Modicon Premium PLCs

TSX 57/PCX 57
Analog and Weighing
Installation Manual Volume 5

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Document Set

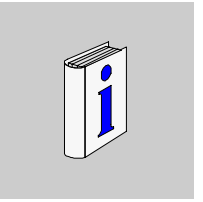
At a Glance

This manual consists of 5 Volumes :

- Volume 1
  - Racks / Power supplies / Processors
  - Start-up / Diagnostics / Maintenance
  - Standards and conditions of service
  - Process power supply
- Volume 2
  - Discrete Interfaces
  - Safety
- Volume 3
  - Counting
  - Movement control
- Volume 4
  - Communication
  - Bus and network interfaces
- Volume 5
  - Analog
  - Weighing

Table of Contents

About the Book



At a Glance

Document Scope

This manual describes the hardware installation of the Premium analog and weighing modules.

Validity Note

This updated version of the manual acknowledges the recent functionality of the analog and weighing modules

Related Documents

Title of Documentation	Reference Number
Premium PLCs – Hardware installation manual	TSX DM 57 4X E
PL7 Junior / Pro – Premium PLCs Application	TLX DS 57 PL7 4X E

User Comments

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Implementation of analog modules

I

This Part at a Glance

Aim of this Part

This part introduces the implementation of the range of Premium PLC analog input and output modules, as well as the dedicated TELEFAST 2 pre-cabling accessories.

What's in this Part?

This part contains the following chapters:

General introduction to analog modules

1

This Chapter at a Glance

Aim of this Chapter

This chapter gives a general introduction to analog input/output modules.

What's in this Chapter?

This chapter contains the following topics:

General description of analog modules

General

There are two types of Premium analog modules available:

- high level voltage/current, thermocouple and thermowell input. The input modules offer :
  - 16 channels for the TSX AEY 16••,
  - 8 channels for the TSX AEY 8••,
  - 4 channels for the TSX AEY 4••.
- high level voltage/current outputs on individual or shared channels. The output modules offer :
  - 8 channels for the TSX ASY 800,
  - 4 channels for the TSX ASY 410.

They are equipped with a 25 pin Sub-D connector (TSX AEY 420/800/810 and TSX ASY 800), and two 25 pin Sub-D connectors (TSX AEY 1600/1614) or a screw terminal block (TSX AEY 414 and TSX ASY 410).

They are standard format modules, which occupy a single position in the TSX RKY••• racks. They can be installed in all positions on the rack except for the first two (PS and 00) which are reserved for the rack power supply module (TSX PSY•••) and the processor module (TSX 57•••) respectively.

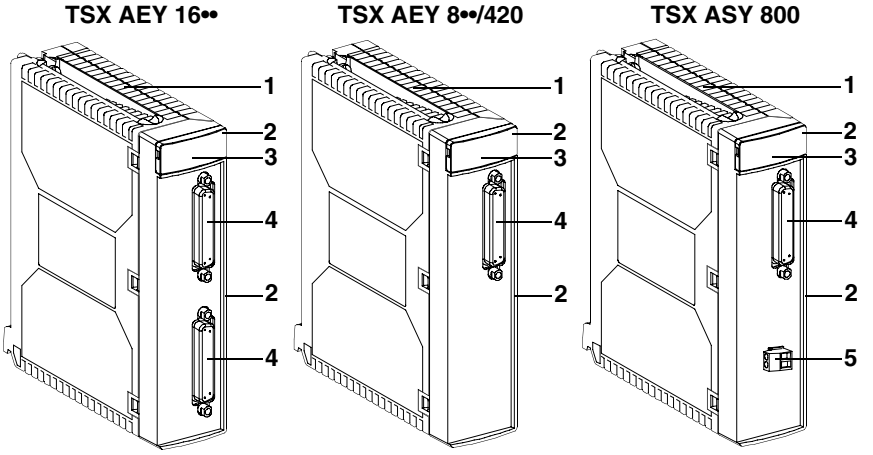
Physical description of analog modules with Sub-D connector(s)

At a Glance

The physical description of the analog modules with connector(s) is given below. These modules include the references:TSX AEY 16••/8••/420 and TSX ASY 800.

Illustration

The following diagrams show the different modules with Sub-D connector(s) :



Elements

The following table describes the different elements of the analog modules with Sub-D connector(s):

Number	Description
1	Rigid body supports and protects the electronic card.
2	Reference label for the module (visible on the front and right-hand side of the module).
3	Display panel showing operating modes and faults.
4	25 pin Sub-D connector, for connecting sensors or pre-actuators.
5	24 VDC external power supply terminal block.

Physical description of the analog modules with terminal block TSX BLY 01

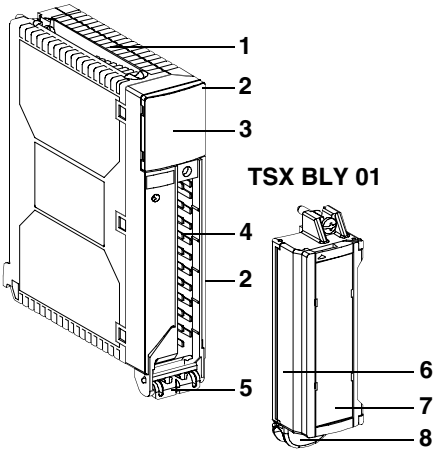
At a Glance

The physical description of the terminal block analog modules is given below. These modules include the references: TSX AEY 414 and TSX ASY 410.

Illustration

The diagram below shows the different screw terminal block modules :

TSX AEY 414 et TSX ASY 410



Elements

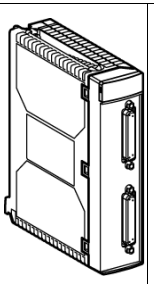
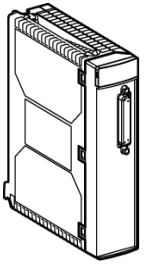
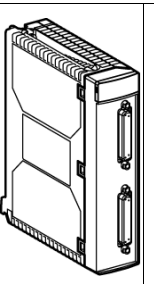
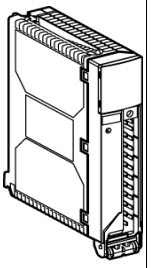
The following table describes the different elements of the screw terminal block analog modules :

Number	Description
1	Rigid body supports and protects the electronic card.
2	Reference label for the module (visible on the front and right-hand side of the module).
3	Display panel showing operating modes and faults.
4	Connector receiving the TSX BLY 01 screw terminal block.
5	Module encoder.
6	Pull-out screw terminal block (TSX BLY 01), for connecting sensors or pre-actuators.
7	Screw terminal block access panel; also where you will find the terminal block cabling label and channel label.
8	Terminal block encoder.

Catalog of Analog Input Modules

Analog Input Modules

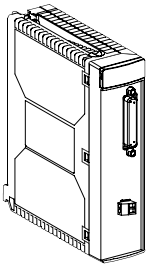
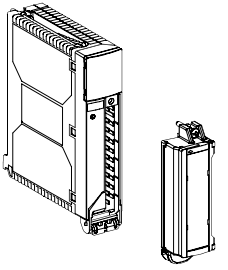
The following table shows the catalog of analog input modules:

Module type	Inputs					
						
Number of channels	16	8		4	16	4
Range	+/- 10 V 0..10 V 0..5 V 1..5 V 0..20 mA 4..20 mA				+/- 80 mV Thermocouple	+/- 10 V 0..10 V +/- 5 V 0..5 V 1..5 V 0..20 mA 4..20 mA -13..+63 mV 0..400 Ohms 0..3850 Ohms Thermowell Thermocouple
Current consumed at 24 VR	0 mA					
Current consumed at 5 V	270 mA (typ.) 380 mA (max.)		475 mA (typ.) 630 mA (max.)	500 mA (typ.) 800 mA (max.)	300 mA (typ.) 400 mA (max.)	660 mA (typ.) 940 mA (max.)
Voltage shared channel mode	Shared		+/- 200 VDC	Shared	+/- 100 VDC	+/- 200 VDC
Resolution	12 bits		16 bits			
Connections	2 x Sub-D 25 pin	1 x Sub-D 25 pin			2 x Sub-D 25 pin	20 pin screw terminal block
Dedicated TELEFAST 2	ABE-7CPA 02 ABE-7CPA 03	ABE-7CPA 02 ABE-7CPA 03	ABE-7CPA 02 ABE-7CPA 31	ABE-7CPA 02 ABE-7CPA 03 ABE-7CPA 21	ABE-7CPA 12	-
TSX•• reference	**AEY 1600**	**AEY 800**	**AEY 810**	**AEY 420**	**AEY 1614**	**AEY 414**

Catalog of Analog Output Modules

Analog Output Modules

The following table shows the catalog of analog output modules:

Module type	**Analog outputs**	
		
Number of channels	8	4
Range	+/- 10 V 0..20 mA 4..20 mA	
Current consumed at 24 VR	300 mA (typ.) (1) 455 mA (max.)	0 mA
Current consumed at 5 V	200 mA (typ.) 300 mA (max.)	990 mA (typ.) (2) 1220 mA (max.) (2)
Voltage shared channel mode	Shared	1500 Vrms insulation
Resolution	14 bits in voltage 13 bits in current	11 bits + sign
Connections	1 x 25 pin Sub-D 2 pin screw terminal block	20 pin screw terminal block
Dedicated TELEFAST 2	ABE-7CPA 02	ABE-7CPA 21
TSX•• reference	**ASY 800**	**ASY 410**
Key:		
(1)	**Only when internal 24 V is used (0 mA if an external power supply is used).**	
(2)	**+20 mA per active channel.**	

General Rules for Analog Module Implementation

2

At a Glance

Aim of this Chapter

This chapter presents the general rules for implementation of analog input/output modules.

What's in this Chapter?

This chapter contains the following topics:

Installing Analog Modules

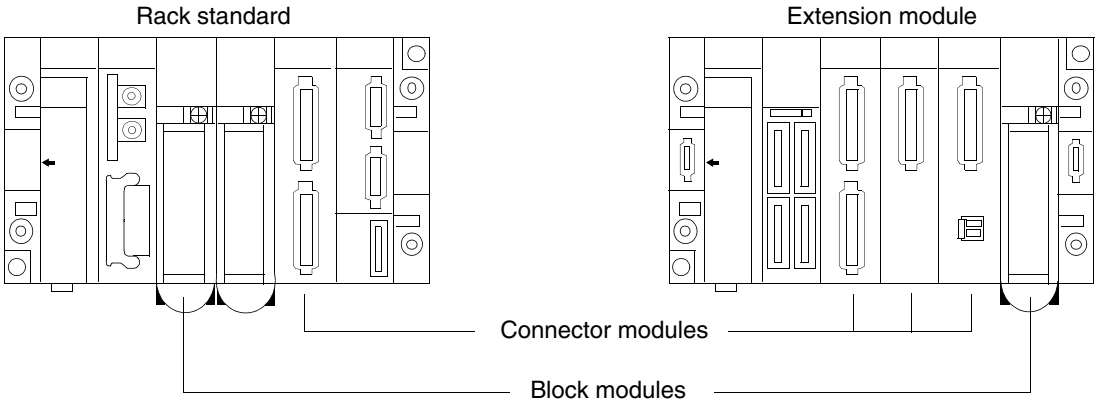
Introduction

The method and precautions relating to the installation analog modules are detailed below.

Installation

All Premium input/output analog modules are standard format and therefore occupy a single position on the TSX RKY••• racks.

They can be installed in all positions on the rack except for the first two (PS and 00) which are reserved for the power supply module of the rack (TSX PSY•••) and the processor module (TSX 57•••) respectively. They are powered by the rack back bus, and can be positioned equally on the standard rack or on an extendable rack.



Installation Precaution

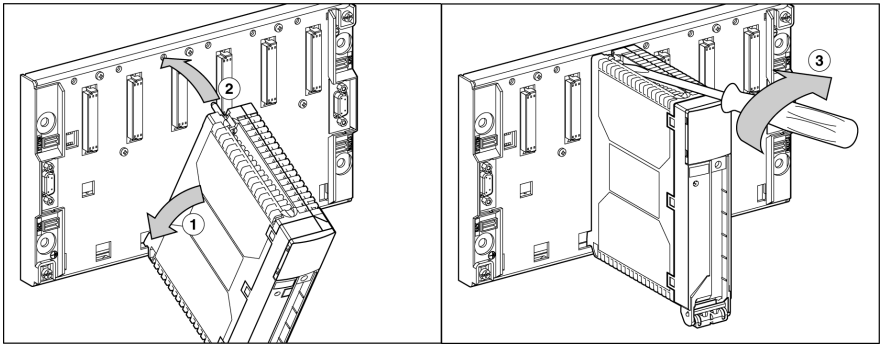
The modules can be handled without danger or risk of damage or disruption to the PLC, without cutting the rack's power supply by the rack.

When detecting terminal block presence using a shunt placed in the upper part of the terminal block, the shunt must always be screwed as tightly as possible. The terminal block must always be dismantled before dismantling the module. This avoids restoring the potential for inputs on the terminal block (up to 1700 V) during a module insulation fault.

	**CAUTION** Installation and dismantling of modules must be done with terminal block TSX BLY 01 disconnected. Similarly, the external 24 V terminal block of module TSX ASY 800 must be disconnected. **Failure to follow these instructions can result in injury or equipment damage.**

Installing the Module on the Rack

Intallation of the analog input/output modules is done on the rack in the following way :

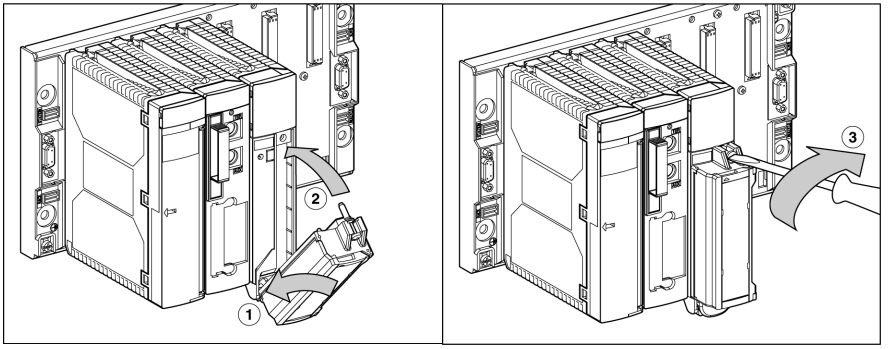


Step	Action
1	Position the two lugs at the rear of the module (the lower part of the module) in the centring holes located on the lower part of the rack.
2	Pivot the module upwards so as to pin it to the back connector of the rack.
3	Fix the module to the rack by tightening the screw located on the upper part of the module.

Note: If this screw is not tightened, the module will not stay in the position of the rack.

Installing the Screw Terminal Block

The TSX AEY 414 and TSX ASY 410 modules are completed with a screw terminal block referenced TSX BLY 01. Installing the screw terminal blocks in the corresponding analog modules is done in the following way:



Step	Action
1	Once the module is in place on the rack, install the terminal block by inserting the encoder of the terminal block (lower rear part) into that of the module (lower front part) as shown below.
2	Pivot the terminal block to bring it into position to pin it on the module.
3	Fix the terminal block to the module by tightening the screw located on the upper part of the terminal block on the module.

Note: If this screw is not tightened, the terminal block will not stay in the position of the module.

Coding the Screw Terminal Block

The first installation of a screw terminal block on a module, dedicated to this type of connectivity involves coding the terminal block. This coding is done by transferring 2 contacts from the module to the terminal block. These contacts are indexors. They are designed to stop the terminal block being installed on another module This avoids manipulation errors during replacement of a module and guarantees electric compatibility by module type.

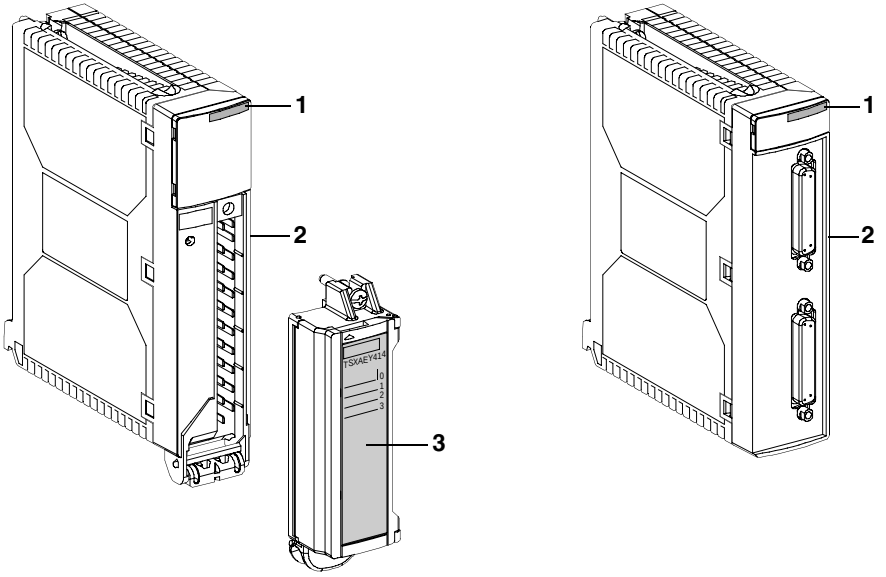
Labeling Analog Modules

At a Glance

Modules are labeled with marks on the front cover and on the right-hand side of the module.

Illustration

The following diagram shows the different elements for labeling analog modules :



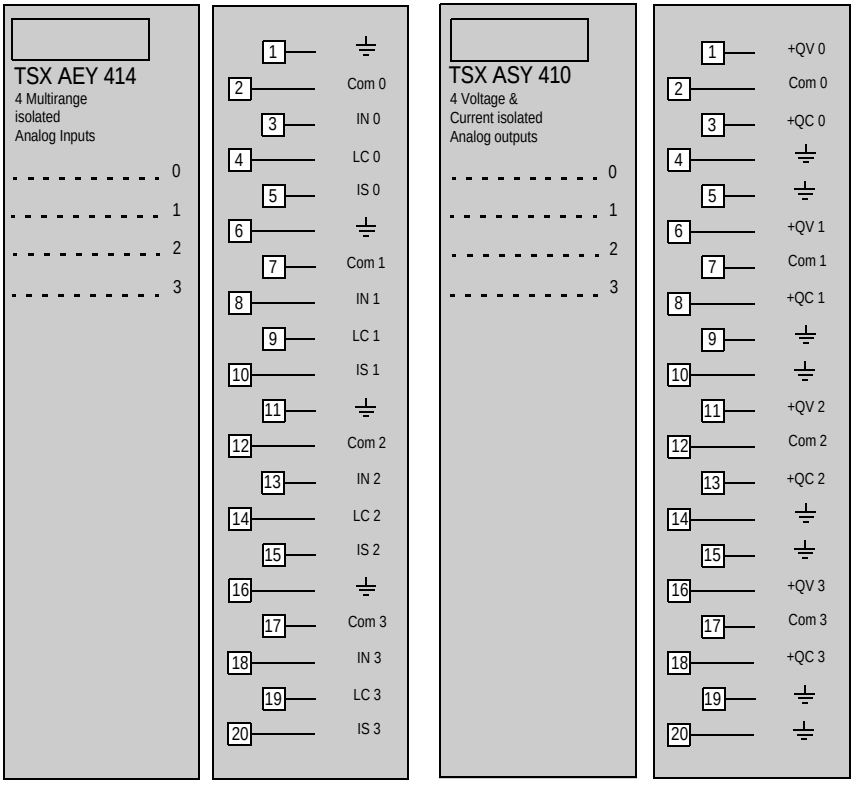
Elements

The following table describes the different labels on analog modules:

Number	Description
1	Badge engraved with the module reference.
2	Mark showing the module reference and type.
3	Terminal block label. This label is positioned inside the panel, and repeats the reference and type of the module which provides terminal block cabling. It can be supplemented with user information on the front and back.

Terminal block label

The following diagram shows the different labels of the screw terminal block analog modules TSX AEY 414 and TSX ASY 410 :



Wiring Precautions for Analog Modules

Introduction

In order to protect the signal from outside noises induced in series mode and noises in common mode, we recommend you take the following precautions.

Type of Conductors

Use twisted shielded pairs with a minimum diameter of 0.28 mm^2 (AWG24 gage).

Cable Shielding

- For modules fitted with a screw terminal block (TSX AEY 414 and TSX ASY 410): Connect the each end of the cable shields to the shield continuation terminals (ground terminals).
- For modules fitted with Sub-D connector(s) (TSX AEY 16••/8••/420 and TSX ASY 800):
  - Connection at the Sub-D connectors:
    Given that there are a large number of channels, a cable of at least 13 twisted pairs is used, with general shielding (outside diameter 15 mm maximum), fitted with a male 25 pin Sub-D connector for direct connection to the module. Connect the cable shielding to the cover of the male Sub-D connector. The controller is then grounded by the small tightening columns of the Sub-D connector. For this reason, it is required to screw the male Sub-D connector to its female base-plate.
  - TELEFAST connection:
    Connect the cable shielding to the terminals provided and the whole assembly to the cabinet ground.

Cable Connector Association

Multiple pairs of cables can be grouped for signals of the same type and with the same reference in relation to the ground.

Routing Cables

Separate as far apart as possible the measuring wires of the discrete input / output cables (especially relay outputs) and cables that transmit "power" signals.

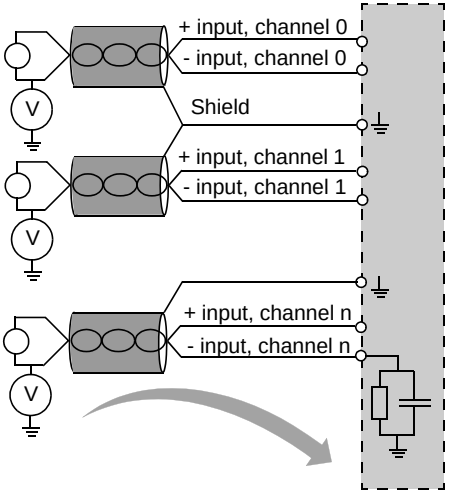
Reference of Sensors in Relation to the Ground

In order for the acquisition system to operate correctly, we recommend you follow the following precautions:

- the sensors must be close together (a few meters),
- all sensors must be referenced for a single point, which is connected to the ground of the module.

Using the Sensors Referenced in Relation to the Ground

The sensors are connected according to the following diagram:



If the sensors are referenced in relation to the ground, this may in some cases return a remote ground potential to the terminal or the Sub-D connector(s). It is therefore necessary to follow the following rules:

- this potential must be less than the safety voltage: for example, 48 V peak for France,
- setting a sensor point to a reference potential generates a leakage current. You must therefore check that all leakage currents generated do not disturb the system.

Using Pre-Actuators Referenced in Relation to the Ground

There are no specific technical constraints for referencing pre-actuators to the ground. For safety reasons, it is nevertheless preferable to avoid returning a remote ground potential to the terminal; this may be very different to the ground potential close by.

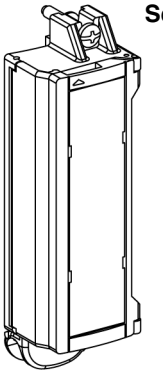
Wiring the TSX BLY 01 Screw Terminal Block

General

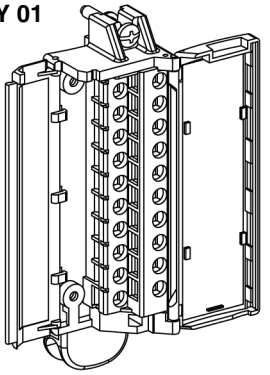
Screw connecting terminal blocks are fitted with captive screws. They are supplied with the screws unscrewed.

The diagram below shows the screw terminal block TSX BLY 01:

Screw terminal block TSX BLY 01



Closed ports



Open ports

The Wire-End Ferrules and Terminals

Each terminal block may receive bare wires, fitted with wire-end ferrules and open terminals.

The capacity of each terminal is:

- minimum: 1 wire of 0.2 mm^2 (AWG 24) with no wire-end ferrule;
- maximum: 1 wire of 2 mm^2 with no wire-end ferrule or 1 wire of 1.5 mm^2 with a wire-end ferrule.

