Modicon Micro PLCs
TSX 3705/3708/3710/3720
Implementation Manual Volume 3

eng March 2005

35004534_05

a brand of Schneider Electric

Telemecanique

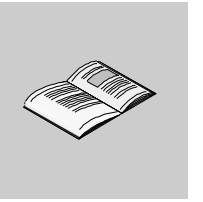
Document Set

At a Glance

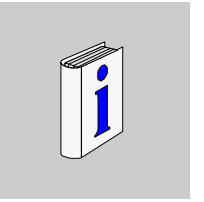
This manual comprises three volumes.

- Volume 1
  - Processors,
  - Implementation/troubleshooting/maintenance,
  - Process supplies and AS-i.
- Volume 2
  - Discrete input/output modules,
  - Discrete I/O remote module.
- Volume 3
  - Analog,
  - Counting built into the bases,
  - Position measurement,
  - Communication built into the bases,
  - Analog input/output modules,
  - Counting module,
  - Communication by PCMCIA card.

Table of Contents



About the Book



At a Glance

Document Scope

This manual describes the various standard functions of the Micro.
It includes 6 parts:

- 1 Analog built in to bases,
- 2 Counter built into bases,
- 3 Communication built into the bases,
- 4 Analog input/output modules,
- 5 Counting modules,
- 6 Communication by PCMCIA cards.

User Comments

We welcome your comments about this document. You can reach us by e-mail at techpub@schneider-electric.com

The analog input/output

I

At a Glance

Aim of this tab

This part introduces the range of analog input/output modules on offer **TSX 37**.

What's in this Part?

This part contains the following chapters:

General introduction to analog input/output modules

1

At a Glance

Aim of this chapter

This chapter gives an outline of the analog input/output modules.

What's in this Chapter?

This chapter contains the following topics:

General description of the analog modules

At a Glance

The analog input/output modules in the Micro range are half-format modules equipped with a screw terminal block.
they can be positioned in all the available positions of the PLCs **TSX 37-05/08/10** et **TSX 37-21/22**, except the first position in the base.

Description

The maximum number of analog modules it is possible to use in a Micro configuration is :

- 2 modules for a **TSX 37-05/08/10 configuration**, positioned either in the base or in the extension ;
- 4 modules for a **TSX 37-21/22 configuration**, positioned either in the base or in the extension, but with the following limitation ; a maximum of 2 modules **TSX ASZ 200** can be positioned in the base because of their power usage.

Note: When the internal cold junction compensation is used it is advisable to position the modules **TSX AEZ 414** in the positions situated in the low part of the PLC (base or extension).

Note: When an analog module is positioned in the mini extension rack of a PLC that is supplied alternatively, this mini rack should be supplied with 24 VDC.

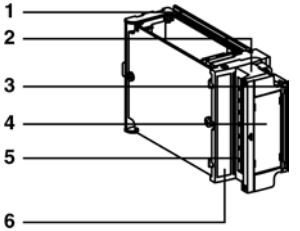
Physical description of analog modules

At a Glance

The physical description of the input/output analog modules is given below.

Illustration

The drawing shows an analog module in the Micro range.



Description

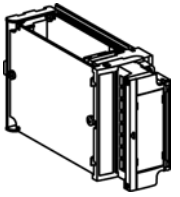
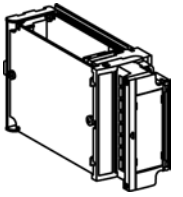
The table below describes the different elements of the analog input/output modules.

Number	Description
1	Rigid metal body, which enables the support : ● functions of the electronic card , ● grounding the module , ● guiding the module into its slot.
2	Detachable screw terminal block for connection to sensors and pre-activators.
3	Bolt to fix the module in position.
4	Access door with screw terminal block which is there both to support the address labeling of the terminal block and the channel labeling.
5	Dismountable cover, which allows for captivity of the screws and for personal protection.
6	Module reference label.

Input/output analog modules catalog

At a Glance Here is the input/output analog modules catalog.

Catalogue The table below shows the input/output analog modules catalog.

Type of module	**Half-format inputs**			**Half-format outputs**	
Illustration					
Number of channels	8		4		2
Range	+- 10 V 0-10 V	0-20 mA 4-20 mA	Thermoprobe Thermocouple +- 10 V 0-10 V 0-5 V (0-20 mA) 1-5 V (4-20 mA)	+- 10 V	+- 10 V 0-20 mA 4-20 mA
Current used on 24 VR	60 mA		86 mA	90 mA	150 mA
Current used on 5 V	30 mA		40 mA	30 mA	
Insulating channels	Common point		Differentials	Common point	
Resolution	12 bits		16 bits	11 bits + sign	
Connections	Screw terminal block				
TSX•• reference	**AEZ 801**	**AEZ 802**	**AEZ 414**	**ASZ 401**	**ASZ 200**

General rules for implementing the analog input/output modules

2

At a Glance

Aim of this chapter

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

What's in this Chapter?

This chapter contains the following topics:

Analog input/output module installation precautions

At a Glance

The precautions taken when putting the modules and terminals into place are given in detail below.

Precautions

	**WARNING** **Risk of modules deteriorating** The modules should always be assembled and dismounted when the PLC is turned off. **Failure to follow this precaution can result in death, serious injury, or equipment damage.**

	**WARNING** **Protection of the slots not used by a module** The empty positions (not occupied by a module) must be protected by a cover, which is sold in a set under the reference **TSX RKA 01**. **Failure to follow this precaution can result in death, serious injury, or equipment damage.**

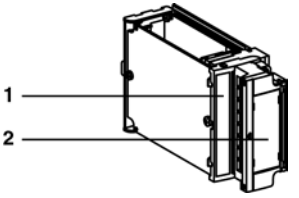
labeling of analog input/output modules

General

The labeling of the analog input/output modules is done by two labels accessible on the front of the module.

Illustration

The drawing below shows the labeling of the analog modules.



Description

The table below describes the different elements of labeling of the analog modules.

Number	Slot	Type of labeling
1	On the front of the module	A fixed module label indicates the reference and the type of the module.
2	Inside the terminal block shutter.	A removable terminal block label, which serves as a reminder of the reference and the type of module as well as giving the wiring of the terminal block. This two-sided label can be completed by user information.

Precautions and general rules concerning the wiring to the analog input/output modules

General

In order to protect the signal in relation to the exterior noises in series mode and noises in common mode, it is advisable respect to the following precautions concerning

- the nature of the conductors,
- shielding of cables,
- the association of conductors in cables,
- routing of the cables,
- the reference to ground of the sensors and pre-sensors potential.

Wiring precautions

	**WARNING** **Nature of the conductors** It is advisable to use shielded twisted pairs with a minimum section of 0.28 mm^2. **Failure to follow this precaution can result in death, serious injury, or equipment damage.**

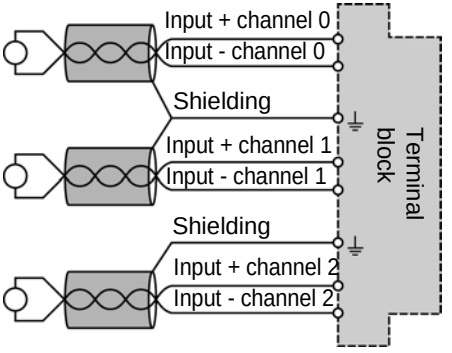
	**WARNING** **Cable shielding** It is advisable to reconnect the cable shielding, at each end, to the shielded restart terminal blocks (ground terminal blocks). **Failure to follow this precaution can result in death, serious injury, or equipment damage.**

	**WARNING** **Association of conductors in wiring** It is possible to group similar signals with the same reference to ground in multi-pair cables. **Failure to follow this precaution can result in death, serious injury, or equipment damage.**

	**WARNING** **Routing the wiring** It is advisable to keep as much distance between the TOR (all or nothing) input/output measuring wires (mostly relay outputs) and the wiring that carries power signals. **Failure to follow this precaution can result in death, serious injury, or equipment damage.**

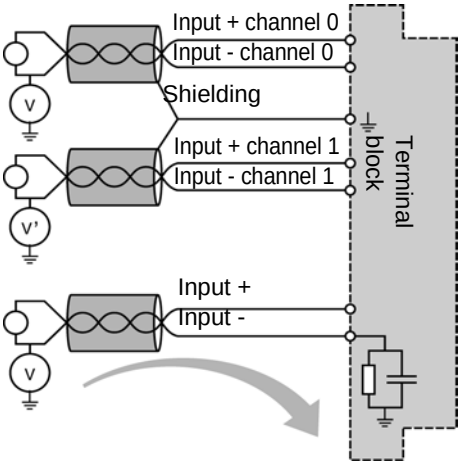
Sensors and pre-sensors

- Reference of the sensors and pre-sensors in connection to the ground :
  For all the modules which possess non-isolated channels between them, it is better to use sensors or pre-sensors, which are not referenced in connection to ground.
  To ensure that the measurement chain works well, it is recommended that the following precautions be taken :
  - The sensors should be close to each other (within several meters) ;
  - all the sensors are referenced at the same point which is reconnected to the ground of the module.



- Using the referenced sensors in connection to the ground :
  If the sensors are referenced in connection to the ground, this can in certain cases bring back a potential to the ground that was distanced on the terminal block.
  It is therefore imperative that the following rules be followed :
  - this potential should be less than the security voltage, 48 V is the limit for France ;
  - if creating a reference potential of a sensor point caused a leakage current, it would be necessary to make sure that all the leakage currents did not disturb the application.

The network to ground the RC has a value of 20 MOhms, 4.7 nF, which results in a leakage current of 2.4 micro A for a reference voltage of 48 V.



- Using the referenced pre-sensors in connection to the ground :
  There are no technical constraints specifically for referencing the pre-sensors to ground.
  For security reasons, it is however preferable to avoid bringing a ground potential distanced on the terminal block this could be very different to the ground potential in proximity.

The analog input modules TSX AEZ 801/802

3

At a Glance

Aim of this chapter

This chapter gives an outline of the analog input modules **TSX AEZ 801/802** as well as their characteristics and their connecting system.

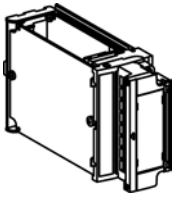
What's in this Chapter?

This chapter contains the following topics:

Introduction to TSX AEZ 801/802 modules

General

Modules **TSX AEZ 801/802**



The modules **TSX AEZ 801** et **TSX AEZ 802** offer 8 high-level analog inputs with a common point.
The module **TSX AEZ 801** offers the range + - 10 V or 0-10 V for each of its inputs, depending on the choice made in configuration.
The module **TSX AEZ 802** offers the range 0-20 mA or 4-20 mA for each of its inputs, depending on the choice made in configuration.

Circuit diagrams

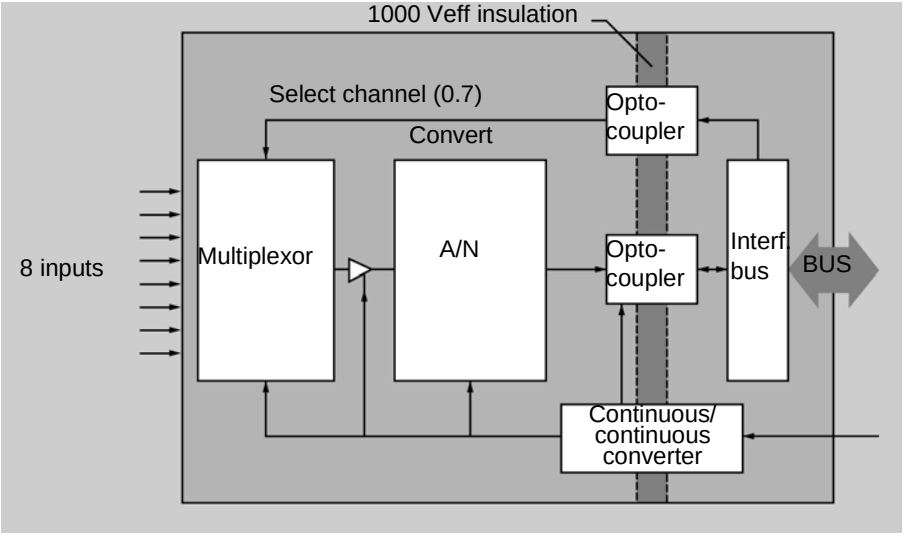
These input modules have the following functions:

- polling of input channels by static multiplexing and value acquisition;
- analog/digital conversion (12 bits) of input measurements.

These functions are then completed by the following treatments, carried out by the PLC processor:

- The check on overshooting inputs;
- Filtering the measurements;
- adapting the input measurement to the user format for display in units, which can be used directly.

Diagram of the principle:



Input processing

General

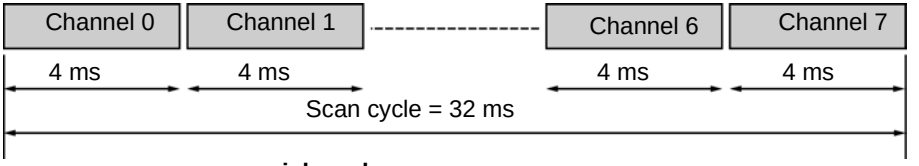
The inputs of the analog module **TSX ASZ 801** have the following functions:

- measurement timing;
- range selection and overshoot monitoring;
- sensor link monitoring;
- module behavior in the event of an overload;
- measurement filtering;
- measurement display.

Measurement timing

Measurement timing depends upon the cycle used, which is defined in configuration:

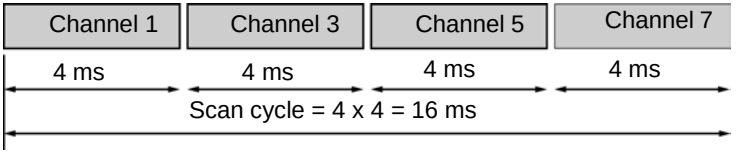
- **normal cycle**
  The input polling cycle is fixed and has a value 32 ms, independent of the number of inputs used.
  Example of a polling cycle with only channels 0, 1, 6 and 7 used:



- **quick cycle**
  Only the channels used are polled even if they are not consecutive, which means that the channel polling cycle time is improved. The channel polling cycle time is given by the formula:

  T cy (ms) = 4 ms x N

  where N = number of channels used.
  Example of a polling cycle with 4 channels used:



Note: In quick cycle channels can be assigned in FAST task. In this case, it is recommended that not too many analog input modules be assigned to FAST task as the system overhead time for processing these modules can be quite large compared to the FAST task cycle time.

Range selection and overshoot monitoring

Each module allows a choice of two ranges for each of its inputs:

- +- 10 V and 0-10 V (with a **TSX AEZ 801** module);
- 0-20 mA and 4-20 mA (with a **TSX AEZ 802** module).

The module performs an overshoot check for the chosen range. In other words it checks that the measurement is between the lower and upper terminals defined in the following tables: Outside these terminals, saturation of the measurement string is likely and an overshoot error is signaled by a usable bit by the program (% Imodule•channel•ERR).

Generally, modules allow a range overshoot of 5% on the full scale:

TSX AEZ 801 analog module			
Range	**Lower terminal**	**Upper terminal**	**Integer values available by default**
+- 10 V	-10.5 V	+10.5 V	+- 10500
0..10 V	-0.5 V	+10.5 V	- 500..10500

TSX AEZ 802 analog module			
Range	**Lower terminal**	**Upper terminal**	**Integer values available by default**
0..20 mA	-1 mA	+21 mA	- 500..10500
4..20 mA	+3.2 mA	+20.8 mA	- 500..10500

For unipolar ranges (0..10 V, 0..20 mA), the module detects a negative overshoot. An error is signaled to –5% of the scale, which allows a quicker diagnostic for implementation and in operation.

Sensor link monitoring

This monitoring is available in the range 4..20 mA. An error is detected by the **TSX AEZ 802** module configured in this range when the intensity of the current loop becomes less than 3.2 mA.

Note: The non-cabled channels of a **TSX AEZ 802** module must ideally be parametered between 0-20 mA. If this is not the case, a "sensor link" error will be signaled by the module.

Module behavior in the event of an overload

In the event of an overload, or an overshoot on the upper (10500) or lower (- 10500) terminal, the module signals a range overshoot error:

- if the overload is less than 14 VDC (positive or negative), the measurement string is saturated to the value of the terminal which has been overshot (10500 or – 10500). The overshoot is not destructive to the module;
- if the overload is between 14 and 30 VDC (positive or negative), the measurement given by the module is not significant. The overshoot is not destructive to the module;
- if the overload is greater than 30 VDC (positive or negative), it can be irreversibly destructive for the module. The range overshoot error is signaled while the module is able to do so.

Measurement filtering

The filtering performed is a first order digital filtering, with a modifiable filtering coefficient from a programming console even when the application is in RUN mode. The mathematical formula used is as follows:

$Mes_n = (1-\alpha) \times Val_n + \alpha \times Mes_{n-1}$

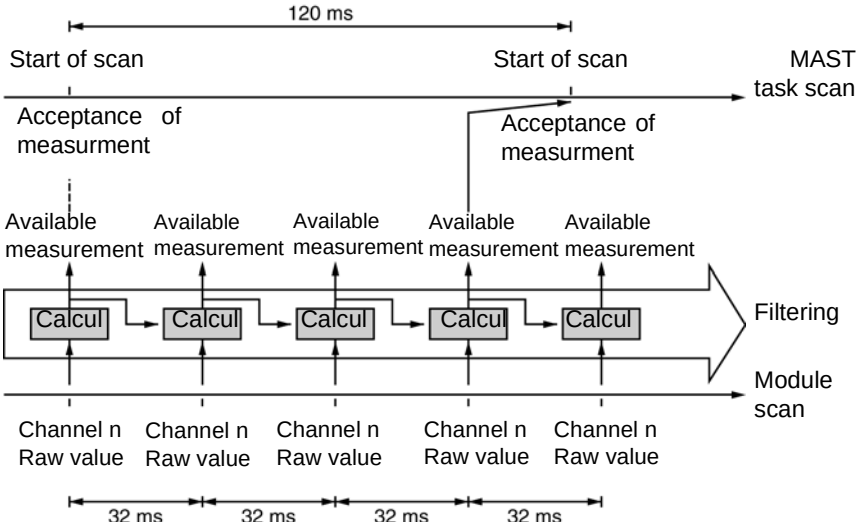
with:
α = filter efficiency ;
Val_n = gross input value ;
Mes_{n-1} = previous measurement delivered to the application ;
Mes_{n-1} = measurement delivered to the application;

In configuration the user chooses the filtering value from 7 possible values (0 to 6). This value can consequently be modified even when the application is in RUN mode.

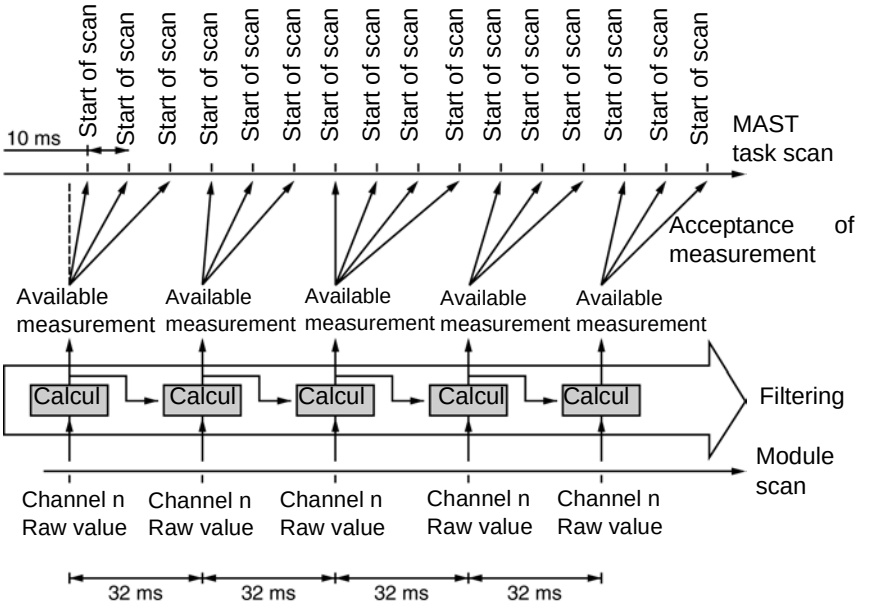
Filtering required	Value to choose	χορρεσπονδινγ a	Filtering response time	Cut-off rate (Hz)
No filtering	0	0	0	Hardware filtering
Little filtering	1 2	0.750 0.875	111 ms 240 ms	1.431 0.664
Average filtering	3 4	0.937 0.969	496 ms 1.01 s	0.321 0.158
Strong filtering	5 6	0.984 0.992	2.03 s 4.08 s	0.078 0.039

About measurement filtering :

- filtering is inhibited in quick cycle;
- the modules continue with their acquisitions and therefore their filtering calculations without considering the cycle time of the application task.
  For example:
  - if the MAST task cycle is 120 ms (module used in normal cycle), the module will have taken 3 or 4 new gross values per channel into account before the MAST task reads the value of the measurement;



- if the MAST task cycle is 10ms, the module will only provide a new value every 3 or 4 cycles of the MAST task.



Measurement display

The measurement given to the application is directly usable by the user who can choose between:

- using standard display 0-10000 (or +- 10000 for the range +- 10 V);
- parametering his/her display format giving the minimum and maximum values required.

Standard display

The values are displayed in standardized units:

- for a unipolar range 0-10 V (**TSX AEZ 801**), 0-20 mA (**TSX AEZ 802**) or 4-20 mA (**TSX AEZ 802**), they are displayed from 0 to 10000 ($0^0/_{000}$ to $10000^0/_{000}$);
- for a bipolar range +- 10 V (TSX AEZ 801), they are displayed from - 10000 to + 10000 (- $10000^0/_{000}$ to + $10000^0/_{000}$).

User display

The user can choose the range of values in which the measurements are expressed by choosing:

- the minimum terminal which corresponds to the range minimum $0^0/_{000}$ (or - $10000^0/_{000}$):
- the maximum terminal which corresponds to the range maximum $10000^0/_{000}$.

These minimum and maximum terminals are integers between - 30000 and + 30000.

Fault processing

External faults

At the time of measurement range overshoot, a sensor link fault or the transmission of an incorrect adjustment parameter, fault bit %I associated with the channel is set to 1 and the I/O indicator lamp is lit. For example, %I3.0.ERR for module channel 0 located in position 3.

When an external fault occurs, the module continues acquisition of input channels, but they are signalled as invalid.

Internal faults

Dialog with the processor as well as access to the calibration data are checked. The result of this check is contained in the module status word.

A fault on an element in the analog/digital conversion circuit most frequently causes a simultaneous range overshoot of the 8 channels.

When an internal fault occurs, the values supplied to the application are at 0. There is no acquisition of input channels.

Fault display

Analog module faults can be accessed via the centralized display block (see).

Characteristics of TSX AEZ 801/802 analog modules

At a Glance

This section describes the general features of the analog modules**TSX AEZ 801/802**.

General characteristics

This table contains the general features of the modules**TSX AEZ 801/802**.

Modules		**TSX AEZ 801**	**TSX AEZ 802**
Number of channels		8	
Analog/Digital conversion		12 bits (4096 pin) successive approximation	
Acquisition cycle time	Normal cycle	32ms	
	Quick cycle	4ms x number of channels used	
Digital filtering		1st order. Configurable time constant.	
Hardware filtering		#33Hz cut-off rate	
Insulation between channels and ground		1000 V eff.	
Insulation between channels		Shared pulse	
Insulation between bus and channels		1000 V eff.	
Input impedance		2.2 MΩ	250 Ω
Maximum voltage surge authorized on the inputs		+- 30 V direct	+- 7.5 V (+- 30 mA)
Norms		IEC 1131 - DIN 43760 - UL508 - IEC 584 ANSI MC96.1 - NF C 42-330	
Electric range		+- 10 V	0-20 mA
Full scale (FS)		10 V	20 mA
Resolution		6 mV (3800 pulses)	6 µA (3800 pulses)
Max. error at 25 °C		0.16 % PE = 16 mV	0.15 % PE = 30 µA
Max. error on the scale at 60 °C		0.46 % PE = 46 mV	0.4 % PE = 100 µA
Electric range		0-10 V	4-20 mA
Full scale (FS)		10 V	20 mA
Resolution		6 mV (1900 pulses)	6 µA (3000 pulses)
Max. error at 25 °C		0.1 % PE = 10 mV	0.15 % PE = 20 µA
Max. error on the scale 0°C to 60 °C		0.46 % PE = 46 mV	0.4 % PE = 100 µA
Maximum temperature deviation		0.068 % / 10 °C	0.054 % / 10 °C

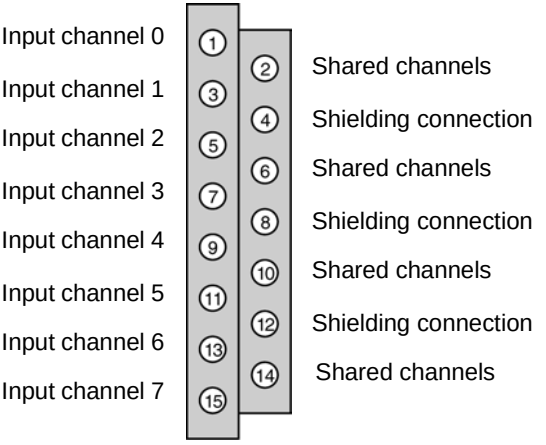
Connections for TSX AEZ 801/802 analog modules

General

The analog modules **TSX AEZ 801** and **TSX AEZ 802** have the same terminal block cabling.

Connection

The diagram below shows the terminal block cabling for the **TSX AEZ 801/802** modules.



The analog input module TSX AEZ 414

4

At a Glance

Aim of this chapter

This chapter describes the **TSX AEZ 414** analog input module, its features and its connection system.

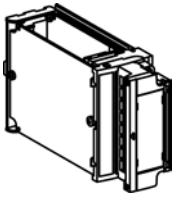
What's in this Chapter?

This chapter contains the following topics:

Introduction to the module TSX AEZ 414

General

Module **TSX AEZ 414**.



The **TSX AEZ 414** module is a multi-range acquisition string with 4 differential inputs.
For each of its inputs and depending on the choice made in configuration, the **TSX AEZ 414** module offers the range :

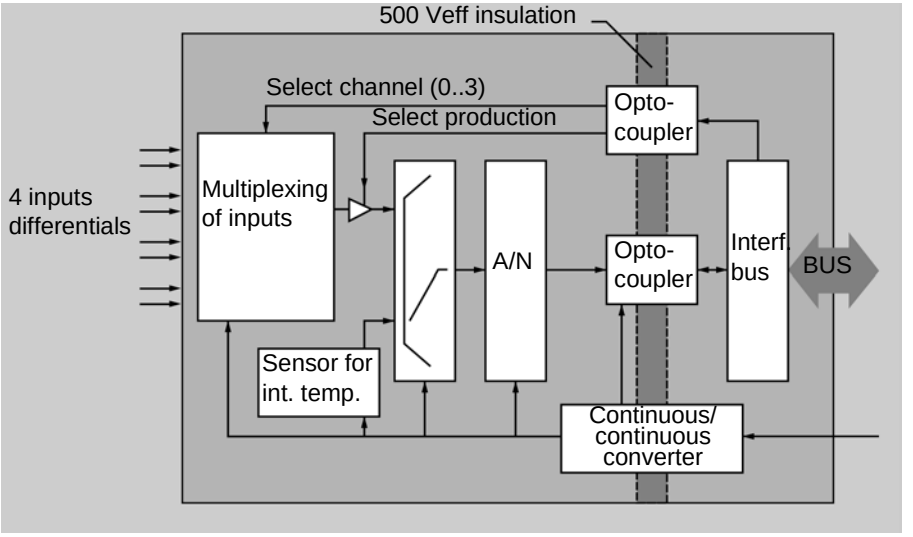
- thermocouple B, E, J, K, L, N, R, S, T or U ;
- thermoprobe Pt100 or Ni1000 in 2 or 4 yarns ;
- high level +- 10 V, 0-10 V, 0-5 V (0-20 mA with an external shunt) or 1-5 V (4-20 mA with an external shunt). It should be noted that external shunts are delivered with the product.

Circuit diagrams

This input module has the following functions:

- selection of the input range for each channel ;
- polling of input channels by multiplexing and value acquisition ;
- analog/digital conversion (16 bits) of input measurements ;
- overshoot monitoring of input values in relation to the declared range ;
- linearization for thermoprobes Pt100 and Ni1000 ;
- linearization and internal or external cold junction compensation for thermocouples ;
- user formatting of the input measurements for display in directly usable units (physical units or user range) ;
- sensor link error detection in thermocouple ranges.

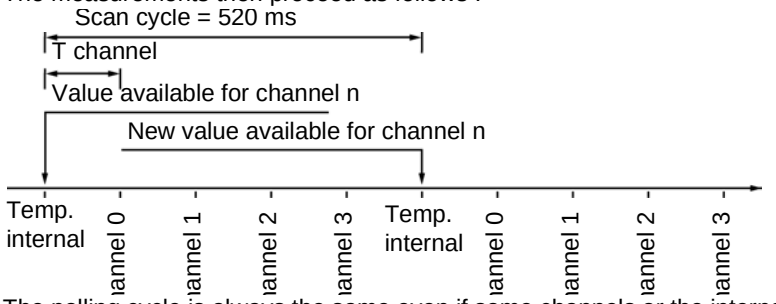
Diagram showing the principle



Input processing

Measurement timing

The cycle time of the module **TSX AEZ 414** and consequently the sampling period, are independent of the sector frequency (50 Hz or 60 Hz).
When 4 channels have been fully acquired the internal module temperature is then acquired (cold junction).
The measurements then proceed as follows :



The polling cycle is always the same even if some channels or the internal temperature are not in use ; it is equal to 520 ms.

Time	Abbreviation	Value
Channel acquisition time	T channel	104 ms
Polling cycle time	Tcycle	520 ms

Note: Initializing the module can take up to 1.5 s. In the meantime, the channel's status word signals the channels are 'not ready'.

Range selection

The user can select one of the following ranges for each channel with software :
- +- 10 V ;
- 0-10 V ;
- 0-5 V (0-20 mA) ;
- 1-5 V (4-20 mA) ;
- Pt100 ;
- Ni1000 ;
- thermocouple B, E, J, K, L, N, R, S, T and U.

The module ensures cold junction compensation for thermocouple ranges.
Cold junction temperature measurement can nevertheless be performed at the module terminal block (using a probe internal to the module) or remotely using an external Pt100 class A probe (not supplied) on channel 0.

Overshoot monitoring

Overshoot monitoring occurs whatever range has been selected.
The module checks that the measurement is between an upper and lower terminal. The measurement chain would probably saturate outside these terminals. A bit the program can use (%I module•voie•err) signals an overshoot error.
In the case of thermocouple ranges, this bit is also set to 1 if a sensor link anomaly occurs.
Overshooting the range corresponds to :

- in the case of the 'bipolar voltage' +- 10 V range, to a value outside the +- 105 % format of the full scale ;
- in the case of 'unipolar voltage' ranges, to a value outside the - 5 % and + 105 % format of the full scale ;
- in cases of thermocouple temperature measurement, either to the dynamic of the acquisition string being overshot, or to the sensor's standardized zone being overshot, or to the dynamic of the compensation temperature(- 5 °C à + 85 °C) being overshot.
  Using internal compensation in a normative atmosphere (0 °C à + 60 °C is compatible with the- 5 °C et 85 °C thresholds;
- where temperature is measured by thermo-probes, either to the dynamic of the acquisition string being overshot (due to a sensor or wiring anomaly), or to the standardized zone of the sensor being overshot.

Electric ranges

Range	Lower terminal	Upper terminal
+- 10 V	- 10.5 V	+ 10.5 V
0-10 V	- 0.5 V	+ 10.5 V
0-5 V (0-20 mA)	- 0.25 V (- 1 mA)	+ 5.25 V (+ 21 mA)
1-5 V (4-20 mA)	+ 0.8 V (+ 3.2 mA)	+ 5.2 V (+ 20.8 mA)

Thermocouple ranges

Range	Lower terminal (1)	Upper terminal (1)
B	0 °C (32 °F)	+ 1802 °C (+ 3276 °F)
E	- 270 °C (- 454 °F)	+ 812 °C (+ 1493 °F)
J	- 210 °C (- 346 °F)	+ 1065 °C (+ 1949 °F)
K	- 270 °C (- 454 °F)	+ 1372 °C (+ 2502 °F)
L	- 200 °C (- 328 °F)	+ 900 °C (+ 1652 °F)
N	- 270 °C (- 454 °F)	+ 1300 °C (+ 2372 °F)
R	- 50 °C (- 58 °F)	+ 1769 °C (+ 3216 °F)
S	- 50 °C (- 58 °F)	+ 1769 °C (+ 3216 °F)
T	- 270 °C (- 454 °F)	+ 400 °C (+ 752 °F)
U	- 200 °C (- 328 °F)	+ 600 °C (+ 1112 °F)

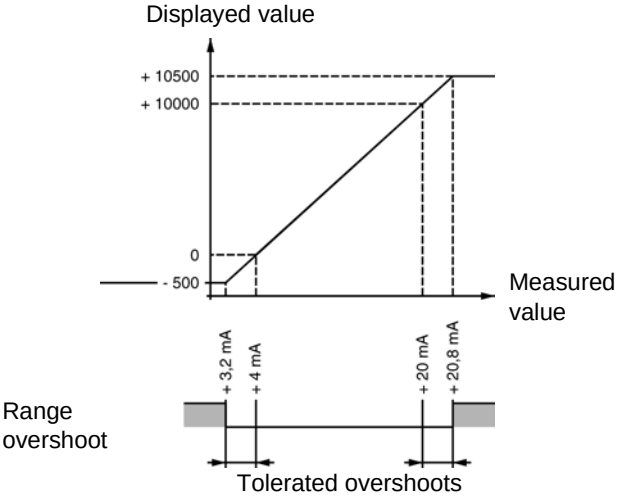
Range	Lower terminal (1)	Upper terminal (1)
Key		
(1)	The terminals are given for the following conditions : ● with internal compensation, the ambient temperature is 20 °C ● with external compensation, the cold junction temperature is 30 °C.	

Thermoprobe ranges

Range	Lower terminal (1)	Upper terminal (1)
Pt100	- 200 °C (- 328 °F)	+ 850 °C (+ 1562 °F)
Ni1000	- 60 °C (- 76 °F)	+ 110 °C (+ 230 °F)

Note: If the range is overshot the value provided saturates at the value of the overshot terminal.

Example of range overshoot : 4-20 mA range.



Sensor link monitoring

This monitoring only occurs in the case of thermocouple measurements. Nevertheless, a range overshoot in the 4-20 mA (< 3.2 mA) range does not cause a sensor link fault.
The sensor link fault corresponds to an open circuit on the thermocouple input. This is not taken into account exactly at the same time as it appears ; it can be delayed by a maximum of 3 ‘module cycles’, e.g. 1560 ms. The same occurs when the error disappears.

Module behavior in the event of an overload

In the event of an overload, or an overshoot on the upper (10500) or lower (- 10500) terminal, the module signals a range overshoot error :

- if the overload is less than 15 VDC (positively or negatively), the interchannel cross-talk is not modified. The overshoot is not destructive to the module ;
- if the overload is between 15 and 30 VDC (positively or negatively), the interchannel cross-talk disables all module inputs. The overshoot is not destructive to the module ;
- if the overload is greater than 30 VDC (positive or negative), it can be irreversibly destructive for the module. The range overshoot error is signaled while the module is able to do so.

Note: A sensor link fault with a 2-wire thermoprobe can cause saturation of the given input, at a voltage between 15 and 30 VDC thus making the module inputs unusable.

Measurement filtering

The filtering performed is a first order digital filtering, with a modifiable filtering coefficient from a programming console even when the application is in RUN mode. The user can select from 7 possible filtering values in the software configuration : - these are numbered 0 to 6 in increasing order of filtering efficiency.

Filtering required	**Value to choose**	**α corresponding**	**Filtering response time**	**Cut-off rate (Hz)**
No filtering	0	0	0	Hardware filtering (see *General characteristics, p. 49*)
Little filtering	1 2	0.750 0.875	1.81 s 3.89 s	0.0879 0.0409
Medium filtering	3 4	0.937 0.969	8.06 s 16.4 s	0.0197 0.0097
Strong filtering	5 6	0.984 0.992	33 s 66.3 s	0.0048 0.0024

Note: Measurement filtering is suspended when the execution of the MAST task is interrupted at a stop point (in debug phase). When the stop point is suppressed, filtering resumes, ignoring inputs acquired during the stop.

Measurement display

This process means the display format used to send the measurements to the user program can be selected. It is necessary to differentiate between the electric ranges and the thermocouple or thermoprobe ranges.

For electric ranges

The user can choose between two display modes :

- **standardized display** (default) : The values are displayed in standardized units ;
  - for a unipolar range 0-10 V, 0-5 V, 0-20 mA ou 4-20 mA, they are displayed between 0 and 10000 ($0^0/_{000}$ and $10000^0/_{000}$) ;
  - for the bipolar range +- 10 V, they are displayed between - 10000 and + 10000 ($-\ 10000^0/_{000}$ and $+\ 10000^0/_{000}$).
- **user display** : The user can choose the range of values in which the measurements are expressed by choosing ;
  - the minimum terminal corresponding to the minimum of the range : $0^0/_{000}$ (or $-\ 10000^0/_{000}$) ;
  - the minimum terminal corresponding to the minimum of the range : $+\ 10000^0/_{000}$).

These minimum and maximum terminals are integers between - 30000 and + 30000.

For thermocouple and thermoprobe ranges

The user can choose between two display modes :

- **Temperature display** : the values are provided in tenths of a degree by default : in standardized units ;
  - tenths of degrees Celsius, if the unit selected at configuration is °C ;
  - tenths of degrees Fahrenheit, if the unit selected at configuration is °F.
- **standardized display** : the user can select a standardized display 0-10000 (e.g. 0 à $10000^{0}/_{000}$), specifying the minimum temperatures corresponding to 0 and 10000.

Shared mode between channels

To define the shared mode between channels when they are configured in different ranges, follow the rule below :

for each channel, the size of the shared mode + the size of the useful signals (differential mode / 2) must be within the 30 V band or again +- 15 V in relation to a central reference point.

The table below shows example no. 1.

Channel	Range	MD V+ V-	MC (V+ + V-) / 2	V+ max MC + MD/2	V- max (MC + MD/2)
0	Type J	60 mV	+ 10 V	+ 10.03 V	+ 9.97 V
1	4-20 mA	5.2 V	+ 10 V	**+ 12.6 V**	+ 7.4 V
2	+- 10 V	10.5 V	- 5 V	+ 0.25	**- 10.25 V**
3	Type J	60 mV	- 10 V	- 9.97 V	- 10.03 V

In example 1, the extreme values : V+ max = + 12.6 V and V- max = - 10,25 V, are within the +- 15 V band. Therefore the shared mode is correct.

The table below shows example no. 2.

Channel	Range	MD V+ V-	MC (V+ + V-) / 2	V+ max MC + MD/2	V- max (MC + MD/2)
0	Type J	60 mV	+ 15 V	**+ 15.03 V**	+ 14.97 V
1	4-20 mA	5.2 V	+ 10 V	+ 12.6 V	+ 7.4 V
2	+- 10 V	10.5 V	- 12 V	- 6.75 V	**- 17.25 V**
3	Type J	60 mV	- 10 V	- 9.97 V	- 10.03 V

In example 2, the extreme values : V+ max = + 15.03 V et V- max = - 17.25 V, are not within the +- 15 V band. Therefore the shared mode is too large.

Fault processing

External faults

These faults correspond to a range overshoot fault (cold junction temperature input channel) or to a sensor link fault in thermocouple range.
When a fault of this type appears, the module status does not change. The channel(s) involved are always acknowledged. However, they are signalled as invalid by the fault bit %I associated with the channel.

Note: The absence of the 24 VR voltage on the "backplane" is translated as an external fault on the TSX AEZ 414 module.

Internal faults

These faults are the result of the module test performed on initilization or of the test of the measurement system, performed every 5 acquisition scans during normal operation. When a fault of this type appears, the module is inoperative and remains so until it is powered off. The result of the monitoring is contained in the module status word.

Fault display

Analog module faults can be accessed via the centralized display block (see).

Features of the analog module TSX AEZ 414

At a Glance This Section describes the general features of the analog module**TSX AEZ 414**.

General characteristics This table contains the general features of the module**TSX AEZ 414**.

Module		**TSX AEZ 414**
Number of channels		4
Analog/digital conversion		16 bit (65535 point) conversion ΣΔ
Acquisition cycle time		520ms
Digital filtering		1st order. Definable time constant.
Hardware filtering	Outage rate	255 Hz (high level)
		169 Hz (thermocouples)
		10.8 Hz (thermoprobes)
Insulation between channels and ground		500 V eff.
Insulation between channels		None
Insulation between bus and channels		500 V eff.
Input impedance (differential mode)		10 MΩ
Shared mode voltage allowed when operating between channels	Thermocouple	+- 15 V continuous
	Thermoprobe	Compatible with the chaining of sensors to the current source.
	High-level	see*Shared mode between channels, p. 47*
Shared mode voltage allowed when operating between channels and ground		+- 100 V continuous or 250 V eff.
Voltage surge permitted in input differential mode		+- 30 V continuous (powered module without external resistance of 250 Ω)
		+- 15 V continuous (non powered module, and without external resistance 250 Ω)
Voltage surge permitted in mode shared between channels		+- 20 V continuous (powered module)
		+- 5 V continuous (non powered module)
Voltage surge permitted in mode shared between channels		+- 25 mA continuous (module using/not using voltage, and with external shunts 250 Ω)
Linearization		Automatic
Cold junction compensation		Internal and automatic
		External for the Pt100 on channel 0, between - 5 °C et 85 °C
Current for thermoprobes		Continuous 1.437 mA

Module	**TSX AEZ 414**
PLC norms	IEC 1131 - IEC 68 - IEC 801 - UL508 - UL94
Sensor norms	IEC 584 - EC 751 - DIN 43760 - DIN 43710 - NF C 42-330

Module	**TSX AEZ 414**					
Electric ranges	+- 10 V	0-10 V	0-5 V	1-5 V	0-20 mA	4-20 mA
Full scale (FS)	10 V		5 V	4 V	20 mA	16 mA
Maximum error at 25 °C (1)	0.03 % FS		0.04 % FS	0.06 % FS	0.18 % FS	0.22 % FS
Maximum format 0 error at 60 °C (1)	0.30 % FS		0.33 % FS	0.4 % FS	0.47 % FS	0.59 % FS
Resolution	1 mV		500 µV	400 µV	2 µA	1.6 µ
Key						
(1)	The details for the electric ranges include the entire input dynamic					

Module	**TSX AEZ 414**	
Thermoprobe ranges	Pt100	Ni1000
Maximum error at 25 °C (1)	0.7 °C + 0.000788 x M	0.2 °C
Maximum format 0 error at 60 °C (1)	1.7 °C + 0.003753 x M	0.7 °C
Resolution	0.1 °C	
Key		
(1)	The details for the thermoprobe ranges are given using measurement M, with a 4-wire configuration.	

