Premium and Atrium Using EcoStruxure™ Control Expert

IP20 and IP65 Sealed Input/Output Modules

Setup Manual

(Original Document)

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

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

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

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

Table of Contents

Safety Information

Important Information

NOTICE

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

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

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

PLEASE NOTE

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

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

BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

⚠ WARNING
UNGUARDED EQUIPMENT ● Do not use this software and related automation equipment on equipment which does not have point-of-operation protection. ● Do not reach into machinery during operation. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

NOTE: Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

START-UP AND TEST

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check be made and that enough time is allowed to perform complete and satisfactory testing.

⚠ WARNING
EQUIPMENT OPERATION HAZARD ● Verify that all installation and set up procedures have been completed. ● Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices. ● Remove tools, meters, and debris from equipment. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

Software testing must be done in both simulated and real environments.

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:
- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer’s instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer’s instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

About the Book

At a Glance

Document Scope

This manual describes the implementation of hardware and software for TBX IP20 and IP65 remote input/output modules with Premium and Atrium PLCs.

Validity Note

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

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

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

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

Related Documents

Title of Documentation	Reference Number
Premium and Atrium Using EcoStruxure™ Control Expert, Fipio Bus, Setup Manual	35008155 (English), 35008156 (French), 35008157 (German), 35013953 (Italian), 35008158 (Spanish), 35013954 (Chinese)

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

Product Related Information

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter, and apply this product. Follow all local and national safety codes and standards. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Part I
Hardware installation of distributed input/output modules on Fipio bus

Subject of this Part

This part presents the range of TBX modules on Premium PLCs.

What Is in This Part?

This part contains the following chapters:

Chapter 1
General overview of TBX distributed input/output modules

Subject of this chapter

This chapter provides a general overview of TBX distributed input/output modules.

What Is in This Chapter?

This chapter contains the following sections:

Section 1.1
TBX modules: general

Subject of this section

This section provides a general overview of TBX distributed input/output modules.

What Is in This Section?

This section contains the following topics:

General

Distributed inputs/outputs

The decentralization of inputs/outputs enables the requirements of both users and machine manufacturers to be met while obtaining performance comparable with that of a centralized architecture:

- the volume of wiring connected to sensors and preactuators is reduced,
- mechanical constraints associated with wiring ducts are eliminated,
- time required for designing and testing connections is reduced,
- machine or plant availability is maximized,
- installations are more flexible and open to expansion,
- PLCs can be operated more rationally.

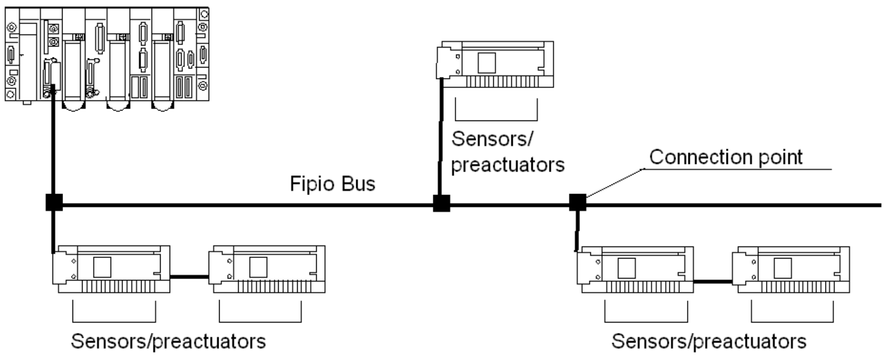
TBX modules

TBX distributed input/output modules provide the following:

- a high level of adaptability: they may be mounted in any position, on any type of support (mounting plate, frame, DIN rail for TBX IP20s, etc.), in all industrial environments,
- the interface elements take up less space,
- easy to set up and connect: sensors and preactuators are directly connected to screw terminals (eliminating the need for intermediate terminal blocks), integral commons, several marking levels (operational, electrical, for identifying modules and connection points, etc.),
- connection close to the sensors and preactuators in a harsh environment using TBX IP65,
- A high level of modularity in order to adapt to the number and type of sensors and preactuators in a cell: input modules, output modules, mixed input/output modules and modules with programmable channels,
- local management of operating modes and diagnostics, of connection points and connected channels,
- conformity with international standards.

Connection

TBX distributed input/output modules are connected to the processor via the Fipio fieldbus, which provides 126 connection points for TBX modules.



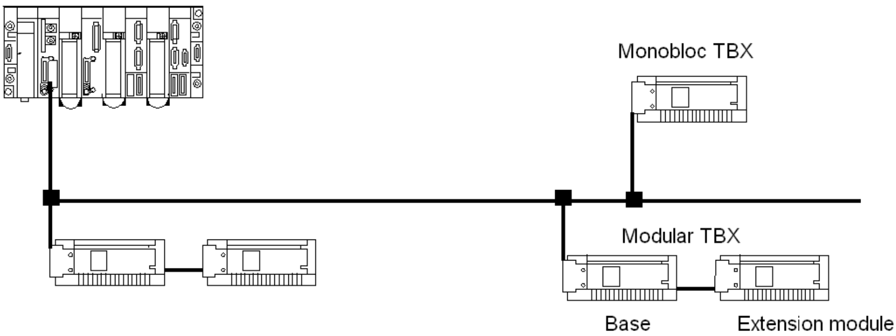
Hardware Structure of Distributed Input/Output Modules

TBX modules

There are three types of TBX remote input/output modules:

- Monobloc TBXs *(see page 26)* comprising only one element, which cannot be extended (IP20),
- Sealed TBXs *(see page 26)* comprising only one element, which cannot be extended (IP65).
  They have 8 inputs, 8 outputs, 16 inputs or 16 outputs,
- Modular TBXs *(see page 31)* assembled by the user by combining a communication module and a base unit, which constitutes a basic module (IP20).
  This base can be extended by a second base, using a connection cable and equipped with a cap connected to the communication module.
  This enables the number of TBX connection points to be doubled.
  The modular structure and ability to mix modular TBXs means that they can be better adapted to the requirements of the cell.

The following diagram illustrates the differences between the three types of TBX module.



Section 1.2
Description of discrete monobloc TBX modules

Subject of this section

This section provides the physical description of TBX discrete monobloc (IP20) and dust and damp proof monobloc (IP65) modules.

What Is in This Section?

This section contains the following topics:

Discrete monobloc TBX modules (IP20)

General

Discrete monobloc TBX modules (IP20) consist of either 16 discrete 24 V DC inputs, or 16 discrete 0.5 A transistor outputs, protected against overload and short-circuits, or 16 relay outputs. They cannot be extended.

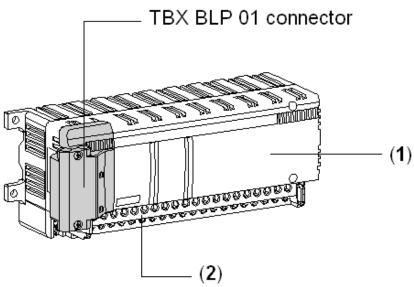
The Fipio connection point address assignment is set by 8 dip-switches (the 3 most significant dip-switches are not set), allowing up to 31 monobloc modules to be connected to the bus; Address 0 is reserved for the PLC *(see Premium and Atrium Using EcoStruxure™ Control Expert, Fipio Bus, Setup Manual)*. A display block indicates locally the status of the module and its inputs or outputs.

At a Glance

TBX monobloc modules have the following components:

- An element which groups together the communication electronics and the input and/or output interfaces (**1**),
- a removable terminal block (**2**) enabling the sensors or preactuators to be connected directly to the 16 discrete inputs/outputs of the module. The necessary power supplies are also wired to the terminal block.

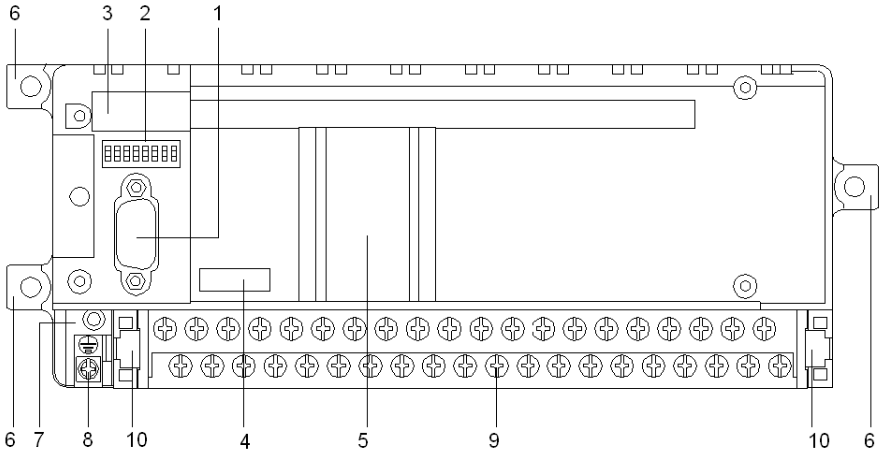
The following diagram shows a discrete monobloc TBX module.



The **TBX BLP 01** connector enables the module to be connected to the Fipio bus *(see Premium and Atrium Using EcoStruxure™ Control Expert, Fipio Bus, Setup Manual)*.

Physical description

The following is a detailed diagram of the discrete monobloc TBX module.



The following is a detailed diagram of the discrete monobloc TBX module.

Number	Description
1	9 pin male SUB D connector for connecting to the Fipio bus via the **TBX BLP 01** connector.
2	8 dip-switches for setting the Fipio connection point address *(see page 110)*.
3	Memo label for the Fipio connection point address setting.
4	Location for customer's Connection point address and Module number identification label.
5	Display block *(see page 123)*.
6	Fixing lugs for the module.
7	Identification label indicating the type of module channels.
8	Screw clamp for grounding the unit.
9	Removable screw terminal block (with terminal block label) for wiring to sensors, preactuators and power supplies.
10	Extractors for removing the terminal block.

Sealed (IP65) Discrete Monobloc TBX Modules

General

Sealed (IP65) TBX monobloc Discrete modules comprise either 8 or 16 Discrete 24 VDC inputs, or 8 or 16 Discrete 0.5 A static outputs, protected against overloads and short-circuits.

The Fipio connection point address assignment is set by 8 dip-switches, allowing up to 126 monobloc modules (IP65) to be connected to the bus (these dip-switches are located inside the **TSX BLP 10** connector). Addresses 0 and 63 are reserved. *(see Premium and Atrium Using EcoStruxure™ Control Expert, Fipio Bus, Setup Manual)*

A display indicates locally the status of the module and its inputs or outputs.

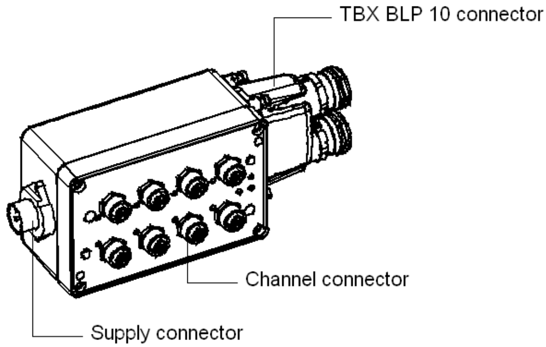
At a Glance

Sealed discrete TBX modules comprise only one element which includes the communication electronics and the input or output interfaces, depending on the model.

Each channel is fitted with an M12 5-pin female fast connector.

The output module has a power supply connector which is used to supply the outputs and the loads.

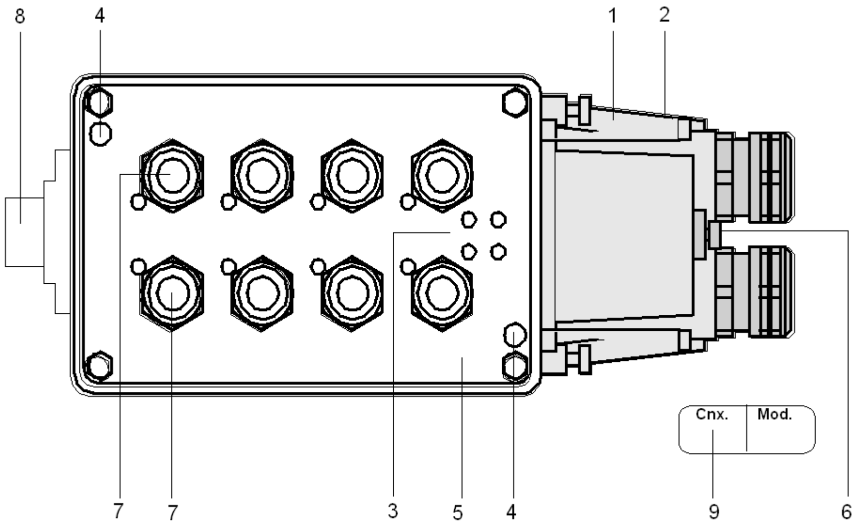
The following diagram shows the sealed Discrete TBX module.



The **TBX BLP 10** connector enables the module to be connected to the Fipio bus *(see Premium and Atrium Using EcoStruxure™ Control Expert, Fipio Bus, Setup Manual)*.

Physical Description

The following is a detailed diagram of the sealed Discrete monobloc TBX module.



The following is a detailed diagram of the sealed Discrete monobloc TBX module.

Number	Description
1	15 pin male SUB D connector for connecting to the Fipio bus, via the **TBX BLP 10** connector.
2	8 dip-switches (in the **TBX BLP 10** connector) for setting the Fipio connection point address *(see page 110)*.
3	Display panel *(see page 124)*.
4	Fixing for the module.
5	Identification label indicating the type of module channels.
6	Screw clamp for grounding the product.
7	Input or output channel connectors.
8	Power supply connector (output modules only).
9	Self-adhesive label for customer's Connection point address and Module number (to be attached to the **TBX BLP 10** connector).

Section 1.3
Description of discrete and analog TBX modular modules

Subject of this section

This section provides the physical description of TBX discrete and analog modules.

What Is in This Section?

This section contains the following topics:

Discrete and analog modular TBX modules (IP20)

General

The number of inputs/outputs in a modular TBX is defined by the number (1 or 2) and the type of base units used.

This number can be from 10 to 32 for discrete base units, and from 4 to 16 for analogue base units.

The Fipio connection point address assignment is set via 8 dip-switches allowing up to 126 modular TBX modules to be connected to the bus. Addresses 0 and 62 are reserved for the PLC and the terminal *(see Premium and Atrium Using EcoStruxure™ Control Expert, Fipio Bus, Setup Manual)*.

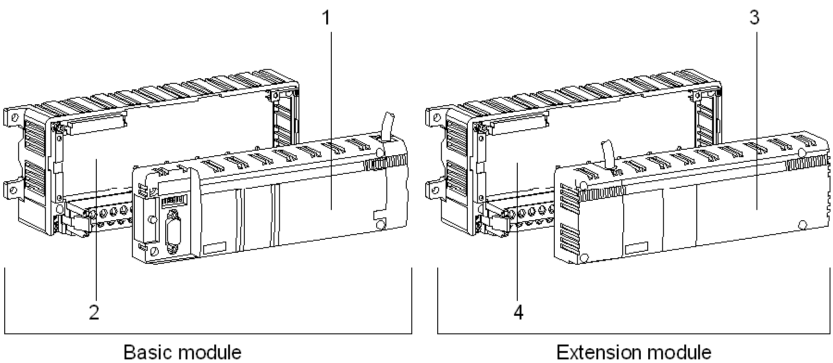
A display block *(see page 123)* indicates locally the status of the modular TBX and its inputs and/or outputs: basic and extension modules.

At a Glance

The modular TBX module has 4 physical components:

- a communication module (**1**) and a base unit (**2**), for the basic module,
- a connection cable/cover (**3**) and a base unit (**4**), for the extension module,

The following diagram shows a modular TBX module.



The base units (**2**) and (**4**) share the same features and thus are interchangeable.

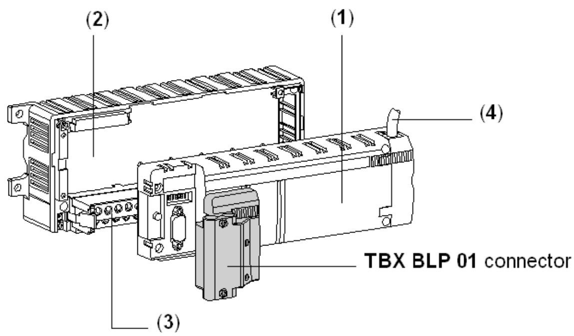
Modular TBX modules (IP20) : the base units

General

The modular TBX modules are composed of a base unit and an optional extension. The base unit is composed of the following elements:

- a **TSX LEP •••** (**1**) communication module *(see page 38)* which enables communication with the PLC via the Fipio bus,
- a base unit (**2**) with discrete and/or analog inputs and/or outputs,
- a removable terminal block (**3**) for direct connection of the sensors and/or preactuators to the I/O. The necessary power supplies are also wired to the terminal block.
- A connection cable (**4**) for linking the extension module *(see page 36)* to the communication module.

The following diagram shows the base unit of a modular TBX module.



The **TBX BLP 01** connector enables the module to be connected to the Fipio bus *(see Premium and Atrium Using EcoStruxure™ Control Expert, Fipio Bus, Setup Manual)*.

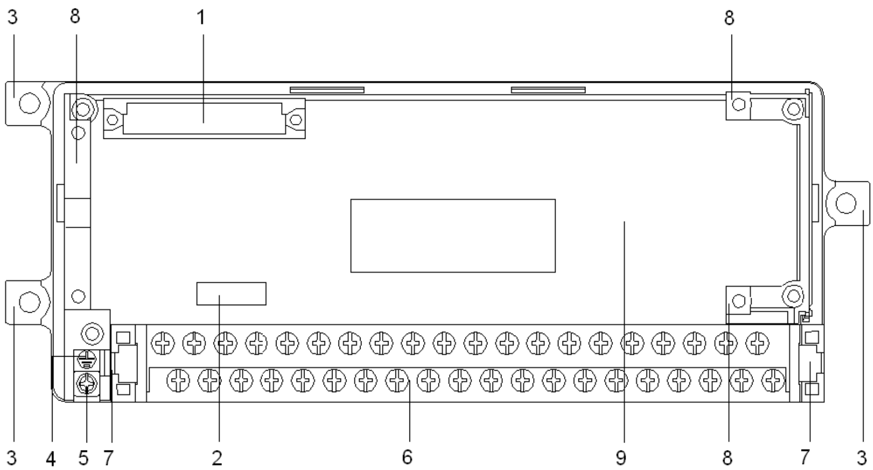
Physical description

The base units are assembled with a **TBX LEP •••** communication module to form a basic module, or with a **TBX CBS 010** assembly to form an extension module. Sensors can be connected directly to the inputs, and preactuators to the outputs and the power supplies, by means of the screw terminal.

The references are:

- for discrete input/output base units:
  - **TBX DES •••** for input base units,
  - **TBX DSS •••** for output base units,
  - **TBX DMS •••** for mixed I/O base units.
- for analog input/output base units:
  - **TBX AES •••** for input base units,
  - **TBX ASS •••** for output base units,
  - **TBX AMS •••** for mixed input/output base units.

The following diagram shows a TBX base unit.



The following table describes the various elements of the TBX base unit.

Number	Description
1	32-pin female 1/2 DIN connector for connection to the communication module.
2	Location for customer's Connection point address and Module number identification label.
3	Fixing lugs for the module.
4	Identification label indicating the type of base unit channels.
5	Screw clamp for grounding the unit.

Number	Description
6	Removable screw terminal block (with terminal block label) for wiring to sensors, preactuators and power supplies.
7	Extractors for removing the terminal block.
8	Tabs for fixing the communication module or cover.
9	Cover for access to electronic board for configuring the bases with input wiring check facilities.

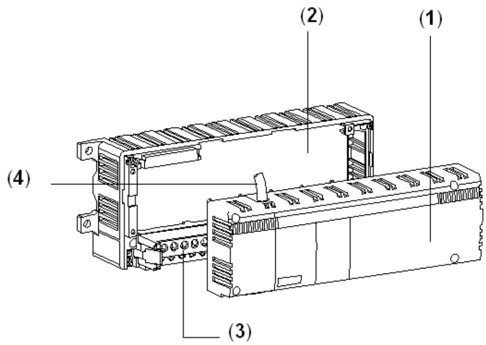
Modular TBX modules (IP20): Extensions

General

The modular TBX modules are composed of a base unit and an optional extension. The extension is composed of the following elements:

- A protective cover for the base unit (**1**),
- A base unit (**2**) featuring Discrete and/or analog inputs and/or outputs.
- A removable terminal block (**3**) for direct connection of the sensors and/or preactuators to the I/O. The necessary power supplies are also wired to the terminal block,
- A connection cable (**4**) for linking the communication module *(see page 33)* to the extension module.

The following diagram shows the base unit of a modular TBX extension.



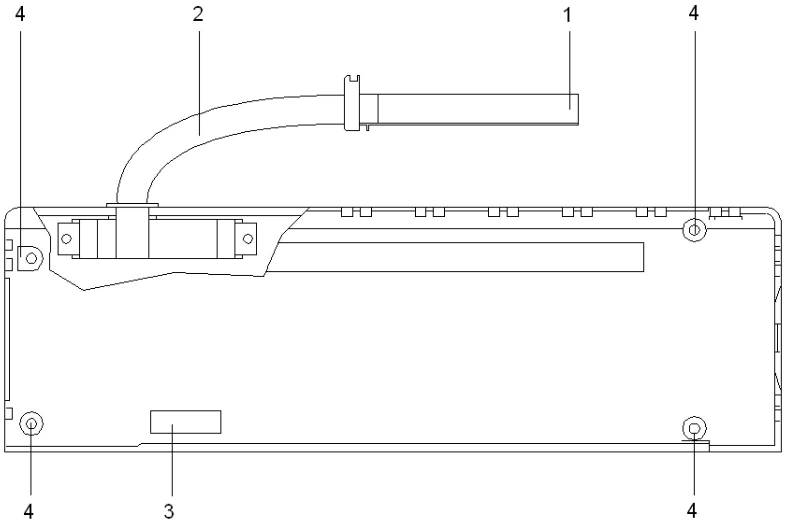
Physical Description

The **TBX CBS 010** assembly comprises:

- A connection cable enabling the extension base unit to be connected to the communication module.
- A cover, which is fixed to the extension base unit, protects the connector and gives the extension module (base unit + cover) a similar size and shape to that of the base module.
- A self-adhesive label is used to label the channels 16 to 31.

To connect the extension module to the basic module, the connection cable between the 32-pin 1/2 DIN connector on the communication module and the 32-pin 1/2 DIN connector on the extension base unit is first connected, and then the cover is placed over this base unit and fixed in place.

The following diagram shows a TBX cover/connection cable.



The following table describes the various elements of the TBX base unit.

Number	Description
1	32-pin male 1/2 DIN compound filled connector for linking the extension base unit to the communication module.
2	Flexible connection cable complete with connector 1 and a 32-pin male 1/2 DIN connector for connection to the base unit.
3	Location for customer's Connection point address and Module number identification label.
4	4 screws for fixing cover to its base unit.

TBX LEP 020 and TBX LEP 030 communication modules

General

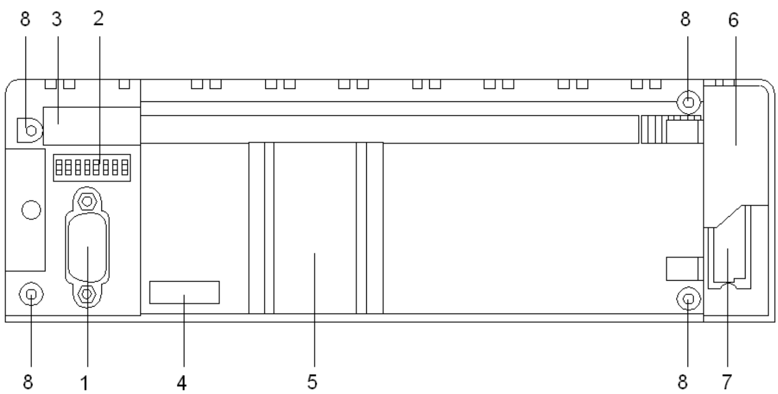
The **TBX LEP 020** or **TBX LEP 030** communication module enables communication with the PLC, via the Fipio bus.

It is connected to the base unit to which it is fixed by a 32-pin male 1/2 DIN connector located in its lower section. A 32 pin female 1/2 DIN connector, protected by a cover, is used to connect the base unit for the extension.

NOTE: For a connection point comprising only the Discrete TBX modules, either a **TBX LEP 020**, or a **TBX LEP 030** module may be used.
For a connection point comprising analog TBX modules, it is **obligatory** to use the **TBX LEP 030** module.

Physical Description

The following diagram shows the **TBX LEP 0•0** communication module.



The following table describes the different elements of the **TBX LEP •••** communication module.

Number	Description
1	9 pin male SUB D connector for connecting to the Fipio bus, via the **TBX BLP 01** connector.
2	8 dip-switches for setting the Fipio connection point address *(see page 110)*.
3	Memo label for the Fipio connection point address setting.
4	Location for customer's Connection point address and Module number identification label.
5	Display block for the basic and extension modules.
6	Access hatch to extension connection.

Number	Description
7	32-pin female 1/2 DIN connector for connecting the extension base unit.
8	4 screws for fixing the communication module to the base unit.

Technical Specifications

The following table describes the technical specifications of the **TBX LEP •••** communication module.

TBX LEP ••• Module	
Nominal voltage	24 VDC or 48 VDC
Supply voltage	19.2 VDC to 60 VDC
Current drawn	70 mA at 24 VDC, 35 mA at 48 VDC
Power dissipated in the module	1.7 W
Dielectric strength between FIP line and ground.	500 VAC 50/60 Hz for 1 min
Dielectric strength between the associated base unit I/O and ground.	1500 VAC 50/60 Hz for 1 min
Protection against a reverse polarity on +SV	Yes, via diode in series

Section 1.4
Description of the TBX SUP 10 power supply module

Subject of this section

This section provides the physical description of the **TBX SUP 10** module.

What Is in This Section?

This section contains the following topics:

TBX SUP 10 power supply module

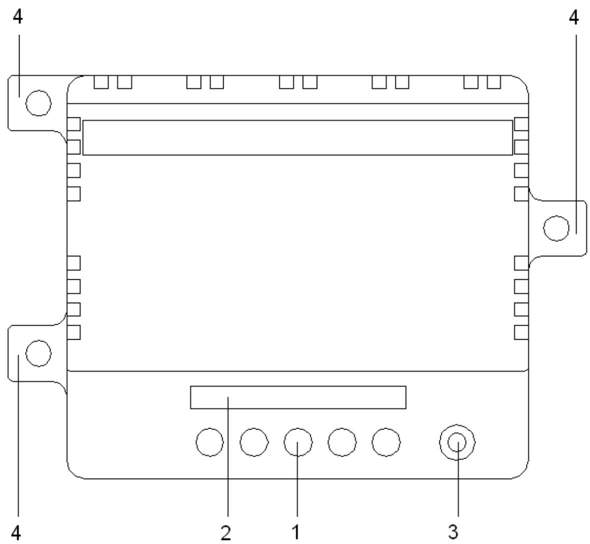
General

For sites which do not have a 24 V DC power supply, you are provided with a **TBX SUP 10** 24 V DC / 1 A power supply module. This provides the power required for a number of TBX modules *(see page 101)*.

The primary of this power supply module is itself powered by 110/230 V AC 50/60 Hz or 110/125 V DC *(see page 42)*.

Physical description

The following diagram shows the power supply module **TBX SUP 10**.



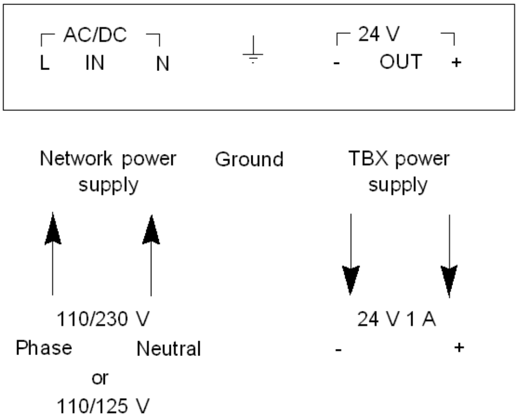
The following table describes the various elements of the power supply module **TBX SUP 10**.

Number	Description
1	Screw terminal block for wiring to power supplies.
2	Identification label for wiring terminals.
3	Power ON indicator lamp.
4	Fixing lugs for the module.

Wiring and characteristics of the TBX SUP 10 power supply module

Wiring

The following diagram shows the **TBX SUP 10** power supply module wiring diagram.



NOTE: Primary : If the module is powered by 110/230 V AC, neutral and live connections must be respected when wiring. However, if the module is powered by 110/125 V DC, polarity is not important.

⚠ WARNING
RISK OF ELECTRICAL SHOCK Connect the ground terminal of the module to the protective ground using a green/yellow wire. The -24 V terminal (0 V potential) must be connected to ground at the power supply module output. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Characteristics

The following table describes the technical characteristics of the power supply module **TBX SUP 10**.

<table>
<tr><td rowspan="4">Primary</td><td rowspan="2">Nominal voltage</td><td>100 - 110 - 120 V AC</td><td rowspan="2">110 - 125 V DC</td></tr>
<tr><td>200 - 230 - 240 V AC</td></tr>
<tr><td>Voltage limits</td><td>90 - 264 V AC</td><td>88 - 156 V DC</td></tr>
<tr><td>Frequency</td><td colspan="2">47 - 63 Hz</td></tr>
<tr><td rowspan="5">Secondary</td><td>Output power</td><td colspan="2">24 W</td></tr>
<tr><td>Output voltage</td><td colspan="2">24 V DC 5%</td></tr>
<tr><td>Maximum current</td><td colspan="2">1 A</td></tr>
<tr><td>Protection</td><td colspan="2">against short-circuits, overload and overvoltage</td></tr>
<tr><td>Hold time</td><td colspan="2">≥10 ms</td></tr>
<tr><td rowspan="4">Climatic environment</td><td>Storage</td><td colspan="2">-25 to +70 °C</td></tr>
<tr><td>Operation</td><td colspan="2">0 to 60 °C</td></tr>
<tr><td>Relative humidity</td><td colspan="2">5 to 95% (without condensation)</td></tr>
<tr><td>Altitude</td><td colspan="2">0 to 2000m</td></tr>
</table>

Section 1.5
Catalog

Subject of this section

This section presents the complete catalog of TBX distributed input/output modules.

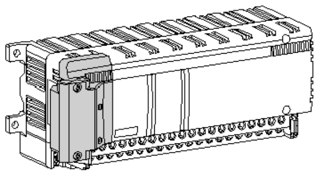
What Is in This Section?

This section contains the following topics:

Catalog of TBX IP20 discrete monobloc modules

Catalog

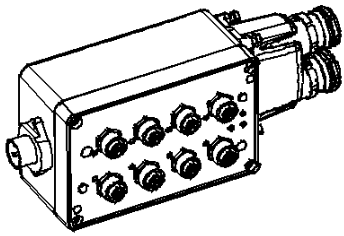
The following table presents the catalog of TBX discrete monobloc modules (IP20).

Type of module	TBX IP20 discrete monobloc modules		
Illustration			
Channel types	inputs	transistor outputs	relay outputs
Number of channels	16	16	16
Range	24 V	24 V 0.5 A	50VA
Reference	**TBX CEP 1622**	**TBX CSP 1622**	**TBX CSP 1625**

Catalog of TBX IP65 dust and damp proof discrete monobloc modules

Catalog

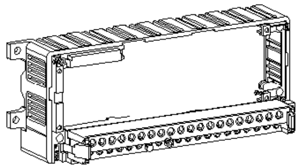
The following table presents the catalog of TBX discrete dust and damp proof monobloc modules (IP65).

Type of module	TBX IP65 Dust and damp proof discrete monobloc modules			
Illustration				
Channel types	inputs	transistor outputs	inputs	transistor outputs
Number of channels	8	8	16	16
Range	24 V	24 V 0.5 A	24 V	24 V 0.5 A
Wiring check	Yes	Yes	No	No
Reference	TBX EEP 08C22	TBX ESP 08C22	TBX EEP 1622	TBX ESP 1622

Catalog of discrete TBX modular modules (IP20)

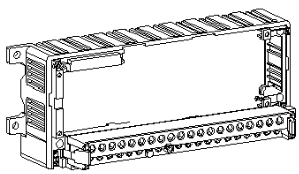
Catalog of input modules

The following table presents the catalog of TBX discrete modular input modules (IP20).

Type of module	discrete modular TBX modules				
Illustration					
Channel types	inputs	inputs	inputs	inputs	inputs
Number of channels	16	16	16	16	16
Range	24 V	24 V	24 V	48 V	120 V AC
Wiring check	No	Yes	No	No	No
Programmable filter	No	No	Yes	No	No
Reference	**TBX DES 1622**	**TBX DES 16C22**	**TBX DES 16 F22**	**TBX DES 1633**	**TBX DES 16S04**

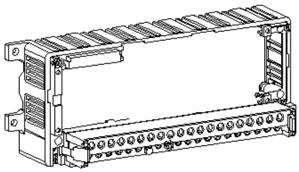
Catalog of output modules

The following table presents the catalog of TBX discrete modular output modules (IP20).

Type of module	discrete modular TBX modules			
Illustration				
Channel types	transistor outputs	transistor outputs	relay outputs	relay outputs
Number of channels	16	16	16	12
Range	24 V 0.5 A	24 V 0.5 A	50 VA	100 VA
Wiring check	No	Yes	No	No
Reference	**TBX DSS 1622**	**TBX DSS 16C22**	**TBX DSS 1625**	**TBX DSS 1235**

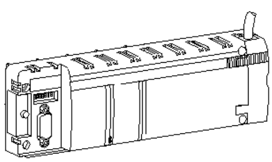
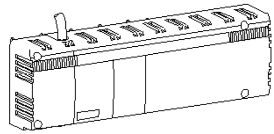
Catalog of input/output modules

The following table presents the catalog of discrete modular TBX input/ output modules (IP20).

Type of module	discrete modular TBX modules					
Illustration						
Channel types	transistor inputs/outputs	transistor inputs/outputs	transistor inputs/outputs	relay inputs/ outputs	relay inputs/ outputs	triac inputs/ outputs
Number of inputs	8 inputs	0 to 16 inputs	8 inputs	8 inputs	8 inputs	8 inputs
Number of outputs	8 outputs	0 to 8 outputs	8 outputs	2 outputs	8 outputs	8 outputs
Range (inputs)	24 V	24 V	24 V	24 V	24 V	120 V AC
Range (outputs)	24 V 0.5 A	24 V 0.5 A	24 V 2 A	50 VA	50 VA	120 V AC
Wiring check	Yes	No	Yes	No	No	No
Reference	**TBX DMS 16C22**	**TBX DMS 16P22**	**TBX DMS 16C222**	**TBX DMS 1025**	**TBX DMS 1625**	**TBX DMS 16S44**

Catalog of communication modules

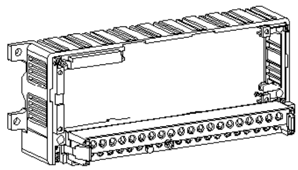
The following table presents the catalog of communication and connection modules for discrete base units (IP20).

Type of module	Communication module for connecting to the discrete base unit	
Illustration	Communication module on the discrete base unit. 	Connection module on the extension base unit. 
Reference	**TBX LEP 020/030**	**TBX CBS 010**

Catalog of TBX modular analog modules (IP20)

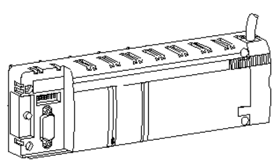
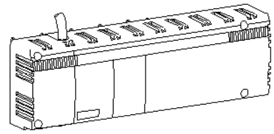
Catalog of modules

The following table presents the catalog of TBX modular analog modules (IP20).

Type of module	modular TBX analog modules		
Illustration			
Channel types	inputs	outputs	inputs/outputs
Number of channels	4	2	6 inputs, 2 outputs
Range	Multirange, V, I, TC, Pt100	Multirange, V, I	Multirange, V, I
Isolation	isolated inputs	isolated outputs	non-isolated inputs, isolated outputs
Reference	TBX AES 400	TBX ASS 200	TBX AMS 620

Catalog of communication modules

The following table presents the catalog of communication and connection modules for analog base units (IP20).

Type of module	Communication module for connecting to the analog base unit	
Illustration	Communication module on the analog base unit. 	Connection module on the extension base unit. 
Reference	TBX LEP 030	TBX CBS 010

Section 1.6
Description of TBX module accessories

Subject of this section

This section describes the accessories of TBX monobloc and modular (IP20) and dust and damp proof monobloc (IP65) modules.

What Is in This Section?

This section contains the following topics:

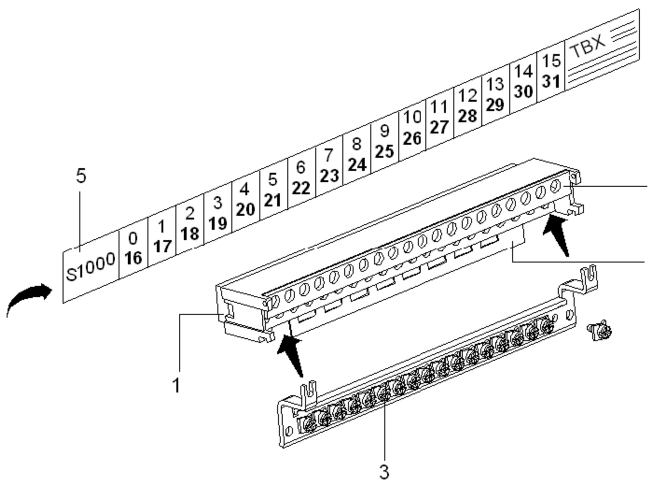
Accessories of TBX IP20 modules

Wiring accessories

To simplify wiring, the following accessories for wiring TBX IP20 distributed I/O modules are proposed:

- A grounding strip connected to ground by the terminal, which enables all the protective screening for sensors and/or preactuators to be connected to the local ground.
  This accessory is sold in lots of 5, reference **TBX GND 015**.
  The quick installation of this strip, (fixed to terminals 2 and 40 on the terminal block) means that, although it is joined to the main terminal block, an additional connection level is formed. The assembly can still be removed.
  In addition, a laterally fixed terminal is used to connect the local ground and the metallic parts of the product in order to provide permanent protection of the base units.
- An inter-terminal connecting comb is used to connect together several terminals at the same voltage.
  This accessory is sold in lots of 5, reference **TBX RV 015**.
  They are designed so that 2 combs may be used in the same connection space, one on top of the other. They are perforated so they can be cut to the correct length by the user, and can be used for 2 to 9 terminals.
  Insulation between the two combs installed one on top of the other is 2000 V AC.

The following drawing shows the wiring accessories for TBX IP20 modules.



The following table provides the various wiring accessory elements for TBX IP20 modules.

Number	Description
1	Terminal block for wiring sensors, preactuators and power supplies.
2	Screw terminal.
3	**TBX GND 015** Grounding strip.
4	**TBX RV 015** inter-terminal connecting comb (to be cut as required).
5	For the Series 1000, a self-adhesive label, indicating the no. of channels from 16 to 31, can be stuck over the label already in place.

Input and transistor output simulators

Two 8 channel simulators are proposed to enable debugging and maintenance of distributed I/O modules:

- a 24 V DC input simulator *(see page 54)*, referenced **TBX SEP 08**.
- a 24 V DC 0.5 A transistor output simulator *(see page 56)*, referenced **TBX SSP 08**.

Accessories of TBX IP65 modules

Wiring accessories

TBX IP65 dust and damp proof monobloc modules are supplied with blanking plugs in order to maintain the level of protection of the modules whenever all the channels are left unused.

A **TBX BAS 10** power supply connector is provided. It provides the power supply to the preactuators connected to the outputs of the modules **TBX ESP 08C22** and **TBX ESP 1622**.

The **TSX BLP 10** is also available. (power supply for logical part of *(see page 97)*, Fipio bus connection *(see page 68)* and station addressing *(see page 113)*).

Input simulators for discrete TBX (IP20) modules

General

It is connected on 8 inputs of a discrete TBX IP20 module, and enables the following to be simulated:

- either the presence of a sensor without leakage current (for example a dry contact or a 3-wire proximity sensor)
- or the presence of a sensor with leakage current (for example a 2-wire proximity sensor).

The green LEDs indicate the state of the sensor:

- passive (open input),
- no leakage current,
- closed (input set to 24 V DC),
- with leakage current.

Connection

The input simulator is fixed directly to the screw terminal of the TBX module (terminals *(see page 133)* I0 to I7, I8 to I15 or I/O8 to I/O15). The common wire (white) must be connected to a +Cs, +Csm,n+1 or +C (24 V DC) terminal *(see page 133)*.

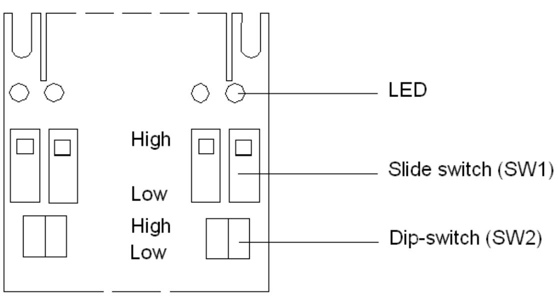
To simulate all the TBX module inputs (I0 to I15), two input simulators are required:

- one simulator connected at I0 to I7,
- and the second connected at I8 to I15.

NOTE: For TBX mixed modules, the input simulator is used with an output simulator.

Illustration

The following diagram shows the switches that can be used with input simulators.



Description: SW2 in upper position

SW2 in upper position: simulates a sensor without leakage current.

- **SW1 in upper position**: the sensor is passive and thus the input is open:
  - the LED is off
  - the TBX input is at state 0.
  - if the module has an input wiring check function, this indicates a fault.
- **SW1 in lower position**: the sensor is active and thus the input is connected to the 24 V DC:
  - the LED is on
  - the TBX input is at state 1
  - the TBX module does not indicate a fault.

Description: SW2 in lower position

SW2 in lower position: simulates a sensor with leakage current (2-wire proximity sensor).

- **SW1 in upper position**: the sensor is passive:
  - the LED is only faintly lit (leakage current),
  - the TBX input is at state 0
  - if the module has an input wiring check function, this indicates a fault.
- **SW1 in lower position**: the sensor is active and thus the input is connected to the 24 V DC:
  - the LED is on
  - the TBX input is at state 1
  - the TBX module does not indicate a fault.

Transistor output simulators for discrete TBX (IP20) modules

General

It is connected on 8 0.5 A transformer outputs of a discrete TBX IP20 module, and enables the following to be simulated:

- either a short-circuit
- or the presence of a load (for modules with a wiring check function).

The red LEDs indicate the state of the outputs when simulating the presence of loads.

Connection

The transistor output simulator is fixed directly on the screw terminal of the TBX module (terminals *(see page 133)* O0 to O7, O8 to O15 or I/O8 to I/O15). The common wire (white) must be connected to a -Cs, -Csm,n+1 or -C (0V) terminal *(see page 133)*.

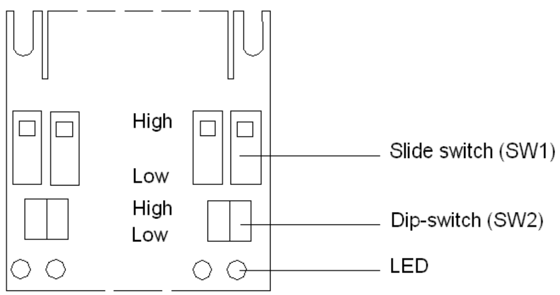
To simulate all the TBX module outputs (O0 to O15), two transistor output simulators are required:

- one simulator connected at O0 to O7,
- and the second connected at O8 to O15.

NOTE: For TBX mixed modules, the transistor output simulator is used with an input simulator.

Illustration

The following diagram shows the switches that can be used with transistor output simulators.



Description: SW2 in upper position

SW2 in upper position: no simulation of load present.

- **SW1 in upper position**: output is not loaded:
  - the LED is off
  - if the module has an input wiring check function, this indicates a fault.
- **SW1 in lower position**: there is a short-circuit on the output:
  - if the output is at "1", the LED is off and a short-circuit fault is signaled
  - if the output is at "0", the LED is off. If the module has an output wiring check function, no "wiring check" fault is signaled.

Description: SW2 in lower position

SW2 in lower position: simulation of load present.

- **SW1 in upper position**: output is loaded and these is no short-circuit:
  - if the output is at "0" and if the module has an output wiring check function, the LED is on but only faintly. No wiring check fault is signaled.
  - if the output is at "0" and if the module does not have an output wiring check function , the LED is off.
  - if the output is at "1" the LED is on.
- **SW1 in lower position**: there is a short-circuit on the output:
  - if the output is at "1", the LED is off and a "short-circuit" fault is signaled
  - if the output is at "0", the LED is off. If the module has an output wiring check function, no "wiring check" fault is signaled.

Chapter 2
General installation rules for TBX distributed input/output modules

Subject of this chapter

This chapter presents the general installation rules for TBX distributed input/output modules.

What Is in This Chapter?

This chapter contains the following sections:

Section 2.1
Operating conditions

Subject of this section

This section presents the operating conditions for TBX IP20 and IP65 modules.

What Is in This Section?

This section contains the following topics:

Standards : TBX IP20 modules

At a Glance

TBX IP20 distributed I/O interfaces have been developed to comply with the principal national and international standards relating to industrial electronic control devices:

- specifications specific to PLCs (operating characteristics, immunity, ruggedness, safety):
  - NF C 63 850,
  - IEC 1131-2,
  - CSA 22.2 No. 142,
  - NEMA ICS 3.304,
  - UL 508.
- immunity to electrostatic discharge:
  - IEC 801.2 level 4.
- dielectric properties and self-extinguishing insulating materials:
  - UL 746C.
  - UL 94.
  - ...
- strict limitation on the degree of electromagnetic interference produced:
  - EN 55022,
  - NF C 91 022,
  - FCC Part 15,
  - VDE 871-877,
  - ...
- merchant navy specification:
  - BV,
  - DNV,
  - GL,
  - LROS,
  - RINA,
  - ...

Environment, operating conditions and limits: TBX IP20 modules

At a Glance

The following table shows the climatic environment as well as the operating conditions for the TBX IP20 modules.