Illustration of the wire-end ferrule and the open terminal:

(1) 5.5 mm maximum.

The maximum capacity of the terminal block is 16 wires of 1 mm^2 (AWG) + 4 wires of 1.5 mm^2 (AWG).

The U-shaped screws are molded at the end to accept screwdrivers :

- cross-shape Pozidriv N° 1,
- flat, with a diameter = 5 mm.

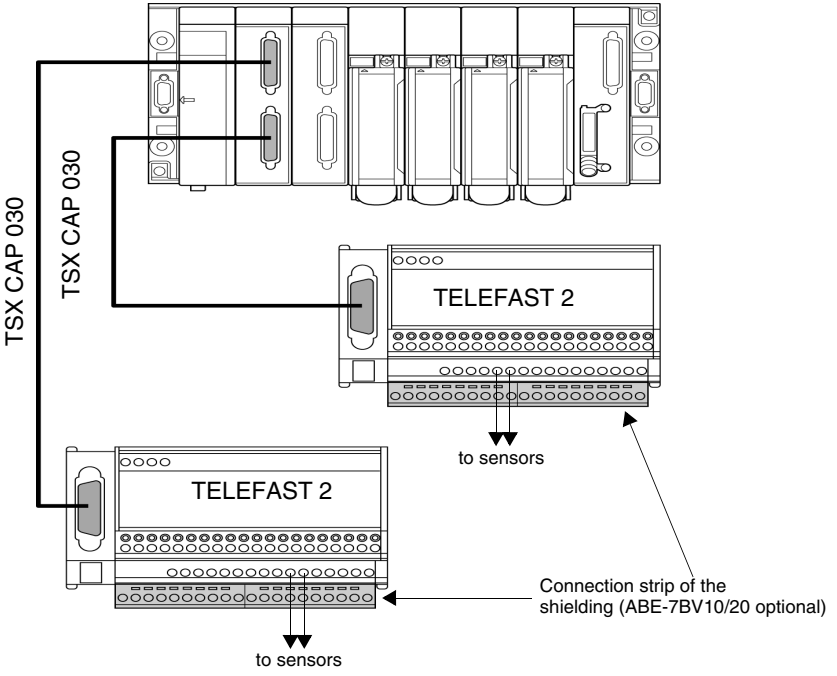
Note: The maximum tightening torque for the connecting terminal block screws is 0.8 N.m

TELEFAST 2 Wiring Accessories for Analog Modules

Introduction

The use of TELEFAST 2 wiring accessories simplifies installation of the TSX AEY 420/800/810/1600/1614 and TSX ASY 800 analog modules by providing access to inputs / outputs via screw terminal blocks.

The analog module is connected to TELEFAST 2 accessories via a 3-meter shielded cable, with the reference TSX CAP 030 and fitted at both ends with Sub-D 25 pin connectors.



The Different Accessories

There are four TELEFAST 2 wiring accessories for analog modules:

- **ABE-7CPA02** distributes 8 channels from a Sub-D 25 pin connector to screw terminal blocks,
- **ABE-7CPA03** distributes 8 channels from a Sub-D 25 pin connector to screw terminal blocks, and is also used for:
  - channel by channel supply of the 2 and 4 wire sensors with 24 V protected and restricted current voltage (to 30 mA),
  - continuity for current loops to be ensured when the Sub-D 25 pin connector is unplugged,
  - protection of current shunts in the modules against over-voltage.
- **ABE-7CPA21** distributes 4 channels from a Sub-D 25 pin connector to screw terminal blocks.
- **ABE-7CPA31** distributes 8 channels from a Sub-D 25 pin connector to screw terminal blocks, and is also used for:
  - channel by channel supply of the 2 and 4 wire sensors with 24 V protected and restricted current voltage (to 25 mA per channel), while retaining insulation between module channels.
  - protection of current shunts in the modules against over-voltage.
- **ABE-7CPA12** distributes 16 channels from two Sub-D 25 pin connectors to screw terminal blocks for thermocouple connection. This unit, which is equipped with a built-in silicon temperature probe, enables cold junction compensation to be performed at the connection terminal block level. It is possible to connect:
  - 16 thermocouple channels in internal cold junction compensation mode via TELEFAST 2,
- analog module TSX ASY 410 is connected to the TELEFAST accessory using one of the following cables:
  - - ABF-Y25S150: 1.5m long
  - - ABF-Y25S200: 2m long
  - - ABF-Y25S300: 3m long
  - - ABF-Y25S500: 5m long

  These cables include the TSX BLY 01 terminal block.

The following table lists which TELEFAST 2s can be used for each module:

Module	ABE-7CPA02	ABE-7CPA03	ABE-7CPA31	ABE-7CPA12	ABE-7CPA21
TSX AEY 420	X (1)	X (1)			X
TSX AEY 800	X	X			
TSX AEY 810	X		X		
TSX AEY 1600	X	X			
TSX AEY 1614				X	
TSX ASY 410					X (2)
TSX ASY 800	X				
Legend					
(1)	Only the first 4 channels are used				
(2)	Requires an ABF Y25S••• connection cable including a TSX BLY 01 terminal block				

Note: The ABE-7BV10 or ABE-7BV20 accessories facilitate the connection of shields.

Analog Module Fault Diagnostics

3

At a Glance

Aim of this Chapter

This chapter introduces the processing of hardware faults linked to analog input/ output modules.

What's in this Chapter?

This chapter contains the following topics:

Display of Analog Module Faults

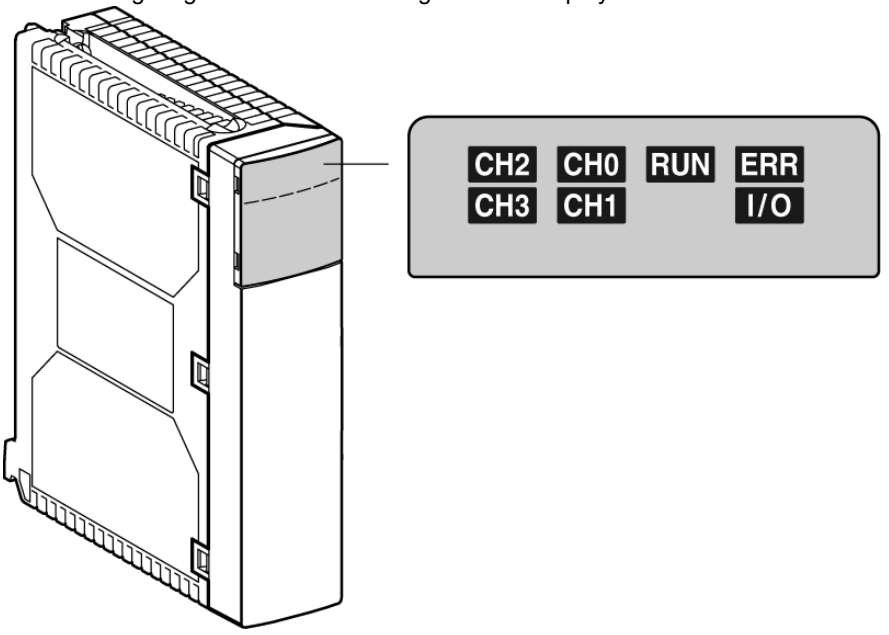
At a Glance

Analog modules have LEDs which show the module's status and the status of the channels. There are:

- Module status LEDs: RUN, ERR and I/O,
- Channels status LEDs: CH•.

Illustration

The following diagram shows the analog modules display screen:



Description

Three LEDs situated on each module indicate, according to their status (indicator on, flashing or off), the operating status of the module:

- The green RUN indicator: indicates the operating status of the module
- The red ERR indicator: indicates an internal fault in the module or a fault between the module and the remainder of the configuration.
- The red I/O indicator: indicates an external fault.

Note: The CH• status LEDs are not used on analog modules.

The various possible faults are listed together in the following table:

Indicator	**On** ●	**Flashing** ⊗	**Off** ○
RUN (green)	Operating normally	-	Module is faulty or off
ERR (red)	Internal fault, module unserviceable	Communication fault	No internal fault
I/O (red)	External faults: ● Overload or underload fault during calibration ● Range under/overflow fault.	Terminal block fault	No external fault
CH•	No channel status LED		

Analog module diagnostics

At a Glance

A faulty module makes itself evident by means of lit or flashing RUN, ERR and I/O LEDs.

Faults are classed in three groups : external errors, internal errors and other faults.

External errors

There are two types of external errors which make the **I/O LED light up**:

- **Measurement range overrun fault**
  This fault occurs when the measurement taken on the input line is outside the user-defined limits.
- **Sensor link fault (only on TSX AEY 414/1614)**
  This occurs when there is a connectivity problem between the module and one or more sensors.

Internal errors

Each module carries out a series of self-tests (watchdog, memory, analog/digital conversion string, etc.).

When an error occurs during these tests, an internal error is signaled. The **ERR LED lights up**.

The table below shows the various self-tests performed by the modules and whether the processor sees a possible error :

Self-test performed	**Status of LED ERR when an error occurs**	**Fault returned to the processor**
Watchdog test	Permanently lit	no
EPROM memory checksum		
X Bus interface test		
External RAM test		
EEPROM memory test		
Converters test (1)		yes
Internal references test (2)		
Key :		
(1) for the modules TSX AEY 414/1614		
(2) for the modules TSX AEY 800/810/1600		

If a module is inoperative and can no longer communicate with the processor, the latter is still informed about it by detection :

- either by the absence of the module,
- or by the fact that the module is switched off.

Other faults

The other faults include :

- **Terminal block fault**
  The terminal block fault occurs when at least one channel is used whilst the corresponding Sub-D connector or terminal block is missing.
- **External supply fault of the outputs (only with the TSX ASY 800)**
  The output supply fault occurs when an external supply is used to supply the module TSX ASY 800 and when this supply is detected as missing.
- **Communication fault**
  It can be caused by a hardware fault at rack back bus level, by a processor fault or extension cable fault.

Note: When there is a communication fault with the processor, the channel value images (at PLC processor level) are frozen at the last value present prior to the fault.

Fault diagnostics

The following table can be used to diagnose faults relating to the three LEDs: RUN, ERR and I/O :

Module status	**Status LEDs**		
	RUN	**ERR**	**I/O**
Normal operation	●	○	○
Module faulty or switched off	○	⊗	○
External errors: ● range under/overshoot ● external 24 V power supply fault	●	○	●
Internal error (module broken down): ● communication with CPU possible ● communication with CPU impossible	● ○	● ●	○ ○
Other faults: ● communication fault ● terminal block fault	● ●	⊗ ○	○ ⊗
Key :			
○ **LED unlit**			
⊗ **LED flashing:**			
● **LED lit:**			

Note: When a range under/overshoot fault occurs at the same time as a terminal block fault, the LEDs behave in the same way as for range under/overshoot (the I/O is lit).

Analog Input Module TSX AEY 414

4

At a Glance

Aim of this Chapter

This chapter introduces the TSX AEY 414 module, its characteristics and its connection to different sensors.

What's in this Chapter?

This chapter contains the following topics:

Introducing the TSX AEY 414 module

At a Glance

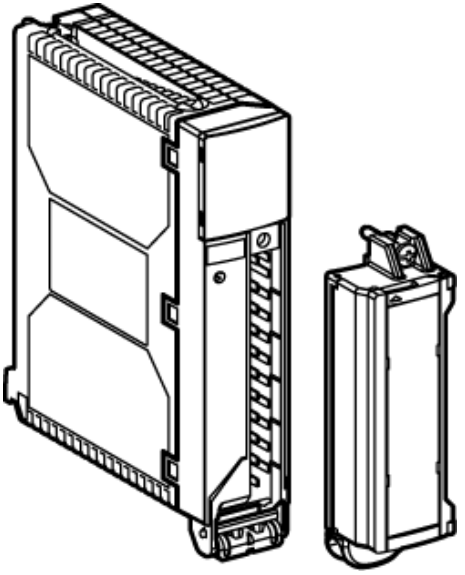
The TSX AEY 414 module is a multi-range acquisition device with four inputs isolated from each other. This module offers the following ranges for each of its inputs according to the selection made at configuration :

- thermocouple B, E, J, K, L, N, R, S, T, U or electrical range -13..63 mV,
- thermowell Pt100, Pt1000, Ni1000 in 2- or 4-wire or ohmic range: 0..400 Ohms and 0..3850 Ohms,
- high level +/- 10 V, 0..10 V, +/- 5 V, 0..5 V (0..20 mA with external shunt), or 1..5 V (4..20 mA with external shunt). It should be noted that the external shunts are supplied with the product.

Illustration

The following diagram shows the analog input module TSX AEY 414 :

TSX AEY 414



Note: The terminal block is supplied separately under the reference TSX BLY 01.

Characteristics of the TSX AEY 414 Module

Introduction

This part presents general characteristics for the TSX AEY 414 module.

General Characteristics

This table presents the general characteristics for the TSX AEY 414 module:

Type of inputs	Isolated inputs, low and high level, thermocouples and thermoprobes
Type of inputs	Multi-range
Number of channels	4
Acquisition cycle time	550 ms for the 4 channels
Analog / Digital converter	16 bits (0..65535 pulses)
Digital filtering	1st order (Time constant = 0 to 68.5 s)
Insulation: ● **between channels** ● **between channels and bus** ● **between channels and ground**	 2830 V rms 1780 V rms 1780 V rms
Isolation resistance under 500VDC between channel and ground	> 10 mOhms
Maximum over-voltage in differential mode authorized for inputs	+/- 30 VDC (switched on, without 250 Ω external shunt) +/-15 VDC (switched off, without 250 Ω external shunt)
Maximum over-voltage authorized for inputs	+/-25 mA (switched on/off, with 250 Ω external shunt)
Linearization	Automatic
Common mode voltage acceptable in operation: ● **between channels** ● **between channels and ground**	 200 VDC or 415 VAC 100 VDC or 240 VAC
Cold junction compensation ● **internal** ● **external class A Pt100 on channel 0**	 Automatic Between -5 and +85°C
Thermoprobe current	2.5 mA DC at 100 Ω 0.559 mA DC at 1000 Ω
Maximum power dissipation	4.7 W
PLC Standards	IEC1131, IEC801, IEC68, UL508, UL94
Sensor Standards	IEC584, IEC751, DIN43760, DIN43710, NFC42-330

Input Characteristics

This table presents the general characteristics for the current / voltage inputs of the TSX AEY 414 module:

Measurement range	Input impedance)	Full scale (FS)	Maximum error at 25°C (2)	Maximum error from 0 to 60°C (2)
+/- 10 V	10 MΩ	10 V	0.27 % of FS	0.50 % of FS
0..10 V	10 MΩ	10 V	0.16 % of FS	0.39 % of FS
+/- 5 V	10 MΩ	5 V	0.27 % of FS	0.50 % of FS
0..5 V (1)	10 MΩ	5 V	0.22 % of FS	0.45 % of FS
1..5 V (1)	10 MΩ	5 V	0.27 % of FS	0.56 % of FS
0..20 mA (1)	250 Ω	20 mA	0.36 % of FS	0.69 % of FS
4..20 mA (1)	250 Ω	20 mA	0.45 % of FS	0.86 % of FS
-13.+63 mV	10 MΩ	63 mV	0.19 % of FS	0.44 % of FS
0..400 Ω		400 Ω	0.13 % of FS	0.27 % of FS
0..3850 Ω		3850 Ω	0.22 % of FS	0.48 % of FS
Legend:				
(1)		**The 0..5 V and 0..20 mA or 1..5 V and 4..20 mA ranges are configured in the same manner, with the only difference being whether or not a 250 Ω shunt is installed.**		
(2)		**For electric ranges, the precision values encompass the entire input dynamic.**		

Thermoprobe Input Characteristics

This table presents the general characteristics for the thermoprobe inputs of the TSX AEY 414 module:

Measurement range	Maximum error at 25°C	Maximum error from 0 to 60°C
Pt100 according to IEC	1.2°C	2.4°C
Pt100 according to IEC	2.5°C	5.0°C
Ni1000 according to DIN	1.1°C	2.0°C

Note: For thermoprobe ranges, precision values are taken from the middle of the standardized range with a 2 or 4-wire configuration. These values comply with the connection requirements described in the chapter Connecting the TSX AEY 414 sensors (see *Connecting Sensors on the TSX AEY 414, p. 65*).

Thermocouple Input Characteristics

This table presents the general characteristics for the thermocouple inputs of the TSX AEY 414 module:

Measurement range	Maximum error at 25°C		Maximum error from 0 to 60°C	
	IC	EC	IC	EC
B	3.5°C	/	8.1°C	/
E	6.1°C	1.5°C	8.1°C	3.2°C
J	7.3°C	1.9°C	9.5°C	4.0°C
K	7.8°C	2.3°C	10.5°C	4.7°C
L	7.5°C	2.0°C	9.8°C	4.2°C
N	6.0°C	2.0°C	8.7°C	4.3°C
R	6.0°C	3.2°C	11.0°C	7.7°C
S	6.6°C	3.4°C	12.0°C	8.5°C
T	6.6°C	1.5°C	8.8°C	3.3°C
U	5.4°C	1.5°C	7.3°C	3.1°C
Legend:				
IC	**With internal cold junction compensation:**			
EC	**With internal cold junction compensation: Values in this column were obtained from across channel 0 using a class A Pt100 probe.**			

Note: Precision values include internal or external cold junction compensation after a 30-minute stabilization period, and are taken from the middle of the standardized range.

Detailed Characteristics of TSX AEY 414 Module Inputs

At a Glance

The TSX AEY 414 module proposes 23 ranges for each of its inputs, which can be configured channel by channel.

Precision

Precision for each input is shown by the formula:

$$\text{Precision} = C + K \times M$$

Equation parameters:

Parameter	Meaning
C	Constant for the range in question
K	Coefficient of proportionality
M	Absolute value of the measurement

A measurement error is therefore made up of a constant value C and a value proportional to the measurement K, which can be different depending on measurement polarity.

For thermocouple ranges, measurement error also takes into account cold junction compensation and linearization errors, and for current ranges, external resistance error (shunt).

Diaphony

Diaphony is expressed in dB and is shown in the formula:

$$\text{Diaphony} = 20 \times \text{Log}_{10}(V_M / V_m)$$

Equation parameters:

Parameter	Meaning
$\mathbf{V_M}$	Full scale voltage in the least sensitive range
$\mathbf{V_m}$	Voltage error on the following channel, configured in the most sensitive range (due to the presence of V_M)

In the example, V_M equals +10 V and V_m is the error due to the presence of +10 V on the following channel configured in +/- 20 mV.

Common Mode Rejection

Common mode rejection between channel and ground is expressed in dB and is shown in the formula:

$$\text{CM Rejection} = 20 \times \text{Log}_{10}(V_{MC} / V_{em})$$

Equation parameters:

Parameter	Meaning
V_{MC}	Common mode voltage expressed in VDC or VAC (50 / 60 Hz)
V_{em}	Voltage error on the measurement (reduced by the conversion resolution) expressed in VDC

For a current range, common mode rejection can naturally be deduced from this formula.

For thermoprobe or thermocouple ranges, common mode rejection is not applicable.

Series Mode Rejection at 50 / 60 Hz

Series mode rejection at 50 / 60 Hz is expressed in dB and is shown in the formula:

$$\text{SM Rejection} = 20 \times \text{Log}_{10}(V_{MS} / V_{em})$$

Equation parameters:

Parameter	Meaning
V_{MS}	Series mode voltage expressed in peak to peak volts
V_{em}	Voltage error on the measurement (reduced by the conversion resolution) expressed in VDC

For a current range, series mode rejection can naturally be deduced from this formula.

For thermoprobe or thermocouple ranges, series mode rejection is not applicable.

Characteristics of the +/- 10 V Range

The following table presents the characteristics of the +/- 10 V range:

Full scale (FS)	10 V	
Conversion resolution	0.570 mV	
View resolution	1 mV	0.01 % of FS
Maximum error at 25°C • **For the 0..10 V range** • **For the -10..0 V range**	 + 2 mV + 0.0014 x M -2 mV +0.0025 x M	0.27 % of FS
Maximum error from 0 to 60°C	0.50 % of FS	
Input dynamic	+/-10 V	+/- 10000
Range overrun	+/-10.5 V	+/- 10500
CM rejection channel / ground • **with VDC voltage** • **with VAC 50 / 60 Hz voltage**	 95 dB 105 dB	
SM rejection at 50 / 60 Hz	35 dB	

Characteristics of the 0..10 V Range

The following table presents the characteristics of the 0..10 V range:

Full scale (FS)	10 V	
Conversion resolution	0.570 mV	
View resolution	1 mV	0.01 % of FS
Maximum error at 25°C	+ 2 mV + 0.0014 x M	0.16 % of FS
Maximum error from 0 to 60°C	0.39 % of FS	
Input dynamic	0..10 V	0..10000
Range overrun	-0.5..10.5 V	-500..10500
CM rejection channel / ground • **with VDC voltage** • **with VAC 50 / 60 Hz voltage**	 95 dB 105 dB	
SM rejection at 50 / 60 Hz	35 dB	

An error at a given temperature T can be deduced by linear extrapolation of the errors defined at 25 and 60°C according to the formula:

$$\varepsilon_T = \varepsilon_{25} + |T - 25| \times [\varepsilon_{60} - \varepsilon_{25}] / 35$$

Characteristics of the +/- 5 V Range

The following table presents the characteristics of the +/- 5 V range:

Full scale (FS)	5 V	
Conversion resolution	0.570 mV	
View resolution	0.5 mV	0.01 % of FS
Maximum error at 25°C ● **For the 0..5 V range** ● **For the -5..0 V range**	 +1.5 mV +0.0019 x M -1.5 mV +0.0024 x M	0.27 % of FS
Maximum error from 0 to 60°C	0.50 % of FS	
Input dynamic	+/- 5 V	+/- 10000
Range overrun	+/-5.25 V	+/- 10500
CM rejection channel / ground ● **with VDC voltage** ● **with VAC 50 / 60 Hz voltage**	 100 dB 110 dB	
SM rejection at 50 / 60 Hz	35 dB	

Characteristics of the 0.. 5 V Range

The following table presents the characteristics of the 0..5 V range:

Full scale (FS)	5 V	
Conversion resolution	0.570 mV	
View resolution	0.5 mV	0.01 % of FS
Maximum error at 25°C	+1.5 mV +0.0019 x M	0.22 % of FS
Maximum error from 0 to 60°C	0.45 % of FS	
Input dynamic	0..5 V	0..10000
Range overrun	-0.25..5.25 V	-500..10500
CM rejection channel / ground ● **with VDC voltage** ● **with VAC 50 / 60 Hz voltage**	 100 dB 110 dB	
SM rejection at 50 / 60 Hz	35 dB	

An error at a given temperature T can be deduced by linear extrapolation of the errors defined at 25 and 60°C according to the formula:

$$\varepsilon_T = \varepsilon_{25} + |T - 25| \times [\varepsilon_{60} - \varepsilon_{25}] / 35$$

Characteristics of the 1.. 5 V Range

The following table presents the characteristics of the 1..5 V range:

Scale range (FSR)	4 V	
Conversion resolution	0.570 mV	
View resolution	0.4 mV	0.01 % of FSR
Maximum error at 25°C	+3.2 mV +0.0019 x M	0.27 % of FSR
Maximum error from 0 to 60°C	0.56 % of FSR	
Input dynamic	1..5 V	0..10000
Range overrun	0.8..5.2 V	-500..10500
CM rejection channel / ground • **with VDC voltage** • **with VAC 50 / 60 Hz voltage**	 100 dB 110 dB	
SM rejection at 50 / 60 Hz	35 dB	

Characteristics of the 0.. 20 mA Range

The following table presents the characteristics of the 0..20 mA range:

Full scale (FS)	20 mA	
Conversion resolution	2.28 microA	
View resolution	0.002 mA	0.01 % of FS
Maximum error at 25°C	+ 0.006 mA + 0.0033 x M	0.36 % of FS
Maximum error from 0 to 60°C	0.69 % of FS	
Input dynamic	0..20 mA	0..10000
Range overrun	-1..21 mA	-500..10500
CM rejection channel / ground • **with VDC voltage** • **with VAC 50 / 60 Hz voltage**	 100 dB 110 dB	
SM rejection at 50 / 60 Hz	35 dB	

An error at a given temperature T can be deduced by linear extrapolation of the errors defined at 25 and 60°C according to the formula:

$$\varepsilon_T = \varepsilon_{25} + |T - 25| \times [\varepsilon_{60} - \varepsilon_{25}] / 35$$

The value includes the shunt (250 Ω - 0.1% - 25 ppm/°C). Influence of the shunt on precision can be reduced by using a more precise resistance (0.01% - 10 ppm/°C).

