Premium and Atrium using EcoStruxure™ Control Expert

Counter Modules User Manual

(Original Document)

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER
DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING
WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

CAUTION
CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE
NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book

At a Glance

Document Scope

This manual describes the hardware and software implementation of the counter application for Premium and Atrium PLCs.

Validity Note

This documentation is valid for EcoStruxure™ Control Expert 14.0 or later.

The technical characteristics of the devices described in the present document also appear online. To access the information online:

Step	Action
1	Go to the Schneider Electric home page *www.schneider-electric.com*.
2	In the **Search** box type the reference of a product or the name of a product range. ● Do not include blank spaces in the reference or product range. ● To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the **Product Datasheets** search results and click on the reference that interests you. If you entered the name of a product range, go to the **Product Ranges** search results and click on the product range that interests you.
4	If more than one reference appears in the **Products** search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the data sheet.
6	To save or print a data sheet as a .pdf file, click **Download XXX product datasheet**.

The characteristics that are presented in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Related Documents

Title of documentation	Reference number
EcoStruxure™ Control Expert, Operating Modes	33003101 (English), 33003102 (French), 33003103 (German), 33003104 (Spanish), 33003696 (Italian), 33003697 (Chinese)
EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual	35006144 (English), 35006145 (French), 35006146 (German), 35013361 (Italian), 35006147 (Spanish), 35013362 (Chinese)
EcoStruxure™ Control Expert, I/O Management, Block Library	33002531 (English), 33002532 (French), 33002533 (German), 33003684 (Italian), 33002534 (Spanish), 33003685 (Chinese)
Premium and Atrium using EcoStruxure™ Control Expert, Processors, racks and power supply modules, Implementation Manual	35010524 (English), 35010525 (French), 35006162 (German), 35012772 (Italian), 35006163 (Spanish), 35012773 (Chinese)

You can download these technical publications and other technical information from our website at *www.schneider-electric.com/en/download*.

Product Related Information

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter, and apply this product.

Follow all local and national safety codes and standards.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Part I
Introduction to the Counting Function

In This Chapter

This part provides a general introduction to the counting function and the operating principles of the modules.

What Is in This Part?

This part contains the following chapters:

Chapter 1
Introduction to the Counting application

Overview of the Counting Application

At a Glance

The counting application makes it possible to carry out fast counting using couplers, Control Expert screens and specialized language objects. The general operation of the expert modules, also called couplers, is described in the *Introduction to TSX CTY2A, TSX CTY4A and TSX CTY2C Coupler Operation, page 43* section, and details about their functions is described in the *Description of the standard functions of TSX CTY2A/4A/2C counting modules, page 167* section.

The physical context in which the counting will be carried out must be defined (rack, power supply, processor, modules or devices,...) during installation, then the software installation *(see page 165)* must take place.

This second aspect is realized from the different Control Expert editors:

- either offline,
- or on-line.

Chapter 2
Introduction to the TSX CTY2A/4A/2C Counting Modules

Aim of this chapter

This chapter introduces the different TSX CTC2A/4A/2C counting modules.

What Is in This Chapter?

This chapter contains the following topics:

General

Introduction

The TSX CTY 2A, TSX CTY 4A and TSX CTY 2C modules are standard format counting modules. They are used to count pulses from a sensor with a maximum frequency of 40 kHz (CTY 2A/4A) or 1 MHz (CTY 2C).

Installation of counting modules

The counting modules can be installed in all the available slots of a Premium PLC configuration.

Number of "application-specific" channels supported:

- Premium *(see Premium and Atrium using EcoStruxure™ Control Expert, Processors, racks and power supply modules, Implementation Manual)*
- Atrium *(see Premium and Atrium using EcoStruxure™ Control Expert, Processors, racks and power supply modules, Implementation Manual)*

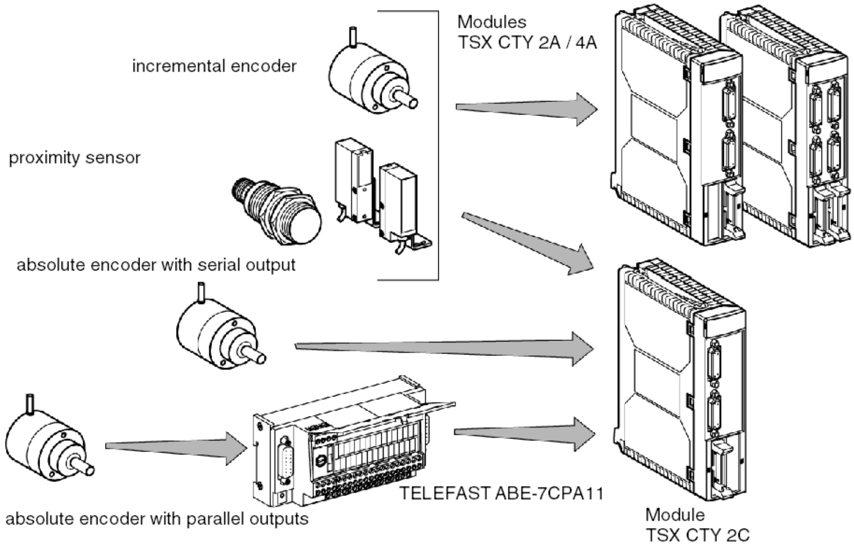
Sensors used on the channels

The sensor used on each channel can be:

- a 2 or 3-wire proximity sensor, type PNP or NPN. When using a mechanical contact output, it is necessary to raise the channel’s immunity in order to curb the closing bounces of the contact,
- an incremental signal encoder with 5 VDC differential outputs (encoder with RS 422/485 line transmitters),
- an incremental signal encoder with 10-30 VDC output (Totem Pole encoder),
- an absolute encoder with serial outputs, standard RS 485 interface (TSX CTY 2C only),
- an absolute encoder with parallel outputs, using the TELEFAST adapter: ABE-7CPA11 (TSX CTY 2C only).

Illustration

This diagram shows the different sensor types:



Physical Description

Illustration

This diagram illustrates the TSX CTY 2A / 4A / 2C counting modules:

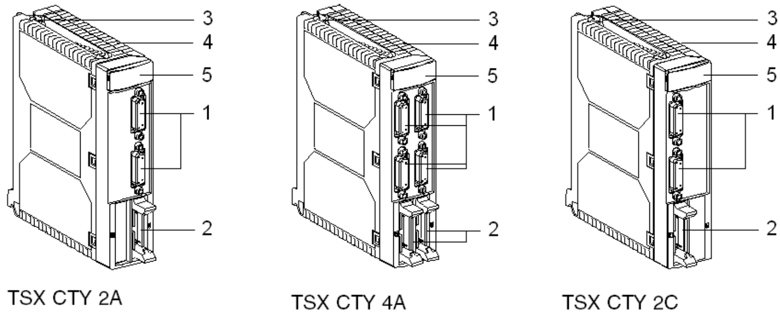


Table of numbers

This table describes the modules according to the different numbers in the diagrams above:

Number	Description
1	Standard SUB D 15-pin connector for connecting: ● the counting sensor(s), related to channels 0 and 1 for TSX CTY 2A / 2C modules, and to channels 0, 1, 2 and 3 for TSX CTY 4A module, ● the encoder supply when using this type of sensor, ● the return encoder supply, which is used to check that the encoder is receiving the correct supply.
2	HE10 20-pin connectors, used for each channel to connect: ● auxiliary inputs: ❍ reset to 0 or set to the preset value, ❍ count confirmation, ❍ capture, ● of auxiliary outputs, ● external supplies: ❍ auxiliary input and output supply, ❍ supply of other sensors.
3	Screw for fixing module in place.
4	Rigid body, which guarantees: ● electromagnetic card support, ● locking of the module in its slot.
5	Module diagnostic LEDs: ● module level diagnostics: ❍ green LED RUN: indicates the operating mode of the module (operative module), ❍ red LED ERR: indicates the internal state of the module (internal error, module broken down), ❍ red LED I/O: indicates an external error or application fault, ● module channel level diagnostics: ❍ green CHx LED: indicates channel diagnostics. - LED on: channel active, - flashing LED: channel inactive, - LED off: channel inoperative, not configured or incorrectly configured.

Chapter 3
Example of the counting application

Aim of this chapter

This chapter introduces an example of the counting application, from the configuration of the modules to the project's development in the PLC.

What Is in This Chapter?

This chapter contains the following sections:

Section 3.1
Introducing and configuring the example

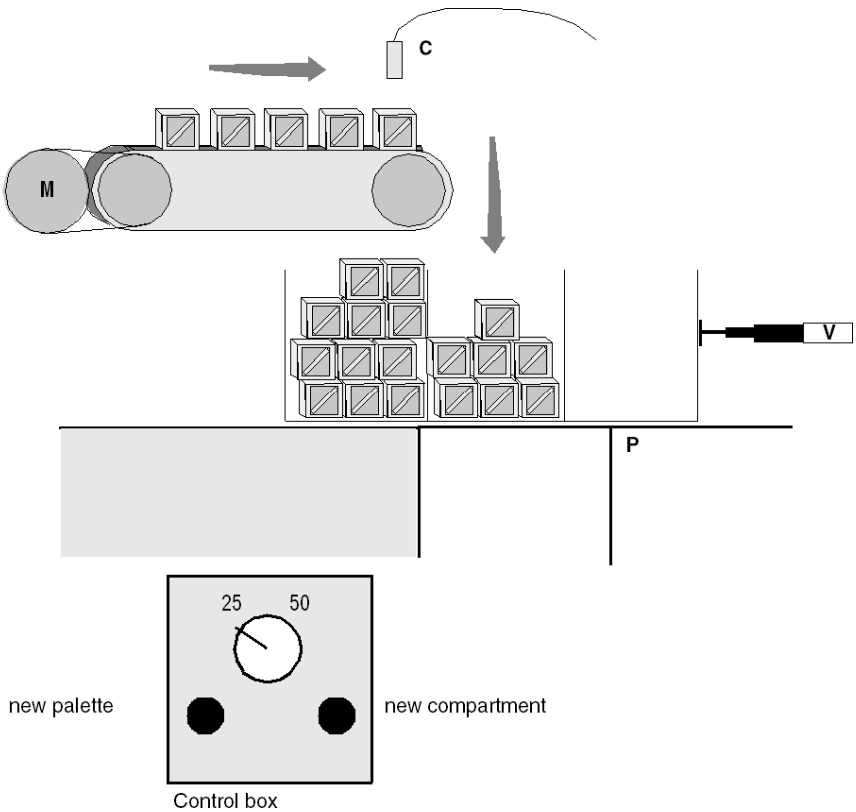
Presentation of the example of batch grouping

At a Glance

This very simple example shows a TSX CTZ 2AA counting module being used in tandem with a discrete module. It consists of a MAST task and an event task.

Illustration

The illustration above shows the principle of monitoring automated palette stacking.



External specifications of the application

The PLC is loaded to monitor the palette stacking. Each palette has three compartments. The compartments are inserted under the stacking device with a 4-slot jack **V**. The last slot is for moving out full palettes.

There are two types of palettes, one with 25 and one with 50 compartments.

The operating principle is as follows:

- The motor **M** powers a conveyor belt which carries the objects.
- A sensor **C** counts the objects before they are put back into the palette.
- A telescopic jack **V** is used to move on to the next compartment when the one in progress is full, and it moves out the full palette.
- A plate **P** allows you to change the palette.

Activating the motor physically enables counting.

The HMI consists of the following controls:

- 25/50 switch: used to choose the type of palette. This takes effect for the next palette (on state),
- **New palette** button: forces the palette to be changed (on the rising edge),
- **New compartment** button: forces the compartment to be changed (on the rising edge).

Section 3.2
Programming details for the example

Object of this section

This section describes in detail the Control Expert programming needed to install the counting application.

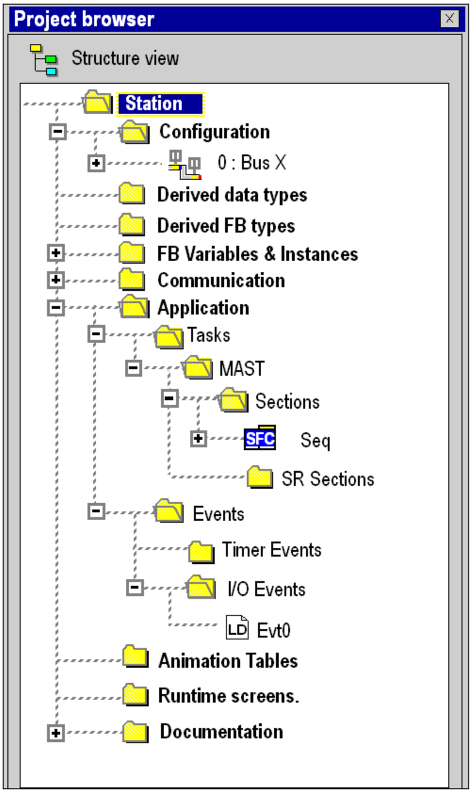
What Is in This Section?

This section contains the following topics:

Project structure

Structural view of project

The diagram below shows the project structure.



Program: preliminary processing

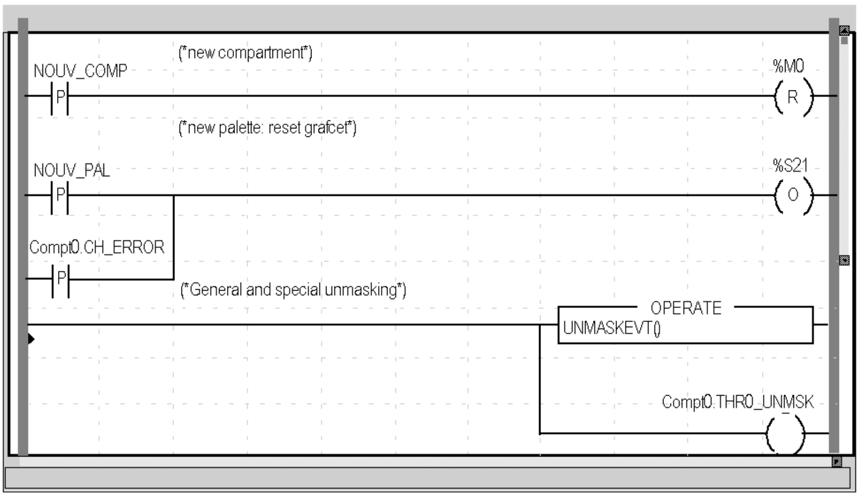
The aims of the preliminary processing

The preliminary processing manages the forced operating modes:

- changing the palette
- changing the compartment

The operation of the preliminary processing

The diagram below shows the programming of the preliminary processing.



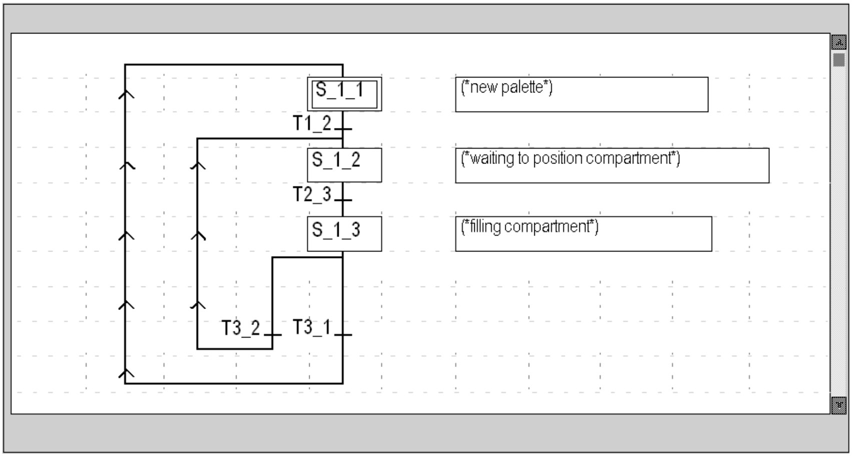
Program: SFC (Sequential Function Charting)

General

Sequential processing constitutes the heart of the project. It concerns monitoring the compartments being filled and changing the palette.

Flowchart of the sequential processing

The diagram below shows the SFC representation.



Program: step 0 of the sequential processing

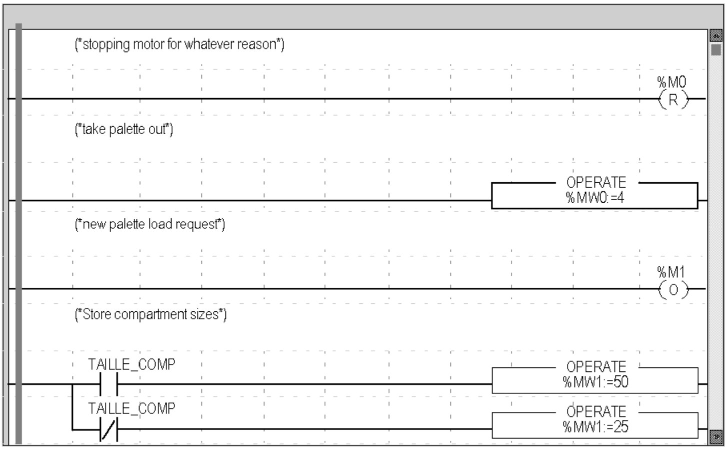
Presentation of step 0

Step 0 initializes the loop:

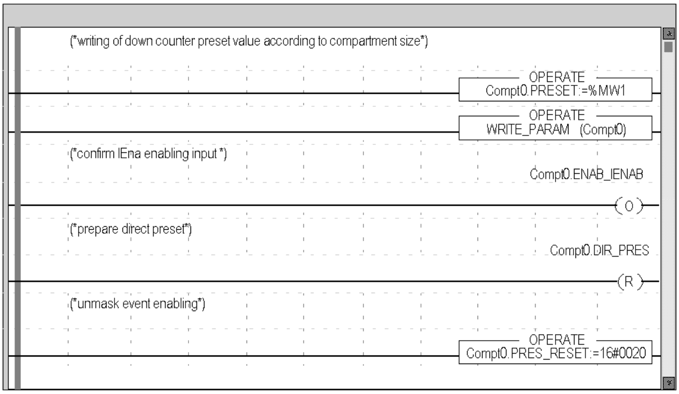
- stops the motor,
- confirms the counting module's **IEna** input,
- unmasks the **zero value overshoot** event.

Step 0: action on step 0 activation

The diagram below shows the action on activation of step 0.

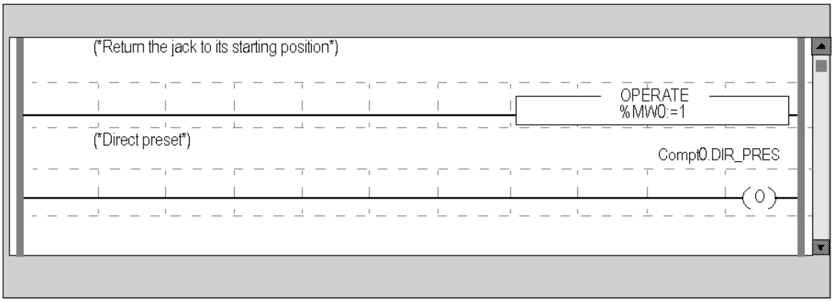


The diagram below shows the result of the action on activation of step 0.



action on step 0 deactivation

The diagram below shows the action on deactivation of step 0.



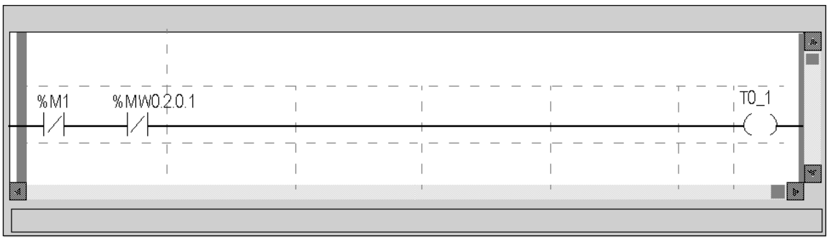
Transition of step 0 to step 1

The transition conditions from step 0 to step 1 are as follows:

- palette ready to receive objects,
- exchanges between the PLC and the counting module are terminated.

Illustration

The diagram below shows the transition conditions from step 0 to step 1.



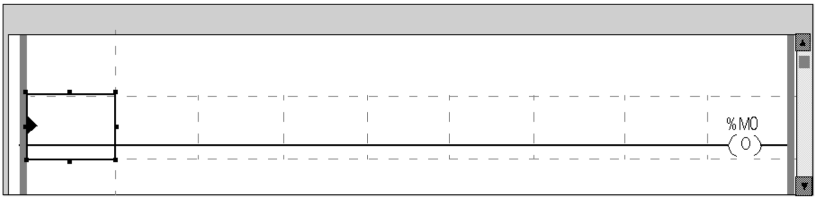
Program: step 2 of the sequential processing

Presentation of step 2

Step 2 deals with monitoring the compartments being stacked.

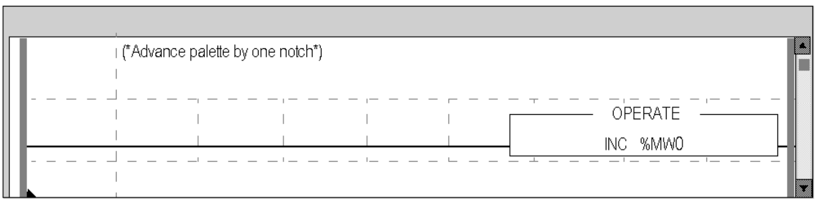
Step 2: action on step 2 activation

The diagram below shows the action on activation of step 2.



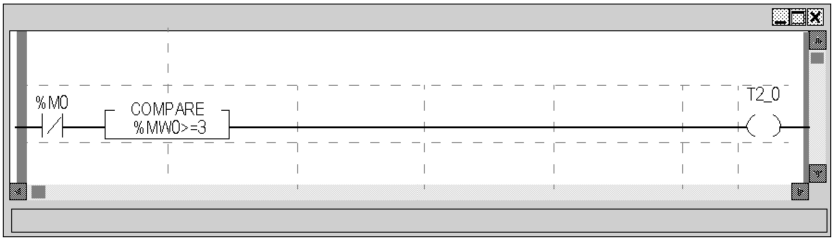
Step 2: action on step 2 deactivation

The diagram below shows the action on deactivation of step 2.



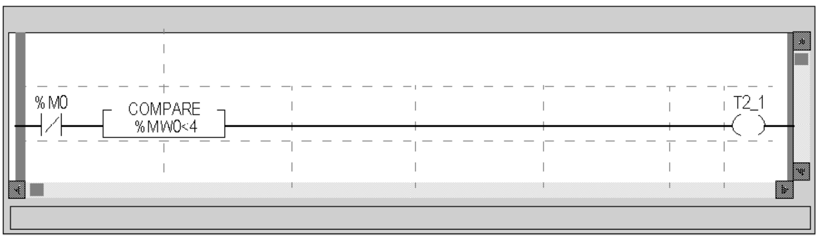
Transition of step 2 to step 0

The diagram below shows the transition conditions from step 2 to step 0.



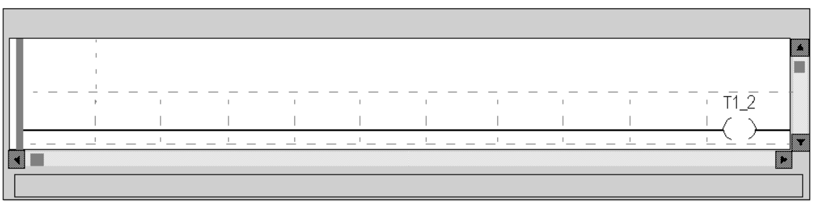
Transition of step 2 to step 1

The diagram below shows the transition conditions from step 2 to step 1.



Transition of step 1 to step 2

The diagram below shows the transition conditions from step 1 to step 2, (this always applies).



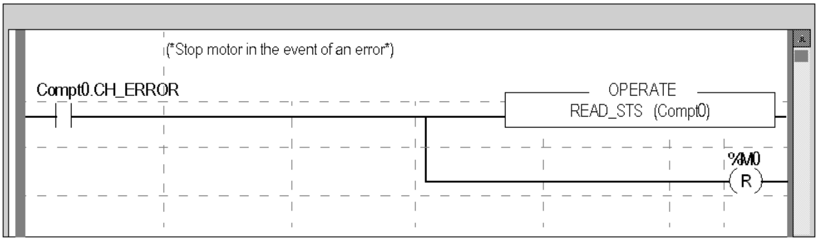
Program: subsequent processing

The aim of subsequent processing

Subsequent processing manages errors and stops the motor if there is a PLC error.

The operation of subsequent processing

The diagram below shows the programming of the subsequent processing.



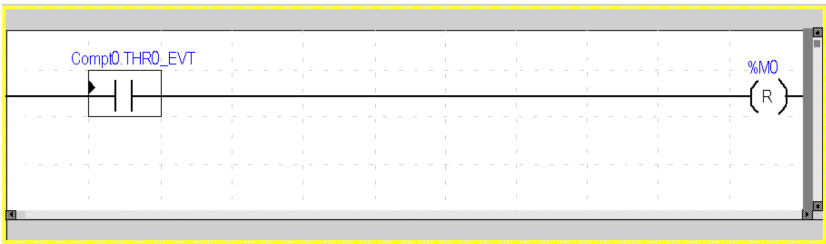
Program: event processing

At a Glance

Event processing stops the motor by resetting the %MO when the switch to zero value event is enabled.

Illustration

The diagram below shows the programming of the 0 event task.

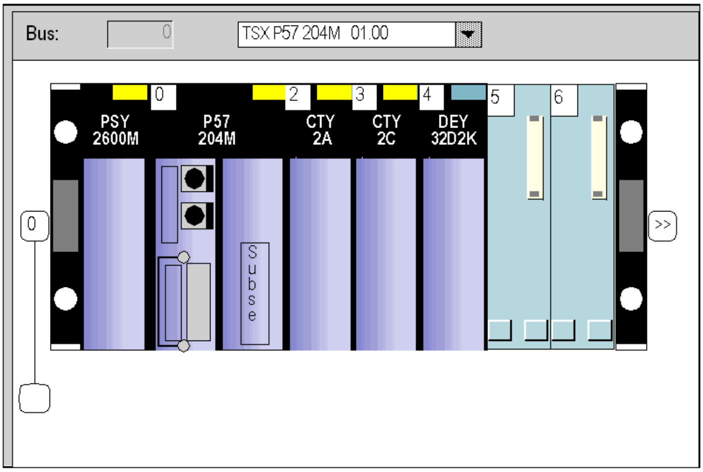


Section 3.3
Configuration of modules and association with IODDT

Configuration of the PLC

The PLC structure

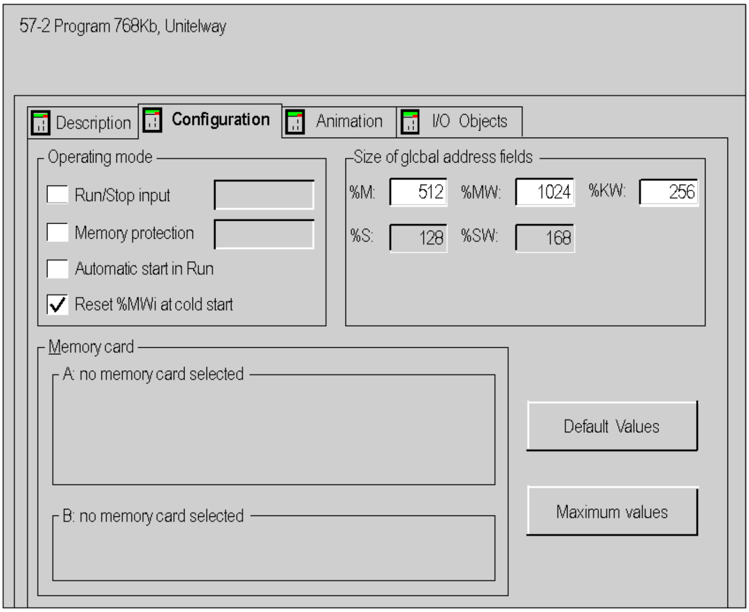
The diagram below shows the composition of the PLC.



NOTE: the CTY 2C module in position 2 is not used in this example.

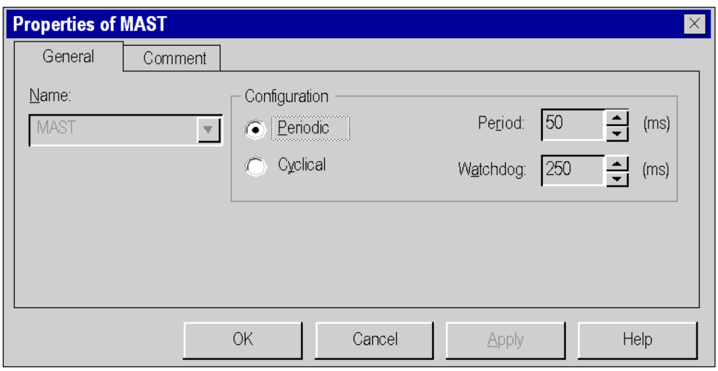
Configuration of the processor

The diagram below shows the processor configuration.



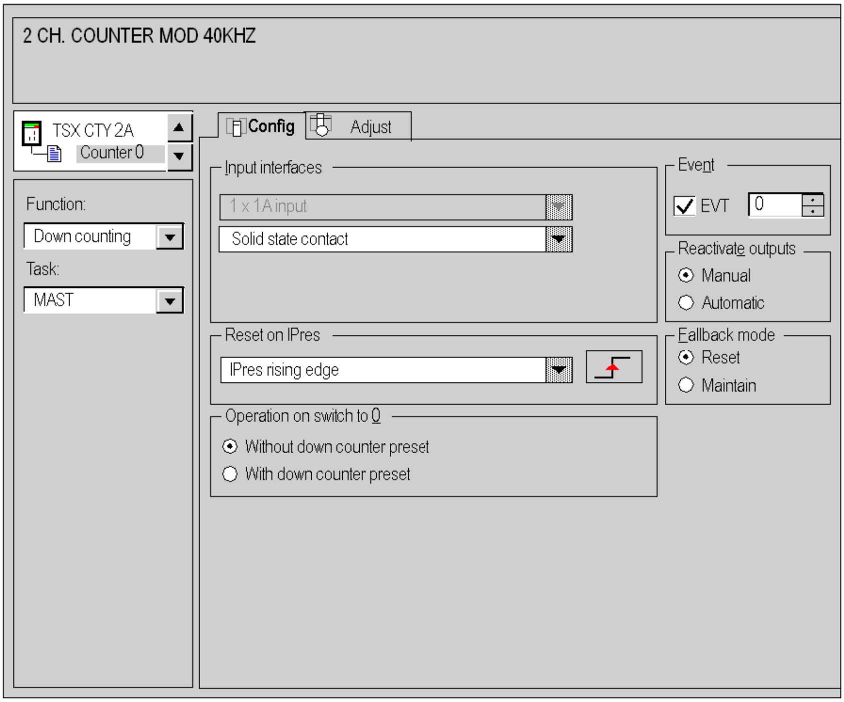
Configuration of the Mast task

The diagram below shows the configuration of the **MAST** task.



Configuration of the counting module

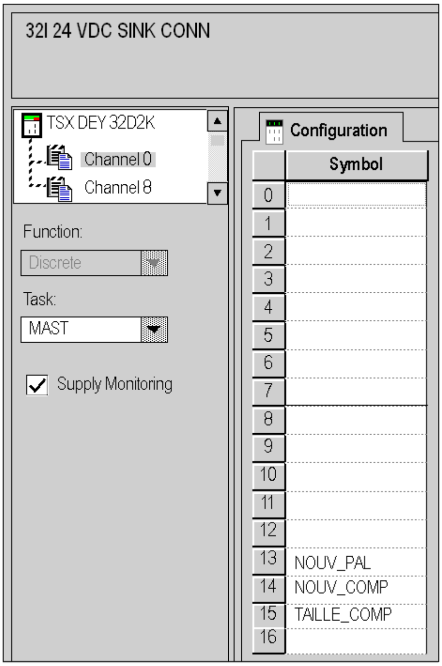
The diagram below shows the configuration of the counting model.



The C sensor (for counting the objects) is mated with the 0 channel.

Configuration of discrete module

The diagram below shows the configuration of the discrete model.



The assignments of the inputs are as follows:

- input 13: new palette forcing button (active at 1),
- input 14: new compartment forcing button (active at 1)
- input 15: 25/50 objects per compartment switch (1 = 50 objects).

NOTE: this module is only used for input.

Assignment of the internal bits and words

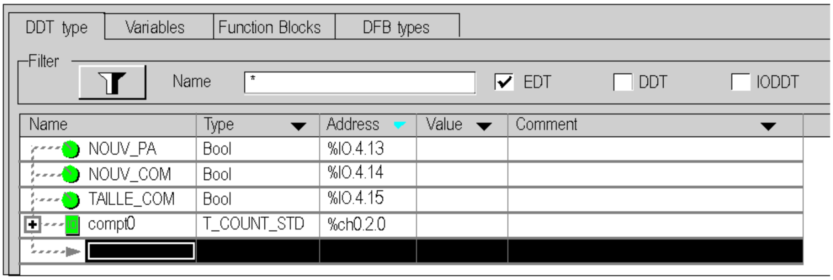
The example uses the assignments of the following internal variables:

- `%M0` : 1 starts the M motor, 0 stops it.
- `%M1` : at 1, the palette is being positioned, at 0 it is ready to receive the objects.
- `%MW0` : positions of the jack: 1,2, ,3 (corresponding to the three compartments) and 4 (for moving out the palette).
- `%MW1` : 25 or 50 (for storing the size of a palette's compartments).

Assignment of down counting channel to the IODDT

Take the IODDT `T_COUNT_STD` `Compt0`variable. The `Compt0` variable is associated with channel 0 of the CTY 2A module.

The diagram below shows the variable editor.



Chapter 4
Introduction to TSX CTY2A, TSX CTY4A and TSX CTY2C Coupler Operation

Aim of this chapter

This chapter describes the operation of TSX CTY2A, TSX CTY4A and TSX CTY2C couplers.

What Is in This Chapter?

This chapter contains the following sections:

Section 4.1
General Information about TSX CTY2A/4A and TSX CTY2C Couplers

Introduction to TSX CTY2A, TSX CTY4A and TSX CTY2C Modules

At a Glance

The TSX CTY2A, 4A and 2C modules are the counting modules used with the Premium modular PLC range. To execute this function, they support all the functions of the Control Expert software.

These modules feature:

- functions designed to release tasks from the processor that are directly related to counting (comparisons, captures, preset or reset to zero, fault detection, etc.)
- event generation functions for the application program,
- TOR outputs configurable as reflex outputs, adapted to fast actions.

These modules constitute a variable characteristic range, adapted to different industrial control situations.

Main characteristics

The main characteristics of these modules are the following:

Type	Functions	Number of channels per module	Number of physical outputs per channel	Maximum frequency (kHz)
TSX CTY2A	Counting, down counting, up / down counting.	2	1 or 2 (depending on the function)	40
TSX CTY4A	Counting, down counting, up / down counting.	4	1 or 2 (depending on the function)	40
TSX CTY2C	Counting / down counting, speed measurement / monitoring.	2	4	1000

The TSX CTY2A and 4A modules are functionally identical. Their only difference is the number of channels.

Section 4.2
Principle functions of the TSX CTY2A and TSX CTY4A modules

The Subject of this Section

This section describes the principle operations of the TSX CTY2A and TSX CTY4A modules.

What Is in This Section?

This section contains the following topics:

Introduction to TSX CTY 2A and 4A couplers

Description

TSX CTY 2A and 4A modules are used for pulse counting, down counting or up / down counting. The following functions are available:

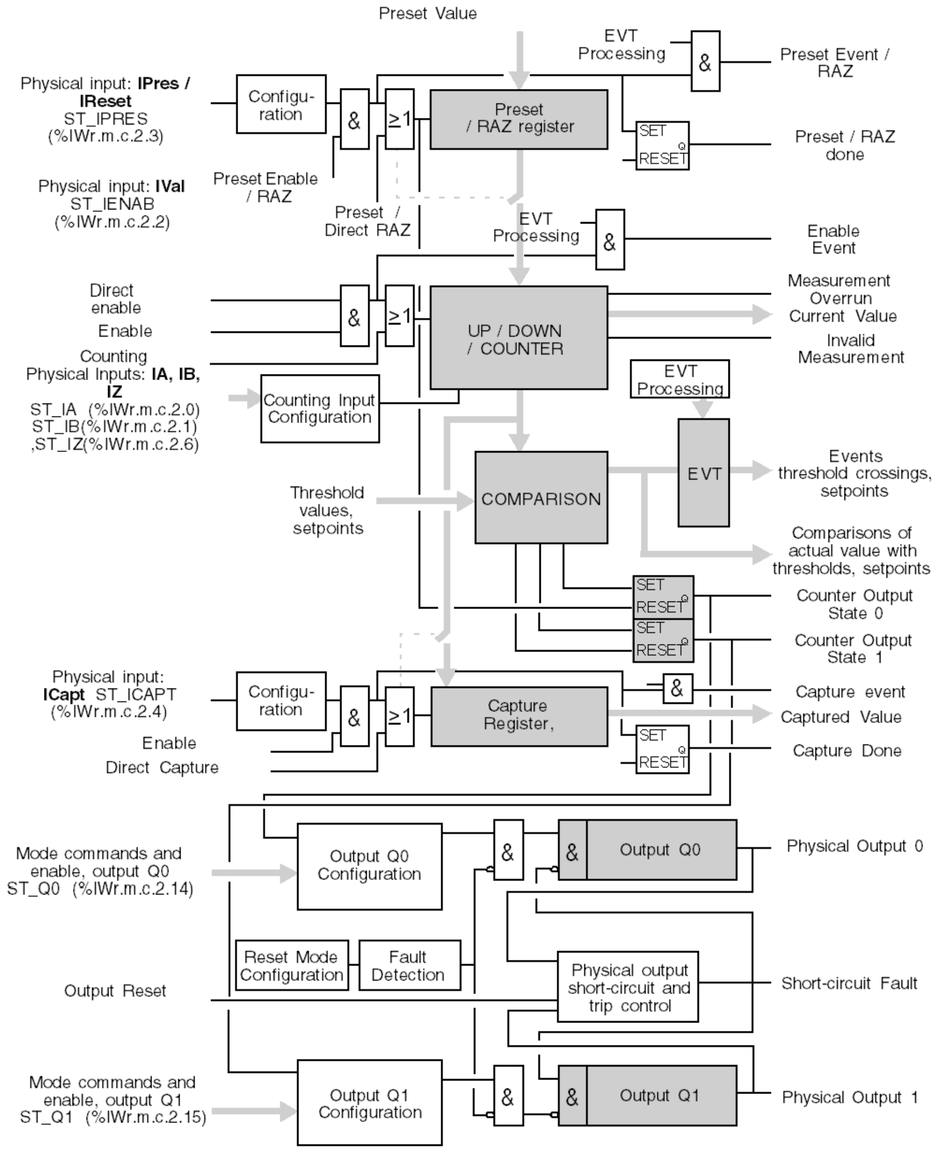
- enable *(see page 48)*,
- capture *(see page 176)* (for up / down counting),
- preset or RESET *(see page 180)*,
- comparisons *(see page 192)*,
- transient event latch by means of two flip-flops *(see page 197)*,
- two physical outputs *(see page 206)*,
- event processing *(see page 276)*.

These modules are **identical**, with this number of channels:

- TSX CTY 2A 2 channels
- TSX CTY 4A 4 channels.

Illustration

The illustration below shows the overall structure of a channel. Depending on the function selected (counting, down counting or up/down counting), certain functionalities are not active.



Introduction to a Counting or Down Counting Channel

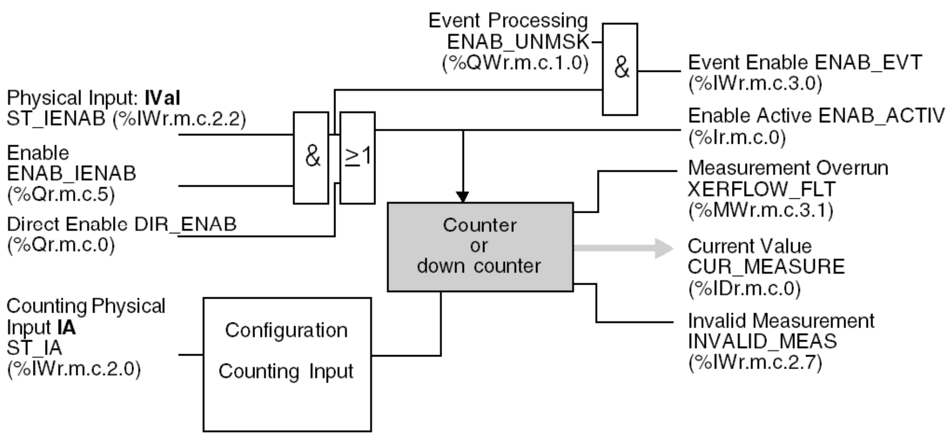
At a Glance

This section introduces the functional core of a channel, consisting of the following blocks:

- counting or down counting,
- enable.

Illustration

The following illustration shows the counting or down counting functional core of the TSX CTY 2A or 4A modules.



Comment

The hardware or software counter enable function is a particular auxiliary function, intrinsically related to the counting or down counting functions. Indeed, without the counter enable, the counting or down counting functions cannot operate. For this reason, unlike the other auxiliary functions, the counter enable function is present in this section. The associated language objects are described in the implicit objects *(see page 290)* part.

Physical input

The counting only or down counting only functions only accept a single counting physical input, which is illustrated below (signal applied on the **IA input** ST_IA (%IWr.m.c.2.2)).

Input characteristics

This table summarizes the input characteristics of the up/down counting function for each channel.

Modules involved	TSX CTY 2A / 4A
Main physical input	**IA** ST_IA (%IWr.m.c.2.0)
Counting or down counting enable	• hardware: **IVal ST_IENAB (%IWr.m.c.2.2) input**, conditioned by the **Enable** software command, • directly using the software (**Direct enable** command).

Counting and Down Counting Operation

At a Glance

The basic operation of the TSX CTY 2A and 4A modules for counting or down counting only is explained below.

Basic principles

The counting or down counting operations are the changes of the same register of the module. The only difference is the direction of the change. This is defined by software configuration (counting or down counting only functions).

The changes of the counting register are possible only when the function is **enabled**:

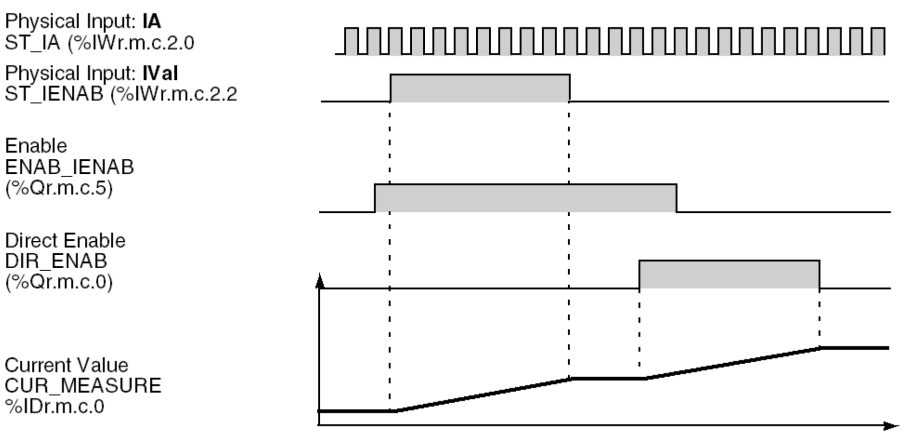
- by a physical input (**IVal** ST_IENAB (%IWr.m.c.2.2)) with software pre-positioning (**Enable** command ENAB_IENAB (%Qr.m.c.5)),
- directly, using the software: **Direct enable** command DIR_ENAB (%Qr.m.c.0).

The count values vary between:

- 0 and +16 777 215 for counting (24 bits with no sign),
- -16 777 216 and +16 777 215 for down counting (24 bits + sign).

Operation

This timing diagram shows the counting process. The down counting function is similar, but the change direction of the current value is reversed. The associated language objects are described in the implicit objects *(see page 290)* part.



Introduction to a Up/Down Counting Channel (TSX CTY 2A/4A)

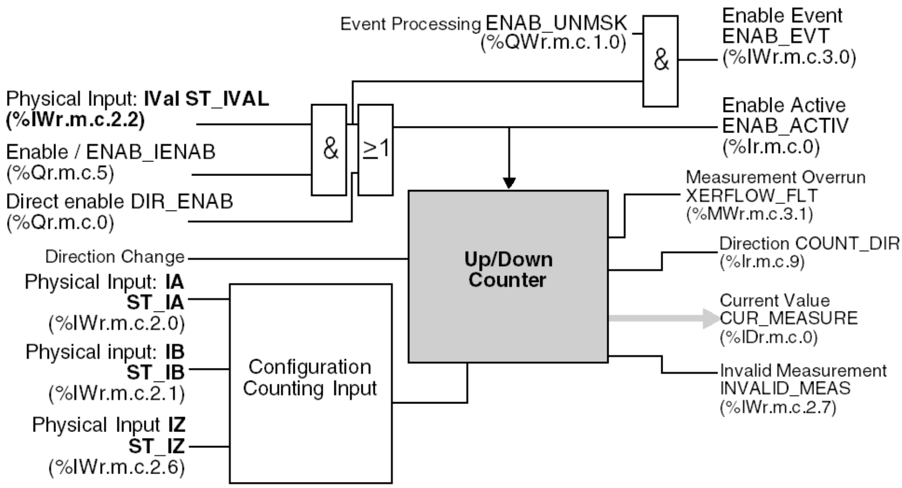
At a Glance

This section introduces the functional core of a channel, consisting of the following blocks:

- up/down counting,
- enable.

Illustration

The following illustration shows the up/down counting functional core of the TSX CTY2A or 4A modules.



NOTE: this illustration is very similar to that of the counting only or down counting only function. The main differences are at the level of the physical inputs. The associated language objects are described in theimplicit objects *(see page 290)* part.

Important comment

The hardware or software counter enable function is a particular function, intrinsically associated to the up/down counting main function. Indeed, without the counter enable, the counting or down counting functions cannot operate. For this reason, unlike the other functions, the counter enable function is present in this case.

Physical inputs

The up/down counting function accepts four counting physical input configurations, which are described in the table below.

Input characteristics

This table summarizes the input characteristics of the up/down counting function (for each channel).

Modules involved	TSX CTY 2A / 4A
Input configuration	• One physical input **IA** ST_IA (%IWr.m.c.2.0) and one software input (counting direction). • Two physical inputs: **IA** (main) and **IB** ST_IB (%IWr.m.c.2.1) (counting direction). • Two physical inputs: **IA** (counting) and **IB** (down counting). • Three physical inputs: **IA** and **IB** on the incremental encoder and **IZ** ST_IZ (%IWr.m.c.2.6) on the encoder turn pulse.
Enable	• hardware: physical input **IVal ST_IVAL (%IWr.m.c.2.2)**, • software.

Up/Down Counting Operation

At a Glance

The TSX CTY2A and 4A module operation for combined up / down counting is introduced below.

Basic Principles

Counting or down counting are the changes of the same register of the module. The only difference is the direction of the change. This is defined by software configuration, by a physical input or by the application of the count signal to a specific input.

The counting register changes are possible only when the function is **enabled**:

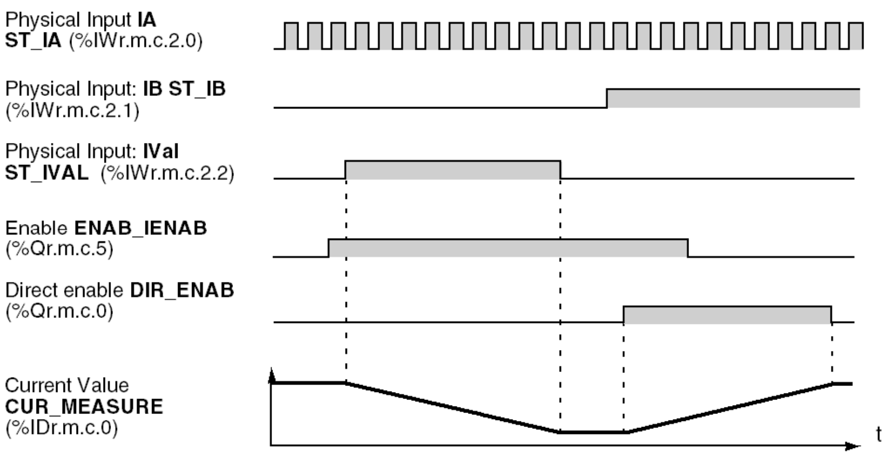
- by a physical input **IVal ST IVAL** (`%IWr.m.c.2.2`) with software pre-positioning (**enable command ENAB_IENAB** (`%Qr.m.c.5`)),
- directly, using the software: **direct enable** command **DIR_ENAB** (`%Qr.m.c.0`).

The count values vary between:

- -16,777,216 and +16,777,215 (24 bits + sign).

Operation

The following timing diagram shows the up/down counting process, when the count signal is applied to the **IA input ST_IA** (%IWr.m.c.2.0), the **IB input ST_IB** (%IWr.m.c.2.1) defines the counting direction. There are many other possibilities (previously introduced) to define the counting direction, but the up/down counting principle is the same. The associated language objects are described in the implicit objects *(see page 301)* part.



Section 4.3
Main Functions of the TSX CTY2C Module

Aim of this chapter

This chapter describes the main functions of the TSX CTY2C fast counting module.

What Is in This Section?

This section contains the following topics:

Introduction to TSX CTY2C Module

Description

The TSX CTY2C module is a counting module used in PREMIUM PLCs.

This module has two identical channels with the following main functions:

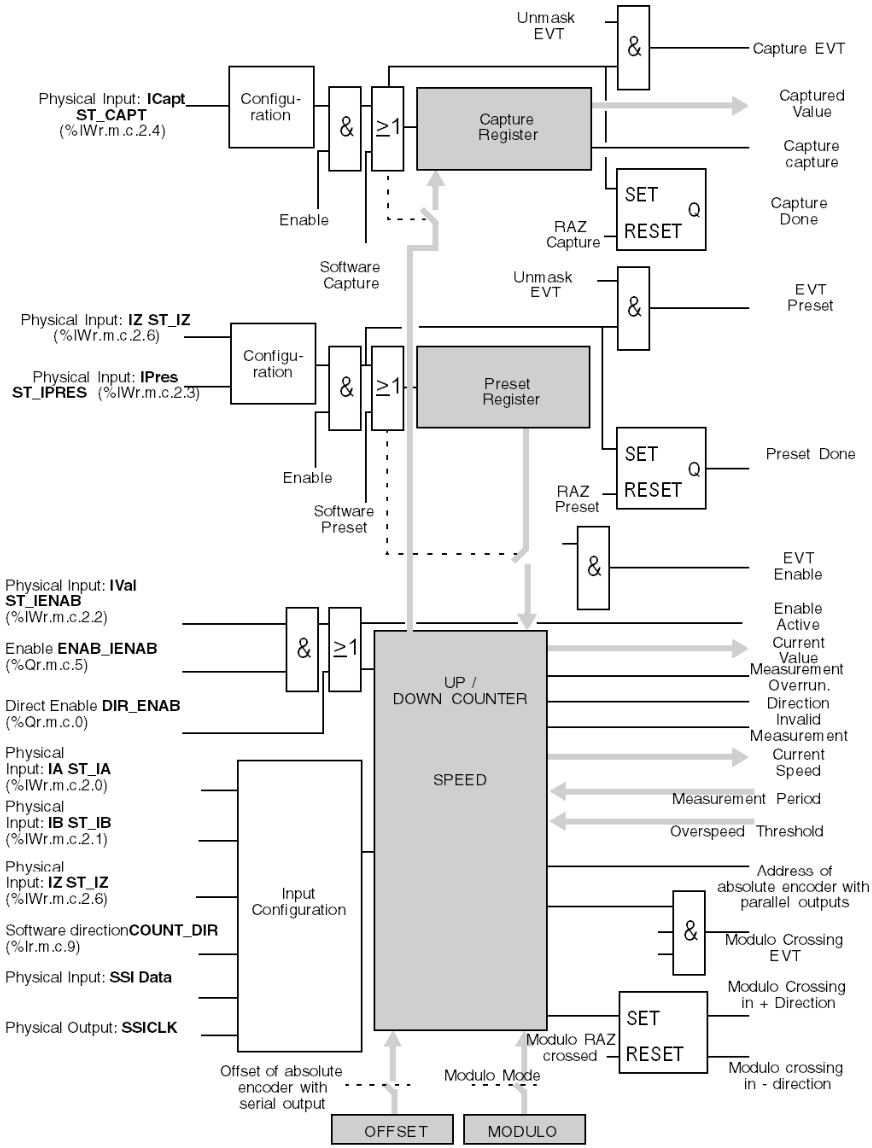
- pulse up / down counting *(see page 57)*,
- absolute encoder position acquisition *(see page 174)*,
- speed (pulse frequency) measurement and monitoring *(see page 219)*.