Climatic environment	
Operating temperature	0 °C to 60 °C (1)
Storage temperature	-25 °C to 70 °C
Humidity without condensation	5 to 95 %
Altitude	0 to 2000 m
Protection index	IP20
Vibrations	
Sinusoidal frequency along 3 axes	5 Hz 16 Hz 150 Hz
Amplitude	2 mm constant
Acceleration	2 G constant
Mechanical impacts	
Acceleration	15 g
Duration	11 ms
Supply voltage	
Nominal voltage	24VDC / 48VDC
Operating range	19.2 to 30 V / 38.4 to 60 V
Primary/secondary isolation	1500 VAC
Maximum break time to module power supply	10 ms
Maximum break time to sensor power supply	2 ms
Maximum break time to preactuator power supply	1 ms
Key:	
(1)	At 60 °C, operates with up to 60 % of the inputs **ON** and/or 60 % of the outputs **ON** at nominal load (except for special temperature derating).

Standards : TBX IP65 modules

At a Glance

TBX IP65 distributed I/O interfaces have been developed to comply with the principal national and international standards relating to industrial electronic control devices:

- specifications specific to PLCs (operating characteristics, immunity, ruggedness, safety):
  - NF C 63 850,
  - IEC 1131-2,
- immunity to electrostatic discharge:
  - IEC 801.2 level 4.

Environment, operating conditions and limits: TBX IP65 modules

At a Glance

The following table shows the climatic environment as well as the operating conditions for the TBX IP 65 modules.

Climatic environment	
Operating temperature	0 °C to 60 °C (1)
Storage temperature	-25 °C to 70 °C
Humidity without condensation	5 to 95 %
Altitude	0 to 2000 m
Protection index	IP65
Vibrations	
Sinusoidal frequency along 3 axes	5 Hz 16 Hz 150 Hz
Amplitude	2 mm constant
Acceleration	2 G constant
Mechanical impacts	
Acceleration	15 g
Duration	11 ms
Supply voltage	
Nominal voltage	24VDC
Operating range	19.2 to 30 V
Primary/secondary isolation	1500 VAC
Maximum break time to module power supply	10 ms
Maximum break time to sensor power supply	2 ms
Maximum break time to preactuator power supply	1 ms
Key:	
(1)	At 60 °C, operates with up to 60 % of the inputs **ON** and/or 60 % of the outputs **ON** at nominal load (except for special temperature derating).

Section 2.2
Installation procedure

Subject of this section

This section presents the installation procedure for TBX IP20 and IP65 modules.

What Is in This Section?

This section contains the following topics:

Installing a TBX IP20 Module

Installation Procedure

The following table describes the different stages of the installation procedure for a TBX IP20 module.

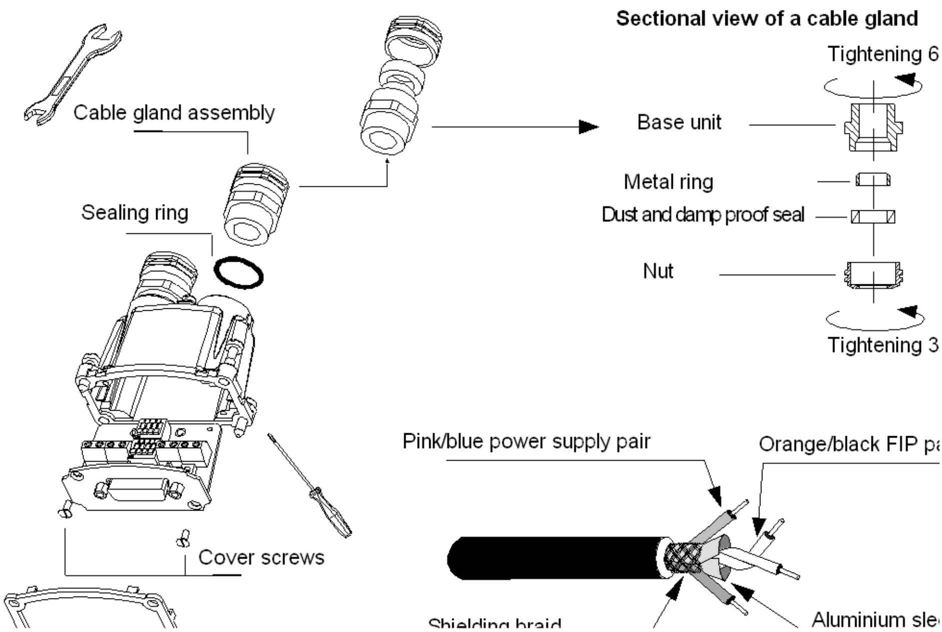
Step	Action
1	Attach the monobloc TBX or the modular base units onto the mounting plate or the DIN rail *(see page 87)*: ● Side by side: the fixing lugs determine the distance between the modules, ● One above the other: the spacing between the modules must be between 4 and 5 cm, so that the devices are well ventilated.
2	Connect a yellow/green wire between the mounting plate (connected to ground) and the protective ground terminal on each TBX monobloc or base unit. During the installation and the wiring procedure, the ventilation louvres on the modules are protected by cardboard which must be removed before switching the units on.
3	Attach the labels supplied with each TBX monobloc or modular base unit: ● Fill out the Connection/Module label *(see page 83)* and then attach it to the TBX monobloc or base unit, ● Lift the removable protective cover on the terminal block and then slide the label under this transparent cover *(see page 85)*: a tear-off diagram at one edge of the label indicates the direction of insertion. There is one label for each terminal block.
4	Prepare the terminal blocks. Depending on the particular module and the wiring: ● Screw in the grounding strip for taking the ground from screened cables *(see page 106)*, ● Wire up one or more wiring combs to facilitate wiring for relay base units and/or distribute currents in the commons for high current applications (the current in common terminals must not exceed 6 A).
5	Wire up the terminal block: power supplies and I/O.
6	In the case of a basic modular TBX, mount the communication module *(see page 89)*. This is fixed to the base unit by 4 captive screws which perform both a mechanical and electrical function by providing ground continuity. Fill out a Connection/Module label *(see page 83)* and attach it to the communication module.
7	Code the Fipio address by correctly positioning the dip-switches *(see page 112)*.
8	In the case of a modular TBX, position the cover and extension connection cable *(see page 91)*.

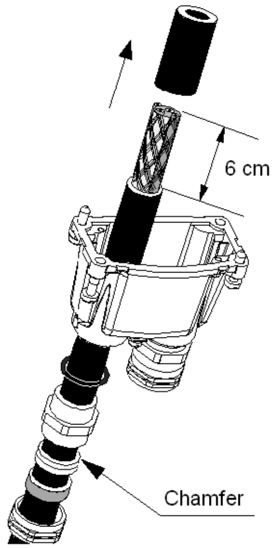
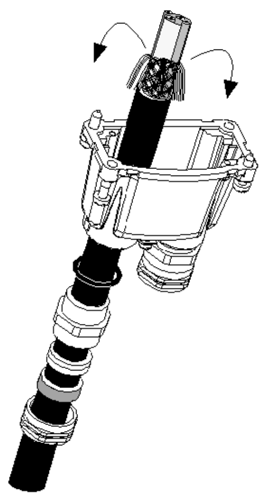
Step	Action
9	Switch on. To do this: • remove the pieces of cardboard which protect the modules during wiring. • Power up the modules. All the lights flash during the self-test phase of the communication module. Following the self-test, the **RUN** LED is permanently on, and where there is no connection to the Fipio bus the **DEF** lamp flashes. The channel display lamps indicate channel status together with any faults (short-circuit or open circuit, etc.). The I/O should be checked when the module is connected to the Fipio bus and when the bus is operational. The connection point configuration is sent automatically to the module from the PLC configuration.
10	Maintenance: • Power must be**switched off** when making alterations to the configuration that concern the branching devices or are on the inside of any devices, • Power must be **switched off** when connecting/disconnecting the Fipio bus to the PLC, • Only connecting/disconnecting the connectors to the Fipio bus can be performed while the module is powered up.

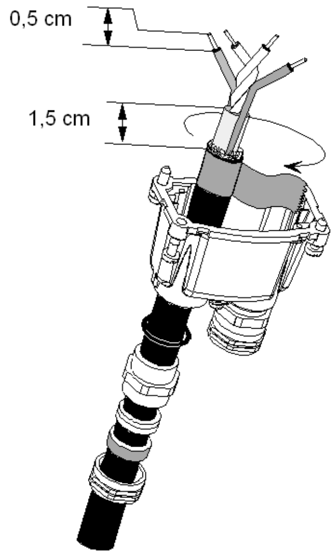
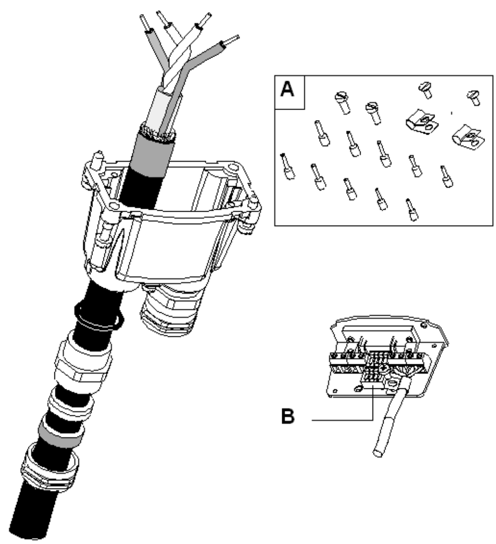
Installing a TBX IP 65 Module

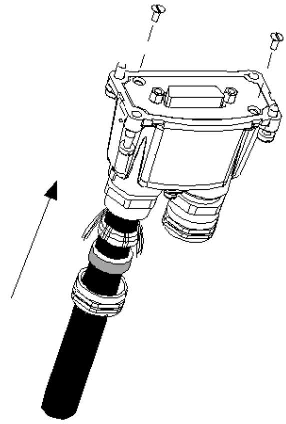
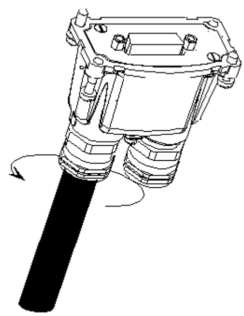
Installation Procedure

The following table describes the different stages of the installation procedure for a TBX IP 65 module.

Step	Action
1	Attach the TBX to its support.
2	Prepare the **TBX BLP 10** connector (wiring). The installation is described in stages 3 to 9.
3	Presentation of the product. 

Step	Action	
4	Remove the cable gland and pass the cable through it (take care to ensure that the chamfer on the metal ring is facing upwards). Strip the cable sheath to a length of 6 cm.	
5	Fold back the shielding braid on the cable sheath; if necessary, undo the braid.	

Step	Action	
6	Strip the conductors by 0.5 cm, and leave 1.5 cm of sleeve. Hold the braid down on the cable sheath using adhesive tape.	
7	It is preferable to use the wiring accessories (**A**) to connect the conductors. There are two possible connection methods: by extension or tap-off. Set the address using the switches *(see page 113)* (**B**).	

Step	Action	
8	Replace the card in the unit, then close the unit using the two screws. Remove the adhesive tape holding the braid and pass the metal ring under the braid. Check that the braid does not protrude beyond the cable gland (to ensure dust and damp proofing) and position the seal under the metal ring.	
9	Tighten the cable gland nut to the tightening torque given at step 3.	
10	Attach the **TBX BLP 10** connector to the module and connect the green/yellow wire to the screw clamp on the **TBX BLP 10**.	
11	Switch on. All the lights flash during the self-test phase of the communication module. Following the self-test, the **RUN** LED is permanently on, and where there is no connection to the Fipio bus the **ERR** lamp flashes. The channel display lamps indicate channel status together with any faults (short-circuit or open circuit, etc.). The I/O should be checked when the module is connected to the Fipio bus and when the bus is operational. The connection point configuration is sent automatically to the module from the PLC configuration.	
12	Maintenance: ● Power must be**switched off** when making alterations to the configuration that concern the branching devices or are on the inside of any devices, ● Power must be **switched off** when connecting/disconnecting the Fipio bus to the PLC, ● Only connecting/disconnecting the connectors to the Fipio bus can be performed while the module is powered up.	

Section 2.3
Installation rules

Subject of this section

This section presents the installation rules for TBX IP20 and IP65 modules.

What Is in This Section?

This section contains the following topics:

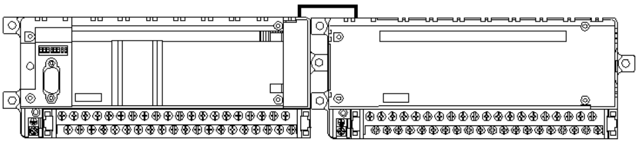
Arrangement of IP20 modules

IP20 modules

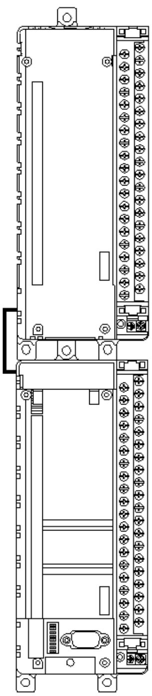
These TBX distributed I/O modules may be installed in a cabinet, in an enclosure as for electrical devices or in a protective box placed as close as possible to the sensors and preactuators.

They may be mounted side by side (horizontally or vertically) in which case the minimum space between two modules is determined by the fixing lugs. The maximum distance is determined by the length of the extension cable.

The following drawing shows horizontal side-by-side installation for the TBX IP20 modules.

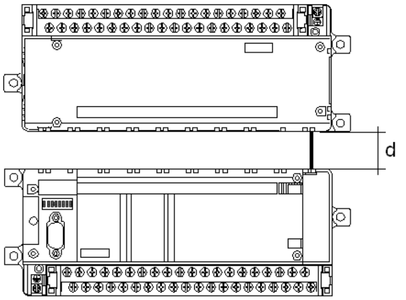


The following drawing shows vertical side-by-side installation for the TBX IP20 modules.



When they are mounted one above the other the spacing, which must be at least 4 to 5 cm, is determined by the length of the cable to the extension unit.

The following drawing shows TBX IP20 modules mounted one above the other.



d Spacing determined by the extension cable (4 to 5 cm min.).

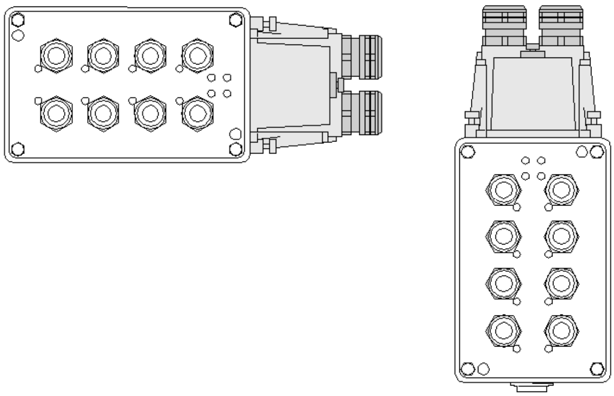
Arrangement of IP65 modules

IP65 modules

These TBX distributed I/O modules may be installed as close as possible to the sensors and preactuators.

They can be mounted either vertically or horizontally on supports (mounting plate, beam, etc.) with a minimum width of 8 cm.

The following drawing shows horizontal or vertical installation for the TBX IP65 modules.



Connecting Modules

General

The various TBX remote I/O devices are connected to each other and to the PLC by daisy chaining or tap links, over the Fipio field bus.

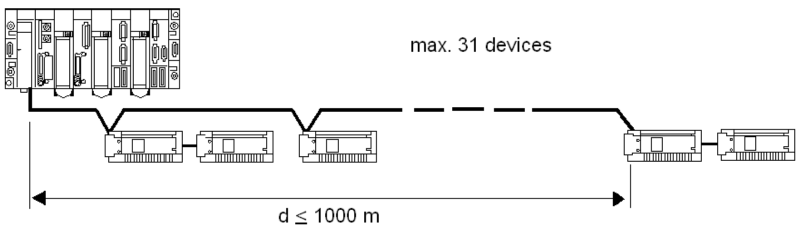
A Fipio bus segment (which can be up to 1000 meters in length) provides 32 connection points to which 31 TBX devices may be connected (one connection point at address 0 is reserved for the PLC).

The use of repeaters enables up to 15 bus segments to be connected together, so that TBX devices can be connected over a maximum distance of 15000 meters.

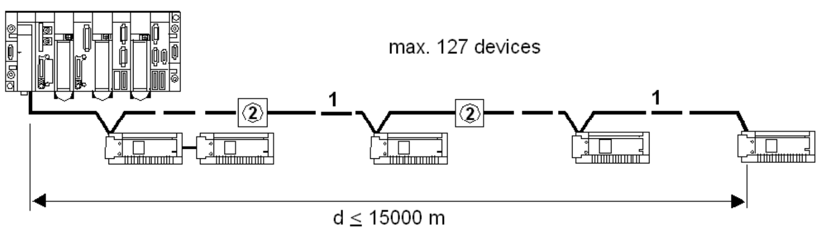
Using several bus segments gives a maximum of 64 connection points. Thus it is possible to connect 62 modular or Discrete (IP65) TBX modules, (in addition to point 0 reserved for PLC connection, and point 63 which is used to connect a terminal).

IP20 Modules

The following drawing shows the connection between TBX IP20 modules and the PLC via a single Fipio bus segment.



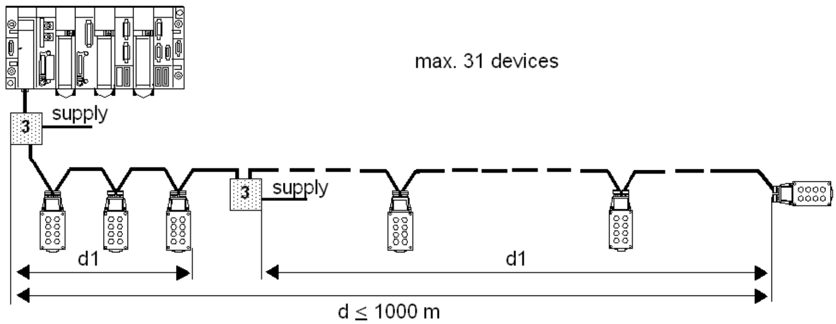
The following drawing shows the connection between TBX IP20 modules and the PLC via several Fipio bus segments.



1 Fipio bus segment (15 x 1000 m segments maximum).
2 Repeater (14 maximum).

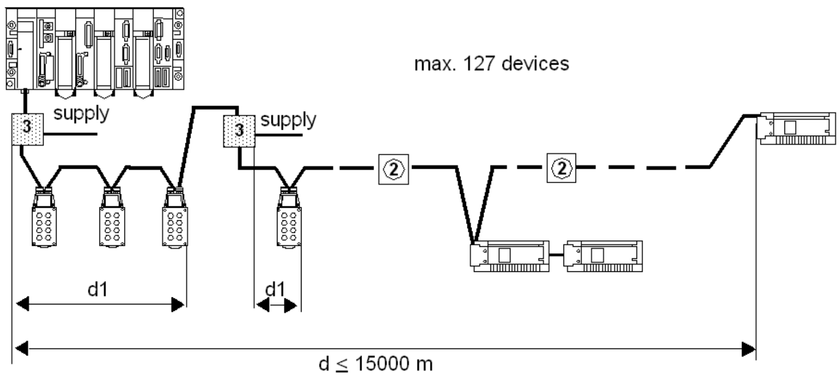
IP65 Modules

The following drawing shows the connection between TBX IP65 modules and the PLC via a single Fipio bus segment.



3 TBX FP ACC10 branch box.

The following drawing shows the connection between TBX IP65 and IP20 modules and the PLC via several Fipio bus segments.



d1 Maximum length of the 24 VDC drop and power cable. Cable reference number: TSX FP CF100,TSX FP CF200,TSX FP CF500.
2 Repeater (14 maximum).
3 TBX FP ACC10 branch box.

Section 2.4
Module dimensions

Subject of this section

This section presents the dimensions for TBX IP20 and IP65 modules.

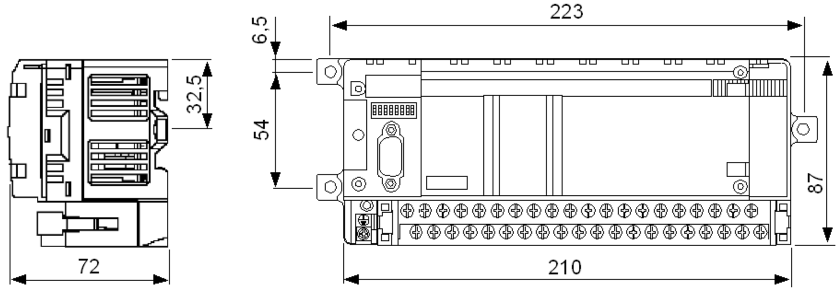
What Is in This Section?

This section contains the following topics:

Monobloc or modular TBX modules (IP20)

Dimensions

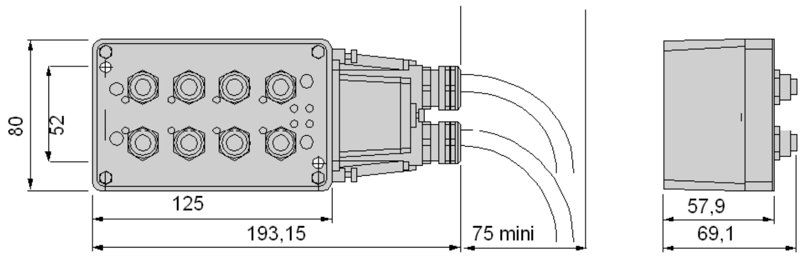
The following drawing shows the dimensions of a TBX IP20 module.



Dust and damp proof monobloc TBX modules (IP65)

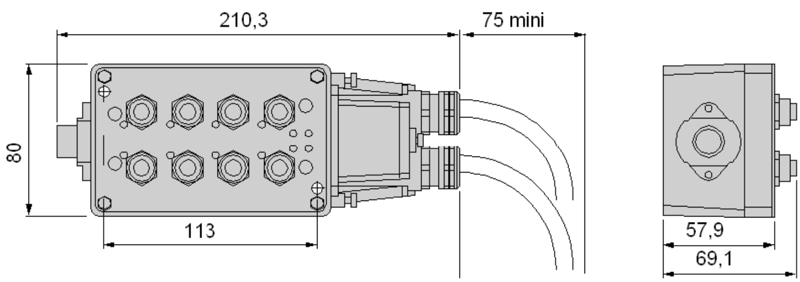
Dimensions: input modules

The following drawing shows the dimensions of a TBX IP65 input module.



Dimensions: output modules

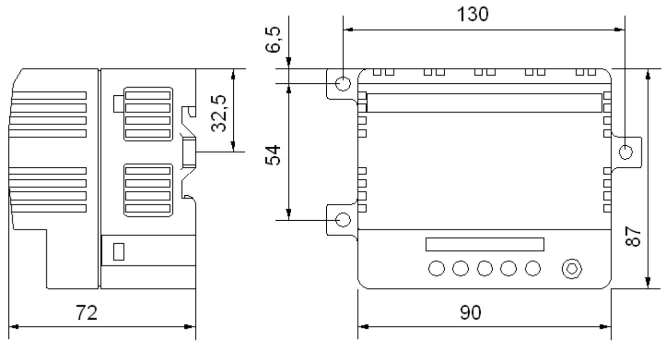
The following drawing shows the dimensions of a TBX IP65 output module.



Power supply module TBX SUP 10

Dimensions

The following drawing shows the dimensions of a **TBX SUP 10** power supply module.



Section 2.5
Module labeling

Subject of this section

This section presents labeling for TBX IP20 and IP65 modules.

What Is in This Section?

This section contains the following topics:

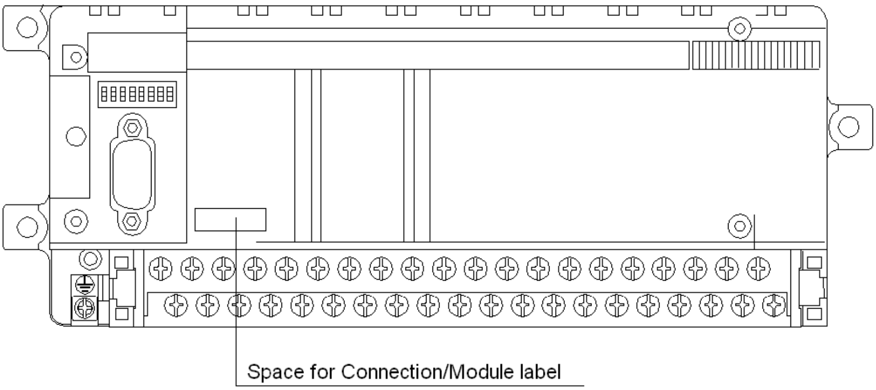
Attaching the Connection/Module label

Attaching to the monobloc TBX

To simplify maintenance, complete the Connection/Module label as follows:

- **Co.** = connection point address on the Fipio bus: 1 to 31,
- **Mod.** = module number: always 0.

Attach the information label to the module in the space provided:

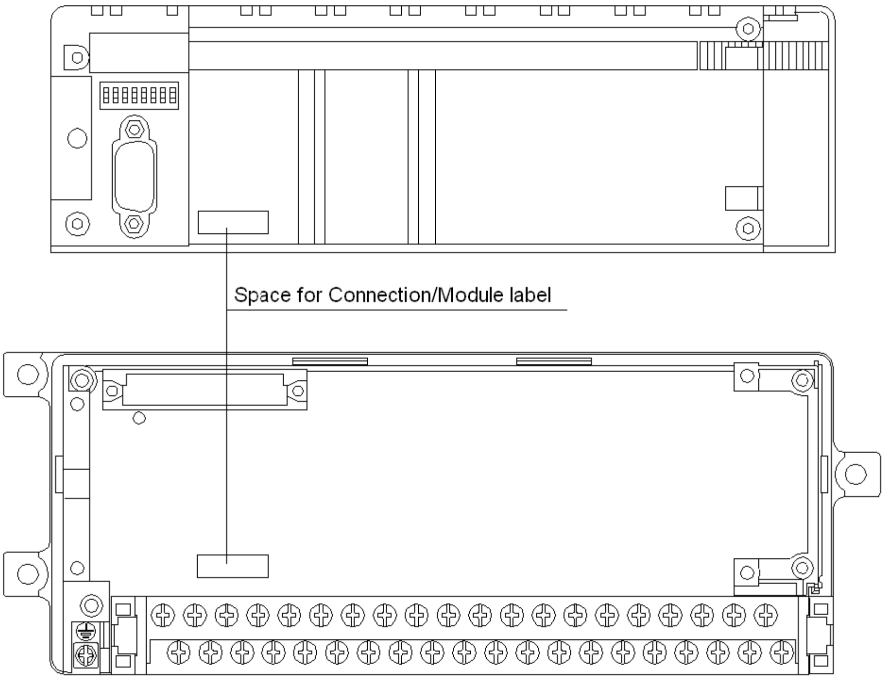


Attaching to the modular TBX

To simplify maintenance, complete the Connection/Module label as follows:

- **Co.** = connection point address on the Fipio bus: 1 to 127,
- **Mod.** = module number : 0 for the base unit and 1 for the extension.

Attach the information label to the space provided on the communication module, on the cover of the extension module or on the base unit:



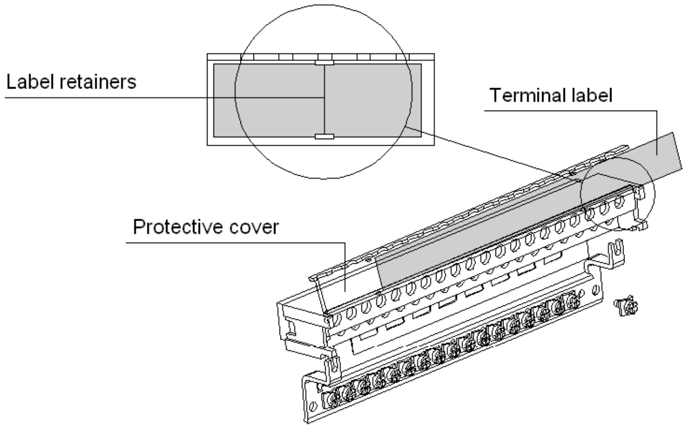
NOTE: for dust and damp proof TBX modules (IP65), the label should be placed on the Fipio cable where it enters the **TBX BLP 10** connector.

Attaching the terminal label

General

To ensure that the terminal labels can be read easily, whatever the position of the TBX module, a two-part label is provided with each monobloc or modular TBX base unit.

The following drawing shows the position of the terminal label.



Installation procedure

The following table shows the procedure to follow for attaching the terminal label.

Stage	Action
1	Cut out the correct part of the terminal label: label 1 for terminal 1, for clear marking. (The TBX diagrams on the edges of the label indicate which part to use, according to the position of the module).
2	Complete the terminal label if necessary: connection point address and module number, label for each of the channels.
3	Raise the removable protective cover.
4	Slide the terminal label inside the protective cover, being careful to position it behind the 4 tabs which will hold the label in place. The terminal labels can be read through the protective cover: label 1 is positioned opposite terminal 1, etc.
5	Close the protective cover over the terminal and push the two ends firmly into place. Any information that it was perhaps necessary to add to the label will then be visible through the cover.

Section 2.6
Mounting and removing modules

Subject of this section

This section presents mounting and removal of TBX IP20 and IP65 modules.

What Is in This Section?

This section contains the following topics:

Mounting the modules on Telequick mounting plate or DIN rail

General

Monobloc TBX modules, modular TBX base units and the **TBX SUP 10** power supply may be mounted on a Telequick mounting plate, or on a DIN rail (profile):

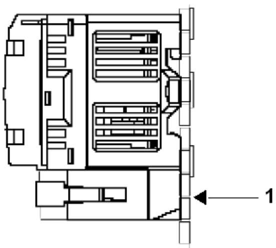
- the modules are fixed to the mounting plate using 3 screws of diameter 4, in the fixing lugs,
- fixing onto a DIN rail does not require any accessories.

NOTE: mounting on a Telequick mounting plate is recommended for installations where there is considerable vibration.

Whatever type of mounting is used, the installation instructions specific to TBX modules should be followed *(see page 72)*.

Mounting

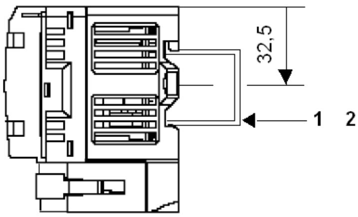
The following drawing shows mounting on a Telequick mounting plate.



Fixing with 3 Ø 4 screws.

1 AM1-PA mounting plate.

The following drawing shows mounting on DIN rail.



Direct clip-on.

1 Combination rail width 35 mm AM1-ED200.
2 Omega rail width 35 mm AM1-DE200.

⚠ WARNING

UNEXPECTED SYSTEM BEHAVIOR - ELECTROMAGNETIC INTERFERENCES

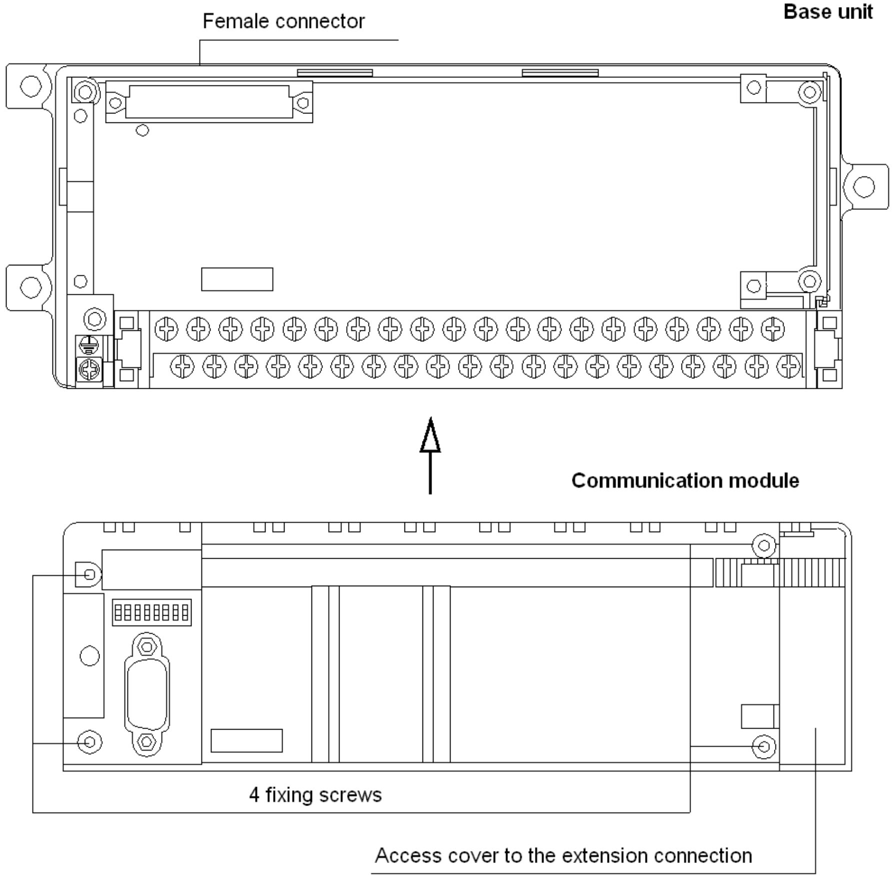
To ensure correct operation of TBX modules in strong electromagnetic environments, they must be mounted on metal supports which are correctly connected to ground. The base and the extension modules of a modular TBX should be mounted on the same plate, on the same mounting DIN rail or on DIN rails which are connected by a metal cross-piece.

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

Mounting a communication module on a base unit

General

The following drawing shows the mounting phase for the communication module on a TBX base unit.



Mounting procedure

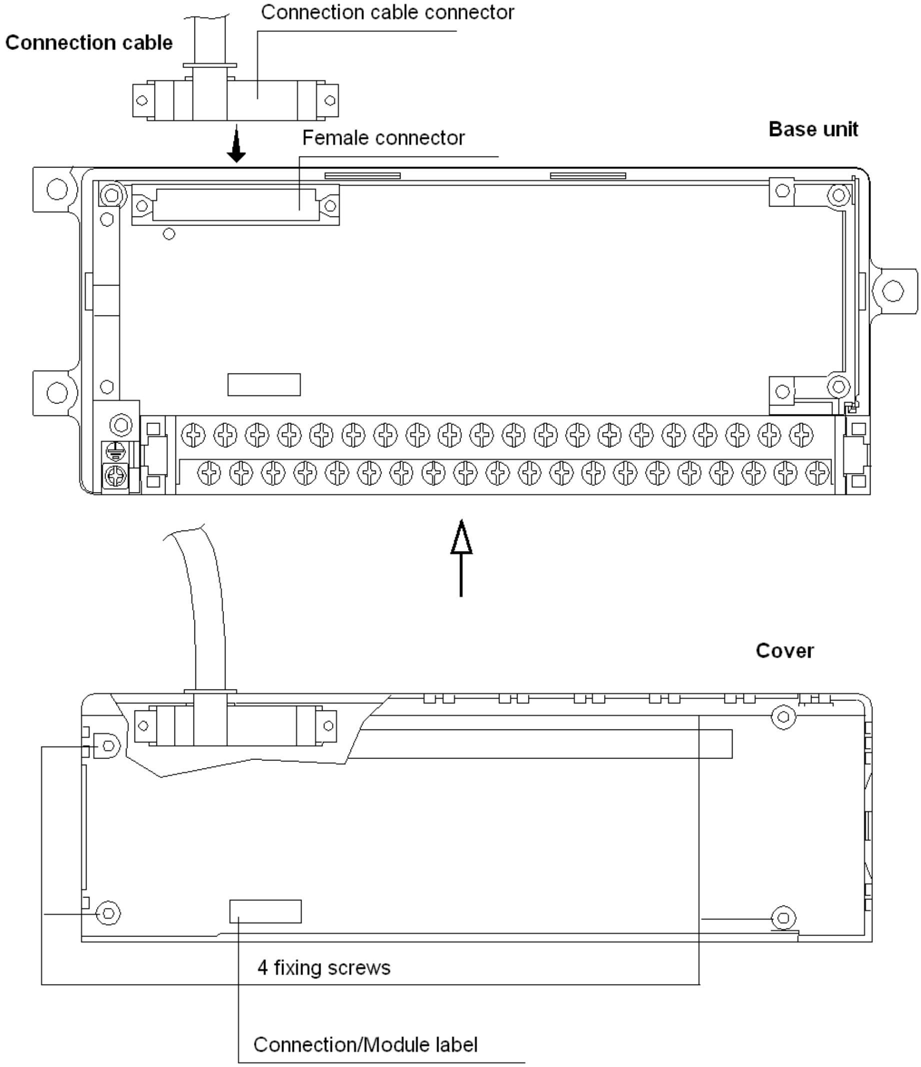
The following table describes the mounting procedure for the communication module on a base unit.

Stage	Action
1	Once the Connection/Module labels are in place *(see page 83)*, fit the communication module on the base unit making sure that the female connector on the base unit is in line with the male connector, located underneath the communication module.
2	Secure the communication module to the base unit using 4 fixing screws.

Mounting the cover and the connection cable on an extension base unit

General

The following drawing shows the phase of mounting the cover and the connection cable on an extension base unit.



Mounting procedure

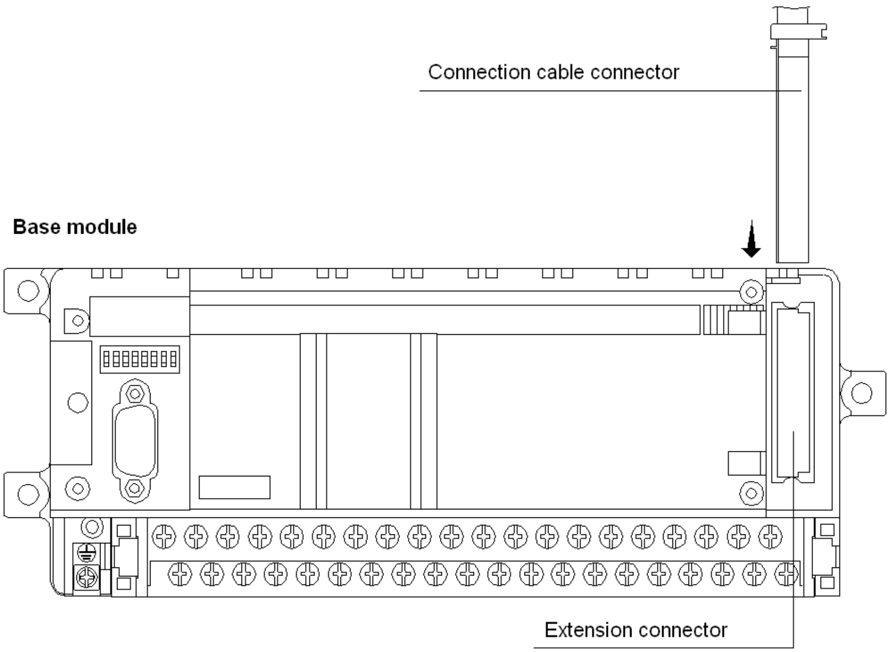
The following table describes the procedure of mounting the cover and the connection cable on an extension base unit.

Stage	Action
1	Plug in the connection cable connector to the base unit.
2	Once the Connection/Module labels are in place *(see page 83)*, fit the communication module on the base unit making sure that the female connector on the base unit is in line with the connection cable connector in the slot on the edge of the cover.
3	Secure the communication module to the base unit using 4 fixing screws.

Connecting the extension module to the base module

General

The following drawing shows the phase of connecting the extension module to the base module.



Mounting procedure

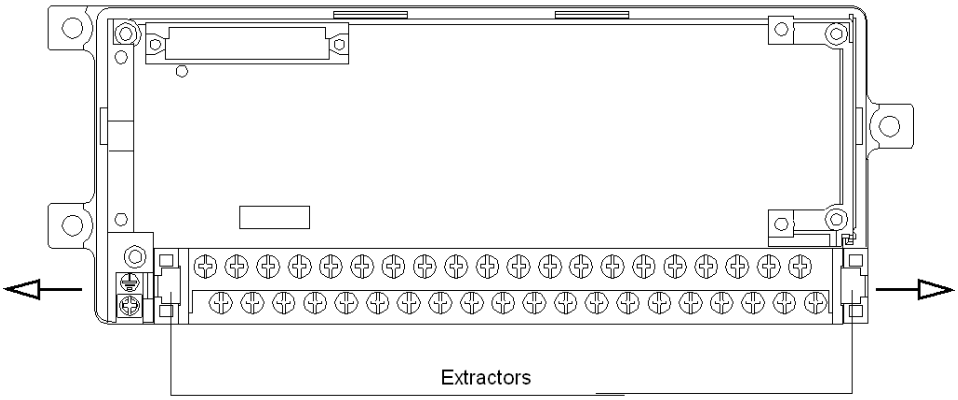
The following table describes the procedure of connecting the extension module to the base module.

Stage	Action
1	Raise the access cover to the extension connection.
2	Remove the cap in the access cover to the connector, which clears the passage for the connection cable.
3	Plug in the free connector of the connection cable (connector on the cable extension) to the female connector on the communication module.
4	Close the cover to allow the connection cable to pass through.

Mounting/Removing the Terminal Block

General

The following drawing shows the mounting/removing phase for the terminal block.



Removal Procedure

The following table describes the procedure for removing the terminal block.

Step	Action
1	To remove the terminal block, simultaneously pull the two extractors on each side of the terminal block, indicated by arrows on the drawing.

Mounting Procedure

The following table describes the procedure for mounting the terminal block.

Step	Action
1	To replace the terminal block, place it in its position and press on each side of the closed protective cover, snapping it into place. The two extractors, which were in the open position, then close.

⚠ DANGER

ELECTRIC SHOCK

Always turn off the power before mounting, removing or replacing the terminal block.

Failure to follow these instructions will result in death or serious injury.

Section 2.7
Module power supply

Subject of this section

This section presents the separate external power supplies and the behavior of the TBX IP20 and IP65 modules on power cut and power return.

What Is in This Section?

This section contains the following topics:

TBX IP20 module power supplies

General

Distributed I/O modules require a direct power supply via a 24 V voltage source (or 48 V for certain modular TBXs). In order to best overcome the various constraints linked to the power sources, modules have separate power inputs to supply the:

- communication circuits and I/O interface (module power supply),
- the sensors,
- the preactuators.

NOTE: the advantage of using separate external power supplies is that it is possible to cut the input or output supply without cutting the supply to the communication module.

Power supplies

The following table shows the number of separate power supplies available by I/O type.

Type of module	Number of separate power supplies	
Discrete inputs	2	module power supply
		input power supply
Transistor outputs	2	module power supply
		output power supply
Discrete inputs and transistor outputs	3	module power supply
		input power supply
		output power supply
Discrete inputs and programmable I/O	2	module power supply
		input and programmable I/O power supply
Relay outputs	1	module power supply
Discrete inputs and relay outputs	2	module power supply
		input power supply

NOTE: relay outputs are powered by the **+-SV** module supply.
The 0 of the external power supplies (**-SV**, **-IS**, **-OS**, **-S**) must be common.

TBX IP65 module power supplies

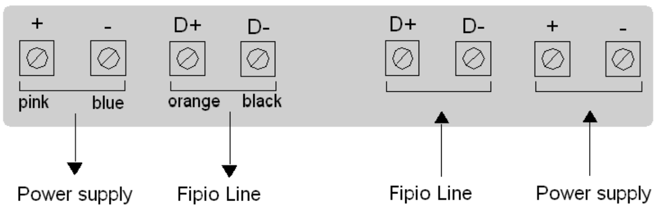
General

Remote I/O TBX IP65 modules require a 24 VDC voltage supply. This supplies the:

- Communication circuits and I/O interface (module power supply),
- Sensors,

The TBX IP65 module power supply is provided by the **TBX BLP 10**.

The following drawing shows the wiring board of the **TBX BLP 10**.



Output modules require an additional power supply which provides energy required for the preactuators.

NOTE: The advantage of using separate external power supplies is that it is possible to cut the output supply without cutting the supply to the communication module.

Power Supplies

The following table shows the number of separate power supplies available by I/O type.

Type of module	Number of separate power supplies	
Discrete inputs	1	Module and input power supply
Static outputs	2	Module power supply
		Output power supply (1)
Key:		
(1)	In order to avoid serious damage during a polarity inversion of the output power supply, the following must be protected: ● The **TBX ESP 08C22** module by a 6 A fast-acting fuse, ● The **TBX ESP 1622** module by a 9 A fast-acting fuse,	

Behavior on power cut and power return of the TBX IP20 modules

General

The following diagram describes the behavior on power cut and power return of the TBX IP20 modules.

	Tc	1 ms	2 ms	10 ms	Tr	Tr + 16 ms	
Module supply SV	Module OK			Module stop	Self-test and reconfiguration		Module OK
Sensor power supply IS	Inputs OK		Incoherent input values			Inputs OK	
Preactuator power supply OS	Outputs OK	Reset outputs to 0				Outputs OK	

Tc Time duration of power cut to power supplies (voltage < 14 V).
Tr Time duration of power return to power supplies (voltage > 19.2 V).

⚠ WARNING

UNEXPECTED SYSTEM BEHAVIOR

In order to ensure correct operation of an extension module on power cut and power return, it must have the same SV power supply as its base module. If this is not the case: a 24 V SV base and a 48 V extension (or vice versa) correct operation on power cut and power return is not assured.

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

SV module power supply voltage

If the power cut to the modules is less than 10 ms, it will not cause a fault in the module.

A break greater than 10 ms can cause the module to stop and therefore reconfigure on return of power.

The voltage supplied to the module is not monitored by the TBX.

IS sensors power supply voltage

If the power cut to the modules is greater than 2 ms, the voltage monitoring system detects this fault before the fastest input is set to 0, (except for the TBX DES 16F22 module that has an input filtering time of 1 ms).

Similarly, when the supply voltage exceeds 19.2 V, the voltage monitoring system waits for 16 ms before signaling this, so as to be able to set the slowest input (except for modules that have an input wiring check whose filtering time is 35 ms).

This combination enables the coherence of input values to be assured, when no power supply fault to the sensors is signaled.

A break in the power supply to the sensors will not cause any internal fault to the module.

OS preactuators power supply voltage

If power to the preactuators is cut for more than 1 ms, voltage monitoring detects this fault and sets the outputs to 0.

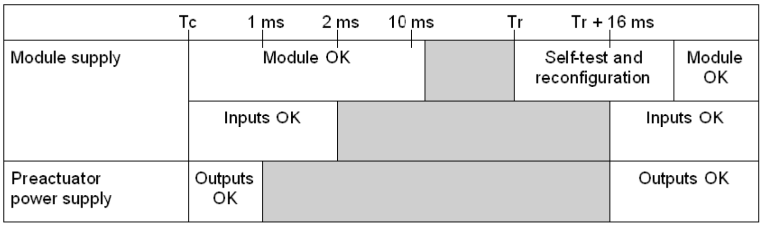
When the power supply voltage exceeds 19.2 V, the voltage monitoring system waits for 16 ms before signaling and validating the outputs again.