Characteristics of the 4.. 20 mA Range

The following table presents the characteristics of the 4..20 mA range:

Scale range (FSR)	16 mA	
Conversion resolution	2.28 microA	
View resolution	1.6 microA	0.01 % of FSR
Maximum error at 25°C	+0.0192 mA + 0.0033 x M	0.45 % of FSR
Maximum error from 0 to 60°C	0.86 % of FSR	
Input dynamic	4..20 mA	0..10000
Range overrun	3.2..20.8 mA	-500..10500
CM rejection channel / ground • **with VDC voltage** • **with VAC 50 / 60 Hz voltage**	 100 dB 110 dB	
SM rejection at 50 / 60 Hz	35 dB	

Characteristics of the -13..63 mV Range

The following table presents the characteristics of the -13..63 mA range:

Range	-13...63V	
Full scale (FS)	63 mV	
Conversion resolution	0.00202 mV	
View resolution	0.0063 mV	0.01 % of FS
Maximum error at 25°C • **For the 0..63 mV range** • **For the -13..0 mV range**	 +0.018 mV +0.001581 x M -0.018 mV +0.004581 x M	0.19 % of FS
Maximum error from 0 to 60°C	0.45 % of FS	
Input dynamic	-13..63 mV	-2064..10000
Range overrun	-13..63 mV	-2064..10000
CM rejection channel / ground • **with VDC voltage** • **with VAC 50 / 60 Hz voltage**	 > 140 dB > 150 dB	
SM rejection at 50 / 60 Hz	> 35 dB	

An error at a given temperature T can be deduced by linear extrapolation of the errors defined at 25 and 60°C according to the formula:

$$\varepsilon_T = \varepsilon_{25} + |T - 25| \times [\varepsilon_{60} - \varepsilon_{25}] / 35$$

Characteristics of the 0..400 Ohms Range

The following table presents the characteristics of the 0..400 Ohms range:

Full scale (FS)	400 Ohms	
Conversion resolution	31 mOhms	
View resolution	40 mOhms (1)	0.01 % of FS
Maximum error at 25°C	63 mOhms + 0.001180 x M	0.13 % of FS
Maximum error from 0 to 60°C	0.27 % of FS	
Input dynamic	0..400 Ohms	0..10000
Range overrun	0..400 Ohms	0..10000
CM rejection channel / ground • **with VDC voltage** • **with VAC 50 / 60 Hz voltage**	 > 110 dB > 120 dB	
SM rejection at 50 / 60 Hz	> 35 dB	

Characteristics of the 0..3,850 Ohms Range

The following table presents the characteristics of the 0..3,850 Ohms range:

Full scale (FS)	3,850 Ohms	
Conversion resolution	139 mOhms	
View resolution	385 mOhms (1)	0.01 % of FS
Maximum error at 25°C	2.114 mOhms +0.001647 x M	0.22 % of FS
Maximum error from 0 to 60°C	0.48 % of FS	
Input dynamic	0..3850 Ohms	0..10000
Range overrun	0..3850 Ohms	0..10000
CM rejection channel / ground • **with VDC voltage** • **with VAC 50 / 60 Hz voltage**	 > 110 dB > 120 dB	
SM rejection at 50 / 60 Hz	> 35 dB	

An error at a given temperature T can be deduced by linear extrapolation of the errors defined at 25 and 60°C according to the formula:

$$\varepsilon_T = \varepsilon_{25} + |T - 25| \times [\varepsilon_{60} - \varepsilon_{25}] / 35$$

(1) Redefine the terminals with the User scale to obtain the converter resolution.

Characteristics of the Thermowell Ranges for the TSX AEY 414

At a Glance

The table below shows the maximum error of accuracy values, at 25°C, of the thermowell ranges Pt100, Pt1000 and Ni1000 :

Temperature		**Thermowell Pt100**	**Thermowell Pt1000**	**Thermowell 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	
Input dynamic		**-200..850°C** **-328..1562°F**	**-200..800°C** **-328..1472°F**	**-60..250°C** **-76..482°F**
Key:				
(1)	**These values are given in the middle of the thermowell range.**			
(2)	**Ambient temperature of TSX AEY 414**			

Note: Accuracies are given for 4-wire connections and include the errors and drifts of the source of the current, 2.5 mA (Pt100) or 0.55903 mA (Pt1000 or Ni1000). The self-heating effect introduces no significant error to the measurement, whether the probe is in the air or in the water.

The table below shows the maximum error of accuracy values, from 0 to 60°C, of the thermowell ranges Pt100, Pt1000 and Ni1000 :

Temperature		**Thermowell Pt100**	**Thermowell Pt1000**	**Thermowell 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 of 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 dynamic		**-200..850°C** **-328..1562°F**	**-200..800°C** **-328..1472°F**	**-60..250°C** **-76..482°F**
Key:				
(1)	**These values are given in the middle of the thermowell range.**			

Note: Accuracies are given for 4-wire connections and include the errors and drifts of the source of the current, 2.5 mA (Pt100) or 0.55903 mA (Pt1000 or Ni1000). The self-heating effect introduces no significant error to the measurement, whether the probe is in the air or in the water.

The error at any temperature T can be deduced by linear extrapolation of the errors defined at 25 and 60°C following the formula :

$$\varepsilon_T = \varepsilon_{25} + |T - 25| \times [\varepsilon_{60} - \varepsilon_{25}] / 35$$

Reference standards:

- thermowell Pt100/Pt1000: NF C 42–330 June 1983 and IEC 751, 2nd edition 1986,
- thermowell Ni1000: DIN 43760 September 1987.

Characteristics of the TSX AEY 414 Thermocouple Range in Degrees Celsius

At a Glance

The following tables show the measuring chain errors for the different thermocouples B, E, J, K, N, R, S and T in degrees Celsius. These values take into account:

- The values given below are valid regardless of the type of cold junction compensation: TELEFAST or Pt100 class A.
- The cold junction temperature considered in the precision calculation is 25°C.
- The resolution is given with a mid-range operating point.
- The values include: electrical errors on the acquisition system for input channels and cold junction compensation, software errors and interchangeability errors on the cold junction compensation sensors. Thermocouple sensor errors are not taken into account.

Thermocouples B, E, J and K

The table below shows the maximum precision error values for thermocouples B, E, J and K at 25°C.

Temperature		Thermocouple B	Thermocouple E		Thermocouple J		Thermocouple K	
Conversion resolution (1)		0.24°C	0.026°C		0.037°C		0.048°C	
View resolution		0.1°C	0.1°C		0.1°C		0.1°C	
Maximum error at 25°C (2)		IC / EC (3)	IC	EC	IC	EC	IC	EC
Operating point	-200°C		16.8°C	2.7°C			18.7°C	3.3°C
	-100°C		9.5°C	1.7°C			9.5°C	1.8°C
	0°C		7.5°C	1.5°C	7.4°C	1.5°C	7.5°C	1.6°C
	100°C		6.7°C	1.4°C	7.1°C	1.5°C	7.4°C	1.7°C
	200°C		6.2°C	1.5°C	7.1°C	1.7°C	7.8°C	1.9°C
	300°C		6.1°C	1.5°C	7.3°C	1.8°C	7.6°C	2.0°C
	400°C		6.1°C	1.7°C	7.4°C	2.0°C	7.6°C	2.1°C
	500°C		6.2°C	1.8°C	7.5°C	2.1°C	7.8°C	2.3°C
	600°C	4.7°C	6.4°C	2.0°C	7.3°C	2.2°C	7.9°C	2.4°C
	700°C	4.0°C	6.6°C	2.1°C	7.0°C	2.2°C	8.2°C	2.6°C
	800°C	4.0°C	6.8°C	2.3°C			8.6°C	2.8°C
	900°C	3.8°C					8.9°C	3.1°C
	1,000°C	3.6°C					9.3°C	3.3°C
	1,100°C	3.5°C					9.8°C	3.6°C
	1,200°C	3.6°C					10.3°C	3.8°C
	1,300°C	3.6°C						
	1,400°C	3.5°C						
	1,500°C	3.5°C						
	1,600°C	3.7°C						
	1,700°C	3.9°C						
Input dynamic (4)		0..1802°C	-270..812°C		-210..1065°C		-270..1372°C	

Legend:	
(1)	These values appear in the middle of the thermocouple range.
(2)	IC: ambient temperature of the TSX AEY 414 (20°C) and automatic internal compensation. EC: ambient temperature of the TSX AEY 414 (30°C) and class A Pt100 automatic external compensation.
(3)	With thermocouple B, the type of cold junction compensation (internal or external) is not taken into account, as this 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.

Thermocouple L, N, R and S The table below shows the maximum precision error values for thermocouples L, N, R and S at 25°C.

Temperature		**Thermocouple L**		**Thermocouple N**		**Thermocouple R**		**Thermocouple S**	
Conversion resolution (1)		**0.036°C**		**0.05°C**		**0.16°C**		**0.19°C**	
View resolution		**0.1°C**		**0.1°C**		**0.1°C**		**0.1°C**	
Maximum error at 25°C (2)		**IC**	**EC**	**IC**	**EC**	**IC**	**EC**	**IC**	**EC**
Operating point	**-200°C**			19.6°C	4.0°C				
	-100°C			9.5°C	2.1°C				
	0°C	7.5°C	1.5°C	7.8°C	1.8°C	11.4°C	4.8°C	11.2°C	4.7°C
	100°C	7.1°C	1.5°C	7.0°C	1.8°C	8.1°C	3.5°C	8.3°C	3.5°C
	200°C	7.2°C	1.7°C	6.5°C	1.7°C	7.1°C	3.2°C	7.4°C	3.3°C
	300°C	7.3°C	1.9°C	6.2°C	1.8°C	6.5°C	2.9°C	6.9°C	3.1°C
	400°C	7.5°C	2.0°C	6.0°C	1.9°C	6.3°C	3.0°C	6.8°C	3.2°C
	500°C	7.4°C	2.1°C	6.0°C	2.0°C	6.2°C	3.0°C	6.8°C	3.3°C
	600°C	7.4°C	2.2°C	6.1°C	2.1°C	6.1°C	3.1°C	6.8°C	3.4°C
	700°C	7.1°C	2.2°C	6.2°C	2.2°C	6.1°C	3.1°C	6.6°C	3.3°C
	800°C	6.8°C	2.3°C	6.3°C	2.4°C	6.0°C	3.2°C	6.6°C	3.4°C
	900°C	6.7°C	2.3°C	6.5°C	2.6°C	6.0°C	3.2°C	6.6°C	3.5°C
	1,000°C			6.8°C	2.7°C	5.9°C	3.3°C	6.6°C	3.6°C
	1,100°C			7.0°C	2.9°C	5.9°C	3.3°C	6.6°C	3.7°C
	1,200°C			7.4°C	3.2°C	5.9°C	3.4°C	6.7°C	3.8°C
	1,300°C					6.0°C	3.5°C	6.8°C	3.9°C
	1,400°C					6.1°C	3.7°C	6.9°C	4.1°C
	1,500°C					6.3°C	3.8°C	7.2°C	4.3°C
	1,600°C					6.5°C	4.0°C	7.5°C	4.5°C
Input dynamic (3)		**-200..900°C**		**-270..1300°C**		**-50..1769°C**		**-50..1769°C**	

Legend:

(1)	**These values appear in the middle of the thermocouple range.**
(2)	**IC: ambient temperature of the TSX AEY 414 (20°C) and automatic internal compensation.** **EC: ambient temperature of the TSX AEY 414 (30°C) and class A Pt100 automatic external compensation.**
(3)	**Internal compensation: ambient temperature = 20 °C,** **External compensation: ambient temperature = 30 °C.**

Reference standards:

- Thermocouple L: DIN 43710, December 1985 edition
- 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.

Thermocouple T and U

The table below shows the maximum precision error values for thermocouples T and U at 25°C.

Temperature		**Thermocouple T**		**Thermocouple U**	
Conversion resolution (1)		**0.046°C**		**0.038°C**	
View resolution		**0.1°C**		**0.1°C**	
Maximum error at 25°C (2)		**IC**	**EC**	**IC**	**EC**
Operating point	**-200°C**	18.3°C	3.2°C		
	-150°C	13.0°C	2.4°C		
	-100°C	10.3°C	2.0°C		
	-50°C	8.7°C	1.7°C		
	0°C	7.7°C	1.6°C	7.7°C	1.6°C
	50°C	7.1°C	1.5°C		
	100°C	6.6°C	1.5°C	6.7°C	1.5°C
	150°C	6.2°C	1.5°C		
	200°C	5.9°C	1.5°C	5.8°C	1.5°C
	250°C	5.7°C	1.5°C		
	300°C	5.6°C	1.5°C	5.4°C	1.5°C
	350°C	5.5°C	1.6°C		
	400°C			5.4°C	1.6°C
	500°C			5.2°C	1.6°C
	600°C			5.0°C	1.7°C
Input dynamic (3)		**-270..400°C**		**-200..600°C**	

Legend:

(1)	**These values appear in the middle of the thermocouple range.**
(2)	**IC: ambient temperature of the TSX AEY 414 (20°C) and automatic internal compensation.** **EC: ambient temperature of the TSX AEY 414 (30°C) and class A Pt100 automatic external compensation.**
(3)	**Internal compensation: ambient temperature = 20 °C,** **External compensation: ambient temperature = 30 °C.**

Reference standards:

- Thermocouple U: DIN 43710, December 1985 edition,
- Thermocouple T: IEC 584-1, 1st edition 1977 and IEC 584-2, 2nd edition 1989.

Characteristics of the TSX AEY 414 Thermocouple Range in Degrees Fahrenheit

At a Glance

The following tables show the errors of the measuring chain for the different thermocouples B, E, J, K, N, R, S and T in degrees Fahrenheit. These values take into account:

- The precision values given below are valid regardless of the type of cold junction compensation: TELEFAST or Pt100 class A.
- The cold junction temperature considered in the precision calculation is 77°F.
- The resolution is given with a mid-range operating point.
- The precision values include: electrical errors on the acquisition system for input channels and cold junction compensation, software errors and interchangeability errors on the cold junction compensation sensors. Thermocouple sensor errors are not taken into account.

Thermocouples B, E, J and K

The table below shows the maximum precision error values for thermocouples B, E, J and K at 77°F:

Temperature		Thermocouple B	Thermocouple E		Thermocouple J		Thermocouple K	
Maximum error at 77°F (1)		IC / EC (2)	IC	EC	IC	EC	IC	EC
Operating point	-300°F		26.4°F	4.3°F			28.5°F	5.1°F
	-100°F		15.8°F	2.9°F			15.7°F	3.1°F
	0°F				13.6°F	2.7°F		
	100°F		12.8°F	2.6°F			13.2°F	2.9°F
	200°F				12.7°F	2.8°F		
	300°F		11.6°F	2.6°F			13.7°F	3.2°F
	400°F				12.8°F	3.0°F		
	500°F		11.0°F	2.7°F			13.8°F	3.5°F
	600°F				13.1°F	3.3°F		
	700°F		10.9°F	2.9°F			13.8°F	3.7°F
	800°F				13.4°F	3.6°F		
	900°F		11.1°F	3.2°F			13.9°F	4.0°F
	1000°F				13.4°F	3.9°F		
	1100°F	8.5°F	11.4°F	3.5°F			14.3°F	4.3°F
	1200°F				12.9°F	4.0°F		
	1300°F	7.3°F	11.8°C	3.9°F			14.7°F	4.7°F
	1400°F				12.5°F	4.0°F		
	1500°F	7.0°F	12.4°F	4.3°F			15.5°F	5.1°F
	1700°F	6.8°F					16.3°F	5.6°F
	1900°F	6.6°F					17.1°F	6.1°F
	2100°F	6.2°F					18.0°F	6.6°F
	2300°F	6.2°F					19.1°F	7.2°F
	2500°F	6.3°F						
	2700°F	6.4°F						
	2900°F	6.6°F						
	3100°F	7.0°F						
Input dynamic		32..3276°F	-454..1493°F		-346..1949°F		-454..2502°F	

Legend:	
(1)	IC: ambient temperature of the TSX AEY 414 (68°F) and automatic internal compensation. EC: ambient temperature of the TSX AEY 414 (86°F) and class A Pt100 automatic external compensation.
(2)	With thermocouple B, the type of cold junction compensation (internal or external) is not taken into account, as this has no effect on precision.
(3)	Internal compensation: Ambient temperature = 68°F External compensation: Ambient temperature = 86°F

Thermocouple L, N, R and S

The table below shows the maximum precision error values for thermocouples L, N, R and S at 77°F:

Temperature		Thermocouple L		Thermocouple N		Thermocouple R		Thermocouple S	
Maximum error at 77°F (1)		IC	EC	IC	EC	IC	EC	IC	EC
Operating point	-300°F			29.4°F	6.0°F				
	-100°F			15.7°F	3.4°F				
	0°F	14.9°F	2.8°F			21.9°F	8.8°F	21.2°F	8.6°F
	100°F			13.5°F	3.3°F				
	200°F	13.1°F	2.7°F			14.8°F	6.4°F	15.1°F	6.5°F
	300°F			12.0°F	3.1°F				
	400°F	12.7°F	2.9°F			12.8°F	5.7°F	13.3°F	6.0°F
	500°F			11.2°F	3.2°F				
	600°F	13.0°F	3.2°F			11.9°F	5.6°F	12.3°F	5.5°F
	700°F			10.9°F	3.3°F				
	800°F	13.3°F	3.5°F			11.2°F	5.3°F	12.1°F	5.7°F
	900°F			10.9°F	3.5°F				
	1000°F	12.4°F	3.8°F			11.0°F	5.3°F	12.1°F	5.9°F
	1100°F			10.9°F	3.8°F				
	1200°F	12.3°F	4.0°F			10.8°F	5.4°F	12.1°F	6.0°F
	1300°F			11.1°F	4.0°F				
	1400°F	12.8°F	4.0°F			10.7°F	5.5°F	12.0°F	6.2°F
	1500°F	12.2°F	4.0°F	11.5°F	4.3°F				
	1600°F					10.5°F	5.6°F	11.9°F	6.3°F
	1700°F			11.9°F	4.7°F				
	1800°F					10.7°F	5.7°F	11.9°F	6.4°F
	1900°F			12.3°F	5.1°F				
	2000°F					10.6°F	6.0°F	3.9°F	2.3°F
	2100°F			13.0°F	5.5°F				
	2200°F					10.5°F	6.1°F	3.9°F	2.3°F
	2300°F			13.7°F	6.0°F				
	2400°F					10.5°F	6.2°F	4.0°F	2.4°F
	2600°F					10.4°F	6.3°F	4.1°F	2.5°F
	2800°F					10.4°F	6.4°F	4.2°F	2.6°F
	3000°F					10.7°F	6.7°F	4.4°F	2.8°F
Input dynamic (2)		-328..1652°F		-454..2372°F		-58..3216°F		-58..3216°F	

Legend:

(1)	IC: ambient temperature of the TSX AEY 414 (68°F) and automatic internal compensation. EC: ambient temperature of the TSX AEY 414 (86°F) and class A Pt100 automatic external compensation.
(2)	Internal compensation: Ambient temperature = 68°F External compensation: Ambient temperature = 86°F

Thermocouple T and U

The table below shows the maximum precision error values for thermocouples T and U at 77°F:

Temperature		Thermocouple T		Thermocouple U	
Maximum error at 77°F (1)		IC	EC	IC	EC
Operating point	-300°F	29.2°F	5.3°F		
	-200°F	21.1°F	4.0°F		
	-100°F	16.9°F	3.3°F		
	0°F	14.4°F	3.0°F	14.3°F	2.9°F
	100°F	13.0°F	2.8°F		
	200°F	11.9°F	2.7°F	12.3°F	2.8°F
	300°F	11.2°F	2.7°F		
	400°F	10.6°F	2.7°F	10.5°F	2.6°F
	500°F	10.3°F	2.7°F		
	600°F	10.0°F	2.7°F	9.8°F	2.7°F
	700°F	9.8°F	2.8°F		
	800°F			9.7°F	2.9°F
	1000°F			9.2°F	3.0°F
Input dynamic (2)		-454..752°F		-328..1112°F	

Legend:

(1)	**IC: ambient temperature of the TSX AEY 414 (68°F) and automatic internal compensation.** **EC: ambient temperature of the TSX AEY 414 (86°F) and class A Pt100 automatic external compensation.**
(2)	**Internal compensation: Ambient temperature = 68°F** **External compensation: Ambient temperature = 86°F**

TSX AEY 414 Screw Terminal Block TSX BLY 01

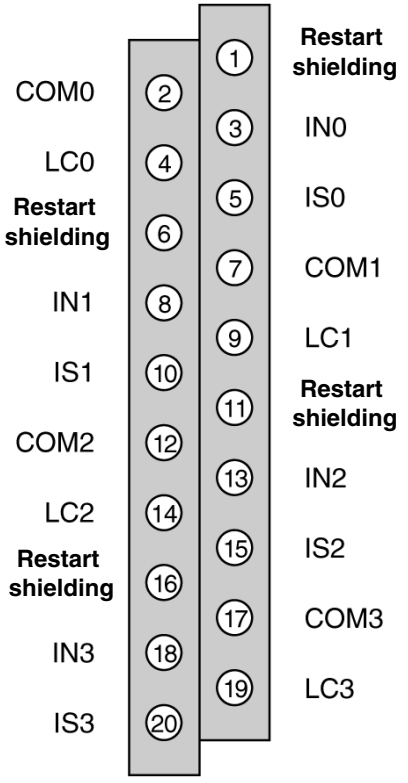
At a Glance

The module TSX AEY 414 is connected using the screw terminal block TSX BLY 01.

Terminal Block Pins

The connections of theTSX BLY 01 screw terminal block are shown below:

TSX BLY 01 terminal block



INx + Pole input of channel x
COMx - Pole input of channel x
ISx + Pole supply of the probe
LCx Line compensation

Connecting Sensors on the TSX AEY 414

General

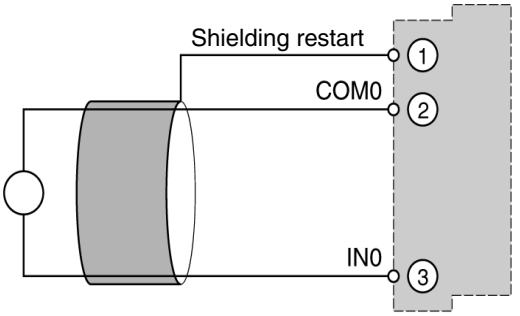
General recommendations:

- use shielded cables and link their shields to the terminals provided for this (Restart shielding),
- for high-level inputs and thermocouples, the "power source + wiring" resistance must be less than 100 Ohms so that the module performance is not impaired,
- for thermowell inputs (four threads installed), each of the threads must have a resistance less than 50 Ohms, which matches a brass wire of 0.6 mm diameter^2 and a maximum run, total length, of 3000 m,
- for Pt100 thermowell inputs, cabled as two wires, each of the wires must have a resistance lower than 50 mOhms (so that a measurement error due to Ohms loss in the cables is not introduced).