Module		**TSX AEZ 414**									
Thermocouple ranges		B	E	J	K	L	No.	R	S	T	U
Maximum error at 25 °C (in °C) (1)	C.E.(2)	3.6	1.3	1.6	1.7	1.6	1.5	2.6	2.9	1.6	1.3
	I.C. (3)	3.6	3.8	4.6	4.8	4.6	3.7	4.2	4.6	4.6	3.8
Maximum format 0 error at 60 °C (in °C) (1)	E.C. (2)	19.1	4.5	5.4	6.4	5.2	6.1	14.1	16.2	5.5	4.7
	I.C. (3)	19.1	5.5	6.9	7.7	6.8	7	14.5	16.6	7.1	5.9
Resolution (en °C)		0.4	0.1					0.2		0.1	
Key											
(1)	The details for the thermocouple ranges include internal or external cold junction compensation after a stabilization of 30 mn, and are given in a standard range environment.										

Module	**TSX AEZ 414**
(2)	E.C. = indicates that external compensation is being used, via channel 0 used in Pt100, with a class A well.
(3)	I.C. = indicates that internal compensation is being used ; in this case, a preferential installation must be carried out.

Module	**TSX AEZ 414**
Maximum temperature deviation	
Electric voltage range (+- 10 V, 0-10 V, ...)	0.08 % / 10 °C
Electric current range (0-5 V, 1-5 V, 0-20 mA, 4-20 mA)	0.1 % / 10 °C

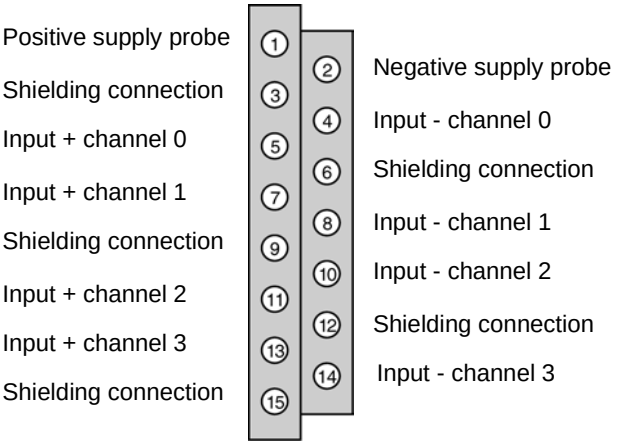
Connections for the analog module TSX AEZ 414

General

This shows the connections for the analog module **TSX ASZ 414**.

Connection

The diagram below shows the cabling for the module **TSX AEZ 414**.



Connection of current loops 0-20 mA and 4-20 mA

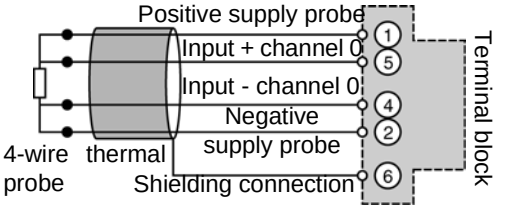
Ranges 0-5 V and 1-5 V can be used in 0-20 mA and 4-20 mA, with an external shunt of 250 Ω - 0,1 % - 1/2 Ω - 25 ppm/°C. The 4 resistances, with the module, can be cabled to the module's terminal block **TSX AEZ 414** or the intermediary block of the PLC cabinet. The resistances can also be provided for separately in batches of 4, under reference **TSX AAK2**.

Examples

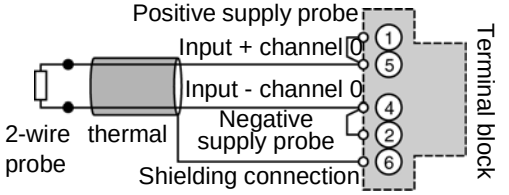
The diagrams below show examples of input cabling.

Note: The use of covered cables is recommended, and the cover should be reconnected to the terminals intended for this purpose (Shielding recovery).

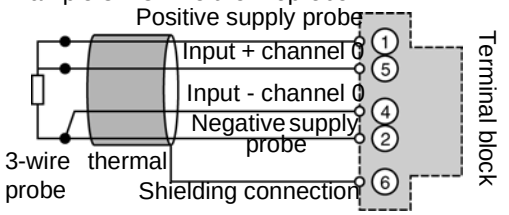
Example 1 : 4-wire thermoprobe.



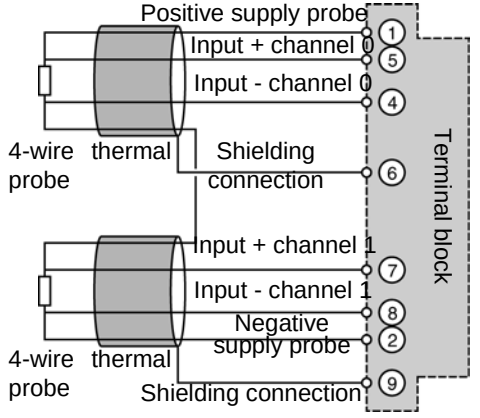
Example 2 : 2-wire thermoprobe.



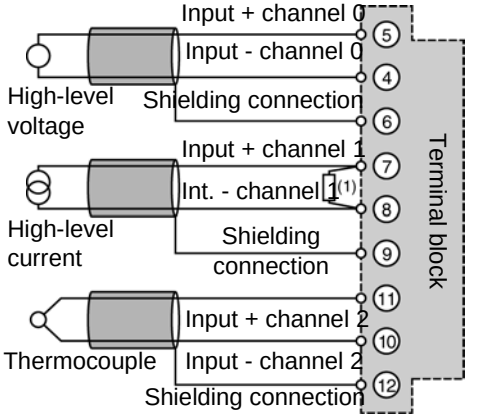
Example 3 : 3-wire thermoprobe.



Example 4 : 2 4-wire thermoprobe.



Example 5 : High-level/thermocouple encasing.



(1) External shunt 250 Ω.

Cabling recommendations for thermoprobes Pt 100 and Ni1000

General

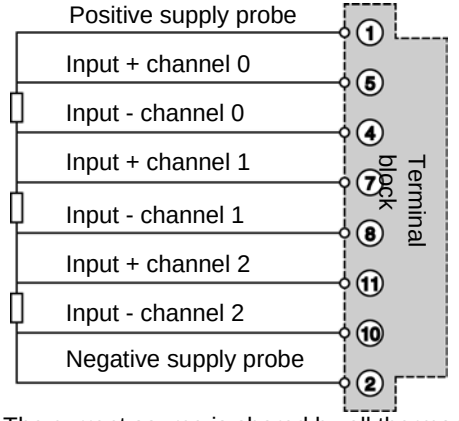
Thermoprobes Pt100 and Ni1000 can be cabled in :
- 2 wires ;
- 4 wires.

Cabling

Cabling in 2 wires :
In order to avoid measurement errors :
- thermoprobe Pt100 must be connected using a cable with a 2 mm^2 section and a maximum length of 5 m outward + return ;
- thermoprobe Pt100 must be connected using a cable with a 2 mm^2 section and a maximum length of 50 m outward + return ;

Beyond these lengths, the wire resistance causes a systematic delay of 0,1 °C per meter for the Pt100 and 0,007 °C for the Ni1000. This delay is doubled if the cable section is half the size, that is 1 mm^2. In order to compensate for this delay, use thermoprobes mounted in 4 wires.

Cabling in 4 wires :
The use of 4 wires does not provoke any theoretical errors regarding measurements, no matter what the distance between the measure and the sensor.



The current source is shared by all thermoprobes, which are mounted in series. Therefore, a fault in the cabling of the current source or of one of the thermoprobes leads to an error on all channels. Such an error will appear as a ‘range overshoot’ fault.

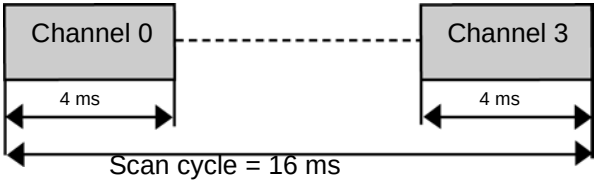
Note: The best way to cable a 3-wire thermoprobe is to cable it as a 4-wire thermal probe (See *Examples, p. 52*), between the module’s terminal block and the well itself.

Cabling and installation recommendations for thermocouples

Cabling

Cabling recommendations for thermocouples :
The following recommendations must be followed to obtain high quality measurements and expedient use of the cold junction compensation :

- in internal mode, the thermocouples should be connected to the module terminal block by covered extension or compensation cables suited to the thermocouple type used. Any intermediate connections should also be suited to the thermocouple used ;
- in external mode, the thermocouples should be connected to the terminal block where the cold junction compensation is performed. Covered extension or compensation cables suited to the thermocouple type used should be used for this. The connections use standard (brass) covered cables between the cold junction compensation and the module terminal block.

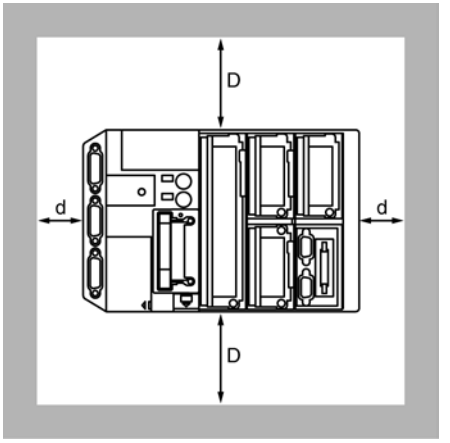


(1) Compensated cables and/or thermocouple cables.
(2) Standard brass cables.

Installation

Installation recommendations for thermocouples :

- Using the cold junction compensation :
  When measurements are made by thermocouple AND with internal compensation (and only then), the following installation instructions are recommended :
  - the PLC should not be ventilated, but convection should be natural ;
  - the ambient temperature should be less than 5 °C per hour ;
  - the **TSX AEZ 414** module should be mounted in the lower slots ;
  - the minimum clearance of the PLC configuration should be 150 mm in height (D) et 100 mm in width (d).



Installation can be performed in the open air, in a cabinet or in a box provided these recommendations are followed.
The module will still function if these installation instructions are not followed. There is however a risk that the precision of the measurements at the configured inputs in thermocouple ranges will be compromised.
In stable ambient temperature conditions, the measurement will simply be scaled down by a value which is itself stable.
These installation restrictions do not apply to thermocouple B as it is not sensitive to the cold junction compensation between 0 and 70 °C.

- Using an external cold junction compensation :
  If a thermocouple with external cold junction compensation is used, the temperature of the cold junction must be obtained using a class A Pt100 probe on channel 0 (probe not supplied). Channels 1, 2 and 3 of the module can thus be used as thermocouples.
  In this case, there are no specific restrictions on installing the module **TSX AEZ 414**.
  However, the Pt100 probe must be put near the cold junction terminal block ; this means compensated cables need not be used, but covered standard cables (brass) can be.

The analog output module TSX ASZ 401

5

At a Glance

Aim of this chapter

This chapter describes the **TSX ASZ 401** analog output module, its features and its connection system.

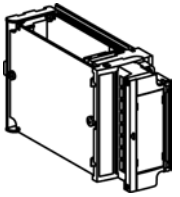
What's in this Chapter?

This chapter contains the following topics:

Introduction to the TSX ASZ 401 module

General

Module **TSX ASZ 401**.



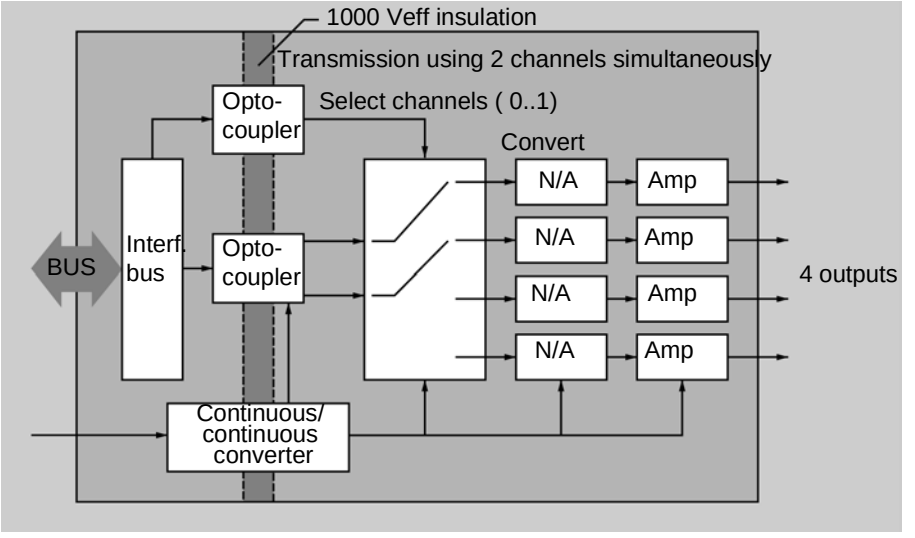
The **TSX ASZ 401** module has four shared point analog outputs, each with an range of +- 10 V available, without energy provision (without external energy supply) on a charge of at least 2 kΩ.

Circuit diagrams

This output module performs the following functions :

- taking into account digital values corresponding to analog values to be obtained at the output. A PLC task which the channels are assigned to calculates these values ;
- dialog error processing with the PLC and especially the fallback setting of the output ;
- digital/analog conversion of the output values.

Diagram showing the principle:



Output processing

Write outputs

The application gives the outputs standardized values:- 10000 à + 10000.

Overshoot monitoring

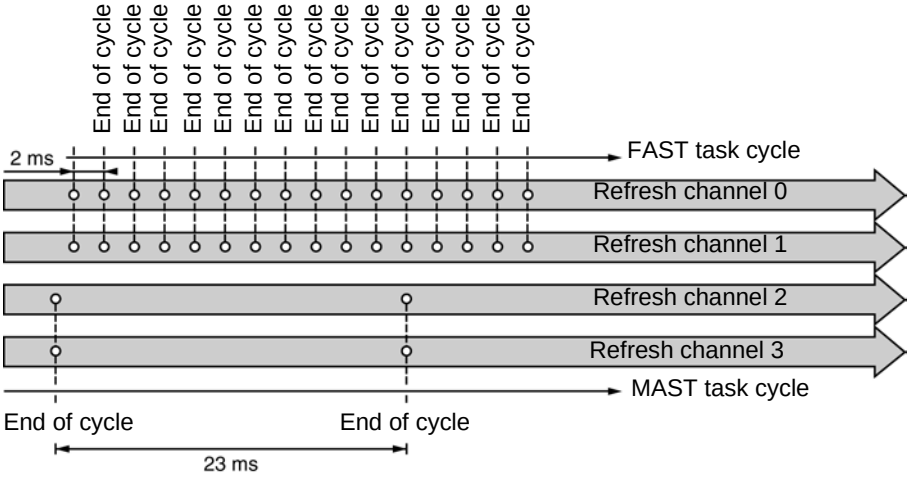
If the values the application provides are less than - 10000 or greater than + 10000, the analog outputs saturate at- 10 V or + 10 V.
Thus an overshoot bit the program can use is at 1.

Digital/analog conversion

Digital/analog conversion is done on 11 bits + sign (- 2048 to + 2047).
Rescaling occurs in the dynamic of the converter.

Refreshing outputs.

The analog module **TSX ASZ 401** outputs are refreshed in pairs at the end of the task they are assigned to.
For example, if channels 0 and 1 are assigned to the FAST task whose cycle time is 2 ms and channels 2 and 3 are assigned to the MAST task whose cycle time is 23 ms:
The channels will be refreshed as follows :



Note: As channels 0/1 and 2/3 are together, it is impossible to assign channels 0 and 2 to one task (e.g. MAST) and 1 and 3 to another (e.g. FAST).

Fault processing

Output fallback state	When the PLC stops, outputs take the fallback value 0 (4 mA in the range 4-20 mA) or are maintained at the last value transmitted according to the choice made during configuration of the module.
Fault display	Analog module faults can be accessed via the central display block (see).

Features of the analog module TSX ASZ 401

At a Glance This Section describes the general features of the analog module**TSX ASZ 401**.

General features This table contains the general features of the module**TSX ASZ 401**.

Module	**TSX ASZ 401**
Number of channels	4
Module response time	400 µs
Digital/analog conversion	11 bits + sign (4096 pulses)
Insulation between channels and ground	1000 V eff.
Insulation between channels	Shared pulse
Insulation between bus and channels	1000 V eff.
Voltage surge permitted on the outputs	+- 30 V direct
Load limit	5 mA max. (load = 2 kΩ mini)
Protection	Permanent short circuit
Maximum temperature deviation	0,096 % / 10 °C
Standards	IEC 1131 - UL508 - ANSI MC96.1 - NF C 42-330
Range	0-10 V
Full scale (FS)	10 V
Resolution	5 mV
Typical error between 0 and 60 °C	0,35 % PE = 35 mV
Maximum error at 25 °C	0,15 % PE = 15 mV
Maximum error between 0 and 60 °C	0,55 % PE = 55 mV
Range	+- 10 V
Full scale (FS)	10 V
Resolution	5 mV
Typical error between 0 and 60 °C	0,45 % PE = 45 mV
Maximum error at 25 °C	0,25 % PE = 25 mV
Maximum error between 0 and 60 °C	0,65 % PE = 65 mV

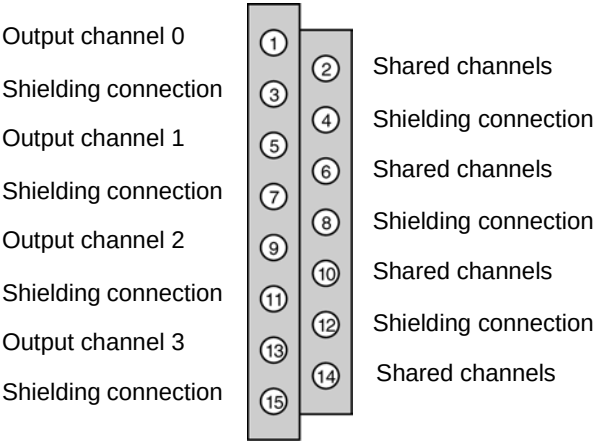
Connections for the analog module TSX ASZ 401

At a Glance

This shows the connections for the analog module **TSX ASZ 401**.

Connection

The diagram below shows the cabling for the module **TSX ASZ 401**.



The analog output module TSX ASZ 200

6

At a Glance

Aim of this chapter

This chapter describes the **TSX ASZ 200** analog output module, its features and its connection system.

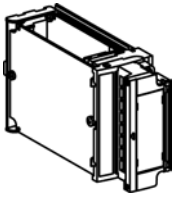
What's in this Chapter?

This chapter contains the following topics:

Introduction to the module TSX ASZ 200

General

Module **TSX ASZ 200**.



The **TSX ASZ 200** module has 2 shared pulse analog outputs and can provide the following ranges for each, without energy provision (without external supply) :

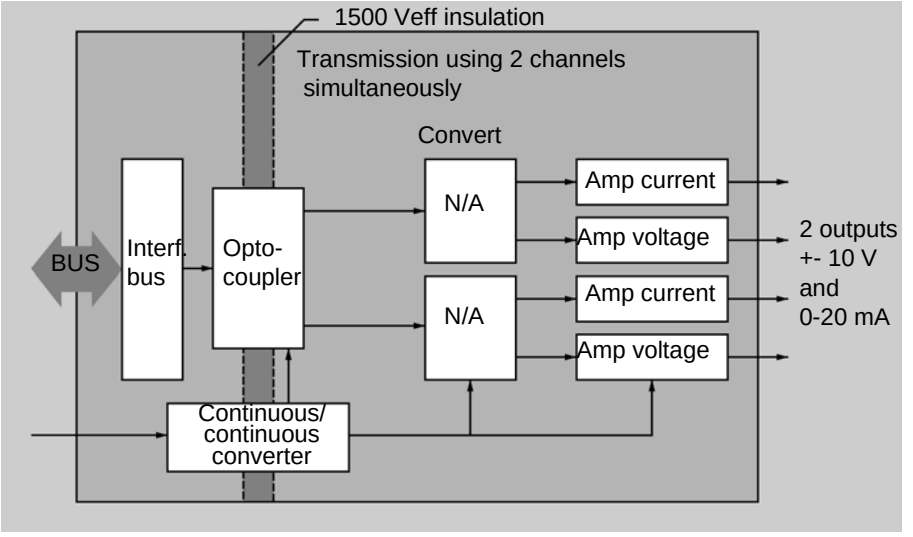
- +- 10 V on a load of 1 kΩ min ;
- 0-20 mA on a load of 600 Ω max ;
- 4-20 mA on a load of 600 Ω max.

Circuit diagrams

This output module performs the following functions :

- taking into account digital values corresponding to analog values to be obtained at the output. A PLC task which the channels are assigned to calculates these values ;
- dialog error processing with the PLC and especially the fallback setting of the output ;
- selecting the range for each output : voltage or current ;
- digital/analog conversion of the output values.

Diagram of the principle:



Output Processing

Write outputs

The application must give the outputs standardized values:

- - 10000 to + 10000 in the range +- 10 V;
- 0 to + 10000 in the 0-20 mA and 4-20 mA ranges (the value 0 corresponds to 4 mA in the range 4-20 mA).

Overflow Monitoring

In the +- 10 V range, if the values provided by the application are less than - 10000 or greater than + 10000, the analog outputs saturate at - 10 V or + 10 V.
In the 0-20 mA and 4-20 mA range, if the values provided by the application are less than 0 or greater than + 10000, the analog outputs saturate at 0 and 20 mA (in the 0-20 mA range) and at 4 and 20 mA (in the 4-20 mA range).
In all cases, an overshoot bit that the program can use is set at 1.

Digital/analog Conversion

Digital/analog conversion occurs on 11 bits + sign (- 2048 to + 2047) in the +- 10 V range and on 11 bits (0 to + 2047) in the 0-20 mA and 4-20 mA ranges.
In all cases, the module ensures verification in the dynamic of the converter.

Refreshing Outputs

The two outputs of the **TSX ASZ 200 module** are refreshed at the end of the task they are assigned to.

Fault processing

Output fallback state	When the PLC stops, outputs take the fallback value 0 (4 mA in the range 4-20 mA) or are maintained at the last value transmitted according to the choice made during configuration of the module. When dialog with the processor is lost, outputs take the fallback value 0 V (voltage range) or 0 mA (current range).
Fault display	Analog module faults can be accessed via the central display block (see).

Features of the analog module TSX ASZ 200

At a Glance This Section describes the general features of the analog module**TSX ASZ 200**.

General features This table contains the general features of the module**TSX ASZ 200**.

Module	**TSX ASZ 200**		
Number of channels	2		
Module response time	300 µs	400 µs	
Digital/analog conversion	11 bits + sign (4096 pulses)	11 bits (2048 pulses)	
Insulation between channels and ground	1500 V eff.		
Insulation between channels	Shared pulse		
Insulation between bus and channels	1500 V eff.		
Voltage surge permitted on the outputs	+- 30 V direct		
Load limit	10 mA max. (load = 1 kΩ min)	600 Ω max. (12 V max.)	
Protection	Permanent short circuit	Permanent open circuit	
Maximum temperature deviation	0,083 % / 10 °C	0,107 % / 10 °C	
Norms	IEC 1131 - UL508 - ANSI MC96.1 - NF C 42-330		
Range	+- 10 V	0-20 mA	4-20 mA
Full scale (FS)	10 V	20 mA	
Resolution	5 mV	10 µA	
Typical error between 0 and 60 °C	0,4 % FS = 40 mV	0,5 % FS = 125 µV	
Maximum error at 25 °C	0,5 % FS = 50 mV	0,57 % FS = 114 µV	
Maximum error at 60 °C	0,58 % FS = 58 mV	0,83 % FS = 166 µV	

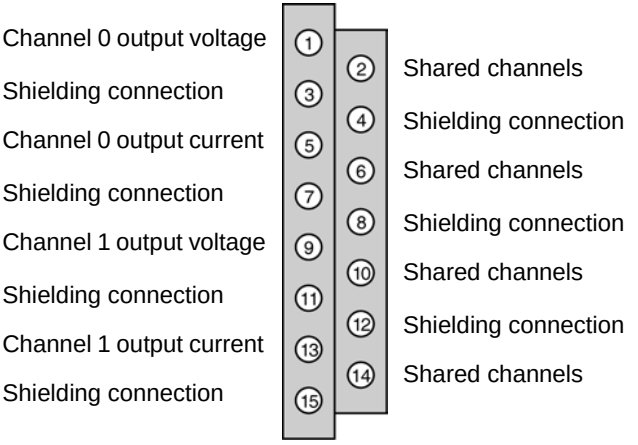
Connections for the analog module TSX ASZ 200

At a Glance

This shows the connections for the analog module **TSX ASZ 200**.

Connection

The diagram below shows the cabling for the **TSX ASZ 200 module**.



TSX AMZ 600 Analog Input Modules

7

At a Glance

Aim of this Chapter

This chapter describes the **TSX AMZ 600** analog input module, as well as its characteristics and its connection system.

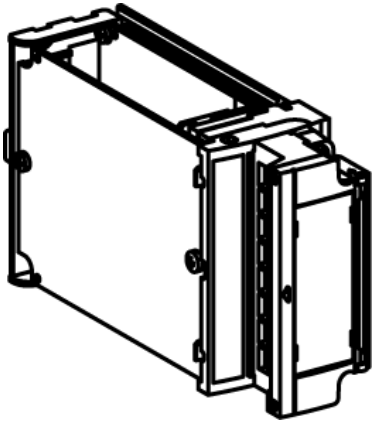
What's in this Chapter?

This chapter contains the following topics:

Introduction to the TSX AMZ 600 Module

General

This analog input/output module is half size and has a screw terminal. It can be positioned in all the available positions of the TSX 37 05/08/10 and the TSX 37 21/22, except the first position in the base.
This module boasts 4 high level analog inputs and 2 high level analog outputs.
Illustration:



TSX AMZ 600

Number of Modules per TSX

The maximum number of TSX AMZ 600 analog modules that it is possible to use in a TSX 37 configuration is:

- 2 modules for a TSX 37 05/08/10 configuration, inserted in the base or the extension,
- 4 modules for a TSX 37 21/22 configuration, inserted in the base or the extension, but with a limit of 2 modules per base, due to their consumption.

Input Functions

This module, with regard to inputs, performs the following functions:

- scanning of input channels by static multiplexing and value acquisition;
- analog/digital conversion (12 bits) of input measurements.

These functions are then completed by the following processes; carried out by the PLC processor:

- monitoring input overshoots;
- filtering the measurements;
- adapting the input measurement to the user format for display in units, which can be used directly.

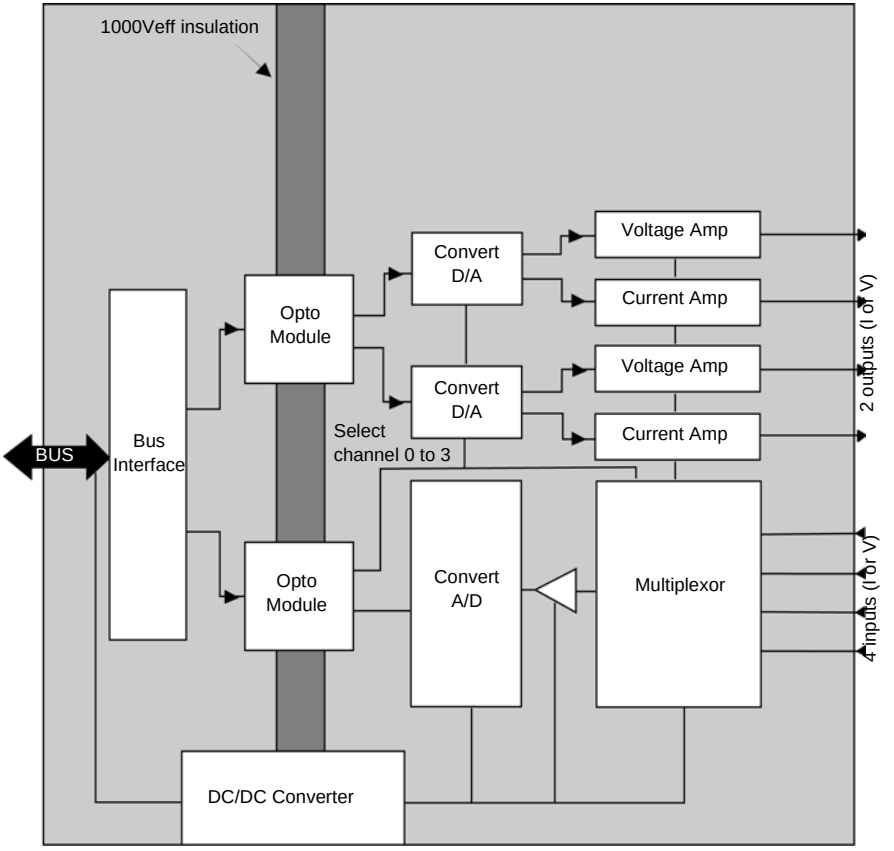
Output Functions

This module, with regard to outputs, performs the following functions:

- taking into account digital values corresponding to analog values to be obtained at the output. A PLC task which, the channels are assigned to calculates these values;
- dialog error processing with the PLC and especially output fallback,
- selecting the range for each output by voltage and by current,
- digital/analog conversion of the output values.

Diagram

Principle diagram:

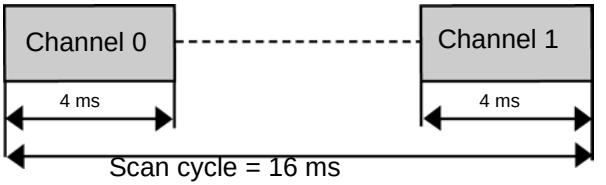


Input Processing

Measurement Timing

Measurement timing depends upon the cycle used, which is defined in configuration:

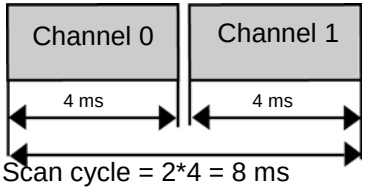
- **normal cycle**
  The input scanning cycle is fixed and has a value of 16 ms, regardless of the number of inputs used.
  Example of a scanning cycle with only channels 0 and 3 used: :



- **quick cycle**
  Only the channels used are scanned even if they are not consecutive, which means that the channel scanning cycle time is improved. The channel scanning cycle time is given by the following formula:

  T cy (ms) = 4 ms x N

  where N = number of channels used.
  Example of a scanning cycle with 4 channels used:



WARNING

Usage precautions

In quick cycle channels can be assigned in FAST task. In this case, it is recommended that not too many analog input modules be assigned to FAST task as the system overhead time for processing these modules can be quite long compared to the FAST task cycle time.

Failure to follow this precaution can result in death, serious injury, or equipment damage.

Range Selection and Overshoot Monitoring

The module offers a choice of two ranges for each of its inputs:

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

The module performs an overshoot check for the chosen range. In other words it checks that the measurement is between the lower and upper terminals defined in the following tables: Outside these terminals, saturation of the measurement string is likely and an overshoot error is signaled by a bit usable by the program (%Imodule•channel•ERR).

Generally, modules allow a range overshoot of 5% on the full scale:

TSX AMZ 600 analog module			
Range	**Lower terminal**	**Upper terminal**	**Whole values available by default**
+- 10 V	- 10.5 V	+ 10.5 V	+- 10500
0-10 V	- 0.5 V	+ 10.5 V	- 500..10500
0-20 mA	- 1 mA	+ 21 mA	- 500..10500
4-20 mA	3.2 mA	+20.8 mA	- 500..10500

For unipolar ranges (0.-10 V, 0.-20 mA), the module detects a negative overshoot. An error is signaled at –5% of the scale, which allows a quicker diagnostic for implementation and in operation.

Sensor Link Monitoring

Monitoring is available in the 4-20 mA range. An error is detected by the **TSX AMZ 600** module configured in this range, when the intensity of the current loop becomes less than 3.2 mA.

Note: The module's non-wired channels should preferably be defined in 0-20 mA, 0-10V or +/- 10V. If this is not the case, a "sensor link" error will be signaled by the module (only in the 4-20 mA range).

Module Behavior in the Event of an Overload

In the event of an overload, that is to say an overshoot of the upper (10500) or lower (- 10500) terminal, the module signals a range overshoot error:

- if the overload is less than 14 VDC (positive or negative), the measurement string is saturated to the value of the terminal which has been overshot (10500 or – 10500). The overshoot is not detrimental to the module;
- if the overload is between 14 and 30 VDC (positive or negative), the measurement given by the module is not significant. The overshoot is not detrimental to the module;
- if the overload is greater than 30 VDC (positive or negative), it can be irreversibly destructive for the module. The range overflow error is signaled as long as the module is able to do so.
- if the overload is +/ -7.5 VDC (current overload equivalent to 20 mA), the measurement string is saturated to the value of the terminal which has been overshot (10500 or -500). The overshoot is not detrimental to the module.

Measurement Filtering

The filtering performed is digital first order filtering, with a modifiable filtering coefficient from a programming console, even when the application is in RUN mode. The mathematical formula used is as follows:

$Mes_n = (1-\alpha) \times Val_n + \alpha \times Mes_{n-1}$

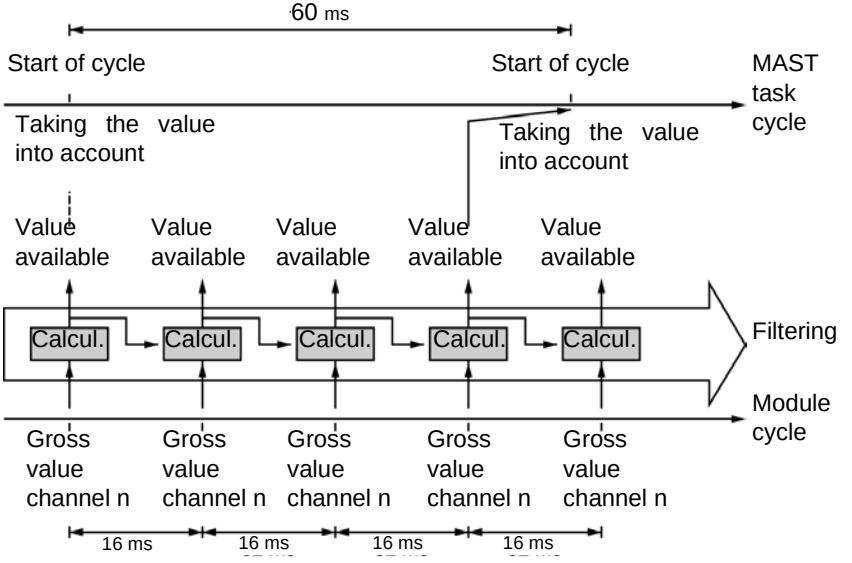
with :
α = filter efficiency;
Val_n = gross input value;
Mes_{n-1} = previous measurement delivered to the application;
Mes_{n-1} = measurement delivered to the application.

In configuration, the user chooses the filtering value from 7 possible values (0 to 6). This value can be modified later.

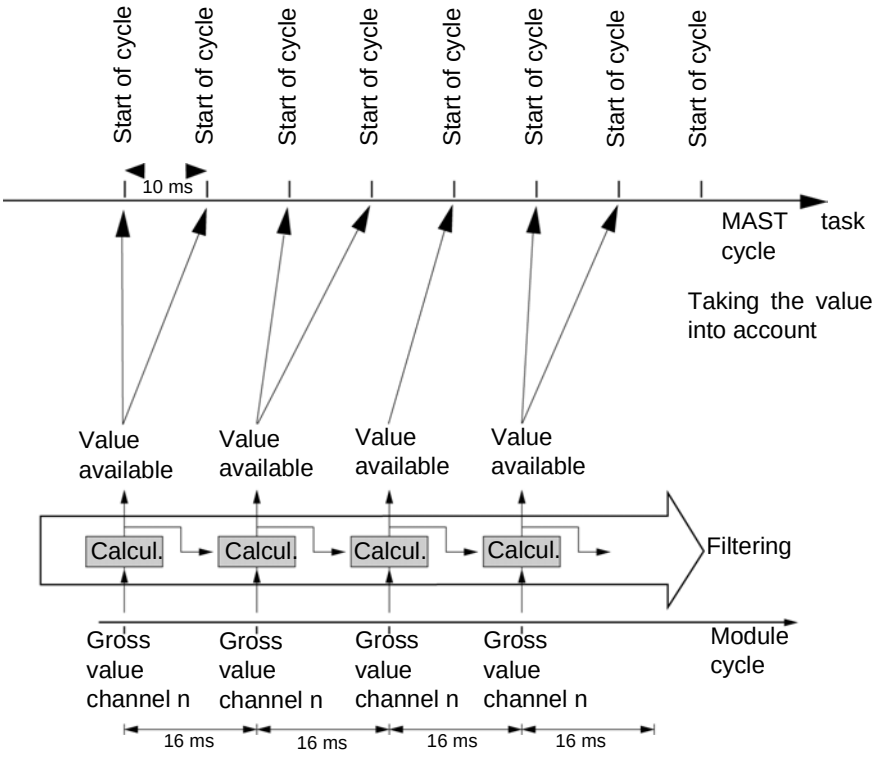
Filtering required	Value to choose	α corresponding	Filtering response time	Cut-out rate (Hz)
No filtering	0	0	0	Hardware filtering
Little filtering	1 2	0,750 0,875	111 ms 240 ms	1,431 0,664
Medium filtering	3 4	0,937 0,969	496 ms 1.01 s	0,321 0,158
High filtering	5 6	0,984 0,992	2.03 s 4,08 s	0,078 0,039

About measurement filtering:

- filtering is inhibited in rapid cycle;
- the module continue with its acquisitions and its filtering calculations without considering the cycle time of the application task.
  For example:
  - if the MAST task cycle is 60 ms (module used in normal cycle)the module will have taken into account 3 or 4 new gross values per channel before the MAST task reads the value of the measurement:



- if the MAST task cycle is 10ms, the module will only provide a new value every 2 or 3 cycles of the MAST task.



Measurement Display

The measurement given to the application can be used directly by the user who can choose between:

- using the standardized display 0-10000 (or +/- 10000 for the range +/- 10 V);
- defining his/her display format by giving the minimum and maximum values required.

Standardized display

The values are displayed in standardized units:

- for a unipolar range 0-10 V, 0-20 mA or 4-20 mA, they are displayed from 0 to 10000 ($0^0/_{000}$ to $10000^0/_{000}$) ;
- for a bipolar range +- 10 V, they are displayed from - 10000 to + 10000 (- $10000^0/_{000}$ to + $10000^0/_{000}$).

User display

The user can choose the format of values by which measurements are displayed, by choosing:

- the minimum terminal corresponding to the range $0^0/_{000}$ (or - $10000^0/_{000}$) ;
- the maximum terminal corresponding to the maximum of the range $10000^0/_{000}$.

These minimum and maximum terminals are whole numbers between - 30000 and + 30000.

Output Processing

General

The outputs of the **TSX AMZ 600** analog module have the following functions:
- write outputs ;
- overshoot monitoring ;
- digital/analog conversion;
- outputs refreshing.

Write Outputs

The application must give the outputs values in standardized format:
- - 10000 to + 10000 in the range +- 10 V;
- 0 to + 10000 in the 0-10, 0-20 mA and 4-20 mA ranges (the value 0 corresponds to 4 mA in the 4-20 mA range).

Overshoot Monitoring

In the +/- 10 V range, if the values provided by the application are less than - 10000 or greater than + 10000, the analog outputs saturate at - 10 V or + 10 V.
In the 0-10, 0-20 mA and 4-20 mA ranges, if the values provided by the application are less than 0 or greater than + 10000, the analog outputs saturate at 0 and 10V (in the 0-10V range), 0and 20 mA (in the 0-20 mA range) and at 4 and 20 mA (in the 4-20 mA range).
In all cases, an overshoot bit that the program can use is set at 1.

Digital/analog Conversion

Digital/analog conversion occurs on 11 bits + sign (- 2048 to + 2047) in the +- 10 V range and on 11 bits (0 to + 2047) in the 0-10,0-20 mA and 4-20 mA ranges.
In all cases, the module ensures verification in the dynamic of the converter.

Refreshing Outputs

The two outputs of the **TSX AMZ 600 module** are refreshed at the end of the task they are assigned to.

Characteristics of the TSX AMZ 600 Module

At a Glance

This section introduces the general characteristics of the **TSX AMZ 600** module.

General Input Characteristics

This table shows the module general input characteristics.