A break in the power supply to the preactuators will not cause any internal fault to the module.

Behavior on power cut and power return of the TBX IP65 modules

General

The following diagram describes the behavior on power cut and power return of the TBX IP65 modules.



Tc Time duration of power cut to power supplies (voltage < 14 V).
Tr Time duration of power return to power supplies (voltage > 19.2 V).

Module power supply voltage

If the power cut to the modules is less than 10 ms, it will not cause a fault in the module.

A break greater than 10 ms can cause the module to stop and therefore reconfigure on return of power.

The voltage supplied to the module is not monitored by the TBX.

If power to the module is cut for more than 2 ms, voltage monitoring detects this fault before the fastest input is set to 0.

Similarly, when the supply voltage exceeds 19.2 V, the voltage monitoring system waits for 16 ms before signaling this, so as to be able to set the slowest input.

This then ensures coherent input values if no power supply fault is detected.

Preactuators power supply voltage

If power to the preactuators is cut for more than 1 ms, voltage monitoring detects this fault and sets the outputs to 0.

When the power supply voltage once more exceeds 19.2 V, the voltage monitoring system waits for 16 ms before signaling and validating the outputs again.

A break in the power supply to the preactuators will not cause any internal fault to the module.

TBX module power consumption table

Power consumption table

The following table shows the power consumption table for the TBX modules.

	Module part (1)			Sensor part	
	If base module	If extension module		If base module or extension module	
	on +SV base	on +SV base	on +SV ext.	on +S or +IS	on S, +OS or preact. supply
TBX LEP 020 (2) with a 24 V supply	70 mA	-	-	-	-
TBX LEP 030 (2) with a 24 V supply	70 mA	-	-	-	-
TBX CEP 1622	90 mA	-	-	70 mA	-
TBX CSP 1622	100 mA	-	-	-	35 mA (3)
TBX CSP 1625	195 mA	-	-	-	-
TBX EEP 08C22	190 mA	-	-	-	120 mA (4)
TBX ESP 08C22	107 mA	negligible	107 mA	-	98 mA (3)
TBX EEP 1622	240 mA	-	-	-	208 mA (5)
TBX ESP 1622	107 mA	negligible	107 mA	-	51 mA (3)
TBX DES 1622	20 mA	negligible	15 mA	150 mA	-
TBX DES 16C22	40 mA	10 mA	30 mA	70 mA	-
TBX DES 16F22	40 mA	10 mA	30 mA	70 mA	-
TBX DES 1633	20 mA	negligible	16 mA	70 mA	-
TBX DMS 16C22	40 mA	10 mA	30 mA	35 mA	25 mA (3)
TBX DMS 16P22	30 mA	negligible	25 mA	75 mA	100 mA
TBX DMS 16C222	45 mA	10 mA	35 mA	35 mA	25 mA (3)
TBX DMS 1025	35 mA	10 mA	25 mA	75 mA	-
TBX DMS 1625	80 mA	10 mA	70 mA	75 mA	-
TBX DSS 1622	30 mA	negligible	25 mA	-	35 mA (3)
TBX DSS 16C22	30 mA	negligible	25 mA	-	45 mA (3)
TBX DSS 1625	125 mA	negligible	115 mA	-	-
TBX DSS 1235 (2)	130 mA	negligible	125 mA	-	-
TBX DES 16S04	60 mA	negligible	55 mA	70 mA	-
TBX DMS 16S44	60 mA	negligible	55 mA	75 mA	-

	Module part (1)			Sensor part	
	If base module	If extension module		If base module or extension module	
	on +SV base	on +SV base	on +SV ext.	on +S or +IS	on S, +OS or preact. supply
TBX AES 400	130 mA	negligible	130 mA	-	-
TBX ASS 200	180 mA	15 mA	162 mA	-	-
TBX AMS 620	224 mA	59 mA	162 mA	-	-
Key:					
(1)	These consumptions correspond to a typical a 24 V module power supply, with a 60 % loading (except for **TBX DES 1633** which is supplied with a 48 V V).				
(2)	With a 48 V power supply, divide the values by 2.				
(3)	Module consumption, loads not included.				
(4)	Leakage current/sensor 15 mA max.				
(5)	Leakage current/sensor 13 mA max.				

Calculation sheet

Example

The following example illustrates use of a calculation sheet for consumptions of the TBX modules.

Fipio address	Module	Consumption on SV (mA)		Consumption on IS or S (mA)	Consumption on OS or S (mA)		Total (mA)
Example: 1		Base	Extension		Module	Load	
	Base						
	TBX LEP 020	70	0	...	...	...	70
	TBX DES 16C22	40	0	70	0	0	110
	Extension						
	TBX DMS 16C22	10	30	35	25	x	100 + x
						Total	280 + x

Fipio address	Module	Consumption on SV (mA)		Consumption on IS or S (mA)	Consumption on OS or S (mA)		Total (mA)
...		Base	Extension		Module	Load	
	Base						
	...	...	...	...	...	...	...
	...	...	...	...	...	...	...
	Extension						
	...	...	...	...	...	...	...
						Total	...

	Total of sheet	...

Section 2.8
Module connection

Subject of this section

This section presents connection of TBX IP20 and IP65 modules.

What Is in This Section?

This section contains the following topics:

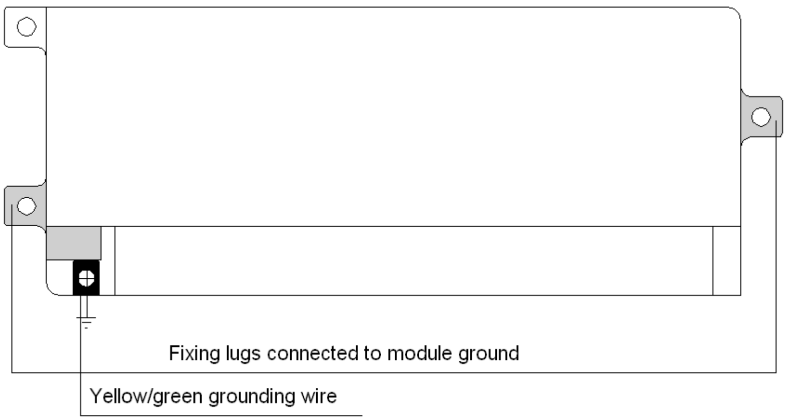
Wiring TBX modules and sensors/preactuators

Connecting the modules to ground (IP20)

The fixing lugs for the monobloc or modular TBX base units have a metallic plate connected to the functional ground of the module. This connection ensures the TBX modules function correctly provided modules are mounted on metal supports which are correctly connected to ground.

Basic modules and extension modules must be mounted on the same support or on supports which are correctly connected to each other.

The following drawing shows how to connect TBX IP20 modules to ground.



⚠ DANGER

ELECTRIC SHOCK

Connect the terminal S of the module to the protective ground by a yellow/green wire.

Failure to follow these instructions will result in death or serious injury.

Connecting the modules to ground (IP65)

The TBX IP65 module is connected to ground using a **TBX BLP 10** connector for the **TBX EEP 08C22/EEP 1622** input modules.

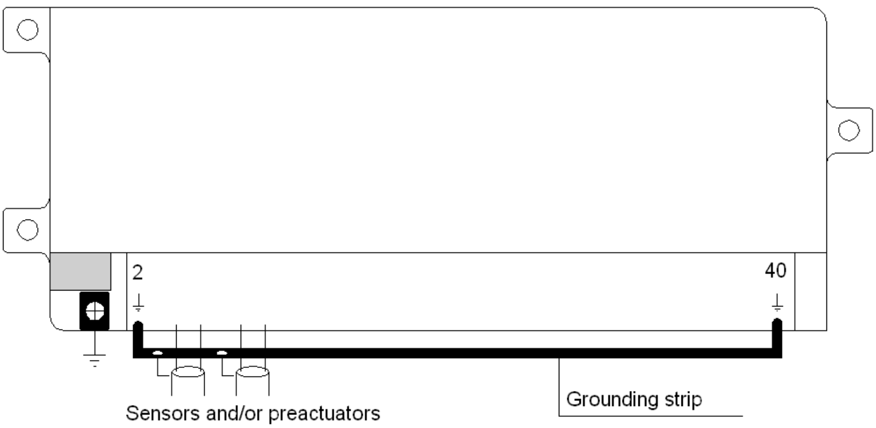
This is done in the same way as for the **TBX ESP 08C22/EEP 1622** output modules and via the grounding wire entering via the **TBX BAS 10** connector which powers the preactuators.

Connecting the sensors and/or preactuators to ground (IP20).

The grounding strip, reference **TBX GND 015**, is fixed to the ground terminals 2 and 40 of the module which allows the protective screening of the sensors and/or preactuators to be connected.

NOTE: it should be noted that this ground connection is not made when the terminal block is disconnected.

The following drawing shows how the sensors and/or preactuators (1P20) are grounded.



Connecting the sensors and/or preactuators to ground (IP65).

The sensors and preactuators (IP65) are connected to ground via terminal 5 of the M12 I/O connectors.

Cable size

The terminals on TBX modules provide a cable size of:

- 1 x 1.5 mm^2 maximum cable with cable end or 2.5 mm^2 maximum (0.2 mm^2 minimum) without cable end,
- 2 x 1 mm^2 maximum flexible cable with cable end.

However, in order to make wiring easier and to increase accessibility, it is advisable to use a 1 mm^2 flexible cable with a molded cable end (reference: **DZ5-CE 010**).

Connecting discrete module power supplies (IP20)

General

There are several types of power supply which may be connected to monobloc TBXs or to modular TBX base units:

- "SV" power supply for the module, common to all modules,
- "IS" power supply for sensors, for modules containing inputs (excluding **TBX DMS 16P22**),
- "OS" power supply for preactuators, for modules containing outputs (excluding **TBX DMS 16P22**),
- "S" power supply for sensors and preactuators, for the **TBX DMS 16P22** module (8 inputs and 8 programmable I/O).

NOTE: If there is only one external power supply, the + terminals for the SV, IS, OS and S power supplies can be connected together.
However, it is essential that the - terminals for these power supplies be connected together.

The advantage of using separate external power supplies is that it is possible to cut the input or output supply without cutting the supply to the communication module.

Module power supply SV

This supplies the communication modules (base module SV) and the I/O control circuits.

This supply is isolated up to 1500 Vrms from ground.

The nominal voltage applied to terminals SV+ and SV- should be the same as the supply voltage for the I/O. For example:

- for a 24 V input base unit, the SV supply is a 24 V,
- for a 48 V input base unit, the SV supply is a 48 V,

For modules with relay outputs, SV supplies the coils of these relay outputs.

Sensor power supply IS

If the TBX module does not have a wiring check function, the IS power supply is distributed on the Cs terminals of the terminal block, to enable the sensors to be wired (intermediate wiring blocks are no longer required).

This IS power supply is continuously monitored to enable the inputs to be processed coherently, during a power break or power return *(see page 98)* (except for **TBX DES 16F22** used with fast filtering).

For modular TBX modules with a wiring check function, the IS supply is distributed on the Csn,n+1 terminals of the terminal block via current limiters, which enables the current to be limited on the line, should a short circuit occur in the application.

Each +Csn,n+1 (0,1 A max. current) or +Cs (unprotected) sensor power terminal can supply two sensors.

Preactuator power supply OS

The OS supply is continuously monitored at the 0.5 A and 2 A transistor outputs and then distributed on the CA terminals of the connection block used for wiring the preactuators (intermediate connection blocks are not required).

Monitoring the voltage enables the outputs to be processed coherently when a power break or power return occurs *(see page 98)*.

Each 0 V (-CA) terminal wires 2 preactuators.

For 2 Amp transistor output modules, a wiring comb must be used, reference **TBX RV 015**, to connect the + terminals together (terminals +OSn,n+1) and to avoid excessive currents in the card.

"S" power supply for sensors and preactuators

The S sensor and preactuator power supply (**TBX DMS 16P22**) is distributed on the C terminals of the terminal block, for wiring the sensors and preactuators (intermediate wiring blocks are no longer required).

Monitoring this voltage enables the inputs and outputs to be processed coherently *(see page 98)*.

NOTE: Supply voltages generated by rectifying/filtering the AC supply should not exceed 30 V.

Connecting discrete module power supplies (IP65)

General

There are several types of power supply which may connected to dust and damp proof monobloc TBXs:

- power supply for the modules, sensors and preactuators,
- output power supply.

Wiring for modules and sensors/preactuators

The power supply for modules, sensors and preactuators is provided by the drop and power cable. (cable reference: **TSX FP CF100**,**TSX FP CF200**,**TSX FP CF500**).

Output power supply

This power supply is provided via the **TBX BAS 10** connector.

Section 2.9
Module addressing

Subject of this section

This section presents addressing for TBX IP20 and IP65 modules.

What Is in This Section?

This section contains the following topics:

Addressing principle

Principle

For a device connected to a Fipio bus to be operational:

- it must be configured in the programming workshop, for the PLC station containing the processor with the Fipio link.
  This operation consists of defining the family of equipment (TBX, ATV, etc.) as well as the type of equipment connected (communication module, base units and extension, etc.) for each of the Fipio bus connection points.
  Connection point addresses 0 and 63, reserved for the PLC and the programming terminal respectively, should not be configured,
- the address of the equipment itself (1 to 127) must be defined by: setting the dip-switches for the TBX modules *(see page 112)*.

NOTE: Particular attention must be paid when addressing devices, as each number is unique and corresponds to the logical configuration.

Coding Addresses

General

The address is coded on dip-switches situated above the connector, which are used to connect to the Fipio bus. These dip-switches, of which there are 8, enable binary coding within the limits given below:

Type of processor	Max no. of TBX addresses	TBX addresses	
		IP20 monobloc	IP20 modular IP65 monobloc
TSX P57 154	62	1 to 31	1 to 62
TSX P57 •54 TSX PCI 57 •54	127	1 to 31	1 to 62, 64 to 127

⚠ WARNING

UNEXPECTED SYSTEM BEHAVIOR

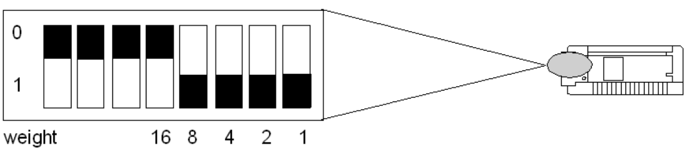
Do check the addresses of the devices to ensure:
- That the connection point number of the device on the Fipio bus is unique,
- That this number corresponds to the number in the configuration.

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

TBX Monobloc IP20

Addressing a TBX Discrete monobloc IP20 device (31 devices maximum per architecture).

The following diagram shows the coding of the device at address 15.

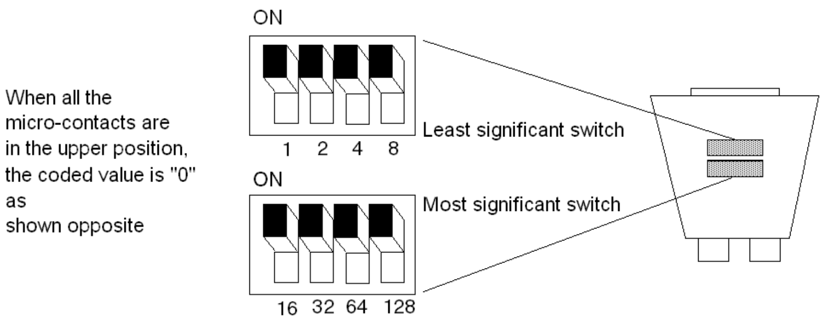


NOTE: As the 3 most important dip-switches (on the left) are inactive, their position is not important.

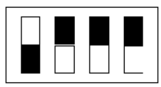
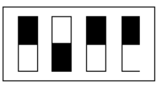
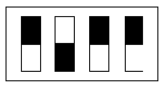
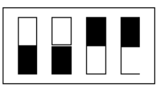
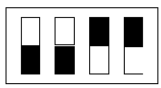
TBX Monobloc IP65

Coding the Fipio address for the TBX IP65.

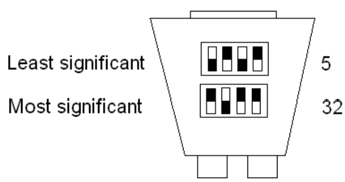
Starting up the TBX only requires the address of the devices to be coded using the switches inside the **TBX BLP 10** (numbered from 1 to 99 inclusive) according to the following diagram:



The following table shows examples of various possible addresses on the rows of micro-contacts:

Least significant switch	Value	Most significant switch	Value
	1		16
	2		32
	3		48

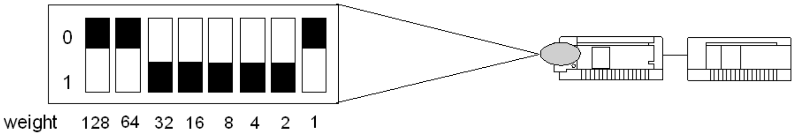
Example: To obtain address 37 (5 + 32), the micro-contacts should be coded as follows:



Modular TBX

Addressing a modular TBX device (126 devices maximum per architecture).

The following diagram shows the coding of the device at address 62.



Section 2.10
Base unit configuration

Subject of this section

This section presents the configuration for TBX TOR IP20 and IP65 base units.

What Is in This Section?

This section contains the following topics:

Configuring IP65 discrete base units (leakage current)

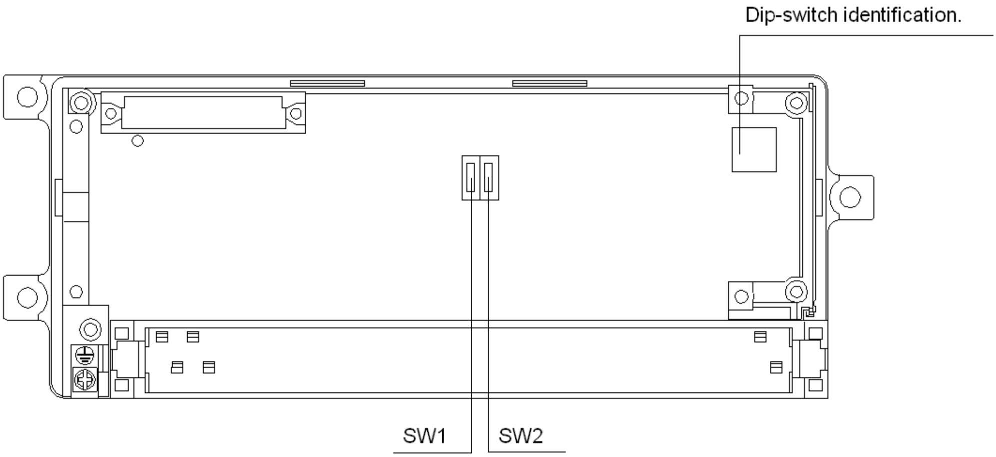
General

NOTE: The sensor has a leakage current of between 0.45 mA and 1 mA.

Access to dip-switches SW1 and SW2 (IP20 discrete base units)

General

The following drawing shows the location of the dip--switches SW1 and SW2 on TBX discrete IP20 base units.



Procedure to follow

The following table describes the procedure for accessing the dip-switches SW1 and SW2 located on the electronic board.

Stage	Action
1	Unplug the terminal block from the base unit *(see page 94)*.
2	Open the access hatch on the electronic board, pivoting it towards the back (opposite side to the terminal block).

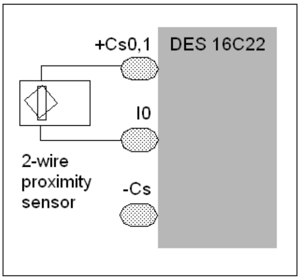
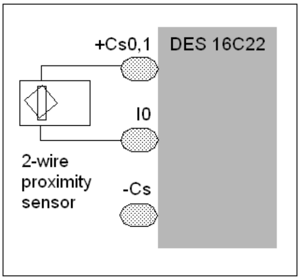
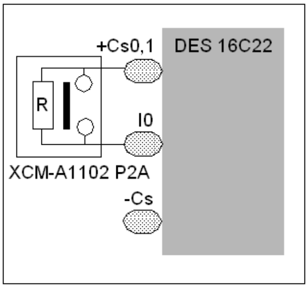
Configuring dip-switch SW1 (IP20 discrete base units)

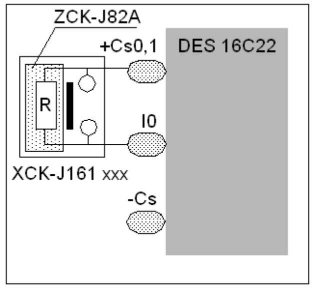
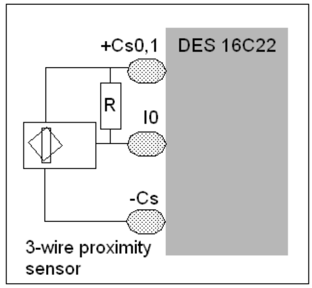
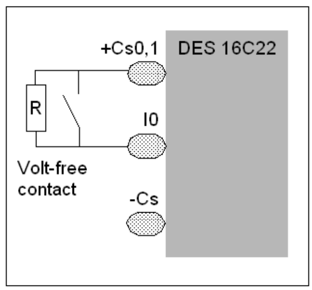
Configuration

The dip-switch SW1 enables regulation of the leakage current according to the sensor used:

Leakage current (natural or induced)	SW1 position
The sensor has a leakage current between 0.45 mA and 1 mA.	ON
The sensor has a leakage current between 1 mA and 1.8 mA.	OFF

The following table shows the different possibilities.

Type of sensor	SW1	External adaptation	Illustration
2 wire proximity sensor with leakage current between 0.45 mA and 1 mA.	ON	No adaptation.	
2-wire proximity sensor with leakage current between 1 mA and 1.8 mA.	OFF	No adaptation.	
Limit switch reference **XCM-A1102 P2A**.	OFF	No adaptation (Limit switch 2 fitted with 15 kΩ resistor connected to the open contact.).	

Type of sensor	SW1	External adaptation	Illustration
Limit switch reference **XCK-J161•••** fitted with a **ZCK-J82A** module.	OFF	No adaptation.	
Volt free contact or 3 wire proximity sensor with induced leakage current between 0.45 mA and 1 mA.	ON	Installation of a 33 kΩ +-5 % resistor in parallel with the 24 V sensor terminals.	 
Volt free contact or 3 wire proximity sensor with induced leakage current between 1 mA and 1.8 mA.	OFF	Installation of a 15 kΩ +-5 % resistor in parallel with the 24 V sensor terminals.	

NOTE: the permissible open line resistance is:

- 500 kΩ with SW1 in the ON position,
- 200 kΩ with SW1 in the OFF position,

NOTE: for each of the channels, the wiring check function may or may not be enabled, which makes it possible to use sensors both with and without a leakage current.

Configuring dip-switch SW2 (IP20 discrete base units)

Configuration

The dip-switch SW2 enables regulation of the input filtering time:

Filter	SW2 position
5 ms fast filter	ON
35 ms normal filter	OFF

NOTE: when replacing a base unit which is configured with input wiring check on site, do not forget to configure SW1 and SW2 on the new base unit, before restarting the application.

The respective positions of SW1 and SW2 determine the maximum length permitted between the wiring check modules and the sensors.

SW1 in the ON position:

	SW2 ON	SW2 OFF
Max. length without 50 Hz coupling	500m	500 m
Max. length (240 VAC coupling)	10 m	200 m
Max. length (24 VAC coupling)	100 m	500 m

SW1 in the OFF position:

	SW2 ON	SW2 OFF
Max. length without 50 Hz coupling	500 m	500 m
Max. length (240 VAC coupling)	35 m	200 m
Max. length (24 VAC coupling)	350 m	500 m

Chapter 3
Processing faults in TBX distributed I/O modules

Subject of this chapter

This chapter presents the processing of hardware faults related to TBX distributed I/O modules.

What Is in This Chapter?

This chapter contains the following sections:

Section 3.1
Description of the indicator lamps

Subject of this section

This section provides the description of the TBX IP20 and IP65 module indicator lamps.

What Is in This Section?

This section contains the following topics:

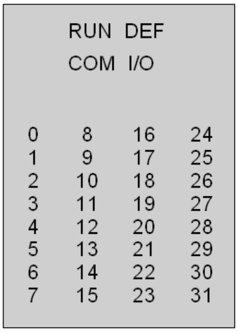
Description of the Discrete TBX IP20 Indicator Lamps

General

Each remote I/O TBX IP20 module has a display block which indicates its state and the state of its channels.

Description

The following drawing shows the display block for the TBX IP20 modules.



The following table describes the state of the lamps:

LEDs	Permanently on	Blinking	Off
RUN (green)	Device operational.	-	-
DEF (red)	Device faulty.	Fipio link fault.	-
COM (yellow)	-	Indicates that a Fipio frame has been sent or received.	-
I/O (red)	Wiring fault or sensors/preactuators are faulty (short-circuit, open circuit, no voltage).	-	-
0 to 15 (red)	Channel is active.	Wire fault on the wiring check modules: open circuit (indicated by flashing lamp) or short-circuit (indicated by inverted flashing lamp).	Channel is inactive.

NOTE: On a TBX monobloc, only the first 16 lamps are used.

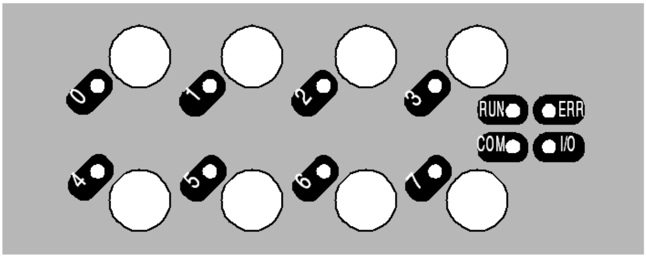
Description of the discrete TBX IP65 indicator lamps

General

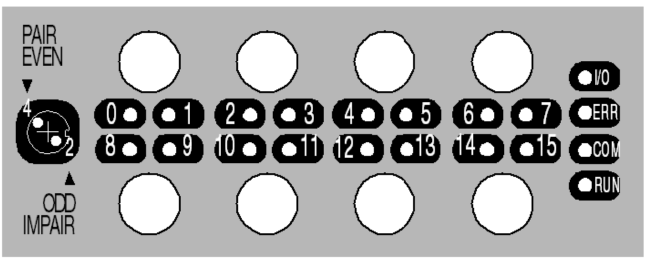
Each TBX distributed I/O IP65 module has display LEDs which indicate the state of the module and its channels.

Description

The following drawing shows the display LEDs for the TBX IP65 **8 channel** modules. The status lamp for each channel is next to the corresponding connection point.



The following drawing shows the display LEDs for the TBX IP65 **16 channel** modules.



The following table describes the state of the lamps:

Lamps	Steady light	Flashing	Off
RUN (green)	Device operational.	-	-
ERR (red)	Faulty device.	Fipio link fault.	-
COM (yellow)	-	Shows whether a Fipio frame is being transmitted or received.	-

Lamps	Steady light	Flashing	Off
I/O (red)	Wiring fault or sensors/preactuators are faulty (short-circuit, open circuit, no voltage).	-	-
0 to 15	Channel is active.	Wire fault on the wiring check modules: open circuit (indicated by flashing lamp) or short-circuit (indicated by inverted flashing lamp).	Channel is inactive.

NOTE: the indicator lamps on 16 channel 1P65 modules are 2 different colors:
- even channels are associated with yellow lamps,
- odd channels are associated with green lamps.

Section 3.2
Fault-finding

Subject of this section

This section describes fault-finding using the TBX indicator lamps.

What Is in This Section?

This section contains the following topics:

Displaying common faults

Description

The following table shows the operation of the display lamps for the TBX distributed I/O modules.

Lamps	● Lit	⊗ Flashing	○ Off
RUN (green)	Device operational.	-	Device switched off
DEF (1) (red)	Internal fault in the module or lack of power supply to base unit no. 2 or insufficient power supply voltage.	Fipio link fault.	No fault.
I/O (red)	External fault. The type of fault depends on the distributed I/O module chosen: ● discrete *(see page 129)*, ● analog *(see page 130)*.	-	No external fault.
Key:			
(1)	**ERR** on the discrete IP65 TBXs.		

NOTE: when a TBX is being connected to the Fipio, if all 4 lamps **RUN**, **DEF** (**ERR** on the discrete IP65 TBXs), **COM** and **I/O** flash simultaneously, this indicates that the connection point address defined for this TBX is already being used by another TBX, connected to the bus.
In this case, modify the connection point address code.

Remedial actions

The following table describes the remedial actions to be taken when faults are indicated.

Lamps	● Lit	⊗ Flashing	○ Off
RUN (green)	-	-	● check the fuse, ● check the terminal block connection, ● check the module supply voltage.

Lamps	● **Lit**	⊗ **Flashing**	○ **Off**
DEF (1) (red)	● check the connection of the **TBX BLP 01** (IP20) or **TBX BLP 10** (IP65) connector. ● check configuration of the module in the software workshop.	● check to see whether the voltage is ≥ 19.4 V. If correct: ❍ modular TBX: change the communication module or the base unit, ❍ monobloc TBX: change the module, ● check the power supply of base unit no. 2.	-
I/O (red)	The type of fault depends on the distributed I/O module chosen: ● discrete *(see page 129)*, ● analog *(see page 130)*.	-	-
Key:			
(1)	**ERR** on the discrete IP65 TBXs.		

Displaying faults in discrete TBX modules

Description

The following table shows the operation of the display lamps for the TBX distributed I/O modules.

Lamps	● Lit	⊗ Flashing	○ Off
I/O (red)	External fault: • short-circuit on outputs, • open circuit on inputs, if wiring check module, • sensor/preactuator voltage failure.	-	No external fault.
Channel 0 to 15 (red)	Channel is active	Wire fault on the wiring check modules: open circuit (indicated by flashing lamp) or short-circuit (indicated by inverted flashing lamp).	Channel is inactive.

Remedial actions

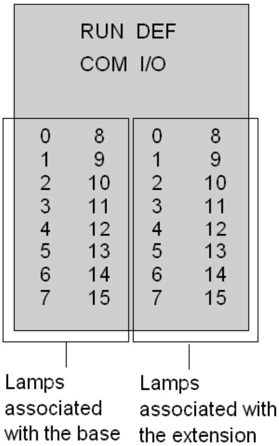
The following table describes the remedial actions to be taken when faults are indicated.

Lamps	● Lit	⊗ Flashing	○ Off
I/O (red)	Check the cabling.	-	-
Channel 0 to 15 (red)	-	• check the tightness of the terminals, • check the sensor or the preactuator.	-

Displaying faults in TBX analog modules

Description

The following drawing shows the display block indicator lamps for the TBX analog modules.



The following table shows the operation of the display lamps for the TBX distributed I/O modules.

Lamps	Lit	Flashing	Off
COM (yellow)	Shows whether a Fipio frame is being transmitted or received.	-	-
I/O (1) (red)	Wiring or sensor/preactuator fault: ● short-circuit, ● open circuit, ● no voltage.	-	No external fault.
Channel 0 to 3 (2) (red)	-	Fault in the associated channel. A channel fault is detected if there is a fault on the sensor link.	-

Lamps	Lit	Flashing	Off
Channel 0 to 15 (red)	-	When all lamps (0 to 15) are flashing (some may be displayed as a steady light), it means that an internal fault has been detected. If this is the case, the module must be changed. **Note**: if an internal fault occurs on the extension, check that this extension has been properly connected and powered.	-
Key:			
(1)	Lamp not used for the **TBX ASS 200** and **TBX AMS 620** modules.		
(2)	Only on the **TBX AES 400** module.		

Chapter 4
Meaning of terminals of TBX distributed input/output modules

Meaning of terminals

Description

The following table provides the definition of discrete TBX module terminals (IP20).

Terminal	Comment
+C	**TBX DMS 16P2**2 modules only. This terminal, connected internally to +S (+24 V DC) serves as the common for 2 sensors. It is not protected against short-circuits.
+C	**TBX DMS 16P22** modules only. This terminal, connected internally to +S (0 V DC) serves as the common for 2 preactuators.
+CA	This terminal, connected internally to +Os (a +24 V), is not protected against short-circuits.
-CA	This terminal, connected internally to -Os (0 V DC) serves as the common for 2 preactuators.
Cn, n+1	On relay output modules, this terminal serves as the common for 2 relays.
+Cs	This terminal, connected internally to +Is (a +24 V DC or a +48 V DC), serves as the common for 2 sensors. It is not protected against short-circuits.
-Cs	This terminal, connected internally to -Is (0 V), serves as the common for two 3-wire proximity sensors.
+Csn, n+1	Only for modules with wiring check function. This terminal, which supplies a +24 V DC protected against short-circuits, serves as the common for 2 sensors. It comes from +Is (+24 V DC).
In	Input.
I/On	**TBX DMS 16P22** modules only. This terminal can be configured as an Input or an Output.
+IS	+ input supply terminal: +24 V DC or +48 V DC
-IS	- input supply terminal: 0 V.
NC	Voltage free terminal: Not Connected.
N1	The two N1 terminals are connected together internally. They only exist on modules with 12 or 16 relay outputs.
On S	Output
+OS	+ output supply terminal: +24 V DC

Terminal	Comment
-OS	- output supply terminal: 0 V.
+Osn, n+1	**TBX DMS 16C222** modules only. This terminal supplies two 2A transistor outputs with +24 V DC.
+S	**TBX DMS 16P22** modules only. + input and I/O supply terminal: +24 V DC.
-S	**TBX DMS 16P22** modules only. - input and I/O supply terminal: 0 V.
+SV	+ module supply terminal: +24 V DC or +48 V DC. This powers the communication module and the I/O interface of the base or extension module.
-SV	- module supply terminal: 0 V. This powers the communication module and the I/O interface of the base or extension module.

Chapter 5
The TBX CEP 1622 distributed input module

Subject of this chapter

This chapter presents the **TBX CEP 1622** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX CEP 1622 module

General

The**TBX CEP 1622** distributed input module is a monobloc module comprising 16 24 V DC inputs, compatible with 2 and 3 wire proximity sensors.

It has a terminal block for direct wiring of the sensors.

The sensor voltage is monitored to ensure that there is sufficient voltage for the inputs.

Technical specifications

The following table provides the technical specifications of the module.

TBX CEP 1622	
Nominal voltage +SV	24 V DC
Supply voltage +SV	19,2 V DC to 30 V DC
Current drawn on +SV	90 mA typically at 24 V
Current drawn on +IS (loading = 60 % of inputs ON)	70 mA typically at 24 V
Power dissipated in the module (loading = 60 % of inputs ON)	3,9 W at 24 V
Dielectric strength between inputs and ground (GND)	1500 V rms - 50/60 Hz for 1 min
Isolation resistance	> 10 MΩ below 500 V DC
Protection against a reverse polarity on SV	Yes: diode in series
Key:	
SV	Power supply to module (communication module and input interfaces).
IS	Power supply to sensors.

Characteristics of the outputs of module TBX CEP 1622

General characteristics

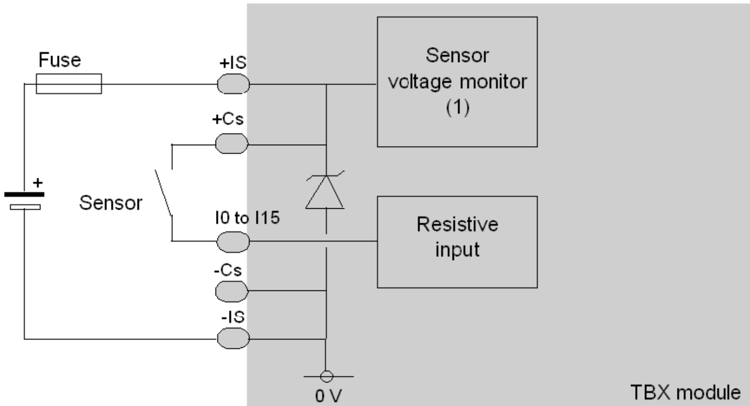
This table presents the characteristics of the outputs of module **TBX CEP 1622**:

Module **TBX CEP 1622**	
Nominal voltage IS	24 V DC
Nominal current	7 mA
Sensor power supply IS	19,2 V DC to 30 V DC
Voltage for ON state	> 7 V
Current at 11 V	≥ 2 mA
Voltage for ON state	< 5 V
Current for OFF state	≤ 1.4 mA
Input impedance at 24 V	3,4 kΩ
Switch-on time	5 to 11 ms
Switch-off time	5 to 13 ms
Permitted line resistance (2 wire proximity sensor)	100 Ω
Permitted line resistance (volt-free contact)	500 Ω
Permitted leakage resistance (2 wire proximity sensor)	200 Ω
Permitted leakage resistance (volt-free contact)	50 Ω
IEC standard 1131	Type 1
Compatibility with Telemecanique 2 wire proximity sensors	Yes
Compatibility with CENELEC 3 wire proximity sensors	Yes
Compatible with TBX transistor outputs	Yes
Type of input	Resistive
Type of logic	Positive
Power dissipated per channel at state 1	0,17 W
Protection against a reverse polarity on IS	Yes: reverse diode in parallel (ext. fuse 2 A (quick blow))
Key:	
IS	Power supply to sensors.

Connecting the module TBX CEP 1622

Circuit diagram

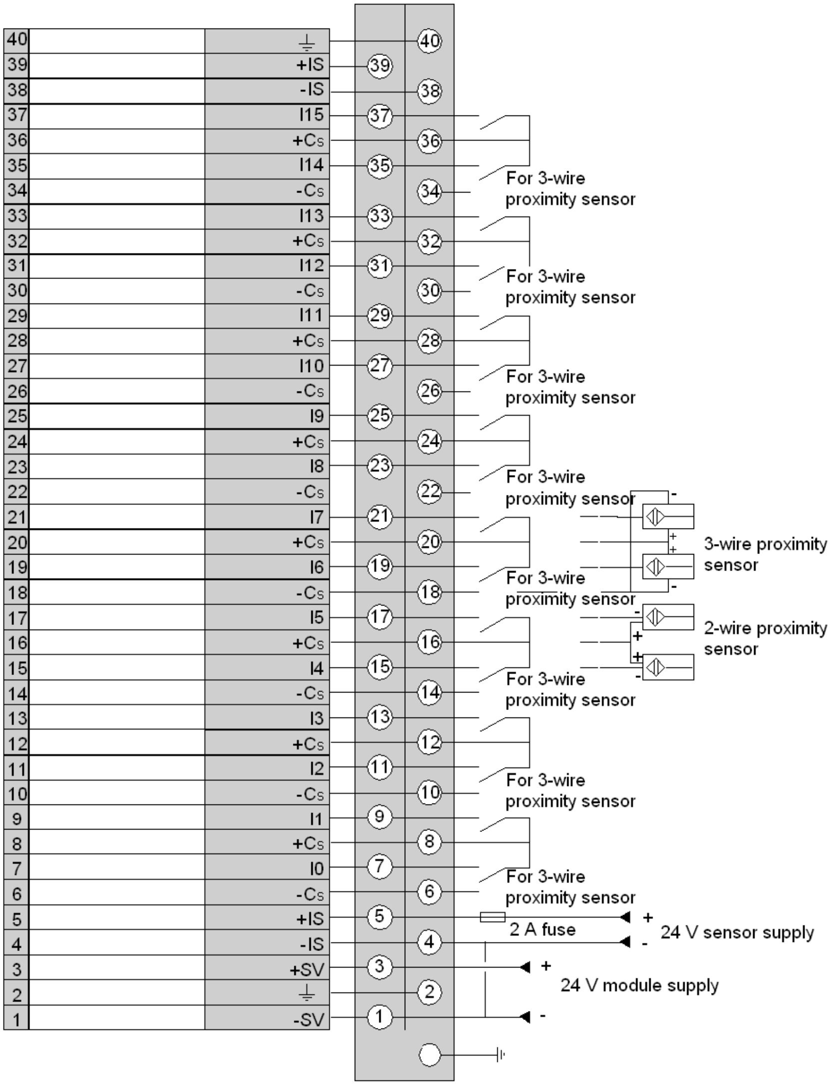
The following illustration shows the circuit diagram for a resistive input.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

Terminal block wiring

The following diagram illustrates the wiring of the terminal.



NOTE: A 2 A quick blow fuse, wired to the sensor power supply IS is needed against short-circuits concerning the +Cs *(see page 133)*.
It is not necessary to connect the two +IS terminals together, nor the two -IS terminals. The -SV terminal and a -IS (0 V) terminal must however be connected together.

Chapter 6
The TBX CSP 1622 distributed output module

Subject of this chapter

This chapter presents the **TBX CSP 1622** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX CSP 1622 module

General

The **TBX CSP 1622** distributed output module is a monobloc module comprising 16 24 V DC 0.5 A transistor outputs.

It has a terminal block for direct wiring of the pre-actuators.

The outputs are protected *(see page 324)* against overloads and short-circuits.

When there is a fault at an output, the I/O indicator lamp lights and the output is set to state 0. To reactivate it, this output must be reset once the fault has been rectified.

The preactuator voltage is monitored to ensure coherent processing of the outputs during variations in the power supply.

Technical specifications

The following table provides the technical specifications of the module.

TBX CSP 1622	
Nominal voltage +SV	24 V DC
Supply voltage +SV	19,2 V DC to 30 V DC
Current drawn on +SV	100 mA typically at 24 V
Current drawn on +OS (with no active outputs)	35 mA typically at 24 V
Power dissipated in the module (loading = 60 % of active outputs)	5,7 W at 24 V
Dielectric strength between outputs and ground (GND)	1500 V rms - 50/60 Hz for 1 min
Isolation resistance	> 10 MΩ below 500 V DC
Protection against a reverse polarity on SV	Yes: diode in series
Key:	
SV	Power supply to module (communication module and output interfaces).
OS	Power supply to pre-actuators..

Characteristics of the outputs of module TBX CSP 1622

General characteristics

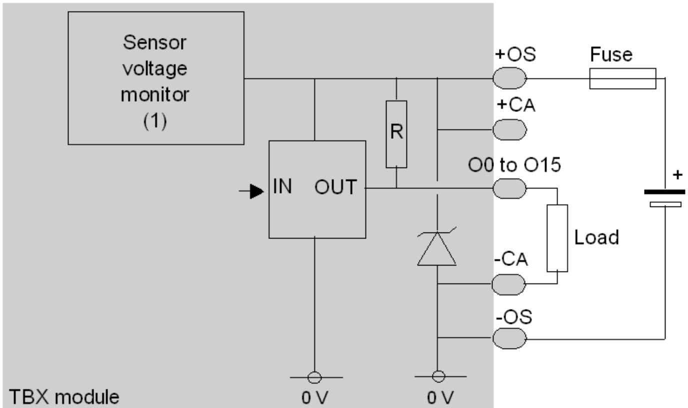
This table presents the characteristics of the outputs of module **TBX CSP 1622**:

Module **TBX CSP 1622**	
Nominal voltage IS	24 V DC
Nominal current	0,5 A
OS supply voltage limits	19.2 to 30 VDC
Permitted filament lamp power	8 W
Leakage current at OFF state	< 0,5 mA
Residual voltage at ON state	< 0,4 V
Switching time at ON or OFF state	≤ 1 ms
Load impedance at ON state	> 50 Ω
Outputs protected against overloads	Yes: thermal
Outputs protected against overvoltages	Yes: Zener diode
Protection against a reverse polarity on OS	Yes : reverse diode in parallel (ext. fuse 12 A (quick blow))
Detection of break in load	No
Conforms to IEC 1131	Yes
Compatible with DC inputs	Yes
Type of logic	Positive
Power dissipated per channel at ON state	0,35 W
Protection against a reverse polarity on IS	Yes: reverse diode in parallel (ext. fuse 2 A (quick blow))
Key:	
OS	Power supply to pre-actuators.

Connecting the module TBX CSP 1622

Circuit diagram

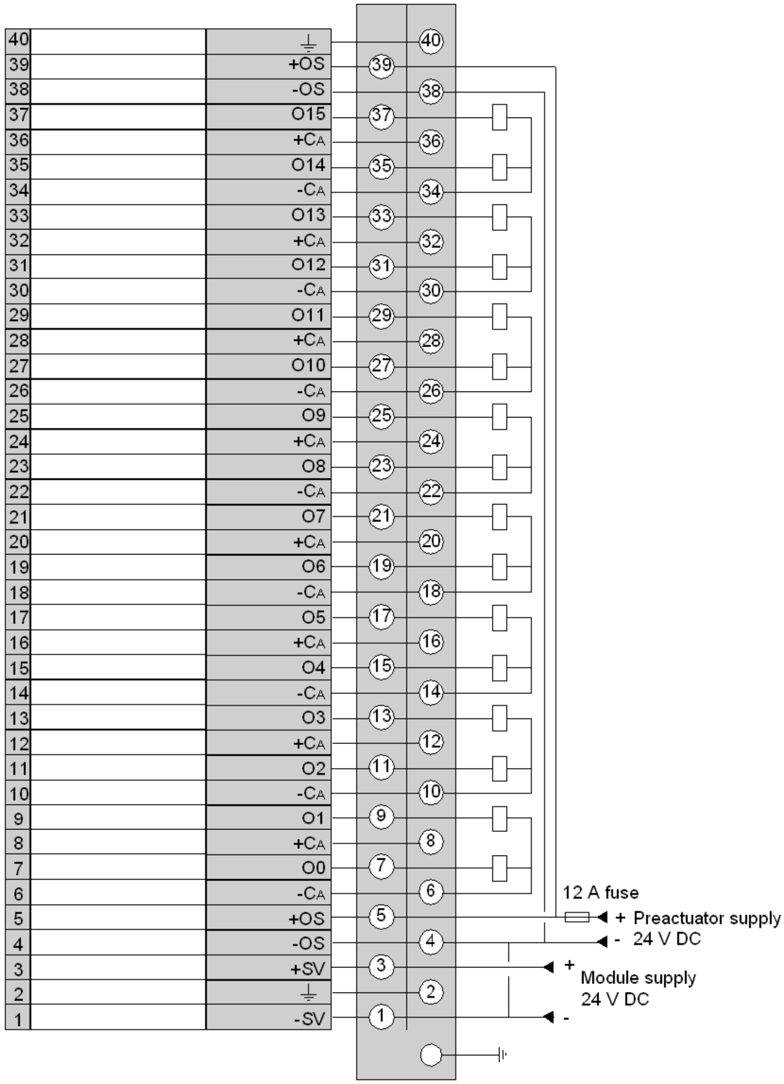
The following illustration shows the circuit diagram for a 24 V 0.5 A transistor output.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

Terminal block wiring

The following diagram illustrates the wiring of the terminal.



NOTE: the two +OS terminals *(see page 133)* must be wired together as well as the two -OS terminals. The -SV terminal and a -OS (0 V) terminal must also be wired together.

