
+55.000 mV ± 0.026%	U, N, L, K
+80.000 mV ± 0.023%	J, E
+166.962 mV ± 0.019%	Pt100
+1.600V ± 0.017%	Telefast probe

- once the reference has been connected (for example 55mV) to the voltage input, select this reference on the screen using the dropdown list box.
- wait the necessary time for the voltage reference to stabilize, then confirm the selection using the "Confirm" button. Recalibration of the ranges linked to this reference is performed automatically.

The 1.25mA current source (for cold junction compensation) can also be recalibrated :

- select the source from the list of references and confirm. Confirming the selection activates the entry field for the measurement value of the source.
- measure the source with a precision multimeter (0.068% to 1.25mA)
- enter the value read on the multimeter in the entry field (in units of 100 nA) and confirm the entry.

The recalibration will only be accepted and saved in the module if the "Save" button is pressed.

The "Return to Factory Parameters" button can be clicked at any time. This button cancels all recalibrations and reverts to the initial recalibration (performed in the factory).

Note : In the recalibration screen, the values displayed in the left-hand section of the screen (channels 0 and 8) indicate the value measured on the voltage reference connected. The display format in tenths of mV (16000 displayed for 1.6V) is not intended to control the precision of the reference but simply indicates the presence of that reference.

2.3 Characteristics

2.3-1 General characteristics

Number of channels	16
Analog/digital conversion	0..65535 points / 16 bits
Acquisition scan time	70 ms/channel(1)
Wiring check	8 ms
Digital filter	1st order / User-definable time constant
Channel / ground dielectric voltage	1000 Vrms
Permissible common mode voltage betw. channels and ground during operation	240VAC
Permissible common mode voltage between channels during operation	250VDC or 280 VAC
Overvoltage permitted in differential mode on inputs	±30 VDC
Linearization	Automatic
Cold junction compensation	On Telefast between -5 and 60°C External by Pt100 class A on channel 0, between -5 °C and +85 °C
Max. dissipated power	2 W
PLC standards	UL508, UL94, IEC1131, IEC68, IEC801
Sensor standards	IEC584, IEC751, DIN 43760, DIN 43710, NF C 42-330
Electrical ranges	± 80mV
Max line R for wiring check	500 Ω
Rejection channel / ground	110 dB (VDC-VAC 50/60Hz)
Rejection 50/60 Hz	100 dB

(1) For electrical ranges, the data applies to the whole input range.
(2) For thermocouple ranges, the data includes internal or external cold junction compensation after a stabilization of 30 min. and is given for the middle of the standard range.
"IC" signifies that internal compensation is used; in this case care must be taken with the installation (refer to section 4.5-4).
"EC" signifies that external compensation is used, across channel 0 for Pt100, with a class A probe.

(1) for more information see section 2.2-2

Characteristics of thermocouple ranges

In the following characteristics :

- data is given in degrees Celsius. To convert into degrees Farenheit, use the formula : °F=9/5°C + 32
- the data given below is valid whatever the type of cold junction compensation : telefast or Pt100 class A
- the cold junction temperature used in the calculations is 25°C
- resolution is given in terms of range
- the data includes : electrical errors on the input channel and cold junction compensation input, software errors, exchange errors on cold junction compensation sensors. Thermocouple sensor errors are not taken into account.

Thermocouple B
Range : 42.20°C to 1819.70°C
Resolution : 0.088°C

Temperature (°C)		Error at 60°C (°C) high precision mode	Error at 60°C (°C) normal mode	Error at 25°C (°C)
Operating point	600 °C	5.7	24.8	3.6
	700 °C	5.1	21.7	3.2
	800 °C	4.7	19.6	3
	900 °C	4.4	17.9	2.7
	1000 °C	4.2	16.6	2.6
	1100°C	4	15.6	2.5
	1200 °C	3.9	14.8	2.4
	1300°C	3.8	14.2	2.3
	1400 °C	3.7	13.8	2.2
	1500°C	3.7	13.5	2.2
	1600 °C	3.8	13.5	2.2
	1700 °C	3.8	13.6	2.2

Thermocouple E
Range : -260.60°C to 990.90°C
Resolution : 0.031°C

Temperature (°C)		Error at 60°C (°C) high precision mode	Error at 60°C (°C) normal mode	Error at 25°C (°C)
Operating point	-200 °C	2.1	6.6	1.3
	-100 °C	1.4	3.9	1
	0 °C	1.1	3.1	0.9
	100 °C	1.1	2.8	0.9
	200 °C	1.2	2.7	0.8
	300 °C	1.2	2.6	0.8
	400 °C	1.2	2.7	0.8
	500 °C	1.3	2.7	0.8
	600 °C	1.4	2.8	0.8
	700 °C	1.5	2.9	0.9
	1000 °C	1.7	3.2	0.9

Thermocouple J
Range : -207.70°C to 1199.40°C
Resolution : 0.044°C

	Temperature (°C)	Error at 60°C (°C) high precision mode	Error at 60°C (°C) normal mode	Error at 25°C (°C)
Operating point	-200 °C	2.3	7.5	1.4
	-100 °C	1.5	4.2	1
	0 °C	1.2	3.5	0.9
	100 °C	1.3	3.3	0.9
	200 °C	1.3	3.4	0.9
	300 °C	1.6	3.4	0.9
	400 °C	1.4	3.5	0.9
	500 °C	1.5	3.5	0.9
	600 °C	1.5	3.5	0.9
	700 °C	1.5	3.4	0.9
	1000 °C	1.8	3.7	0.9
	1100°C	1.9	3.9	1
	1200 °C	2	4	1

Thermocouple K
Range : -263.90°C to 1371.30°C
Resolution : 0.036°C

	Temperature (°C)	Error at 60°C (°C) high precision mode	Error at 60°C (°C) normal mode	Error at 25°C (°C)
Operating point	-200 °C	2.9	10.3	1.8
	-100 °C	1.7	5.4	1.2
	0 °C	1.4	4.2	1
	100 °C	1.4	4.1	1
	200 °C	1.5	4.3	1
	300 °C	1.5	4.3	1
	400 °C	1.6	4.3	1
	500 °C	1.6	4.3	1
	600 °C	1.7	4.4	1
	700 °C	1.8	4.5	1.1
	800 °C	1.9	4.7	1.1
	900 °C	2	4.8	1.1
	1000 °C	2.1	5	1.1
	1100°C	2.2	5.2	1.1
	1200 °C	2.4	5.5	1.2

Thermocouple N
Range : -245.90°C to 1298.60°C
Resolution : 0.04°C

	Temperature (°C)	Error at 60°C (°C) high precision mode	Error at 60°C (°C) normal mode	Error at 25°C (°C)
Operating point	-200 °C	4	15.4	2.4
	-100 °C	2.1	7.6	1.4
	0 °C	1.8	6.1	1.3
	100 °C	1.7	5.5	1.2
	200 °C	1.6	5.1	1.1
	300 °C	1.6	4.8	1.1
	400 °C	1.7	4.7	1.1
	500 °C	1.7	4.7	1.1
	600 °C	1.7	4.7	1.1
	700 °C	1.8	4.7	1.1
	800 °C	1.9	4.8	1.1
	900 °C	2	4.9	1.1
	1000 °C	2	5	1.1
	1100°C	2.1	5.1	1.1
	1200 °C	2.2	5.3	1.1

Thermocouple R
Range : -48.30°C to 1768.90°C
Resolution : 0.061°C

	Temperature (°C)	Error at 60°C (°C) high precision mode	Error at 60°C (°C) normal mode	Error at 25°C (°C)
Operating point	0 °C	6.1	27.6	4
	100 °C	4.6	19.7	3
	200 °C	4	16.8	2.6
	300 °C	3.8	15.4	2.4
	400 °C	3.6	14.6	2.3
	500 °C	3.6	14	2.3
	600 °C	3.5	13.5	2.2
	700 °C	3.5	13	2.1
	800 °C	3.4	12.6	2.1
	900 °C	3.4	12.3	2
	1000 °C	3.4	11.9	2
	1100 °C	3.3	11.7	2
	1200 °C	3.4	11.5	1.9
	1300 °C	3.4	11.4	1.9
	1400 °C	3.4	11.5	1.9
	1500 °C	3.5	11.6	1.9
	1600 °C	3.6	11.8	2

Thermocouple S

Range : -48.60°C to 1768.20°C

Resolution : 0.069°C

	Temperature (°C)	Error at 60°C (°C) high precision mode	Error at 60°C (°C) normal mode	Error at 25°C (°C)
Operating point	0 °C	6	27	3.9
	100 °C	4.6	20.1	3
	200 °C	4.2	17.6	2.7
	300 °C	4	16.4	2.6
	400 °C	3.9	15.7	2.5
	500 °C	3.8	15.3	2.4
	600 °C	3.8	14.9	2.4
	700 °C	3.8	14.5	2.3
	800 °C	3.7	14.2	2.3
	900 °C	3.7	13.9	2.2
	1000 °C	3.7	13.5	2.2
	1100 °C	3.7	13.3	2.2
	1200 °C	3.7	13.1	2.1
	1300 °C	3.8	13.1	2.1
	1400 °C	3.8	13.2	2.1
	1500 °C	3.9	13.3	2.2
	1600 °C	4	13.6	2.2

Thermocouple T

Range : -265.70°C to 399.70°C

Resolution : 0.017°C

	Temperature (°C)	Error at 60°C (°C) high precision mode	Error at 60°C (°C) normal mode	Error at 25°C (°C)
Operating point	-200 °C	2.7	9.9	1.7
	-100 °C	1.7	5.7	1.2
	0 °C	1.3	4.3	1
	100 °C	1.3	3.7	1
	200 °C	1.3	3.4	0.9
	300 °C	1.3	3.2	0.9
	400 °C	1.3	3.1	0.9

B

Characteristics of the ± 80mV range

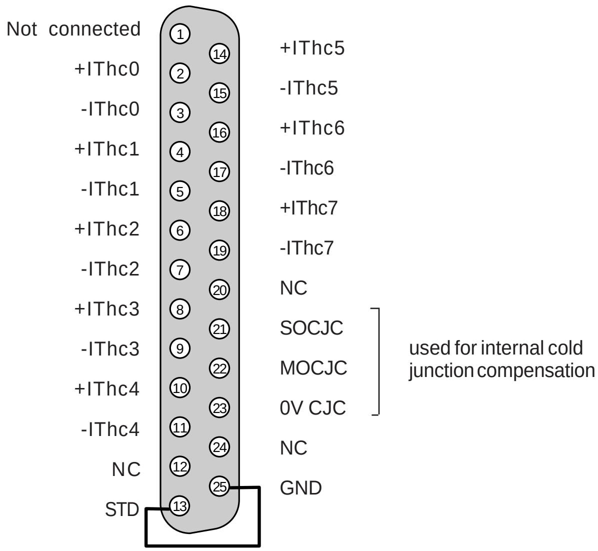
Range : -265.70°C to 399.70°C
Resolution : 0.017°C

Voltage (mV)	Error at 60°C (µV) high precision mode	Error at 60°C (µV) normal mode	Error at 25°C (µV)
0	30.637	144.037	19.262
1	31.331	144.731	19.324
2	32.025	145.425	19.386
3	32.719	146.119	19.448
4	33.413	146.813	19.51
5	34.107	147.507	19.572
6	34.801	148.201	19.634
7	35.495	148.895	19.696
8	36.189	149.589	19.758
9	36.883	150.283	19.82
10	37.577	150.977	19.882
11	38.271	151.671	19.944
12	38.965	152.365	20.006
13	39.659	153.059	20.068
14	40.353	153.753	20.13
15	41.047	154.447	20.192
16	41.741	155.141	20.254
17	42.435	155.835	20.316
18	43.129	156.529	20.378
19	43.823	157.223	20.44
20	44517	157.917	20.502
21	45211	158.611	20.564
22	45905	159.305	20.626
23	46.599	159.999	20.688
24	47.293	160.693	20.75
25	47.987	161.387	20.812

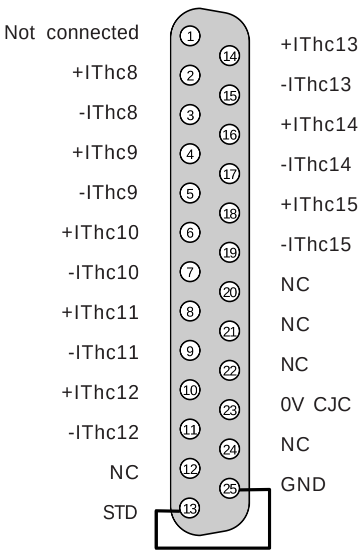
2.4 Connections

2.4-1 Connector pinout

SUB D 0



SUB D 1



+IThcx	:	+ve input of thermocouple channel x
-IThcx	:	-ve input of thermocouple channel x
SOCJC	:	TELEFAST internal cold junction compensation power supply output
MOCJC	:	TELEFAST internal cold junction compensation measurement input
0VCJC	:	0 V internal cold junction compensation probe
STD	:	"Strap" to detect removal.
NC	:	Not connected

To detect removal of the terminal block, connect pin 13 to pin 15 (ground).
For use with Telefast, the removal detection "strap" is integrated in the Telefast accessory.

Sensor connection

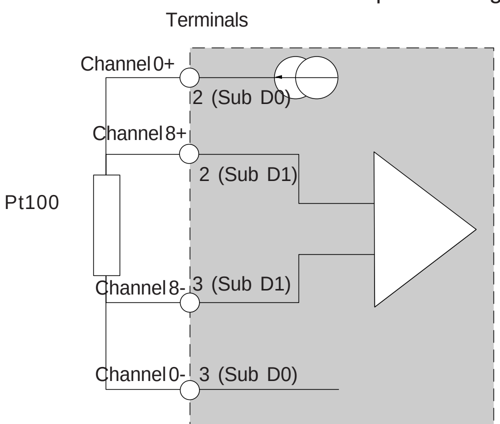
It is advisable to use shielded cables and to link the shielding to the terminals designed for this purpose (Shielding connection).
For high level and thermocouple inputs, the "source + wiring" resistance should be less than 500 Ω so as not to adversely affect the module performance.
For temperature probe inputs, the resistance of each of the wires in a 4-wire configuration should be less than 50 Ω, which corresponds to a copper wire with a cross-section of 0.6 mm^2 and maximum overall length of 3000 m.

Use with Telefast

For use with a Telefast 7CPA12 accessory, the removal detection "strap" is integrated in the Telefast accessory.

- **Telefast internal cold junction compensation**
  Telefast cold junction compensation is performed by a temperature probe (made of silicon) placed in the Telefast accessory. If this compensation mode is selected, no special wiring is required. Simply connect the Telefast accessory to the module using the TSX CAP030 cable.
  In this case, all 16 channels can be wired as thermocouples.
  To obtain the cold junction temperature value select "Read cold junction" in PL7.

- **External cold junction compensation using the external Pt100 platinum probe**
  In the case of direct connection to Sub D connectors, it is the user's responsibility to connect a Pt 100 probe to measure the terminal block temperature, in which case "external cold junction compensation" mode should be selected. Channels 0 and 8 are reserved for this measurement. Channel 0 conducts the current to the Pt 100 probe and channel 8 carries out the measurement at high impedance. In this case, only 14 channels can be wired as thermocouples. Wiring is as follows :



Use without Telefast

Cold junction compensation will be external. Channels 0 and 8 are used to wire a Pt 100 4-wire probe. In this case, only 14 channels can be wired as thermocouples.

2.4-2 TELEFAST pinout

After connecting the analog module to a TELEFAST accessory, via cable TSX CAP 030, the distribution of the analog channels on the TELEFAST terminals is as follows :

TELEFAST, reference ABE 7 CP A12

TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal	TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal
1	/	Ground	11	/	Ground
2	/	Ground	12	/	Ground
3	/	Ground	13	/	Ground
4	/	Ground	14	/	Ground
100	2 (SubD0)	Input Thc+ V0/ Pt100_supp+	101	3 (SubD0)	Input Thc- V0/ Pt100_supp-
102	4 (SubD0)	Input Thc+ V1	103	5 (SubD0)	Input Thc- V1
104	6 (SubD0)	Input Thc+ V2	105	7 (SubD0)	Input Thc- V2
106	8 (SubD0)	Input Thc+ V3	107	9 (SubD0)	Input Thc- V3
200	10 (SubD0)	Input Thc+ V4	201	11 (SubD0)	Input Thc- V4
202	14 (SubD0)	Input Thc+ V5	203	15 (SubD0)	Input Thc- V5
204	16 (SubD0)	Input Thc+ V6	205	17 (SubD0)	Input Thc- V6
206	18 (SubD0)	Input Thc+ V7	207	19 (SubD0)	Input Thc- V7
108	2 (SubD1)	Input Thc+ V8/ Pt100_Mes+	109	3 (SubD1)	Input Thc- V8/ Pt100_Mes-
110	4 (SubD1)	Input Thc+ V9	111	5 (SubD1)	Input Thc- V9
112	6 (SubD1)	Input Thc+ V10	113	7 (SubD1)	Input Thc- V10
114	8 (SubD1)	Input Thc+ V11	115	9 (SubD1)	Input Thc- V11
208	10 (SubD1)	Input Thc+ V12	209	11 (SubD1)	Input Thc- V12
210	14 (SubD1)	Input Thc+ V13	211	15 (SubD1)	Input Thc- V13
212	16 (SubD1)	Input Thc+ V14	213	17 (SubD1)	Input Thc- V14
214	18 (SubD1)	Input Thc+ V15	215	19 (SubD1)	Input Thc- V15

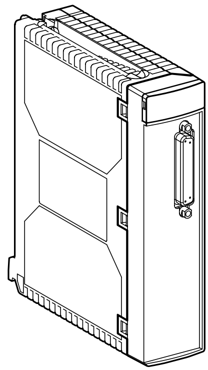
3.1 Presentation

General

The TSX AEY 420 module is an analog input module with 4 high-level fast inputs. Linked to sensors or transmitters, they perform monitoring, measurement and continuous process control functions.

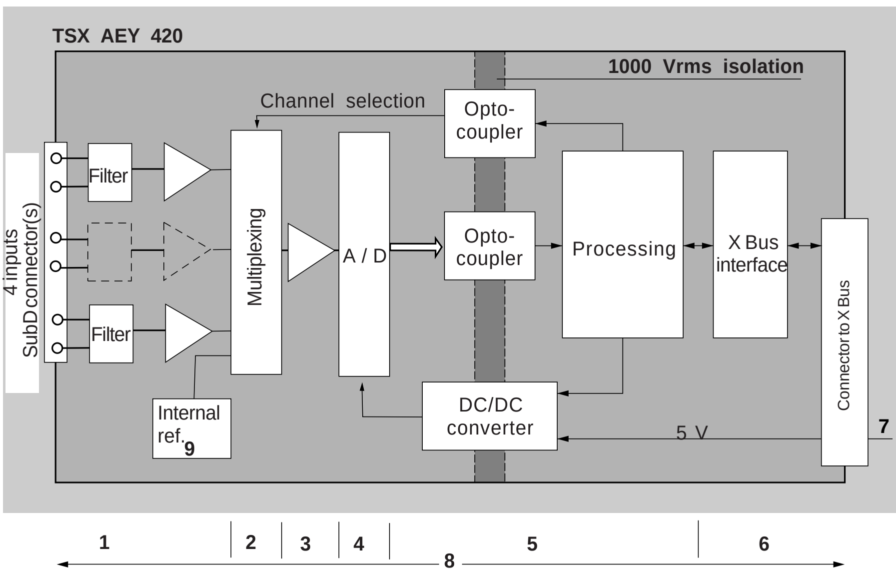
The TSX AEY 420 module offers the range ± 10 V, 0..10 V, 0..5 V, 1..5 V, 0..20 mA or 4..20 mA for each of its inputs, depending on the choice made during configuration.

TSX AEY 420



TSX AEY 420 module functions

The TSX AEY 420 input module performs the following functions :



1 **Connection to the process and scanning of input channels**
- physical connection to the process, via SubD connector(s),
- adaptation of input signals by analog filtering,

2 **Multiplexing of input signals**
- scanning of input channels via solid state multiplexing.

3 **Adapting input signals**

4 **Digitalization of input measurement analog signals** (16-bit analog/digital converter).

5 **Converting input measurements to a unit which can be handled by the user**
- acceptance of scaling and alignment coefficients to be applied to the measurements, as well as the autocalibration coefficients of the module,
- measurement scaling, according to the parameters set during configuration.

6 **Interface and communication with the application**
- management of exchanges via X Bus,
- geographical addressing,
- reception of module and channel configuration parameters,
- transmission of measured values, as well as the module status, to the application.

7 **Module power supply**

8 **Monitoring the module and indicating possible faults to the application**
- test for the conversion circuit,
- test for range overshoot on the channels,
- test for the presence of the terminal block,
- test of watchdog,
- test for threshold overshoot on the channels.

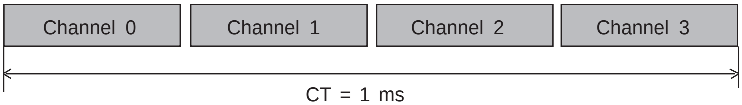
9 **Internal reference :** the module can calculate its autocalibration coefficients by reading an internal voltage calibration reference.

B

3.2 Input processing

3.2-1 Measurement sampling

The scan cycle is not dependent on the number of inputs used. It lasts 1 ms if event processing has not been activated.



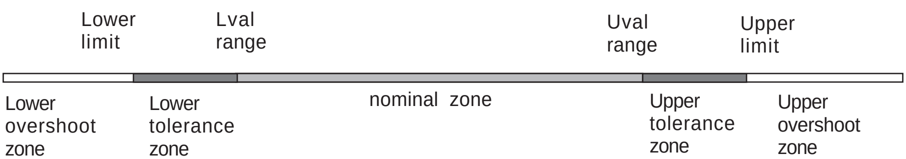
The scan cycle is increased by 150 µs per channel if event processing is activated.

Examples :
- if event processing is activated on one of the channels, the cycle time is 1.15ms
- if event processing is activated on all 4 channels, the cycle time is 1.6ms

3.2-2 Range selection and overshoot monitoring

Each module offers a choice of 6 ranges for each of its inputs : ± 10 V, 0..10 V, 0..5 V, 1..5 V, 0..20 mA and 4..20 mA.
The module monitors overshoot for the chosen range, ie. it checks that the measurement is between the upper and lower limits.

Overshoot monitoring is optional. The measurement range is divided into 5 zones:
- **the nominal zone,** corresponding to the selected range,
- **the upper tolerance zone,**, with values between the upper value of the range (eg. : +10V for a range +10V/-10V) and the upper limit,
- **lower tolerance zone**, with values between the lower value of the range (eg.: -10V for a range +10V/-10V) and the lower limit,
- **the upper overshoot zone**, located above the upper limit,
- **the lower overshoot zone**, located below the lower limit.



When the value read is in one of the 2 tolerance zones, warning bit %IWxy.i.1:X5 (for the lower zone) or %IWxy.i.1:X6 (for the upper zone) is set to 1.
If the read value is in one of the 2 overshoot zones (and overshoot monitoring is required), the following bits are set to 1 :
- error bit %Ixy.ERR,
- range overshoot bit %MWxy.i.2:X1,
- bit %MWxy.i.2:X14 if there is a lower limit overshoot,
- bit %MWxy.i.2:X15 if there is an upper limit overshoot

The measured value is then limited.

The upper and lower limits can be configured separately.

They can have whole values between the following values :
Lower limit = Lval range + lower tolerance zone
Upper limit = Uval range + upper tolerance zone

Range	**Lower tolerance zone**			**Upper tolerance zone**		
Range	**Default value**	**Min value**	**Max value**	**Default value**	**Min value**	**Max value**
Bipolar ± 10V	-0.125 x FS/2	0	-0.25 x FS/2	0.125 x FS/2	0	0.25 xFS/2
Unipolar 0..10 V, 0..5 V 1..5 V, 0..20 mA 4..20 mA	-0.125 x FS	0	-0.25 x FS	0.125 xFS	0	0.25 xFS
Standardized	-1250	0	-2500	1250	0	2500
User Bipolar ± 10 V	-0.125 x Δ range/2	0 x	-0.25 x Δ range/2	0.125 x Δ range/2	0 x	0.25 x Δ range/2
User Unipolar 0..10 V,0..5 V 1..5 V, 0..20 mA 4..20 mA	-0.125 x Δ range	0 x	-0.25 x Δ range	0.125 x Δ range	0 x	0.25 x Δ range

where FS = 20 (range ± 10V and 0..20mA), = 10 (range ± 5V and 0..10V), = 5 (range 0..5V), = 4 (range 1..5V), = 16 (range 4..20mA)

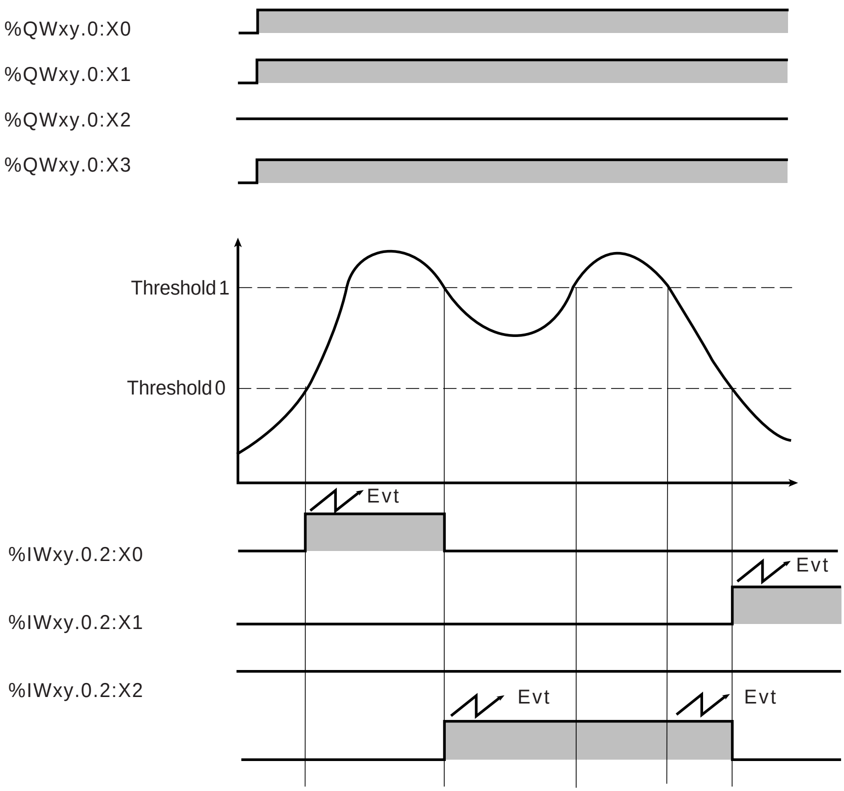
3.2-3 Thresholds and event processing

The TSX AEY 420 module manages 2 thresholds per channel (threshold 0 and 1). When the thresholds are crossed, the module can trigger event processing.
The threshold values are entered and modified in the adjustment screen.
The user associates event processing with an analog channel when configuring the module. The event which triggers event processing could be caused by :

- the measurement dropping below threshold 0 (↓T0)
- the measurement rising above threshold 0 (↑T0),
- the measurement dropping below threshold 1 (↓T1),
- the measurement rising above threshold 1 (↑T1),

These causes can be masked or unmasked by the program using the bits of word %QWxy.i : bit 0 for↑T0, bit 1 for↓T0, bit 2 for↑T1, bit 3 for↓T1 (0=masking, 1=unmasking).
The bits of word %IWxy.i.2 indicate the source of the event : bit 0 for ↑T0, bit 1 for ↓T0, bit 2 for ↑T1, bit 3 for ↓T1 (0=no event, 1=event).

Example :



Note : In this example, -T1 is inhibited so %IWxy.0.2:X2 remains at 0 and does not generate an event.

Comments :

- Input word %IWxy.i.2 is only updated when a new event cause appears.
- If the measured value is equal to the threshold but does not cross it, no events are triggered.
- Event processing can be activated or deactivated in the configuration of each channel.
- An event number from 0 to 63 is associated with each channel. The number selected determines the priority of the event (0=highest priority, 1 to 63 lowest priority).

3.2-4 Measurement display

The measurement supplied to the application can be used directly by the operator, who can choose between :

- using the 0..10000 standardized display (or ±10000 for the range ±10 V),
- setting his own display format parameters by indicating his required minimum and maximum values.

Standardized display. Values are displayed in standard units :

- for a unipolar range of 0-10 V, 0-5 V, 0-20 mA or 4-20 mA, they are displayed from 0 to 10000 (0 $^0/_{000}$ to 10000 $^0/_{000}$),
- for the bipolar range of ± 10 V, they are displayed from - 10000 to + 10000 (-10000$^0/_{000}$ to +10000$^0/_{000}$).

User display. The user can choose the range of values in which the measurements are expressed, by choosing :

- the lower limit corresponding to the minimum of the range 0 $^0/_{000}$ (or - 10000 $^0/_{000}$),
- the upper limit corresponding to the maximum of the range + 10000 $^0/_{000}$.

These upper and lower limits are integers between -30000 and +30000.

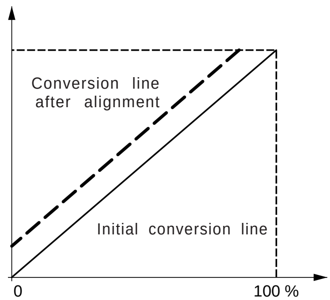
For example, suppose a conditioning unit indicates information about pressure on a 4-20 mA loop, with 4 mA corresponding to 3200 mB and 20 mA corresponding to 9600 mB. The user can then select the User format, by defining the following upper and lower limits :

- 0 $^0/_{000}$ <=> 3200 as lower limit,
- 10000 $^0/_{000}$ <=> 9600 as upper limit.

The values transmitted to the program will vary between 3200 (= 4 mA) and 9600 (= 20 mA).

3.2-5 Sensor alignment

Alignment consists of eliminating a systematic shift observed by a given sensor, around a given operating point. An error linked to the process will be compensated but not an error linked to the control system. For this reason, replacing a module does not require a new alignment. On the other hand, replacing the sensor or changing the operating point of that sensor will require a new alignment.



For example, suppose that a pressure sensor, linked to a conditioning unit (1mV/mB), indicates 3200 mB, while the actual pressure is 3210 mB. The value measured by the module in standard scale will be 3200 (3.20 V). The user can align the measurement to the value 3210 (required value). After this alignment procedure, the measurement channel will apply a systematic offset of +10 to any new measurement.

The alignment value which should be entered is 3210.

The alignment value can be modified via a programming terminal, even if the program is in RUN. For each input channel, the user can :

- display and modify the required measurement value,
- save the alignment value,
- know if the channel already has an alignment.

The alignment offset can also be modified via the program.
Alignment is performed when the channel is in normal operation, without affecting the operating modes of the module channel.

The maximum deviation between the measured value and the required value (aligned value) should not exceed ± 1000.

Note : bit %IWxy.i.1:X0 = 1 indicates that the channel is aligned.

3.3 Characteristics

3.3-1 Input characteristics

Number of channels	4 common point channels
Analog / digital conversion	SAR (successive approximation register)
Resolution	16 bits (52400 points for voltage/13100 points for current)
Acquisition scan time	1 ms for the 4 channels
Monotonicity	yes (on 15 bits)
Max. permissible overvoltage on inputs	± 30 V for voltage ± 30 mA for current
Input filter	2nd order / overvoltage coefficient : 0.5 Cut off frequency at -6dB : 3.4 kHz
Dielectric voltage channels / ground	500 V rms.
Isolation between channels	Common point
Isolation betw. bus and channels	500 V rms
Crosstalk between channels	- 80 dB
Permissible common mode voltage between channels and ground during operation	240 VAC rms 150 VDC
Common mode rejection channel / ground (DC,50Hz,60Hz)	80 dB
Wire break detection	No (detection out of range for 4/20 mA)
Max. dissipated power	4 W
Standards	IEC 1131, CSA22.2, UL508

Electrical range	± 10 V / 0..10 V	0..5 V / 1..5 V	0..20 mA / 4..20 mA
Full scale (FS)	10 V	5 V	20 mA
Resolution (1)	0.4 mV	0.4 mV	1.5 µA
Input impedance • **on** • **off**	2.2MΩ 10kΩ	2.2MΩ 10kΩ	250Ω ± 0.1 % 250Ω ± 0.1 %
Maximum error at 25 °C **Max. error at 0 to 60 °C**	± 0.1% FS ± 0.2% FS	± 0.2% FS ± 0.4% FS	± 0.2% FS ± 0.4% FS
Temperature drift	30 ppm / °C	30 ppm / °C	60 ppm / °C
Range overshoot	± 12.5 V (range ± 10 V) -2.5..12.5 V (range 0..10 V)	0..6.25 V (range 0.. 5 V) 0..6 V (range 1..5 V)	0..25 mA (range 0.. 20 mA) 0..24 mA (range 4..20 mA)
Precision of internal conversion resistance	/	/	0.1% - 25 ppm / °C

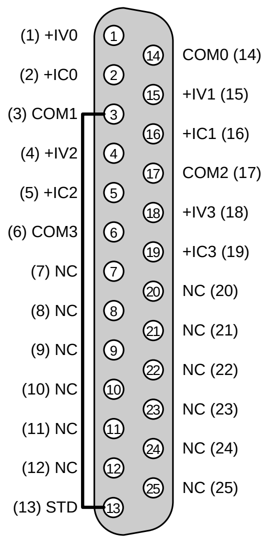
(1) 52 400 points for ± 10 V, 26200 points for 0..10 V, 13100 points for 0..5 V or 0..20mA, 10400 points for 1..5 V or 4..20mA.

B

3.4 Connections

3.4-1 Connector pinout

TSX AEY 420



+IVx : +ve voltage input of channel x
+ICx : +ve current input of channel x
COMx: -ve input of channel x (voltage or current)
STD : Strap to detect removal.
NC : not connected

Notes :
- COM0, COM1, COM2 and COM3 are connected internally in the module.
- For use with Telefast, the removal detection strap should be located on the Telefast accessory.

3.4-2 TELEFAST pinout

After connecting the analog module to a TELEFAST accessory, via cable TSX CAP 030, the distribution of the analog channels on the TELEFAST terminals is as follows :

TELEFAST, reference ABE 7 CP A02

TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal	TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal
1	/	Ground	Supp1	/	Ground
2	/	STD (1)	Supp2	/	Ground
3	/	STD (1)	Supp3	/	Ground
4	/	STD (2)	Supp4	/	Ground
100	1	+IV0	200	14	COM0
101	2	+IC0	201	/	Ground
102	15	+IV1	202	3	COM1
103	16	+IC1	203	/	Ground
104	4	+IV2	204	17	COM2
105	5	+IC2	205	/	Ground
106	18	+IV3	206	6	COM3
107	19	+IC3	207	/	Ground
108	7	NC	208	20	NC
109	8	NC	209	/	Ground
110	21	NC	210	9	NC
111	22	NC	211	/	Ground
112	10	NC	212	23	NC
113	11	NC	213	/	Ground
114	24	NC	214	12	NC
115	25	NC	215	/	Ground

NC : Not connected

Note : To perform terminal block detection, connect terminals STD (1) and STD (2) using a strap

TELEFAST, reference ABE 7 CP A03

TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal	TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal
1	/	0 V	Supp1	/	24 V (sensor supp.)
2	/	0 V	Supp2	/	24 V (sensor supp.)
3	/	0 V	Supp3	/	0 V (sensor supp.)
4	/	0 V	Supp4	/	0 V (sensor supp.)
100	/	IS1(*)	200	/	IS0 (*)
101	15	+IV1	201	1	+IV0
102	16	+IC1	202	2	+IC0
103	/	Ground	203	14 / 3	COM0 / COM1
104	/	IS3 (*)	204	/	IS2 (*)
105	18	+IV3	205	4	+IV2
106	19	+IC3	206	5	+IC2
107	/	Ground	207	17 / 6	COM2 / COM3
108	/	NC	208	/	IS4 or IS12 (*)
109	21	NC	209	7	NC
110	22	NC	210	8	NC
111	/	Ground	211	20 / 9	NC
112	/	NC	212	/	NC
113	24	NC	213	10	NC
114	25	NC	214	11	NC
115	/	Ground	215	23 /12	NC

(*) ISx : 24 V supply on channel x

TELEFAST, reference ABE 7 CP A21

TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal	TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal
1	/	Ground	Supp1	/	Ground
2	/	STD (1)	Supp2	/	Ground
3	/	STD (1)	Supp3	/	Ground
4	/	STD (2)	Supp4	/	Ground
100	1	+IV0	200	14	COM0
101	2	+IC0	201	/	Ground
102	15	+IV1	202	3	COM1
103	16	+IC1	203	/	Ground
104	4	+IV2	204	17	COM2
105	5	+IC2	205	/	Ground
106	18	+IV3	206	6	COM3
107	19	+IC3	207	/	Ground

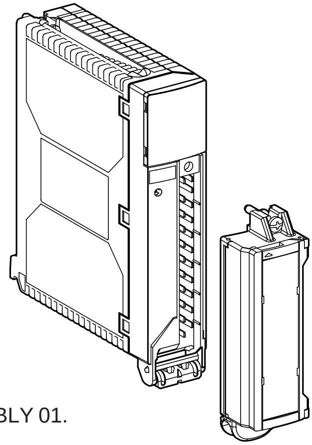
Note : To perform terminal block detection, connect terminals STD (1) and STD (2) using a strap

4.1 Presentation

General

The TSX AEY 414 is a multirange input module, with 4 inputs isolated from each other. This module provides for each of its inputs, according to the selection made during configuration, the range :

- B, E, J, K, L, N, R, S, T, U thermocouple or electrical range -13..+63 mV,
- 2 or 4-wire Pt100, Pt1000, Ni1000 temperature probes, or ohmic range : 0..400 Ω, 0..3850 Ω,
- high level ± 10 V, 0..10 V, ±5 V, 0..5 V (0..20 mA with an external shunt) or 1..5 V (4..20 mA with an external shunt). Note that external shunts are delivered with the product.