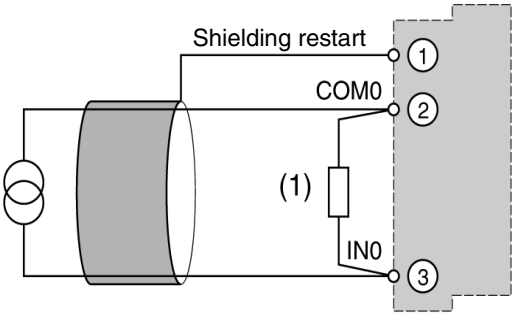
High-Level Sensors

Wiring example for a high-level voltage and current sensor on channel 0:

High-level voltage



High-level current

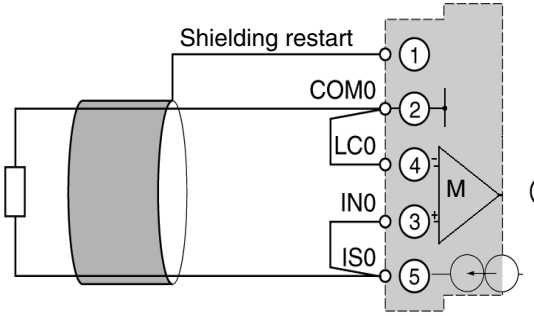


(1) Using range 0.20 mA or 4.20 mA requires the recording of an external shunt of 250 Ohms – 0.1 % - 1/2 W - 25 ppm/°C, parallel on the input limits. This shunt provided with the module in the form of a batch of four, which can also be separately supplied under the reference TSX AAK2.

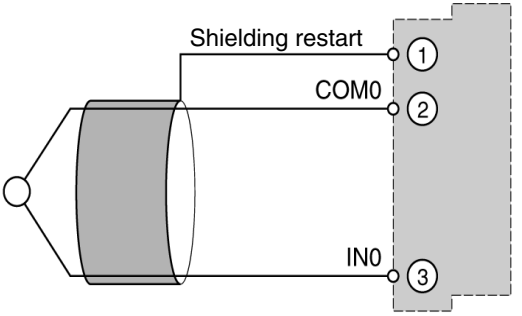
2 Thread Thermowell and 2 Thread Thermocouple

Wiring example for a 2 thread thermowell and a 2 thread thermocouple on channel 0:

Two thread thermowell



Two thread thermocouple

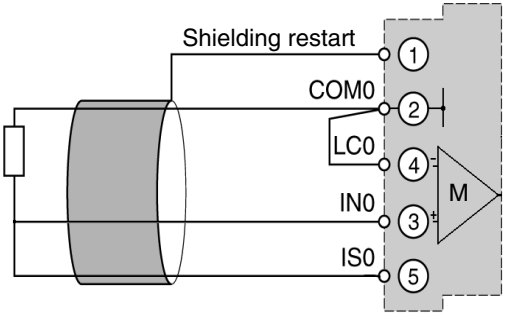


M Measurement

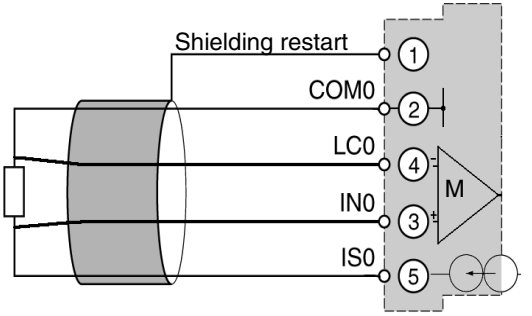
3 and 4 Thread Thermowells

Wiring example for 3 and 4 thread thermowells on channel 0:

Three thread thermowell



Four thread thermowell



M Measurement

Note: The module TSX AEY 414 was not designed to interface with the three thread Pt100 probes (no compensation effect), but it is nevertheless possible to connect this type of probe according to the diagram above. The precision obtained is therefore the same as in a 2 thread installment.

Recommendations for installing the thermocouples for TSX AEY 414

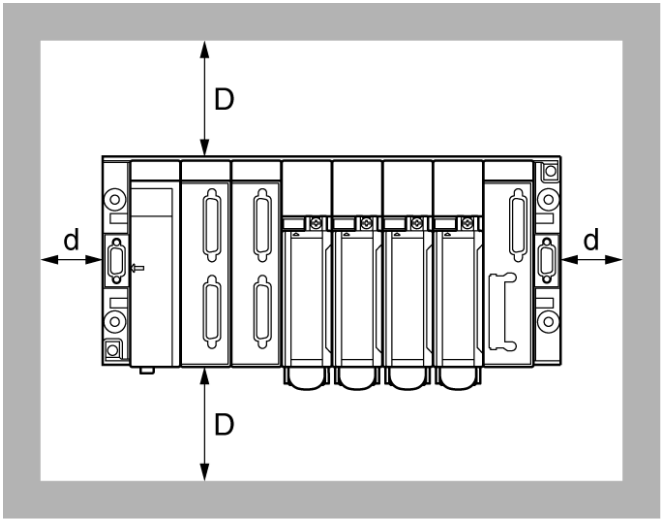
At a Glance

Described here you will find the recommendations for using a thermocouple with internal and external cold junction compensation.

Use of internal cold junction compensation

When measurements are made by thermocouple with cold junction compensation (and only in this case), it is advisable to follow the installation rules below :

- the PLC must not be directly ventilated, as there must be natural convection,
- variations in ambient temperature must be less than 5°C per hour,
- the immediately neighboring modules must dissipate between 2.2 W and 3.3 W, which corresponds to the most commonly used modules (TSX P57, TSX DEY 16D2, TSX DEY 32DK, TSX DEY 16FK, TSX DSY 16R5, TSX AEY 414, etc),
- module TSX AEY 414 must be installed in a PLC with a height clearance D, of a minimum of 150 mm, and a width clearance d, of 100 mm.



If these recommendations are followed, it can be installed in the open, in a cabinet or a case.

Not following the installation rules described above will not stop the module functioning. However, the accuracy of the measurements on the parameterized inputs in the thermocouple range will be altered. In conditions of stable ventilation and for a fixed configuration, the measurement will simply be offset to a stable value, for which you will be able to compensate, by proceeding to a "sensor alignment". (Sensor alignment for the TSX AEY 414 module)

Note: Because the thermocouple B is not affected by the cold junction compensation of 0 to 70°C, these installation constraints do not concern it.

Use of external cold junction compensation

The use of a thermocouple with external cold junction compensation requires that the temperature of the cold junction compensation is acquired with a Pt100 class A probe on channel 0 (probe not provided). Channels 1, 2 and 3 of the module can then be used for thermocouple measurement.

When used in this way, there are no particular installation constraints for module TSX AEY 414. However, the Pt100 probe must be placed near the terminal block.

Analog Input Module TSX AEY 420

5

At a Glance

Aim of this Chapter

This chapter introduces the TSX AEY 420 module, its characteristics and its connection to different sensors.

What's in this Chapter?

This chapter contains the following topics:

Introducing the TSX AEY 420 Module

At a Glance

The TSX AEY 420 module is a high level 4-input industrial measurement device.

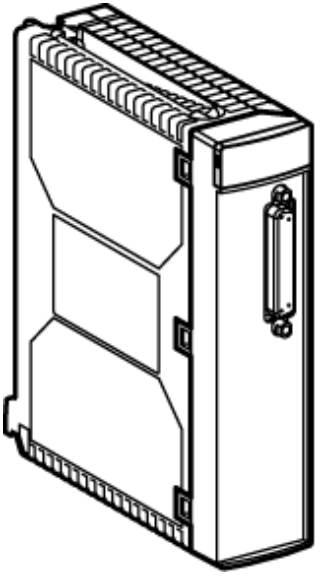
Used in conjunction with sensors or transmitters, it performs monitoring, measurement and continuous process control functions.

For each input, the TSX AEY 420 module provides a range of +/-10 V, 0..10 V, 0..5 V, 1..5 V, 0..20 mA or 4..20 mA, depending on selections made during configuration.

Illustration

The diagram below shows the TSX AEY 420 analog input module:

TSX AEY 420



Characteristics of the TSX AEY 420 Module

Introduction

This part presents general characteristics for the TSX AEY 420 module and characteristics of its analog inputs.

General characteristics

This table presents the general characteristics for the TSX AEY 420 module:

Type of inputs	High level inputs with common pulse
Type of inputs	Voltage / Current
Number of channels	4
Acquisition cycle time	1 ms for the 4 channels
Analog / Digital converter	16 bits (52,400 voltage pulses / 13,100 current pulses)
Monotonicity	Yes (for 15 bits)
Input filter	2nd order (Over-voltage coefficient = 0.5 V / Outage frequency at -6 dB = 3.4 kHz)
Insulation: • **between channels** • **between channels and bus** • **between channels and ground**	 Common pulse 500 V rms 500 V rms
Isolation resistance under 500VDC between channel and ground	> 10 mOhms
Maximum over-voltage authorized for inputs	+/- 30 V in voltage +/- 30 mA in current
Common mode voltage between the channels and ground that is acceptable in operation	240 VAC rms 150 VDC
Rejection of common mode channel / ground (DC, 50 Hz, 60 Hz)	80 dB
Diaphony between channels	80 dB
Detection of cut wire	No (except for 4..20 mA range)
Maximum power dissipation	4 W
Standards	IEC 1131, CSA22.2, UL508

Input characteristics

This table presents the general characteristics for the analog inputs of the TSX AEY 420 module:

Electric 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)	0.4 mV	0.4 mV	0.0015 mA
Input impedance: • **switched on** • **switched off**	 2.2 MOhms 10 kOhms	 2.2 MOhms 10 kOhms	 250 Ohms +/-0.1% 250 Ohms +/-0.1%
Maximum error at 25 °C	0.1 % of FS	0.2 % of FS	0.2 % of FS
Maximum error from 0 to 60 °C	0.2 % of FS	0.4 % of FS	0.4 % of FS
Temperature drift	30 ppm/°C	30 ppm/°C	60 ppm/°C
Range overrun	+/- 12.5V (+/-10V range) -2.5V..12.5V (0...10V range)	0..6.25V (0..5V range) 0..6V (1..5V range)	0..25mA (0..20mA range) 0..24mA (4..20mA range)
Precision of the conversion internal resistance	-	-	0.1 % -25 ppm/°C
Legend			
(1)	**Pulse resolution:** • **52,400 pulses for the +/- 10 V range,** • **26,200 pulses for the 0..10 V range,** • **13,100 pulses for the 0..5 V and 0..20 mA ranges,** • **10,400 pulses for the 1..5 V and 4..20 mA ranges**		

TSX AEY 420 Connector Pins

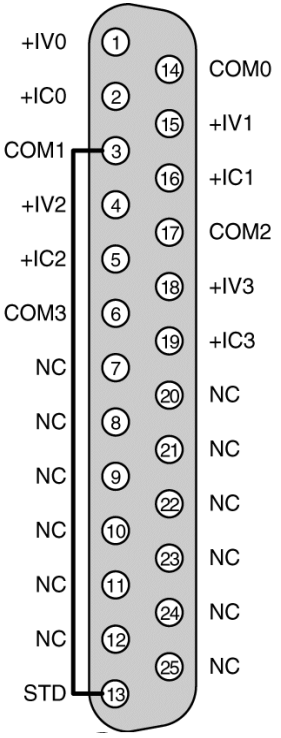
At a Glance

The TSX AEY 420 input module consists of a 25-pin Sub-D connector.

Connector Pins

The connector pins are shown below:

SubD Connector



NC Pin not connected
+IVx + Pole voltage input of channel x
+ICx + Pole current input of channel x
COMx - Pole current or voltage input of channel x
STD The "strap" between pins 3 and 13 detects the unplugging of the connector.

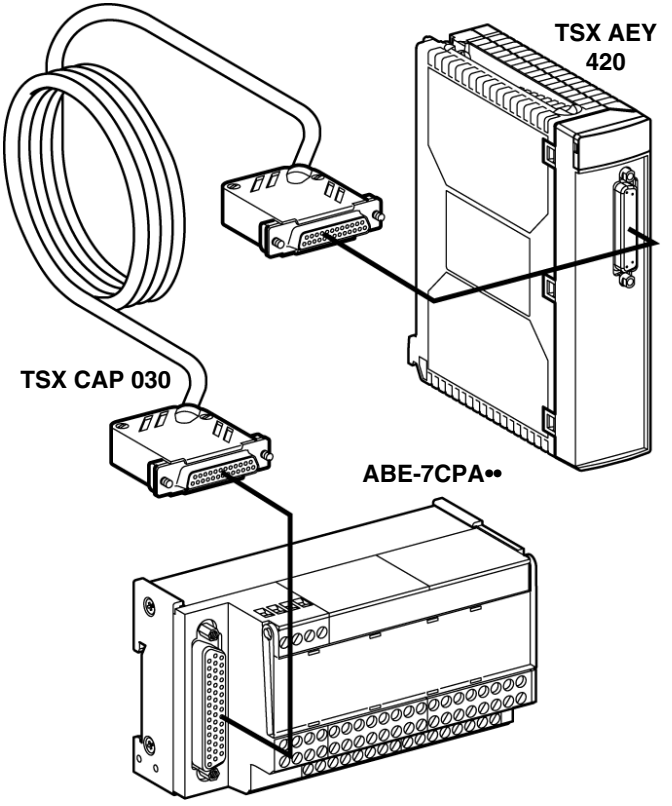
Note: The COM0, COM1, COM2, and COM3 pins are linked internally in the module.

TELEFAST 2 Pin Assignment for the TSX AEY 420 Module

At a Glance

The TSX AEY 420 analog module is connected to a TELEFAST 2 accessory using the TSX CAP 030 cable, which guarantees continuous shielding. There are several types of connection base:

- ABE-7CPA02 for connecting current or voltage inputs to a screw connector terminal block,
- ABE-7CPA03 with a 4-20 mA sensor loop power supply and a 25 mA limiter per channel,
- ABE-7CPA21 for connecting 4-channel analog modules to a screw connector terminal block.



ABE-7CPA02 The distribution of analog channels on TELEFAST 2 terminal blocks with the reference ABE-7CPA02 is as follows:

TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type	TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type
1	/	Ground	**Supp 1**	/	Ground
2	/	STD (1)	**Supp 2**	/	Ground
3	/	STD (1)	**Supp 3**	/	Ground
4	/	STD (2)	**Supp 4**	/	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

Legend	
NC	**Terminal not connected**
+IVx	**+ pole voltage input for channel x**
+ICx	**+ pole current input for channel x**
COMx	**- pole voltage or current input for channel x**

Note: Removal of the connector is detected by a strap linking terminal blocks STD (1) and STD (2).

Note: For the ground connection use the additional terminal block ABE-7BV20.

ABE-7CPA03 The distribution of analog channels on TELEFAST 2 terminal blocks with the reference ABE-7CPA03 is as follows:

TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type	TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type
1	/	0 V	**Supp 1**	/	24 V (sensor supply)
2	/	0 V	**Supp 2**	/	24 V (sensor supply)
3	/	0 V	**Supp 3**	/	0 V (sensor supply)
4	/	0 V	**Supp 4**	/	0 V (sensor supply)
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

Legend	
NC	**Terminal not connected**
ISx	**24 V power supply for channel x**
+IVx	**+ pole voltage input for channel x**
+ICx	**+ pole current input for channel x**
COMx	**- pole voltage or current input for channel x**

Note: For the ground connection use the additional terminal block ABE-7BV10.

ABE-7CPA21 The distribution of analog channels on TELEFAST 2 terminal blocks with the reference ABE-7CPA21 is as follows:

TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type	TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type
1	/	Ground	**Supp 1**	/	Ground
2	/	STD (1)	**Supp 2**	/	Ground
3	/	STD (1)	**Supp 3**	/	Ground
4	/	STD (2)	**Supp 4**	/	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
Legend					
+IVx		**+ pole voltage input for channel x**			
+ICx		**+ pole current input for channel x**			
COMx		**- pole voltage or current input for channel x**			

Note: Removal of the connector is detected by a strap linking terminal blocks STD (1) and STD (2).

Note: For the ground connection use the additional terminal block ABE-7BV10.

Analog Input Module TSX AEY 800

6

At a Glance

Aim of this Chapter

This chapter introduces the TSX AEY 800 module, its characteristics and its connection to different sensors.

What's in this Chapter?

This chapter contains the following topics:

Introduction to the TSX AEY 800 module

At a Glance

The TSX AEY 800 module is a high level 8 input industrial measurement device. Associated with sensors or transmitters.

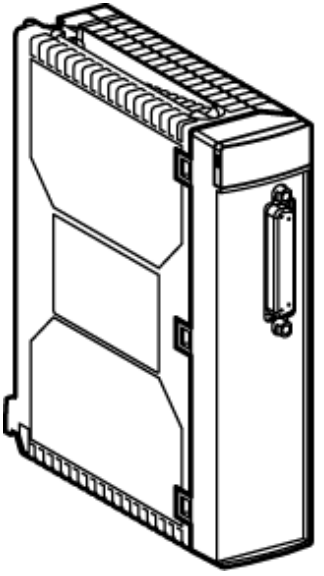
It performs monitoring, measurement and continuous processes control functions.

For each of its inputs, the TSX AEY 800 module offers the range +/-10 V, 0..10 V, 0..5 V, 1..5 V, 0..20 mA or 4..20 mA, according to the selection made at configuration.

Illustration

The following diagram shows the analog input module TSX AEY 800 :

TSX AEY 800



Characteristics of the TSX AEY 800 Module

Introduction

This part presents general characteristics for the TSX AEY 800 module and characteristics of its analog inputs.

General Characteristics

This table presents the general characteristics for the TSX AEY 800 module:

Type of inputs	High level inputs with common pulse
Type of inputs	Voltage / Current
Number of channels	8
Acquisition cycle time: ● **Fast (periodic acquisition for the declared channels used)** ● **Normal (periodic acquisition for all channels)**	(Number of channels used + 1) x 3 ms) 27 ms
Analog / Digital converter	12 bits (3719 voltage pulses / 3836 current pulses)
Digital filtering	1st order (time constant from 0 to 3.44s)
Insulation: ● **between channels** ● **between channels and bus** ● **between channels and ground**	 Common pulse 1000 V rms 1000 V rms
Isolation resistance under 500VDC between channel and ground	> 10 mOhms
Maximum over-voltage authorized for inputs	+/- 30 V in voltage +/- 30 mA in current
Maximum power dissipation	1.9 W
Standards	IEC 1131

Measurement Range

This table shows the measurement range processed by the TSX AEY 800 module analog inputs:

Measurement 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	5.38 mV	1.34 mV	0.00521 mA
Voltage input impedance	10 MOhms	10 MOhms	250 Ohms
Maximum error at 25 °C	0.19 % of FS	0.15 % of FS	0.25 % of FS
Maximum error from 0 to 60 °C	0.22 % of FS	0.22 % of FS	0.41 % of FS
Temperature drift	20 ppm/°C	20 ppm/°C	45 ppm/°C

Pin Assignment for the TSX AEY 800 Connector

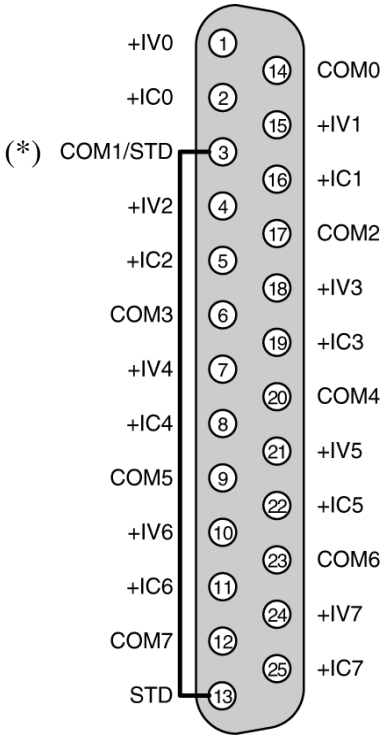
At a Glance

The TSX AEY 800 input module is composed of a Sub-D 25 pin connector.

Connector Pin Assignment

The pin assignment of the connector is shown below:

Sub-D connector



+IVx + pole voltage input for channel x
+ICx + pole current input for channel x
COMx - pole voltage or current input for channel x
(*) STD The strap between pins 3 and 13 enables any removal of the connector to be detected.

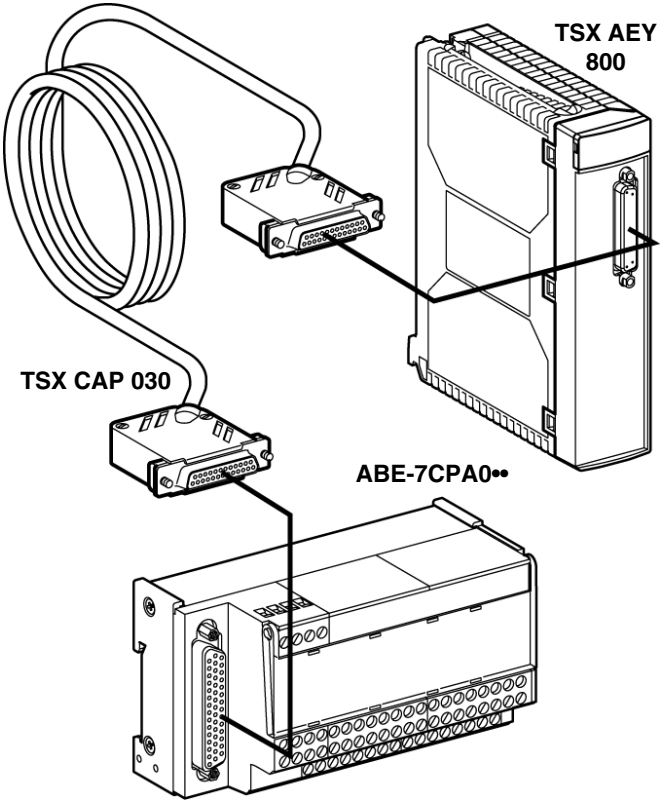
Note: The COMx pins are connected internally in the module.

TELEFAST 2 Pin Assignment for the TSX AEY 800 Module

At a Glance

The TSX AEY 800 analog module is connected to a TELEFAST 2 accessory through the TSX CAP030 cable which guarantees continuous shielding. There are several types of connection base:

- ABE-7CPA02 for connecting current and voltage inputs to a screw connector terminal block,
- ABE-7CPA03 with a 4-20 mA sensor loop power supply and a 25 mA limiter per channel.



ABE-7CPA02 The distribution of analog channels on TELEFAST 2 terminal blocks with the reference ABE-7CPA02 is as follows:

TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type	TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type
1	/	Ground	**Supp 1**	/	Ground
2	/	STD (1)	**Supp 2**	/	Ground
3	/	STD (1)	**Supp 3**	/	Ground
4	/	STD (2)	**Supp 4**	/	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	+IV4	**208**	20	COM4
109	8	+IC4	**209**	/	Ground
110	21	+IV5	**210**	9	COM5
111	22	+IC5	**211**	/	Ground
112	10	+IV6	**212**	23	COM6
113	11	+IC6	**213**	/	Ground
114	24	+IV7	**214**	12	COM7
115	25	+IC7	**215**	/	Ground

Legend	
+IVx	**+ pole voltage input for channel x**
+ICx	**+ pole current input for channel x**
COMx	**- pole voltage or current input for channel x**

Note: Removal of the connector is detected by a strap linking terminal blocks STD (1) and STD (2).

Note: For the ground connection use the additional terminal block ABE-7BV20.

ABE-7CPA03 The distribution of analog channels on TELEFAST 2 terminal blocks with the reference ABE-7CPA03 is as follows:

TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type	TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type
1	/	0 V	**Supp 1**	/	24 V (sensor supply)
2	/	0 V	**Supp 2**	/	24 V (sensor supply)
3	/	0 V	**Supp 3**	/	0 V (sensor supply)
4	/	0 V	**Supp 4**	/	0 V (sensor supply)
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	/	IS5	**208**	/	IS4
109	21	+IV5	**209**	7	+IV4
110	22	+IC5	**210**	8	+IC4
111	/	Ground	**211**	20/9	COM4 / COM5
112	/	IS7	**212**	/	IS6
113	24	+IV7	**213**	10	+IV6
114	25	+IC7	**214**	11	+IC6
115	/	Ground	**215**	23/12	COM6 / COM7

Legend	
ISx	**24 V channel power supply**
+IVx	**+ pole voltage input for channel x**
+ICx	**+ pole current input for channel x**
COMx	**- pole voltage or current input for channel x**

Note: For the ground connection use the additional terminal block ABE-7BV10.

Analog Input Module TSX AEY 810

7

At a Glance

Aim of this Chapter

This chapter introduces the TSX AEY 810 module, its characteristics and its connection to different sensors.