Number of channels		4	
Analog/digital conversion		12 bits (4096 pin) successive approximation	
Acquisition cycle time	Normal cycle	16 ms	
	Quick cycle	4ms x number of channels used	
Digital filtering		1st order, 6 digital filtering values.	
Hardware filtering		#33Hz cut-off frequency	
Insulation between channels and ground		1000 V eff.	
Insulation between channels		Shared pulse	
Insulation between bus and channels		1000 V eff.	
Input impedance		• 2.2 MΩ ιν ϖολταγε, • 250 Ω ιν χυρρεντ,	
Maximum overvoltage authorized on the inputs		• +- 30 V direct • +- 7.5 V (+- 30 mA)	
Norms		IEC 1131 - DIN 43760 - UL508 - IEC 584 ANSI MC96.1 - NF C 42-330	
Electric range		**+- 10 V**	**0-20mA**
Full scale (FS)		10 V	20 mA
Resolution		6 mV (3800 pulses)	12 µA (1900 pulses)
Max. error at 25 °C		0.16 % FS = 16 mV	0.15 % PE = 30 µA
Max. error on the 0°C to 60 °C format		0.46 % FS = 46 mV	0.4 % PE = 80 µA
Electric range		**0-10 V**	**4-20 mA**
Full scale (FS)		10 V	20 mA
Resolution		6 mV (1900 pulses)	12 µA (1500 pulses)
Max. error at 25 °C		0.1 % FS = 10 mV	0.15 % PE = 20 µA
Max. error on the 0°C to 60 °C format		0.46 % FS = 46 mV	0.4 % PE = 80 µA
Maximum temperature deviation		0.068 % / 10 °C for voltage ranges	0.054 % / 10 °C for current ranges

General Output Characteristics

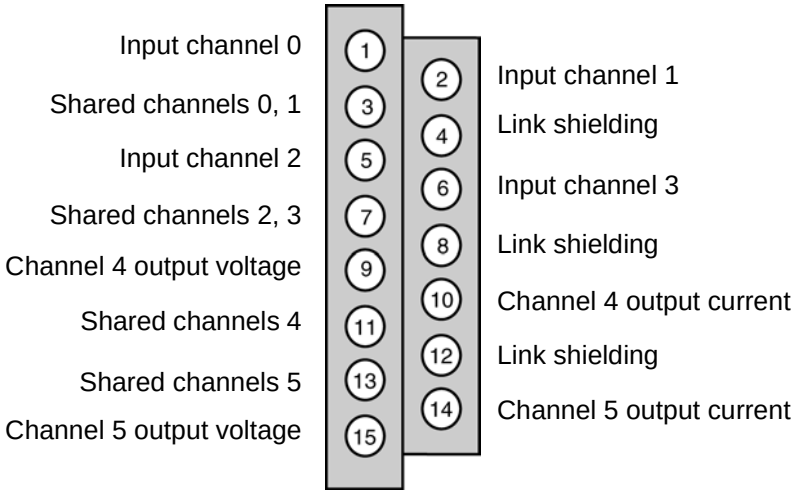
This table shows the module general output characteristics.

Number of channels	2	
Analog/digital conversion	12 bits (4096 pin) successive approximation	
Response time relative to the end of the task in which they are programmed	400 µs	
Insulation between channels	Shared pulse	
Load limit	• 10mA max voltage (Rcmin=1kΩ • 12V max current (Rcmax=600Ω)	
Electric range	**+- 10 V**	**0-20mA**
Full scale (FS)	10 V	20 mA
Resolution	6 mV (3800 pulses)	12 µA (1900 pulses)
Max. error at 25 °C	0.5 % FS = 50 mV	0.57 % FS = 114 µA
Max. error on the 0°C to 60 °C format	0.58 % FS = 58 mV	0.83 % FS = 166 µA
Electric range	**0-10 V**	**4-20 mA**
Full scale (FS)	10 V	20 mA
Resolution	6 mV (1900 pulses)	12 µA (1500 pulses)
Max. error at 25 °C	0.5 % FS = 50 mV	0.57 % FS = 114 µA
Max. error on the 0°C to 60°C format	0.58 % FS = 58 mV	0.83 % FS = 166 µA
Maximum temperature deviation	0.083 % / 10 °C in the voltage range	0.107 % / 10 °C in the current range

Connecting the TSX AMZ 600 Analog Module

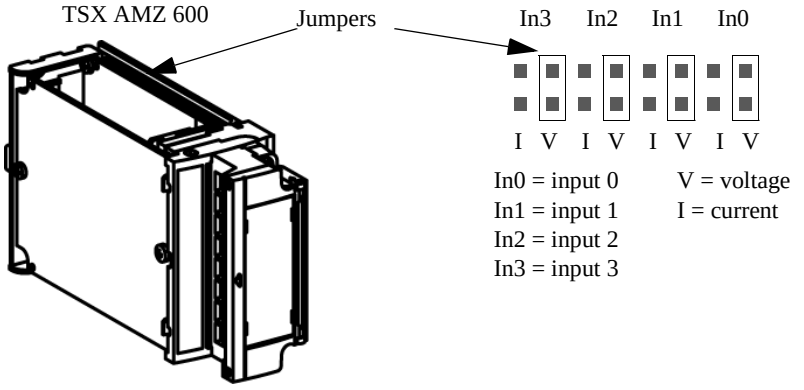
Connection

The diagram below shows the pin assignment of the TSX AMZ 600 module.



Position of the jumpers on the module

The diagram below shows how the configuration jumpers of the TSX AMZ 600 module are positioned.



- If the jumper is positioned on V, the corresponding input will be configured as an " voltage input "
- If the jumper is positioned on I, the corresponding input will be configured as a "current input"

Counter modules

II

At a Glance

General

This chapter is about counter modules.

What's in this Part?

This part contains the following chapters:

Counter modules: Introduction

8

At a Glance

Aim of this chapter

This chapter serves as a general introduction to TSX CTZ counter modules**...** .

What's in this Chapter?

This chapter contains the following topics:

Counter modules: General

General

TSX CTZ 1A/2A and TSX CTZ 2AA counter modules are half-format modules, which means that pulses with a maximum frequency of 40 KHz and 500 KHz.to be counted. They can be put in any of the available positions on a basic TSX 37 05/08/10 or TSX 3721/22 except positions 1 and 2, which can only receive one standard format module. These modules can not be placed in a mini extension rack.

The number of TSX CTZ 1A/2A/2AA counter modules that can be used in a TSX 37 module is limited to two for a TSX 37 05/08/10 PLC and 4 for a TSX 3721 or TSX 3722 PLC with certain limitations.

Functions

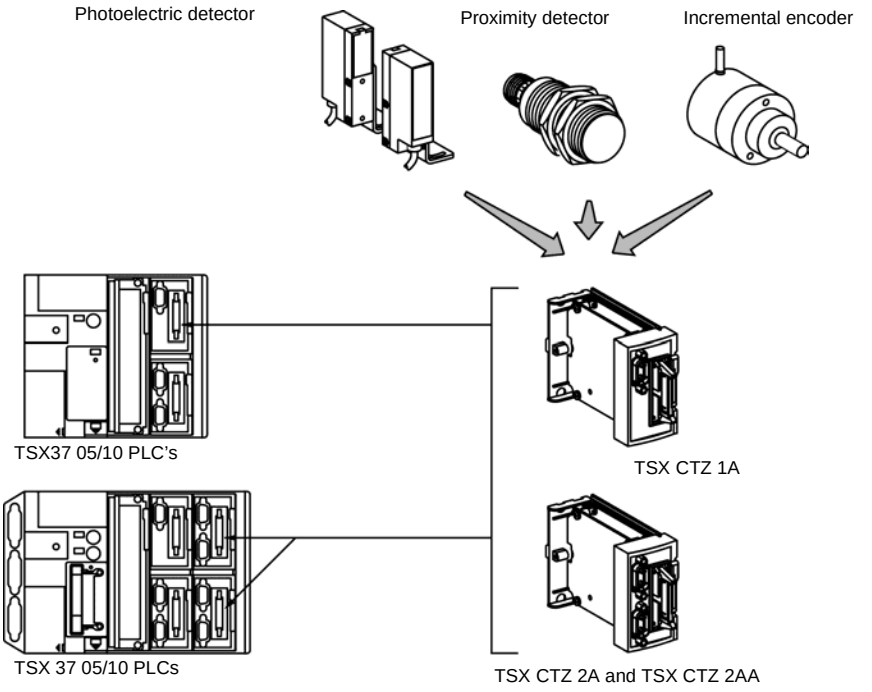
The TSX CTZ 1A/2A and TSX CTZ 2AA modules allow each channel to have up counting, down counting or up/down counting functions:

- a channel for the TSX CTZ 1A module,
- two channels for the TSX CTZ 2A/2AA module.

The sensors used on each channel can be:

- either 5 VDC or 10 to 30VDC static outputs (encoders to line transmitters to RS 422 standards or totem pole), in this case the maximum counting frequency can reach 40 kHz (TSX CTZ 1A/2A modules) or 500 kHz (TSXCTZ 2AA module),
- or mechanical contact outputs, in this case the immunity of the input receiving counting pulses is increased in order to suppress bounces on closing the contact.

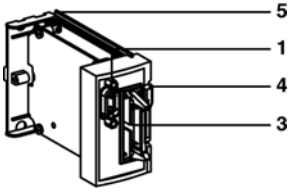
Illustration TSX, counting modules and detectors:



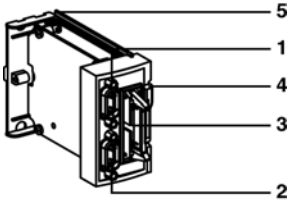
Physical description

Illustration

TSX CTZ 1A/2A/2AA modules:



TSX CTZ 1A



TSX CTZ 2A and TSX CTZ 2AA

Table of addresses

addresses and descriptions:

Address	Description
1	High density sub-D 15 connector points for connecting: ● from the counting sensors relating to the channel 0 (TSX CTZ 1A/2A/2AA modules), ● from the encoder supply in the case of using this type of sensor, ● returning from the encoder supply allowing to check that this is correctly supplied.
2	High density sub-D 15 connector points for connecting: ● from the counting sensors relating to channel 1 (only on TSX CTZ 2A and TSX CTZ 2AA modules), ● from the encoder supply in the case of using this type of sensor, ● returning from the encoder supply allowing to check that this is correctly supplied.

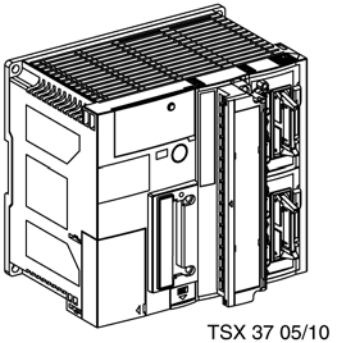
3	HE 10 type 20 pin connector used for connecting:
	● auxiliary inputs:
	  ● reset to 0 or set to the preset value,
	  ● validation counting,
	  ● capture,
	● external supplies
	  ● Encoder supply,
	  ● supply of other sensors.

4	Bolt to fix the module in position.
5	Rigid metal body, which assures the functions of: ● electronic card mount, ● grounding the module, ● guiding the module into its slot.

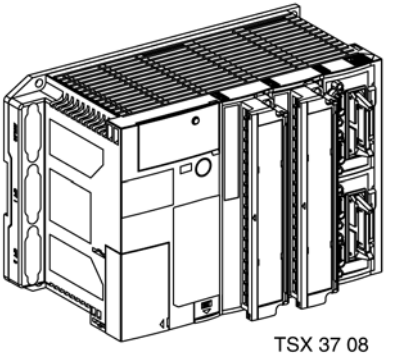
Installation and assembly of the TSX CTZ 1A/2A/2AA modules

Installation in a TSX 3705/08/10 PLC

A TSX 37 05/08/10 PLC can receive a maximum of 2 counting modules TSX CTZ 1A, TSX CTZ 2A or TSX CTZ2AA. These modules can be inserted in position 3 and 4 of a TSX 05/10 PLC and position 5 and 6 of a TSX 08 PLC.
Illustration:



TSX 37 05/10



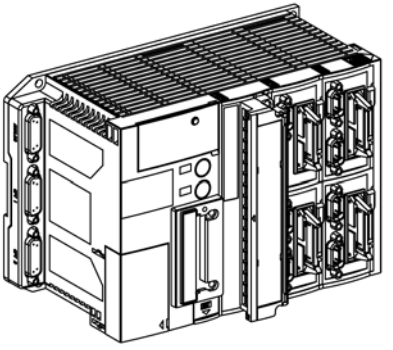
TSX 37 08

Installation of a TSX 3721/22 PLC

A TSX 3721 or TSX 3722 PLC can receive a maximum of 4 counter modules within the limit of the number of channels generated by the PLC:

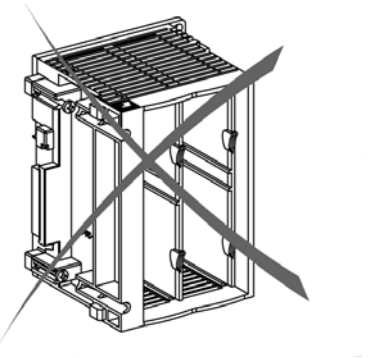
- 4 TSX CTZ 1A modules,
- 3 TSX CTZ 2A/2AA modules + 1 TSX CTZ 1A modules.

These modules can be inserted in the following positions **3**, **4**, **5** et **6**.
Illustration:



In a mini extension rack

It forbidden to assemble the TSX CTZ 1A or the TSX CTZ 2A/2AA module in a mini extension rack.
Illustration:



Counter modules: Standard functions

9

At a Glance

Aim of this chapter

This chapter introduces the different standard features of the TSX CTZ 1A/2A/2AA counter module.

What's in this Chapter?

This chapter contains the following topics:

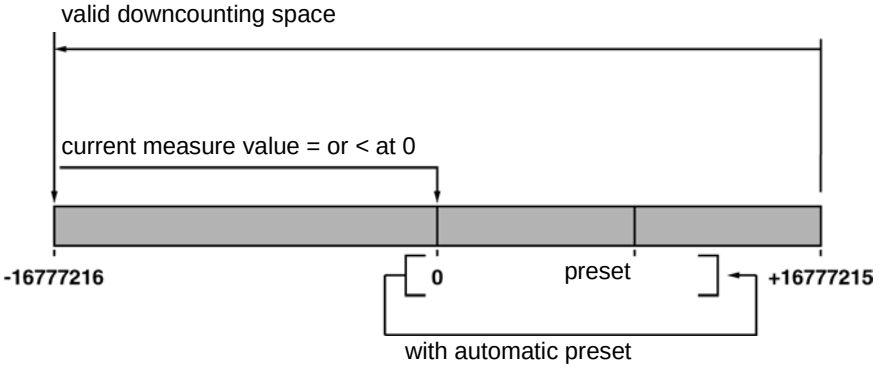
Down-counter function

General

The down counting function makes it possible to count down pulses (for 24 bits + sign) from a preset value between 0 and + 16777215 and indicates that the current value is equal to, or less than 0.
The down counting range is between –16777216 and + 16777215.

Illustration

provisional diagram:



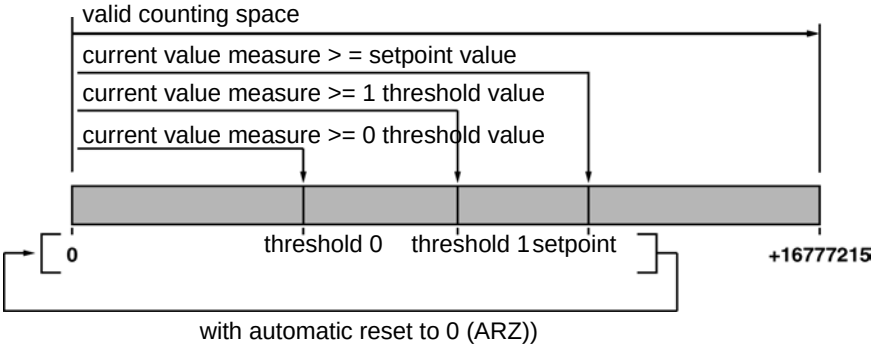
Up-counting function

General

The up counting function counts the pulses (on 24 bits +sign) from 0 value to a predefined value known as the setpoint value.
The up-counting range is between 0 and +16777215.
The change to setpoint value is reported.
The current value of the counter is always compared with two adjustable thresholds (threshold 0 and threshold 1).

Illustration

Provisional diagram:



Up/down counting function

Introduction

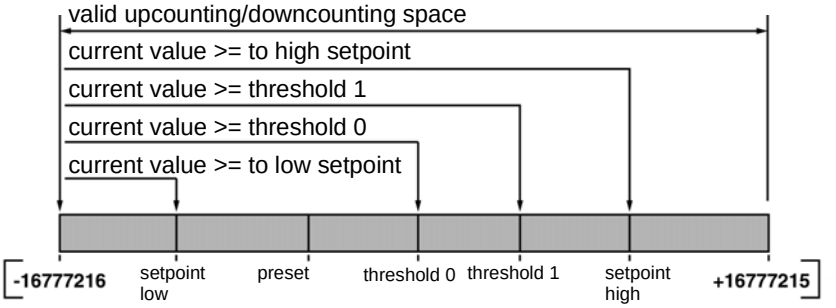
The up/down counting function carries out up and down counting pulses from the same counter (on 24 bits + sign) from a preset value in the up/down counting range.

Up/down counting mode

The up/down counting range is between –16777216 and +16777215 with the possibility of defining two setpoints (a high and a low setpoint).
The current value of the counter is always compared with two adjustable thresholds (threshold 0 and threshold 1).

Up/down counting mode illustration

Principle diagram:

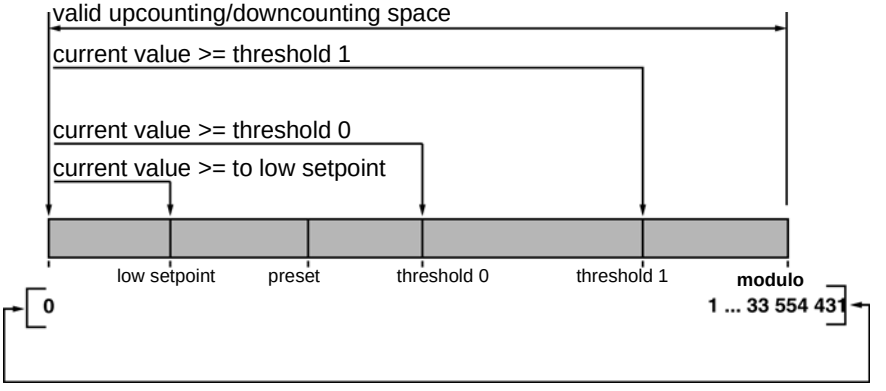


In module mode

The Up/down counting range is between 0 and the value of the modulo (from 1 to 33 554 431) with the possibility of defining a low setpoint. The current value of the counter is always compared with two adjustable thresholds (threshold 0 and threshold 1).

Modulo mode illustration

Principle diagram:



Up/down counting on TSX CTZ 1A/2A/2AA modules

Introduction

The counter modules TSX CTZ 1A/2A/2AA allow for:
- 1 up/down counter channel for the TSX CTZ 1A module,
- 2 independent up/down counter channels for the TSX CTZ 2A module; the maximum counting frequency on each channel being 40 khz,
- 2 independent up/down counter channels for the TSX CTZ 2AA module; the maximum counting frequency on each channel being 500 khz,

Up/down counting signals

The up-down counting signals relating to a channel as well as the encoder supply, which is able to generate these signals regroup on a high density 15 point Sub-D. Each up/down counting channel can receive 5 VDC or 24 VDC signals. The pulses are received on the input**IA**.

Auxiliary input

24 VDC auxiliary inputs (reset to 0: counting, set to the preset value: down counting and up/down counting validation) as well as the external supplies regroup on a HE10 type connector, which is common to both channels in the case of the TSX CTZ 2A and TSX CTZ 2AA modules.

- **Reset to 0** (up counter) **or preset** (down counter)
  Resetting to 0 (up counting) or setting the preset value (down counting) can be carried out according to one of the methods described below:
  - either when the input status is changed **IPress•** (rising or falling edge, choice carried out in configuration),
  - automatically as soon as the up counting preset value or the down counting 0 value has been reached, this choice is made in configuration),
  - directly by software,
- **validation counting**
  The up/down counting is validated according to one of the methods described below:
  - on 1 status of the signal (24 VDC) emitted on the input **IVAL•**,
  - directly by software

Note: On counting, the input IPres carries the denomination IReset in the PL7 Micro screens.

Line control input: EPSR

This input, which in general is recorded at the output "supply return" of an encoder allows for checks to make sure the supply of this is normal.
If a line break should occur on the cable holding the voltage of the encoder supply, the error caused is indicated and can be explored by the application program.

Flip-flop outputs

The up/down counter has flip-flop outputs, which can be associated via the program to physical outputs situated on output modules.

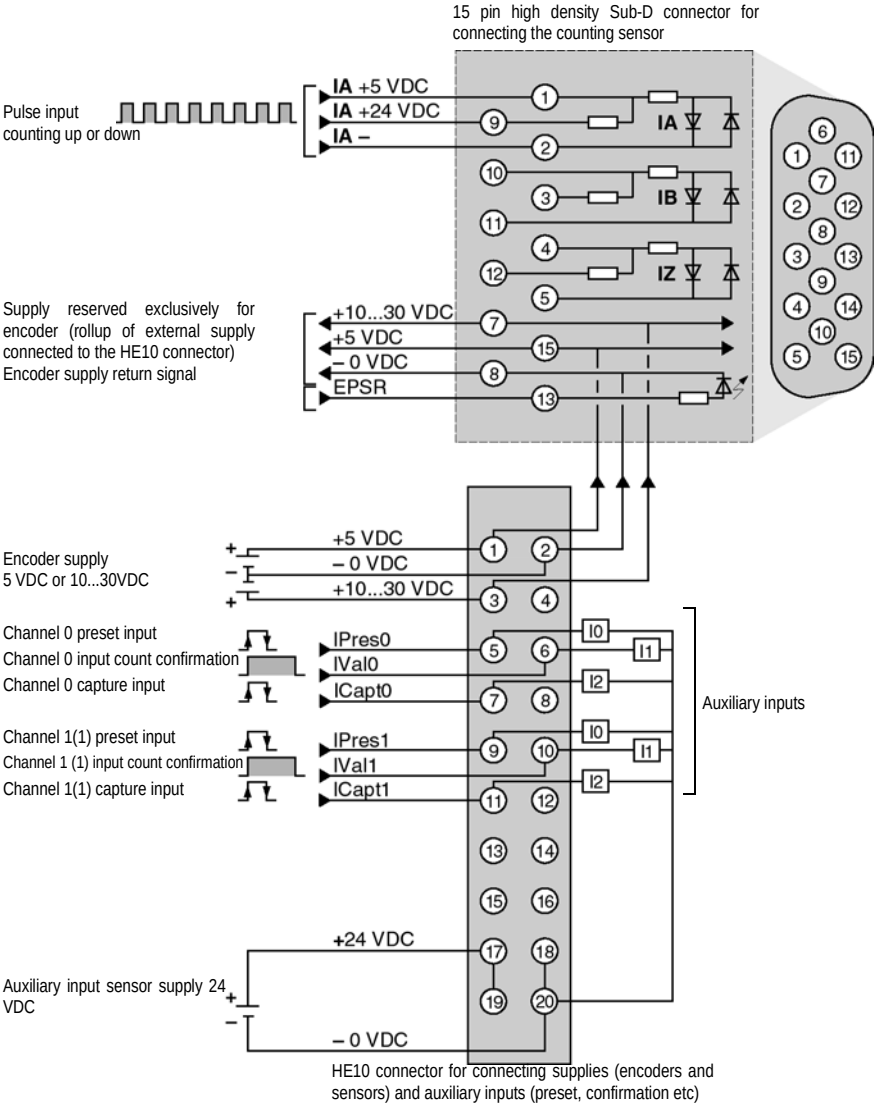
- Down counter functions: a single flip-flop output with predefined enabling and disabling conditions:
  - enabling when current value is reset to 0,
  - Disabling during the presetting,
- up counting function: two flip-flop outputs
  a flip-flop output with predefined enabling and disabling conditions:
  - enabling when setpoint value is returned to,
  - disabling as the counter is reset to 0,

  a flip-flop output with enabling and disabling conditions defined by the user in the coding matrix, accessible from the adjustment function.

Principle Diagram

General

The diagram below shows only a single 15 point sub -D 15 connector. In the case of the TSX CTZ 2A and TSX CTZ 2AA modules, the second 15 points sub-D connector relating to the second channel performs exactly the same functions.



(1) only on TSX CTZ 2A and TSX CTZ 2AA.

Up/down counting on TSX CTZ 1A/2A/2AA modules

Introduction

The counter modules TSX CTZ 1A/2A/2AA allow for:
- 1 up/down counter channel for the TSX CTZ 1A module,
- 2 independent up/down counter channels for the TSX CTZ 2A module, the maximum frequency on each channel is 40 kHz,
- 2 independent up/down counter channels for the TSX CTZ 2AA module, the maximum frequency on each channel is 500 kHz.

Up/down counting signals

There are several possibilities, which can be used on each channel:
- **First possibility:** (See *Provisional diagram 1, p. 103*)
  When using a single physical up/down counting input, the direction (up or down counting) is defined by the application by positioning a status 0 or 1 bit object
  Each up/down counting channel can receive 5VDC or 24VDC signals. The up/down counting pulses are received on the input**IA**:
- **Second possibility:** (See *Provisional diagram 2, p. 104*)
  When using a single up/down counting physical input, the direction (up or down counting) is defined by positioning the second input in status 0 or 1. The up/down counting pulses are received on the input**IA**:

Note: The pulses on the IA input will be up counted if the IB input has been at 1 for more than 3 micro-seconds, the pulses on the IA input will be down counted if the input IB has been at 0 for more than 3 micro-seconds.

- **Third possibility:** (See *Provisional diagram 3, p. 105*)
  Using two physical inputs, an up-counting input and a down-counting input: the up counting pulses are received on the **IA**input, the down counting pulses are received on the **IB**input.

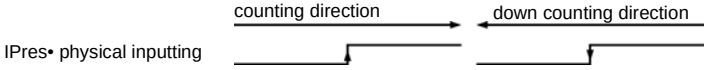
Note: All pulses on IA and IB are up counted whatever the synchronism of the signals.

- **Fourth possibility:** (See *Provisional diagram 4, p. 106*)
  Using two physical inputs with shifted signals **Pi/2** (incremental encoder signals): the up counting signals are received on the **IA input** for the A signals and on **IB** for the B signals.
  In this case, it is possible to choose a function in configuration, which can be multiplied by 1 or 4:
  - for the TSX CTZ 1A/2A modules the maximum frequency of the physical counting inputs is 40 kHz (multiplied by 1) and 40 kHz (multiplied by 4),
  - for the TSX CTZ2AA modules the maximum frequency of the physical counting inputs is 500 kHz (multiplied by 1) and 125 kHz (multiplied by 4).

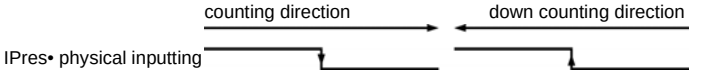
Auxiliary inputs

The auxiliary inputs of the two channels and the external supplies regroup on a HE10 type connector: set to the preset value (IPres 0: channel 0/ IPres 1: channel 1), up counting or down counting validation (IVal0: channel 0 / IVall: channel 1), capture the current value (ICapt 0: channel 0 / ICapt1: channel 1).
These inputs are only up counted if the corresponding software confirmation is performed.

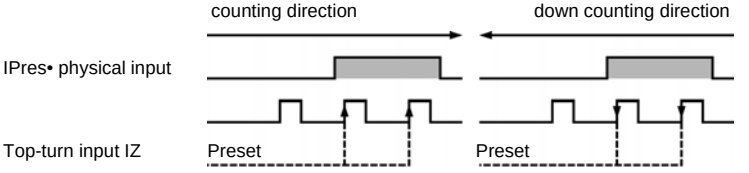
- **Preset**
  The presetting can be performed according to one of the methods described below (the choice is made in configuration):
  - on changing the status, the rising or falling edge, of the input **IPres•**,
  - on the rising edge of the input **IPres•**, if the direction of counting is (+) or on the falling edge **IPres•**, if the direction of counting is (-).



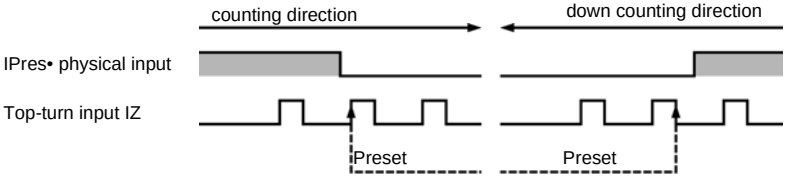
  - on the rising edge of the input **IPres•**, if the direction of counting is down (-) or on the falling edge of the input**IPres•**, if the direction of counting is (+).



  - on status 1 of the input **IPres•**, the current value will not change as long as the status of the input is 1,
  - Short cam on terminal:
    preset is taken into account:
    - if the direction is up counting (+): input **IPres•** in status 1 and Top-turn input IZ rising edge,
    - if the direction is down counting (-): input **IPres•** in status 1 and Top-turn input IZ falling edge,



  - on long cam reference point:
    Preset is taken into account on the first Top-turn input IZ rising edge, which follows the change to status 0 of the input **IPres•** in increasing direction as well decreasing direction.



- directly by software,

- **up/down counting validation**
  The up/down counting is validated according to one of the methods described below:
  - either on status 1 of the signal emitted on input **IVal•**,
  - or directly by software,
- **Capture**
  The capture command of the current value is given according to one of the methods described below:
  - on changing the status:
    - rising edge of the input **ICapt**,
    - falling edge of the input **ICapt** (only for the TSX CTZ 2AA module),
  - or directly by software,
  - either during the presetting on the physical entry IPres (mode: capture before preset on **IPres**).

Line control input: EPSR

This input, which is generally connected to the "supply return" output of an encoder, allows for checks to make sure that the encoder's supply is normal.
If a line break should occur on the cable holding the voltage of the encoder supply, the error caused is indicated and can be explored by the application program.

Counter outputs

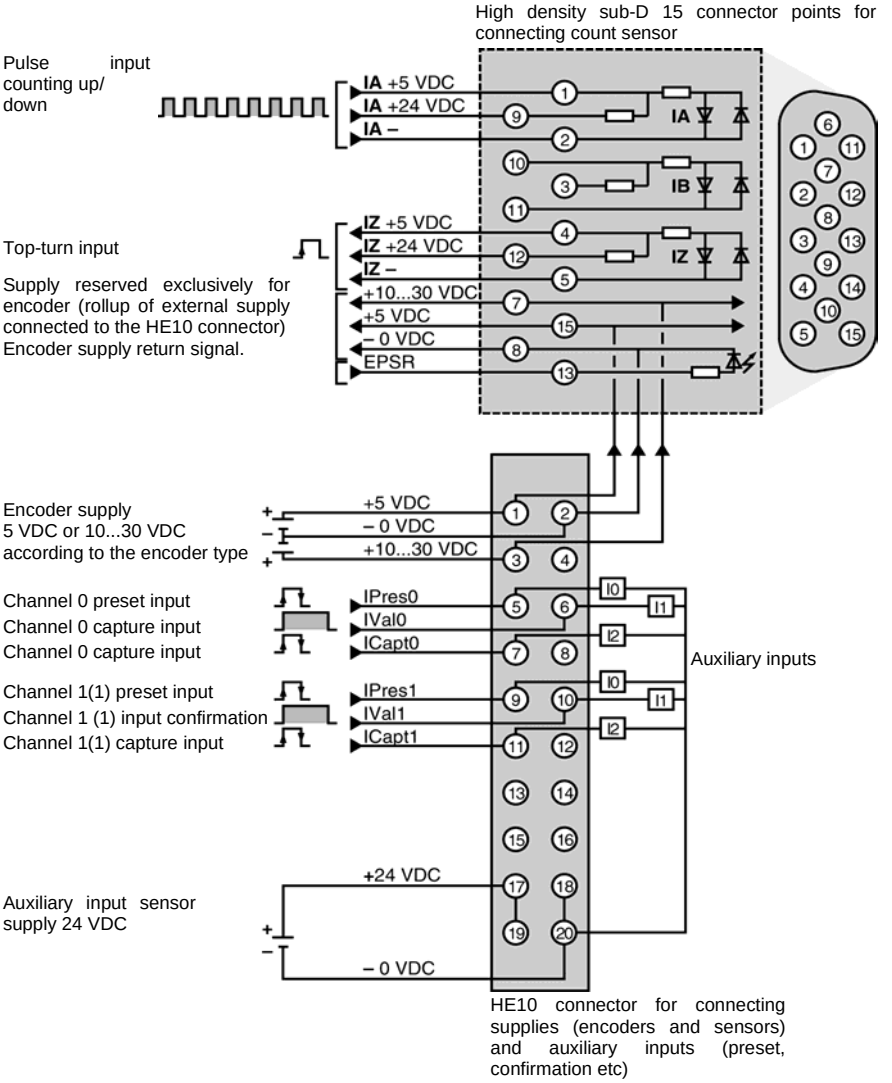
The up/down counter has two counter outputs, which can be associated via the program to physical outputs situated on output modules.
These two counter outputs with enabling and deenabling conditions defined by the user in the coding matrix, accessible from the adjustment function.

Note: the provisional diagrams in the following pages are not shown in their entirety:
- in the case of TSX CTZ 2A/2AA modules, a second high density 15 point sub-D connector allows connection to the counting sensor relating to channel 1, it is shown in exactly the same way,
- on the provisional diagrams 2, 3 and 4 the HE10 connector is not shown, see provisional diagram 1.

Provisional diagram 1

General

Using a single physical up/down counting input, the direction (up/down counting) being defined by the application:

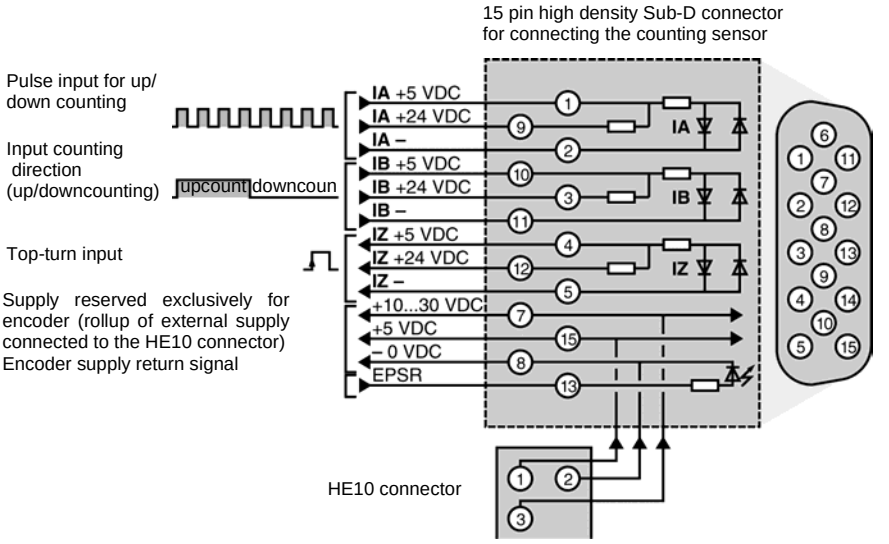


(1) only on TSX CTZ 2A module.

Provisional diagram 2

General

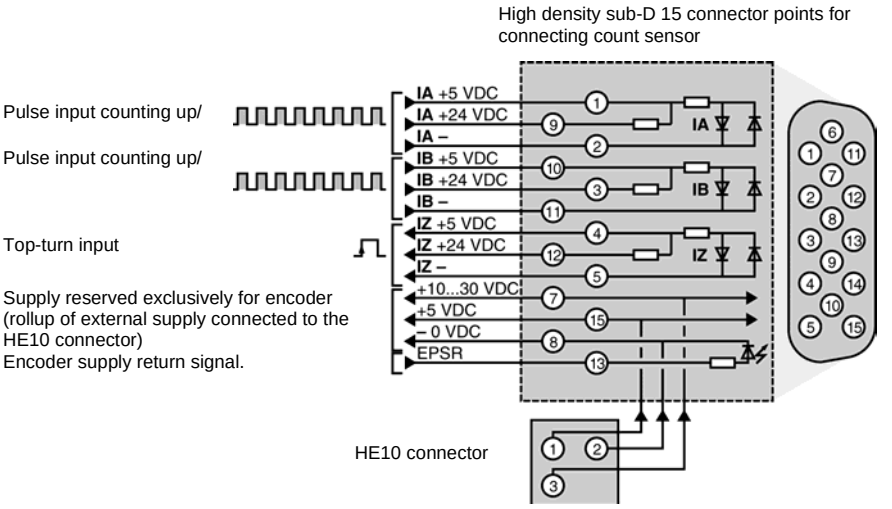
When using a single up/down counting physical input, the direction (up or down counting) is defined by positioning the second input in status 0 or 1.



Provisional diagram 3

General

Using two physical inputs, an up-counting input and a down-counting input:



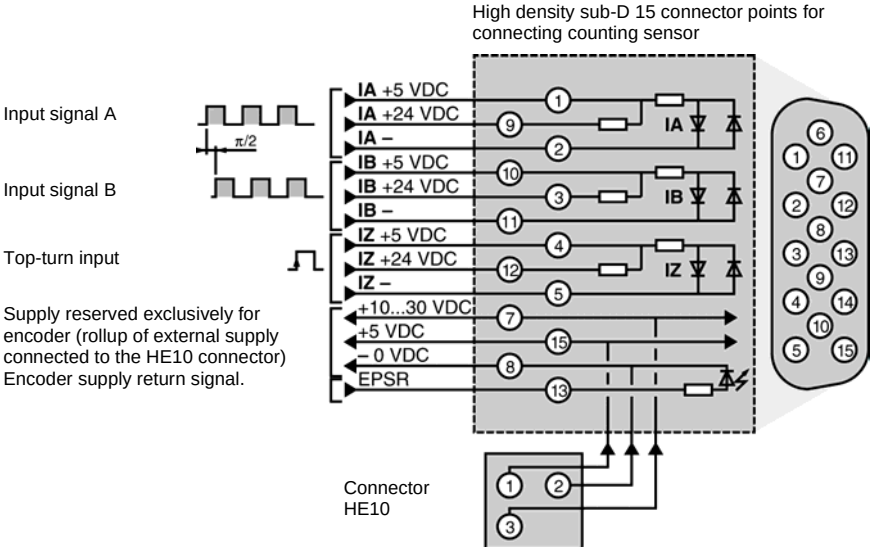
Provisional diagram 4

General

Using two physical inputs with shifted signals **Pi/2** (incremental encoder signals) with the possibility to multiply by 1 or 4:

- with multiplication by 1: the up/down counting is done on the rising edge of the IB input,
- with multiplication by 4: the up/down counting is done on the rising and falling edges of the IA and IB inputs.

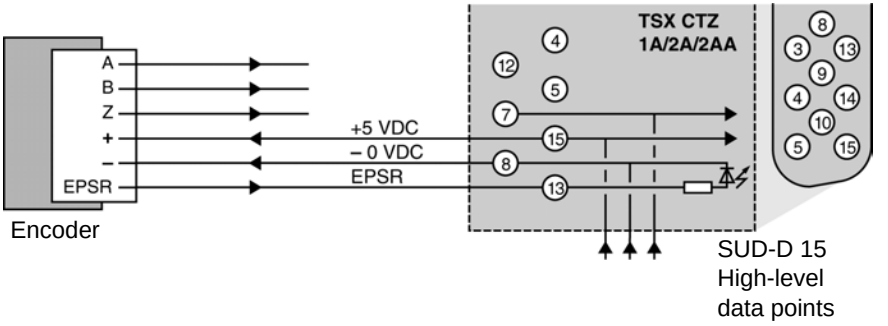
Illustration:



How the EPSR is connected

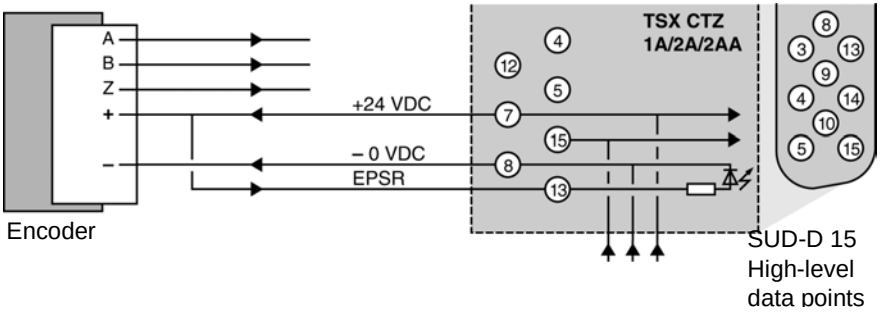
Counting up or down with an encoder with a "send supply" output

The EPSR input is connected to the "send supply" encoder output:



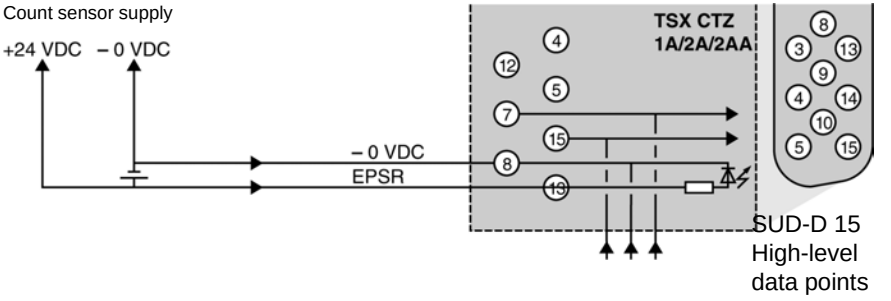
Counting up or down with an encoder without a "send supply" output

The EPSR input is connected to the + of the encoder supply, as shown:



Counting up or down with inductive proximity detector type sensors (ddp)

The EPSR input is connected to the + of the counting sensors' supply; the –0VDC output is connected to the – of the counting sensors' supply:



Implementing up counting

10

At a Glance

Aim of this chapter

This chapter is about 40KHz or 500kHz implementing up counting on TSX CTZ 1A/2A/2AA.

What's in this Chapter?