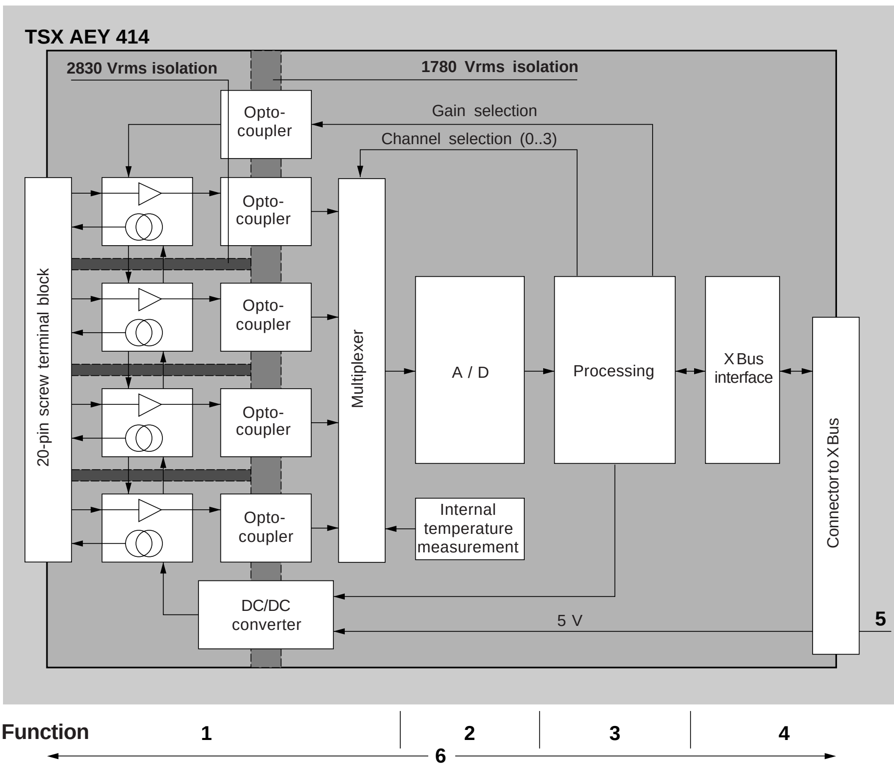


Note

The terminal block is supplied separately under reference TSX BLY 01.

Functions

This input module performs the following functions :



1 Connection to the process and scanning of input channels

- physical connection to the process, via screw terminal block,
- gain selection, according to the characteristics of the input signals, defined for each channel during configuration (high level, thermocouple or temperature probe range),
- multiplexing

2 Digitalization of input measurement analog signals

3 Converting input measurements to a unit which can be handled by the user

- acceptance of recalibration and alignment coefficients to be applied to the measurements (channel by channel and range by range), as well as the autocalibration coefficients of the module,
- linearization of the measurement provided by Pt or Ni temperature probes,
- linearization of the measurement and acceptance of the internal or external cold junction compensation, in the case of thermocouples,
- measurement scaling, according to the parameters set during configuration (physical units or user range).

4 Interface and communication with the application

- management of exchanges via X Bus,
- geographical addressing,
- reception of module and channel configuration parameters,
- transmission of measured values, as well as the module status, to the application.

5 Module power supply

6 Monitoring the module and indicating possible faults to the application

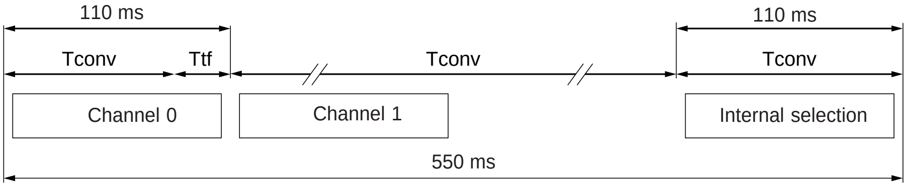
- test for the conversion circuit,
- test for range overshoot on the channels,
- test for the presence of the terminal block,
- test of the sensor link (except on ranges ±10 V, 0..10 V, ±5 V, 0..5 V and 0..20 mA),
- test for the watchdog.

4.2 Input processing

4.2-1 Measurement sampling

The TSX AEY 414 module scan time and consequently the sampling rate are independent of the AC supply frequency (50 Hz or 60 Hz).

The measurements are linked together in the following way : channel 0, channel 1, channel 2, channel 3 and internal selection. Internal selection corresponds to the internal temperature or internal references for module autocalibration or to the line compensation for the temperature probe ranges.



Tconv is the time taken to convert a channel : Tconv = 106 ms,
Ttf is the time taken for the wiring test : Ttf = 4 ms.

Internal selection does not require a wiring test, except for line compensation.

The scan is always executed in the same way and lasts 550 ms.

4.2-2 Range selection and overshoot monitoring

Using the software, the user can choose one of the following ranges for each channel : ±10 V, 0..10 V, ±5 V, 0..5 V (0..20 mA), 1..5 V (4..20 mA), -13..+63 mV, 0..400 W, 0..3850 W, Pt100, Pt1000, Ni1000, thermocouple B, E, J, K, L, N, R, S, T and U.

For thermocouple ranges, cold junction compensation is performed by the module. However, the cold junction temperature can be measured via the module terminal block (by an internal probe in the module) or remotely via a Pt100 Class A external probe (not supplied), connected to channel 0 of the module.

Whatever the selected range, the module monitors overshoot; that is, it checks that the measurement is between the upper and lower limits defined by the following table. Outside these limits, saturation of the analog measurement circuit is likely and an overshoot fault is signaled by a bit which can be used by the program (error bit **%Ixy.i.ERR** = 1 signals a fault on the channel and status word bit **%MWxy.i.2:X1** = 1 indicates a range overshoot on the channel).

For ranges ±10 V, 0..10 V, ±5 V, 0..5 V, 1..5 V, 0..20 mA and 4..20 mA :
modules generally allow a 5% positive overshoot of the electrical range.

For temperature ranges :
the range overshoot corresponds to an overshoot of the input range, an overshoot of the standard sensor measurement zone or an overshoot of the compensation temperature range (-5 °C to +85 °C). The use of internal compensation in a normal environment (0 °C to +60 °C) is compatible with thresholds -5 °C to +85 °C.

Overshoot values

TSX AEY 414 Range	Lower limit	Upper limit	Default values	Min. limit in User mode	Max. limit in User mode
±10 V	-10.5 V	+10.5 V	±10500	Min - 5%(max-min)/2	Max + 5%(max-min)/2
0..10 V	-0.5 V	+10.5 V	-500..+10500	Min - 5%(max-min)	Max + 5%(max-min)
± 5 V	-5.25 V	+5.25 V	±10500	Min - 5%(max-min)	Max + 5%(max-min)
0..5 V	-0.25 V	+5.25 V	-500..+10500	Min - 5%(max-min)	Max + 5%(max-min)
1..5 V	+0.8 V	+5.2 V	-500..+10500	Min - 5%(max-min)	Max + 5%(max-min)
0..20 mA	-1 mA	+21 mA	-500..+10500	Min - 5%(max-min)	Max + 5%(max-min)
4..20 mA	+3.2 mA	+20.8 mA	-500..+10500	Min - 5%(max-min)	Max + 5%(max-min)
B	0 °C (32 °F)	+1802 °C (+3276 °F)	d°C or d°F	0	+10000
E	-270 °C (-454 °F)	+812 °C (+1495 °F)	d°C or d°F	0	+10000
J	-210 °C (-346 °F)	+1065 °C (+1953 °F)	d°C or d°F	0	+10000
K	-270 °C (-454 °F)	+1372 °C (+2502 °F)	d°C or d°F	0	+10000
L	-200 °C (-328 °F)	+900 °C (+1652 °F)	d°C or d°F	0	+10000
N	-270 °C (-454 °F)	+1300 °C (+2372 °F)	d°C or d°F	0	+10000
R	-50 °C (-58 °F)	+1769 °C (+3216 °F)	d°C or d°F	0	+10000
S	-50 °C (-58 °F)	+1769 °C (+3216 °F)	d°C or d°F	0	+10000
T	-270 °C (-454 °F)	+400 °C (+752 °F)	d°C or d°F	0	+10000
U	-200°C (-328 °F)	+600 °C (+1112 °F)	d°C or d°F	0	+10000
Pt100	-200 °C (-328 °F)	+850 °C (+1562 °F)	d°C or d°F	-500	+10000
Pt1000	-200 °C (-328 °F)	+800 °C (+1472 °F)	d°C or d°F	-500	+10000
Ni1000	-60 °C (-76 °F)	+240 °C (+464 °F)	d°C or d°F	-500	+10000
-13..+63 mV	-13 mV	+63 mV	-2064..10000	Min	Max
0..400 Ω	0	400 Ω	0..10000	Min	Max
0..3850 Ω	0	3850 Ω	0..10000	Min	Max

4.2-3 Sensor link monitoring

Sensor link monitoring imposes a maximum value on the resistance, Rs, of the sensors connected to the module inputs. This maximum Rs value is compatible with normal operation of TSX AEY 414 module (refer to the following table).

A sensor link fault can correspond to a short-circuit (S.C.) or an open circuit (O.C.) according to the type of sensor used. However, report is global and makes no distinction between a short-circuit and an open circuit.

Notes

- the module manages the consistency between the terminal block fault and the sensor link fault.
- the sensor link fault is not detected in the 0-5 V / 0-20 mA range (this function is not offered to the user and the wiring test is not performed).
- in the 1-5 V/ 4-20 mA range, the wiring test is only effective if the 250 Ω shunt is connected. If the shunt is not connected, the wiring test may not detect a fault, even if the cables are cut.
- in the case of temperature probes, the sensor link fault caused by a line compensation anomaly can appear or disappear with a maximum delay of 12 s, in relation to the occurrence of the anomaly.

Sensor	Pt1000 / Ni1000 temperature probes	Pt100 temperature probe	Thermocouples -15/60 mV, B, E, J, K, L, N, R, S, T, U
Max Rs	-	-	100 Ω
C.0.	> 3850 Ω	> 400 Ω	100000 Ω
S.C.	150 Ω	15 Ω	not detectable

4.2-4 Measurement filtering

First order filtering is performed with a filtering coefficient which can be modified from a programming terminal or by the program. The mathematical formula used is as follows :

$$\mathbf{Mes_{fn} = \alpha \times Mes_{fn-1} + (1-\alpha) \times Val_{bn}}$$

where : α = filter efficiency,
Mes_{fn} = filtered measurement at moment n,
Mes_{fn-1} = filtered measurement at moment n-1,
Val_{bn} = "raw" value measured at moment n.

During configuration the user selects a filter value from 7 possible values (0 to 6).
This value may be subsequently modified, even when the application is in RUN.

Efficiency required	**Value to select**	**Corresponding α**	**Filter response time at 63%**	**Cut off frequency (Hz)**
No filtering	0	0	0	-
Low level of filtering	1 2	0.750 0.875	1.91 s 4.12 s	0.083 0.039
Medium level of filtering	3 4	0.937 0.969	8.45 s 17.5 s	0.019 0.0091
High level of filtering	5 6	0.984 0.992	34.1 s 68.5 s	0.0046 0.0022

4.2-5 Measurement display

This processing is used to select the display format in which the measurements are supplied to the user program. It is necessary to differentiate between electrical ranges and thermocouple or temperature probe ranges.

Electrical ranges

The measurement supplied to the application can be used directly by the operator who can choose between :

- using 0..10000 standardized display (or ±10000 for the range ±10 V),
- setting his own display format parameters by indicating his required minimum and maximum values.

Standardized display (default). Values are displayed in standard units :
- for a unipolar range 0..10 V, 0..5 V, 0..20 mA or 4..20 mA, they are displayed from 0 to 10000 ($0^{0}/_{000}$ to $10000^{0}/_{000}$),
- for ± 10 V and ±5 V bipolar ranges, they are displayed from -10000 to +10000 ($-10000^{0}/_{000}$ to $+10000^{0}/_{000}$).

User display. The user can choose the range of values in which the measurements are expressed, by choosing :
- the lower limit corresponding to the minimum of the range : $0^{0}/_{000}$ (or $-10000^{0}/_{000}$),
- the upper limit corresponding to the maximum of the range : $+10000^{0}/_{000}$.

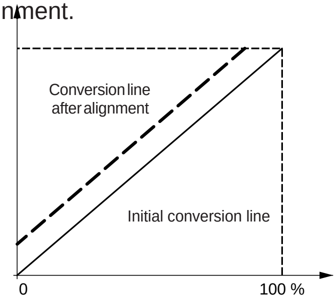
These upper and lower limits are integers between -30000 and +30000.

Thermocouple and temperature probe ranges
The user has the choice of two types of display :

- **Temperature display**. Values are supplied by default in tenths of a degree :
  - tenths of a degree Celsius, if the unit chosen during configuration is °C,
  - tenths of a degree Fahrenheit, if the unit chosen during configuration is °F.
- **Standardized display**. The user can choose a 0..10000 standardized display (0 to $10000^{0}/_{000}$), by specifying the minimum and maximum temperatures corresponding to 0 and 10000.

4.2-6 Sensor alignment

Alignment consists of eliminating a systematic shift observed by a given sensor, around a given operating point. An error linked to the process will be compensated but not an error linked to the control system. For this reason, replacing a module does not require a new alignment. On the other hand, replacing the sensor or changing the operating point of that sensor will require a new alignment.



For example, suppose that a Pt100 probe, plunged into melting ice (probe adjustment procedure) displays 10 °C after measurement (and not 0 °C). The user can align the measurement to the value 0 (required value). After this alignment procedure, the measurement channel will apply a systematic offset of -10 to any new measurement.

The alignment value can be modified via a programming terminal, even if the program is in RUN. For each input channel, the user can :

- display and modify the required measurement value,
- save the alignment value,
- know if the channel already has an alignment.

Alignment is performed when the channel is in normal operation, without affecting the operating modes of the module channel.
The maximum deviation between the measured value and the required value (aligned value) should not exceed ± 1000.

4.2-7 Recalibration

Recalibrating a module :

- corrects long-term drifts on the module,
- improves precision at an ambient temperature other than 25 °C (recommended).

The recalibration range is limited to between ±1% of the full scale, since beyond that range the module will consider there to be an analog input circuit anomaly.
Recalibration (full scale) is performed on each of the channels and in each of the ranges, by placing a calibration source directly on the input terminals. The following table indicates the calibration value to be supplied, according to the user range :

User range	±10 V, 0..10 V, ±5 V, 0..5 V, 1..5 V, 0..20 mA & 4..20 mA	Pt100, Pt1000 and Ni1000	-13..63 mV, B, E, J, K, L, N, R, S, T and U
Calibration voltage	10 V ±0.018%	2.5 V ±0.016%	60 mV ±0.028%
Current value	/	2.5 mA ±0.0328%	/

- In the case of temperature probes, recalibration of the current source takes place channel by channel. This consists of reading the value supplied by each of the current sources (only in 2.5 mA) to within 0.0328% and supplying the value in units of 100 nA. The recalibration procedure is available via the PL7 Junior software debug screens (refer to the installation manual for analog applications).
- for the calibration voltages 10 V and 2.5 V, the expected value read after calibration is 10000 ±2. For a calibration voltage of 60 mV, the value read is expected to be 9523 ±2 (10000 corresponding to full scale, ie 63 mV).

4.3 Characteristics

4.3-1 General characteristics

Number of channels	4
Analog/digital conversion	0..65535 points / 16 bits
Acquisition scan time	550 ms
Digital filter	1st order / User-definable time constant
Channel / ground dielectric voltage	1780 Vrms
Dielectric voltage between channels	2830 Vrms
Permissible common mode voltage betw. channels and ground during operation	240 VAC or 100 VDC
Permissible common mode voltage between channels during operation	415 VAC or 200 VDC
Overvoltage permitted in differential mode on inputs	±30 VDC (powered on, without 250Ω external resistors) ±15 VDC (powered off, without 250Ω external resistors)
Overcurrent permitted on inputs	±25 mA (powered on/off, with 250Ω external shunts)
Linearization	Automatic
Cold junction compensation	Internal and automatic External by Pt100 class A on channel 0, between -5 °C and +85 °C
Temperature probe current	2.5 mA DC for 100 Ω and 559 µA DC for 1000 Ω
Max. dissipated power	4.7 W
PLC standards	UL508, UL94, IEC1131, IEC68, IEC801
Sensor standards	IEC584, IEC751, DIN 43760, DIN 43710, NF C 42-330

Electrical ranges	±10V	0..10V	±5V (1)	0..5V (1)	1..5V (1)	0..20mA (1)	4..20mA	-13..63 mV	0..400Ω	0..3850Ω
Full Scale	10V	10V	5V	5V	5V	20mA	20mA	63mV	400Ω	3850Ω
Max. error at 25 °C (2)	0.27% FS	0.16% FS	0.27% FS	0.22% FS	0.27% FS	0.36% FS	0.45% FS	0.19% FS	0.13% FS	0.22% FS
Max. error from 0 to 60 °C (2)	0.50% FS	0.39% FS	0.50% FS	0.45% FS	0.56% FS	0.69% FS	0.86% FS	0.44% FS	0.27% FS	0.48% FS

Temp. probe ranges	Pt100 according to IEC	Pt1000 according to IEC	Ni1000 according to DIN
Max. error at 25 °C (3)	1.2 °C	2.5 °C	1.1 °C
Max. error from 0 to 60 °C (3)	2.4 °C	5.0 °C	2.0 °C

(1) The parameters for ranges 0..5 V and 0..20 mA or 1..5 V and 4..20 mA are set in the same way during configuration; the only difference lies in their installation (250 W shunt or not).
(2) For electrical ranges, the data applies to the whole input range.
(3) For temperature probe ranges, the data is given for the middle of the standard range, in 4-wire or 2-wire configuration, whilst conforming to connection restrictions (see section 4.5-3).

General characteristics (continued)

Thermocouple ranges (31)	B	E	J	K	L	N	R	S	T	U
Max error IC **at 25 °C (4)** EC	3.5°C /	6.1°C 1.5°C	7.3°C 1.9°C	7.8°C 2.3°C	7.5°C 2.0°C	6.0°C 2.0°C	6.0°C 3.2°C	6.6°C 3.4°C	6.6°C 1.5°C	5.4°C 1.5°C
Max error IC **0 to 60 °C** EC	8.1°C /	8.1°C 3.2°C	9.5°C 4.0°C	10.5°C 4.7°C	9.8°C 4.2°C	8.7°C 4.3°C	11.0°C 7.7°C	12.0°C 8.5°C	8.8°C 3.3°C	7.3°C 3.1°C

(4) For thermocouple ranges, the data includes internal or external cold junction compensation after a stabilization of 30 min. and is given for the middle of the standard range.
"IC" signifies that internal compensation is used; in this case care must be taken with the installation (refer to section 4.5-4).
"EC" signifies that external compensation is used, across channel 0 for Pt100, with a class A probe.

4.3-2 Detailed input characteristics

The TSX AEY 414 module has 23 ranges on each of its inputs, which can be configured channel by channel.

Precision

The precision of each input is given by the following formula :

Measurement = C + K x M

where **C** = constant for the range examined,
K = proportionality coefficient,
M = absolute value of the measurement.

The measurement error is therefore composed of a constant value (C) and a value proportional to the measurement (K), which can be different depending on the polarity of the measurement.
For thermocouple ranges, the measurement error also takes into account the cold junction compensation error and the linearization error, and for current ranges it takes into account the external resistance error (shunt).

Crosstalk

Crosstalk is expressed in dB and is given by the following formula :

$$\textbf{Crosstalk} = 20 \times \text{Log}_{10} (V_M / V_m)$$

where V_M = full scale voltage in the least sensitive range,
V_m = error voltage on the following channel, configured in the most sensitive range (due to the presence of V_M).

In this case, V_M equals +10 V and V_m is the error due to the presence of +10 V on the following channel configured for ±20 mV.

Rejection in common mode

Rejection in common mode between channel and ground is expressed in dB and is given by the following formula :

CM rejection = 20 x Log_{10} (V_{MC} / V_{em})

where V_{MC}= voltage in common mode, expressed in VDC or VAC (50 / 60 Hz),
V_{em} = error voltage on the measurement (reduced by the conversion resolution), expressed in VDC.

For a current range, rejection in common mode is naturally deduced from this formula.
For temperature probe or thermocouple ranges, rejection in common mode has no significance.

Rejection in 50/60 Hz serial mode

Rejection in 50/60 Hz serial mode, superimposed on the measured value, is expressed in dB and is given by the following formula :

SM rejection = 20 x Log_{10} (V_{MS} / V_{em})

where V_{MS}= serial mode voltage, expressed in peak to peak V,
V_{em} = error voltage on the measurement (reduced by the conversion resolution), expressed in VDC.

For a current range, rejection in serial mode is naturally deduced from this formula.
For temperature probe or thermocouple ranges, rejection in serial mode has no significance.

Characteristics of the ±10 V range

Range	±10 V	
Full scale (FS)	10 V	
Conversion resolution	570 µV	
Display resolution	1 mV	(0.01%)
Max. error at 25 °C	+2 mV + 0.0014 x M - 2 mV + 0.0025 x M	(0.27% FS)
Max. error from 0 to 60 °C	0.50% FS	
Input range	±10 V	(±10000)
Range overshoot	±10.5 V	(±10500)
CM rejection channel / ground (VDC)	95 dB	
CM rejection channel / ground (VAC - 50 / 60 Hz)	105 dB	
SM rejection - 50 / 60 Hz	35 dB	

Errors at temperatures other than 25 °C and 60 °C can be deduced by linear extrapolation of the errors defined at 25 and 60 °C. The formula is :

E(T) = E(25°C) + I T - 25°C I x [E(60°C) - E(25°C)]/35

Characteristics of the 0..10 V range

Range	0..10 V	
Full scale (FS)	10 V	
Conversion resolution	570 µV	
Display resolution	1 mV	(0.01% FS)
Max. error at 25 °C	+2 mV + 0.0014 x M	(0.16% FS)
Max. error from 0 to 60 °C	0.39% FS	
Input range	0..10 V	(0..10000)
Range overshoot	-0.5..10.5 V	(-500..10500)
CM rejection channel / ground (VDC)	95 dB	
CM rejection channel / ground (VAC - 50 / 60 Hz)	105 dB	
SM rejection - 50 / 60 Hz	35 dB	

Characteristics of the ±5 V range

Range	±5 V	
Full scale (FS)	5 V	
Conversion resolution	570 µV	
Display resolution	0.5 mV	(0.01% FS)
Max. error at 25 °C	+1.5 mV + 0.0019 x M -1.5 mV + 0.0024 x M	(0.27% FS)
Max. error from 0 to 60 °C	0.50% FS	
Input range	±5 V	(±10000)
Range overshoot	±5,25 V	(±10500)
CM rejection channel / ground (VDC)	100 dB	
CM rejection channel / ground (VAC - 50 / 60 Hz)	110 dB	
SM rejection - 50 / 60 Hz	35 dB	

Errors at temperatures other than 25 °C and 60 °C can be deduced by linear extrapolation of the errors defined at 25 and 60 °C. The formula is :

$$E(T) = E(25°C) + | T - 25°C | \times [E(60°C) - E(25°C)]/35$$

Characteristics of the 0..5 V range

Range	0..5 V	
Full scale (FS)	5 V	
Conversion resolution	570 µV	
Display resolution	500 µV	(0.01% FS)
Max. error at 25 °C	+1.5 mV + 0.0019 x M	(0.22% FS)
Max. error from 0 to 60 °C	0.45% FS	
Input range	0..5 V	(0..10000)
Range overshoot	-0.25..5.25 V	(-500..10500)
CM rejection channel / ground (VDC)	100 dB	
CM rejection channel / ground (VAC - 50 / 60 Hz)	110 dB	
SM rejection- 50 / 60 Hz	35 dB	

Characteristics of the 1..5 V range

Range	1..5 V	
Full scale (FS)	4 V	
Conversion resolution	570 µV	
Display resolution	400 µV	(0.01% FS)
Max. error at 25 °C	+3.2 mV + 0.0019 x M	(0.27% FS)
Max. error from 0 to 60 °C	0.56% FS	
Input range	1..5 V	(0..10000)
Range overshoot	0.8..5.2 V	(-500..10500)
CM rejection channel / ground (VDC)	100 dB	
CM rejection channel / ground (VAC - 50 / 60 Hz)	110 dB	
SM rejection - 50 / 60 Hz	35 dB	

Errors at temperatures other than 25 °C and 60 °C can be deduced by linear extrapolation of the errors defined at 25 and 60 °C. The formula is :

$$E(T) = E(25°C) + | T - 25°C | \times [E(60°C) - E(25°C)]/35$$

Characteristics of the 0..20 mA range

Range	0..20 mA	
Full scale (FS)	20 mA	
Conversion resolution	2.28 µA	
Display resolution	2 µA	(0.01% FS)
Max. error at 25 °C	+6 µA + 0.0033 x M	(0.36% Fs)
Max. error from 0 to 60 °C	0.69% FS	
Input range	0..20 mA	(0..10000)
Range overshoot	-1..21 mA	(-500..10500)
CM rejection channel / ground (VDC)	100 dB	
CM rejection channel / ground (VAC - 50 / 60 Hz)	110 dB	
SM rejection - 50 / 60 Hz	35 dB	

Characteristics of the 4..20 mA range

Range	4..20 mA	
Full scale (FS)	16 mA	
Conversion resolution	2.28 µA	
Display resolution	1.6 µA	(0.01% FS)
Max. error at 25 °C	+19.2 µA + 0.0033 x M	(0.45% Fs)
Max. error from 0 to 60 °C	0.86% FS	
Input range	4..20 mA	(0..10000)
Range overshoot	3.2..20.8 mA	(-500..10500)
CM rejection channel / ground (VDC)	100 dB	
CM rejection channel / ground (VAC - 50 / 60 Hz)	110 dB	
SM rejection - 50 / 60 Hz	35 dB	

Errors at temperatures other than 25 °C and 60 °C can be deduced by linear extrapolation of the errors defined at 25 and 60 °C. The formula is :

$$E(T) = E(25°C) + | T - 25°C | \times [E(60°C) - E(25°C)]/35$$

Precision includes the shunt (250Ω - 0.1% - 25 ppm/°C). The influence of the shunt on the precision can be reduced by using a more precise resistance (0.01% - 10 ppm/°C).

Characteristics of the -13..63 mV range

Range	-13..63 mV	
Full scale (FS)	63 mV	
Conversion resolution	2.02 µV	
Display resolution	6.3 µV (1)	(0.01% FS)
Max. error at 25 °C	+18 µV + 0.001581 x M -18 µV + 0.004581 x M	(0.19% FS)
Max. error from 0 to 60 °C	0.44% FS	
Input range	-13..63 mV	(-2064..10000)
Range overshoot	-13..63 mV	(-2064..10000)
CM rejection channel / ground (VDC)	>140 dB	
CM rejection channel / ground (VAC - 50 / 60 Hz)	>150 dB	
SM rejection - 50 / 60 Hz	>35 dB	

Characteristics of the 0..400 Ω range

Range	0..400 Ω	
Full scale (FS)	400 Ω	
Conversion resolution	31 mΩ	
Display resolution	40 mΩ (1)	(0.01% FS)
Max. error at 25 °C	63 mΩ + 0.001180 x M	(0.13% FS)
Max. error from 0 to 60 °C	0.27% FS	
Input range	0..400 Ω	(0..10000)
Range overshoot	0..400 Ω	(0..10000)
CM rejection channel / ground (VDC)	>110 dB	
CM rejection channel / ground (VAC - 50 / 60 Hz)	>120 dB	
SM rejection - 50 / 60 Hz	>35 dB	

Errors at temperatures other than 25 °C and 60 °C can be deduced by linear extrapolation of the errors defined at 25 and 60 °C. The formula is :

E(T) = E(25°C) + I T - 25°C I x [E(60°C) - E(25°C)]/35

(1) Converter resolution can be achieved by redefining the limits in the User scale.

Characteristics of the 0..3850 Ω range

Range	0..3850Ω	
Full scale (FS)	3850Ω	
Conversion resolution	139 mΩ	
Display resolution	385 mΩ (1)	(0.01% FS)
Max. error at 25 °C	2.114 Ω + 0.001647 x M	(0.22% FS)
Max. error from 0 to 60 °C	0.48% FS	
Input range	0..3850 Ω	(0..10000)
Range overshoot	0..3850 Ω	(0..10000)
CM rejection channel / ground (VDC)	>110 dB	
CM rejection channel / ground (VAC - 50 / 60 Hz)	>120 dB	
SM rejection - 50 / 60 Hz	>35 dB	

Errors at temperatures other than 25 °C and 60 °C can be deduced by linear extrapolation of the errors defined at 25 and 60 °C. The formula is :

$$E(T) = E(25°C) + | T - 25°C | \times [E(60°C) - E(25°C)]/35$$

(1) Converter resolution can be achieved by redefining the limits in the User scale.

Characteristics of the temperature probe ranges

Range		Pt100	Pt1000	Ni1000
Conversion resolution (1)		0.09 °C	0.04 °C	0.02 °C
Display resolution		0.1 °C	0.1 °C	0.1 °C
Max error at 25 °C (2)				
Operating point	-200 °C	0.3 °C	0.4 °C	
	-100 °C	0.5 °C	0.8 °C	
	0 °C	0.6 °C	1.2 °C	0.9 °C
	100 °C	0.8 °C	1.6 °C	1.1 °C
	200 °C	1.0 °C	2.1 °C	1.2 °C
	300 °C	1.2 °C	2.5 °C	
	400 °C	1.4 °C	3.0 °C	
	500 °C	1.7 °C	3.4 °C	
	600 °C	1.8 °C	4.0 °C	
	700 °C	2.1 °C	4.5 °C	
	800 °C	2.3 °C	5.1 °C	
Max error from 0 to 60 °C				
Operating point	-200 °C	0.5 °C	0.5 °C	
	-100 °C	0.8 °C	1.4 °C	
	0 °C	1.2 °C	2.2 °C	1.6 °C
	100 °C	1.6 °C	3.1 °C	2.0 °C
	200 °C	2.0 °C	4.0 °C	2.3 °C
	300 °C	2.4 °C	4.9 °C	
	400 °C	2.9 °C	5.9 °C	
	500 °C	3.3 °C	7.0 °C	
	600 °C	3.8 °C	8.0 °C	
	700 °C	4.4 °C	9.1 °C	
	800 °C	5.0 °C	10.3 °C	
Input range	**in °C**	-200..850 °C	-200..800 °C	-60..250 °C
	in °F	-328..1562 °F	-328..1472 °F	-76..482 °F

Errors at temperatures other than 25 °C and 60 °C can be deduced by linear extrapolation of the errors defined at 25 and 60 °C. The formula is :

E(T) = E(25°C) + I T - 25°C I x [E(60°C) - E(25°C)]/35

The data is given for 4-wire connections and include errors and drifts from the current source 2500 µA (Pt100) or 559.03 µA (Pt1000 or Ni1000).

The effect of self-heating does not cause a significant error on the measurement, whether the probe is in air or water.

(1) these values are given for an operating point in the middle of the temperature probe range.
(2) ambient temperature of TSX AEY 414.

Reference standards : NF C 42-330 June 1983 and IEC 751, 2nd edition 1986 for Pt100 / 1000, DIN 43760 September 1987 for Ni1000.

Characteristics of thermocouple ranges

Thermocouple range	B	E		J		K	
Conversion resolution (1)	0.24 °C	0.026 °C		0.037 °C		0.048 °C	
Display resolution	0.1 °C	0.1 °C		0.1 °C		0.1 °C	
Max error at 25 °C (2)	IC / EC(°C) (3)	IC (°C)	EC (°C)	IC (°C)	EC (°C)	IC (°C)	EC (°C)
Operating point -200 °C		16.8	2.7			18.7	3.3
-100 °C		9.5	1.7			9.5	1.8
0 °C		7.5	1.5	7.4	1.5	7.5	1.6
100 °C		6.7	1.4	7.1	1.5	7.4	1.7
200 °C		6.2	1.5	7.1	1.7	7.8	1.9
300 °C		6.1	1.5	7.3	1.8	7.6	2.0
400 °C		6.1	1.7	7.4	2.0	7.6	2.1
500 °C		6.2	1.8	7.5	2.1	7.8	2.3
600 °C	4.7	6.4	2.0	7.3	2.2	7.9	2.4
700 °C	4.0	6.6	2.1	7.0	2.2	8.2	2.6
800 °C	4.0	6.8	2.3			8.6	2.8
900 °C	3.8					8.9	3.1
1000 °C	3.6					9.3	3.3
1100 °C	3.5					9.8	3.6
1200 °C	3.6					10.3	3.8
1300 °C	3.6						
1400 °C	3.5						
1500 °C	3.5						
1600 °C	3.7						
1700 °C	3.9						
Input range (4)	0..1802 °C	-270..812 °C		-210..1065 °C		-270..1372 °C	

Errors at temperatures other than 25 °C and 60 °C can be deduced by linear extrapolation of the errors defined at 25 and 60 °C. The formula is :

E(T) = E(25°C) + I T - 25°C I x [E(60°C) - E(25°C)]/35

(1) These values are given for an operating point in the middle of the thermocouple range.

(2) IC = ambient temperature of the TSX AEY 414 (4) and automatic **internal** compensation (see section 4.5-4),
EC = ambient temperature of the TSX AEY 414 (4) and automatic **external** compensation, with Pt100 class A.

(3) With thermocouple B, the type of cold junction compensation (internal or external) is not taken into account, since it has no effect on precision.

(4) Internal compensation : ambient temperature = 20 °C,
External compensation : ambient temperature = 30 °C.

Reference standards : IEC 584-1, 1st edition 1977 and IEC 584-2, 2nd edition 1989.

Characteristics of thermocouple ranges (continued)

Thermocouple range		B	E		J		K	
Max error at 25 °C (1)		IC / EC (°F) (2)	IC (°F)	EC (°F)	IC (°F)	EC (°F)	IC (°F)	EC (°F)
Operating point	-300 °F		26.4	4.3			28.5	5.1
	-100 °F		15.8	2.9			15.7	3.1
	0 °F				13.6	2.7		
	100 °F		12.8	2.6			13.2	2.9
	200 °F				12.7	2.8		
	300 °F		11.6	2.6			13.7	3.2
	400 °F				12.8	3.0		
	500 °F		11.0	2.7			13.8	3.5
	600 °F				13.1	3.3		
	700 °F		10.9	2.9			13.8	3.7
	800 °F				13.4	3.6		
	900 °F		11.1	3.2			13.9	4.0
	1000 °F				13.4	3.9		
	1100 °F	8.5	11.4	3.5			14.3	4.3
	1200 °F				12.9	4.0		
	1300 °F	7.3	11.8	3.9			14.7	4.7
	1400 °F				12.5	4.0		
	1500 °F	7.0	12.4	4.3			15.5	5.1
	1700 °F	6.8					16.3	5.6
	1900 °F	6.6					17.1	6.1
	2100 °F	6.2					18.0	6.6
	2300 °F	6.2					19.1	7.2
	2500 °F	6.3						
	2700 °F	6.4						
	2900 °F	6.6						
	3100 °F	7.0						
Input range (3)		32..3276 °F	-454..1493 °F		-346..1949 °F		-454..2502 °F	

(1) IC = ambient temperature of the TSX AEY 414 (3) and automatic **internal** compensation (see section 4.5-4),
EC = ambient temperature of the TSX AEY 414 (3) and automatic **external** compensation, with Pt100 class A.