What's in this Chapter?

This chapter contains the following topics:

Introducing the TSX AEY 810 module

At a Glance

The TSX AEY 810 module is a high level 8 isolated input industrial measurement device.

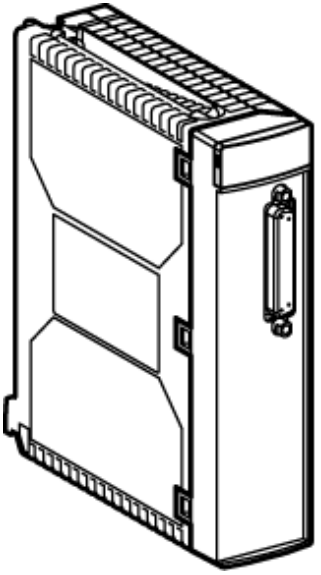
It is associated with sensors or transmitters, and performs monitoring, measurement and continuous process functions.

For each of its inputs, the TSX AEY 810 module offers the ranges +/-10 V, 0..10 V, 0..5 V, 1..5 V, 0..20 mA or 4..20 mA, according to the selection made in configuration.

Illustration

The following diagram shows the analog input module TSX AEY 810 :

TSX AEY 810



Characteristics of the TSX AEY 810 Module

Introduction

This part presents general characteristics for the TSX AEY 810 module and characteristics of its analog inputs.

General Characteristics

This table presents the general characteristics for the TSX AEY 810 module:

Type of inputs	High level isolated inputs
Type of inputs	Voltage / Current
Number of channels	8
Acquisition cycle time: ● **Fast (periodic acquisition for the declared channels used)** ● **Normal (periodic acquisition for all channels)**	(Number of channels used + 1) x 3.3 ms) 29.7 ms
Analog / Digital converter	16 bits (49090 voltage pulses / 24545 current pulses)
Digital filtering	1st order (time constant from 0 to 3.82s)
Insulation: ● **between channels** ● **between channels and bus** ● **between channels and ground**	 +/- 200 VDC 1000 V rms 1000 V rms
Isolation resistance under 500VDC between channel and ground	> 10 mOhms
Maximum over-voltage authorized for inputs	+/- 30 V in voltage +/- 30 mA in current
Maximum power dissipation	3.15 W
Standards	IEC1131, CSA222, UL508

Measurement Range

This table shows the measurement range processed by the TSX AEY 810 module analog inputs:

Measurement 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	0.406 mV	0.203 mV	812 mA
Voltage input impedance	10 MOhms	10 MOhms	250 Ohms
Maximum error at 25 °C	0.244 % of FS	0.13 % of FS	0.142 % of FS
Maximum error from 0 to 60 °C	0.305 % of FS	0.191 % of FS	0.212 % of FS
Temperature drift	15.3 ppm/°C	15.3 ppm/°C	17.5 ppm/°C

Pin Assignment for the TSX AEY 810 Connector

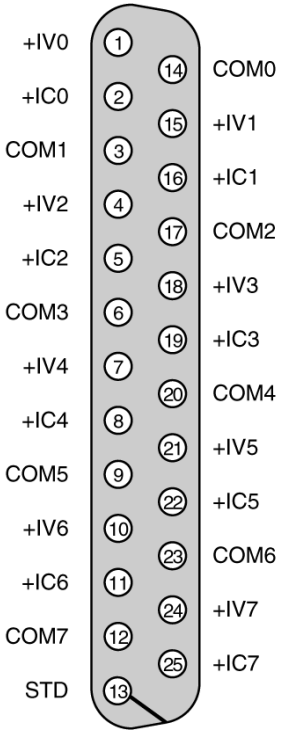
At a Glance

The TSX AEY 810 input module consists of a 25-pin Sub-D connector.

Connector Pins

The connector pins are shown below:

Sub-D Connector



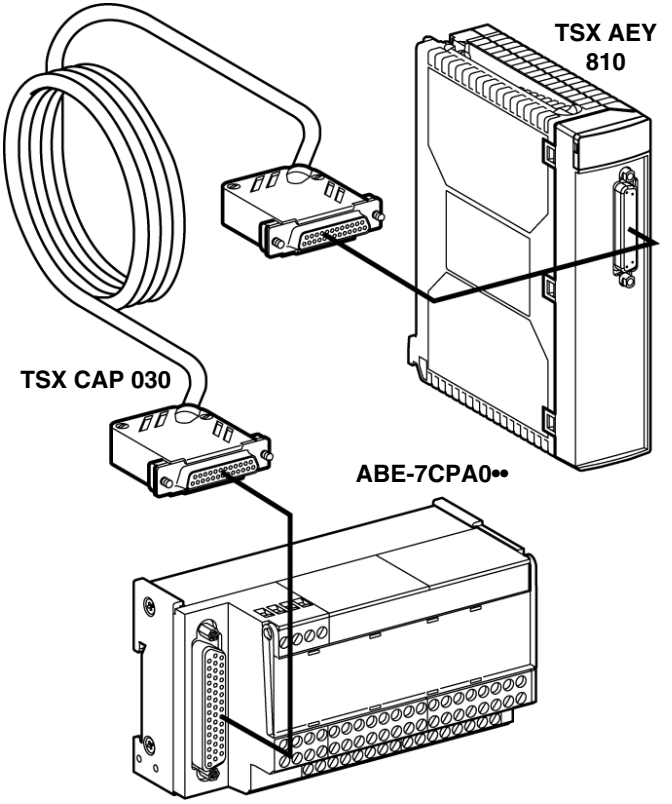
+IVx + Pole voltage input of channel x
+ICx + Pole current input of channel x
COMx - Pole current or voltage input of channel x
STD The "strap" between pin 13 and the ground (using a cover) is used to detect connector unpinning.

TELEFAST 2 Pin Assignment for the TSX AEY 810 Module

At a Glance

The TSX AEY 810 analog module is connected to a TELEFAST 2 accessory through the TSX CAP 030 which guarantees continuous shielding. There are several types of connection base:

- ABE-7CPA02 for connecting current, voltage inputs to a screw connector terminal block,
- ABE-7CPA31 with isolated power supply for 4..20 mA sensor loops for 8 isolated input channels.



ABE-7CPA02 The distribution of analog channels on TELEFAST 2 terminal blocks with the reference ABE-7CPA02 is as follows:

TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type	TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type
1	/	Ground	**Supp 1**	/	Ground
2	/	STD (1)	**Supp 2**	/	Ground
3	/	STD (1)	**Supp 3**	/	Ground
4	/	STD	**Supp 4**	/	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	+IV4	**208**	20	COM4
109	8	+IC4	**209**	/	Ground
110	21	+IV5	**210**	9	COM5
111	22	+IC5	**211**	/	Ground
112	10	+IV6	**212**	23	COM6
113	11	+IC6	**213**	/	Ground
114	24	+IV7	**214**	12	COM7
115	25	+IC7	**215**	/	Ground

Legend	
+IVx	**+ pole voltage input for channel x**
+ICx	**+ pole current input for channel x**
COMx	**- pole voltage or current input for channel x**

Note: Removal of the connector pin is detected by a strap linking terminal block STD (1) and the ground (TELEFAST 2 terminal block No. 1).

Note: For the ground connection use the additional terminal block ABE-7BV20.

ABE-7CPA31 The distribution of analog channels on TELEFAST 2 terminal blocks with the reference ABE-7CPA31 is as follows:

TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type	TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type
1	/	Ground	**Supp 1**	/	24 V (sensor supply)
2	/	Ground	**Supp 2**	/	24 V (sensor supply)
3	/	Ground	**Supp 3**	/	0 V (sensor supply)
4	/	Ground	**Supp 4**	/	0 V (sensor supply)
100	/	IS0	**116**	/	IS4
101	1	+IV0	**117**	7	+IV4
102	2	+IC0	**118**	8	+IC4
103	14	0 V	**119**	20	0 V
104	/	IS1	**120**	/	IS5
105	15	+IV1	**121**	21	+IV5
106	16	+IC1	**122**	22	+IC5
107	3	0 V	**123**	9	0 V
108	/	IS2	**124**	/	IS6
109	4	+IV2	**125**	10	+IV6
110	5	+IC2	**126**	11	+IC6
111	17	0 V	**127**	23	0 V
112	/	IS3	**128**	/	IS7
113	18	+IV3	**129**	24	+IV7
114	19	+IC3	**130**	25	+IC7
115	6	0 V	**131**	12	0 V
Legend					
ISx	**24 V channel power supply**				
+IVx	**+ pole voltage input for channel x**				
+ICx	**+ pole current input for channel x**				
COMx	**- pole voltage or current input for channel x**				

Note: The TELEFAST 2 ABE-7CPA31 is pre-equipped with the strap necessary for detecting the terminal block.

Note: For the ground connection use the additional terminal block ABE-7BV10.

Analog Input Module TSX AEY 1600

8

At a Glance

Aim of this Chapter

This chapter introduces the TSX AEY 1600 module, its characteristics and its connection to different sensors.

What's in this Chapter?

This chapter contains the following topics:

Introducing the TSX AEY 1600 module

At a Glance

The TSX AEY 1600 module is a high level 16 input industrial measurement device.

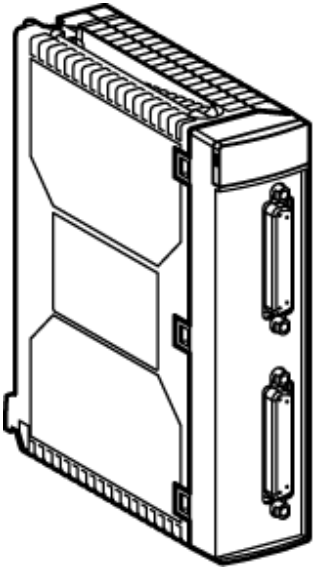
It is associated with sensors or transmitters, and performs monitoring, measurement and continuous process functions.

For each of its inputs, the 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, according to the selection made in configuration.

Illustration

The following diagram shows the analog input module TSX AEY 1600 :

TSX AEY 1600



Characteristics of the TSX AEY 1600 Module

Introduction

This part presents general characteristics for the TSX AEY 1600 module and characteristics of its analog inputs.

General Characteristics

This table presents the general characteristics for the TSX AEY 1600 module:

Type of inputs	High level inputs with common pulse
Type of inputs	Voltage / Current
Number of channels	16
Acquisition cycle time: ● **Fast (periodic acquisition for the declared channels used)** ● **Normal (periodic acquisition for all channels)**	(Number of channels used + 1) x 3 ms) 51 ms
Analog / Digital converter	12 bits (3719 voltage pulses / 3836 current pulses)
Digital filtering	1st order (time constant from 0 to 6.5s)
Insulation: ● **between channels** ● **between channels and bus** ● **between channels and ground**	 Common pulse 1000 V rms 1000 V rms
Isolation resistance under 500VDC between channel and ground	> 10 mOhms
Maximum over-voltage authorized for inputs	+/- 30 V in voltage +/- 30 mA in current
Maximum power dissipation	1.9 W
Standards	IEC 1131

Measurement Range

This table shows the measurement range processed by the TSX AEY 1600 module analog inputs:

Measurement 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	5.38 mV	1.34 mV	0.00521 mA
Voltage input impedance	10 MOhms	10 MOhms	250 Ohms
Maximum error at 25 °C	0.1 % of FS	0.1 % of FS	0.16 % of FS
Maximum error from 0 to 60 °C	0.13 % of FS	0.13 % of FS	0.32 % of FS
Temperature drift	20 ppm/°C	20 ppm/°C	45 ppm/°C

Pin Assignment for the TSX AEY 1600 Connector

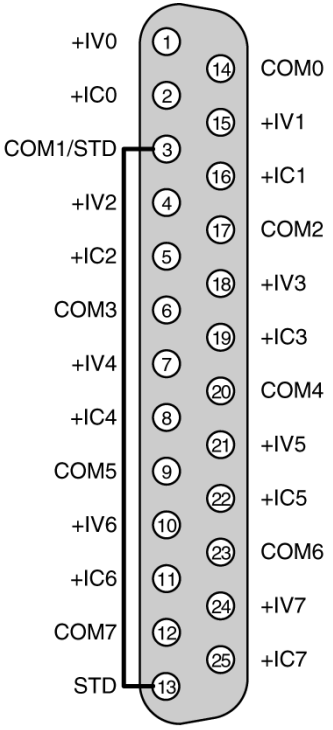
At a Glance

The TSX AEY 1600 input module consists of two 25-pin Sub-D connectors.

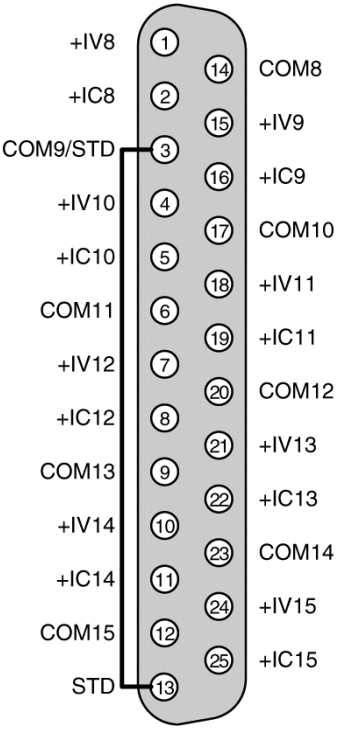
Connector Pins

The connector pins are shown below:

High Sub-D connector



Low Sub-D connector



+IVx + Pole voltage input of channel x
+ICx + Pole current input of channel x
COMx - Pole current or voltage input of channel x
STD The "strap" between pins 3 and 13 detects the unplugging of the connector.

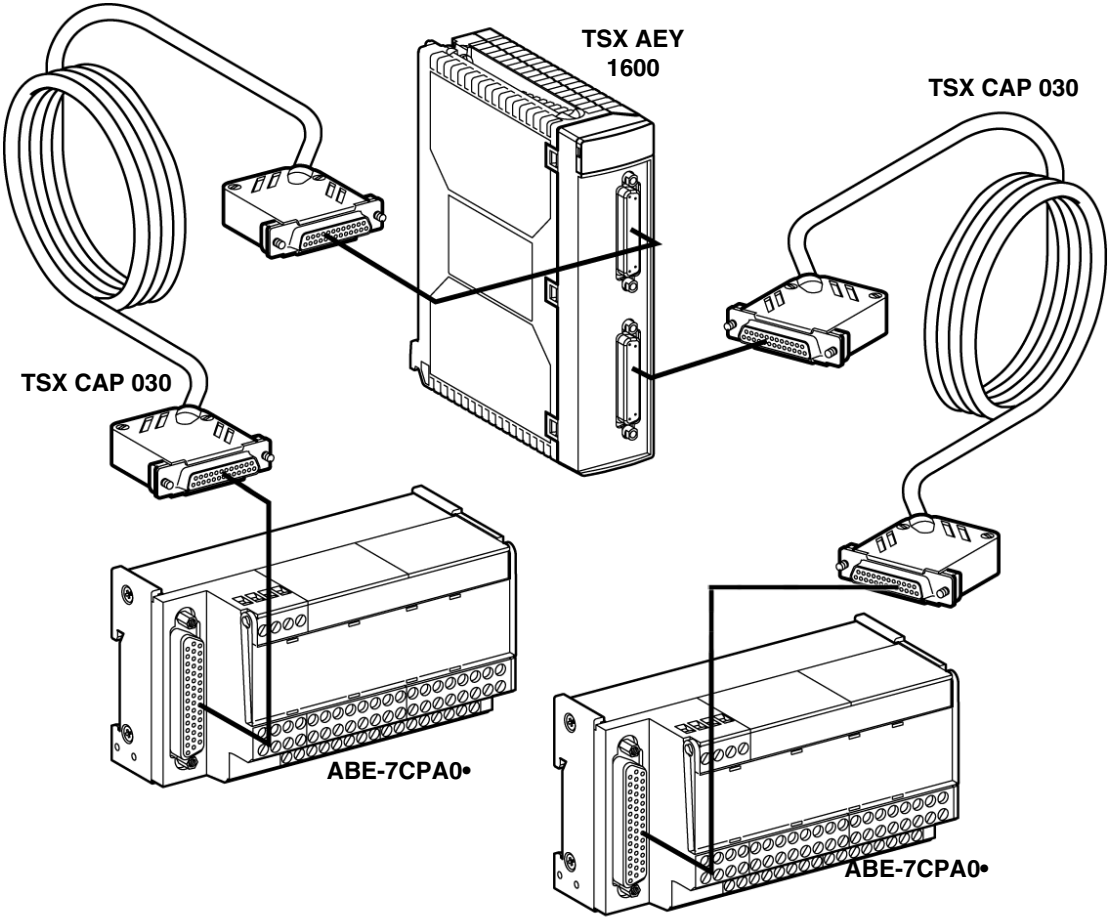
Note: The COMx pins are linked internally in the module.

TELEFAST 2 Pin Assignment for the TSX AEY 1600 Module

At a Glance

The TSX AEY 1600 analog module is connected to a TELEFAST 2 accessory through the TSX CAP 030 which guarantees continuous shielding. There are several types of connection base:

- ABE-7CPA02 for connecting current or voltage to a screw connector terminal block,
- ABE-7CPA03 with a 4-20 mA sensor loop power supply and a 25 mA limiter per channel.



ABE-7CPA02 The distribution of analog channels on TELEFAST 2 terminal blocks with the reference ABE-7CPA02 is as follows:

TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type	TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type
1	/	Ground	**Supp 1**	/	Ground
2	/	STD (1)	**Supp 2**	/	Ground
3	/	STD (1)	**Supp 3**	/	Ground
4	/	STD (2)	**Supp 4**	/	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

Legend	
+IVx	**+ pole voltage input for channel x**
+ICx	**+ pole current input for channel x**
COMx	**- pole voltage or current input for channel x**

Note: Removal of the connector is detected by a strap linking terminal blocks STD (1) and STD (2).

Note: For the ground connection use the additional terminal block ABE-7BV20.

ABE-7CPA03 The distribution of analog channels on TELEFAST 2 terminal blocks with the reference ABE-7CPA03 is as follows:

TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type	TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type
1	/	0 V	**Supp 1**	/	24 V (sensor supply)
2	/	0 V	**Supp 2**	/	24 V (sensor supply)
3	/	0 V	**Supp 3**	/	0 V (sensor supply)
4	/	0 V	**Supp 4**	/	0 V (sensor supply)
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 +IV12
111	/	Ground	**211**	20/9	COM4 / COM5 or COM12 / COM13
112	/	IS7 or IS15	**212**	/	IS6 or IS14
113	24	+IV7 or +IC15	**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

Legend	
ISx	**24 V channel power supply**
+IVx	**+ pole voltage input for channel x**
+ICx	**+ pole current input for channel x**
COMx	**- pole voltage or current input for channel x**

Note: For the ground connection use the additional terminal block ABE-7BV10.

Analog Input Module TSX AEY 1614

9

At a Glance

Aim of this Chapter

This chapter introduces the TSX AEY 1614 module, its characteristics and its connection to different sensors.

What's in this Chapter?

This chapter contains the following topics:

Introducing the TSX AEY 1614 module

At a Glance

The TSX AEY 1614 module is a 16 thermocouple input industrial measurement device.

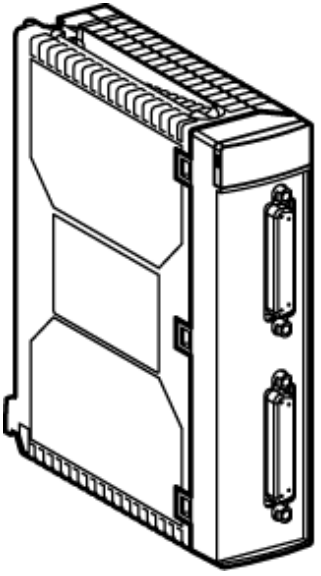
This module offers the following range for each of its inputs according to the selection made at configuration :

- thermocouple B, E, J, K, L, N, R, S, T or U,
- voltage +/-80 mV.

Illustration

The following diagram shows the analog input module TSX AEY 1614 :

TSX AEY 1614



Note: The TELEFAST 2 accessory referenced ABE-7CPA12 facilitates connection and provides an integrated cold junction compensation device.

Characteristics of the TSX AEY 1614 Module

Introduction

This part presents general characteristics for the TSX AEY 1614 module.

General Characteristics

This table presents the general characteristics for the TSX AEY 1614 module:

Type of inputs	Thermocouple inputs
Type of inputs	Multi-range
Number of channels	16
Acquisition cycle time: ● **Fast (periodic acquisition for the declared channels used)** ● **Normal (periodic acquisition for all channels)**	Number of dual channels used x 70 ms (1) 1120 ms
Analog / Digital converter	16 bits (0..65535 pulses)
Wiring test	8 ms
Digital filtering	1st order (Time constant = 0 to 128 x module cycle time)
Insulation: ● **between channels** ● **between channels and bus** ● **between channels and ground**	 100 V rms 1000 V rms 1000 V rms
Isolation resistance under 500VDC between channel and ground	> 10 mOhms
Input impedance	> 10 mOhms
Linearization	Automatic
Maximum over-voltage in differential mode authorized for inputs	+/- 30 VDC
Common mode voltage acceptable in operation: ● **between channels** ● **between channels and ground**	 250 VDC or 280 VAC 240 VAC
Series mode rejection at 50/60 Hz	100 dB
Rejection channel / ground	110 dB (VDC-VAC 50 / 60Hz
Legend	
(1) This calculation does not take any test into consideration. For more details, please consult the manual (Timing of measurements)	

Cold junction compensation • **on TELEFAST 2** • **external class A Pt100 on channel 0**	 between -5 and +60°C between -5 and +85°C
Maximum line resistance for wiring test	500 Ohms
Maximum power dissipation	2 W
PLC Standards	IEC1131, IEC801, IEC68, UL508, UL94
Electric ranges	-/+ 80 mV
Sensor Standards	IEC584, IEC751, DIN43760, DIN43710, NFC42-330
Legend	
(1) This calculation does not take any test into consideration. For more details, please consult the manual (Timing of measurements)	

Characteristics of the Thermocouple Ranges for the TSX AEY 1614

At a Glance

The following tables show the measurement string errors for the different thermocouples B, E, J, K, N, R, S and T. These values take into account the following :

- The accuracies below are valid regardless of the type of cold junction compensation: TELEFAST 2 or Class A Pt100.
- The cold junction temperature is taken as 25°C in the accuracy calculations.
- Resolution is given with an operating point in the middle of the range.
- The accuracies include : electrical errors on the input channels and cold junction compensation acquisition string, software errors, interchangeability errors on the cold junction compensation sensors. The thermocouple sensor error is not taken into account.