Chapter 7
The TBX CSP 1625 distributed output module

Subject of this chapter

This chapter presents the **TBX CSP 1625** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX CSP 1625 module

General

The **TBX CSP 1625** distributed output module is a monobloc module comprising 16 50 VA relay outputs.

It has a terminal block for direct wiring of the pre-actuators.

When a fault appears at an output, it is set to state 0.

Technical specifications

The following table provides the technical specifications of the module.

TBX CSP 1625	
Nominal voltage +SV	24 V DC
Supply voltage +SV	19,2 V DC to 30 V DC
Current drawn on +SV (with 60 % of the relays active)	195 mA typically at 24 V
Immunity to +SV microbreaks (with 60 % of the relays active)	10 ms
Power dissipated at nominal load in the module (with 60 % of the relays active)	4,7 W at 24 V
Dielectric strength between outputs and ground (GND)	1500 V rms - 50/60 Hz for 1 min
Isolation resistance	> 10 MΩ below 500 V DC
Protection against a reverse polarity on SV	Yes: diode in series
Key:	
SV	Power supply to module (communication module and output interfaces).

Characteristics of the outputs of module TBX CSP 1625

General characteristics

This table presents the characteristics of the outputs of module **TBX CSP 1625**:

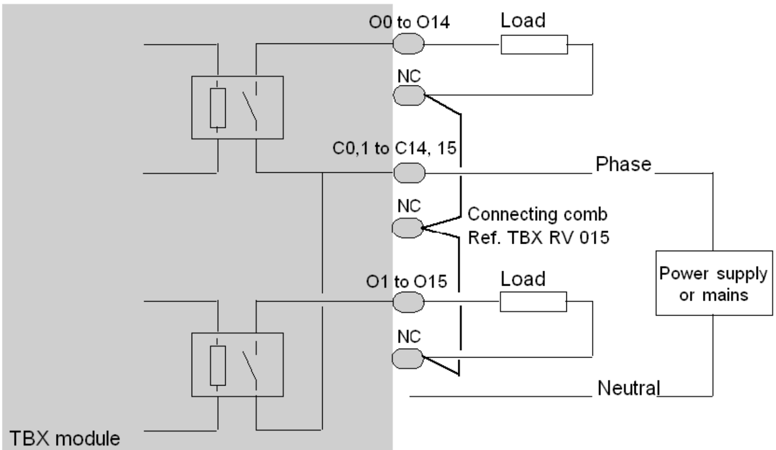
Module **TBX CSP 1625**	
Operating voltage	19 to 30 V DC, 24 to 264 V AC
Permitted DC current DC12 resistive loads	24 W 0.2 x 10^6 operations
Permitted DC current DC13 inductive loads (L/R = 60 ms)	10 W 10^6 operations
Permitted AC current AC12 resistive loads	1 A - 110/220 V 0.2 x 10^6 operations 0,5 A - 110/220 V 2 x 10^6 operations 1 A -24/48 V 0.5 x 10^6 operations 2 A - 24 V 0,2 x 10^6 operations
Permitted AC current AC15 resistive loads	50 VA - 110/220 V 10^6 operations 0,5 A - 110/220 V 2 x 10^6 operations 10 VA -48/220 V 10^7 operations 1 A - 24 V 0,2 x 10^6 operations
Accidental power breaks (opening due to inrush current of the contactor)	30 A peak 50 operations
Thermal current (1)	3 A
Switch-on response time	10 ms max.
Switch-off response time	20 ms max.
Dielectric strength of contacts	2000 V rms.
Compatible with DC inputs	Yes
Preactuators protected against overvoltages	No internal protection (2)
Protection against short-circuits and overloads	No internal protection

Common per channel	1 for 2 channels
Type of contact	Normally open
Key:	
(1)	Maximum value of current which can cross the contact without damaging it. This value, which is associated with the relay, should not be confused with the permissible current, relating to the module. The permissible current takes into account the breaking capacity of the relay (maximum switching current) and the characteristics of the other components which constitute the output.
(2)	With an inductive load on an AC supply, an RC or GMOV peak limiter circuit must be wired across the load. For DC, wire a reverse mounted diode in parallel to the load.

Connecting the module TBX CSP 1625

Circuit diagram

The following illustration shows the circuit diagram of a relay output (normally open contacts).



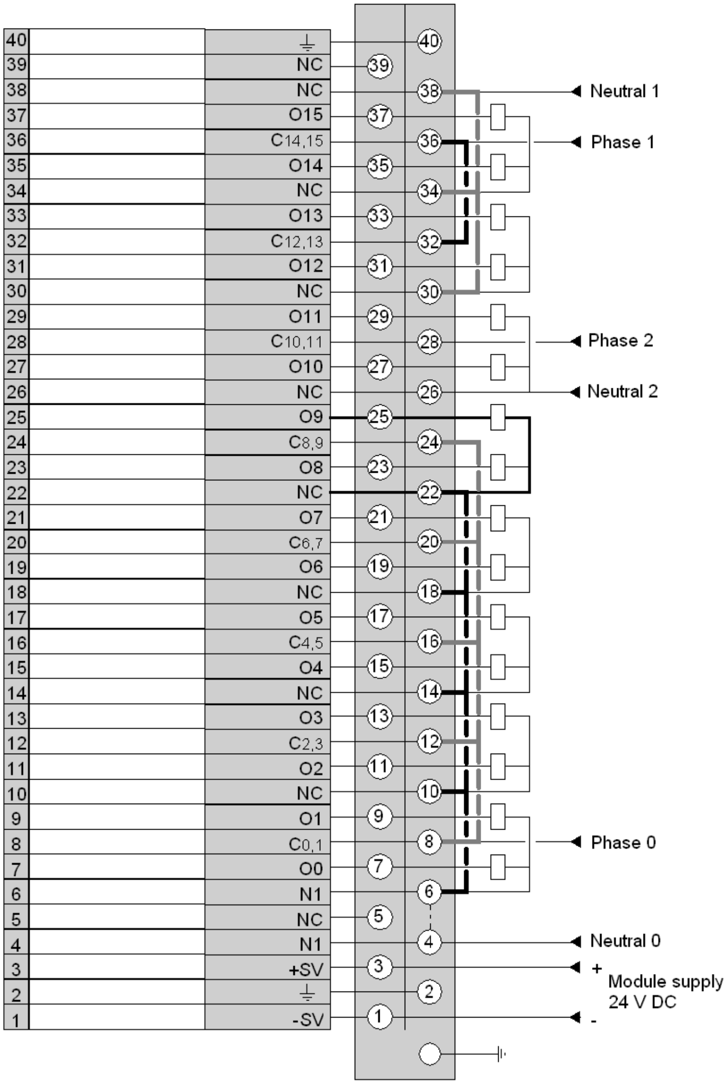
Terminal block wiring

The illustration below provides an example of a wiring diagram: The module outputs organized into two groups by the user have separate power supplies (outputs 0 to 9, outputs 10 and 11 and outputs 12 to 15).

The NC terminals *(see page 133)* are not wired within the modules, but are used to distribute the power supply neutral to the various loads. For this purpose, use connecting combs, reference **TBX RV 015**.

A connecting comb is also used to connect the relay commons (C0,1, C2,3,...) with the supply phase.

The following diagram illustrates the wiring of the terminal.



NOTE: The two N1 terminals *(see page 133)* are connected together internally.

Chapter 8
The TBX EEP 08C22 distributed input module

Subject of this chapter

This chapter presents the **TBX EEP 08C22** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX EEP 08C22 module

General

The **TBX EEP 08C22** dust and damp proof distributed input module is a monobloc module comprising 8 24 V DC inputs, compatible with 2 and 3 wire proximity sensors.

It is equipped with M12 type connectors for direct wiring of the sensors.

The sensor voltage is monitored to ensure that there is sufficient voltage for the inputs to operate correctly.

Technical specifications

The following table provides the technical specifications of the module.

TBX EEP 08C22	
Nominal voltage	24 V DC
Supply voltage	19,2 V DC to 30 V DC
Current drawn at +24 V	135 mA typical at 24 V (8 channels at 0)
Current drawn at +24 V (loading = 60 % of inputs ON)	190 mA typically at 24 V
Power dissipated in the module (loading = 60 % of inputs ON)	5,2 W at 24 V
Dielectric strength between inputs and ground (GND)	1500 V DC for 1 min
Isolation resistance	> 10 MΩ below 500 V DC
Protection against a reverse polarity on +24 V	Yes: diodes in series
Key:	
SV	Power supply to module (communication module and output interfaces).

Characteristics of the inputs of module TBX EEP 08C22

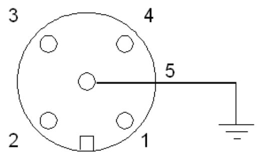
General characteristics

This table presents the characteristics of the outputs of module **TBX EEP 08C22**:

Module **TBX EEP 08C22**	
Nominal voltage	24 V DC
Nominal current	6 mA
Sensor power supply	19,2 V DC to 30 V DC
Voltage for ON state	≥ 11 V
Current at 11 V	≥ 5 mA
Voltage for OFF state	< 6 V
Current for OFF state	≤ 2 mA
Input impedance at 24 V	3,4 kΩ
Switch-on time	5 to 8.5 ms
Switch-off time	5 to 8.5 ms
Permitted line resistance (2 wire proximity sensor)	100 Ω
Permitted line resistance (volt-free contact)	500 Ω
IEC standard 1131	Type 2
Compatibility with Telemecanique 2 wire proximity sensors	Yes
Compatibility with CENELEC 3 wire proximity sensors	Yes (leakage current ≥ 1 mA)
Compatible with TBX transistor outputs	Yes
Type of input	Current sink
Type of logic	Positive
Power dissipated per channel at state 1	0,17 W
Protection of 4 signal terminals against overload or short-citcuit	Yes
Protection per diode against a reverse polarity on +24 V	Yes

Connections

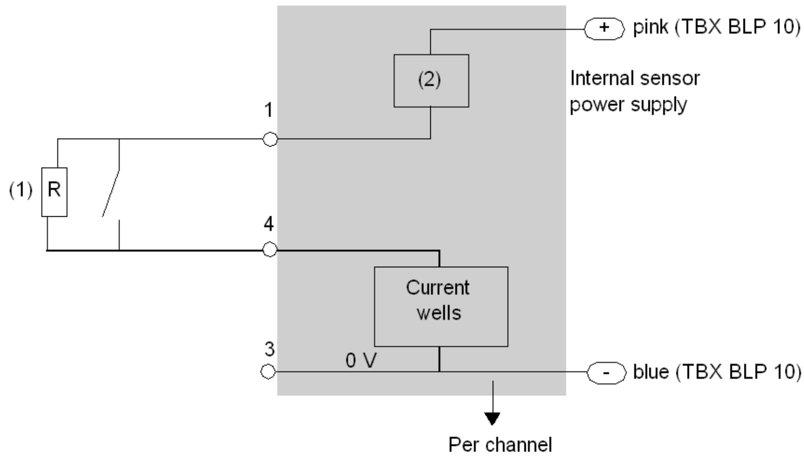
The following table illustrates channel connection for module **TBX EEP 08C22**

Illustration	Terminal	Description
Type M12 female connector (one per channel).  	1	+24 V (supplied by module)
	2	not connected
	3	0 V (supplied by module)
	4	sensor signal
	5	ground connection

Connecting the module TBX EEP 08C22

Circuit diagram

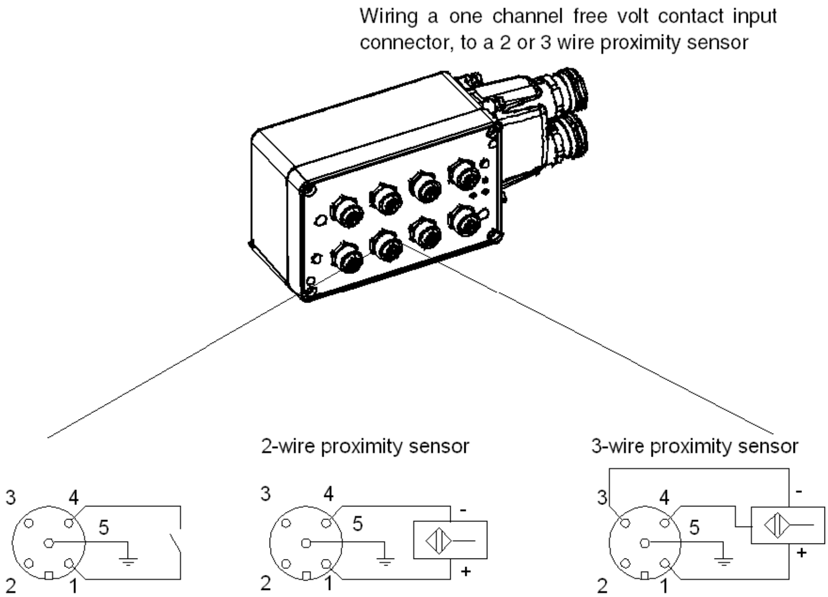
The following illustration shows the circuit diagram for a wiring check input.



1 Resistance R for a dry contact or a 3-wire proximity sensor, enables the input wiring check to be used.
2 Power supply to the sensors is provided via the module.

Wiring the input connectors

The following illustration shows the wiring diagram for input connectors.



NOTE: the module is powered by cable **TBX FP CB100**.

⚠ WARNING
SHORT CIRCUIT - LOSS OF PROOF Do place the blanking plugs on slots where channels are not in use (tightening torque of cable glands: 1 Nm), in order to retain the IP65 dust and damp proof protection. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Chapter 9
The TBX ESP 08C22 distributed output module

Subject of this chapter

This chapter presents the **TBX ESP 08C22** module, its characteristics and the wiring of output connectors.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX ESP 08C22 Module

General

The **TBX ESP 08C22** sealed (IP65) remote output module is a monobloc module comprising 8 24 VDC, 0.5 A static outputs.

It is equipped with M12-type connectors for direct wiring of the pre-actuators.

The outputs are protected *(see page 324)* against overloads and short-circuits.

When there is a fault at an output, the I/O indicator lamp lights and the output is set to state 0. To reactivate it, this output must be reset once the fault has been rectified.

The preactuator voltage is monitored to ensure consistent processing of the outputs during variations in the power supply.

Technical Specifications

The following table provides the technical specifications of the module.

TBX ESP 08C22	
Nominal voltage	24 VDC
Supply voltage	19.2 to 30 VDC
Current drawn at +24 V (1)	107 mA typically at 24 V
Current drawn at +24 V (2) (with no active outputs)	120 mA typically at 24 V
Power dissipated in the module (loading = 60 % of active outputs)	4.1 W at 24 V
Dielectric strength between outputs and ground (GND)	1500 VDC for 1 min
Isolation resistance	> 10 MΩ below 500 VDC
Protection against a reverse polarity on +24 V (1)	Yes: diodes in series (3)
R $_{on}$ outputs	1006 Ω max
Key:	
(1)	Power supply to module (communication and output interfaces).
(2)	Power supply to preactuators.
(3)	Only when the module 24V and the pre-actuator 24V are isolated.

Characteristics of the outputs of module TBX ESP 08C22

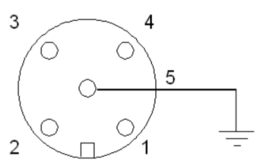
General characteristics

This table presents the characteristics of the outputs of module **TBX ESP 08C22**:

Module **TBX ESP 08C22**	
Nominal voltage	24 V DC
Nominal current	0,5 A
OS supply voltage limits	19.2 to 30 VDC
Permitted filament lamp power	8 W
Leakage current at OFF state	< 2 mA
Residual voltage at ON state	< 0,4 V
Switching time at ON or OFF state	≤ 1 ms
Load impedance at ON state	> 50 Ω < 3 kΩ
Outputs protected against overloads	Yes: thermal
Sensor power supply protected against overvoltages	Yes: Zener diode
Protection against reverse polarity on preactuator power supply	No *(see page 97)*
Detection of break in load	Yes
Conforms to IEC 1131	Yes
Compatible with DC inputs	Yes
Type of logic	Positive
Power dissipated per channel when ON	0,25 W

Connections

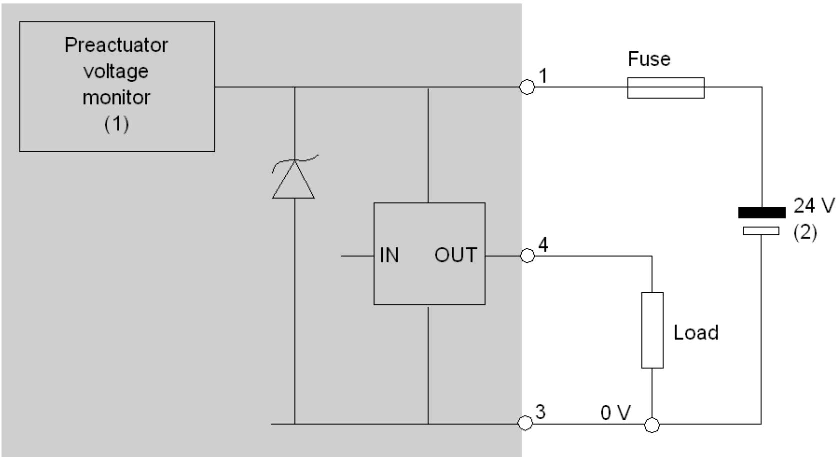
The following table illustrates channel connection for module **TBX ESP 08C22**

Illustration	Terminal	Description
Type M12 female connector (one per channel). 	1	+24 V (supplied by module)
	2	not connected
	3	0 V (supplied by module)
	4	preactuator signal
	5	ground connection

Connecting the TBX ESP 08C22 Module

Circuit Diagram

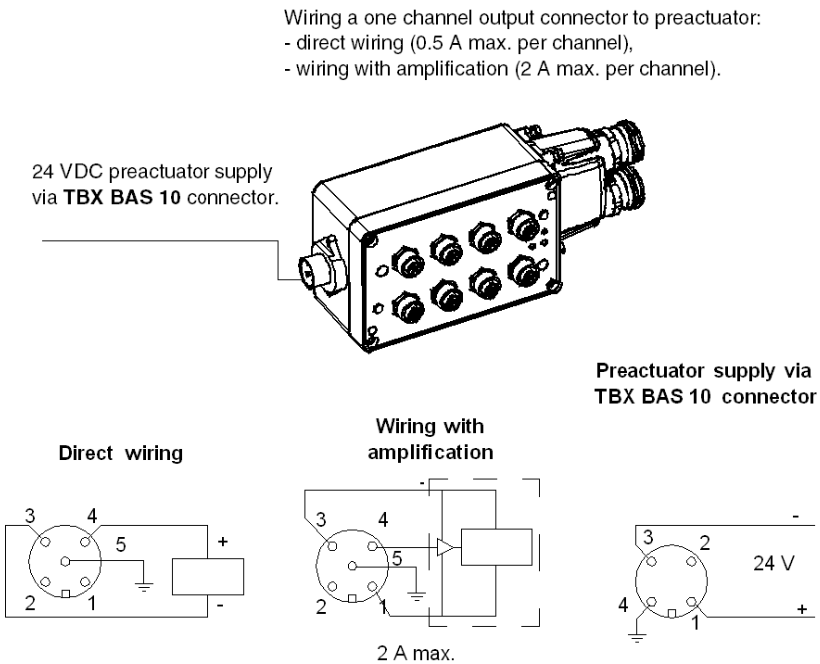
The following illustration shows the circuit diagram for a 24 V 0.5 A static output.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.
2 This power supply is provided via the TBX BAS 10 connector.

Wiring of Output Connections

The following is an illustration of the wiring diagram for output connectors.



NOTE: The module is powered by cable **TBX FP CB100**.

The following table provides the maximum permitted current per module.

Number of channels	Maximum output current per module
8 direct channels	8 x 0.5 A = 4 A
6 direct channels 2 amplified channels	6 x 0.5 A + 2 x 1 A = 5 A
7 direct channels 1 amplified channel	7 x 0.5 A + 1 x 2 A = 5.5 A

⚠ WARNING

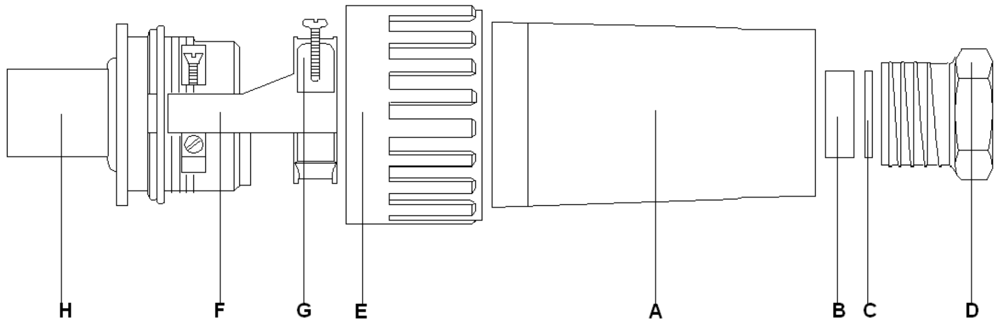
SHORT CIRCUIT - LOSS OF PROOF

Do place the blanking plugs on slots where channels are not in use in order to retain the IP65 dust and damp proof protection.

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

Wiring the TBX BAS 10 Connector

The following illustration shows the different parts of the **TBX BAS 10** connector.



A screw terminal block is used to connect the cable (diameter between 7.5 and 10 mm). The following table provides installation details.

Step	Action
1	Strip the cable back up to a maximum of 2 cm.
2	Mount the connector as follows: ● Assemble parts **A**, **B**, **C** and **D**, tighten part **D** without forcing it, ● Place part **E** over part **H**.
3	Feed the cable through the part which has been assembled (cable gland).
4	Attach the wires to the terminals of the second part (+ on terminal 1, - on terminal 3, protective ground on terminal 4). **Caution**: if the 24V module supply and 24V preactuator supply are not isolated, a reversion of polarity may destroy the module.
5	Place part **F** over part **H**.
6	Attach the cable in the cable clamp **F**, using part **G** and the two screws provided.
7	Fit both parts of the connector together and tighten the cable gland **D**.

Chapter 10
The TBX EEP 1622 distributed input module

Subject of this chapter

This chapter presents the **TBX EEP 1622** module, its characteristics and the wiring of its input connectors.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX EEP 1622 module

General

The **TBX EEP 1622** dust and damp proof distributed input module (IP65) is a monobloc module comprising 16 24 V DC inputs, compatible with 2 and 3 wire proximity sensors.

It is equipped with M12 type connectors for direct wiring of the sensors.

The sensor voltage is monitored to ensure that there is sufficient voltage for the inputs to operate correctly.

Technical specifications

The following table provides the technical specifications of the module.

TBX EEP 1622	
Nominal voltage	24 V DC
Supply voltage	19.2 V DC to 30 V DC
Current drawn at +24 V	95 mA typical at 24 V (16 channels at 0)
Current drawn at +24 V (loading = 60 % of inputs ON)	240 mA typically at 24 V
Power dissipated in the module (loading = 60 % of inputs ON)	4 W at 24 V
Dielectric strength between outputs and ground (GND)	1500 V DC for 1 min
Isolation resistance	> 10 MΩ below 500 V DC
Protection against a reverse polarity on +24 V	Yes: diodes in series

Characteristics of the inputs of module TBX EEP 1622

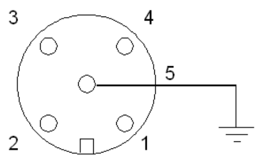
General characteristics

This table presents the characteristics of the outputs of module **TBX EEP 1622**:

Module TBX EEP 1622	
Nominal voltage	24 V DC
Nominal current	7 mA
Sensor power supply	19,2 V DC to 30 V DC
Voltage for ON state	≥ 7 V
Current at 11 V	≥ 2 mA
Voltage for ON state	< 5 V
Current for OFF state	≤ 1.4 mA
Input impedance at 24 V	3,4 kΩ
Switch-on time	5 to 11 ms
Switch-off time	5 to 13 ms
Permitted line resistance (2 wire proximity sensor)	100 Ω
Permitted line resistance (volt-free contact)	500 Ω
IEC standard 1131	Type 1
Compatibility with Telemecanique 2 wire proximity sensors	Yes
Compatibility with CENELEC 3 wire proximity sensors	Yes
Compatible with TBX transistor outputs	Yes
Type of input	Resistive
Type of logic	Positive
Power dissipated per channel at ON state	0,17 W

Connections

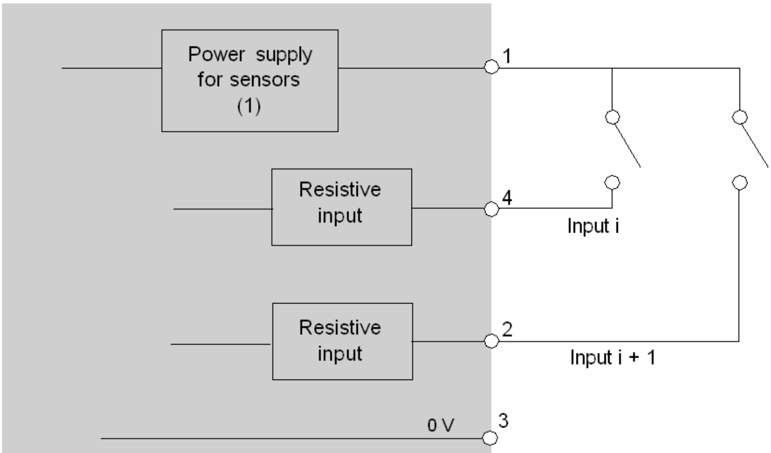
The following table illustrates channel connection for module **TBX EEP 1622**

Illustration	Terminal	Description
Type M12 female connector (one per two channels). 	1	+24 V (supplied by module)
	2	sensor signal, green LED (odd channel 1, 3, ..., 15)
	3	0 V (supplied by module)
	4	sensor signal, yellow LED (even channel 0, 2, ..., 14)
	5	ground connection

Connecting the module TBX EEP 1622

Circuit diagram

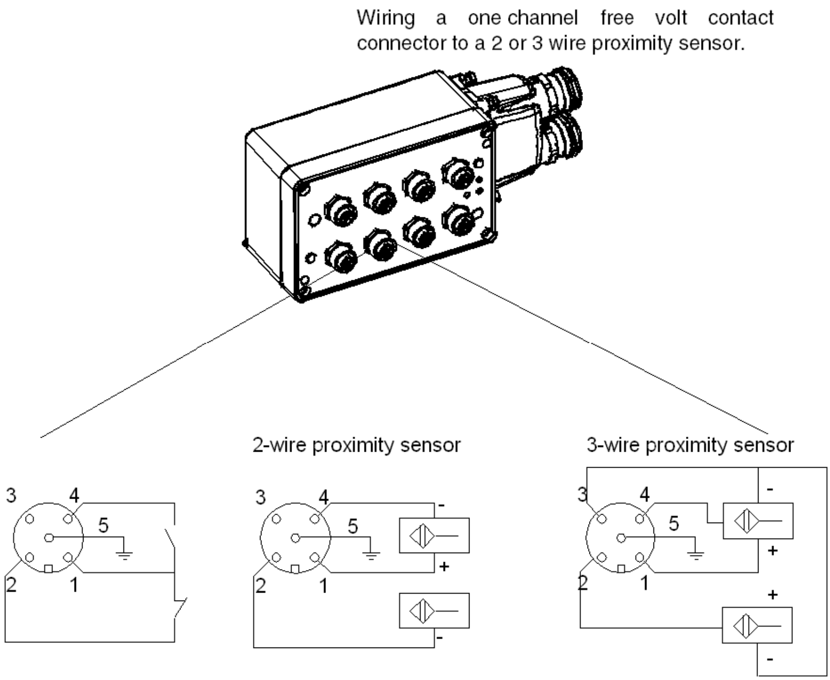
The following illustration shows the circuit diagram for a resistive input.



1 Power supply to the sensors is provided via the module.

Wiring the input connectors

The following illustration shows the wiring diagram for input connectors.



NOTE: the module is powered by cable **TBX FP CB100**.

⚠ WARNING
SHORT CIRCUIT - LOSS OF PROOF Do place the blanking plugs on slots where channels are not in use in order to retain the IP65 dust and damp proof protection. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Chapter 11
The TBX ESP 1622 distributed output module

Subject of this chapter

This chapter presents the **TBX ESP 1622** module, its characteristics and the wiring of its output connectors.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX ESP 1622 Module

General

The TBX ESP 1622 sealed (IP65) remote output module is a monobloc module comprising 16 24 VDC 0.5 A transistor outputs.

It is equipped with M12-type connectors for direct wiring of the pre-actuators.

The outputs are protected *(see page 324)* against overloads and short-circuits.

When there is a fault at an output, the I/O indicator lamp lights and the output is set to state 0. To reactivate it, this output must be reset once the fault has been rectified.

The preactuator voltage is monitored to ensure consistent processing of the outputs during variations in the power supply.

Technical Specifications

The following table provides the technical specifications of the module.

TBX ESP 1622	
Nominal voltage	24 VDC
Supply voltage	19.2 to 30 VDC
Current drawn at +24 V (1)	107 mA typically at 24 V
Current drawn at +24 V (2) (with no active outputs)	51 mA typically at 24 V
Power dissipated in the module (loading = 60 % of active outputs)	4.3 W at 24 V
Dielectric strength between outputs and ground (GND)	1500 VDC for 1 min
Isolation resistance	> 10 MΩ below 500 VDC
Protection against a reverse polarity on +24 V (1)	Yes, via diode in series (3)
Key:	
(1)	Power supply to module (communication and output interfaces).
(2)	Power supply to preactuators.
(3)	Only when the module 24V and the pre-actuator 24V are isolated.

Characteristics of the TBX ESP 1622 Module Outputs

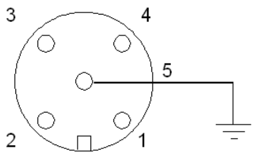
General characteristics

This table presents the characteristics of the **TBX ESP 1622** module outputs:

Module **TBX ESP 1622**	
Nominal voltage	24 VDC
Nominal current	0.5 A
OS supply voltage limits	19.2 to 30 VDC
Permitted filament lamp power	8 W
Leakage current at OFF state	< 2 mA
Residual voltage at ON state	< 0.4 V
Switching time at ON or OFF state	≤ 1 ms
Load impedance at ON state	> 50 Ω < 3 kΩ
Outputs protected against overloads	Yes: thermal
Sensor power supply protected against overvoltages	Yes, by Zener diode
Protection against reverse polarity on preactuator power supply	Yes, by reverse diode (9A fast external fuse) (1)
Detection of break in load	Yes
Conforms to IEC 1131	Yes
Compatible with DC inputs	Yes
Type of logic	Positive
Power dissipated per channel when ON	0.05 W
Legend:	
(1)	Only when the module 24V and the pre-actuator 24V are isolated, and on condition that a quick-blow 9A fuse is placed on the preactuator + 24V.

Connections

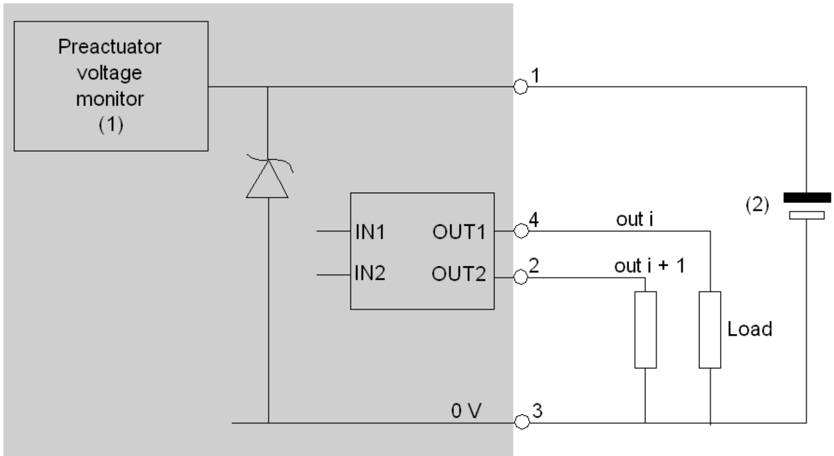
The following table illustrates channel connection for module **TBX ESP 1622**

Illustration	Terminal	Description
Type M12 female connector (one per two channels). 	1	+24 V (supplied by the module)
	2	Preactuator signal, green LEDs (odd channel 1, 3, ..., 15)
	3	0 V (supplied by the module)
	4	Preactuator signal, yellow LED (even channel 0, 2, ..., 14)
	5	Ground connection

Connecting the TBX ESP 1622 Module

Circuit Diagram

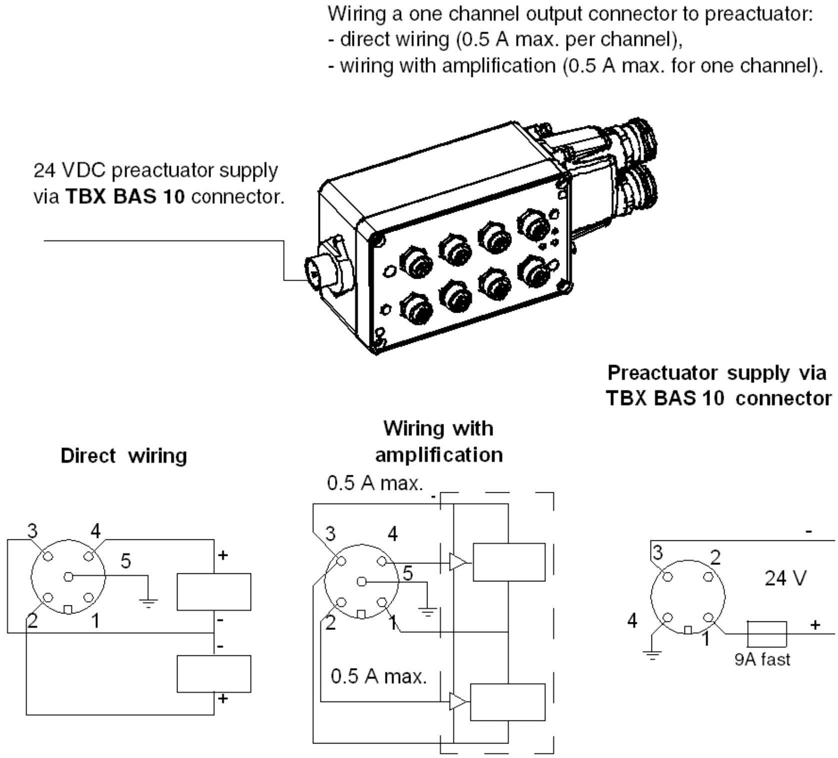
The following illustration shows the circuit diagram for a 24 V 0.5 A static output.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.
2 This power supply is provided via the TBX BAS 10 connector.

Wiring of Output Connections

The following is an illustration of the wiring diagram for output connectors.



NOTE: The module is powered by cable **TBX FP CB100**.

⚠ WARNING

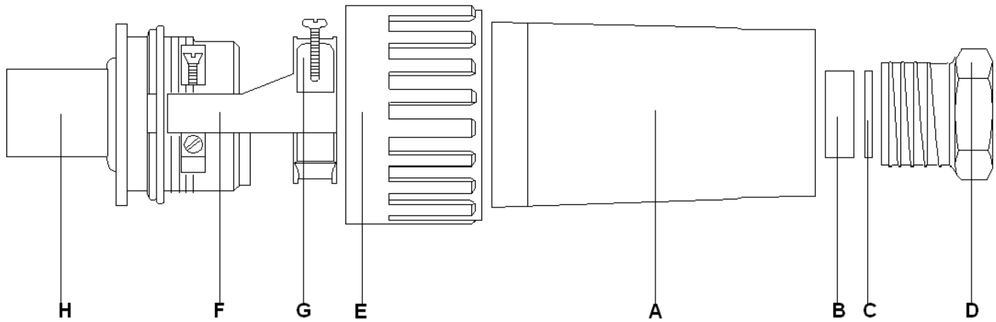
SHORT CIRCUIT - LOSS OF PROOF

Do place the blanking plugs on slots where channels are not in use in order to retain the IP65 dust and damp proof protection.

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

Wiring the TBX BAS 10 Connector

The following illustration shows the different parts of the **TBX BAS 10** connector.



A screw terminal block is used to connect the cable (diameter between 7.5 and 10 mm). The following table provides installation details.

Step	Action
1	Strip the cable back up to a maximum of 2 cm.
2	Mount the connector as follows: ● Assemble parts **A**, **B**, **C** and **D**, tighten part **D** without forcing it, ● Place part **E** over part **H**.
3	Feed the cable through the part which has been assembled (cable gland).
4	Attach the wires to the terminals of the second part (+ on terminal 1, - on terminal 3, protective ground on terminal 4). **Caution**: if the 24V module supply and 24V preactuator supply are not isolated, a reversion of polarity may destroy the module.
5	Place part **F** over part **H**.
6	Attach the cable in the cable clamp **F**, using part **G** and the two screws provided.
7	Fit both parts of the connector together and tighten the cable gland **D**.

Chapter 12
The TBX DES 1622 distributed input module

Subject of this chapter

This chapter presents the **TBX DES 1622** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DES 1622 module

General

The **TBX DES 1622** distributed input module is a modular base unit comprising 16 24 V DC inputs, compatible with 2 and 3 wire proximity sensors. The module is equipped with a terminal block for direct wiring of the sensors, which can be removed when it is switched off.

The sensor voltage is monitored to ensure that there is sufficient voltage for the inputs to operate correctly.

The inputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Technical specifications

The following table provides the technical specifications of the module.

TBX DES 1622		
Nominal voltage +SV		24 V DC
Supply voltage +SV		19,2 V DC to 30 V DC
Current drawn on +SV of the base module (at 24 V) (1)	if basic unit	20 mA typically
	if extension base unit	negligible
Current drawn at +SV by extension module (at 24 V)		15 mA typically
Current drawn at +IS (at 24 V) (loading = 60 % of inputs ON)		150 mA typically
Power dissipated in the base unit (2) (loading = 60 % of inputs ON)		4,1 W at 24 V
Dielectric strength between inputs and ground (GND)		1500 V rms - 50/60 Hz for 1 min
Isolation resistance		> 10 MΩ below 500 V DC
Key:		
SV	Power supply to module (communication module if present and input interfaces).	
IS	Power supply to sensors.	
(1)	Current drawn on +SV by the communication module of the base unit: 70 mA (at 24 V).	
(2)	Power dissipated in the communication module of the base: 1,7 W at 24 V	

Characteristics of the inputs of module TBX DES 1622

General characteristics

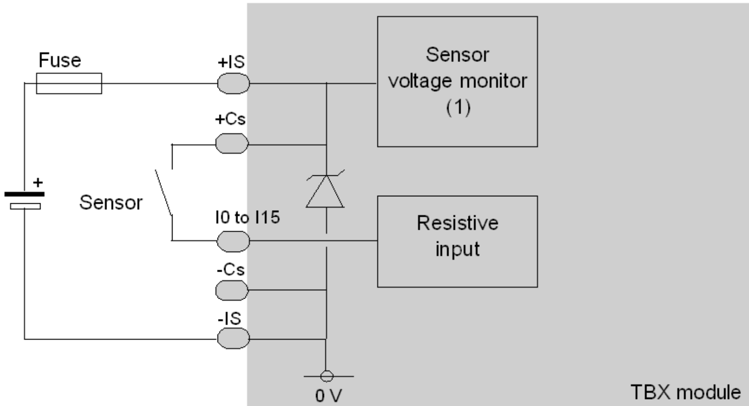
This table presents the characteristics of the inputs of module **TBX DES 1622**:

Module TBX DES 1622	
Nominal voltage IS	24 V DC
Current at 24 V	15 mA
Sensor power supply IS	19.2 V DC to 30 V DC
Voltage for ON state	≥ 11 V
Current at 11 V	≥ 6 mA
Voltage for OFF state	< 5 V
Current for OFF state	≤ 2 mA
Input impedance	1.6 kΩ
Switch-on time	7 to 15.5 ms
Switch-off time	7 to 15.5 ms
Permitted line resistance (2 wire proximity sensor)	100 Ω
Permitted line resistance (volt-free contact)	500 Ω
Permitted leakage resistance (2 wire proximity sensor)	> 100 kΩ
Permitted leakage resistance (volt-free contact)	> 30 kΩ
IEC standard 1131	Type 2
Compatibility with Telemecanique 2 wire proximity sensors	Yes
Compatibility with CENELEC 3 wire proximity sensors	Yes
Compatible with TBX transistor outputs	Yes
Type of input	Resistive
Type of logic	Positive
Power dissipated per channel at ON state	0,36 W
Protection of +C terminals against overload or short-circuit	No
Protection against a reverse polarity on IS	Yes: reverse diode in parallel (ext. fuse 2 A (quick blow))
Key:	
IS	Power supply to sensors.

Connecting the module TBX DES 1622

Circuit diagram

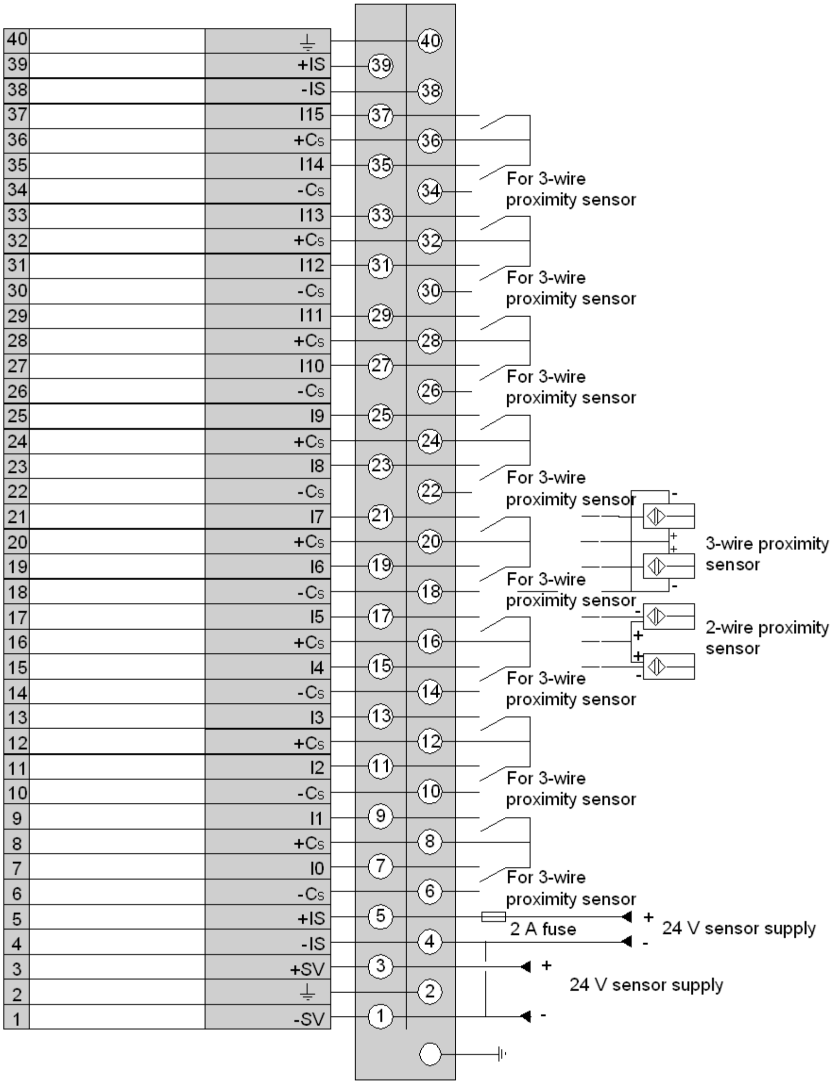
The following illustration shows the circuit diagram for a resistive input.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

Terminal block wiring

The following diagram illustrates the wiring of the terminal.



NOTE: the Cs *(see page 133)* terminals are not protected against short-circuits, so a 2 A quick blow fuse, must be wired to the sensor power supply IS.
It is not necessary to connect the two +IS terminals together, nor the two -IS terminals. The -SV terminal and a -IS (0 V) terminal must however be connected together.

Chapter 13
The TBX DES 16C22 distributed input module

Subject of this chapter

This chapter presents the **TBX DES 16C22** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DES 16C22 module

General

The **TBX DES 16C22** module is a modular base unit comprising 16 24 V DC inputs, compatible with 2 and 3 wire proximity sensors. The module is equipped with a terminal block for direct wiring of the sensors, which can be removed when it is switched off.

The sensor voltage is monitored to ensure that there is sufficient voltage for the inputs to operate correctly.

The inputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Specific function

The wiring check function *(see page 328)* in this base unit continuously checks the quality of the connection to the sensors and detects the two main faults in a discrete input module:

- loosening of the terminal screws or disconnecting a wire,
- and short-circuits to the cable ground.

Wiring check faults are diagnosed for each channel and cause the input to be set to 0.

Two dip-switches *(see page 115)*, on the board, enable the channels to be adapted to their environment.

Technical specifications

The following table provides the technical specifications of the module.