(2) With thermocouple B, the type of cold junction compensation (internal or external) is not taken into account, since it has no effect on precision.

(3) Internal compensation : ambient temperature = 20 °C,
External compensation : ambient temperature = 30 °C.

Characteristics of thermocouple ranges (continued)

Thermocouple range		L		N		R		S	
Conversion resolution (1)		0.036 °C		0.05 °C		0.16 °C		0.19 °C	
Display resolution		0.1 °C		0.1 °C		0.1 °C		0.1 °C	
Max. error at 25 °C (2)		IC (°C)	EC (°C)	IC (°C)	EC (°C)	IC (°C)	EC (°C)	IC (°C)	EC (°C)
Operating point	-200 °C			19.6	4.0				
	-100 °C			9.5	2.1				
	0 °C	7.5	1.5	7.8	1.8	11.4	4.8	11.2	4.7
	100 °C	7.1	1.5	7.0	1.8	8.1	3.5	8.3	3.5
	200 °C	7.2	1.7	6.5	1.7	7.1	3.2	7.4	3.3
	300 °C	7.3	1.9	6.2	1.8	6.5	2.9	6.9	3.1
	400 °C	7.5	2.0	6.0	1.9	6.3	3.0	6.8	3.2
	500 °C	7.4	2.1	6.0	2.0	6.2	3.0	6.8	3.3
	600 °C	7.4	2.2	6.1	2.1	6.1	3.1	6.8	3.4
	700 °C	7.1	2.2	6.2	2.2	6.1	3.1	6.6	3.3
	800 °C	6.8	2.3	6.3	2.4	6.0	3.2	6.6	3.4
	900 °C	6.7	2.3	6.5	2.6	6.0	3.2	6.6	3.5
	1000 °C			6.8	2.7	5.9	3.3	6.6	3.6
	1100 °C			7.0	2.9	5.9	3.3	6.6	3.7
	1200 °C			7.4	3.2	5.9	3.4	6.7	3.8
	1300 °C					6.0	3.5	6.8	3.9
	1400 °C					6.1	3.7	6.9	4.1
	1500 °C					6.3	3.8	7.2	4.3
	1600 °C					6.5	4.0	7.4	4.5
Input range (3)		-200..900 °C		-270..1300 °C		-50..1769 °C		-50..1769 °C	

Errors at temperatures other than 25 °C and 60 °C can be deduced by linear extrapolation of the errors defined at 25 and 60 °C. The formula is :

$$E(T) = E(25°C) + | T - 25°C | \times [E(60°C) - E(25°C)]/35$$

(1) These values are given for an operating point in the middle of the thermocouple range.

(2) IC = ambient temperature of the TSX AEY 414 (4) and automatic **internal** compensation (see section 4.5-4),
EC = ambient temperature of the TSX AEY 414 (4) and automatic **external** compensation, with Pt100 class A.

(3) Internal compensation : ambient temperature = 20 °C,
External compensation : ambient temperature = 30 °C.

Reference standards :
- thermocouple L : DIN 43710, edition December 1985,
- thermocouple N : IEC 584-1, 2nd edition 1989 and IEC 584-2, 2nd edition 1989,
- thermocouple R : IEC 584-1, 1st edition 1977 and IEC 584-2, 2nd edition 1989,
- thermocouple S : IEC 584-1, 1st edition 1977 and IEC 584-2, 2nd edition 1989.

Characteristics of thermocouple ranges (continued)

Thermocouple range		L		N		R		S	
Max. error at 25 °C (1)		IC (°F)	EC (°F)	IC (°F)	EC (°F)	IC (°F)	EC (°F)	IC (°F)	EC (°F)
Operating point	-300 °F			29.4	6.0				
	-100 °F			15.7	3.4				
	0 °F	14.9	2.8			21.9	8.8	21.2	8.6
	100 °F			13.5	3.3				
	200 °F	13.1	2.7			14.8	6.4	15.1	6.5
	300 °F			12.0	3.1				
	400 °F	12.7	2.9			12.8	5.7	13.3	6.0
	500 °F			11.2	3.2				
	600 °F	13.0	3.2			11.9	5.6	12.3	5.5
	700 °F			10.9	3.3				
	800 °F	13.3	3.5			11.2	5.3	12.1	5.7
	900 °F			10.9	3.5				
	1000 °F	13.4	3.8			11.0	5.3	12.1	5.9
	1100 °F			10.9	3.8				
	1200 °F	13.3	4.0			10.8	5.4	12.1	6.0
	1300 °F			11.1	4.0				
	1400 °F	12.8	4.0			10.7	5.5	12.0	6.2
	1500 °F	12.2	4.0	11.5	4.3				
	1600 °F					10.5	5.6	11.9	6.3
	1700 °F			11.9	4.7				
	1800 °F					10.7	5.7	11.9	6.4
	1900 °F			12.3	5.1				
	2000 °F					10.6	6.0	3.9	2.3
	2100 °F			13.0	5.5				
	2200 °F					10.5	6.1	3.9	2.3
	2300 °F			13.7	6.0				
	2400 °F					10.5	6.2	4.0	2.4
	2600 °F					10.4	6.3	4.1	2.5
	2800 °F					10.4	6.4	4.2	2.6
	3000 °F					10.7	6.7	4.4	2.8
Input range (2)		-328..1652 °F		-454..2372 °F		-58..3216 °F		-58..3216 °F	

(1) IC = ambient temperature of the TSX AEY 414 (2) and automatic **internal** compensation (see section 4.5-4),
EC = ambient temperature of the TSX AEY 414 (2) and automatic **external** compensation, with Pt100 class A.

(2) Internal compensation : ambient temperature = 20 °C,
External compensation : ambient temperature = 30 °C.

Characteristics of thermocouple ranges (continued)

Thermocouple range	T		U	
Conversion resolution (1)	0.046 °C		0.038 °C	
Display resolution	0.1 °C		0.1 °C	
Max. error at 25 °C (2)	IC (°C)	EC (°C)	IC (°C)	EC (°C)
Operating point -200 °C	18.3	3.2		
-150 °C	13.0	2.4		
-100 °C	10.3	2.0		
-50 °C	8.7	1.7		
0 °C	7.7	1.6	7.7	1.6
50 °C	7.1	1.5		
100 °C	6.6	1.5	6.7	1.5
150 °C	6.2	1.5		
200 °C	5.9	1.5	5.8	1.5
250 °C	5.7	1.5		
300 °C	5.6	1.5	5.4	1.5
350 °C	5.5	1.6		
400 °C			5.4	1.6
500 °C			5.2	1.6
600 °C			5.0	1.7
Input range (3)	-270..400 °C		-200..600 °C	

Errors at temperatures other than 25 °C and 60 °C can be deduced by linear extrapolation of the errors defined at 25 and 60 °C. The formula is :

E(T) = E(25°C) + I T - 25°C I x [E(60°C) - E(25°C)]/35

(1) These values are given for an operating point in the middle of the thermocouple range.

(2) IC = ambient temperature of the TSX AEY 414 (4) and automatic **internal** compensation (see section 4.5-4),
EC = ambient temperature of the TSX AEY 414 (4) and automatic **external** compensation, with Pt100 class A.

(3) Internal compensation : ambient temperature = 20 °C,
External compensation : ambient temperature = 30 °C.

Reference standards :
• thermocouple T : IEC 584-1, 1st edition 1977 and IEC 584-2, 2nd edition 1989,
• thermocouple U : DIN 43710, edition December 1985.

Characteristics of thermocouple ranges (continued)

Thermocouple range		T		U	
Max error at 25 °C (1)		IC (°F)	EC (°F)	IC (°F)	EC (°F)
Operating point	-300 °F	29.2	5.3		
	-200 °F	21.1	4.0		
	-100 °F	16.9	3.3		
	0 °F	14.4	3.0	14.3	2.9
	100 °F	13.0	2.8		
	200 °F	11.9	2.7	12.3	2.8
	300 °F	11.2	2.7		
	400 °F	10.6	2.7	10.5	2.6
	500 °F	10.3	2.7		
	600 °F	10.0	2.7	9.8	2.7
	700 °F	9.8	2.8		
	800 °F			9.7	2.9
	1000 °F			9.2	3.0
Input range (2)		-454..752 °F		-328..1112 °F	

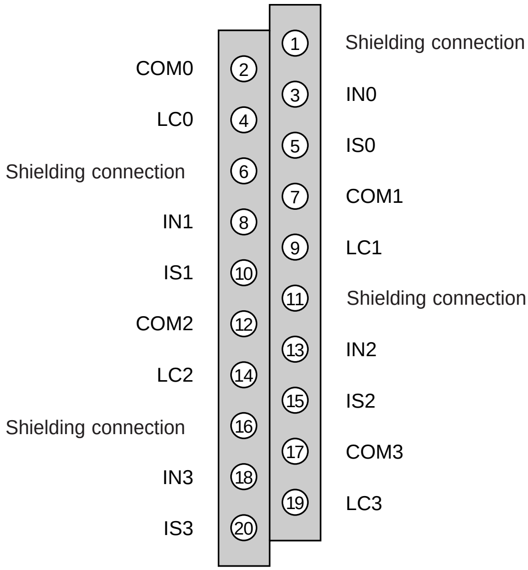
(1) IC = ambient temperature of the TSX AEY 414 (2) and automatic **internal** compensation (see section 4.5-4),
EC = ambient temperature of the TSX AEY 414 (2) and automatic **external** compensation, with Pt100 class A.

(2) Internal compensation : ambient temperature = 20 °C,
External compensation : ambient temperature = 30 °C.

4.4 Connections

4.4-1 Terminal block pinout

The TSX AEY 414 module uses a TSX BLY 01 terminal block.



INx	:	+ve input channel x
COMx	:	-ve input channel x
ISx	:	+ve sensor supply
LCx	:	Line compensation

Note
The terminal block is fitted with an internal shunt, which cannot be accessed at the terminals.

4.4-2 External shunts (0..20 mA and 4..20 mA range)

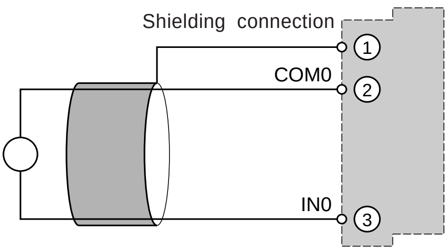
When the 0..20 mA or 4..20 mA range is used, an external shunt of 250 Ω - 0.1% - 1/2 W - 25ppm/°C is required, connected in parallel on the input terminals. This shunt is supplied with the module in lots of 4, which can also be supplied separately, under reference TSX AAK2.

4.4-3 Sensor connection

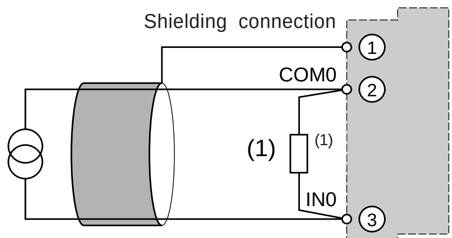
It is advisable to use shielded cables and to link the shielding to the terminals designed for this purpose (Shielding connection).
For high level and thermocouple inputs, the "source + wiring" resistance should be less than 100 Ω so as not to adversely affect the module performance.
For temperature probe inputs, the resistance of each of the wires in 4-wire configuration should be less than 50Ω, which corresponds to a copper wire with a cross-section of 0.6 mm^2 and maximum overall length of 3000 m.
For temperature probes, the resistance of each of the wires in 2-wire configuration should be less than 50 mΩ (to avoid measurement errors caused by resistive losses in the cables).

Examples of wiring sensors on channel 0

High level voltage

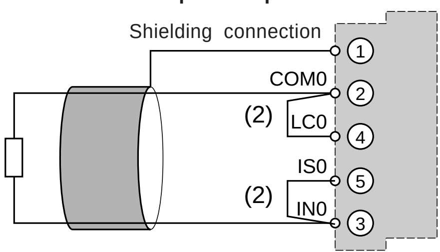


High level current

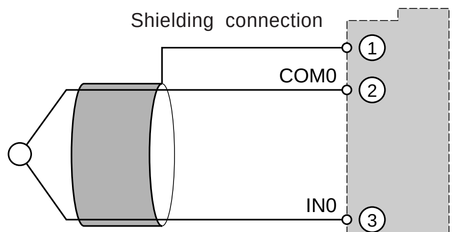


(1) External shunt 250 Ω

2-wire temperature probe

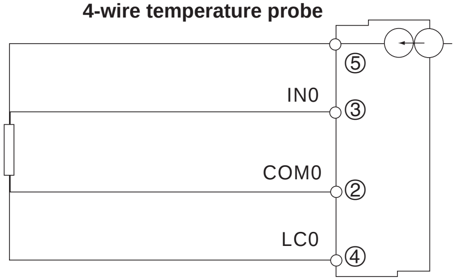


Thermocouple

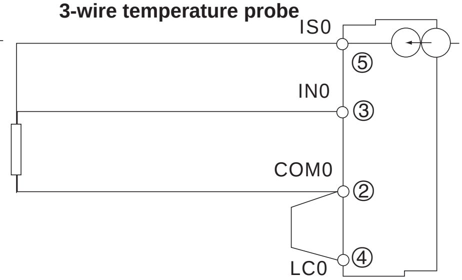


(2) Probe supply straps

4-wire temperature probe



3-wire temperature probe



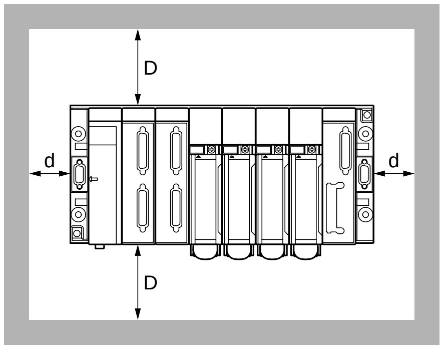
4.4-4 Recommendations for installing thermocouples

- **Use of internal cold junction compensation**

  In the case of measurements by ET thermocouple with internal compensation (and only in this case) it is advisable to follow the rules below :

  - the PLC must not be directly fan-cooled, convection must be natural,
  - variations in ambient temperature must be less than 5 °C per hour,
  - the modules in the immediate vicinity must dissipate between 2.2 W and 3.3 W, corresponding to the most commonly used modules (TSX P5710, TSX P5720, TSX DEY 16D2, TSX DEY 32DK, TSX DEY 16FK, TSX DSY 16R5, TSX AEY 414, etc),
  - the TSX AEY 414 module must be mounted in a PLC which has a minimum clearance height of 150 mm (D) and width (d) of 100 mm.

  If these recommendations are followed, installation can be made in a wall or floor-mounted enclosure, or without an enclosure.



  If the installation rules described above are not observed, module operation is not impaired. However, measurement precision on inputs set for thermocouple ranges will be affected. In stable ambient temperature conditions and with fixed configuration, the measurement will simply be shifted by a stable value, which can be compensated by carrying out "sensor alignment".

  Since thermocouple B is not sensitive to cold junction compensation from 0 to 70 °C, these installation restrictions do not apply.

- **Use of external cold junction compensation**

  If thermocouples with external compensation are used, the acquisition of the cold junction temperature must be made using a Pt100 class A probe on channel 0 (probe not supplied). Channels 1, 2 and 3 of the module can therefore be used for the thermocouple measurement.

  This type of use places no particular constraints on TSX AEY 414 installation. The Pt100 must be placed close to the cold junction terminal. This means that standard (copper) shielded cables will be used instead of compensated cables.

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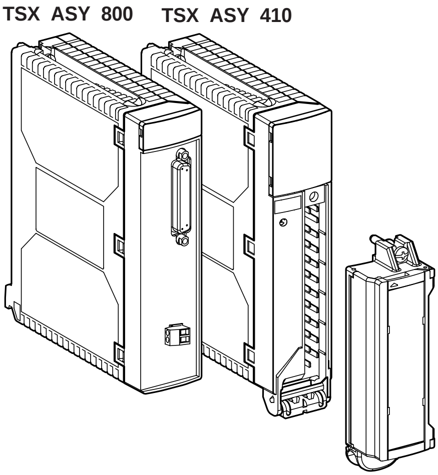
1.1 Presentation

General

TSX ASY 410 and TSX ASY 800 modules have 4 and 8 analog outputs and provide the ranges ± 10 V, 0..20 mA and 4..20 mA for each of their inputs.

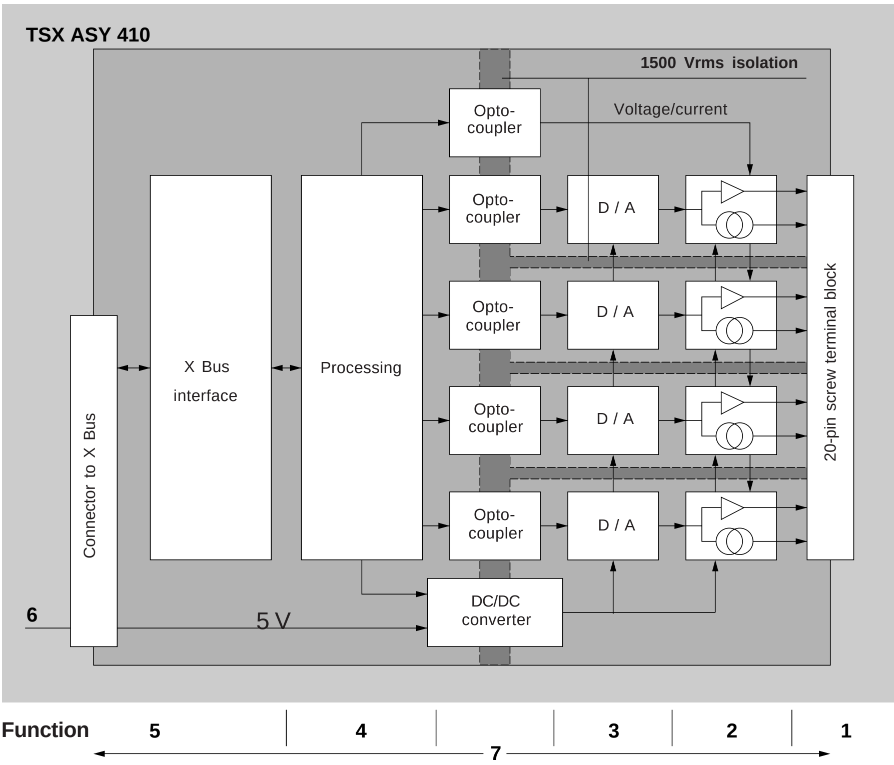
- TSX ASY 410 : 4 analog outputs isolated from each other,
- TSX ASY 800 : 8 non-isolated analog outputs,



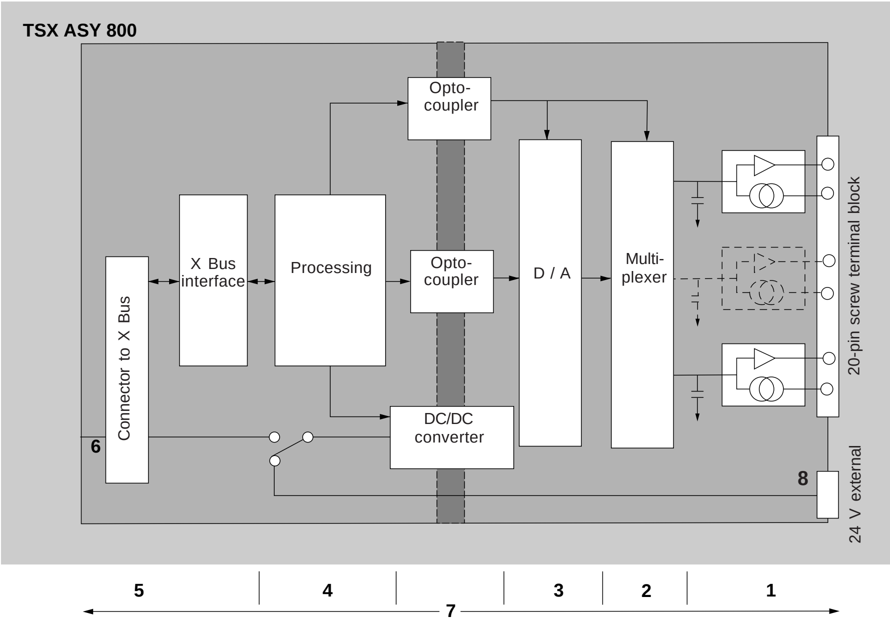
Functions

These output modules perform the following functions :

TSX ASY 410



TSX ASY 800



1 Connection to the process
- physical connection to the process, via a 20-pin screw terminal block (TSX ASY 420) or a 25-pin SubD connector (TSX ASY 800),
- protection of the module against overvoltages.

2 Adaptation to different actuators (voltage or current output).

3 Conversion of digital data into analog signals

4 Converting application data into data which can be used by the digital/ analog converter.

5 Interface and communication with the application
- management of exchanges via X Bus,
- geographical addressing,
- reception, from the application, of module and channel configuration parameters, as well as digital channel settings,
- transmission of module status to the application.

6 Module power supply

7 Monitoring the module and indicating possible faults to the application
- converter test,
- test for range overshoot on the channels,
- test for the presence of the terminal block,
- test of watchdog.

C

1.2 Output processing

1.2-1 Writing to the outputs

The application must provide the outputs with standard format values :
• -10000 to +10000 in the range ±10 V,
• 0 to +10000 in the ranges 0-20mA and 4-20mA.

The values must be written in words %QWxy.i.0 to 3 for channels 0 to 3 of the TSX ASY 400 module or %QWxy.i.0 to 7 for channels 0 to 7 of the TSX ASY 800 module.

1.2-2 Behavior of outputs when the program is in STOP or absent

When the task which controls the outputs is in STOP or when the program is absent, the outputs take the following position :

- programmable fallback, if the "Fallback" option was selected during module configuration,
- maintain last value transmitted, if the "Maintain" option was selected during module configuration.

The fallback value can be modified from the PL7 Junior debug screen or via the program.

1.2-3 Forcing outputs

From the PL7 Junior debug screen, each output can be forced to a value between -10000 and +10000, defined by the user. This function is mainly used for the wiring test.

Forcing can only be accessed if the program task which controls the output is in RUN (the output is in Fallback or Maintain position when the program task is in STOP).

1.2-4 Behavior during external output supply fault

If an external output supply fault occurs (TSX ASY 800), all the module outputs are set to 0.

Note :
If an external supply fault and a terminal block fault occur at the same time on the module, only the supply fault is indicated.

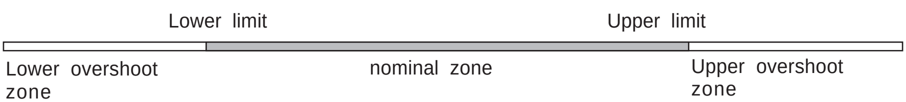
1.2-5 Overshoot monitoring

TSX ASY 410 (software version : II≤10) (1)
If the values supplied by the application are less than -10000 or greater than +10000, analog outputs will become saturated at the following value :

- -10 V or +10 V in the range ±10 V,
- 4 mA or 20 mA in the range 4..20 mA,
- 0 mA or 20 mA in the range 0..20 mA.

An overshoot fault is signalled by a bit which can be used by the program (error bit **%Ixy.i.ERR** = 1 signals a fault on the channel and status word bit **%MWxy.i.2:X1** = 1 indicates a range overshoot on the channel).

TSX ASY 800 and TSX ASY 410 (software version : II>10) (1)
These modules allow an overshoot of ±5% on voltage and 4..20mA ranges and +5% on the range 0..20mA.



Overshoot value according to range :

Range	Lower limit	Upper limit
±10V	-10 500 (or -10.5 V)	+10 500 (or +10.5 V)
0..20mA	0 (or 0mA)	+10 500 (or 21mA)
4..20mA	- 500 (or 3.2 mA)	+10 500 (or 20.8 mA)

Range overshoot detection is optional : during configuration, the user can select overshoot detection by upper or lower values or both.

When the value is transmitted outside the overshoot limits and overshoot monitoring is required, bit **%Ixy.ERR** is set to 1 and the type of overshoot (upper or lower) is registered in bits **%MWxy.i.2:X1** (range overshoot) and **%MWxy.i.2:X3** (=1 if upper value overshoot =0 if lower value overshoot).

(1) the module software version is marked on the label which gives the module reference.

C

1.2-6 Digital/analog conversion

Digital / analog conversion is executed on :
- 11 bits + sign (-2048 to +2047) for the TSX ASY 410 module,
- 13 bits + sign (-8192 to +8191) for voltage for the TSX ASY 800 module,
- 13 bits (0 to +8191) for current for the TSX ASY 800 module,

The data supplied by the program is converted automatically within the range limits of the converter.

1.2-7 Updating the outputs

The maximum time between the transmission of the output value on the PLC bus and its positioning on the terminal block is 2.5 ms for the TSX ASY 410 and 5 ms for the TSX ASY 800.
Outputs can be individually assigned to the MAST task or to the FAST task of the application program.

1.2-8 Fallback / Maintain outputs or set outputs to 0

When a fault occurs, depending on the seriousness of the fault, the outputs take the "Fallback/Maintain" value individually or together or are forced to 0 (0 V or 0 mA).

Fault	Behavior of voltage outputs	Behavior of current outputs
Task in STOP or program absent	Fallback/Maintain (channel by channel)	Fallback/Maintain (channel by channel)
Communication fault	Fallback/Maintain (all channels)	Fallback/Maintain (all channels)
Configuration fault	0 V (channel by channel)	0 mA (channel by channel)
Internal module fault	0 V (all channels)	0 mA (all channels)
Output value outside limits (range overshoot)	Value transmitted with saturation at +10.5/ -10.5V (1) (channel by channel)	Value transmitted with saturation at 3.2 / 20.8 mA (1) or 0 / 20 mA (channel by channel)
Terminal block fault	Maintain value (all channels)	Maintain value (all channels)
Insertion while powered up Processor stopped	Outputs to 0 (all channels)	0 mA (all channels)
Reloading of program	0 V (all channels)	0 mA (all channels)

(1) These values apply to the TSX ASY 800 and TSX ASY 410 (II>10) modules, for TSX ASY 410 (II<10) modules, they are +10/-10V for voltage and 4/20mA or 0/20 mA for current.

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1.2-9 Behavior during power up (TSX ASY 800)

When the module is powered up (power up of rack or insertion while powered up), the outputs take a second to become operational. During this time, they are at 0V, 0mA. This time is required to stabilize the output power supply.

1.3 Characteristics

1.3-1 Output characteristics

Voltage or current outputs	TSX ASY 410	TSX ASY800
Number of channels	4	8
Conversion time	2.5 ms	5ms
Output power supply	by the PLC	by the PLC or 24 V IEC external supply
Type of protection	short-circuits and overloads	short-circuits and overloads
Crosstalk between channels	-80 dB	-80 dB
Monotonicity	yes	yes
Non linearity	≤ 1 LSB	≤ 1 LSB
RC ground network	R = 50 MΩ, C = 4.7 nF	C = 4.7 nF
Isolation between channel and ground	500 VDC	1000 V rms
Isolation between channels	1500 V rms	common point
Isolation between bus and channels	1500 V rms	1000 Vrms
Dissipated power typical **maximum**	8.2 W 12.2 W	5 W 6.1 W
Voltage outputs	**TSX ASY 410**	**TSX ASY800**
Voltage output range	±10 V	±10.5 V
Maximum voltage without damage for voltage output	±30 V	±30 V
Load impedance	1 kΩ minimum	1 kΩ minimum
Capacitive load	< 0.1 µF	< 0.1 µF
Maximum resolution	5.12 mV (1) for ±10 V	1.28 mV for ±10 V
Measurement error as a % of Full Scale (10V) 25 °C **0 to 60 °C**	0.45% 0.75% (35 ppm / °C)	±0.14% ± 0.28% (26ppm / °C)

(1) Value given for TSX ASY 410 (software version : II > 10). For TSX ASY 410 (software version : II ≤ 10) this value is 4.88 mV,

Current outputs		TSX ASY 410	TSX ASY800
Current output range		20 mA	21 mA
Maximum voltage without damage for current output		±30 V	±30 V
Load impedance		600 Ω maximum	600 Ω maximum/
Inductive load		< 300 µH	< 300 µH
Maximum resolution		10.25 µA (1)	2.56 µA
Measurement error as a % of Full Scale (20mA)	25 °C 0 to 60 °C	0.52% 0.98% (70 ppm/°C)	±0.21% (2) ±0.52% (64 ppm/°C)
Max. leakage current		50 µA	33 µA
External power supply		**TSX ASY 410**	**TSX ASY800**
Characteristics		-	24 V ± 5% ripple 1V max
Cable		-	shielded cable
Consumption		-	455mA max/300mA typical
Connection		-	removable screw terminal block

(1) Value given for TSX ASY 410 (software version : II > 10). For TSX ASY 410 (software version : II ≤ 10) this value is 9.77 µA.
(2) Precision calculated in a ventilated cabinet (in a non-ventilated cabinet, precision is 0.32%).

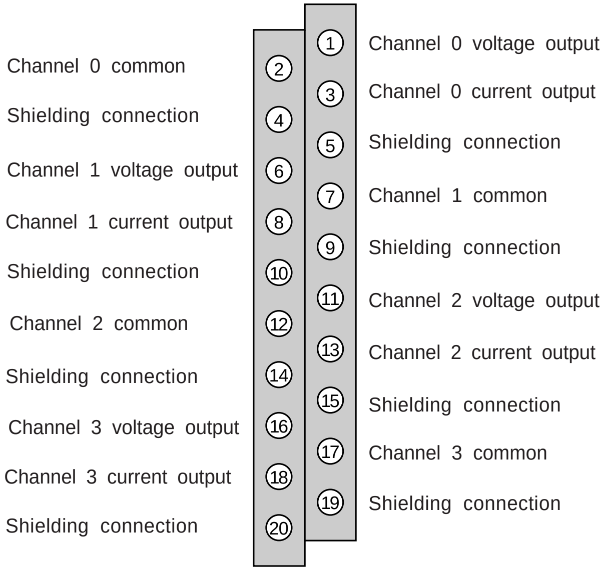
Important :
- in an ambient temperature above 50°C, the TSX ASY 800 module must be ventilated.
- if an external power supply is used (TSX ASY 800), it must be a SELV (Safety Extra Low Voltage) type power supply. Examples of SELV type power supplies include : TSX SUP 1011, TSX SUP 1021,TSX SUP 1051, TSX SUP 1101 and TSX SUP A05.

C

1.4 Connections

1.4-1 TSX ASY 410 terminal block pinout

The TSX ASY 410 module uses a TSX BLY 01 terminal block.



Note

It is advisable to use shielded cables and to link the shielding to the terminals designed for this purpose (shielding connection).

Wiring accessories :

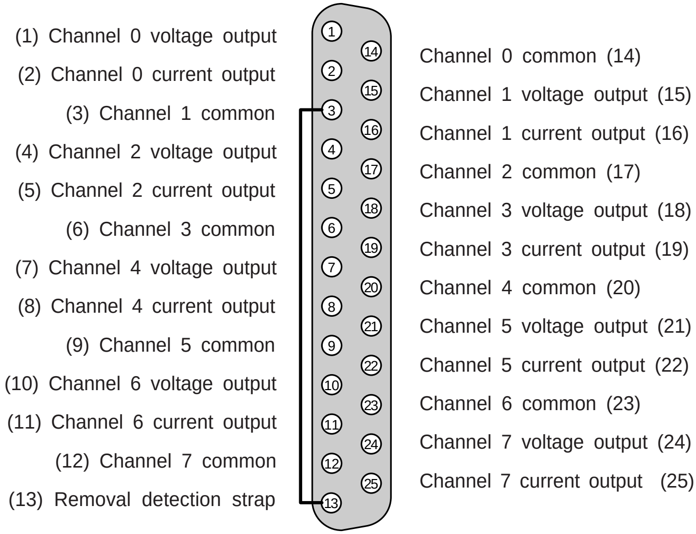
The TELEFAST accessory, reference ABE 7CPA21, distributes the 4 channels from a 25-pin SubD connector, to the screw terminals.

The analog module is connected to the TELEFAST accessory using one of the following cables :

- ABF Y25S150 : length 1.5m
- ABF Y25S200 : length 2m
- ABF Y25S300 : length 3m
- ABF Y25S500 : length 5m

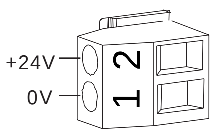
These cables are part of the TSX BLY 01 terminal block.

1.4-2 TSX ASY 800 connector pinout



For use with Telefast, the removal detection strap should be located on the Telefast.

External power supply connector



- the external power supply must be a 24 V $\pm$ 5% SELV, maximum ripple : 1V
- the connection cable must be a shielded cable (the shielding braid should be connected at the supply end and as close as possible to the module using grounded cable ties).
- SELV type power supplies include : TSX SUP 1011, TSX SUP 1021,TSX SUP 1051, TSX SUP 1101 and TSX SUP A05.

C

1.4-3 TELEFAST pinout

After connecting the TSX ASY 800 analog module to a TELEFAST accessory, via cable TSX CAP 030, the distribution of the analog channels on the TELEFAST terminals is as follows :

TELEFAST, reference ABE 7 CP A02

TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal	TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal
1	/	Ground	Supp1	/	Ground
2	/	STD (1)	Supp2	/	Ground
3	/	STD (1)	Supp3	/	Ground
4	/	STD (2)	Supp4	/	Ground
100	1	Voltage output V0	200	14	Channel 0 common
101	2	Current output V0	201	/	Ground
102	15	Voltage output V1	202	3	Channel 1 common
103	16	Current output V1	203	/	Ground
104	4	Voltage output V2	204	17	Channel 2 common
105	5	Current output V2	205	/	Ground
106	18	Voltage output V3	206	6	Channel 3 common
107	19	Current output V3	207	/	Ground
108	7	Voltage output V4	208	20	Channel 4 common
109	8	Current output V4	209	/	Ground
110	21	Voltage output V5	210	9	Channel 5 common
111	22	Current output V5	211	/	Ground
112	10	Voltage output V6	212	23	Channel 6 common
113	11	Current output V6	213	/	Ground
114	24	Voltage output V7	214	12	Channel 7 common
115	25	Current output V7	215	/	Ground

After connecting the TSX ASY 410 analog module to the TELEFAST accessory ABE 7CPA21, via cable ABF Y25S•••, the distribution of the analog channels on the TELEFAST terminals is as described above, limited to terminals 1 to 107.

To perform terminal block detection : connect terminals STD (1) and STD (2) using a strap.

TELEFAST, reference ABE 7 CP A21

TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal	TELEFAST terminal no.	25-pin SubD connector pin no.	Type of signal
1	/	Ground	Supp1	/	Ground
2	/	STD (1)	Supp2	/	Ground
3	/	STD (1)	Supp3	/	Ground
4	/	STD (2)	Supp4	/	Ground
100	1	Voltage output V0	200	14	Channel 0 common
101	2	Current output V0	201	/	Ground
102	15	Voltage output V1	202	3	Channel 1 common
103	16	Current output V1	203	/	Ground
104	4	Voltage output V2	204	17	Channel 2 common
105	5	Current output V2	205	/	Ground
106	18	Voltage output V3	206	6	Channel 3 common
107	19	Current output V3	207	/	Ground

C

D

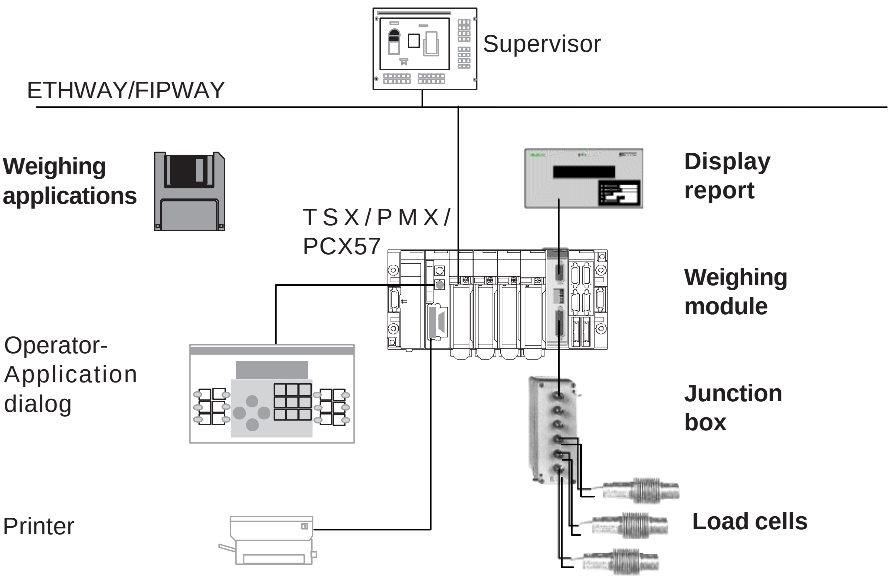
D

1.1 Introduction of the weighing range

The Modicon TSX Premium range of weighing devices consists of :

- a specialized module, TSX ISP Y100,
- a TSX XBT H100 weighing protocol display unit,
- process control applications : weigher dosers, multi-product batching, flow rate controllers, weigher sorters, discontinuous and continuous totalizers,
- load cells,
- junction boxes.