The module also includes the following functions:

- enable *(see page 57)*,
- capture *(see page 176)*,
- preset *(see page 186)*,
- comparisons *(see page 196)*,
- latch *(see page 203)* of transient events by means of two flip-flops,
- four physical outputs *(see page 212)*,
- event processing *(see page 276)*.

Illustration

The illustration below shows the structure of the functional core of a channel (up / down counting and speed measurement, enable, preset and capture). To know the associated language objects see the implicit objects *(see page 311)*.



Introduction to an Up/Down Counting and Measurement Channel

Introduction

This section introduces the functional core of a channel of the TSX CTY2C module, consisting of the following blocks:

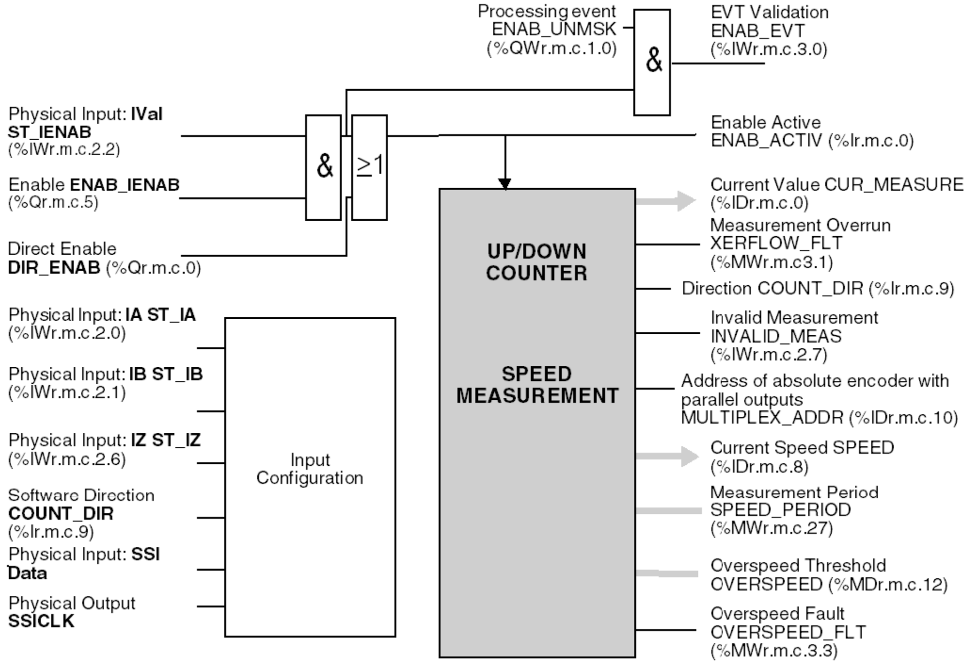
- up/down counting and speed measurement,
- enable.

Comment

Hardware or software counter enable is a particular function, intrinsically related to the up/down counting function. For this reason, unlike the other functions, the counter enable function is present in this case.

Illustration

The following illustration shows the main functions of a channel of the TSX CTY2C module. The associated language objects are described in implicit objects *(see page 311)* part



Input characteristics

The TSX CTY 2C module accepts five hardware input configurations, which are described in the table below (for each channel).

Module involved	TSX CTY 2C
Input configuration	• One physical input **IA** ST_IA (%IWr.m.c.2.0) and a software input (counting direction). • Two physical inputs: **IA** (main) and **IB** ST_IB (%IWr.m.c.2.1) (counting direction). • Two physical inputs: **IA** (counting) and **IB** (down counting). • Three physical inputs: **IA** and **IB** on the incremental encoder and **IZ** ST_IZ (%IWr.m.c.2.6) on the encoder turn pulse. • A SSI series absolute encoder input/output interface, with: ❍ one physical input **SSI Data** ❍ a transmission clock output **SSICLK**.
Up/down counting enable	• hardware: **IVal** input ST_IVAL (%IWr.m.c.2.2) (combined with **Q2** output ST_Q2 (%IWr.m.c.2.12), to be configured), conditioned by the **Enable** software command ENAB_IENAB (%Qr.m.c.5), • directly using the software (**Direct enable** command DIR_ENAB (%Qr.m.c.0)).

Up/Down Counting Operation

At a Glance

The up / down counting operation of the TSX CTY2C is introduced below.

Basic Principles

The counting or down counting operations are the changes of the same register of the module. The only difference is the direction of the change. This is defined by software configuration, by a physical input or by applying a count signal to a particular input.

The changes of the counting register are possible only when the function is **enabled**:

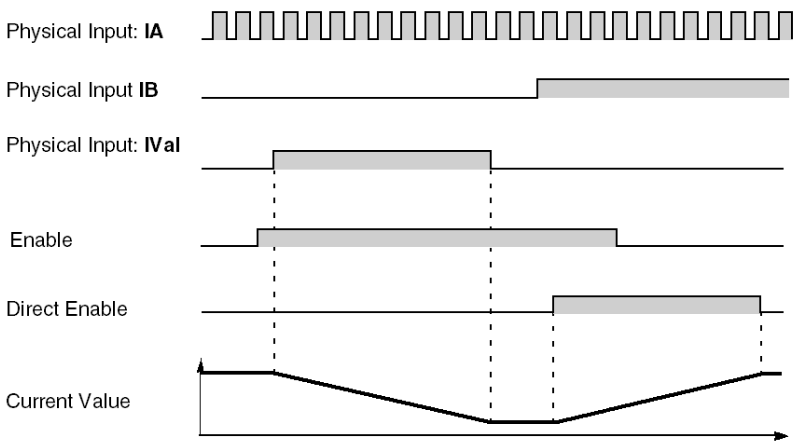
- by the physical input **IVal** with a software pre-positioning (**Enable** command).
- directly, using the software: **Direct Enable** command.

The count values vary between:

- -16,777,216 and +16,777,215 in normal mode (24 bits + sign).
- 0 and +33,554,431 in modulo mode (25 bits without sign).

Operation

The following timing diagram shows the up/down counting process, when the count signal is applied to the **IA input**, the **IB input** defines the counting direction. There are many other possibilities (previously introduced) to define the counting direction, but the up/down counting principle is the same. The associated language objects are described in the implicit objects *(see page 311)* part.



Speed Measurement Operation

At a Glance

In addition to the up / down counting function, the TSX CTY 2C module can execute the speed measurement function.

This function can be used with the counting sensors (which generate the pulses) or with the absolute encoders (which generate a word describing a position).

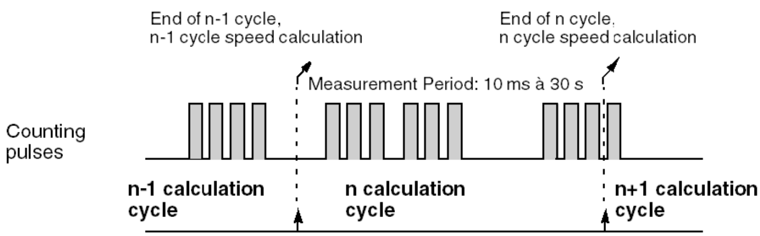
Comment

Strictly speaking, the position acquisition is not a pulse counting or down counting process, but the same result is obtained using successive writings in the counting register.

Principle of measurement

The principle of the speed calculation is that of the frequency meter: the speed is calculated and updated on a period set by the user, in number of points per second. The default measurement period value is 1 second.

The following illustration shows the principle of measurement:



The sampling period must be chosen according to the desired precision and the speed (frequency) lower limit of the signal to be measured, using the following formula:

$$\text{Sampling Period} \geq \frac{1}{\text{precision x speed}}$$

where the precision is expressed as a decimal value (for example: 0.1% = 0,001) and the speed (pulse frequency) in thousands of points/second (kHz). The sampling period is calculated in milliseconds.

Example: for a 40,000 to 250,000 points/second pulse frequency and a desired precision of 0.1%, the minimum sampling period is 25 ms.

NOTE: the minimum sampling period is 10 ms.

Principle of speed monitoring

Speed monitoring makes it possible to set to 0 the reflex outputs after a configurable speed threshold overrun and to command directly a safety device (for example).

For more details about the speed measurement function, see *Description of the speed measuring function of the TSX CTY2C Module,* *page 219*.

Part II
Installing the Counting Module

In This Chapter

This part deals with the installation of TSX CTY 2A / 4A / 2C counting modules.

What Is in This Part?

This part contains the following chapters:

Chapter 5
Installation

Aim of this Chapter

This chapter introduces the different methods of installing the TSX CTY2A/4A/2C counting module.

What Is in This Chapter?

This chapter contains the following sections:

Section 5.1
Installation

Aim of this chapter

This chapter describes the installation of the counting modules and the associated sensor types.

What Is in This Section?

This section contains the following topics:

Maximum number of Counting Modules

Introduction

The TSX CTY 2A/4A/2C counting modules can be installed in any available slot of a Premium PLC configuration, providing that the maximum number of channels.

Number of "application-specific" channels supported:

- Premium *(see Premium and Atrium using EcoStruxure™ Control Expert, Processors, racks and power supply modules, Implementation Manual)*
- Atrium *(see Premium and Atrium using EcoStruxure™ Control Expert, Processors, racks and power supply modules, Implementation Manual)*

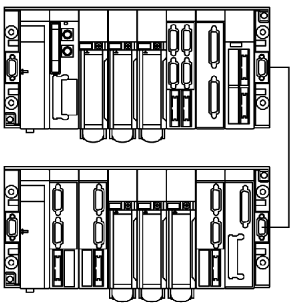
NOTE: The term "application-specific" applies to all channels on an application-specific module (counting module, axis command module etc.). The TSX CTY 2A/C modules comprise 2 "application-specific" channels, and the TSX CTY 4A module comprises 4 "application-specific" channels. Only the configured channels are included.

Example

It is possible to install 12 TSX CTY 2A/2C modules or 6 TSX CTY 4A modules with all channels configured into the configuration of a TSX P57 204 processor.

These modules can be installed in any position on the main rack, or on the 7 extension racks.

Illustration: Example of configuration:



Types of sensor that can be used on counter inputs

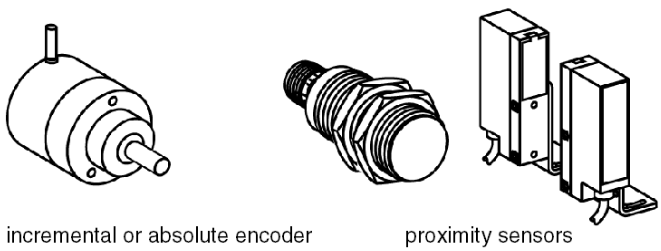
General

The counter inputs of TSX CTY 2A/4A/2C modules can receive pulses generated by:

- PNP / NPN type 2 / 3-wire proximity sensors,
- incremental encoders with 5 V differential output signals and RS 422/485 line transmitters, on a 10-30 V supply,
- incremental encoders with 5 V differential output signals and RS 422/485 line transmitters, on a 5 V supply, incremental encoders with 10-30 V output signals and Totem Pole, on a 10-30 V supply,
- an absolute encoder with SSI serial outputs, RS 485 standard interface (TSX CTY 2C only),
- absolute encoders with parallel outputs and a TELEFAST ABE7CPA11 adapter (TSX CTY 2C only).

Illustration

This diagram shows the different types of incremental encoder:



Section 5.2
General Rules of Implementation

Aim of this chapter

This chapter deals with the general rules for implementing counting modules.

What Is in This Section?

This section contains the following topics:

General Rules for Implementation

Installation

Connecting or disconnecting the standard 15 pin SUB-D connectors of the TSX CTY 2A/ 4A/ 2C modules to/from the encoder and sensor supplies present is not recommended as this may damage the encoder. Some encoders cannot withstand sudden and simultaneous signal and supply power-ups or outages.

General wiring instructions

Wire sections

Use wires of a satisfactory section to avoid drops in voltage (mainly with 5 V) and overheating.

Example of falls in voltage for encoders supplied with 5 V with a cable length of 100 meters:

Section of the wire	Encoder consumption			
	50 mA	100 mA	150 mA	200 mA
0.08 mm^2 (gauge 28)	1.1 V	2.2 V	3.3 V	4.4 V
0.12 mm^2 (gauge 26)	-	1.4 V	-	-
0.22 mm^2 (gauge 24)	-	0.8 V	-	-
0.34 mm^2 (gauge 22)	0.25 V	0.5 V	0.75 V	1 V
0.5 mm^2	0.17 V	0.34 V	0.51 V	0.68 V
1 mm^2	0.09 V	0.17 V	0.24 V	0.34 V

Connection cable

All cables carrying the sensor supply (encoders, proximity sensor etc.) and the counting signals must:

- be at a distance from high voltage cables,
- be protected with shielding, which is linked to the protective ground connection on both the PLC and encoder side,
- never carry signals other than counting signals and supplies relating to counting sensors.

The connection cable between the module and encoder should be as short as possible to avoid creating loops, as the circuit capacities can interfere with operation.

NOTE: If necessary, direct the flow of the signal in the same cable as the supplies. Cables with twisted pairs should preferably be used for this.

Encoder and auxiliary sensor supply

Principle

Encoder supply

This must:

- be reserved exclusively for supplying the encoder to avoid parasitic pulses which could interfere with the encoders, whose electronics are sensitive,
- be placed as close to the TELEFAST 2 base as possible to reduce drops in voltage and coupling with other cables,
- be protected against short circuits and overloads by fast blow fuses,
- work well independently to avoid micro-power outages.

Auxiliary sensor supply

Refer to the general regulations for implementing discrete modules.

NOTE: The – 0 VDC polarity of the auxiliary encoder and sensor supplies should be grounded as near to the supplies as possible.
The shielding of the cables carrying the voltages should be grounded.

Section 5.3
15 point SUD-D type and 20 point HE10 type connectors

Aim of this chapter

This chapter describes the SUB-D 15 and HE10 connectors used for counting sensors, power supplies, auxiliary inputs and outputs.

What Is in This Section?

This section contains the following topics:

15-pin SUB-D connectors Standard for a TSX CTY 2A / 4A module

General

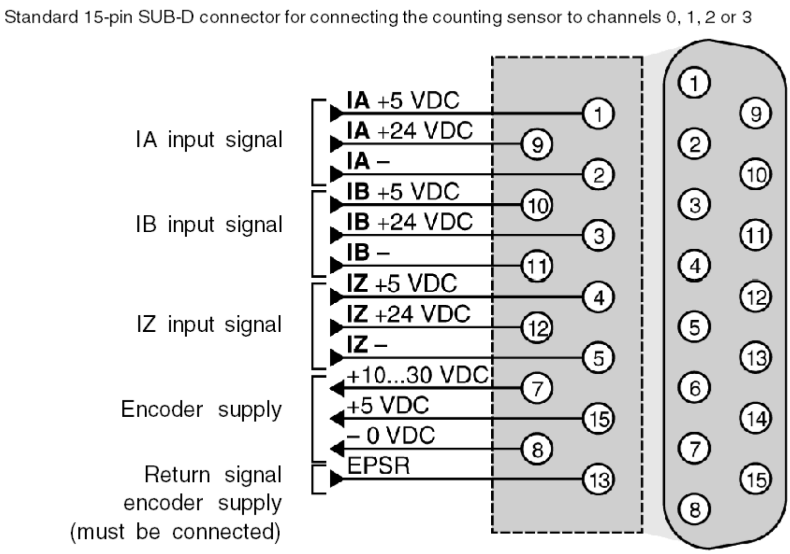
These connectors are designed to connect the count sensors and the encoder supply:

- TSX CTY 2A module: two 15-pin SUB-D connectors (channels 0 and 1),
- TSX CTY 4A module: four 15-pin SUB-D connectors (channels 0, 1, 2 and 3).

NOTE: the pinout configuration of the different connectors is exactly the same.

Illustration

Pinout configuration of a 15-pin SUB-D connector:



Key:

5 VDC signal	Pins
+ IA input	1
- IA input	2
+ IB input	10
- IB input	11
+ IZ input	4
- IZ input	5
Encoder supply:	

5 VDC signal	Pins
+5 VDC	15
-0 VDC	8
Encoder supply feedback	13

Key:

10…30 VDC signals	Pins
+ IA input	9
- IA input	2
+ IB input	3
- IB input	11
+ IZ input	12
- IZ input	5
Encoder supply:	
+10…30 V	7
-0 VDC	8
Encoder supply feedback	13

15-pin SUB-D connectors Standard for a TSX CTY 2C module

General

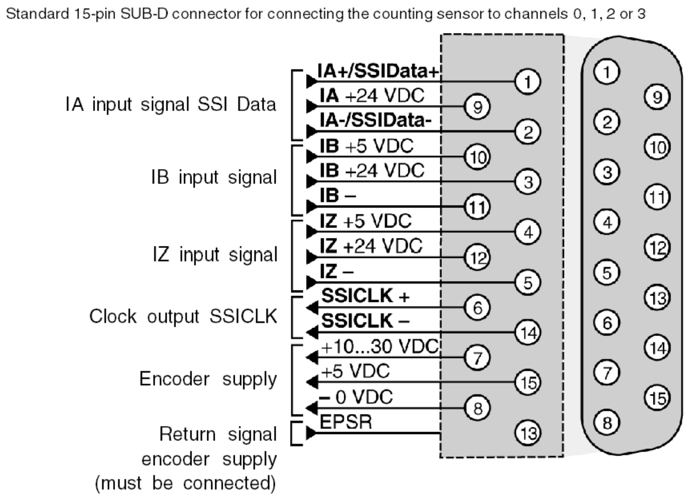
These connectors are designed to connect the count sensors and the encoder supply:

- TSX CTY 2C module: two 15-pin SUB-D connectors (channels 0 and 1).

NOTE: the pinout configuration of the different connectors is exactly the same.

Illustration

Pinout configuration of a 15-pin SUB-D connector:



Key:

5 VDC signal	Pins
+ IA input	1
- IA input	2
+ IB input	10
- IB input	11
+ IZ input	4
- IZ input	5
Encoder supply:	
+5 VDC	15
-0 VDC	8
Encoder supply feedback	13

Key:

10…30 VDC signals	Pins
+ IA input	9
- IA input	2
+ IB input	3
- IB input	11
+ IZ input	12
- IZ input	5
Encoder supply:	
+10…30 V	7
-0 VDC	8
Encoder supply feedback	13

Key:

Serial signals (absolute encoder with serial or parallel outputs, using a TELEFAST ABE-7CPA11 adapter)	Pins
+ SSI Data	1
- SSI Data	2
+ SSI CLK input	6
- SSI CLK input	14
Encoder supply:	
+5 VDC	15
-0 VDC	8
Encoder supply feedback	13

HE10 20-pin connector of a TSX CTY 2A/4A module

General

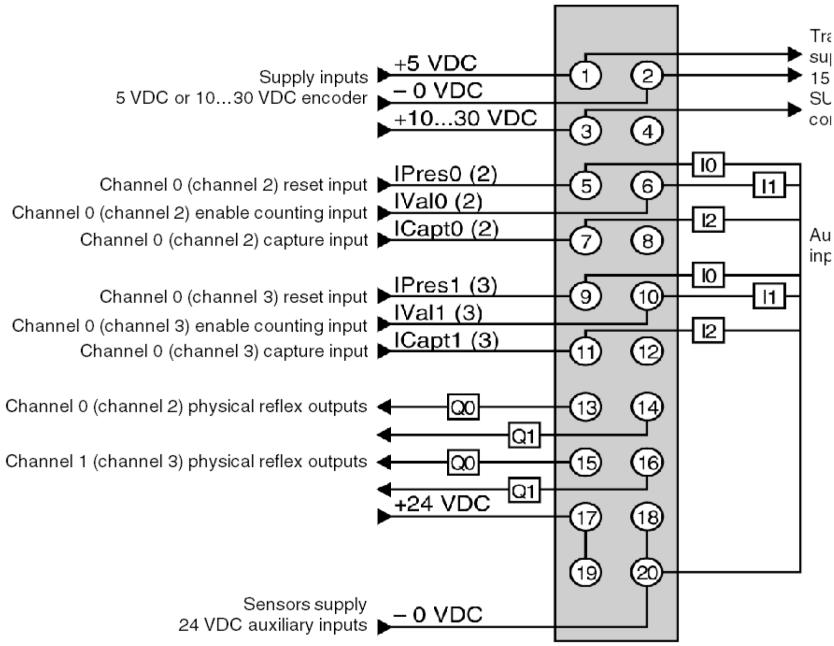
This connector is used to connect the auxiliary inputs, the outputs, the encoder supplies and the other sensors.

The TSX CTY 2A module comprises only one HE10 connector for channels 0 and 1.

The TSX CTY 4A module includes 2 HE10 connectors for channels 0 and 1 and channels 2 and 3 respectively.

Illustration

Wiring diagram for a HE10 20-pin connector:



Key:

24 VDC signals	Pins
Channel 0 (channel 2) auxiliary input:	
Preset IPres0/2	5
Confirmation IVal0/2	6
Capture ICapt0/2	7

24 VDC signals	Pins
Channel 1 (channel 3) auxiliary input:	
Preset IPres1/3	9
Confirmation IVal1/3	10
Capture ICapt1/3	11
Channel 0 (channel 2) reflex output:	
Output Q0	13
Output Q1	14
Channel 1 reflex output:	
Output Q0	15
Output Q1	16

Key:

Supplies	Pins
Encoder supply:	
+5 VDC	1
- 0 VDC	2
+10...30 VDC	3
Sensor supply:	
+24 VDC	17 or 19
-0 VDC	18 or 20

20-pin HE10 connector of a TSX CTY 2C module

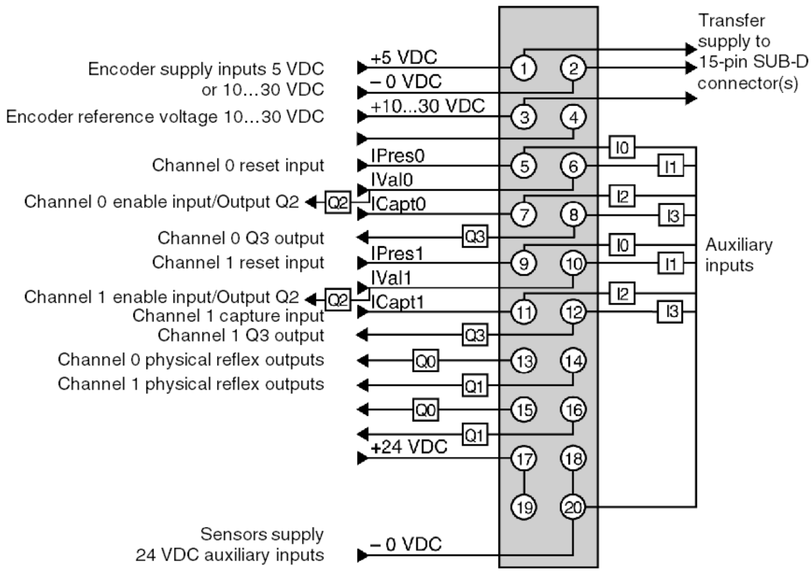
General

This connector is used to connect the auxiliary inputs, the outputs, the encoder supplies and the other sensors.

The TSX CTY 2C module comprises only one HE10 connector for channels 0 and 1.

Illustration

Wiring diagram for a 20-pin HE10 connector:



Key:

24 VDC signals	Pins
Channel 0 auxiliary input:	
Preset IPres0	5
Confirmation IVal0/Output Q2	6
Capture ICapt0	7
Output Q3	8
Channel 1 auxiliary input:	
Preset IPres1	9
Confirmation IVal1/Output Q2	10

24 VDC signals	Pins
Capture ICapt1	11
Output Q3	12
Channel 0 reflex output:	
Output Q0	13
Output Q1	14
Channel 1 reflex output:	
Output Q0	15
Output Q1	16

Key:

Supplies	Pins
Encoder supply:	
+5 VDC	1
- 0 VDC	2
+10...30 VDC	3
Encoder reference voltage +10…30 VDC	4
Sensor supply:	
+24 VDC	17 or 19
-0 VDC	18 or 20

Section 5.4
Connection Principles for the DDP Type Counting Sensor

Aim of this chapter

This chapter describes the connection principle for proximity detector (DDP) type counting sensors.

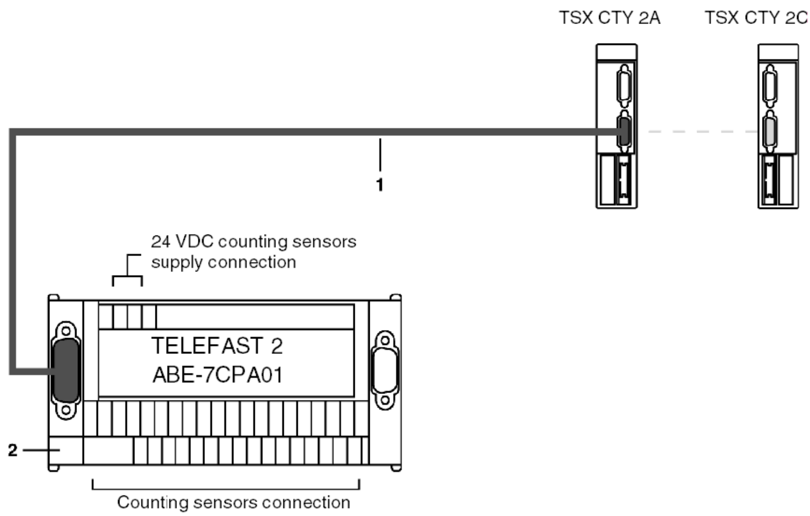
What Is in This Section?

This section contains the following topics:

Principle for connecting counter proximity sensors

Illustration

Process diagram:



Number table

This table describes the labels on the diagram:

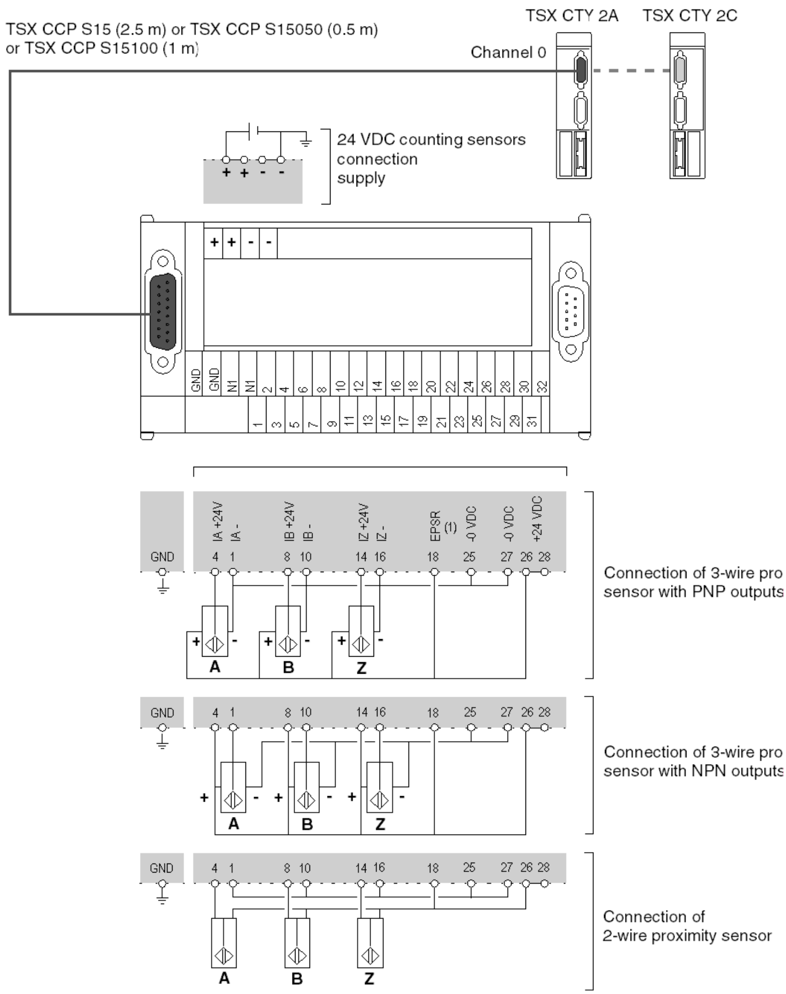
Number	Description
1	TSX CCP S15 cable (2.5m long) or TSX CCPS15050 (0.5m long) or TSXCCP S15100 (1m long), equipped with a high-density 15-pin SUB-D connector and a standard 15-pin SUB-D connector. This cable is used to connect the counting channel to the TELEFAST 2 (ABE-7CPA01) base. It carries the various relevant signals to the counter channel.
2	TELEFAST 2 connection base, reference ABE-7CPA01: Used to connect the count sensors to their supply for the relevant channel.

NOTE: The connection of channels 2 and 3 of a TSX CTY 4A module is exactly the same as for channels 0 and 1.

Connecting counter sensors and their supply

General

Process diagram:



NOTE: In order to use counter proximity sensors, it is necessary to polarize the EPSR input (encoder return supply). To do this, connect:

- the EPSR (terminal 18) to the + 24 VDC sensor supply (terminal 26 or 28),
- the –0 VDC sensor supply (terminal 27) to the –0 VDC encoder supply (terminal 25).

Wiring precautions

General

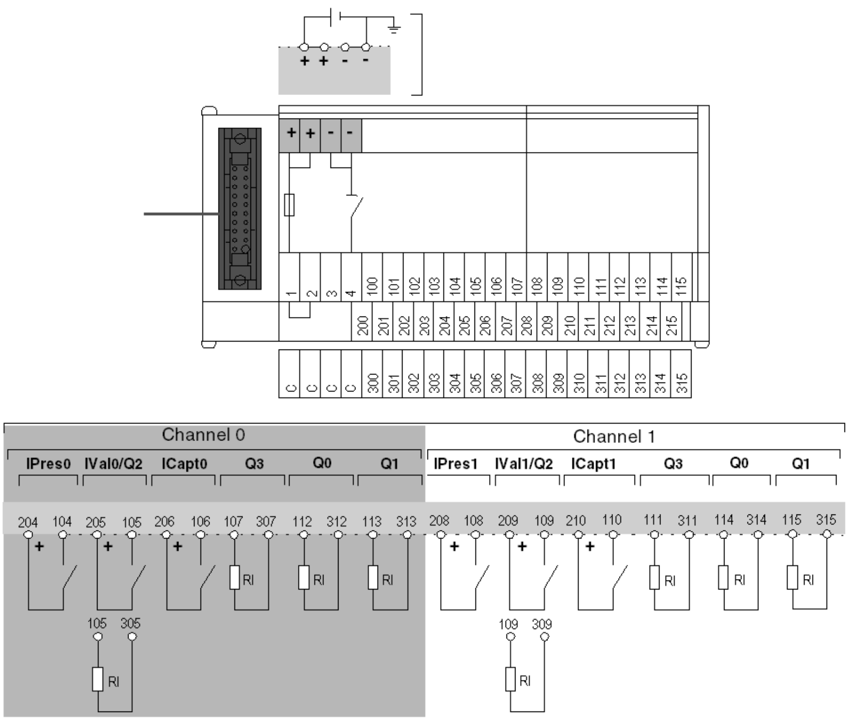
The IPres, IVal and ICapt inputs are rapid inputs, which should be connected to the sensor using either a twisted wire, if it is a dry contact, or using shielded cables if it is a 2 or 3-wire proximity sensor.

The module integrates basic protection against short circuits or polarity inversions. **It is necessary** however, to use **fuses in series** for the supplies. These should be non-delay fuses, with a maximum caliber of 1A.

Important: wiring of Q0 and Q3 static outputs

The actuator connected to the Q0 and Q3 outputs has its shared point at 0 V of the supply. If, due to an incorrect contact, or the accidental disconnection of a wire, the output amplifier is no longer connected to the 0 V supply, the point shared by the actuators remains linked to the 0 V; this could generate a current of a few mA from the amplifier, sufficient to keep the low-power actuators locked.

Illustration:



Connection via TELEFAST

This kind of connection provides the most guarantees, on condition that shared actuators are connected to shared pin bar 2•• (jump wire in position 1-2). In this case there can be no outage of the shared module without an outage of the shared actuators.

Section 5.5
Connection Principles for Encoder Type Counting Sensors

Aim of this chapter

This chapter introduces the connection principle for encoder type counting sensors.

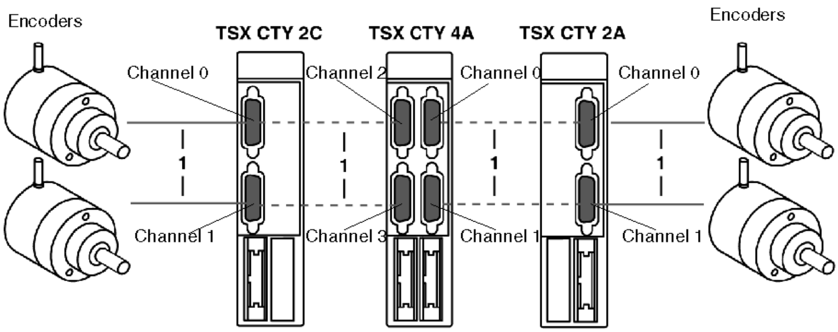
What Is in This Section?

This section contains the following topics:

Process for connecting encoder count sensors

Illustration

The TSX CTY 4A module wiring is as follows. For a TSX CTY 2A or TSX CTY 2C module, only the elements related to channels 0 and 1 should be connected.



Description of the different connection elements

Process for connecting the encoder to the standard 15-pin SUB-D connector, located on the TSX CTY 2A/4A/2C module. Given the various encoder types, it is your responsibility to carry out this connection, which consists of:

- a connector for linking to the encoder (determined by the connector on the encoder in use; normally a female 12-pin DIN connector),
- a standard male 15-pin SUB-D connector, to connect to the female 15-pin SUB-D connector on the TSX CTY 2A/4A/2C module. This connector is available under reference TSX CAP S15,
- a cable:
  - with twisted pairs (gauge 26) and shielding for an incremental encoder with standard RS 422 line transmitter outputs or an absolute encoder,
  - multi-conductor (gauge 24) with shielding for an incremental encoder with Totem Pole outputs.

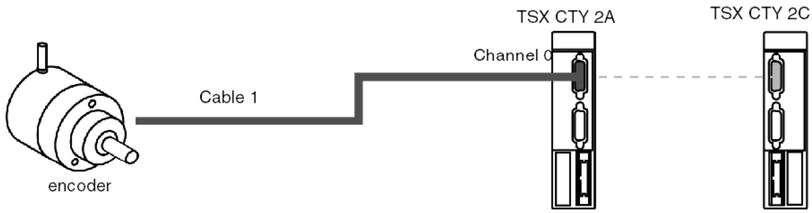
The type of cable shielding should be "braid and foil". The cables should be completely supported to ensure the "braid and foil" is connected to the ground connection of each connector.

Connection of the cable to the two connectors can vary according to the type of encoder supply (5 VDC or 10…30 VDC) and the type of outputs (RS 422, Totem Pole). By way of an example, certain types of connection are described in the following pages.

Connecting an encoder to a TSX CTY 2A / 4A / 2C module

Illustration

Process diagram:

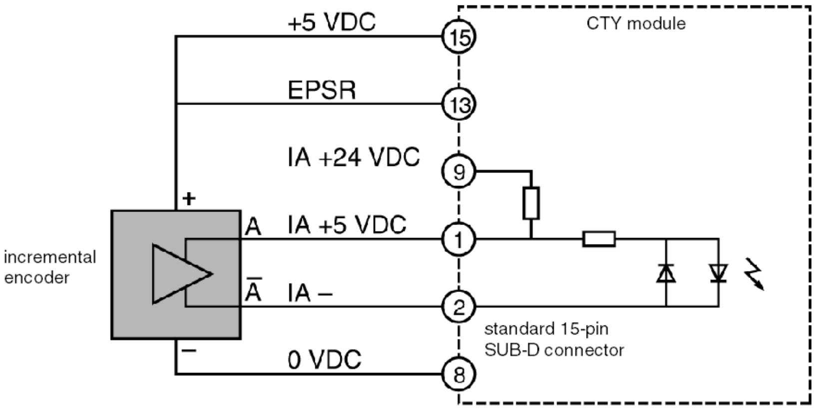


Example for connecting an incremental encoder with RS 422 / RS 485 line transmitter outputs

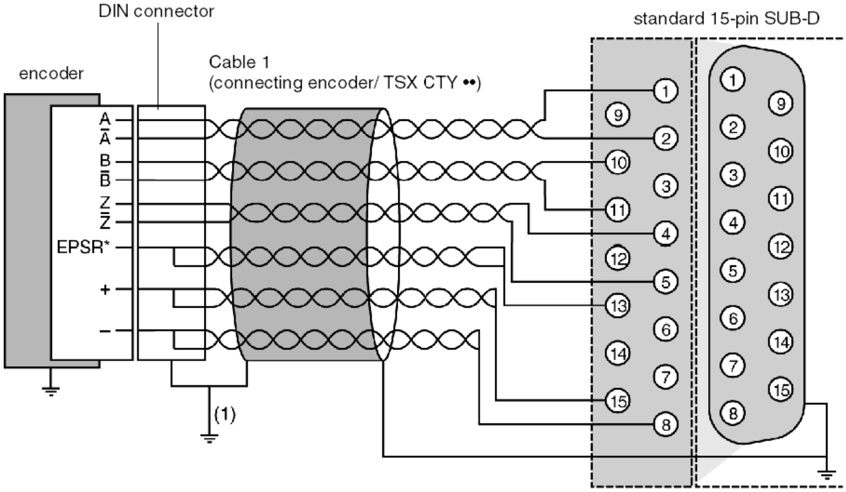
Encoder characteristics

- supply voltage: 5 VDC,
- output voltage: 5 VDC differential,
- high-level output: line transmitter, RS 422 / RS 485 standard.

Process diagram:



Channel connection diagram:



*EPSR: supply feedback of the encoder,

(1) link directly if the encoder is grounded.

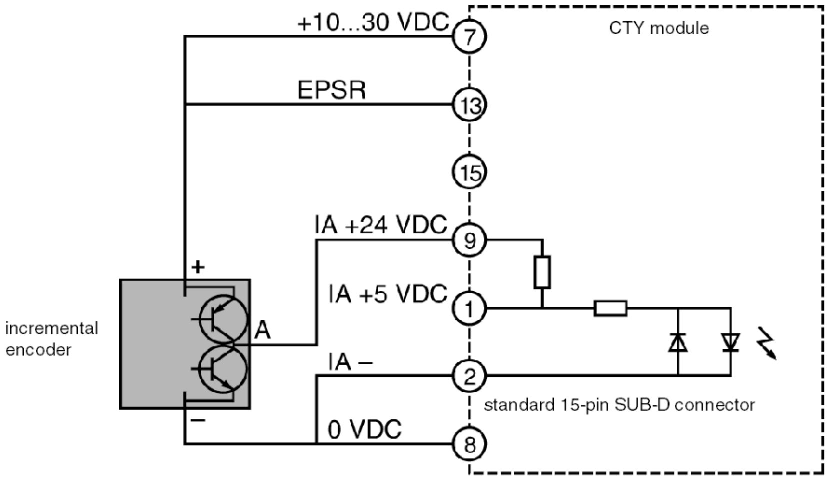
Example of connecting an incremental encoder with Totem Pole outputs

Encoder characteristics

- supply voltage: 10...30 VDC,
- output voltage: 10…0 VDC,
- high-level outputs: Totem Pole.

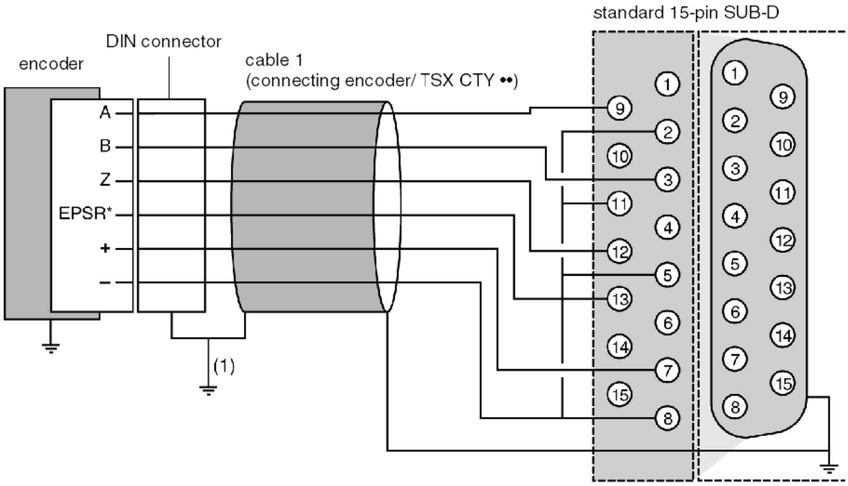
Process diagram

This diagram shows the principles for connection:



Channel connection diagram

This diagram shows the principles for connecting a channel:



*EPSR: supply feedback of the encoder.

If the encoder has no supply feedback, link the EPSR input on the encoder side to the + of the supply.

(1) link directly if the encoder is grounded.

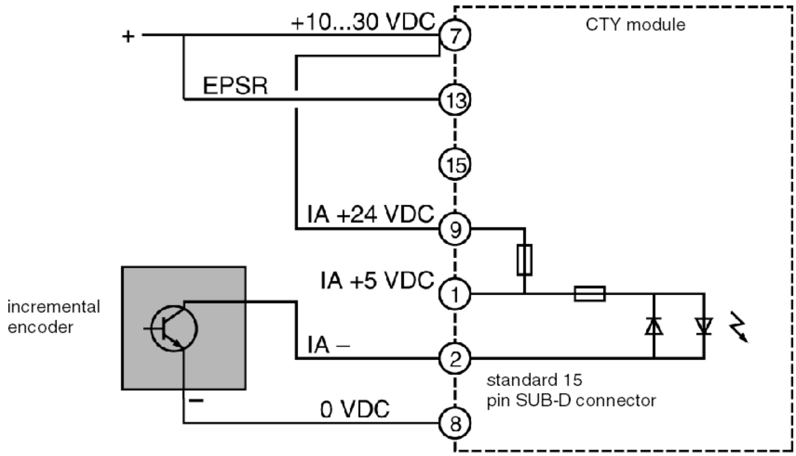
Example of connecting an incremental encoder with NPN open collector outputs

Encoder characteristics

- supply voltage: 24 VDC,
- output voltage: 24 VDC,
- high-level outputs: NPN open collector.

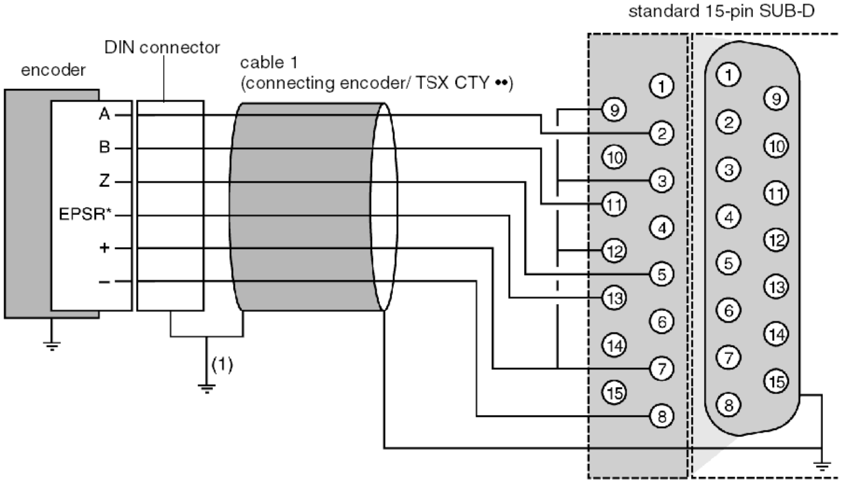
Process diagram

This diagram shows the principles for connection:



Channel connection diagram

This diagram shows the principles for connecting a channel:



*EPSR: supply feedback of the encoder.

If the encoder has no supply feedback, link the EPSR input on the encoder side to the + of the supply.

(1) link directly if the encoder is grounded.

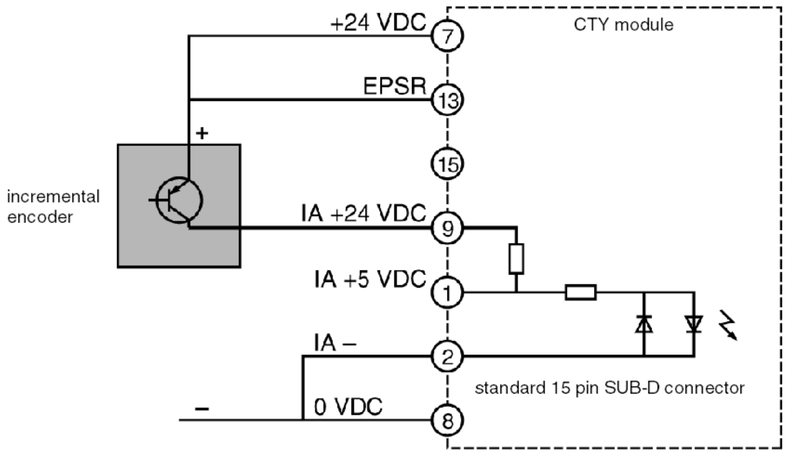
Example of connecting an incremental encoder with PNP open collector outputs

Encoder characteristics

- supply voltage: 24 VDC,
- output voltage: 24 VDC,
- high-level outputs: PNP open collector.

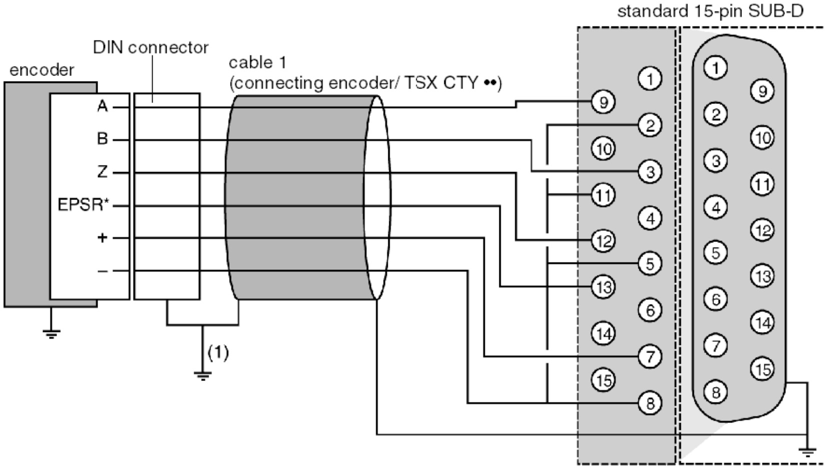
Process diagram

This diagram shows the principles for connection:



Channel connection diagram

This diagram shows the principles for connecting a channel:



*EPSR: supply feedback of the encoder.

If the encoder has no supply feedback, link the EPSR input on the encoder side to the + of the supply.

(1) link directly if the encoder is grounded.

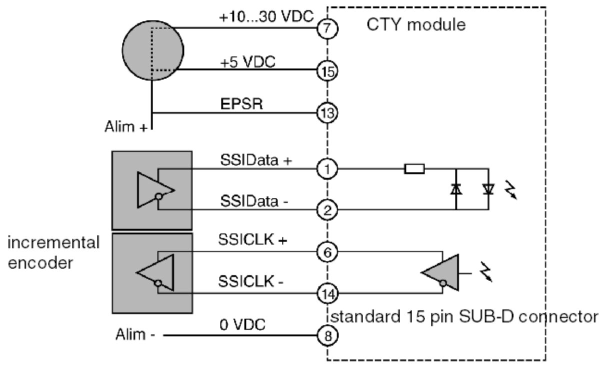
Example of connecting an absolute encoder with a serial output or parallel outputs, via ABE-7CPA11 adapted TELEFAST (only TSX CTY 2C module)

Encoder characteristics

- supply voltage: 5 VDC or 10...30 VDC,
- high-level outputs: differential line transmitter.

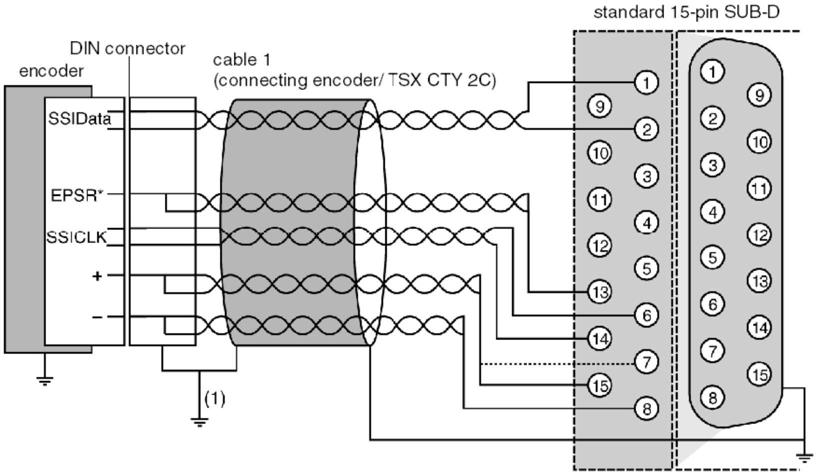
Process diagram

This diagram shows the principles for connection:



Channel connection diagram

This diagram shows the principles for connecting a channel:



*EPSR: supply feedback of the encoder.

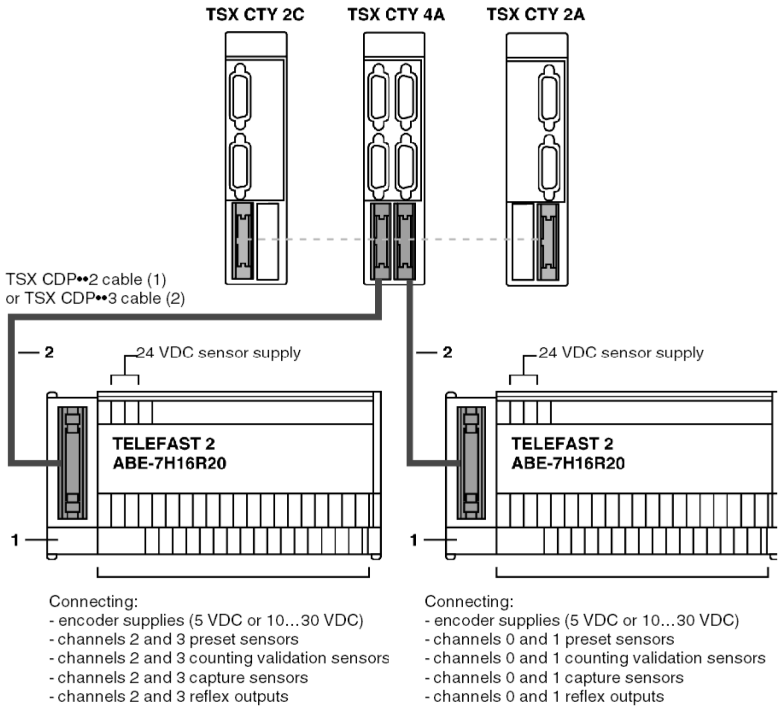
If the encoder has no supply feedback, link the EPSR input on the encoder side to the + of the supply.

(1) link directly if the encoder is grounded.

Principle for connecting sensors onto auxiliary I/O

Connection principle

The TSX CTY 4A wiring is as follows. For a TSX CTY 2A or TSX CTY 2C module, only one TELEFAST is connected (channels 0 and 1).



NOTE: Using a discrete TELEFAST connection base is not compulsory, but advisable as it facilitates the connection of supplies, sensors and pre-actuators on to the auxiliary I/O.

(1) TSX DCP 102: 1 m in length,

TSX CDP 202: 2 m in length,

TSX CDP 302: 3 m in length,

(2) TSX CDP 053: 0.5 m in length,

TSX CDP 103: 1 m in length,

TSX CDP 203: 2 m in length,

TSX CDP 303: 3 m in length,

TSX CDP 503: 5 m in length.