TBX DES 16C22		
Nominal voltage +SV		24 V DC
Supply voltage +SV		19,2 V DC to 30 V DC
Current drawn on +SV of the base module (at 24 V) (1)	if basic unit	40 mA typically
	if extension base unit	10 mA typically
Current drawn at +SV by extension module (at 24 V)		30 mA typically
Current drawn at +IS (at 24 V) (loading = 60 % of inputs ON)		70 mA typically
Power dissipated in the base unit (2) (loading = 60 % of inputs ON)		2,6 W at 24 V
Dielectric strength between inputs and ground (GND)		1500 V rms - 50/60 Hz for 1 min
Isolation resistance		> 10 MΩ below 500 V DC
Key:		
SV	Power supply to module (communication module if present and input interfaces).	
IS	Power supply to sensors.	
(1)	Current drawn on +SV by the communication module of the base unit: 70 mA (at 24 V).	
(2)	Power dissipated in the communication module of the base: 1,7 W at 24 V	

Characteristics of the inputs of module TBX DES 16C22

General characteristics

This table presents the characteristics of the inputs of module **TBX DES 16C22**:

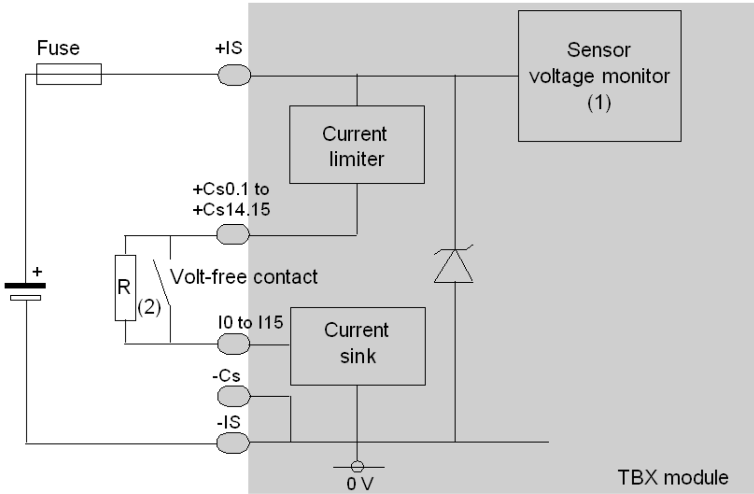
Module TBX DES 16C22		
Nominal voltage IS		24 V DC
Current at 24 V		7 mA
Sensor power supply IS		19,2 V DC to 30 V DC
Voltage for ON state		≥ 11 V
Current at 11 V		≥ 6 mA
Voltage for OFF state		< 5 V
Current for OFF state		≤ 2 mA
Input impedance		3,4 kΩ
Switch-on time	fast filtering	5 to 8.5 ms
	slow filtering	30 to 45 ms
Switch-off time	fast filtering	5 to 8.5 ms
	slow filtering	30 to 45 ms
Permitted line resistance (2 wire proximity sensor)		100 Ω
Permitted line resistance (volt-free contact)		500 Ω
Permitted leakage resistance (2 wire proximity sensor)		(1)
Permitted leakage resistance (volt-free contact)		(1)
IEC standard 1131		Type 2
Compatibility with Telemecanique 2 wire proximity sensors		Yes
Compatibility with CENELEC 3 wire proximity sensors		Yes (2)
Compatible with TBX transistor outputs		Yes
Type of input		Current sink
Type of logic		Positive
Power dissipated per channel at ON state		0,17 W

Module TBX DES 16C22		
Protection of +C terminals against overload or short-circuit		Yes
Protection against a reverse polarity on IS		Yes: reverse diode in parallel (ext. fuse 2 A (quick blow))
Key:		
IS	Power supply to sensors.	
(1)	Permitted leakage resistance values are not included in this table *(see page 115)*.	
(2)	With a standard 3 wire proximity sensor, with a resistor in parallel *(see page 115)*, the **open circuit** fault corresponds to a break in the input/proximity sensor link, or in the +power supply (+Cs) of the 3 wire proximity sensor. **Note**: the break in the - power supply to the proximity sensor (-Cs) is not detected.	

Connecting the module TBX DES 16C22

Circuit diagram

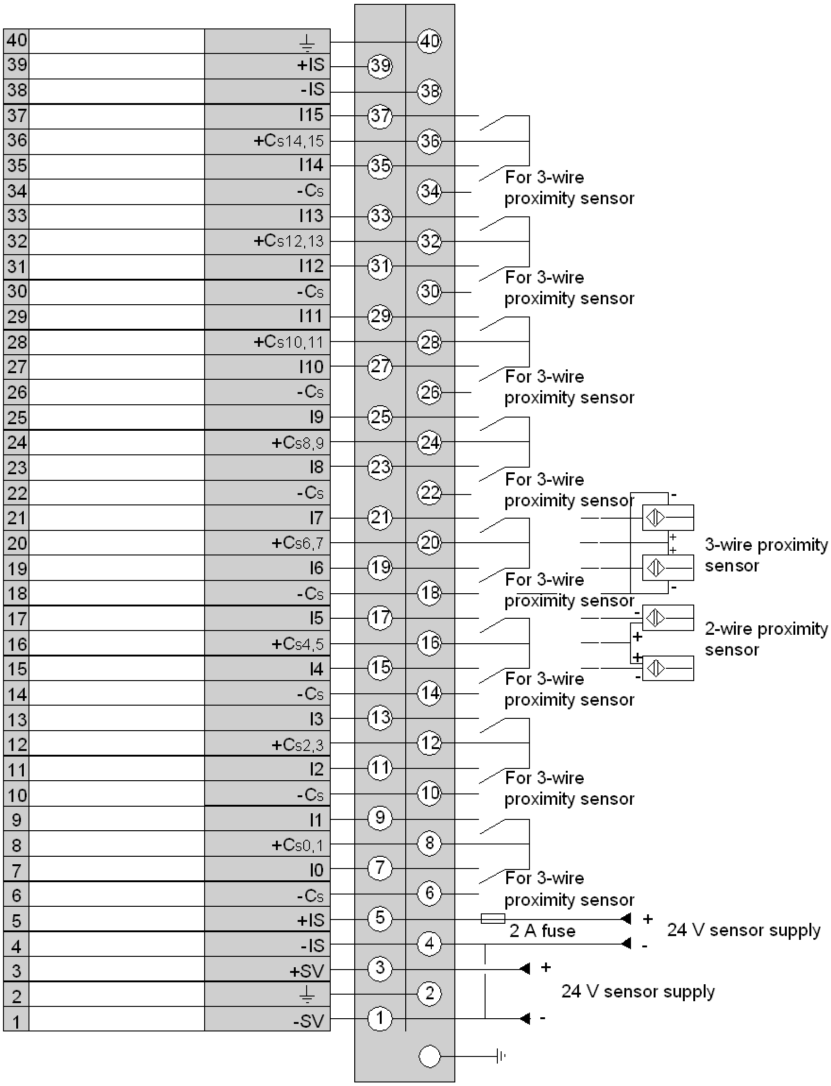
The following illustration shows the circuit diagram for a wiring check input.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.
2 Resistance R for a dry contact or a 3-wire proximity sensor, enables the input wiring check to be used.

Terminal block wiring

The following diagram illustrates the wiring of the terminal.



NOTE: a quick blow 2 A fuse, must be wired to the sensor power supply IS.
It is not necessary to connect the two +IS terminals *(see page 133)* together, nor the two -IS terminals. The -SV terminal and a -IS (0 V) terminal must however be connected together.

Chapter 14
The TBX DES 16F22 distributed input module

Subject of this chapter

This chapter presents the **TBX DES 16F22** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DES 16F22 module

General

The **TBX DES 16F22** module is a modular base unit comprising 16 24 V DC inputs, compatible with 2 and 3 wire proximity sensors. The module is equipped with a terminal block for direct wiring of the sensors, which can be removed when it is switched off.

The sensor voltage is monitored to ensure that there is sufficient voltage for the inputs to operate correctly.

The inputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Specific function

The channel filter time *(see page 329)* for this module is configured in groups of 8 channels:

- normal,
- or fast mode.

With this base unit, when configuring the channels under XTEL-CONF, the user can choose that positive pulses of more than 2 ms are recognized.

Technical specifications

The following table provides the technical specifications of the module.

TBX DES 16F22		
Nominal voltage +SV		24 V DC
Supply voltage +SV		19,2 V DC to 30 V DC
Current drawn on +SV of the base module (at 24 V) (1)	if basic unit	40 mA typically
	if extension base unit	10 mA typically
Current drawn at +SV by extension module (at 24 V)		30 mA typically
Current drawn at +IS (at 24 V) (loading = 60 % of inputs ON)		70 mA typically
Power dissipated in the base unit (2) (loading = 60 % of inputs ON)		2,6 W at 24 V
Dielectric strength between inputs and ground (GND)		1500 V rms - 50/60 Hz for 1 min
Isolation resistance		> 10 MΩ below 500 V DC
Key:		
SV	Power supply to module (communication module if present and input interfaces).	
IS	Power supply to sensors.	
(1)	Current drawn on +SV by the communication module of the base unit: 70 mA (at 24 V).	
(2)	Power dissipated in the communication module of the base: 1,7 W at 24 V	

Characteristics of the inputs of module TBX DES 16F22

General characteristics

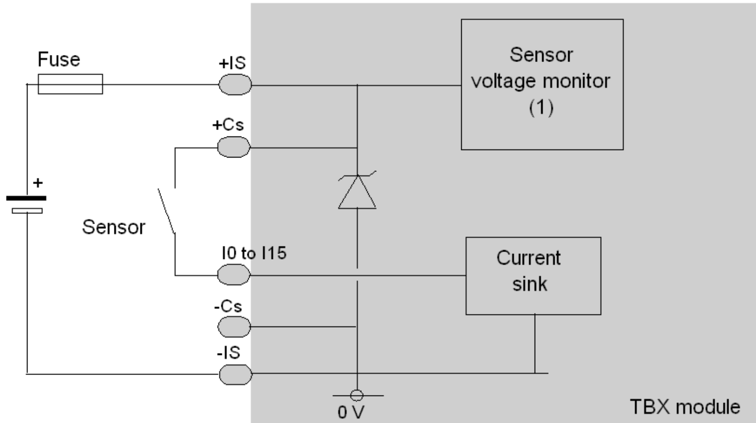
This table presents the characteristics of the inputs of module **TBX DES 16F22**:

Module TBX DES 16F22		
Nominal voltage IS		24 V DC
Current at 24 V		7 mA
Sensor power supply IS		19,2 V DC to 30 V DC
Voltage for ON state		≥ 11 V
Current at 11 V		≥ 6 mA
Voltage for OFF state		< 5 V
Current for OFF state		≤ 2 mA
Input impedance		3,4 kΩ
Switch-on time	fast filtering	0,3 to 1.5 ms
	slow filtering	4,5 to 8.5 ms
Switch-off time	fast filtering	0,3 to 1.5 ms
	slow filtering	4,5 to 8.5 ms
Permitted line resistance (2 wire proximity sensor)		100 Ω
Permitted line resistance (volt-free contact)		500 Ω
Permitted leakage resistance (2 wire proximity sensor)		> 100 kΩ
Permitted leakage resistance (volt-free contact)		> 30 kΩ
IEC standard 1131		Type 2
Compatibility with Telemecanique 2 wire proximity sensors		Yes
Compatibility with CENELEC 3 wire proximity sensors		Yes
Compatible with TBX transistor outputs		Yes
Type of input		Current sink
Type of logic		Positive
Power dissipated per channel at ON state		0,17 W
Protection of +C terminals against overload or short-circuit		No
Protection against a reverse polarity on IS		Yes: reverse diode in parallel (ext. fuse 2 A (quick blow))
Key:		
IS	Power supply to sensors.	

Connecting the module TBX DES 16F22

Circuit diagram

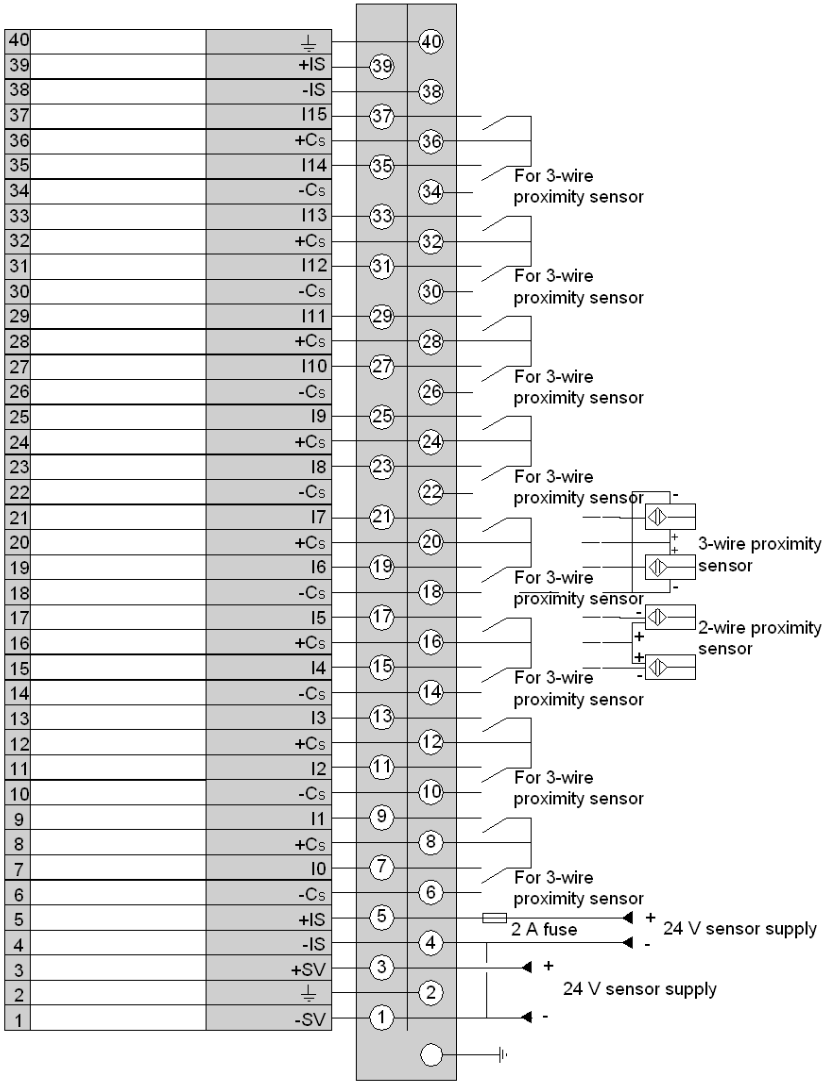
The following illustration shows the circuit diagram for a current sink input.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

Terminal block wiring

The following diagram illustrates the wiring of the terminal.



NOTE: A 2 A quick blow fuse, wired to the sensor power supply IS is needed against short-circuits concerning the Cs *(see page 133)*.
It is not necessary to connect the two +IS terminals together, nor the two -IS terminals. The -SV terminal and a -IS (0 V) terminal must however be connected together.

Chapter 15
The TBX DES 1633 distributed input module

Subject of this chapter

This chapter presents the **TBX DES 1633** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DES 1633 module

General

The **TBX DES 1633** distributed input module is a modular base unit comprising 16 48 V DC inputs, compatible with 2 and 3 wire proximity sensors. The module is equipped with a terminal block for direct wiring of the sensors, which can be removed when it is switched off.

The sensor voltage is monitored to ensure that there is sufficient voltage for the inputs to operate correctly.

The inputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Technical specifications

The following table provides the technical specifications of the module.

TBX DES 1633		
Nominal voltage +SV		48 V DC
Supply voltage +SV		38 V DC to 60 V DC
Current drawn on +SV of the base module (at 24 V) (1)	if basic unit	20 mA typically
	if extension base unit	negligible
Current drawn at +SV by extension module (at 48 V)		16 mA typically
Current drawn at +IS (at 48 V) (loading = 60 % of inputs ON)		70 mA typically
Power dissipated in the base unit (2) (loading = 60 % of inputs ON)		4,3 W at 48 V
Dielectric strength between inputs and ground (GND)		1500 V rms - 50/60 Hz for 1 min
Isolation resistance		> 10 MΩ below 500 V DC
Key:		
SV	Power supply to module (communication module if present and input interfaces).	
IS	Power supply to sensors.	
(1)	Current drawn on +SV by the communication module of the base unit: 35 mA (at 48 V).	
(2)	Power dissipated in the communication module of the base: 1,7 W.	

Characteristics of the inputs of module TBX DES 1633

General characteristics

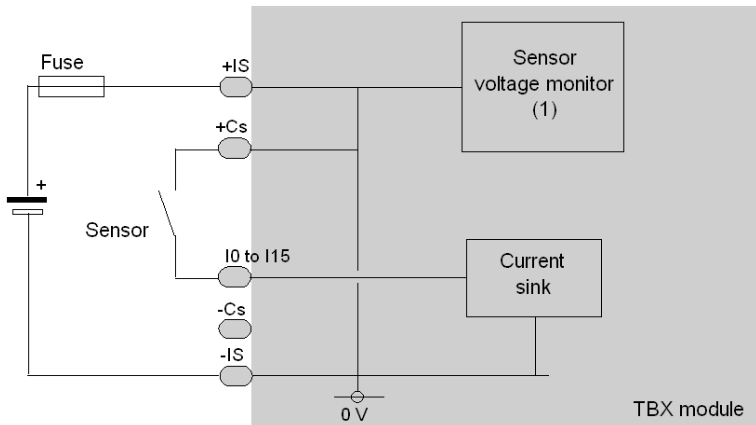
This table presents the characteristics of the inputs of module **TBX DES 1633**:

Module TBX DES 1633	
Nominal voltage IS	48 V DC
Current at 48 V	7 mA
Sensor power supply IS	38 V DC to 60 V DC
Voltage for ON state	30 V
Current at 30 V	≥ 6 mA
Voltage for OFF state	< 10 V
Current for OFF state	≤ 2 mA
Input impedance	6,7 kΩ
Switch-on time	5 to 11 ms
Switch-off time	5 to 13 ms
Permitted line resistance (2 wire proximity sensor)	100 Ω
Permitted line resistance (volt-free contact)	500 Ω
Permitted leakage resistance (2 wire proximity sensor)	> 100 kΩ
Permitted leakage resistance (volt-free contact)	> 30 kΩ
IEC standard 1131	Type 2
Compatibility with Telemecanique 2 wire proximity sensors	Yes
Compatibility with CENELEC 3 wire proximity sensors	Yes
Compatible with TBX transistor outputs	Yes
Type of input	Current sink
Type of logic	Positive
Power dissipated per channel at ON state	0,33 W

Connecting the module TBX DES 1633

Circuit diagram

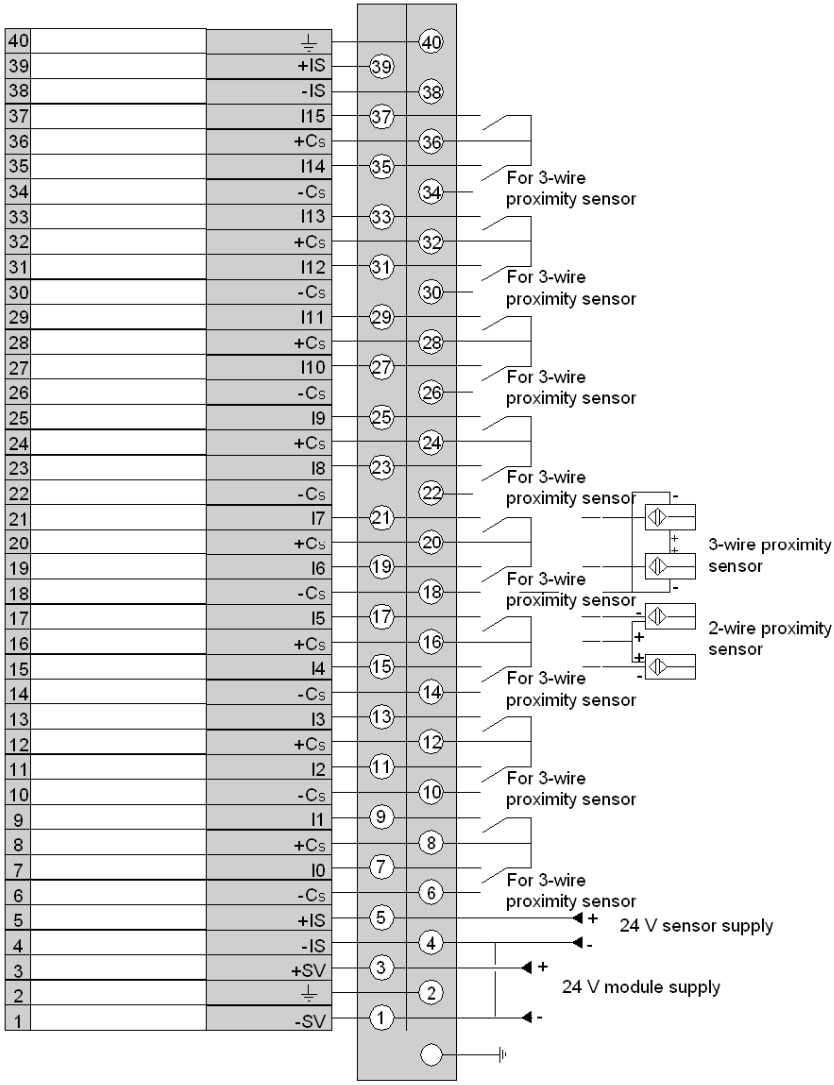
The following illustration shows the circuit diagram for a current sink input.



1 Guaranteed threshold for monitored voltage OK: > 36 V, guaranteed threshold for monitored voltage faulty: < 28 V.

Terminal block wiring

The following diagram illustrates the wiring of the terminal.



NOTE: it is not necessary to connect the two +IS terminals *(see page 133)* together, nor the two -IS terminals. The -SV terminal and a -IS (0 V) terminal must however be connected together.

Chapter 16
The TBX DMS 16C22 distributed input/output module

Subject of this chapter

This chapter presents the **TBX DMS 16C22** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DMS 16C22 module

General

The **TBX DMS 16C22** is a modular base unit with 8 24 V DC inputs compatible with 2- and 3-wire proximity sensors, and 8 24 V DC transistor outputs. The module is equipped with a terminal for the direct wiring of sensors and preactuators which can be removed when the power is switched off.

The sensor voltage and preactuator voltage are monitored to ensure that there is sufficient voltage for the inputs to operate correctly and for coherent processing of the outputs.

The outputs are protected against overloads and short-circuits. If there is a fault at an output, it is set to a safe state, the default state, which is determined by the user: fallback position.

Once the fault has been corrected, the output can be reactivated, if it is reset *(see page 332)*.

The inputs/outputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Specific function

The input and output wiring check *(see page 328)* functions for this module continually check the quality of the connections to the sensors and preactuators. Two dip-switches *(see page 115)*, on the board, enable the channels to be adapted to their environment.

Output wiring check faults enable diagnosis of a short-circuit or an open circuit depending on the channel state.

The module provides independent power supplies: +Csn,n+1 *(see page 133)* (one for 2 sensors) which are protected against line short-circuits (0.1 A maximum current).

Technical specifications

The following table provides the technical specifications of the module.

TBX DMS 16C22		
Nominal voltage +SV		24 V DC
Supply voltage +SV		19,2 V DC to 30 V DC
Current drawn on +SV of the base module (at 24 V)	if basic unit	40 mA typically
	if extension base unit	10 mA typically
Current drawn at +SV by extension module (at 24 V)		30 mA typically
Current drawn at +IS (at 24 V) (loading = 60 %)		35 mA typically
Current drawn at +OS (at 24 V) (with no active outputs)		25 mA typically

TBX DMS 16C22		
Power dissipated at nominal load in the module (loading = 60 %)		3,4 W at 24 V
Dielectric strength between inputs and ground (GND)		1500 V rms - 50/60 Hz for 1 min
Isolation resistance		> 10 MΩ below 500 V DC
Key:		
SV	Power supply to module (communication module if present and input/output interfaces).	
IS	Power supply to sensors.	
OS	Power supply to pre-actuators.	

Characteristics of the inputs/outputs of module TBX DMS 16C22

General characteristics of the inputs

This table presents the characteristics of the inputs of module **TBX DMS 16C22**:

Module TBX DMS 16C22		
Nominal voltage IS		24 V DC
Nominal current		7 mA
Sensor supply IS or S		19,2 V DC to 30 V DC
Voltage for ON state		7 V
Current at 11 V		≥ 6 mA
Voltage for OFF state		< 5 V
Current for OFF state		≤ 2 mA
Input impedance		3,4 kΩ
Switch-on time	fast filtering	5 to 8.5 ms
	slow filtering	30 to 45 ms
Switch-off time	fast filtering	5 to 8.5 ms
	slow filtering	30 to 45 ms
Permitted line resistance (2 wire proximity sensor)		100 Ω
Permitted line resistance (volt-free contact)		500 Ω
Permitted leakage resistance (2 wire proximity sensor)		(1)
Permitted leakage resistance (volt-free contact)		(1)
IEC standard 1131		Type 2
Compatibility with Telemecanique 2 wire proximity sensors		Yes
Compatibility with CENELEC 3 wire proximity sensors		Yes (2)
Compatible with TBX transistor outputs		Yes
Type of input		Current sink
Type of logic		Positive
Power dissipated per channel at ON state		0,17 W

Module TBX DMS 16C22	
Protection of +C terminals against overload or short-circuit	Yes
Protection against a reverse polarity on IS	Yes: reverse diode in parallel (ext. fuse 1 A (quick blow))
Key:	
IS	Power supply to sensors.
(1)	Permitted leakage resistance values are not included in this table *(see page 115)*.
(2)	With a standard 3 wire proximity sensor, with a resistor in parallel *(see page 115)*, the **open circuit** fault corresponds to a break in the input/proximity sensor link, or in the +power supply (+Cs) of the 3 wire proximity sensor. **Note**: the break in the - power supply to the proximity sensor (-Cs) is not detected.

General characteristics of the outputs

This table presents the characteristics of the outputs of module **TBX DMS 16C22**:

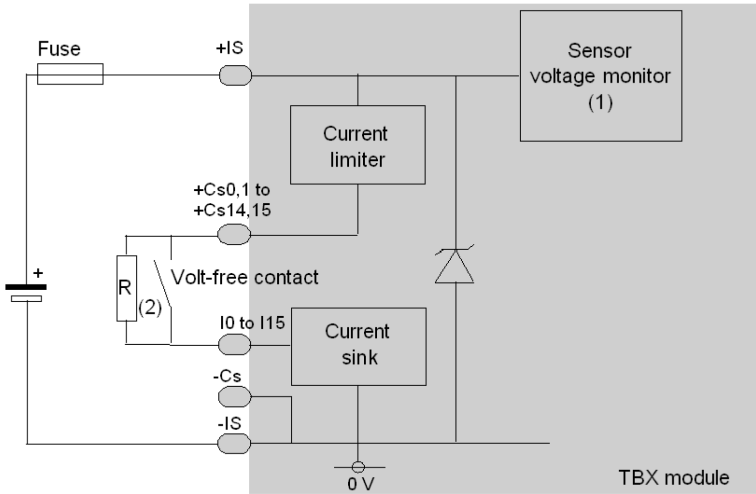
Module TBX DMS 16C22	
Nominal voltage	24 V DC
Nominal current	0,5 A
OS supply voltage limits	19,2 V DC to 30 V DC
Permitted filament lamp power	8 W
Leakage current at OFF state	< 2,3 mA
Residual voltage at ON state	< 0,4 V
Switching time at ON or OFF state	< 1,5 ms
Load impedance at ON state	> 50 Ω < 3 kΩ
Primary/secondary dielectric behavior	1500 V rms. 50 Hz
Outputs protected against overloads	Yes: thermal
Outputs protected against overvoltages	Yes: Zener diode
Protection against a reverse polarity on OS	Yes: reverse-mounted diode (external 8 A fuse)
Detection of break in load	Yes
Conforms to IEC 1131	Yes
Compatible with DC inputs	Yes (1)

Module TBX DMS 16C22	
Type of logic	Positive
Power dissipated per channel at ON state	0,35 W
Key:	
OS	Power supply to pre-actuators.
(1)	All inputs for which the impedance is < 3 kΩ.

Connecting the module TBX DMS 16C22

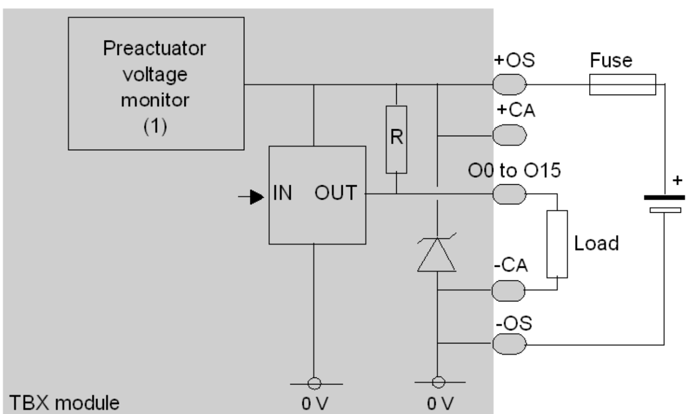
Circuit diagram

The following illustration shows the circuit diagram for a wiring check input.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.
2 Resistance R for a dry contact or a 3-wire proximity sensor enables the input wiring check to be used.

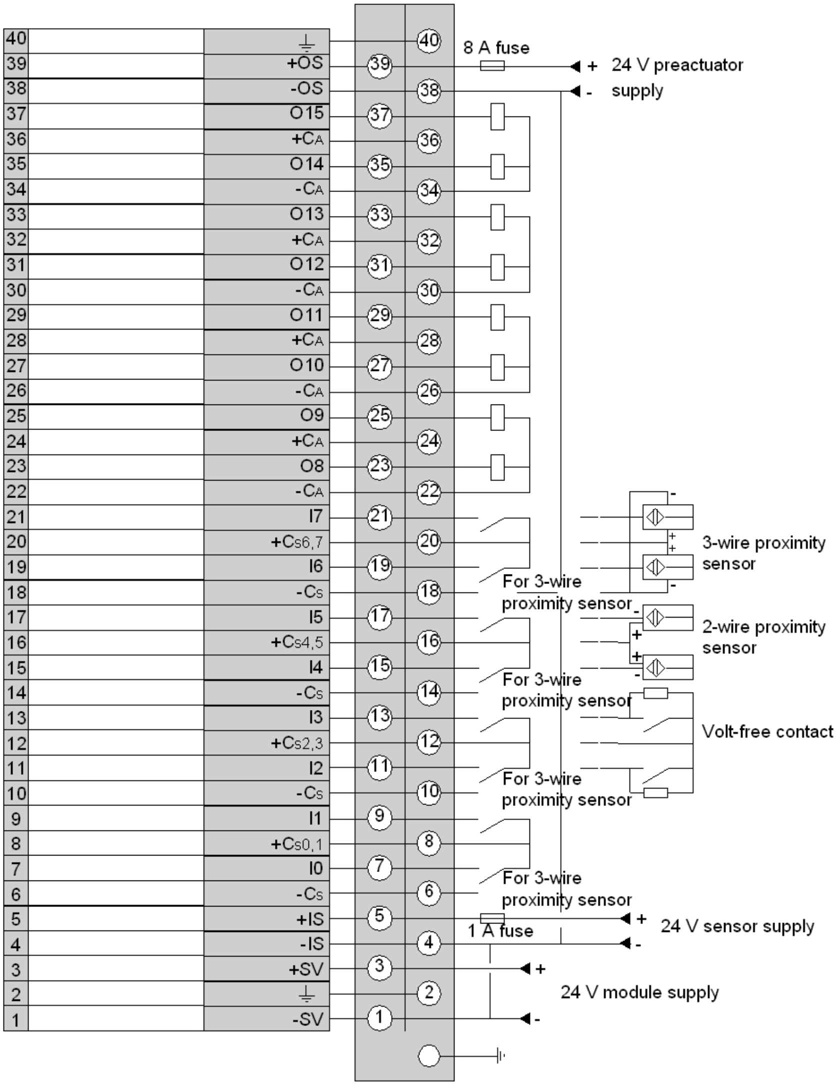
The following illustration shows the circuit diagram for a transistor output.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

Terminal block wiring

The following diagram illustrates the wiring of the terminal.



NOTE: a quick blow 1 A external fuse must be wired to the sensor power supply and a quick blow 8 A external fuse must be wired to the preactuator power supply.
The terminals -SV, -IS and -OS (0 V) *(see page 133)* must be wired together

Chapter 17
The TBX DMS 16P22 distributed input/output module

Subject of this chapter

This chapter presents the **TBX DMS 16P22** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DMS 16P22 module

General

The **TBX DMS 16P22** is a modular base unit with 24 V DC inputs, compatible with 2 and 3 wire proximity sensors and 24 V DC 0.5 A transistor outputs. The number of inputs/outputs is variable (8I/8O, 9I/7O, ..., 16I/0O).

The module is equipped with a terminal block for direct wiring of the sensors and preactuators, which can be removed when it is switched off.

The sensor voltage and preactuator voltage are monitored to ensure that there is sufficient voltage for the inputs to operate correctly and for coherent processing of the outputs.

The outputs are protected against overloads and short-circuits. If there is a fault at an output, it is set to a safe state, the default state, which is determined by the user: fallback position.

Once the fault has been corrected, the output can be reactivated, if it is reset *(see page 332)*.

The inputs/outputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Specific function

Each of the channels 8 to 15 of this base unit can be programmed *(see page 325)*, either as an input or as an output. This enables one base unit to have either 16 inputs, or 1 to 8 outputs and 15 to 8 inputs.

Technical specifications

The following table provides the technical specifications of the module.

<table>
<tr><th colspan="3">TBX DMS 16P22</th></tr>
<tr><td colspan="2">Nominal voltage +SV</td><td>24 V DC</td></tr>
<tr><td colspan="2">Supply voltage +SV</td><td>19,2 V DC to 30 V DC</td></tr>
<tr><td rowspan="2">Current drawn on +SV of the base module (at 24 V)</td><td>if basic unit</td><td>30 mA typically</td></tr>
<tr><td>if extension base unit</td><td>negligible</td></tr>
<tr><td colspan="2">Current drawn at +SV by extension module (at 24 V)</td><td>25 mA typically</td></tr>
<tr><td colspan="2">Current drawn at +IS (at 24 V)
(loading = 60 %)</td><td>75 mA typically</td></tr>
<tr><td colspan="2">Current drawn at +OS (at 24 V)
(with no active outputs)</td><td>100 mA typically</td></tr>
<tr><td colspan="2">Power dissipated at nominal load in the module
(loading = 60 %)</td><td>6,5 W at 24 V</td></tr>
<tr><td colspan="2">Dielectric strength between inputs and ground (GND)</td><td>1500 V rms - 50/60 Hz for 1 min</td></tr>
<tr><td colspan="2">Isolation resistance</td><td>> 10 MΩ below 500 V DC</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Key:</td></tr>
<tr><td>SV</td><td colspan="2">Power supply to module (communication module if present and input/output interfaces).</td></tr>
<tr><td>IS</td><td colspan="2">Power supply to sensors.</td></tr>
<tr><td>OS</td><td colspan="2">Power supply to pre-actuators.</td></tr>
</table>

Characteristics of the inputs/outputs of module TBX DMS 16P22

General characteristics of the inputs

This table presents the characteristics of the inputs of module **TBX DMS 16P22**:

Module TBX DMS 16P22	
Nominal voltage IS	24 V DC
Nominal current	15 mA
Sensor supply IS or S	19,2 V DC to 30 V DC
Voltage for ON state	≥ 11 V
Current at 11 V	≥ 6 mA
Voltage for OFF state	< 5 V
Current for OFF state	≤ 2 mA
Input impedance	1,6 kΩ
Switch-on time	5 to 10 ms
Switch-off time	5 to 12 ms
Permitted line resistance (2 wire proximity sensor)	100 Ω
Permitted line resistance (volt-free contact)	500 Ω
Permitted leakage resistance (2 wire proximity sensor)	> 100 kΩ
Permitted leakage resistance (volt-free contact)	> 30 kΩ
IEC standard 1131	Type 2
Compatibility with Telemecanique 2 wire proximity sensors	Yes
Compatibility with CENELEC 3 wire proximity sensors	Yes
Compatible with TBX transistor outputs	Yes
Type of input	Resistive
Type of logic	Positive
Power dissipated per channel at ON state	0,36 W
Protection of +C terminals against overload or short-circuit	No
Protection against a reverse polarity on IS	Yes: reverse diode in parallel (ext. fuse 1 A (quick blow))
Key:	
IS	Power supply to sensors.

General characteristics of the outputs

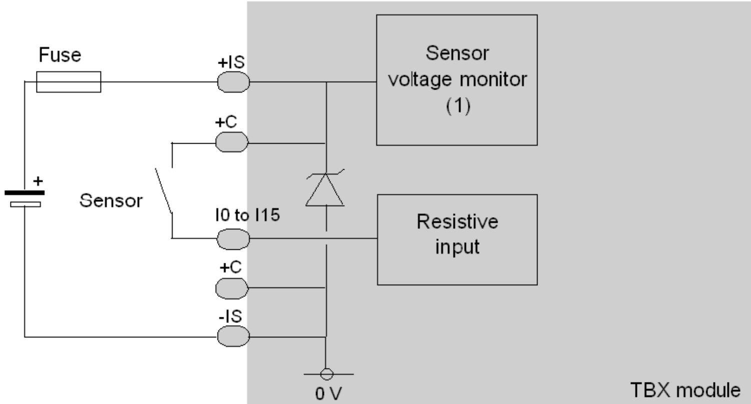
This table presents the characteristics of the outputs of module **TBX DMS 16P22**:

Module TBX DMS 16P22	
Nominal voltage	24 V DC
Nominal current	0,5 A
OS supply voltage limits	19,2 V DC to 30 V DC
Permitted filament lamp power	8 W
Leakage current at OFF state	< 0,5 mA
Residual voltage at ON state	< 0,4 V
Switching time at ON or OFF state	≤ 1 ms
Load impedance at ON state	> 50 Ω
Primary/secondary dielectric behavior	1500 V rms. 50 Hz
Outputs protected against overloads	Yes: thermal
Outputs protected against overvoltages	Yes: Zener diode
Protection against a reverse polarity on OS	Yes: reverse-mounted diode (external 8 A fuse)
Detection of break in load	No
Conforms to IEC 1131	Yes
Compatible with DC inputs	Yes
Type of logic	Positive
Power dissipated per channel at ON state	0,35 W
Protection of +C terminals against overload or short-circuit	No
Protection against a reverse polarity on IS	Yes: reverse diode in parallel (ext. fuse 2 A (quick blow))
Key:	
OS	Power supply to preactuators.

Connecting the module TBX DMS 16P22

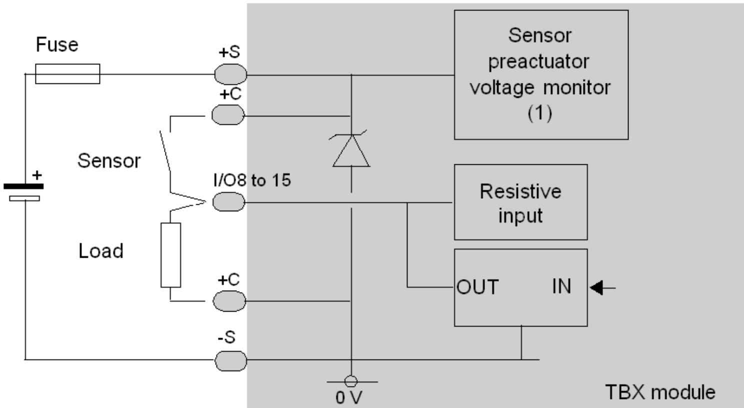
Circuit diagram

The following illustration shows the circuit diagram for a resistive input.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

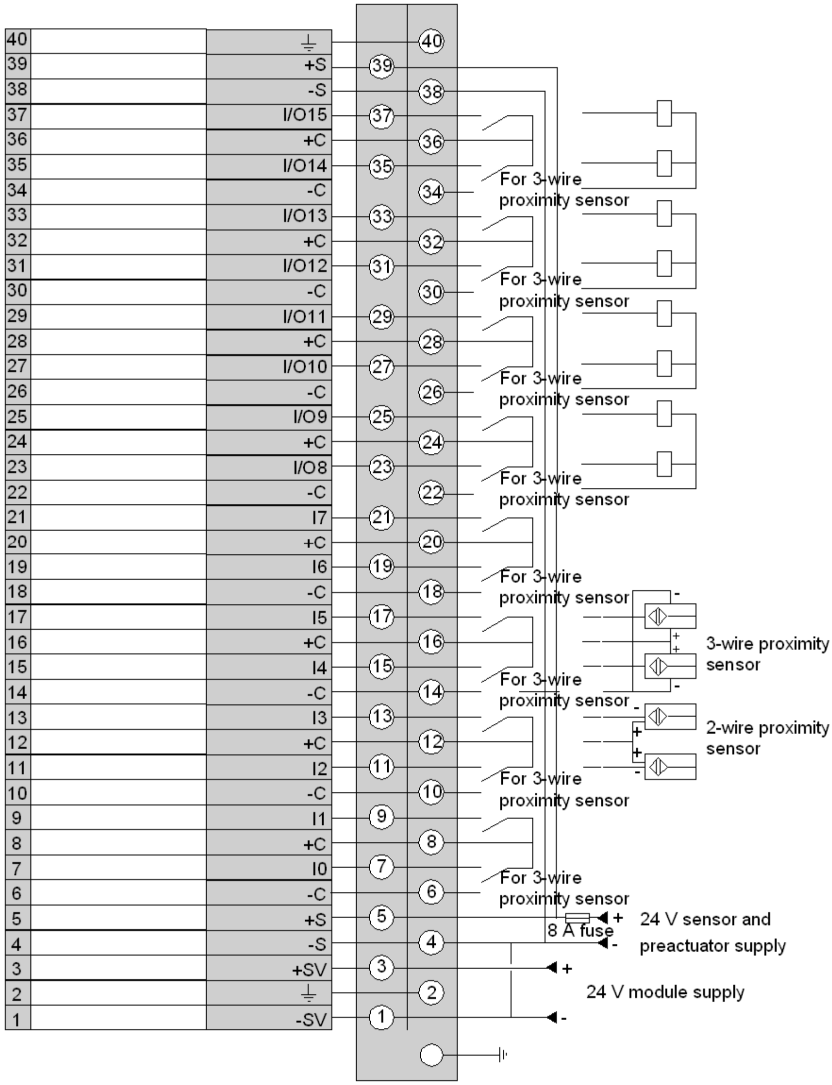
The following illustration shows the circuit diagram for a programmable input/output.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

Terminal block wiring

The following diagram illustrates the wiring of the terminal.



NOTE: a quick blow 8 A fuse must be wired to the sensor/preactuator power supply.
The two +S terminals *(see page 133)* as well as the two -S terminals. The -SV terminal and a -S (0 V) terminal must also be connected together.

Chapter 18
The TBX DMS 16C222 distributed input/output module

Subject of this chapter

This chapter presents the **TBX DMS 16C222** module, its characteristics and terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DMS 16C222 module

General

The **TBX DMS 16C222** is a modular base unit with 8 24 V DC inputs compatible with 2- and 3-wire proximity sensors, and 8 24 V DC 2A transistor outputs. The module is equipped with a terminal for the direct wiring of sensors and preactuators which can be removed when the power is switched off.

The sensor voltage and preactuator voltage are monitored to ensure that there is sufficient voltage for the inputs to operate correctly and for coherent processing of the outputs. Monitoring the voltage of the preactuators requires that shunts are installed.

The outputs are protected against overloads and short-circuits. If there is a fault at an output, it is set to a safe state, the default state, which is determined by the user: fallback position.

Once the fault has been corrected, the output can be reactivated, if it is reset *(see page 332)*.

The inputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Specific function

The wiring check *(see page 328)* function for this module continually checks the quality of the connections to the sensors and preactuators.

Two dip-switches *(see page 115)*, on the board, enable the channels to be adapted to their environment.

Output wiring check faults enable diagnosis of a short-circuit or an open circuit depending on the channel state.

The module provides independent power supplies: +Csn,n+1 *(see page 133)* (one for 2 sensors) which are protected against line short-circuits (0.1 A maximum current).

Technical specifications

The following table provides the technical specifications of the module.

<table>
<tr><th colspan="3">TBX DMS 16C222</th></tr>
<tr><td colspan="2">Nominal voltage</td><td>24 V DC</td></tr>
<tr><td colspan="2">Supply voltage +SV</td><td>19,2 V DC to 30 V DC</td></tr>
<tr><td rowspan="2">Current drawn on +SV of the base module (at 24 V)</td><td>if basic unit</td><td>45 mA typically</td></tr>
<tr><td>if extension base unit</td><td>10 mA typically</td></tr>
<tr><td colspan="2">Current drawn at +SV by extension module (at 24 V)</td><td>35 mA typically</td></tr>
<tr><td colspan="2">Current drawn at +IS (at 24 V)
(loading = 60 %)</td><td>35 mA typically</td></tr>
<tr><td colspan="2">Current drawn at +OS (at 24 V)
(with no active outputs)</td><td>25 mA typically</td></tr>
<tr><td colspan="2">Power dissipated at nominal load in the module
(loading = 60 %)</td><td>8,1 W at 24 V</td></tr>
<tr><td colspan="2">Dielectric strength between inputs and ground (GND)</td><td>1500 V rms - 50/60 Hz for 1 min</td></tr>
<tr><td colspan="2">Isolation resistance</td><td>> 10 MΩ below 500 V DC</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">Key:</td></tr>
<tr><td>SV</td><td colspan="2">Power supply to module (communication module if present and input/output interfaces).</td></tr>
<tr><td>IS</td><td colspan="2">Power supply to sensors.</td></tr>
<tr><td>OS</td><td colspan="2">Power supply to pre-actuators.</td></tr>
</table>

Characteristics of the inputs/outputs of module TBX DMS 16C222

General characteristics of the inputs

This table presents the characteristics of the inputs of module **TBX DMS 16C222**:

Module TBX DMS 16C222		
Nominal voltage		24 V DC
Nominal current		7 mA
Sensor power supply IS		19,2 V DC to 30 V DC
Voltage for ON state		7 V
Current at 11 V		≥ 6 mA
Voltage for OFF state		< 5 V
Current for OFF state		≤ 2 mA
Input impedance		3,4 kΩ
Switch-on time	fast filtering	5 to 8.5 ms
	slow filtering	30 to 45 ms
Switch-off time	fast filtering	5 to 8.5 ms
	slow filtering	30 to 45 ms
Permitted line resistance (2 wire proximity sensor)		100 Ω
Permitted line resistance (volt-free contact)		500 Ω
Permitted leakage resistance (2 wire proximity sensor)		(1)
Permitted leakage resistance (volt-free contact)		(1)
IEC standard 1131		Type 2
Compatibility with Telemecanique 2 wire proximity sensors		Yes
Compatibility with CENELEC 3 wire proximity sensors		Yes (2)
Compatible with TBX transistor outputs		Yes
Type of input		Current sink
Type of logic		Positive
Power dissipated per channel at ON state		0,17 W

Module TBX DMS 16C222	
Protection of +C terminals against overload or short-circuit	Yes
Protection against a reverse polarity on IS	Yes: reverse diode in parallel (ext. fuse 1 A (quick blow))
Key:	
IS	Power supply to sensors.
(1)	Permitted leakage resistance values are not included in this table *(see page 115)*.
(2)	With a standard 3 wire proximity sensor, with a resistor in parallel *(see page 115)*, the **open circuit** fault corresponds to a break in the input/proximity sensor link, or in the +power supply (+Cs) of the 3 wire proximity sensor. **Note**: the break in the - power supply to the proximity sensor (-Cs) is not detected.