This chapter contains the following topics:

Number of channels managed by the TSX 37 PLC

General

All the TSX 37 (TSX 37 05/08/10/21/22) PLCs can manage several counting channels, and according to the TSX 37 PLC type, they can have:

- two 500 Hz counting channels on discrete inputs,
- two built-in 10 kHz counting channels,
- one or more counting channels on the TSX CTZ 1A/2A 40 kHz or TSX CTZ 2AA 500 kHz modules (module compatible with processors of a version above 2).

Maximum number of counting modules

The maximum number of counting modules which can be installed on a TSX 37 PLC depends on the number of channels used when counting 500 Hz and 10 kHz, not exceeding:

- 2 modules for a TSX 37 05/08/10 PLC,
- 4 modules for a TSX 37 21 or TSX 37 22 PLC.

This table shows the maximum number of counting channels and TSX CTZ 1A/2A/2AA modules supported by the different types of TSX 37 PLC:

PLC type	Number of counting channels				Maximum number of TSX CTZ 1A/2A/2AA modules
	On discrete inputs (500 Hz)	Built-in 10 kHz	On the TSX CTZ 1A/2A (40 kHz) and TSX CTZ 2AA (500 kHz) module	Total no. of channels	
TSX 37 05/08/10	0	-	4	4	2 (1)
	1	-	4	5	2 (1)
	2	-	4	6	2 (1)
TSX 3721	0	-	7	7	4 (2)
	1	-	6	7	3 (3)
	2	-	6	8	3 (3)
TSX 3722	0	0	7	7	4 (2)
	1	0	6	7	3 (3)
	2	0	6	8	3 (3)
	0	1	6	7	3 (3)
	0	2	6	8	3 (3)
	1	1	6	8	3 (3)
	2	1	5	8	3 (4)
	1	2	5	8	3 (4)
	2	2	5	9	3 (4)

(1) 2 TSX CTZ 2A/2AA modules.
(2) 3 TSX CTZ 2A/2AA modules + 1 TSX CTZ 1A module.
(3) 3 TSX CTZ 2A/2AA modules.
(4) 2 TSX CTZ 2A/2AA modules + 1 TSX CTZ 1A module.

Sensor and encoder types used

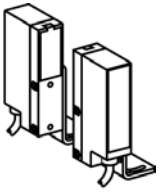
Sensors which can be used on the counting inputs

The TSX CTZ 1A/2A/2AA modules' counting inputs can receive pulses generated by:

- inductive, photoelectric, or other detectors:
  - 24 VDC supply voltage,
  - 2 or 3 PNP or NPN type wires,
- incremental encoders whose main features are described in the table below.

Illustration

Sensors and encoders:



Most frequently used encoders

Table of features:

Supply voltage	Output voltage	Type of output mailstop
5 V	differential 5V	RS 422 line transmitter
10...30V	10...30V	Totem pole.
10...30 V (1)	differential 5V	RS 422 line transmitter

(1) encoders not very common yet.

General features of the TSX CTZ 1A/2A/2AA modules

Table of features

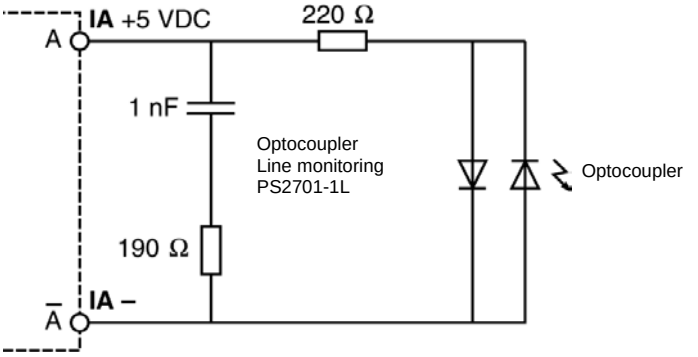
This chapter introduces the different features of the TSX CTZ 1A/2A/2AA modules.

Modules		**TSX CTZ 1A**	**TSX CTZ 2A**	**TSX CTZ 2AA**
Maximum frequency on the counting inputs		40 kHz	40 kHz	500 kHz
Current used by the module	on the internal 5V	100 mA	120 mA	120 mA
	on the internal 24	15 mA	15 mA	15 mA
Power dispersed in the module		2.6 W	4.5 W	4.5 W
Sensor supply check		Yes	Yes	Yes
Operational temperature		0 to 60°C	0 to 60°C	0 to 60°C
Input/ground or input and internal logic dielectric strength		1000 V effective – 50/60 Hz – 1 mn		
Insulation resistance		> 10 MΩ under 500 VDC		
Hygrometry		5% to 95% without condensation		
Storage temperature		-25° to +70°C		
Operational altitude		0 to 2000 meters		

Counting input features

Features for use in RS 422 C

Example of equivalent diagram for each counting input: IA, IB, IZ:



The IA, IB and IZ inputs used in RS422 are entirely compatible with the incremental encoders' line transmitters at RS 422 outputs and with the encoders at complementary pushpull outputs with 5V supply. There is line break monitoring for each input.

Features of the IA, IB and IZ inputs with 5 and 24 VDC

Table of features:

Inputs			**5VDC counting**		**24 VDC counting**
TSX			CTZ1A/2A	CTZ2AA	
Logic			Positive		Positive
Nominal values	Voltage		5 V		24 V
	Current		18 mA		18 mA
	Sensor supply (including ripples)		-		19…30V (possible up to 34V, limited to 1 hour in 24)
Thresholds	Maximum Ue voltage		≤ 5.5V		-
	In state 1	Ue voltage	≥ 2.4V		≥ 11V
		Current	> 3.7mA Ue = 2.4V	> 6.8mA Ue = 3V	> 6mA for Ue =11V
	In state 0	Ue voltage	≤ 1.2V		≤ 5V
		Current	< 1 mA for Ue = 1.2V		< 2mA for Ue = 5V
Input impedance for nominal U			270 Ω		1.4 kΩ

Inputs	5VDC counting		24 VDC counting
Input impedance(RS 422 compatible)	>440 Ω Ue = 2.4	> 350 Ω Ue = 3V	-
Input type	Resistive		Resistive
IEC 1131 conformity	-		Type 2
2-wire DDP compatibility	-		Yes
3-wire DDP compatibility	-		Yes

Features of counting sensor supply check (encoder or DDP)

Illustration:

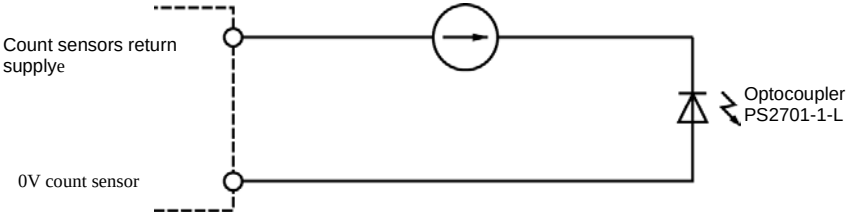


Table of features:

Voltage **without** encoder supply or DDP error		> 2.5V
Current **with** supply fault detected		< 0.5mA
Thresholds	Voltage	30V (possible up to 34V, limited to 1hr in 24)
	Current for 2.5V<U<30V	< 3mA

Auxiliary input features

Table of features This table shows the auxiliary input features:

Inputs			**24 VDC auxiliaries (preset, confirmation, capture)**	
			TSX CTZ 1A/2A	**TSX CTZ 2AA**
Logic			Positive	Positive
Nominal values	Voltage		24 V	24 V
	Current		7 mA	7 mA
	Sensor supply (including ripples)		19..30 V (up to 34V possible, 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
Voltage monitoring thresholds	OK		> 18 V	> 18 V
	Fault		< 14 V	< 14 V
Voltage sensor check response time	when 24 V appears		2 ms <t<5ms (3)	2 ms <t<5ms (3)
	when 24 V disappears		< 10 ms (3)	< 10 ms (3)
Input impedance			3.4 kΩ	3.4 kΩ
Response time	State 0 at 1		< 250 µs (2)	< 250 µs (2)
	State 1 at 0		< 250 µs (2)	< 250 µs (2)
Input type			Current well	Current well
IEC 1131 conformity			Type 2	Type 2
2-wire DDP compatibility			Yes (all 2-wire 24 VDC DDPs)	
3-wire DDP compatibility			Yes (all 2-wire 24 VDC DDPs)	

(1) for U = 11V.
(2) the auxiliary inputs are fast (response time < 250 µs < 50 µs ou < 25 µs) matching the maximum 40 kHz or 500 kHz counting input frequency permitted.
(3) when the supply sensor voltage disappears, the fast inputs can be taken into account.

Pin configuration in the high density point SUB D 15 connectors

General

Connector to be linked to the counting sensors and encoder supply:
- TSX CTZ 1A module: a SUB D 15 point connector
- TSX CTZ 2A/2AA modules: two SUB D 15 point connectors (channels 0 and 1).

Note: In the case of the TSX CTZ 2A/2AA modules, the pin configuration of the second connector is exactly the same.

Illustration

This diagram shows the pin configuration of the SUB D 15 high density point connector for connecting the counting sensor to channel 0 or 1.

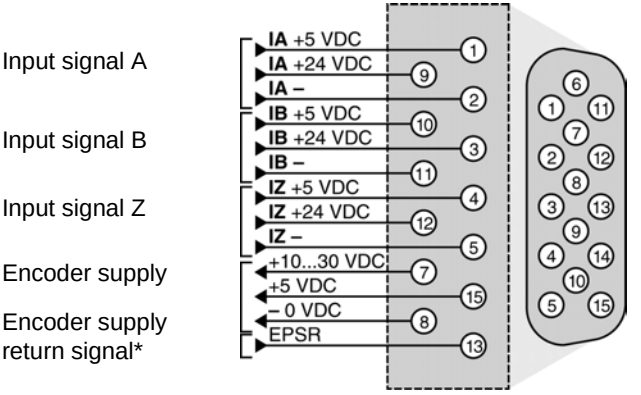


Table of the 5VDC signals:

5VDC signals	**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 return*	13

Table of 10…30 VDC signals:

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 VDC	7
-0 VDC	8
Encoder supply return*	13

* The encoder supply return signal must be connected to the module to prevent an error from arising.

Pin configuration of a 20-pin HE10 type connector

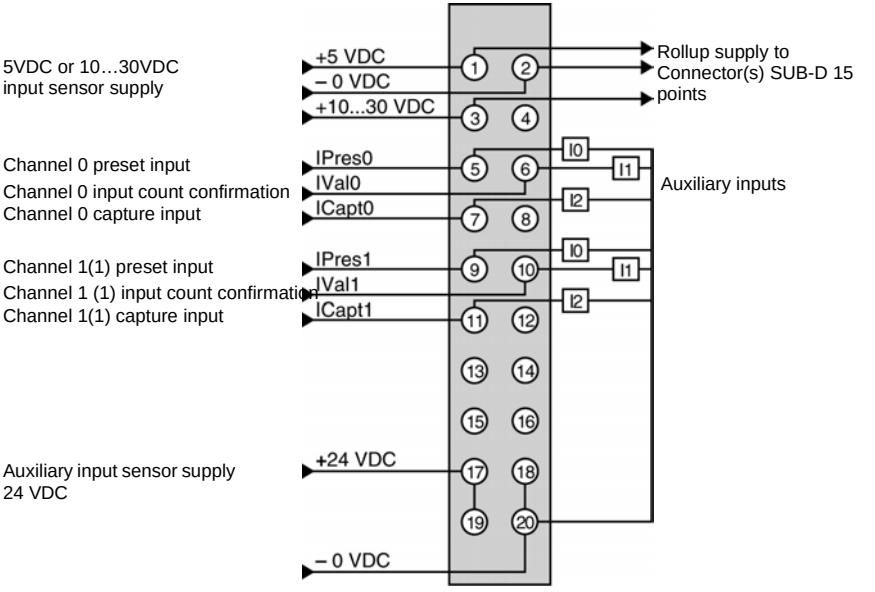
General

A connector to connect the auxiliary inputs and the power supplies for encoders and other sensors.

Note: In the case of TSX CTZ 2A/2AA modules, this connector is shared by both channels.

Illustration

Pin configuration diagram for the HE10 connector:



(1) uniquely for TSX CTZ 2A/2AA modules

24VDC signals table:

24VDC signals	**Pins**
Channel 0 auxiliary inputs:	
Preset IPres 0	5
Confirmation IVal 0	6
Capture ICapt 0	7
Channel 1 auxiliary inputs:	
Preset IPres 1	9
Confirmation IVal 1	10

24VDC signals	Pins
Capture ICapt 1	11

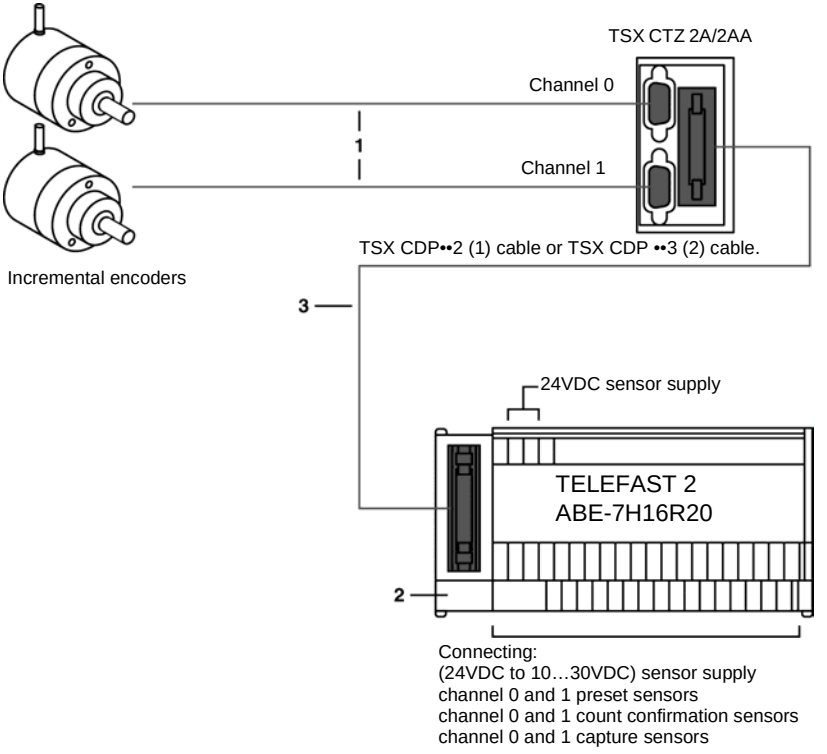
Table of supplies:

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

Principle of connection for encoder type counting sensors

Diagram showing the principle

In the case of the TSX CTZ 1A module, only the elements relative to channel 0 are to be connected:



(1) TSX CDP 102: length 1m, TSX CDP 202: length 2 m, TSX CDP 302: length 3m,
(2) TSX CDP 053: length 0,5 m, TSX CDP 103: length 1m, TSX CDP 203: length 2 m, TSX CDP 303: length 3 m, TSX CDP 503: length 5 m.

Note:
- using a TELEFAST 2 connection base is not obligatory but is advised to facilitate the connection of supplies and sensors on the auxiliary inputs,
- TELEFAST 2 connection bases are described in the current manual:

Description of the different connection elements

- **1 Connection of an encoder to the high density 15-pin SUB-D connector** found on the TSX CTZ 1A/2A/2AA modules. Taking into account the different encoder types, this connection is your responsibility and is made up of:
  - a connector to be connected to the encoder (generally a 12-pin female DIN connector, but to be defined according to the encoder connection used),
  - a high density 15-pin SUB-D male connector to connect to the 15-pin SUB-D female connector of the TSX CTZ 1A/2A/2AA modules. A component provided separately under the reference TSX CAP H15,
  - a cable:
    - with twisted pairs(gage 26) and shielding for an encoder with RS 422 standard line sender outputs,
    - multi-conductors (gauge 24) with shielding for an encoder with Totem Pole outputs.

    The cable shielding will be "tress and steel strip"; the "tress and steel strip" contact with each connector's ground must be ensured by tightening across the whole diameter of the cable.

    The connection of this cable to these two connectors varies according to the encoder supply type (5 VDC or 10…30 VDC) and the output type (RS 422, Totem Pole). For example, some connection types are described in the present chapter.

- **2 TELEFAST 2 connection base: ABE-7H08R10 or ABE-7H16R20.**
  This base is used for a quick connection of:
  - the 24 VDC supply for sensors other than the encoder,
  - the encoder supply
  - the sensors on the auxiliary inputs (preset, confirmation, capture).

  Type of base to use according to the counting module:
  - TSX CTZ 1A module: use the reference ABE-7H8R10 or ABE-7H16R20,
  - TSX CTZ 2A module: use the reference ABE-7H16R20,
  - TSX CTZ 2AA module: use the reference ABE-7H16R20.

- **3 TSX CDP••3 connection cable or a TSX CDP••2 multi-stranded sheathed cable.**

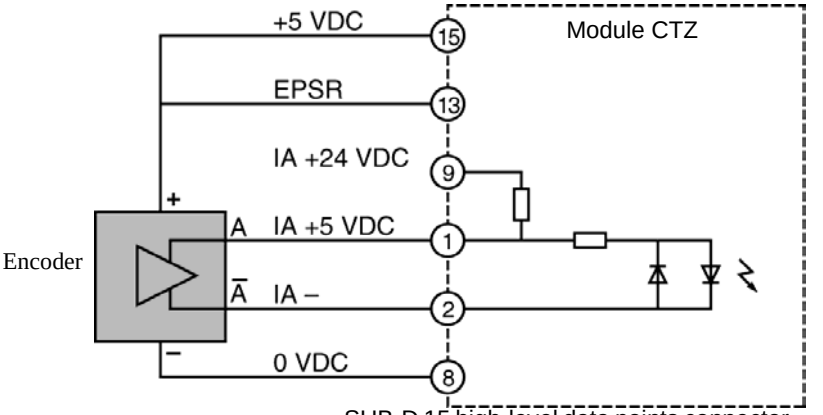
Example of module/encoder connection with RS 422 line transmitter outputs

Encoder characteristics

- supply voltage: 5VDC,
- output voltage: differential 5VDC,
- output mailstop: RS 422 standard line transmitter.

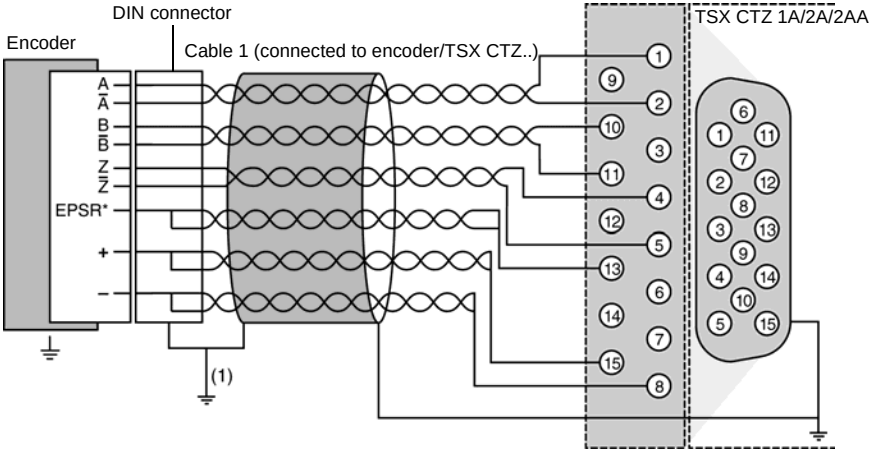
Diagram showing the principle

Illustration:



Channel connection diagram

Illustration:



*EPSR = encoder supply return.
(1) make this link directly if the encoder is isolated from the ground.

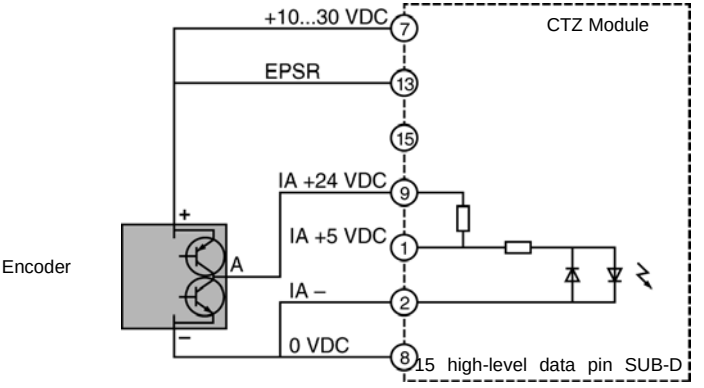
Example of PLC/encoder with Totem Pole Outputs

Encoder Characteristics

- supply voltage: 10...30VDC,
- output voltage: 10...30VDC,
- output mailstop: totem pole.

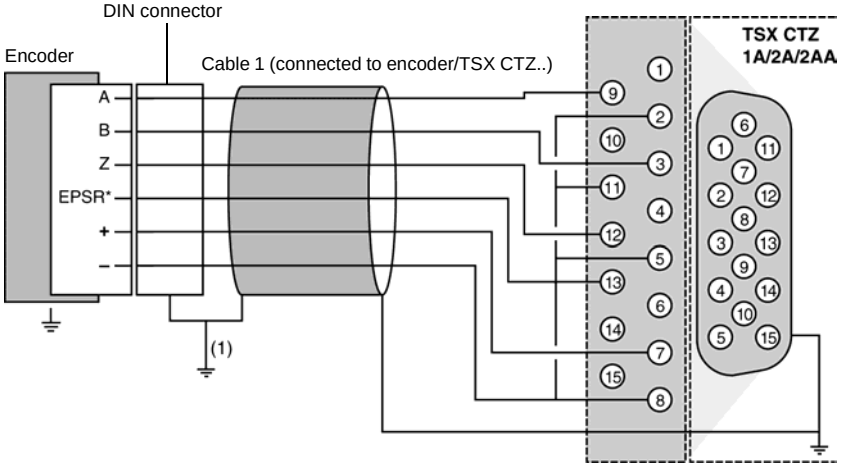
Provisional diagram

Illustration:



Channel connection diagram

Illustration:



15 high-level data pin SUB-D

*EPSR: encoder supply return.
If the encoder does not have a supply return, the EPSR input on the encoder side must be linked to the + of the supply.

(1) link directly if the encoder is isolated from the ground.

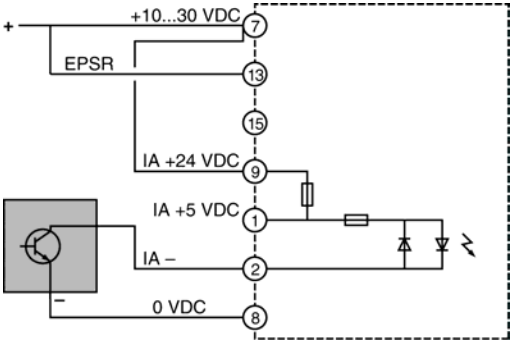
Example of PLC/encoder connection with NPN open collector outputs

Encoder characteristics

- supply voltage: 5VDC,
- output voltage: 5VDC,
- output mailstop: NPN open collector.

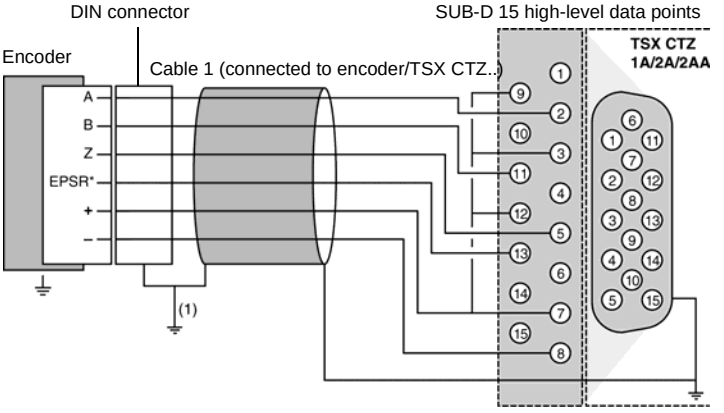
Diagram showing the principle

Illustration:



Channel connection diagram

Illustration:



*EPSR: encoder supply return.
When the encoder does not have a supply return, the EPSR input on the encoder side must be linked to the + of the supply.

(1) make this link directly if the encoder is isolated from the ground.

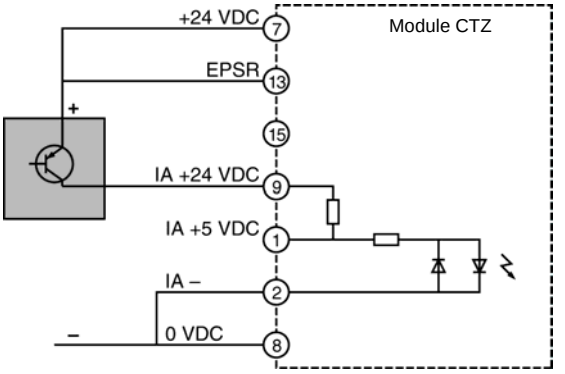
Example of PLC/encoder connection with PNP open collector outputs

Encoder characteristics

- supply voltage: 5VDC,
- output voltage: 5VDC,
- output mailstop: PNP collector.

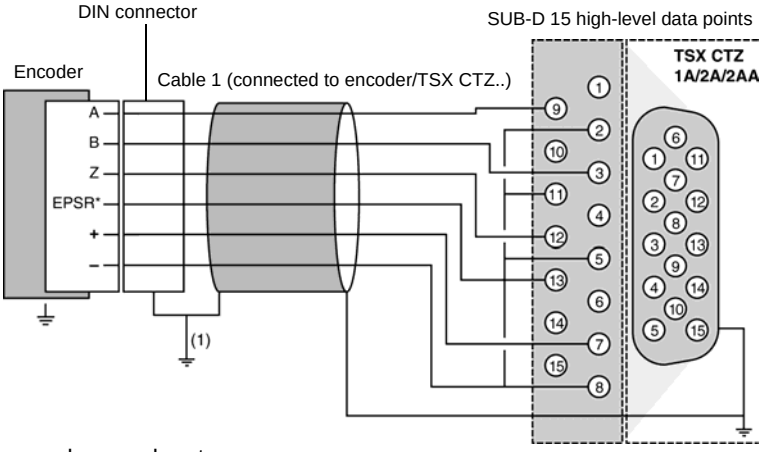
Diagram showing the principle

Illustration:



Channel connection diagram

Illustration:



*EPSR: encoder supply return.
When the encoder does not have a supply return, the EPSR input on the encoder side must be linked to the + of the supply.

(1) make this link directly if the encoder is isolated from the ground.

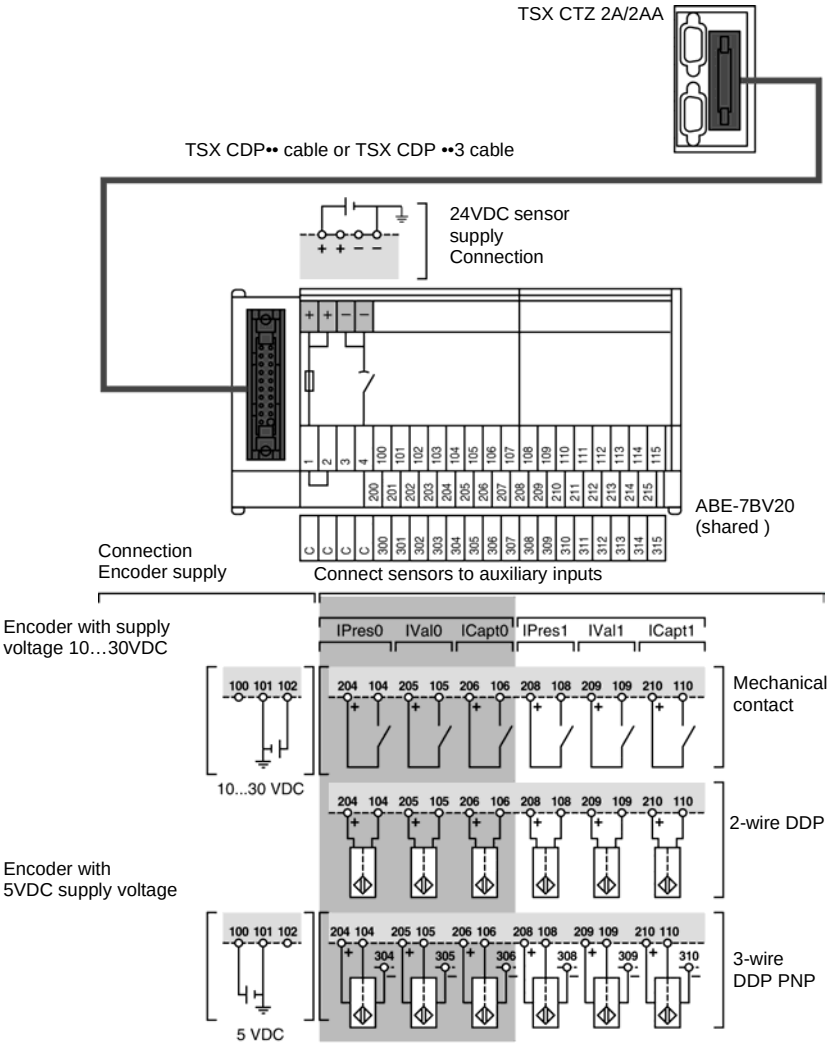
Connection of supply and sensors on auxiliary inputs

General

This connection is done using a TELEFAST 2 pre-cabling base:
- ABE-7H08R10 or ABE-7H16R20 for a TSX CTZ 1A module,
- ABE-7H16R20 for TSX CTZ 2A and TSX CTZ 2AA modules.

Diagram showing the principle

Illustration:



Maximum phase shifting between inputs IA and IB

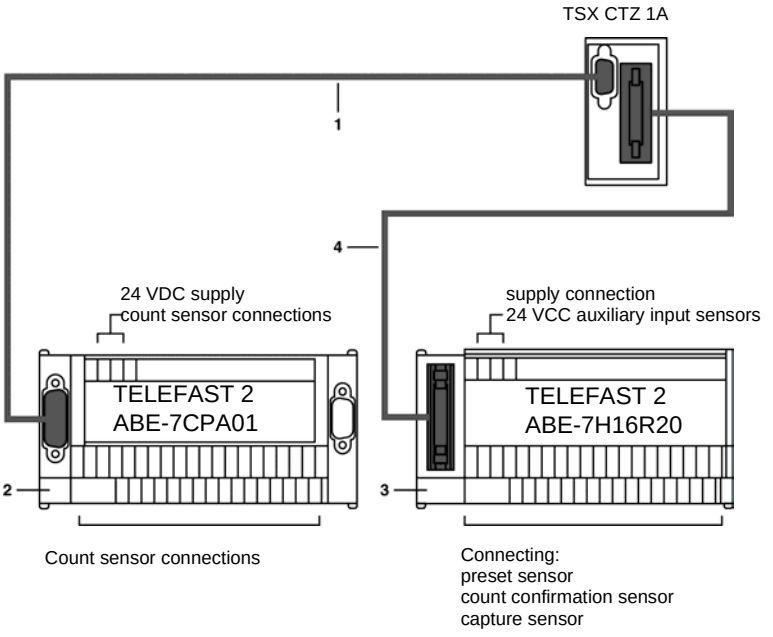
General

An incremental encoder connected to a TSX CTZ 1A/2A/2AA module gives counting pulses which are separated by 90°.
The module input signals are not rigorously separated by 90° according to the length of the connection cables. The maximum separation limits allowed between signals IA and IB are +/- 45°.

Connection principle for DDP type counting sensors

Diagram showing the principle

Illustration:



Label table

This table describes the different labels in the above diagram:

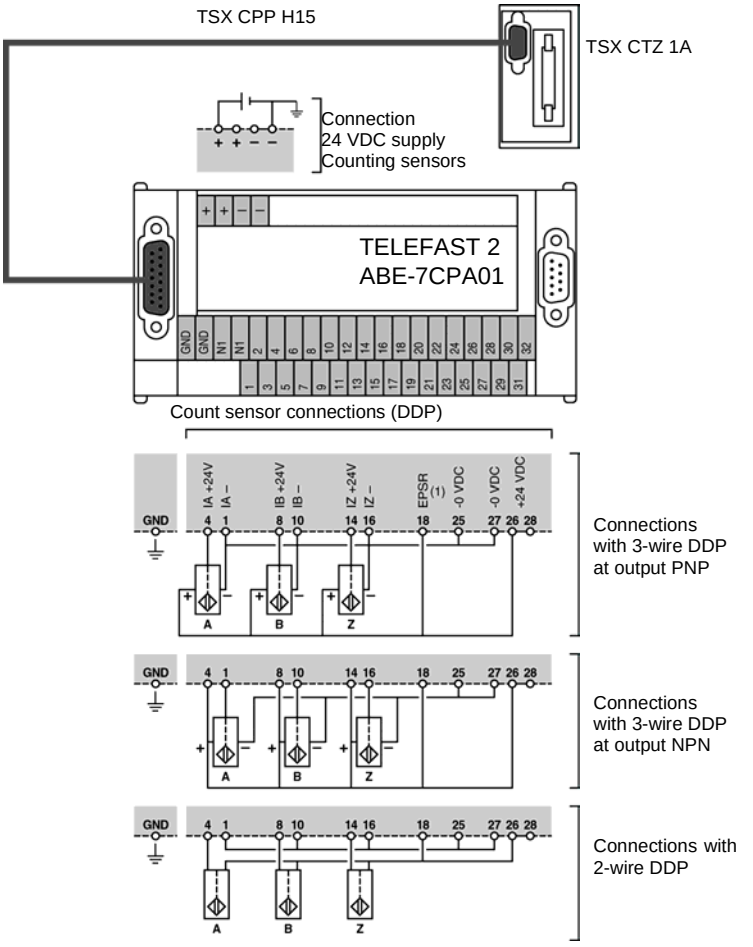
Label	Description
1	TSX CPP H15 cable of length 2.5m with high density 15-pin SUB-D connectors and standard 15-pin SUB-D connector for connecting the counting channel to the TELEFAST 2 connection base (ABE-7CPA01). This cable transports the different signals relative to the counting channel.
2	TELEFAST 2 connection base: ABE-7CPA01: is used to connect of counting sensors and the supply for the particular channel.
3	TELEFAST 2 connection base: ABE-7H16R20 (with TSX CTZ 1A/2A module) or ABE-7H08R10 (with TSX CTZ 1A module).
4	TSX CDP••3 connection cable or TSX CDP••2 multi-stranded sheathed cable. This is used to connect the module auxiliary inputs to the ABE-7H16R20. or ABE-7H08R10. TELEFAST 2 connection base.

Note: For TSX CTZ 2A/2AA modules, the connection of channel 1 is completely identical to that of channel 0 of a TSX CTZ 1A module.

Connection of counting sensors and their supply

Diagram showing the principle

Illustration:



(1) when the counting sensors are of type DDP the EPSR input must be polarized (encoder supply return)

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

Connection of sensors on auxiliary inputs and their supply

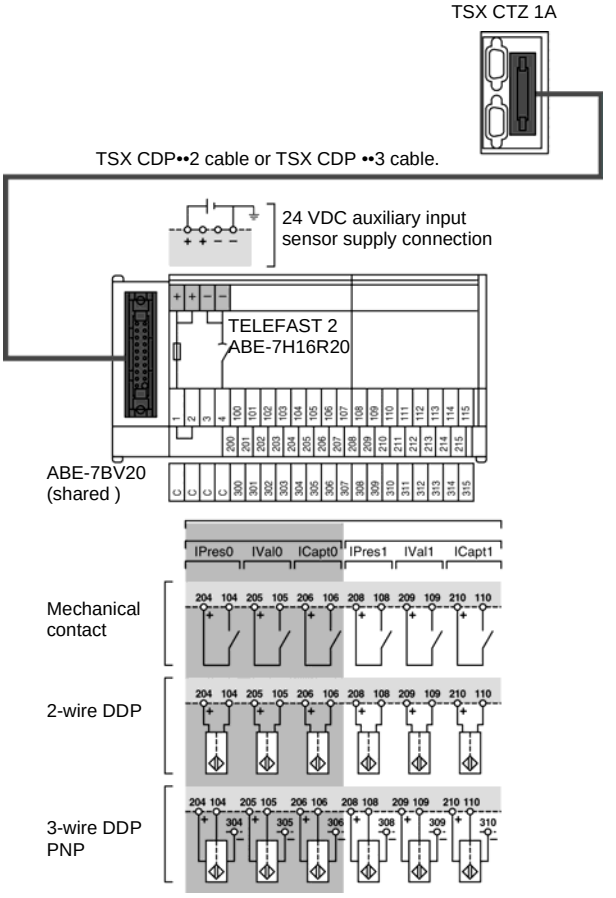
General

This connection is done using a TELEFAST 2 pre-cabling base:

- ABE-7H08R10 or ABE-7H16R20 for a TSX CTZ 1A module,
- ABE-7H16R20 for TSX CTZ 2A and TSX CTZ 2AA modules.

Diagram showing the principle

Illustration:



General rules for implementation

Installation

We advise against connecting or disconnecting the high density 15-pin SUB-D connectors of TSX CTZ 1A/2A/2AA modules with the encoder and sensor supplies present, as there is a risk of destroying the encoder, some encoders cannot cope with sudden, simultaneous switching on or cutting off of signals and supplies.

General cabling advice

Wire section

Use wires which have a sufficiently section, so as to avoid drops in voltage (mainly at 5V) and overheating.

Example of a drop in tension for encoders supplied with 5V with a 100 meter-long cable:

Wire section	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
0.12mm^2 (gauge 26)	-	1.4 V	-	-
0.22mm^2 (gauge 24)	-	0.8 V	-	-
0.34mm^2 (gauge 22)	0.25 V	0.5 V	0.75 V	1 V
0.5mm^2	0.17 V	0.34 V	0.51 V	0.68 V
1mm^2	0.09 V	0.17 V	0.24 V	0.34 V

Connection cable

All cables which carry the sensor supplies (encoders, DDP, etc,) and the counting signals must:

- be away from the cables carrying high energies,
- be covered with shielding linked to the mechanical ground on both the PLC and the encoder side equally,
- never carry signals other than the counting signals and the supplies relative to the counting sensors.

The PLC/encoder connection cable should be as short as possible to avoid loops which create coupling capacities which can disrupt operation.

Note: Make sure that the outward and return trip of one signal is carried in the same cable, with the supplies if necessary. In order to this, cables with twisted pairs should be used ideally.

Encoder and auxiliary sensor supply

Encoder supply

The encoder must:

- be reserved exclusively for supplying the encoder, to cut off parasitic pulses which could disrupt the encoders which contain sensitive electronics,
- be placed as near as possible to the TELEFAST 2 base to reduce drops in voltage and couplings with other cables,
- be protected against short-circuits and overloading by fast-blow fuses,
- have a good level of endurance to be able to cut off micro outages.

Important

The polarity – 0VDC of encoder and auxiliary sensor supplies must be grounded as close to the supplies as possible.

The cables carrying supply voltages should have their shielding grounded.

TELEFAST 2 connection base: ABE-7CPA01

11

At a Glance

Aim of this chapter

This chapter aims to introduce the TELEFAST 2 connection base: ABE-7CPA01.

What's in this Chapter?

This chapter contains the following topics:

Introduction

General

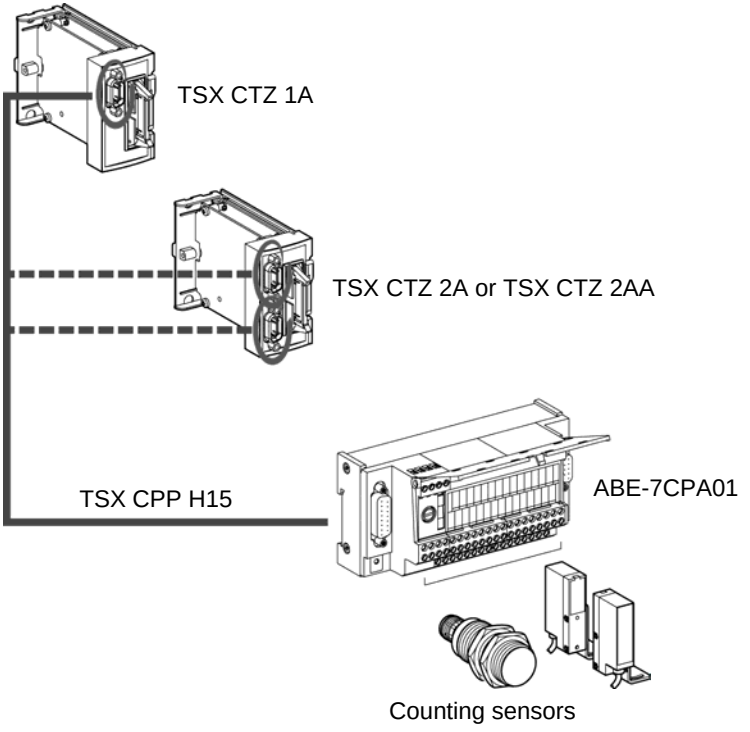
The TELEFAST 2 (ABE-7CPA01) connection base ensures the transformation of a standard female 15-pin SUB-D connector into a screw terminal block connector with:

- 32 terminals on two rows which make it possible to connect different sensors and their supply,
- 4 checkpoint terminals (2 GND terminals + 2 specific checkpoint terminals),
- 4 terminals for connecting the sensor supply.

It is used for a rapid connection of proximity detector type sensors on a counting channel of TSX CTZ 1A, TSX CTZ 2A and TSX CTZ 2AA modules.

Illustration

This diagram shows a TELEFAST 2: ABE-7CPA01 with TSX CTZ : modules

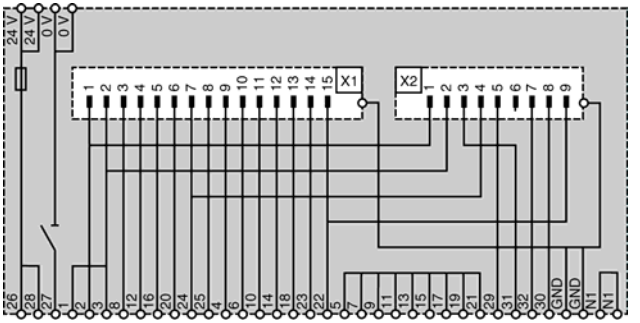


The 9-pin SUB-D connector allows information to be sent to an Altivar when this base is used with analog inputs/outputs.