This document only covers module setup and operation : other points are dealt with in the documentation for associated products.



The diagram above shows the various elements which may be used to create a complete weighing configuration.

D

1.2 Presentation of the weighing module

1.2-1 General

The TSX ISP Y100 has :

- a **measurement input** channel connected to one or more load cells which provides a numerical value corresponding to the weight being measured. A maximum of 8 load cells may be connected to the measurement input which has a resolution of 20 bits (1 048 576 points). The module executes 50 measurements per second.
- **2 high speed discrete outputs** with constant response times, which trigger actions when thresholds are exceeded.
  This type of operation is used for “weigher doser” applications.
- a **sealable digital link** used to display the weight on an external TSX XBT H100 type display unit

To ensure that measurements are accurate, the measurement input, weighing module and display unit may all be sealed in order to meet any legal requirements relating to weighing instruments for use in commercial transactions.

The TSX ISP Y100 module may be inserted into any available slot on a TSX/PMX/PCX Premium PLC rack.

Maximum number of TSX ISP Y100 modules per station

Although the TSX ISP Y100 application-specific module has only one measurement channel, it is comparable to a module which has **2 application-specific channels**.
The maximum number of application-specific channels managed by a PLC station depends on the type of processor installed. The maximum number of TSX ISP Y100 modules in a PLC station thus depends on :

- the type of processor installed,
- the number of application-specific channels already used.

The user should therefore perform a review at station level to determine the number of application-specific channels already used, in order to define the number of TSX ISP Y100 modules which can be used.

Note:
The definition and number of application-specific channels is given in the manual " Processors and discrete I/O" - section A - paragraph 3.5-3).

Number of application-specific channels managed by each type of processor

Processor	Number of app.-spec. channels managed
TSX P57 102/TPMX P57 102/TPCX 571012	8
TSX P57 2•2/TPMX P57 202	24
TSX P57 3•2/TPMX P57 352/TPCX 57 3512	32
TSX P57 4•2/TPMX P57 452 (1)	48

The module offers functions specific to weighing, such as :

- calibration,
- zero reset,
- semi-automatic tare,
- zero tracking function,
- temporary measurement freeze.

The module communicates with the processor and provides various data relating to weighing, such as :

- weight measurement (gross or net),
- flow rate,
- data on stability, zero, underload, overload, manual tare, etc,
- discrete output image,
- the tare value,
- the offset memory value,
- status words : operating report for module and internal or external faults.

The PLC language is used to manage :

- module operation (via the configuration),
- reading measurements
- module operating modes,
- start processing commands (calibration, tare, zero reset, control of discrete outputs, freezing display, etc).

D

1.2-2 Physical description of the weighing module

The TSX ISP Y100 module may be inserted into any slot on the TSX RKY racks.

The module consists of the following elements :

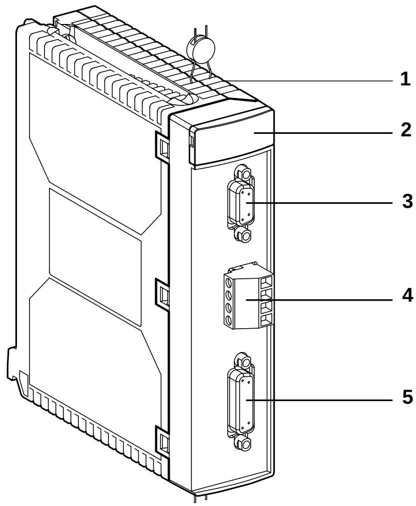
1 a plastic box with metal screening to protect the electronic circuitry and provide protection against radiated interference.

2 a display unit,

3 a 9-pin female Sub-D connector for the remote display unit (TSX XBT H100),

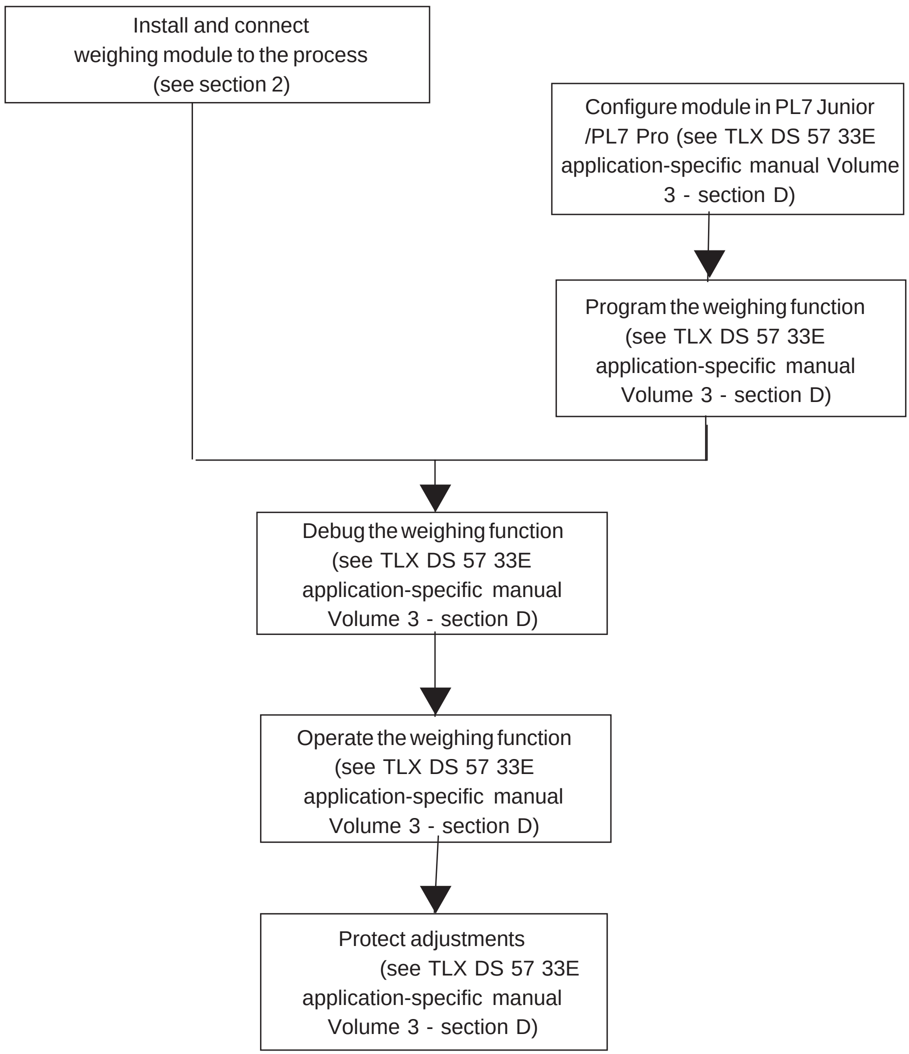
4 a 5-pin screw terminal block to connect the discrete outputs,

5 a 15-pin female Sub-D connector for the load cells.



1.3 Suggested methodology

To facilitate the development of a control system integrating a weighing function, the flowchart below suggests an installation method and gives section and document references.



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2.1 Installation precautions

The weighing modules and terminal blocks may be mounted or removed while the PLC is powered up with no risk of damaging the module.

2.2 Wiring recommendations

To protect the signal from external noise induced in serial mode and from noise occurring in common mode, the following precautions are recommended :

Type of wires
Use shielded twisted pairs.

Cable screening
Measurement cable screening may only be grounded at the module end.
In the event of difficulty, and if the ground connections at both ends are of good quality, both ends of the screening may be grounded. Connect the cable screening to the Sub-D connector covers : the PLC ground connection is via the Sub-D connector securing pins (it is therefore obligatory to screw the Sub-D connector into its socket).

Cable routing
Route the measurement cables at the maximum possible distance from the discrete I/O cables (especially for relay outputs) and cables carrying “power” signals.
Avoid parallel routing (ensure there is a distance of at least 20 cm between the cables) and make sure any intersections are at right angles.

The measurement input is referenced to ground via the module.

2.3 Display of module status

Module operation and status are shown on the display unit :

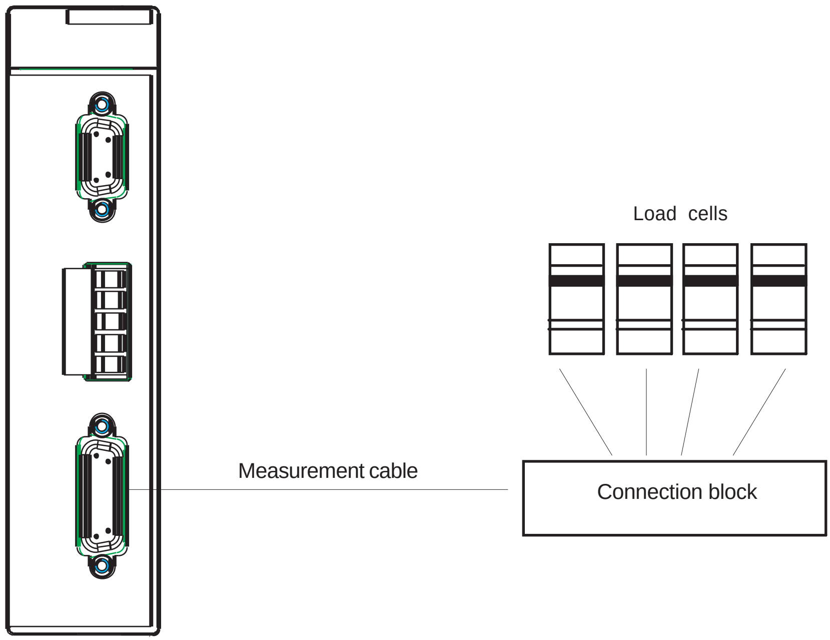
- two indicator lamps show that the module is powered up and operating correctly (a green RUN lamp and a red ERR lamp),
- the I/O lamp (red) indicates an external fault on the measurement channel.

Status / Lamps	On ●	Flashing ⊗	Off ○
RUN	Normal operation		Module faulty or off
ERR	Internal fault, module fault	Communication fault, application absent, invalid or faulty	No fault
I/O	External faults : • Overload or underload fault during calibration • Range overshoot fault • Measurement fault • Sealed module (configuration refused)	Loss of communication with the processor	No fault
CH	No channel status indicator lamp		

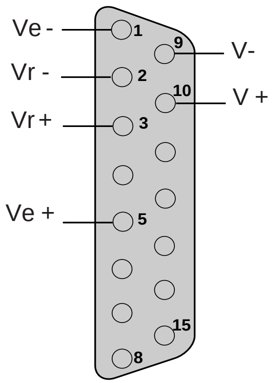
2.4 Description of the connections

2.4-1 Connecting the measurement system

The module and the Sub-D connectors may be connected and disconnected while powered up.



The load cells are connected via a 15-pin female Sub-D connector at the module end.
A cable with two shielded twisted pairs should be used.
The load cells are powered exclusively by the module.



1 - Measurement input (-)
2 - Load cell input (-)
3 - Load cell input (+)
5 - Measurement input (+)
9 - Power supply output (-)
10 - Power supply output (+)

View from module

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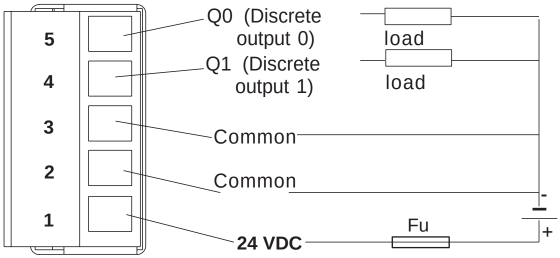
2.4-2 Connecting the discrete outputs

The 24V transistor outputs are connected via a screw terminal block as shown below.



The discrete outputs are electrically isolated from ground.
Commons 2 and 3 are connected via the card

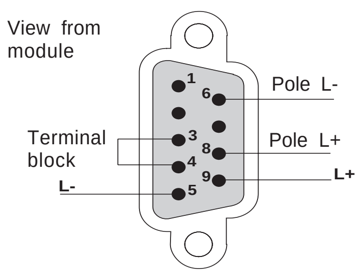
Discrete transistor outputs	Characteristics
Number of channels	2
Nominal supply voltage	24 V
Maximum current	500 mA

Protection

- Protection on each channel against short-circuits and overloads :
  All the channels have an integrated protection device providing protection against these types of faults
- Protection against polarity inversion :
  The module is fitted with a device which short-circuits the power supply if the polarity is reversed, without damaging the module. For this protection to operate in the best possible conditions, a fast-blow fuse should be placed on the power supply upstream of the loads.

2.4-3 Pinout for the display unit serial link

The serial link enables the weight to be displayed on an external unit.
The terminal is connected via a 9-pin female Sub-D connector at the module end, RS485 link : connections are as follows :



Straps 6-5 and 8-9 are used to polarize the line at the module end

2.4-4 TSX XBT H100 display unit

The TSX XBT H100 unit is connected to the weighing module, and is the principal weight indicator display.
The display unit must be connected to the module via a shielded 2-wire cable. It has a 25-pin female Sub-D connector.

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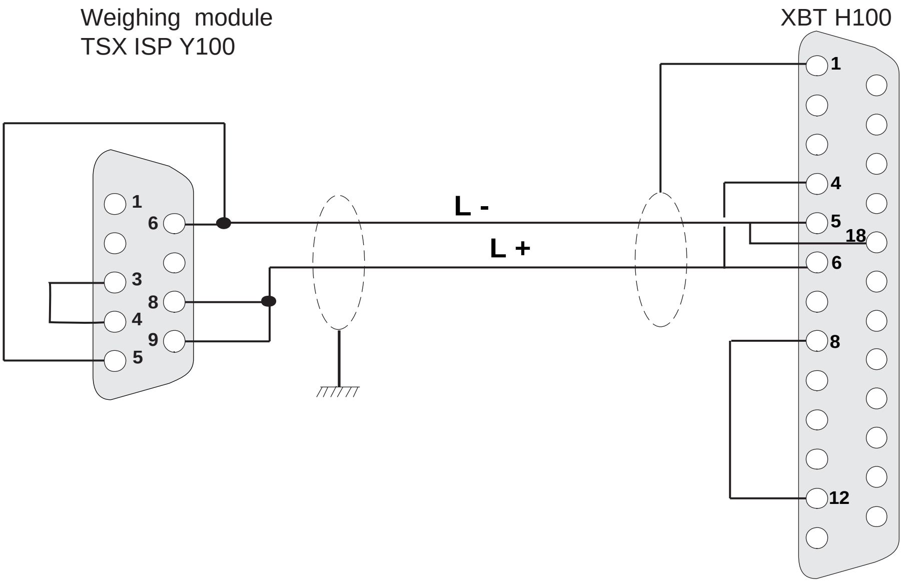
Electrical characteristics	
Serial line	RS485 2, isolated wires
Transmission speed	9600 bauds
Connection	Via sealable Sub-D port
Power supply	3-pin plug-in terminal block from 24 VDC external source
Voltage limits	18V to 30V
Ripple factor	25% maximum
Consumption	10 W
Display unit	Back-lit liquid crystal display (2 lines of 20 characters)
Refresh period	Every 100ms

Note:
For more details refer to the “Magelis Range / user’s guide” documentation.
The serial link is isolated at the TSX XBT H100 end.

2.4-5 Connecting the display unit

The **shielded twisted pair** cable connecting the weighing module to the TSX XBT H100 must not exceed 100 meters.
The screening must be connected to the metal part of the Sub-D connector at the module end.



View from solder side

2.4-6 TSX ISP Y100 module consumption

Consumption	**Typical**	**Maximum**
On 5VDC	150 mA	330 mA
On 24 VR (1)	7 mA + 17 mA x N	14 mA + 17 mA x N

(1) consumption depends on the number of load cells (N) present at the measurement input

Dissipated power	**Typical**	**Maximum**
	0.75 W	1.65 W

Metrology :
The science of weights and measures.

Calibration :
Graduates the measurement equipment.

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Weighing instruments :
Measurement instruments used to determine the mass of an object through the action of its weight.
These instruments can also be used to determine other sizes, quantities, parameters or characteristics relating to weight.
Weighing instruments are classed as either non-automatic or automatic instruments depending on their type of operation.

Non-automatic weighing instruments :
Weighing instruments which require operator intervention during weighing operations, for example by placing the loads to be weighed on or off the load receptacle or reading the result. These instruments are used for direct observation of the result of the weighing by either displaying or printing it. Both possibilities are covered by the word “indication”.

Load receptacle :
The part of the instrument designed to receive the load.

Indicator (of a weighing instrument) :
The part of the load measurement device which gives a direct reading of the result (TSX XBT H100).

Reset device :
The facility to reset the indicator to zero when there is no load on the load receptacle.

Tare device :
The facility to reset the instrument indication to zero when a load is placed on the load receptacle :
- without affecting the extent of the weighing range of net loads (tare addition device), or
- by reducing the extent of the weighing range of net loads (tare subtraction device, see ISP Y100).

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Predefined tare device :
The facility to subtract a predefined tare value from a gross weight and indicate the calculated result. The weighing range is, therefore reduced.

Maximum range (Max) :
The maximum weighing capacity, without taking into account the added tare capacity.

Minimum range (Min) :
The load value below which weighing results may be adversely affected by significant relative error.

Weighing range :
The interval between the minimum and maximum ranges.

Load limit (Lim) :
The maximum static load which the instrument can withstand without permanently impairing its measurement accuracy.

Scale division :
The value, expressed in units of weight, of the difference between two consecutive numerical indications for a given value.

Gross value :
The indication of the weight of a load on an instrument when no tare facility or tare predefined device has been used.

Net value (N) :
The indication of the weight of a load on an instrument when a tare facility has been used.

Tare value (T) :
The value of the weight of a load determined by a tare weighing facility.

Predefined tare value (PT)
The numerical value representing a weight introduced into an instrument.
The word ‘introduced’ covers any procedure such as, for example, tabulation, data retrieval following storage or the introduction of the value via an interface.

Sealing :
The sealing of an appliance to meet legal requirements.

Language objects :
PLC variables : bits, words, etc.

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Table of Contents

Presentation of the Electronic Cam Module

1

At a Glance

Introduction

This chapter presents the TSX CCY 1128 electronic cam module.

What's in this Chapter

This chapter contains the following topics:

Presentation of the Module in its Environment

Introduction

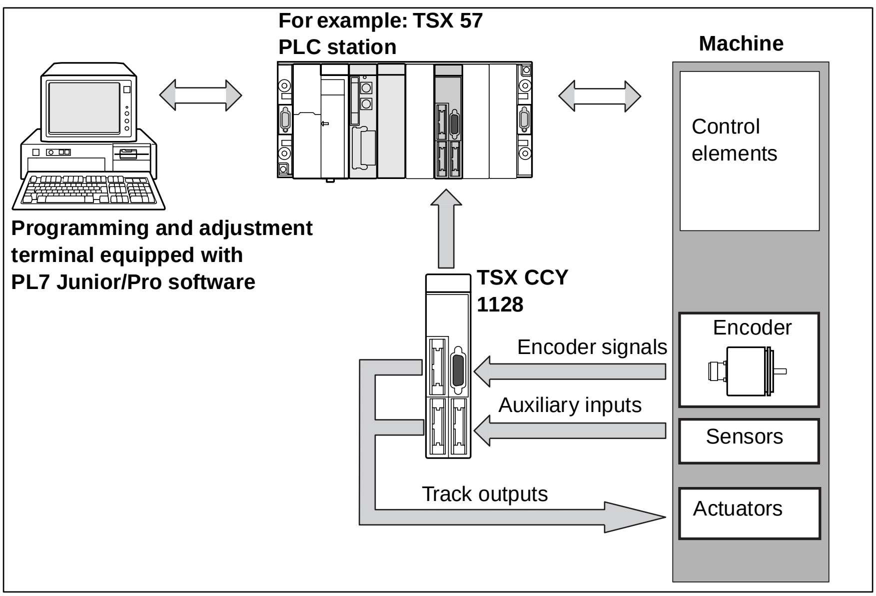
The TSX CCY 1128 is a standard format application-specific module in the Premium range. It can be integrated in a TSX RKY•• rack on a TSX/PMX/PCX 57 PLC station. It performs the "electronic cam" function for a rotary, alternating, cyclic or endless axis, managed by an incremental or absolute encoder.

Operating Principle

The module manages up to 128 cams independently. The cams may be distributed over a maximum of 32 tracks, to which up to 24 physical outputs and 8 logic outputs can be assigned. After transmission of configuration and adjustment data by the PLC processor, the module processes the cam program and controls the track outputs independently of the PLC scan. The various functions of the module are described in the "Electronic cam" application-specific manual - Reference 35001381.

Diagram of an Installation

The diagram below shows a basic configuration for an installation



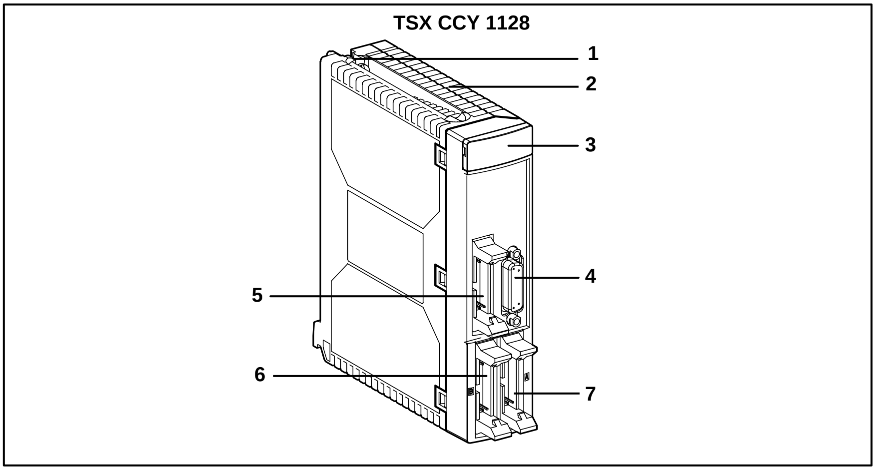
Physical Presentation of the Module

Introduction

The connectors for the I/O interfaces to the machine are on the front panel of the module. The connector for linking to Bus X is at the rear of the module. All the control data and signals from the processor travel via this bus.

View of the Module

The diagram below shows the TSX CCY 1128 module with its various elements.



Physical Presentation of the Module, continued

Elements and Their Functions

Number	**Element**	**Function**
1	Screw	Attaches the module to the TSX RKY •• rack
2	Module casing	Performs the following functions: • Supports and protects the electronic cards • Attaches the module in its slot • Supports the connectors
3	Display block comprising 4 LEDs: • green RUN LED • red ERR LED • red I/O LED • green CH0 LED	Display the module states and faults, and the channel diagnostics. Indicates the module operating mode Indicates a module internal fault Indicates a fault which is external to the module or an application fault Used for channel diagnostics. (The states of the lamps and their meanings are described in chapter 6).
4	15-pin SUB D connector	For connecting to the encoder.
5	HE 10 connector	For connecting the group 0 and 1 track outputs
6	HE 10 connector	For connecting the group 2 and 3 track outputs
7	HE 10 connector	For connecting the auxiliary outputs and the encoder power supply

Electronic Cam Function

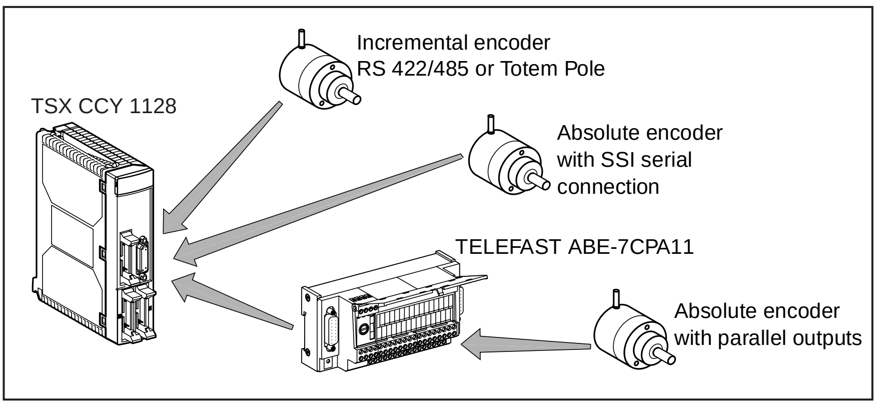
Introduction

The electronic cam function controls the module outputs according to the position of the encoder installed on the machine. Several types of encoder can be used:

- Incremental encoder with RS 422 / RS 485 line emitter outputs
- Incremental encoder with Totem Pole outputs
- SSI serial output absolute encoder
- Parallel output absolute encoder. Use of this encoder requires a Telefast ABE-7CPA11 interface which converts the parallel output signals to serial output signals.

Illustration

The diagram below shows the various types of encoder which can be connected to the module.



Compatibility with the Installed Base

Hardware Compatibility

To take the TSX CCY 112 8 module, the PLC station must have a processor with software version SV $\geq$ 3.3

Software Compatibility

To develop an application which integrates the TSX CCY 1128 module, the PL7 Junior / Pro software must be version SV $\geq$ 3.4 + option or SV 3.4.

General Rules for Setting up the Module

2

At a Glance

Introduction

This chapter describes the general rules for setting up the TSX CCY 1128 electronic cam module.

What's in this Chapter

This chapter contains the following topics:

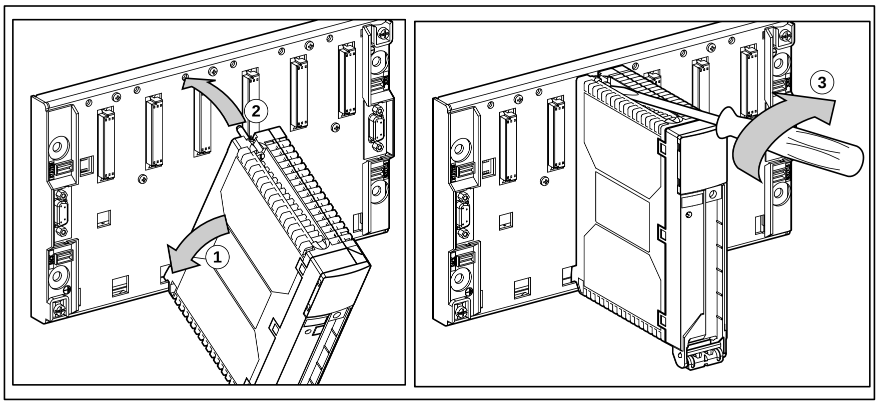
Mounting the Module in a PLC Station Rack

Introduction

The TSX CCY 1128 module can be mounted in any of the available slots in a TSX RKY •• rack on a TSX 57/PMX 57/PCX 57 PLC station, except for the slots specifically for the power supply and processor modules.

Illustration

The diagrams below show the procedure for mounting a module from the Premium range in the TSX RKY •• rack.



Procedure

The following table describes the operations to be performed:

Step	Operation
1	Position the pins on the rear of the module in the locating holes at the bottom of the rack.
2	Rotate the module to bring it into contact with the rack.
3	Attach the module to the rack by tightening the screw at the bottom of the module. Maximum tightening torque for the screw: 2.0 N.m

Installing the Module in a PLC Station

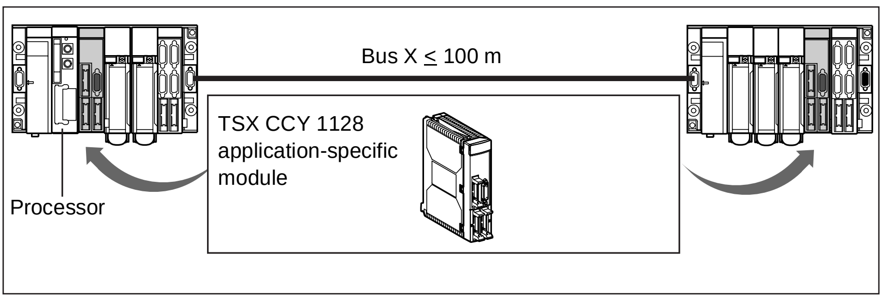
Introduction

The TSX CCY 1128 module can be installed in any of the racks in a PLC station:

- TSX RKY•• extendable racks on the main Bus X segment (segment on which the rack which supports the processor is installed).
- TSX RKY•• extendable racks located on remote Bus X segments.

Installation on a Rack Belonging to the Main Bus X Segment

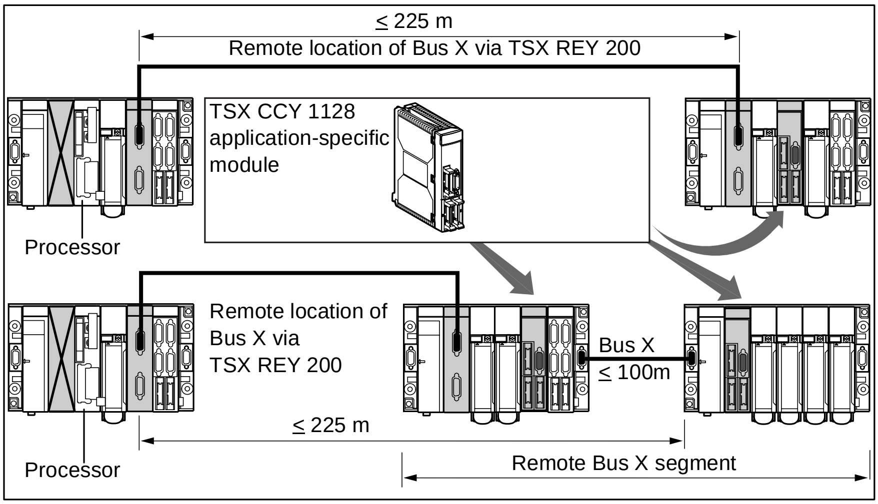
The following diagram shows the installation of the module on racks belonging to the main Bus X segment. The module can be installed on the rack which supports the processor and on any of the other racks present on the Bus X. The distance between the rack which supports the module and the rack which supports the processor must not exceed 100 meters.



Installing the Module in a PLC Station, continued

Installation on a Rack Belonging to a Remote Bus X Segment

The following diagram shows the installation of the module on racks belonging to remote Bus X segments. In all cases, the distance between the rack which supports the module and the rack which supports the processor must not exceed 225 meters.



Number of Application-Specific Channels Managed by one PLC Station

Definition of an Application-Specific Channel

An application-specific module (TSX CTY• counter modules, TSX CAY• axis control modules, TSX CFY • stepper motor control modules, TSX YSP Y• weighing module, TSX CCY 1128 electronic cam module, etc) has a number of channels varying from 1 to n depending on the type of module. These channels are called application-specific channels.

Why Count the Number of Application-Specific Channels in the Station?

To define:

- The power of the processor to install
- The maximum number of application-specific modules which can be installed in the station.

The number of application-specific channels for each type of application-specific module is defined in manual TSX DM 57 33E - part A - chapter 3.

Number of Application-Specific Channels Managed by Each Type of Processor

The following table defines the number of application-specific channels managed by each type of processor.

Processor type	Number of channels managed
TSX P57 102 / TPMX P57 102 / TPCX 57 1012	8
TSX P57 202 / TPMX P57 202	24
TSX P57 252	24
TSX P57 302	32
TSX P57 352 / TPMX P57 352 / TPCX 57 3512:	32
TSX P57 402	48
TSX P57 452 / TPMX P57 452	48

Number of Channels for a TSX CCY 1128 Module

A TSX CCY 1128 module has one application-specific channel.

Installation Recommendations

Introduction

In order to ensure that the module operates correctly, certain precautions must be taken when it is inserted and removed, when plugging in and removing connectors on the front panel of the module and when tightening the module fixing screw and the 15-pin SUB D connector.

Inserting and Removing a Module

A module can be inserted or removed without switching off the rack power supply. The module has been designed to allow this operation to be performed with the power supply on to ensure availability of the equipment.

Plugging and Unplugging Connectors on the Front Panel of the Module

It is not advisable to plug or unplug the connectors located on the front panel of the module if the sensor/preactuator power supplies are switched on.

Reasons:

- The encoders do not allow simultaneous startup and switching off of the signals and power supplies.
- The track outputs may be damaged if they are at state 1 and connected to inductive loads.

Tightening the Screws and Locking the HE10 Connectors

To ensure good electrical contact between the grounds and thus obtain good resistance to electrostatic and electromagnetic interference:

- the module fixing screws and those on the 15-pin SUB D connector must be correctly tightened.
  - tightening torque on the module fixing screw: 2.0 N.m
  - tightening torque on the 15-pin SUB D connector fixing screws 0.5 N.m
- The HE10 connectors must be correctly locked.

General Wiring Instructions

Introduction

Certain basic rules must be followed to ensure that the control system works correctly.

Cross-section of Wires Used

This must be sufficient to prevent any line voltage drops and overheating.

Cable Routing

The connection cables of the encoders, of other sensors and of the preactuators must be kept away from any source of radiation caused by the switching of high power electrical circuits which could cause malfunctions.

Encoder Signal Connection Cables

The module/encoder connection cables must observe the following rules:

- They must be shielded using good quality shielding
- They must only carry signals relating to the encoder
- The shielding of the cables must be connected to the machine ground on the module side and the encoder side
- There must be electrical continuity over the whole connection.

Selection and Protection of the Auxiliary Power Supplies

Introduction

The encoders, sensors and preactuators associated with the module require the use of auxiliary power supplies (5 VDC and/or 24 VDC).

Type of Power Supply

Only regulated power supplies should be used, in order to:

- Ensure more accurate sensor and preactuator response times
- Increase the reliability of the equipment by lower temperature rises in the module I/O circuits.

These power supplies must have a sufficiently long period of independent operation ($\geq$ 10 ms) to deal with mains supply micro-cuts and ensure continuous correct operation of the module.

Protection of Power Supplies

The power supplies of the encoder, other sensors and preactuators must be protected against overloads and short-circuits by fast-blow fuses of the appropriate rating.

Machine Grounding of the Power Supply 0V

The 0V of the power supplies must be machine grounded as close as possible to the power supply outputs.

General Rules for Setting up the Encoder Power Supply

- It must only be used for supplying the encoder
- It must have a sufficiently long period of independent operation to deal with mains supply micro-cuts ($\geq$ 10 ms).
- It must be placed as close as possible to the TSX CCY 1128 module in order to reduce the coupling capacities as much as possible.

Choice of Encoder

Introduction

The inputs of TSX CCY 1128 modules can receive signals from an encoder, which may be:

- An incremental encoder
- An SSI serial output absolute encoder
- A parallel output absolute encoder. The last type requires the use of a special ABE-7CPA11 TELEFAST interface.

The user chooses one of these types of encoder according to requirements.

Encoder Output Interfaces

The following table summarizes the main specifications of the output interface for the types of encoder generally used.

Type of encoder	Supply voltage	Output voltage	Type of interface
Incremental	5 VDC	5 VDC differential	Standard RS 422 line emitter outputs with 2 outputs per signal A+/A-, B+/B-, Z+/Z-
	10...30 VDC	10...30 VDC	Totem Pole outputs with one output per signal A, B, Z
Absolute with SSI outputs	10...30 VDC	5 VDC differential	Standard RS 422 line emitter output for the data signal (Data SSI) RS 422 compatible input for the clock signal (CLK SSI).
Absolute with parallel outputs	5 VDC or 10...30 VDC	5 VDC or 10...30 VDC	Parallel outputs. Require the use of the ABE-7CPA11 Telefast interface to convert the parallel output signals to serial signals

Choice of Encoder, continued

Encoder Power Supply

The design of the module enables the encoder to be supplied with:

- 5VDC
- or 24 VDC, standard voltage in the range 10...30 VDC.

The choice of supply voltage depends on the supply voltage of the encoder.

5VDC Encoder Power Supply

For encoders with a 5VDC supply, the line voltage drop must be taken into account. This depends on:

- The length of the cable between the module and the encoder (length in both directions)
- The cross-section of the wire
- The consumption of the encoder

The voltage drop permitted by the encoder is generally 10% of the nominal voltage.

The following table gives the line voltage drop for a wire length of 100 meters and a given encoder consumption, according to the wire cross-section.