General characteristics of the outputs

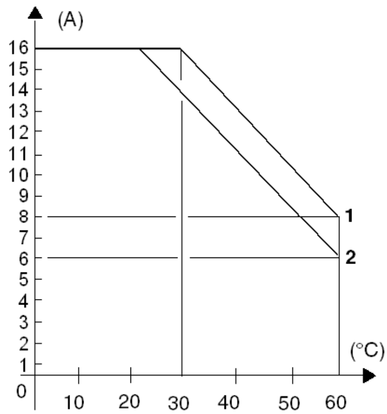
This table presents the characteristics of the outputs of module **TBX DMS 16C222**:

Module TBX DMS 16C222	
Nominal voltage	24 V DC
Nominal current	2 A
OS supply voltage limits	19,2 V DC to 30 V DC
Permitted filament lamp power	15 W
Leakage current at OFF state	< 2,5 mA
Residual voltage at ON state	< 0,8 V
Switching time at ON or OFF state	< 1 ms
Load impedance at ON state	> 12 Ω < 3 kΩ
Outputs protected against overloads	Yes: current limited to > 2.5 A
Outputs protected against overvoltages	Yes: Zener diode
Protection against a reverse polarity on OS	Yes: reverse-mounted diode (external 20 A very fast)
Detection of break in load	Yes
Conforms to IEC 1131	Yes

Module TBX DMS 16C222	
Compatible with DC inputs	Yes (1)
Power dissipated per channel at ON state	1,7 W
Key:	
OS	Power supply to preactuators.
(1)	All inputs for which the impedance is < 3 kΩ.

Current derating

The following graph shows the current derating as a function of the temperature.



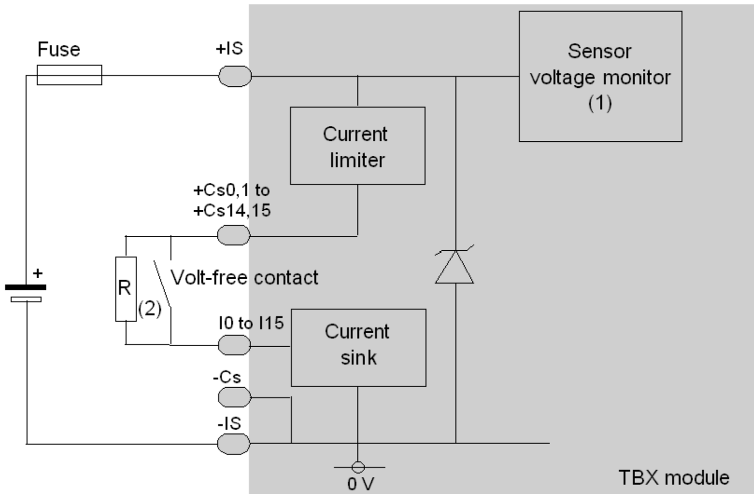
The maximum possible current as a function of temperature (°C) can be defined as the sum of the output currents for the module.

- **Curve 1**: the current at the 8 outputs is identical and less than 2 A per output. For example:
  - 8 outputs at 1 A at 60 °C,
  - 8 outputs at 1.3 A at 50 °C.
- **Curve 2**: the maximum current at an individual output reaches, but at no point exceeds, 2.5 A. For example:
  - 2 outputs at 2.5 A + 1 output at 1 A at 60 °C,
  - 5 outputs at 2.5 A + 1 output at 1.5 A at 30 °C.

Connecting the module TBX DMS 16C222

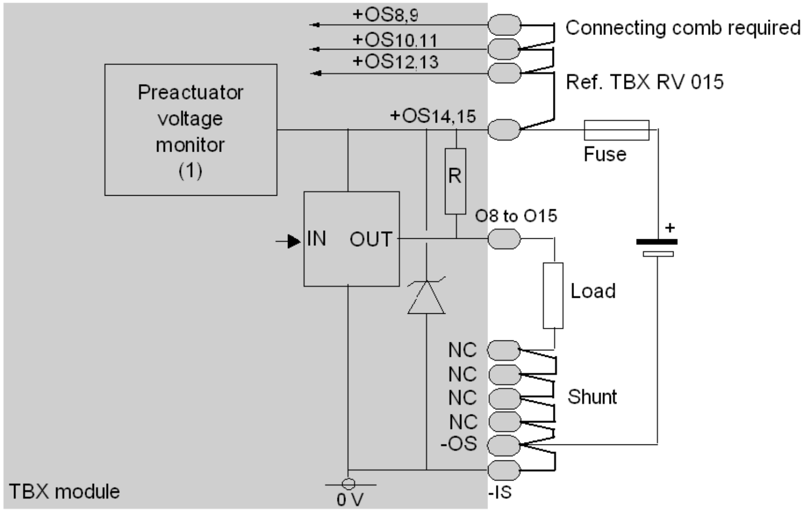
Circuit diagram

The following illustration shows the circuit diagram for a wiring check input.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.
2 Resistance R for a dry contact or a 3-wire proximity sensor enables the input wiring check to be used.

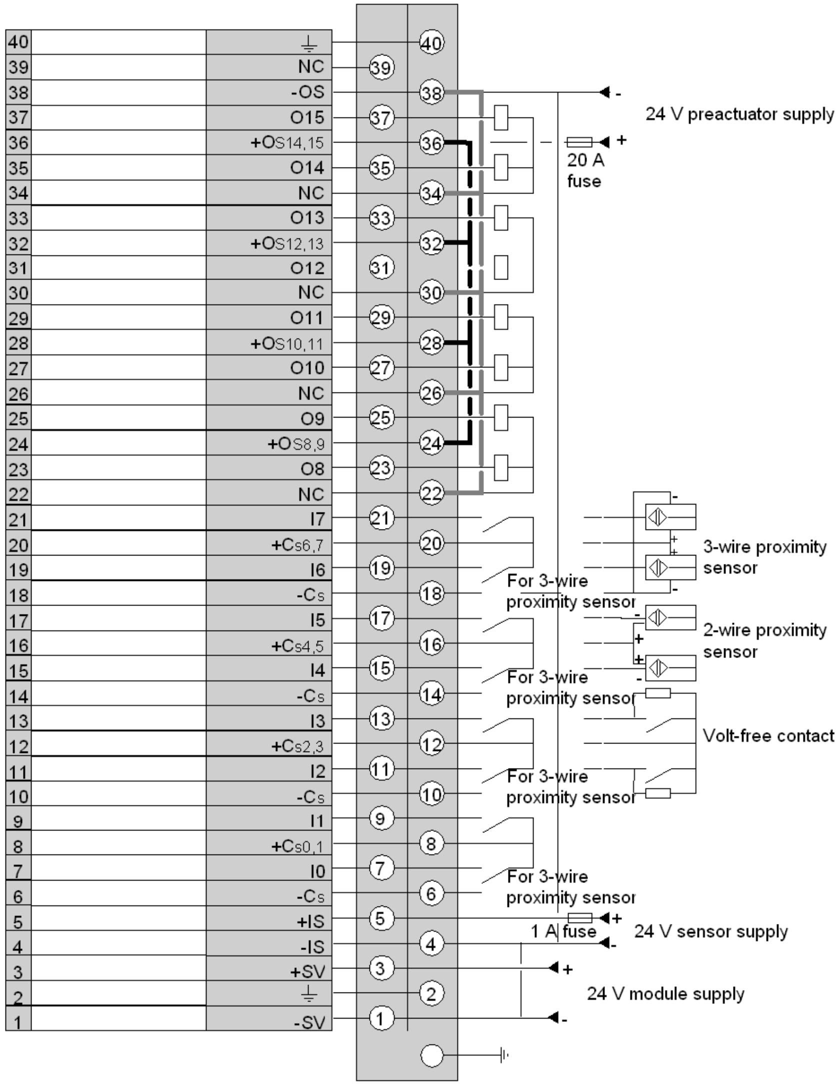
The following illustration shows the circuit diagram for a 24 V -2 A transistor output.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

Terminal block wiring

The following diagram illustrates the wiring of the terminal.



NOTE: you must wire an external 1 A quick blow fuse on the sensor power supply and 20 A on the preactuator power supply.
The four terminals *(see page 133)* $+OS_{x,y}$ must be wired together via an external shunt, reference **TBX RV 015**. The -SV, -IS and -OS terminals must also be wired together.

Chapter 19
The TBX DMS 1025 distributed input/output module

Subject of this chapter

This chapter presents the **TBX DMS 1025** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DMS 1025 module

General

The **TBX DMS 1025** is a modular base unit comprising 8 24 V DC inputs, compatible with 2 and 3 wire proximity sensors and 2 50 VA relay outputs. The module is equipped with a terminal block for direct wiring of the sensors and preactuators, which can be removed when it is switched off.

The sensor voltage is monitored to ensure that there is sufficient voltage for the inputs to operate correctly.

The inputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Technical specifications

The following table provides the technical specifications of the module.

TBX DMS 1025		
Nominal voltage		24 V DC
Supply voltage +SV		19,2 V DC to 30 V DC
Current drawn on +SV of the base module (at 24 V)	if basic unit	35 mA typically
	if extension base unit	25 mA typically
Current drawn at +SV by extension module (at 24 V)		10 mA typically
Current drawn at +IS (at 24 V) (loading = 60 %)		75 mA typically
Power dissipated at nominal load in the module (loading = 60 %)		2,6 W at 24 V
Dielectric strength between inputs and ground (GND)		1500 V rms - 50/60 Hz for 1 min
Isolation resistance		> 10 MΩ below 500 V DC
Key:		
SV	Power supply to module (communication module if present and input/output interfaces).	
IS	Power supply to sensors.	

Characteristics of the inputs/outputs of module TBX DMS 1025

General characteristics of the inputs

This table presents the characteristics of the inputs of module **TBX DMS 1025**:

Module TBX DMS 1025	
Nominal voltage	24 V DC
Nominal current	15 mA
Sensor power supply IS	19,2 V DC to 30 V DC
Voltage for ON state	≥ 11 V
Current at 11 V	≥ 6 mA
Voltage for OFF state	< 5 V
Current for OFF state	≤ 2 mA
Input impedance	1,6 kΩ
Switch-on time	5 to 15 ms
Switch-off time	5 to 17 ms
Permitted line resistance (2 wire proximity sensor)	100 Ω
Permitted line resistance (volt-free contact)	500 Ω
Permitted leakage resistance (2 wire proximity sensor)	> 100 Ω
Permitted leakage resistance (volt-free contact)	> 30 Ω
IEC standard 1131	Type 2
Compatibility with Telemecanique 2 wire proximity sensors	Yes
Compatibility with CENELEC 3 wire proximity sensors	Yes
Compatible with TBX transistor outputs	Yes
Type of input	Resistive
Type of logic	Positive
Power dissipated per channel at ON state	0,36 W

General characteristics of the outputs

This table presents the characteristics of the outputs of module **TBX DMS 1025**:

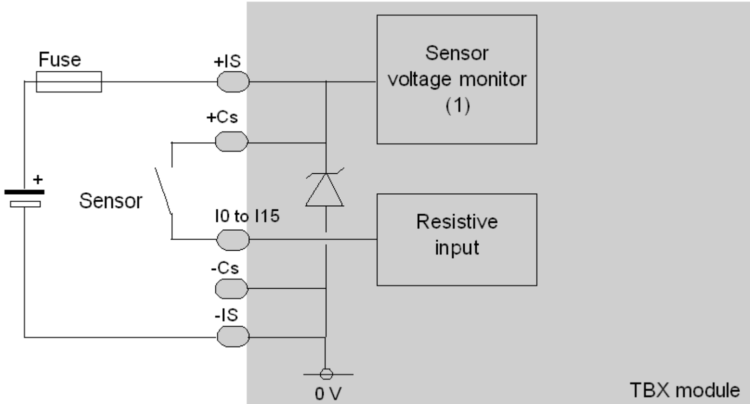
Module TBX DMS 1025	
Operating voltage	19.2 to 30 V 24 to 264 V
Permitted DC power DC12 resistive loads	24 W 0.2 x 10^6 operations
Permitted DC power DC13 inductive loads (L/R = 60 ms)	10 W 10^6 operations
Permitted AC current AC12 resistive loads	1 A - 110/220 V 0.2 x 10^6 operations 0,5 A - 110/220 V 2 x 10^6 operations 1 A -24/48 V 0.5 x 10^6 operations 2 A - 24 V 0,2 x 10^6 operations
Permitted AC current AC15 inductive loads	50 VA - 110/220 V 10^6 operations 0.5 A - 24/48 V 10^6 operations 10 VA -48/220 V 10^7 operations 1 A - 24 V 0.2 x 10^6 operations
Accidental power breaks (opening due to inrush current of the contactor)	30 A peak 50 operations
Thermal current (1)	3 A
Switch-on response time	10 ms max.
Switch-off response time	20 ms max.
Dielectric strength of contacts	2000 V rms.
Compatible with DC inputs	Yes
Preactuators protected against overvoltages	No internal protection (2)
Protection against short-circuits and overloads	No internal protection

Module TBX DMS 1025	
Common per channel	1 for 2 channels
Type of contact	normally open
Key:	
(1)	Maximum value of current which can cross the contact without damaging it. This value, which is associated with the relay, should not be confused with the permissible current, relating to the module. The permissible current takes into account the breaking capacity of the relay (maximum switching current) and the characteristics of the other components which constitute the output.
(2)	With an inductive load on an AC supply, an RC or GMOV peak limiter circuit must be wired across the load. For DC, wire a reverse mounted diode in parallel to the load.

Connecting the module TBX DMS 1025

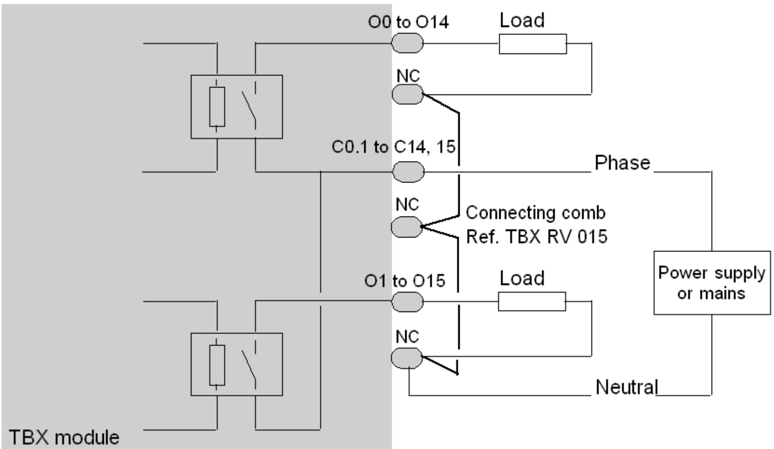
Circuit diagram

The following illustration shows the circuit diagram for a resistive input.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

The following illustration shows the circuit diagram of a relay output (normally open contacts).



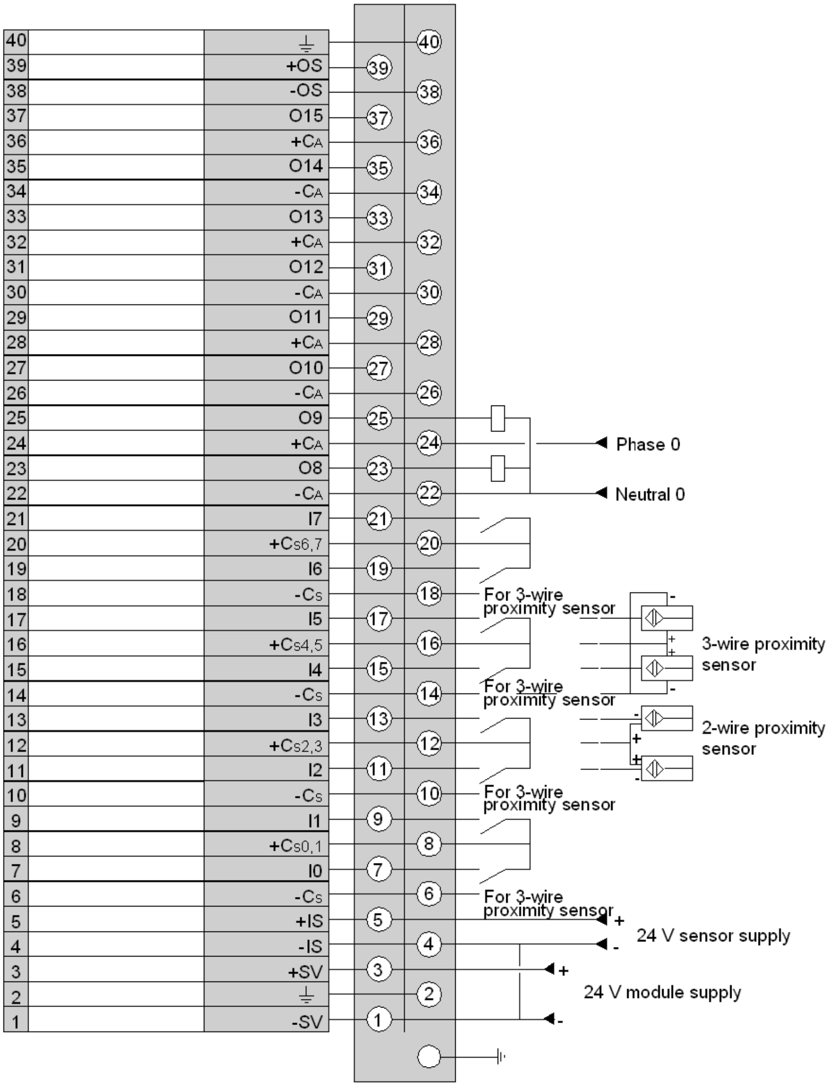
Terminal block wiring

The diagram on the following page represents an example of wiring: the module outputs grouped together by the user have a single power supply.

The NC terminals *(see page 133)* are not wired within the modules, but are used to distribute the power supply neutral to the various loads. For this purpose, use connecting combs, reference TBX RV 015.

A connecting comb is also used to connect the relay commons (C8.9, C10.11,...) with the supply phase.

The following diagram illustrates the wiring of the terminal.



NOTE: the -SV terminal *(see page 133)* and the -IS (0 V) terminal must be connected together.

Chapter 20
The TBX DMS 1625 distributed input/output module

Subject of this chapter

This chapter presents the **TBX DMS 1625** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DMS 1625 module

General

The **TBX DMS 1625** is a modular base unit comprising 8 24 V DC inputs, compatible with 8 and 3 wire proximity sensors and 2 50 VA relay outputs. The module is equipped with a terminal block for direct wiring of the sensors and preactuators, which can be removed when it is switched off.

The sensor voltage is monitored to ensure that there is sufficient voltage for the inputs to operate correctly.

The inputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Technical specifications

The following table provides the technical specifications of the module.

TBX DMS 1625 (1)		
Nominal voltage		24 V DC
Supply voltage +SV		19,2 V DC to 30 V DC
Current drawn on +SV of the base module (at 24 V)	if basic unit	80 mA typically
	if extension base unit	70 mA typically
Current drawn at +SV by extension module (at 24 V)		10 mA typically
Current drawn at +IS (at 24 V) (loading = 60 %)		75 mA typically
Power dissipated at nominal load in the module (loading = 60 %)		3,7 W at 24 V
Dielectric strength between inputs and ground (GND)		1500 V rms - 50/60 Hz for 1 min
Isolation resistance		> 10 MΩ below 500 V DC
Key:		
SV	Power supply to module (communication module if present and input/output interfaces).	
IS	Power supply to sensors.	
(1)	For a configuration comprising 2 **TBX DMS 1625** base units, the maximum ambient temperature is 40 °C, if the 2 base units are used at 100 % (16 ON relays).	

Characteristics of the inputs/outputs of module TBX DMS 1625

General characteristics of the inputs

This table presents the characteristics of the inputs of module **TBX DMS 1625**:

Module TBX DMS 1625	
Nominal voltage	24 V DC
Nominal current	15 mA
Sensor power supply IS	19.2 V DC to 30 V DC
Voltage for ON state	≥ 11 V
Current at 11 V	≥ 6 mA
Voltage for OFF state	< 5 V
Current for OFF state	≤ 2 mA
Input impedance	1,6 kΩ
Switch-on time	5 to 15 ms
Switch-off time	5 to 17 ms
Permitted line resistance (2 wire proximity sensor)	100 Ω
Permitted line resistance (volt-free contact)	500 Ω
Permitted leakage resistance (2 wire proximity sensor)	> 100 Ω
Permitted leakage resistance (volt-free contact)	> 30 Ω
IEC standard 1131	Type 2
Compatibility with Telemecanique 2 wire proximity sensors	Yes
Compatibility with CENELEC 3 wire proximity sensors	Yes
Compatible with TBX transistor outputs	Yes
Type of input	Resistive
Type of logic	Positive
Power dissipated per channel at ON state	0,36 W

General characteristics of the outputs

This table presents the characteristics of the outputs of module **TBX DMS 1625**:

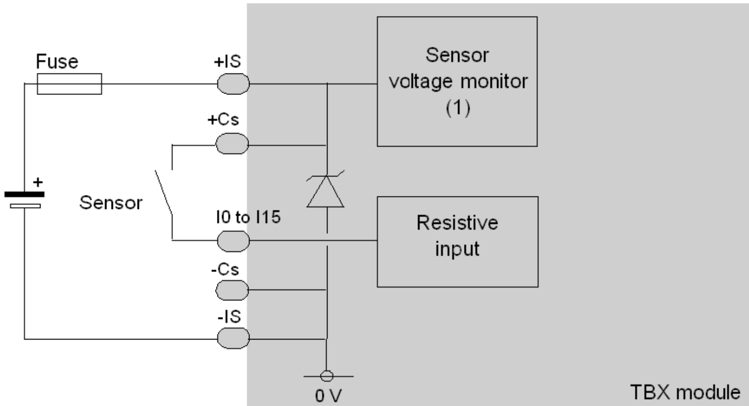
Module TBX DMS 1625	
Operating voltage	19,2 to 30 V 24 to 264 V
Permitted DC power DC12 resistive loads	24 W 0.2 x 10^6 operations
Permitted DC power DC13 inductive loads (L/R = 60 ms)	10 W 10^6 operations
Permitted AC current AC12 resistive loads	1 A - 110/220 V 0.2 x 10^6 operations 0,5 A - 110/220 V 2 x 10^6 operations 1 A -24/48 V 0.5 x 10^6 operations 2 A - 24 V 0.2 x 10^6 operations
Permitted AC current AC15 inductive loads	50 VA - 110/220 V 10^6 operations 0,5 A - 24/48 V 10^6 operations 10 VA -48/220 V 10^7 operations 1 A - 24 V 0.2 x 10^6 operations
Accidental power breaks (opening due to inrush current of the contactor)	30 A peak 50 operations
Thermal current (1)	3 A
Switch-on response time	10 ms max.
Switch-off response time	20 ms max.
Dielectric strength of contacts	2000 V rms.
Compatible with DC inputs	Yes
Preactuators protected against overvoltages	No internal protection (2)
Protection against short-circuits and overloads	No internal protection

Module TBX DMS 1625	
Common per channel	1 for 2 channels
Type of contact	normally open
Key:	
(1)	Maximum value of current which can cross the contact without damaging it. This value, which is associated with the relay, should not be confused with the permissible current, relating to the module. The permissible current takes into account the breaking capacity of the relay (maximum switching current) and the characteristics of the other components which constitute the output.
(2)	With an inductive load on an AC supply, an RC or GMOV peak limiter circuit must be wired across the load. For DC, wire a reverse mounted diode in parallel to the load.

Connecting the module TBX DMS 1625

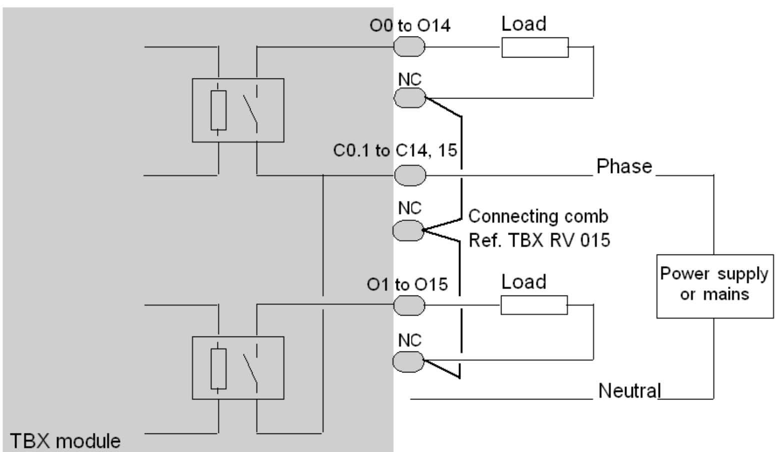
Circuit diagram

The following illustration shows the circuit diagram for a resistive input.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

The following illustration shows the circuit diagram of a relay output (normally open contacts).



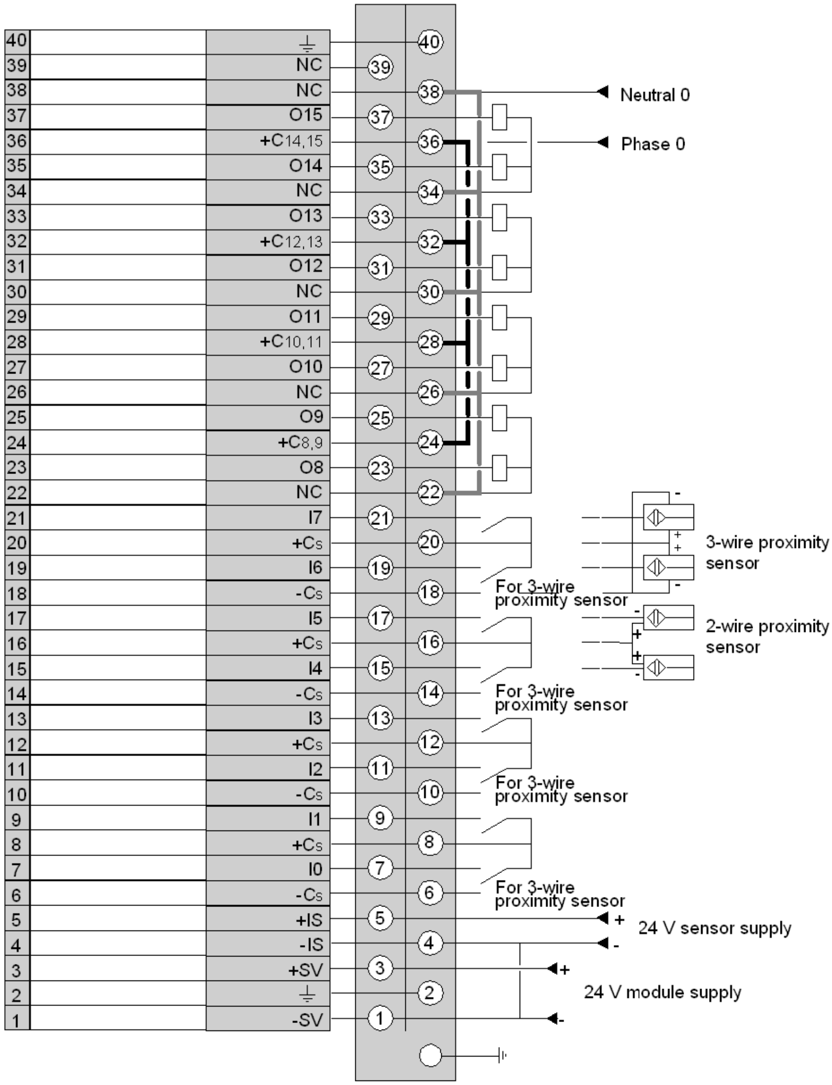
Terminal block wiring

The diagram on the following page represents an example of wiring: the module outputs grouped together by the user have a single power supply.

The NC terminals *(see page 133)* are not wired within the modules, but are used to distribute the power supply neutral to the various loads. For this purpose, use connecting combs, reference TBX RV 015.

A connecting comb is also used to connect the relay commons (C8.9, C10.11,...) with the supply phase.

The following diagram illustrates the wiring of the terminal.



NOTE: the -SV terminal *(see page 133)* and the -IS (0 V) terminal must be connected together.

Chapter 21
The TBX DSS 1622 distributed output module

Subject of this chapter

This chapter presents the **TBX DSS 1622** module, its characteristics and terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DSS 1622 module

General

The **TBX DSS 1622** is a modular base unit which has 16 transistor outputs 24 V DC 0.5 A. The module is equipped with a terminal for direct wiring of the sensors and preactuators, which can be removed when it is switched off.

The preactuator voltage is monitored to ensure coherent processing of the outputs during variations in the power supply.

The outputs are protected against overloads and short-circuits. If there is a fault at an output, it is set to a safe state, the default state, which is determined by the user: fallback position.

Once the fault has been corrected, the output can be reactivated, if it is reset *(see page 332)*.

The outputs of this base unit have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of these base units to the various tasks in the application.

Technical specifications

The following table provides the technical specifications of the module.

TBX DSS 1622		
Nominal voltage +SV		24 V DC
Supply voltage +SV		19,2 V DC to 30 V DC
Current drawn on +SV of the base module (at 24 V)	if basic unit	30 mA typically
	if extension base unit	negligible
Current drawn at +SV by extension module (at 24 V)		25 mA typically
Current drawn at +OS (at 24 V) (with no active output)		35 mA typically
Power dissipated in the base unit (loading = 60 %)		4,1 W at 24 V
Dielectric strength between inputs and ground (GND)		1500 V rms - 50/60 Hz for 1 min
Isolation resistance		> 10 MΩ below 500 V DC
Key:		
SV	Power supply to module (communication module if present and input interfaces).	
OS	Power supply to pre-actuators.	

Characteristics of the outputs of module TBX DSS 1622

General characteristics

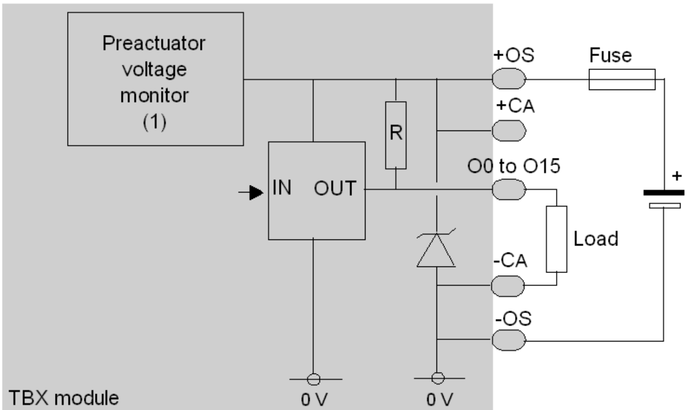
This table presents the characteristics of the outputs of module **TBX DSS 1622**:

Module TBX DSS 1622	
Nominal voltage	24 V DC
Nominal current	0.5 A
OS supply voltage limits	19.2 V DC to 30 V DC
Permitted filament lamp power	8 W
Leakage current at OFF state	< 0,5 mA
Residual voltage at ON state	< 0,4 V
Switching time at ON or OFF state	< 1 ms
Load impedance at ON state	> 50 Ω
Outputs protected against overloads	Yes: thermal
Outputs protected against overvoltages	Yes: Zener diode
Protection against reverse polarity on preactuator supply	Yes: reverse-mounted diode (external 12 A fuse)
Detection of break in load	No
Conforms to IEC 1131	Yes
Compatible with DC inputs	Yes
Type of logic	Positive
Power dissipated per channel at ON state	0,35 W
Key:	
OS	Power supply to pre-actuators.

Connecting the module TBX DSS 1622

Circuit diagram

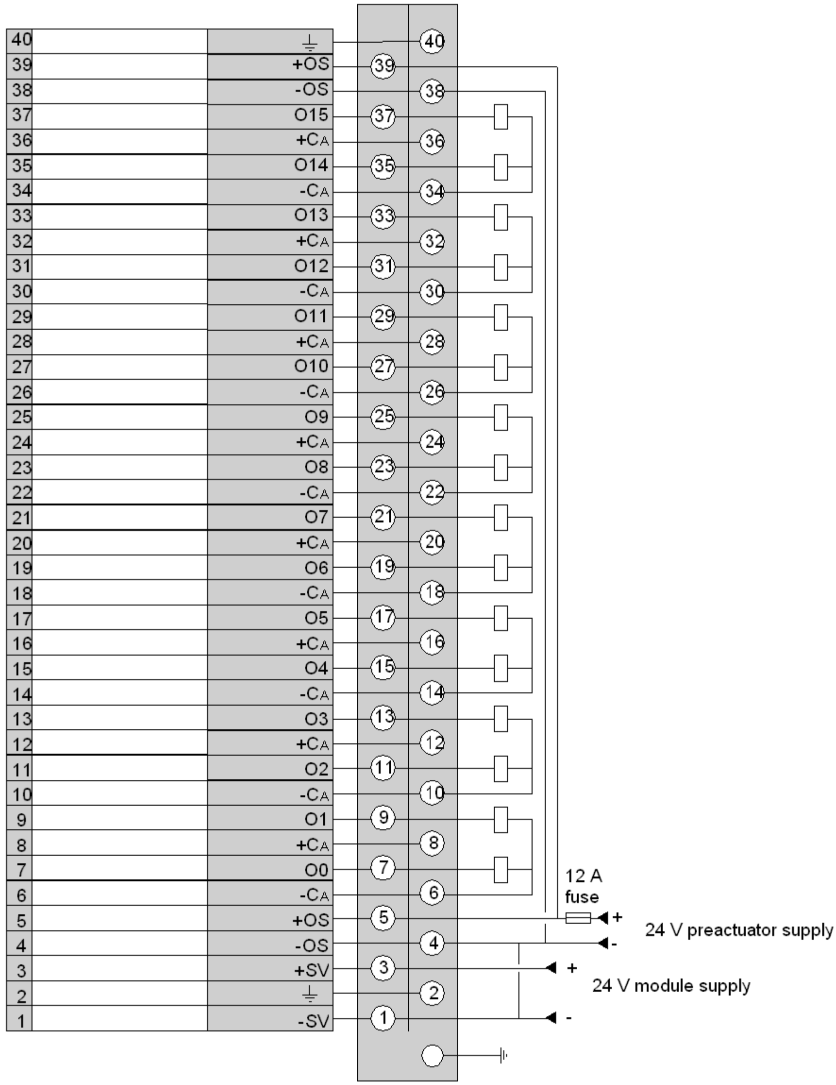
The following illustration shows the circuit diagram for a 24 V -0.5 A transistor output.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

Terminal block wiring

The following diagram illustrates the wiring of the terminal.



NOTE: a quick blow 12 A fuse must be wired to the sensor/preactuator power supply.
The two +OS terminals *(see page 133)* must be wired together as well as the two -OS terminals, the -SV terminal and an -OS terminal.

Chapter 22
The TBX DSS 16C22 distributed output module

Subject of this chapter

This chapter presents the **TBX DSS 16C22** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DSS 16C22 module

General

The **TBX DSS 16C22** is a modular base unit which has 16 transistor outputs 24 V DC 0.5 A. The module is equipped with a terminal for direct wiring of the sensors and preactuators, which can be removed when it is switched off.

The preactuator voltage is monitored to ensure coherent processing of the outputs during variations in the power supply.

The outputs are protected against overloads and short-circuits. If there is a fault at an output, it is set to a safe state, the default state, which is determined by the user: fallback position.

Once the fault has been corrected, the output can be reactivated, if it is reset *(see page 332)*.

The outputs of this base unit have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of these base units to the various tasks in the application.

Specific function

The wiring check *(see page 328)* function for this module continually checks the quality of the connections to the preactuators.

Output wiring check faults enable diagnosis of a short-circuit or an open circuit depending on the channel state.

Technical specifications

The following table provides the technical specifications of the module.

TBX DSS 16C22		
Nominal voltage +SV		24 V DC
Supply voltage +SV		19,2 V DC to 30 V DC
Current drawn on +SV of the base module (at 24 V)	if basic unit	30 mA typically
	if extension base unit	negligible
Current drawn at +SV by extension module (at 24 V)		25 mA typically
Current drawn at +OS (at 24 V) (with no active output)		35 mA typically
Power dissipated in the base unit (loading = 60 %)		4,3 W at 24 V
Dielectric strength between inputs and ground (GND)		1500 V rms - 50/60 Hz for 1 min
Isolation resistance		> 10 MΩ below 500 V DC
Key:		
SV	Power supply to module (communication module if present and input interfaces).	
OS	Power supply to pre-actuators.	

Characteristics of the outputs of module TBX DSS 16C22

General characteristics

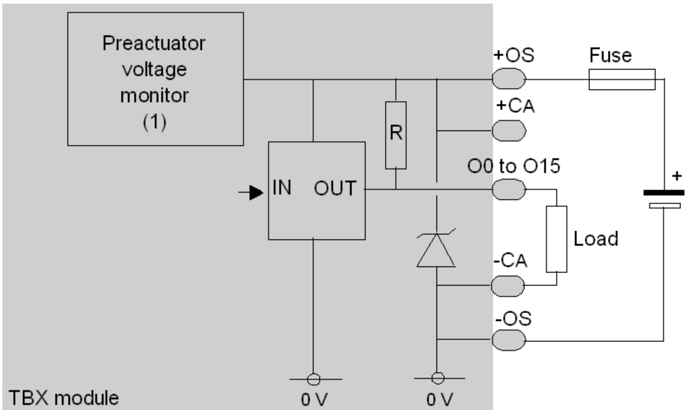
This table presents the characteristics of the outputs of module **TBX DSS 16C22**:

Module TBX DSS 16C22	
Nominal voltage	24 V DC
Nominal current	0,5 A
OS supply voltage limits	19,2 V DC to 30 V DC
Permitted filament lamp power	8 W
Leakage current at OFF state	< 2 mA
Residual voltage at ON state	< 0,4 V
Switching time at ON or OFF state	≤ 1 ms
Load impedance at ON state	> 50 Ω < 30 kΩ
Outputs protected against overloads	Yes: thermal
Outputs protected against overvoltages	Yes: Zener diode
Protection against reverse polarity on preactuator supply	Yes: reverse-mounted diode (external 12 A fuse)
Detection of break in load	Yes
Conforms to IEC 1131	Yes
Compatible with DC inputs	Yes
Type of logic	Positive
Power dissipated per channel at ON state	0,35 W
Key:	
OS	Power supply to pre-actuators.

Connecting the module TBX DSS 16C22

Circuit diagram

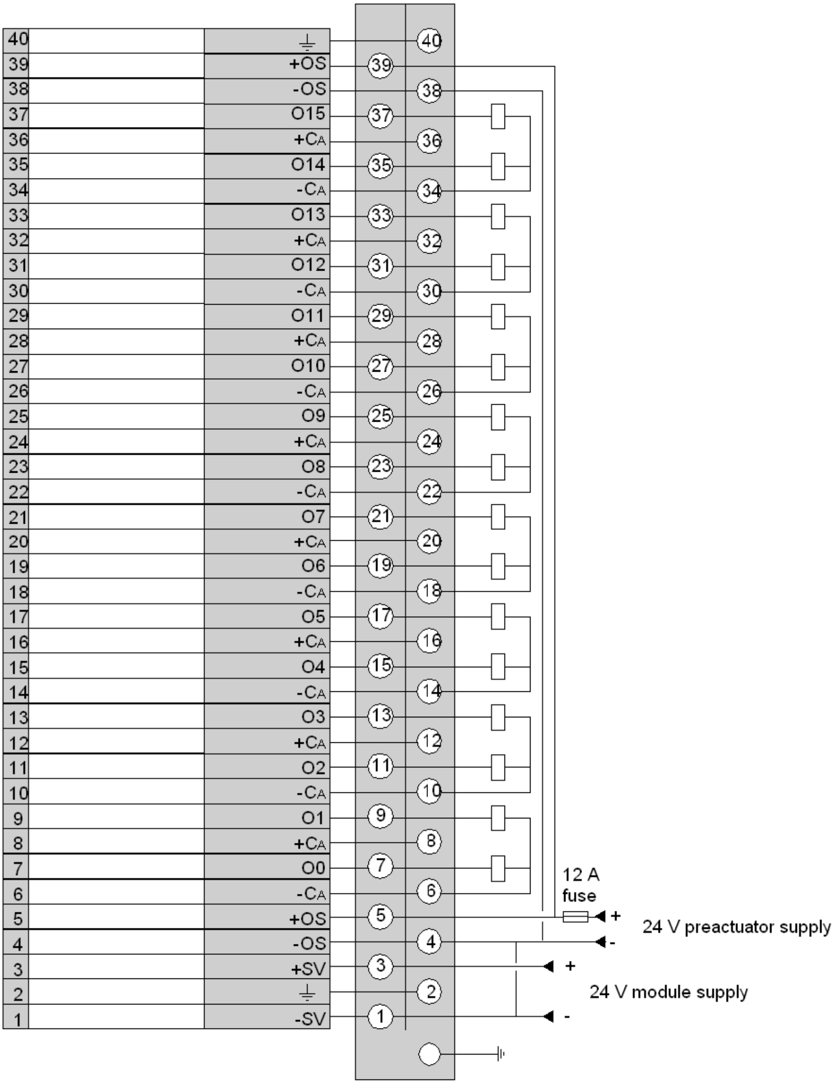
The following illustration shows the circuit diagram for a 24 V -0.5 A transistor output.



1 Guaranteed threshold for monitored voltage OK: > 18 V, guaranteed threshold for monitored voltage faulty: < 14 V.

Terminal block wiring

The following diagram illustrates the wiring of the terminal.



NOTE: a quick blow 12 A fuse must be wired to the sensor/preactuator power supply.
The two +OS terminals *(see page 133)* must be wired together as well as the two -OS terminals.
The -SV terminal and a -OS (0 V) terminal must also be wired together.

Chapter 23
The TBX DSS 1625 distributed output module

Subject of this chapter

This chapter presents the **TBX DSS 1625** module, its characteristics and terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DSS 1625 module

General

The **TBX DSS 1625** is a modular base unit comprising 16 50 VA relay outputs. The module is equipped with a terminal block for direct wiring of the preactuators, which can be removed when it is switched off.

The outputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Technical specifications

The following table provides the technical specifications of the module.

TBX DSS 1625		
Nominal voltage +SV		24 V DC
Supply voltage +SV		19,2 V DC to 30 V DC
Current drawn on +SV of the base module (at 24 V) (with 60 % of the relays active)	if basic unit	125 mA typically
	if extension base unit	negligible
Current drawn at +SV by extension module (at 24 V) (with 60 % of the relays active)		115 mA typically
Immunity to +SV microbreaks (with 60 % of the relays active)		10 ms
Power dissipated at nominal load in the module (with 60 % of the relays active)		3,1 W at 24 V
Dielectric strength between inputs and ground (GND)		1500 V rms - 50/60 Hz for 1 min
Isolation resistance		> 10 MΩ below 500 V DC
Key:		
SV	Power supply to module (communication module if present and input interfaces).	

Characteristics of the outputs of module TBX DSS 1625

General characteristics

This table presents the characteristics of the outputs of module **TBX DSS 1625**:

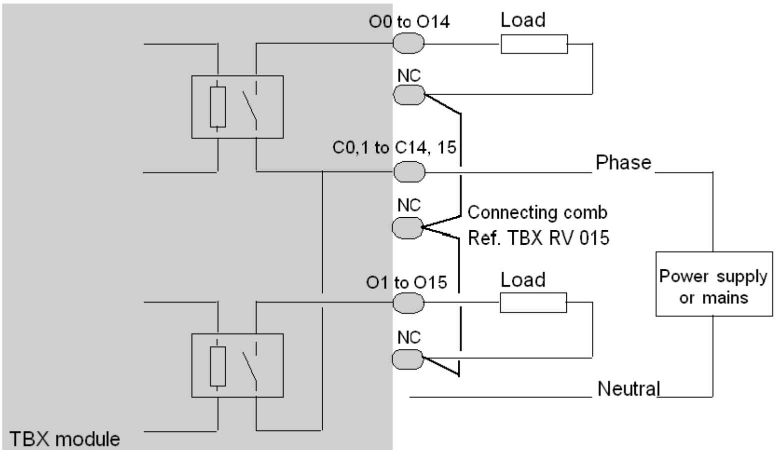
Module TBX DSS 1625	
DC operating voltage	19 to 30 V
AC operating voltage	24 to 264 V
Permitted DC power DC12 resistive loads	24 W 0.2 x 10^6 operations
Permitted DC power DC13 inductive loads (L/R = 60 ms)	10 W 10^6 operations
Permitted AC current AC12 resistive loads	1 A - 110/220 V 0.2 x 10^6 operations 0,5 A - 110/220 V 2 x 10^6 operations 1 A -24/48 V 0.5 x 10^6 operations 2 A - 24 V 0.2 x 10^6 operations
Permitted AC current AC15 inductive loads	50 VA - 110/220 V 10^6 operations 0,5 A - 24/48 V 10^6 operations 10 VA -48/220 V 10^7 operations 1 A - 24 V 0.2 x 10^6 operations
Accidental power breaks (opening due to inrush current of the contactor)	30 A peak 50 operations
Thermal current (1)	3 A
Switch-on response time	10 ms max.
Switch-off response time	20 ms max.
Dielectric strength of contacts	2000 V rms.
Compatible with DC inputs	Yes
Preactuators protected against overvoltages	No internal protection (2)
Protection against short-circuits and overloads	No internal protection

Module TBX DSS 1625	
Common per channel	1 for 2 channels
Type of contact	normally open
Key:	
(1)	Maximum value of current which can cross the contact without damaging it. This value, which is associated with the relay, should not be confused with the permissible current, relating to the module. The permissible current takes into account the breaking capacity of the relay (maximum switching current) and the characteristics of the other components which constitute the output.
(2)	With an inductive load on an AC supply, an RC or GMOV peak limiter circuit must be wired across the load. For DC, wire a reverse mounted diode in parallel to the load.

Connecting the module TBX DSS 1625

Circuit diagram

The following illustration shows the circuit diagram of a relay output (normally open contacts).