Cabling layout

Diagram showing the principle

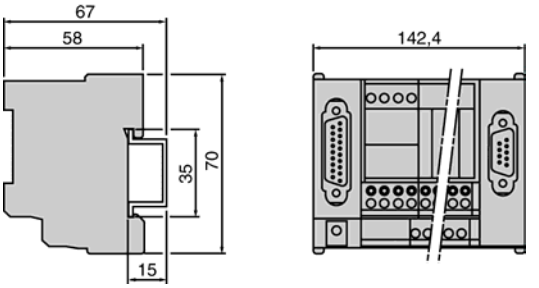
Illustration of the cabling layout:



Construction and mounting

Construction

Illustration:



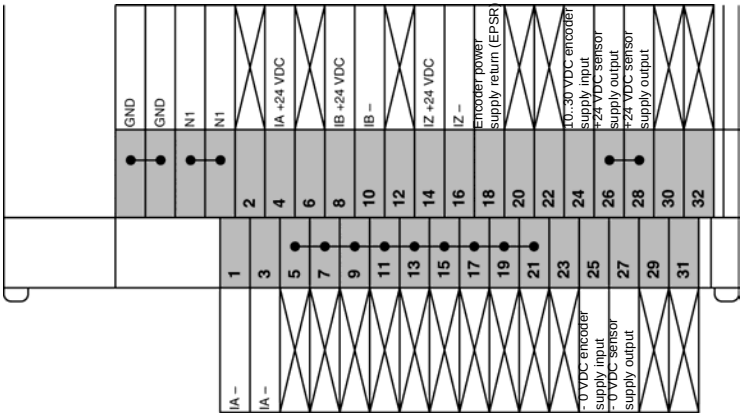
Mounting

The ABE-7CPA01 connection base should be mounted on a 35mm-wide DIN mounting rail.

Availability of the counting signals on the TELEFAST screw terminal block

Use with proximity detector-type counting sensors

Illustration:



Note:

- Each TELEFAST 2 ABE-7CPA01 connection base comes with 6 labels which enable you to personalize the addressing of each base according to the way in which it is used.
- An optional ABE-7BV20 strip can be added to make a shared GND for example.

Matching TELEFAST terminal blocks and 15-pin SUB-D connector

Correspondence table

This table shows the correspondence between a TELEFAST and a 15-pin SUB-D connector:

TELEFAST screw terminal block (Terminal #)	Standard 15-pin SUB-D connector (Terminal #)	Signal activity type
1	2	IA -
2		
3	2	IA -
4	9	IA + 24VDC
5		
6		
7		
8	3	IB + 24VDC
9		
10	11	IB -
11		
12		
13		
14	12	IZ + 24VDC
15		
16	5	IZ -
17		
18	13	Encoder supply return (EPSR)
19		
20		
21		
22		
23		
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

TELEFAST screw terminal block (Terminal #)	Standard 15-pin SUB-D connector (Terminal #)	Signal activity type
28		Sensor supply output +24 VDC
29		
30		
31		
32		

TELEFAST 2 connection base: ABE-7H08R10/7H16R20

12

At a Glance

Aim of this chapter

This chapter aims to introduce the TELEFAST 2 connection base: ABE-7H08R10/7H16R20.

What's in this Chapter?

This chapter contains the following topics:

At a Glance

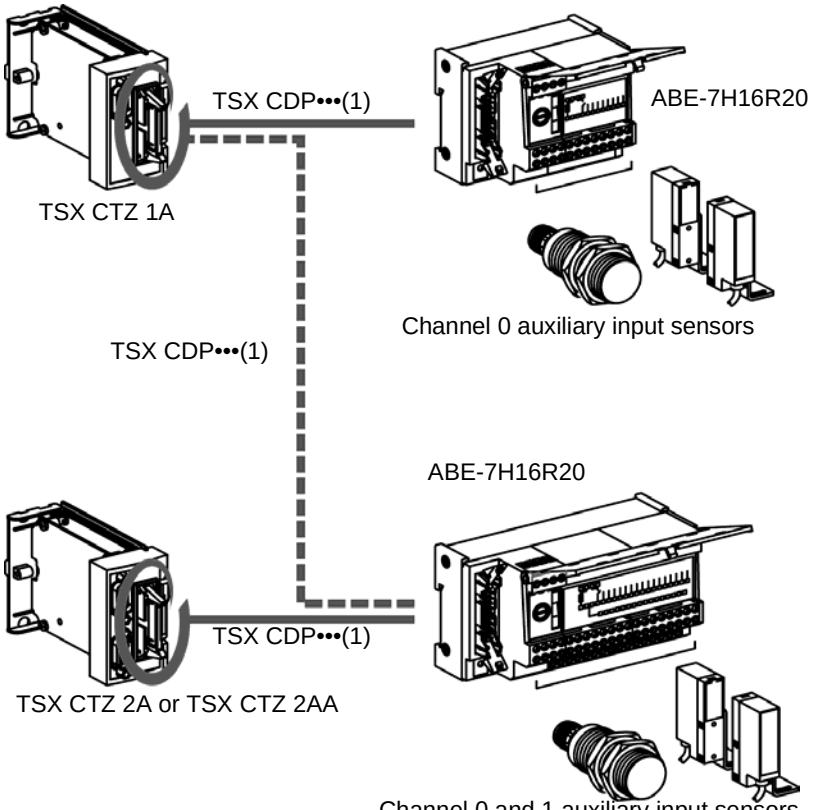
General

The TELEFAST 2 (ABE-7H08R10 and ABE-7H16R20) connection bases ensure the transformation of a HE10-type 20-pin connector into a screw terminal block connector enabling the quick connection of sensors and supplies to the auxiliary inputs of TSX CTZ 1A/2A/2AA counting modules.

The choice of pre-cabling base will depend upon the module used:
- TSX CTZ 1A: use the pre-cabling base ABE-7H16R20 or ABE-7H08R10,
- TSX CTZ 2A: use the pre-cabling base ABE-7H16R20,
- TSX CTZ 2AA: use the pre-cabling base ABE-7H16R20.

Diagram showing the principle

Illustration:

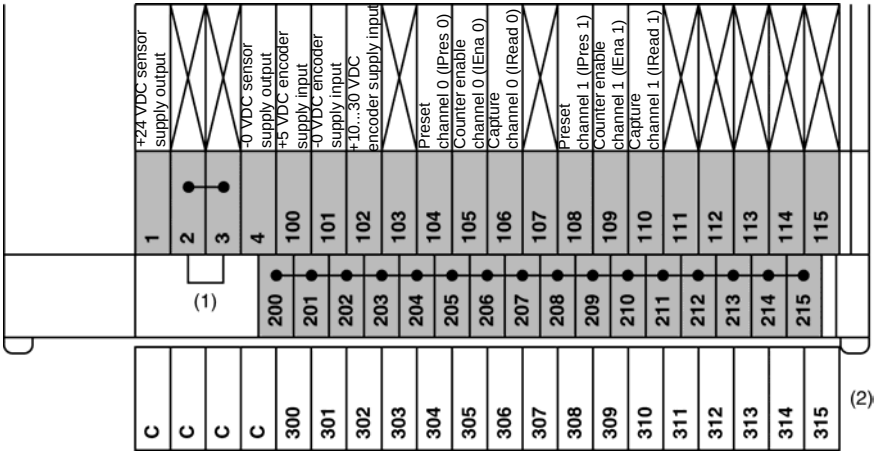


(1) TSX CDP••2 cable or TSX CDP ••3 cable.

Availability of the signals on the TELEFAST screw terminal block

Illustration

The terminal block below represents the ABE-7H16R20 base terminal block. In the case of the ABE-7H08R10 base, the terminal block is restricted to terminals 1 to 4 et 100 to 107:



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

- jumper wire in 1 and 2: the 2•• terminals are at the + pole,
- jumper wire in 3 and 4: the 2•• terminals are at the – pole.

(2) On the ABE-7H16R20 base, possibility of adding an optional ABE-7BV20 strip to create a second shared sensor (+ or – according to the user's choice).

Correspondences between TELEFAST terminal blocks and HE10 connector

Correspondence table

The following table shows the correspondences between TELEFAST and the HE10 connector:

TELEFAST screw terminal block (Terminal no.)	20 point HE10 connector (No. of pin)	Signal activity type	
100	1	+ 5 VDC	Encoder supply
101	2	-0 VDC	
102	3	+ 10…30 VDC	
103	4		
104	5	IPres 0 (preset channel 0)	Channel 0 auxiliary inputs
105	6	IVal 0 (counting channel 0 confirmation)	
106	7	ICapt 0 (channel 0 capture)	
107	8		
108	9	IPres 1 (preset channel 1)	Channel 1 auxiliary inputs
109	10	IVal 1 (counting channel 1 confirmation)	
110	11	ICapt 1 (channel 1 capture)	
111	12		
112	13		
113	14		
114	15		
115	16		
+24 VDC	17	Sensor supply	
-0 VDC	18		
+24 VDC	19		
-0 VDC	20		
1		All 2•• terminals at + 24 VDC	
2			
3		All 2•• terminals at -0 VDC	
4			
200...215		Connecting the shared sensors to: ● +24 VDC if terminals 1 & 2 are linked, ● -0VDC if terminals 3 & 4 are linked.	

TELEFAST screw terminal block (Terminal no.)	20 point HE10 connector (No. of pin)	Signal activity type
300...315		On the optional ABE-7BV20 strip, terminals can be used as a shared sensor.

Wiring accessories for incremental encoder: TSX TAP S15••

13

At a Glance

Aim of this chapter

This chapter aims to introduce the wiring accessories for the incremental encoder: TSX TAP S15••

What's in this Chapter?

This chapter contains the following topics:

Description

General

The TSX TAP S15•• cabling accessories are connecting devices for an incremental encoder with Totem pole (or push-pull) outputs:

- TSX TAP S15 05: cabling accessory for an incremental encoder with a 5VDC supply,
- TSX TAP S15 24: cabling accessory for an incremental encoder with a 24VDC supply (or 10…30VDC).

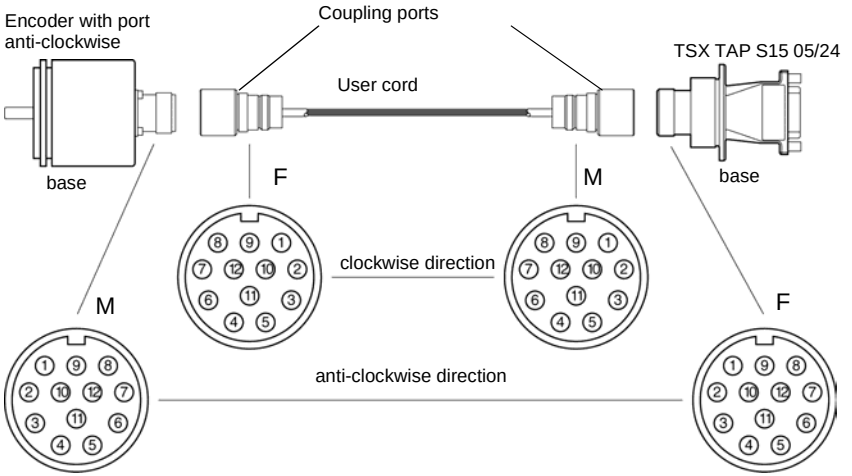
The TSX TAP S15 have 2 connectors:

- a female 12-pin DIN connector which allows the encoder cable to be screwed in a clockwise direction (the ring fastener is on the encoder cable),
- a standard 15-pin SUB-D connector which allows the module counting inputs to be connected to the SUB-D connector using a standard TSX CCP H15 cable.

These products, TSX TAP S15 05/24, can be fixed onto a DIN rail, using a set square supplied with the product, or they can be fixed across the cabinet with a gasket supplied with the product.

Precise information about the DIN 12 point connectors

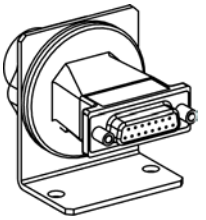
The number of these connector pins can be addressed in two different ways. The majority of the encoders have a built in 12-pin DIN base; addressing is carried out in an anti-clockwise direction. The TSX TAP S15 has a female 12-pin DIN base addressed in an anti-clockwise direction. All the user cables must be fitted with coupling ports addressed in a clockwise direction, which makes the pin numbers correspond one by one during wiring.
Illustration:

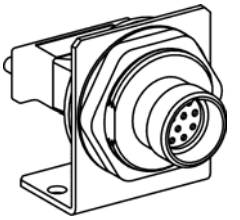


Mounting and measurements of the TSX TAP S15 05/24

Mounting on a Telequick plate

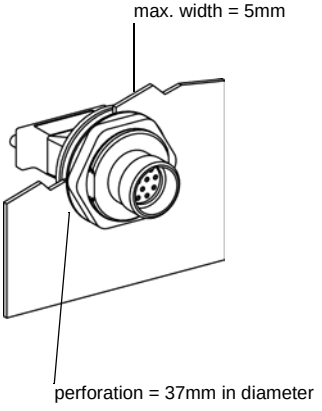
The set square supplied makes it possible to fix the TSX TAP S15 05/24 on an AM1-PA••• type perforated plate or on any other support.

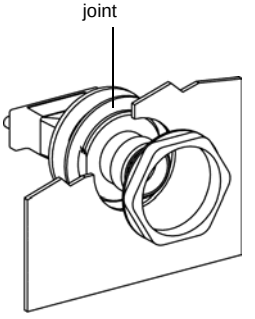




Mounting through a cabinet

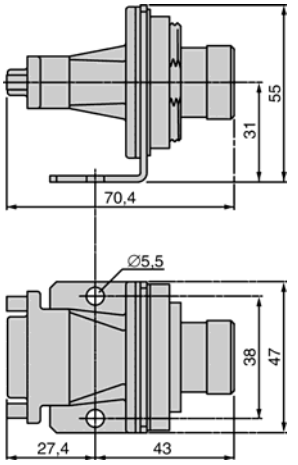
Thanks to its rifle nut, the TSX TAP S15 05/24 can be mounted through a cabinet. Its seal means the area between the interior and the exterior is guaranteed to be watertight.





Size

Illustration:



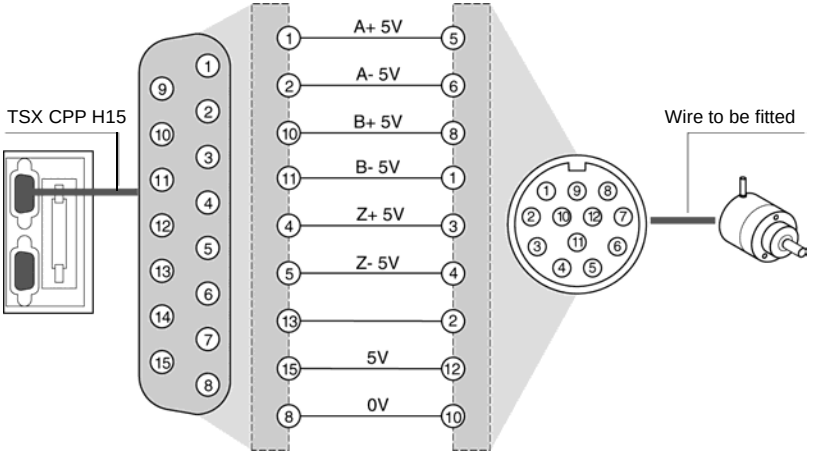
Connecting an encoder with a TSX TAP S15 05 accessory

General

Connecting an encoder using a TSX TAP S15 05 accessory as intermediary, requires a specific cable to be created between the accessory and the encoder.

Illustration

The TSX TAP S15 05 pin configuration is shown below:



This type of connection is compatible with encoders supplied with 5 V:

- Heidenheim,
- Hengstler,
- Ivo,
- Ideacod,
- ...

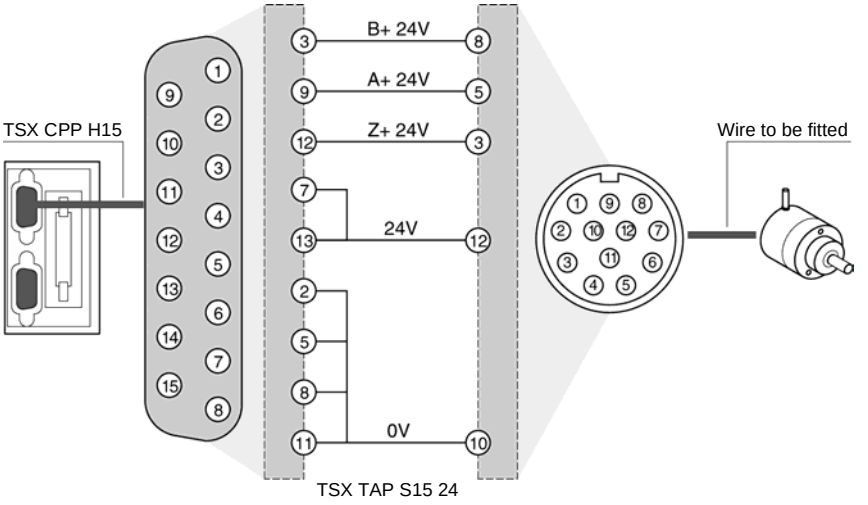
Connecting an encoder with a TSX TAP S15 24 accessory

General

Connecting an encoder using a TSX TAP S15 24 accessory as intermediary requires a specific cable to be created between the accessory and the encoder.

Illustration

The TSX TAP S15 24 pin configuration is shown below:



This type of connection is compatible with encoders supplied with 24 V:

- Heidenheim,
- Hengstler,
- Ivo,
- Ideacod,
- ...

Connection to modules with HE10 connectors

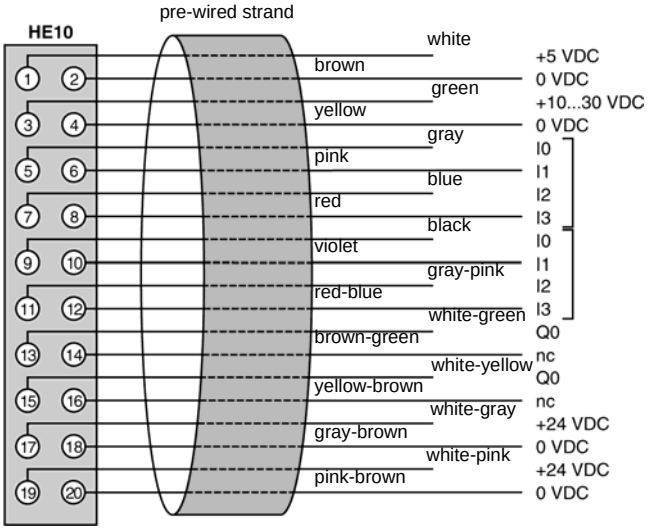
Strand pre-wired with 20 wires, gauge 22 (0.34 mm^2)

This is designed to allow the inputs/outputs of the HE10 connector modules to be connected to sensors, pre-actuators or terminals easily, directly and wire-to wire.

This pre-wired strand is made up of:

- an HE10 connector with 20 0.34 mm^2 section sheathed wires molded onto it at one end,
- and free wires differentiated by color coding according to norm DIN 47100 at the other.

Illustration



Note: A nylon fiber built into the cable means the sheath can easily be stripped off. Two references are available:

- TSX CDP 301: 3 meters long,
- TSX CDP 501: 5 meters long.

Sheathed and clad connection cable, gauge 25 (0.08 mm^2)

This is designed for connecting the HE10 connector module inputs/outputs to connection and adaptation interfaces with fast wiring called TELEFAST 2. This cable is made up of 2 HE10 connectors and a flat clad, sheathed cable with 0.08 mm section wires^2.
As the wires' section is small, they should only be used at inputs or outputs with a low current (< 100 mA per input or output).

Three references are available:
- TSX CDP 102: 1 meter long,
- TSX CDP 202: 2 meters long,
- TSX CDP 302: 3 meters long.

Connection cable, gauge 22 (0.34 mm^2)

This is designed for connecting the HE10 connector module inputs/outputs to connection and adaptation interfaces with fast wiring called TELEFAST 2. This cable is made up of 2 HE10 connectors and a flat clad, sheathed cable with 0.34 mm section wires^2 permitting higher currents (<500 mA).

Five references are available:
- TSX CDP 053: 0.5 meters long,
- TSX CDP 103: 1 meter long,
- TSX CDP 203: 3 meters long,
- TSX CDP 503: 5 meters long.

TSX CTZ 1B Position Measurement Module

III

At a Glance

Aim of this Part

This part introduces the TSX CTZ 1B position measurement module.

What's in this Part?

This part contains the following chapters:

Introduction to the CTZ 1B Measurement Module

14

At a Glance

Aim of this Chapter

This chapter deals with the TSX CTZ 1B measurement module associated with the absolute SSI encoder.

What's in this Chapter?

This chapter contains the following topics:

General Information on the Measurement Module

At a Glance

The TSX CTZ 1B measurement module can be set up in several positions on a base (see (See *Installation and Assembly of TSX CTZ 1B Modules, p. 165*)).
The number of modules to each PLC is limited to

- 2 for TSX 37 05/08/10,
- 4 for TSX 37 21/22.

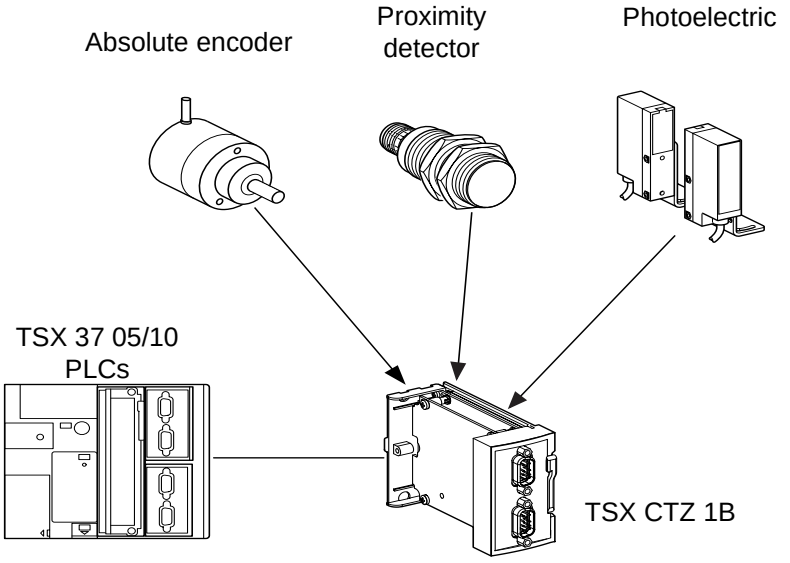
The measurement module cannot be set up in a mini extension rack.
This module can only manage one channel at a time.

Functions

A TSX CTZ 1B module and a SSI encoder allow position measurement to be carried out (see Applications Installation Manual volume 2). Capture inputs compatible with most 24V sensors or detectors; allow length measurement to be carried out.

Illustration

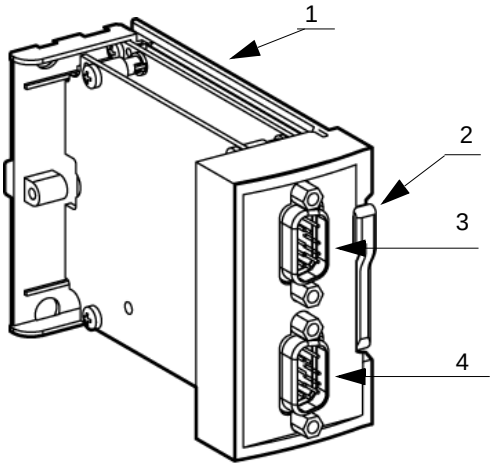
The diagram below shows a TSX, a measurement module, a SSI encoder and different types of components for the capture inputs.



Physical Description of the Module

Illustration

Physical representation of module TSX CTZ 1B:



Information table

Number and descriptions:

Number	Description
1	Rigid metal body that ensures the following functions: ● electronic card support, ● earthing the module, ● guidance of the module into its slot.
2	Screw to hold the module in position
3	Sub-D 9pin connector for connecting: ● the encoder, ● the power supply to the encoder, ● the return of information regarding the validity of the supply.
4	Sub-D 15pin connector for connecting: ● capture inputs, ● the module and encoder's supply

Number of Channels Managed by a TSX 37

At a Glance

This module occupies the equivalent of one type CTZ1A counting channel.

All the TSX 37 (05/08/10/10/21/22) PLCs can manage several counting or measurement channels, and depending on the type of TSX 37 PLC, they can have:

- two 500 Hz counting channels on discrete inputs,
- two built-in 10 kHz counting channels,
- one or more counting channels on module TSX CTZ1A/2A 40kHz or 2AA 500kHz,
- one or more absolute SSI encoder channels on module TSX CTZ1B.

The maximum number of modules, which can be installed on a TSX 37 PLC, will depend on the number of channels already used in counting 500Hz, 10kHz, 40kHz or 500kHz.

The limit for the number of CTZ modules is:

- 2 TSX CTZ modules for a TSX 37 05/08/10 PLC,
- 4 TSX CTZ modules for a TSX 37 21/22 PLC.

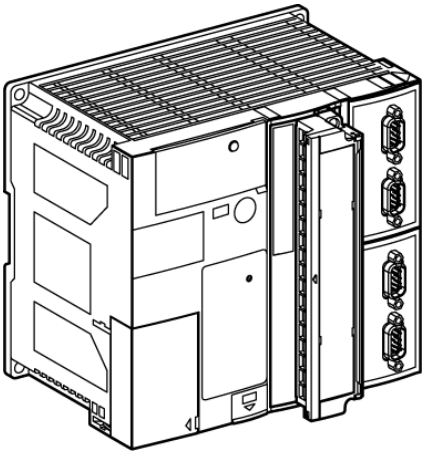
The limit for the number of channels from CTZ modules is:

- 7 channels if base or discrete counting is not used,
- 6 channels if base counting or discrete input is used,
- 5 channels if base counting or discrete input is used,

Installation and Assembly of TSX CTZ 1B Modules

Installation in a TSX 3705/08/10 PLC

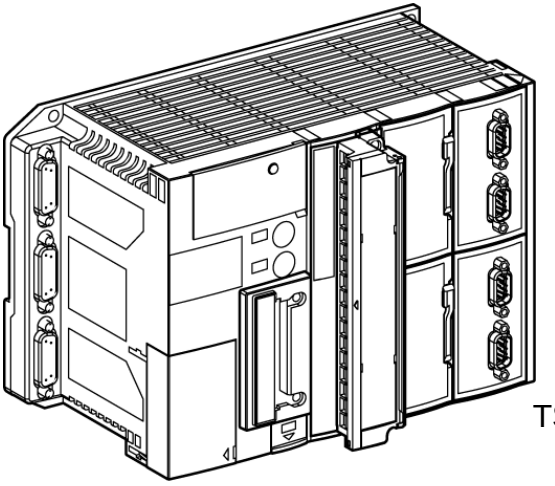
A TSX 37 05/08/10 PLC can receive a maximum of 2 TSX CTZ 1B measurement modules. These modules can be installed in positions 3 and 4 of a TSX 05/10 PLC and positions 5 and 6 of a TSX 08 PLC.
Illustration:



TSX 3710

Installation in a TSX 3721/22 PLC

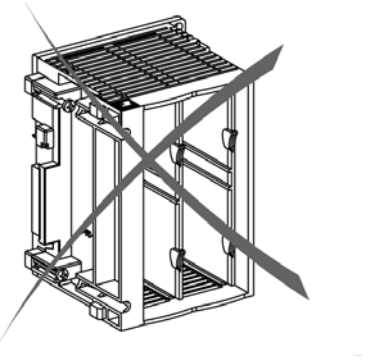
A TSX 3721 or TSX 3722 PLC can receive a maximum of 4 measurement modules within the limit of the number ofchannels (See *Number of Channels Managed by a TSX 37, p. 164*) generated by the PLC(1).
These modules can be installed in positions**3**, **4**, **5** and **6**.
Illustration:



TSX 3722

In an mini rack of extension

You must not assemble a TSX CTZ 1B module on a mini rack extension.
Illustration:



Characteristics of the Apparatus Used

15

At a Glance

Aim of this Chapter

This chapter aims to introduce the encoder module characteristics.

What's in this Chapter?

This chapter contains the following topics:

Encoder Selection

At a Glance

The TSX CTZ 1B module can manage two types of encoders:
- an absolute type encoder with SSI serial outputs,
- an absolute parallel type encoder. This type requires the use of a specific TELEFAST ABE-7CPA11 interface.

Supply Selection

The design of the module allows the encoder to be supplied from two types of continuous voltage:
- 5V (Caution: drop in mains voltage),
- 24V with a 10 ....30Vstandardized voltage.

Note: Encoders with a supply voltage of 24 VDC are more highly recommended for the following reasons:
- the power supply does not need a high level of precision. As a general rule, these encoders have a 10....30VDC supply format,
- the mains leakage is of little importance, which limits the distances between the encoder and the module less.

These supplies must be sufficiently autonomous (>10ms) to endure micro power outages and ensure continuity of the functioning of the module.

Selecting the 5VDC encoder

When selecting this encoder, it is important to take into account the mains voltage leakage, which depends on the length of the cable, of the gauge of the wire and of the encoder consumption (the first two parameters make the cable impedance vary). As a general rule, the mains voltage leakage is normally 10% of the nominal voltage. The table below gives the mains voltage leakage of the wire gauge, using 100m wire and a given consumption.

Wire gauge	**Voltage leakage in VDC**			
	50mA	100mA	150mA	200mA
0.22mm (24 gauge)	0.4			
0.34mm (22 gauge)	0.25	0.5		
0.5mm	0.17	0.34	0.51	
1mm	0.09	0.17	0.24	0.34

CAUTION

For a 5VDC encoder

It is dangerous to increase the supply voltage to support a mains voltage leak. Failure to observe this recommendation may lead to module damage.

Failure to follow this precaution can result in injury or equipment damage.

Maintaining Ground Connections

To ensure good performance in a disrupted environment, the following is imperative:

- select an encoder whose metal protection is referenced to the mechanical ground connection of the connected device,
- that the ground connection is ensured between:
  - the encoder,
  - the connecting cable shield,
  - and the module.

Selection and Protection of the Encoder Power Supply

At a Glance

The supply to the encoder associated with the module requires a special location and protection.
The encoder supply must be protected against overloads and short circuits by an appropriate size, high speed fuse.

CAUTION

Protecting the encoder power supply

The power supply must only be the same for encoders of the same voltage (5 VDC or 24VDC), it must be placed very close to the module in order to reduce the coupling capacity as much as possible. The distance between the supply ground connection and the mechanical ground connection must be as short as possible.

Failure to follow this precaution can result in injury or equipment damage.

General Characteristics of the TSX CTZ 1B Module

Table of Characteristics

This table shows the different characteristics of the TSX CTZ 1B module:

Modules		**TSX CTZ 1B**
Maximum frequency		1 MHz
Module power consumption	by the internal 5V	100 mA
	by the 24V encoder by the 5V encoder	<15 mA <25 mA
Module power dissipation		<1.5 W
Sensor supply monitoring		no
Encoder link monitoring		yes
Encoder supply monitoring		yes (*)
Working temperature		0 to 60°C
Storage temperature		-25° to +70°C
Input/earth dielectric rigidity or internal logic and input		1000 V effective – 50/ 60 Hz – 1 mn
Resistance of insulation		> 10 MΩ under 500 VDC
Hygrometry		5% to 95% excluding condensation

(*) The encoder return supply voltage applied to the EPSR input must be more than 70% of the encoder's supply voltage in order to satisfy the monitoring system.
(*) Immunity to micro-cuts is 1ms.

Capture Input Characteristics

Table of Characteristics

The table below shows the electric characteristics of the capture inputs.

Electrical Specifications	Symbolization	Values	Units
Nominal voltage:	One	24	Vdc
Voltage limits	U1 Utemp (*)	19 to 30 34	Vdc
Nominal current for U=24VDC	In	8	mA
Voltage for "ON" status:	Uon	>=11	Vdc
Current for Uon = (11V)	Ion	>3	mA
Voltage for "OFF" status:	Uoff	<5	Vdc
Current for "OFF" status:	Ioff	<1.5	mA
Input impedance	Re	3	kΩ
Implementation time $OFF \rightarrow ON$	ton	<50	µs
Implementation time $ON \rightarrow OFF$	toff	<50	µs
Dielectric rigidity with the ground:	1000 Veff 50/60 Hz 1mn		
IEC 1131 compatibility with sensors	type 1		
Input type	resistant		
Logic type	sink (positive)		

Compatibility	• dry contacts,
	• 3-wire DDP: all 3-wire DDP functioning in 24V
	• 2-wire DDP: all 2-wire DDP functioning in 24V with the following characteristics:
	  • voltage reduction in closed status =<7V,
	  • minimal switched current =<2.5mA
	  • residual current in open status =>1.5mA		

(*) Utemp: maximum voltage allowed for 1 hour in 24 hour.
The SSI link characteristics are:

- output: RS422 line transmitter,
- input: RS422.compatible.input

Implementation Measurement Module

16

At a Glance

Aim of this Chapter

This chapter deals with the implementation of module TSX CTZ 1B.

What's in this Chapter?

This chapter contains the following topics:

Installation Precautions

At a glance	In order to ensure good working order, certain precautions must be taken during the implementation and removal of the module, connection and disconnection of the connectors on the front face of the module and the (dis)connection of the module and connector's clamping screws.
Implementation and removal of the module	The implementation and removal of the module must only take place while the PLC is not connected to the power supply (this gives physical and hardware protection).
Connection and Disconnection of the Connectors	Connection or disconnection of a connector on the front face of the module should always take place when the encoder power supply is off. Encoders cannot endure a start-up or a simultaneous cut-out of signals and power supply.
Screw Tightening	In order to maintain a ground connection and to reduce electromagnetic disturbances, you should screw the clamping screws in correctly (clamping torque = 0.5Nm).

Wiring Precautions

At a Glance

In order to guarantee the good working order of the PLC, you should respect certain basic rules, which will be explained below.

Wire Gauge

The gauge of the wire should be enough to reduce mains leakages and the heat of the cable. In fact, the cable's impedance being inversely proportional to the gauge, if you use larger gauge wire, mains leakage will be reduced.

Wire Location

Linking cables must be kept away from any source of radiation generated by the commutation of electric power circuits, which could provoke electromagnetic disturbances. In fact, this could cause an error in the position measurement

Encoder Signals Linking Cables

Linking cables should conform to the following electric rules:

- they should be shielded,
- the whole connection should always be grounded,
- shielding should be linked to the mechanical ground connection on the module side and the encoder side,
- the encoder cable should only convey signals relating to the encoder

Link between an Encoder and the TSX CTZ 1B Module

Introduction to Pin Assignment

The table below shows the pin assignment of a Sub-D 9pin connector on a TSX CTZ 1B module to which an encoder or a TELEFAST ABE-7CPA11 (See *TELEFAST ABE-7CPA11 Connection Base, p. 189*) will be connected:

Number	Signal	Designation
1	DAT+	DATA+ input differential
2	CLK+	CLK+ output differential
3	EPSR	Input of encoder feedback supply
4	10/30V-COD	10/30Vdc encoder supply (*)
5	0V-COD	0Vdc encoder supply (*)
6	DAT-	DATA- input differential
7	CLK-	CLK- output differential
8		
9	5V-COD	5Vdc encoder supply (*)

(*) The supply signals are outputs for connecting an encoder, when using a TELEFAST ABE-7CPA11, they are inputs.

Illustration of the Sub-D 9pin labeled ENC

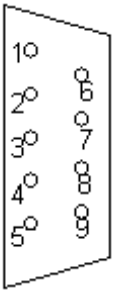


Diagram of a 10/ 30Vdc Encoder

The diagram below shows the linking of an absolute SSI 10-30V encoder to the TSX CTZ 1B module:

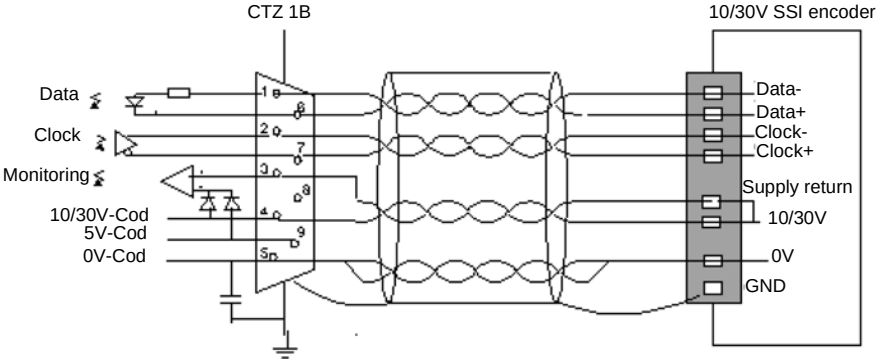
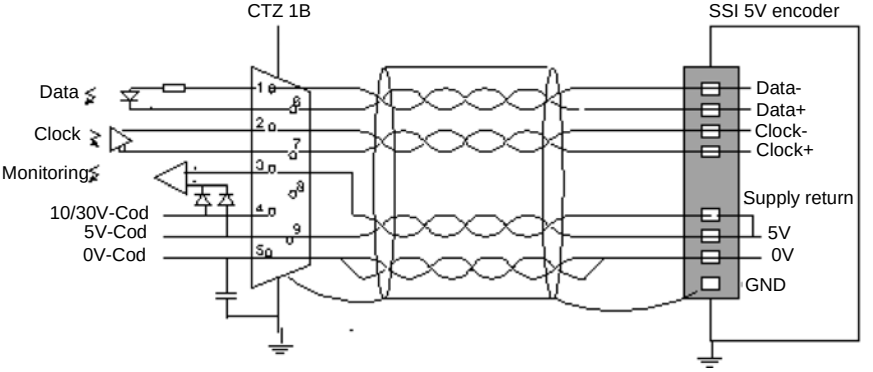


Diagram of a 5Vdc encoder

The diagram below shows the linking of an absolute SSI 5V encoder to the TSX CTZ 1B module:



Recommendations

Below are a few recommendations for linking the encoder:

- The signals DATA +/- and CLK +/- must be linked with a twisted pair,
- the cable shielding must be linked to the mechanical ground connection at each end,
- the EPSR input must be linked to the "+" module of the encoder side supply, if this does not have a "+" feedback output supply.
- it is advisable to connect a 0V twisted pair to limit the common mode between the module and the encoder by doubling the gauge.

CAUTION

Recommendations on input/output pin assignment

Before making any connection between the encoder and the module, check the pin assignment recommended by the encoder manufacturer.

Failure to follow this precaution can result in injury or equipment damage.

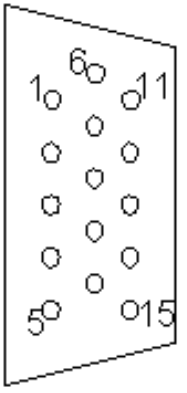
Linking the Encoder Supply and Capture Inputs

Pin Assignment

The table below shows the pin assignment of the 15 pin Sub-D connector, which receives the supply and capture signals.

Number	Signal	Designation
1		
2		
3	CAPT1+	Capture input 1
4	CAPT1-	Capture input 1
5		
6		
7	10/30V_COd	10/30 Vdc encoder supply input
8	0V_COd	Input 0V encoder
9	CAPT0+	Capture input 0
10	CAPT0-	Capture input 0
11		
12		
13		
14		
15	5V_COD	5 Vdc encoder supply input

Illustration of the 15pin Sub-D labeled AUX.



TELEFAST ABE-7CPA01 Connection Base

17

At a Glance

Aim of this Chapter

This chapter describes the use of TELEFAST for the TSX CTZ 1B module using connection diagrams.

What's in this Chapter?

This chapter contains the following topics:

Connecting TELEFAST 2: ABE-7CPA01

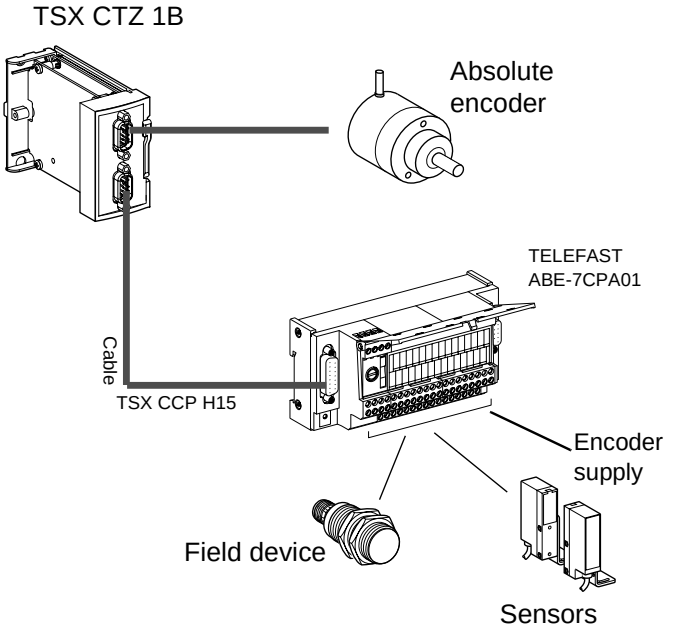
At a Glance

The TELEFAST 2 (ABE-7CPA01) connection base ensures the transformation of a standard 15-pin SUB-D female connector into a screw terminal block connector with:

- 32 terminals on two rows which make it possible to connect different sensors and their supply,
- 4 checkpoint terminals (2 GND terminals + 2 N1 terminals for specific checkpoints),
- 4 terminals for connecting the sensor supply.