To convert to degrees Fahrenheit, use the formula:

$$T_{Farenheit} = \frac{9}{5} \times T_{Celcius} + 32$$

Thermocouple B

Dynamic: 42.20°C to 1819.70°C

Resolution 0.088°C

Temperature		Error at 60°C High precision mode	Error at 60°C Normal mode	Error at 25°C
Operating point	**600°C**	5.7°C	24.8°C	3.6°C
	700°C	5.1°C	21.7°C	3.2°C
	800°C	4.7°C	19.6°C	3.0°C
	900°C	4.4°C	17.9°C	2.7°C
	1000°C	4.2°C	16.6°C	2.6°C
	1100°C	4.0°C	15.6°C	2.5°C
	1200°C	3.9°C	14.8°C	2.4°C
	1300°C	3.8°C	14.2°C	2.3°C
	1400°C	3.7°C	13.8°C	2.2°C
	1500°C	3.7°C	13.5°C	2.2°C
	1600°C	3.8°C	13.5°C	2.2°C
	1700°C	3.8°C	13.6°C	2.2°C

Thermocouple E Dynamic: -260.60°C to 990.90°C

Resolution 0.031°C

Temperature		Error at 60°C High precision mode	Error at 60°C Normal mode	Error at 25°C
Operating point	**-200°C**	2.1°C	6.6°C	1.3°C
	-100°C	1.4°C	3.9°C	1.0°C
	0°C	1.1°C	3.1°C	0.9°C
	100°C	1.1°C	2.8°C	0.9°C
	200°C	1.2°C	2.7°C	0.8°C
	300°C	1.2°C	2.6°C	0.8°C
	400°C	1.2°C	2.7°C	0.8°C
	500°C	1.3°C	2.7°C	0.8°C
	600°C	1.4°C	2.8°C	0.8°C
	700°C	1.5°C	2.9°C	0.9°C
	1000°C	1.7°C	3.2°C	0.9°C

Thermocouple J Dynamic: -270.70°C to 1199.40°C

Resolution: 0.044°C

Temperature		Error at 60°C High precision mode	Error at 60°C Normal mode	Error at 25°C
Operating point	**-200°C**	2.3°C	7.5°C	1.4°C
	-100°C	1.5°C	4.2°C	1.0°C
	0°C	1.2°C	3.5°C	0.9°C
	100°C	1.3°C	3.3°C	0.9°C
	200°C	1.3°C	3.4°C	0.9°C
	300°C	1.6°C	3.4°C	0.9°C
	400°C	1.4°C	3.5°C	0.9°C
	500°C	1.5°C	3.5°C	0.9°C
	600°C	1.5°C	3.5°C	0.9°C
	700°C	1.5°C	3.4°C	0.9°C
	1000°C	1.8°C	3.7°C	0.9°C
	1100°C	1.9°C	3.9°C	1.0°C
	1200°C	2.0°C	4.0°C	1.0°C

Thermocouple K Dynamic: -263.90°C to 1371.30°C

Resolution: 0.036°C

Temperature		Error at 60°C High precision mode	Error at 60°C Normal mode	Error at 25°C
Operating point	**-200°C**	2.9°C	10.3°C	1.8°C
	-100°C	1.7°C	5.4°C	1.2°C
	0°C	1.4°C	4.1°C	1.0°C
	100°C	1.4°C	4.1°C	1.0°C
	100°C	1.5°C	4.3°C	1.0°C
	300°C	1.5°C	4.3°C	1.0°C
	400°C	1.6°C	4.3°C	1.0°C
	500°C	1.6°C	4.3°C	1.0°C
	600°C	1.7°C	4.4°C	1.0°C
	700°C	1.8°C	4.5°C	1.1°C
	800°C	1.9°C	4.7°C	1.1°C
	900°C	2.0°C	4.8°C	1.1°C
	1000°C	2.1°C	5.0°C	1.1°C
	1100°C	2.2°C	5.2°C	1.1°C
	1200°C	2.4°C	5.5°C	1.2°C

Thermocouple N Dynamic: -245.90°C to 1298.60°C

Resolution: 0.04°C

Temperature		Error at 60°C High precision mode	Error at 60°C Normal mode	Error at 25°C
Operating point	**-200°C**	4.0°C	15.4°C	2.4°C
	-100°C	2.1°C	7.6°C	1.4°C
	0°C	1.8°C	6.1°C	1.3°C
	100°C	1.7°C	5.5°C	1.2°C
	100°C	1.6°C	5.1°C	1.1°C
	300°C	1.6°C	4.8°C	1.1°C
	400°C	1.7°C	4.7°C	1.1°C
	500°C	1.7°C	4.7°C	1.1°C
	600°C	1.7°C	4.7°C	1.1°C
	700°C	1.8°C	4.7°C	1.1°C
	800°C	1.9°C	4.8°C	1.1°C
	900°C	2.0°C	4.9°C	1.1°C
	1000°C	2.0°C	5.0°C	1.1°C
	1100°C	2.1°C	5.1°C	1.1°C
	1200°C	2.1°C	5.3°C	1.1°C

Thermocouple R Dynamic: -48.30°C to 1768.90°C

Resolution: 0.061°C

Temperature		Error at 60°C High precision mode	Error at 60°C Normal mode	Error at 25°C
Operating point	**0°C**	6.1°C	27.6°C	4.0°C
	100°C	4.6°C	19.7°C	3.0°C
	100°C	4.0°C	16.8°C	2.6°C
	300°C	3.8°C	15.4°C	2.4°C
	400°C	3.6°C	14.6°C	2.3°C
	500°C	3.6°C	14.0°C	2.3°C
	600°C	3.5°C	13.5°C	2.2°C
	700°C	3.5°C	13.0°C	2.1°C
	800°C	3.4°C	12.6°C	2.1°C
	900°C	3.4°C	12.3°C	2.0°C
	1000°C	3.4°C	11.9°C	2.0°C
	1100°C	3.3°C	11.7°C	2.0°C
	1200°C	3.4°C	11.5°C	1.9°C
	1300°C	3.4°C	11.4°C	1.9°C
	1400°C	3.4°C	11.5°C	1.9°C
	1500°C	3.5°C	11.6°C	1.9°C
	1600°C	3.6°C	11.8°C	2.0°C

Thermocouple S Dynamic: -48.60°C to 1768.10°C

Resolution: 0.069°C

Temperature		Error at 60°C High precision mode	Error at 60°C Normal mode	Error at 25°C
Operating point	**0°C**	6.0°C	27.0°C	3.9°C
	100°C	4.6°C	20.1°C	3.0°C
	200°C	4.2°C	17.6°C	2.7°C
	300°C	4.0°C	16.4°C	2.6°C
	400°C	3.9°C	15.7°C	2.5°C
	500°C	3.8°C	15.3°C	2.4°C
	600°C	3.8°C	14.9°C	2.4°C
	700°C	3.8°C	14.5°C	2.3°C
	800°C	3.7°C	14.2°C	2.3°C
	900°C	3.7°C	13.9°C	2.2°C
	1000°C	3.7°C	13.5°C	2.2°C
	1100°C	3.7°C	13.3°C	2.2°C
	1200°C	3.7°C	13.1°C	2.1°C
	1300°C	3.8°C	13.1°C	2.1°C
	1400°C	3.8°C	13.2°C	2.1°C
	1500°C	3.9°C	13.3°C	2.2°C
	1600°C	4.0°C	13.6°C	2.2°C

Thermocouple T Dynamic: -265.70°C to 399.70°C

Resolution: 0.017°C

Temperature		Error at 60°C High precision mode	Error at 60°C Normal mode	Error at 25°C
Operating point	**-200°C**	2.7°C	9.9°C	1.7°C
	-100°C	1.7°C	5.7°C	1.2°C
	0°C	1.3°C	4.3°C	1.0°C
	100°C	1.3°C	3.7°C	1.0°C
	200°C	1.3°C	3.4°C	0.9°C
	300°C	1.3°C	3.2°C	0.9°C
	400°C	1.3°C	3.1°C	0.9°C

Characteristics of the +/-80 mV Range

At a Glance

The following table gives the measurement string errors for the +/-80 mV range.

Table of Measurement String Errors

Dynamic: -265.70°C to 399.70°C

Resolution: 0.017°C

Voltage	Error at 60°C High precision mode	Error at 60°C High precision mode in micro V	Error at 25°C in micro V
0 mV	30,637	144,037	19,262
1 mV	31,331	144,731	19,324
2 mV	32,025	145,425	19,386
3 mV	32,719	146,119	19,448
4 mV	33,413	146,813	19,510
5 mV	34,107	147,507	19,572
6 mV	34,801	148,201	19,634
7 mV	35,495	148,895	19,696
8 mV	36,189	149,589	19,758
9 mV	36,883	150,283	19,820
10 mV	37,577	150,977	19,882
11 mV	38,271	151,671	19,944
12 mV	38,965	152,365	20,006
13 mV	39,659	153,059	20,068
14 mV	40,353	153,753	20,130
15 mV	41,047	154,447	20,192
16 mV	41,741	155,141	20,254
17 mV	42,435	155,835	20,316
18 mV	43,129	156,529	20,378
19 mV	43,823	157,223	20,440
20 mV	44,517	157,917	20,502
21 mV	45,211	158,611	20,564
22 mV	45,905	159,305	20,626
23 mV	46,599	159,999	20,688
24 mV	47,293	160,693	20,750
25 mV	47,987	161,387	20,812

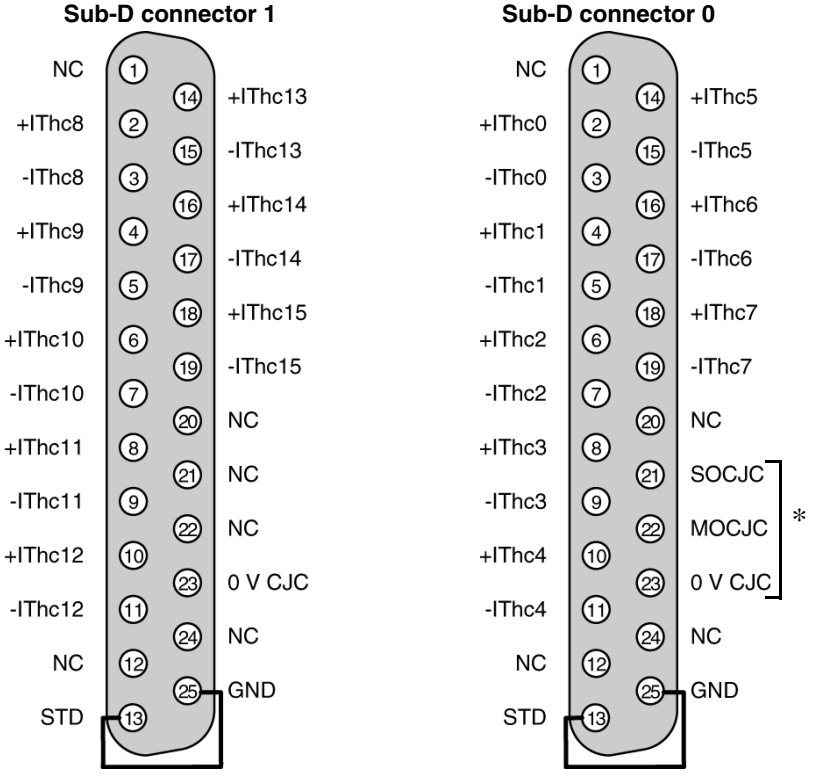
Pin Assignment for the TSX AEY 1614 Connector

At a Glance

The TSX AEY 1614 input module is composed of 2 x 25 point Sub-D connectors, the pin assignment of which is shown below:

Connector Pin Assignment

The connector pins are shown below:



NC Pin not connected
+IThcx + input of the thermocouple for channel x
-IThcx - input of the thermocouple for channel x
SOCJC Power supply output for internal cold junction compensation by TELEFAST
MOCJC Input for internal cold junction compensation measurement by TELEFAST
STD The strap between pins 13 and 25 enables any removal of the connector to be detected.
***** For internal cold junction compensation

Connecting the TSX AEY 1614 Sensors

General

We recommend that shielded cables be used. The shielding is connected on one side, as close as possible to the terminal. Preferably, use terminal ABE-7BV10 or ABE-7BV20 to connect the shielding.

Use with TELEFAST

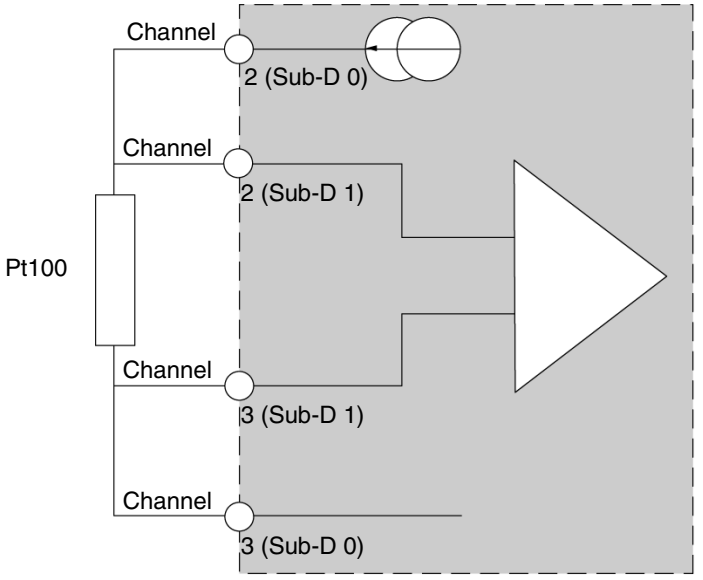
Note: For use with TELEFAST, reference number ABE-7CPA12, the terminal block detection strap is built in as standard in the TELEFAST.
Internal cold junction compensation:
is performed in the TELEFAST by a temperature probe (silicon).
If this compensation mode is chosen, no specific wiring has to be performed. Simply connect the TELEFAST to the module using lead TSX CAP 030. In this case, the 16 channels can be wired as thermocouples.

Use Without TELEFAST

External cold junction compensation using an external Pt 100 probe:

when connecting directly to the SUB-D connectors, it is the user's responsibility to connect a Pt 100 probe (4 wires) to measure the terminal block temperature. In this case, the "external cold junction compensation" mode must be selected and channels 0 and 8 dedicated to this measurement. Channel 0 delivers the current to the Pt100 probe, and channel 8 performs the high impedance measurement.

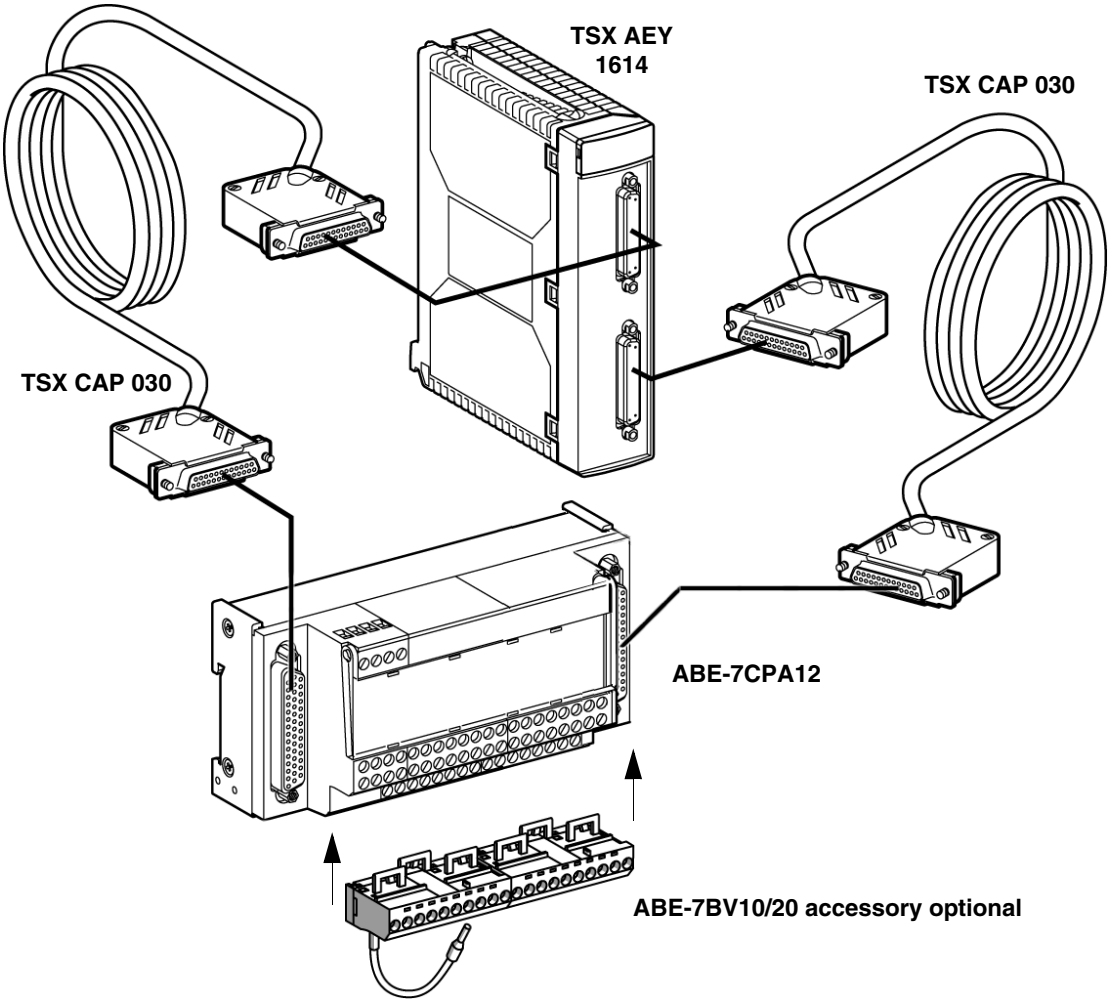
In this case, only 14 thermocouple channels can be wired. The wiring should be carried out as follows:



TELEFAST 2 Pin Assignment for the TSX AEY 1614 Module

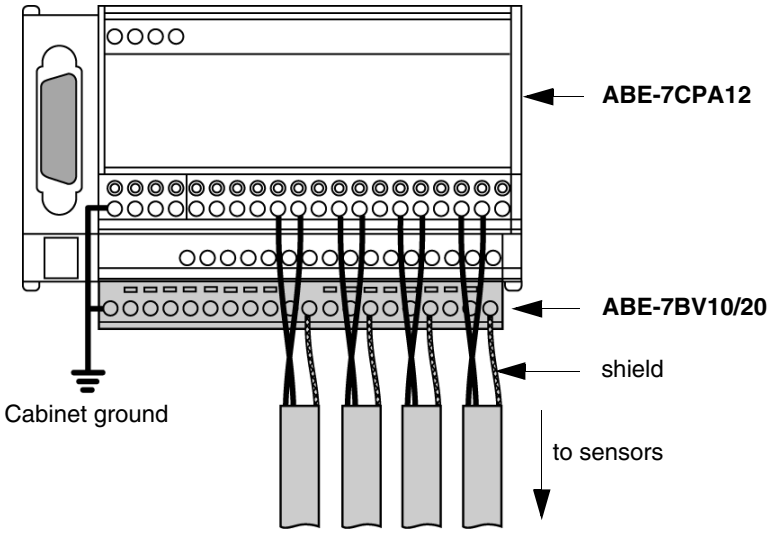
At a Glance

The TSX AEY 1614 analog module is connected to a TELEFAST 2 ABE-7CPA12 using a TSX CAP 030 cable which guarantees continuous shielding. This accessory is a connection base used for connecting 16 thermocouples.



Description of Cabling the ABE-7BV••

The diagram below describes how the cable shielding is linked to the terminal



Note: If you do not have the ABE-7BV10/20 connecting strip, the shielding must be connected to the TELEFAST ground terminals, and one of the terminals to the cabinet ground.

ABE-7CPA12 The distribution of analog channels on TELEFAST 2 terminal blocks with the reference ABE-7CPA12 is as follows:

TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type	TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type
1	/	Ground	**11**	/	Ground
2	/	Ground	**12**	/	Ground
3	/	Ground	**13**	/	Ground
4	/	Ground	**14**	/	Ground
100	2 (Sub D0)	IThc+ V0 / PT100_+supply	**200**	10 (Sub D0)	IThc+ V4
101	3 (Sub D0)	IThc- V0 / PT100_-supply	**201**	11 (Sub D0)	IThc- V4
102	4 (Sub D0)	IThc+ V1	**202**	14 (Sub D0)	IThc+ V5
103	5 (Sub D0)	IThc- V1	**203**	15 (Sub D0)	IThc- V5
104	6 (Sub D0)	IThc+ V2	**204**	16 (Sub D0)	IThc+ V6
105	7 (Sub D0)	IThc- V2	**205**	17 (Sub D0)	IThc- V6
106	8 (Sub D0)	IThc+ V3	**206**	18 (Sub D0)	IThc+ V7
107	9 (Sub D0)	IThc- V3	**207**	19 (Sub D0)	IThc- V7
108	2 (Sub D1)	IThc+ V8 / PT100_+measurement	**208**	10 (Sub D1)	IThc+ V12
109	3 (Sub D1)	IThc- V8 / PT100_-measurement	**209**	11 (Sub D1)	IThc- V12
110	4 (Sub D1)	IThc+ V9	**210**	14 (Sub D1)	IThc+ V13
111	5 (Sub D1)	IThc- V9	**211**	15 (Sub D1)	IThc- V13
112	6 (Sub D1)	IThc+ V10	**212**	16 (Sub D1)	IThc+ V14
113	7 (Sub D1)	IThc- V10	**213**	17 (Sub D1)	IThc- V14
114	8 (Sub D1)	IThc+ V11	**214**	18 (Sub D1)	IThc+ V15
115	9 (Sub D1)	IThc- V11	**215**	19 (Sub D1)	IThc- V15

Legend	
+IThcx	**+ input of the thermocouple for channel x**
-IThcx	**- input of the thermocouple for channel x**

Analog Output Module TSX ASY 410

10

At a Glance

Aim of this Chapter

This chapter introduces the TSX ASY 410 module, its characteristics and its connection to different pre-actuators and actuators.

What's in this Chapter?

This chapter contains the following topics:

Introducing the TSX ASY 410 module

At a Glance

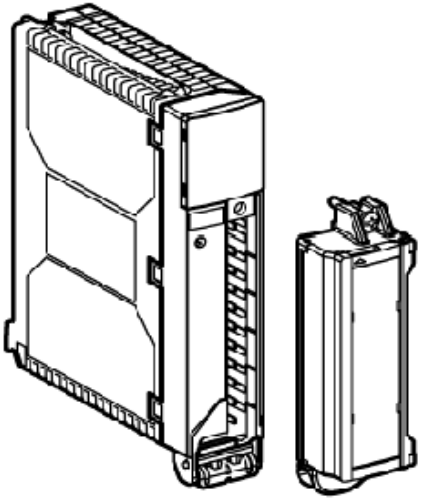
The TSX ASY 410 module is a module with 4 outputs isolated from each other. The following ranges are offered for each output:

- voltage +/- 10 V
- current 0..20 mA and 4.. 20 mA

Illustration

The following diagram shows the analog input module TSX ASY 410 :

TSX ASY 410



Note: The terminal block is supplied separately under the reference TSX BLY 01.

Characteristics of the TSX ASY 410 Module

Introduction

This part presents general characteristics for the TSX AEY 410 module and characteristics of its analog outputs.

General Characteristics

This table presents the general characteristics for the TSX AEY 410 module:

Type of outputs	Isolated inputs between channels
Nature of outputs	Voltage / Current
Number of channels	4
Output refresh time	2.5 ms
Power supply for outputs	by the PLC
Types of protection	Short circuits and overloads
Insulation: • **between channels** • **between channels and bus** • **between channels and ground**	 1500 V rms 1500 V rms 500 VDC
Isolation resistance under 500VDC between channel and ground	> 10 mOhms
Diaphony between channels	-80 dB
Monotonicity	Yes
Non linearity	<= 1 LSB
RC network ground connection	R = 50 MOhms, C = 4.7 nF
Dissipated power: • **typical** • **maximum**	 8.2 W 12.2 W

Voltage Outputs

This table presents the general characteristics for the TSX AEY 410 module voltage outputs:

Variation range	+/- 10 V
Full scale (FS)	10 V
Max voltage without damaging the voltage outputs	+/- 30 V
Load impedance	1 KOhm minimum
Capacitative load	< 100 nF
Maximum resolution: ● **software version Sv or VL > 1.0** ● **software version Sv or VL = 1.0**	 5.12 mV to +/- 10 V 4.88 mV to +/- 10 V
Measuring error: ● **at 25°C** ● **from 0 to 60°C**	 0.45 % of FS 0.75 % of FS (35 ppm/°C)

Current Outputs

This table presents the general characteristics for the TSX AEY 410 module current outputs:

Variation range	20 mA
Full scale (FS)	20 mA
Max voltage without damaging the voltage outputs	+/- 30 V
Load impedance	600 Ohms maximum
Inductance load	< 0.3 mH
Maximum resolution: ● **software version Sv or VL > 1.0** ● **software version Sv or VL = 1.0**	 0.01025 mA 0.00977 mA
Measuring error: ● **at 25°C** ● **from 0 to 60°C**	 0.52 % of FS 0.98 % of FS (70 ppm/°C)
Maximum leakage current	0.05 mA

TSX ASY 410 Screw Terminal Block TSX BLY 01

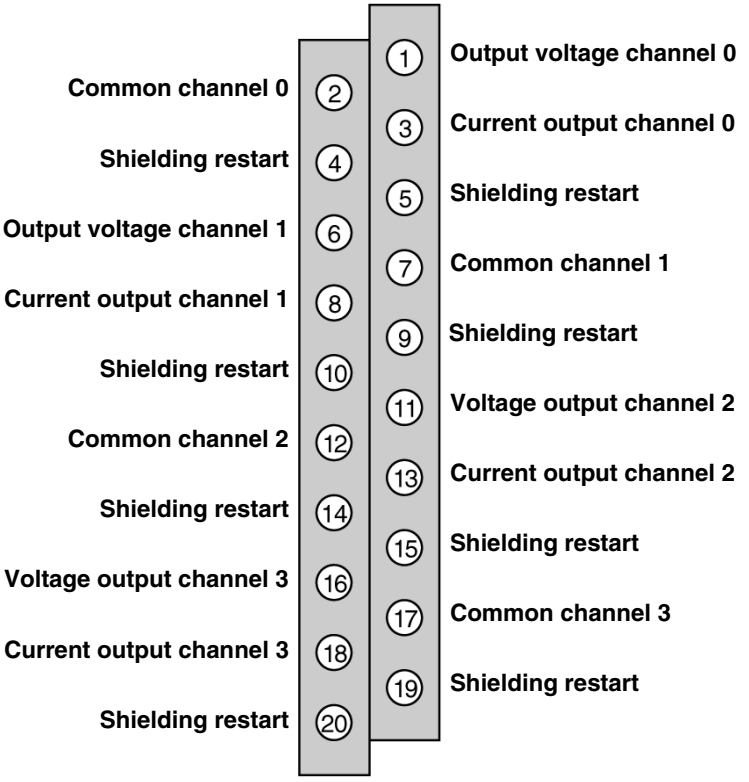
At a Glance

The module TSX ASY 410 is connected using the screw terminal block TSX BLY 01.