Description of the different connection elements

This table shows the different connection elements according to address:

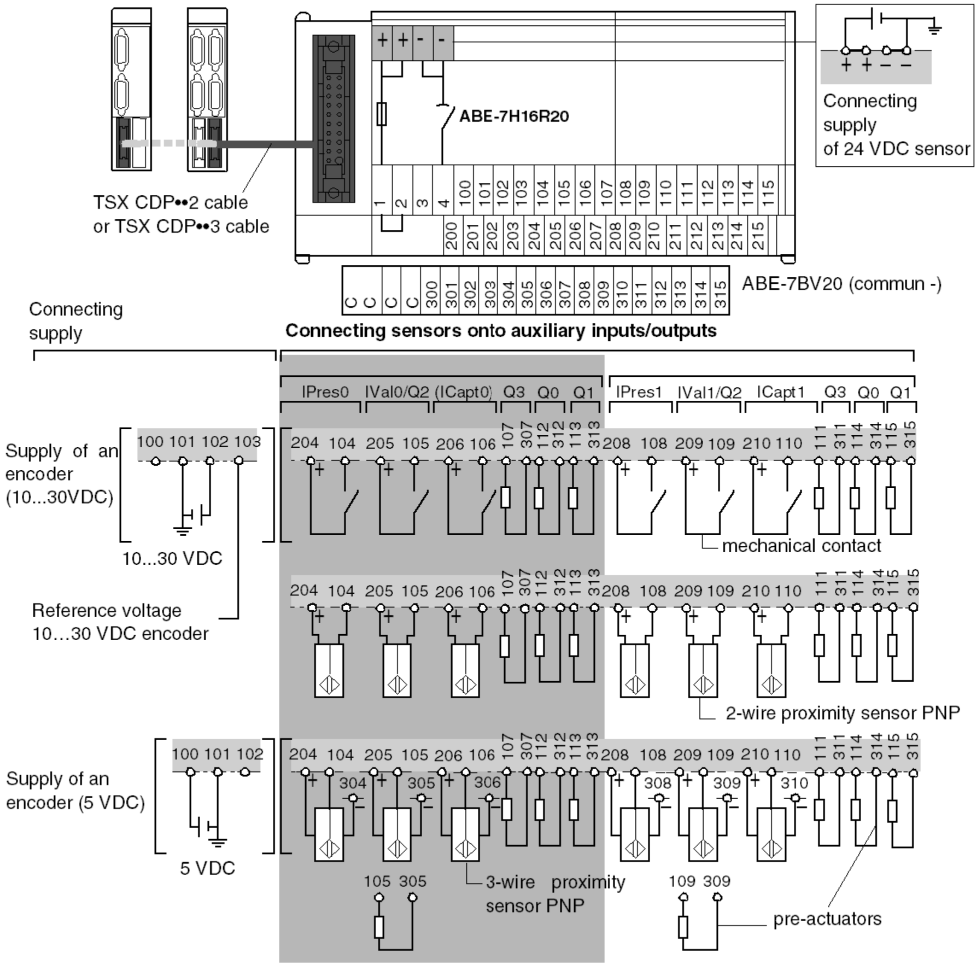
Number	Description
1	TELEFAST 2 connection base: ABE-7H16R20. This allows rapid connection of: • the 24 VDC supply for the sensors connected to the auxiliary I/O, • the encoder supply (if the counting sensor is of the encoder type), • the sensors onto the auxiliary I/O (preset, confirmation, capture), • the pre-actuators.
2	Stranded and clad TSX CDP •• 2 cable or connection cable TSX CDP ••3.

NOTE: The ABE-7BV20 accessory (sold in inseparable quantities of 5) facilitates shared connection.

Connecting Sensors and their Supply

Diagram of the principle

This connection is made using a TELEFAST 2 connection base with the reference no. ABE-7H16R20:



NOTE: The connection of channels 2 and 3 of a TSX CTY 4A module is exactly the same as for channels 0 and 1.

Section 5.6
TELEFAST 2 Connection Base: ABE-7CPA01

Aim of this chapter

This chapter introduces the TELEFAST 2: ABE-7H16R20 connection base.

What Is in This Section?

This section contains the following topics:

Connecting TELEFAST 2: ABE-7CPA01

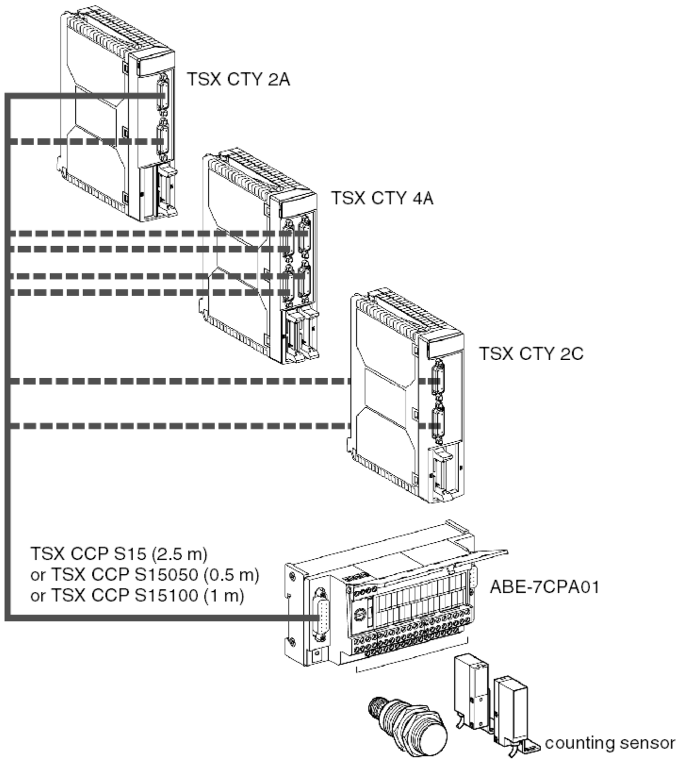
At a Glance

Using a TELEFAST 2 (ABE-7CPA01) connection base, a standard 15 pin female SUB-D connection can be transformed into a screw connection base connection with:

- 32 terminals on two rows, where the different sensors and their supplies can be connected,
- 4 terminals for restart (2 GND terminals + 2 N1 terminals for specific restarts),
- 4 terminals for connecting the sensor supply.

This means proximity detector type sensors can be quickly connected onto a counting channel of the TSX CTY 2A, TSX CTY 4A and TSX CTY 2 modules.

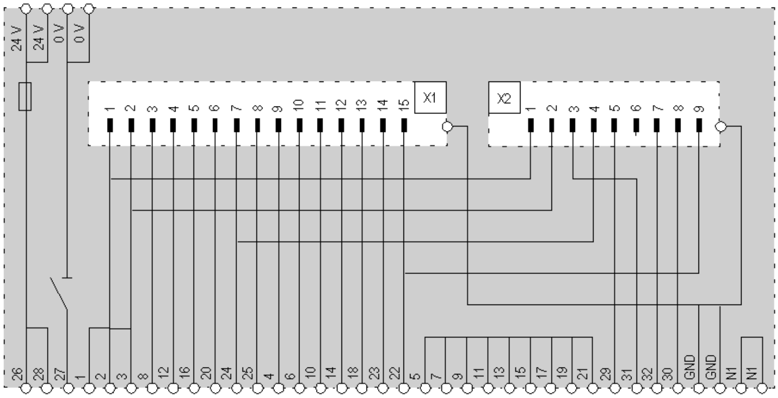
Illustration:



The 9 pin SUB-D connector means information can be reported to an Altivar when this base is used with analog inputs/outputs.

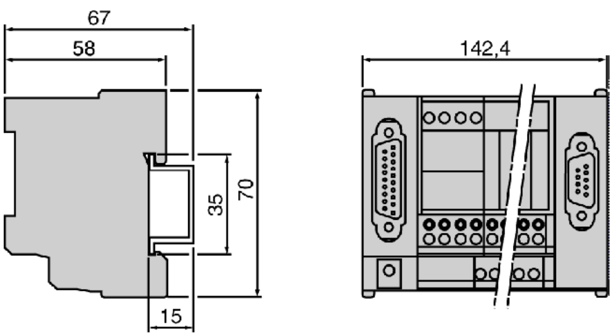
Wiring layout

Illustration:



Dimensions and mounting

Dimensions



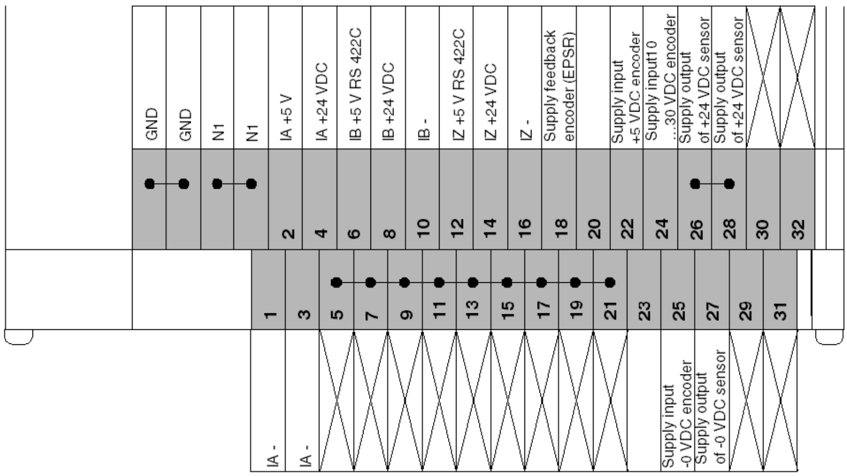
Mounting

The ABE-7CPA01 connection base is mounted on a DIN mounting rail, which has a width of 35 mm.

Availability of counting signals on the TELEFAST screw connection base

Counting channel used with proximity detector type sensors

Illustration:



NOTE: Each TELEFAST 2 ABE-7CPA01 connection base comes with 6 labels so that each base can be individually identified according to the function.
An optional ABE-7BV20 bar can be added, for example for a shared GND.

Correspondence between TELEFAST ABE-7CPA01 connection base and 15 pin SUB-D connector

General

This table shows the correspondences between TELEFAST ABE-7CPA01 connection bases and the 15 pin SUB-D connector:

TELEFAST screw connection base (Terminal No.)	Standard 15 pin SUB D connector (Pin No.)	Signal type	
		TSX CTY 2A / 4A	TSX CTY 2C
1	2	IA-	IA-
2	1	IA + 5 V RS 422C	IA + 5 V RS 422C
3	2	IA-	IA-
4	9	IA + 24 VDC	IA + 24 VDC
5			
6	10	IB + 5 V RS 422 C	IB + 5 V RS 422 C
7			
8	3	IB + 24 VDC	IB + 24 VDC
9			
10	11	IB-	IB-
11			
12	4	IZ + 5 V RS 422 C	IZ + 5 V RS 422 C
13			
14	12	IZ + 24 VDC	IZ + 24 VDC
15			
16	5	IZ-	IZ-
17			
18	13	Encoder supply return (EPSR)	
19			
20	6		Reserved
21			
22	15	Encoder supply input + 5 VDC	
23	14		Reserved
24	7	Encoder supply input +10…30 VDC	
25	8	Encoder supply input -0 VDC	
26		Sensor supply output + 24 VDC	
27		Sensor supply output -0 VDC	

28		Sensor supply output + 24 VDC	
29			
30			
31			
32			

Section 5.7
TELEFAST 2 Connection Base: ABE-7H16R20

Aim of this chapter

This chapter introduces the TELEFAST 2: ABE-7H16R20 connection base.

What Is in This Section?

This section contains the following topics:

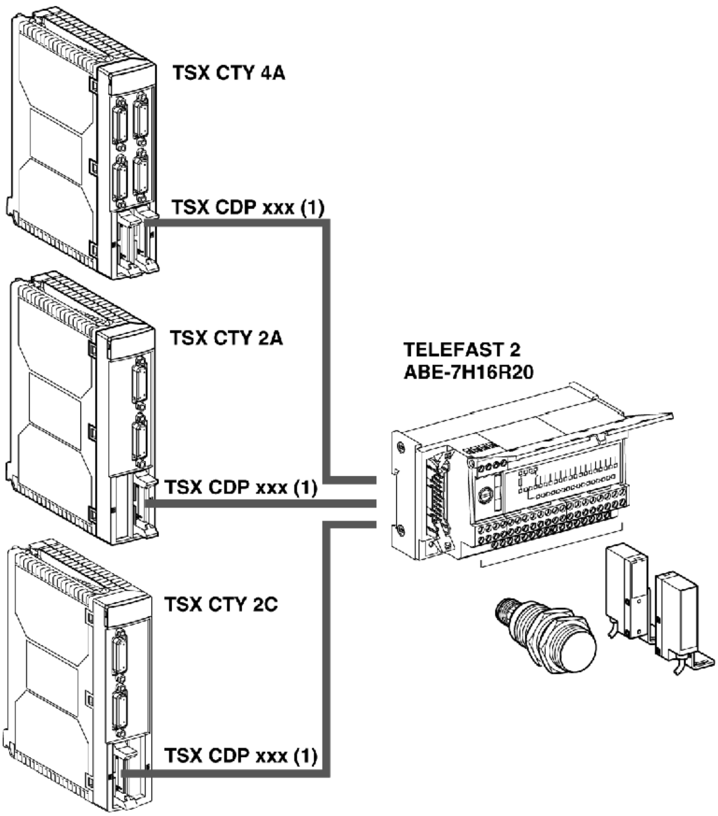
TELEFAST 2 Connection Base: ABE-7H16R20

At a Glance

With a TELEFAST 2 (ABE-7H16R20) connection base, a 20 pin HE10 type connection can be converted into a screw connection base connection, so that sensors and supplies can be quickly connected to the auxiliary inputs of the TSX CTY 2A / 4A / 2C counting modules.

Illustration

This diagram shows the connection of a TELEFAST to the counting modules:

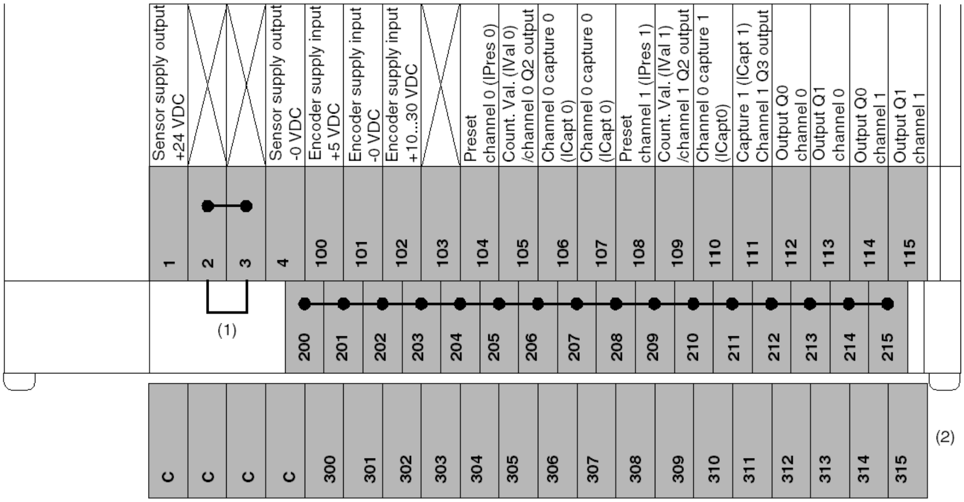


(1) TSX CDP ••2 or TSX CDP ••3 cable.

Availability of signals on TELEFAST screw connection bases

Illustration

The connection base below represents the connection base of the ABE-7H16R20 base.



(1) On the ABE-7H16R20 base, the position of the jumper wire determines the polarity of all the 2•• terminals:

- jumper wire in position 1 or 2: terminals 200 to 215 have + polarity,
- jumper wire in position 3 or 4: terminals 200 to 215 have - polarity.

(2) On the ABE-7H16R20 base, it is possible to add an optional ABE-7BV20 bar to create a second shared sensor (+ or - according to users choice).

Correspondence between TELEFAST ABE-7H16R20 connection bases and HE10 connector

General

This table introduces the correspondence between TELEFAST ABE-7H16R20 connection bases and the HE10 connector:

TELEFAST screw connection base (Terminal No.)	20 pin HE10 connector (Pin No.)	Kind of signal		
		TSX CTY 2A / 4A	TSX CTY 2C	Type of signal
100	1	+ 5 VDC	+ 5 VDC	Encoder supply
101	2	- 0 VDC	- 0 VDC	
102	3	+ 10...30 VDC	+ 10...30 VDC	
103	4		Encoder reference voltage 10…30 VDC	
104	5	IPres 0/2	IPres 0	Auxiliary inputs channels 0 / 2
105	6	IVal 0/2	IVal 0 / Q2 output channel 0	
106	7	ICapt 0/2	ICapt 0	
107	8		Q3 output channel 0	
108	9	IPres 1/3	IPres 1	Auxiliary inputs / outputs channels 1 / 3
109	10	IVal 1/3	IVal 1 / Q2 output channel 1	
110	11	ICapt 1/3	ICapt 1	
111	12		Q3 output channel 1	
112	13	Q0 output channel 0/2	Q0 output channel 0	Reflex outputs channels 0 / 2
113	14	Q1 output channel 0/2	Q1 output channel 0	
114	15	Q0 output channel 1/3	Q0 output channel 1	Reflex outputs channels 1 / 3
115	16	Q1 output channel 1/3	Q1 output channel 1	
+24 VDC	17	Auxiliary input/output supply		
- 0 VDC	18			
+24 VDC	19			
- 0 VDC	20			
1		Terminals 200 to 215 at +24 VDC		
2				

3		Terminals 200 to 215 at -0 VDC
4		
200...215		Connecting shared sensors to: +24 VDC if terminals 1 and 2 are connected - 0 VDC if terminals 3 and 4 are connected
300...315		On the ABE-7BV20 optional bar, terminals can be used as sensors

Section 5.8
TELEFAST 2 Connection and Adaptation Base: ABE-7CPA11

Aim of this chapter

This chapter describes the TELEFAST 2 connection and adaptation base: ABE-7CPA11.

What Is in This Section?

This section contains the following topics:

TELEFAST 2 connection and adaptation base: ABE-7CPA11

At a Glance

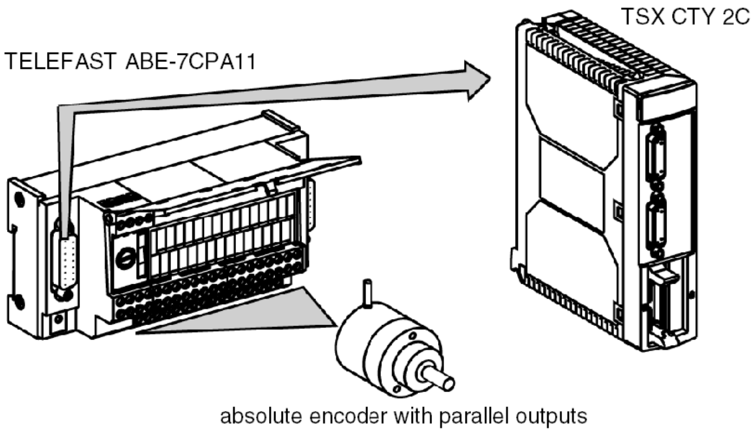
The TELEFAST 2 connection and adaptation base: ABE-7CPA11 is used to connect absolute encoders with parallel outputs to the TSX CTY 2C counting module.

It converts the position value provided by the absolute encoder with parallel outputs into serial information. The absolute encoder must be encoded in pure binary or Gray with a maximum of 24 bits of data.

2 absolute encoders with parallel outputs can be connected on the same adaptation TELEFAST. Further, serializing several ABE-7CPA11 bases (4 maximum) means up to 4 absolute encoders with parallel outputs can be multiplexed on one counting channel (position acquisition).

Illustration

This diagram shows an absolute encoder with a TELEFAST ABE-7CPA11 and a TSX CTY 2C module:



Physical description of the TELEFAST 2: ABE-7CPA11

Illustration

This diagram shows a TELEFAST 2: ABE-7CAP11:

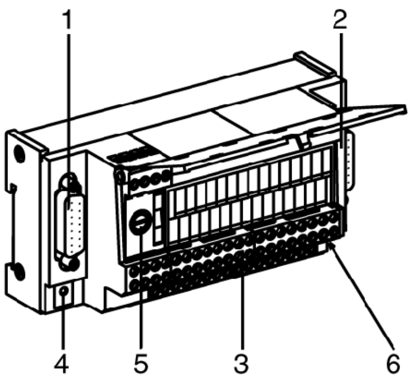


Table of numbers

This table describes the diagram below using numbers:

Number	Description
1	Standard 15 pin SUB-D connector for connecting the TELEFAST to the TSX CTY 2C module.
2	Standard 15 pin SUB-D connector for putting several TELEFASTS (maximum 4) in series.
3	Screw connection base for connecting one or more absolute encoders with parallel outputs (maximum 2). The supplies can be shared out by using additional snap on connection bases: ABE-7BV10 (10 terminals) or ABE-7BV20 (20 terminals).
4	TELEFAST diagnostics LED. This green LED is illuminated when the TELEFAST is powered.
5	Protection fuse for the 10…30 V supply (rapid 1A type).
6	Microswitch for configuring one or more encoders (encoder number, type, etc.).

Characteristics of the TELEFAST 2 base ABE-7CPA11

General characteristics

This is a table of the general characteristics:

Parameters	Values
Permitted voltage at 10…30 VDC	11…30 V
Permitted voltage at 5 VDC	5…6V
Maximum frequency for change in state of the least significant bit	75 kHz
Read frequency of the serial frame	150 kHz...1 MHz
Current used (excluding encoder)	typical: 90 mA Max: 130 mA
Dissipated power	typical: 450 mW Max: 1.5 W
Encoder supply return monitoring: ● on the + supply ● on the - supply	-15% Vsuppl +15% Vsuppl
Insulation resistance	> 10 MΩ under 500 VDC
Dielectric rigidity	1000 Veff.50/60 Hz in 1 min
Operating temperature	0…60°C
Hygrometry	5%…95% without condensation
Storage temperature	-25 °C…+70°C
Operating altitude	0...2000 m

Characteristics of the encoder read inputs (in0 to in23)

This table shows the characteristics of the read inputs (in0 to in23):

Parameters	Values
Logic	positive or negative (1)
Compatibility with encoder outputs	11-30 V Totem pole outputs 5 V TTL outputs 11-30 V NPN open collector transistor outputs
Max. voltage permissible on the inputs	+30 V
Max. wiring length between encoder and TELEFAST	200 m (2)
VIL input voltage	0 V < VIL < 2.5 V
VIH input voltage	3.9 V > VIL > 30 V

(1)

- Positive logic:
  - voltage < 2.5 V -> state 0,
  - voltage > 3.9 V -> state 1.
- Negative logic:
  - voltage < 2.5 V -> state 1,
  - voltage > 3.9 V -> state 0.

(2) 50m max with pure binary encoded encoders with NPN open collector outputs and derating according to length.

Characteristics of the discrete address inputs (AD0, AD1)

This table shows the characteristics of the discrete address inputs (AD0, AD1):

Parameters	Values
Logic	positive
Voltage limit ● max. voltage limit permissible	30 V 34 V (1hr in 24)
Nominal values ● with voltage ● in current	24 V 7 mA
Voltage for ON state Current for ON state at 11 V Voltage for OFF state Current for OFF state	≥11 V ≥3mA ≤ 5 V ≤ 2 mA
Input impedance for nominal U	3.6 kΩ
Response time	25 µs...50 µs
Type of inputs	resistive
IEC 1131 conformity	type 1

Characteristics of the command outputs with 3 encoder states (3OT0, 3OT1)

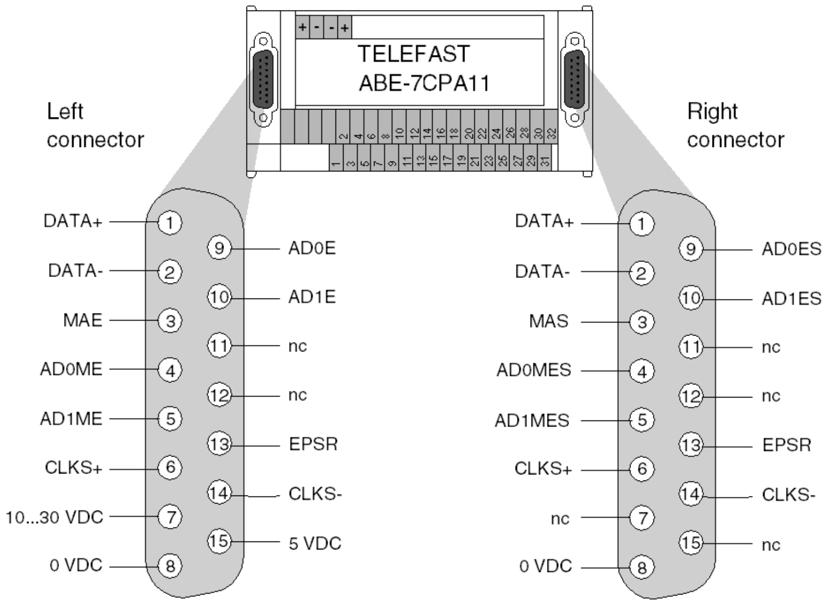
This table shows the characteristics of the command outputs with 3 encoder states (3OT0, 3ST1):

Parameters	Values
Output voltage	encoder supply
Nominal current	enc. supply / 3 kΩ
Max fall in voltage	< 0.5 V
Max. current	10 mA
Protection against overloads and short-circuits	no

Connecting the TELEFAST 2 base: ABE-7CPA11

15 pin SUB-D connector pinouts

Illustration:



Key:

Supply	
0 VDC	8
10...30 VDC	7
0 VDC	15
Addressing the encoders	
● inter-TELEFAST bus (Input):	
AD0E	9
AD1I	10
AD0MI	4
AD1MI	5
MAI	3
Encoder supply return EPSR	13

Serial link	
• data outputs:	
DATA+	1
DATA-	2
• clock inputs:	
CLKS+	6
CLKS-	14

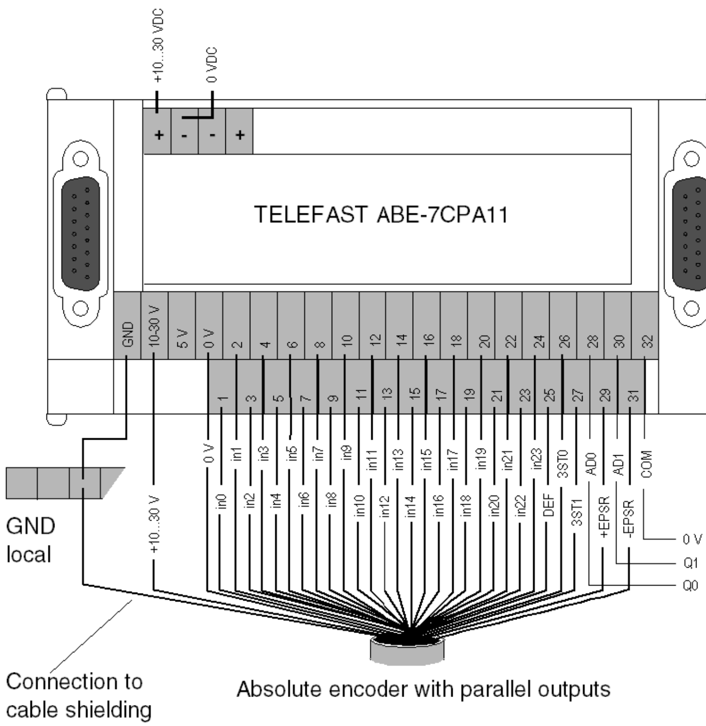
Key:

Supply	
0 VDC	8
Addressing the encoders	
• inter-TELEFAST bus (Output):	
AD0IO	9
AD1IO	10
AD0MIO	4
AD1MIO	5
MAO	3
Encoder supply return EPSR	13
Serial link	
• data outputs:	
DATA+	1
DATA-	2
• clock inputs:	
CLKS+	6
CLKS-	14

Connecting encoders with 10…30 V supply

Process diagram

Illustration:



Key:

Signals	Meaning	Terminal No.
GND	ground connection of the encoder(s)	
+10…30 V	+ supply terminal of the encoder(s)	
0 V	- supply terminal of the encoder(s)	
in0 to in23	outputs of the encoder(s)	1…24
ERR	error output of the encoder(s)	25
3OT0	command to inhibit the 0 encoder outputs (for multiplexing)	26
3OT1	command to inhibit the 1 encoder outputs (for multiplexing)	27
AD0, AD1	encoder multiplexing command	28,30

Signals	Meaning	Terminal No.
COM	shared AD0 and AD1 signals	32
+ EPSR	encoder supply return input + (connector at 10…V if no monitoring)	29
- EPSR	encoder supply return input + (connector at 0 V without monitoring)	31

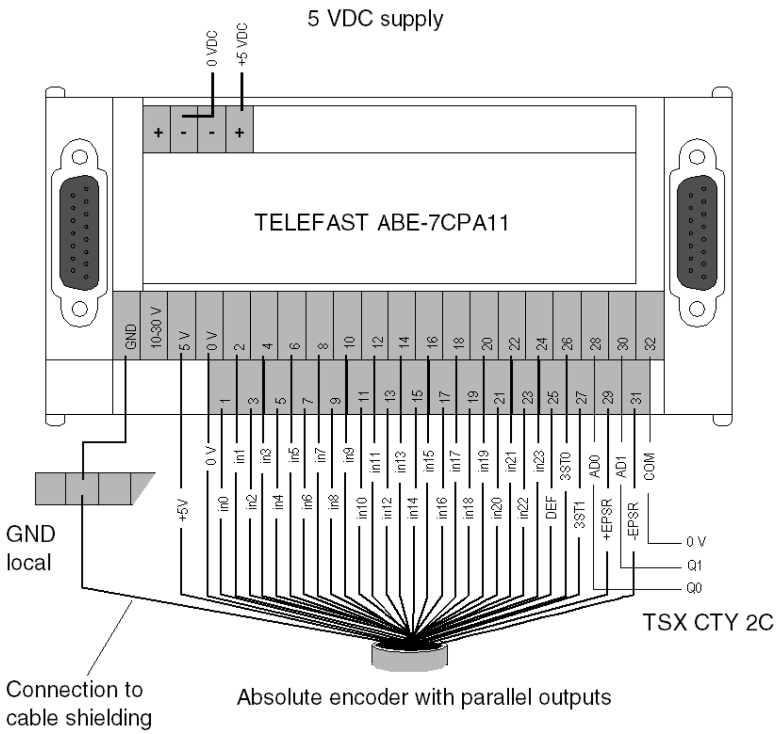
Note:

refer to wiring rules and precautions *(see page 132)* for encoder outputs.

Connecting encoders with 5 V supply

Process diagram

Illustration:



Key:

Signals	Meaning	Terminal No.
GND	ground connection of the encoder(s)	
+5 V	+ supply terminal of the encoder(s)	
0 V	- supply terminal of the encoder(s)	
in0 to in23	outputs of the encoder(s)	1...24
ERR	error output of the encoder(s)	25
3OT0	command to inhibit the 0 encoder outputs (for multiplexing)	26
3OT1	command to inhibit the 1 encoder outputs (for multiplexing)	27
AD0, AD1	encoder multiplexing command	28,30

Signals	Meaning	Terminal No.
COM	shared AD0 and AD1 signals	32
+ EPSR	encoder supply return input + (connect to +5 V if no monitoring)	29
- EPSR	encoder supply return input + (connector at 0 V if no monitoring)	31

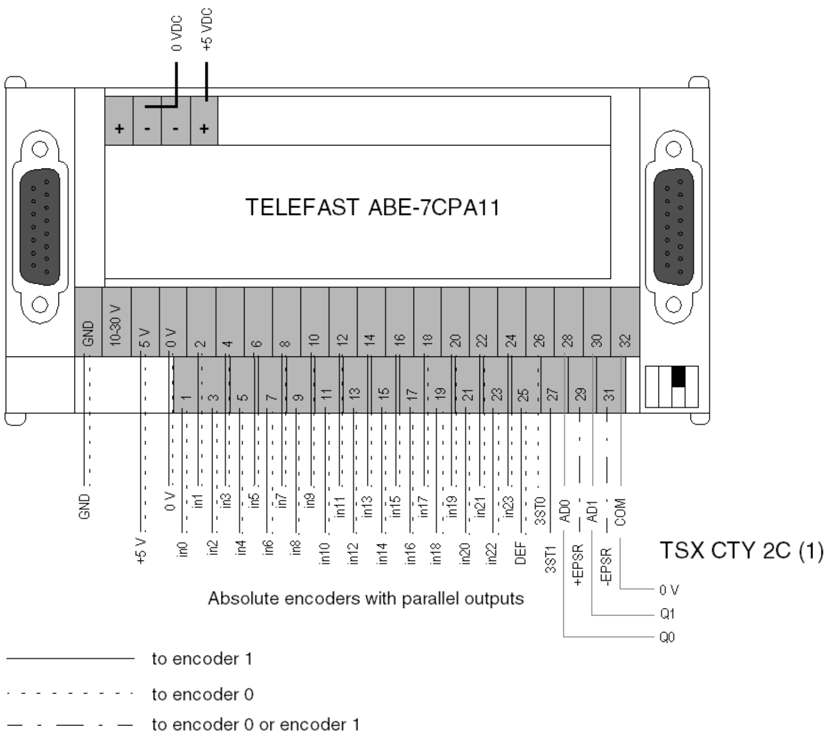
Note:

refer to wiring rules and precautions *(see page 132)* for encoder outputs.

Example of the multiplexing of encoders with a 5 V supply.

General

Illustration:



IMPORTANT

When carrying out multiplexing, encoders with parallel outputs of the same type must be used:

- with the same number of data bits,
- and the same supply (the encoders have a supply of either 10…30 VDC, or 5 VDC).

NOTE: if the control supply encoder is not used, the +EPSR terminal (encoder + supply feedback) must be connected to +10…30 V or +5 Vand the –EPSR terminal (encoder supply feedback) must be connected to 0 V.

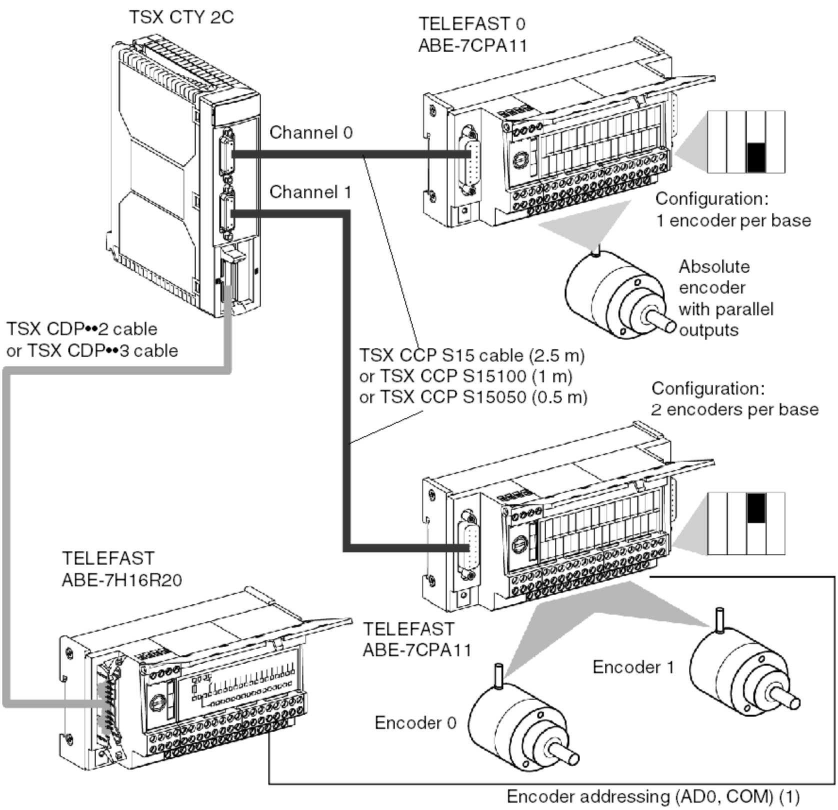
(1) Using the Q0 and Q1 reflex outputs from TSX CTY 2C is not compulsory for addressing encoders; as this operation can be carried out by 2 outputs from a discrete module. In this case, the shared outputs at the COM input of the TELEFAST ABE-7CPA11 must be connected.

(2) It is compulsory to set the configuration micro-switch according to the number of encoders connected on the base (OFF if 1 encoder, or ON if 2 encoders).

Example of connection: each TSX CTY 2C channel is only connected to one TELEFAST

Illustration

This diagram illustrates the connection of each TSX CTY 2C channel to one TELEFAST:



NOTE: (1) it is not necessary to wire the TELEFAST 0 (channel 0) encoder addressing because it has the default address of 00.

Addressing the encoders

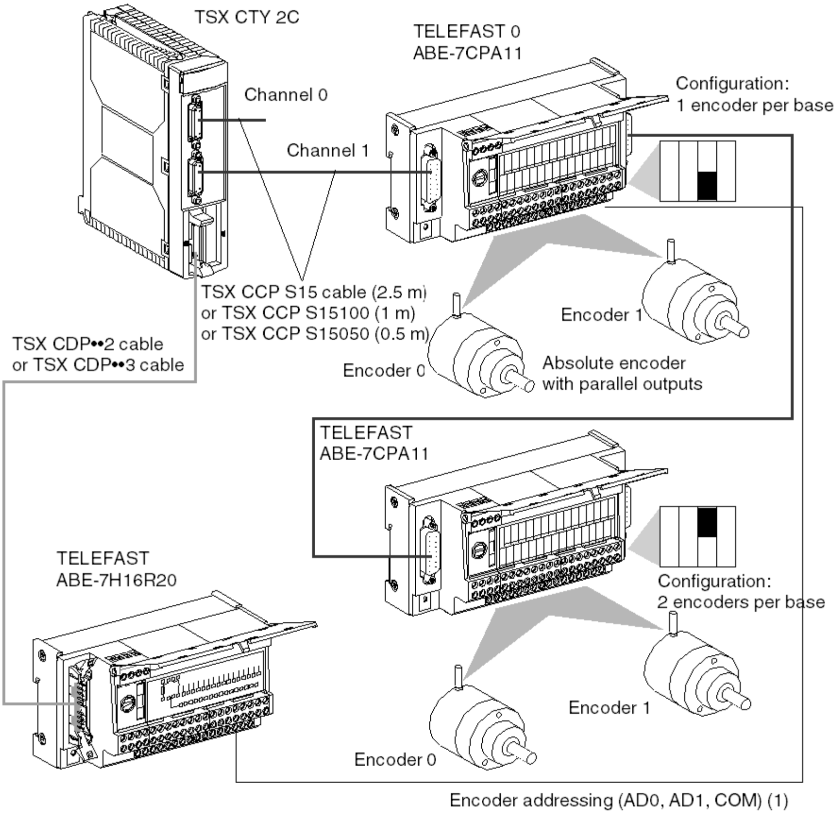
Addressing the TELEFAST encoders is as follows:

AD1	AD0	Action
0	0	Read encoder 0
0	1	Reading encoder 1
1	0	No reading
1	1	No reading

Example of connection: 2 TELEFAST are connected on the same channel

Illustration

This diagram illustrates the connection of 2 TELEFAST on the same channel:



Addressing the encoders

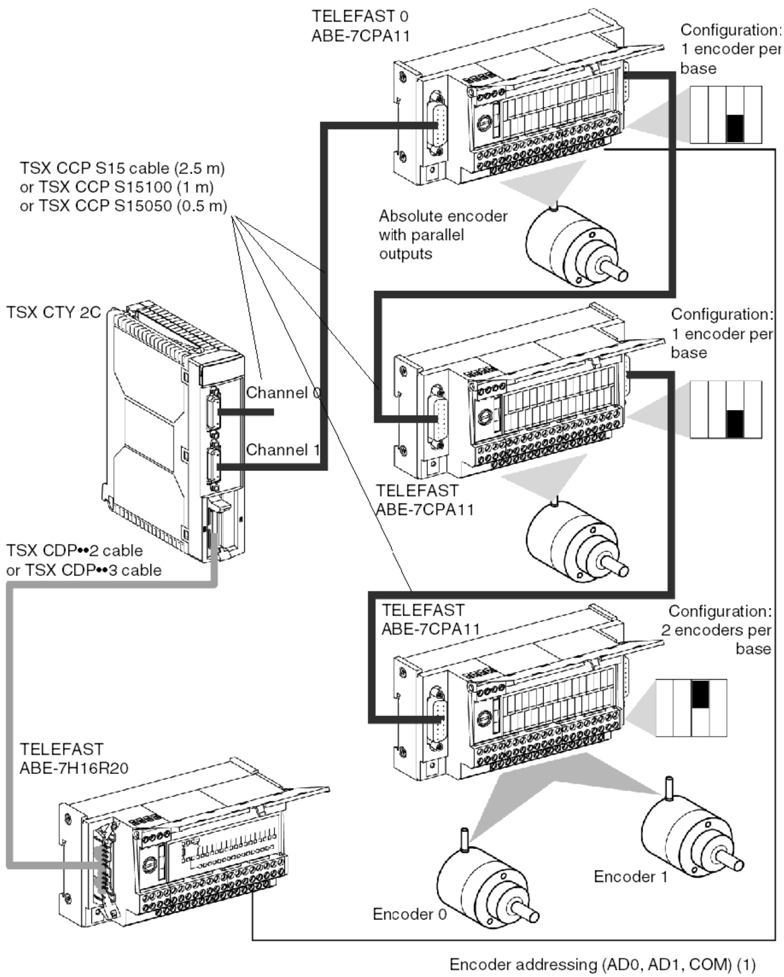
(1) Addressing the TELEFAST encoders is as follows:

AD1	AD0	Action
0	0	Reading the TELEFAST 0 encoder 0
0	1	Reading the TELEFAST 0 encoder 1
1	0	Reading the TELEFAST 1 encoder 0
1	1	Reading the TELEFAST 1 encoder 1

Example of connection: 3 TELEFAST are connected on the same channel

Illustration

This diagram illustrates the connection of 3 TELEFAST on the same channel:



Addressing the encoders

(1) Addressing the TELEFAST encoders is as follows:

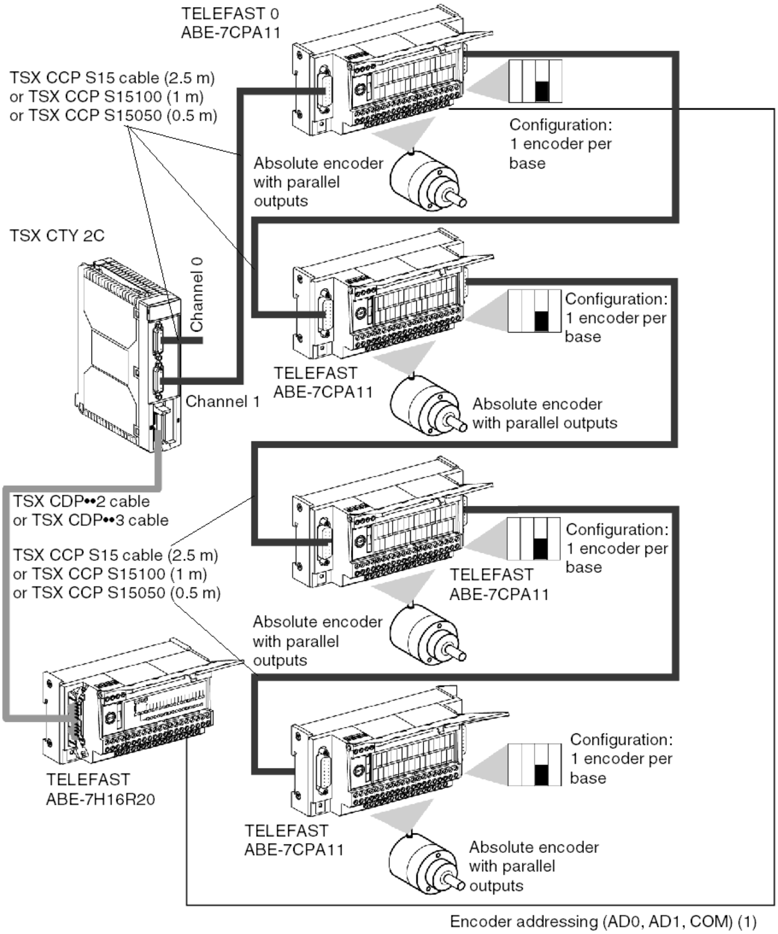
AD1	AD0	Action
0	0	Reading the TELEFAST 0 encoder
0	1	Reading the TELEFAST 1 encoder
1	0	Reading the TELEFAST 2 encoder 0
1	1	Reading the TELEFAST 2 encoder 1

If, for example, 2 encoders are wired on TELEFAST 0 and a single encoder on TELEFAST 2, the addressing becomes: 00-reading of the TELEFAST 0 encoder 0, 01-reading of the TELEFAST 0 encoder 1,10-reading of the TELEFAST 1 encoder and 11-reading of the TELEFAST 2 encoder.

Example of connection: 4 TELEFAST are connected on the same channel

Illustration

This diagram illustrates the connection of 4 TELEFAST on the same channel:



Addressing the encoders

(1) Addressing the TELEFAST encoders is as follows:

AD1	AD0	Action
0	0	Reading the TELEFAST 0 encoder
0	1	Reading the TELEFAST 1 encoder
1	0	Reading the TELEFAST 2 encoder
1	1	Reading the TELEFAST 3 encoder

Rules and precautions for wiring

Important

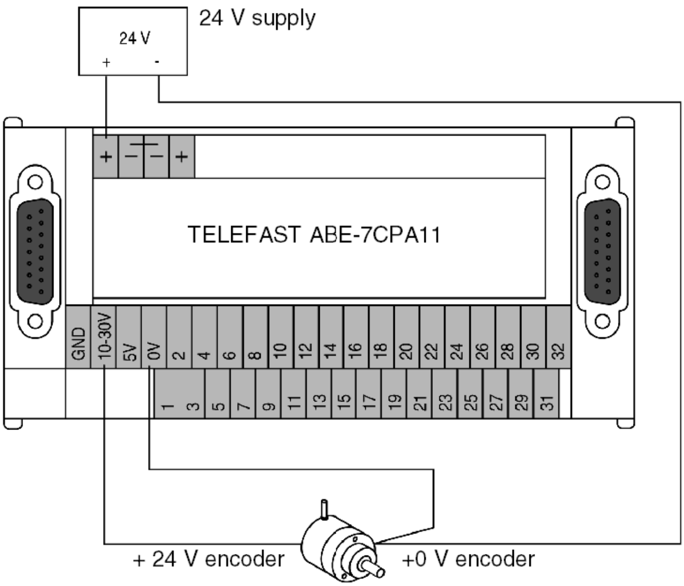
All connections or disconnections on the TELEFAST must be made when SWITCHED OFF (encoders, link to counting module, links between TELEFAST bases).

Connecting TELEFAST 0 to TELEFAST counting and chaining module

The TSX CCP S15 (2.5m), TSX CCP S15100 (1m) and TSX CCP S15050 (0.5m) cables are offered for connecting TELEFASTS amongst themselves or for connecting TELEFAST 0 to the TSX CTY 2C module. The user can however carry out longer links by using the wiring kit, reference no. TSX CAP S15••, and by respecting the following setpoint when the encoders have a 5 V supply : if the link between the counting module and the TELEFAST 0 does not exceed 100m, use gauge 28 wires (0.008mm^2). If it is > 100m, use wires with at least gauge 22 (0.34mm^2). However, to limit the drop in voltage at 0 V (due to the encoder supply current), we recommend that you wire the 0 V according to the following diagram.

Illustration

Wiring diagram:



Cable length between counting module and TELEFAST

The total length of the link between the counting module and the TELEFAST (sum of the lengths between the counting channel and the first TELEFAST and the different TELEFAST between one another) must not exceed 200m, in the knowledge that the maximum cable length between 2 TELEFAST is 50m.

If the total distance between the first and the last TELEFAST exceeds 20m, the line on the right connector of the last TELEFAST must be adapted by inserting an end-of-line stopper (220 Ω resistance between pins 1 and 2 of the connector).

The following table shows the serial transmission clock frequencies, according to the total length of the link:

Cable lengths	Frequency of the serial transmission clock
< 10m	1 MHz
< 20m	750 kHz
< 50m	500 kHz
< 100m	375 kHz
< 150m	200 kHz (default)
< 200m	150 kHz

Protecting the encoder supply

The voltage used by the encoder(s) connected to TELEFAST determine whether this supply should be 10…30 VDC or 5 VDC. If the supply is 10…30 VDC, the protective fuse is built-in to the TELEFAST (fast-blow 1A fuse). However, if the TELEFAST has a supply of 5 VDC, the user must provide in series with the +supply terminal a fast-blow fuse, which is adapted to TELEFAST consumption and to the encoders connected.

Monitoring the encoder supply voltage

This function is only valid if a single encoder is connected to the TELEFAST. If the encoder supply voltage decreases by more than 15%, the default EPSR is sent back to the module.

If the encoder does not have an encoder supply feedback, you must wire:

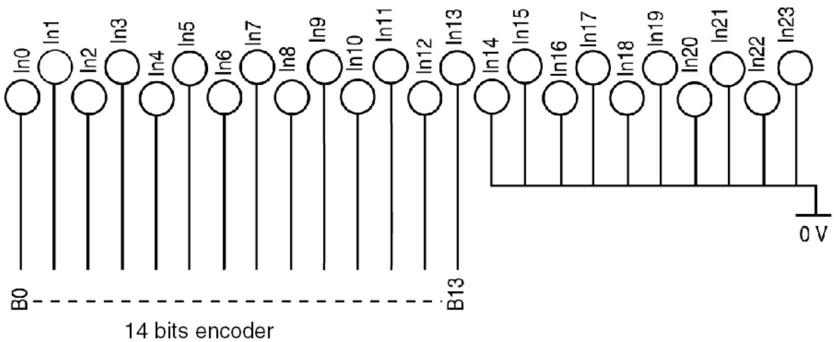
- the TELEFAST +EPSR terminal to the + of the encoder supply,
- the TELEFAST -EPSR terminal to the - of the encoder supply.

Wiring the encoder outputs

If the encoder outputs have positive logic and there are less than 24 of them, the following rules must be adhered to:

- wire the encoder outputs to the TELEFAST inputs, working up from the least to the most significant,
- wire the unused TELEFAST inputs to the 0 V terminal.

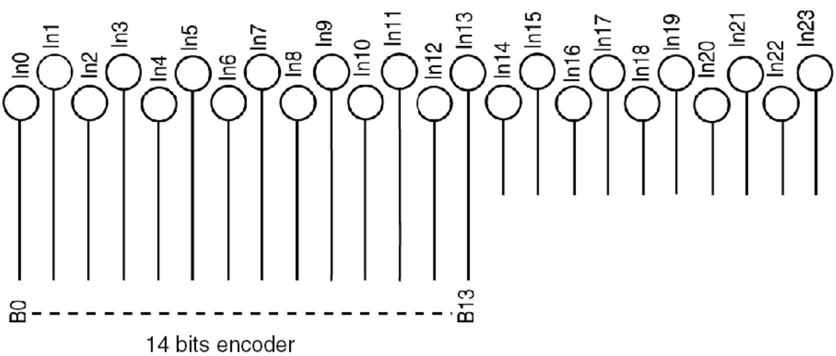
Illustration:



If the encoder outputs have negative logic, and there are less than 24 of them, the following rules must be adhered to:

- wire the encoder outputs to the TELEFAST inputs, working from the up from the least to the most significant,
- do not wire the unused TELEFAST inputs (leave loose).

Illustration:



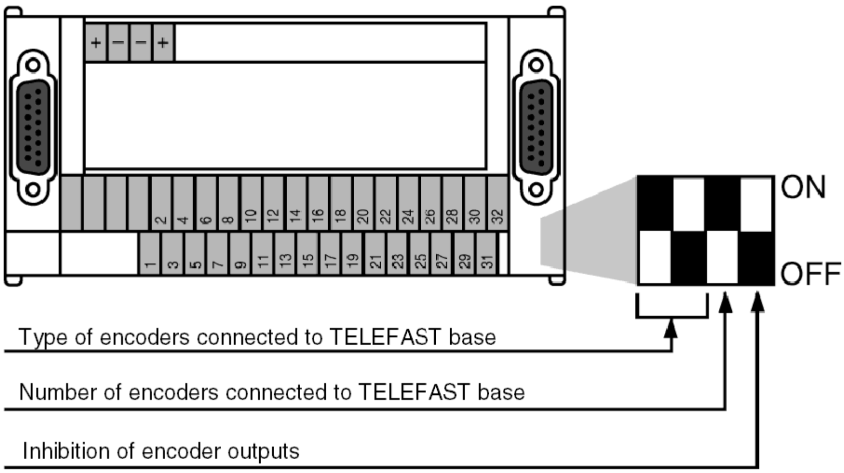
Configuration of the TELEFAST base

Introduction

The base is configured by setting the 4 micro-switches, which are located under the connector to the right of this.

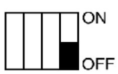
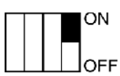
They make it possible to inhibit the encoder outputs and to define the number and the type of encoders connected to the TELEFAST base.

Illustration:



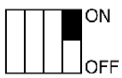
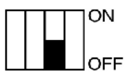
Inhibiting the encoder outputs

This micro-switch chooses the state of the 2 inhibition commands (3ST0 and 3ST1) of the encoder outputs.

Illustration	Description
	The encoder outputs are at high impedance with a 3ST0 or 3ST1 command active at 0.
	The encoder outputs are at high impedance with a 3ST0 or 3ST1 command active at 1.