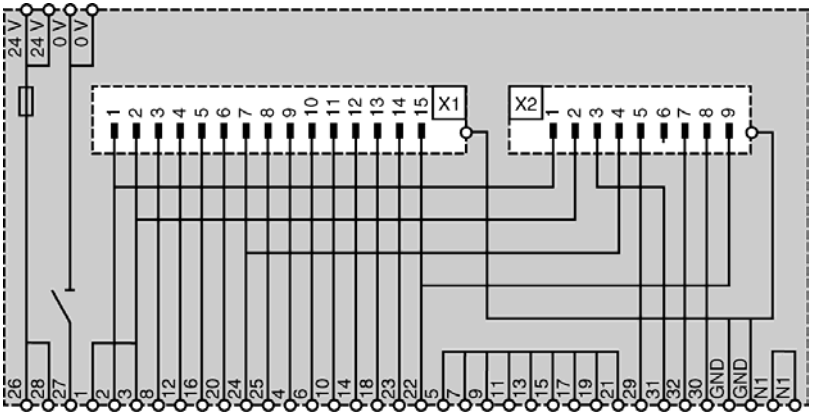
This allows rapid connection of the sensors on a TSX CTZ 1B module measurement channel.

Illustration:



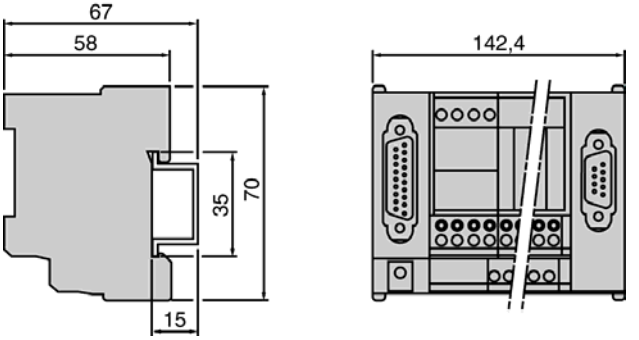
Cabling Layout

Illustration :



Dimensions and Assembly

Dimensions



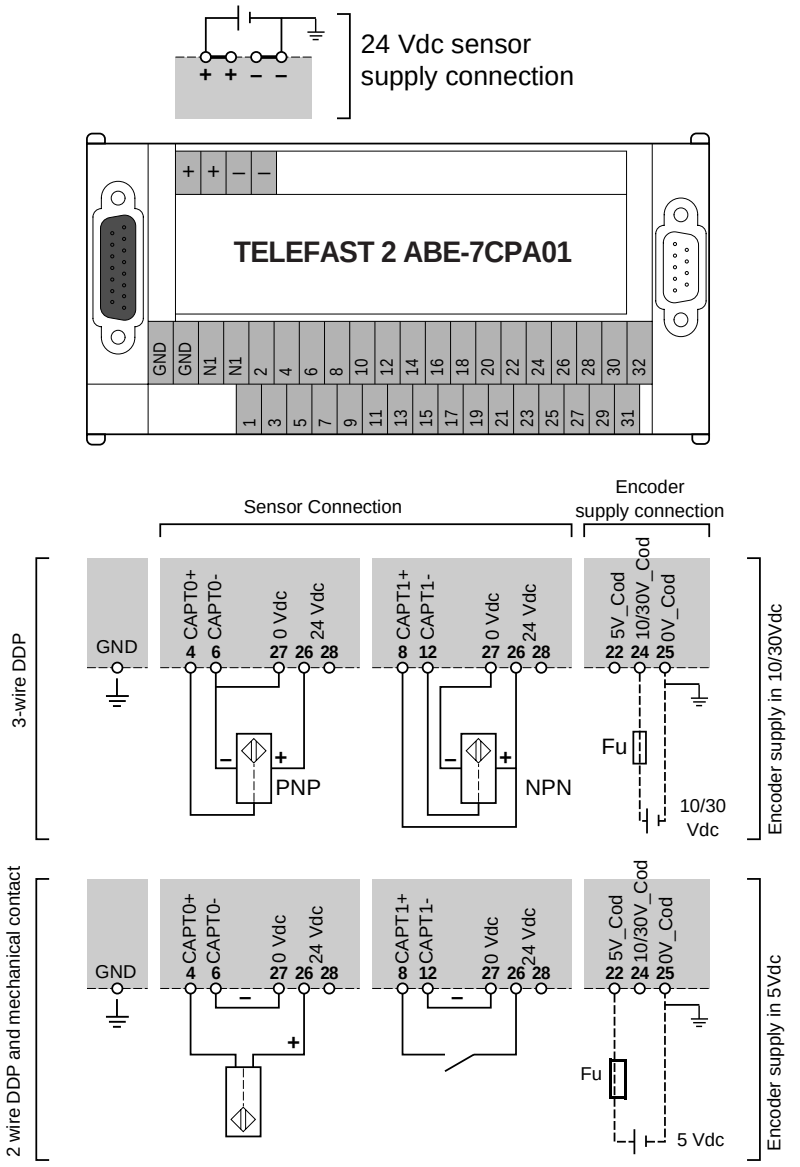
Assembly

The ABE-7CPA01 connection base should be mounted on a 35mm wide DIN mounting plate.

Connection diagram for the TELEFAST ABE-7CPA01

Diagram

The diagram below shows TELEFAST ABE-7CPA01connections:



CAUTION

Supply connections.

In order for the encoder supply control to work correctly:

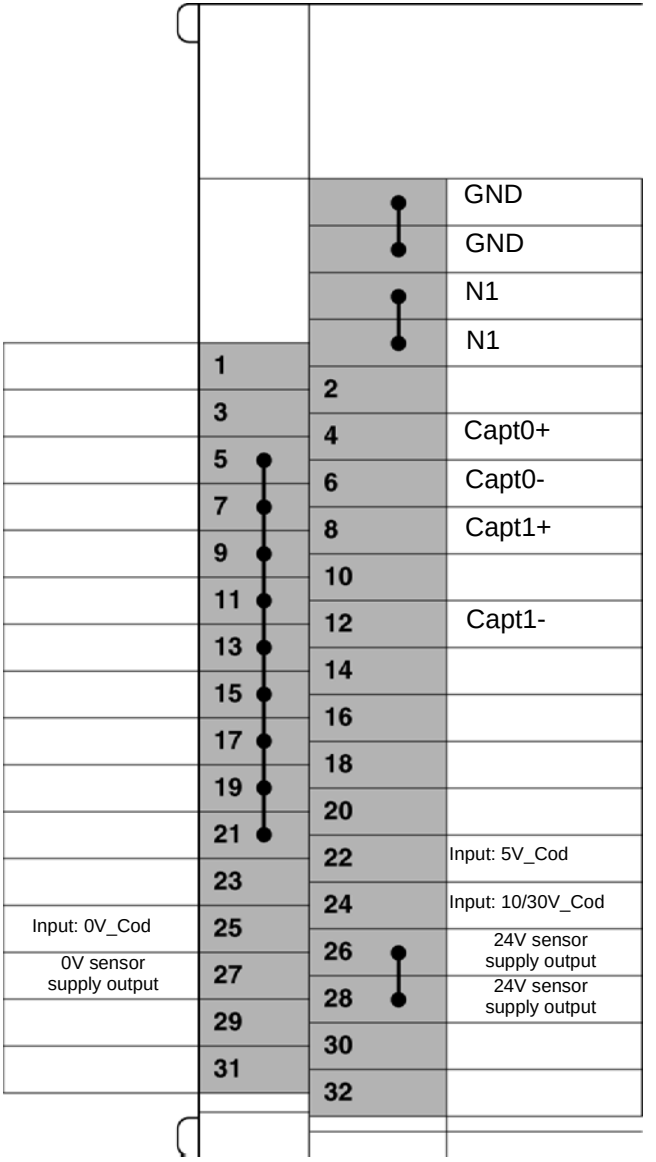
- only connect a 5Vdc supply if it is a 5Vdc encoder,
- only connect a 10/30Vdc supply if it is a 10/30Vdc encoder,
- do not connect any supply to this TELEFAST whilst using a TELEFAST ABE-7CPA11 as an encoder interface on the ENC connector.

Failure to follow this precaution can result in injury or equipment damage.

Description of the Screw Terminal Blocks for the TELEFAST ABE-7CPA01

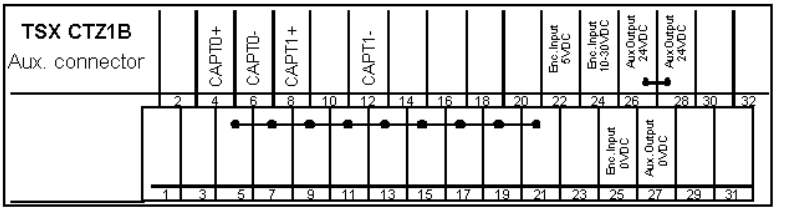
Diagram

The table below shows the labeling of TELEFAST signals seen from below



Label

This diagram shows TELEFASTs personalization label.
Illustration:



Print, cut and insert this label in your TELEFAST.

TELEFAST ABE-7CPA11 Connection Base

18

At a Glance

Aim of this Chapter

This chapter, using diagrams, describes connections and examples of usage of the TELEFAST ABE-7CPA11

What's in this Chapter?

This chapter contains the following topics:

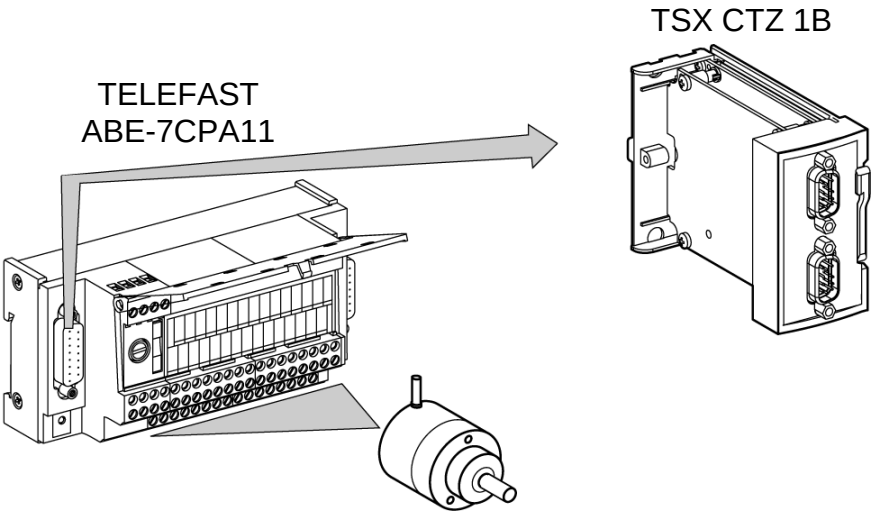
TELEFAST 2 Connection and Adaptation Base: ABE-7CPA11

At a Glance

TELEFAST 2 connection and adaptation base: ABE-7CPA11 allows the connection of absolute encoders with parallel outputs to the TSX CTZ1B counting module.
It converts the position value supplied by the absolute encoder with parallel outputs to serial information. The absolute encoder must be encoded in pure or gray binary with a maximum of 24 bits of data.
It is possible to connect 2 absolute encoders with parallel outputs on the same adaptation TELEFAST. Furthermore, the sequencing of several ABE-7CPA11 connecting bases (a maximum of 4) allows the multiplexing of up to 4 absolute encoders with parallel outputs on the same counting channel (position acquisition).

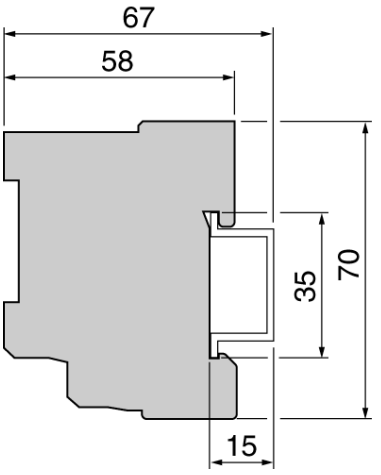
Illustration

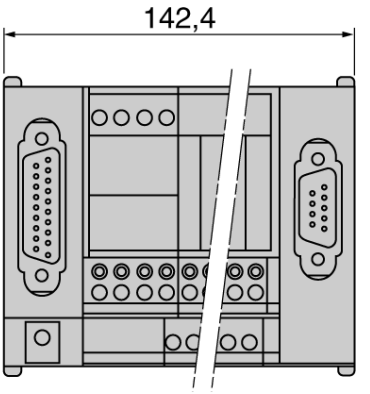
This diagram shows an absolute encoder with a TELEFAST ABE-7CPA11 and a TSX CTZ 1B module:



Dimensions and Assembly

Dimensions :





Assembly:
The ABE-7CPA01 connection base should be mounted on a 35mm-wide DIN mounting rail.

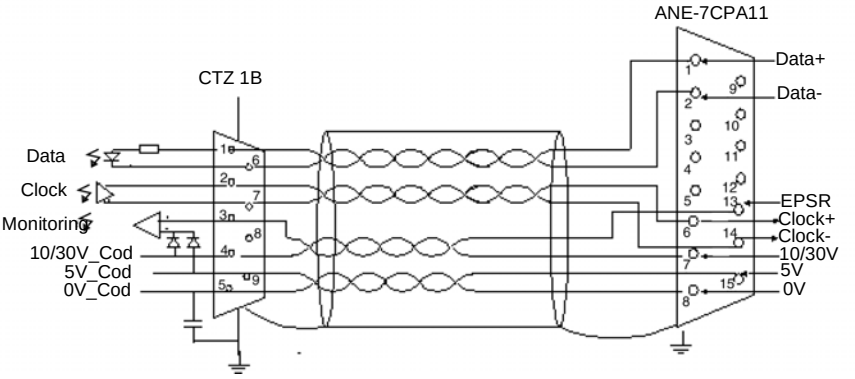
Connecting the TELEFAST ABE-7CPA11 to the TSX CTZ 1B Module

Introduction to Pin Assignment

The table below shows the pin assignment for a 15-pin Sub-D on TELEFAST ABE-7CPA11:

Number	Signal	Designation
1	DAT+	DATA+ output differential
2	DAT-	DATA- output differential
3		
4		
5		
6	CLK+	CLK+ input differential
7	10/30V-COD	10/30Vdc encoder supply
8	0V-COD	0Vdc encoder supply
9		
10		
11		
12		
13	EPSR	Input of encoder feedback supply
14	CLK-	DATA- input differential
15	5V-COD	5Vdc encoder supply

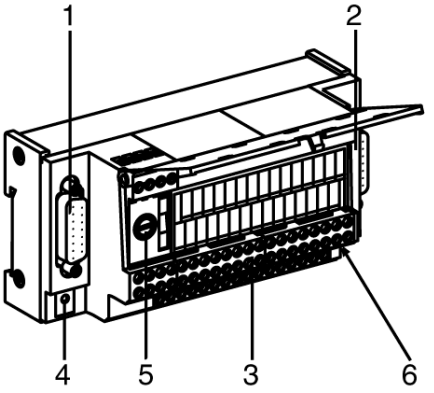
The diagram below shows the connection of TELEFAST ABE- CPA11 to the TSX CTZ 1B module:



Physical Description of the TELEFAST 2: ABE-7CPA11

Illustration

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



Information Table

This table explains the diagram above:

Number	Description
1	Standard 15 pin SUB-D connector to link the TELEFAST module to the TSX CTZ 1B.
2	Standard 15 pin SUB-D connector to sequence several TELEFAST modules (maximum of 4).
3	Screw terminal to link one or several of the absolute encoders with parallel outputs (maximum of 2). It is possible to distribute the supplies using additional locking terminal blocks. ABE-7BV10 (10 blocks) or ABE-7BV20 (20 blocks).
4	TELEFAST diagnostic display LED. The green LED is on if the TELEFAST module is connected to the supply.
5	10...30 V supply protection fuse (rapid type 1A).
6	Micro-switch to configure one or more of the encoders (number of encoders, type of encoders etc.).

TELEFAST 2 Connection Base Characteristics: ABE-7CPA11

General Characteristics

This table shows general characteristics:

Parameters	Values
Voltage allowed in 10...30 VDC	11...30 V
Admissible voltage in 5 VDC	5...6 V
Maximum status change frequency of the least significant bit.	75 kHz
Read frequency of the serial frame	150 kHz...1 MHz
Power consumption (excluding encoder)	typical: 90 mA max: 130 mA
Power dissipation	typical: 450 mW max: 1.5W
Monitoring of the encoder supply feedback: ● on the + supply ● on the - supply	 -15% V supply +15% V supply
Resistance of insulation	> 10 MΩ under 500 VDC
Dielectric rigidity	1000 Veff.50/60 Hz for 1 min
Working temperature	0...60°C
Hygrometry	5% to 95% excluding condensation
Storage temperature	-25 °C...+70°C
Operational altitude	0...2000 m

Encoder read input characteristics (in0 to in23)

This table shows read input characteristics (in0 to in23):

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

(1) **Positive logic**: voltage < 2.5 V -> status 0,
voltage > 3.9 V -> status 1,
Negative logic: voltage < 2.5 V -> status 1,
voltage > 3.9 V -> status 0.

Characteristics of (AD0, AD1) discrete address inputs

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

Parameters	Values
Logic	positive
Voltage limit ● max. limit of voltage admissible	30 V 34 V (1hour in 24 hours)
Nominal values ● voltage ● current	 24 V 7 mA
Voltage for "ON" status: Voltage for ON status at 11V Voltage for "OFF" status: Current for "OFF" status:	≥ 11 V ≥ 3 mA ≤ 5 V ≤ 2 mA
Input impedance for nominal U	3.6 kΩ
Response time	25 µs...50 µs
Input type	resistant
IEC 1131 conformity	type 1

Characteristics of command outputs, 3 states of encoders (3STO, 3ST1)

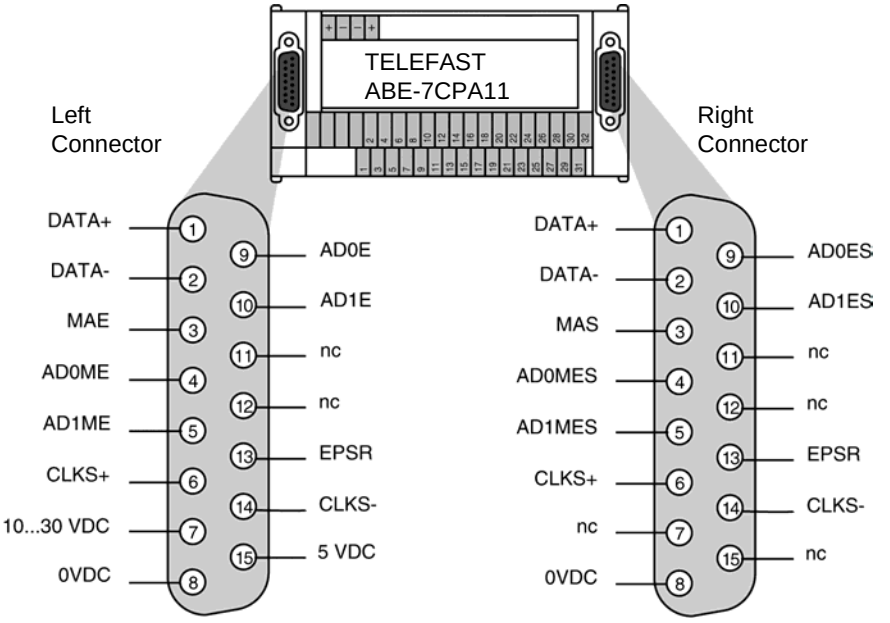
This table shows the characteristics of command outputs, 3 states of encoders (3ST0, 3ST1)

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

Connecting the TELEFAST 2 Base: ABE-7CPA11

Pin Assignment of 15 pin SUB-D connectors

Illustration:



Left connector:

Supply	
0 VDC	8
1030 VDC	7
5 VDC	15
Encoder address settings	
• inter-TELEFAST bus (Input):	
AD0E	9
AD1E	10
AD0ME	4
AD1ME	5
MAE	3
EPSR encoder supply feedback	13
Serial link	
• data outputs:	

DATA+	1
DATA-	2
• clock inputs:	
CLK+	6
CLK-	14

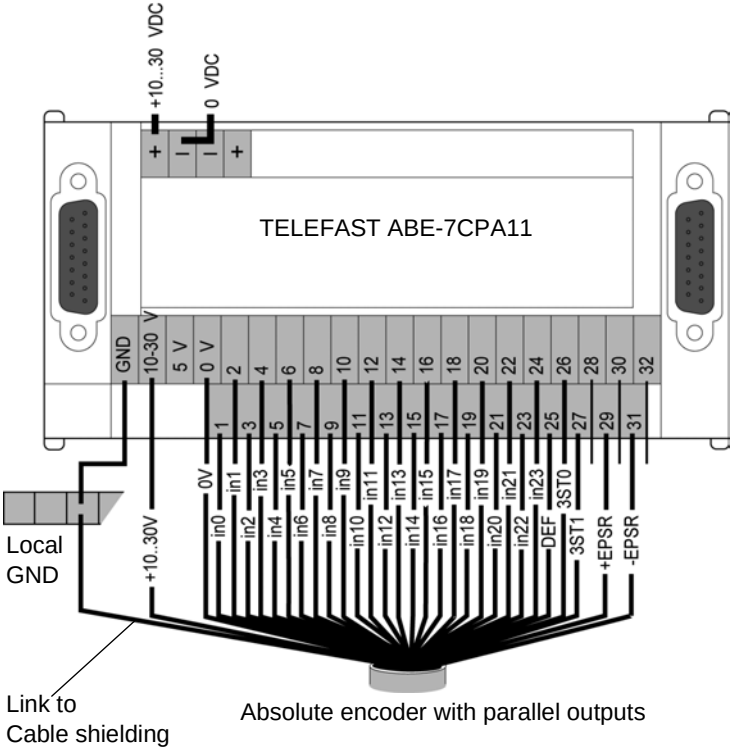
Right connector:

Supply	
0 VDC	8
Encoder address settings	
• inter-TELEFAST bus (Output):	
AD0ES	9
AD1ES	10
AD0MES	4
AD1MES	5
MAS	3
EPSR encoder supply feedback	13
Serial link	
• data outputs:	
DATA+	1
DATA-	2
• clock inputs:	
CLK+	6
CLKS-	14

Connecting Encoders Supplied with 10...30 V

Provisional Diagram

Illustration:



Key:

Signals	Meaning	Terminal number
GND	mass of one or more of the encoders	
+10...30 V	+ terminal supply of one or more of the encoders	
0 V	- terminal supply of one or more of the encoders	
in0 to in23	outputs of one or more of the encoders	1...24
DEF	default outputs of one or more of the encoders	25
3ST0	inhibition command of the outputs of encoder 0 (if multiplexing)	26
3ST1	inhibition command of the outputs of encoder 1 (if multiplexing)	27

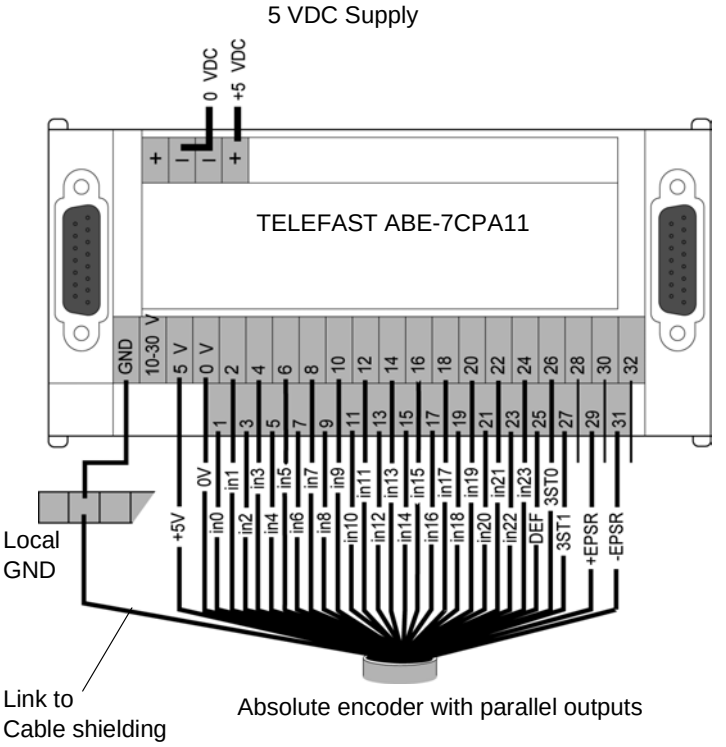
Signals	Meaning	Terminal number
AD0, AD1	encoder multiplexing command	28,30
COM	common to signals AD0 and AD1	32
+EPSR	+ encoder input feedback supply (connect to +10...30 V if it is not monitored)	29
-EPSR	- encoder input feedback supply (connect to 0V if it is not monitored)	31

Note:
Refer to encoder outputs rules and precautions.

Connecting Encoders Supplied with 5 V

Provisional Diagram

Illustration:



Key:

Signals	Meaning	Terminal number
GND	ground connection of one or more of the encoders	
+5 V	+ terminal supply of one or more of the encoders	
0 V	- terminal supply of one or more of the encoders	
in0 to in23	outputs of one or more of the encoders	1...24
DEF	default outputs of one or more of the encoders	25
3ST0	inhibition command of the outputs of encoder 0 (if multiplexing)	26

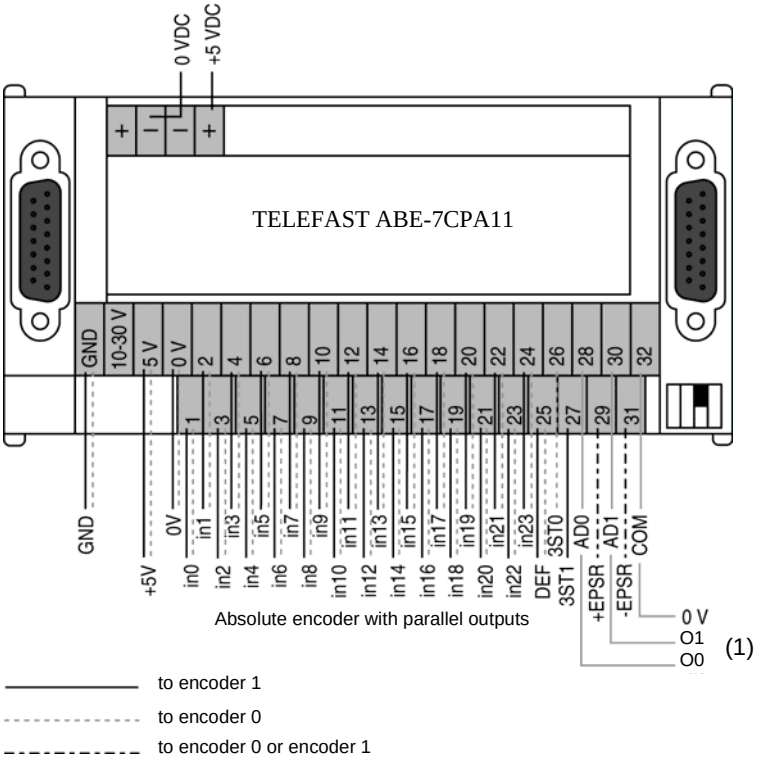
Signals	Meaning	Terminal number
3ST1	inhibition command of the outputs of encoder 1 (if multiplexing)	27
AD0, AD1	encoder multiplexing command	28,30
COM	common to signals AD0 and AD1	32
+EPSR	+ encoder input feedback supply (connect to +5V if it is not monitored)	29
-EPSR	- encoder input feedback supply (connect to 0V if it is not monitored)	31

Note:
Refer to wiring rules and precautions for the encoder outputs.

Example of Multiplexing of Encoders Supplied with 5V

General

Illustration:



IMPORTANT

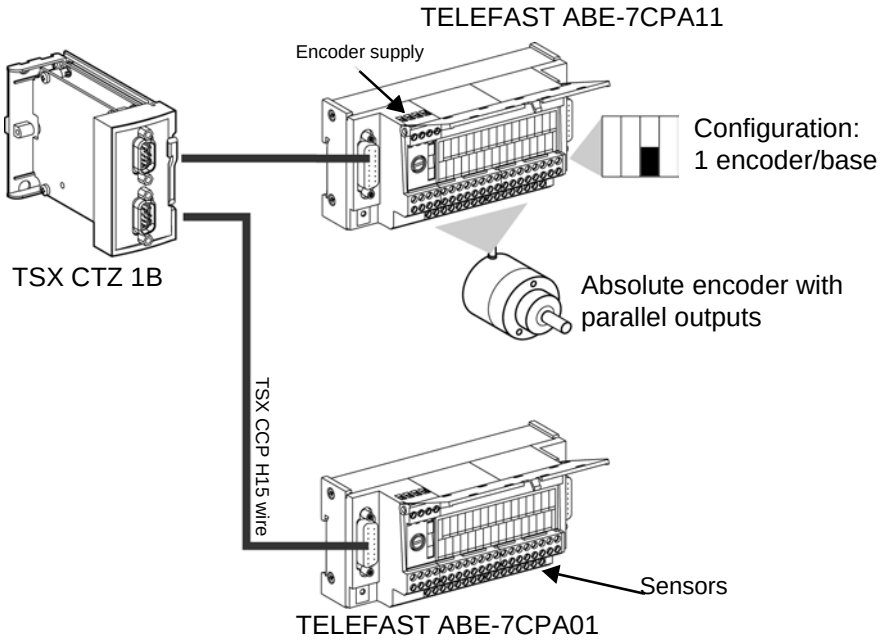
When multiplexing, it is important to use encoders with the same type of parallel outputs:

- the same number of data bits,
- the same supply (encoders are supplied with either 10...30 VDC, or with 5 VDC).

Note: if the supply check encoder is not used, the +EPSR terminal (+encoder supply feedback) must be connected to +10...30 V or to + 5 V and the -EPSR terminal (-encoder feedback supply) must be connected to 0V.
(1) The multiplexing command can be carried out through the PLC 24V static outputs (O1 - O0).

Example of a connection: an encoder connected by a TELEFAST to the TSX CTZ 1B ENC connector

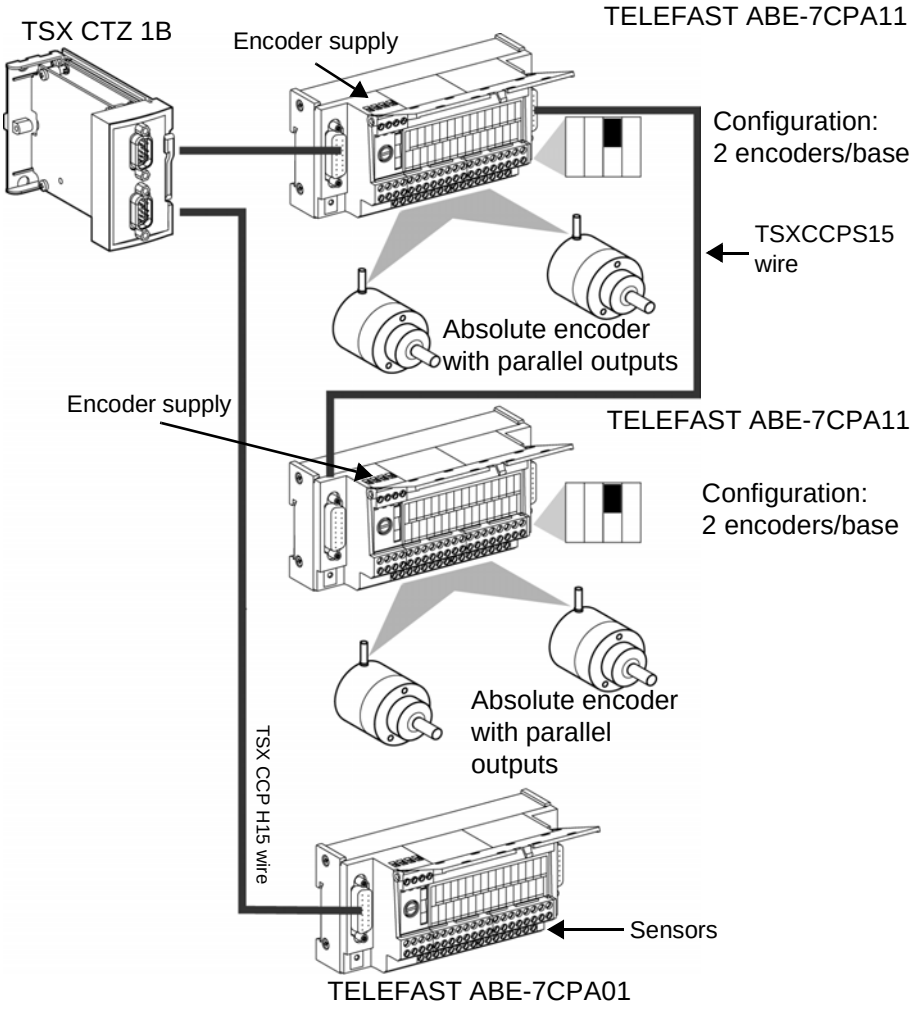
Illustration This diagram shows the connection of each channel of a TSX CTZ 1B module to a single TELEFAST:



Note: (1) it is not necessary to wire the TELEFAST 0 address settings (channel 0), as this by default has the address 00.

Example of a connection: 4 encoders connected by 2 TELEFASTs to the TSX CTZ 1B ENC connector

Illustration This diagram shows the connection of 2 TELEFASTs on the same channel:



Encoder Address Settings

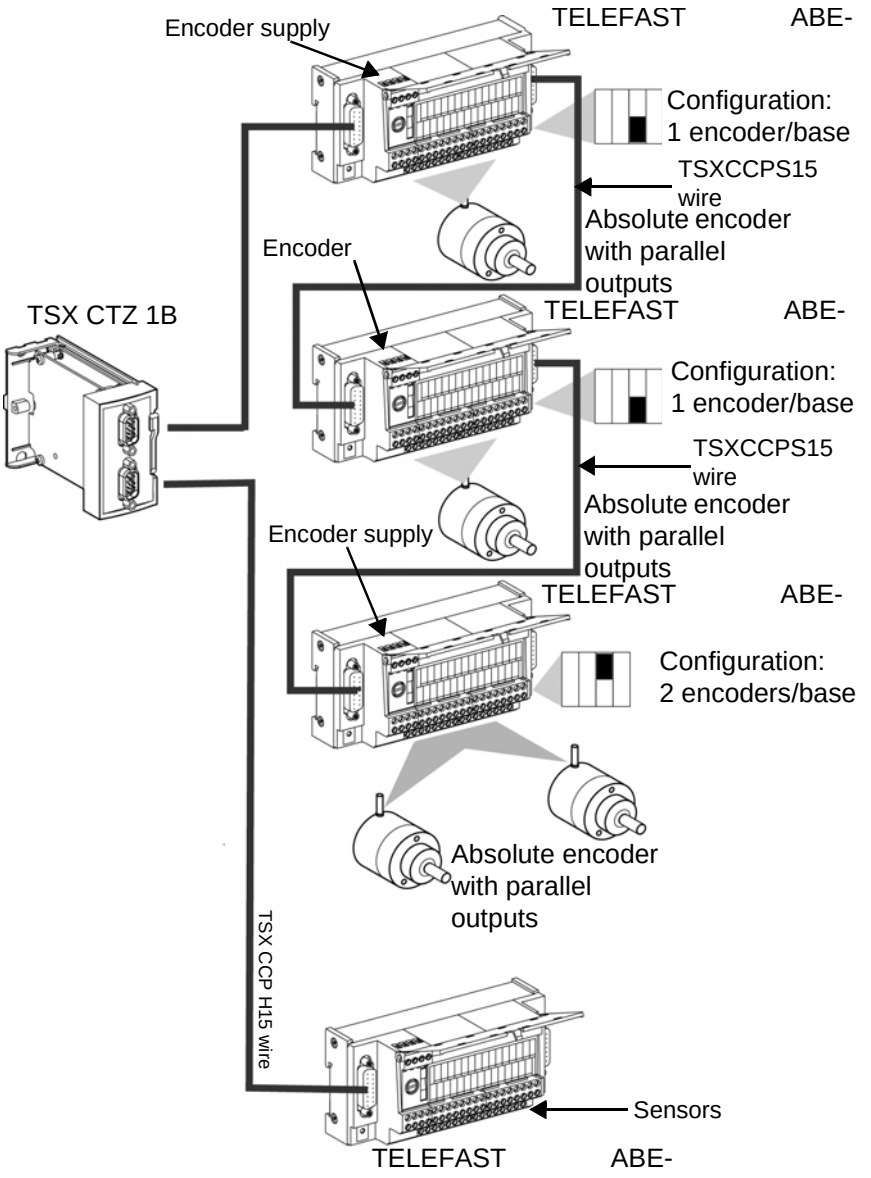
(1) The address settings of the TELEFAST's encoders are as follows:

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

Example of a connection: 4 encoders connected by 3 TELEFASTs to the TSX CTZ 1B ENC connector

Illustration

This diagram shows the connection of 3 TELEFASTs on the same channel:



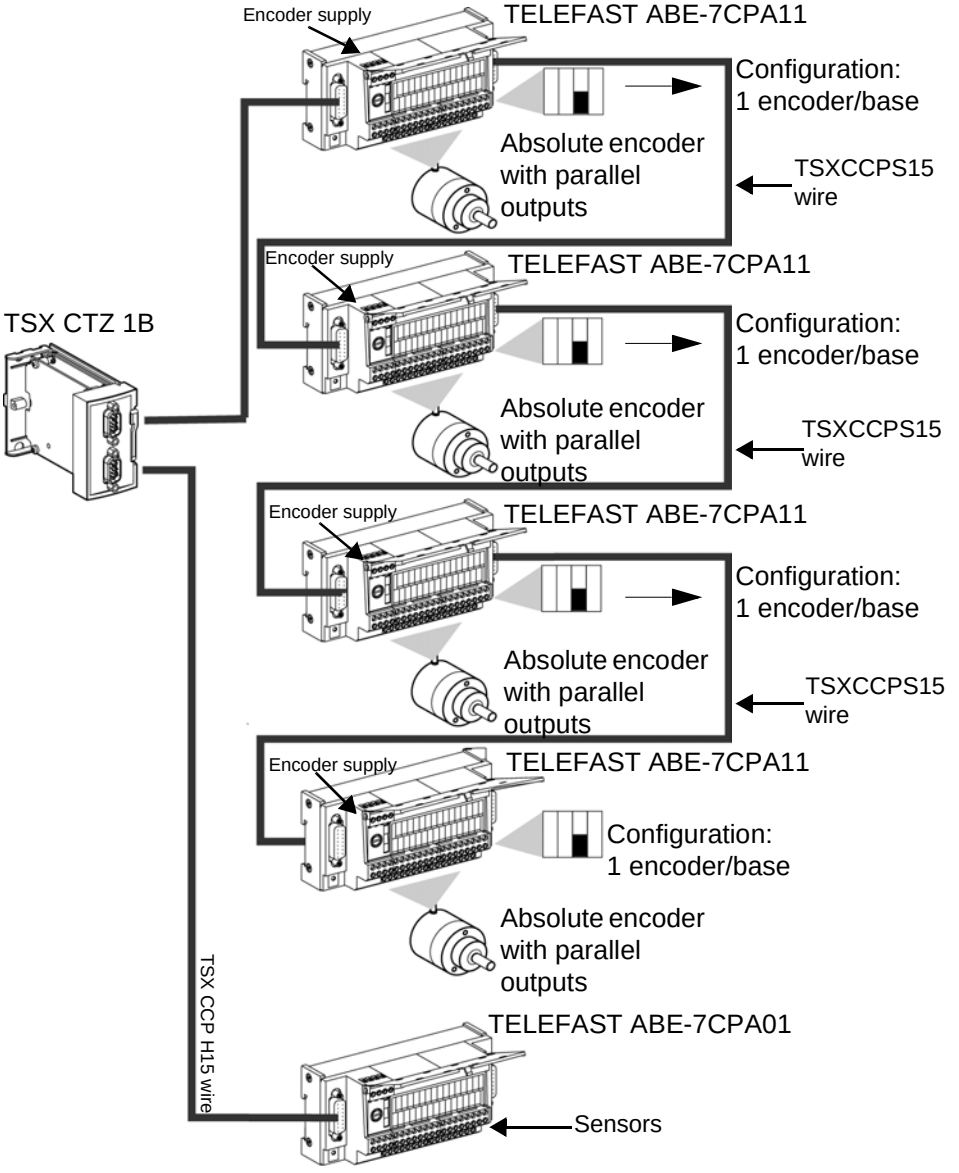
Encoder Address Settings

(1) The address settings of the TELEFAST encoders are 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 1 encoder 2

Example of a connection: 4 encoders connected by 4 TELEFASTs to the TSX CTZ 1B ENC connector

Illustration This diagram shows the connection of 4 TELEFASTs on the same channel:



Encoder Address Settings

(1) The address settings of the TELEFAST encoders are 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

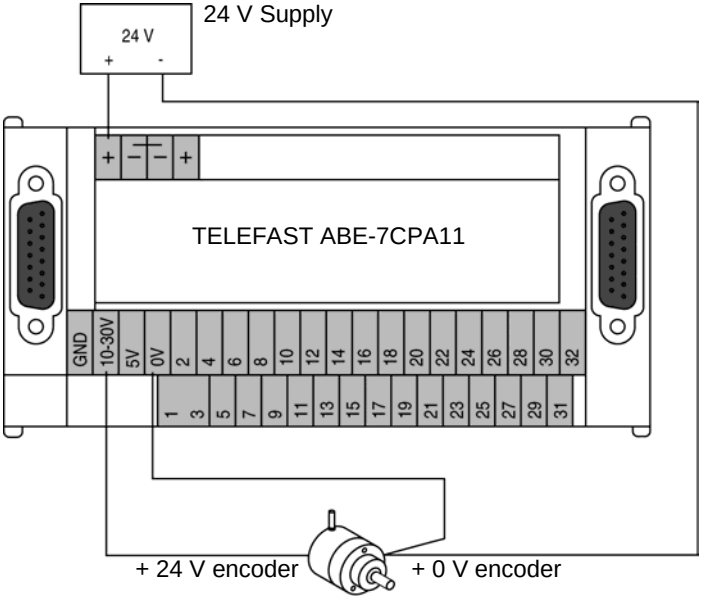
Wiring Rules and Precautions

Important

All connections or disconnections carried out on the TELEFAST should be done when the SUPPLY IS OFF (encoders, links to the counting module, links between TELEFAST connecting bases).
In order to limit the drop in voltage in the 0V, which is due to the encoder's supply current, it is recommended that the 0V be wired according to the following diagram:

Encoder Supply Connection

Wiring diagram:



Protecting encoder power supply

The usage voltage of one or more of the encoders linked to the TELEFAST determines if it should be supplied with 10...30 VDC or 5 VDC. When a 10...30VDC supply is used, the protection fuse is built into the TELEFAST (type 1A rapid fuse). However, if the TELEFAST is supplied with 5VDC, the user must put in place a rapid fuse which is in accordance with the + terminal of the supply and adapted to the consumption of the TELEFAST and the encoders linked to it.