Connector Pins

The connections of the TSX BLY 01 screw terminal block are shown below:

TSX BLY 01 terminal block

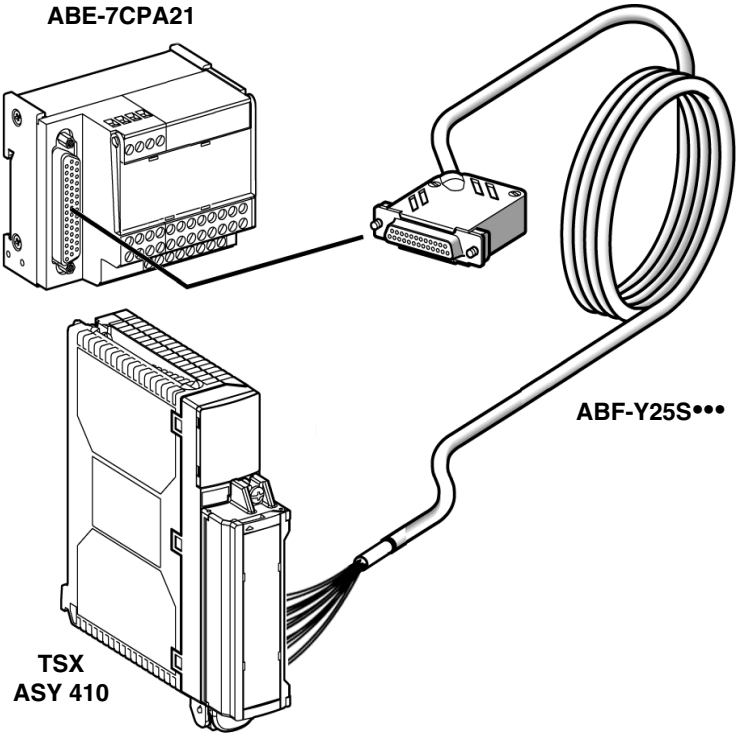


Note: Shielded cables should be used and their shields should be linked to the terminals provided for this (Restart shielding).

TELEFAST 2 Pin Assignment for the TSX ASY 410 Module

At a Glance

The TSX ASY 410 analog module is connected to a TELEFAST 2 accessory using the TSX ABF-Y25S••• cable, which guarantees continuous shielding. The accessory ABE-7CPA21 is a connection base for connecting 4-channel analog modules to a screw connector terminal block



ABE-7CPA21

The distribution of analog channels on TELEFAST 2 terminal blocks with the reference ABE-7CPA21 is as follows:

TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type	TELEFAST 2 terminal block number	25 pin SubD connector pin number	Signal type
1	/	Ground	**Supp 1**	/	Ground
2	/	STD (1)	**Supp 2**	/	Ground
3	/	STD (1)	**Supp 3**	/	Ground
4	/	STD (2)	**Supp 4**	/	Ground
100	1	Voltage output 0	**200**	14	Common channel 0
101	2	Current output 0	**201**	/	Ground
102	15	Voltage output 1	**202**	3	Common channel 1
103	16	Current output 1	**203**	/	Ground
104	4	Voltage output 2	**204**	17	Common channel 2
105	5	Current output 2	**205**	/	Ground
106	18	Voltage output 3	**206**	6	Common channel 3
107	19	Current output 3	**207**	/	Ground

Connecting via the TSX ABF-Y25S••• Cable

Connection of the TSX ASY 410 analog module to the TELEFAST 2 ABE-7CPA21 accessory is carried out 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 include the TSX BLY 01 terminal block.

Analog Output Module TSX ASY 800

11

At a Glance

Aim of this Chapter

This chapter introduces the TSX ASY 800 module, its characteristics and its connection to different pre-actuators and actuators.

What's in this Chapter?

This chapter contains the following topics:

Introducing the TSX ASY 800 module

At a Glance

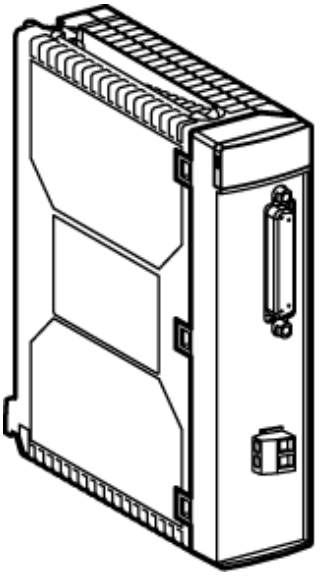
The TSX module ASY 800 is a module with 8 shared outputs. The following ranges are offered for each output:

- voltage +/- 10 V
- current 0..20 mA and 4.. 20 mA

Illustration

The following diagram shows the analog input module TSX ASY 800 :

TSX ASY 800



Note: if the modules TSX ASY 800 are supplied by internal 24 V (TSX PSY •••), the number of modules is reduced to :

- 1 per rack with simple format or standard supply,
- 2 per rack with double format supply.

Characteristics of the TSX ASY 800 Module

Introduction

This part presents general characteristics for the TSX ASY 800 module and characteristics of its analog outputs.

General Characteristics

This table presents the general characteristics for the TSX ASY 800 module:

Type of outputs	Common pulse outputs
Nature of outputs	Voltage / Current
Number of channels	8
Output refresh time	5 ms
Power supply for outputs	provided by the PLC or external 24 V supply
Types of protection	Short circuits and overloads
Insulation: ● **between channels** ● **between channels and bus** ● **between channels and ground**	 Common pulse 1000 V rms 1000 V rms
Isolation resistance under 500VDC between channel and ground	> 10 mOhms
Diaphony between channels	-80 dB
Monotonicity	Yes
Non linearity	<= 1 LSB
RC network ground connection	R = 50 MOhms, C = 4.7 nF
Dissipated power: ● **typical** ● **maximum**	 5 W 6.1 W

Voltage Outputs

This table presents the general characteristics for the TSX ASY 800 module voltage outputs:

Voltage output dynamic	+/- 10.5 V
Full scale (FS)	10 V
Max voltage without damaging the voltage outputs	+/- 30 V
Load impedance	1 KOhm minimum
Capacitative load	< 100 nF
Maximum resolution:	1.28 mV to +/- 10 V
Measuring error: ● **at 25°C** ● **from 0 to 60°C**	 +/- 0.14 % of FS +/- 0.28 % of FS (26 ppm/°C)

Current Outputs

This table presents the general characteristics for the TSX ASY 800 module current outputs:

Current output dynamic	21 mA
Full scale (FS)	20 mA
Max voltage without damaging the voltage outputs	+/- 30 V
Load impedance	600 Ohms maximum
Inductance load	< 0.3 mH
Maximum resolution:	0.00256 mA
Measuring error: ● **at 25°C** ● **from 0 to 60°C**	 +/- 0.21 % of FS (1) +/- 0.52 % of FS (64 ppm/°C)
Maximum leakage current	0.033 mA
Legend	
(1) Precision calculated in a ventilated cabinet (in a non-ventilated cabinet, the precision is: 0.32 % of FS.	

External Supply

This table shows the characteristics needed for calculating an external supply:

Characteristics	24 V +/- 5 % ripple of 1 V maximum
Cable	Shielded cable
Power consumption: ● **typical** ● **maximum**	 300 mA 455 mA
Connection	Removable screw terminal block

Note: Important:
- If the ambient temperature is greater than 50°C, the TSX ASY 800 module must be ventilated.
- If an external power supply is used, it must be VLSV (very low safety voltage). Examples of VLSV power supply: TSX SUP 1011/1021/1051/1101 and TSX SUP A05.

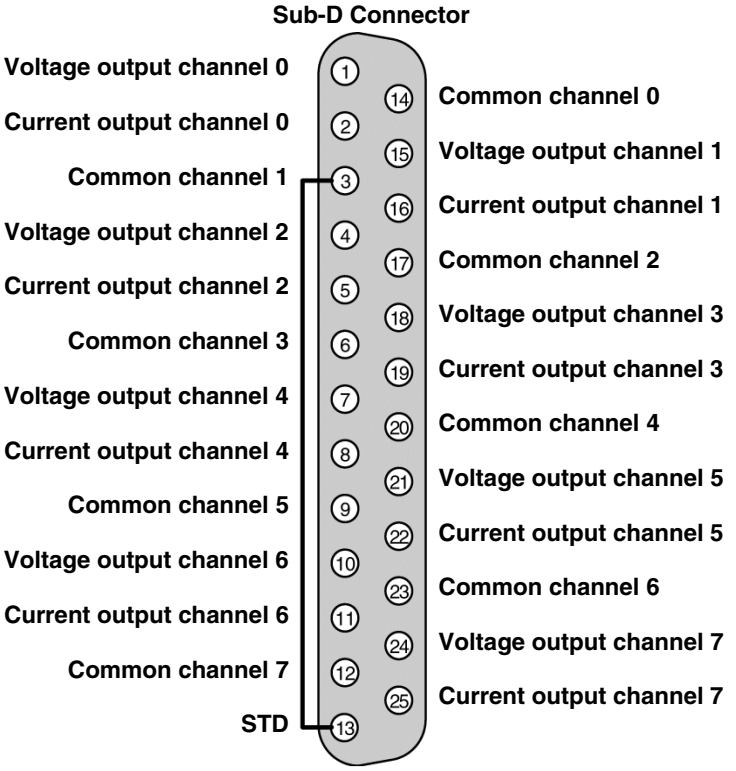
The TSX ASY 800 Connector and External Power Supply Terminal Block Pins

At a Glance

The TSX ASY 800 output module consists of a 25 pin Sub-D connector and an external supply terminal block.

25 Pin Sub-D Connector

The Sub-D connection is shown below:

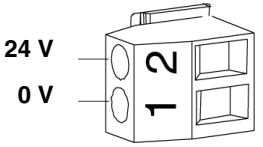


STD: The "strap" between pins 3 and 13 detects disconnection.

External Supply Terminal Block

The connection of the external supply terminal block is shown below:

External supply terminal block



Some recommendations:

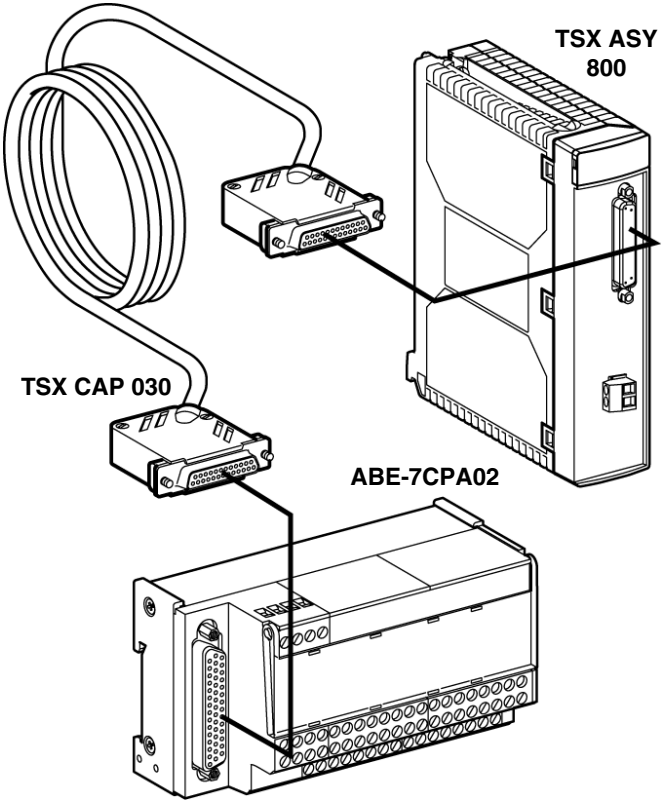
- External supply must be of the type VLVS (very low voltage for safety) 24 V +/- 5 %, ripple < 1 V.
- The connection lead must be a shielded cable (it is advised to connect the shielding braid on the supply side and as close as possible to the module, using ground clips).

Supplies that are suitable: TSX SUP 1011/1021/1051/1101 and TSX SUP A05.

TELEFAST 2 Pin Assignment for the TSX ASY 800 Module

At a Glance

Connecting the analog module TSX ASY 800 to a TELEFAST 2 ABE-7CPA02 is done using the cable TSX CAP 030, which guarantees shield continuity. This accessory is a connection base for the connection of current and voltage outputs to a screw terminal block.



ABE-7CPA02

The distribution of the analog channels to the terminals of the TELEFAST 2 ABE-7CPA02 is as follows:

TELEFAST 2 terminal number	Nature of the signals	TELEFAST 2 terminal number	Nature of the signals
1	Ground	**Supply 1**	Ground
2	STD (1)	**Supply 2**	Ground
3	STD (1)	**Supply 3**	Ground
4	STD (2)	**Supply 4**	Ground
100	Output voltage 0	**200**	Common channel 0
101	Current output 0	**201**	Ground
102	Voltage output 1	**202**	Common channel 1
103	Current output 1	**203**	Ground
104	Voltage output 2	**204**	Common channel 2
105	Current output 2	**205**	Ground
106	Voltage output 3	**206**	Common channel 3
107	Current output 3	**207**	Ground
108	Voltage output 4	**208**	Common channel 4
109	Current output 4	**209**	Ground
110	Voltage channel 5	**210**	Common channel 5
111	Current channel 5	**211**	Ground
112	Voltage output 6	**212**	Common channel 6
113	Current channel 6	**213**	Ground
114	Voltage channel 7	**214**	Common channel 7
115	Current channel 7	**215**	Ground

Note: Disconnections are detected by a link via a "strap" between terminals STD (1) and STD (2).

Implementation of the weighing module

II

At a Glance

Aim of this Part

This part introduces the hardware implementation of the weighing module of the Premium PLC range, as well as the dedicated display accessory.

What's in this Part?

This part contains the following chapters:

General introduction to the weighing module

12

At a Glance

Aim of this Chapter

This chapter is a general introduction to the weighing module.

What's in this Chapter?

This chapter contains the following topics:

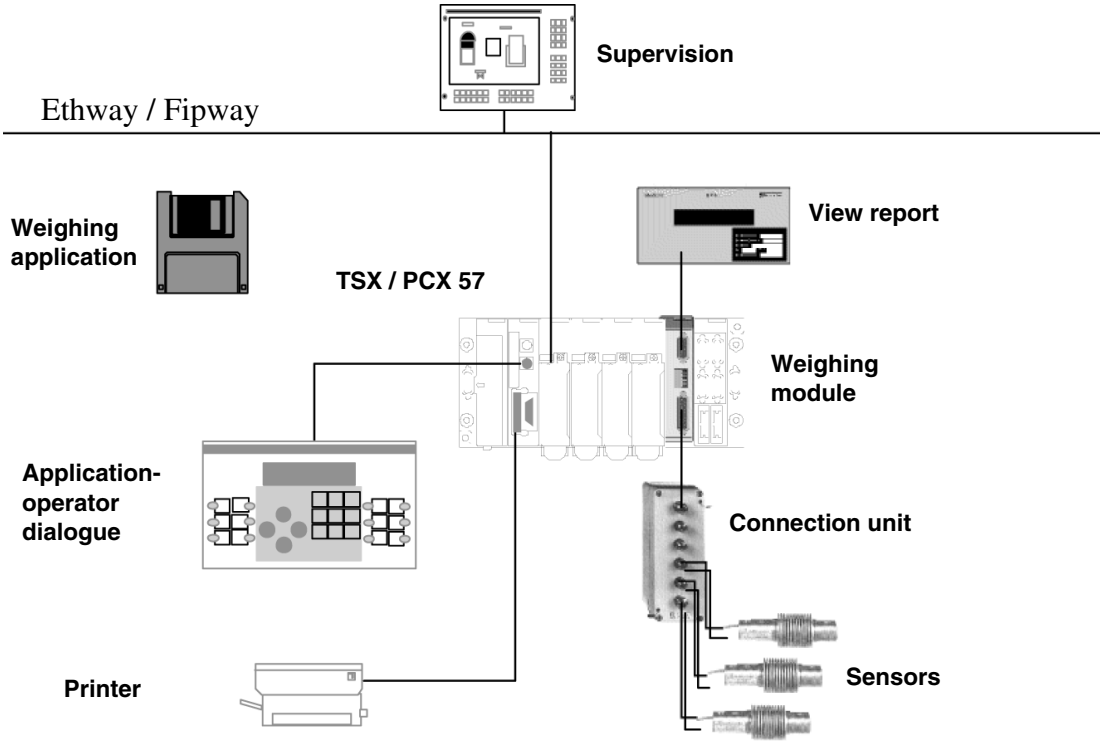
Presentation of the weighing range

General

The Premium weighing range includes:

- a specific TSX ISP Y100/101 module
- a TSX XBT N410 display unit with weighing protocol,
- automation applications: weighted dosing unit, multi-product dosing, throughput regulator, weighted sorting unit, continuous/non-continuous totaliser,
- weighing sensors,
- connection units.

The following diagram shows the different elements that may form a complete configuration of the weighing range.



General description of the weighing module

At a Glance

The TSX ISP Y100/101 weighing module features the following:

- a **measurement input** channel,
- **2 fast discrete outputs**,
- a **sealable digital link** for viewing the weight of the manual tare on an external TSX XBT N410 display.

In order to guarantee the integrity of the measurements made, the assembly consisting of the measurement input, weighing module and display can be sealed to meet legal metrology requirements concerning weighing instruments used in commercial transactions.

Maximum number of TSX ISP Y100/ 101 modules per station

The application-specific TSX ISP Y100/101 module, despite having only one measuring channel, is assimilated to a module with **2 application-specific channels**.

The maximum number of TSX ISP Y100/101 modules in a PLC station depends on:

- the type of processor installed (see table below),
- the number of application-specific channels already used: see documentation Premium PLCs, Part III - Chapter 25 (Defining and counting application-specific channels).

Reminder of the number of application-specific channels managed by each processor type

Processor	Number of application-specific channels
TSX P57 102	8
TSX P57 2•2	24
TSX P57 3•2	32
TSX P57 4•2	48

Physical description of the weighing module

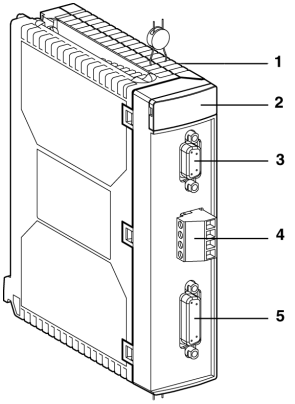
General

The following is a physical description of the weighing module TSX ISP Y100/101.

Illustration

Module TSX ISP Y100/101 look like this :

TSX ISP Y100/101



Elements

The following table describes the different elements of the weighing module :

Number	Description
1	A plastic case equipped with shielding plates protecting the electronic circuits and providing protection against radiant interference.
2	Display panel
3	A female 9 pin Sub-D connector for connecting the remote display (TSX XBT N410),
4	A 5 pin screw terminal block for connecting discrete outputs
5	A female 15 pin Sub-D connector for connecting weighing sensors.

Protecting the adjustments

13

At a Glance

Subject of this Chapter

This chapter describes how to protect the adjustments done during the previous phases.

What's in this Chapter?

This chapter contains the following topics:

Protection of the Adjustments to Weighing Parameters

General

Any weighing instrument which can be used for commercial transactions must be approved. The parameters associated with the measurement must therefore be protected. It should not be possible to introduce into an instrument, via the interface, instructions or data likely to:

- falsify the weighing results displayed,
- change an adjustment factor.

Note: Protection by sealing aims to guarantee measurement conformity, so that the parameters accessible only apply to the exploitation aspects of the module information by the mechanism.

Effect of Protecting the Configuration Parameters

There are two types of information. Information, which can be protected (if a module is sealed, this type of information will be available in read only) and information with free access (Read and Write)

The table below identifies the characteristics of this information according to the protection put in place.

Functions	Without sealing	With sealing
Task	Modifiable	Modifiable
Flow/ Calculation on n measurements	Modifiable	Modifiable
Tare/ Predefined	Modifiable	Modifiable
Threshold checking/ Active	Modifiable	Modifiable
Threshold checking/ Direction	Modifiable	Modifiable
Threshold checking/ Active outputs	Modifiable	Modifiable
Threshold Checking/ Cut-off points	Modifiable	Modifiable
Threshold checking/ LV Mask Time	Modifiable	Modifiable
Unit	Modifiable	Non modifiable
Max Range (MR)	Modifiable	Non modifiable
Scale Division	Modifiable	Non modifiable
Overload Threshold	Modifiable	Non modifiable
Filtering/ Coefficient	Modifiable	Modifiable
Data format	Modifiable	Non modifiable
Stability/ Extent of Range	Modifiable	Non modifiable
Stability/ Time	Modifiable	Non modifiable
Zero/ Zero tracking	Modifiable	Non modifiable
Zero/ Recalibration range	Modifiable	Non modifiable

The information word %IWxy.0.4:X4 (to 1) tells you if the measurement is protected.

Consequences of Protection

- A sealed module that receives a different configuration to the one memorized (before being switched off prior to the movement of the rider) is refused.
- In this case the module is seen as missing in the PLC diagnostics, but sends a weight to the display.
- A sealed module will not accept a new calibration request

Note: Using the file lets you keep a paper record for the configuration

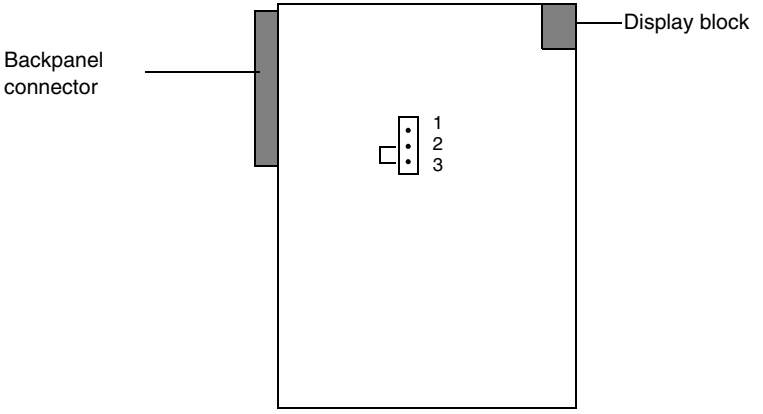
How to protect the adjustments

Necessary conditions

The calibration and adjustment operations must be completed.

Illustration

The following illustration shows how to position the jumpers in order to protect the adjustments.



Procedure

The following table describes the operation of protecting the adjustments (leading).