Number of encoders connected to TELEFAST

This micro-switch makes it possible to define the number of encoders connected to the TELEFAST base (1 or 2 parallel output absolute encoders).

Illustration	Description
	An encoder is connected to the base.
	Two encoders are connected to the base.

If the number of connected encoders is odd and the number of TELEFAST in series is equal to 2 or 3 for one counting channel, **the TELEFAST must be configured so that the sum of the encoders equals 4**.

With 2 TELEFAST bases

This table shows the configuration if there are two TELEFAST bases:

Hardware configuration (number of encoders per TELEFAST)	TELEFAST micro-switch		Address		Action
	0	1	AD0	AD1	
2 encoders on TELEFAST 0 and 1 encoder on TELEFAST 1	ON	ON	0 0 1 1	0 1 0 1	Reading the TELEFAST 0 encoder 0 Reading the TELEFAST 0 encoder 1 Reading the TELEFAST 1 encoder Reading the TELEFAST 1 encoder
1 encoder on TELEFAST 0 and 2 encoders on TELEFAST 1	ON	ON	0 0 1 1	0 1 0 1	Reading the TELEFAST 0 encoder Reading the TELEFAST 0 encoder Reading the TELEFAST 1 encoder 0 Reading the TELEFAST 1 encoder 1

With 3 TELEFAST bases

This table shows the configuration if there are two TELEFAST bases:

Hardware configuration (number of encoders per TELEFAST)	TELEFAST micro-switch			Address		Action
	0	1	2			
1 encoder on TELEFAST 0 1 encoder on TELEFAST 1 and 1 encoder on TELEFAST 2	ON	OFF	OFF	0 0 1 1	0 1 0 1	Reading the TELEFAST 0 encoder Reading the TELEFAST 0 encoder Reading the TELEFAST 1 encoder Reading the TELEFAST 2 encoder

1 encoder on TELEFAST 0 1 encoder on TELEFAST 1 and 1 encoder on TELEFAST 2	OFF	ON	OFF	0 0 1 1	0 1 0 1	Reading the TELEFAST 0 encoder Reading the TELEFAST 1 encoder Reading the TELEFAST 1 encoder Reading the TELEFAST 2 encoder
1 encoder on TELEFAST 0 1 encoder on TELEFAST 1 and 1 encoder on TELEFAST 2	OFF	OFF	ON	0 0 1 1	0 1 0 1	Reading the TELEFAST 0 encoder Reading the TELEFAST 1 encoder Reading the TELEFAST 2 encoder Reading the TELEFAST 2 encoder

Type of encoders connected to TELEFAST

These micro-switches make it possible to define the type of encoders connected to the TELEFAST base. The following tables show the performance characteristics of the encoder/TELEFAST link, according to the code chosen by the micro-switches:

Table 1

Encoders with positive logic outputs, Totem pole outputs, TTL outputs and NPN open collector outputs coded in Gray	Max.length encoder/ TELEFAST	Max. frequency for changing least significant bit
	50 m	75 kHz

Table 2

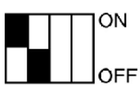
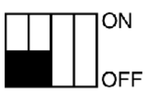
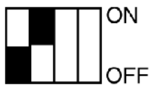
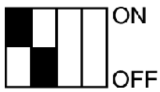
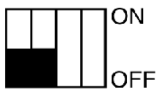
Encoders with negative logic outputs, Totem pole outputs, TTL outputs and NPN open collector outputs coded in Gray	Max.length encoder/ TELEFAST	Max. frequency for changing least significant bit
	50 m	75 kHz
	100 m	40 kHz
	200 m	5 kHz

Table 3

Encoders with positive or negative logic outputs, NPN open collector, binary coded	Max. length encoder/ TELEFAST	Max. frequency for changing least significant bit
	10 m	40 kHz
	30 m	20 kHz
	50 m	5 kHz

NOTE: For encoders with positive logic, TTL and Totem pole outputs, it is possible to go beyond these capacities, without exceeding the recommendations of the encoder manufacturers.

Section 5.9
Introduction to TSX TAP S15.. Wiring Accessories

Aim of this chapter

This chapter introduces the different TSX TAP S15.. wiring accessories used to connect an incremental encoder to the counting module.

What Is in This Section?

This section contains the following topics:

Overview of the TSX TAP S15xx wiring accessories

General

The TSX TAP S15•• wiring accessories make it possible to connect an incremental encoder to the counting module, by using a specific cable (supplied by the encoder manufacturer):

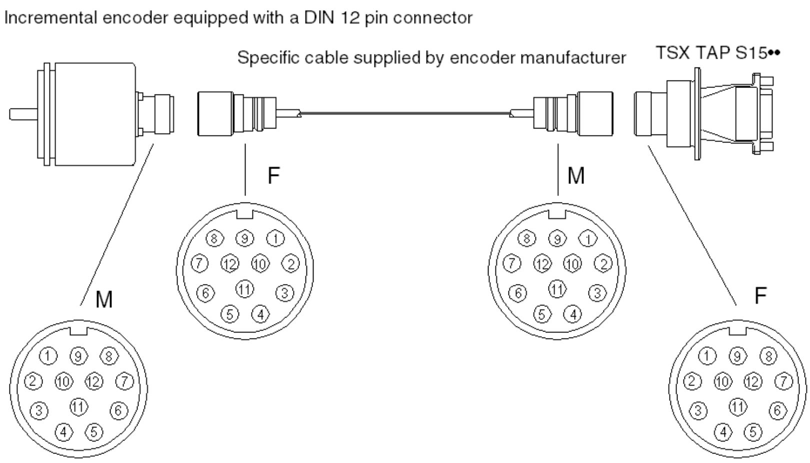
- TSX TAP S15 05: makes it possible to connect an incremental encoder with a 5 VDC supply: encoder with RS 422 line issuer outputs,
- TSX TAP S15 24: makes it possible to connect an incremental encoder with a 24 VDC supply: encoder with totem pole outputs or open collector PNP outputs.

The TSX TAP S15•• has 2 connectors:

- a female 12-pin DIN base, labeled in an anti-clockwise direction. This connector makes it possible to connect the encoder, via a cable supplied by the manufacturer of the encoder,
- a standard 15-pin SUB-D connector making it possible to connect the module counting inputs to the SUB-D connector, using a standard TSX CCP S15 cable.

The TSX TAP S15•• product can be fixed onto a DIN rail using a bracket supplied with the accessories, or it can be fixed to a cabinet lead-in with a gasket, which is supplied with the product.

Illustration:



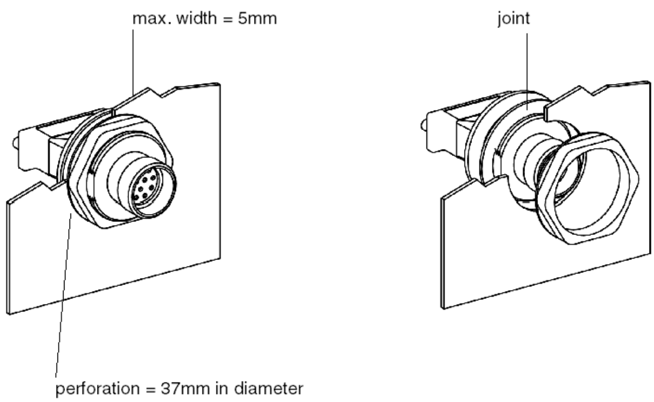
Mounting and measurements of the TSX TAP S15 05/24

Mounting on a Telequick plate

The set square supplied makes it possible to fix the TSX TAP S15 05/24 on an AM1-PA••• type perforated plate or on any other support.

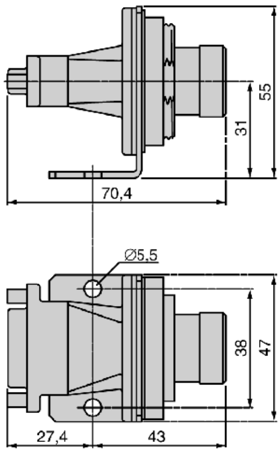
Mounting through a cabinet

Thanks to its rifle nut, the TSX TAP S15 05/24 can be mounted through a cabinet. Its seal means the area between the interior and the exterior is watertight.



Size

Illustration:



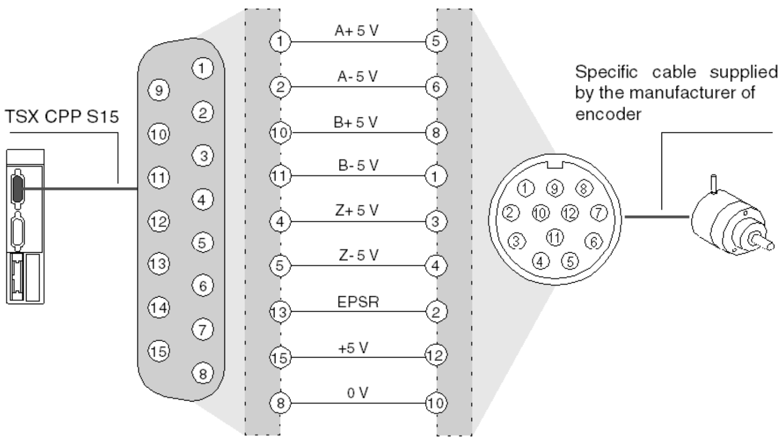
Connecting an encoder with a TSX TAP S15 05 accessory

General

A specific cable, supplied by the manufacturer of the encoder, is used for connecting an encoder using an auxiliary TSX TAP S15 05.

Illustration

The pinout of TSX TAP S15 05 is as follows:



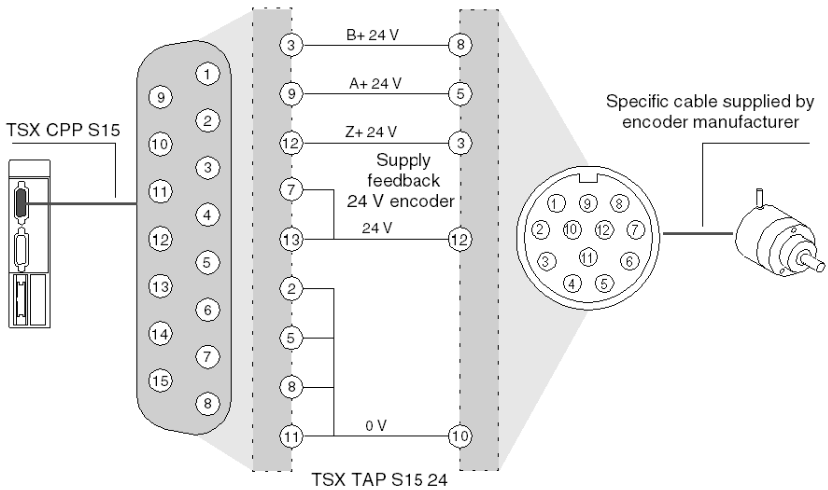
Connecting an encoder with a TSX TAP S15 24 accessory

General

A specific cable, supplied by the manufacturer of the encoder, is required for connecting an encoder using an auxiliary TSX TAP S15 24.

Illustration

The pinout of TSX TAP S15 24 is as follows:



This type of connection is compatible with encoders with a 24V supply (Heidenheim, Hengstler, Codechamp, Ivo, Ideacod, etc.).

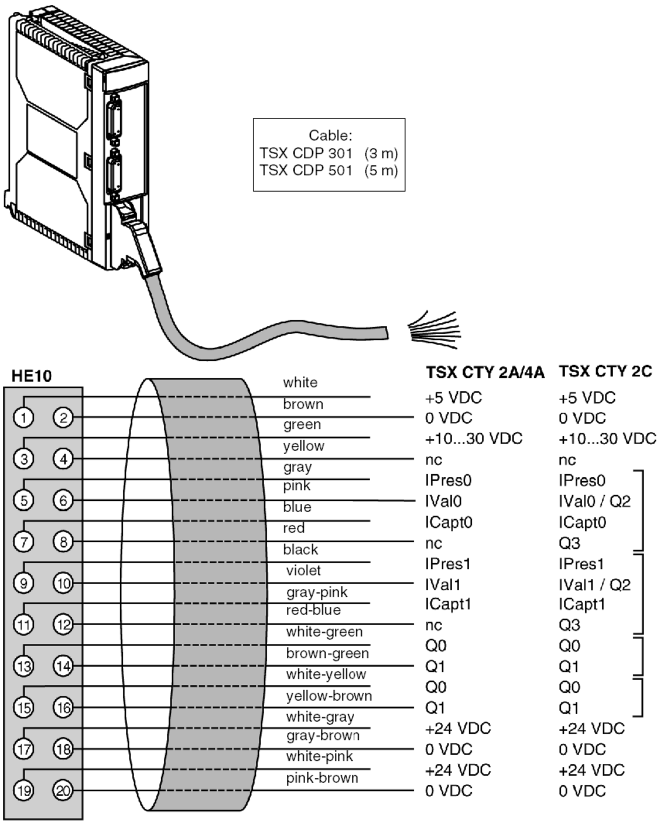
Section 5.10
Cables and Pre-formed Cables

Pre-wired strands and cable

TSX CDP 301 and TSX CDP 501 pre-wired strands

These pre-wired strands (or strips) make it possible to connect the sensors, pre-actuators or terminals directly to the counting modules. They comprise 20 gauge-22 wires ($0.34m^2$) and are fitted with an HE10 connector at one end. The free wires at the other end are labeled with a color code according to the DIN 47100 standard.

The correspondence between the color of the wires and the pin number of the HE10 connector is as follows:



TSX CDP 102, TSX CDP 202 and TSX CDP 302 connection cables

These stranded and clad connection cables make it possible to connect the HE10 connector of a counting module to a TELEFAST 2 (1) connection interface. They are made up of a stranded, flat cable and clad with gauge-28 wires ($0.08mm^2$), and are fitted with an HE10 connector at each end.

Given the small area of each of the wires, you are advised to only use these connection cables for low current inputs or outputs (< 100mA per input or output).

3 connection cable lengths are offered:

- **TSX CDP 202**: 2 meters long,
- **TSX CDP 102**: 1 meter long,
- **TSX CDP 302**: 3 meters long.

TSX CDP 053/103/203/303/503 connection cable

These connection cables make it possible to connect the HE10 connector of a counting module to a TELEFAST 2 (1) connection interface. They are made up of a cable with gauge-22 wires ($0.34 mm^2$), and are fitted with a compound-filled HE10 connector at each end.

These cables allow higher levels of current to enter (< 500mA) than connection cables.

5 cable lengths are offered:

- **TSX CDP 053**: 0.5 meter long,
- **TSX CDP 103**: 1 meter long,
- **TSX CDP 203**: 2 meters long,
- **TSX CDP 303**: 3 meters long,
- **TSX CDP 503**: 5 meters long.

Chapter 6
Counting Modules General Characteristics and Maintenance

Aim of this chapter

This chapter describes the counting modules general characteristics and its maintenance.

What Is in This Chapter?

This chapter contains the following sections:

Section 6.1
General Characteristics of Counting Modules

Aim of this chapter

This chapter describes the general characteristics of the counting modules and the display of the module state.

What Is in This Section?

This section contains the following topics:

General counting module characteristics

General

This table shows the characteristics of counting modules:

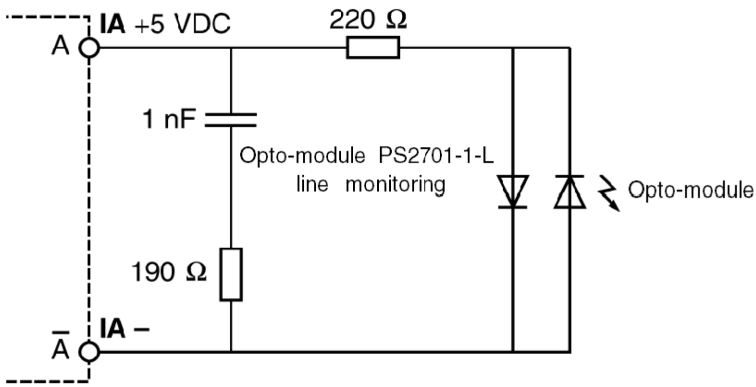
Modules			TSX CTY 2A	TSX CTY 4A	TSX CTY 2C
Maximum frequency at the counter inputs			40 kHz	40 kHz	1 MHz
Current used by the module	5 V internal	Typical maximum	280 mA 330 mA	330 mA 470 mA	850mA (*) 1A (*)
	24V sensors/pre-actuators	Typical maximum	30 mA 60 mA	36 mA 72 mA	15 mA 18 mA
Power dissipated in the module		Typical maximum	4.5 W 6 W	8 W 11.5 W	7 W 10 W
Sensor/pre-actuator supply monitoring			Yes	Yes	Yes
Operating temperature			0 to 60°C	0 to 60°C	0 to 60°C
Dielectric rigidity of inputs/ground or internal logic and inputs			1000 V efficient – 50/60 Hz/min		
Insulation resistance			> 10 MΩ under 500 VDC		
Hygrometry			5% to 95% without condensation.		
Storage temperature			-25° to +70°C		
Operating altitude			0 to 2000m		

(*) with operating ventilator.

Counter input characteristics (TSX CTY 2A / 4A)

Characteristics for RS 422 C use

Example diagram for each counter input IA, IB and IZ:



The IA, IB and IZ input used in RS 422 are entirely compatible with the line transmitters of incremental encoders with RS 422 outputs, and also with encoders complemented by pushpull, on a 5 V supply. A check for line breaks is executed on each input.

TSX CTY 2A/4A: Characteristics of use on 5 VDC/24 VDC

General

This table shows the characteristics of use on 5 VDC/24 VDC:

Input			5 VDC counts (IA/IB/IZ)	24 VDC counts (IA/IB/IZ)
Logic			Positive	Positive or negative
Nominal values	Voltage		5 V	24 V
	Current		18 mA	18 mA
	Sensor supply (ripple included)		-	19...30 V (possible up to 34 V, limited to 1hr in 24)
Thresholds	Voltage		≤ 5.5 V	34 V (1hr in 24)
	In state 1	Voltage	≥2.4	≥11 V
		Current	> 3.7 mA (1)	> 6 mA (2)
	In state 0	Voltage	≤ 1.2 V	≤ 5 V
		Current	< 1 mA (3)	< 2 mA (4)
Input impedance for nominal U			400Ω	1.4kΩ
Input impedance for U = 2.4 V (RS 422 compatible)			> 270Ω	-
Response time			Maximum permitted frequency 40 kHz	
Type of inputs			Resistive	Resistive
IEC 1131 conformity			-	Type 2
2-wire proximity sensor compatibility (5)			-	Yes
3-wire proximity sensor compatibility (5)			-	Yes

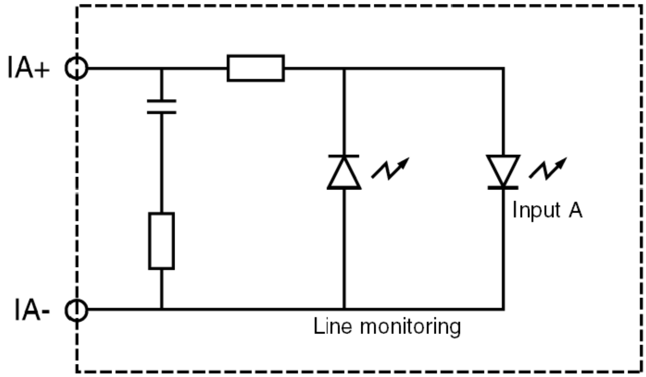
(1) for U = 2.4 V, (2) for U = 11 V, (3) for U = 1.2 V, (4) for U = 5 V

(5) see compatibility of sensors with type 1 and 2 inputs.

Counter input characteristics (TSX CTY 2C)

General

Example diagram of input IA:



TSX CTY 2C: Characteristics of use on 5 VDC/24 VDC

General

This table shows the characteristics of use on 5 VDC/24 VDC:

Input			5 VDC counts (IA/IB/IZ) or measurements (SSI data)	24 VDC counts (IA/IB/IZ)
Logic			Positive	Positive or negative
Nominal values	Voltage		5 V	24 V
	Current		18 mA	16 mA
	Sensor supply (ripple included)		-	19...30 V (possible up to 34 V, limited to 1hr in 24)
Thresholds	Voltage		≤ 5.5 V	34 V (1hr in 24)
	In state 1	Voltage	≥2.4 V	≥11 V
		Current	> 3.6 mA (1)	> 6 mA (2)
	In state 0	Voltage	≤ 1,2 V	≤ 5 V
		Current	< 1 mA (3)	< 2 mA
Input impedance for nominal U			270Ω	1.5kΩ
Response time Maximum permitted frequency for: ● Counting pulses, ● Incremental encoders, ● absolute SSI encoders and with parallel outputs (with a TELEFAST ABE-7CPA11 adapter)			1 MHz 500 kHz multiplied by 1 and 250 kHz multiplied by 4 SSICLK transmission clock: 150 kHz…1 MHz	
Type of inputs			Resistive	Resistive
IEC 1131 conformity			-	Type 2
2-wire proximity sensor compatibility (3)			-	Yes
3-wire proximity sensor compatibility (3)			-	Yes

(1) for U = 2.4 V, (2) for U = 11 V,

(3) see compatibility of sensors with type 1 and 2 inputs.

Compatibility of IA, IB and IZ inputs

Illustration 1

RS 422 / RS 485 line transmitter outputs, 7 mA current loop Differential line monitor on each input.

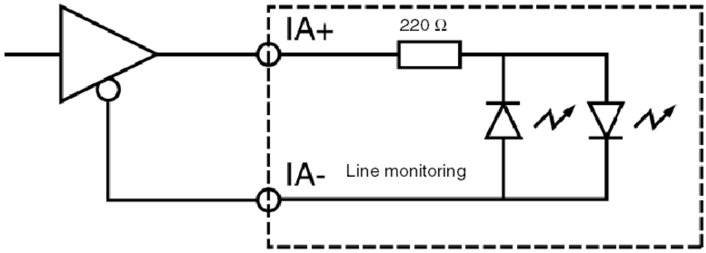
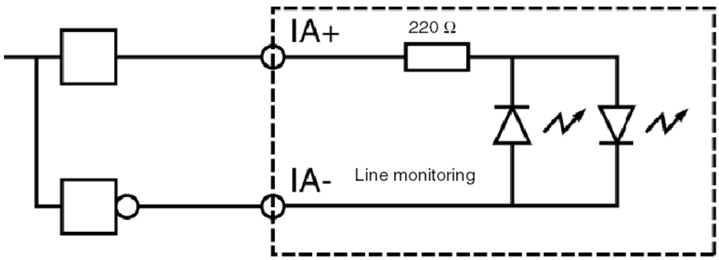


Illustration 2

Additional Totem Pole outputs, 5 V supply. Differential line monitor on each input.



Auxiliary input characteristics (preset, confirmation, capture)

General

This table shows the characteristics of use on 5 VDC/24 VDC:

Modules			TSX CTY 2A / 4A	TSX CTY 2C
Logic			Positive	Positive or negative
Nominal values	Voltage		24 VDC	24 VDC
	Current		7 mA	8 mA
	Sensor supply (ripple included)		19...30 V (possible up to 34 V, limited to 1hr in 24)	
Thresholds	In state 1	Voltage	≥11 V	≥11 V
		Current	> 6 mA (1)	> 6 mA (1)
	In state 0	Voltage	≤ 5 V	≤ 5 V
		Current	< 2 mA	< 2 mA
Sensor/pre-actuator voltage check threshold		OK	> 18 V	> 18 V
		Fault	< 14 V	< 14 V
Sensor/pre-actuator voltage check response time		With a loss of 24V	< 2.5ms (4)	< 2.5ms (4)
		With an increase of 24V	< 10 ms (4)	< 10 ms (4)
Input impedance			3.4kΩ	3.4kΩ
Response time		State 0 to 1	< 250 µs (3)	< 25 µs (3)
		State 1 to 0	< 250 µs (3)	< 50 µs (3)
Type of inputs			Current ducts	Resistive
IEC 1131 conformity			Type 2	Type 2
2-wire proximity sensor compatibility (3)			Yes (all 2-wire proximity sensors at 24 VDC)	
3-wire proximity sensor compatibility (3)			Yes (all 3-wire proximity sensors at 24 VDC)	

(1) for U = 11 V,

(2) see compatibility of sensors with type 1 and 2 rapid inputs,

(3) the auxiliary inputs are rapid inputs (response time < 50 µs or < 250 µs) dependent on the maximum permitted frequency (1 MHz or 40 kHz) of the counter inputs,

(4) with the loss of the sensor supply voltage, the rapid auxiliary inputs can be taken into account.

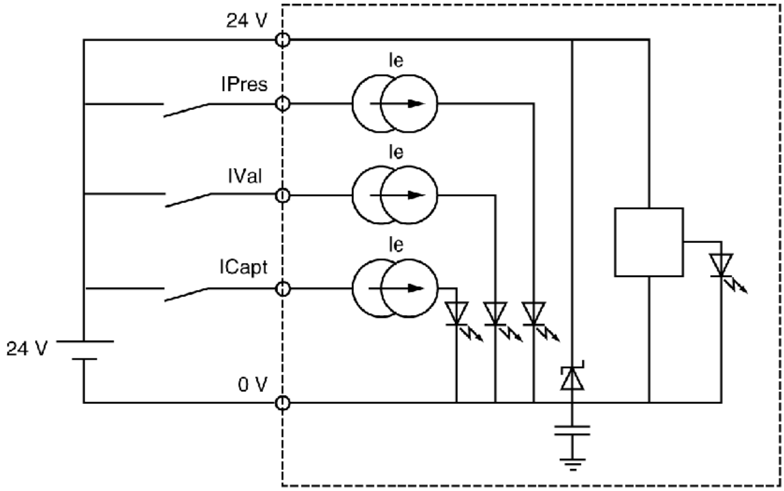
NOTE: If the auxiliary inputs/outputs remain unused on one TSX CTY 2C module, it is possible not to wire the auxiliary supply. In this case, it is recommended to hide the "auxiliary I/O supply" fault.

NOTE: For more information on these functions, refer to the application manual.

Illustration

The auxiliary inputs use a 24 V supply provided via the connector.

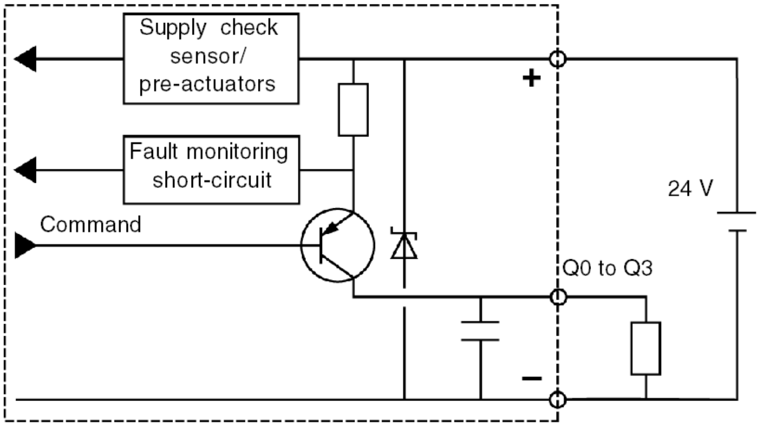
Diagram of the TSX CTY 2A/4A:



Auxiliary output characteristics

Diagram

Illustration:



Characteristics

Table of characteristics:

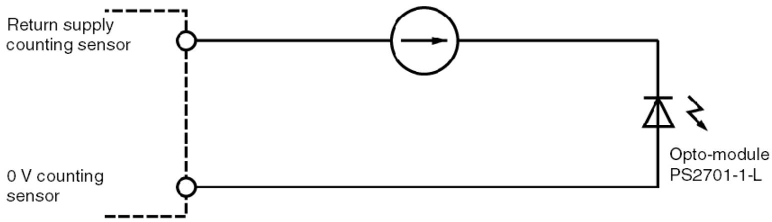
Modules	TSX CTY 2A / 4A	TSX CTY 2C
Nominal voltage	24 VDC	24 VDC
Voltage limit	19...30 V (possible up to 34 V, limited to 1hr in 24)	
Nominal current	500 mA	500 mA
Waste voltage	< 0.5 V	< 0.5 V
Leakage current	< 0.1 mA	< 0.1 mA
Max current to 30 V and to 34 V	625 mA	625 mA
Switching time	< 250 µs	< 250 µs
Dielectric rigidity with the ground connection	1500 V eff 50/60 Hz per mn	
Compatibility with direct current inputs	All positive logic inputs whose input resistance is < 15 kΩ	
Compliance with IEC 1131-2	Yes	Yes
Protection against overloads and short-circuits	Using current limiter and thermal circuit breaker (0.7A<id<2A)	
Monitoring short-circuits of each channel's outputs	One signaling bit per channel	

Modules	TSX CTY 2A / 4A	TSX CTY 2C
Configurable reset: • manual (using the application program), • automatic	One configuring bit per channel	
Protection against channel overvoltage	using a Zener (breakdown) diode between the outputs and the + 24 V supply	
Protection against polarity inversions	Using a reverse diode on the supply	
Power of a filament lamp	8 W (max)	8 W (max)

Count sensor supply monitor characteristics (encoder or proximity sensor)

Process diagram

Illustration:



Characteristics

This table shows the characteristics according to the modules:

Modules		TSX CTY 2A / 4A	TSX CTY 2C
Voltage with no proximity sensor or encoder supply fault	5 V supply	> 2.5 V	> 3.75 V
	10…30 V supply	> 2.5 V	> 3.75 V if the 10…30 V encoder reference voltage input is **not wired** (pin 4 of the HE10 connector).
			> 80% of the encoder or proximity sensor supply voltage, if a 10…30 V encoder reference voltage input is **wired** (pin 4 of the HE10 connector).
Current **with** detection of a proximity sensor or encoder supply fault		< 0.5 mA	/
Thresholds	Voltage	30 V (possible up to 34 V, limited to 1hr in 24)	
	Current	< 3 mA	< 3 mA

NOTE: If the sensor is not equipped with a "supply feedback" output, it is possible not to wire the EPSR input of a TSX CTY 2C module. In this case, it is recommended to hide the "encoder supply or proximity sensor" fault.

NOTE: For more information on these functions, refer to the application specific manual.

Section 6.2
Maintenance

Module display

General

The TSX CTY 2A/4A/2C modules are fitted with LEDs on the front panel, which make it possible to view the state of the module and the counting channels:

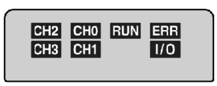
- Module state LEDs (RUN, ERR, I/O)
  These 3 LEDs provide information on the operation mode of the module:
  - RUN indicates the state of the module operation,
  - ERR signals an error inside the module,
  - I/O signals an external module error or an application fault.
- Channel state LEDs (CH.)
  These are 2 or 4 LEDs, which make it possible to view and diagnose the state of each channel in the module.

Diagnostics

This table shows the diagnostics of the module according to the state of the LEDs:

	Lit ●	Flashing ⊗	Off ○
RUN	Module operative	/	Module switched off or experiencing a fault
ERR	Internal module error: module has broken down.	Communication error or awaiting configuration.	No error.
I/O	External module error: ● wiring fault, ● encoder supply error, ● measurement overrun. Application fault	/	No error.
CH **TSX CTY 2A/2C** CH0 and CH1 **TSX CTY 4A** CH0, CH1, CH2, CH3.	The channel is operational.	The channel is not functioning correctly due to: ● an internal fault, ● an external fault, ● a communication error, ● an application fault.	Channel inoperative: The channel is not configured, or is badly configured.

Illustration of module LEDs:



Part III
Software installation of counting modules

In This Chapter

This part describes the software installation and functions of counting modules.

What Is in This Part?

This part contains the following chapters:

Chapter 7
Installation methodology

Installation Phase Overview

Introduction

The software installation of the application-specific modules is carried out from the various Control Expert editors:

- in offline mode
- in online mode

If you do not have a processor to connect to, Control Expert allows you to carry out an initial test using the simulator. In this case the installation *(see page 166)* is different.

The following order of installation phases is recommended but it is possible to change the order of certain phases (for example, starting with the configuration phase).

Installation Phases with Processor

The following table shows the various phases of installation with the processor:

Phase	Description	Mode
Declaration of variables	Declaration of IODDT-type variables for the application-specific modules and variables of the project.	Offline (1)
Programming	Project programming.	Offline (1)
Configuration	Declaration of modules.	Offline
	Module channel configuration.	
	Entry of configuration parameters.	
Association	Association of IODDTs with the channels configured (variable editor).	Offline (1)
Generation	Project generation (analysis and editing of links).	Offline
Transfer	Transfer project to PLC.	Online
Adjustment/Debugging	Project debugging from debug screens, animation tables.	Online
	Modifying the program and adjustment parameters.	
Documentation	Building documentation file and printing miscellaneous information relating to the project.	Online (1)

Phase	Description	Mode
Operation/Diagnostic	Displaying miscellaneous information necessary for supervisory control of the project.	Online
	Diagnostic of project and modules.	
Key:		
(1)	These various phases can also be performed in the other mode.	

Implementation Phases with Simulator

The following table shows the various phases of installation with the simulator.

Phase	Description	Mode
Declaration of variables	Declaration of IODDT-type variables for the application-specific modules and variables of the project.	Offline (1)
Programming	Project programming.	Offline (1)
Configuration	Declaration of modules.	Offline
	Module channel configuration.	
	Entry of configuration parameters.	
Association	Association of IODDTs with the modules configured (variable editor).	Offline (1)
Generation	Project generation (analysis and editing of links).	Offline
Transfer	Transfer project to simulator.	Online
Simulation	Program simulation without inputs/outputs.	Online
Adjustment/Debugging	Project debugging from debug screens, animation tables.	Online
	Modifying the program and adjustment parameters.	
Key:		
(1)	These various phases can also be performed in the other mode.	

NOTE: The simulator is only used for the discrete or analog modules.

Chapter 8
Description of the standard functions of TSX CTY2A/4A/2C counting modules

Subject of this chapter

This chapter comprehensively describes all the standard functions of the TSX CTY2A, TSX CTY4A and TSX CTY2C counting modules.

What Is in This Chapter?

This chapter contains the following sections:

Section 8.1
Introduction to functions associated with counting modules

Introduction to input configurations and functions associated with counting

At a Glance

TSX CTY 2A, 4A and 2C modules offer several possibilities for processing unprocessed results in offline mode, according to the type of module, the type of sensor and the mode (counting function) selected. This chapter describes input configurations and the associated functions which are available.

Input configurations

Modules TSX CTY 2A, 4A and 2C have three counting inputs *(see page 171)* for each channel: **IA**, **IB** and **IZ**. These inputs cannot be changed round.

The TSX CTY 2C module also has an SSI series interface *(see page 174)* for each channel.

Advantages of associated functions

Associated functions are used to adapt modules to the application. As long as the main counting function for one module is similar enough to another, selecting the latter may depend on these other functions.

Common functions

The table below summarizes the main characteristics of the functions common to the three module types, and their availability according to the operating mode.

Function	Description	Availability
Invalid Measurement *(see page 227)*	Detecting a loss of pulse caused by defective operating conditions, or when capacity has been exceeded.	All modes.
Preset or reset *(see page 180)*	Pre-setting a counting register to a defined value (zero for a reset).	Resetting to zero in counting, presetting in down counting or up/down counting combined.
Capture *(see page 176)*	Storing an immediate up/down counting register value.	Only in combined up/down counting.
Comparison *(see page 192)*	Comparing a **current** value with a preset value (zero in down counting only). Comparing the **captured** value with a preset value.	All modes. Only in up/down counting.

Function	Description	Availability
Switches *(see page 197)*	Storing a preset temporary event.	All modes. Number of switches (one or two) varies according to the module and the mode.
Outputs *(see page 206)*	According to configuration: physical outputs linked to switches (reflexive outputs), or positioned by software (discrete "manual" outputs).	Number of outputs (one to four) variable according to the module and the mode.
Event processing *(see page 276)*	Several events can trigger a processing operation and a reflex action: ● enabling up or down counting, ● presetting or resetting, ● crossing the threshold or setpoint, ● capture (when up/down counting).	All modes

Specific function

Speed monitoring *(see page 219)* is only available with the TSX CTY 2C module.

One or two physical outputs can be linked to the comparators, and can then translate the result of the comparison between the immediate speed and a preset value.

Special functions (TSX CTY 2C)

The TSX CTY 2C module can also configure three special functions *(see page 221)*. These functions are derived from the previous standard functions, and they respond to the specific requirements of certain counting applications. These are:

- Special Function Number 1: time elapsed since the last pulse and a capture.
- Special Function Number 2: triggering a capture and a direct (software) preset synchronized with the programmable frequency output.
- Special Function Number 3: monitoring the **correct speed** and **stationary moving part**. Tolerance values for the **correct** speed and **stop** speed can be configured.

Section 8.2
Description of counting module input interfaces

Subject of this section

This section describes the input interfaces of counting modules.

What Is in This Section?

This section contains the following topics:

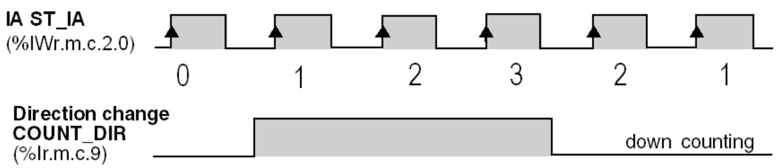
Description of counting input interfaces (TSX CTY 2A/4A/2C)

At a Glance

This section describes the operation of counting input interfaces which are common to modules TSX CTY 2A, 4A and 2C.

Configuration: IA up/down counts, direction according to application

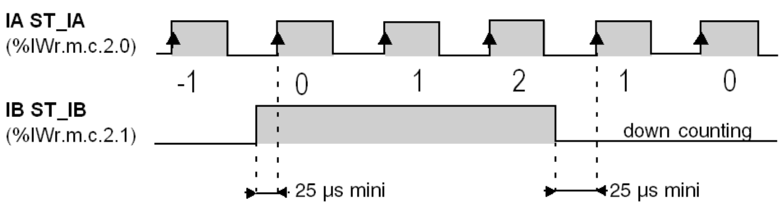
The figure below represents the counting signal applied to the **IA ST_IA** (%IWr.m.c.2.0) input.



In this configuration, the **change of direction COUNT_DIR** (%Ir.m.c.9) bit managed by the application determines direction of the up or down counting on the rising edges of the signal.

Configuration: IA up/down counts, direction according to IB

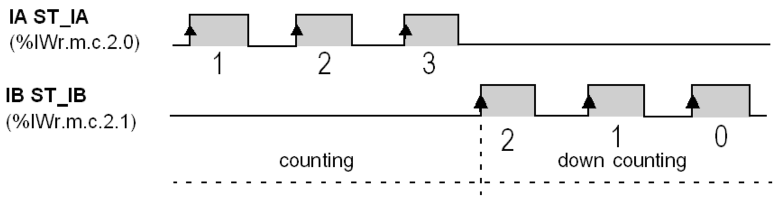
The following figure represents the counting signal applied to the **IA** and **IB ST_IB** (%IWr.m.c.2.1) inputs defining the counting direction.



Up/down counting is done on the rising edges of pulses received on **IA** input.

Configuration: IA up counts, IB down counts

The figure below represents the counting signal applied to **IA** input (in up counting) or to **IB** input (in down counting)

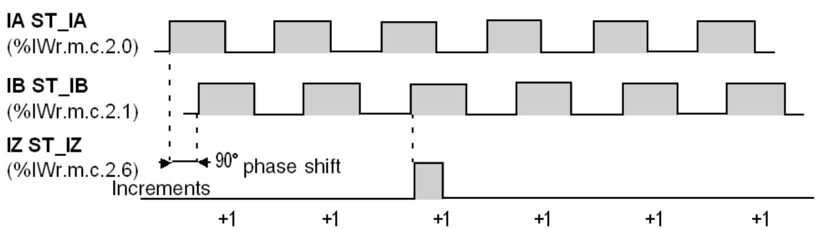


Pulses are taken into account by the up/down counter on the rising edges of the physical input in progress. **IA** input increments the up/down counter (upcounting) and **IB** input decrements it (downcounting). If pulses on the two inputs are simultaneous, the up/down counter does not change.

Configuration: incremental encoder

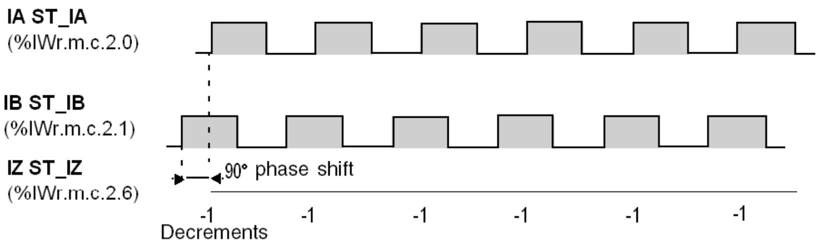
In this operating mode, physical inputs **IA** and **IB** are connected to an incremental encoder which supplies two out-of-phase signals of 90°. The extent to which inputs **IA** and **IB** are out of phase determines the direction of up/down counting.

The figure below represents the case of **counting** (**IA** ahead of **IB**).



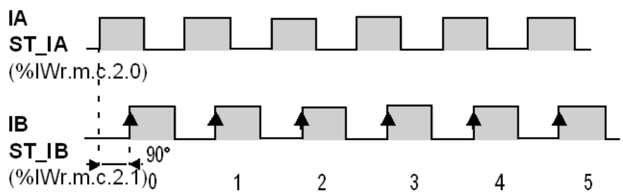
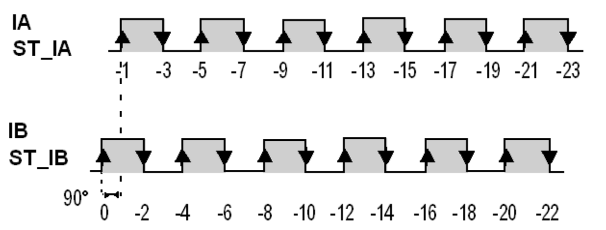
NOTE: the incremental encoder also provides marker information on the **IZ** input.
This pulse on the **IZ ST_IZ** (%IWr.m.c.2.6) input enables an up/down counter to be preset.

The figure below represents the case of **down counting** (**IA** behind **IB**).



Incremental encoder interface options

Several options are available on the configuration screen when an incremental encoder is connected:

If	Then
the **line check** is configured (encoder with RS 422 / 485 output),	the PLC indicates a fault when it detects a break in the encoder cable on one of the **IA, IB** or **IZ** physical inputs. It is then possible to start the application procedure which corresponds to the fault.
multiplication by 1 is configured,	up/down counting is done on rising edges of **IB** physical input (case shown: counting) 
multiplication by 4 is configured,	up/down counting is done on all the rising and falling edges of **IA** and **IB** physical inputs (case shown: down counting) 

Specialized interface for an absolute encoder (TSX CTY 2C)

At a Glance

Module TSX CTY 2C also has a specialized interface for a series absolute encoder, for applications that measure and monitor speed.

This section describes the operation of this specific input interface.

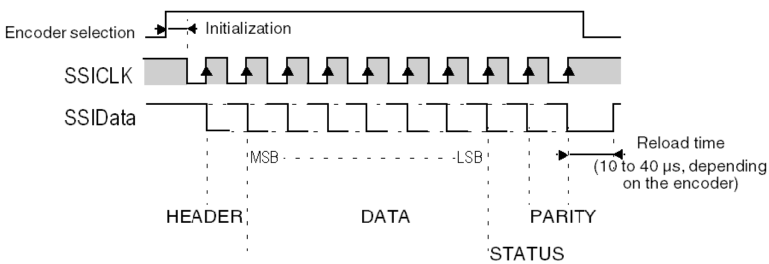
Inputs

In this configuration, **SSI Data** physical input and **SSICLK** physical output are connected to the series output absolute encoder.

It is also possible to connect up one to four parallel output absolute encoders by using the adaptation bases (see the Installation Manual).

Description of the SSI interface

The figure below represents an SSI frame.



The main other frame and interface features are as follows:

Parameters	Values or observations
Code	Binary or Gray
SSICLK transmission speed	150 kHz, 200 kHz, 375 kHz, 500 kHz, 750 kHz or 1 MHz
Header bits	Ignored
Data bits	● 8 active data bits minimum. ● 17 masked most significant bits maximum (rollover counting). ● 17 masked least significant bits maximum (resolution reduction).

Parameters	Values or observations
Status bits	An error bit specific to the encoder. Its frame position and significance can be configured.
Parity	Even, odd (not monitored by the module) or without parity.

Note

With an absolute encoder, the up/down counting is carried out implicitly in **rollover** mode. The number of unmasked bits directly gives the rollover value. The counting register changes in the [0, rollover] interval. The minimum rollover value is 1 and its maximum value is +33 554 432 (25 data bits without masked bit).

Section 8.3
Description of the capture function in counting modules

Subject of this section

This section describes the **capture** function for counting modules.

What Is in This Section?

This section contains the following topics:

Capture function for data module counters

Description

Capture is used to copy the current value of the up/down counting register to a capture register. It therefore fixes the immediate value at the precise moment the operation started.

Capture is only possible in combined up/down counting mode (all modules).

Module TSX CTY 2C also has a combined captured mode in the hardware preset (see: *Capture, TSX CTY 2C module specific features,* *page 179*).

Capture done CAPT_DONE information (%Ir.m.c.2) is an event which can undergo an event processing operation.

Triggering a capture

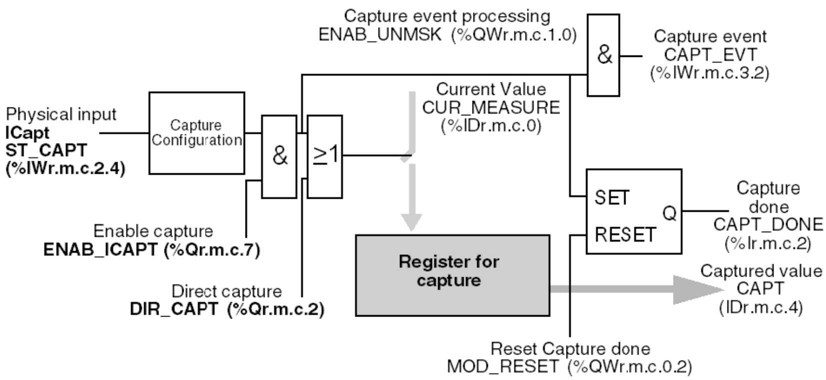
The operation is triggered:

- either directly, via the software: **Direct capture DIR_CAPT** command (Qr.m.c.2),
- or by the hardware: when the **ICapt ST_CAPT** (%IWr.m.c.2.4) physical input status has changed, with pre-enabled software (**Capture enable DIR_ENAB** (%Qr.m.c.0) command). This signal can be:
  - the rising edge of **ICapt** input,
  - the falling edge of **ICapt** input,
  - The rising edges **and** the falling edges of **ICapt** input (TSX CTY 2C only).

NOTE: time performances are at a maximum when **ICapt** input is configured on the rising or falling edge.

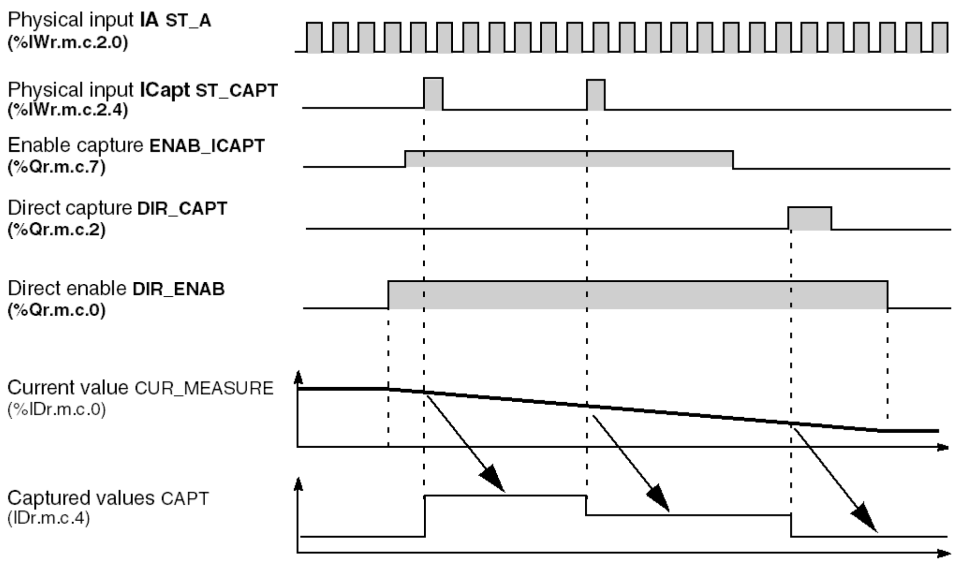
Function hardware structure

The figure below shows the hardware structure of the capture function. The associated language objects are described in the default objects *(see page 311)* section.



Operation

The time diagram below shows the capture mode on the rising edge of **ICapt**. The other modes (capture on falling edge, on rising **and** falling edges) are similar.



Capture, TSX CTY 2C module specific features

Specific modes

Except for the **single** capture modes, described in the previous paragraph, module TSX CTY 2C has two specific modes:

- capture of rising edges **and** falling edges of the input **ICapt**. This is an extension to the **single** capture principle, described in the previous Section.
- capture combined at hardware preset (**capture before preset** mode).

Capture mode on rising and falling edges

The capture mode on rising edges **and** falling edges of the **ICapt** physical input can be used, for example, to measure the lengths of parts. This depends on an exterior pulse for two successive captures to be carried out.

The allowable interval between the two capture fronts must be **a minimum of 0.5 ms**. This is therefore the minimum size of the capture pulse.

Respecting this condition guarantees the correct running of the function, i.e. taking into account of all the edges present on the physical capture input.

Examples

The table below gives as an example this interval according to counting input frequency.

Counting input frequency	Minimum interval between capture edges (in number of counting pulses)
125 kHz	63
250 kHz	125
500 kHz	250
1 MHz	500

Capture before preset mode

This capture mode, specific to module TSX CTY 2C, applies to the up/down counting of pulses (proximity detector, incremental encoder), but not to the acquisition of data from the absolute encoder

The preset **IPres** physical input triggers successively:

- a capture,
- followed by the preset.

Section 8.4
Description of the preset and reset function in counting modules

Subject of this sectionSubject of this Section

This sub-section describes the **preset** and **reset** function for counting modules.

What Is in This Section?

This section contains the following topics:

Introduction to the preset/reset function

General

The preset initializes the up/down counting register to a predefined value (by software). Reset initializes to zero the same register.

The preset concerns the down counting mode and the combined up/down counting mode. Resetting only involves the counting mode (TSX CTY 2A/4A).

The operation can be **triggered** or **automatic**.

The following sections detail the conditions for preset/resetting to zero, according to the counting method and module used.

Notes

- Preset (or reset) acts on the object *(see page 227)* INVALID_MEAS (%IWr.m.c.2.7).
- Preset (or reset) done is an event which can undergo an event processing operation.

Preset in down counting mode (TSX CTY 2A/4A)

At a Glance

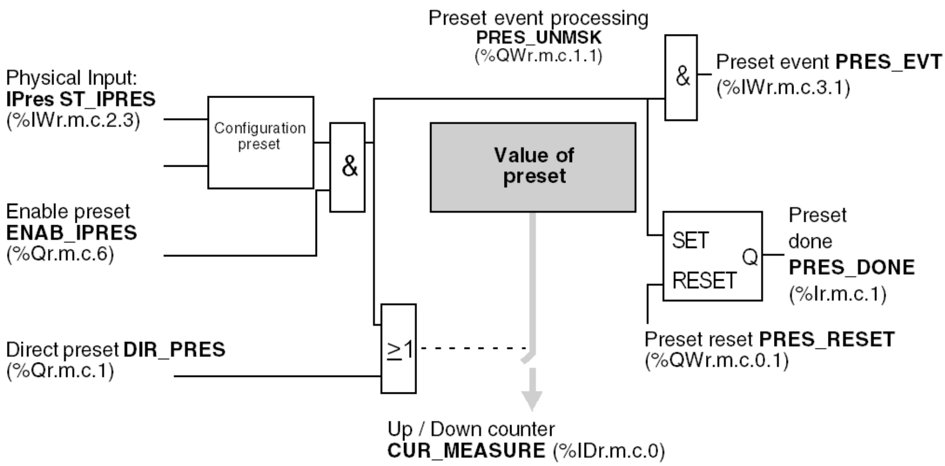
Presetting initializes the down counting register to a value preset by the software. Preset is:

- **triggered**
  - by the hardware: on the rising or falling edge of the **IPres ST_IPRES** (%IWr.m.c.2.3) physical input with pre-enabled software, **Preset enable** command,
  - directly by the software: **Direct preset** command.
- **automatic**, will be done when the zero value is crossed.

NOTE: the two types of preset (triggered and automatic) are independent and can co-exist.