Monitoring the Encoder Supply Voltage

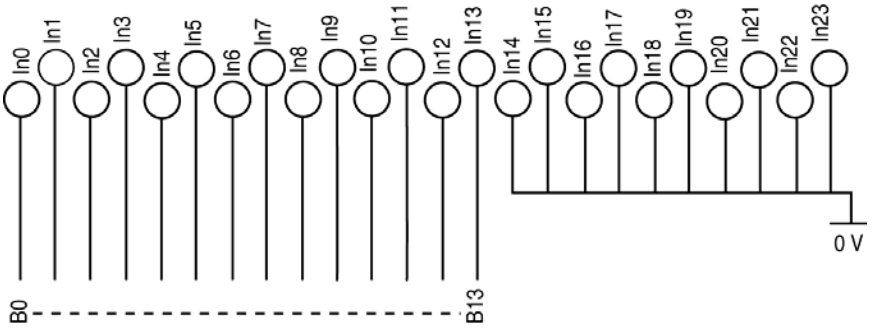
This function is only valid if only one encoder is linked to the TELEFAST. If the encoder supply voltage drops by more than 15%, the module is reset to the EPSR default.

If the encoder does not have an encoder feedback supply, it is essential to wire:
- the TELEFAST +EPSR terminal to the + of the encoder supply,
- the TELEFAST -EPSR terminal to the - of the encoder supply,

Encoder Output Wiring

If the encoder outputs are set to positive logic and if there are less than 24, you must obey the following rules:
- wire the encoder outputs to the TELEFAST inputs, starting from the least significant and going towards the most significant,
- wire the TELEFAST inputs which are not used on the 0V terminal.

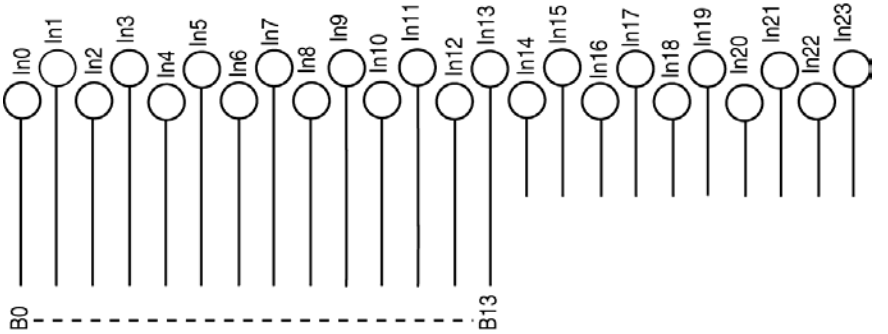
Illustration:



14 bit Encoder

If the encoder outputs are set to negative logic and if there are less than 24, you must obey the following rules:
- wire the encoder outputs to the TELEFAST inputs, starting from the least significant and going towards the most significant,
- do not wire (leave free) the TELEFAST inputs which are not being used.

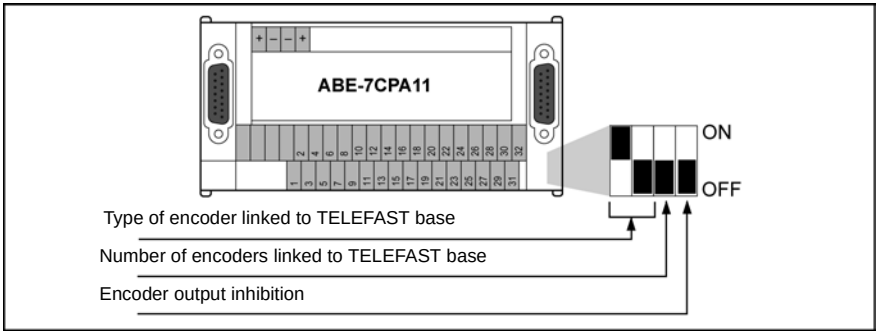
Illustration:



Configuration of the TELEFAST Connection Base

At a Glance

TELEFAST connection base configuration is performed by positioning the 4 micro-switches which are situated under the 15 pin SUB D connector. When using the TSX CTZ 1B module, the configuration is limited to defining the type of encoder connected.
The diagram below shows the geographical position and the function of these 4 micro-switches.



The two micro-switches situated to the right should always be in the OFF position. The two micro-switches situated on the left, according to the encoder outputs characteristics, define the link performances depending on the TELEFAST/encoder distance.

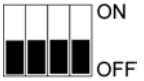
Micro-switch Positioning: encoder with positive logic outputs

Encoder with positive logic outputs, GRAY encoding

Encoder output type			**micro-switch position:**	**Max. length encoder/ TELEFAST**	**Max. frequency of change of the least significant bit**
Logic	**Output interface**	**Code**			
Positive	• Totem pole. • TTL • NPN open collector	Gray		50 meters	75 kHz

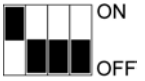
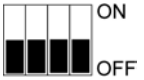
Micro-switch Positioning: Encoder with Negative Logic Outputs

Encoder with negative logic outputs, GRAY encoding

Encoder output type			micro-switch position	Max. length encoder/ TELEFAST	Max. frequency of change of the least significant bit
Logic	**Output interface**	**Code**			
Negative	Totem Pole	Gray		50 meters	75 kHz
	TTL			100 meters	40 kHz
	NPN open collector			200 meters	5 kHz

Micro-switch Positioning: Encoder with Positive or Negative Logic Outputs

Encoder with positive or negative logic outputs, Binary encoding

Encoder output type			Micro-switch positioning:	Max. length encoder/ TELEFAST	Max. frequency of change of the least significant bit
Logic	**Output interface**	**Code**			
Positive or negative	Totem Pole	Binary		10 meters	40 kHz
	TTL			30 meters	20 kHz
	NPN open collector			50 meters	5 kHz

Communication via a PCMCIA Card

IV

At a Glance

Aim of this Part

This part aims to introduce communication via a PCMCIA card.

What's in this Part?

This part contains the following chapters:

Introduction to PCMCIA Cards

19

At a Glance

Aim of this Chapter

This chapter introduces and describes PCMCIA cards, their characteristics and operating norms.

What's in this Chapter?

This chapter contains the following topics:

Introduction to PCMCIA Cards

General

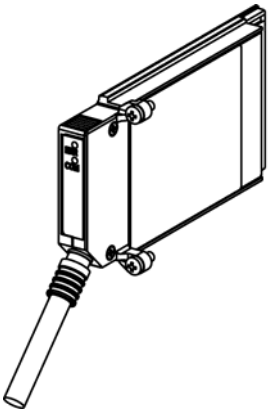
TSX 37-2• PLCs connect to bus networks and communication links via PCMCIA link cards.

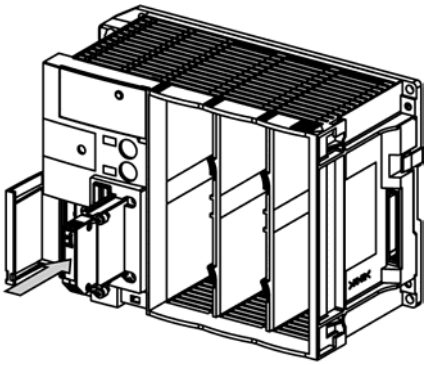
The connection card consists of a metal unit, whose dimensions conform to the PCMCIA type III extended format.

These cards are installed in the receptor slot on the central unit module of PLCs from the TSX 37-2• family.

	CAUTION
	Connecting PCMCIA cards The PCMCIA cards must not be connected with the current on **Failure to follow this precaution can result in injury or equipment damage.**

Illustration:





TSX SCP 11• Serial Link Cards

Each PCMCIA TSX SCP 11card tolerates a different physical covering. There are three products in this family of cards.

The three physical coverings supported by the cards are only either:
- the RS 232-D link, reference TSX SCP 111,
- (20 mA) current loop link, reference TSX SCP 112,
- RS 485 link (RS 422 compatible), reference TSX SCP 114.

Cards from the TSX SCP 11• family offer communication protocols for each of them.

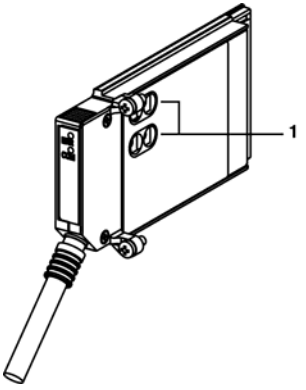
The protocols that can be used for each PCMCIA card are:
- the Modbus/Jbus protocol,
- the UNI-TELWAY protocol,
- character mode in asynchronous link.

FIPWAY Network TSX FPP20 PCMCIA Card

The PCMCIA TSX FPP 20 card supports the FIP physical covering.

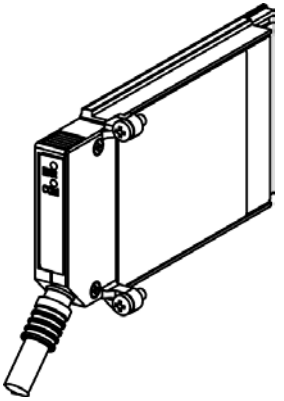
This means a TSX 37-2• PLC can be connected to a FIPWAY network and to equipment belonging to manufacturers who want to connect their products to the FIPWAY network.

The card is equipped with four channel connection switches (**1**) (see the illustration below) allowing network and station number encoding.
The PCMCIA cards can also be used on equipment with a type III receptor such as the CCX 17, FTX 417-40 consoles or third party equipment, for example PC compatibles.
Illustration of a PCMCIA card showing channel connection switches:



FIPIO Bus Agent TSX FPP10 PCMCIA Card

A PCMCIA TSX FPP 10 card allows a TSX 37 PLC to connect to a FIPIO bus as a FIPIO agent. It ensures a link to the TSX 47-107 and April 5000 PLCs.
Illustration:



Modbus + Network Card

A PCMCIA TSX MBP 100 card allows a TSX 37-2• PLC to connect to a Modbus + network. It ensures a link with Modicon type PLCs.

Note: PCMCIA cards are implemented, operated and maintained with the help of PL7 Micro or PL7 Junior programming and operation software for TSX 37 PLCs.

Description of PCMCIA cards

General

PCMCIA type III E (extended) communication cards are built into a metal unit with the following dimensions :

- length 85,6 mm,
- width 51 mm,
- height 10 mm.

The card's front panel shows the physical network connection and a display of the communication operation.

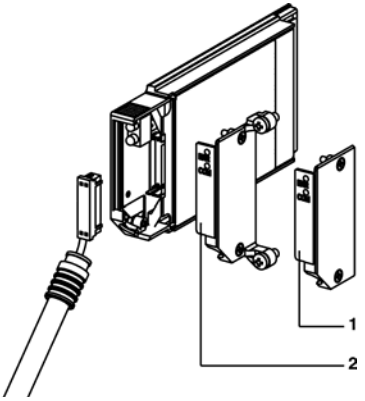
Mechanical configuration

The card's mechanical configuration must be adapted to the desired installation type using a removable cover :

- installation onto a PLC TSX 37 :
  use the movable cover at bracket (**2**) (see diagram), using a screw to ensure that it is fixed to the PLC,
- installation onto a PC compatible device :
  use the movable cover (**1**) (see diagram).

Diagram

This diagram shows a PCMCIA card and the two types of cover :



Note: The two covers (1) and (2) are provided with the PCMCIA card.

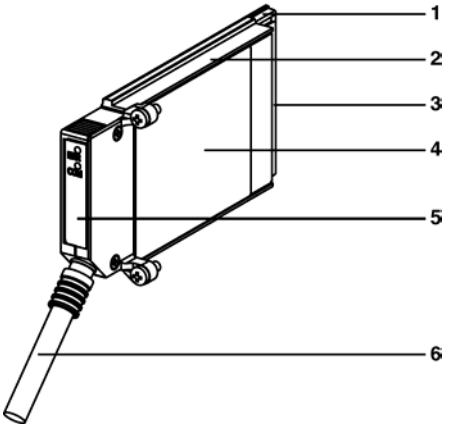
Connect to the network by attaching the link cord to the front panel of the card. A polarization system prevents incorrect installation. The product reference label informs the user about the kind of physical cover the card supports.

Note: Bracket covers mounted on PCMCIA cards prevent accidental extraction while the voltage is switched on, and ensure that the card will operate faultlessly.

Physical features

Diagram

PCMCIA card :



Description

This table describes the different labels in the above diagram:

Label	Description
1	Fitted card.
2	Zamak body.
3	PCMCIA connector.
4	Outer cover.
5	Movable cover.
6	Link cord with protector.

The movable cover (**5**) ensures that the card's operation can be displayed in its workspace. The designation of the two LEDs is serigraphed onto the front panel of the movable cover.

The product reference label shows the type of PCMCIA card. It is affixed to the outer cover (**4**).

The metallic protector (**6**) attached to the end of the cord connected to the PCMCIA card prevents the cord from being pinched by the movable cover. The protector eliminates the risk of bending the cord, which could damage the quality of the connection.

Operational standard

General

PCMCIA cards connected to a TSX 37 conform to the standards of usage referred to below, according to the applicable country.:

- US Standards : UL508, CEI 1131-2,
- Canadian Standard : CSA C22.2/142,
- CEI 1131,
- Conforms to rules : FCC-B,
- EC labeling
- Standard PCMCIA, mechanical type III E,
- PCMCIA 2.01,
- Marine VB (Veritas) DNV, GL, LROS,
- Petrochemistry FM,
- Energy EDF, ENEL.

The protection index for PCMCIA cards is PI = 40.

The PCMCIA FIPWAY TSX FPP 20 cards and FIPIO agent TSX FPP 10 conform to the following communication standards :

- the FIP protocol (connection, network management),
- the PCMCIA standard,
- the XWAY communication standard.

The PCMCIA TSX SCP 111, 112, 114 cards conform to the following communication standards :

- the UNI-TELWAY, MODBUS protocol (connection, network management),
- the PCMCIA standard,
- the XWAY communication standard.

Compatibility

General

The PCMCIA TSX SCP 111/112/114 cards ensure communication with TSX 7, 1000 series, and Modicon PLCs, aswell as other products compatible to UNIT-TELWAY, MODBUS and character mode. PCMCIA cards are also MODBUS/JBUS compatible with series 1000 PLCs.

The TSX FPP 20 FIPWAY card is compatible with the following FIPWAY devices :

- Model 40 PLCs (TSX 47-455, TSX 67-455…) with more recent versions than 5.0,
- PLC TSX 17,
- Compatible PCs connected using TSX FPP10 and TSX FPP20 cards.

Implementation of PCMCIA cards

20

At a Glance

Aim of this chapter

This chapter deals with the implementation of PCMCIA cards.

What's in this Chapter?

This chapter contains the following topics:

Installing cards and cords for the TSX 37-2•

General

To install a PCMCIA card, assemble the connection accessory (the activity type of the cord depends on the type of transmission support to be used), then screw the movable cover fitted with fixing brackets to the terminal block. The cover allows the PCMCIA card to be fixed to the TSX 37-2 PLC•.

The connector attached to the PCMCIA is a 20 point connector.

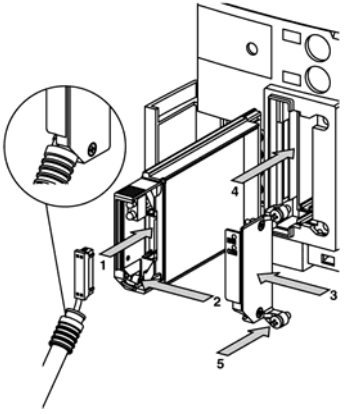
How to install the card and the cord

To attach the transmission support to the card, you must first remove the cover screwed to the unit, then do the following :

Step	Action
1	Connect the cord.
2	Place the appropriate cover onto the unit, taking care to insert the protector into the section cut away for this purpose, so that the cable is integrated with the card.
3	Screw the cover back on.
4	Then insert the card into the allocated housing in the host device.
5	Screw the card in, in order to prevent any movement caused by the voltage, and to ensure that it will operate effectively.

Diagram

Diagram of the principle:



PCMCIA card references

General

The PCMCIA card references are as follows :

- **TSX SCP 111 :** multiprotocol card RS 232 D, 9 non isolated signals,
- **TSX SCP 112 :** multiprotocol card current loop 20 mA,
- **TSX SCP 114 :** multiprotocol card RS 485 compatible RS 422 remote,
- **TSX FPP 20 :** FIPWAY network card,
- **TSX FPP 10 :** FIPIO Agent bus card,
- **TSX MBP 100 :** Modbus + network card.

PCMCIA card operational display

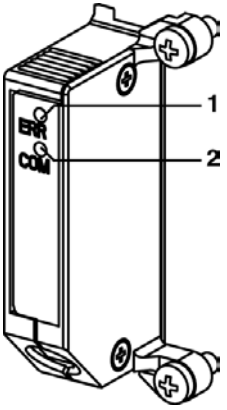
General

Two diagnostic LEDs are located on the front panel of the card. They inform the user about the exchange operations between the device supporting the PCMCIA card and the connected device.
LED table :

LED	Description
ERR (1)	Red indicates a fault.
COM (2)	This communication LED shows line activity. It is: • yellow for the TSX SCP 11•, TSX FPP 10 and TSX FPP 20 cards, • green for the TSX MBP 100 card.

Diagram

This diagram shows the LEDs on the front panel of the PCMCIA card :



Visual diagnostics of the PCMCIA card

Introduction

The indicator lamps on the PCMCIA card display the mode of operation of the card's communication, aswell as its diagnostics .

Cards TSX SCP 11•, TSX FPP 10/ FPP 20

Indicator lamp status :

ERR	COM	Meaning	Corrective action
○	○	Device switched off. No dialog.	Check connection and supply. Card inoperative.
○	⊗	Operating normally	-
●	**(1)**	Serious fault.	Change card.
⊗	○	Operational error on communication bus.	Check connection and configuration.
⊗	⊗	Operational error.	Check configuration.

Key :

● LED on

○ LED off

⊗ LED blinking

(1) : LED status unchanged

When the "ERR" indicator lamp of the TSX FPP 20 card is flashing, an external fault has occurred. The following type of external faults can occur :

- Line fault,
- Station already present on the network,
- Incorrect encoding in the network station address (Channel connect switch encoding).

TSX MBP 100 cards

Indicator lamp status :

ERR	COM	Meaning	Corrective action
○	○	Device switched off. No dialog.	Check connection and supply. Card inoperative.
○	**(1)** ⊗	Operating normally	-
●	**(2)**	Serious fault.	Change card.
⊗	○	Operational error : Card not configured, communication cannot be started on the network.	Configure card from : PL7 Micro (PLC Micro) PL7 Junior or PL7 Pro (Premium PLCs).
⊗	**(1)** ⊗	Operational error	Check configuration and connection to the Modbus+ network. The way in which the COM indicator is flashing indicates the nature of the problem.

Key :

● LED on

○ LED off

⊗ LED blinking

(1) : The way in which the LED COM is blinking indicates the operational state of the network (normal operation, faults etc.).

(2) : LED status unchanged.

Meaning of the different flashes of indicator lamp COM

This table gives the status of communication on the PCMCIA card according to the status of indicator lamp COM :

Indicator lamp status	Meaning
6 flashes per second	Normal node operation. Receiving and sending network token. All nodes on an operational network flash in this way.
1 flash per second	The node is offline either just after the power-up or after the 4-flashes per second mode. In this situation, the node searches the network and creates a table of active words. Having been in this state for 5 seconds, the node attempts to reenter normal operating mode, indicated by 6 flashes per second.
2 flashes, followed by a two-second pause	The node is detecting a token being sent between the other nodes, but is not receiving the token. Check for an open circuit or a faulty network termination.
3 flashes, followed by a 1.7-second pause	The node cannot detect any token being sent between the other nodes. It searches for the token at regular intervals, but cannot find another node to pass it to. Check for an open circuit or a faulty network termination.
4 flashes, followed by a 1.4-second pause	The node has detected a valid message from a node using an identical network address to its own. The node will remain in this state as long as it can still detect the duplicate address. If the duplicate address is not detectable for 5 seconds, the node changes mode, and begins to flash once per second.

Connecting the PCMCIA cards

21

At a Glance

Aim of this chapter

This chapter is about connecting the PCMCIA cards.

What's in this Chapter?

This chapter contains the following topics:

Connecting the TSX SCP 111 card

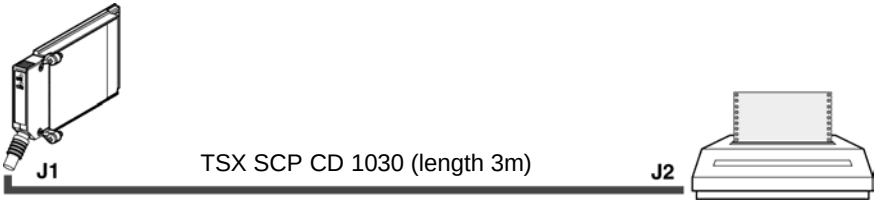
Point-to-point connection in character mode

The TSX SCP 111 card is dedicated to character mode and its physical support is RS 232 D. It is connected to the network using the TSX SCP CD 1030/1100 cable, or a Modem and a telephone link.

The equipment to be connected is of the DTE to DTE (data terminal equipment) type, e.g.: terminal, printer…
The reference of the cable needed for this connection is TSX SCP CD 1030/1100.

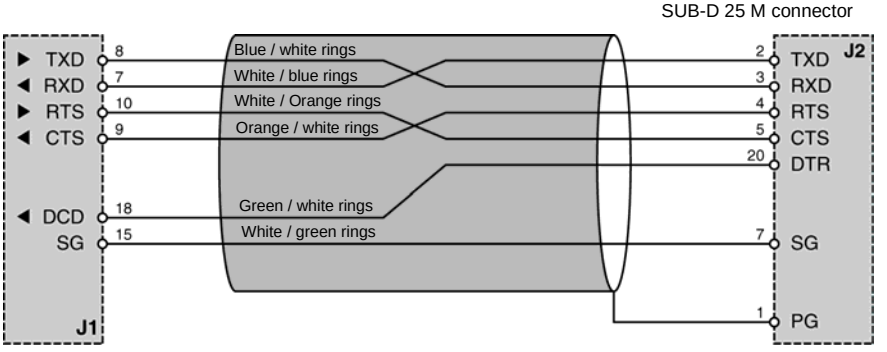
Type of connection

The PCMCIA TSC SCP 111 card is directly connected to the connected equipment with the bias of the TSX SCP 1030 cable.
Both pieces of connected equipment are DTE (Data Terminal Equipment).
Illustration: connection between a card and a printer.



Description of the TSX SCP CD 1030/1100 cable

Illustration: the miniature 20 pin PCMCIA connector supports the signals:

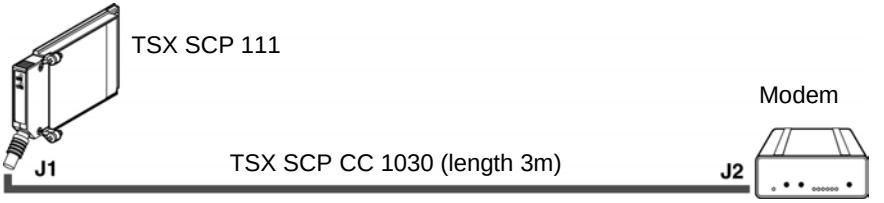


UNI-TELWAY, Modbus or character mode via Modem

The PCMCIA card is connected to the UNI-TELWAY buses, Modbus or character mode via a Modem and a telephone link (DTE/DCE type) using reference cable TSX SCP CC 1030.

Type of connection

The PCMCIA TSC SCP 111 card is directly connected to the connected equipment with the bias of the TSX SCP CC 1030 cable.
The connected equipment is of the DCE (Data Conversion Equipment) type.



Description of the TSX SCP CC 1030 cable

the miniature 20 pin PCMCIA connector supports the signals:

Connecting the TSX SCP 112 card

General

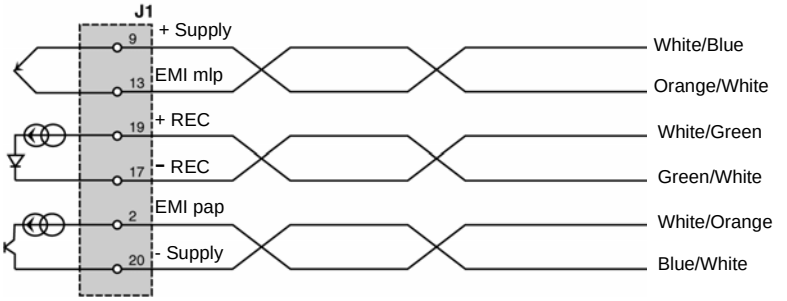
Point-to-point or multidrop connection between a TSX 37-21/22 PLC and a connection loop with 20 mA current is possible using the PCMCIA TSX SCP 112 card.

Note: In all cases a supply: of 24V +/- 20% external to the TSX SCP 112 card should provide the current needed to supply the current loop.

This type of connection is possible using the TSX SCP CX 2030 cable (3m long).

Description of the TSX SCP CX 2030 cable

the miniature 20 pin PCMCIA connector supports the signals:

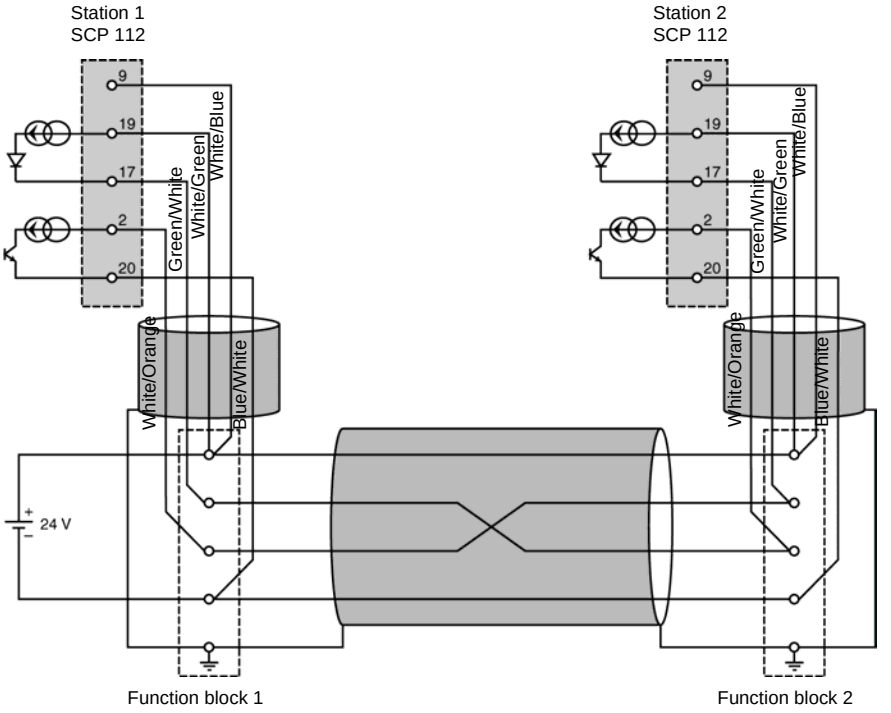


Note: A screw terminal block must be implemented to connect the TSX SCP 112 card in multidrop mode.

Point-to-point connection

Diagram

Point-to-point wiring of the TSX SCP 112 current loop PCMCIA cards. Point-to-point is only done in 20mA mode when idle.

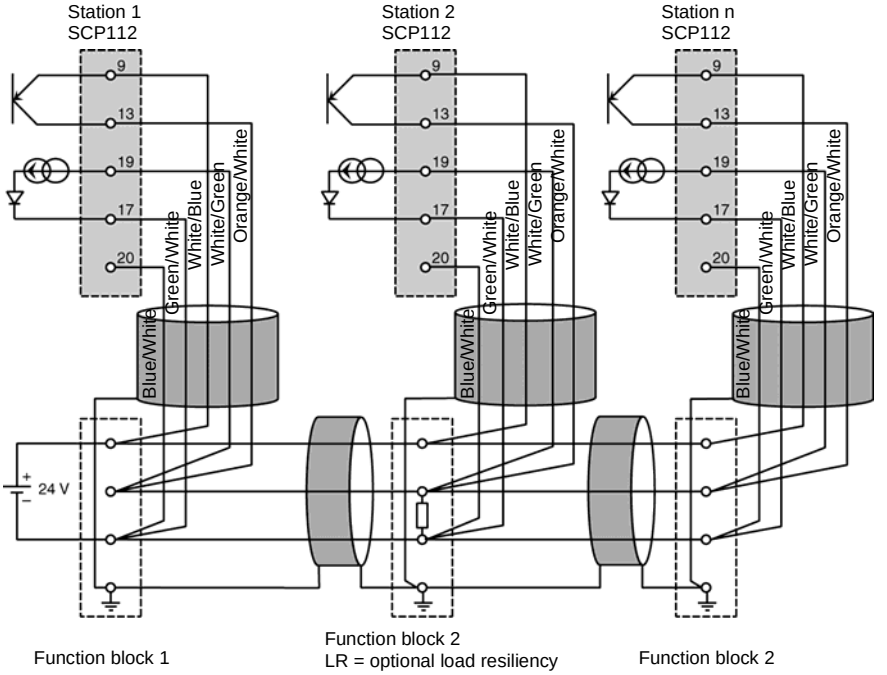


Important:
the wires' shielding must be connected to the shortest of the junction blocks.

Multipoint connection

Diagram

Multipoint is only carried out in 0 mA mode when idle. Transmittals and receptions are wired in parallel. The master should be set by the software.
Example of connecting the TSX SCP 112 n cards:



Important:
the wires' shielding must be connected to the shortest of the junction blocks.

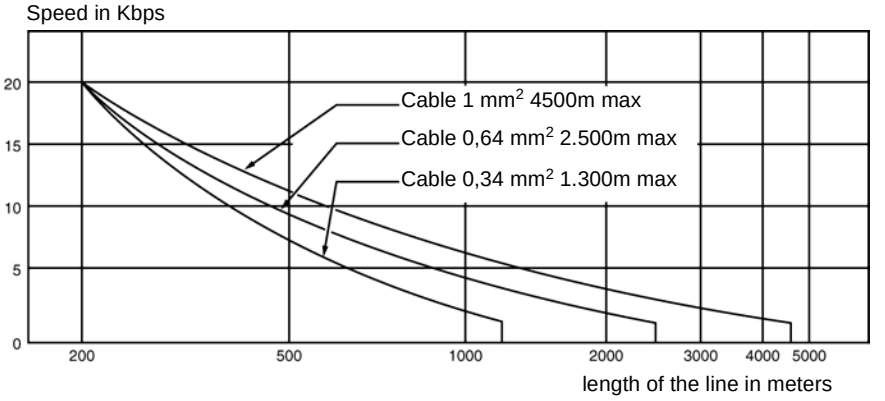
Dynamic performances

Introduction

The section and length of the cable used restrict the throughput of a current loop connection.
The two charts below show the performances the application can achieve.

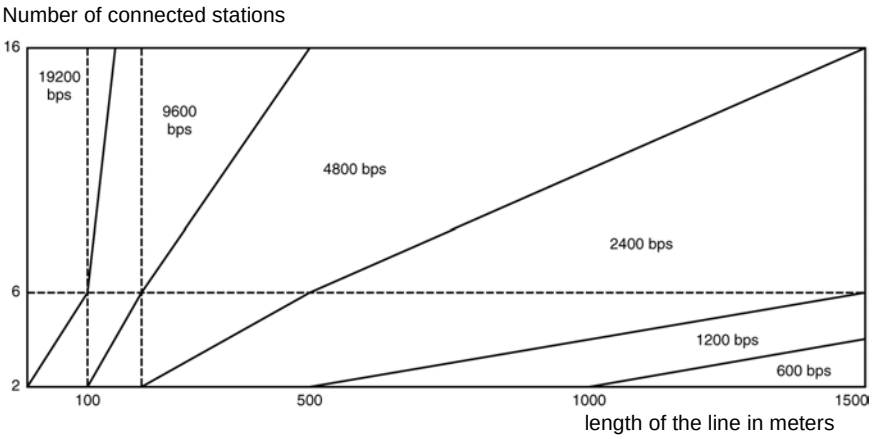
Point-to-point

The curves below are for a two pair shielded cable (transmittal in one pair, reception in the other), respecting all safety measures:



Multidrop

The chart below is for a shielded cable with conductors whose section is 0.34 mm^2. Connection was carried out according to the parallel multidrop diagram above. The quality of the signals transmitted improves when the conductors in the section above are used.
Illustration:



The performances of a multidrop link increase when the number of connected stations is increased. The line is more loaded which improves the quality of the signal transmitted.

When the connection is made according to the diagram above, the number of stations can be increased artificially (up to a maximum of 16) by loading the line at one end. This can be done by incorporating a load resistance. This load resistance can be connected to any junction block provided it is inserted between pins 17 and 19 of the TSX SCP 112 cards.

The value of resistance R simulating the load of "N" stations is determined by this formula: **R = U / (N x 20)**.
R in KΩ .
U = external supply voltage.
N = number of stations to be simulated.
Example:
An installation physically contains 6 stations with multidrop connection according to the diagram above, with an external supply of 24 V.
The line performances will be those of 10 stations simulating the load of 4 supplementary stations via a resistance: R = 24 / (4 x 20) = 0.3 KΩ.

Note: The load resistance should not produce an inductive effect, otherwise it could fail to function. Use a thick layer type resistance.

Connecting the TSX SCP 112 to April 5000/7000 PLCs

General

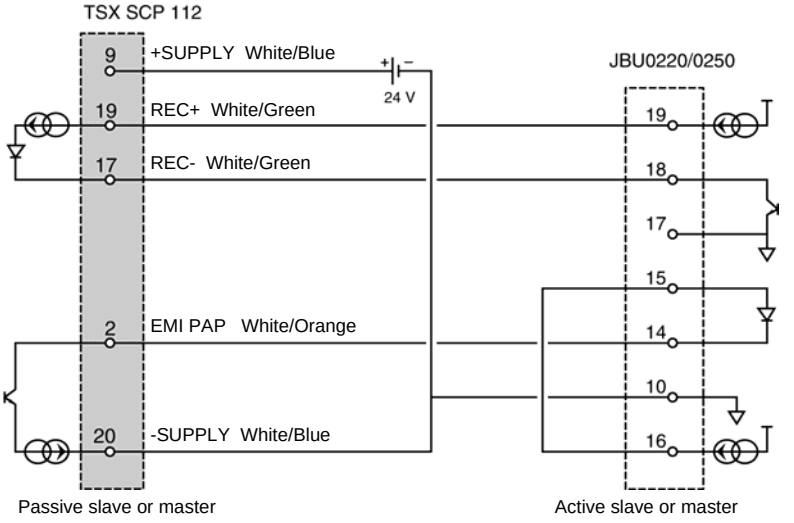
The PCMCIA card TSX SCP 112 20 mA current loop allows April communication modules of type JBU0220 and JBU0250 to be connected. The **multidrop connection** of the PCMCIA TSX SCP 112 card to the JBU0220 and JBU0250 modules is made in **series mode**.

Important:
the TSX SCP 112 card must be configured in **point-to-point** mode in the PL7 configuration screen, whether the link is point-to-point or multidrop series.

Note: The current loop allows a current of 20 mA when idle both in point-to-point and multidrop mode.
If a slave has no supply, its transmitter can be passed and the line is available. If the loop supply has been transferred to one of the slaves, cutting off the slave's supply causes communication to be interrupted.

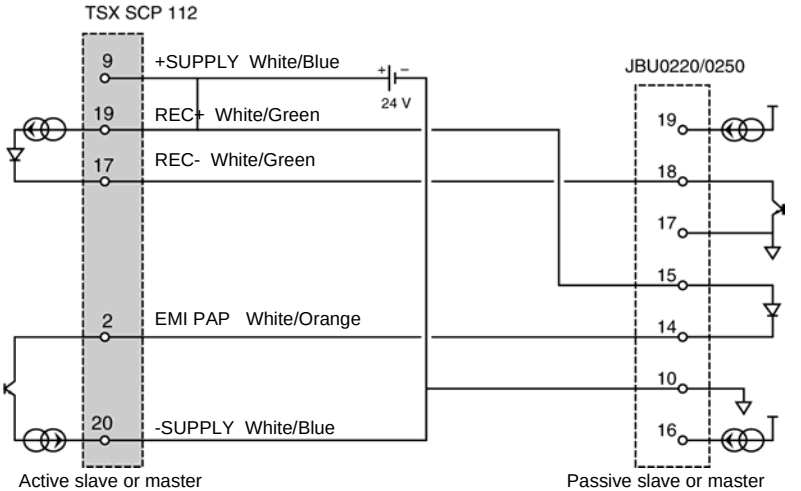
Point-to-point type link: JBU0220 or JBU0250 module active

Illustration:



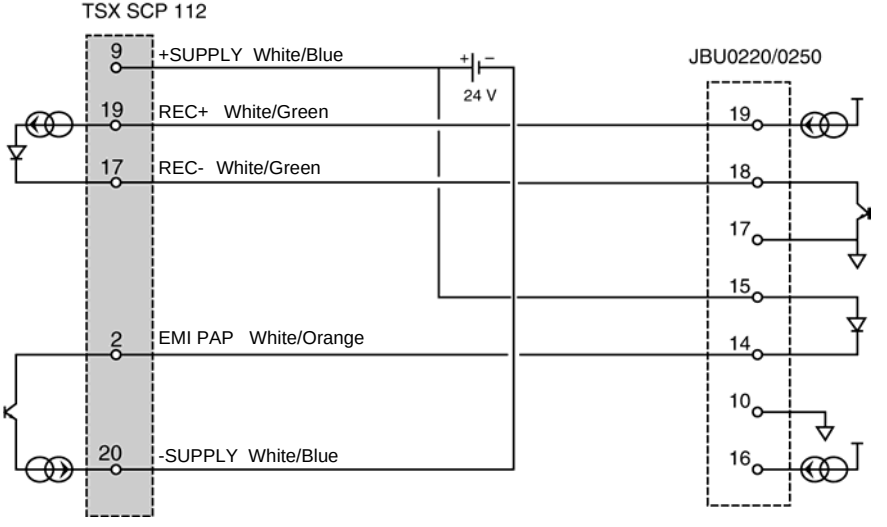
Point-to-point type link: TSX SCP 112 card active

Illustration:



Mixed station link

Illustration:



Multidrop type link for the TSX SCP 112 cards

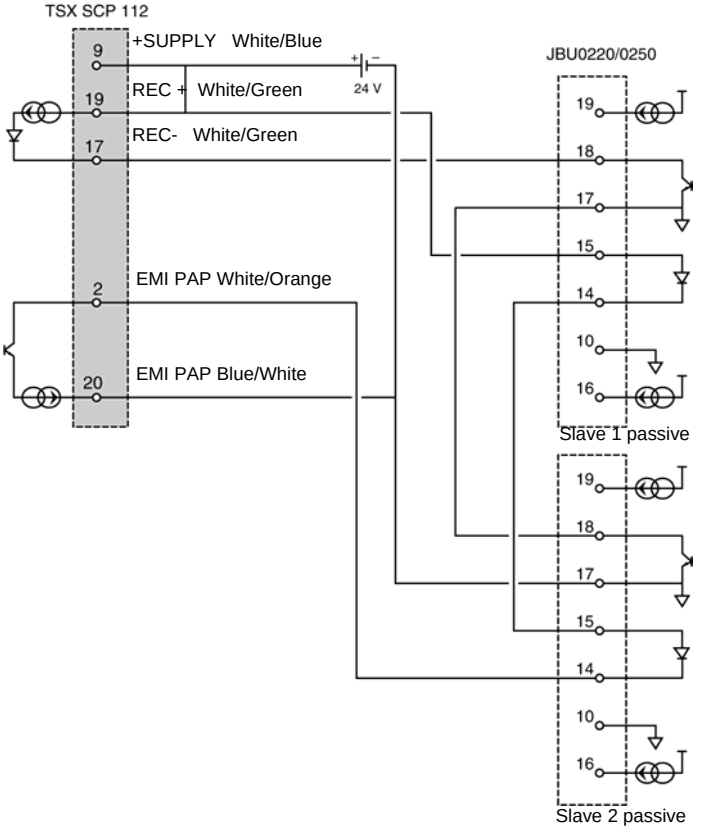
General

The examples below describe the different wiring possibilities for the TSX SCP 112 card with the JBU0220/0250 modules.