Terminal block wiring

The diagram on the following page represents an example of wiring. The module outputs organized into three groups by the user have separate power supplies:

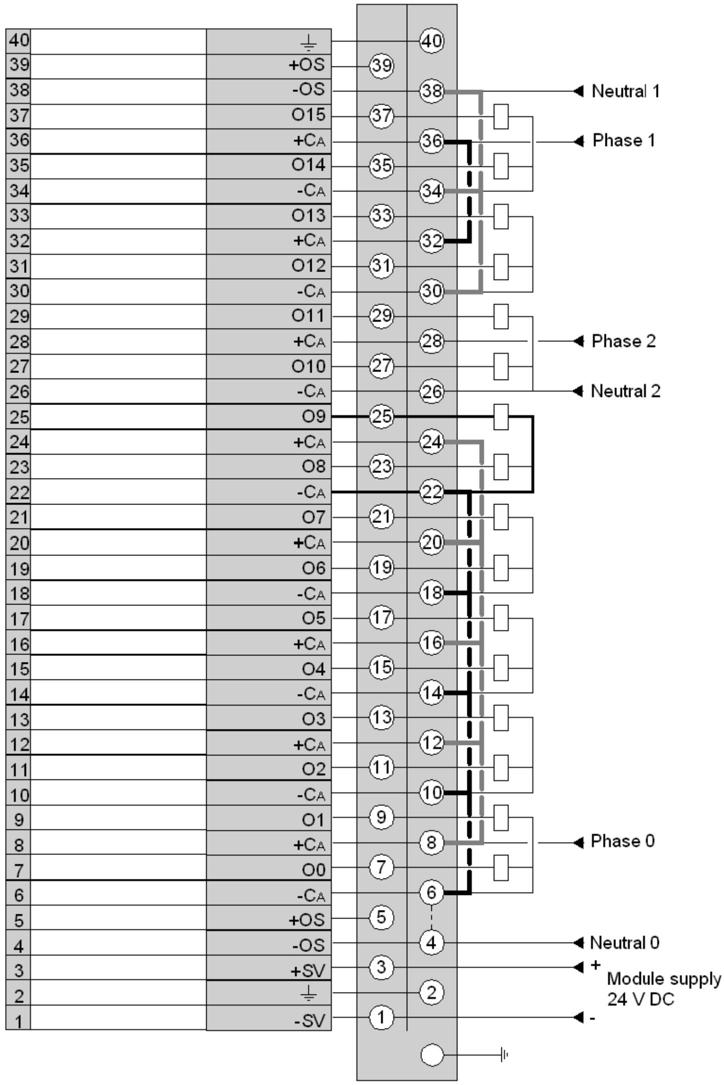
- outputs 0 to 9,
- outputs 10 and 11,
- outputs 12 to 15.

The NC terminals *(see page 133)* are not wired within the modules, but are used to distribute the power supply neutral to the various loads.

For this purpose, use connecting combs, reference **TBX RV 015**.

Two connecting combs are also used to connect the relay commons together.

The following diagram illustrates the wiring of the terminal.



NOTE: the two N1 terminals *(see page 133)* are connected together internally.

Chapter 24
The TBX DSS 1235 distributed output module

Subject of this chapter

This chapter presents the **TBX DSS 1235** module, its characteristics and terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DSS 1235 module

General

The **TBX DSS 1235** is a modular base unit comprising 12 100 VA relay outputs. The module is equipped with a terminal block for direct wiring of the preactuators, which can be removed when it is switched off.

The outputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Relays available on the **TBX DSS 1235** module are:

- 4 groups of 2 normally open (NO). The common for the contact of the two relays is connected to one terminal on the terminal block,
- 4 change-over (NO and NC) relays.

Technical specifications

The following table provides the technical specifications of the module.

TBX DSS 1235			
Nominal voltage +SV		24 V DC	48 V DC
Supply voltage +SV		19,2 V DC to 30 V DC	
Current drawn at +SV by the basic module (with 60 % of the relays active)	if basic unit	130 mA typically	70 mA typically
	if extension base unit	negligible	negligible
Current drawn at +SV by the extension module (with 60 % of the relays active)		125 mA typically	65 mA typically
Immunity to +SV microbreaks (with 60 % of the relays active)		10 ms	
Power dissipated at nominal load in the module (with 60 % of the relays active)		3,1 W at 24 V	3,3 W at 48 V
Dielectric strength between inputs and ground (GND)		1500 V rms - 50/60 Hz for 1 min	
Isolation resistance		> 10 MΩ below 500 V DC	
Key:			
SV	Power supply to module (communication module if present and input interfaces).		

Characteristics of the outputs of module TBX DSS 1235

General characteristics

This table presents the characteristics of the outputs of module **TBX DSS 1235**:

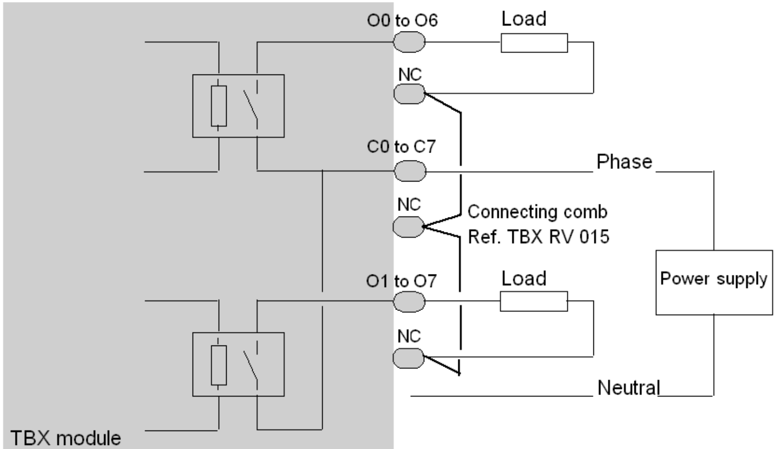
Module TBX DSS 1235	
DC operating voltage	24 to 48 V
AC operating voltage	24 to 264 V
Permitted DC current DC12 resistive loads	2 A - 24 V 0.25 x 10^6 operations 1 A -48 V 0.5 x 10^6 operations
Permitted DC current DC13 inductive loads (L/R = 60 ms)	2 A - 24 V 0.25 x 10^6 operations 0,5 A -48 V 0.15 x 10^6 operations
Permitted AC current AC12 resistive loads	2 A -110 V 0.5 x 10^6 operations 1 A - 110/220 V 1.5 x 10^6 operations 2 A -24/48 V 0.5 x 10^6 operations 2 A - 24 V 0.2 x 10^6 operations 4 A - 24 V 0.15 x 10^6 operations (1)
Permitted AC current AC15 inductive loads	100 VA - 110/240 V 10^6 operations 1 A - 24/48 V 10^6 operations 20 VA -48 V 2 x 10^6 operations 20 VA - 110/240 V 5 x 10^6 operations
Accidental power breaks (opening due to inrush current of the contactor)	30 A peak 50 operations
Thermal current (2)	7 A
Switch-on response time	10 ms max.
Switch-off response time	20 ms max.
Dielectric strength of contacts	2000 V rms.
Compatible with DC inputs	Yes
Preactuators protected against overvoltages	No internal protection (3)
Protection against short-circuits and overloads	No internal protection

Module TBX DSS 1235	
Common per channel	1 for every 2 channels (channels 0 to 7) 1 per channel (channels 8 to 11)
Type of contact	normally open (channels 0 to 7) normally open/normally closed (channels 8 to 11)
Key:	
(1)	Limited to 7 A per terminal (NC) in the case of 2 outputs with common terminal.
(2)	Maximum value of current which can cross the contact without damaging it. This value, which is associated with the relay, should not be confused with the permissible current, relating to the module. The permissible current takes into account the breaking capacity of the relay (maximum switching current) and the characteristics of the other components which constitute the output.
(3)	With an inductive load on an AC supply, an RC or GMOV peak limiter circuit must be wired across the load. For DC, wire a reverse mounted diode in parallel to the load.

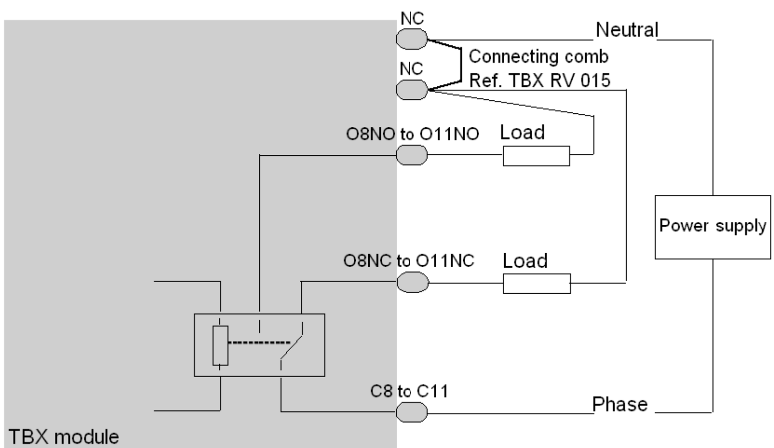
Connecting the module TBX DSS 1235

Circuit diagram

The following illustration shows the circuit diagram of a relay output (normally open contacts, outputs 0 to 7).



The following illustration shows the circuit diagram of a relay output (normally closed and normally open contacts, outputs 8 to 11).



Terminal block wiring

The diagram on the following page represents an example of wiring. The module outputs organized into two groups by the user have separate power supplies:

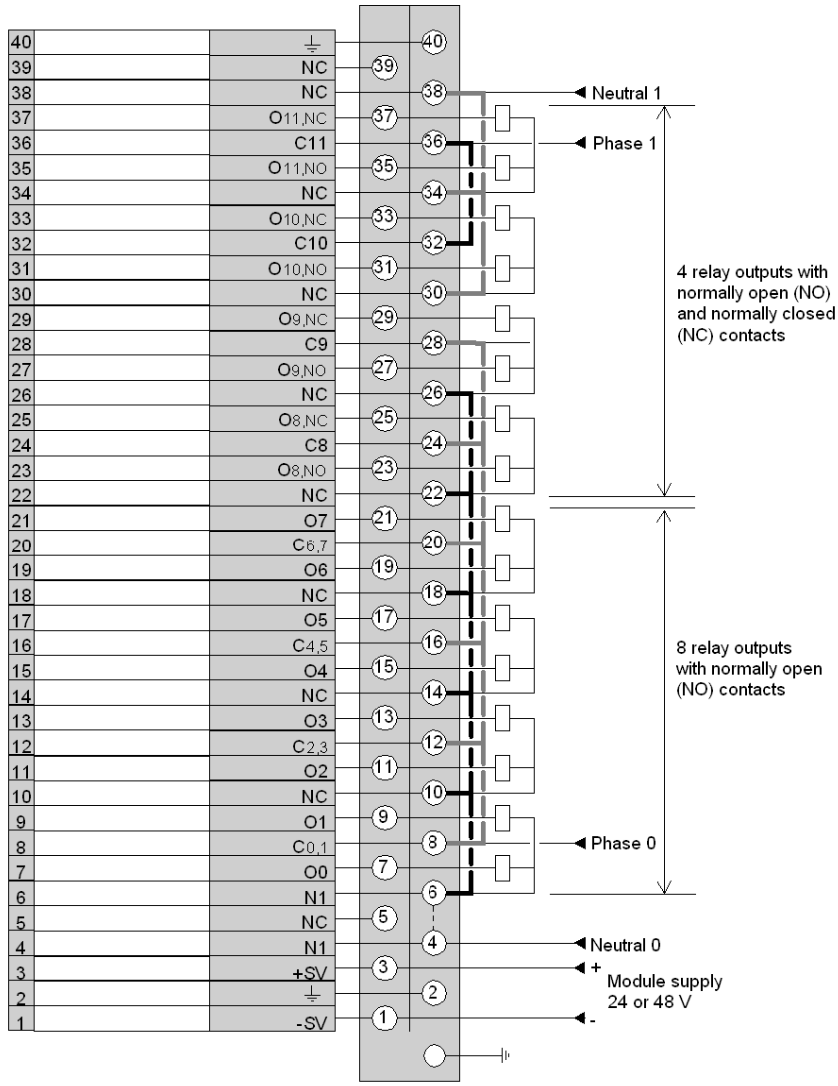
- outputs 0 to 9,
- outputs 10 to 11.

The NC terminals *(see page 133)* are not wired within the modules, but are used to distribute the power supply neutral to the various loads. For this purpose, use connecting combs, reference **TBX RV 015**.

A connecting comb is also used to connect the relay commons (C0,1, C2,3,...) with the supply phase.

NOTE: the 8 outputs 0 to 7 are relay outputs with one N/O contact.
The 4 outputs 8 to 11 are relay outputs with a one N/O contact and one N/C contact.

The following diagram illustrates the wiring of the terminal.



NOTE: the two N1 terminals *(see page 133)* are connected together internally.

Chapter 25
The TBX DES 16S04 distributed input module

Subject of this chapter

This chapter presents the **TBX DES 16S04** module, its characteristics and terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DES 16S04 module

General

The **TBX DES 16S04** is a modular base unit comprising 16 120 V AC inputs, compatible with 2 wire CENELEC proximity sensors. The module is equipped with a terminal block for direct wiring of the sensors, which can be removed when it is switched off.

The sensor voltage is monitored to ensure that there is sufficient voltage for the inputs to operate correctly.

The inputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Technical specifications

The following table provides the technical specifications of the module.

TBX DES 16S04	
Nominal voltage	120 V AC
Supply voltage	93 at 132 V AC
Current drawn for the module power supply	60 mA typically
Current drawn for the sensor supply (loading 60 %)	70 mA typically
Power dissipated at nominal load in the module (loading 60 %)	6 W
Dielectric strength between inputs and ground (GND)	1500 V rms - 50/60 Hz for 1 min
Isolation resistance	> 10 MΩ below 500 V DC

Characteristics of the inputs of module TBX DES 16S04

General characteristics

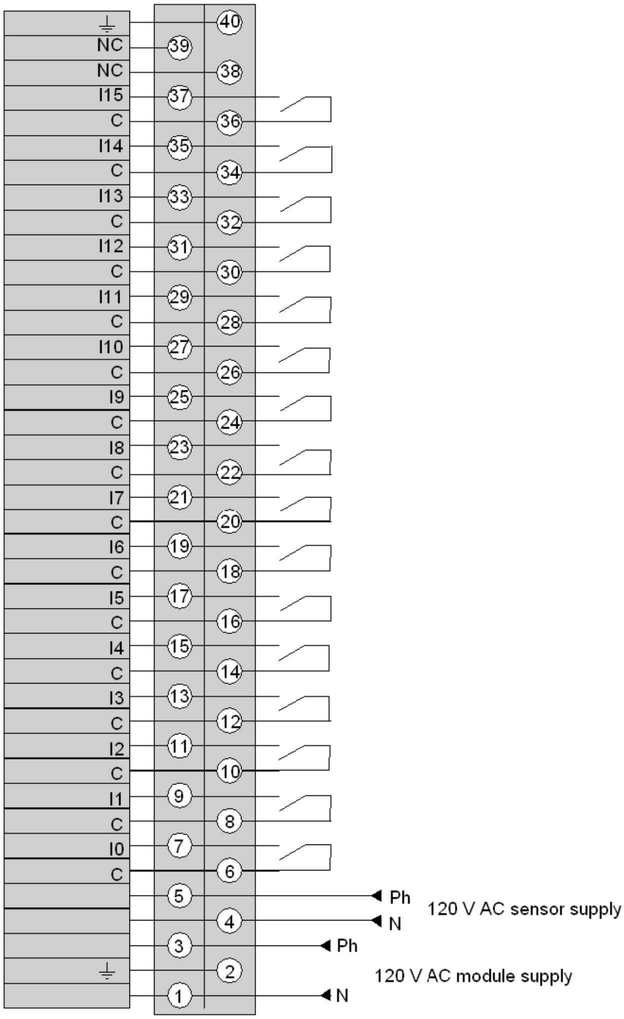
This table presents the characteristics of the inputs of module **TBX DES 16S04**:

Module TBX DES 16S04	
Nominal voltage	120 V AC
Nominal current	15 mA
Sensor power supply	93 at 132 V AC
Voltage for ON state	> 74 V
Current at 74 V	6 mA
Voltage for OFF state	< 20 V
Current for OFF state	< 4 mA
Input impedance	10 kΩ
Switch-on time (change from 0 to 1)	5 ms
Switch-off time (change from 1 to 0)	5 ms
IEC standard 1131	Type 2
Compatibility with CENELEC 3 wire proximity sensors	Yes
Type of input	Capacitive
Type of logic	Positive
Sensor common	At the supply phase

Connecting the module TBX DES 16S04

Terminal block wiring

The following diagram illustrates the wiring (see page 133) of the terminal.



Chapter 26
The TBX DMS 16S44 distributed input/output module

Subject of this chapter

This chapter presents the **TBX DMS 16S44** module, its characteristics and terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX DMS 16S44 module

General

The **TBX DMS 16S44** is a modular base unit comprising 8 120 V DC inputs, compatible with 2 wire CENELEC proximity sensors and 8 120 VA triac outputs. The module is equipped with a terminal block for direct wiring of the sensors and preactuators, which can be removed when it is switched off.

The sensor voltage and preactuator voltage are monitored to ensure that there is sufficient voltage for the inputs to operate correctly and for coherent processing of the outputs.

The inputs of this module have functions *(see page 320)* which, in certain cases, are common to a group of channels. Thus, it is possible to assign the 2 channel groups of the module to the various tasks in the application.

Technical specifications

The following table provides the technical specifications of the module.

TBX DMS 16S44	
Nominal voltage	120 V AC
Supply voltage	93 at 132 V AC
Nominal frequencies	50 / 60 Hz
Frequency range	47 to 63 Hz
Current drawn for the module power supply	60 mA typically
Current drawn for the sensor supply (loading 60 %)	75 mA typically
Power dissipated at nominal load in the module (loading 60 %)	6 W
Dielectric strength between inputs and ground (GND)	1500 V rms - 50/60 Hz for 1 min
Isolation resistance	> 10 MΩ below 500 V DC

Characteristics of the inputs/outputs of module TBX DMS 16S44

General characteristics of the inputs

This table presents the characteristics of the inputs of module **TBX DMS 16S44**:

Module TBX DMS 16S44	
Nominal voltage	120 V AC
Nominal current	15 mA
Sensor power supply (including ripple)	93 at 132 V AC
Voltage for ON state	>74 V
Current at 74 V	6 mA
Voltage for OFF state	< 20 V
Current for OFF state	< 4 mA
Input impedance	10 kΩ
Switch-on time (change from 0 to 1)	5 ms
Switch-off time (change from 1 to 0)	5 ms
Permitted line resistance (2 wire proximity sensor)	< 100 Ω
Permitted line resistance (volt-free contact)	< 500 Ω
Permitted leakage resistance (2 wire proximity sensor)	> 100 Ω
Permitted leakage resistance (volt-free contact)	> 30 Ω
IEC standard 1131	Type 2
Compatibility with CENELEC 2 wire proximity sensors	Yes
Type of input	Capacitive
Type of logic	Positive
Sensor common	At the supply phase

General characteristics of the outputs

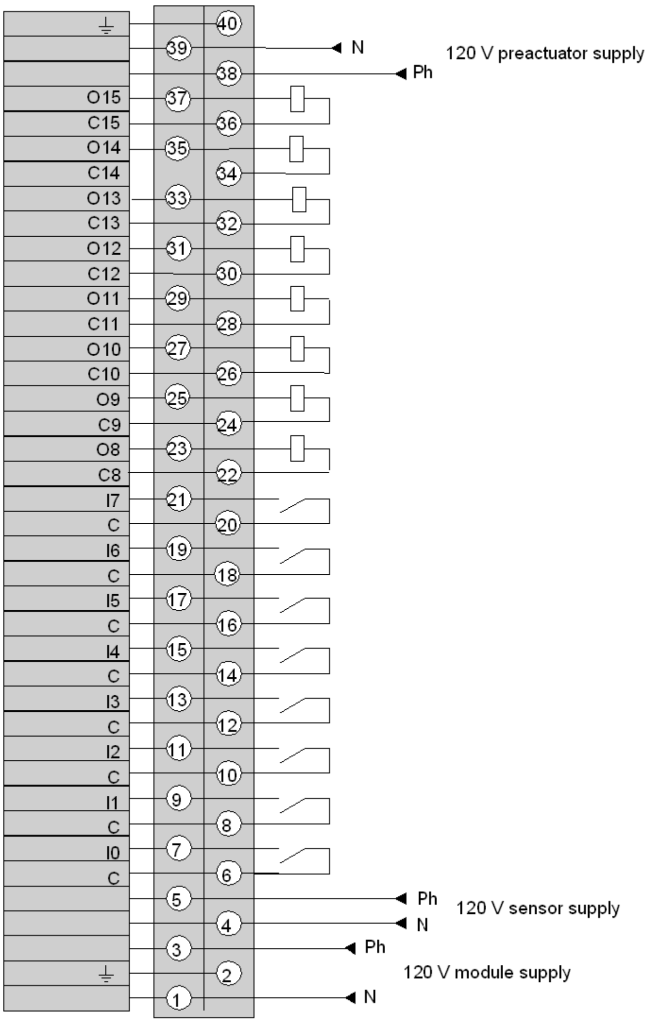
This table presents the characteristics of the outputs of module **TBX DMS 16S44**:

Module TBX DMS 16S44	
Nominal voltage	120 V AC
Nominal current at 25 °C	1 A
Frequency	50/60 Hz
Supply voltage limits	93 at 132 V AC
Current at 60 °C	0,5 A
Peak current at switch-on	12 A (1 cycle)
Voltage for ON state	> 80 V
Voltage for OFF state	< 20 V
Leakage current at OFF state	< 3 mA
Residual voltage at ON state	< 1,5 V
Switching time at ON state	≤ 80 ms
Switching time at OFF state	≤ 20 ms
Protection against overloads and short-circuits	Yes: internal fuse
Protection against inductive overvoltages	No, (provide an RC or GMOV)
Conforms to IEC 1131	Yes
Compatible with DC inputs	No
Type of logic	Positive
Sensor common	At the supply phase
Isolation between channels or groups of channels and internal bus	1500 V rms. 50 - 60 Hz

Connecting the module TBX DMS 16S44

Terminal block wiring

The following diagram illustrates the wiring (see page 133) of the terminal.



Chapter 27
The TBX AES 400 distributed input module

Subject of this chapter

This chapter presents the **TBX AES 400** module, its characteristics and terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX AES 400 module

General

The **TBX AES 400** base unit is an analog input module with 4 multirange isolated channels. It must be used with a **TBX LEP 030** communicator.

This module can provide each input with the following ranges:

- high level voltage,
- high level current,
- thermocouples (B,E,J,K,N,R,S,T),
- temperature probes (Pt100, Pt1000, Ni1000).

Technical specifications

The following table provides the technical specifications of the module.

TBX AES 400			
Supply voltage +SV		19,2 to 60 V	
Nominal voltage +SV		24 V	48 V
Current drawn at +SV by the AES used as a basic module (1)		130 mA typically 190 mA max.	75 mA typically 105 mA max.
Additional current drawn from a basic module when the AES module is used as an extension		negligible	
Current drawn at +SV by the AES used as an extension		130 mA typically 190 mA max.	75 mA typically 105 mA max.
Isolation	between channels	500 V rms - 50/60 Hz for 1 min	
	between channels and ground (GND)	500 V rms - 50/60 Hz for 1 min	
	between channel and supply	1500 V rms - 50/60 Hz for 1 min	
	between ground and supply	1500 V rms - 50/60 Hz for 1 min	
Permissible common mode voltage between channel and ground and between channels during operation		+ or - 100 V continuous or 75 Vrms.	
Key:			
(1)	In terms of consumption, do not forget to consider the current drawn at +SV by the **TBX LEP 030** communication module *(see page 38)* from the basic module.		

Characteristics of the inputs of module TBX AES 400

Specific characteristics: electrical range

This table presents the characteristics specific to the electrical ranges:

Electrical ranges (1)	+ or -10 V	+ or -5 V	0/20 mA 4/20 mA	+ or - 500 mV	+ or - 200 mV	+ or - 50 mV	+ or 20 mV
Full scale (FS)	10 V	5 V	20 mA	500 mV	200 mV	50 mV	20 mV
Typical error at 25 °C in % FS	0.05 %	0.05 %	0.13 % 0.16 %	0.05 %	0.05 %	0.11 %	0.13 %
Typical error at 60 °C in % FS	0.29 %	0.26 %	0.24 % 0.30 %	0.24 %	0.18 %	0.47 %	0.63 %
Key:							
(1)	The values cover the entire input dynamic range. They are valid 5 mins after switch-on of the assembly **TBX AES 400** and **TBX LEP 030** for the ranges 20 mV and 50 mV.						

Specific characteristics: thermocouple ranges

This table presents the characteristics specific to the thermocouple ranges:

Thermocouple range		B	E	J	K	N	R	S	T
Input dynamic (1)	°C	0/1802	-270/685	-210/895	-270/1266	-270/1300	-50/1697	-50/1769	-270/400
	°F	32/3276	-454/1265	-346/1643	-454/2310	-454/2372	-58/3086	-58/3216	-454/752
Typical error at 25 °C (2)	°C	2,0	1,0	1,2	1,3	1,2	1,4	1,5	2,0
	°F	3,6	1,8	2,2	2,4	2,2	2,5	2,7	1,8
Typical error at 60 °C (2)	°C	5,0	1,9	2,3	2,8	2,5	4,0	4,4	2,1
	°F	9,0	3,4	4,1	5,0	4,5	7,2	7,9	3,8
Key:									
(1)	The dynamic is expressed at an ambient temperature of 25 °C.								
(2)	The values include cold junction compensation. They are given for the middle of the range and in a preferential installation *(see page 293)*. They are guaranteed 15 mins after the **TBX AES 400** and **TBX LEP 030** have been powered up.								

Specific characteristics: temperature probe ranges

This table presents the characteristics specific to the temperature probe ranges:

Temperature probe range		Pt100	Pt1000	Ni1000
Input dynamic	°C	-200/850	-200/850	-60/250
	°F	-328/1562	-328/1562	-76/482
Typical error at 25 °C (1)	°C	1,2	1,2	0,5
	°F	2,2	2,2	0,9
Typical error at 60 °C (1)	°C	1,8	1,8	0,8
	°F	3,2	3,2	1,4
Current for temperature probe	500 µA direct			
Key:				
(1)	The values are given for the middle of the dynamic range.			

Common characteristics

This table presents the common characteristics of the inputs of module **TBX AES 400**:

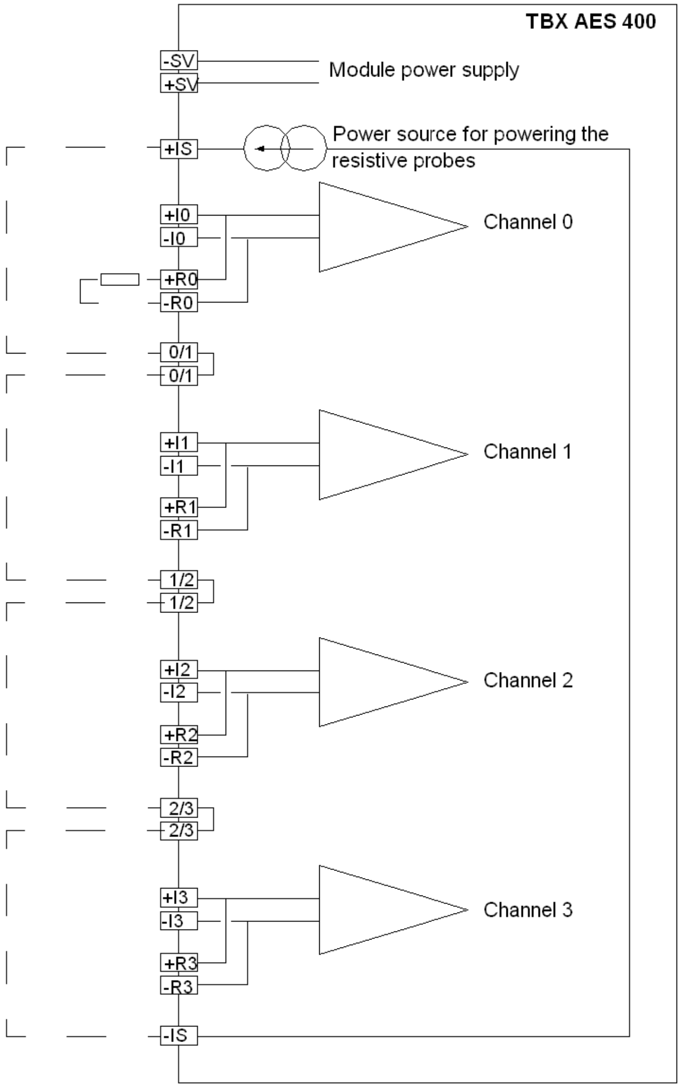
Module **TBX AES 400**			
Resolution		12 bits + sign	
Acquisition time of the 4 channels		400 ms (mode 50 Hz)	340 ms (mode 60 Hz)
Rejection 50/60 Hz	series mode	50 dB	
	common mode	> 90 dB for + or - 10 V	> 130 dB for + or - 20 mV
Type de conversion		Double ramp integration	
Input impedance		> 1,5 MΩ	
External resistance		250 Ω in parallel at input (for current range)	
Permissible overload	voltage	+ or - 30 V	
	current	+ or - 25 mA	
Digital filtering		Type de conversion	
Automatic		linearization	
Life cycle of relays		> 55000 hours in mode 50 Hz > 47000 hours in mode 60 Hz	

Maximum error		High level (1)	Low level (1)
	at 25 °C, in % FS (2)	0,23 %	0,90 %
	at 60 °C, in % FS (2)	0,99 %	1,69 %
Key:			
(1)	High level: ranges 10 V, 5 V, 0/20 mA, 4/20 mA, 500 mV, 200 mV, Low level: ranges 20 mV, 50 mV, B, E, J, K, N, R, S, T, Pt100, Pt1000 and Ni1000.		
(2)	Precision at low level covers the whole 20 mV, 50 mV range, the middle of the range for Pt100, Pt1000 and Ni1000, with any orientation, and the middle of the range for all thermocouples.		

Connecting the module TBX AES 400

Circuit diagram

The following illustration shows the circuit diagram for the module **TBX AES 400**.

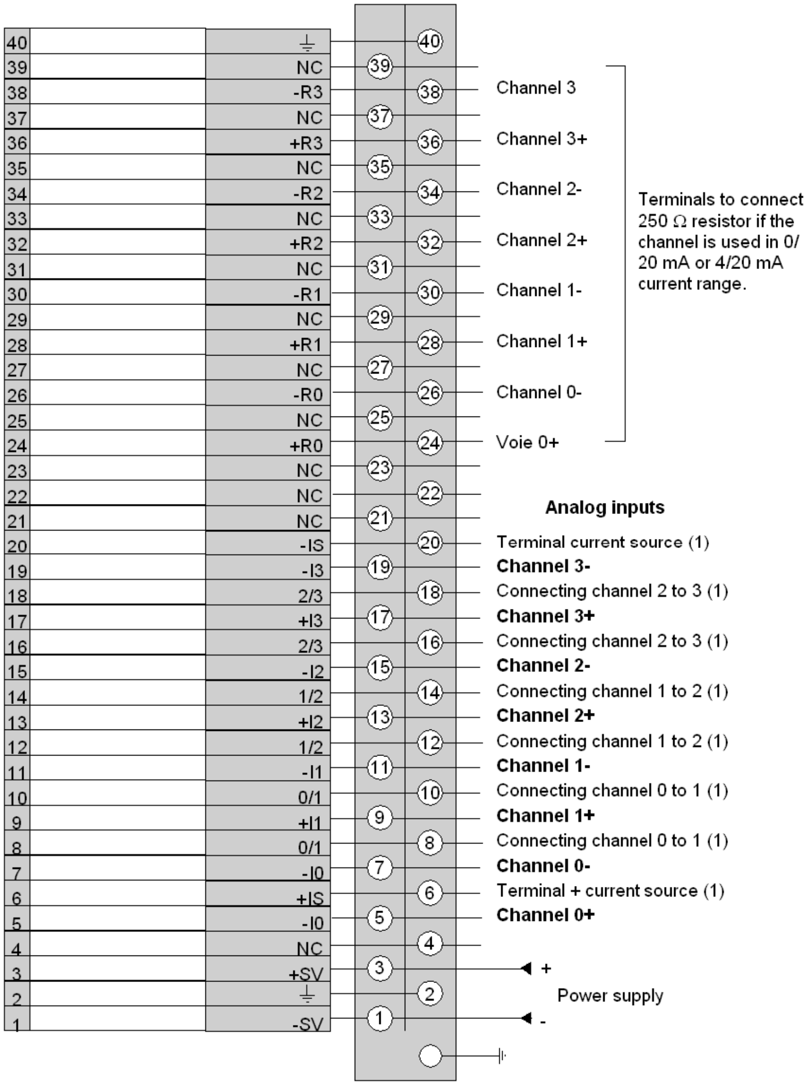


NOTE: the terminals + R• and - R• are a repetition of terminals + I• and - I• , and enable the shunt to be connected for the ranges 0..20 mA and 4..20 mA.

The terminals 0/1,1/2, 2/3 enable the daisy chaining of power supplies to resistive probes *(see page 290)* to be carried out. It is not essential to use them, however the current loop must be closed on -Is.

Terminal block wiring

The following diagram illustrates the wiring of the terminal. *(see page 133)*.

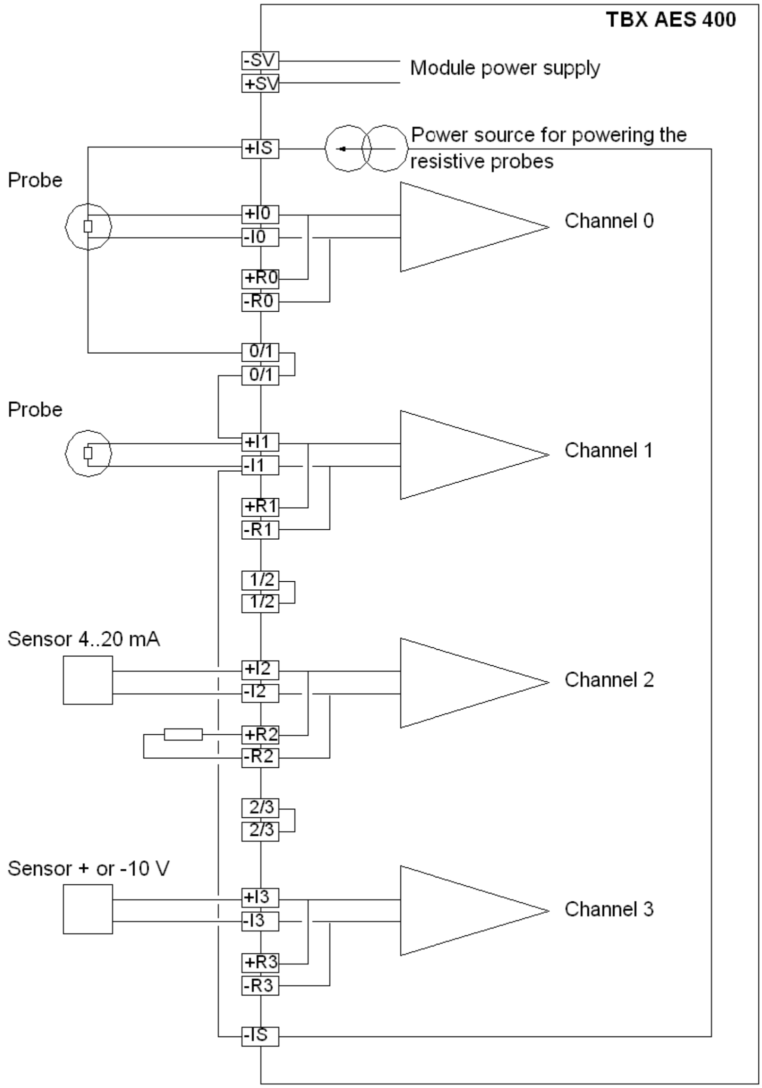


1 Inputs to be used for the wiring of temperature probes.

Wiring example for the TBX AES 400 module

Circuit diagram

The following illustration shows the circuit diagram for the module **TBX AES 400**.

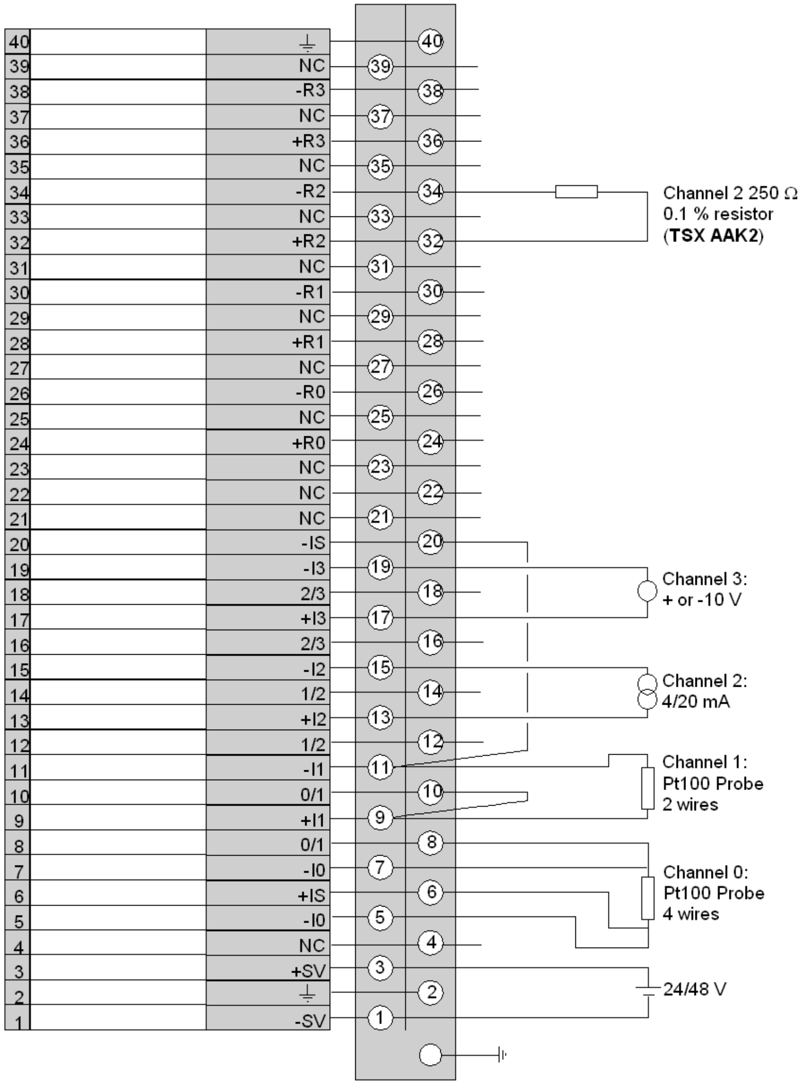


Terminal block wiring example

The following table shows the terminal block wiring example.

Terminal block wiring	
Channel 0	Pt 100, 4 wires
Channel 1	Pt 100, 2 wires
Channel 2	4/20 mA
Channel 3	+ or -10 V

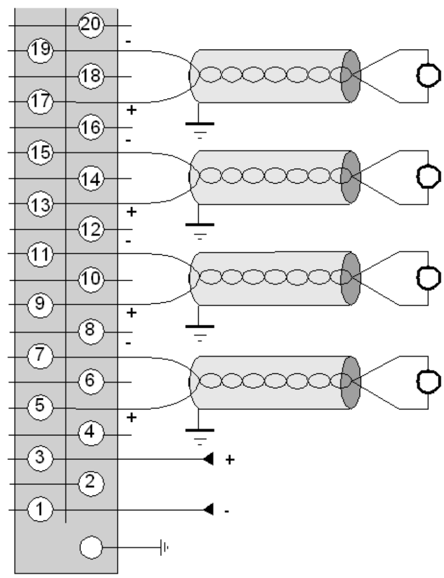
The following table shows the terminal block wiring *(see page 133)* example.



Wiring and installation recommendations for the model TBX AES 400

Wiring recommendations

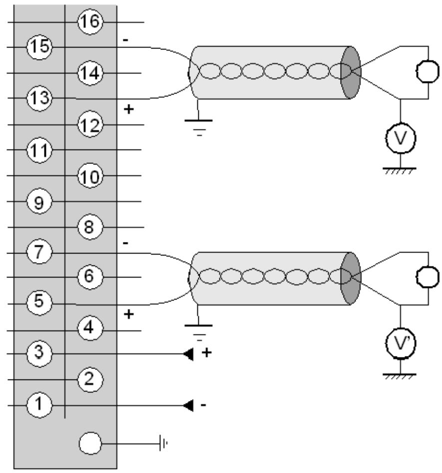
To protect the signal from induced external noise in serial mode and noise in common mode, it is advisable to take the following precautions regarding:

Precautions to take	
Type of conductors	Use screened twisted pairs, with a minimum conductor cross-section of 0.28 mm^2.
Cable screening	Connect the cable screening to the shortest TBX module ground on the **TBX GND 015** grounding strip.
Arrangement of the conductors in cables	Multipair cables can be rearranged for signals of a similar type which have the same reference to ground.
Cable routing	Keep the measurement wires separate from the discrete I/O cables (in particular from relay outputs) and from power cables.
Sensor reference to ground	The **TBX AES 400** has 4 inputs which are isolated from the PLC bus and from each other. This double isolation means that sensors of different voltages can be used. For safety reasons, a grounding network (15 MΩ//4.7 nF) is provided for each channel. This network causes a leakage current if the sensor is referenced to ground.
Sensor reference to ground (continued)	• Use of floating sensors (recommended mounting - with no reference to ground): an internal network for each channel grounds the cold points of the sensors. 

<table>
<tr><th colspan="3">Precautions to take</th></tr>
<tr>
<td>Sensor reference to ground
(continued)</td>
<td>

- Use of sensors referenced to ground:
If the following characteristics are respected, then each sensor can be assigned a voltage rate according to ground:
  - must be lower than the safety voltage
  - setting a reference voltage from a sensor point will cause a leakage current to be generated. If several analog TBX modules are used, measure the total leakage current and check that it will not interfere with the application. The RC grounding network has a value of 15 MΩ, 4.7 nF, for a 48 volt reference voltage, in relation to ground, with a current of 3.8 mA being created.

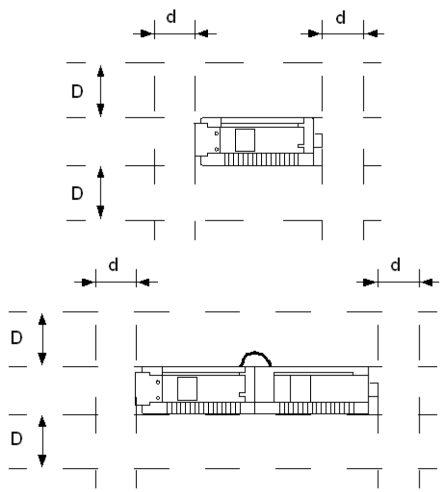
</td>
<td>

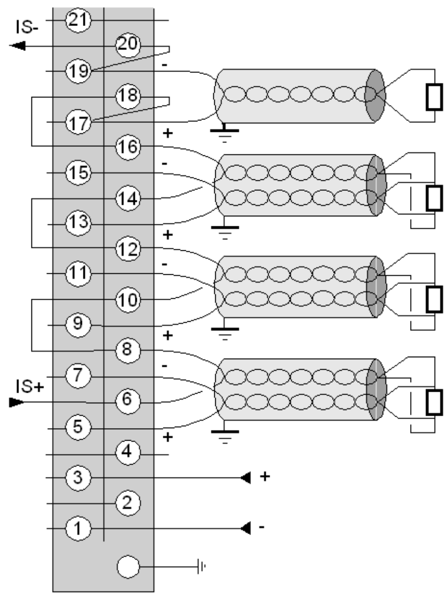


</td>
</tr>
</table>

Specific cases

The following table describes the precautions to be taken in the specific case of thermocouple, current, and temperature probe inputs.

<table>
<tr><th>Specific cases</th><th colspan="2">Precautions to take</th></tr>
<tr><td rowspan="3">Thermocouple inputs</td><td colspan="2">The thermocouple/terminal block connections must be carried out using compensation cables adapted to the type of thermocouple.</td></tr>
<tr><td>Preferential installations for thermocouple measurements are the following:
● standard convection with an ambient temperature gradient of < 5 °C/hour:
The TBX AES 400 will be mounted horizontally uninsulated as a base and/or as an extension with a minimum clearance of 150 mm in height (D) and 100 mm in width (d). The best results are obtained at an ambient temperature of 25 °C (see page 285). The module supply voltage must be 24 V DC.</td><td>
</td></tr>
<tr><td colspan="2">● standard or forced convection with an ambient temperature gradient of > 5 °C/hour:
the TBX AES 400 will be horizontally mounted as a base in an AC1-GV 263016 enclosure. The guaranteed performances are the same as in the case for standard convection with an ambient temperature gradient of < 5 °C/hour.
The module supply voltage must be 24 V DC.</td></tr>
<tr><td>Current inputs</td><td colspan="2">When the input signal is a current of 0/20 mA or 4/2 0mA, it is necessary to connect a resistance of 250 Ω - 0.1 % - 1/2 Ω - 25 ppm / °C (TSX AAK2 : packs of 4 resistors) to terminals R+ and R- which are assigned to the channel.</td></tr>
</table>

Specific cases	Precautions to take	
Temperature probe inputs	2 or 4 wire temperature probes may be used. For Pt100 2 wire probes, the probe can be at a distance of 2.50 m without affecting the measurement (1) if cables with a 2 mm^2 cross-section are used. For Pt1000/Ni1000 2 wire probes, the probe can be at a distance of 25 m without affecting the measurement (1) if cables with a 2 mm^2 cross-section are used.	
	Note: the current source is common to all temperature probes which are then mounted in series. The diagram opposite shows how the connecting terminals facilitate 4 wire wiring. A fault in the wiring of the current source or in one of the temperature probes will lead to there being a fault on all the channels, which will be seen as a sensor connection fault *(see page 374)*.	Channels 0, 1 and 2: 4-wire Pt100 probe. Channel 3: 2-wire Pt100 probe. 
Key:		
(1)	Beyond this, the wire resistance systematically causes an error which can be corrected by the sensor alignment procedure *(see page 378)*.	

⚠ CAUTION

DEGRADATION OF PERFORMANCES

Any use which does not respect the **thermocouple input** recommendations (orientation, ambience, module power supply) will result in a degradation of performances of the **TBX AES 400**. However, in stable ambient temperature conditions, it is possible to reduce error by carrying out a sensor alignment *(see page 378)*.

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

Chapter 28
The TBX ASS 200 distributed output module

Subject of this chapter

This chapter presents the **TBX ASS 200** module, its characteristics and the terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX ASS 200 module

General

The **TBX ASS 200** base unit is an analog output module which has 2 isolated channels. It must be used with a **TBX LEP 030** communicator.

This module can provide each output with the following ranges:

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

Technical specifications

The following table provides the technical specifications of the module.