Illustration

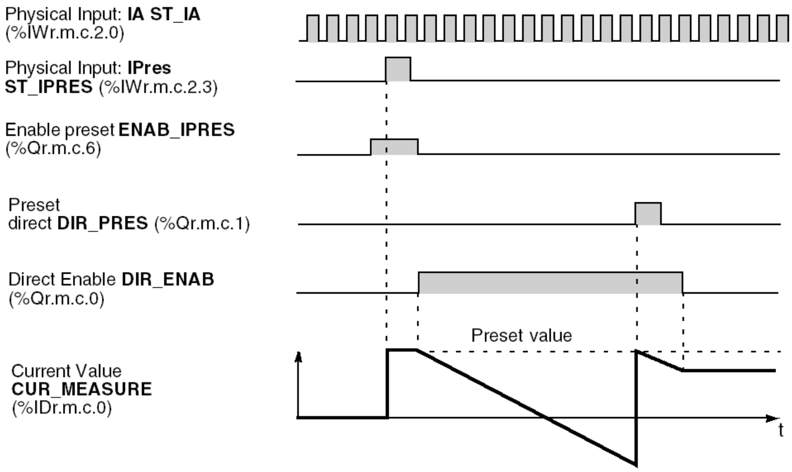
The figure below represents the preset function triggered by the hardware. The associated language objects are described in the default objects *(see page 301)* section.



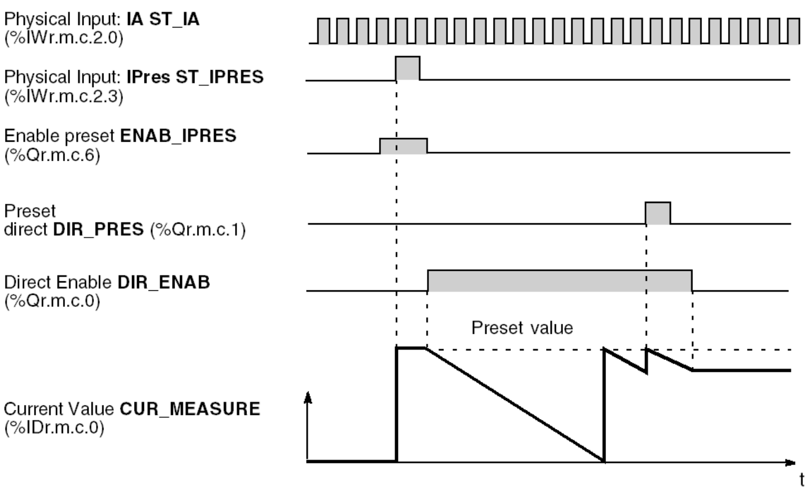
Time diagrams

The following time diagrams show the different cases for preset with or without automatic reloading when crossing the zero value threshold.

The time diagram below shows a preset triggered by **IPres**, then a direct (software) preset. Zero value is crossed without automatic preset.



The time diagram below shows a preset triggered by **IPres**, a direct preset, and an automatic preset when crossing the zero value.



Resetting when counting (TSX CTY 2A/4A)

At a Glance

Resetting initializes the counting register at zero value.

Resetting is:

- triggered
  - by the hardware: on the rising or falling edge of the IReset ST_IPRES (%IWr.m.c.2.3) physical input, with the software being pre-enabled, Reset enable ENAB_IPRES (%Qr.m.c.6) command,
  - directly by the software: Direct reset DIR_PRES command (Qr.m.c.2),
- automatic, will be done when the zero value is crossed.

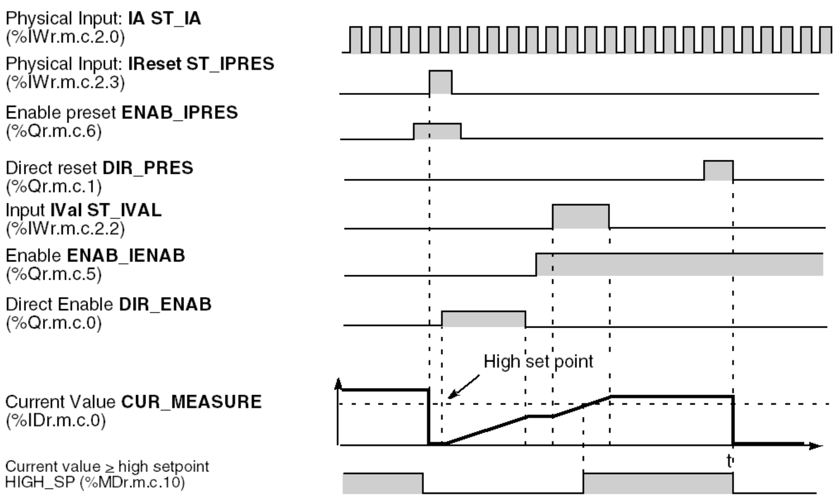
NOTE: the **IReset** input is physically the same as the **IPres ST_IPRES** (%IWr.m.c.2.3) input used for presetting in down counting mode.
The diagram block of the **Reset** function is the same as that of the function for **Preset** *(see page 182)*.

NOTE: the two types of Reset (triggered and automatic) are independent and can co-exist.

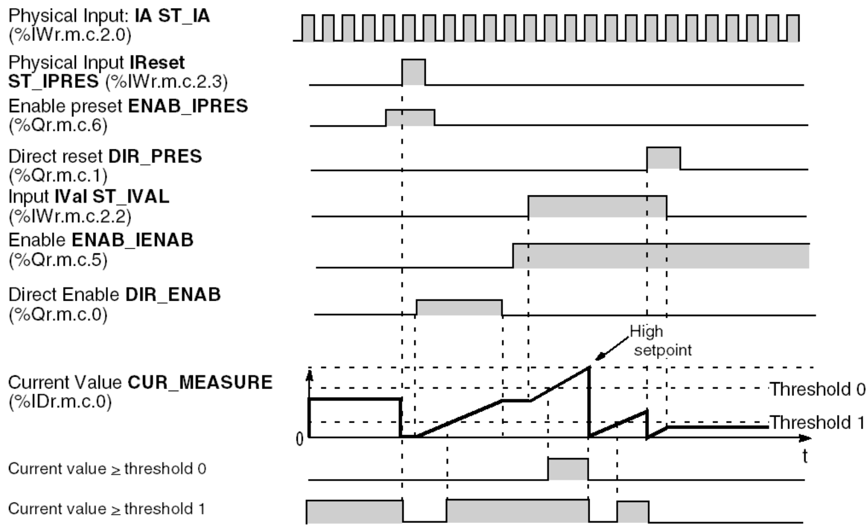
Time diagrams

The following figures show examples of triggered and automatic resetting to zero:

The time diagram below shows both a triggered reset on the rising edge of the **IReset** input, and a direct (software) reset. The high setpoint is crossed without automatic reset. The associated language objects are described in the default objects *(see page 301)* section.



The time diagram below shows a triggered reset on the rising edge of **IReset** input, a direct (software) reset and an automatic reset when crossing the high setpoint.



Preset in up/down counting (TSX CTY 2A/4A/2C)

Presetting modes

In the combined up/down counting modes there are 7 **hardware preset** modes which are combinations relating to states and/or edges of **Ipres ST_IPRES** (%IWr.m.c.2.3) and **IZ ST_IZ** (%IWr.m.c.2.6) physical inputs:

- **IPres** rising edge,
- **IPres** falling edge,
- rising edge of **IPres** + direction / falling edge of **IPres** - direction,
- rising edge of **IPres** - direction / falling edge of **IPres** + direction,
- status of **IPres**,
- reference point short cam (with incremental encoder),
- reference point long cam (with incremental encoder).

Direct preset DIR_PRES (%Qr.m.c.1) (by software) exists alongside the hardware presetting modes mentioned above.

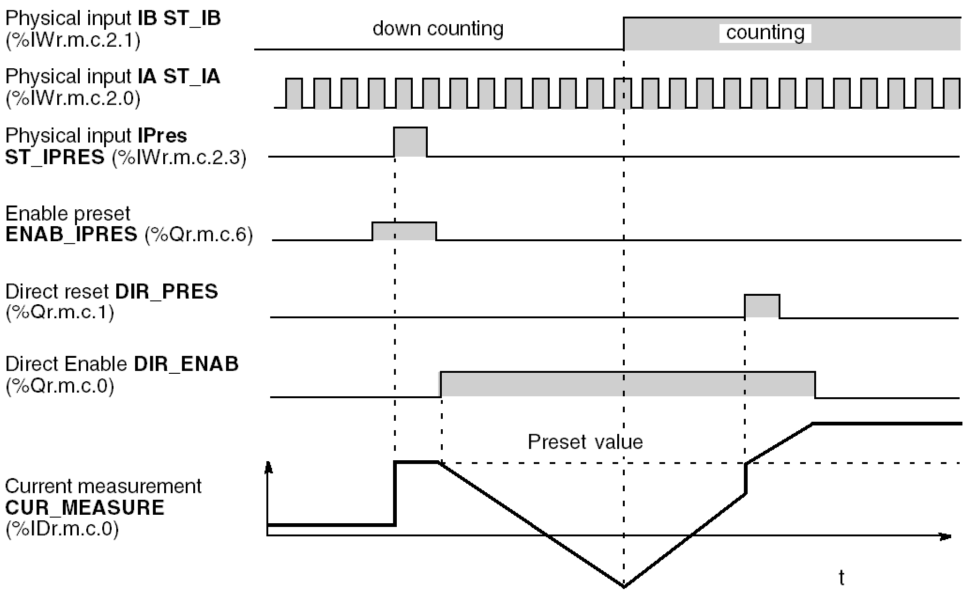
Notes

- There is no automatic preset in combined up/down counting (on crossing a value as there is for up or down counting alone).
- There is no preset in conjunction with absolute encoders (TSX CTY 2C).

Presetting on IPres edge

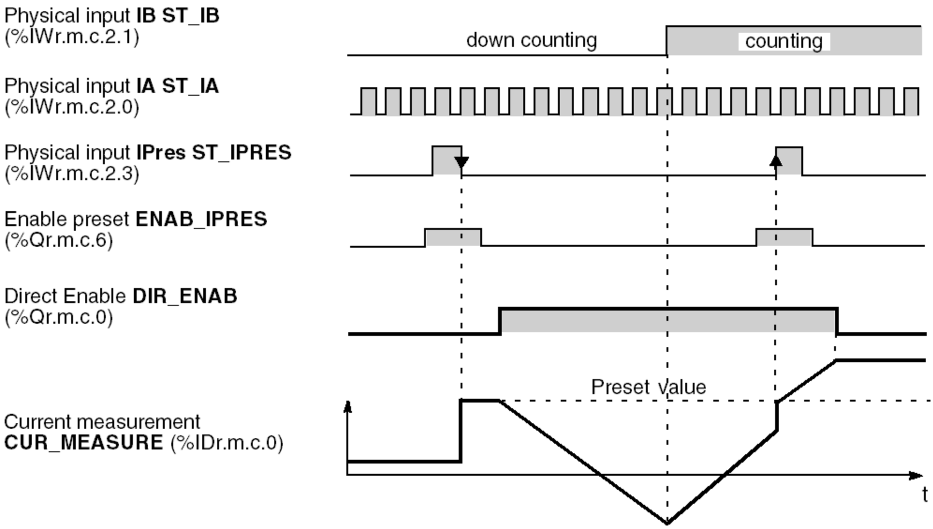
The first two presetting modes (on **IPres** rising or falling edge) are the same as those described for down counting only.

The figure below shows an example of preset on the **IPres** rising edge, as well as direct (software) preset. Preset on the **IPres** falling edge is similar. The associated language objects are described in the implicit objects *(see page 298)* section.



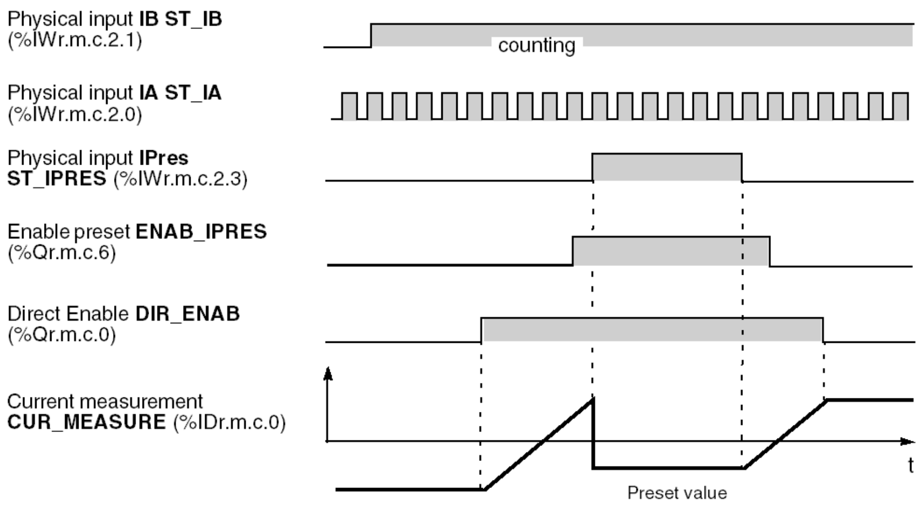
Preset on IPres edge combined with counting direction

The figure below shows an example of preset on the rising edge of **IPres** in up counting (+ direction), and on the falling edge of **IPres** in down counting (- direction). The reverse case is similar.



Preset on IPres state

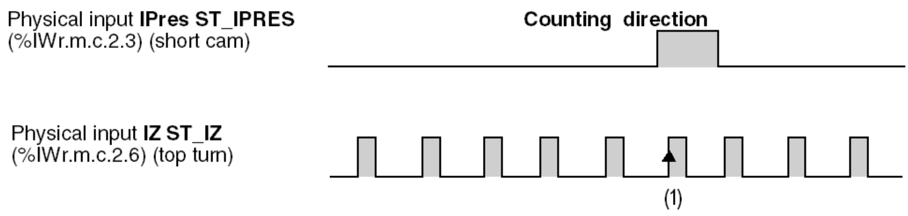
The figure below shows an example of preset on **IPres** state (high level). The counting value is fixed at the preset value for the duration of the active state of **IPres**.

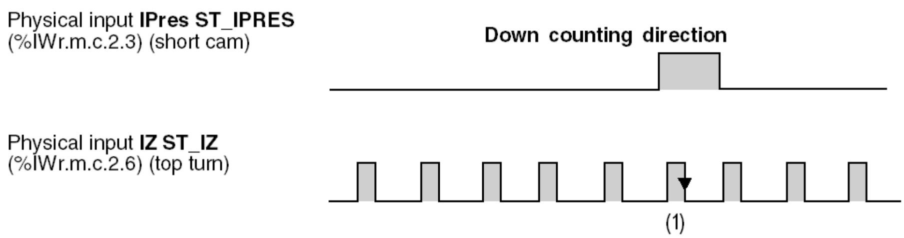


Preset on reference point short cam

This mode and the one that follows (reference point long cam) are to be used with an incremental encoder.

The time diagrams below show preset mode on a **reference point short cam** .



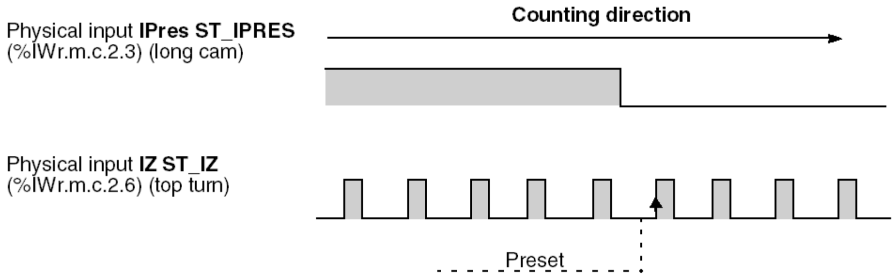


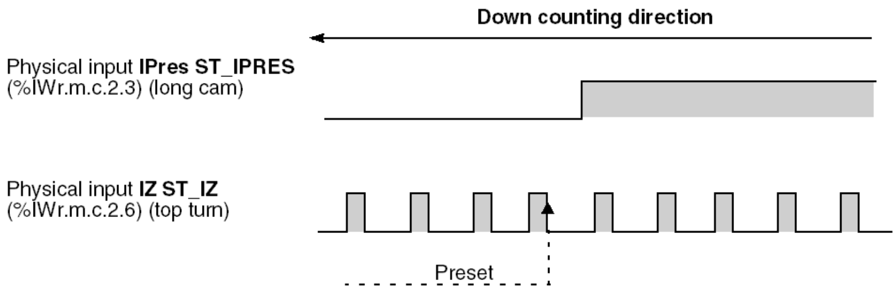
NOTE: (1) preset is taken into account:
- in + direction (up counting): **IPres** input at state 1, rising edge of marker input at **IZ ST_IZ** (%IWr.m.c.2.6) revolution and software enabling.
- in direction - (down): **IPres** input in state 1, falling edge of marker input at **IZ** revolution and software enabling.

NOTE: In principle, as the short cam is less than an incremental encoder revolution, the revolution marker is only produced once in the cam. If, however, there are several incremental revolutions in the cam, the last active edge of the revolution marker signal triggers the preset.

Preset on long cam reference point

The time diagrams below show preset mode on a **reference point long cam**.





NOTE: preset is taken into account on the first rising edge of the **IZ** revolution marker input, which follows the change of **Ipres** input to status 0, both in the counting and the down counting directions and software enabling.

Section 8.5
Description of the comparison function in counting modules

Subject of this section

This section describes the **comparison** function for counting modules.

What Is in This Section?

This section contains the following topics:

Introduction to the comparison function

General

Modules TSX CTY 2A, 4A and 2C have a **comparison** function which compares the current value and the captured value with:

- zero value,
- threshold 0,
- threshold 1,
- the high setpoint,
- the low setpoint,
- the rollover crossing.

The table below summarizes the various possibilities:

Element for comparison	The comparison in relation to the current value is possible for:	The comparison in relation to the captured value is possible for:
Zero value	CTY 2A/4A (down counting only)	No module
Threshold 0	CTY 2A/4A (up counting only) CTY 2A/4A (up/down counting) CTY 2C (up/down counting)	CTY 2A/4A (up/down counting) CTY 2C (up/down counting)
Threshold 1	CTY 2A/4A (up counting only) CTY 2A/4A (up/down counting) CTY 2C (up/down counting)	CTY 2A/4A (up/down counting) CTY 2C (up/down counting)
High setpoint	CTY 2A/4A (up counting only) CTY 2A/4A (up/down counting)	CTY 2A/4A (up/down counting)
Low setpoint	CTY 2A/4A (up/down counting)	CTY 2A/4A (up/down counting)
Rollover crossing	CTY 2C (up/down counting)	CTY 2C (up/down counting)

Note

Crossing thresholds, setpoints and rollover can be subjects of an event process operation.

Comparison in counting or down counting (TSX CTY2A/4A)

Comparisons in down counting

In down counting only mode, a single possibility is autorized:

- comparison of the current value to the zero value.

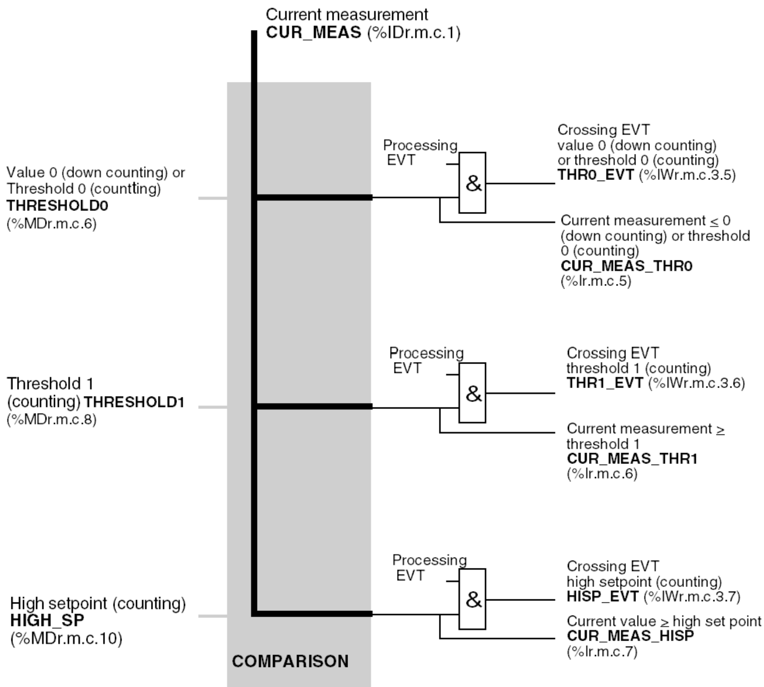
Comparisons in up counting

In up counting only mode, three possibilities are offered:

- comparison of the current value to the 0 threshold,
- comparison of the current value to the 1 threshold,
- comparison of the current value to the high setpoint.

Operation

The diagram below illustrates the operation of the comparisons available in up counting only and down counting only modes in the TSX CTY 2A/4A modules. The associated language objects are described in the default objects *(see page 301)* section.



Comparison in Up Counting/Down Counting Mode (TSX CTY2A/4A)

Possible Comparisons

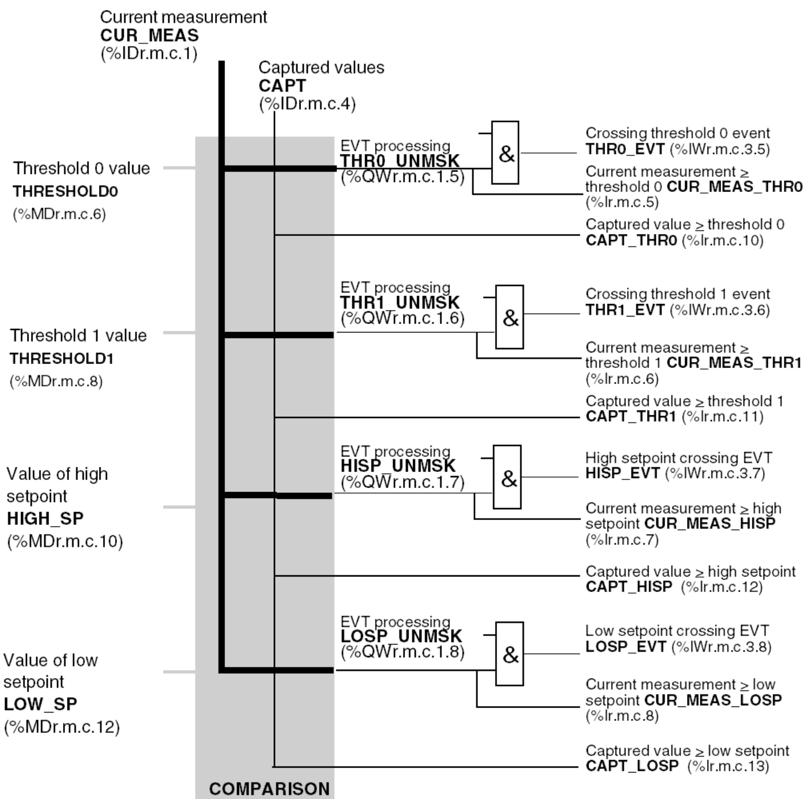
In combined up counting/down counting mode, comparisons are possible with:

- two thresholds (0 and 1 threshold),
- and two setpoint values (high and low).

There are therefore 8 possible comparisons.

Operation

The figure below illustrates the operation of comparisons available in up counting / down counting mode in TSX CTY 2A /4A modules. The relevant language objects are described in the implicit objects *(see page 301)* section.



Comparison in up/down counting and measurement mode (TSX CTY2C)

At a Glance

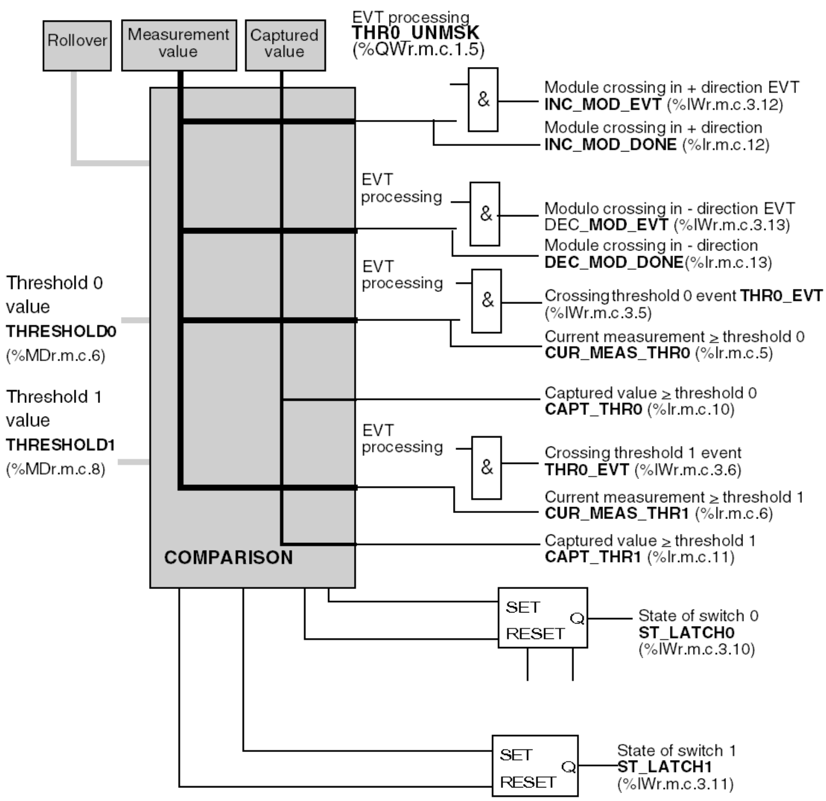
In up/down counting and measurement mode, comparison can be used with:

- threshold 0,
- threshold 1,

There are four ways of comparing: current value and captured value in relation to the thresholds.

Operation

The figure below illustrates the operation of comparisons available in up / down counting mode in TSX CTY 2C modules. The associated language objects are described in the default objects *(see page 311)* section.



Section 8.6
Description of counter outputs associated with counting modules

Subject of this section

This section describes how counter outputs associated with counting modules operate.

What Is in This Section?

This section contains the following topics:

Introduction to storing switches

General

Some temporary circumstances that occur during up or down counting are stored in switches. The number of these switches (one or two) depends on the operating mode.

Switch outputs can be tested by the software and in some cases sent to physical outputs (reflex outputs).

Switches have automatic adjustable setting to 1 conditions (SET) and resetting to zero conditions (RESET) and direct setting to 1 or 0 conditions by the software. The latter always have the highest priority. Priority rules are set out in the sections *Switches in up/down counting mode (TSX CTY 2A, 4A, 2C),* *page 203* and *Switches in counting mode (TSX CTY2A/4A),* *page 200*.

This section describes SET and RESET conditions according to the modules and their operating modes.

Adjusting switch conditions is described in the section *Adjustment of TSX CTY2A, TSX CTY4A and TSX CTY2C Modules,* *page 251*.

Switches in down counting mode (TSX CTY2A/4A)

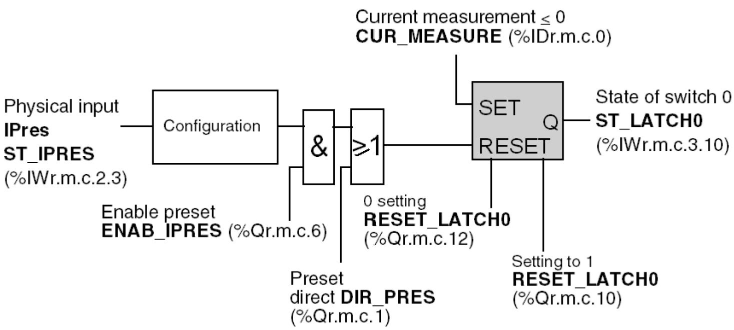
General

In counting down mode alone, TSX CTY2A/4A modules only have one switch setting (0) with pre-defined automatic SET and RESET conditions:

- SET: current value less than or equal to 0,
- RESET: direct (software) preset or hardware preset done.

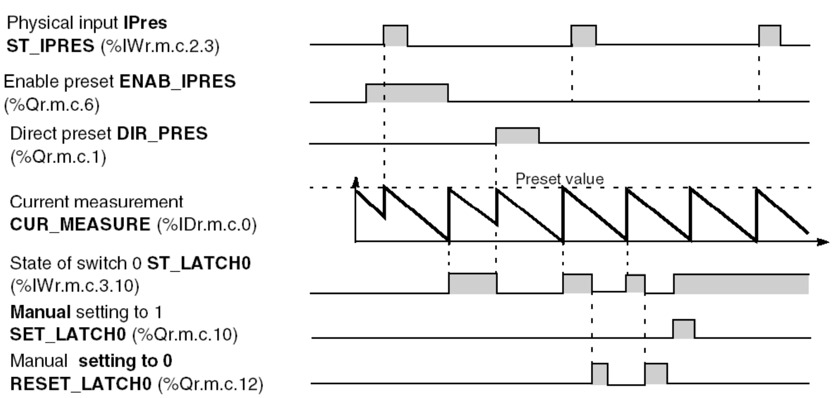
Inputs for switch 0

The following figure shows inputs for switch 0 in down counting mode. You will also see **manual** inputs for setting to 0 or 1.



Operating example

The following time diagram shows how switch 0 operates.



Switches in counting mode (TSX CTY2A/4A)

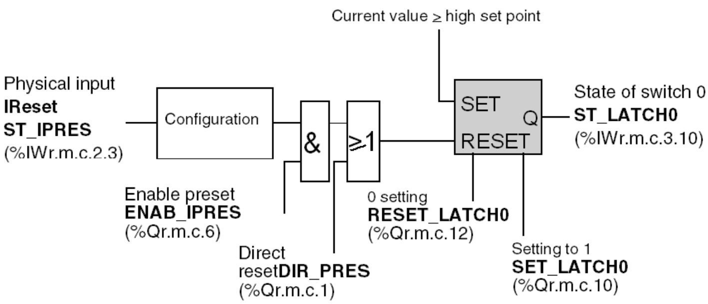
General

In counting mode alone, TSX CTY2A/4A modules have two switch settings:

- switch 0 where automatic SET and RESET conditions are predefined,
- switch 1 where automatic SET and RESET conditions can be adjusted using 5 combinations.

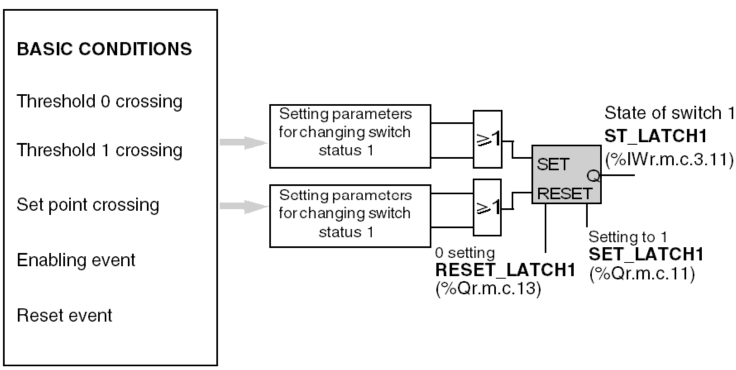
Inputs for switch 0

The following figure shows inputs for switch 0 in counting mode alone. You will also see manual inputs for setting to 0 or 1.



Inputs for switch 1

The following figure shows inputs for switch 1 in counting mode alone, as well as direct inputs for setting to 0 or to 1.



NOTE: switches 0 and 1 have the same basic SET and RESET conditions. If these happen at the same time the global RESET combination takes priority over the SET combination.

Switch setting conditions and priorities

The following tables shows the conditions for switches 0 and 1 with their related priorities.

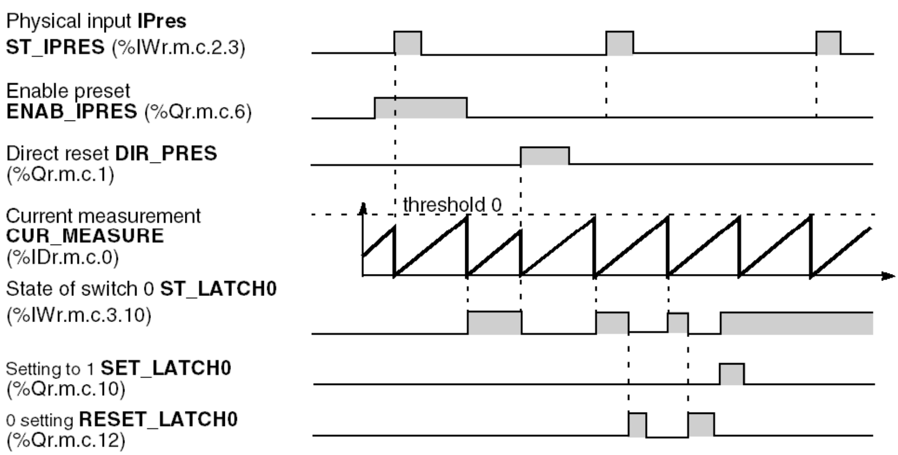
Priority	Switch 0	Switch 1
Greater priority ↓ Lesser priority	**Manual** setting to 0 **Manual** setting to 1 RESET: Reset to zero (direct or done). SET: current value greater than or equal to the setpoint value	**Manual** setting to 0 **Manual** setting to 1 RESET SET Enabling event Reset event Set point crossing Threshold 1 crossing Threshold 0 crossing

Notes

- Adjustable conditions (events, crossing thresholds or set points) are the same for switch 1 SET and RESET conditions.
- The RESET input takes priority over the SET input.

Operating example (switch 0)

The following time diagram shows how switch 0 operates.

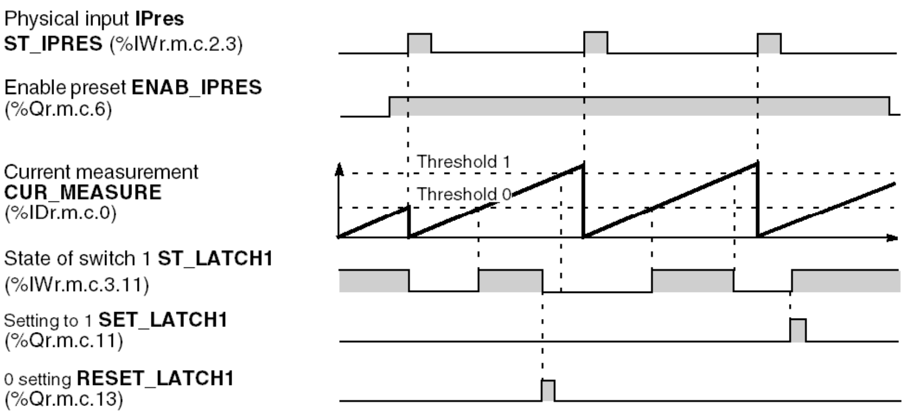


Operating example (switch 1)

The following time diagram shows how switch 1 operates, with the adjustments shown below:

If	Then: final state
Enabling event	-
Reset event	R
Set point crossing	-
Threshold 1 crossing	R
Threshold 0 crossing	S

Time diagram showing how switch works:



Switches in up/down counting mode (TSX CTY 2A, 4A, 2C)

General

These modules offer two storing switches in up/down counting mode (and also measurement mode where applicable for the TSX CTY2C module).

Switch SET (setting to 1) and RESET (setting to 0) conditions can be adjusted using combinations of:

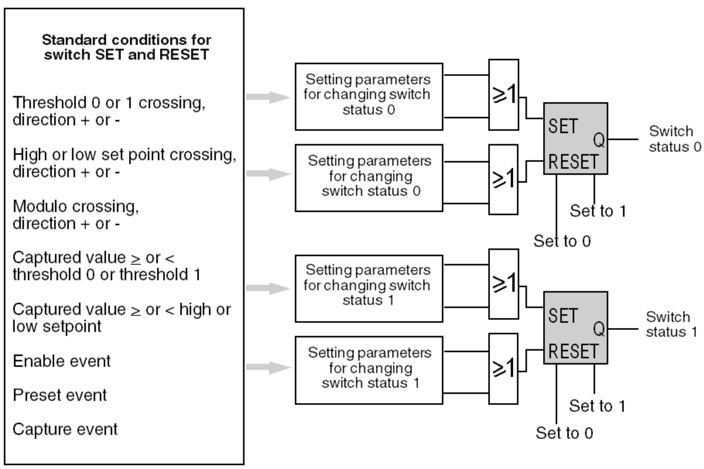
- 17 basic conditions for TSX CTY2A/4A modules,
- 13 basic conditions for TSX CTY 2C modules.

These basic conditions are relative to:

Module	Overshooting by the current value of:	Captured value settings in relation to:	Events:
TSX CTY 2A/4A	thresholds and setpoints	thresholds and setpoints	enabling, preset and capture
TSX CTY 2C	thresholds and rollover	thresholds	enabling, preset and capture

Switch inputs

The following figure shows switch inputs in up/down counting mode. Also note **manual** inputs for setting to 0 and 1.



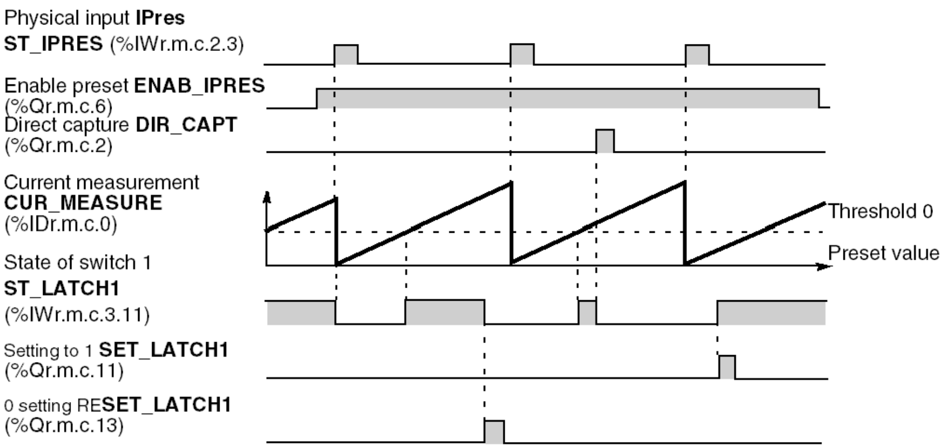
NOTE: switches 0 and 1 have the same basic SET and RESET conditions. If these happen at the same time the global RESET combination takes priority over the SET combination.
According to the type of module, some conditions cannot be set. Conditions and their priority status are listed later on.

Operating example

The time diagram below shows how switch 0 operates with the following adjustments:

If	Then: final state
Crossing threshold 0 in + direction	S
Captured value > threshold 0	R
Other conditions	-

Time diagram showing how switch 1 operates.



Basic conditions and priorities

The following tables shows the basic positioning conditions for switches 0 and 1 with their related priorities.

Priority	TSX CTY 2A/4A	TSX CTY 2C
Greater priority Lesser priority	Manual setting to 0 Manual setting to 1 RESET SET Enabling event Captured value position in relation to low setpoint Captured value position in relation to high setpoint Captured value position in relation to threshold 1 Captured value position in relation to threshold 0 Capture event Low setpoint crossing High setpoint crossing Threshold 1 crossing Threshold 0 crossing Preset event	Manual setting to 0 Manual setting to 1 RESET SET Enabling event Threshold 1 crossing Threshold 0 crossing Rollover crossing Captured value position in relation to threshold 1 Captured value position in relation to threshold 0 Capture event Preset event

NOTE: In reality, crossing setpoints, thresholds and rollovers group two conditions each time, according to the direction (+ or -) of the crossing.

Section 8.7
Description of physical outputs associated with counting modules

Subject of this section

This section describes how physical outputs associated with counting modules operate.

What Is in This Section?

This section contains the following topics:

Counting modules physical outputs

General

Each counting module channel offers one to four physical outputs **Q0** to **Q3**, according to the module.

Q0 and **Q1** outputs, available in all modules, can be configured using two modes:

- **manual** mode: the state of the output is monitored by the software as for a discrete output,
- **automatic** mode: the output copies the associated switch state (switch 0 or 1), and therefore the latches defined for these switches.
  This mode is used to set up reflex actions in the module.

Q2 and **Q3** outputs (only available in TSX CTY 2C modules), have more limited configuration options (see: *Introduction to TSX CTY2C module outputs, page 212*.

The behavior of outputs in the event of a fault (ie. in fallback mode) varies according to whether the module is a TSX CTY 2A / 4A *(see page 215)* or a TSX CTY 2C *(see page 211)*.

In the event of a trip (ie. through a voltage surge or short-circuit), outputs must be reset **manually** using the application, or **automatically** when the voltage surge disappears.

Introduction to modules TSX CTY 2A/4A physical outputs

Description

Each channel in TSX CTY 2A and 4A modules has two physical outputs: **Q0** and **Q1**.

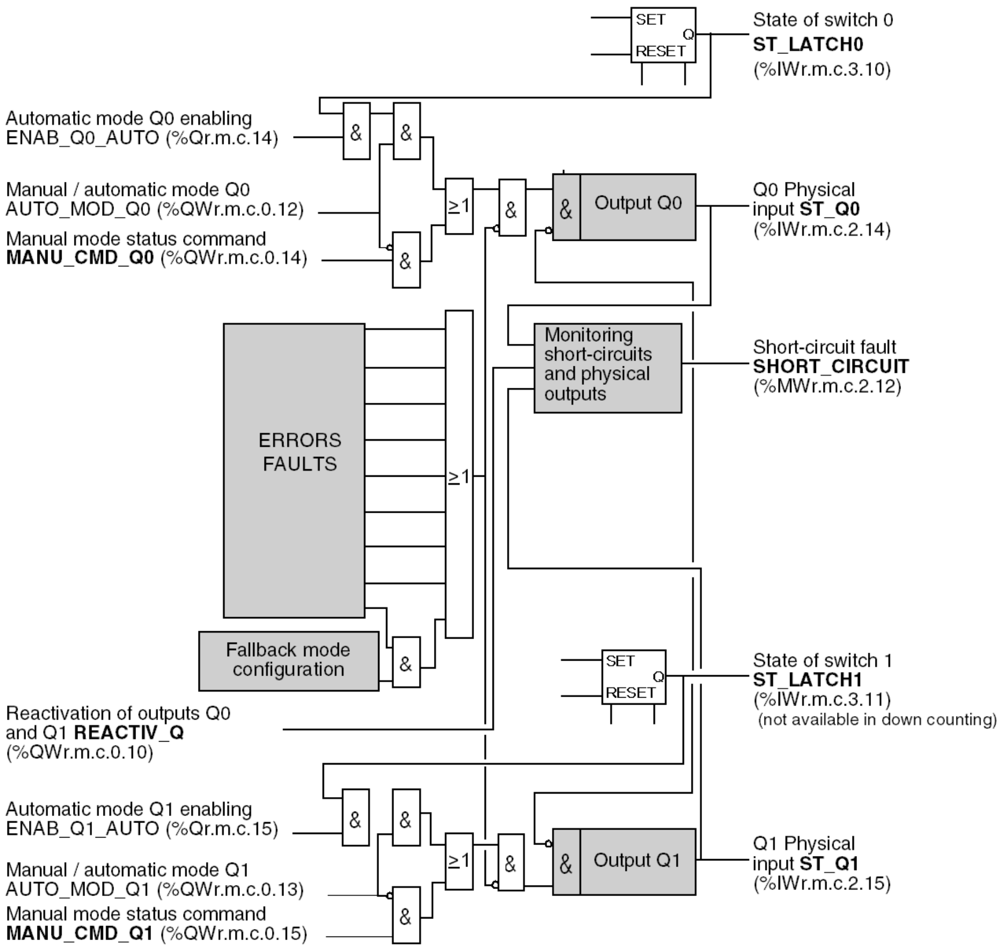
These outputs can be used in manual mode (discrete). The state of these outputs is then set with commands sent by software.

Q0 and **Q1 physical** outputs can also be configured automatically. Automatic mode is used to install reflex actions in the module by copying the state of the storing switches respectively.

- Counting: two switches are available. The two outputs can be configured automatically.
- Down counting: only switch **0** is available. Only one output (**Q0**) can be configured automatically.

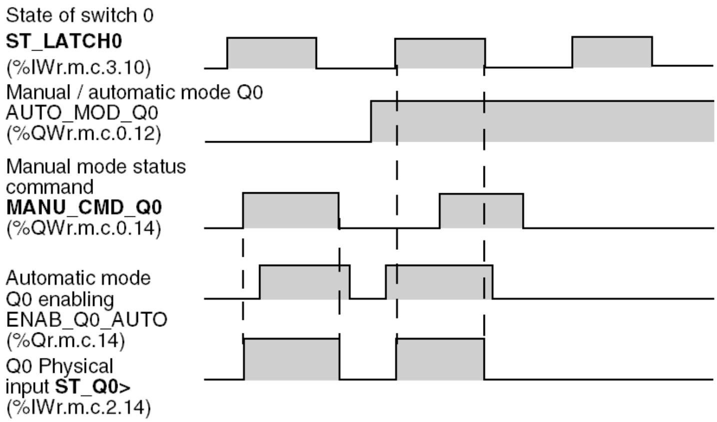
Structure of outputs

The figure below shows the structure of physical outputs from a TSX CTY 2A/4A channel. The associated language objects are described in the default objects *(see page 301)* section.



How outputs operate

The time diagram below shows how outputs operate (using **Q0** output as an example).



Output Fallback Mode for TSX CTY2A/4A Modules in the Event of a Fault

Why Have a Fallback Mode?

The physical outputs from TSX CTY 2A/4A modules can directly control certain parts of the process. It is therefore necessary for the safety of the operation to have a fallback mode in the event of a fault in the outputs themselves, the module or the application.

Fallback Mode

The state of **Q0** and **Q1** physical outputs is **forced to 0** when one of the following faults occurs:

- tripped output (short-circuit or voltage surge),
- module failure,
- self-testing in progress,
- auxiliary input/output fault,
- counting input fault,
- fault in the counting application,
- application fault,
- stop in communication with the PLC: special fault for which the fallback mode can also be configured following the table below.

All these faults are indicated by the software. The relevant language objects are described in the implicit objects *(see page 301)* section.

Communication Stop - Special Case

If communication with the PLC stops:

If the fallback mode is configured to	Then outputs are
Reset,	forced to 0,
maintain	maintained in the state they were before the fault appeared.

Indicating a Trip

In the event of a voltage surge or short-circuit of an output, a trip is indicated:

- by software via language objects,
- and by LEDs:
  - the module **I/O** LED is always lit,
  - the **CH** LED associated with the voltage overload channel flashes.

In addition, a current limit of 625 mA is put in place.

Introduction to TSX CTY2C module outputs

Description

Each TSX CTY 2C module channel has four physical outputs: **Q0, Q1, Q2** and **Q3**.

All outputs can be used in manual (discrete) mode. The state of these outputs is then set with commands sent by software. The associated language objects are described in the implicit objects *(see page 311)* section.

The physical outputs **Q0 ST_Q0** (%IWr.m.c.2.14) or **Q1 ST_Q1** (%IWr.m.c.2.15) can also be configured in automatic mode. The state of outputs **Q0** and **Q1** is then that of the counter outputs **0** and **1** respectively. Automatic mode is used to install reflex actions in the module, depending on the state of the up/down counter.

Q2 output – special case

Q2 is actually an input/output which can be configured:

- either as an enabling physical input **IVal ST_IENAB** (%IWr.m.c.2.2),
- or as a physical output **Q2** (in manual mode only).

Q3 output – special case

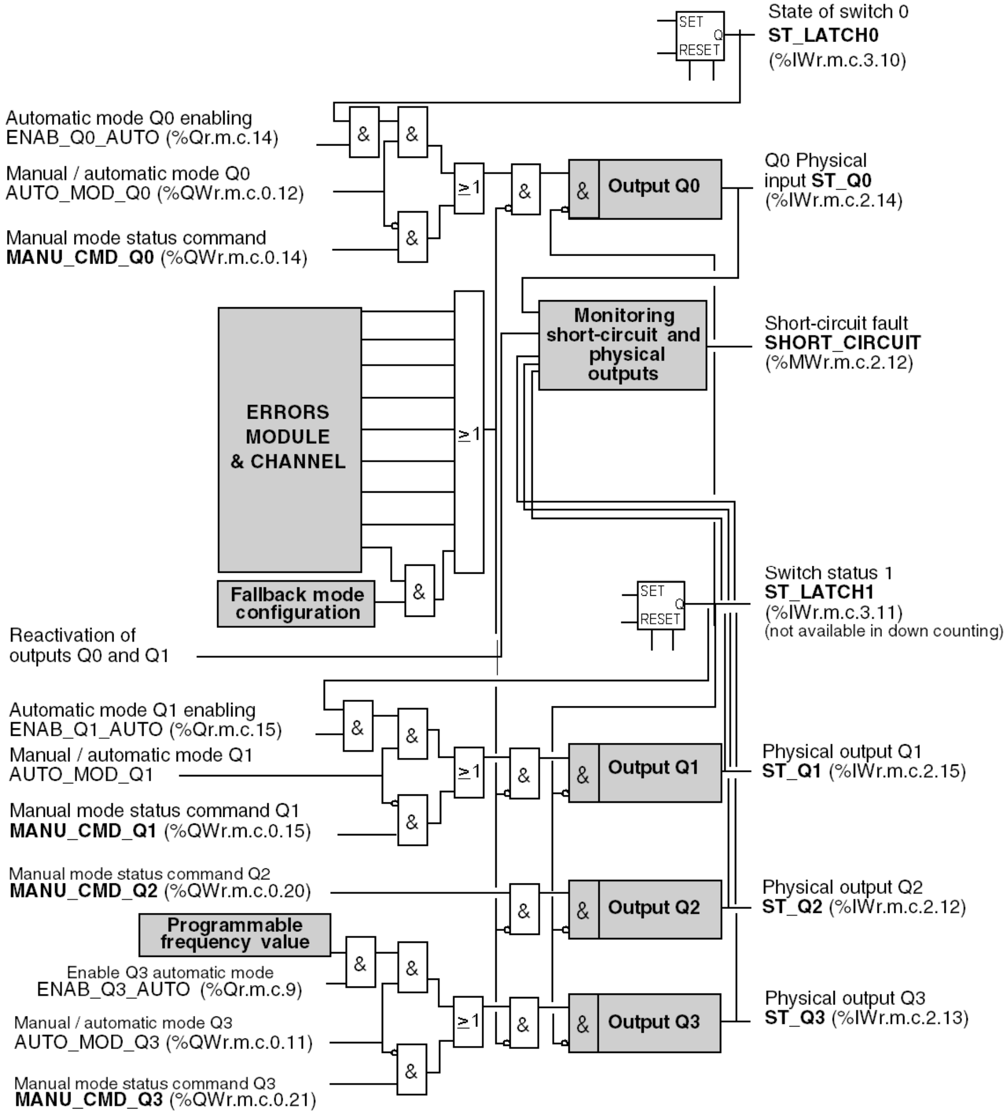
The output **Q3 ST_Q3** (%IWr.m.c.2.13) can be used:

- either in manual mode,
- or in frequency mode which can be programmed from 1 ms to 4000 s by increments of 1 ms.

Programmable frequency output enables an external synchronization marker to be used on several channels of modules.

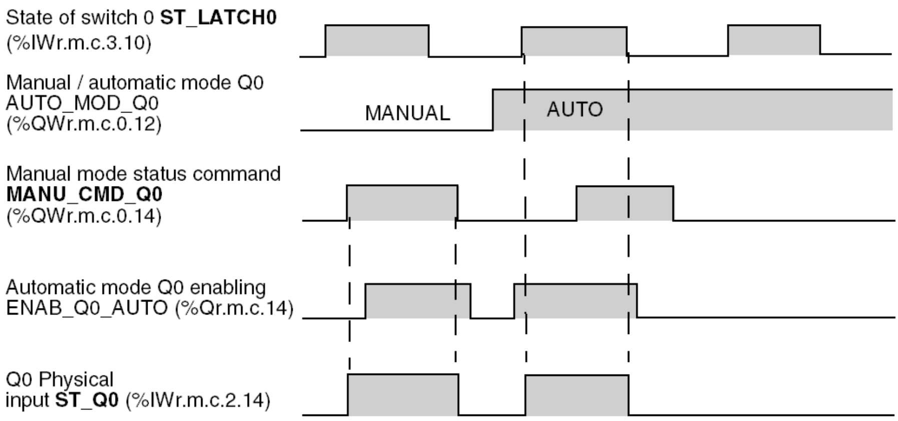
Structure of outputs

The figure below shows the structure of module TSX CTY 2C physical outputs. The associated language objects are described in the default objects *(see page 311)* section.



How outputs operate

The time diagram below shows how outputs operate (using Q0 output as an example)



Outputs fallback mode for TSX CTY2C modules in the event of a fault

Why have a fallback mode?

The physical outputs from TSX CTY2C modules can directly control certain parts of the process. It is therefore necessary for the safety of the operation to have a fallback mode in the event of a fault in the outputs themselves, the module or the application.