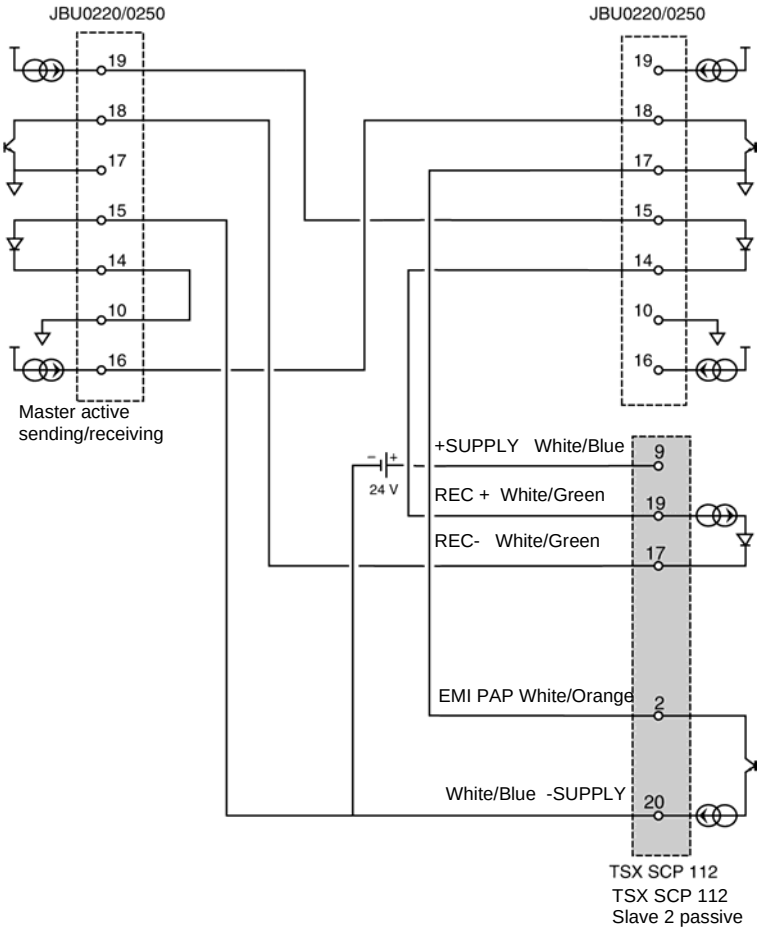
Important:
The 24V supply of each TSX SCP 112 in the loop must be connected whether it is active or passive, otherwise the link will not function.
These supplies should have no (potential) shared pins between them. Do not connect the –24 V supplies to the ground.

Example 1

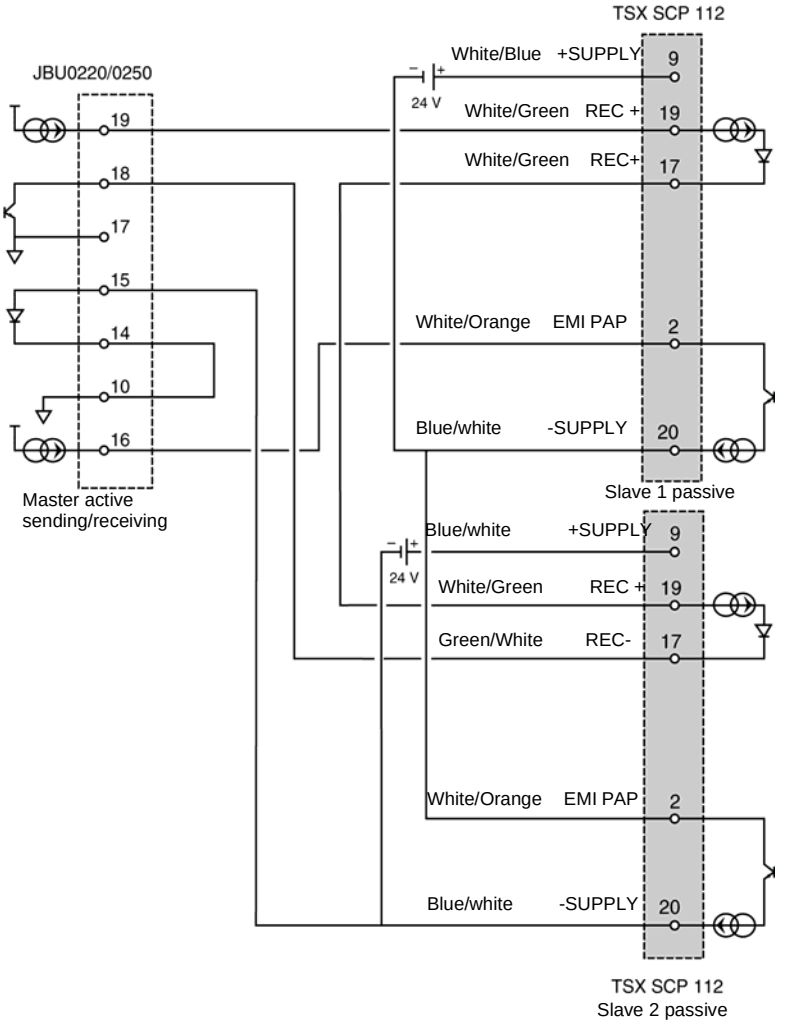
Multidrop TSX SCP 112 master active.



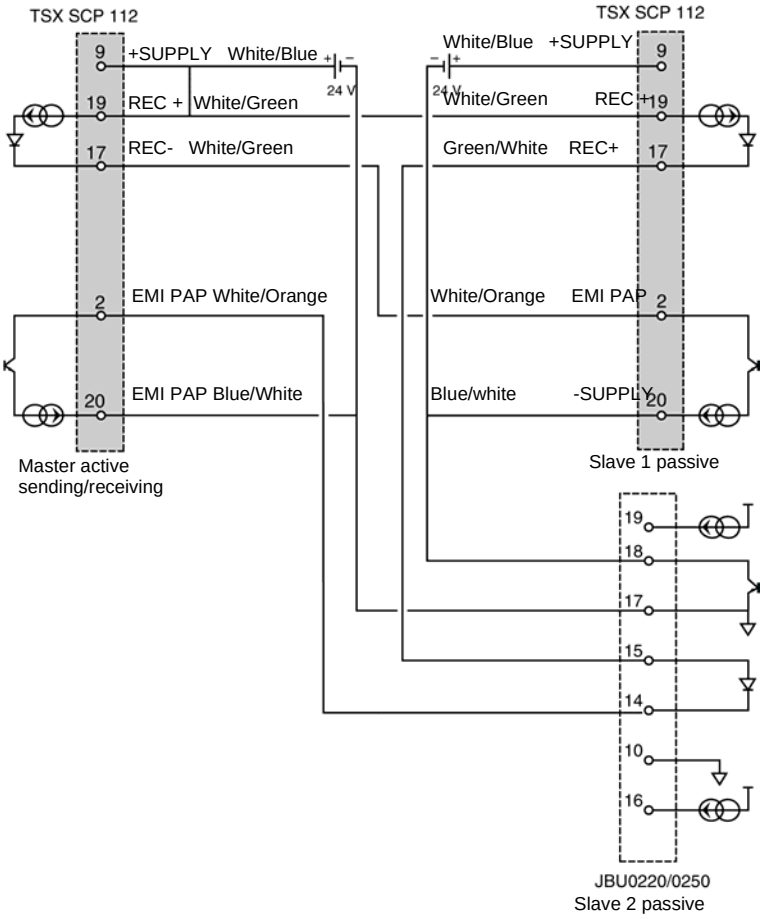
Example 2 Multidrop JBU0220/0250 master active for sending/receiving.



Example 3 Multidrop JBU0220/0250 master active for sending/receiving - TSX SCP 112 slaves.



Example 4 Multidrop TSX SCP 112 master active:



Connecting the TSX SCP 114 card to the UNITELWAY network

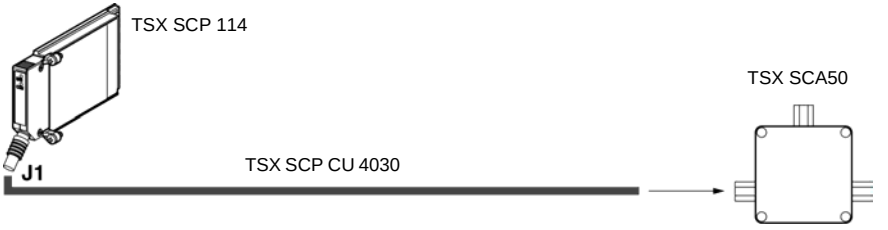
General

The TSX SCP 114 card with RS 485 physical support is connected to the UNI-TELWAY networkd using the TSX SCP CU 4030 cable via the TSX SCA 50 connection terminal block.

The connection terminal block is of the passive type and contains a printed circuit equipped with 3 sets of screw terminals. It is used to connect a station to the main section of a UNI-TELWAY bus via a branch.
It ensures the electrical continuity of the signals, the shielding and the end of line adaptation function. A termination device (resistance Rt) should be used to connect the line to its characteristic impedance. Mounting this minimizes noise and reflections, ensuring improved transmission quality.

Type of connection

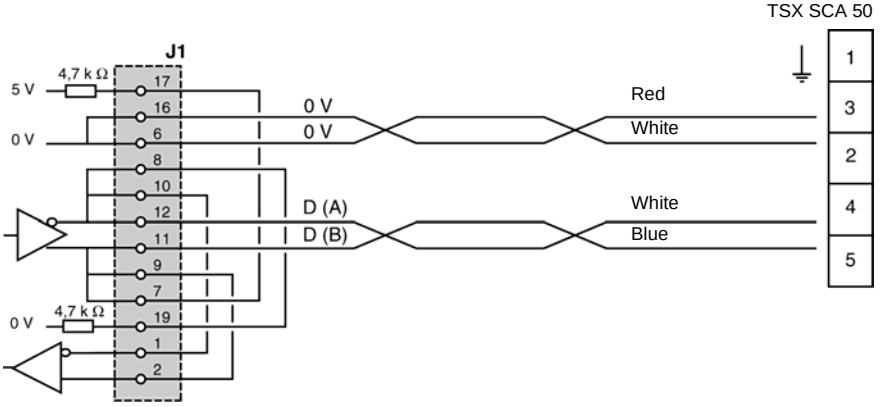
The PCMCIA TSX SCP 114 card is connected to the UNI-TELWAY bus by the bias of the TSX SCA 50 device.
Via its cable, the PCMCIA card has naked wires at the end which are to be connected to the terminal block inside the device:



Note: Using the branching device configures the card's wiring system and a branch type connection system.

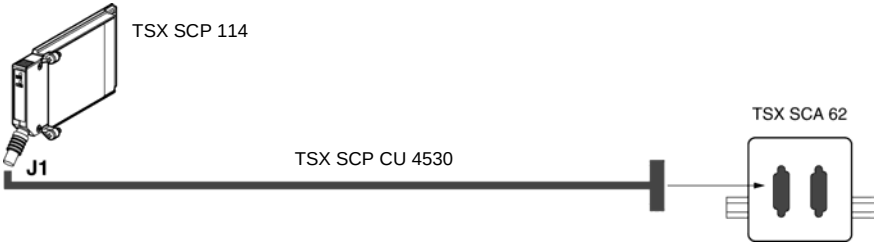
Description of the TSX SCP CU 4030 cable

Illustration: the miniature 20 pin PCMCIA connector supports the signals:



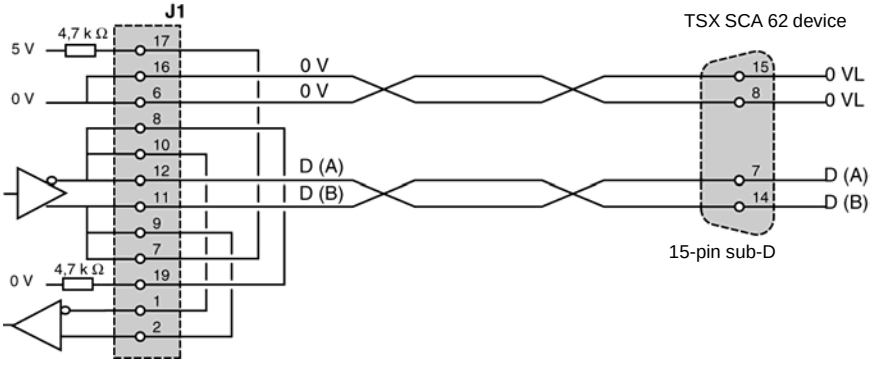
Connection via a TSX SCA 62 device

Diagram of the principle:



Description of the TSX SCP CU 4530 cable

The miniature 20 pin PCMCIA connector supports the signals:



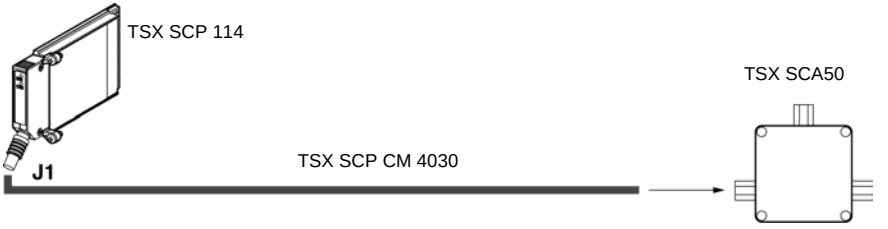
Connecting the TSX SCP 114 card to the Modbus/JBus

Introduction

The PCMCIA TSX SCP 114 card is connected to the Modbus bus using the TSX SCP CM 4030 series link cord which is connected to the TSX SCA 50 branch terminal block.

Type of connection

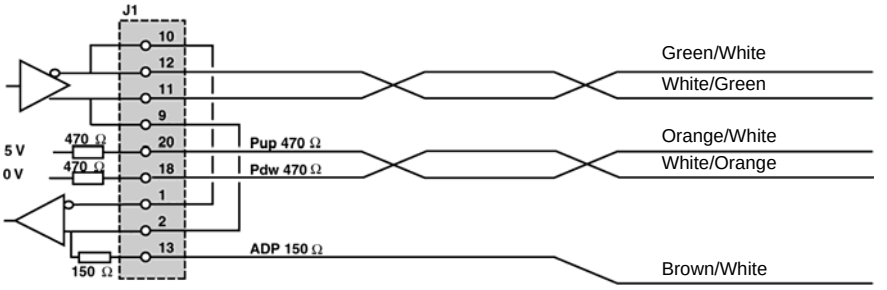
The PCMCIA TSX SCP 114 card is directly connected to the connected equipment with the bias of the TSX SCA 50 cable.
Via its cable, the PCMCIA card has naked wires at the end which are to be connected to the terminal block inside the device.



Note:
The length of the user cable (3 m) means equipment can be connected to a TSX SCA 50 connection device within 3 meter radius of the card. This length ensures a connection inside a standard cabinet.

Description of the TSX SCP CM 4030 cable

The miniature 20 pin PCMCIA connector supports the signals:



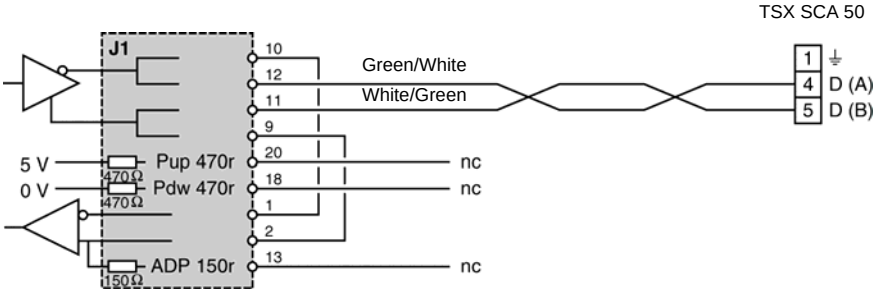
Important: on a Modbus/Jbus bus it is necessary to:

- Polarize the line, generally in one place only (generally on the master equipment) with resistances of 470Ω of pull-down and pull-up available of the PCMCIA card. Connect R pull-down to EMI- (D(A)) and R pull-up to EMI+(D(B)).
- Adapt the line on both end pieces of equipment with a resistance of 150Ω between EMI+ and EMI- (the connection EMI+ has already been internally made by the card).

Important: to connect a TSX SCP 114 card to a Series 1000 (S1000) PLC, EMI+ must be connected to L-.

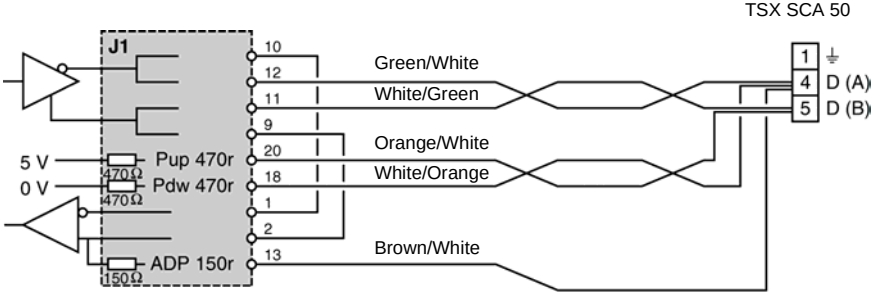
Connecting Modbus to the TSX SCA 50 device

Connecting without line termination:



Note: the jumper wire internal to the TSX SCA 50 device has no affect when wiring in the Modbus/Jbus bus.

Connecting a SCA 50 with line termination:



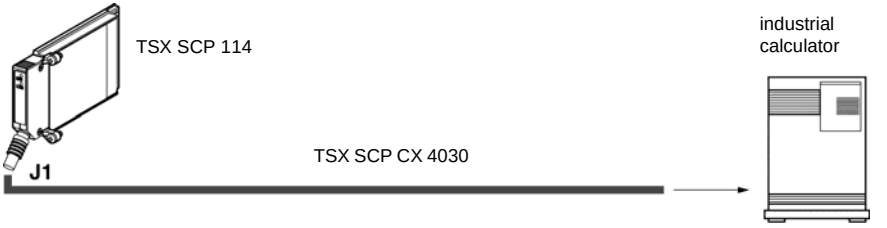
RS 422, multi-protocol asynchronous link connection

General

There are no particular accessories required to connect the TSX SCP 114 card in character mode.
The RS 485/RS 422 PCMCIA card link cord is referenced TSX SCP CX 4030. It is 3 meters in length.

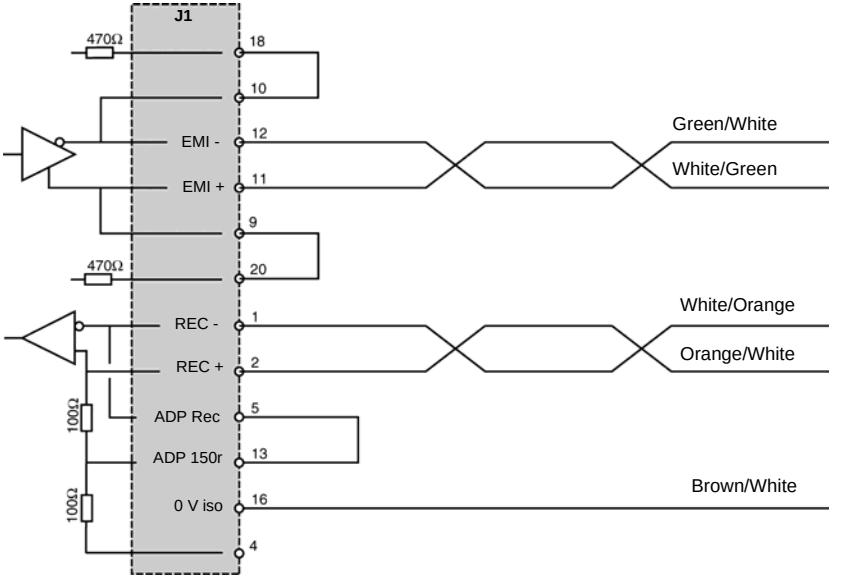
Type of connection

The TSX SCP 115 PCMCIA card is connected pin-to-pin to an industrial calculator-type standard RS 422 device:



Description of the TSX SCP CX 4030 cable

The miniature 20 pin PCMCIA connector supports the signals:



Connecting TSX FPP 20 cards

General

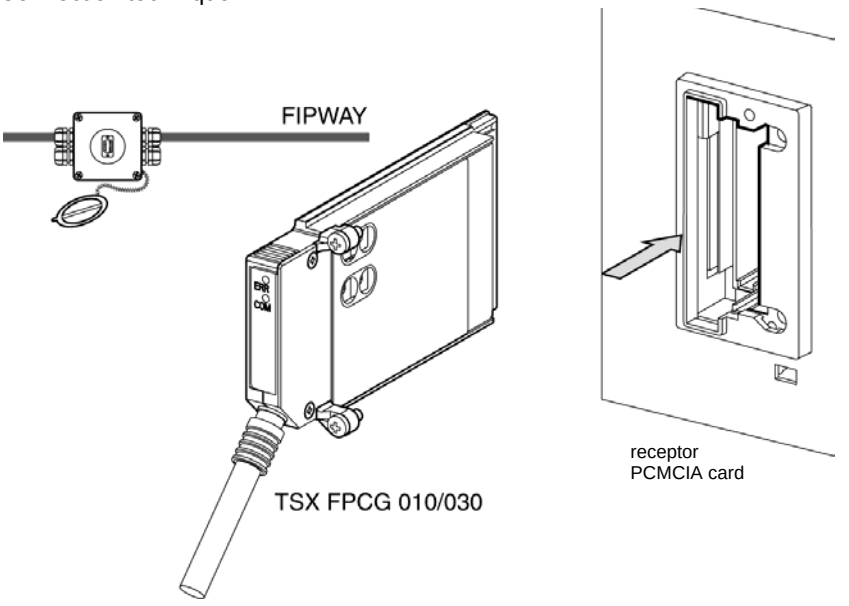
The TSX FPP 20 PCMCIA cards are connected to the FIP network via a TSX FP ACC4 connector.

To link the PCMCIA card the ACC4 connector, you can choose:
- either a 1m cable, reference TSX FPCG 010,
- or a 3m cable, reference TSX FPCG 030.

The opposite figure details the elements which are required for connecting TSX 37-21/22 PLC's to the FIPWAY network:
- TSX FPP 20 PCMCIA card,
- TSX FPCG 010/030 unit,
- TSX FP ACC4 connection unit.

Diagram

Connection technique



Note: To implement a FIPWAY network, consult the FIPWAY network reference manual.

Important:
The (TSX FPCG 010 and 030) cables can only be connected to and disconnected from the PCMCIA card **when the PLC is off**.

Connecting TSX FPP 10 card

General

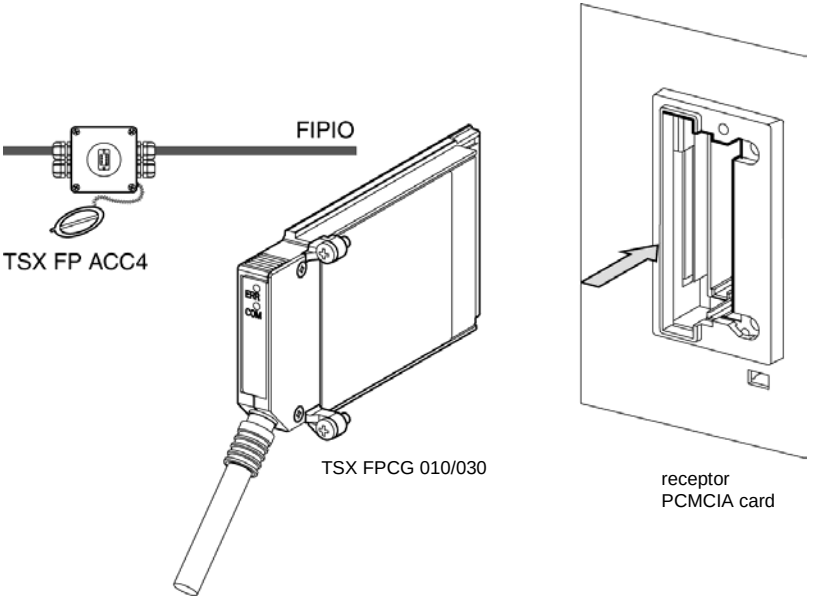
The TSX FPP 10 PCMCIA cards are connected to the FIPIO bus via a TSX FP ACC4 or TSX FP ACC12 connector.

To link the PCMCIA card to the ACC4/ACC12 connector, you can choose:
- either a 1m cable, reference TSX FPCG 010,
- or a 3m cable, reference TSX FPCG 030.

The opposite figure details the elements which are required for connecting TSX 37-21/22 PLC's to the FIPIO remote input/output bus:
- TSX FPP 010 PCMCIA card,
- TSX FPCG 010/030 cable,
- TSX FP ACC4 connection unit.

Diagram

Connection technique:



Important:
The (TSX FPCG 010 and 030) cables can only be connected to and disconnected from the PCMCIA card **when the PLC is off**.

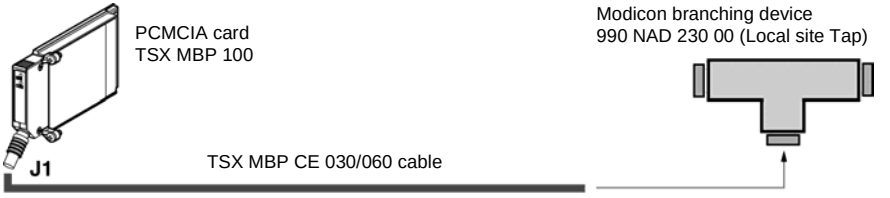
Connecting TSX MBP 100 card

General

The TSX MBP 100 PCMCIA card is connected to the Modbus + network by using a TSX MBP CE 030, 3m long branching cable, or a TSX MBP CE 060, 6m long branching cable.
This cable is connected to the Modicon branching unit (local site tap) 990NAD23000.

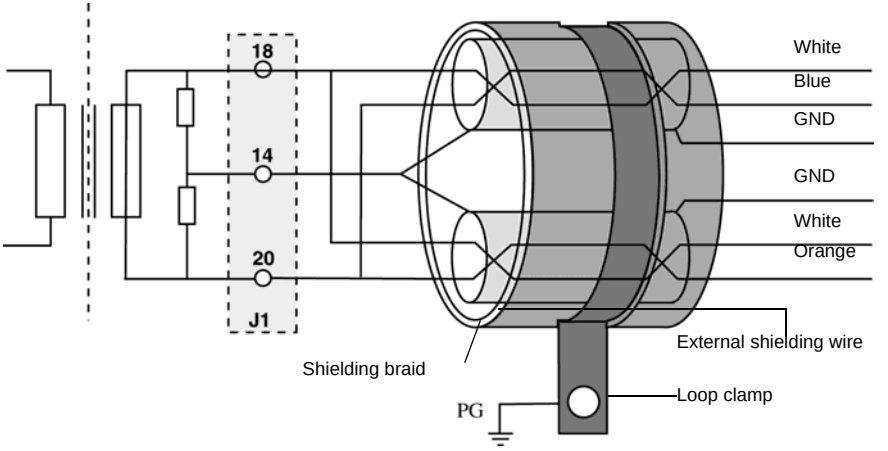
Connection technique for the PCMCIA card

Illustration:



Description of the TSX MBP CE 030/060 cable

Illustration:



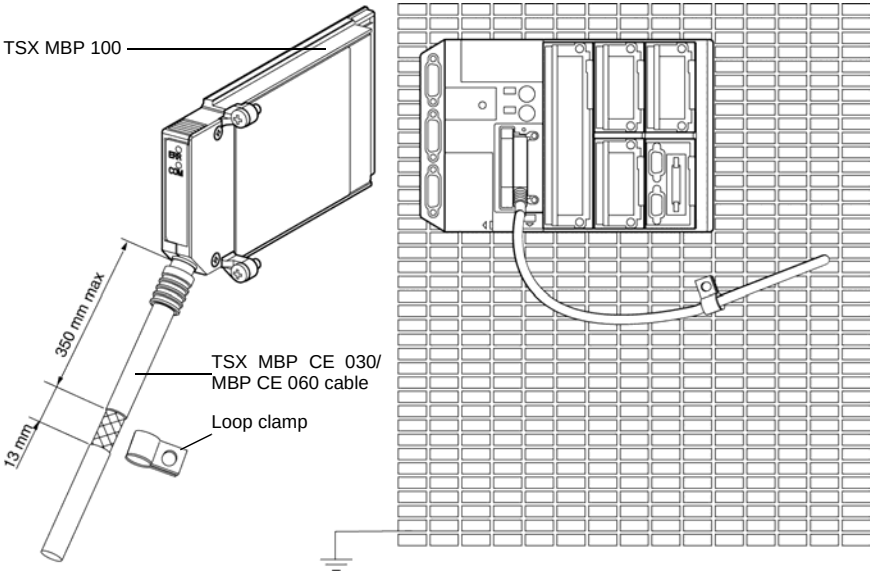
Important:
the main shielding of the cable is grounded by using a metal loop clamp as intermediary, in contact with the shielding braid, which is itself attached to the chassis which supports the rack.
The cable must be grounded even if the PCMCIA card is not present.

Grounding the TSX MBP CE 030/ 060 cable

The connection cable from the PCMCIA card to the Modicon branching unit must be grounded as shown in the figures below.
Carry out the following steps:

Step	Action
1	Please insert the loop clamp in the cable. This loop clamp is delivered with the Modicon branching unit (Local Site Tap), reference 990 NAD 230 00.
2	Attach the loop clamp and the cable to the chassis, with the cable linked to ground.

Illustration:



Connecting the TSX MBP CE 030/060 cable on the Modicon 990 NAD 230 00 connection device side

Introduction

The TSX MBP CE 030/060 cables are made up of distinct wires set with twisted, shielded pairs and an external grounding shielded wire, which makes a total of seven wires.
For connection, carry out the steps described below.

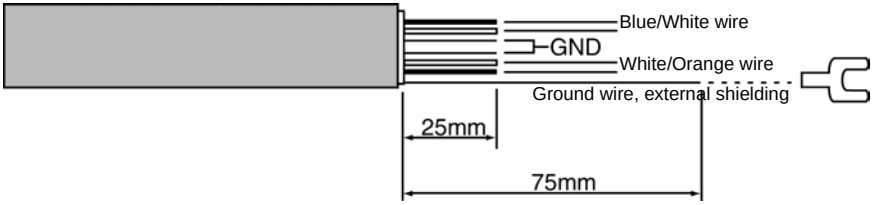
1 Identifying the wires set and preparing the cable

Identifying the wires:

- a set wire is labeled by white and orange colors, with bare, shielded wire,
- a set wire is labeled by white and blue colors, with bare, shielded wire,
- an external shielding cable.

Before connecting the wires to the appropriate terminals, make sure that you correctly identify the wires set with twisted pairs as the two white wires are not interchangeable.

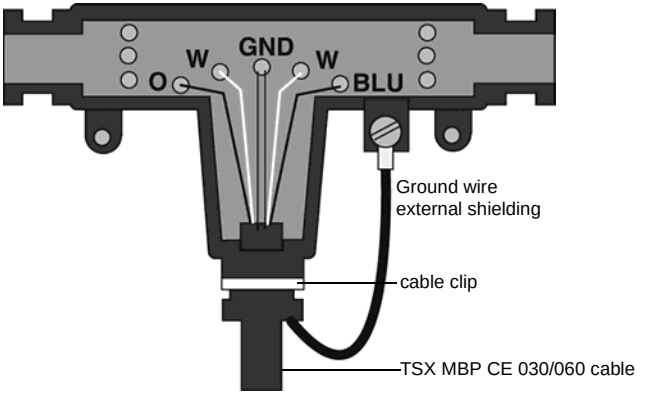
Preparing the cable:



2 Connecting the wires to the Modicon unit

- insert the wire in the terminal slot and hold it in place with a loop clamp,
- connect the wires following the directions in the figure below:

Illustration: 990 NAD 230 Modicon branching device



Caption label:

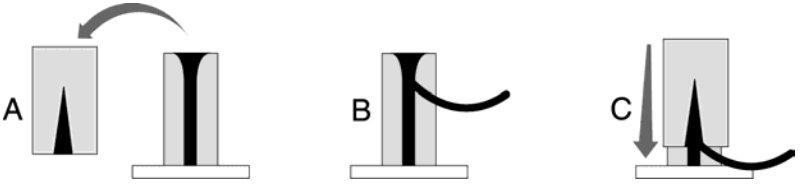
Terminal	Wire color
O	Orange
W	White
GND	Shielding of the 2 wires set
W	White
BLU	Blue

3 Technique for connecting the wires to the unit terminals

- to connect each wire, pull back the plastic cap from the terminal (figure **A**),
- insert the wire in the terminal slot (figure **B**),
- replace the cap using a screwdriver, press on it to secure the wire in the slot (figure **C**).

One tool is specifically for this use (reference AMP 552714-3).

The figures below show the connection sequences:



4 Connecting the external shielding cable

Install a terminal spade onto the external shielding wire either by soldering or tacking and fastening it. Then connect this to the ground screw of the 990 NAD 230 Modicon branching device as indicated in the figure below.

Summary of the link cables

TSX SCP 111 card

Summary table:

Cable type	Product reference	Designation
Modem cable	TSX SCP CC 1030.	Connecting cable via DTE/DCE 9 Modem RS 232D signals, l = 3m.
Standard cable	TSX SCP CD 1030. TSX SCP CD 1100.	DTE/DTE connection cable. RS 232D, l = 3m or 10m.

TSX SCP 112 card

Summary table:

Cable type	Product reference	Designation
Current loop cable	TSX SCP CX 2030.	BC cable 20mA l = 3m.

TSX SCP 114 card

Summary table:

Cable type	Product reference	Designation
Universal cable	TSX SCP CX 4030.	Universal cable, type RS 485 RS 422A, l = 3m.
UNI-TELWAY cable	TSX SCP CU 4030.	Cable type RS 485 2-wire, l = 3m.
Modbus cable	TSX SCP CM 4030.	RS 485 2-wire cable, l = 3m.
Connection unit	TSX SCA50.	Unit connected by screw to the bus for RS 485 series link.
Connection unit	TSX SCA 62.	Unit connected by connector to the bus for RS 485 series link.
Converting device	TSX SCA 72.	RS 232D/RS 485 converting device.

TSX FPP 10 and TSX FPP 20 cards

Summary table:

Cable type	Product reference	Designation
FIPWAY/FIPIO cable	TSX PPCG 010.	Connection cable, l = 1m.
FIPWAY/FIPIO cable	TSX FPPCG 030.	Connection cable, l = 3 m.
Connection unit	TSX FP ACC4.	FIPWAY/FIPIO connection unit.
Connection unit	TSX FPACC 12.	Low cost FIPWAY/FIPIO connection unit.

TSX MBP 100 card

Summary table:

Cable type	Product reference	Designation
Modbus+ cable	TSX MBP CE 030.	Connection cable, l = 3 m.
Modbus+ cable	TSX MBP CE 060.	Connection cable, l = 6 m.

Safety measures for connecting PCMCIA cards

Important

The PCMCIA cards in the host device (TSX 37 central unit) must be connected and disconnected when the device is **switched off**.

The ferule which is placed directly in contact with the PCMCIA card unit, makes it possible to drain off the electrical parasites carried by the link cords.

PCMCIA card consumption

TSX SCP 111 card consumption

Data table:

Voltage	Typical current	Maximum current
5 volts	140 mA	300 mA

TSX SCP 112 card consumption

Data table:

Voltage	Typical current	Maximum current
5 volts	120 mA	300 mA

TSX SCP 114 card consumption

Data table:

Voltage	Typical current	Maximum current
5 volts	150 mA	300 mA

TSX FPP 10 and TSX FPP20 card consumption

Data table:

Voltage	Typical current	Maximum current
5 volts	280 mA	330 mA

TSX MBP 100 card consumption

Data table:

Voltage	Typical current	Maximum current
5 volts	220 mA	310 mA

Communication via a Modem PCMCIA card

22

At a Glance

Aim of this chapter

This chapter aims to describe communication via a Modem PCMCIA card.

What's in this Chapter?

This chapter contains the following topics:

At a Glance

General

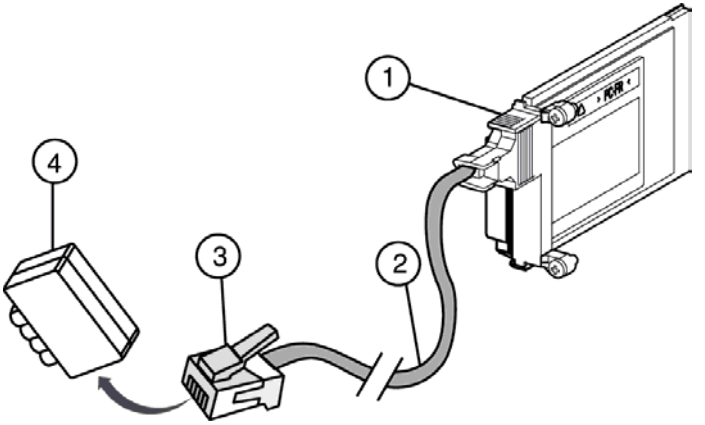
The TSX DMZ 10 card makes it possible to connect to the switched telephone network (STN) to access the remote stations following the UNI-TELWAY protocols or character mode.

This type of communication is available by using the Modem PCMCIA card as an intermediary. It can only be installed in the PCMCIA acceptance slot of a Micro PLC (TSX 37 21/22) Version V≥ 3.3.

Description

Diagram

The TSX MDM 10 product comprises the following elements:



Address table

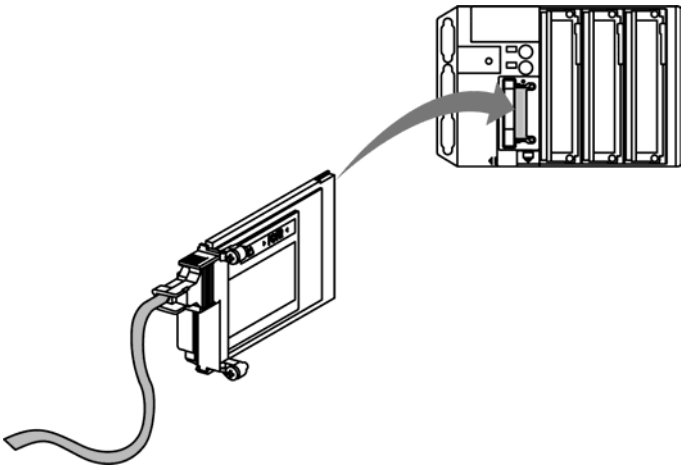
Description depending on addresses:

Address	Description
1	a Modem PCMCIA card.
2	a cable to link up to the switched telephone network (3 meters long).
3	a RJ11 port to connect to a telephone adapter (4), or directly to a telephone port.
4	a telephone adapter (in conformance with the country in which it was bought) enabling link up to the telephone network.

Installing the TSX MDM 10 card

Choosing the processor and slot type

Illustration: the TSX MDM 19 card can only be installed in the PCMCIA receptor channel of the TSX 37 21/22 PLC processor:



Only the TSX 37 21/22 PLC's version V Σ 3.3 are compatible with the TSX MDM 10 card.

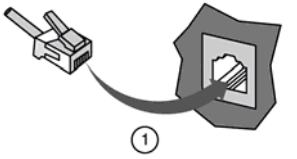
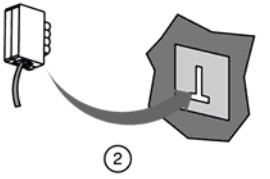
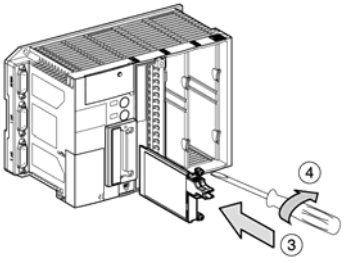
	CAUTION
	Using a PCMCIA memory card We recommend that you use a PCMCIA memory expansion module (The CALL_MODEM communication function which occupies 12.5Kwords of program memory space). **Failure to follow this precaution can result in injury or equipment damage.**

	DANGER
	Plugging in/unplugging when on Inserting or removing the TSX MDM 10 communication card is prohibited when the PLC is on. **Failure to follow this precaution will result in death, serious injury, or equipment damage.**

Connecting to the telephone network

Procedure

To connect to the switched telephone network, carry out the following steps:

Step	Action	Illustration
1	Connect the RJ11 port to the telephone adapter if the former is required.	
2	Plug the RJ11 port or the telephone adapter into a port on your telephone line. If a device is already connected to this port, unplug it, then plug in the telephone adapter in its place. Plug the device back in at the back of the telephone adapter.	
3	Insert the PCMCIA card in the processor housing which is made for this.	
4	Screw the card onto the processor to avoid it being moved at all when the PLC is on.	

DANGER

Inserting/removing the card

The host processor must be switched off when the card is inserted or removed.

Failure to follow this precaution will result in death, serious injury, or equipment damage.

Connecting the adapters

The different adapters

Telephone adapters, in conformance with the country in which they were bought, make it possible to guarantee the connection between the RJ11 port of the TSX MDM 10 PCMCIA card and the wall port of the telephone network.

To use the TSX MDM 10 card in a different country, all you need to do is change the telephone adapter.

They are available under the following references:

- TSX MDM ADT F : adapter for French telephone lines,
- TSX MDM ADT G : adapter for German telephone lines,
- TSX MDM ADT B : adapter for Belgian telephone lines,
- TSX MDM ADT S : adapter for Spanish telephone lines,
- TSX MDM ADT T : adapter for Italian telephone lines.

Electrical features and technical specifications

Electrical features

This table shows the consumption of a modem PCMCIA card:

Voltage	Physical current
5V	195mA

Communication protocols

The TSX MDM 10 card supports the different ITU-TV.32 communication protcols.

Operational features

The TSX MDM 10 card supports the following features:
- AT command emission,
- Half and Full Duplex communication,
- automatic calls and responses,
- calls with dialing pulses or ringing tones.

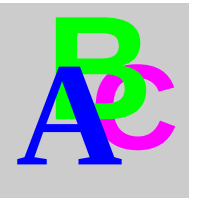
Maximum operational temperature

- no TSX FAN•• ventilation module : 50°C max,
- with TSX FAN•• ventilation module : 60°C max.

CE labeling

The TSX MDM 10 card conforms to the European Directive for Telecommunications DTTC 98/13/EC.
The guaranteed immunity level of the card in radiated electromagnetic fields is 3V/m, above this threshold communication faults may appear; this conforms to the CEM 89/336/CEE Directive which is applied to residential, commercial and light industry sites.
The TSX MDM 10 card conforms to the 73/23 CEE Low Voltage Directive, modified by 93/68/CEE.

Index



D

E

F

G

I

L

M

N

O

P

R

S

T

U

W