Step	Action
1	Take the module out of the PLC rack (the rack can remain switched on).
2	Remove the module's casing (use a TORX type screwdriver for this).
3	Place the jumper in position 2-3 as shown in the illustration.
4	Put the module back into its casing.
5	Replace the module in the rack in its previous position.

Legal metrology and regulations

EU approval

The set consisting of: load holder + sensors + module can be considered as an IPFNA (non automatic weighing instrument).

As such, and to be able to use it for commercial transitions, it has been approved by the EU.

If it is only used for internal processes, the displayt must have an identification plate mentioning:

Trademark	Max =
Type of instrument	e =
Serial number	
'All transitions prohibited'	

If it is used for regulated uses (e.g. commercial transitions), the display must have a identification plate, showing:

Trademark	Max =
Type of instrument	Min =
Serial Number	e=
Number and date of EU approval of type	Number 97.00.620.016.0 29th September 1997

Moreover, it must receive a first check on leaving the factory, as well as regular on-site monitoring by a licensed body. Generally, monitoring takes place once a year, and this is the responsibility of the owner.

Approval of the model

Measurement and control device for filling machine and a discontinuous counter

This IPFNA can be supplemented by the specific software applications 'Filling Machine' or 'Discontinuous counter'. As such, it has passed national approvals, as a measurement and automatic control device for filling machines and discontinuous counters.

It is therefore up to the manufacturer of the measurer or discontinuous counter to get a complete approval of any automatic weighing instruments made up in this way, in the most straightforward conditions possible.

It is also up to the manufacturer of the machine to install the identification plate and to present the machine for its first check, when necessary.

Approval of a continuous counter model

Associated with a weighing table, it is authorized as a continuous counter device.

Except for when used for commercial transitions, the identification plate shows:

- Mark	QMax =
- Type	dt =
- Serial number	
'All transitions prohibited'	

When used for commercial transitions, the identification plate shows:

- Mark	QMax =
- Type	dt =
- Serial number	
Weighed products:	
- Max=	L =
- v=	d =

It must be checked. The first phase of the first check is done in the factory on the complete instrument uncoupled from its conveyor, by means of a movement simulator; the other phases are carried out on the complete instrument.

Class of appliance

With average precision, the appliance covers the range from the minimum (500 scale divisions) up to 6000 scale divisions. These instruments can be authorized or unauthorized to carry out commercial transitions. If it is unauthorized, 'PROHIBITED FOR ALL TRANSACTIONS' must be written on the appliance's front panel.

General rules for implementation of the weighing module

14

At a Glance

Aim of this Chapter

This chapter presents the general rules for implementation of the weighing module.

What's in this Chapter?

This chapter contains the following topics:

Recommendations on how to install a measurement system

General

The quality of the measurement provided by the module may be reduced considerably if the sensor set-up and installation precautions have not been observed. Thus in place of exhaustive information, these few lines should make you aware of some of the precautions which need to be taken.

Dividing up the loads

In a measurement system, the weighing sensors support the following weights :

- the maximum weight to be weighed,
- the weight of the loading receiver and its structures (or metrological tare).

This total weight is divided up between 1, 2, 3, 4, 6, even 8 sensors. The design of the mechanical structures, the shape of the loading receiver and the dividing of the load on or within the receiver, means that the total weight is not always equally divided between all the sensors (except of course in the case of a single sensor).

It is therefore a good idea to make sure that the dimensions of the weighing sensors are calculated in such a way as to be able to support the total weight (maximum weight + tare) to which they will be subjected

Inhibiting interference on the load receiver

As a weighing sensor deflection is very weak (a few tenths of a millimeter), all interference on the load receiver or any friction on the permanent framework will cause an invalid weight measurement and make correct adjustment of the module impossible.

Mechanical installation of the weighing sensors

The sensors in traction or compression must be used vertically respecting their action direction (traction or compression). The maximum admissible tolerance on the installation's verticality is in the region of the degree according to the installation and the required precision.

Protecting the sensors from interference currents

It is recommended that each sensor be provided with a mass flex which plays the role of the electric " shunt " with the aim of protecting sensors from currents capable of circulating in the metallic framework (ground currents, from the terminal to be connected, and electrostatic discharges…).

This flex will be of a sufficient length to not result in mechanical constraints and it will be placed directly next to the sensors, between the permanent framework and the load receiver.

Contact with water and corrosive products

Weighing sensors are manufactured as waterproof. It is recommended, however, that they be prevented from coming into contact with water, corrosive products and direct sunlight.

Preventive maintenance of the installation and accessories

The weighing module requires no special maintenance. The weighing sensors, however, should be cleaned periodically if used in a difficult environment.

It is advisable to periodically test and service the mechanical state of the load receiver.

- Cleaning the receiver and its structures because of a product deposit or various material deposits may result in a noticeable variation of the tare.
- Checking the verticality of the weighing sensors.
- Checking the sensor and actuator states according to their period of use.
- Etc...

Note: Statistics show that 90% of breakdowns occurring on a weighing/dosing installation are not attributable to the electric command device, but to the installation itself (defective limit switches, mechanical faults…).

Installation of the weighing module

At a Glance

The method and precautions relating to the installation of the weighing module are detailed below :

Installation

The weighing module TSX ISP Y100/101 is standard format and therefore occupies a single position in the TSX RKY••• racks. It can be installed in all positions on the rack except for the first two (PS and 00) which are reserved for the rack power supply module (TSX PSY•••) and the processor module (TSX 57•••) respectively.

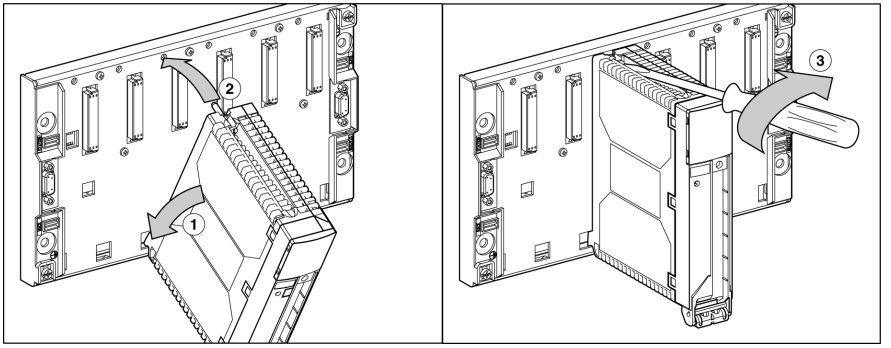
They are powered by the rack back bus, and can be positioned either in the standard rack or in an extendable rack.

Installation precaution

The installation and removal of the weighing module can be done with the PLC **switched on** (without risk of damage to the module or disruption to the PLC).

Installing the module on the rack

Installation of the weighing module on the rack is done in the following way :



Step	Action
1	Position the two lugs at the rear of the module (the lower part of the module) in the centering holes located on the lower part of the rack.
2	Pivot the module upwards so as to plug it into the rack's back connector.
3	Fix the module to the rack by tightening the fixing screw located on the upper part of the module.

Note: If this screw is not tightened, the module will not stay in the rack position.

Cabling precautions on the weighing module

At a Glance

To protect the signal from external noises induced in serial mode and from noises in common mode, you are advised to take the following precautions.

Kind of conductors

Use shielded twisted pairs of a minimum section of 0.28 mm^2 (AWG24 gage).

Cable shielding

The measurement cable shielding should only be connected to the ground on the module side. If problems arise, if the grounds on either side of the connection are of good quality, then both ends of the shield can be connected to the ground.

On the Sub-D connectors connect the cable shield to the cover of the connector, the PLC ground being connected by the tightening screws of the Sub-D connector. For this reason, the male Sub-D connector **must** be screwed onto its female connection base.

Cable routing

Keep the measurement wires as far as possible from the discrete input/output cables (particularly relay outputs) and the cables which transmit "power" signals.

Avoid :

- parallel routing (maintain a distance of at least 20 cm between the cables),
- and cross them at right-angles.

Note: The measurement input is grounded via the module.

Weighing module fault display

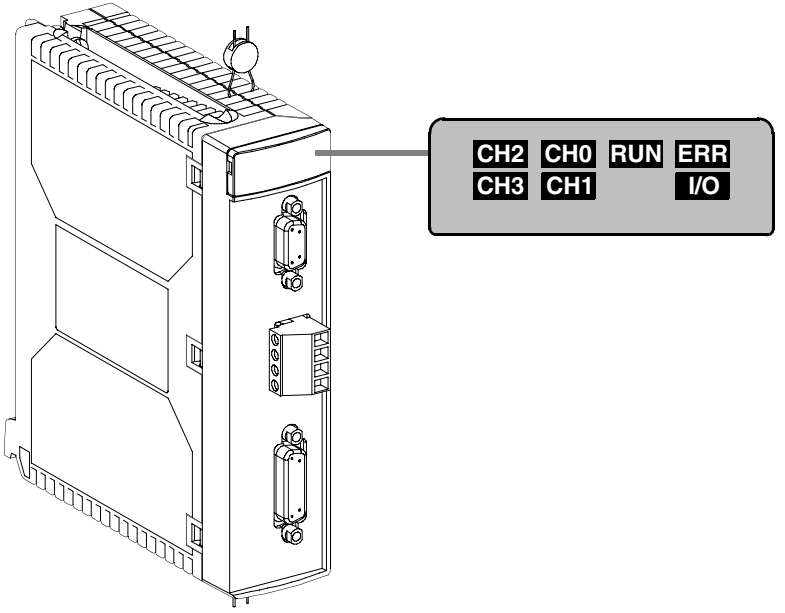
At a Glance

The weighing module is fitted with LEDs which display the status of the module and the status of the channels. We distinguish between :

- the module status LEDs : RUN, ERR and I/O,
- the channel status LEDs : CH•.

Illustration

The following diagram shows the weighing module display screen :



Description

Three LEDs located on the display panel of each module indicate the operational status of the module (LED on, flashing and off) :

- The green LED RUN : indicates the module's operational status
- The red LED ERR : indicates an internal fault in the module or a fault between the module and the rest of the configuration
- The red LED I/O : indicates an external fault.

Note: The CH• status LEDs are not used in analog modules.

The various possible faults are grouped in the following table :

LED	**On** ●	**Flashing** ⊗	**Off** ○
RUN (green)	Normal operation	-	Module faulty or switched off
ERR (red)	Internal error, module faulty	Communication error, missing, invalid or faulty application.	No internal error
I/O (red)	External errors: ● overload or underload error during calibration, ● range overshoot error, ● measurement error, ● sealed module (configuration refused).	No connector to the weighing sensors.	No external error
CH•	No channel status LEDs		

Weighing module diagnostics

At a Glance

A faulty module is makes itself evident be means of lit or flashing RUN, ERR and I/O LEDs.

There are three groups of faults: external errors, internal errors and other faults.

Fault diagnostics

The following table can be used to diagnose faults relating to the three LEDs: RUN, ERR and I/O :

Module status	**Status of LEDs**		
	RUN	**ERR**	**I/O**
Normal operation	●	○	○
Module faulty or switched off	○	⊗	○
Internal errors (module broken down): ● communication with CPU possible ● communication with CPU impossible	 ● ○	 ● ●	 ○ ○
External errors : ● overload or underload error during calibration, ● range overshoot error, ● measurement error, ● sealed module (configuration refused)	●	○	●
Other faults : ● communication error (absent, invalid or faulty application)	●	⊗	○
Key :			
○ **LED unlit**			
⊗ **LED flashing**			
● **LED lit**			

Description of the weighing module connections

15

At a Glance

Aim of this Chapter

This chapter introduces the weighing module connections.

What's in this Chapter?

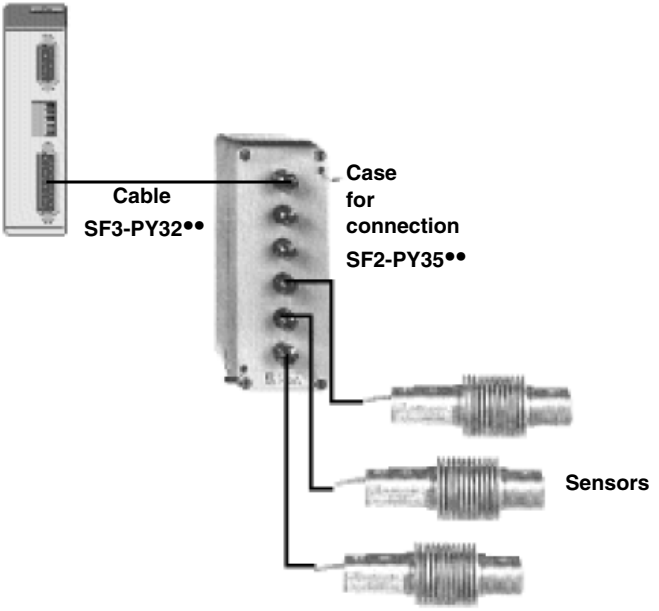
This chapter contains the following topics:

Measurement connections

General

The measurement sensors are connected using a female 15 pin Sub-D connector on the module side.

TSX ISP Y100/101



The module and the Sub-Ds can be plugged-in and unplugged with the power on.

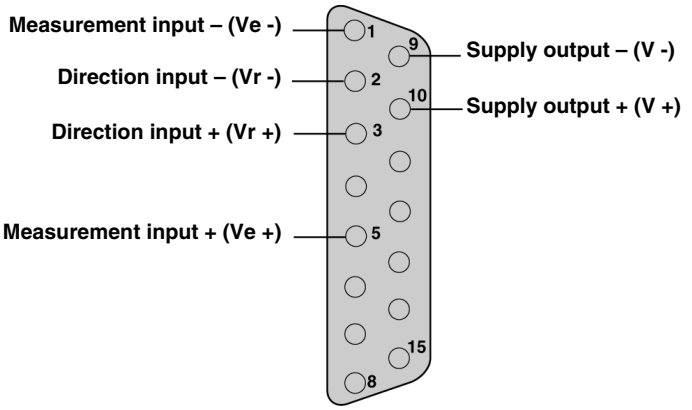
The type of cable to be used is a 6 conductor with a 15 pin Sub-D connector.

Sensor supply is exclusively assured by the module.

Sub-D Connector 15

The Sub-D connector 15 pins are shown below :

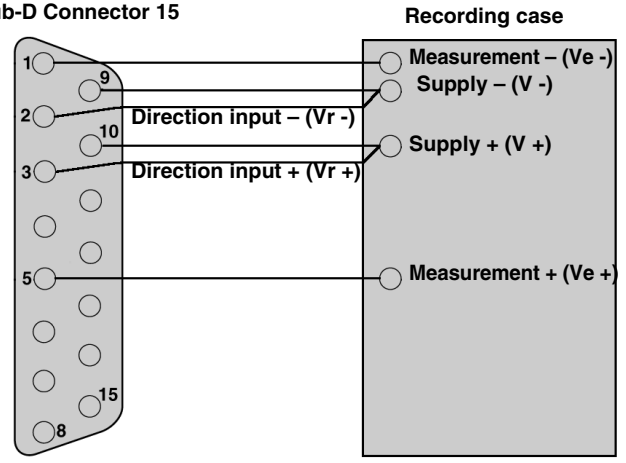
Sub-D Connector 15



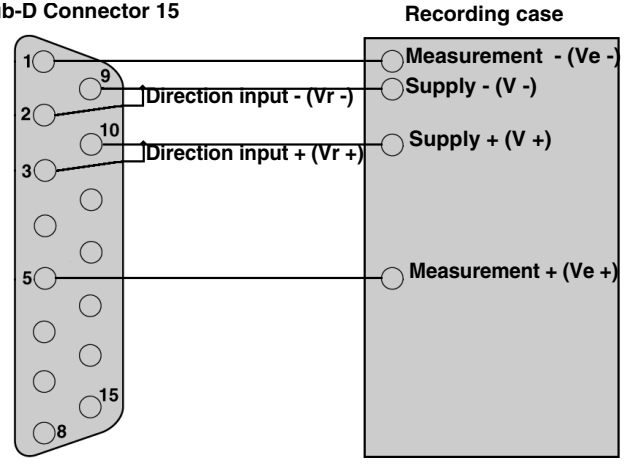
Cabling of sensor input

Depending on the accuracy desired, there are two ways to cable the sensor input. In each case**it is essential to cable them in order to obtain a measurement**.

High accuracy cabling or where the length of the cable between the module and the sensor connection unit is important :



Average accuracy cabling or where the length of the cable between the module and the sensors connection is unimportant :

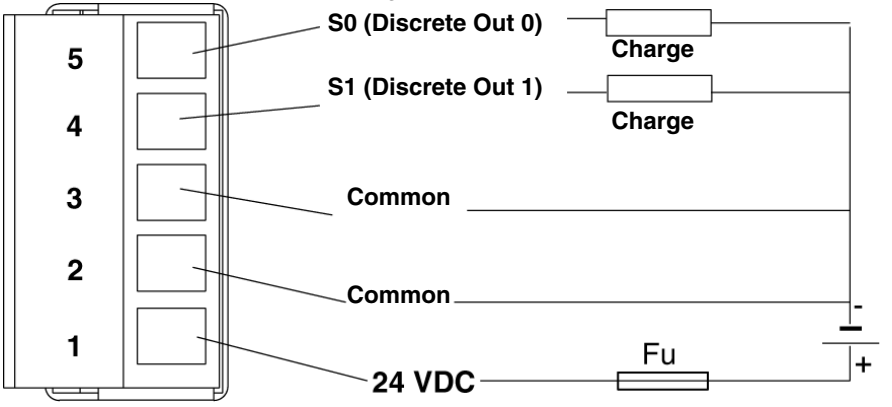


Connection of the weighing module discrete outputs

General

Weighing module discrete outputs are used to trigger actions on threshold crossing. This functionality is used in the "filling machine" application.

Discrete outputs are connected using a screw terminal block :



The common 2 and 3 are linked by the card.

Characteristics of the discrete outputs

The following table shows the characteristics of the discrete outputs of the module TSX ISP Y100/101 :

Discrete output	Characteristics
Number of channels	2
Type	A transistors
Response time	1 ms discrimination. The point where the threshold between two measurements is crossed is calculated by millisecond interpolation
Nominal supply voltage	24 V
Insulation voltage	1500 Veff
Maximum current	500 mA
Protection	Polarity and short-circuit inversion Provide a fuse on the pre-actuators +24 V

Protection

The outputs are galvanically protected by the ground.

Each of the two output channels is protected against:

- short-circuits and overloads
- polarity inversions

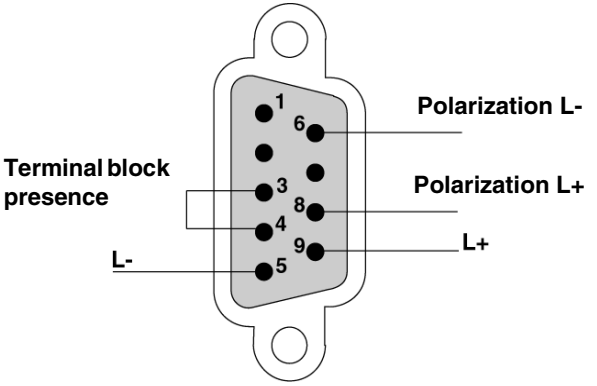
Note: In order to best protect against polarity inversions, it is essential **to place** a fast-acting **fuse** on the supply, upstream of the load (shown as Fu in the diagram above).

Pins of the serial link for the display panel

General

The serial link is used to carry over the weight to an external display panel.

The connection to the terminal is via a female 9 pin Sub-D connector on the module side, the link is RS485, the connections are described below :



The line on the module side is polarized using straps 6-5 and 8-9.

Characteristics

The following table shows the characteristics of output display panel :

Output display panel	Characteristics
Physical interface	non-isolated RS 485
Bit rate	9,6 Kbits/s
Format	1 start bit, 8 data bits and 1 stop bit
Remote distance	Maximum 30 m

The TSX XBT N410 Display

General

The TSX XBT N410 should be attached to the weighing module, to provide weight information on the main display.

The display should be connected to the module by a 2-conductor shielded cable. It is equipped with a female 15 point Sub-D 15 connector.

Characteristics

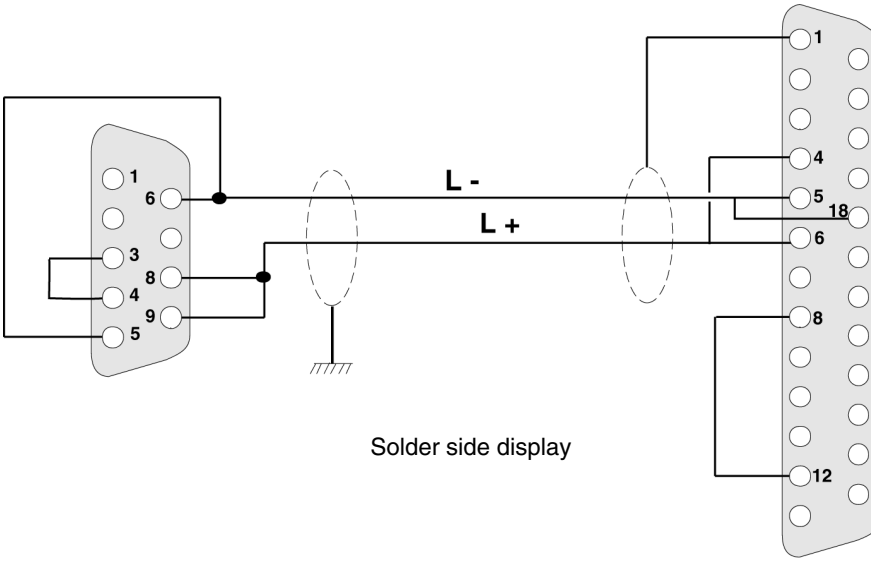
The following table gives the electrical characteristics of the display:

Type of screen	Backlit liquid crystal (123 x 32 pixels)
Display	2 lines of 20 characters
Refresh period	100 ms
Serial connection	RS 485
Transmission speed	9.6 Kbits/s
Connection	By sealable Sub-D socket
Power supply	Exterior 24 VDC source on a 3-point detachable terminal strip
Voltage limits	18 to 30 V, DC
Ripple rate	25% maximum
Consumption	10 W
Temperatures • **operating** • **storage**	 0...55°C -20...60°C
Level of protection • **front panel** • **rear panel**	 IP65 according to IEC 60529 standards, Nema 4x (outdoor use) IP20 according to IEC 60529 standards
Standards followed	IEC 61131-2, IEC 60068-2-6, IEC 60068-2-27, UL 508 and CSA C22-2 no.14

Note: For more details, see the User Manual for the Magelis Range.

Connecting the Display

The diagram below shows the TSX ISP Y100/101 Weighing module with the TSX XBT N410 display:



The cable, **a shielded twisted pair**, the weighing module with the XBT N410 cannot exceed 100 meters in length.

On the module side the shielding must be connected to the metallic part of the Sub-D connector.

Module TSX ISP Y100/101

16

General characteristics of the module TSX ISP Y100/101

At a Glance

This part introduces the general characteristics of the module TSX ISP Y100/101, the general characteristics of the measurement device and the consumption table.

The measurement device

Table showing the general characteristics of the module TSX ISP Y100/101

Electrical range	0 to 25 mV
Minimum dynamic	4,5 mV
Maximum dynamic	25 mV
Converter resolution	20 bits (1 048 576 pulses)
Limitations of use	50 000 pulses
Conversion speed	50 measurements/second
Zero drift	< 200 nV/°C
Gain drift	< 10 ppm/°C
Non linearity	< 20 ppm (FS)
50 Hz series mode rejection	> 120 dB
Maximum length of the measurement cable	100 m for cable at 0.4 mm^2 200 m for cable at 0.6 mm^2 For 1 to 8 sensors

Consumption

The following table shows the consumption values of the module TSX ISP Y100/101 :

Consumption	**Typical**	**Maximum**
On 5 VDC	150 mA	330 mA
On 24 VR (1)	7 mA + 17 mA x N	14 mA + 17 mA x N
Dissipated power	**Typical**	**Maximum**
	0,75 W	1,65 W
Key:		
(1)	Consumption depends on the number of sensors (N) present on the measurement input	

Index