Wire cross-section	**Voltage drop for a 100 meter length wire and an encoder consumption of:**			
	50 mA	**100 mA**	**150 mA**	**200 mA**
0.22 mm² = 24 gauge	0.4 V	-	-	-
0.34 mm² = 22 gauge	0.25 V	0.5 V	-	-
0.5 mm²	0.17 V	0.34 V	0.51 V	-
1 mm²	0.09 V	0.17 V	0.24 V	0.34 V

Continued on next page

Choice of Encoder, continued

5VDC Encoder Power Supply, continued

CAUTION

Recommendation concerning the 5 VDC encoder power supply

It is dangerous to increase the encoder supply voltage to compensate for a line voltage drop. If there is a load break, this may result in an overvoltage on the module inputs.

Failure to follow this recommendation may result in damage to the module.

24VDC Encoder Power Supply

Encoders with a 24 VDC supply voltage are recommended for the following reasons:

- The power supply source does not require a high level of accuracy. These encoders generally have a power supply range of 10...30V.
- The line voltage drop is low, thus there can be a considerable distance between the module and the encoder.

Electrical Continuity

To ensure correct operation in an environment which is subject to interference, it is essential:

- to select an encoder whose metal casing is connected to the machine ground of the connected device.
- that there is electrical continuity between:
  - the encoder
  - the connection cable shielding
  - the module.

Connecting an Incremental Encoder and an SSI Absolute Encoder

3

At a Glance

Introduction

This chapter describes the operations for connecting an incremental encoder and an SSI absolute encoder to the TSX CCY 1128 electronic cam module.

What's in this Chapter

This chapter contains the following topics:

Principle

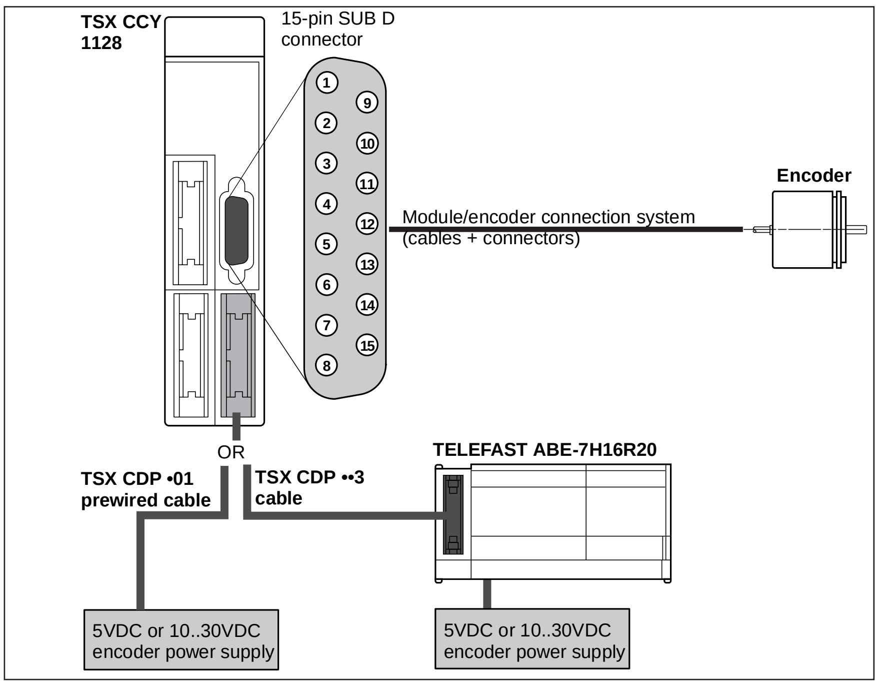
Connection Interfaces

The 15-pin SUB D connector, located on the module front panel, connects the module to the encoder. The following pass via this connector:

- All signals from and to the encoder
- The encoder power supply source, which is itself connected to the HE10 connector:
  - either via an ABE-7H16R20 TELEFAST wiring interface.
  - or directly via a TSX CDP •01 prewired cable

Illustration

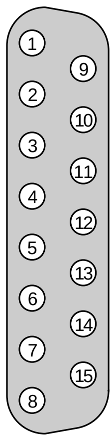
The following diagram illustrates the principle for connecting an encoder to a TSX CCY 1128 module.



Connecting an RS 422 Output Incremental Encoder

Pinout of the Module 15-pin SUB D Connector

The pinout of the module 15-pin SUB D connector for connecting an RS 422 output incremental encoder is as follows:

Diagram (view from the front)	Pin no.	Signal	Description
	1	A+ 5V	Encoder input, pulse A+ (5VDC)
	2	A-	Encoder input, pulse A-
	3	-	-
	4	Z+ 5V	Encoder input, zero marker pulse Z+ (5 VDC)
	5	Z-	Encoder input, zero marker pulse Z-
	6	-	-
	7	10...30 V	Encoder power supply output (+ 10...30 VDC)
	8	0 V	Encoder power supply output (- 0 VDC)
	9	-	-
	10	B+ 5V	Encoder input, pulse B+ (5 VDC)
	11	B-	Encoder input, pulse B-
	12	-	-
	13	EPSR	Encoder power supply return + input. It receives the feedback from the power supply + from the encoder which enables the module to check that the encoder is present.
	14	-	-
	15	5 V	Encoder power supply output (+5 VDC)

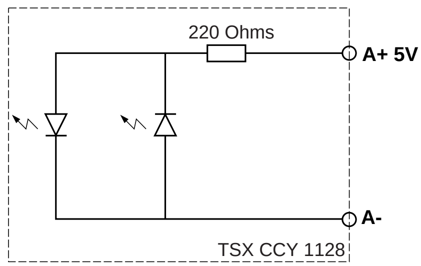
Connecting an RS 422 Output Incremental Encoder, continued

Equivalent Circuit Diagram of Module Encoder Inputs A, B and Z

The following diagram shows the equivalent circuit diagram of encoder input A, B or Z used with an incremental encoder which has:

- a line emitter output stage
- a 5VDC standard RS 422 output voltage.

Note: Each A, B and Z input has a differential line check.

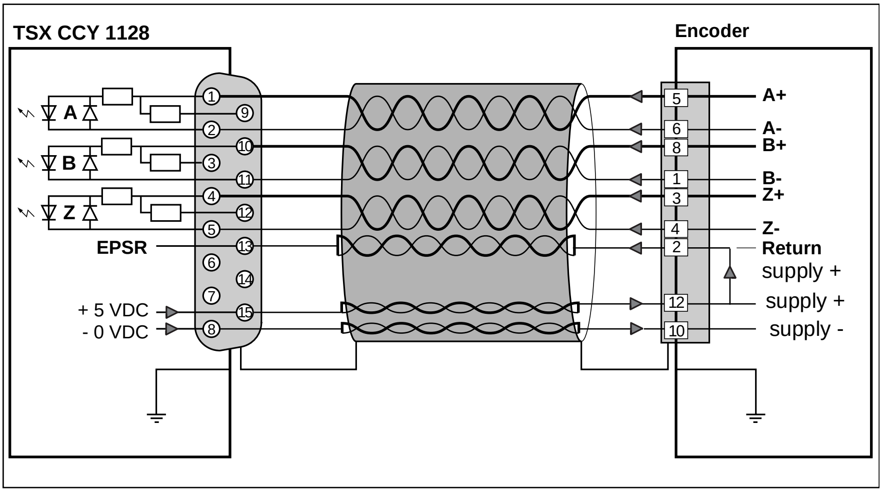


This diagram shows the equivalent circuit diagram of input A.
The diagram is identical for inputs B and Z.

Connecting an RS 422 Output Incremental Encoder, continued

Connection Diagram

The following diagram shows the principle for connecting the TSX CCY 1128 module to an RS 422 output incremental encoder powered with 5VDC.



Recommend-ations

The following recommendations must be followed when making the connection:

- Connect each encoder signal, A+/A-, B+/B-, Z+/Z- , using a twisted pair
- Connect each power supply point using a twisted pair, in order to reduce line voltage drops
- Connect the cable shielding to the machine ground at both ends

CAUTION:

Recommendations concerning the pinout of the encoder I/O

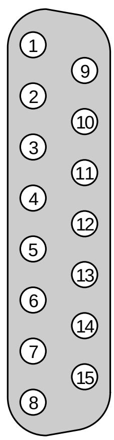
Before connecting the encoder to the module, check the pinout given by the encoder manufacturer.

Failure to follow this recommendation may result in damage to the encoder and the module.

Connecting a Totem Pole Output Incremental Encoder

Pinout of the Module 15-pin SUB D Connector

The pinout of the module 15-pin SUB D connector for connecting a Totem Pole output incremental encoder is as follows:

Diagram (view from the front)	Pin no.	Signal	Description
	1	-	-
	2	A-	Input to be connected to encoder 0V
	3	B+ 24V	Encoder input, pulse B+ (10...30VDC)
	4	-	-
	5	Z-	Input to be connected to encoder 0V
	6	-	-
	7	10...30 V	Encoder power supply output (+ 10...30 VDC)
	8	0 V	Encoder power supply output (- 0 VDC)
	9	A+ 24V	Encoder input, pulse A+ (10...30VDC)
	10	-	-
	11	B-	Input to be connected to encoder 0V
	12	Z+ 24V	Encoder input, zero marker pulse Z+ (+10...30 VDC)
	13	EPSR	Encoder power supply return + input. It receives the feedback from the power supply + of the encoder which enables the module to check that the encoder is present.
	14	-	-
	15	5 V	Encoder power supply output (+5 VDC)

Connecting a Totem Pole Output Incremental Encoder, continued

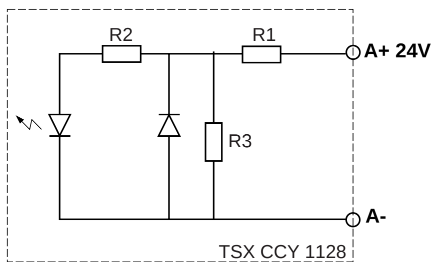
Equivalent Circuit Diagram of Module Encoder Inputs A, B and Z

The following diagram shows the equivalent circuit diagram of encoder input A, B or Z used with an incremental encoder which has:

- A Totem Pole output stage
- A 10...30 VDC output voltage.

Notes:

- Differential mounting is not possible. The - pole of each input (A-, B-and Z-) must be linked to the encoder 0V, and the + inputs (A+, B+ and Z+) to encoder outputs A+, B+, Z+.
- No line check.

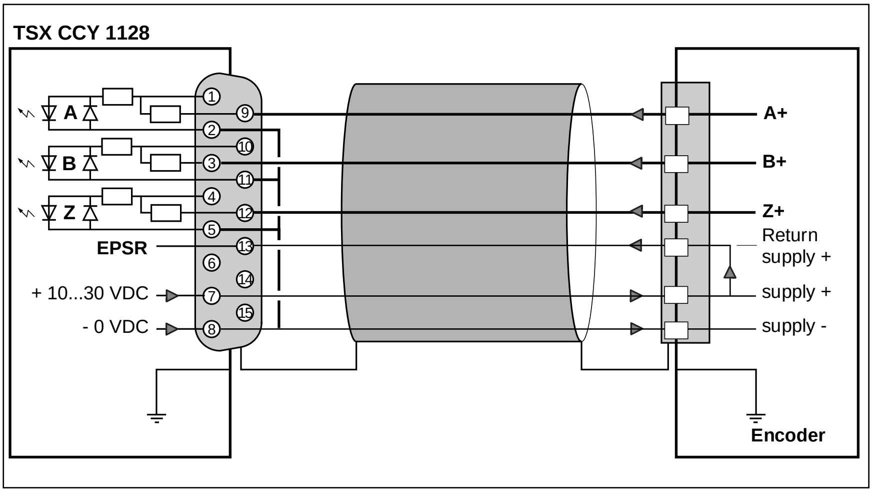


This diagram shows the equivalent circuit diagram of input A.
The diagram is identical for inputs B and Z.

Connecting a Totem Pole Output Incremental Encoder, continued

Encoder Connection Diagram

The following diagram shows the connection of a Totem Pole output incremental encoder, supplied with 10...30VDC.



Recommend-ations

- Connect the encoder supply + to pin 7 of the module 15-pin SUB D connector
- Connect the module EPSR input to the supply + if the encoder does not have a supply + return output.
- Connect the cable shielding to the machine ground at both ends

CAUTION

Recommendations concerning the pinout of the encoder I/O

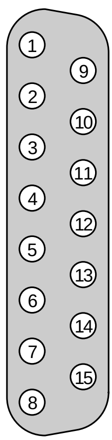
Before connecting the encoder to the module, check the pinout given by the encoder manufacturer.

Failure to follow this recommendation may result in damage to the encoder and the module.

Connecting an SSI Absolute Encoder

Pinout of the Module 15-pin SUB D Connector

The pinout of the module 15-pin SUB D connector for connecting an SSI absolute encoder is as follows:

Diagram (view from the front)	**Pin no.**	**Signal**	**Description**
	1	SSI data +	Encoder input, SSI data + (5 VDC)
	2	SSI data -	Encoder input, SSI data-
	3	-	-
	4	-	-
	5	-	-
	6	CLK +	Encoder output, CLK SSI + (5 VDC)
	7	10...30 V	Encoder power supply output (+ 10...30 VDC)
	8	0 V	Encoder power supply output (- 0 VDC)
	9	-	-
	10	-	-
	11	-	-
	12	-	-
	13	EPSR	Encoder power supply return + input. It receives the feedback from the power supply + of the encoder which enables the module to check that the encoder is present.
	14	CLK -	Encoder output, CLK SSI -
	15	5 V	Encoder power supply output (+5 VDC)

Connecting an SSI Absolute Encoder, continued

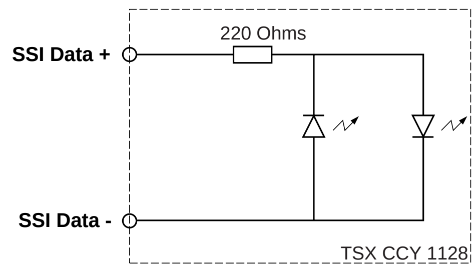
Equivalent Circuit Diagram of the Module SSI Data Encoder Input

The following diagram gives the equivalent circuit diagram of the SSI Data encoder input used with an SSI absolute encoder which has:

- A line emitter output stage
- A standard RS 422/RS 485 5VDC output voltage.

Note: The SSI Data input has a differential line check.

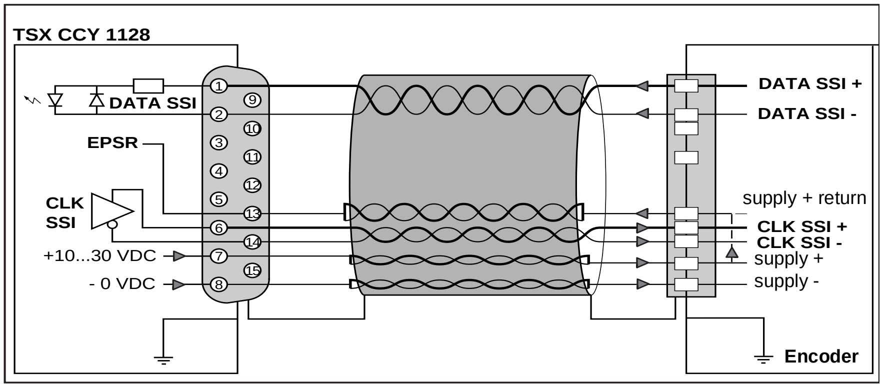
This diagram shows the equivalent circuit diagram of input A.
The diagram is identical for inputs B and Z.



Connecting an SSI Absolute Encoder, continued

SSI Absolute Encoder Connection Diagram

The following diagram shows the connection of an SSI serial link absolute encoder, supplied with 10...30VDC with RS 422 standard line emitter outputs.



Recommend-ations

- Connect each DATA SSI+/DATA SSI- encoder signal using a twisted pair
- Connect each power supply point using a twisted pair, in order to reduce line voltage drops
- Connect the cable shielding to the machine ground at both ends
- Connect the module EPSR input to the power supply + on the encoder side if the encoder does not have a power supply + return output.

CAUTION

Recommendations concerning the pinout of the encoder I/O

Before connecting the encoder to the module, check the pinout given by the encoder manufacturer.

Failure to follow this recommendation may result in damage to the encoder or the module.

Connecting the Encoder Power Supply Return Check

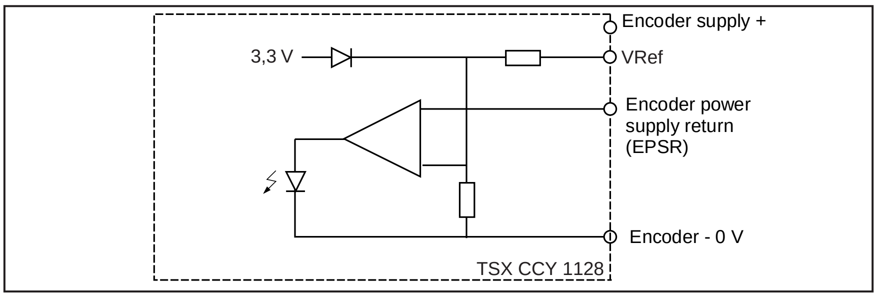
Principle

The EPSR input signal from the encoder is compared with:

- Either a fixed voltage of 3.3 V generated internally, if the VRef input is not connected.
- Or a voltage equal to 66% of the voltage applied at the Vref input, + pole of the encoder supply voltage.

Equivalent Circuit Diagram of the Encoder Power Supply Return Check

The following diagram gives the equivalent circuit diagram of the encoder power supply return check.



Using the Vref Input

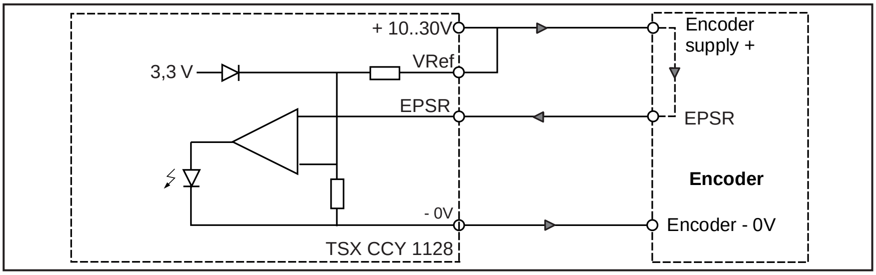
The following table summarizes the use of the Vref input according to the encoder supply voltage.

If	Then
The encoder is supplied with 5V	The VRef input is not connected to the encoder power supply +. The EPSR signal is compared with the internal voltage of 3.3V. OK if > 3.3 V
The encoder is supplied with 10...30V	The VRef input is connected to the encoder power supply +. The EPSR signal is compared with 66% of the encoder power supply voltage. OK if > 66%

Connecting the Encoder Power Supply Return Check, continued

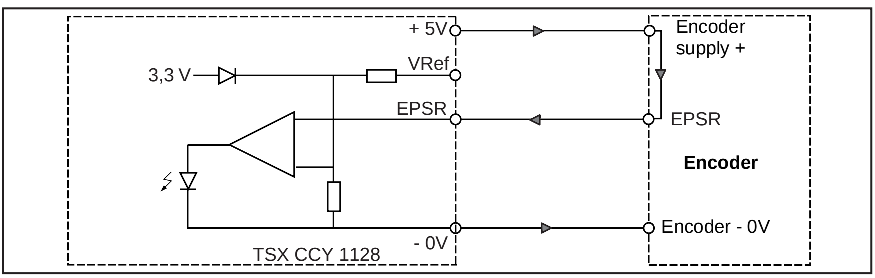
Connection Diagram if the Encoder is Supplied with 10...30 V

The following is the connection diagram for the encoder power supply return check if the encoder is supplied with 10...30 V.



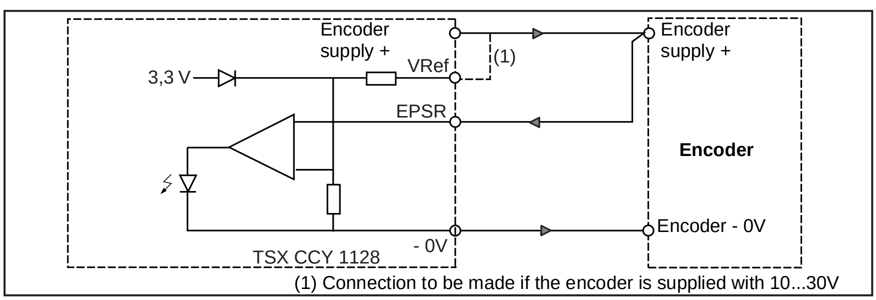
Connection Diagram if the Encoder is Supplied with 5 V

The following is the connection diagram for the encoder power supply return check if the encoder is supplied with 5 V.



Connection Diagram if the Encoder does not have a Power Supply Return Output

In this case, the EPSR input is connected to the power supply + on the encoder side.



Connecting the Encoder Power Supply

Introduction

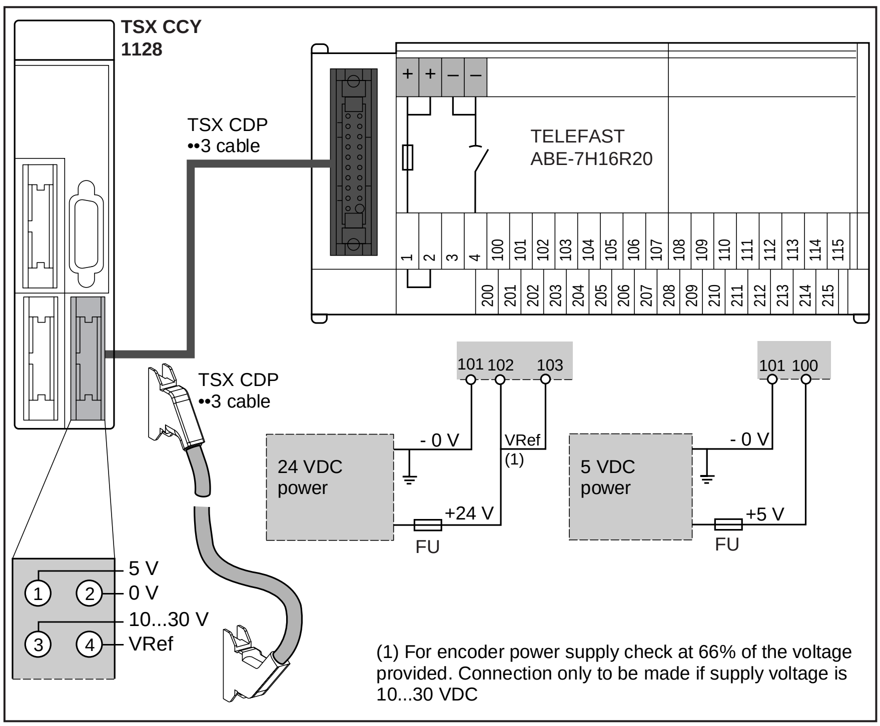
The encoder power supply is connected:

- either via an ABE-7H16R20 TELEFAST wiring interface, which is itself connected to the module via a TSX CDP ••3 cable.
- or directly via a TSX CDP •01 prewired cable

Connection Diagram for the Encoder Power Supply via a TELEFAST Interface

The following diagram shows the connection of the encoder power supply:

- either 24 VDC, for encoders with 10...30VDC power supply range
- or 5 VDC, for encoders with 5 VDC power supply.



Connecting the Encoder Power Supply, continued

Catalog of TSX CDP ••3 Connection Cables

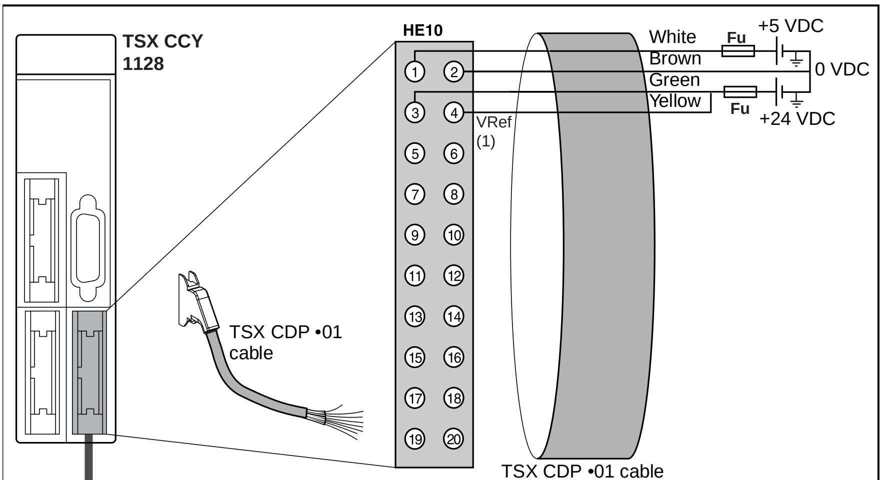
The following table gives the part numbers of the various cables for connecting the TELEFAST to the module, together with their respective lengths.

Part no. of cable	Length of cable
TSX CDP 053	0.5 meter
TSX CDP 103	1 meter
TSX CDP 203	2 meters
TSX CDP 303	3 meters
TSX CDP 503	5 meters

Power Supply Connection Diagram using Prewired Cable TSX CDP •01

The following diagram shows the connection of the encoder power supply:

- either 24 VDC, for encoders with 10...30VDC power supply range
- or 5 VDC, for encoders with 5 VDC power supply.



(1) For encoder power supply check at 66% of the voltage provided. Connection only to be made if the supply voltage is 10...30 VDC

Connecting the Encoder Power Supply, continued

Catalog of TSX CDP •01 Connection Cables

The following table gives the part numbers of the various cables for connecting the TELEFAST to the module, together with their respective lengths.

Part no. of cable	Length of cable
TSX CDP 301	3 meters
TSX CDP 501	5 meters

Recommend-ations

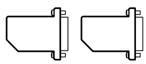
- Maximum length of the wires between the power supply outputs and the connection points on the TELEFAST: must be less than 0.5 meter
- Protections on the power supply + : although the module has a number of integrated protection systems against wiring errors and accidental short-circuits on the cable, it is essential to install a 1A fast blow fuse (Fu) on the power supply +.
- Machine grounding of the power supply 0V: this must be done as close as possible to the power supply output.

TSX CAP S15 Connection Accessory

At a Glance

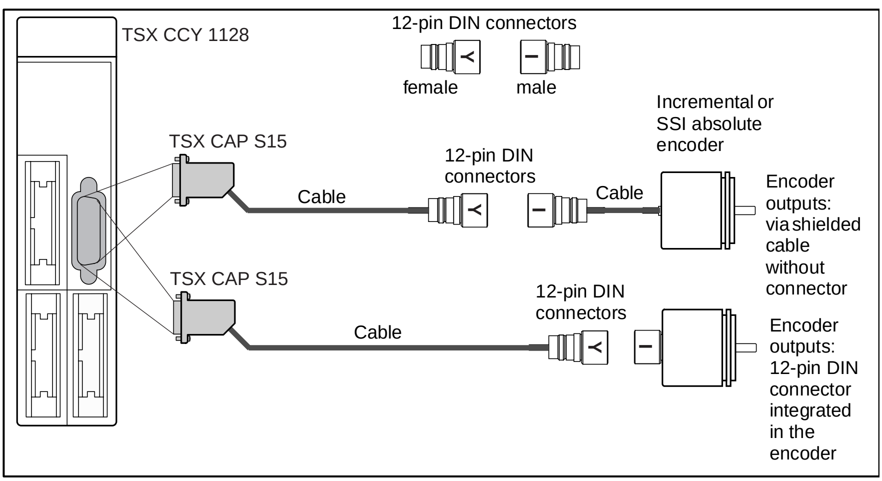
The TSX CAP S15 accessory consists of two 15-pin SUB D connectors. One of these connectors is used to provide the interface for connecting the module to the encoder connection system.

The following table presents the TSX CAP S15 connection accessory.

Diagram	Part number	Use	Composition
	TSX CAP S15	Can be used in the module/encoder connection system	Kit consisting of two 15-pin SUB D connectors with covers.

Integration of the TSX CAP S15 in the Connection System

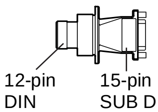
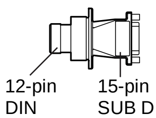
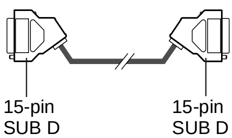
The following diagram shows the integration of a 15-pin SUB D connector from the TSX CAP S15 kit in the encoder connection system.



TSX TAP S1505/S1524 and TSX CCP S15• Connection Accessories

Presentation of the Accessories

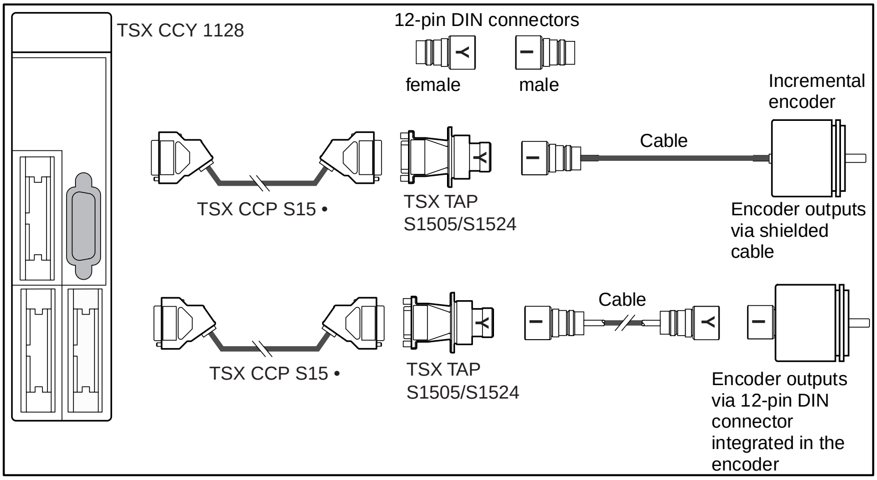
The following table presents the various accessories, their use and functions.

Diagram	Part number	Use	Function
	TSX TAP S1505	Can be used in the module/encoder connection system to connect an RS 422 output incremental encoder supplied with 5 VDC. Signals A+/A-, B+/B-, Z+/Z-.	Mechanical interface, equipped with two connectors which convert a 15-pin SUB D connector to a 12-pin DIN connector.
	TSX TAP S1524	Can be used in the module/encoder connection system to connect a Totem Pole output encoder supplied with 24 VDC. Signals A, B, Z.	Mechanical interface, equipped with two connectors which convert a 15-pin SUB D connector to a 12-pin DIN connector.
	TSX CCP S15•	Can be used in the module/encoder connection system to connect the module to the TSX TAP S1505 or TSX TAP S1524	Connection cables consisting of one cable with 24 gauge wires equipped with a 15-pin SUB D connector at both ends.

TSX TAP S1505/S1524 and TSX CCP S15• Connection Accessories, continued

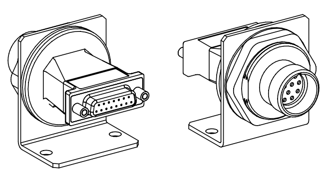
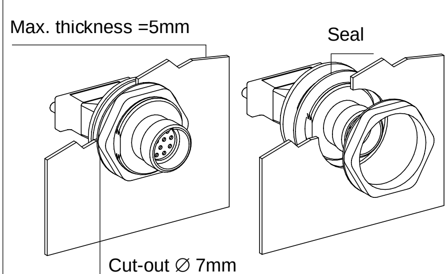
Integration of the TSX TAP S1505/ S1524 and TSX CCP S15• Accessories in the Connection System

The following diagram shows the integration of the TSX CCP S15, TSX TAP S1505 and TSX TAP S1524 accessories in the connection system of an encoder.



Mounting the TSX TAP S1505 / TAP S1524 Accessories

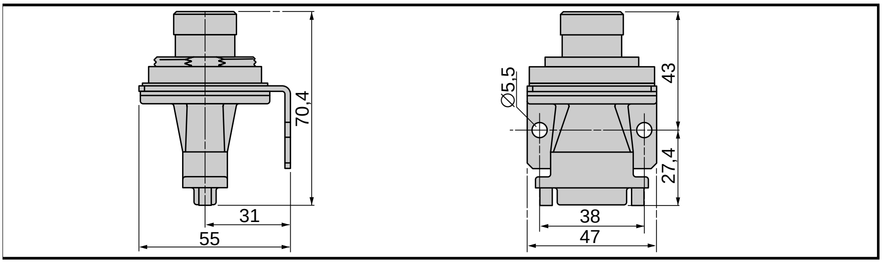
The following diagrams show both methods for mounting these accessories.

Mounting on Telequick plate AM1-PA•	Mounting on enclosure feedthrough
	

TSX TAP S1505/S1524 and TSX CCP S15• Connection Accessories, continued

Dimensions of the TSX TAP S1505 / TAP S1524 Accessories

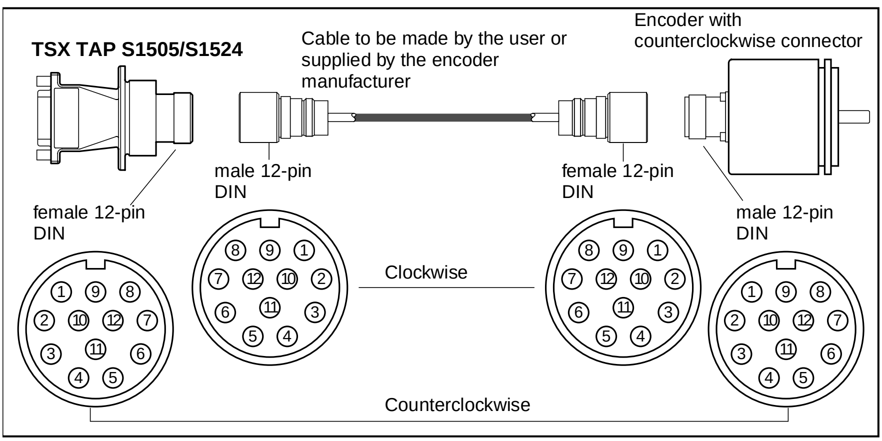
The following diagram gives the dimensions and fixing centers for the TSX TAP S1505 and TSX TAP 1524 accessories on AM1-PA• Telequick plates.



Clockwise and Counter-clockwise Direction of the 12-point DIN Connector in the Connection System

For ease of connection, the numbers of the pins on the 12-point DIN connectors in the connection system must correspond exactly. For this, the pinout of these connectors must be:

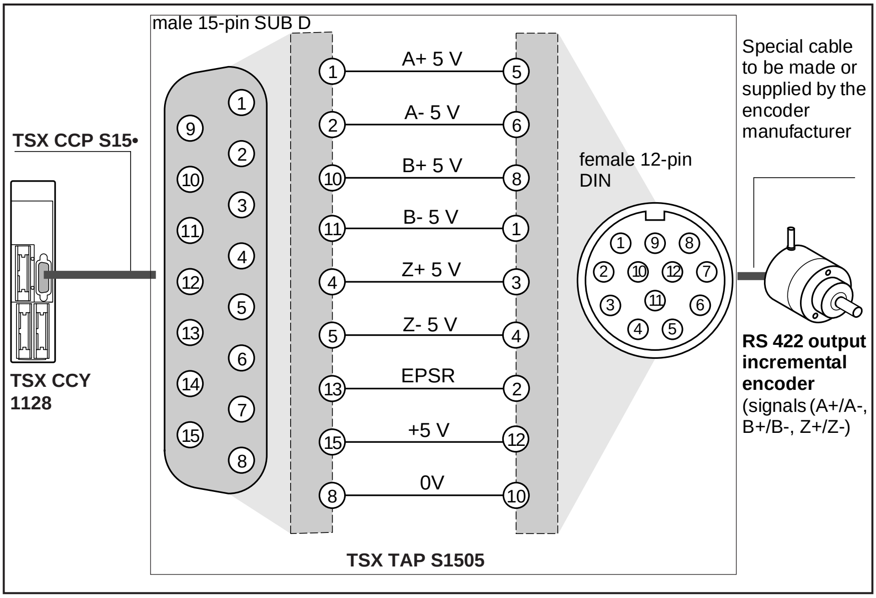
- Clockwise for connectors which belong to the cable connecting the TSX TAP S1505/S1524 accessory to the encoder
- Counterclockwise for connectors which belong to the encoder and to the TSX TAP S1505/S1524 accessory.