For a TSX CTY2C modules, the fallback modes vary according to:

- the nature of the fault,
- the operating mode (manual or automatic) of the faulty output.

Fallback conditions in manual mode

In the event of one of the following faults :	Q0 to Q3 outputs in manual mode :
• module failure, • self-testing in progress, • counting application fault(invalid software configuration or channel reconfiguration), • auxiliary inputs/outputs fault, • auxiliary input power supply fault, • tripping of any output (short circuit or voltage surge),	are reset to zero.
• counting input fault • counting application fault (adjustment fault), • fault in the encoder power supply or sensor, • encoder line break or short-circuit, • SSI series frame fault, • specific absolute encoder fault, • measurement overrun or overspeed	are **not** reset to zero.

All these faults are indicated by the software via language objects. To find out the associated language objects, see CH_FLT word for explicit language objects *(see page 315)*

Fallback conditions in automatic mode

When outputs are in automatic mode, they are reset to zero whatever the fault. In this way the module ensures the safety of the operation, even if the fault is masked.

These faults are also indicated by the software.

Communication fault – special case

In the event of PLC communication stopping, independently of manual or automatic output mode:

If the fallback mode is configured to	Then outputs are
Reset,	forced to 0,
maintain	maintained in the state they were before the fault appeared.

Indicating a trip

In the event of a voltage surge or short-circuit of an output, a trip is indicated:

- by software via language objects, as mentioned before,
- and by LEDs:
  - the module **I/O** LED is always lit,
  - the **CH** LED associated with the voltage overload channel flashes.

In addition, a current limit of 625 mA is put in place.

Reactivating outputs after a trip (TSX CTY2A/4A/2C)

At a Glance

When a fault has tripped one or several physical outputs, it is essential to reactivate them. This operation varies according to whether the configuration is set up to be manual or automatic.

When a trip causes an incorrect operation of a PLC-controlled process, it is recommended to link output reactivation to a manual operation (for example: press a button to acknowledge, etc.). The operator can then take the necessary action with regard to the automatic process and personnel safety (e.g. request to change to manual mode).

NOTE: It is possible to program an automatic reactivation, if under the responsibility of the user and PLC-controlled process allowing.

Basic principle

When one of the physical outputs short-circuits, all outputs are set to 0 by the down counting module. In spite of this, as long as the short circuit is present, physical outputs on 0 must be blocked for safety reasons:

- whatever the mode, (**manual** or **automatic**), you must **disable** output: set physical output enabling bits to 0,
- in **manual** mode: program a **set to 0** of physical output manual command objects.

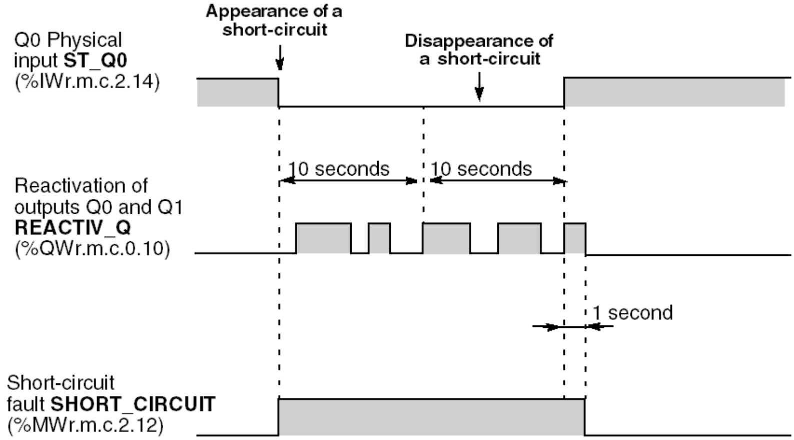
Principle of manual reactivation

The **short-circuit fault** bit is set on 1 as soon as a short-circuit appears. The **output reactivation** bit must be enabled to reactivate physical output, providing the **manual reactivation** mode has been configured.

The program can, for example, wait until an acknowledgement button has been pressed before activating this bit.

Reactivation will take effect at least **10** seconds after the short-circuit has been detected, providing that the short-circuit is no longer present. To find out the associated language objects, see implicit objects *(see page 299)* and explicit objects *(see page 298)*.

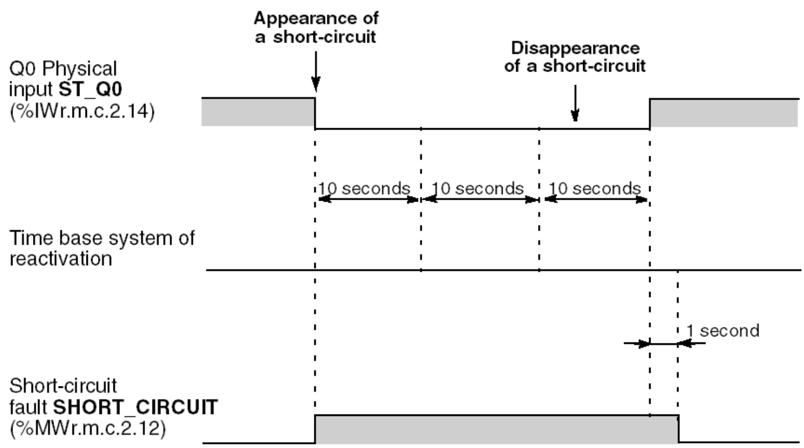
The time diagram below shows how a short-circuit is manually acknowledged.



Principle of automatic reactivation

Reactivation is automatically requested by the module every **10** seconds. The basic time of 10 seconds is synchronous in relation to the appearance of the fault.

The time diagram below shows how a short-circuit is automatically acknowledged.



Section 8.8
Description of the speed measuring function of the TSX CTY2C Module

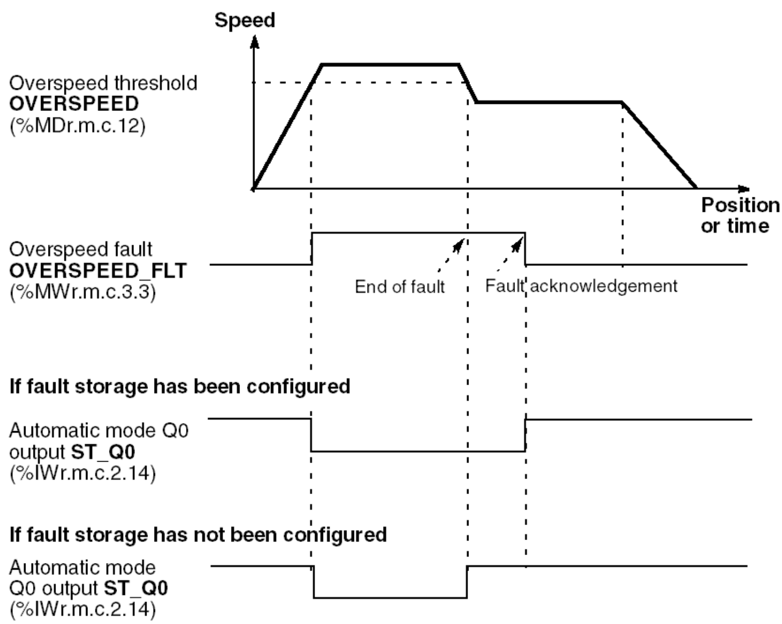
Overspeed Monitoring Function (TSX CTY2C)

At a Glance

Overspeed monitoring, via a user-adjusted speed limit, enables safety action to be applied to output(s) where the overspeed limit has been exceeded (outputs are then set to 0). These outputs must be configured automatically.

Operation

The figure below shows the changes in reflex outputs following configuration (example using Q0 output).



Storing Faults

When an output is automatic:

- if fault storing has been configured: when a fault has disappeared, it must be acknowledged in order to reposition the output to its initial state before the fault. Acknowledging a fault prematurely has no effect.
- if fault storing has not been configured: the disappearance of an overspeed fault repositions output to its initial state.

Note: Output in Manual Mode

Outputs in **manual** mode are not affected by an overspeed fault, and retain their state.

Selecting the Measurement Period

By default, the measurement period is 1 second, which can lead to an excessive delay in detecting overspeed, or insufficient precision. The measurement period can be programmed according to the speed to be monitored and precision sought:

$$\text{Measurement period} \geq \frac{1}{\text{precision x speed}}$$

where the precision is shown in decimal value (for example: 0.1% = 0.001) and speed in pulses/second. The sampling period is acquired in seconds.

Permissible values range from 10^{-2} s to 30 s.

The following table gives the minimum measurement period according to the speed to be measured, in order to guarantee precision within 0.1%.

Speed to be measured (pulses/second)	Minimum measurement period (s)	Precision (%)
250 000 ...1 000 000	Greater than or equal to 10^{-2}	0,1
40 000 ... 250 000	Greater than or equal to 25 10^{-3}	0,1
10 000 ... 40 000	Greater than or equal to 0.1	0,1
1 000 ...10 000	Greater than or equal to 1	0,1
100 ...1 000	Greater than or equal to 10	0,1

Section 8.9
Description of the special functions of the TSX CTY2C counting module

Subject of this section

This section describes the three special functions of the TSX CTY2C counting module.

What Is in This Section?

This section contains the following topics:

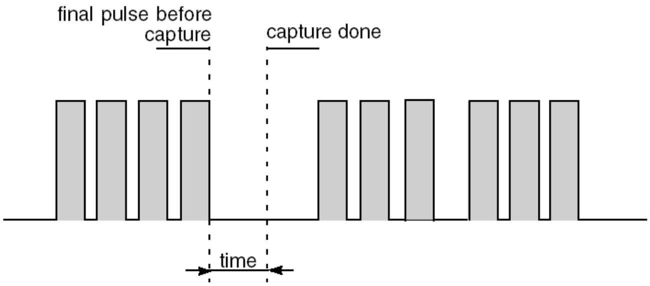
Special function number 1 (TSX CTY2C)

At a Glance

Special function number 1 calculates the time elapsed between the last up/down count pulse and a capture event. The time between the last pulse and the capture is expressed in milliseconds with an accuracy within + or – 1ms.

Operation

The time diagram below shows how special function number 1 operates.



Special function number 2 (TSX CTY2C)

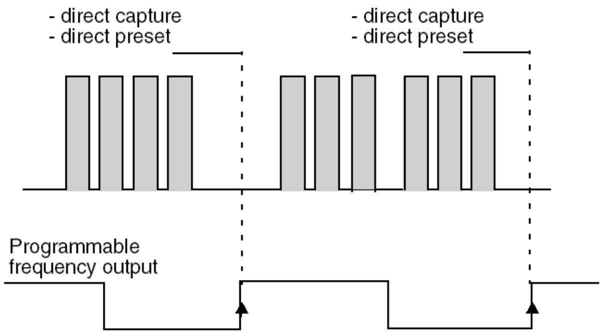
At a Glance

Special function number 2 triggers a direct (software) capture and a direct (software) preset of the up/down counter on the counting channel. These two events are synchronized with the programmable output frequency (this output must not be used externally in this case).

Each rising edge of the programmable frequency output of the counting channel enables a direct (software) capture of the counter value followed by a direct (software) preset.

Operation

The principle of special function number 2 is shown below:



Notes

The following language objects behave differently in relation to the standard direct capture and preset functions:

- the **%Ir.m.c.2 capture done** bit is then positioned on 1 (standard direct capture does not set this bit to 1),
- the **%Ir.m.c.l preset done** bit is then positioned on 1 (standard direct preset does not set this bit to 1),

The associated language objects are described in the implicit objects *(see page 311)* section.

Special function number 3 (TSX CTY2C)

At a Glance

Special function number 3 is an extension of the speed monitor and measurement function. It enables the counting and measurement channel to:

- monitor the **correct speed**, corresponding to the boolean function:

(Target speed - X% ≤ Speed measurement) AND (Speed measurement ≤ Target speed + X%)

- and detect a **stationary moving part**, which corresponds to the following boolean function:

(Speed measurement ≤ Stop speed)

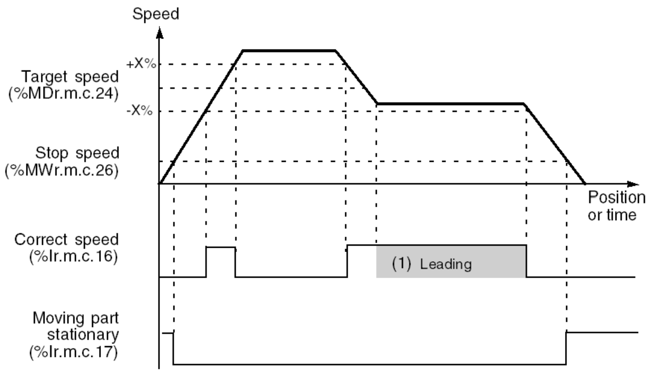
Function parametering

Tolerance on the **X%** speed is a configuration parameter completed by the user.

The **Target speed** (%MDr.m.c.24) and the **Stop speed** (%MWr.m.c.26) are adjustment parameters set by the application program using a WRITE_PARAM (IODDT_VAR1) *(see page 320)* or a variables animation table in online mode.

Operation

The time diagram below shows the principle of special function number 3.



(1) Significant zone, no other zone for correct speed or stationary moving part is significant.

Notes

Correct speed (%Ir.m.c.16) and **Moving part stationary** (%Ir.m.c.17) information is only significant for speed plateaus. Managing the relevance of this information is the responsibility of the application program.

Section 8.10
Description of how counting modules deal with faults

Subject of this section

This sub-section describes how faults that might occur in a counting application are processed. It also describes the tools provided by the counting modules to detect and deal with them.

What Is in This Section?

This section contains the following topics:

Introduction to dealing with channel and module faults

At a Glance

Counting modules can indicate and identify faults occurring in their configuration and during operation. These indication/identification functions vary according to the type of module.

In addition, module outputs have fallback modes, which are either preset or can be configured, in order to ensure safe operation. Output behavior is described in detail in the *Description of physical outputs associated with counting modules,* *page 206* section.

Dealing with TSX CTY 2A / 4A module faults

These modules indicate that a fault has occurred, shown by the following default exchange language objects:

- channel error CH_ERROR (%Ir.m.c.ERR)
- module error MOD_ERROR (%Ir.m.MOD.ERR)
- invalid measurement INVALID_MEAS (%IWr.m.c.2.7)

The project can identify the cause of the fault by examining the status words. This is only possible if the fault is still present when the processing takes place.

Dealing with TSX CTY 2C module faults

This module uses the same language objects as before to indicate the occurrence of faults.

However, in addition, it has functions for:

- storage, which is used to acknowledge and identify temporary faults,
- and masking, which is used selectively to avoid certain faults being brought up again.

How to deal with an invalid measurement

At a Glance

Invalid measurement information is available to the user, in addition to diagnostics. It is used to detect a loss of counting or measurement data.

This fault management, which is similar to latching, is provided in all counting modules.

Fault context

Faults can be indicated by:

- a cold start or warm restart of the application,
- a fault on counting input:
  - a power supply fault or a break in the sensor line (proximity detector or encoder),
  - a series frame transmission error (TSX CTY 2C),
  - a specific absolute encoder fault (TSX CTY 2C),
- exceeding the capacity of the counting register.
- exceeding the speed threshold (TSX CTY 2C).

In this case the contents of the counting register cannot be used and counter outputs are set to 0. If this happens, the **Invalid measurement INVALID_MEAS** (%IWr.m.c.2.7) bit is set to 1.

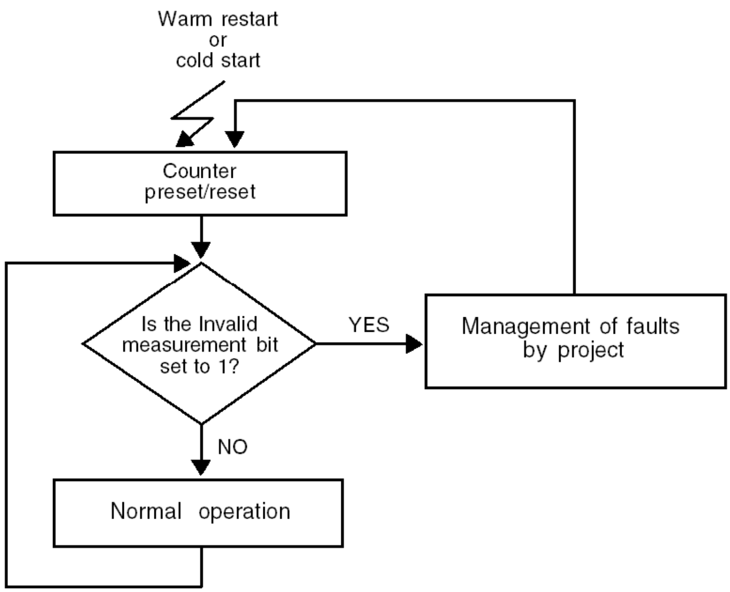
When the register is initialized or re-initialized by presetting (or reset) and as long as none of the faults above are still present, the **Invalid measurement** bit switches to 0.

Notes

- The **Invalid measurement** bit set to 1 does not give any information about the fault which caused it. To find this out, the project must examine status words **%MWr.m.c.2** and **3** *(see page 299)*, as long as the fault is still there (TSX CTY 2C).
- Masked faults do not trigger the **Invalid measurement** indicator (TSX CTY2C).

How to manage the incident

The procedure for managing and removing the invalid measurement by the project is as follows:



Dealing with faults (TSX CTY2C)

At a Glance

The TSX CTY2C module has two independent and additional functions, which can be configured by the user, for dealing with channel faults:

- **Storing** is used to indicate occurrence of a fault, however temporary.
- **Masking** certain faults enables the application to continue operating in downgraded mode.

These two functions are selected using the configuration screen *(see page 232)*.

Principle of fault storing

Storing is used to:

- indicate to the application the occurrence of a fault, temporary or otherwise, shown by the channel error bit **CH_ERROR** (%Ir.m.c.ERR) and the module error bit **MOD_ERROR** (%Ir.m.MOD.ERR) (implicit exchanges),
- and identify it via status words (explicit exchanges).

In the absence of a latch, there is a risk that temporary faults will not be detected in the regular scans by the processor, for these language objects are reset to zero as soon as the fault has disappeared.

Principle of masking faults

Masking involves preventing, according to the situation, channel error bits, module error bits and I/O and ERR LEDS being set. The faults concerned are selected individually (fault masking by default).

NOTE: In the event of an error whether masking was enabled or not, outputs will change to fallback mode to ensure safety, and the CH LED will flash.

Masked faults therefore risk being ignored by the application. Nevertheless, the application can access the fault warning if the test of the bit **COUNT_FLT** (%MWr.m.c.2.5) has been programmed.

Status words continue to be positioned normally, whether faults are masked or not.

Important notes

- Even if a fault has been unmasked, it can pass unnoticed by the application if the store has not been configured, and if this fault is temporary.
- There is also another parallel function which indirectly indicates faults linked to counting, using an Invalid measurement *(see page 227)* which has been detected.

Principle of reading and acknowledging faults

When the fault has been indicated to the processor, the latter must read the module status words using a READ_STS instruction.

Module status words are reset to zero when:

- the fault(s) have disappeared,
- and if there is a latch, after the acknowledgement command by the bit **FLT_ACK** (%Qr.m.c.3).

Chapter 9
Configuration of TSX CTY2A, TSX CTY4A and TSX CTY2C modules

Aim of this Chapter

This chapter describes the different configuration options of the TSX CTY2A, TSX CTY4A and TSX CTY2C modules.

What Is in This Chapter?

This chapter contains the following topics:

Description of the configuration screen of a counting module

General

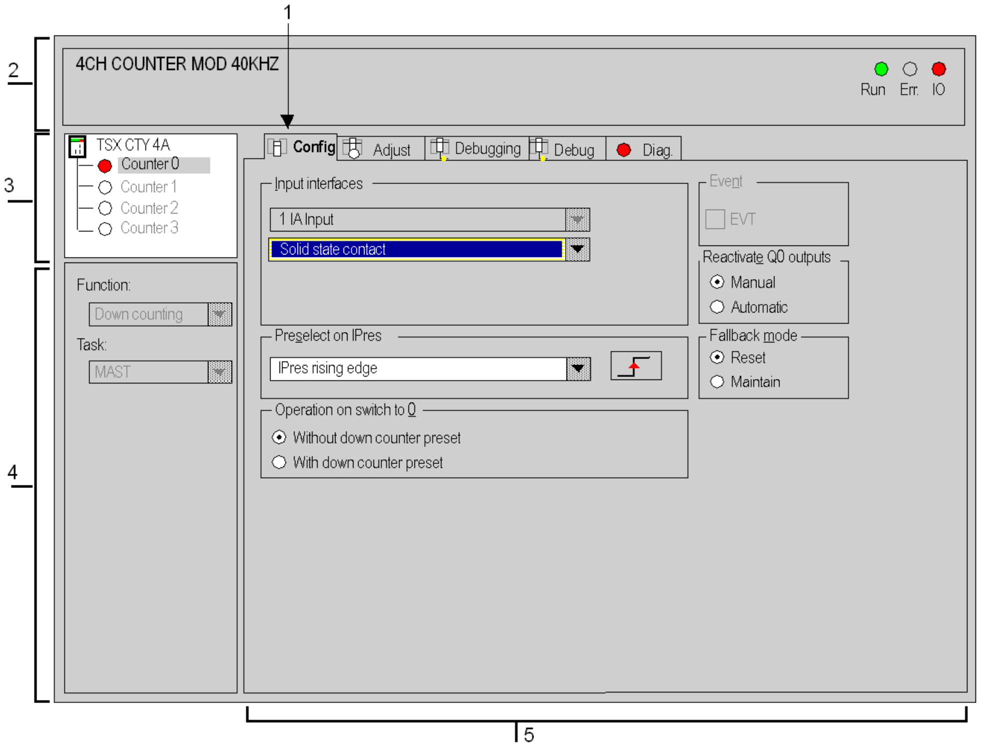
The configuration screen is a graphic tool used to configure *(see EcoStruxure™ Control Expert, Operating Modes)* a module selected from a rack. It displays the parameters associated with the module channels and is used to modify them in both offline and on-line modes.

It also enables access to adjustment and debug screens (only in on-line mode for the latter).

NOTE: it is not possible to configure a module with the program by using language objects %KW directly. These words are accessible in read-only format.

Illustration

The diagram below shows a configuration screen.



Description

The following table shows the different elements of the configuration screen and their functions.

Number	Element	Function
1	Tabs	The foreground tab shows the mode in progress (**Configuration** for this example). Each mode can be selected by means of the corresponding tab. The available modes are: ● **Configuration**, ● **Adjustment**, ● **Debug** only accessible in on-line mode, ● **Diagnostics** (Fault) only accessible in online mode.
2	**Module** zone	Shows the abbreviated name of the module and the state of the module in online mode (LEDs).
3	**Channel** field	Is used: ● By clicking on the reference number, to display the tabs: ❍ **Description** which gives the characteristics of the device. ❍ **I/O Objects** *(see EcoStruxure ™ Control Expert, Operating Modes)* which is used to presymbolize the input/output objects. ❍ **Fault** which shows the device faults (in online mode). ● To select the channel, ● To display the **Symbol**, name of the channel defined by the user (using the variable editor).
4	Zone **general parameters**	Is used to select the counting channel and the task associated with the channel: ● **Function:** counting function from those available for the module concerned. Depending on this selection, the headings of the configuration field can differ. By default, **No** function is configured. ● **Task:** defines the **MAST** or **FAST** task through which the channel's implicit exchange objects will be exchanged.
5	**Configuration** zone	Is used to configure the configuration parameters of the channel. This field contained various headings, displayed according to the counting function selected. Some selections can be fixed and appear grayed out.

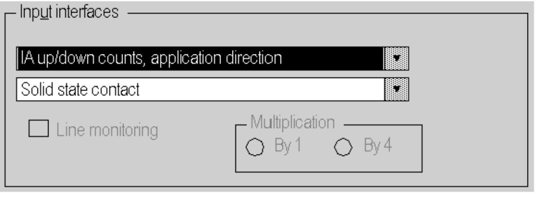
How to configure the counting inputs (TSX CTY 2A/4A)

At a Glance

The counting modules TSX CTY 2A and 4A have several possible input interface types, according to the selected counting function. The interface is configured using the configuration editor.

Procedure

The table below summarizes the procedure for configuring the input interface of a TSX CTY2A or 4A module.

Step	Action
1	Open the module to be configured.
2	In the **channel** field: select the counter (i.e. the channel) concerned.
3	In the **general parameters** field: select the counting function required. **Result**: the configuration screen appears
4	In the **general parameters** field: select the task for the exchange of objects.
5	In the **Input interfaces** field, select from the drop-down list in the first field:  ● the type of input interface: The details of the different types of interface are described in the section named *Description of counting module input interfaces, page 170*. **Note:** In up or down counting only, the **IA Input** selection is frozen.
6	Select input filtering from the drop-down list of the second field: ● **Solid state contact** (reduced filtering), or ● **Mechanical contact** (anti-rebound filtering, pulse frequency limited to 100 Hz).
7	If an **incremental encoder** interface is selected at step 5, fill in the following fields, otherwise, go to step 8 to complete the configuration: ● **Line check** (is used to indicate a channel fault in the event of a break in the physical connection of the encoder). ● **Multiplication by 1 or by 4** (is used to increase counting accuracy at the expense of maximum frequency).
8	Configuration of the input interface is complete. Confirm the new configuration. To do this: ● scroll down the **Edit** menu and select the **Enable** command.

How to configure the counting and measurement inputs (TSX CTY2C)

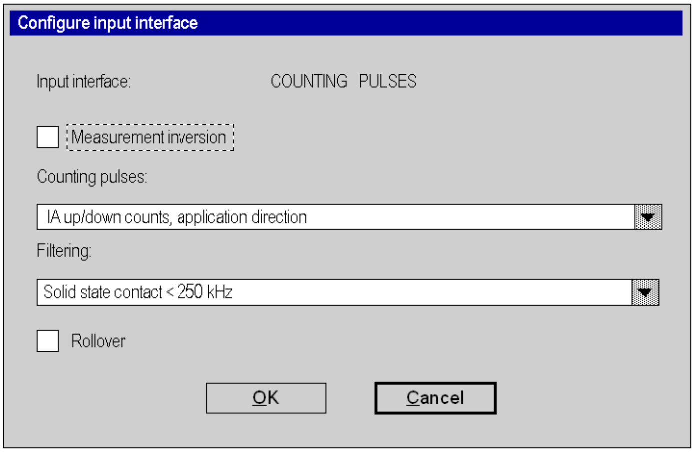
At a Glance

The TSX CTY2C speed counting and measurement module has several possible input interface types. The interface is configured using the configuration editor.

Procedure

The table below summarizes the procedure for configuring a TSX CTY2C module input interface.

Step	Action
1	Open the module to be configured.
2	In the **channel** field: select the counter (i.e. the channel) concerned.
3	In the **general parameters** field: select or enable the counting function. **Result**: the configuration screen appears.
4	In the **general parameters** field: select the task for the exchange of objects.
5	In the **Input interfaces** field, select from the drop-down list :  ● the type of input interface: ❍ Counting pulses, ❍ Incremental encoder, ❍ Absolute encoder, ❍ absolute encoder with parallel outputs.
6	Click on the **Configuration** button to access these details.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>7</td><td>The following screen entitled Configure input interface depends on the type of interface chosen in step 5:
Counting pulses interface: choose the configuration for the physical inputs IA, IB, IZ, then the filtering (signal frequency limit).


Incremental encoder interface: choose the filtering, while taking into account the multiplication by 1 or by 4.
Absolute encoder (see page 237) interface.</td></tr>
<tr><td>8</td><td>Then select, according to the application:
Measurement inversion (invert the measurement change direction given by the input definition).
The modulo mode and its value.</td></tr>
<tr><td>9</td><td>Configuration of the input interface is complete.
Confirm the new configuration. To do this:
enable the Configure the input interface screen,
scroll down the Edit menu and select the OK command.</td></tr>
</table>

How to configure an absolute encoder interface (TSX CTY 2C)

At a Glance

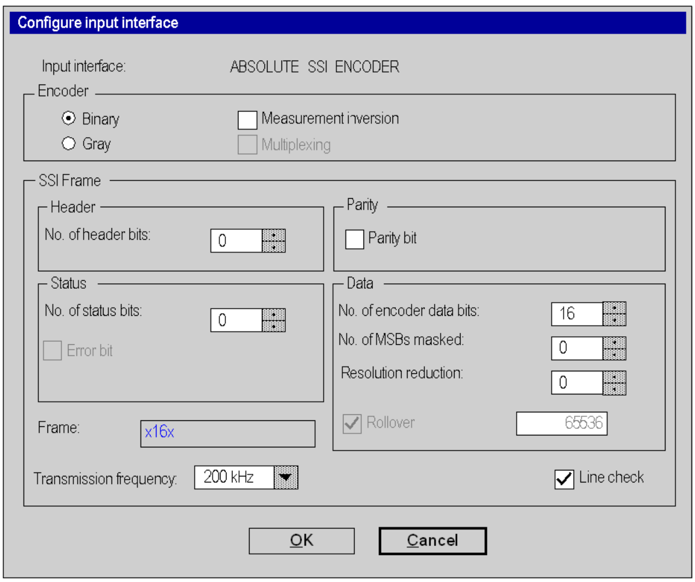
Module TSX CTY 2C as well as having counting pulse inputs, has a specific interface for data acquisition:

- of data from a series output absolute encoder (SSI),
- or of data from one of four parallel output absolute encoders, with adaptation base(s) ABE-7CPA11.

Procedure

The table below shows the interface configuration steps.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Start the configuration using the general procedure (see page 235) for the TSX CTY 2C module until reaching the next entry screen Configure the input interface.



Some headings are frozen, or not displayed, according to the type of encoder output (series or parallel).</td></tr>
<tr><td>2</td><td>Fill in the accessible headings according to the following table.</td></tr>
<tr><td>3</td><td>Confirm the new configuration. To do this:
● enable the entry screen above,
● scroll down the Edit menu and select the OK command.</td></tr>
</table>

Definitions and heading options

The table below shows the possible definitions and heading options on the **Configure input interface** screen according to the type of absolute encoder output.

Zone	Heading	SSI Series output encoder	Parallel output encoder(s)
Encoder	**Binary** or **Gray**	Coding type.	idem series output
	Measurement inversion	Invert the measurement change direction to a rotation direction given by the encoder.	idem series output
	Multiplexing	Does not exist.	Authorizes encoder multiplexing by the application *(see page 243)*.
SSI Frame	**Transmission frequency**	150, 200 (by default), 375, 500, 750 kHz or 1 MHz.	idem series output
	Line monitoring	Line check selection (rupture or short circuit).	Frozen: line check control present.
	Frame	Information: summary of the series frame characteristics.	idem series output
Header	**No. of header bits**	0 to 4 (0 by default)	Frozen at 0.
Data	**No. of encoder data bits**	8 to 25 (16 by default)	8 to 24 (24 by default)
	No. of masked MSBs	0 to 17 (0 by default)	0 to 16 (0 by default)
	Reducing the resolution	0 to 17 (least significant masked bits, 0 by default).	0 to 16 (0 by default).
	Limit: No. of encoder data bits – No. of most significant masked bits – No. of least significant masked bits > 8 active data bits.		
	Rollover	Frozen (depending on the number of active data bits).	idem series output
Status	**No. of status bits**	0 to 4 (0 by default)	Frozen at 3.
	Error bit	**none** by default. To gain access to this choice, the number of status bits must be > 1.	**none** by default.
	Position	1 to 4 (1 by default). The heading only appears if the error bit is selected.	Frozen at 3. The heading only appears if the error bit is selected.
	Active at 0/1	Error bit active level (1 by default). The heading only appears if the error bit is selected.	idem series output
Parity	**Parity bit**	**none** by default. The choice of parity only appears if the bit is selected. If the parity is odd, the number of status bits is limited to 3.	Frozen: **with**, even parity.

How to configure the capture of a counting register

At a Glance

This parameter defines how to capture the current counting register value at a precise moment defined by the signal on the physical input **ICapt ST_CAPT** (%IWr.m.c.2.4). This function only exists in up/down counting (TSX CTY 2A / 4A) and up/down counting and measurement (TSX CTY 2C).

Hardware capture configuration is defined in the **Capture on ICapt** zone in the configuration screen. There are two available options:

- capture on rising edge,
- capture on falling edge.

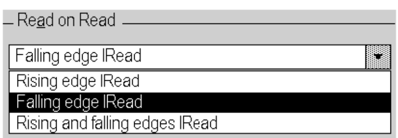
Notes

So that capture takes place correctly, it must be enabled beforehand by the software using the corresponding language objects *(see page 301)*, run by the project.

Direct capture by the software does not require the following procedure to be set up.

Procedure

The table below summarizes the procedure for configuring hardware capture with TSX CTY 2A, 4A and 2C modules.

Step	Action
1	Open the module to be configured.
2	In the **channel** field: select the counter (i.e. the channel) concerned.
3	In the **general parameters** field: select or enable the counting function and the task. **Result**: the configuration screen appears
4	In the **Capture on ICapt** zone click on the drop-down menu button. **Result:** the list of options below appears. 
5	Select the hardware capture edge required.
6	Hardware capture configuration is complete. If there are no more parameters to configure, enable the new configuration. To do this: • scroll down the **Edit** menu and select the **Enable** command.

How to configure preset or reset in a counting function

At a Glance

This parameter defines the initialization mode of the counting register at a moment defined by the signal on the physical input **IPres ST_IPRES** (%IWr.m.c.2.3) or **IReset** (depending on the counting function).

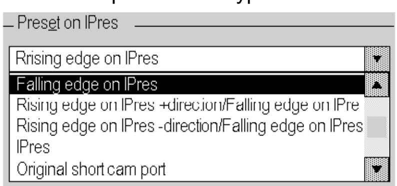
Configuring hardware preset or reset is defined in the **Preset on IPreset** zone or **Reset on IReset** zone in the configuration screen.

Notes

- So that the hardware preset **IPreset** or Reset **IReset** does take place, it must first be enabled by the software using the corresponding language objects *(see page 301)*, run by the project.
- Direct presetting or resetting by the software does not require implementation of the following procedure.
- The preset value is defined in the adjustment screen *(see page 255)*.

Procedure

The table below summarizes the hardware preset configuration procedure for the TSX CTY2A, 4A and 2C modules.

Step	Action
1	Open the module to be configured.
2	In the **channel** field: select the counter (i.e. the channel) concerned.
3	In the **general parameters** field: select the counting function and the task. **Result**: the configuration screen appears.
4	In the **Preset on IPres** or **Reset on IReset** zone click on the drop-down menu button. **Result:** a list of options similar to this one appears. The options that are actually available depend on the type of module and the counting function selected. 
5	Select the hardware preset (or reset) required.
6	Hardware preset (or reset) configuration is complete. If there are no more parameters to configure, enable the new configuration. To do this: ● scroll down the **Edit** menu and select the **Enable** command.

How to configure event processing

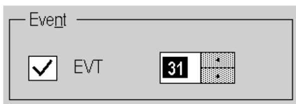
At a Glance

This parameter is used to associate event processing to the counting channel.

This configuration is defined in the **Event** zone of the configuration screen.

Procedure

The table below summarizes the procedure for configuring event processing for all TSX CTY2A, 4A and 2C modules.

Step	Action
1	Open the module to be configured.
2	In the **channel** field: select the counter (i.e. the channel) concerned.
3	In the **general parameters** field: select the counting function and the task. **Result**: the configuration screen appears
4	In the **Event** zone, check the **EVT** box. 
5	Select the number of the event task which is associated to the counting channel (this task must then be programmed).
6	Configuration of the event processing is complete. If there are no more parameters to configure, enable the new configuration. To do this: ● scroll down the **Edit** menu and select the **Enable** command.

How to configure the combined input IEna/Q2 (TSX CTY2C)

At a Glance

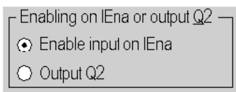
This parameter defines the use of this combined input/output:

- either as counter enable input **IEna**,
- or as physical output **Q2** (in manual mode).

These parameters are set in the **Enable on IEna or Q2 output** zone in the configuration screen.

Procedure

The table below summarizes the procedure for configuring the combined input/output **IEna / Q2** of the TSX CTY2C module.

Step	Action
1	Open the module to be configured.
2	In the **channel** field: select the counter (i.e. the channel) concerned.
3	In the **general parameters** field: select the counting function and the task. **Result**: the configuration screen appears.
4	In the **Enable on IEna or Q2 output** zone, click on the button corresponding to the required option. 
5	Configuration of the combined input/output **IEna/Q2** is complete. If there are no more parameters to configure, enable the new configuration. To do this: ● scroll down the **Edit** menu and select the **Enable** command.

How to program multiplexing of absolute encoders with parallel outputs

At a Glance

Each channel of the TSX CTY 2C module is used to acquire the signals supplied by an absolute encoder with parallel outputs, via a series frame, using adaptation TELEFAST ABE-7CPA11. Use of several TELEFASTs enables up to 4 absolute encoders with parallel outputs to be multiplexed on the same channel.

Multiplexing is managed by the counting application.

Principals of multiplexing

The encoders are addressed by two discrete outputs (belonging to the TSX CTY 2C module, preferably Q2 and Q3 outputs, or to a discrete module). These outputs are looped onto the dedicated TELEFAST inputs. This sends the acquisition value and the address of the present encoder to the TSX CTY 2C module.

The context linked to the encoder (offset value, threshold values, SET and RESET values of the switches), which must change when a new encoder is addressed, is controlled by the application program.

Furthermore, this must take into account the fact that the information regarding position/crossing of thresholds, rollover, the speed value and the overspeed fault is invalid when an encoder is being changed.

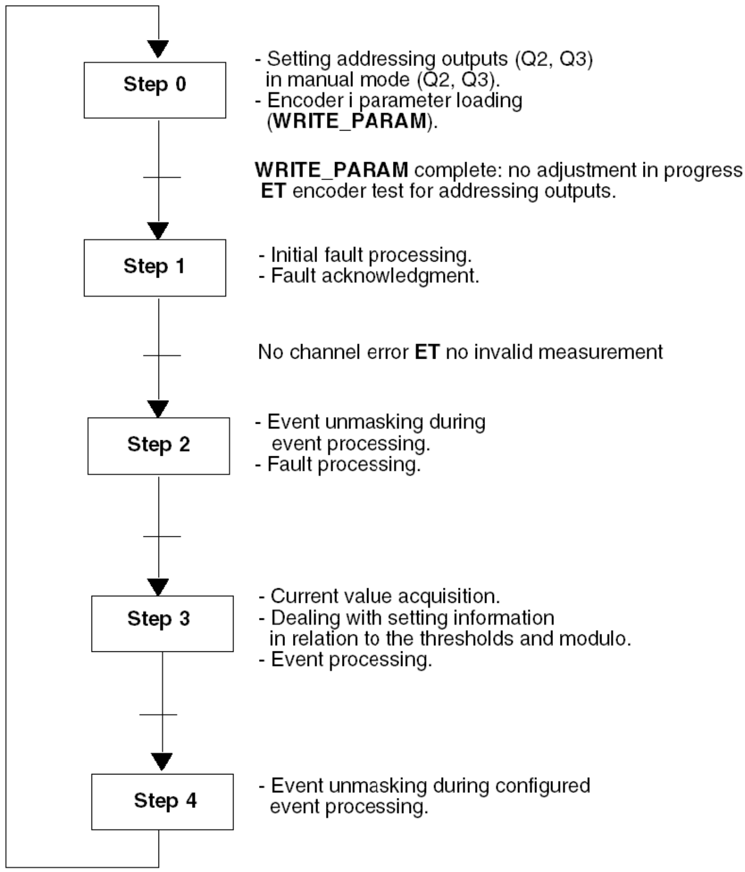
Analysis of multiplexing

This operation involves the following steps for each absolute encoder and at each acquisition:

Step	Action
1	Application loading of the context for the encoder concerned.
2	Application addressing of the encoder concerned.
3	Acquisition of data.
4	Possible wait linked to the acquisition period, then return to step 1 to process the next encoder.

Multiplexing flowchart

The diagram below shows an example of how to program multiplexing:



How to configure action when counter value = 0 or when crossing setpoint

At a Glance

This parameter defines the automatic reset mode of a TSX CTY2A /4A module’s counting register:

- on switch to the value zero (only during down counting),
- on high setpoint crossing (only during up counting).

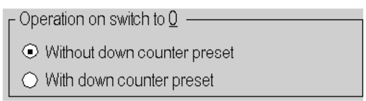
This configuration is defined in the **Action when counter value = 0** or **Action when crossing setpoint** zone in the configuration screen.

Notes

- These operations are similar to automatic preset or reset respectively. They do not require any preset or reset software enabling.
- The setpoint values are defined in the adjustment screen.

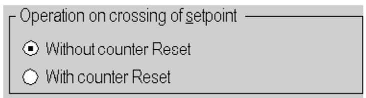
Procedure

The following table summarizes the procedure for configuring the action when crossing zero values of the TSX CTY2A and 4A modules.

Step	Action
1	Open the module to be configured.
2	In the **channel** field: select the counter (i.e. the channel) concerned.
3	In the **general parameters** field: select the down counting function and the task. **Result**: the configuration screen appears.
4	In the **Action when counter value = 0** zone, click on the button corresponding to the required option. 
5	The configuration of the action when crossing counter value = 0 is complete. If there are no more parameters to configure, enable the new configuration. To do this: ● scroll down the **Edit** menu and select the **Enable** command.

Procedure

The following table summarizes the procedure for configuring the action when crossing high setpoint values of the TSX CTY2A and 4A modules.

Step	Action
1	Open the module to be configured.
2	In the **Channel** field: select the counter (i.e. the channel) concerned.
3	In the **general parameters** field: select the counting function. **Result**: the configuration screen appears.
4	In the **general parameters** field: select the task for the exchange of objects.
5	In the **Action when crossing setpoint** zone, click on the button corresponding to the required option. 
6	The configuration of the action when crossing setpoint is complete. If there are no more parameters to configure, enable the new configuration. To do this: ● scroll down the **Edit** menu and select the **Enable** command.

How to configure the behavior of faulty outputs

At a Glance

These parameters define the behavior of physical outputs of a channel on TSX CTY 2A, 4A and 2C modules when faults occur due to a voltage surge or short-circuit:

- reactivation of outputs,
- fallback mode.

These configurations are defined in the zones of the same name in the configuration screen.

CAUTION

UNEXPECTED APPLICATION BEHAVIOR - I/O BEHAVIOR CONFIGURATION

Ensure that the desired configuration, and in particular the reactivation mode, is compatible with the operation safety requirements

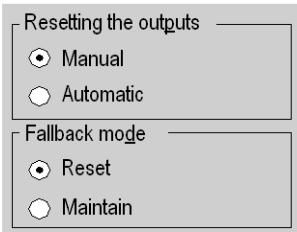
Failure to follow these instructions can result in injury or equipment damage.

Note

Configurations defined in this way are only valid when there is an overload or short-circuit of one or more outputs. In the event of a different kind of fault, the fallback mode is predefined according to the fault and the type of module *(see page 206)*.

Procedure

The table below summarizes the procedure for adjusting the behavior of faulty outputs.

Step	Action
1	Open the module to be configured.
2	In the **channel** field: select the counter (i.e. the channel) concerned.
3	In the **general parameters** field: select the counting function and the task. **Result**: the configuration screen appears.
4	In the **Reactivation of outputs** zone, select: ● **Manual** or ● **Automatic** 
5	In the "Fallback mode" zone, select: ● **Reset** or ● **Maintain**
6	Configuration of physical output behavior is complete. If there are no more parameters to configure, enable the new configuration. To do this: ● scroll down the **Edit** menu and select the **Enable** command.

How to configure a special function (TSX CTY2C)

At a Glance

The special functions of the TSX CTY2C module are used to respond to certain particular needs that are not covered by the standard functions.

The table below shows the objects of these functions and the numbers of the version required for the module:

Function No.	Description	Version module
1	Time lapsed between the last pulse and a hardware capture occurrence.	1.0
2	Triggering a direct and synchronized capture and preset with each rising edge of the programmable frequency output.	1.0
3	Speed checks **correct** and **moving part stationary**.	1.1

Functions that are specific to a case can also be developed.

Compatibility of special functions

Any attempt to configure a counting module with an unsupported special function will result in an application error.

The counting module version is indicated on the product reference label found on the module's right side.

Configuring several special functions

It is possible to configure two special functions simultaneously if they are not exclusive, that is to say if there is no overlap between their language objects. In practice, these are functions nos. 1 and 2.

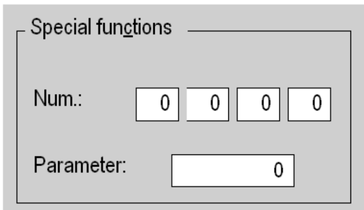
The table below summarizes the properties of reciprocal exclusions.

	Funct. No. 1	Funct. No. 2	Funct. No. 3
Funct. No. 1	-	Non exclusive (1)	Exclusive
Funct. No. 2	Non exclusive (1)	-	Exclusive
Funct. No. 3	Exclusive	Exclusive	-

(1) When special functions 1 and 2 are used simultaneously, the time calculation of special function number 1, %IDr.m.c.11, can only be accessed in a Fast or Mast task, on capture done **CAPT_DONE** (%Ir.m.c.2=1).

Procedure

The table below summarizes the procedure for configuring the special functions of the TSX CTY2C module.

Step	Action
1	Open the module to be configured.
2	In the **channel** field: select the counter (i.e. the channel) concerned.
3	In the **general parameters** field: select the counting function and the task. **Result**: the configuration screen appears.
4	In the **Special functions** zone, enter the number of the special function in one of the **Num** fields.  Enter the number of the second special function, if necessary. A zero means that no function has been selected.
5	Complete the **Parameter** field if necessary, for special function number 3 *(see page 224)* for example.
6	Special function(s) configuration is complete. If there are no more parameters to configure, enable the new configuration. To do this: ● scroll down the **Edit** menu and select the **Enable** command.

Chapter 10
Adjustment of TSX CTY2A, TSX CTY4A and TSX CTY2C Modules

Aim of this Chapter

This chapter describes the different adjustment options of the TSX CTY2A, TSX CTY4A and TSX CTY2C modules.

What Is in This Chapter?

This chapter contains the following topics:

Description of the adjustment screen of a counting module

General

The adjustment screen displays adjustment parameters for the module and is used to modify them in both offline and on-line mode.

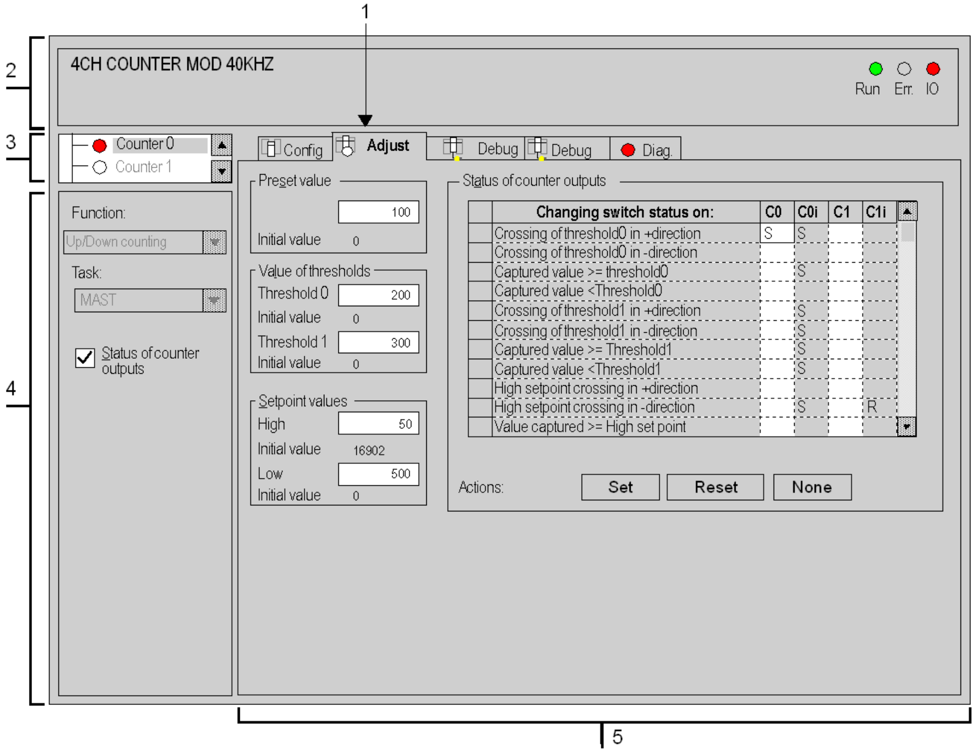
It also gives access to configuration and debug screens.

The structure of the adjustment screen is very similar to that of the configuration screen.

NOTE: the adjustment screen is a graphic tool for facilitating the development of a project. Unlike in configuration, it is possible to program adjustments by using language objects directly.

Illustration

The diagram below shows an example of an adjustment screen.



Description

The table below shows the different elements of the adjustment screen and their functions.

Number	Element	Function
1	Tabs	The foreground tab shows the mode in progress (**Adjustment** for this example). Each mode can be selected by means of the corresponding tab. The available modes are: ● **Adjustment**, ● **Configuration**, ● **Debug** only accessible in on-line mode, ● **Diagnostics** (Fault) only accessible in online mode.
2	**Module** zone	Shows the abbreviated name of the module.
3	**Channel** field	Is used: ● By clicking on the reference number, to display the tabs: ❍ **Description** which gives the characteristics of the device. ❍ **I/O Objects** *(see EcoStruxure™ Control Expert, Operating Modes)* which is used to presymbolize the input/output objects. ❍ **Fault** which shows the device faults (in online mode). ● To select the channel, ● To display the **Symbol**, name of the channel defined by the user (using the variable editor).
4	Zone **general parameters**	Is used to select the heading for setting counter outputs: ● **Function:** calls up the configured counting function. This heading is fixed. ● **Task:** specifies the **MAST** or **FAST** task configured. This heading is fixed. ● **Switch status:** box to be checked if you wish to set latch change of status parameters. Otherwise, the heading does not appear in the adjustment field.
5	**Adjustment** field	This field contains various headings to be completed (parameter values), displayed according to the counting function selected.

Current value and initial value

For each heading **two** values appear:

- the entered value which can be modified, in one window,
- and the **initial** value which cannot be directly modified.

The behavior of these values depends on the PLC connection mode.

- **In offline mode:** after enabling (**Edit → Enable** command), the entered value becomes the initial value and appears in the corresponding field. On transfer the initial value becomes the current value.
- **In on-line mode:** after enabling, the entered value becomes the current value. The **Services → Save parameters** command is used to copy the current value in the initial value.

NOTE: the initial value is the one that the parameter concerned takes when the PLC starts from cold.

How to adjust the offset value of an absolute encoder

At a Glance

This parametering is an option when the input interface of the TSX CTY 2C module is configured for a serial output absolute encoder.

This parameter is used to perform a shift from zero by adding the offset value to the current value supplied by the encoder.

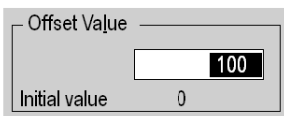
Parameters are set in the **Offset value** zone in the adjustment screen.

For encoders with parallel outputs

For encoder(s) with multiplexed *(see page 243)* parallel outputs, the offsets must be managed by the application.

Procedure

The table below summarizes the procedure for adjusting the offset value.

Step	Action
1	Open the module to be set.
2	In the **channel** field, select or enable the counter selection (i.e. the channel) involved.
3	In the **general parameters** field, select or enable the counting function.
4	Access the adjustment screen by clicking on the **Adjustment** tab.
5	In the **Offset value** zone enter the value desired.  This value must be between: **0** and the **rollover** value (this mode is implicit for an absolute encoder interface).
6	Offset value adjustment is complete. ● If there are no more parameters to be defined, enable the new adjustment with the **Edit** → **Enable** command. Note: in offline mode, the value entered is then copied again in the **Initial value** field. In on-line mode, the value entered then becomes the current value.

How to adjust the preset value

At a Glance

This parameter defines the preset value (in down counting only or up/down counting) i.e. the value reloaded in the counting register after:

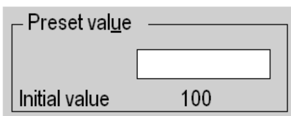
- a hardware or software preset command, especially after an invalid measurement,
- or automatic preset when switching to zero.

This parameter exists when the input is configured for counting pulses or for an incremental encoder.

Parameters are set in the **Preset value** zone in the adjustment screen.

Procedure

The table below summarizes the procedure for adjusting the preset value.

Step	Action
1	Open the module to be set.
2	In the **channel** field, select or enable the counter selection (i.e. the channel) involved.
3	In the **general parameters** field, select or enable the counting function.
4	Access the adjustment screen by clicking on the **Adjustment** tab.
5	In the **Preset value** zone enter the required value.  This value must be between: ● -16 777 216 and +16 777 215 in normal mode, ● 0 and the rollover value if this mode is configured (TSX CTY 2C).
6	Reset value adjustment is complete. ● If there are no more parameters to be defined, enable the new adjustment with the **Edit** → **Enable** command. Note: in offline mode, the value entered is then copied again in the **Initial value** field. In on-line mode, the value entered then becomes the current value.