TSX TAP S1505/S1524 and TSX CCP S15• Connection Accessories, continued

Pinout of the Connectors on the TSX TAP S1505 Accessory

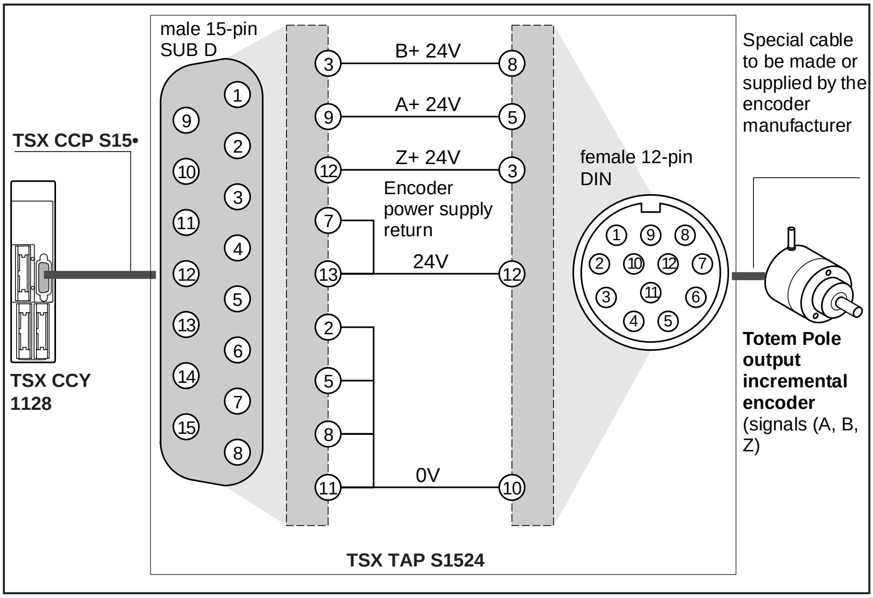
The following diagram shows the pinout of the TSX TAP S1505 accessory on the 15-pin SUB D connector side and the 12-pin DIN connector side.



TSX TAP S1505/S1524 and TSX CCP S15• Connection Accessories, continued

Pinout of the Connectors on the TSX TAP S1524 Accessory

The following diagram shows the pinout of the TSX TAP S1524 accessory on the 15-pin SUB D connector side and the 12-pin DIN connector side.



Connecting the Auxiliary Inputs and the Track Outputs

4

At a Glance

Introduction

This chapter describes the operations for connecting the auxiliary inputs and track outputs of the TSX CCY 1128 electronic cam module.

What's in this Chapter

This chapter contains the following topics:

At a Glance

Connection Interfaces

The three HE10 connectors on the front panel of the module are designed to connect:

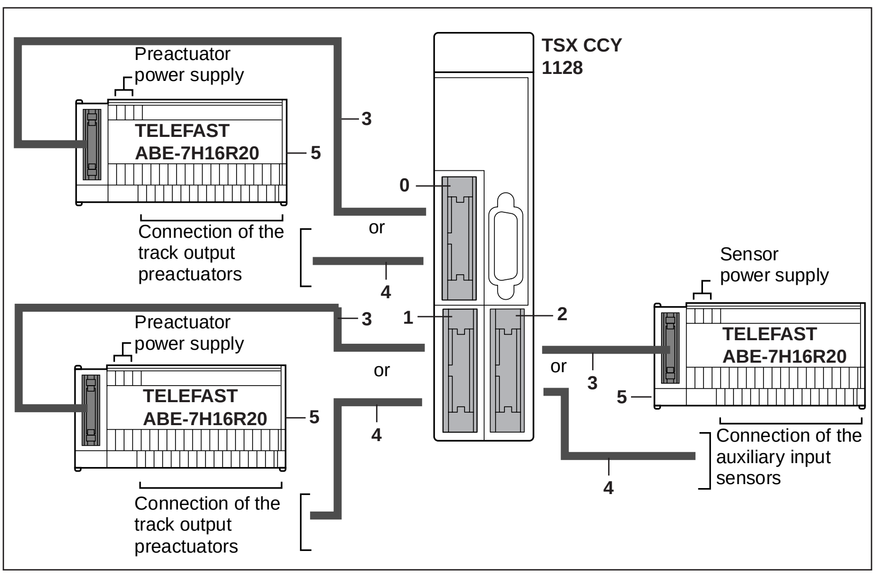
- The sensors and preactuators associated with the module I/O
- The power supplies of the sensors and preactuators associated with the module I/O

The module/sensors and preactuators are connected using:

- either TELEFAST sub-bases and TSX CDP ••3 cables (this is the recommended connection system).
- or TSX CDP •01 flat cables.

Illustration

The following diagram illustrates the principle of the system for connecting the I/O of a TSX CCY 1128 module.



At a Glance, continued

Elements and Their Functions

The following table gives the various elements of the connection system.

Number	Element	Function
0	20-pin HE10 connector	Connects: • the preactuators controlled by the group 0 and 1 track outputs • the preactuator power supply
1	20-pin HE10 connector	Connects: • the preactuators controlled by the group 2 and 3 track outputs • the preactuator power supply
2	20-pin HE10 connector	Connects: • the sensors which control the auxiliary inputs, • the sensor power supply • the incremental encoder or SSI absolute encoder power supply
3	TSX CDP••3 cables equipped at both ends with an HE10 connector	Connect the module to the TELEFAST sub-base. They are available in 5 lengths: • TSX CDP 053: length 0.5 meter • TSX CDP 103: length 1 meter • TSX CDP 203: length 2 meters • TSX CDP 303: length 3 meters • TSX CDP 503: length 5 meters
4	TSX CDP•01 flat cables equipped with an HE10 connector at one end and with color-coded flying leads at the other	Used to connect the module I/O directly to the sensors and preactuators. They are available in 2 lengths: • TSX CDP 301: length 3 meters • TSX CDP 501: length 5 meters
5	TELEFAST sub-bases ABE-7H16R20	Used to convert an HE10 connector to a screw terminal connector, for quick connection of power supplies, sensors and preactuators

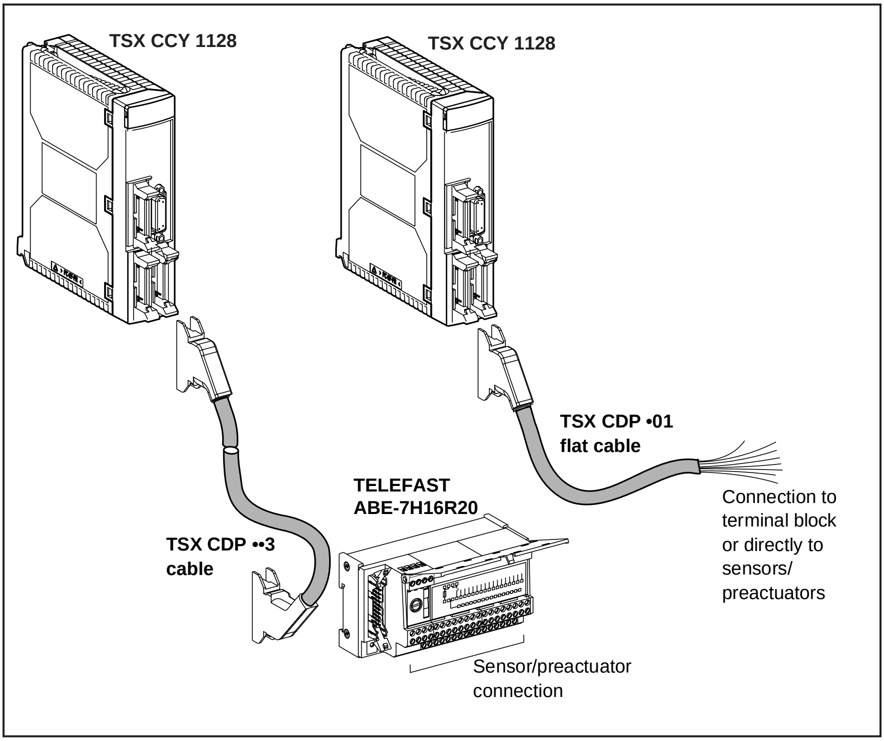
At a Glance, continued

Connection Accessories

The sensors are connected to the auxiliary inputs and the preactuators to the track outputs in the following way:

- either via an ABE-7H16R20 TELEFAST sub-base and TSX CDP ••3 cable (recommended system).
- or directly using a TSX CDP •01 flat cable.

The following diagram shows both these types of connection



Connecting the Auxiliary Inputs

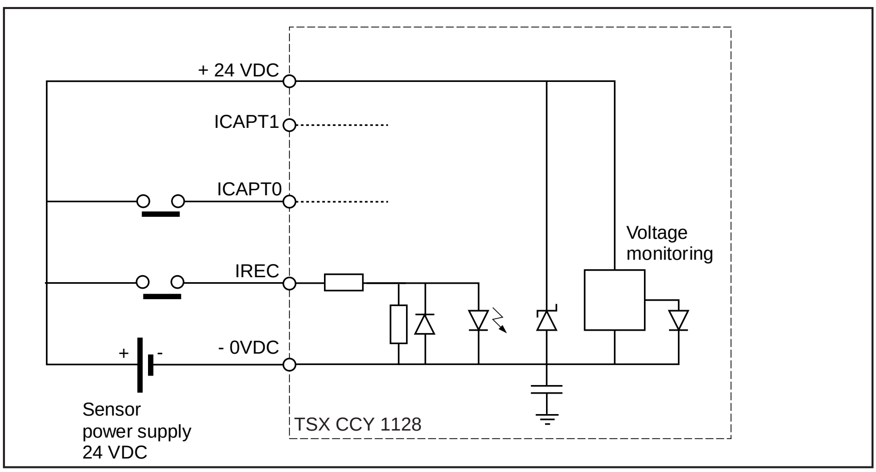
Number of Auxiliary Inputs

The TSX CCY 1128 module has 3 auxiliary inputs:

Input	Function
IREC	Recalibration of the position measurement
ICAPT0	Reading the position in register 0
ICAPT1	Reading the position in register 1

Equivalent Circuit Diagram

The auxiliary inputs are supplied with 24 VDC from an external power supply to be provided on the connector. The following illustration gives the equivalent circuit diagram.

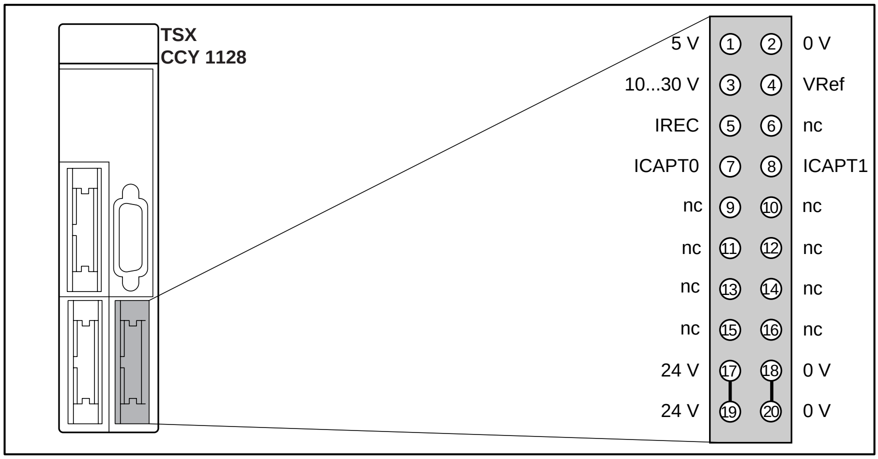


Connecting the Auxiliary Inputs, continued

Position of the HE10 Connector and Identification of the Signals

The following diagram shows the position of the HE 10 connector on the module relative to the auxiliary inputs and identifies the signals carried via this connector.

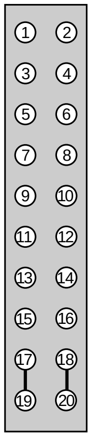
This connector also carries the power supply for the incremental encoder or SSI absolute encoder. This information is given in more detail in Chapter 3.



Connecting the Auxiliary Inputs, continued

Pinout of the Module HE10 Connector

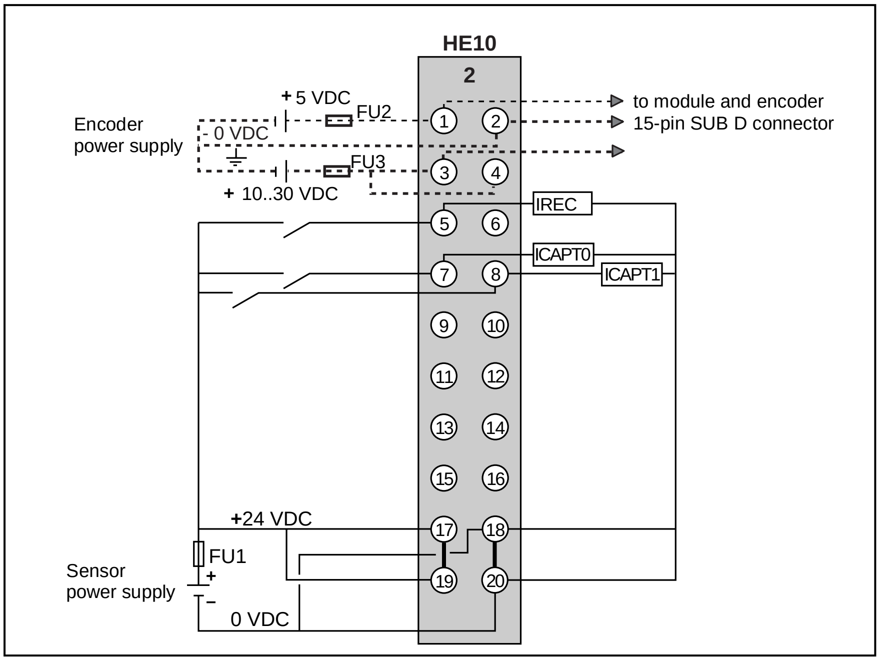
The pinout of the HE10 connector relative to the auxiliary inputs is as follows:

Diagram (view from the front)	Pin no.	Signal	Description
	1	5 V	Encoder +5 VDC power supply input
	2	0 V	Encoder - 0VDC power supply input
	3	10...30V	Encoder + 10...30 VDC power supply input
	4	VRef	Voltage reference input for the encoder power supply check
	5	IREC	Recalibration auxiliary input
	6	-	Not wired
	7	ICAPT0	Read auxiliary input 0
	8	ICAPT1	Read auxiliary input 1
	9	-	Not wired
	10	-	Not wired
	11	-	Not wired
	12	-	Not wired
	13	-	Not wired
	14	-	Not wired
	15		Not wired
	16		Not wired
	17	24 V	Sensor +24 VDC power supply input
	18	0 V	Sensor - 0 VDC power supply input
	19	24 V	Sensor +24 VDC power supply input
	20	0 V	Sensor - 0 VDC power supply input

Connecting the Auxiliary Inputs, continued

Outline Diagram

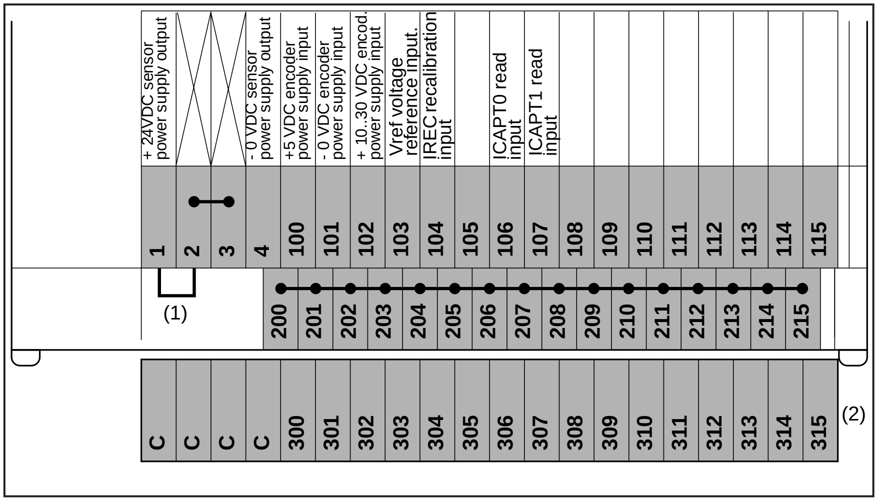
The following illustration gives the outline diagram for connecting the auxiliary inputs



Connecting the Auxiliary Inputs, continued

Connection Using TELEFAST Sub-Base and TSX CDP ••3 Cable

- Availability of the signals on the TELEFAST sub-base screw terminal block



(1) On the ABE-7H16R20 TELEFAST sub-base, the position of the jumper defines the polarity of terminals 200 to 215:

- Jumper in positions 1 and 2: terminals 200 to 215 are at + polarity
- Jumper in positions 2 and 4: terminals 200 to 215 are at - polarity

(2) On the ABE-7H16R20 TELEFAST sub-base it is possible to add an optional ABE-7BV20 terminal bar to create a second sensor common (+ or - depending on the user's choice).

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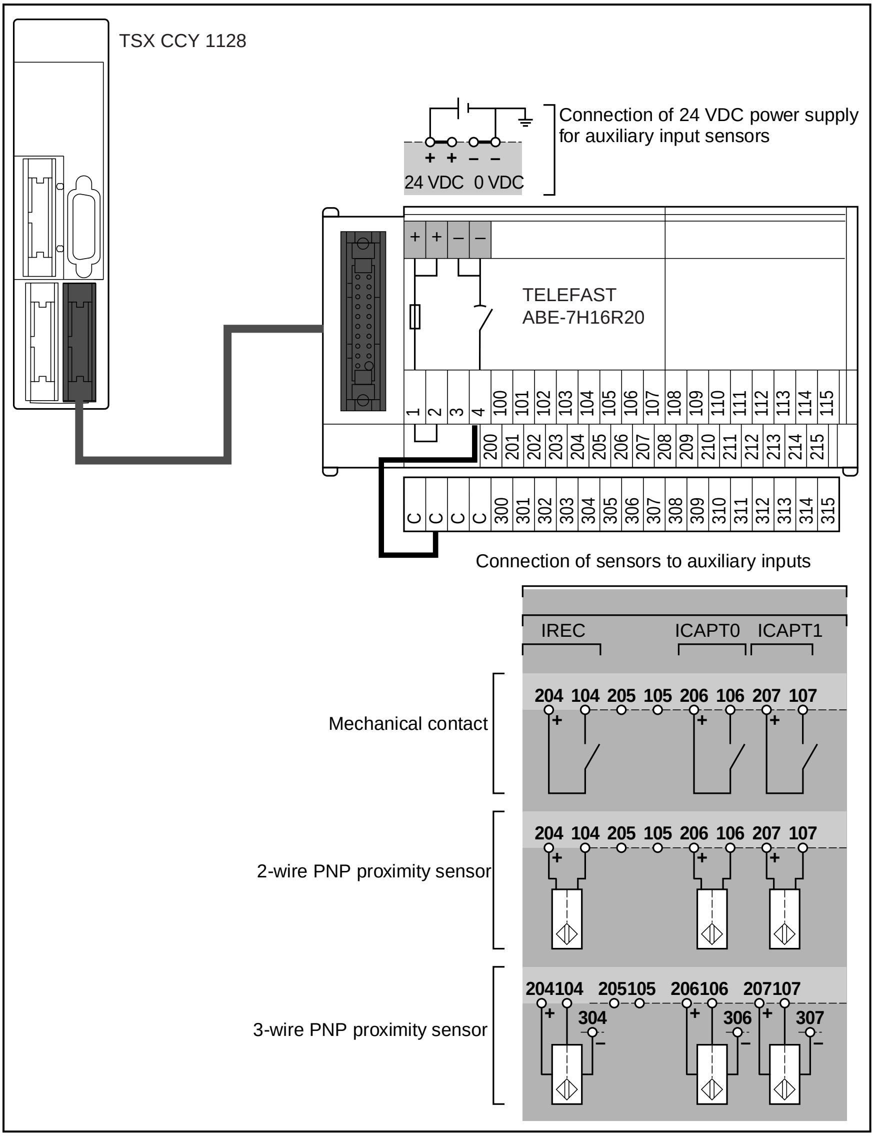
Connecting the Auxiliary Inputs, continued

Connection Using TELEFAST Sub-Base and TSX CDP ••3 Cable, continued

- Example of connecting the sensors to the auxiliary inputs



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Connecting the Auxiliary Inputs, continued

Connection Using TELEFAST Sub-Base and TSX CDP ••3 Cable, continued

- Correspondence between the TELEFAST terminal block and the module HE10 connector

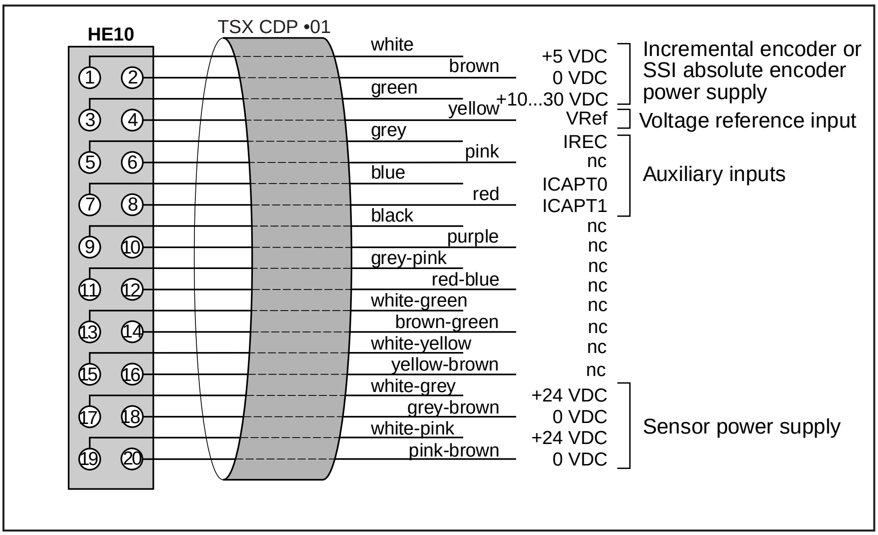
TELEFAST screw terminal block (terminal no.)	**HE10 connector 20 pins (pin no.)**	**Type of signal**	**Function**
100	1	+ 5VDC	Encoder power supply
101	2	- 0 VDC	
102	3	+ 10...30 VDC	
103	4	VRef	Voltage reference input for the encoder power supply monitoring
104	5	IREC	Recalibration input
105	6	Not connected	-
106	7	ICAPT0	Register 0 read input
107	8	ICAPT1	Register 1 read input
108 to 115	9 to 16	Not connected	-
+ 24 VDC	17	-	Auxiliary input sensor power supply
- 0 VDC	18	-	
+24 VDC	19	-	
- 0 VDC	20	-	
1	-	-	Terminals 200 to 215 at + 24 VDC, if terminals 1 and 2 are linked
2	-	-	
3	-	-	Terminals 200 to 215 at - 0 VDC, if terminals 3 and 4 are linked
4	-	-	
200...215	-	-	Connection of sensor commons to: • + 24 VDC if terminals 1 & 2 linked • - 0 VDC if terminals 3 & 4 linked
300...315	-	-	On ABE-7BV20 optional terminal bar, terminals which can be used as sensor common are to be linked by wire at the required common voltage.

Connecting the Auxiliary Inputs, continued

Connection Using TSX CDP •01 Flat Cable

With this type of connection all the signals from or to the module can be connected directly:

- on a terminal block, or
- on the sensors.



nc = not connected

Connecting the Track Outputs

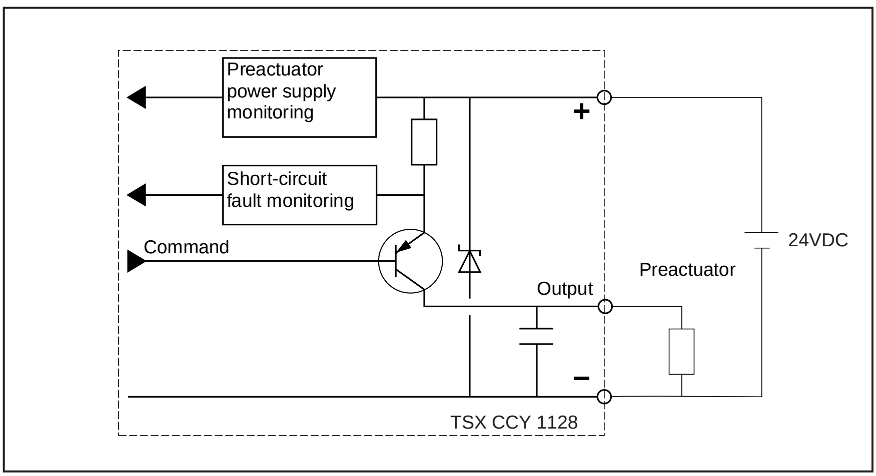
Number and Division of Track Outputs

The TSX CCY 1128 module has 32 track outputs, 24 of which are physically accessible. These track outputs are divided into 4 groups on two HE10 connectors on the front panel of the module.

Connectors	0		1	
Groups	0	1	2	3
Tracks	01234567	0123	01234567	0123
Outputs	Q0. 01234567	Q1. 0123	Q2. 01234567	Q3. 0123

Equivalent Circuit Diagram

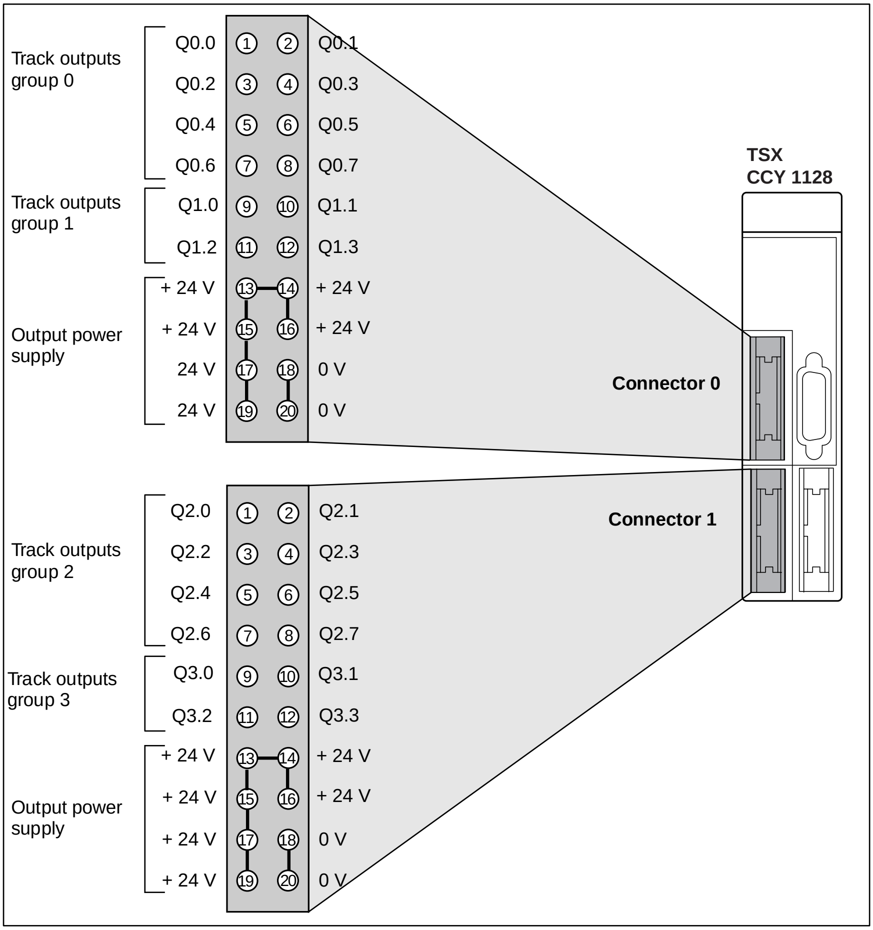
The following illustration gives the equivalent circuit diagram of a track output.



Connecting the Track Outputs, continued

Position of the HE10 Connectors and Identification of the Signals

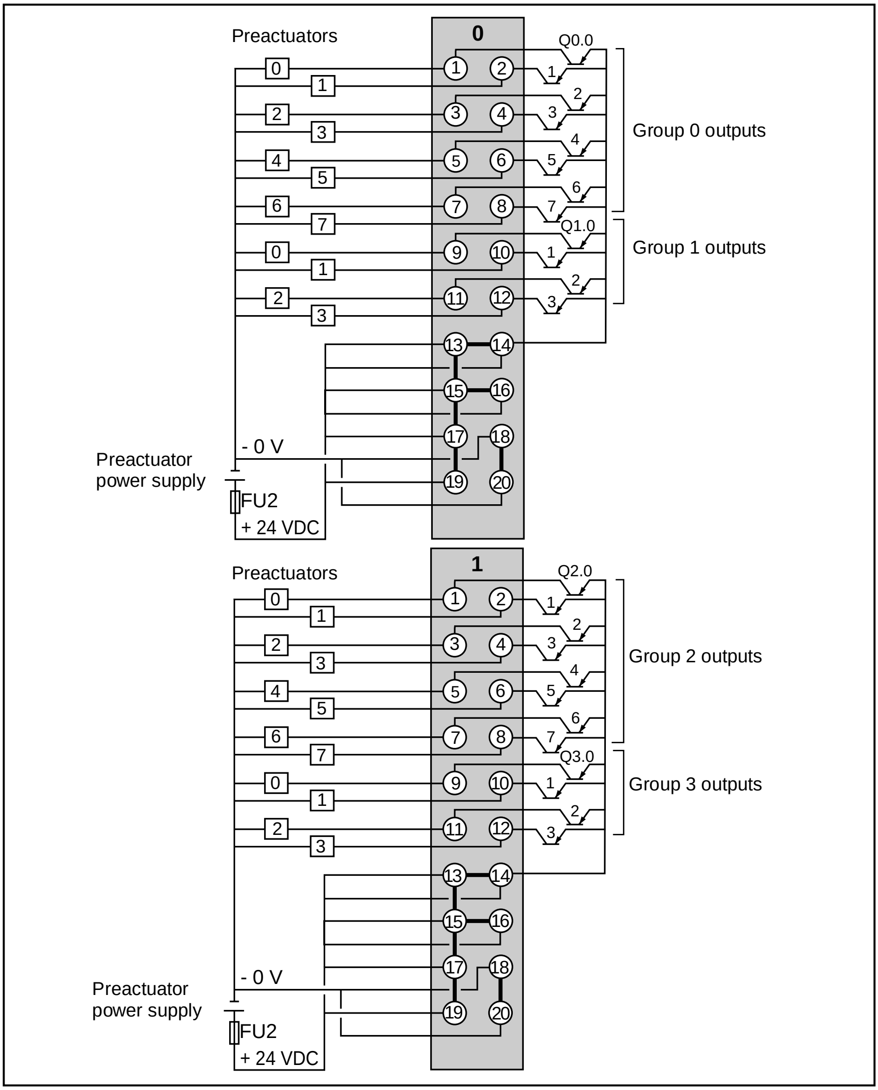
The following diagram shows the position of the HE 10 connectors on the module relative to the track outputs and identifies the signals carried via these connectors.



Connecting the Track Outputs, continued

Outline Diagram

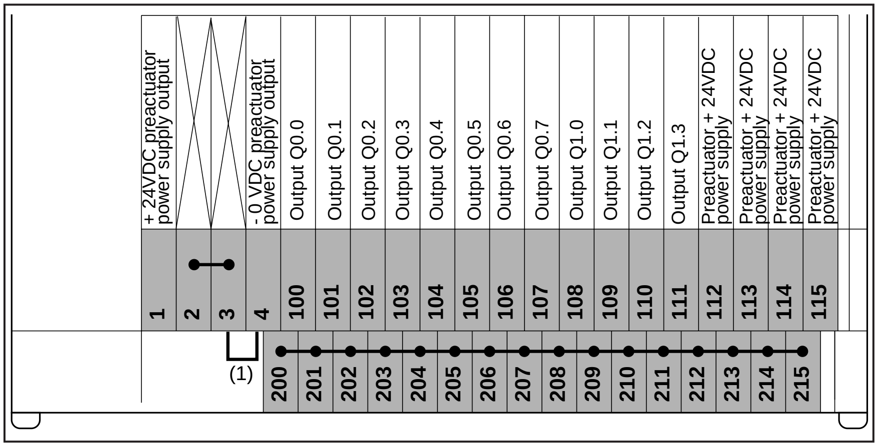
The following illustrations give the outline diagrams of the connection principle.



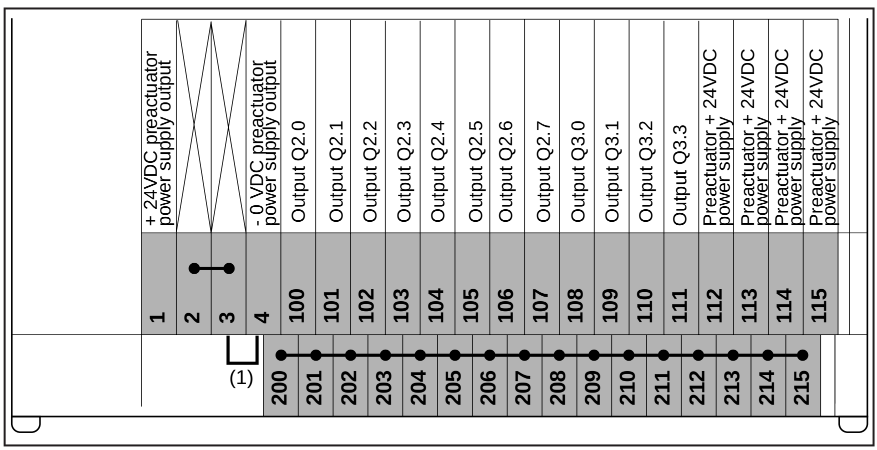
Connecting the Track Outputs, continued

Connection via TELEFAST Sub-Base and TSX CDP ••3 Cable

- Availability of the **connector 0** signals on the TELEFAST screw terminal block



- Availability of the **connector 1** signals on the TELEFAST screw terminal block



(1) On the ABE-7H16R20 TELEFAST sub-base, the position of the jumper defines the polarity of terminals 200 to 215:

- Jumper in positions 1 and 2: terminals 200 to 215 are at + polarity
- Jumper in positions 3 and 4: terminals 200 to 215 are at - polarity

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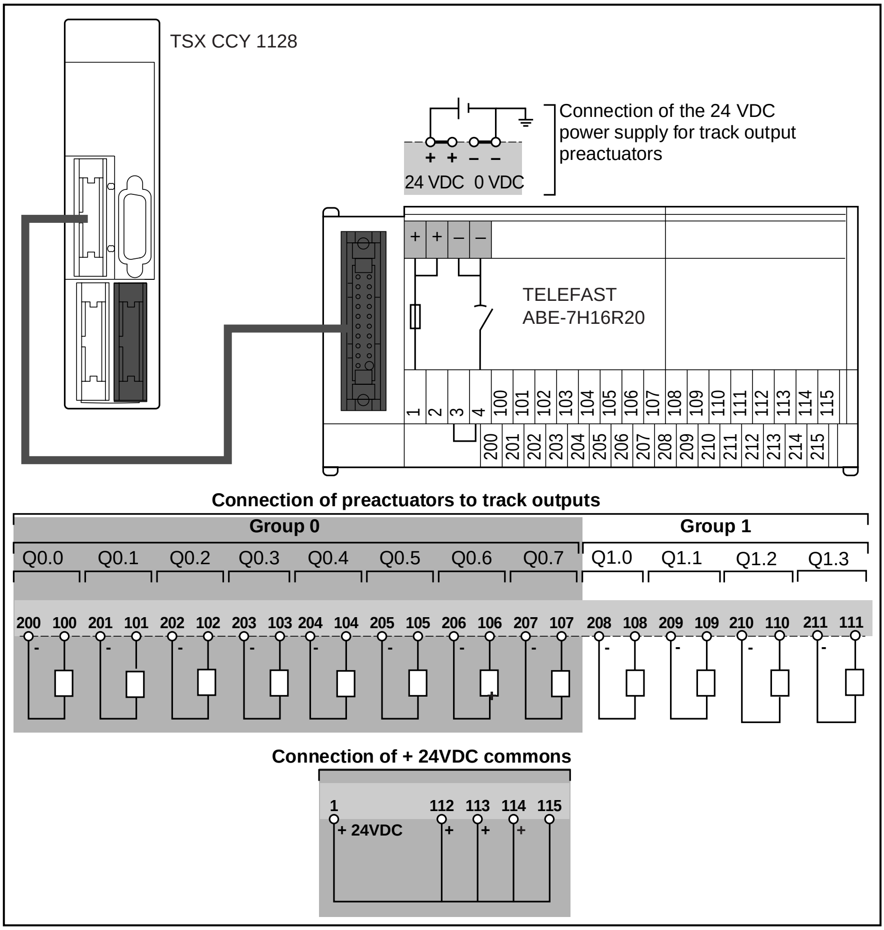
Connecting the Track Outputs, continued

Connection Using TELEFAST Sub-Base and TSX CDP ••3 Cable, continued

Example of connecting the preactuators on the connector 0 track outputs (groups 0 and 1). Perform the same operations for connector 1 (output groups 2 and 3).