How to adjust channel fault processing (TSX CTY2C)

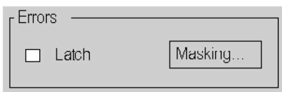
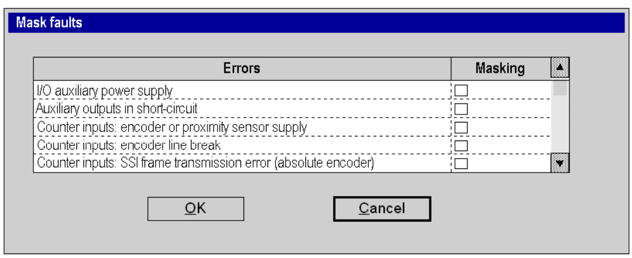
At a Glance

The TSX CTY2C module has two independent channel fault processing mechanisms which can be configured by the user:

- **Storing** enables the application to detect the occurrence of a fault temporary or otherwise.
- **Masking** certain faults enables the application to continue operating in downgraded mode (safeguards activated).

Procedure

The table below summarizes the procedure for configuring fault processing for a TSX CTY2C module:

Step	Action
1	Open the module to be set.
2	In the **channel** field, select or enable the counter selection (i.e. the channel) involved.
3	In the **general parameters** field, select or enable the counting function.
4	Under the **Faults** heading of the configuration screen, check the **Latch** box if required or leave blank. 
5	Click on the **Mask** button. The following dialog box appears: 
6	Check the boxes corresponding to the faults which are to be masked. The **masked** information is displayed next to each checked box.
7	Enable the dialog box.
8	Fault processing adjustment is complete. ● If there are no more parameters to be defined, enable the new configuration with the command **Edit** → **Enable**.

How to adjust threshold and set point values

At a Glance

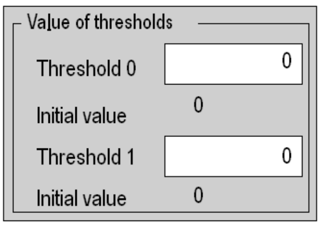
These parameters define threshold values 0 and 1 and high and low setpoints.

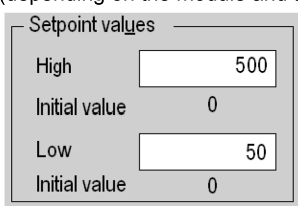
These objects have very similar roles in comparisons.

Parameters are set in the **Threshold value** and **Setpoint value** zones in the adjustment screen.

Procedure

The table below summarizes the procedure for adjusting threshold values.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Open the module to be set.</td></tr>
<tr><td>2</td><td>In the channel field, select or enable the counter selection (i.e. the channel) involved.</td></tr>
<tr><td>3</td><td>In the general parameters field, select or enable the counting function.</td></tr>
<tr><td>4</td><td>Access the adjustment screen by clicking on the Adjustment tab.</td></tr>
<tr><td>5</td><td>In the Threshold value zone enter the required values.


These values must be between:
● -16 777 216 and +16 777 215 in normal mode,
● 0 and the rollover value if this mode is configured or implicit (TSX CTY 2C, absolute encoder interface).
Note: the respective values of threshold 0 and threshold 1 do not have to be in this order.</td></tr>
<tr><td>6</td><td>In the Set point value zone enter the value(s) required; when they are defined (depending on the module and the counting function configured).


These values must be between: -16 777 216 and +16 777 215.</td></tr>
</table>

Step	Action
7	Threshold and set point value adjustment is complete. ● If there are no more parameters to be defined, enable the new adjustment with the **Edit** → **Enable** command. Note: in offline mode the value entered is then copied in the **Initial value** fields. In on-line mode the values entered then become the current values.

How to adjust the speed measurement and monitoring function

At a Glance

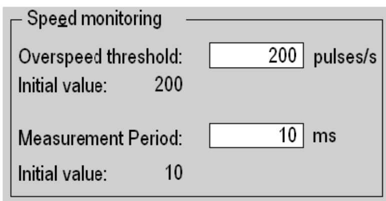
This parametering is offered with the TSX CTY 2C module.

The **Speed monitoring** zone is used to define:

- the overspeed threshold value,
- the speed measurement period.

Procedure

The table below summarizes the procedure for adjusting the speed measurement and monitoring function.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Open the module to be set.</td></tr>
<tr><td>2</td><td>In the channel field, select or enable the counter selection (i.e. the channel) involved.</td></tr>
<tr><td>3</td><td>In the general parameters field, select or enable the counting function.</td></tr>
<tr><td>4</td><td>Access the adjustment screen by clicking on the Adjustment tab.</td></tr>
<tr><td>5</td><td>In the Speed monitoring zone enter the required overspeed threshold value.


This value must be between: 1 and 4 000 000 pulses/s.
The value 0 inhibits the overspeed monitoring.</td></tr>
<tr><td>6</td><td>Enter the value of the measurement period (see page 219), according to the estimated pulse frequency and the desired precision or response time.
This value must be between: 10 and 30 000 ms.</td></tr>
<tr><td>7</td><td>Speed reading function and monitoring adjustment is complete.
• If there are no more parameters to be defined, enable the new adjustment with the Edit → Enable command.
Note: in offline mode, the value entered is then copied again in the Initial value field. In on-line mode, the value entered then becomes the current value.</td></tr>
</table>

How to adjust the frequency output period (TSX CTY2C)

At a Glance

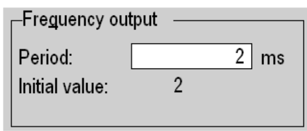
The TSX CTY2C module has a **Q3** output which can be programmed in automatic mode to generate an adjustable period signal, destined for various uses (for example: synchronization of several channels or modules).

Output configuration (automatic or manual) is controlled by the application, but it is possible to modify it temporarily in the Debugging *(see page 263)* screen.

Parameters for the signal period are set under the **Frequency output** heading in the adjustment screen.

Procedure

The table below summarizes the procedure for adjusting the frequency output signal period.

Step	Action
1	Open the module to be set.
2	In the **channel** field, select or enable the counter selection (i.e. the channel) involved.
3	In the **general parameters** field, select or enable the counting function.
4	Access the adjustment screen by clicking on the **Adjustment** tab.
5	Under the **Frequency output** heading enter the required value.  This value must be between: **0** and **4 000 000 ms**, per 1 ms step.
6	The **Q3** output period adjustment is complete. ● If there are no more parameters to be defined, enable the new adjustment with the **Edit** → **Enable** command. Note: in offline mode, the value entered is then copied again in the **Initial value** field. In on-line mode, the value entered then becomes the current value.

How to adjust the switch change of status conditions

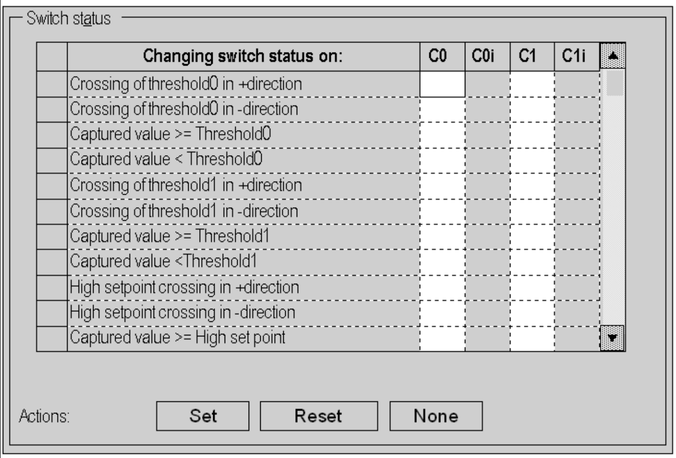
At a Glance

Switch 0 and 1 change of status condition parameters can be set from the adjustment screen.

There are a great number of these conditions and they depend on the module *(see page 197)* and function configured.

Procedure

The table below summarizes the procedure for adjusting the change of status conditions of switches 0 and 1.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Open the module to be set.</td></tr>
<tr><td>2</td><td>In the channel field, select or enable the counter selection (i.e. the channel) involved.</td></tr>
<tr><td>3</td><td>In the general parameters field, select or enable the counting function.</td></tr>
<tr><td>4</td><td>Access the adjustment screen by clicking on the Adjustment tab.</td></tr>
<tr><td>5</td><td>In the general parameters field, check the Switch status box.</td></tr>
<tr><td>6</td><td>A heading with the same name appears in the adjustment zone.

</td></tr>
<tr><td>7</td><td>Under the heading Switch status:
● select the box corresponding to the condition and the switch (C0 or C1) concerned,
● then click on the SET button (set to 1), the RESET button (set to 0), or the NONE button (delete an existing value).
Note: the conditions are not shown in order of priority.</td></tr>
</table>

Step	Action
8	Adjust the other change of status conditions in the same way.
9	Adjustment of the switch change of status conditions is complete. • If there are no more parameters to be defined, enable the new adjustment with the **Edit** → **Enable** command. Notes: in offline mode, the values entered are then copied into the initial status fields **C0i** and **C1i**. Priority rules also apply to initial values. In on-line mode the values entered then become the current status values.

Chapter 11
Debugging the Data Modules TSX CTY2A, TSX CTY4A and TSX CTY2C

Aim of this Chapter

This chapter describes the different debug options of the TSX CTY2A, TSX CTY4A and TSX CTY2C modules.

What Is in This Chapter?

This chapter contains the following topics:

Introducing the debugging screens

General

Debugging screens are used to debug a project. They are used to display the status of inputs and outputs on a channel, the contents of the registers, the possible faults and to control language objects (setting to 0 or 1, forcing or unforcing a bit, etc.) They can therefore only be accessed in on-line mode.

They also give access to *(see page 251)* and *(see page 231)* screens.

There are two debugging screens:

- a **minimized** screen, to monitor the how the project functions on the counting or measurement channel. It displays the main data: contents of registers, status of inputs and outputs, fault indicators.
- a **maximized** screen for debugging. It is used to view and control language objects.

Switching from one to the other is immediate, and there is no need to stop the project or counting in progress.

Opening a module in on-line mode displays the minimized debugging screen by default.

Description of the minimized debug screen

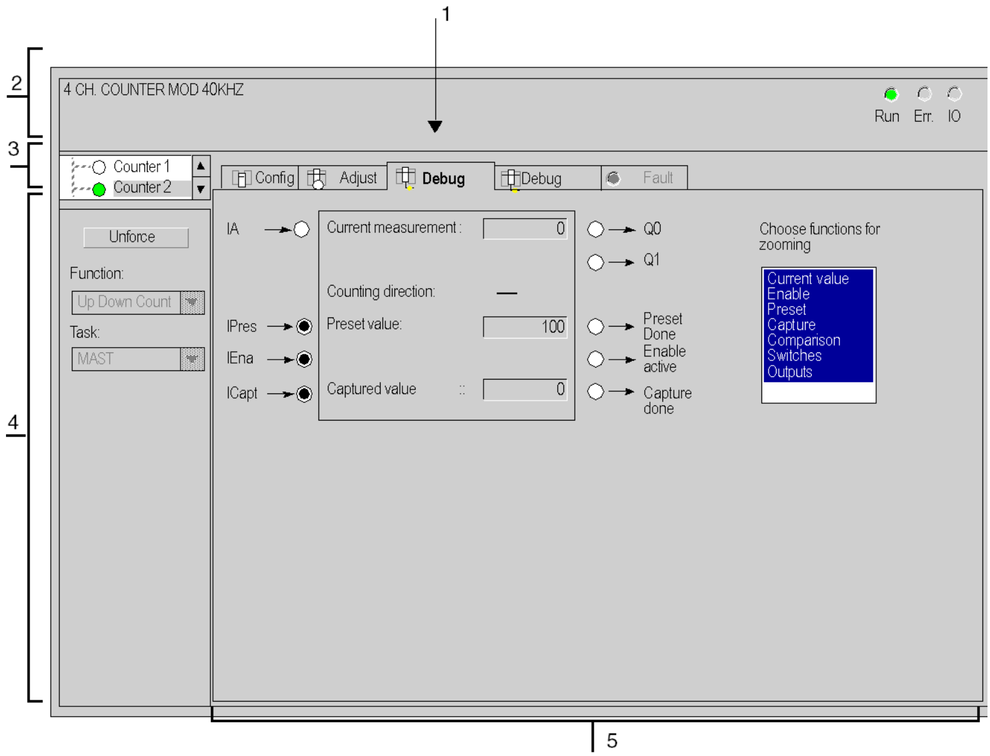
At a Glance

The minimized debug screen is used to monitor the operation of a project at counting module level. It displays the status of inputs, outputs and main channel bits, contents of registers, and possible faults.

To switch to the maximized screen, just click on the second **Debug** tab.

Illustration

The figure below shows an example of a minimized debug screen.



Description

The table below shows the different elements of the debug screen.

<table>
<tr><th>Number</th><th>Element</th><th>Function</th></tr>
<tr><td>1</td><td>Tabs</td><td>The tab in the foreground indicates the current mode (Debug for this example). Each mode can be selected by means of the corresponding tab. The available modes are:
● Debug only accessible in on-line mode,
● Diagnostics (Fault) only accessible in online mode.
● Adjustment,
● Configuration.</td></tr>
<tr><td>2</td><td>Module zone</td><td>Shows the abbreviated name of the module.
There are three indicators in the same field that provide the status of module in online:
● RUN indicates the operating status of the module.
● ERR signals an internal error to the module.
● I/O signals an external error or an application error to the module.</td></tr>
<tr><td>3</td><td>Channel field</td><td>Is used:
● By clicking on the reference number, to display the tabs:
○ Description which gives the characteristics of the device.
○ I/O Objects (see EcoStruxure ™ Control Expert, Operating Modes) which is used to presymbolize the input/output objects.
○ Fault which shows the device faults (in online mode).
● To select the channel,
● To display the Symbol, name of the channel defined by the user (using the variable editor).</td></tr>
<tr><td>4</td><td>Zone general parameters</td><td>Allows bits to be unforced and the counting function to be displayed:
● Unforce: this button allows forced bits (see page 271) to be unforced.
● Function: calls up the configured counting function. This heading is fixed.
● Task: specifies the MAST or FAST task configured. This heading is fixed.</td></tr>
<tr><td>5</td><td>Current parameters field</td><td>This zone displays the status of the inputs and outputs and the various counting parameters in progress. If the contents of the counting register cannot be used following an input fault, the Invalid measurement indicator or LED appear in red.
Note: with CTY 2A/4A modules only, the functions to be displayed in the extended screen can be selected in a window in the parameter field on the right. For the CTY 2C module, all functions will be displayed systematically.</td></tr>
</table>

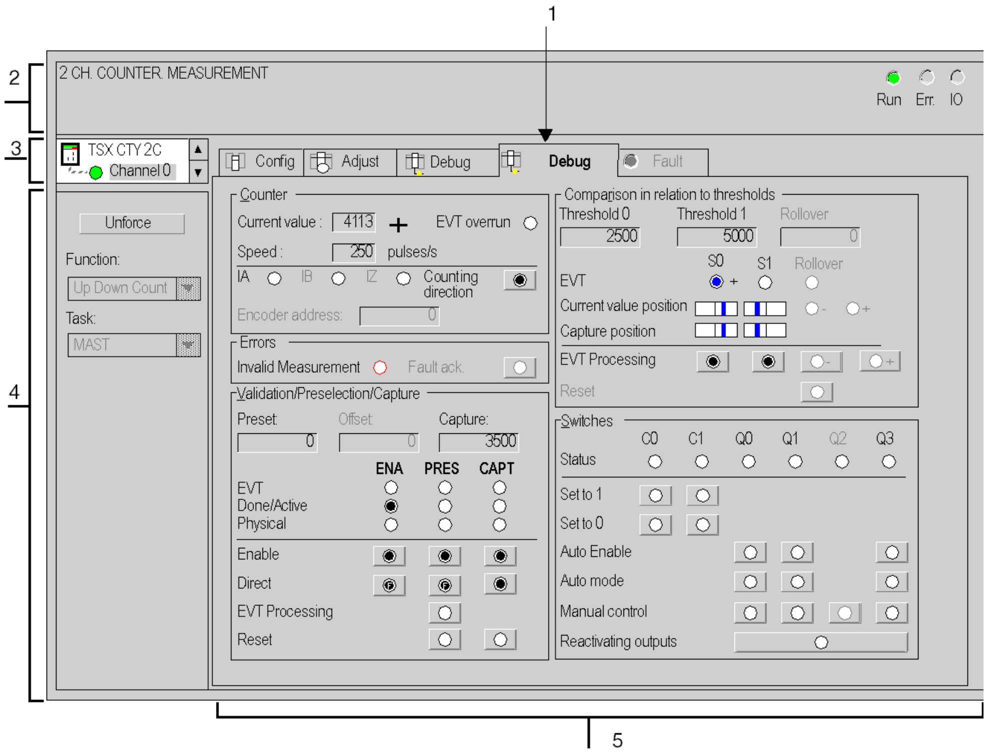
Description of the maximized debug screen

At a Glance

The maximized debug screen is used to temporarily modify the operation of a project at counting module level, with a view to detecting programming faults. It displays the status of inputs, outputs and main channel bits, contents of registers, and possible faults. It is used to control or force (lock) certain bits.

Illustration

The diagram below shows an example of a maximized debug screen.



Description

The table below shows the different elements of the maximized debug screen and their functions.

Number	Element	Function
1	Tabs	The tab in the foreground indicates the current mode (**Debug** for this example). Each mode can be selected by means of the corresponding tab. The available modes are: ● **Debug** only accessible in on-line mode, ● **Diagnostics** (Fault) only accessible in online mode. ● **Adjustment**, ● **Configuration**.
2	**Module** zone	Shows the abbreviated name of the module. There are three indicators in the same field that provide the status of module in online: ● **RUN** indicates the operating status of the module, ● **ERR** signals an internal error to the module, ● **I/O** signals an external error or an application error to the module.
3	**Channel** field	Is used: ● By clicking on the reference number, to display the tabs: ❍ **Description** which gives the characteristics of the device. ❍ **I/O Objects** *(see EcoStruxure ™ Control Expert, Operating Modes)* which is used to presymbolize the input/output objects. ❍ **Fault** which shows the device faults (in online mode). ● To select the channel, ● To display the **Symbol**, name of the channel defined by the user (using the variable editor).
4	Zone **general parameters**	Allows bits to be unforced and the counting function to be displayed: ● **Unforce:** this button allows forced bits *(see page 271)* to be unforced. ● **Function:** calls up the configured counting function. This heading is fixed. ● **Task:** specifies the **MAST** or **FAST** task configured. This heading is fixed.
5	**Display and command** field	This field displays the status of inputs, outputs, intermediate bits and the values of the various counting in progress registers. It is also used to control and force various objects (bits). The field is divided into function groups corresponding to the main functions *(see page 167)*.

NOTE: the LEDs and commands that are not available appear grayed out.

How to use value or parameter windows

At a Glance

The maximized debugging screen commands zone is divided into headings or function groups. The corresponding functions are described in detail in the *Description of the standard functions of TSX CTY2A/4A/2C counting modules, page 167* section, and their essential characteristics are shown in the module configuration *(see page 231)* procedures.

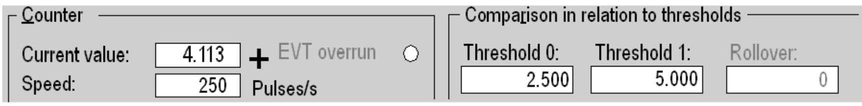
The next part shows the general principles for using measurement or parameter windows.

A **measurement** is the result of counting, acquisition or calculation.

A **parameter** is a piece of input data by the user or project.

Principle for using measurement windows

Windows shown in the example below are used to display the current contents of a register. The values displayed cannot be modified directly by selecting these windows.



The following table summarizes the behavior of values that cannot be modified:

Value	Behavior
Measurement	Cannot be modified. Can be preset by a preset or reset command. The + or - sign on the right of the window indicates the actual direction measurement change.
Speed (CTY 2C)	Cannot be modified or preset.
Address of multiplexed encoder (CTY 2C)	Cannot be modified. Can be preset using the **manual Q2** and **Q3** outputs if these control the multiplexing.

To modify a parameter value, such as threshold, preset, or rollover values, use the following procedure.

How to change a parameter value

The table below describes the procedure for changing a parameter.

Step	Action
1	Access the adjustment screen by clicking on the **Adjustment** tab.
2	In the adjustment screen modify the required parameter.
3	Validate (**Edit** → **Enable** menu).
4	Go back to the adjustment screen by clicking on the **Adjustment** tab. **Result:** the new parameter value is displayed.

How to use the LEDs and buttons

At a Glance

The maximized debug screen commands zone is divided into headings or function groups. The corresponding functions are described in detail in the *Description of the standard functions of TSX CTY2A/4A/2C counting modules, page 167* section, and their essential characteristics are shown in the module configuration *(see page 231)* procedures.

This section shows the general principles for using LEDs and buttons.

The LEDs are used to display the status of a bit.

The buttons are used to set a bit, triggering an action or not (depending on the case).

Meaning of the LEDs

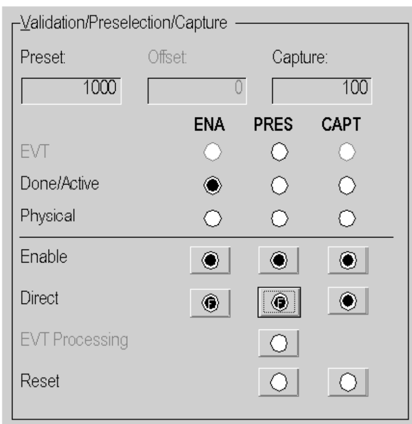
When the bit is at 0, the LED is off (white) (see the example below).

When the bit is at 1, the LED is on (black, blue or red). Some LEDs display a little black dot in status 1.

There are also position LEDs which use a bold dash to display the measurement or capture position in relation to a threshold or a set point. These latter are represented by a thin central dash.

Button use principle

In the example below the **Direct enabling** and **Direct capture**buttons are set to 1.



Clicking on this button sets the associated bit to 1. The button and possibly the LED above light up (switch to a color).

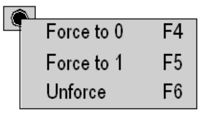
Clicking on this button  sets the associated bit to 0. The button and possibly the LED above go out (switch to white).

These actions are temporary, in the sense that the project or counting can change the bit status.

NOTE: the LED status can be different from the button status. Some LEDs are reserved for storing the action carried out by the physical input (capture, preset or reset). These LEDs can be recognized by the presence of a reset button (action carried out) in the same column. In this case you can switch off the LED, if necessary, by pressing this button.

Forcing a bit

To lock the status of a bit (i.e. to make it permanent), use the forcing commands, which can be accessed by right-clicking on the mouse. The button goes on or off in the same way as before but



with the letter **F** superimposed . Conversely, use the same menu to delete bit forcing.

You can also unforce all forced bits by clicking on the **Unforce** button in the **General parameters** field.

Chapter 12
Operating modes and event processing

Subject of this chapter

This chapter describes the counting modules’ operating modes as well as the operation of the event processing, which supports completion of the counting applications with optimized response times.

What Is in This Chapter?

This chapter contains the following topics:

How counting modules behave in the different operating modes

General

Counting modules operate in specific ways according to the different PLC operating modes *(see EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual)*. Knowing about these specific ways is important for programming and debugging the project.

Summary table

The table below shows the special features of counting modules in different operating modes.

	Cold start	Warm restart	STOP	Reconfiguring in online mode
Invalid measurement bit	1	1	0	1
Adjustment parameters: set points, thresholds, preset, measurement period (speed), output period (frequency) %MDr.m.c.r	initial values	unchanged	unchanged	initial values
Commands (direct software actions, various actions, event unmasking) %Qr.m.c.r, %QWr.m.c.r	0	unchanged	unchanged, new commands not sent	unchanged
Information and module data -> processor %IDr.m.c.r, %IWr.m.c.r, %Ir.m.c.r	unchanged if no power outage	unchanged if no power outage	sent	unchanged
Forced objects	unforced	unchanged	unchanged	unchanged
Switches (as a result of **Invalid measurement**)	0	0	unchanged	0
Outputs	0	0	fallback mode	0

The paragraphs below show the essential properties of these operating modes, seen from a module.

Cold start

A **cold** start occurs when the application first starts running, when some power is restored, when initialization takes place from Control Expert, or when the Reset button on the processor is pressed.

Parameters are initialized at their set initial values using the configuration editor. The current counter measurement cannot be used (**Invalid measurement** bit set to 1).

If the module has not had a power outage, the current value of the counter is unchanged although the **Invalid measurement** bit is set.

The user must set the procedure to be carried out from a cold start *(see page 227)*.

Warm restart

The program starts again from the program element where the power outage took place, but the outputs remain at 0 until refreshed by the task.

The values of counting application-specific function objects are not changed by a warm restart, except for those involved with the **Invalid measurement** bit.

If the module has not had a power outage, the current value of the counter is unchanged although the **Invalid measurement** bit is set.

The user must define the processing procedure to be carried out on a warm restart.

Power outage and restart

When there is a power outage, the application context and time of the outage are stored.

When the power is restored the saved context is compared with that in progress:

- if the application context has changed (i.e. loss of system context or new project), the PLC initializes the application: see **cold start**,
- if the application context is the same, the PLC carries out a **warm restart**.

STOP mode

In STOP mode the user program is not run. However the application-specific counting function does operate: the counter advances according to the status of the physical inputs (**IA**, **IB**, **IPres** or **IReset**, **IEna**, **ICapt**).

Reconfiguring in online mode

This mainly involves debugging a project.

Changes must be confirmed.

Introduction to event processing

At a Glance

Event processing is used to minimize the reaction time when installing counting modules by:

- programming reflex actions,
- extending (physical) reflex output time performances **Q0** and **Q1** to other outputs on the PLC output modules.

One event (task) process can be associated with each counting channel. The appearance of an event in the application-specific counting function re-routes the project program to the event task associated with the channel.

The priority of the task is linked to its number. There are two priority levels determined by the process number: EVT0 has priority over all other EVTi's (i: from 1 to 31 or 63, depending on processor type). You must therefore assign EVT0 to the most important channel of the project, which will not necessarily be a counting channel.

Event processing principle

Event processing is enabled when:

- bit %S38 which enables Control Expert event processing is set to 1,
- the UNMASKEVT is carried out in MAST and FAST tasks,
- the counting channel events involved are unmasked.

The objects indicating:

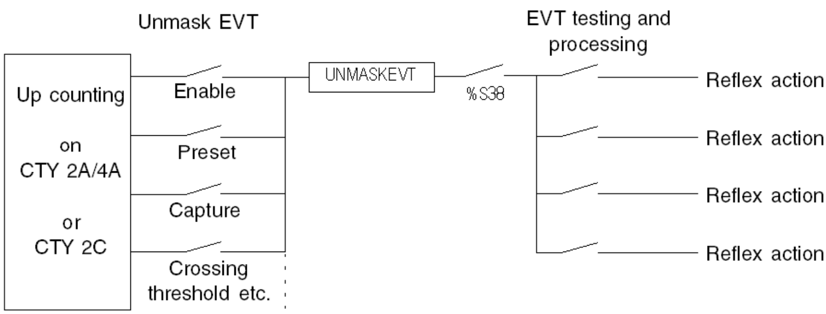
- the source of the event (event status word %IWr.m.c.3),
- and the captured value,

are updated implicitly before the event process is carried out. The other counting objects are not updated.

Event processing must first of all identify the source of the event by testing the event status word bits set to 1.

Illustration

The figure below illustrates the event processing principle



How to program event processing

Procedure

The table below summarizes the essential steps for programming event processing.

Step	Action
1	**Configuration phase** In offline mode, in the configuration editor, select **Event processing** and the event number for the counting channel.
2	**Unmasking phase** In particular, the **MAST** or **FAST** calling task must: ● Enable processing of events at system level: set bit %S38 to 1 (default value). ● Unmask events in MAST and FAST tasks with the UNMASKEVT instruction (active by default). ● Unmask events concerned at channel level by setting implicit event unmasking language objects *(see page 304)* to 1. By default, the events are masked. ● Check that the stack of events at system level is not saturated (bit %S39 must be at 0).
3	**Event program creation phase** On the Events tab, select **Edit → New event section** and create the event program. In particular, this program must: ● Determine the source of the event(s) from the event status word *(see page 302)* in implicit exchange. ● Carry out the reflex tasks associated with the event. This process must be as short as possible. **Note**: the event status word is automatically reset to zero.

Illustration of event unmasking

This figure shows event unmasking in the MAST task.

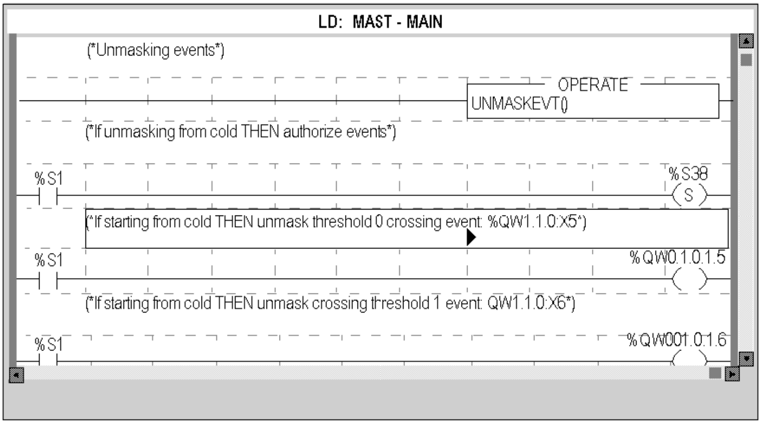
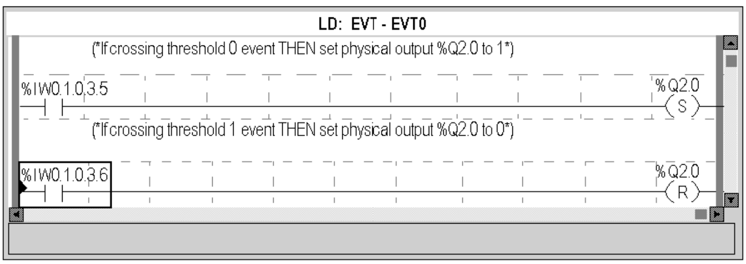


Illustration of the contents of an event task

This figure shows the possible contents of an event task (testing event and action bit).



Chapter 13
Diagnostics of the TSX CTY2A, TSX CTY4A and TSX CTY2C Modules

Aim of this Chapter

This chapter describes the different diagnostic options of the TSX CTY2A, TSX CTY4A and TSX CTY2C data modules.

What Is in This Chapter?

This chapter contains the following topics:

Viewing fault diagnostics

At a Glance

The diagnostic screens on the module or channel are only accessible in connected mode. When an **un-masked** fault appears, this is reported:

- in the configuration screen of the rack, with the presence of a red square in the position of the faulty counting module,
- in all screens at module level (**Description** and **Fault** tabs),
  - in the module field with the **I/O** LED.
- in all channel level screens (**Configuration**, **Adjustment**, **Debug** and **Fault** tabs),
  - in the module field with the **I/O** LED.
  - in the channel field with the channel fault LED.
- in the fault screen that is accessed by the **Fault** where the fault diagnostics are described.

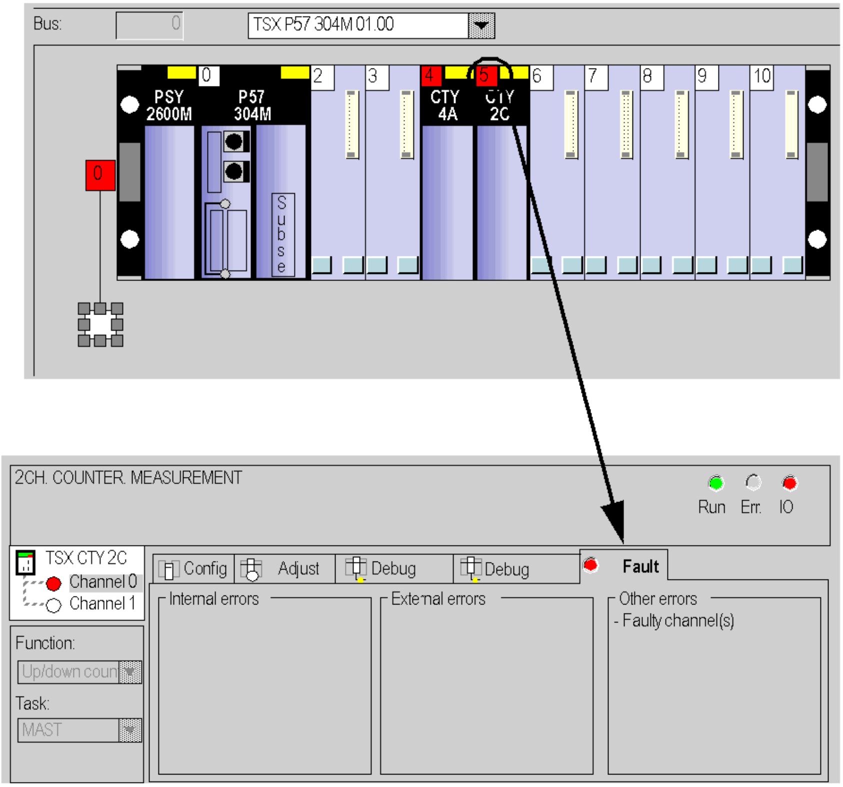
The fault is also reported:

- on the module, through the centralized viewing,
- with the dedicated language objects: **CH_ERROR** (%Ir.m.c.ERR) and module error **MOD_ERROR** (%Ir.m.MOD.ERR), **%MWr.m.MOD.2**, etc., and the status words *(see page 321)*.

NOTE: even if the fault is masked (TSX CTY 2C), it is reported by the flashing of the LED **I/O** and in the fault screen.

Illustration

The diagram below shows the fault reporting structure.



Lists of fault diagnostics

At a Glance

The messages displayed on the diagnostics screens are used to assist in debugging the project. These messages must be concise and are sometimes ambiguous (as different faults may have the same consequences).

These diagnostics are on two levels: module and channel, the latter being the most explicit. The lists below show the message headings with suggestions for finding out what is wrong.

List of the module fault messages

The table below provides a list of the module fault messages.

Fault indicated	Possible interpretation and/or action
Module failure	The module has a fault. Check the module mounting. Change the module.
Faulty channel(s)	One or more channels have a fault. Refer to channel diagnostics.
Self-test	The module is running a self-test. Wait until the self-test is complete. **Note: For Modicon M340, if the Xbus line termination are missing, the module will stay in this state.**
Different hardware and software configurations	There is a lack of compatibility between the module configured and the module in the rack. Make the configuration and the software configuration compatible.
Module is missing or off	Install the module. Fasten the mounting screws.

List of channel fault messages

The table below gives the list of fault messages at channel level.

Fault indicated. Other consequences.	Possible interpretation and/or action.
External fault or counting input fault: • encoder or proximity sensor supply fault, • line break or short circuit of at least one encoder differential signal (1A, 1B or 1Z), • SSI series frame fault, • specific fault on absolute encoder. Outputs are set to 0 in automatic mode. **Invalid measurement** message.	Check the sensor connections. Check the sensor power supply. Check the sensor operation. Delete the fault and acknowledge if the fault storing is configured (CTY 2C). Counting pulses or incremental encoder: preset or reset to acknowledge the Invalid measurement message.
Counting application fault: • measurement overrun • overspeed Outputs are set to 0 in automatic mode. **Invalid measurement** message.	Diagnose the fault more precisely (external causes). Check the application again, if necessary. Delete the fault and acknowledge if the fault storing is configured (CTY 2C). Counting pulses or incremental encoder: preset or reset to acknowledge the **Invalid measurement** message.
Auxiliary input/output fault: • power supply • short circuit of at least one output Outputs are set to 0 in automatic mode.	Check the output connections. Check the input/output power supply (24V). Diagnose the fault more precisely (external causes). Delete the fault and acknowledge if the fault storing is configured (CTY 2C).
Internal fault or channel self-test: • faulty module, • module missing or off, • module running self-test.	Module fault has gone down to channel level. Refer to module level diagnostics.
Different hardware and software configurations	Module fault has gone down to channel level. Refer to module level diagnostics.
Invalid software configuration: • incorrect constant • bit combination not associated with any configuration	Check and modify the configuration constants.
Communication fault	Check the connections between the racks.
Application fault: refusal to configure or adjust	Diagnose the fault more precisely.

Chapter 14
The Language Objects of the Counting Function

Subject of this Chapter

This chapter describes the language objects associated to the counting tasks as well as the different ways of using them.

What Is in This Chapter?

This chapter contains the following sections:

Section 14.1
The Language Objects and IODDT of the Counting Function

Subject of this Section

This section describes the general features of the language objects and IODDT of the counting function.

What Is in This Section?

This section contains the following topics:

Introducing language objects for application-specific counting

General

The counting modules have different associated IODDTs. IODDTs are predefined by the manufacturer and contain language objects for inputs/outputs belonging to the channel of an application-specific module.

There are three IODDT types for the counting function:

- `T_COUNT_ACQ` which applies to the 3 TSX CTY 2A/4A and CTY 2C modules
- `T_COUNT_HIGH_SPEED` specific to the TSX CTY 2C module
- `T_COUNT_STD` specific to the TSX CTY 2A /4A modules

NOTE: IODDT variables can be created in two different ways:
- Using the **I/O objects** *(see EcoStruxure™ Control Expert, Operating Modes)* tab,
- Data Editor.

Language object types

Each IODDT includes a set of language objects enabling the IODDTs to be controlled and their operation to be checked.

There are two types of language object:

- **implicit exchange objects**, which are automatically exchanged on each cycle revolution of the task associated with the module,
- **explicit exchange objects**, which are exchanged at the request of the application using explicit exchange instructions.

Implicit exchanges concern the inputs/outputs of the module: measurement results, information and commands.

Explicit exchanges enable the module to be set and diagnosed.

Implicit Exchange Language Objects Associated with the Application-Specific Function

At a Glance

An integrated application-specific interface or the addition of a module automatically enhances the language objects application used to program this interface or module.

These objects correspond to the input/output images and software data of the module or integrated application-specific interface.

Reminders

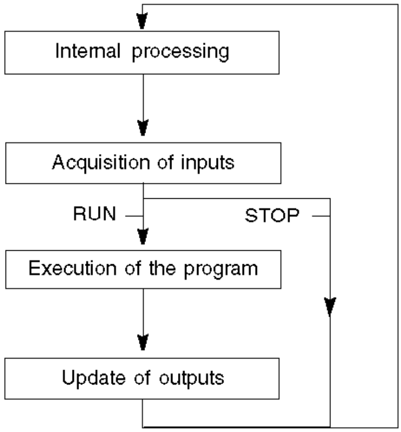
The module inputs (`%I` and `%IW`) are updated in the PLC memory at the start of the task, the PLC being in RUN or STOP mode.

The outputs (`%Q` and `%QW`) are updated at the end of the task, only when the PLC is in RUN mode.

NOTE: When the task occurs in STOP mode, either of the following are possible, depending on the configuration selected:
- outputs are set to fallback position (fallback mode)
- outputs are maintained at their last value (maintain mode)

Figure

The following diagram shows the operating cycle of a PLC task (cyclical execution).



Explicit Exchange Language Objects Associated with the Application-Specific Function

Introduction

Explicit exchanges are performed at the user program's request using these instructions:

- READ_STS (read status words)
- WRITE_CMD (write command words)
- WRITE_PARAM (write adjustment parameters)
- READ_PARAM (read adjustment parameters)
- SAVE_PARAM (save adjustment parameters)
- RESTORE_PARAM (restore adjustment parameters)

For more details about instructions, refer to *EcoStruxure™ Control Expert, I/O Management, Block Library*.

These exchanges apply to a set of %MW objects of the same type (status, commands or parameters) that belong to a channel.

These objects can:

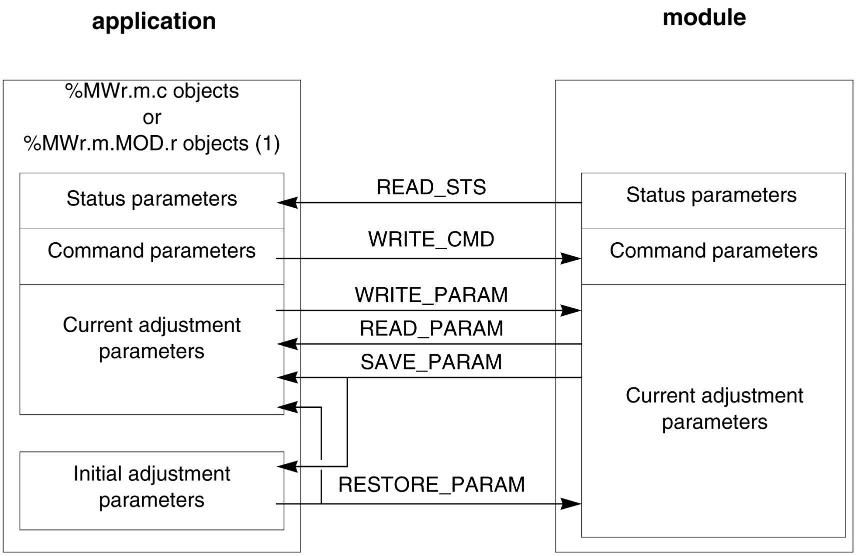
- provide information about the module (for example, type of error detected in a channel)
- have command control of the module (for example, switch command)
- define the module's operating modes (save and restore adjustment parameters in the process of application)

NOTE: To avoid several simultaneous explicit exchanges for the same channel, it is necessary to test the value of the word EXCH_STS (`%MWr.m.c.0`) of the IODDT associated to the channel before calling any EF addressing this channel.

NOTE: Explicit exchanges are not supported when X80 analog and digital I/O modules are configured through an eX80 adapter module (BMECRA31210) in a Quantum EIO configuration. You cannot set up a module's parameters from the PLC application during operation.

General Principle for Using Explicit Instructions

The diagram below shows the different types of explicit exchanges that can be made between the application and module.



(1) Only with READ_STS and WRITE_CMD instructions.

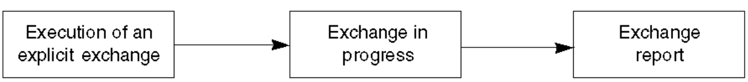
Managing Exchanges

During an explicit exchange, check performance to see that the data is only taken into account when the exchange has been correctly executed.

To do this, two types of information is available:

- information concerning the exchange in progress *(see page 295)*
- the exchange report *(see page 296)*

The following diagram describes the management principle for an exchange.



NOTE: In order to avoid several simultaneous explicit exchanges for the same channel, it is necessary to test the value of the word EXCH_STS (`%MWr.m.c.0`) of the IODDT associated to the channel before calling any EF addressing this channel.

Management of Exchanges and Reports with Explicit Objects

At a Glance

When data is exchanged between the PLC memory and the module, the module may require several task cycles to acknowledge this information. IODDTs use two words to manage exchanges:

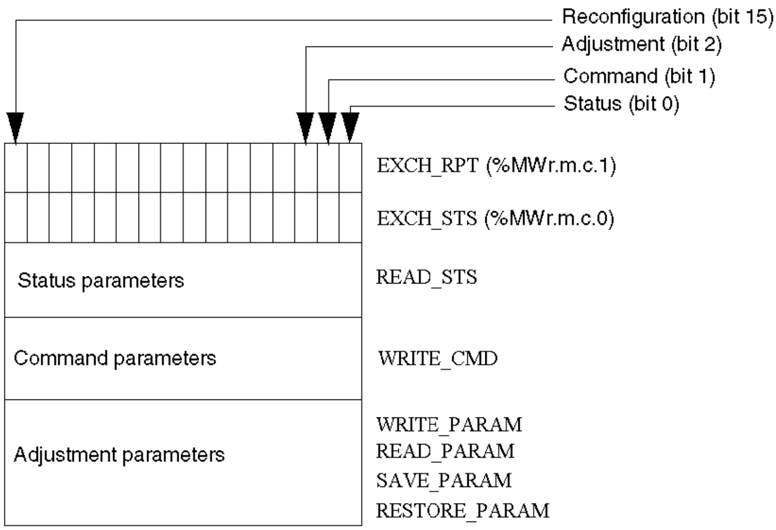
- `EXCH_STS` (`%MWr.m.c.0`): exchange in progress
- `EXCH_RPT` (`%MWr.m.c.1`): report

NOTE:
Depending on the localization of the module, the management of the explicit exchanges (`%MW0.0.MOD.0.0` for example) will not be detected by the application:

- For in-rack modules, explicit exchanges are done immediately on the local PLC Bus and are finished before the end of the execution task. So, the `READ_STS`, for example, is finished when the `%MW0.0.mod.0.0` bit is checked by the application.
- For remote bus (Fipio for example), explicit exchanges are not synchronous with the execution task, so the detection is possible by the application.

Illustration

The illustration below shows the different significant bits for managing exchanges:



Description of Significant Bits

Each bit of the words `EXCH_STS` (`%MWr.m.c.0`) and `EXCH_RPT` (`%MWr.m.c.1`) is associated with a type of parameter:

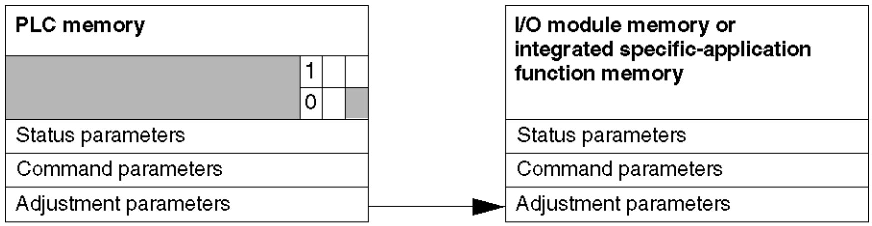
- Rank 0 bits are associated with the status parameters:
  - The `STS_IN_PROGR` bit (`%MWr.m.c.0.0`) indicates whether a read request for the status words is in progress.
  - The `STS_ERR` bit (`%MWr.m.c.1.0`) specifies whether a read request for the status words is accepted by the module channel.
- Rank 1 bits are associated with the command parameters:
  - The `CMD_IN_PROGR` bit (`%MWr.m.c.0.1`) indicates whether command parameters are being sent to the module channel.
  - The `CMD_ERR` bit (`%MWr.m.c.1.1`) specifies whether the command parameters are accepted by the module channel.
- Rank 2 bits are associated with the adjustment parameters:
  - The `ADJ_IN_PROGR` bit (`%MWr.m.c.0.2`) indicates whether the adjustment parameters are being exchanged with the module channel (via `WRITE_PARAM, READ_PARAM, SAVE_PARAM, RESTORE_PARAM`).
  - The `ADJ_ERR` bit (`%MWr.m.c.1.2`) specifies whether the adjustment parameters are accepted by the module. If the exchange is correctly executed, the bit is set to 0.
- Rank 15 bits indicate a reconfiguration on channel **c** of the module from the console (modification of the configuration parameters + cold start-up of the channel).
- The *r*, *m* and *c* bits indicates the following elements:
  - the **r** bit represents the rack number.
  - The **m** bit represents the position of the module in the rack.
  - The **c** bit represents the channel number in the module.

NOTE: **r** represents the rack number, **m** the position of the module in the rack, while **c** represents the channel number in the module.

NOTE: Exchange and report words also exist at module level `EXCH_STS` (`%MWr.m.MOD`) and `EXCH_RPT` (`%MWr.m.MOD.1`) as per IODDT type `T_GEN_MOD`.

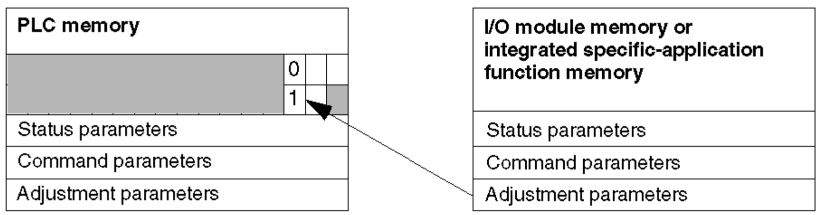
Example

Phase 1: Sending data by using the `WRITE_PARAM` instruction



When the instruction is scanned by the PLC, the **Exchange in progress** bit is set to 1 in `%MWr.m.c`.

Phase 2: Analysis of the data by the I/O module and report.



When the data is exchanged between the PLC memory and the module, acknowledgement by the module is managed by the `ADJ_ERR` bit (`%MWr.m.c.1.2`).

This bit makes the following reports:
- **0:** correct exchange
- **1:** incorrect exchange)

NOTE: There is no adjustment parameter at module level.

Execution Indicators for an Explicit Exchange: EXCH_STS

The table below shows the control bits of the explicit exchanges: `EXCH_STS` (`%MWr.m.c.0`)

Standard Symbol	Type	Access	Meaning	Address
STS_IN_PROGR	BOOL	R	Reading of channel status words in progress	%MWr.m.c.0.0
CMD_IN_PROGR	BOOL	R	Command parameters exchange in progress	%MWr.m.c.0.1

Standard Symbol	Type	Access	Meaning	Address
ADJ_IN_PROGR	BOOL	R	Adjust parameters exchange in progress	%MWr.m.c.0.2
RECONF_IN_PROGR	BOOL	R	Reconfiguration of the module in progress	%MWr.m.c.0.15

NOTE: If the module is not present or is disconnected, explicit exchange objects (`READ_STS` for example) are not sent to the module (`STS_IN_PROG` (%MWr.m.c.0.0) = 0), but the words are refreshed.

Explicit Exchange Report: EXCH_RPT

The table below shows the report bits: `EXCH_RPT` (`%MWr.m.c.1`)

Standard Symbol	Type	Access	Meaning	Address
STS_ERR	BOOL	R	Error detected while reading channel status words (1 = detected error)	%MWr.m.c.1.0
CMD_ERR	BOOL	R	Error detected during a command parameter exchange (1 = detected error)	%MWr.m.c.1.1
ADJ_ERR	BOOL	R	Error dectected during an adjust parameter exchange (1 = detected error)	%MWr.m.c.1.2
RECONF_ERR	BOOL	R	Error detected during reconfiguration of the channel (1 = detected error)	%MWr.m.c.1.15

Counting Module Use

The following table describes the steps realized between a couting module and the system after a power-on.

Step	Action
1	Power on.
2	The system sends the configuration parameters.
3	The system sends the adjust parameters by WRITE_PARAM method. **Note:** When the operation is finished, the bit %MWr.m.c.0.2 switches to 0.

If, in the begining of your application, you use a WRITE_PARAM command, wait until the bit %MWr.m.c.0.2 switches to 0.

Section 14.2
The language objects and IODDT associated with the counting function

Subject of this section

This section describes the language objects and the IODDTs that are associated with the counting function.

What Is in This Section?

This section contains the following topics:

Details of the IODDT's implicit exchange objects of type T_COUNT_ACQ

List of implicit exchange objects

The table below shows the IODDT's implicit exchange objects of type `T_COUNT_ACQ` which applies to the three modules TSX CTY 2A/4A/2C.

Standard symbol	Type	Access	Meaning	Address
CH_ERROR	BOOL	R	Counting channel error bit	%Ir.m.c.ERR
ENAB_ACTIV	EBOOL	R	Counter enable active	%Ir.m.c.0
PRES_DONE	EBOOL	R	Preset done	%Ir.m.c.1
COUNT_DIR	EBOOL	R	Counting direction 0 : direction - (down counting), 1: direction + (up counting)	%Ir.m.c.9
DIR_ENAB	EBOOL	R/W	Direct enabling by the software	%Qr.m.c.0
DIR_PRES	EBOOL	R/W	Direct preset by the software	%Qr.m.c.1
FLT_ACK	EBOOL	R/W	Fault acknowledgment	%Qr.m.c.3
ENAB_IENAB	EBOOL	R/W	Enabling the physical input **IEna**	%Qr.m.c.5
ENAB_IPRES	EBOOL	R/W	Enabling the physical input **IPRES**	%Qr.m.c.6
CUR_MEASURE	DINT	R	Current counter value (24 active bits)	%IDr.m.c.0
ST_IA	BOOL	R	Status of physical counting input **IA**	%IWr.m.c.2.0
ST_IB	BOOL	R	Status of physical counting input **IB**	%IWr.m.c.2.1
ST_IENAB	BOOL	R	Status of physical enable input **IEna**	%IWr.m.c.2.2
ST_IPRES	BOOL	R	State of the **IPres** or **IReset** physical preset input	%IWr.m.c.2.3
INVALID_MEAS	BOOL	R	Invalid measurement	%IWr.m.c.2.7
PRES_RESET	BOOL	R/W	Reset preset	%QWr.m.c.0.1
COUNT_DIR_CHG	BOOL	R/W	Change of counting direction 0 : direction - (down counting), 1: direction + (up counting)	%QWr.m.c.0.9

Details of the IODDT's explicit exchange objects of type T_COUNT_ACQ

At a Glance

This part shows the IODDT's implicit exchange objects of type `T_COUNT_ACQ` which applies to the three modules TSX CTY 2A/4A/2C. It brings together word-type objects whose bits have a special meaning. This objects are described in detail below.

Example of declaration of a variable: `IODDT_VAR1` of type `T_COUNT_ACQ`

Notes

- Generally speaking, the meaning of the bits is given for state 1 of this bit. In specific cases, each state of the bit is explained.
- Not all of the bits are used.

Explicit exchange operation indicators: EXCH_STS

The table below shows the meanings of exchange control bits of the channel `EXCH_STS` (%MWr.m.c.0).

Standard symbol	Type	Access	Meaning	Address
STS_IN_PROGR	BOOL	R	Reading channel status words	%MWr.m.c.0.0
ADJ_IN_PROGR	BOOL	R	Adjust parameters exchange in progress	%MWr.m.c.0.2
RECONF_IN_PROGR	BOOL	R	Reconfiguring of the module	%MWr.m.c.0.15

Explicit exchange report: EXCH_RPT

The table below shows the meanings of report bits `EXCH_RPT` (%MWr.m.c.1).

Standard symbol	Type	Access	Meaning	Address
STS_ERR	BOOL	R	Reading fault of channel state words	%MWr.m.c.1.0
ADJ_ERR	BOOL	R	Fault when exchanging adjustment parameters	%MWr.m.c.1.2
RECONF_ERR	BOOL	R	Fault when reconfiguring the channel	%MWr.m.c.1.15

Standard channel faults, CH_FLT

The table below shows the meanings of status word bits `CH_FLT` (%MWr.m.c.2). The reading is made by a `READ_STS` (`IODDT_VAR1`).

Standard symbol	Type	Access	Meaning	Address
COUNT_INP_FLT	BOOL	R	Counting input error	%MWr.m.c.2.0
COUNT_APP_FLT	BOOL	R	Counting application fault	%MWr.m.c.2.1
AUX_IO_FLT	BOOL	R	Auxiliary I/O fault	%MWr.m.c.2.3
INTERNAL_FLT	BOOL	R	Internal error or channel self-testing	%MWr.m.c.2.4
CONF_FLT	BOOL	R	Different hardware and software configurations	%MWr.m.c.2.5
COM_FLT	BOOL	R	Communication error with the PLC	%MWr.m.c.2.6
APPLI_FLT	BOOL	R	Application fault (adjustment or configuration fault)	%MWr.m.c.2.7
CH_LED0	BOOL	R	Green indicator's command bits **CHx** (channel state) 00 = off, 01 = blinking, 11 = lit	%MWr.m.c.2.8
CH_LED1	BOOL	R		%MWr.m.c.2.9
AUX_PS_FLT	BOOL	R	Auxiliary I/O power supply fault	%MWr.m.c.2.11
SHORT_CIRCUIT	BOOL	R	Short-circuit fault on a channel	%MWr.m.c.2.12
ENC_PS_FLT	BOOL	R	Supply, encoder or potential difference error	%MWr.m.c.2.13
LINE_BRK_FLT	BOOL	R	Encoder line break or short-circuit error	%MWr.m.c.2.14

Specific channel faults, %MWr.m.c.3

The table below shows the meanings of channel status word bits %MWr.m.c.3. The reading is made by a `READ_STS` (`IODDT_VAR1`)

Standard symbol	Type	Access	Meaning	Address
CH_CONF_FLT	BOOL	R	Channel configuration error	%MWr.m.c.3.0
MEASURE_OVR	BOOL	R	Measurement overrun fault	%MWr.m.c.3.1
ABS_ENC_FLT	BOOL	R	Specific absolute encoder error	%MWr.m.c.3.2

Preset command, %MWr.m.c.4

The table below gives the meaning of the word `PRESET` (%MWr.m.c.4). The requests used are those associated with parameters (`READ_PARAM`,`WRITE_PARAM`..)

Standard symbol	Type	Access	Meaning	Address
PRESET	DINT	R/W	Preset value (parameter)	%MDr.m.c.4

Details of the IODDT's implicit exchange objects of type T_COUNT_STD

At a Glance

The tables below show the IODDT's implicit exchange objects of type `T_COUNT_STD` which applies to the modules TSX CTY 2A and TSX CTY 4A

Current value and captured value

The table below shows different implicit exchange objects of the IODDT.

Standard symbol	Type	Access	Meaning	Address
CUR_MEASURE	DINT	R	Current counter value (24 active bits).	%IDr.m.c.0
CAPT	DINT	R	Captured counter value (24 active bits).	%IDr.m.c.4

Software information, bits %Ir.m.c.d

The table below shows the meanings of the %Ir.m.c.d status bits.

Standard symbol	Type	Access	Meaning	Address
CH_ERROR	BOOL	R	Counting channel error bit	%Ir.m.c.ERR
ENAB_ACTIV	EBOOL	R	Counter enable active	%Ir.m.c.0
PRES_DONE	EBOOL	R	Preset done	%Ir.m.c.1
CAPT_DONE	EBOOL	R	Capture done	%Ir.m.c.2
CUR_MEAS_THR0	EBOOL	R	Current value ≥ at threshold 0	%Ir.m.c.5
CUR_MEAS_THR1	EBOOL	R	Current value ≥ at threshold 1	%Ir.m.c.6
CUR_MEAS_HISP	EBOOL	R	Current value ≥ with high setpoint	%Ir.m.c.7
CUR_MEAS_LOSP	EBOOL	R	Current value ≥ with low setpoint	%Ir.m.c.8
COUNT_DIR	EBOOL	R	Counting direction 0 : direction - (down counting), 1: direction + (up counting)	%Ir.m.c.9
CAPT_THR0	EBOOL	R	Captured value ≥ at threshold 0	%Ir.m.10
CAPT_THR1	EBOOL	R	Captured value ≥ at threshold 1	%Ir.m.11
CAPT_HISP	EBOOL	R	Captured value ≥ with high setpoint	%Ir.m.12
CAPT_LOSP	EBOOL	R	Captured value ≥ with low setpoint	%Ir.m.13

Status of physical inputs/outputs, word %IWr.m.c.2

The table below shows the meanings of status word bits %IWr.m.c.2.

Standard symbol	Type	Access	Meaning	Address
ST_IA	BOOL	R	Status of physical counting input **IA**	%IWr.m.c.2.0
ST_IB	BOOL	R	Status of physical counting input **IB**	%IWr.m.c.2.1
ST_IENAB	BOOL	R	Status of physical enable input **IEna**	%IWr.m.c.2.2
ST_IPRES	BOOL	R	State of the **IPres** or **IReset** physical preset input	%IWr.m.c.2.3
ST_ICAPT	BOOL	R	State of physical capture input **ICapt**	%IWr.m.c.2.4
INVALID_MEAS	BOOL	R	Invalid measurement	%IWr.m.c.2.7
ST_Q0	BOOL	R	Output state **Q0**	%IWr.m.c.2.14
ST_Q1	BOOL	R	Output state **Q1**	%IWr.m.c.2.15

Events and state of switches, word %IWr.m.c.3

The table below shows the meanings of status word bits %IWr.m.c.3.

Standard symbol	Type	Access	Meaning	Address
ENAB_EVT	BOOL	R	Enabling event	%IWr.m.c.3.0
PRES_EVT	BOOL	R	Event preset or reset	%IWr.m.c.3.1
CAPT_EVT	BOOL	R	Capture event	%IWr.m.c.3.2
THR0_EVT	BOOL	R	Threshold 0 crossing event	%IWr.m.c.3.5
THR1_EVT	BOOL	R	Threshold 1 crossing event	%IWr.m.c.3.6
HISP_EVT	BOOL	R	High setpoint crossing event	%IWr.m.c.3.7
LOSP_EVT	BOOL	R	Low setpoint crossing event	%IWr.m.c.3.8
ST_COUNT_DIR	BOOL	R	Direction when crossing threshold or setpoint 0 : direction - (down counting), 1: direction + (up counting)	%IWr.m.c.3.9
ST_LATCH0	BOOL	R	State of switch 0	%IWr.m.c.3.10
ST_LATCH1	BOOL	R	State of switch 1	%IWr.m.c.3.11
OVERRUN_EVT	BOOL	R	Overrun events (channel level)	%IWr.m.c.3.15

Software commands, bits %Qr.m.c.d

The table below shows the meanings of command bits %Qr.m.c.r.

Standard symbol	Type	Access	Meaning	Address
DIR_ENAB	EBOOL	R/W	Direct enabling by the software	%Qr.m.c.0
DIR_PRES	EBOOL	R/W	Direct preset by the software	%Qr.m.c.1
DIR_CAPT	EBOOL	R/W	Direct capture by the software	%Qr.m.c.2
ENAB_IENAB	EBOOL	R/W	Enabling the physical input **IEna**	%Qr.m.c.5
ENAB_IPRES	EBOOL	R/W	Enabling the physical input **IPRES**	%Qr.m.c.6
ENAB_ICAPT	EBOOL	R/W	Enabling the physical input **ICapt**	%Qr.m.c.7
SET_LATCH0	EBOOL	R/W	Switch 1 set to 1	%Qr.m.c.10
SET_LATCH1	EBOOL	R/W	Switch 1 set to 1	%Qr.m.c.11
RESET_LATCH0	EBOOL	R/W	Switch 0 set to 0	%Qr.m.c.12
RESET_LATCH1	EBOOL	R/W	Switch 1 set to 0	%Qr.m.c.13
ENAB_Q0_AUTO	EBOOL	R/W	Enabling the **Q0** output in automatic mode	%Qr.m.c.14
ENAB_Q1_AUTO	EBOOL	R/W	Enabling the **Q1** output in automatic mode	%Qr.m.c.15

Reset and output commands, word %QWr.m.c.0

The table below shows the meanings of the command word bits %QWr.m.c.0.

Standard symbol	Type	Access	Meaning	Address
PRES_RESET	BOOL	R/W	Reset of hardware preset done	%QWr.m.c.0.1
CAPT_RESET	BOOL	R/W	Hardware reset capture done	%QWr.m.c.0.2
COUNT_DIR_CHG	BOOL	R/W	Change of counting direction 0 : direction - (down counting), 1: direction + (up counting)	%QWr.m.c.0.9
REACTIV_Q	BOOL	R/W	Reactivation of outputs **Q0**, **Q1**, and outputs **Q2**, **Q3**	%QWr.m.c.0.10
AUTO_MOD_Q0	BOOL	R/W	Manual/automatic output mode **Q0** 0 : manual, 1: automatic	%QWr.m.c.0.12
AUTO_MOD_Q1	BOOL	R/W	Manual/automatic output mode **Q1** 0 : manual, 1: automatic	%QWr.m.c.0.13
MANU_CMD_Q0	BOOL	R/W	Manual command output **Q0**	%QWr.m.c.0.14
MANU_CMD_Q1	BOOL	R/W	Manual command output **Q1**	%QWr.m.c.0.15

Unmask event commands, word %QWr.m.c.1

The table below shows the meanings of word bits QWr.m.c.1.

Standard symbol	Type	Access	Meaning	Address
ENAB_UNMSK	BOOL	R/W	Enable event unmasking	%QWr.m.c.1.0
PRES_UNMSK	BOOL	R/W	Unmask preset or reset event	%QWr.m.c.1.1
CAPT_UNMSK	BOOL	R/W	Unmask capture event	%QWr.m.c.1.2
THR0_UNMSK	BOOL	R/W	Unmask threshold 0 event	%QWr.m.c.1.5
THR1_UNMSK	BOOL	R/W	Unmask threshold 1 event	%QWr.m.c.1.6
HISP_UNMSK	BOOL	R/W	Unmask high setpoint event	%QWr.m.c.1.7
LOSP_UNMSK	BOOL	R/W	Unmask low setpoint event	%QWr.m.c.1.8

Details of the IODDT's explicit exchange objects of type T_COUNT_STD

At a Glance

This part shows the IODDT's explicit exchange objects of type `T_COUNT_STD` which applies to the modules TSX CTY 2A and TSX CTY 4A. It brings together word-type objects whose bits have a special meaning. This objects are described in detail below.

Example of declaration of a variable: `IODDT_VAR1` of type `T_COUNT_STD`

Notes

- Generally speaking, the meaning of the bits is given for state 1 of this bit. In specific cases, each state of the bit is explained.
- Not all of the bits are used.

Explicit exchange operation indicators: EXCH_STS

The table below shows the meanings of exchange control bits of the channel `EXCH_STS` (%MWr.m.c.0).

Standard symbol	Type	Access	Meaning	Address
STS_IN_PROGR	BOOL	R	Reading channel status words	%MWr.m.c.0.0
ADJ_IN_PROGR	BOOL	R	Adjust parameters exchange in progress	%MWr.m.c.0.2
RECONF_IN_PROGR	BOOL	R	Reconfiguring of the module	%MWr.m.c.0.15

Explicit exchange report: EXCH_RPT

The table below shows the meanings of report bits `EXCH_RPT` (%MWr.m.c.1).

Standard symbol	Type	Access	Meaning	Address
STS_ERR	BOOL	R	Reading fault of channel state words	%MWr.m.c.1.0
ADJ_ERR	BOOL	R	Fault when exchanging adjustment parameters	%MWr.m.c.1.2
RECONF_ERR	BOOL	R	Fault when reconfiguring the channel	%MWr.m.c.1.15

Standard channel faults, CH_FLT

The table below shows the meanings of status word bits `CH_FLT` (%MWr.m.c.2). The reading is made by a `READ_STS` (`IODDT_VAR1`).

Standard symbol	Type	Access	Meaning	Address
COUNT_INP_FLT	BOOL	R	Counting input error	%MWr.m.c.2.0
COUNT_APP_FLT	BOOL	R	Counting application fault	%MWr.m.c.2.1
AUX_IO_FLT	BOOL	R	Auxiliary I/O	%MWr.m.c.2.3

Standard symbol	Type	Access	Meaning	Address
INTERNAL_FLT	BOOL	R	Internal error or channel self-testing	%MWr.m.c.2.4
CONF_FLT	BOOL	R	Different hardware and software configurations	%MWr.m.c.2.5
COM_FLT	BOOL	R	Communication error with the PLC	%MWr.m.c.2.6
APPLI_FLT	BOOL	R	Application fault (adjustment or configuration fault)	%MWr.m.c.2.7
CH_LED0	BOOL	R	Green indicator's command bits **CHx** (channel state) 00 = off, 01 = blinking, 11 = lit	%MWr.m.c.2.8
CH_LED1	BOOL	R		%MWr.m.c.2.9
AUX_PS_FLT	BOOL	R	Auxiliary I/O supply fault	%MWr.m.c.2.11
SHORT_CIRCUIT	BOOL	R	Short-circuit fault on a channel	%MWr.m.c.2.12
ENC_PS_FLT	BOOL	R	Supply, encoder or potential difference error	%MWr.m.c.2.13
LINE_BRK_FLT	BOOL	R	Encoder line break or short-circuit error	%MWr.m.c.2.14

Specific channel faults, %MWr.m.c.3

The table below shows the meanings of channel status word bits %MWr.m.c.3. The reading is made by a `READ_STS` (`IODDT_VAR1`)

Standard symbol	Type	Access	Meaning	Address
CH_CONF_FLT	BOOL	R	Channel configuration error	%MWr.m.c.3.0
MEASURE_OVR	BOOL	R	Measurement overrun fault	%MWr.m.c.3.1
ABS_ENC_FLT	BOOL	R	Specific absolute encoder error	%MWr.m.c.3.2
OVERSPEED_FLT	BOOL	R	Overspeed fault	%MWr.m.c.3.3

Parameters

The table below shows different parameters, the requests used are (`READ_PARAM`,`WRITE_PARAM`, e.g.: `READ_PARAM` (`IODDT_VAR1`))

Standard symbol	Type	Access	Meaning	Address
PRESET	DINT	R/W	Preset value (parameter)	%MDr.m.c.4
THRESHOLD0	DINT	R/W	Value of threshold 0 (parameter)	%MDr.m.c.6
THRESHOLD1	DINT	R/W	Value of threshold 1 (parameter)	%MDr.m.c.8
HIGH_SP	DINT	R/W	High setpoint value	%MDr.m.c.10
LOW_SP	DINT	R/W	Low setpoint value	%MDr.m.c.12

0 counter output SET commands, %MWr.m.c.14

The table below shows the meanings of the bits of the command word %MWr.m.c.14. The requests used are those associated with parameters (`READ_PARAM`, `WRITE_PARAM`, e.g.: `READ_PARAM (IODDT_VAR1)`).

Standard symbol	Type	Access	Meaning	Address
S0_ENAB	BOOL	R/W	on confirmation	%MWr.m.c.14.0
S0_PRES	BOOL	R/W	on preset	%MWr.m.c.14.1
S0_CAPT	BOOL	R/W	on capture	%MWr.m.c.14.2

0 counter output SET commands, %MWr.m.c.15

The table below shows the meanings of the bits of the command word %MWr.m.c.15. The requests used are those associated with parameters (`READ_PARAM`, `WRITE_PARAM`, e.g.: `READ_PARAM (IODDT_VAR1)`).

Standard symbol	Type	Access	Meaning	Address
S0_TH0_INC	BOOL	R/W	on crossing threshold 0 + direction	%MWr.m.c.15.0
S0_TH0_DEC	BOOL	R/W	on crossing threshold 0 - direction	%MWr.m.c.15.1
S0_CAPT_GE_TH0	BOOL	R/W	if captured value ≥ at threshold 0	%MWr.m.c.15.2
S0_CAPT_LT_TH0	BOOL	R/W	if captured value < at threshold 0	%MWr.m.c.15.3
S0_TH1_INC	BOOL	R/W	on crossing threshold 1 + direction	%MWr.m.c.15.4
S0_TH1_DEC	BOOL	R/W	on crossing threshold 1 - direction	%MWr.m.c.15.5
S0_CAPT_GE_TH1	BOOL	R/W	if captured value ≥ at threshold 1	%MWr.m.c.15.6
S0_CAPT_LT_TH1	BOOL	R/W	if captured value < at threshold 1	%MWr.m.c.15.7
S0_HISP_INC	BOOL	R/W	on high setpoint crossing +direction	%MWr.m.c.15.8
S0_HISP_DEC	BOOL	R/W	on high setpoint crossing -direction	%MWr.m.c.15.9
S0_CAPT_GE_HISP	BOOL	R/W	if captured value ≥ with high setpoint	%MWr.m.c.15.10
S0_LOSP_INC	BOOL	R/W	on low setpoint crossing +direction	%MWr.m.c.15.12
S0_LOSP_DEC	BOOL	R/W	on low setpoint crossing -direction	%MWr.m.c.15.13
S0_CAPT_LT_LOSP	BOOL	R/W	if the captured value < at the low setpoint	%MWr.m.c.15.15

0 counter output RESET commands, %MWr.m.c.16

The table below shows the meanings of the bits of the command word %MWr.m.c.16. The requests used are those associated with parameters (READ_PARAM, WRITE_PARAM, e.g.: READ_PARAM (IODDT_VAR1)).

Standard symbol	Type	Access	Meaning	Address
R0_ENAB	BOOL	R/W	on confirmation	%MWr.m.c.16.0
R0_PRES	BOOL	R/W	on preset	%MWr.m.c.16.1
R0_CAPT	BOOL	R/W	on capture	%MWr.m.c.16.2

0 counter output RESET commands, %MWr.m.c.17

The table below shows the meanings of the bits of the command word %MWr.m.c.17. The requests used are those associated with parameters (READ_PARAM, WRITE_PARAM, e.g.: READ_PARAM (IODDT_VAR1)).

Standard symbol	Type	Access	Meaning	Address
R0_TH0_INC	BOOL	R/W	on crossing threshold 0 + direction	%MWr.m.c.17.0
R0_TH0_DEC	BOOL	R/W	on crossing threshold 0 - direction	%MWr.m.c.17.1
R0_CAPT_GE_TH0	BOOL	R/W	if captured value ≥ at threshold 0	%MWr.m.c.17.2
R0_CAPT_LT_TH0	BOOL	R/W	if captured value < at threshold 0	%MWr.m.c.17.3
R0_TH1_INC	BOOL	R/W	on crossing threshold 1 + direction	%MWr.m.c.17.4
R0_TH1_DEC	BOOL	R/W	on crossing threshold 1 - direction	%MWr.m.c.17.5
R0_CAPT_GE_TH1	BOOL	R/W	if captured value ≥ at threshold 1	%MWr.m.c.17.6
R0_CAPT_LT_TH1	BOOL	R/W	if captured value < at threshold 1	%MWr.m.c.17.7
R0_HISP_INC	BOOL	R/W	on high setpoint crossing +direction	%MWr.m.c.17.8
R0_HISP_DEC	BOOL	R/W	on high setpoint crossing -direction	%MWr.m.c.17.9
R0_CAPT_GE_HISP	BOOL	R/W	if captured value ≥ with high setpoint	%MWr.m.c.17.10
R0_LOSP_INC	BOOL	R/W	on low setpoint crossing +direction	%MWr.m.c.17.12
R0_LOSP_DEC	BOOL	R/W	on low setpoint crossing -direction	%MWr.m.c.17.13
R0_CAPT_LT_LOSP	BOOL	R/W	if the captured value < at the low setpoint	%MWr.m.c.17.15

1 counter output SET commands, %MWr.m.c.18

The table below shows the meanings of the bits of the command word %MWr.m.c.18. The requests used are those associated with parameters (READ_PARAM, WRITE_PARAM, e.g.: READ_PARAM (IODDT_VAR1)).

Standard symbol	Type	Access	Meaning	Address
S1_ENAB	BOOL	R/W	on confirmation	%MWr.m.c.18.0
S1_PRES	BOOL	R/W	on preset	%MWr.m.c.18.1
S1_CAPT	BOOL	R/W	on capture	%MWr.m.c.18.2

1 counter output SET commands, %MWr.m.c.19

The table below shows the meanings of the bits of the command word %MWr.m.c.19. The requests used are those associated with parameters (READ_PARAM, WRITE_PARAM, e.g.: READ_PARAM (IODDT_VAR1)).

Standard symbol	Type	Access	Meaning	Address
S1_TH0_INC	BOOL	R/W	on crossing threshold 0 + direction	%MWr.m.c.19.0
S1_TH0_DEC	BOOL	R/W	on crossing threshold 0 - direction	%MWr.m.c.19.1
S1_CAPT_GE_TH0	BOOL	R/W	if captured value ≥ at threshold 0	%MWr.m.c.19.2
S1_CAPT_LT_TH0	BOOL	R/W	if captured value < at threshold 0	%MWr.m.c.19.3
S1_TH1_INC	BOOL	R/W	on crossing threshold 1 + direction	%MWr.m.c.19.4
S1_TH1_DEC	BOOL	R/W	on crossing threshold 1 - direction	%MWr.m.c.19.5
S1_CAPT_GE_TH1	BOOL	R/W	if captured value ≥ at threshold 1	%MWr.m.c.19.6
S1_CAPT_LT_TH1	BOOL	R/W	if captured value < at threshold 1	%MWr.m.c.19.7
S1_HISP_INC	BOOL	R/W	on high setpoint crossing +direction	%MWr.m.c.19.8
S1_HISP_DEC	BOOL	R/W	on high setpoint crossing -direction	%MWr.m.c.19.9
S1_CAPT_GE_HISP	BOOL	R/W	if captured value ≥ with high setpoint	%MWr.m.c.19.10
S1_LOSP_INC	BOOL	R/W	on low setpoint crossing +direction	%MWr.m.c.19.12
S1_LOSP_DEC	BOOL	R/W	on low setpoint crossing -direction	%MWr.m.c.19.13
S1_CAPT_LT_LOSP	BOOL	R/W	if the captured value < at the low setpoint	%MWr.m.c.19.15

1 counter output RESET commands, %MWr.m.c.20

The table below shows the meanings of the bits of the command word %MWr.m.c.20. The requests used are those associated with parameters (READ_PARAM, WRITE_PARAM, e.g.: READ_PARAM (IODDT_VAR1)).

Standard symbol	Type	Access	Meaning: Switch 1 RESET condition	Address
R1_ENAB	BOOL	R/W	on confirmation	%MWr.m.c.20.0
R1_PRES	BOOL	R/W	on preset	%MWr.m.c.20.1
R1_CAPT	BOOL	R/W	on capture	%MWr.m.c.20.2

1 counter output RESET commands, %MWr.m.c.21

The table below shows the meanings of the bits of the command word %MWr.m.c.21. The requests used are those associated with parameters (READ_PARAM, WRITE_PARAM, e.g.: READ_PARAM (IODDT_VAR1)).

Standard symbol	Type	Access	Meaning: Switch 1 RESET condition	Address
R1_TH0_INC	BOOL	R/W	on crossing threshold 0 + direction	%MWr.m.c.21.0
R1_TH0_DEC	BOOL	R/W	on crossing threshold 0 - direction	%MWr.m.c.21.1
R1_CAPT_GE_TH0	BOOL	R/W	if captured value ≥ at threshold 0	%MWr.m.c.21.2
R1_CAPT_LT_TH0	BOOL	R/W	if the captured value is less than the 0 threshold	%MWr.m.c.21.3
R1_TH1_INC	BOOL	R/W	on crossing threshold 1 + direction	%MWr.m.c.21.4
R1_TH1_DEC	BOOL	R/W	on crossing threshold 1 - direction	%MWr.m.c.21.5
R1_CAPT_GE_TH1	BOOL	R/W	if captured value ≥ at threshold 1	%MWr.m.c.21.6
R1_CAPT_LT_TH1	BOOL	R/W	if captured value < at threshold 1	%MWr.m.c.21.7
R1_HISP_INC	BOOL	R/W	on high setpoint crossing +direction	%MWr.m.c.21.8
R1_HISP_DEC	BOOL	R/W	on high setpoint crossing -direction	%MWr.m.c.21.9
R1_CAPT_GE_HISP	BOOL	R/W	if captured value ≥ with high setpoint	%MWr.m.c.21.10
R1_LOSP_INC	BOOL	R/W	on low setpoint crossing +direction	%MWr.m.c.21.12
R1_LOSP_DEC	BOOL	R/W	on low setpoint crossing -direction	%MWr.m.c.21.13
R1_CAPT_LT_LOSP	BOOL	R/W	if the captured value < at the low setpoint	%MWr.m.c.21.15

Details of the IODDT's implicit exchange objects of type T_COUNT_HIGH_SPEED

At a Glance

The tables below show the IODDT's implicit exchange objects of type `T_COUNT_HIGH_SPEED` which applies to the module TSX CTY 2C.

Certain objects associated with the special functions of the TSX CTY 2C module are not built into the IODDTs *(see page 320)*

List of numerical values

The table below shows different implicit exchange numerical values of the IODDT.

Standard symbol	Type	Access	Meaning	Address
CUR_MEASURE	DINT	R	Current counter value (24 active bits).	%IDr.m.c.0
CAPT	DINT	R	Captured counter value (24 active bits).	%IDr.m.c.4
SPEED	DINT	R	Speed in number of pulses per second (24 active bits)	%IDr.m.c.8
MULTIPLEX_ADDR	INT	R	Multiplexed address of the absolute encoder with parallel outputs.	%IWr.m.c.10

Software information: bits %Ir.m.c.d

The table below shows the meanings of the %Ir.m.c.d status bits.

Standard symbol	Type	Access	Meaning	Address
CH_ERROR	BOOL	R	Counting channel error bit	%Ir.m.c.ERR
ENAB_ACTIV	EBOOL	R	Counter enable active	%Ir.m.c.0
PRES_DONE	EBOOL	R	Preset done	%Ir.m.c.1
CAPT_DONE	EBOOL	R	Capture done	%Ir.m.c.2
COUNT_FLT	EBOOL	R	Counting fault	%Ir.m.c.4
CUR_MEAS_THR0	EBOOL	R	Current value ≥ at threshold 0	%Ir.m.c.5
CUR_MEAS_THR1	EBOOL	R	Current value ≥ at threshold 1	%Ir.m.c.6
COUNT_DIR	EBOOL	R	Counting direction 0 : direction - (down counting), 1: direction + (up counting)	%Ir.m.c.9
CAPT_THR0	EBOOL	R	Captured value ≥ at threshold 0	%Ir.m.10
CAPT_THR1	EBOOL	R	Captured value ≥ at threshold 1	%Ir.m.11
INC_MOD_DONE	EBOOL	R	Modulo crossing increasing direction	%Ir.m.12
DEC_MOD_DONE	EBOOL	R	Modulo crossing - direction	%Ir.m.13

Status of physical inputs/outputs, word %IWr.m.c.2

The table below shows the meanings of status word bits %IWr.m.c.2.

Standard symbol	Type	Access	Meaning	Address
ST_IA	BOOL	R	Status of physical counting input **IA**	%IWr.m.c.2.0
ST_IB	BOOL	R	Status of physical counting input **IB**	%IWr.m.c.2.1
ST_IENAB	BOOL	R	Status of physical enable input **IEna**	%IWr.m.c.2.2
ST_IPRES	BOOL	R	State of the **IPres** or **IReset** physical preset input	%IWr.m.c.2.3
ST_CAPT	BOOL	R	State of physical capture input **ICapt**	%IWr.m.c.2.4
ST_IZ	BOOL	R	Status of physical counting input **IZ**	%IWr.m.c.2.6
INVALID_MEAS	BOOL	R	Invalid measurement	%IWr.m.c.2.7
ST1_SSI_FRAME	BOOL	R	• Rank 1 status bit from the SSI frame, • or odd parity bit (SSI absolute encoder with odd parity, not checked by the module), • or least significant part of the address (absolute encoder with multiplexed parallel outputs and adaptation base unit).	%IWr.m.c.2.8
ST2_SSI_FRAME	BOOL	R	• Rank 2 status bit from the SSI frame, • or most significant part of the address (absolute encoder with multiplexed parallel outputs and adaptation base unit).	%IWr.m.c.2.9
ST3_SSI_FRAME	BOOL	R	• Rank 3 status bit from the SSI frame, • or specific fault bit on absolute encoder with parallel outputs.	%IWr.m.c.2.10
ST4_SSI_FRAME	BOOL	R	Rank 4 status bit 4 from the SSI frame	%IWr.m.c.2.11
ST_Q2	BOOL	R	**Q2** output status	%IWr.m.c.2.12
ST_Q3	BOOL	R	**Q3** output status	%IWr.m.c.2.13
ST_Q0	BOOL	R	**Q0** output status	%IWr.m.c.2.14
ST_Q1	BOOL	R	**Q1** output status	%IWr.m.c.2.15

Status of events and switches, word %IWr.m.c.3

The table below shows the meanings of status word bits %IWr.m.c.3.

Standard symbol	Type	Access	Meaning	Address
ENAB_EVT	BOOL	R	Enabling event	%IWr.m.c.3.0
PRES_EVT	BOOL	R	Event preset or reset	%IWr.m.c.3.1
CAPT_EVT	BOOL	R	Capture event	%IWr.m.c.3.2
CAPT_EDGE	BOOL	R	Capture edge direction 0 : rising edge, 1: falling edge.	%IWr.m.c.3.3

Standard symbol	Type	Access	Meaning	Address
THR0_EVT	BOOL	R	Threshold 0 crossing event	%IWr.m.c.3.5
THR1_EVT	BOOL	R	Threshold 1 crossing event	%IWr.m.c.3.6
ST_COUNT_DIR	BOOL	R	Direction when crossing threshold or setpoint 0 : direction - (down counting), 1: direction + (up counting)	%IWr.m.c.3.9
ST_LATCH0	BOOL	R	State of switch 0	%IWr.m.c.3.10
ST_LATCH1	BOOL	R	State of switch 1	%IWr.m.c.3.11
INC_MOD_EVT	BOOL	R	Modulo crossing in + direction event	%IWr.m.c.3.12
DEC_MOD_EVT	BOOL	R	Modulo crossing in - direction event	%IWr.m.c.3.13
OVERRUN_EVT	BOOL	R	Overrun events (channel level).	%IWr.m.c.3.15

Software commands, bits %Qr.m.c.d

The table below shows the meanings of command bits %Qr.m.c.d.

Standard symbol	Type	Access	Meaning	Address
DIR_ENAB	EBOOL	R/W	Direct enabling by the software	%Qr.m.c.0
DIR_PRES	EBOOL	R/W	Direct preset by the software	%Qr.m.c.1
DIR_CAPT	EBOOL	R/W	Direct capture by the software	%Qr.m.c.2
FLT_ACK	EBOOL	R/W	Fault acknowledgment	%Qr.m.c.3
ENAB_IENAB	EBOOL	R/W	Enabling the physical input **IEna**	%Qr.m.c.5
ENAB_IPRES	EBOOL	R/W	Enabling the physical input **IPRES**	%Qr.m.c.6
ENAB_ICAPT	EBOOL	R/W	Enabling the physical input **ICapt**	%Qr.m.c.7
ENAB_Q3_AUTO	EBOOL	R/W	Enabling the **Q3** output in automatic mode	%Qr.m.c.9
SET_LATCH0	EBOOL	R/W	Switch 0 set to 1	%Qr.m.c.10
SET_LATCH1	EBOOL	R/W	Switch 1 set to 1	%Qr.m.c.11
RESET_LATCH0	EBOOL	R/W	Switch 0 set to 0	%Qr.m.c.12
RESET_LATCH1	EBOOL	R/W	Switch 1 set to 0	%Qr.m.c.13
ENAB_Q0_AUTO	EBOOL	R/W	Enabling the **Q0** output in automatic mode	%Qr.m.c.14
ENAB_Q1_AUTO	EBOOL	R/W	Enabling the **Q1** output in automatic mode	%Qr.m.c.15
MANU_CMD_Q2	EBOOL	R/W	Manual command output Q2	%Qr.m.c.20
MANU_CMD_Q3	EBOOL	R/W	Manual command output Q3	%Qr.m.c.21

Reset and output commands, word %QWr.m.c.0

The table below shows the meanings of the command word bits %QWr.m.c.0.

Standard symbol	Type	Access	Meaning	Address
PRES_RESET	BOOL	R/W	Reset of hardware preset done	%QWr.m.c.0.1
CAPT_RESET	BOOL	R/W	Hardware reset capture done	%QWr.m.c.0.2
MOD_RESET	BOOL	R/W	Reset modulo crossing done	%QWr.m.c.0.4
COUNT_DIR_CHG	BOOL	R/W	Counting direction 0 : direction - (down counting), 1: direction + (up counting)	%QWr.m.c.0.9
REACTIV_Q	BOOL	R/W	Reactivation of outputs **Q0**, **Q1**, and outputs **Q2**, **Q3**	%QWr.m.c.0.10
AUTO_MOD_Q3	BOOL	R/W	Manual/automatic mode output **Q3** (frequency) 0 : manual, 1: automatic (programmable frequency)	%QWr.m.c.0.11
AUTO_MOD_Q0	BOOL	R/W	Manual/automatic output mode **Q0** 0 : manual, 1: automatic	%QWr.m.c.0.12
AUTO_MOD_Q1	BOOL	R/W	Manual/automatic output mode **Q1** 0 : manual, 1: automatic	%QWr.m.c.0.13
MANU_CMD_Q0	BOOL	R/W	Manual command output **Q0**	%QWr.m.c.0.14
MANU_CMD_Q1	BOOL	R/W	Manual command output **Q1**	%QWr.m.c.0.15

Unmask event commands, word %QWr.m.c.1

The table below shows the meanings of word bits QWr.m.c.1.

Standard symbol	Type	Access	Meaning	Address
ENAB_UNMSK	BOOL	R/W	Enable event unmasking	%QWr.m.c.1.0
PRES_UNMSK	BOOL	R/W	Unmask preset or reset event	%QWr.m.c.1.1
CAPT_UNMSK	BOOL	R/W	Unmask capture event	%QWr.m.c.1.2
THR0_UNMSK	BOOL	R/W	Unmask threshold 0 event	%QWr.m.c.1.5
THR1_UNMSK	BOOL	R/W	Unmask threshold 1 event	%QWr.m.c.1.6
INC_MOD_UNMSK	BOOL	R/W	Unmask module crossing + direction event	%QWr.m.c.1.12
DEC_MOD_UNMSK	BOOL	R/W	Unmask module crossing - direction event	%QWr.m.c.1.13

Details of the IODDT's explicit exchange objects of type T_HIGH_SPEED

At a Glance

This part shows the IODDT's explicit exchange objects of type `T_COUNT_HIGH_SPEED` which applies to the module TSX CTY 2C. It brings together word-type objects whose bits have a special meaning. This objects are described in detail below.

Example of declaration of a variable: `IODDT_VAR1` of type `T_COUNT_HIGH_SPEED`

Certain objects associated with the special functions of the TSX CTY 2C module are not built into the IODDTs *(see page 320)*

Notes

- Generally speaking, the meaning of the bits is given for state 1 of this bit. In specific cases, each state of the bit is explained.
- Not all of the bits are used.

Explicit exchange operation indicators: EXCH_STS

The table below shows the meanings of exchange control bits of the channel `EXCH_STS` (%MWr.m.c.0).

Standard symbol	Type	Access	Meaning	Address
STS_IN_PROGR	BOOL	R	Reading channel status words	%MWr.m.c.0.0
ADJ_IN_PROGR	BOOL	R	Adjust parameters exchange in progress	%MWr.m.c.0.2
RECONF_IN_PROGR	BOOL	R	Reconfiguring of the module	%MWr.m.c.0.15

Explicit exchange report: EXCH_RPT

The table below shows the meanings of report bits `EXCH_RPT` (%MWr.m.c.1).

Standard symbol	Type	Access	Meaning	Address
STS_ERR	BOOL	R	Reading fault of channel state words	%MWr.m.c.1.0
ADJ_ERR	BOOL	R	Fault when exchanging adjustment parameters	%MWr.m.c.1.2
RECONF_ERR	BOOL	R	Fault when reconfiguring the channel	%MWr.m.c.1.15

Standard channel faults, CH_FLT

The table below gives the meanings of the bits of the status word `CH_FLT` (%MWr.m.c.2). The reading can be taken by `READ_STS` (`IODDT_VAR1`).

Standard symbol	Type	Access	Meaning	Address
COUNT_INP_FLT	BOOL	R	Counting input error	%MWr.m.c.2.0
COUNT_APP_FLT	BOOL	R	Counting application fault	%MWr.m.c.2.1

Standard symbol	Type	Access	Meaning	Address
AUX_IO_FLT	BOOL	R	Auxiliary I/O	%MWr.m.c.2.3
INTERNAL_FLT	BOOL	R	Internal error or channel self-testing	%MWr.m.c.2.4
CONF_FLT	BOOL	R	Different hardware and software configurations	%MWr.m.c.2.5
COM_FLT	BOOL	R	Communication error with the PLC	%MWr.m.c.2.6
APPLI_FLT	BOOL	R	Application fault	%MWr.m.c.2.7
CH_LED0	BOOL	R	Green indicator’s command bits **CHx** (channel state) 00 = off, 01 = blinking, 11 = lit	%MWr.m.c.2.8
CH_LED1	BOOL	R		%MWr.m.c.2.9
AUX_PS_FLT	BOOL	R	Auxiliary I/O supply fault	%MWr.m.c.2.11
SHORT_CIRCUIT	BOOL	R	Short-circuit fault on a channel	%MWr.m.c.2.12
ENC_PS_FLT	BOOL	R	Supply, encoder or potential difference error	%MWr.m.c.2.13
LINE_BRK_FLT	BOOL	R	Encoder line break or short-circuit error	%MWr.m.c.2.14
SSI_FRAME_FLT	BOOL	R	Transmission of SSI absolute encoder frame fault	%MWr.m.c.2.15

Specific channel faults, %MWr.m.c.3

The table below gives the meanings of the bits of the channel status word %MWr.m.c.3. The reading can be taken by `READ_STS` (`IODDT_VAR1`)

Standard symbol	Type	Access	Meaning	Address
CH_CONF_FLT	BOOL	R	Channel configuration error	%MWr.m.c.3.0
MEASURE_OVR	BOOL	R	Measurement overrun error	%MWr.m.c.3.1
ABS_ENC_FLT	BOOL	R	Specific absolute encoder error	%MWr.m.c.3.2
OVERSPEED_FLT	BOOL	R	Overspeed fault	%MWr.m.c.3.3

Parameters

The table below shows different parameters, the requests used are (`READ_PARAM`,`WRITE_PARAM` , e.g.: `READ_STS` (`IODDT_VAR1`)

Standard symbol	Type	Access	Meaning	Address
PRESET	DINT	R/W	Preset value (parameter)	%MDr.m.c.4
THRESHOLD0	DINT	R/W	Value of threshold 0 (parameter)	%MDr.m.c.6
THRESHOLD1	DINT	R/W	Value of threshold 1 (parameter)	%MDr.m.c.8
OFFSET	DINT	R/W	Absolute encoder offset value	%MDr.m.c.10
OVERSPEED	DINT	R/W	Overspeed threshold	%MDr.m.c.12
FREQ_PERIOD	DINT	R/W	Frequency output period Q3	%MDr.m.c.22
SPEED_PERIOD	INT	R/W	Speed measurement period	%MWr.m.c.27

0 counter output SET commands, %MWr.m.c.14

The table below shows the meanings of the bits of the command word %MWr.m.c.14. The requests used are those associated with parameters (`READ_PARAM`, `WRITE_PARAM`, e.g.: `READ_STS` (`IODDT_VAR1`)).

Standard symbol	Type	Access	Meaning	Address
S0_ENAB	BOOL	R/W	on confirmation	%MWr.m.c.14.0
S0_PRES	BOOL	R/W	on preset	%MWr.m.c.14.1
S0_CAPT	BOOL	R/W	on capture	%MWr.m.c.14.2
S0_MOD_INC	BOOL	R/W	on modulo crossing in + direction	%MWr.m.c.14.4
S0_MOD_DEC	BOOL	R/W	on modulo crossing in - direction	%MWr.m.c.14.5

0 counter output SET commands, %MWr.m.c.15

The table below shows the meanings of the bits of the command word %MWr.m.c.15. The requests used are those associated with parameters (`READ_PARAM`, `WRITE_PARAM`, e.g.: `READ_STS` (`IODDT_VAR1`)).

Standard symbol	Type	Access	Meaning	Address
S0_TH0_INC	BOOL	R/W	on crossing threshold 0 + direction	%MWr.m.c.15.0
S0_TH0_DEC	BOOL	R/W	on crossing threshold 0 - direction	%MWr.m.c.15.1
S0_CAPT_GE_TH0	BOOL	R/W	if captured value ≥ at threshold 0	%MWr.m.c.15.2
S0_CAPT_LT_TH0	BOOL	R/W	if captured value < at threshold 0	%MWr.m.c.15.3
S0_TH1_INC	BOOL	R/W	on crossing threshold 1 + direction	%MWr.m.c.15.4
S0_TH1_DEC	BOOL	R/W	on crossing threshold 1 - direction	%MWr.m.c.15.5
S0_CAPT_GE_TH1	BOOL	R/W	if captured value ≥ at threshold 1	%MWr.m.c.15.6
S0_CAPT_LT_TH1	BOOL	R/W	if captured value < at threshold 1	%MWr.m.c.15.7

0 counter output RESET commands, %MWr.m.c.16

The table below shows the meanings of the bits of the command word %MWr.m.c.16. The requests used are those associated with parameters (`READ_PARAM`, `WRITE_PARAM`, e.g.: `READ_STS` (`IODDT_VAR1`)).

Standard symbol	Type	Access	Meaning	Address
R0_ENAB	BOOL	R/W	on confirmation	%MWr.m.c.16.0
R0_PRES	BOOL	R/W	on preset	%MWr.m.c.16.1
R0_CAPT	BOOL	R/W	on capture	%MWr.m.c.16.2
R0_MOD_INC	BOOL	R/W	on modulo crossing in + direction	%MWr.m.c.16.4
R0_MOD_DEC	BOOL	R/W	on module crossing - direction	%MWr.m.c.16.5

0 counter output RESET commands, %MWr.m.c.17

The table below shows the meanings of the bits of the command word %MWr.m.c.17. The requests used are those associated with parameters (READ_PARAM, WRITE_PARAM, e.g.: READ_STS (IODDT_VAR1)).

Standard symbol	Type	Access	Meaning	Address
R0_TH0_INC	BOOL	R/W	on crossing threshold 0 + direction	%MWr.m.c.17.0
R0_TH0_DEC	BOOL	R/W	on crossing threshold 0 - direction	%MWr.m.c.17.1
R0_CAPT_GE_TH0	BOOL	R/W	if captured value ≥ at threshold 0	%MWr.m.c.17.2
R0_CAPT_LT_TH0	BOOL	R/W	if captured value < at threshold 0	%MWr.m.c.17.3
R0_TH1_INC	BOOL	R/W	on crossing threshold 1 + direction	%MWr.m.c.17.4
R0_TH1_DEC	BOOL	R/W	on crossing threshold 1 - direction	%MWr.m.c.17.5
R0_CAPT_GE_TH1	BOOL	R/W	if captured value ≥ at threshold 1	%MWr.m.c.17.6
R0_CAPT_LT_TH1	BOOL	R/W	if captured value < at threshold 1	%MWr.m.c.17.7

1 counter output SET commands, %MWr.m.c.18

The table below shows the meanings of the bits of the command word %MWr.m.c.18. The requests used are those associated with parameters (READ_PARAM, WRITE_PARAM, e.g.: READ_STS (IODDT_VAR1)).

Standard symbol	Type	Access	Meaning	Address
S1_ENAB	BOOL	R/W	on confirmation	%MWr.m.c.18.0
S1_PRES	BOOL	R/W	on preset	%MWr.m.c.18.1
S1_CAPT	BOOL	R/W	on capture	%MWr.m.c.18.2
S1_MOD_INC	BOOL	R/W	on modulo crossing in + direction	%MWr.m.c.18.4
S1_MOD_DEC	BOOL	R/W	on module crossing - direction	%MWr.m.c.18.5

1 counter output SET commands, %MWr.m.c.19

The table below shows the meanings of the bits of the command word %MWr.m.c.19. The requests used are those associated with parameters (READ_PARAM, WRITE_PARAM, e.g.: READ_STS (IODDT_VAR1)).

Standard symbol	Type	Access	Meaning	Address
S1_TH0_INC	BOOL	R/W	on crossing threshold 0 + direction	%MWr.m.c.19.0
S1_TH0_DEC	BOOL	R/W	on crossing threshold 0 - direction	%MWr.m.c.19.1
S1_CAPT_GE_TH0	BOOL	R/W	if captured value ≥ at threshold 0	%MWr.m.c.19.2
S1_CAPT_LT_TH0	BOOL	R/W	if captured value < at threshold 0	%MWr.m.c.19.3
S1_TH1_INC	BOOL	R/W	on crossing threshold 1 + direction	%MWr.m.c.19.4

Standard symbol	Type	Access	Meaning	Address
S1_TH1_DEC	BOOL	R/W	on crossing threshold 1 - direction	%MWr.m.c.19.5
S1_CAPT_GE_TH1	BOOL	R/W	if captured value ≥ at threshold 1	%MWr.m.c.19.6
S1_CAPT_LT_TH1	BOOL	R/W	if captured value < at threshold 1	%MWr.m.c.19.7

1 counter output RESET commands, %MWr.m.c.20

The table below shows the meanings of the bits of the command word %MWr.m.c.20. The requests used are those associated with parameters (`READ_PARAM`, `WRITE_PARAM`, e.g.: `READ_STS` (`IODDT_VAR1`)).

Standard symbol	Type	Access	Meaning	Address
R1_ENAB	BOOL	R/W	on confirmation	%MWr.m.c.20.0
R1_PRES	BOOL	R/W	on preset	%MWr.m.c.20.1
R1_CAPT	BOOL	R/W	on capture	%MWr.m.c.20.2
R1_MOD_INC	BOOL	R/W	on modulo crossing in + direction	%MWr.m.c.20.4
R1_MOD_DEC	BOOL	R/W	on module crossing - direction	%MWr.m.c.20.5

1 counter output RESET commands, %MWr.m.c.21

The table below shows the meanings of the bits of the command word %MWr.m.c.21. The requests used are those associated with parameters (`READ_PARAM`, `WRITE_PARAM`, e.g.: `READ_STS` (`IODDT_VAR1`)).

Standard symbol	Type	Access	Meaning	Address
R1_TH0_INC	BOOL	R/W	on crossing threshold 0 + direction	%MWr.m.c.21.0
R1_TH0_DEC	BOOL	R/W	on crossing threshold 0 - direction	%MWr.m.c.21.1
R1_CAPT_GE_TH0	BOOL	R/W	if captured value ≥ at threshold 0	%MWr.m.c.21.2
R1_CAPT_LT_TH0	BOOL	R/W	if captured value < at threshold 0	%MWr.m.c.21.3
R1_TH1_INC	BOOL	R/W	on crossing threshold 1 + direction	%MWr.m.c.21.4
R1_TH1_DEC	BOOL	R/W	on crossing threshold 1 - direction	%MWr.m.c.21.5
R1_CAPT_GE_TH1	BOOL	R/W	if captured value ≥ at threshold 1	%MWr.m.c.21.6
R1_CAPT_LT_TH1	BOOL	R/W	if captured value < at threshold 1	%MWr.m.c.21.7

Section 14.3
The language objects associated with special functions

Details of language objects associated with the special functions of the TSX CTY2C module

At a Glance

The TSX CTY2C counting module has three special functions. They each have different associated language objects. These objects are not built into the IODDTs related to the counting module.

List of implicit exchange objects

The table below shows the implicit exchange objects.

Address	Type	Access	Meaning
%IDr.m.c.6	DINT	R	Time elapsed (in event task) between the capture and the last pulse (special function number 1)
%IDr.m.c.11	DINT	R	Time elapsed (in Mast or Fast task) between the capture done and the last pulse detected (special function number 1)
%Ir.m.c.16	INT	R	Correct speed (special function number 3)
%Ir.m.c.17	INT	R	Moving part stationary (special function number 3)
%Qr.m.c.16	INT	R	Reserved for special functions
%Qr.m.c.17	INT	R	Reserved for special functions
%Qr.m.c.18	INT	R	Reserved for special functions
%Qr.m.c.19	INT	R	Reserved for special functions

List of explicit exchange objects

The table below shows the explicit exchange objects.

Address	Type	Access	Meaning
%MDr.m.c.24	DINT	R/W	Target speed (special function number 3)
%MWr.m.c.26	INT	R/W	Stopping speed (special function number 3)
%MWr.m.c.28	INT	R/W	Reserved for special functions

Section 14.4
The IODDT Type T_GEN_MOD Applicable to All Modules

Details of the Language Objects of the T_GEN_MOD-Type IODDT

Introduction

Modules of Premium PLCs have an associated IODDT of type `T_GEN_MOD`.

Observations

- In general, the meaning of the bits is given for bit status 1. In specific cases, an explanation is given for each status of the bit.
- Not all bits are used.

List of Objects

The table below presents the objects of the IODDT:

Standard symbol	Type	Access	Meaning	Address
MOD_ERROR	BOOL	R	Module error bit	%Ir.m.MOD.ERR
EXCH_STS	INT	R	Module exchange control word	%MWr.m.MOD.0
STS_IN_PROGR	BOOL	R	Reading of status words of the module in progress	%MWr.m.MOD.0.0
EXCH_RPT	INT	R	Exchange report word	%MWr.m.MOD.1
STS_ERR	BOOL	R	Error detected while reading module status words	%MWr.m.MOD.1.0
MOD_FLT	INT	R	Internal error word of the module	%MWr.m.MOD.2
MOD_FAIL	BOOL	R	Internal error, inoperable module	%MWr.m.MOD.2.0
CH_FLT	BOOL	R	Channel error detected	%MWr.m.MOD.2.1
BLK	BOOL	R	Terminal block error	%MWr.m.MOD.2.2
CONF_FLT	BOOL	R	Hardware or software configuration mismatch	%MWr.m.MOD.2.5
NO_MOD	BOOL	R	Module missing or inoperative	%MWr.m.MOD.2.6
EXT_MOD_FLT	BOOL	R	Internal error word of the module (Fipio extension only)	%MWr.m.MOD.2.7
MOD_FAIL_EXT	BOOL	R	Module is unserviceable (Fipio extension only)	%MWr.m.MOD.2.8
CH_FLT_EXT	BOOL	R	Channel error detected (Fipio extension only)	%MWr.m.MOD.2.9
BLK_EXT	BOOL	R	Terminal block error detected (Fipio extension only)	%MWr.m.MOD.2.10

Standard symbol	Type	Access	Meaning	Address
CONF_FLT_EXT	BOOL	R	Hardware or software configuration mismatch (Fipio extension only)	%MWr.m.MOD.2.13
NO_MOD_EXT	BOOL	R	Module missing or inoperative (Fipio extension only)	%MWr.m.MOD.2.14

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