Connecting the Track Outputs, continued

Connection Using TELEFAST Sub-Base and TSX CDP ••3 Cable, continued

The following table gives the correspondence between the TELEFAST screw terminal block and the module HE10 connectors (connectors **0 and 1**).

Terminal no. on TELEFAST screw terminal block	**HE 10 connector pin no.**	**Type of signals on connectors**		**Functions of connectors**	
		0	**1**	**0**	**1**
100	1	Q0.0	Q2.0	Group 0 track outputs	Group 2 track outputs
101	2	Q0.1	Q2.1		
102	3	Q0.2	Q2.2		
103	4	Q0.3	Q2.3		
104	5	Q0.4	Q2.4		
105	6	Q0.5	Q2.5		
106	7	Q0.6	Q2.6		
107	8	Q0.7	Q2.7		
108	9	Q1.0	Q3.0	Group 1 track outputs	Group 3 track outputs
109	10	Q1.1	Q3.1		
110	11	Q1.2	Q3.2		
111	12	Q1.3	Q3.3		
112	13	+ 24 VDC		Preactuator power supply + 24 VDC commons if external connection to terminal 1 of the TELEFAST	
113	14				
114	15				
115	16				
+ 24 VDC	17-19	+ 24 VDC		Track output preactuator power supply	
- 0 VDC	18-20	- 0 VDC			
1	-	+ 24 VDC		Terminals 200 to 215 at + 24 VDC, if terminals 1 and 2 are linked	
2	-	Common of terminals 200 to 215			
3	-	Common of terminals 200 to 215		Terminals 200 to 215 at - 0 VDC, if terminals 3 and 4 are linked	
4	-	- 0 VDC			
200...215	-	• + 24 VDC if terminals 1 & 2 linked • - 0 VDC if terminals 3 & 4 linked		Connection of sensor commons	

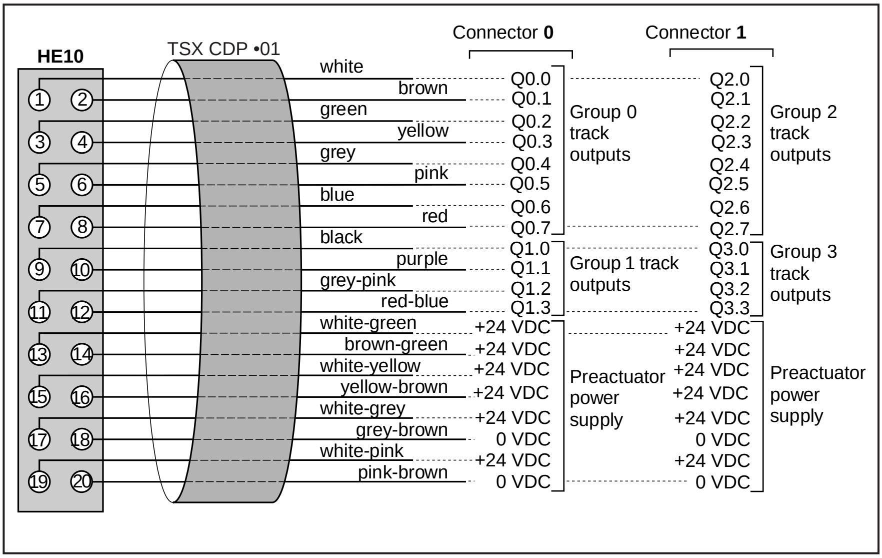
Connecting the Track Outputs, continued

Connection Using TSX CDP •01 Flat Cable

With this type of connection all the signals from or to the module can be connected directly:

- either on a terminal block, or
- on the preactuators.

The following diagrams gives the correspondence between the color of the wires and the pin number on the HE10 connector for connectors 0 and 1



Electrical Specifications of the Module

5

Introduction

This chapter describes the electrical specifications of the TSX CCY 1128 electronic cam module.

What's in this Chapter

This chapter contains the following topics:

General Specifications

Table of General Specifications of the Module

The following table gives the general specifications of the module.

Description of parameter		Value	
		Typical	**Maximum**
Current consumption of the module	On internal 5V (with module internal fan running)	0.66 A	1 A
	On sensor/ preactuator 24 V (auxiliary inputs and track outputs)	15 mA	18 mA
	On 10...30V (when using an SSI absolute encoder and single 24V power supply)	11 mA	20 mA
Power dissipated in the module		7 W (1)	10 W (2)
Sensor/preactuator supply monitoring		Yes	
Insulation resistance		> 10 MOhms at 500 VDC	
Dielectric strength with ground or PLC logic 0V		1000V rms - 50/60 Hz for 1 min	
Operating temperature		0 to 60°C	
Storage temperature		-25°C to 70°C	
Relative humidity (without condensation)		5% to 95%	
Operating altitude		0 to 2000 m	

(1) Under normal operating conditions: one auxiliary input active, 24 VDC supply voltage, standard RS 422 signals.

(2) Under extreme operating conditions: 100% of auxiliary inputs active, 30 VDC supply voltage, etc.

Encoder Input Specifications

Encoder Input Specifications

The following table gives the specifications of encoder inputs A, B and Z.

Input			**RS 422 operation**	**10… 30 VDC operation**
Logic			Differential inputs	Positive or negative
Nominal values	Voltage		-	24 V
	Current		10 mA	15.5 mA
Limit values	Voltage		≤ 5.5 V	≤ 30 V (possible up to 34 V, limited to 1 hour in every 24 hours)
	At state 1	Voltage	> 3 V (1)	≥ 11 V
		Current	> 5.8 mA (1)	> 5 mA
	At state 0	Voltage	≤ -3 V	< 5 V
		current	≤ -5.8 mA	< 2 mA
Input impedance at nominal voltage			-	1.5 kOhms
Input type			Resistive	Resistive
Maximum permissible frequency	Incremental encoders		500 kHz with multiplication by 1 250 kHz with multiplication by 4	

(1) The positive or negative differential voltage must be greater than 3 volts and the current in the positive or negative loop must be greater than 5.8 mA to ensure:

- that counting pulses up to 500 kHz are taken into account
- that the line check does not detect any errors whatever the frequency.

Note: Paralleling of standard RS 422 encoder outputs

An encoder which has standard RS 422 outputs can control the inputs of two TSX CCY 1128 modules in parallel. To ensure the required voltage levels, the encoder supply voltage should be greater than 4.5V.

Specifications of the Encoder Power Supply Return Check

Specifications of the EPSR input

The following table gives the specifications of the encoder power supply check.

Parameters		Value
Limit values on the EPSR input	Voltage	30 V (possible up to 34V, limited to 1 hour in every 24 hours)
	Current	≤ 1.5 mA
Voltage for OK state	VRef input not connected	OK if U > 3.3 V
	VRef input connected to encoder power supply +	OK if U > 66% of the voltage applied at VRef input

Specifications of the Auxiliary Inputs

Auxiliary Input Specifications Table

The following table gives the specifications of auxiliary inputs IREC, ICAPT1 and ICAPT2.

Description of the parameters			Symbol	Value	Unit
Nominal values	Voltage		Un	24	V
	Current		In	8	mA
	Sensor power supply, including ripple		U1 Utemp (1)	19...30 34	V
Limit values	At state 1	Voltage	Uon	$\geq$ 11	V
		Current at Uon	Ion	> 3	mA
	At state 0	Voltage	Uoff	< 5	V
		Current	Ioff	< 1.5	mA
Response time	State 0 to 1		Ton	< 100	µs
	State 1 to 0		Toff	< 100	µs
Sensor voltage monitoring threshold	OK		Uok	> 18	V
	Fault		Udef	< 14	V
Input impedance			Re	3	kOhms
Input type	Resistive				
Logic type	Positive (sink)				
IEC 1131 compatibility with the sensors	Type 1				
3-wire/2-wire proximity sensor compatibility	• 3-wire proximity sensor: All 3-wire proximity sensors operate at 24 VDC • 2-wire proximity sensor: All 2-wire proximity sensors operate at 24 VDC with the following specifications: Residual voltage at closed state $\leq$ 7V Minimum switching capacity: $\leq$ 2.5 mA Residual current at open state: $\leq$ 1.5 mA				
Dielectric strength with ground	1500 V rms 50/60 Hz for 1 min				

(1) Utemp: maximum voltage permissible for 1 hour in every 24 hour period.

Track Output Specifications

Track Output Specifications Table

The following table gives the specifications of the track outputs.

Description of the parameters			Symbol	Value	Unit
Nominal values	Voltage		Un	24	V
	Current		In	500	mA
Limit values	Voltage		U1	19...30	V
			Utemp (1)	34	V
	Max. current per output for U= 30V or 34V		I1	600	mA
	Maximum current	per connector	I2	≤ 6	A
		per module	I3	≤ 12	A
Max. power for tungsten filament lamp			P1	10	W
Max. switching frequency on inductive load			F	$< 0.6/LI^2$	Hz
Electro discharge time			T	< L/R	s
Preactuator voltage monitoring threshold		OK	Uok	> 18	V
		Fault	Udef	< 14	V
Compatibility with DC inputs			All positive logic DC inputs with input resistance of < 15 kOhms		
Protection against overloads and short-circuits			By current limiter and thermal breaking (0.7A<Id<2A)		
Protection against output overvoltages			By Zener diode between the outputs and the + 24V		
Protection against polarity inversion			By diode reverse-mounted on the supply		
Dielectric strength with ground			1500 V rms 50/60 Hz for 1 min		
IEC 1131-2 conformity			Yes		

6 Module Displays

Introduction

This chapter presents the LEDs on the TSX CCY 1128 electronic cam module and their meaning.

What's in this Chapter

This chapter contains the following topics:

Presentation of the TSX CCY 1128 Module Display Block

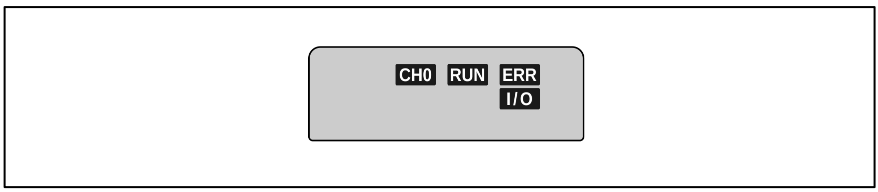
Role

The module display block has four LEDs whose role it is to provide the user with information on:

- The operating mode of the module (normal operation, module faulty or off)
- Operating faults which are internal or external to the module.

Physical Presentation

The following diagram shows the physical appearance of the display block on the module and the geographical position of its four LEDs



LED States and Their Meaning

Indication of the Operating Mode

The following table gives the states of the RUN LED and their meaning

LED	Color	State	Meaning
RUN	Green	Lit	Module operating normally
		Off	Module faulty or off

Fault Indication

The following table gives the states of the ERR, I/O and CH0 LEDs and their meaning.

LED	Color	State	Meaning
ERR	Red	Lit	Internal module fault: • module failure
		Flashing	• Communication fault with the processor • Application missing, invalid or execution fault
		Off	Normal operation, no fault
I/O	Red	Lit	Fault external to the module: • Wiring fault • Encoder power supply fault • Configuration/adjustment parameters refused
		Flashing	Not significant
		Off	Normal operation, no fault
CH0	Green	Lit	Normal operation, the channel is operational
		Flashing	The channel is not operating correctly, due to: • an external fault • a communication fault
		Off	The channel is inoperative: • channel not configured • channel incorrectly configured

Appendix: Connecting a Parallel Output Absolute Encoder

7

At a Glance

Introduction

This chapter describes the procedure for connecting a parallel output absolute encoder to the TSX CCY 1128 electronic cam module.

What's in this Chapter

This chapter contains the following topics:

Principle

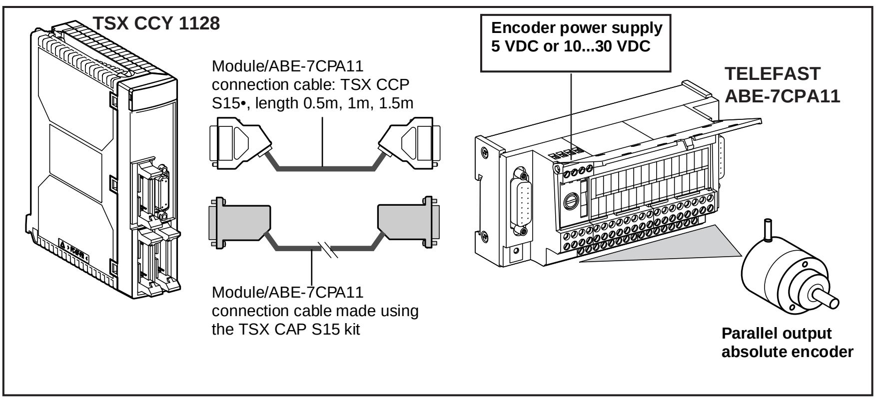
Connection System

The 15-pin SUB D connector, located on the module front panel, connects the module to the encoder via an ABE-7CPA11 TELEFAST sub-base.

- The TELEFAST sub-base receives:
  - All the parallel signals from the encoder
  - The 5 VDC or 10...30 VDC encoder power supply source.
- The TELEFAST sub-base restores the encoder signals
  - to the module in the form of standard RS 422 serial signals.

Illustration

The following diagram illustrates the principle for connecting a parallel output absolute encoder to a TSX CCY 1128 module.



TELEFAST ABE-7CPA11 Sub-Base

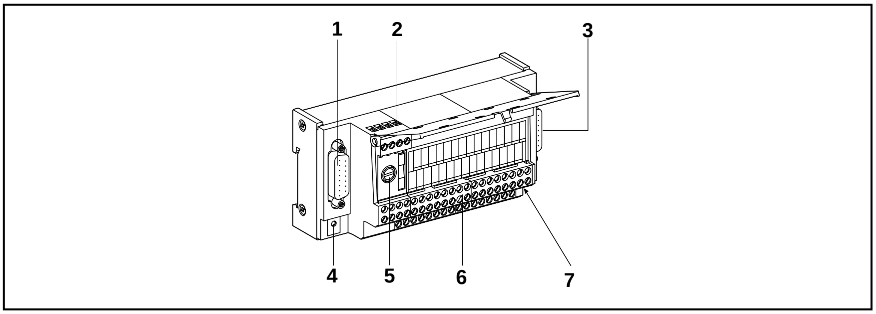
Role

The ABE-7CPA11 TELEFAST sub-base performs the following functions:

- Acts as the connection interface between:
  - the parallel output absolute encoder and
  - the TSX CCY 1128 module
- Converts the position value supplied by the parallel output encoder to standard RS 422 serial data. The absolute encoder must be coded in pure binary code or Gray code with a maximum of 24 data bits.

View of the TELEFAST Sub-Base

The following diagram shows the ABE-7CPA11 TELEFAST sub-base with its various elements.



Elements and Their Functions

The following table gives the functions of the TELEFAST sub-base elements.

Number	Element	Function
1	15-pin SUB D connector	For connection to the TSX CCY 1128 module via a TSX CCP S15• cable.
2	Screw terminal block	For connecting the encoder power supply
3	15-pin SUB D connector	Not used
4	LED	When it is lit, shows that the TELEFAST is powered up.

Continued on next page

ABE-7CPA11 TELEFAST Sub-Base, continued

Elements and Their Functions, continued

The following table gives the functions of the remaining TELEFAST sub-base elements.

Number	Element	Function
5	Fuse	Protects the power supply: • rating: 1A • type: fast-blow
6	Screw terminal block	For connecting the encoder.
7	Microswitches	For configuring the type of encoder connected to the TELEFAST (Gray or binary).

Specifications of the TELEFAST Sub-Base

- General Specifications

The following table gives the general specifications of the ABE-7CPA11 TELEFAST sub-base.

Parameter	Value
Permissible voltage at 10...30 VDC	11...30 VDC
Permissible voltage at 5 VDC	5…6 VDC
Maximum frequency of change of state of least significant bit	75 kHz
Serial frame reading frequency	150 kHz...1 MHz
Current consumption (excluding encoder)	Typical: 90 mA - Maximum: 130 mA
Dissipated power	Typical: 450 mW - Maximum: 1.5 W
Encoder power supply return monitoring limit	- 15% < supply voltage < + 15%
Insulation resistance	> 10 MΩ at 500 VDC
Dielectric strength	1000 Vrms - 50 / 60 Hz for 1 min
Operating temperature	0...60°C
Storage temperature	-25°C...+70°C
Relative humidity	5%...95% without condensation
Operating altitude	0...2000 meters

Continued on next page

ABE-7CPA11 TELEFAST Sub-Base, continued

Specifications of the TELEFAST Sub-Base, continued

- Specifications of encoder read inputs In0 to In23

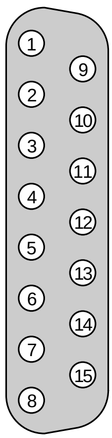
The following table gives the various parameters of the TELEFAST inputs which are connected to the encoder channels.

Parameter	**Type**	**Value**
Logic input	Positive	State 0: U < 2.5V, state 1: U > 3.9V
	Negative	State 0: U > 3.9V, state 1: U < 2.5V
Compatibility with the encoder outputs	Totem Pole outputs	11…30 VDC
	5V TTL outputs	5VDC
	NPN open collector transistor outputs	11…30 VDC
Maximum voltage on the inputs	-	+ 30 VDC
Maximum length of the encoder/TELEFAST wiring	-	200 m This maximum distance depends on the type of encoder used and limits the frequency with which the least significant bit changes. See the TELEFAST sub-base configuration
Maximum length of the module/TELEFAST wiring	-	200 m. This maximum distance limits the serial transmission clock frequency. See special wiring precautions and rules
Lower input voltage limit	-	0 VDC < VIL < 2.5 VDC
Upper input voltage limit	-	3.9 VDC < VIH< 30 VDC

Pinout of the 15-pin SUB D Module and TELEFAST Connectors

Pinout of the 15-pin SUB D Connector on the Module

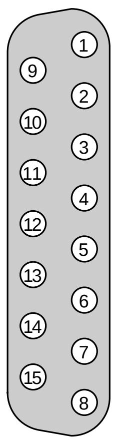
The pinout for connecting a parallel output absolute encoder via the TELEFAST ABE-7CPA11 is as follows.

Diagram (view from the front)	Pin no.	Signal	Description
	1	Data +	Encoder input, Data + (5 VDC)
	2	Data -	Encoder input, Data-
	3	-	-
	4	-	-
	5	-	-
	6	CLK +	Encoder input, CLK + (5 VDC)
	7	10...30 V	Encoder power supply input (+ 10...30 VDC)
	8	0 V	Encoder power supply input (- 0 VDC)
	9	-	-
	10	-	-
	11	-	-
	12	-	-
	13	EPSR	Encoder power supply return + input. It receives the feedback from the power supply + of the encoder which enables the module to check that the encoder is present.
	14	CLK -	Encoder input, CLK -
	15	5 V	Encoder power supply input (+ 5 VDC)

Pinout of the 15-pin SUB D Module and TELEFAST Connectors, continued

Pinout of the 15-pin SUB D Connector on the TELEFAST

The pinout of the 15-pin SUB D connector on the TELEFAST ABE-7CPA11 is as follows.

Diagram (view from the front)	Pin no.	Signal	Description
	1	Data +	Encoder output, data + signal (5 VDC)
	2	Data -	Encoder output, data- signal
	3	-	-
	4	-	-
	5	-	-
	6	CLK +	Encoder output, CLK + signal (5 VDC)
	7	10...30 V	Encoder power supply output (+ 10...30 VDC)
	8	0 V	Encoder power supply output (- 0 VDC)
	9	-	-
	10	-	-
	11	-	-
	12	-	-
	13	EPSR	Encoder power supply return + output. It receives the feedback from the power supply + of the encoder which enables the module to check that the encoder is present.
	14	CLK -	Encoder output, CLK - signal
	15	5 V	Encoder power supply output (+5 VDC)

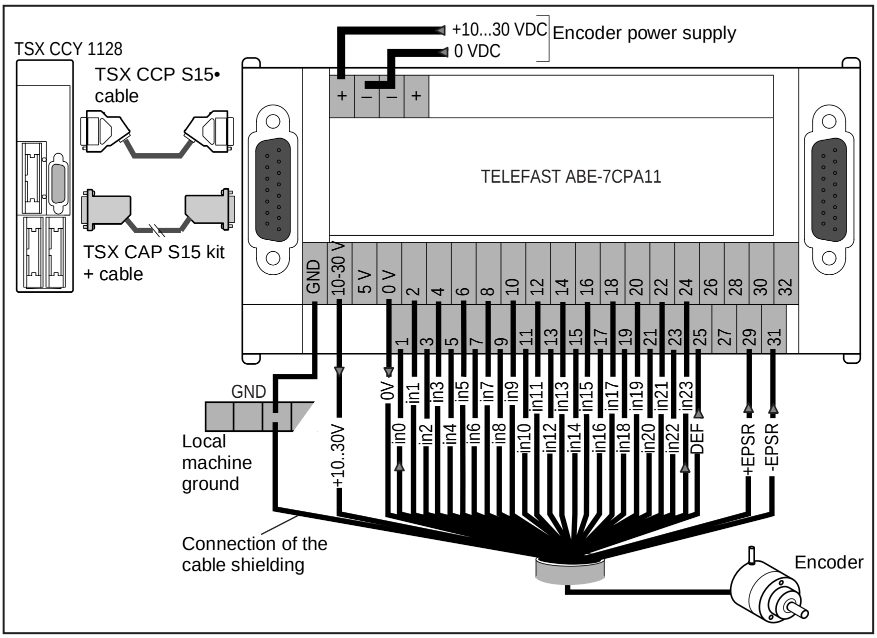
Connecting a Parallel Output Absolute Encoder

Introduction

A parallel output absolute encoder is always connected to the module via an ABE-7CPA11 TELEFAST sub-base. The signals returned to the module will be standard RS 422 SSI serial signals. The encoder power supply will be 10...30 VDC or 5 VDC depending on the type of encoder.

Outline Diagram Showing the Connection of a Parallel Output Absolute Encoder, Supplied with 10...30VDC

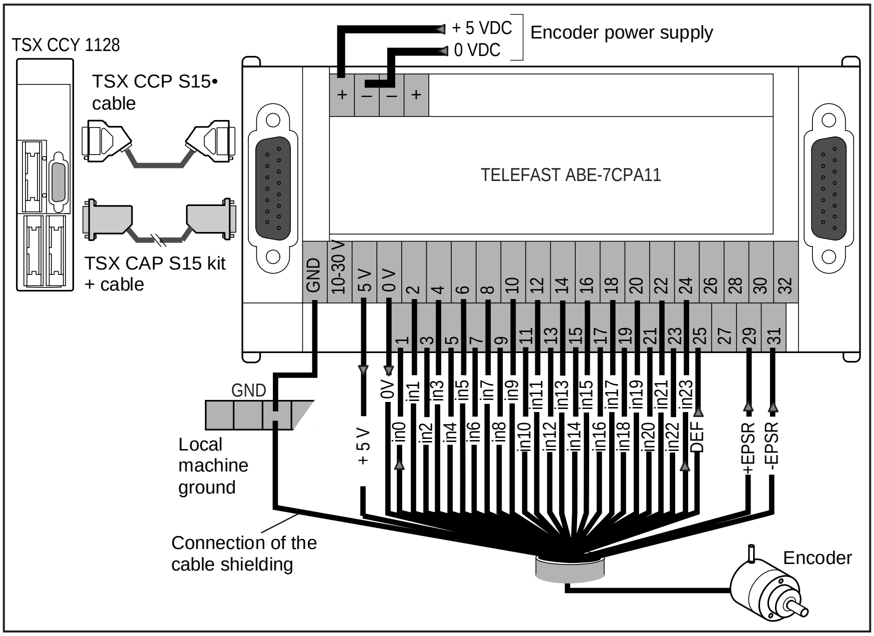
The following diagram shows the connection system of a parallel output absolute encoder supplied with 10...30 VDC.



Connecting a Parallel Output Absolute Encoder, continued

Outline Diagram Showing the Connection of a Parallel Output Absolute Encoder, Supplied with 5 VDC

The following diagram shows the connection system of a parallel output absolute encoder supplied with 5 VDC.



Connecting a Parallel Output Absolute Encoder, continued

Functions of the Screw Terminal Blocks on the TELEFAST

The TELEFAST sub-base has two terminal blocks:

- One terminal block in the upper part, consisting of 4 terminals, designed to connect the encoder power supply source.

Terminals on the screw terminal blocks	Signal	Function
+	-	Encoder power supply source + inputs
-	-	Encoder power supply source - inputs

- Two terminal blocks in the lower part, consisting of 36 terminals, designed to connect all the signals from and to the encoder.

Terminals on the screw terminal blocks	Signal	Function
GND	-	Machine grounding of the TELEFAST. Provides electrical continuity between the encoder and the module
+10...30V	-	Connection of the encoder power supply + for encoder supplied with 10...30 VDC
+ 5 V	-	Connection of the encoder power supply + for encoder supplied with 5 VDC
0 V	-	Connection of the encoder power supply -
1 to 24	In0 to In24	Encoder parallel outputs
25	DEF	Encoder fault output
29	EPSR +	Encoder power supply + return. If there is no encoder power supply return, the terminal should be connected to the + 10...30 V or + 5 V terminal depending on the encoder power supply
30	EPSR -	Encoder power supply - return. If there is no encoder power supply return, the terminal should be connected to the 0 V terminal

Special Wiring Rules and Precautions

Connecting to and Disconnecting from the TELEFAST

The connectors and the connection wires on the TELEFAST must be always be connected and disconnected with the **POWER OFF**:

- Connecting or disconnecting the connectors of the connection cable between the module and the TELEFAST sub-base
- Connecting or disconnecting the wires linking the TELEFAST sub-base to the encoder.

Length of the Cable and Cross-Section of the Connection Wires Between the Module and the TELEFAST

- Cable length

The length of the module/TELEFAST connection cable limits the frequency of the serial transmission clock.

The following table gives the serial transmission clock frequency according to the distance.

If	then
cable length < 10 meters	serial transmission clock frequency: 1 MHz
cable length < 20 meters	serial transmission clock frequency: 750 kHz
cable length < 50 meters	serial transmission clock frequency: 500 kHz
cable length < 100 meters	serial transmission clock frequency: 375 kHz
cable length < 150 meters	serial transmission clock frequency: 200 kHz
cable length < 200 meters	serial transmission clock frequency: 150 kHz

- Cross-section of the wires in the cable

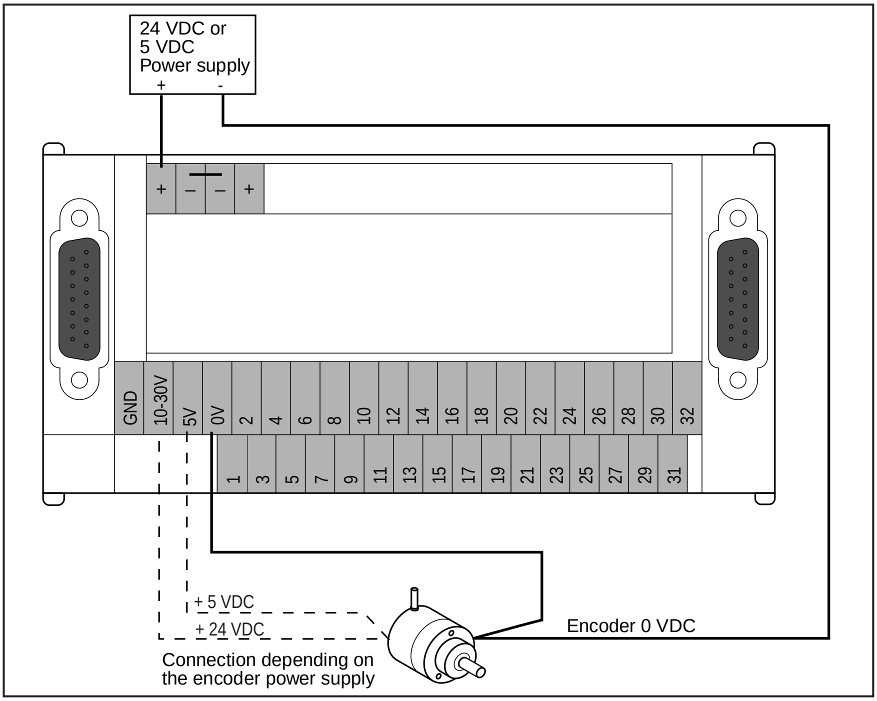
To reduce line voltage drops as much as possible, the following instructions should be followed:

If	And	Then
The encoder is supplied with 5V	The module/TELEFAST distance is ≤ 100m	Use wires with a minimum cross-section of 0.08 mm² (28 gauge)
	The module/TELEFAST distance is > 100m	Use wires with a minimum cross-section of 0.34 mm² (22 gauge)

Special Wiring Rules and Precautions, continued

Connecting the Encoder Power Supply

To limit the voltage drop in the 0V, due to the encoder power supply current, it is recommended that the 0V is wired in the following way:

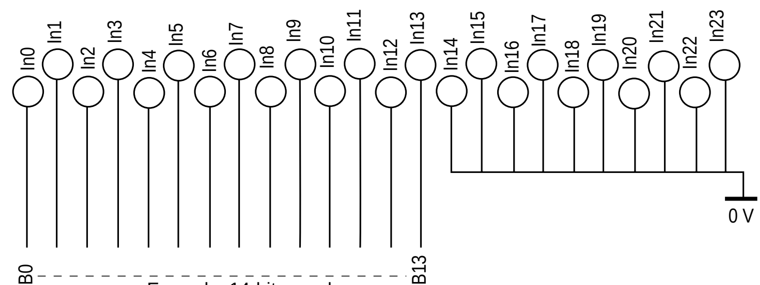


Special Wiring Rules and Precautions, continued

Wiring the Encoder Outputs on the TELEFAST

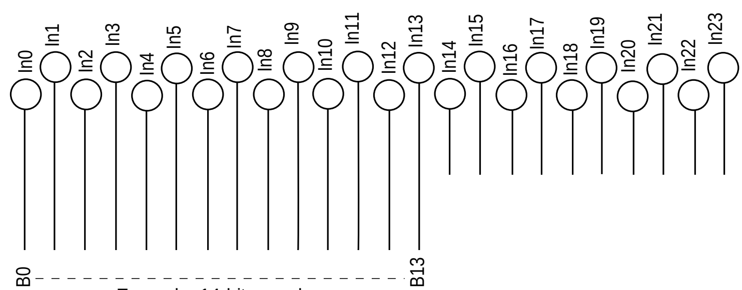
If the encoder outputs are positive or negative logic and there are fewer than 24, then the following connection rules should be followed:

If	And	Then
the encoder outputs are positive logic	there are fewer than 24	• wire the encoder outputs on the TELEFAST inputs starting from the least significant, up to the most significant • wire the unused TELEFAST inputs to the 0V terminal



Example: 14-bit encoder

If	And	Then
the encoder outputs are negative logic	there are fewer than 24	• wire the encoder outputs on the TELEFAST inputs starting from the least significant, up to the most significant • do not wire the unused TELEFAST inputs (leave them unconnected)

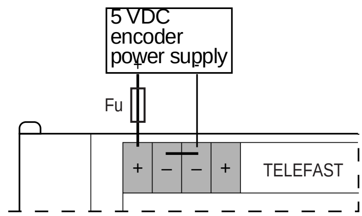


Example: 14-bit encoder

Special Wiring Rules and Precautions, continued

Protecting the Encoder Power Supply

Depending on the encoder supply voltage, the encoder power supply should be protected in the following way:

If	Then
The encoder supply voltage is 10...30 VDC	The protective fuse is integrated in the TELEFAST: • rating: 1A • type: fast-blow
The encoder supply voltage is 5 VDC	Install a fuse (Fu) in series on the power supply +: • rating: to be defined by the user according to the consumption of the TELEFAST and the encoder • type: fast-blow 

Checking the Encoder Power Supply

If the encoder supply voltage falls by 15%, the fault (EPSR signal) is fed back to the module. If the encoder does not have a power supply return, proceed as follows:

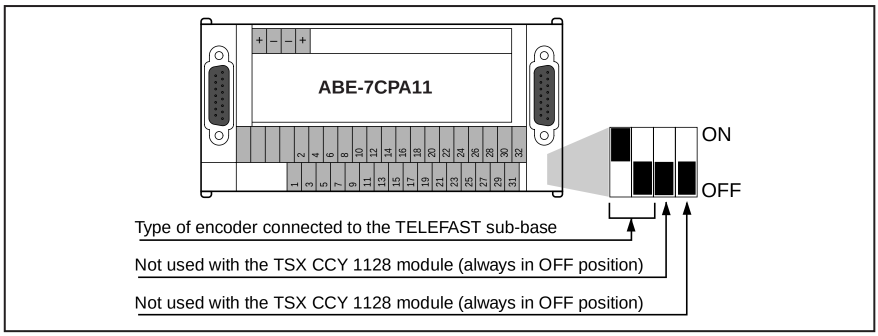
If	Then
No encoder power supply return	Connect the EPSR + and EPSR - inputs on the TELEFAST: • EPSR + terminal on the TELEFAST to the encoder power supply + terminal • EPSR - terminal on the TELEFAST to the encoder power supply - terminal

Configuring the TELEFAST Sub-Base

At a Glance

The TELEFAST sub-base is configured by setting the 4 microswitches located under the right-hand 15-pin SUB D connector. With the TSX CCY 1128 module, the configuration is limited to defining the type of encoder connected.

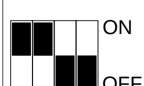
The following diagram shows the geographical position and the function of these 4 microswitches.



Setting the Microswitches

The two microswitches on the right must always be set to the OFF position. The two microswitches on the left are used to define the performance of the link according to the TELEFAST/encoder distance and depending on the specifications of the encoder outputs.

- Encoder with positive logic outputs, GRAY code

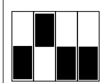
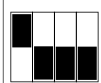
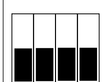
Type of encoder outputs			position of the micro-switches	Max. encoder/ TELEFAST length	Max. frequency of change of least significant bit
Logic	**Output interface**	**Code**			
Positive	• Totem Pole • TTL • NPN open collector	Gray		50 meters	75 kHz

Continued on next page

Configuring the TELEFAST Sub-Base, continued

Setting the Microswitches, continued

- Encoder with negative logic outputs, GRAY code

Type of encoder outputs			**position of the micro-switches**	**Max. encoder/ TELEFAST length**	**Max. frequency of change of least significant bit**
Logic	**Output interface**	**Code**			
Negative	• • • • • • Totem Pole • TTL • NPN open collector	Gray	 ON OFF	50 meters	75 kHz
			 ON OFF	100 meters	40 kHz
			 ON OFF	200 meters	5 kHz

- Encoder with positive or negative logic outputs, Binary code

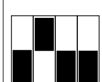
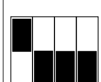
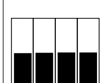
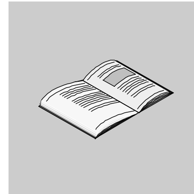
Type of encoder outputs			**Position of the micro-switches**	**Max. encoder/ TELEFAST length**	**Max. frequency of change of least significant bit**
Logic	**Output interface**	**Code**			
Positive or negative	• • • • • • Totem Pole • TTL • NPN open collector	Binary	 ON OFF	10 meters	40 kHz
			 ON OFF	30 meters	20 kHz
			 ON OFF	50 meters	5 kHz

Table of Contents



Presentation of the TSX CSY 84 Module

1

At a Glance

Introduction

This chapter presents the TSX CSY 84 multi-axis control module.

What's in this Chapter

This chapter contains the following topics:

Presentation of the Module in its Environment

Introduction

The TSX CSY 84 is a double format application-specific module in the Premium range. It can be integrated in a TSX RKY•• rack in a TSX/PMX/PCX 57 PLC station. It is part of the SERCOS® offer on Premium PLCs which is used to create a multi-axis control system.

Presentation of the Components of the SERCOS® Offer on Premium PLCs

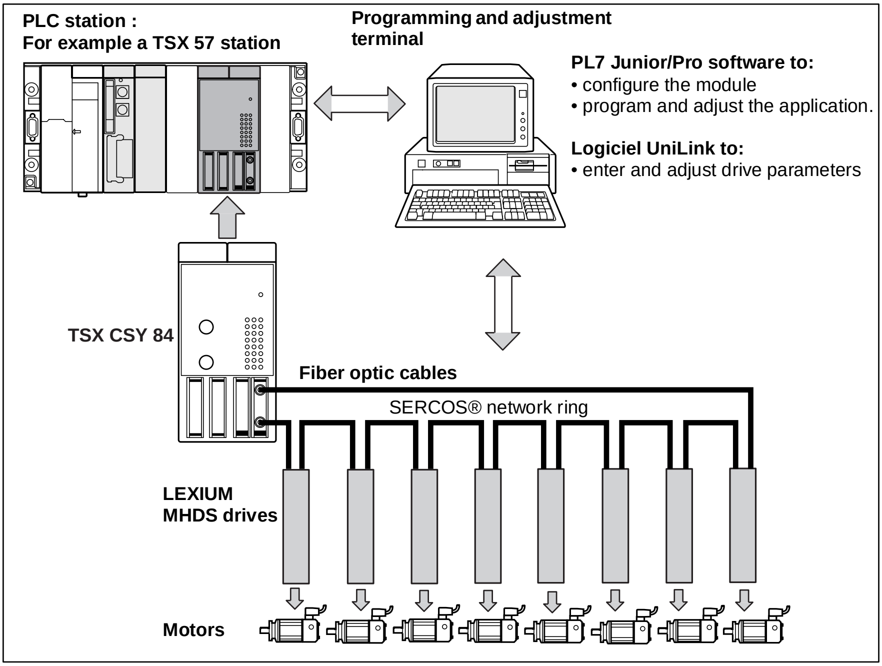
The SERCOS® offer on Premium PLCs is made up of the following elements :

- a TSX/PMX/PCX 57 PLC station comprising:
  - one or more racks
  - power supply modules
  - a processor module
  - the various modules required by the application.
- one or more TSX CSY 84 multi-axis control modules, each able to control up to 8 servo drives distributed on a SERCOS® network.
- a range of 5 LEXIUM MHDS servo drives
- a range of motors
- plastic fiber optic cables, from 0.3 to 16.5 meters long:
  - for making the physical connection between the module and the drives and between the drives in a network ring structure
  - which act as the medium for the digital link between the TSX CSY 84 (master) module and the drives (slaves).The digital link is defined by European standard EN61491.
- PL7 Junior/Pro software which is used to configure the TSX CSY 84 module and to program the motion application
- UniLink software which is used to enter parameters and adjust drives

Presentation of the Module in its Environment, continued

Block Diagram of an Installation

The diagram below gives an example of a SERCOS® multi-axis control installation



Physical Presentation of the Module

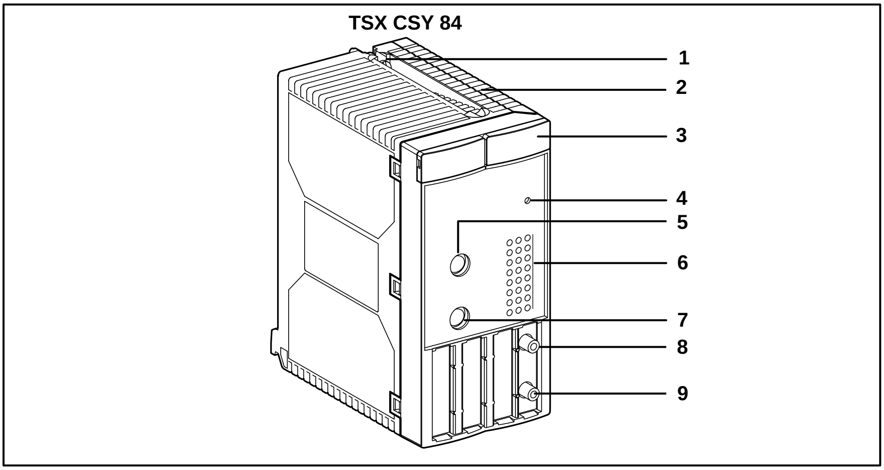
Description of the Front Panel

The following items are to be found on the front panel of the module:

- a display block consisting of 6 indicator lamps to display and diagnose the state of the module.
- a set of 24 indicator lamps to display and diagnose the various channels of the module
- two connectors for attaching the fiber optic cables which link the module and the drives.
- two 8-pin Mini DIN connectors.

View of the Module

The diagram below shows the TSX CSY 84 module with its various elements.



Physical Presentation of the Module, continued

Elements and their Functions

Number	Element	Function
1	Screw	Used to fix the module on the TSX RKY •• rack
2	Module casing	Performs the following functions: • supports and protects the electronic cards • fixes the module in its slot
3	Display block of 6 indicator lamps: • green RUN indicator lamp • red ERR indicator lamp • red I/O indicator lamp • yellow SER indicator lamp • yellow COM indicator lamp • yellow INI indicator lamp	Display the module states and faults Indicates the operating mode of the module Indicates a module internal fault Indicates a fault external to the module or an application fault Indicates traffic on the SERCOS® network during normal operation Not used Indicates that the module is in the reinitialization phase
4	Pencil-point pushbutton	Used to initialize the module
5	COM2 8-pin Mini DIN connector	Reserved
6	24 indicator lamps	Display and diagnose the module channels
7	COM1 8-pin Mini DIN connector	Reserved
8	TX transmission SMA connector	For connecting the fiber optic transmission cable from the SERCOS® network ring
9	RX reception SMA connector	For connecting the fiber optic reception cable from the SERCOS® network ring

Compatibility with the Installed Base

Hardware Compatibility

To take a TSX CSY 84 module, the PLC station must have a processor with software version SV $\geq$ 3.3

Software Compatibility

To develop an application which integrates the TSX CSY 84 module, the PL7 Junior / Pro software must be version SV 3.4 + option or SV > 3.4.

Module Setup

2

At a Glance

Introduction

This chapter describes the operations for setting up the TSX CSY 84 multi-axis control module.

What's in this Chapter

This chapter contains the following topics:

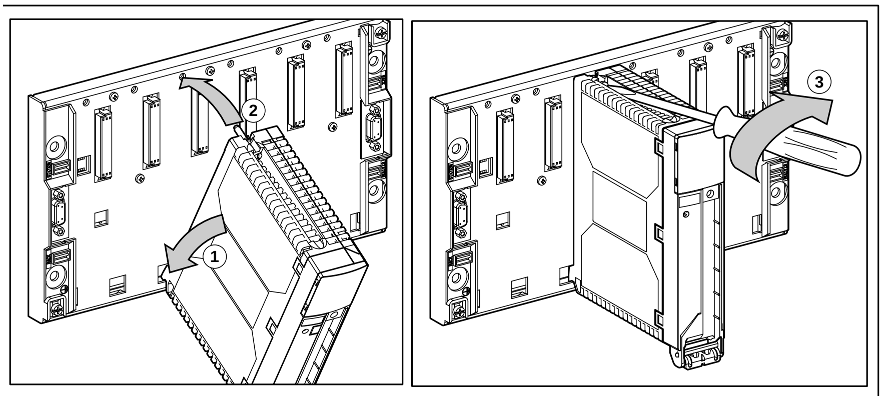
Mounting the Module in a PLC Station Rack

Introduction

The TSX CSY 84 module can be mounted in any of the available slots in a TSX RKY •• rack on a TSX 57/PMX 57/PCX 57 PLC station, except for those slots specifically for the power supply and processor modules. This double format module takes up 2 slots on a TSX RKY •• rack.

Illustration

The diagrams below show the procedure for mounting a standard format module from the Premium range in the TSX RKY •• rack. The procedure is identical for a double format module.



Procedure

The following table describes the operations to be performed:

Step	Action
1	Position the pins at the rear of the module in the locating holes at the bottom of the rack.
2	Turn the module round to place it in contact with the rack.
3	Attach the module to the rack by tightening the screw at the top of the module. Maximum tightening torque for the screw : 2.0 N. m

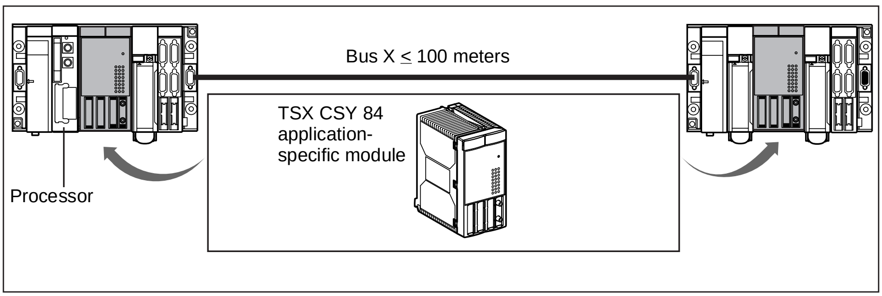
Installing the Module in a PLC Station

Introduction

The TSX CSY 84 module can be installed in any of the racks on the main Bus X segment of a PLC station.

Installing the Module

The diagram below shows the installation of the module in the racks belonging to the main Bus X segment. The module can be installed in the rack which contains the processor and in any of the other racks on Bus X. The distance between the rack which contains the module and the rack which contains the processor should not exceed 100 meters.



Note: The TSX CSY 84 module cannot be installed in a rack belonging to a Bus X segment which is remotely located using a TSX REY 200 module.

Number of Application-Specific Channels Managed by one PLC Station

Definition of an Application-Specific Channel

An application-specific module (TSX CTY• counter modules, TSX CAY• axis control modules, TSX CFY• stepper control modules, TSX YSP Y• weighing module, TSX CCY 1128 electronic cam module, TSX CSY 84 motion control module, etc) have a number of channels which may vary from 1 to n depending on the type of module. These channels are called application-specific channels.

Why Count the Number of Application-Specific Channels in the Station:

To define:

- the power of the processor to be installed
- the maximum number of application-specific modules which can be installed in the station.

The number of application-specific channels for each type of application-specific module is defined in the TSX DM 57 33E manual - Part A - Chapter 3.

Number of Application-Specific Channels Managed by Each Type of Processor

The table below defines the number of application-specific channels managed by each type of processor.

Type of processor	Number of application-specific channels managed
TSX P57 102 / TPMX P57 102 / TPCX 57 1012:	8
TSX P57 2x2 / TPMX P57 202:	24
TSX P57 252	24
TSX P57 302	32
TSX P57 352 / TPMX P57 352 / TPCX 57 3512:	32
TSX P57 402	48
TSX P57 452 / TPMX P57 452	48

Number of Application-Specific Channels Managed by one PLC Station, continued

Number of Application-Specific Channels for one TSX CSY 84 Module

One TSX CSY 84 module can contain up to 32 application-specific channels. Only those application-specific channels which are configured must be taken into account.

Types of Application-Specific Channel on the TSX CSY 84 Module

- Channel 0: SERCOS® channel for managing the digital bus
- Channels 1 to 8: Real axes
- Channels 9 to 12: Imaginary axes
- Channels 13 to 16: Remote axes
- Channels 17 to 20: Sets of coordinated axes
- Channels 21 to 24: Sets of follower axes
- Channels 25 to 31: Cam profiles

Installation Precautions

Introduction

To ensure that it operates correctly, certain precautions must be taken when installing and removing the module, connecting and disconnecting the connectors on the front panel of the module and tightening the screws for fixing the module.

Installing and Removing the Module

A module can be safely installed or removed without switching off the power supply to the rack.

To prevent the application from malfunctioning, these operations should preferably be performed with the module powered down

Connecting and Disconnecting the Fiber Optic Connectors on the Front Panel of the Module

The fiber optic connectors on the front panel of the module can be safely connected or disconnected with the module powered up.

To prevent the application from malfunctioning, these operations should preferably be performed with the module powered down

Tightening Torque for the Module Fixing Screw

Tightening torque: 2.0 N.m.

Module Displays

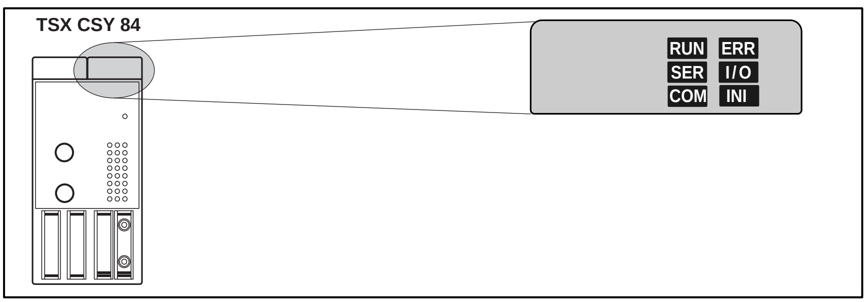
Role

The TSX CSY 84 module has two sets of displays:

- A standard Premium display block comprising 6 LEDs whose role it is to inform the user about:
  - the operating mode of the module: module operating normally, faulty or off
  - Operating faults which are internal or external to the module.
- A set of 24 LEDs to display the state of the application-specific channels of the module (real or imaginary axes, etc).

Presentation of the Display Block

The diagram below shows the module display block and the geographical position of its 6 LEDs.



States of the Various LEDs on the Display Block and their Meaning

The following tables give the various states of each LED on the display block and their meaning

LED	Color	State	Meaning
RUN	Green	Lit	Module operating normally
		Off	Module faulty, off, in the initialization phase or application missing

Continued on next page

Module Displays, continued

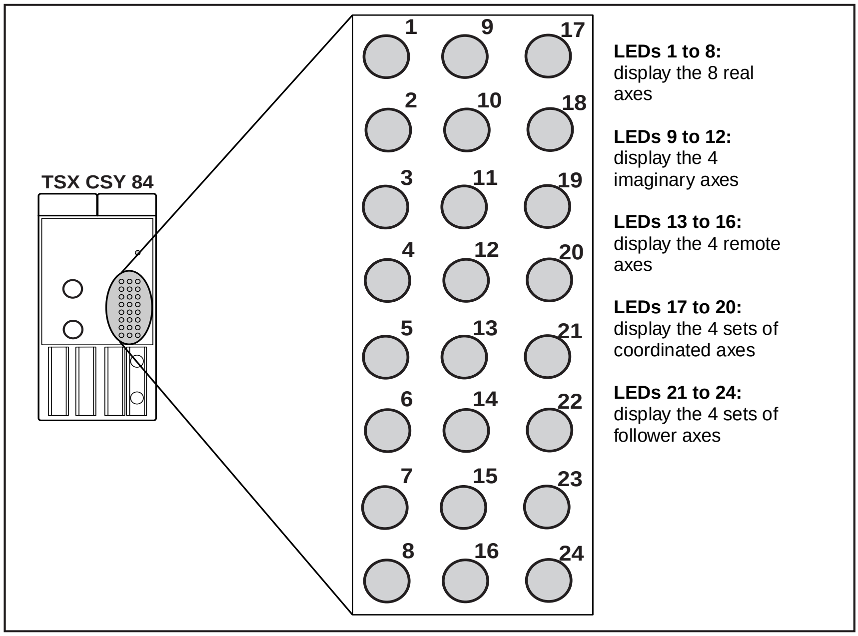
States of the Various LEDs on the Display Block and their Meaning, continued

LED	Color	State	Meaning
ERR	Red	Lit	Module internal fault: • module failure
		Flashing	• Module starting • Communication Fault • Application missing, not valid or execution fault
		Off	Normal operation, no fault
I/O	Red	Lit	External module fault: • Wiring fault
		Flashing	Not significant
		Off	Normal operation, no fault
INI	Yellow	lit	Not significant
		Flashing	The module is in the reinitialization phase
		Off	Normal operation
SER	Yellow	Lit	Not significant
		Flashing	Traffic on the SERCOS network operating normally
		Off	No traffic on the SERCOS network
COM	Yellow	-	not used

Module Displays, continued

Presentation of the LEDs for the Application-Specific Channels

The diagram below shows the 24 LEDs for certain application-specific channels on the module.



Module Displays, continued

States and Meanings of the LEDs for the Application-Specific Channels

The table below gives the various states of the LEDs for the application-specific channels which represent the 8 real axes.

LED	Assignment	Color	State	Meaning
1	Real axis 1	Green	Lit	Axis operating normally
2	Real axis 2			
3	Real axis 3			
4	Real axis 4		Flashing	Axis being configured or faulty
5	Real axis 5			
6	Real axis 6			
7	Real axis 7		Off	Axis not configured or configuration fault
8	Real axis 8			

The table below gives the various states of the LEDs for the application-specific channels which represent the 4 imaginary axes.

LED	Assignment	Color	State	Meaning
9	Imaginary axis 1	Green	Lit	Axis operating normally
10	Imaginary axis 2		Flashing	Axis being configured or faulty
11	Imaginary axis 3			
12	Imaginary axis 4		Off	Axis not configured or configuration fault

Continued on next page

Module Displays, continued

States and Meanings of the LEDs for the Application-Specific Channels, continued

The table below gives the various states of the LEDs for the application-specific channels which represent the 4 remote axes.

LED	Assignment	Color	State	Meaning
13	Remote axis 1	Green	Lit	Axis operating normally
14	Remote axis 2		Flashing	Axis being configured or faulty
15	Remote axis 3			
16	Remote axis 4		Off	Axis not configured or configuration fault

The table below gives the various states of the LEDs for the application-specific channels which represent the 4 sets of coordinated axes.

LED	Assignment	Color	State	Meaning
17	Set of Axes 1	Green	Lit	Set operating normally
18	Set of Axes 2		Flashing	Set being configured or faulty
19	Set of Axes 3			
20	Set of Axes 4		Off	Set not configured or configuration fault

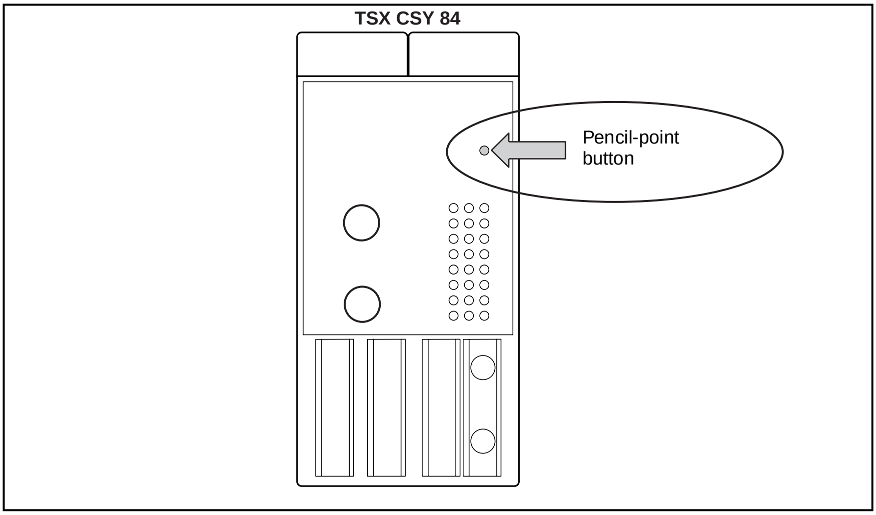
The table below gives the various states of the LEDs for the application-specific channels which represent the 4 sets of follower axes.

LED	Assignment	Color	State	Meaning
21	Set of Axes 1	Green	Lit	Set operating normally
22	Set of Axes 2		Flashing	Set being configured or faulty
23	Set of Axes 3			
24	Set of Axes 4		Off	Set not configured or configuration fault

Initialization of the Module on an Internal Fault

How to Initialize the Module

The module is initialized by pressing the pencil-point button on the front panel as shown in the diagram below.



CAUTION:

Recommendations on pressing the pencil-point button

This button should only be pressed gently.
The point of the tool must be held at right angles to the front panel of the module and in the center of the aperture.

Failure to follow these recommendations may lead to the button being damaged.

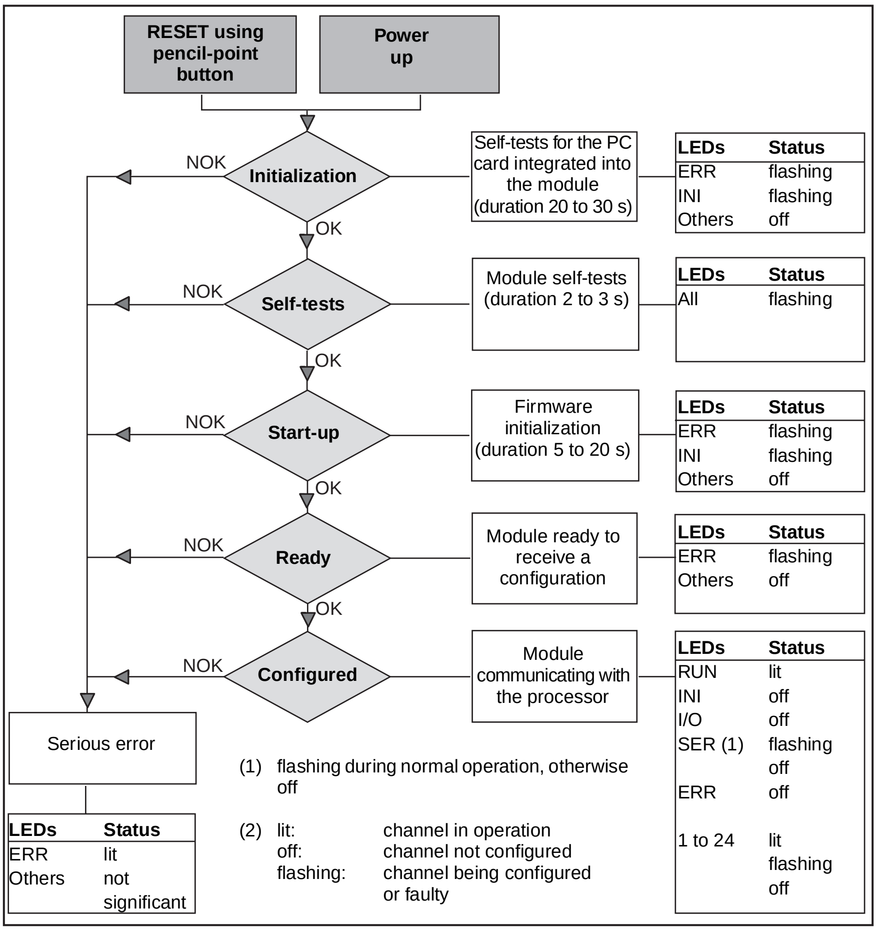
Consequences of an Initialization

The module restarts in the initialization phase in the same way as when it is powered up. See the block diagram of the module operating modes

TSX CSY 84 Module Operating Mode

Block Diagram of the Operating Mode of the TSX CSY 84 Module

The following block diagram describes the various steps in the operation of the module and gives the state of the LEDs on the module front panel for each step.



Description of the Multi-Axis Control System

3

At a Glance

Introduction

This chapter describes how the TSX CSY 84 module interfaces with the speed drives in a SERCOS® network configuration to form a multi-axis control system.

What's in this Chapter

This chapter contains the following topics:

SERCOS® Multi-Axis Control System on Premium PLCs

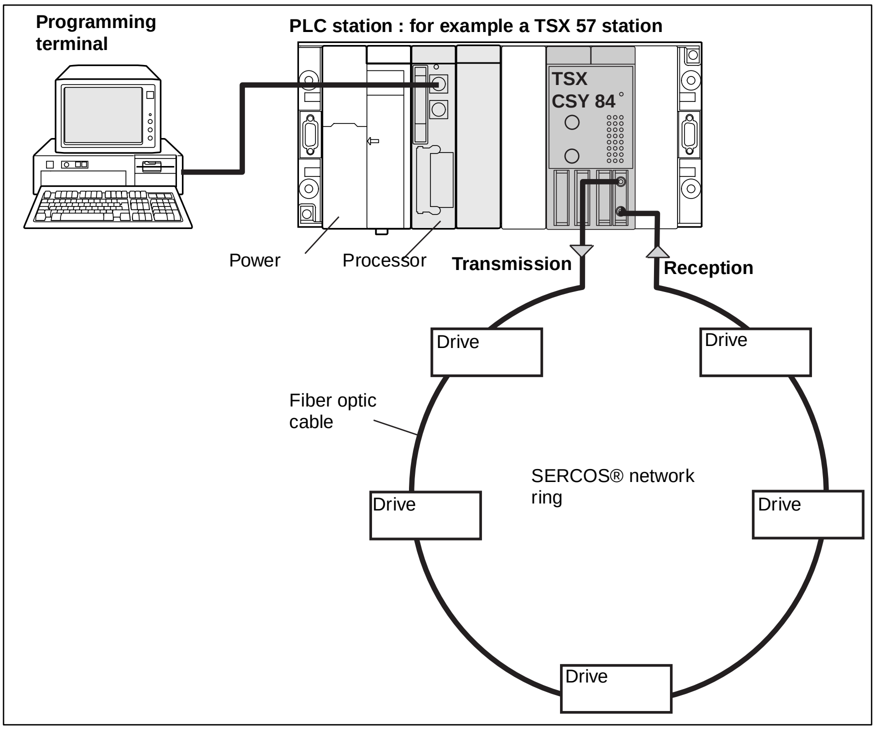
Architecture of a SERCOS® Multi-Axis Control System

The architecture of a SERCOS® multi-axis control system on Premium PLCs consists of :

- a TSX/PMX/PCX 57 PLC station
- a TSX CSY 84 multi-axis control module
- speed drives which control the motors associated with the different axes.
- a SERCOS® fiber optic network.

Illustration

The diagram below gives an example of a SERCOS® multi-axis control system architecture



SERCOS® Multi-Axis Control System on Premium PLCs, continued

Operating Principle

The TSX CSY 84 multi-axis control module and the drives are connected together in a network using fiber optic cables to form the multi-axis control system. Drives which are connected together on the fiber optic network behave in the same way as individual axes. Motion control instructions transmitted by the TSX CSY 84 module are sent to each drive on the network, and in return the module receives the actual position values for each axis from the network.

Maximum Number of Real Axes Controlled by one Module

A TSX CSY 84 module controls a maximum of 8 real axes, that is, axes associated with speed drives.

In addition to these real axes, the module can control:

- 4 imaginary axes
- 4 remote axes
- 4 sets of coordinated axes
- 4 sets of follower axes
- 7 cam profiles

Developing Applications

Applications are developed using a terminal (PC) equipped with PL7 Junior/Pro software to:

- configure the axes
- start the system
- adjust and diagnose the application

(See the application-specific setup manual “Motion Control on a SERCOS® network” - Reference 35001368)

SERCOS® Network Ring

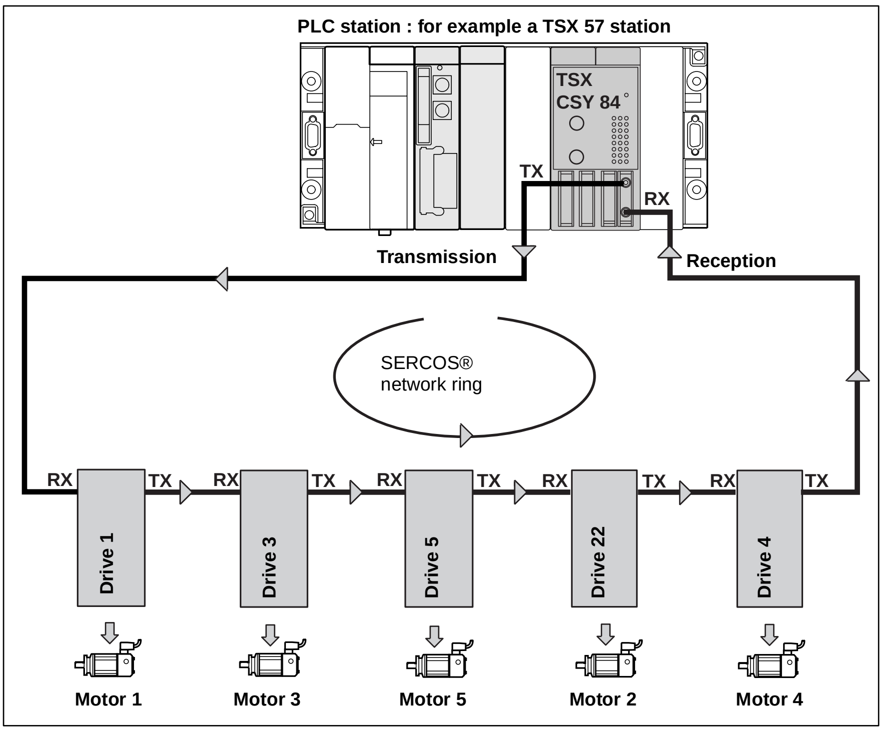
At a Glance

The TSX CSY 84 module performs the following operations via the SERCOS® fiber optic network ring:

- transmits motion control instructions defined by the application program to each axis
- in return receives, via the drives, the actual data transmitted by the various position sensors on the axes.

SERCOS® Network Ring

The diagram below shows an example of a SERCOS® network configuration comprising 5 LEXIUM servo drives, connected to a TSX CSY 84 module via fiber optic cables.



SERCOS® Network Ring, continued

Transmission of Commands and Reception of Data

The module coordinates the movement activities of the various axes installed on the network:

- It transmits to the drives, via the network, the motion control instructions for the various axes.
- It receives current data on each axis, via the network, and executes the required processing according to this data.

The module transmits the move instructions from the connector (TX), via the fiber optic cable, to the first drive, which interprets and executes them. The instructions are then transmitted to the next drive.

The last drive on the ring sends the current data on all the axes to the (RX) connector on the module via the fiber optic cable.

Note: If a drive on the SERCOS® network is powered down, this will cause the ring to open and the system to be set to fault mode.

Cycle Time

Data is transmitted in one direction only on the network, with a typical cycle time of 4 ms. This may be reduced to 2 ms in configuration mode if it is permitted by the volume of data. (See the application-specific setup manual “Motion Control on a SERCOS® network” - Reference 35001368)

Transmission Speed

The default transmission speed is 4 Mbauds. If the drives do not support this speed, it may be reduced to 2 Mbauds in configuration mode. (See the application-specific setup manual “Motion Control on a SERCOS® network” - Reference 35001368)

SERCOS® Network Ring, continued

Maximum Length of the Various Segments of the Network

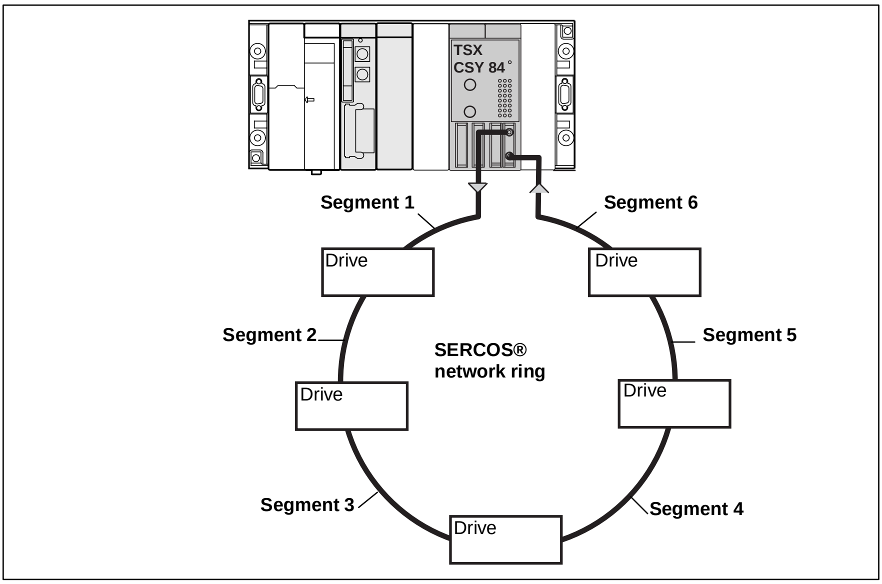
The maximum length of each segment of the SERCOS® network is limited to 40 meters when using the plastic fiber optic cables recommended by Schneider Automation.

Illustration of the Various Segments

The various segments of the SERCOS® network:

- TSX CSY 84 module / drive: segment 1
- Drive / drive: segment 2 to n
- Drive / module: segment n+1

The diagram below shows the various segments of a SERCOS® network to which 5 drives are connected.



SERCOS® Network Ring, continued

Setting the Optical Power of the Transceiver According to the Length of the Segment

Each component on the SERCOS® network (TSX CSY 84 module and drives) has a fiber optic transceiver.

The operator should set the optical power of each fiber optic transceiver according to the length of the segment.

- Optical power of segment 1 (module / first drive): this is always provided by the fiber optic transceiver of the TSX CSY 84 module. The optical power is set in configuration mode using PL7 Junior / Pro software by defining a percentage of the optical power according to the length of the segment. (See the application-specific setup manual “Motion Control on a SERCOS® network” - Reference 35001368)

Length of the segment (in meters)	**Optical power** (as a percentage of the total power)
$0 < L \leq 15$	66%
$15 < L \leq 40$	100%

- Optical power of the other segments (drive / drive and last drive / module): This is always provided by the fiber optic transceiver of the drive. The optical power is set using UniLink software by defining only the length of the segment.

Fiber Optic Cables

4

At a Glance

Introduction

This chapter presents the fiber optic cables used to connect the various components of the SERCOS network (TSX CSY 84 module and drives).

What's in this Chapter

This chapter contains the following topics:

Pre-Equipped Fiber Optic Cables

At a Glance

Schneider Automation has a range of 1 mm diameter plastic fiber optic cables for connecting the various components on the SERCOS network (TSX CSY 84 module and speed drives). Each cable is equipped with an SMA connector at both ends.

List of Cables

The following table gives the part number and length of each cable.

Part number	Length
990 MCO 00001	0.3 meters
990 MCO 00003	0.9 meters
990 MCO 00005	1.5 meters
990 MCO 00015	4.5 meters
990 MCO 00055	16.5 meters

Pre-Equipped Fiber Optic Cables, continued

Recommend-ations

The following recommendations must be followed when installing fiber optic cables:

CAUTION:

Recommendation concerning the radius curvature of the cables

The minimum radius curvature for this type of cable, is 25 mm.

Failure to follow this recommendation may lead to the cables being damaged.

CAUTION:

Recommendation concerning the tension exerted on the cables during installation

The maximum tension on the cables during installation should not exceed 6 Kg.

Failure to follow this recommendation may lead to the cables being damaged.

Maximum permissible temperature: - 40°C...+80°C.

Kits for Creating Fiber Optic Cables on Request

At a Glance

Schneider Automation offers two kits for creating cable on request:

- 1 tool kit
- 1 equipment kit, consisting of one cable and connectors.

Tool Kit

The table below gives the part number and contents of the tool kit

Part number	Contents	
	Quantity	Description
990 MCO KIT 00	1	Instructions for creating the cable
	1	Cable stripping tool
	1	Crimping pliers for connectors
	1	25W soldering iron

Equipment Kit

The table below gives the part number and contents of the equipment kit

Part number	Contents	
	Quantity	Description
990 MCO KIT 01	12	SMA type connectors
	12	Insulating sleeves
	1	Plastic fiber optic cable (30 meters long)

Specifications, Standards and Operating Conditions

5

Introduction

This chapter presents the specifications of the TSX CSY 84 module and the SERCOS network

What's in this Chapter

This chapter contains the following topics:

Module Specifications

Electrical Specifications

The following table gives the electrical specifications of the module.

Description of the parameters	**Values**	
	Typical	**Maximum**
Current consumption of the module on the 5V of the rack power supply	1.8 A	2 A
Power dissipated in the module	9 W	10 W
Optical fiber outputs	Conforming to standard EN 61491	

Operating and Storage Temperature/ Relative Humidity/ Altitude

The following table gives the specifications of the module.

Description of the parameters	**Values**
Operating temperature	0 to 60°C
Storage temperature	-25°C to 70°C
Relative humidity (without condensation)	5% to 95%
Operating altitude	0 to 2000 m

SERCOS® Network Specifications

Specifications Table

The following table gives the main specifications of the SERCOS® network.

Description of the parameters	Values
Addresses	1...254
Baud rate	2 or 4 Mbauds, configurable via the software
Cycle time	4 ms

Standards and Operating Conditions

Standards

Standards identical to those applied to Premium PLCs.
(See the Premium PLC Installation Manual TSX DM 57 33E - Volume 1-Part D).

Standard EN 61491: Electrical equipment for industrial machines. Serial data link for realtime communication between control units and drive devices

Operating Conditions and Requirements Relating to the Environment

These are identical to those applied to Premium PLCs.
(See the Premium PLC Installation Manual TSX DM 57 33E - Volume 1-Part D).

Compatible Speed Drives

6

At a Glance

Introduction

This chapter gives a list of speed drives which are compatible with the SERCOS offer on Premium PLCs.

What's in this Chapter

This chapter contains the following topic:

List of Speed Drives

List of Drives from the Schneider Automation Offer

Schneider Automation has a range of speed drives which are compatible with the SERCOS offer on Premium PLCs. The following table gives the part number and description of each speed drive.

Part Number	Description
MHDS 1004 N00	LEXIUM speed drive, 1.5 A rms continuous current
MHDS 1008 N00	LEXIUM speed drive, 3 A rms continuous current
MHDS 1017 N00	LEXIUM speed drive, 6 A rms continuous current
MHDS 1028 N00	LEXIUM speed drive, 10 A rms continuous current
MHDS 1056 N00	LEXIUM speed drive, 20 A rms continuous current

Other Drives

Any drive which complies with standard EN 61491 can be used with the TSX CSY 84 module.