<table>
<tr><th colspan="4">TBX AMS 200</th></tr>
<tr><td colspan="2">Supply voltage +SV</td><td colspan="2">19,2 V DC to 60 V DC</td></tr>
<tr><td colspan="2">Nominal voltage +SV</td><td>24 V DC</td><td>48 V DC</td></tr>
<tr><td colspan="2">Current drawn at +SV by the ASS used as a basic module (1)</td><td>180 mA typically
257 mA max.</td><td>92 mA typically
132 mA max.</td></tr>
<tr><td colspan="2">Additional current drawn from a basic module when the ASS module is used as an extension</td><td>15 mA typically
23 mA max.</td><td>8 mA typically
12 mA max.</td></tr>
<tr><td colspan="2">Current drawn at +SV by the ASS used as an extension</td><td>162 mA typically
202 mA max.</td><td>84 mA typically
104 mA max.</td></tr>
<tr><td rowspan="3">Isolation</td><td>between channels</td><td colspan="2">1500 V rms - 50/60 Hz for 1 min</td></tr>
<tr><td>between channels and ground (GND)</td><td colspan="2">1500 V rms - 50/60 Hz for 1 min</td></tr>
<tr><td>between channel and supply</td><td colspan="2">1500 V rms - 50/60 Hz for 1 min</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td colspan="4">Key:</td></tr>
<tr><td>(1)</td><td colspan="3">In terms of consumption, do not forget to consider the current drawn at +SV by the TBX LEP 030 communication module (see page 38) from the basic module.</td></tr>
</table>

Characteristics of the outputs of module TBX ASS 200

General characteristics

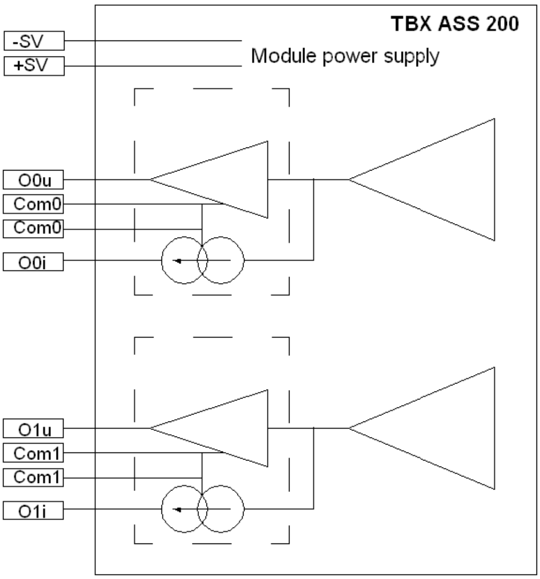
This table presents the characteristics of the outputs of module **TBX ASS 200**:

Module **TBX ASS 200**			
Number of channels		2	
Range		+ or -10V	0/20 mA 0/40 mA
Full scale (FS)		10 V	20 mA
Resolution		11 bits + sign	11 bits
LSB		4,88 mV	9,76 µA
Load impedance		≥ 1 kΩ	≤ 600 Ω
Maximum error	at 25 °C	0,45 % FS	0,52 % FS
	at 60 °C	0,75 % FS	0,98 % FS
Maximum drift		65 ppm (PE) / °C	103 ppm (PE) / °C
Update period		5 ms	
Continuous overvoltage		+ or - 30 V	
Monotonicity		Yes	
Maximum leakage current		-	50 µA (0/20 mA)

Connecting the module TBX ASS 200

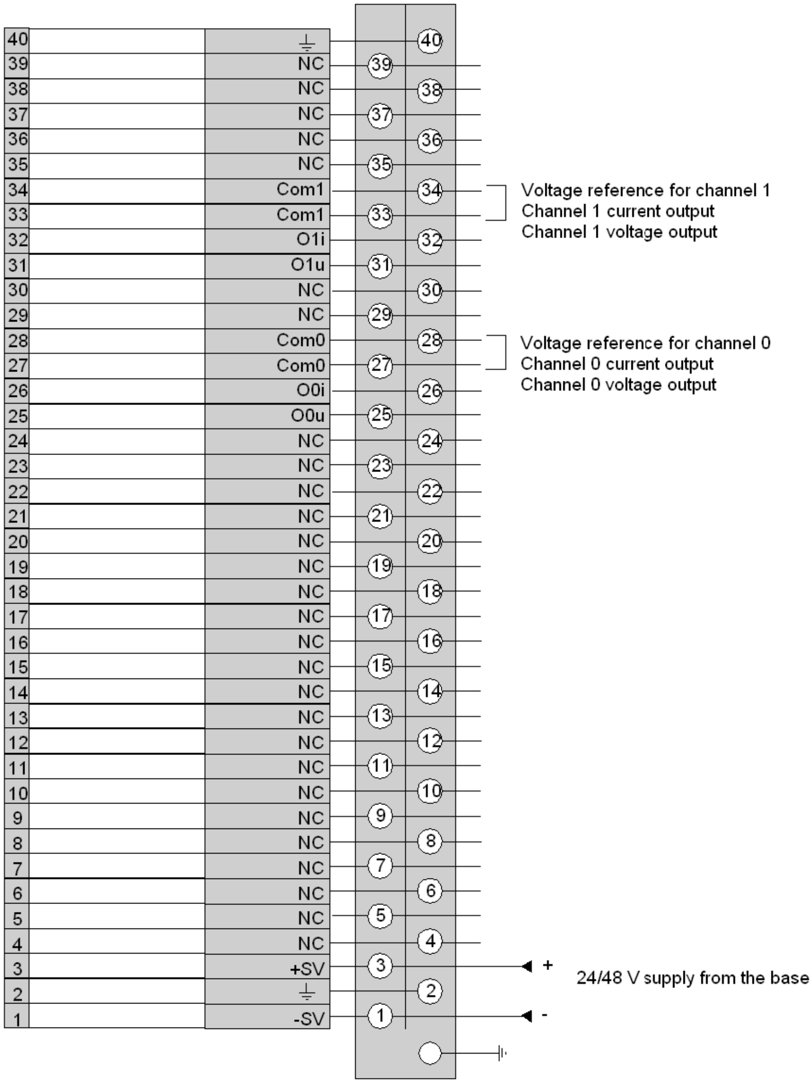
Circuit diagram

The following illustration shows the circuit diagram for the module **TBX ASS 200**.



Terminal block wiring

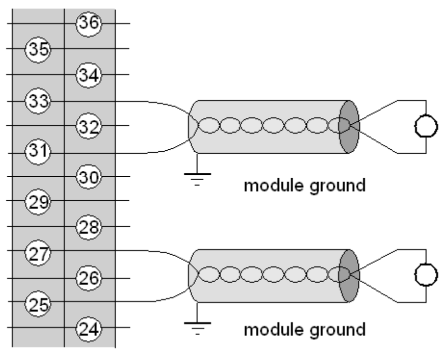
The following diagram illustrates the wiring of the terminal. *(see page 133)*.



Wiring and installation recommendations for the model TBX ASS 200

Wiring recommendations

To protect the signal from induced external noise in serial mode and noise in common mode, it is advisable to take the following precautions regarding:

<table>
<tr><th colspan="3">Precautions to take</th></tr>
<tr><td>Type of conductors</td><td colspan="2">Use screened twisted pairs, with a minimum conductor cross-section of 0.28 mm^2.</td></tr>
<tr><td>Cable screening</td><td colspan="2">Connect the cable screening to the shortest TBX module ground on the TBX GND 015 grounding strip.</td></tr>
<tr><td>Arrangement of the conductors in cables</td><td colspan="2">Multipair cables can be rearranged for signals of a similar type which have the same reference to ground.</td></tr>
<tr><td>Cable routing</td><td colspan="2">Keep the measurement wires separate from the discrete I/O cables (in particular from relay outputs) and from power cables.</td></tr>
<tr><td rowspan="2">Preactuator reference to ground</td><td colspan="2">Note: There are no technical restrictions in referencing the preactuators to ground. However, for safety reasons, it is advisable to avoid using a ground voltage which is some distance from the terminal, as this ground voltage may be very different from the nearby ground voltage. Distributed I/O modules minimize this risk as they are usually close to the process.</td></tr>
<tr><td>Recommended voltage and current wiring: It is recommended to use preactuators with no reference to ground.</td><td>channel 0 (voltage)
channel 1 (current)

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

Chapter 29
The TBX AMS 620 distributed input/output module

Subject of this chapter

This chapter presents the **TBX AMS 620** module, its characteristics and terminal wiring.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the TBX AMS 620 module

General

The module **TBX AMS 620** is a module with 6 non-isolated high level analog inputs and 2 isolated outputs. It must be used with a **TBX LEP 030** communicator. This module can be used as a basic module or as an extension.

This module can provide each input with the following ranges:

- high level voltage: 0/5 V -10 V,
- high level current: 0/20 mA and -4/20 mA,

and the inputs on this module have the following ranges:

- high level voltage: 10 V,
- high level current: 0/20 mA and -4/20 mA.

Technical specifications

The following table provides the technical specifications of the module.

TBX AMS 620			
Supply voltage +SV		19,2 to 60 V	
Nominal voltage +SV		24 V	48 V
Current drawn at +SV by the AMS used as a basic module (1)		224 mA typically 321 mA max.	114 mA typically 164 mA max.
Additional current drawn from a basic module when the AMS module is used as an extension		59 mA typically 87 mA max.	30 mA typically 44 mA max.
Current drawn at +SV by the AMS used as an extension		162 mA typically 202 mA max.	84 mA typically 104 mA max.
Isolation	between input channels	non isolated	
	between output channels	500 V rms - 50/60 Hz for 1 min	
	between channels and ground (GND)	500 V rms - 50/60 Hz for 1 min	
	between channel and supply	1500 V rms - 50/60 Hz for 1 min	
Permissible common mode voltage between channel and ground and between channels during operation		150 V rms - 50/60 Hz for 1 min	
Key:			
(1)	In terms of consumption, do not forget to consider the current drawn at +SV by the **TBX LEP 030** communication module *(see page 38)* from the basic module.		

Characteristics of the outputs of module TBX AMS 620

General characteristics of the inputs

This table presents the characteristics of the inputs of module **TBX AMS 620**:

<table>
<tr><td colspan="6">Module TBX AMS 620</td></tr>
<tr><td colspan="2">Number of channels</td><td colspan="4">6</td></tr>
<tr><td colspan="2">Electrical range</td><td>+ or -10 V</td><td>0/5 V</td><td>0/20 mA</td><td>4/20 mA</td></tr>
<tr><td colspan="2">Full scale (FS)</td><td>10 V</td><td>5 V</td><td>20 mA</td><td>20 mA</td></tr>
<tr><td colspan="2">Resolution</td><td>11 bits + sign</td><td>12 bits</td><td>12 bits</td><td>12 bits</td></tr>
<tr><td colspan="2">LSB</td><td>5,13 mV</td><td>1,30 mV</td><td>4,97 µA</td><td>4,97 µA</td></tr>
<tr><td colspan="2">Converter</td><td colspan="4">by successive approximation</td></tr>
<tr><td rowspan="2">Maximum error</td><td>at 25 °C</td><td>0,2 % FS</td><td>0,15 % FS</td><td>0,25 % FS</td><td>0,25 % FS</td></tr>
<tr><td>at 60 °C</td><td>0,26 % FS</td><td>0,22 % FS</td><td>0,43 % FS</td><td>0,43 % FS</td></tr>
<tr><td colspan="2">Temperature drift</td><td>20 ppm (FS) °C</td><td>15 ppm (FS) °C</td><td>40 ppm (FS) °C</td><td>40 ppm (FS) / °C</td></tr>
<tr><td colspan="2">Impedance</td><td>10 MΩ</td><td>10 MΩ</td><td>250 MΩ</td><td>250 MΩ</td></tr>
<tr><td rowspan="2">Time to read</td><td>one channel</td><td colspan="4">5,3 ms</td></tr>
<tr><td>6 channels</td><td colspan="4">42.4 ms</td></tr>
<tr><td rowspan="2">Permissible overload</td><td>voltage</td><td colspan="4">+ or -30 V DC (voltage range)</td></tr>
<tr><td>current</td><td colspan="4">30 mA ; + or -7.9 V (current range)</td></tr>
<tr><td colspan="2">Digital filtering</td><td colspan="4">1° order with configurable time constant</td></tr>
<tr><td colspan="2">Linearization</td><td colspan="4">automatic</td></tr>
<tr><td colspan="2">Monotonocity</td><td colspan="4">Yes</td></tr>
</table>

General characteristics of the outputs

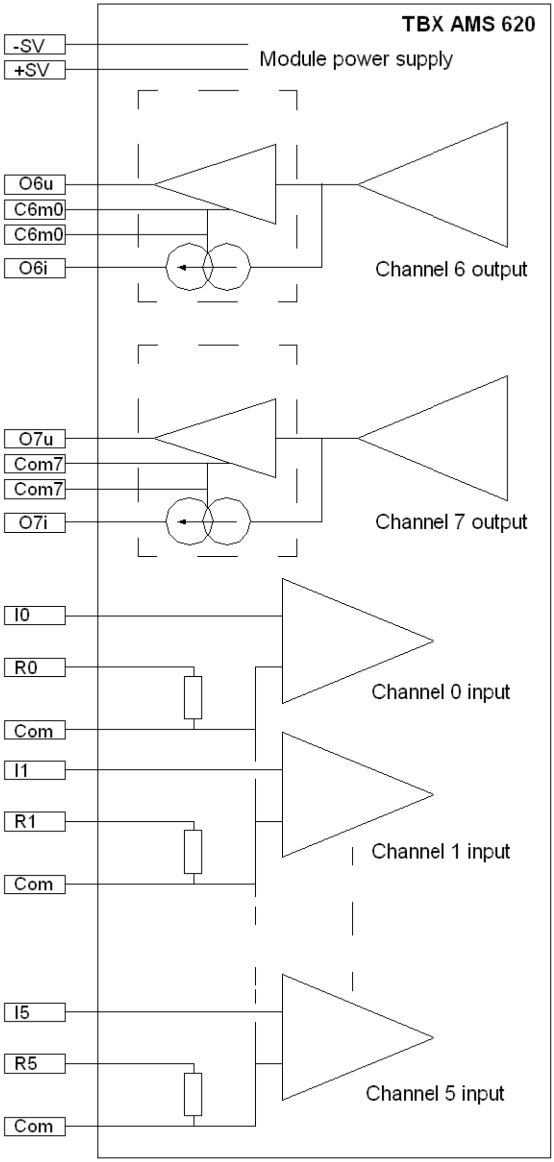
This table presents the characteristics of the outputs of module **TBX AMS 620**:

Module **TBX AMS 620**			
Number of channels		2	
Range		+ or -10V	0/20 mA 0/40 mA
Full scale (FS)		10 V	20 mA
Resolution		11 bits + sign	11 bits
LSB		4,88 mV	9,76 µA
Load impedance		≥ 1 kΩ	≤ 600 Ω
Maximum error	at 25 °C	0,45 % FS	0,52 % FS
	at 60 °C	0,75 % FS	0,98 % FS
Maximum drift		65 ppm (FS) / °C	103 ppm (FS) / °C
Update period		5 ms	
Continuous overvoltage		+ or - 30 V	
Monotonicity		Yes	
Maximum leakage current		-	50 µA (0/20 mA)

Connecting the module TBX AMS 620

Circuit diagram

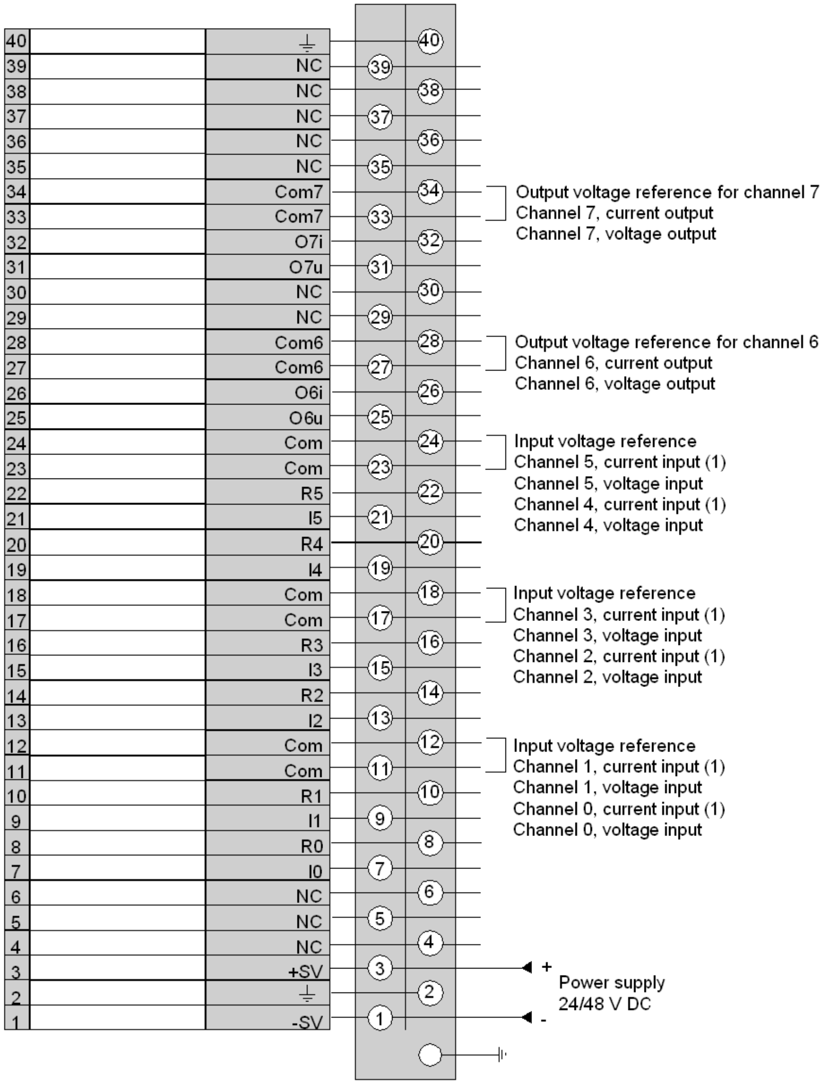
The following illustration shows the circuit diagram for the module **TBX AMS 620**.



NOTE: to use an input channel in current, the I and R terminals must be connected to the channel concerned.
All terminals referenced COM are connected in the module interior.

Terminal block wiring

The following diagram illustrates the wiring of the terminal. *(see page 133)*.



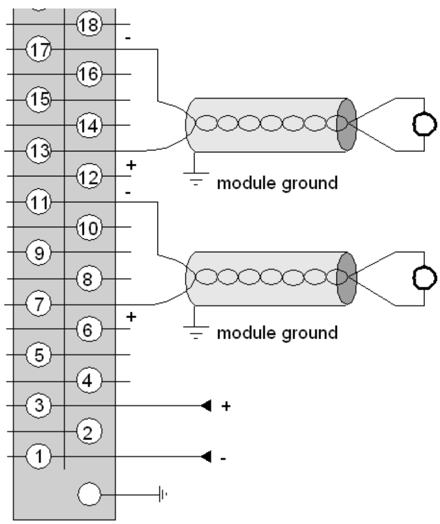
1 The current-voltage conversion resistances are incorporated in the base unit (and therefore require no external resistance).

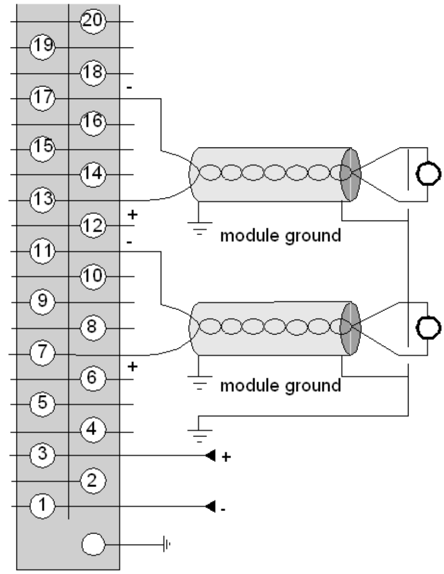
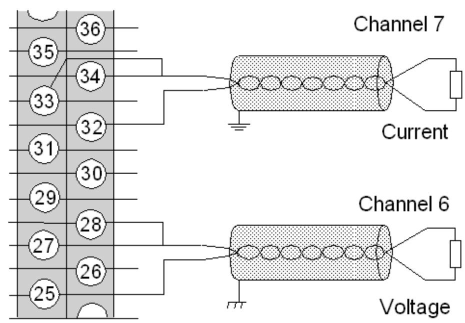
Wiring and installation recommendations for the model TBX AMS 620

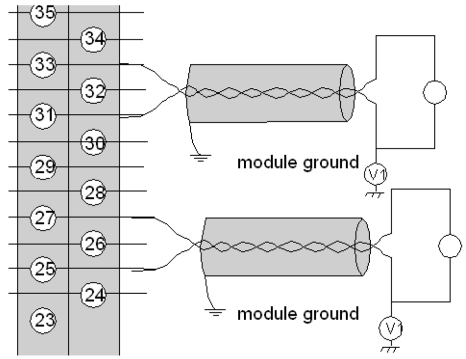
Wiring recommendations

To protect the signal from induced external noise in serial mode and noise in common mode, it is advisable to take the following precautions regarding:

Precautions to take	
Type of conductors	Use screened twisted pairs, with a minimum conductor cross-section of 0.28 mm^2.
Cable screening	Connect the cable screening to the shortest TBX module ground on the **TBX GND 015** grounding strip.
Arrangement of the conductors in cables	Multipair cables can be rearranged for signals of a similar type which have the same reference to ground.
Cable routing	Keep the measurement wires separate from the discrete I/O cables (in particular from relay outputs) and from power cables.
Preactuator and sensor reference to ground	The **TBX AMS 620** module has 6 inputs which are not isolated from each other but which are isolated from the PLC bus, and 2 outputs which are isolated from each other and from the PLC bus. The sensor cold points are connected to each other internally by the Com terminals. To ensure good immunity to high frequency interference, a 4.7 nF capacitor is connected between the channel voltage and the ground. To ensure correct operation of the analog measurement system, the following precautions must be taken: ● The sensors must be in close proximity to each other (several meters apart). ● All sensors must be referenced at the same point. This point is then connected to the terminal ground. **Note**: There are no technical restrictions in referencing the preactuators to ground. However, for safety reasons, it is advisable to avoid using a ground voltage which is some distance from the terminal, as this ground voltage may be very different from the nearby ground voltage. Distributed I/O modules minimize this risk as they are usually close to the process.



Precautions to take		
Sensor reference to ground	If the following characteristics are respected, then each sensor can be assigned a voltage rate according to ground: ● The sensors must be in close proximity to each other (several meters apart). ● all sensors are referenced to the same point. This point is then connected to the COM terminal on the terminal block.	
Preactuator reference to ground	● Recommended voltage and current wiring: It is advisable to use preactuators which are not referenced with respect to ground, with each channel reference being connected to the ground via a 4.7 nF capacitor.	

Precautions to take		
Preactuator reference to ground (cont.)	• Possible voltage wiring: The preactuators can be referenced to ground if the modules have voltage outputs and if the following precautions are taken: ❍ The common mode voltages must be below the safety voltage (48 V peak), ❍ Connecting a point in the preactuator to a reference voltage causes a leakage current to be generated. If several analog modules are used, measure the total leakage current and check that it will not interfere with the application.	

Part II
Software Installation of Remote Discrete Input/Output Modules on the Fipio Bus

Subject of this Part

This part presents the Discrete input/output TBX modules, and describes their installation using Control Expert software.

What Is in This Part?

This part contains the following chapters:

Chapter 30
General Introduction to the Discrete Application -Specific Function Applied to Remote TBX Modules

Overview

Introduction

The software installation for the modules is carried out from the various Control Expert editors:

- In offline mode,
- In online mode.

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

Installation Phases with Processor

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

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

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

Chapter 31
Discrete Application Configuration

Subject of this Chapter

This chapter describes the Configuration aspect of the installation of the Discrete application applied to remote TBX modules.

What Is in This Chapter?

This chapter contains the following sections:

Section 31.1
Configuration of a Remote TBX Input/Output Module: General

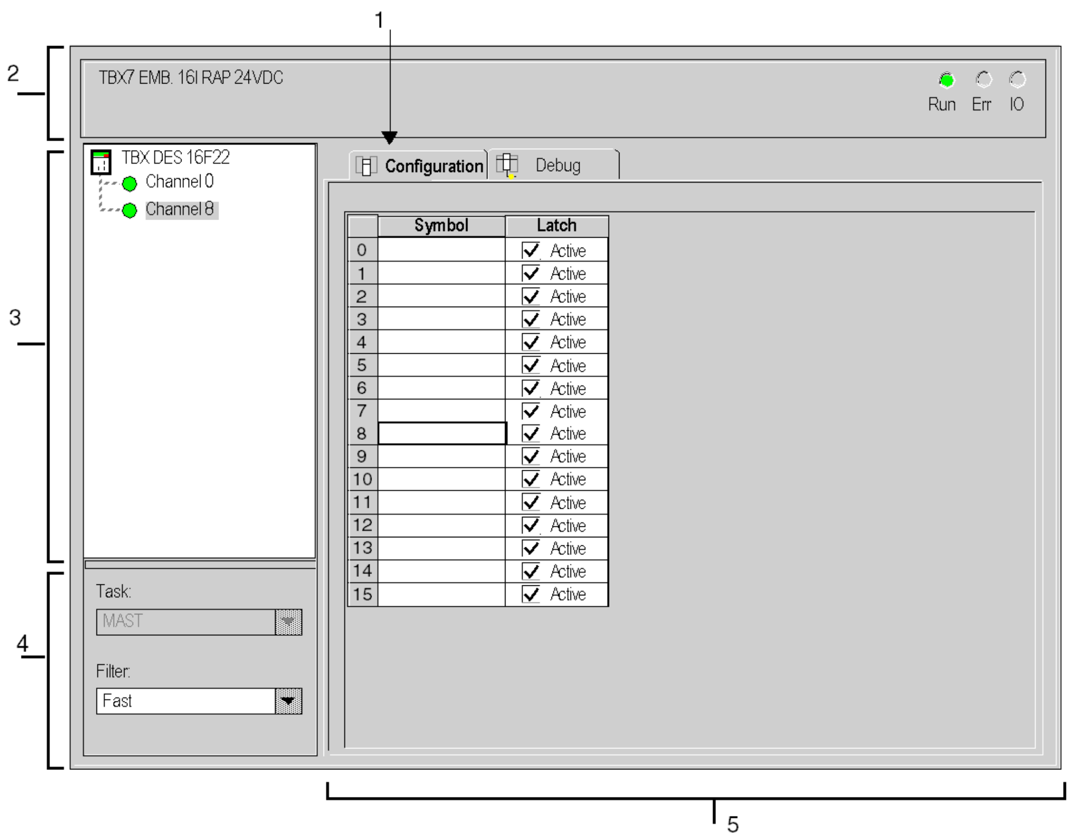
Description of the Discrete Remote Module Configuration Screen

At a Glance

The module configuration screen, selected on the Fipio bus, displays the parameters associated with the Discrete input or output channels

Illustration

The figure below represents a configuration screen.



Description

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

Number	Element	Function
1	Tabs	The tab in the foreground indicates the mode in progress (**Configuration** in this example). Every mode can be selected using the respective tab. The available modes are: ● **Configuration**, ● **Debugging**, accessible only in online mode.
2	**Module** area	Gives a reminder of the device's shortened name.
3	**Channel** area	Is used: ● By clicking on the reference number, to display the tabs: ❍ **Description** which gives the characteristics of the device. ❍ **I/O Objects** *(see EcoStruxure™ Control Expert, Operating Modes)* which is used to presymbolize the input/output objects. ❍ **Fault**, which shows the device faults (in online mode only). ● By clicking on the **Channel**, to select the channel or group of channels (maximum 8) to configure. To the right of the **Channel** is the **Symbol**. This is the name of the channel defined by the user (using the variable editor).
4	**General parameters** area	This area is used to define the task (**MAST** or **FAST**) in which the channel implicit exchange objects will be exchanged. According to the type of Fipio device configured, it is also possible to adjust: ● The channel filtering, ● The fallback mode, ● The reactivation.
5	**Configuration** area	This area is used to set up the devices.

Section 31.2
Discrete Input/Output Channel Parameters

Subject of this Section

This section introduces the different input and output channel parameters of remote input/output TBX modules.

What Is in This Section?

This section contains the following topics:

Parameters of the Remote TBX Discrete Inputs on the Fipio Bus

At a Glance

The Discrete TBX inputs on the Fipio bus feature parameters for each channel, each group of 8 channels, or for all channels.

Parameters

The table below shows the parameters available for each TBX discrete input module.

Module reference	No. of inputs	Associated task (for the module)	Filtering	Latching (per channel)	Wire test (per channel)
TBX CEP 1622	16	**Mast** / Fast	-	-	-
TBX DES 1622	16	**Mast** / Fast	-	-	-
TBX DES 1633	16	**Mast** / Fast	-	-	-
TBX EEP 1622	16	**Mast** / Fast	-	-	-
TBX DMS 1025	8 (inputs)	**Mast** / Fast	-	-	-
TBX DMS 1625	8 (inputs)	**Mast** / Fast	-	-	-
TBX DES 16S04	16	**Mast** / Fast	-	-	-
TBX DMS 16S44	(1)	**Mast** / Fast	-	-	-
TBX DMS 16P22	8 (inputs)	**Mast** / Fast	-	-	-
TBX DES 16C22	16	**Mast** / Fast	-	-	**Active** / Inactive (2)
TBX EEP 08C22	16	**Mast** / Fast	-	-	**Active** / Inactive (2)
TBX DMS 16C22	8	**Mast** / Fast	-	-	**Active** / Inactive (2)
TBX DMS 16C222	8	**Mast** / Fast	-	-	**Active** / Inactive (2)
TBX DES 16F22	16	**Mast** / Fast	**Normal** / Fast	**Active** / Inactive (2)	-
Legend:					
(1)	8 input channels + 8 programmable input/output channels.				
(2)	Check box.				

NOTE: Parameters in bold correspond to the parameters configured by default.

Parameters of the Remote 8-, 10- or 12-Channel TBX Discrete Outputs on the Fipio Bus

At a Glance

The 8-, 10- or 12-channel Discrete TBX output modules feature parameters for each channel, each group of 8 channels, or for all channels.

Parameters

The table below shows the parameters available for each remote 8-, 10- or 12-channel TBX Discrete output module on the Fipio bus.

Module reference	No. of outputs	Associated task (for the module)	Reset (group of 8 channels)	Fallback mode (group of 8 channels)	Fallback value (per channel)	Wire test (per channel)
TBX ESP 08C22	8	**Mast** / Fast	**Automatic**/ Programmed	**Fallback** / Maintain	**0** / 1	**Active** / Inactive (1)
TBX DSS 1235	12	**Mast** / Fast	-	**Fallback** / Maintain	**0** / 1	-
TBX DMS 1025	2 (outputs)	**Mast** / Fast	-	**Fallback** / Maintain	**0** / 1	-
Legend:						
(1)	Check box.					

NOTE: Parameters in bold correspond to the parameters configured by default.

Parameters of the Remote 16-Channel TBX Discrete Outputs on the Fipio Bus

At a Glance

The 16-channel Discrete TBX output modules feature parameters for each channel, each group of 8 channels, or for all channels.

Parameters

The table below shows the parameters available for each remote 16-channel TBX Discrete output module on the Fipio bus.

Module reference	No. of outputs	Associated task (for the module)	Reset (group of 8 channels)	Fallback mode (group of 8 channels)	Fallback value (per channel)	Wire test (per channel)
TBX CSP 1625	16	**Mast** / Fast	-	-	-	-
TBX DSS 1622	16	**Mast** / Fast	**Automatic** / Programmed	**Fallback** / Maintain	**0** / 1	-
TBX ESP 1622	16	**Mast** / Fast	**Automatic** / Programmed	**Fallback** / Maintain	**0** / 1	-
TBX DSS 16C22	16	**Mast** / Fast	**Automatic** / Programmed	**Fallback** / Maintain	**0** / 1	**Active** / Inactive (2)
TBX DMS 16C22	16	**Mast** / Fast	**Automatic** / Programmed	**Fallback** / Maintain	**0** / 1	**Active** / Inactive (2)
TBX DMS 16C222	16	**Mast** / Fast	**Automatic** / Programmed	**Fallback** / Maintain	**0** / 1	**Active** / Inactive (2)
TBX CSP 1622	16	**Mast** / Fast	**Automatic** / Programmed	-	-	-
TBX DSS 1625	16	**Mast** / Fast	-	**Fallback** / Maintain	**0** / 1	-
TBX DMS 1625	8 (outputs)	**Mast** / Fast	-	**Fallback** / Maintain	**0** / 1	-
TBX DMS 16S44	8 (outputs)	**Mast** / Fast	-	**Fallback** / Maintain	**0** / 1	-
TBX DMS 16P22	(1)	**Mast** / Fast	**Automatic** / Programmed	**Fallback** / Maintain	**0** / 1	-
Legend:						
(1)	8 programmable output channels.					
(2)	Check box.					

NOTE: Parameters in bold correspond to the parameters configured by default.

Section 31.3
Configuration of Discrete Module Parameters

Subject of this Section

This section describes the implementation of the different configuration parameters for remote input/output TBX modules.

What Is in This Section?

This section contains the following topics:

How to Configure Programmable Channels for the TBX DMS 16P22 Module

At a Glance

The **TBX DMS 16P22** module has, in addition to its 8 input channels, 8 extra channels that can be individually configured as input or output channels.

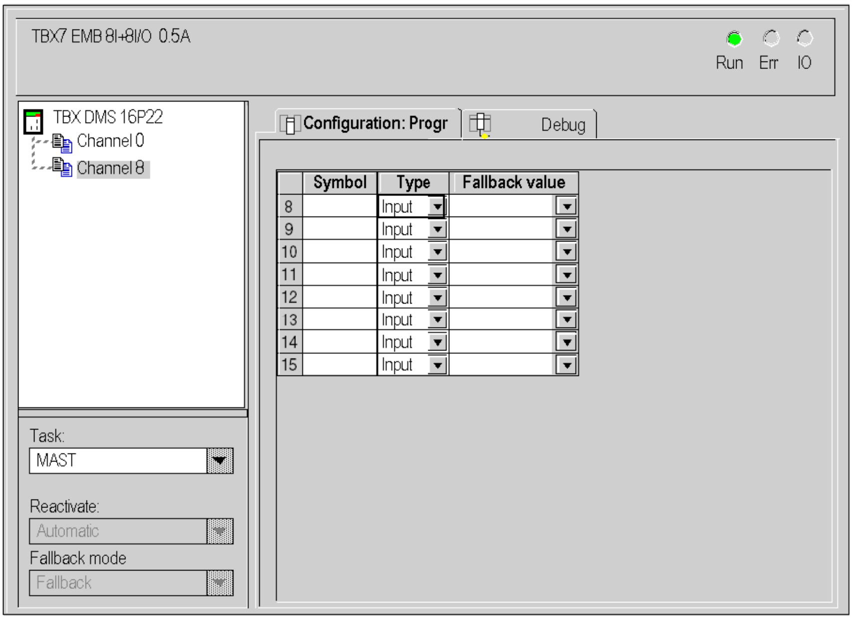
These make it possible for a single base to have 16 inputs, or from 1 to 8 outputs and 15 to 8 inputs. By default, the base is configured with all 16 channels set to input.

The power supply (+ and -) of the sensors and pre-actuators is shared.

NOTE: It is not possible to reconfigure channel types in online mode.

Illustration

The following illustration shows the configuration screen of the **TBX DMS 16P22** module.



Procedure

The following table shows the procedure to configure the programmable channels of the **TBX DMS 16P22** module.

Step	Action
1	Access the module's hardware configuration screen.
2	Select, in the **channel** area, the second group of the channel.
3	Select the tab **Configuration: Programmable**.
4	In the **configuration** area, individually configure the channels as inputs or outputs using the drop-down list in the **Type** column.

How to Modify the Task Parameter of a Remote Discrete Module

At a Glance

This parameter defines the processor task in which inputs are acquired and outputs are updated.

For the base module and extension module, the task is defined for all channels per channel group.

The possible choices are as follows:

- The **MAST** task,
- The **FAST** task.

NOTE: This parameter can only be modified in offline mode.

Procedure

The table below shows the procedure for defining the type of task assigned to the channels of a module.

Step	Action
1	Access the hardware configuration screen of the required module.
2	In the **channel** area, select the required channel group.
3	In the **General parameters** area, click on the drop-down menu button in the **Task** field. **Result:** a drop-down list appears. 
4	Select the required task.
5	Confirm the reconfiguration if necessary.

How to Modify the Wiring Check Parameter of a Discrete TBX Module

At a Glance

This function is used to permanently check the quality of the link between:

- Sensors and inputs,
- Actuators and outputs.

The input wiring check function is used to permanently check the quality of the link between the sensors and the inputs of the TBX module. This function is used to detect the two main faults on a Discrete input module:

- Loosening of screws on the terminal block,
- Short-circuit at the grounding of the cabling wires.

Modular Discrete TBX bases with input wiring check are fitted with 2 switches *(see page 115)*, which must be configured by the user in order to make inputs compatible with the 2-wire proximity sensors.

With all static outputs protected against short-circuits of the 0 V or 24 V load and against overloads, the output wiring check function also performs a permanent open circuit detection function: This detection is performed both when the pre-actuator is at idle (OFF) and triggered (ON).

NOTE: This parameter can be modified in online mode.

Procedure

The following table presents the procedure for activating or deactivating the **Wiring check** parameter.

Step	Action
1	Access the hardware configuration screen of the required module.
2	Select the required channel group in the **channel** area.
3	In the **configuration** area, click the checkbox in the **Wiring check** column of the channel to be configured.
4	Repeat the operation for every channel to be configured (from step 3).

How to Modify the Filtering Parameter of a Discrete Input Module

At a Glance

This parameter defines the filtering period for the selected channel.

The values proposed are:

- 0.7 ms (**Fast**) or
- 5.7 ms (**Normal**).

Procedure

The table below shows the procedure for defining the **Filtering** time parameter.

Step	Action
1	Access the hardware configuration screen of the required module.
2	In the **channel** area, select the required channel group.
3	In the **General parameters** area, click on the drop-down menu button in the **Filter** field. **Result:** one of the following scroll lists appears: 
4	Select the required filtering period.

How to Modify the Latch Parameter of a Discrete Input Module

At a Glance

This parameter defines whether or not to acknowledge a positive pulse lasting less than the task period.

By default, acknowledgement is enabled (box checked).

Procedure

The table below shows the procedure for activating or deactivating the Latch function.

Step	Action
1	Access the hardware configuration screen of the required module.
2	In the **channel** area, select the required channel group.
3	In the **configuration** area, click the checkbox in the **Latch** column of the channel to be configured.
4	Repeat the operation for every channel to be configured (from step 3).

NOTE: This parameter can be modified in online mode.

How to Modify the Fallback Mode Parameter for a Discrete Output TBX Module

At a Glance

This parameter defines the fallback mode adopted by outputs when the PLC changes to **Stop**, in the event of a processor, rack or inter-rack cable fault.

The possible modes are as follows:

Mode	Meaning
Fallback	The channels are set to 0 or 1 depending on the fallback value set for the group of 8 corresponding channels.
Maintain	The outputs remain in the status they were in before switching to **Stop**.

⚠ WARNING

UNEXPECTED APPLICATION BEHAVIOR

Ensure that the extension module is connected to the base module via the connection cable, else the extension module outputs would not switch to fallback mode.

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

Procedure

The table below shows the procedure for defining the Fallback mode assigned to a group of channels.

Step	Action
1	Access the hardware configuration screen of the required module.
2	In the **channel** area, select the required channel group.
3	In the **General parameters** area, click on the drop-down menu button in the **Fallback mode** field. **Result:** a drop-down list appears. 
4	Select the required fallback mode.
5	For the **Fallback** mode, configure each channel of the selected group. To do this, click on the drop-down menu button in the **Fallback value** column of the **configuration** area.
6	Click on the required value (0 or 1).

How to modify the Reactivation of Outputs Parameter of a Discrete TBX module.

At a Glance

All 0.5 A and 2 A static outputs are equipped with a protection device enabling them, when an output is active, to detect an overload or short-circuit on its 0 V or 24 V load. Such faults limit the current of the output, make the module trip the output and indicate a fault.

For a tripped output to return to activity, it must first be reactivated.

The possible modes of the output reactivation parameter are as follows:

Mode	Meaning
Programmed	Reactivation is executed by a PLC application command. **Caution**: in order to avoid closely spaced, repetitive reactivation, the module automatically allows a period of 10 seconds between two reactivations. **Note**: Having sent the channel reactivation command, a command must be sent with a zero value for the agent to remain in its programmed reactivation status.
Automatic	Reactivation is carried out automatically every 10 seconds until the fault disappears.

The reactivation mode is defined per 8-channel group.

Procedure

The following table shows the procedure for defining the reactivation mode for the module’s output channels.

Step	Action
1	Access the hardware configuration screen of the required module.
	In the **channel** area, select the required channel group.
2	In the **General parameters** area, click on the drop-down menu button in the **Reactivate** field. **Result:** a drop-down list appears. 
3	Select the required type of reactivation.

Chapter 32
Presentation of Discrete Application Language Objects

Subject of this Chapter

This chapter describes the language objects associated with the Discrete application using different IODDTs.

What Is in This Chapter?

This chapter contains the following sections:

Section 32.1
Remote TBX Input/Output Module Language Objects and IODDTs

Subject of this Section

This section presents general information about language objects and IODDTs of TBX Discrete modules.

What Is in This Section?

This section contains the following topics:

Presentation of Language Objects of the Discrete Application Function Associated with Remote Modules

General

Discrete modules have different associated IODDTs.

The IODDTs are predefined by the manufacturer. They contain input/output language objects belonging to a channel of an application-specific module.

NOTE: IODDT variables can be created in two different ways:
- Using the **I/O objects** *(see EcoStruxure™ Control Expert, Operating Modes)* tab,
- Using the Data Editor *(see EcoStruxure™ Control Expert, Operating Modes)*.

There are four types of IODDT for TBX remote Discrete input/output modules:

- `T_DIS_IN_GEN`,
- `T_DIS_IN_FIP_STD`,
- `T_DIS_OUT_GEN`,
- `T_DIS_OUT_STD`.

Language Object Types

Each IODDT contains a group of language objects which are used to control them and check their operation.

There are two types of language objects:

- **Implicit exchange objects**, which are automatically exchanged on each cycle of the task associated with the module,
- **Explicit exchange objects**, which are exchanged when requested to do so by the project, using explicit exchange instructions.

Implicit exchanges concern the module inputs/outputs: process value results, information and commands.

Explicit exchanges are used to set up the module's parameters and for module diagnostics.

Implicit Exchange Language Objects Associated with the Application-Specific Function

At a Glance

An integrated application-specific interface or the addition of a module automatically enhances the language objects application used to program this interface or module.

These objects correspond to the input/output images and software data of the module or integrated application-specific interface.

Reminders

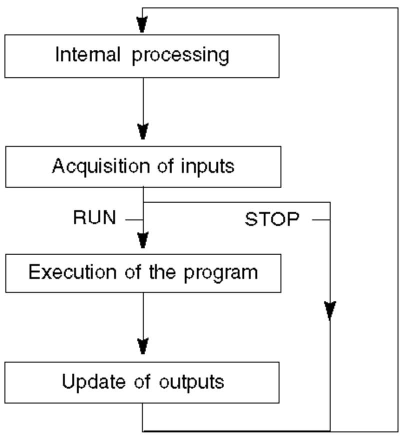
The module inputs (`%I` and `%IW`) are updated in the PLC memory at the start of the task, the PLC being in RUN or STOP mode.

The outputs (`%Q` and `%QW`) are updated at the end of the task, only when the PLC is in RUN mode.

NOTE: When the task occurs in STOP mode, either of the following are possible, depending on the configuration selected:
- outputs are set to fallback position (fallback mode)
- outputs are maintained at their last value (maintain mode)

Figure

The following diagram shows the operating cycle of a PLC task (cyclical execution).



Explicit Exchange Language Objects Associated with the Application-Specific Function

At a Glance

Explicit exchanges are exchanges performed at the user program's request, and using instructions:

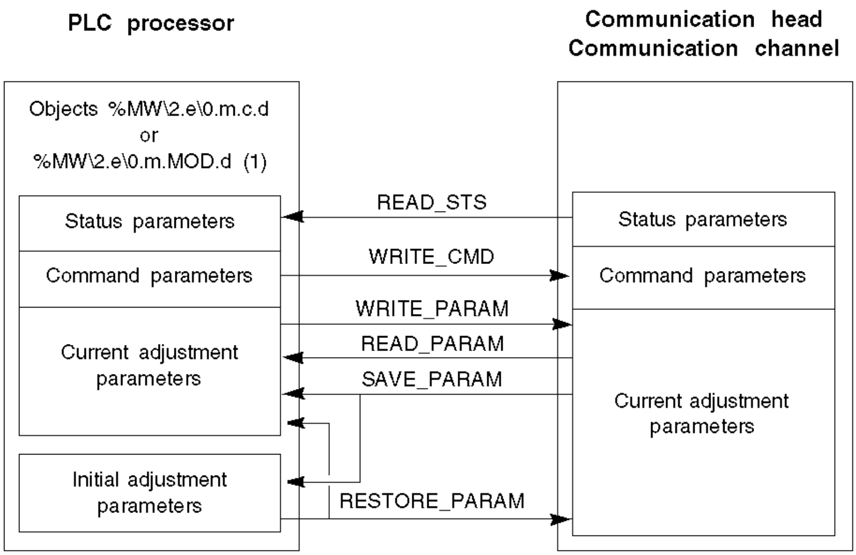
- READ_STS *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (read status words)
- WRITE_CMD *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (write command words)
- WRITE_PARAM *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (write adjustment parameters)
- READ_PARAM *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (read adjustment parameters)
- SAVE_PARAM *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (save adjustment parameters)
- RESTORE_PARAM *(see EcoStruxure™ Control Expert, I/O Management, Block Library)* (restore adjustment parameters)

These exchanges apply to a set of %MW objects of the same type (status, commands or parameters) that belong to a channel.

NOTE: These objects provide information about the module (e.g., type of channel fault, etc.), and are used to control the modules and to define their operating modes (saving and restoring currently applied adjustment parameters).

General Principle For Using Explicit Instructions

The diagram below shows the different types of explicit exchanges that can be made between the processor and module.



(1) Only with the instructions READ_STS and WRITE_CMD.

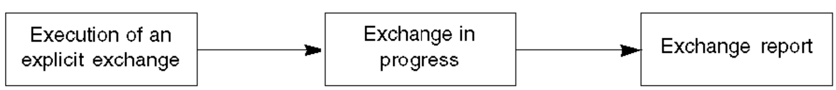
Managing exchanges

During an explicit exchange, it is necessary to check its performance in order that data is only taken into account when the exchange has been correctly executed.

To do this, two types of information are available:

- information concerning the exchange in progress *(see page 341)*
- the exchange report *(see page 342)*

The following diagram describes the management principle for an exchange:



NOTE: In order to avoid several simultaneous explicit exchanges for the same channel, it is necessary to test the value of the word EXCH_STS (`%MWr.m.c.0`) of the IODDT associated to the channel before to call any EF using this channel.

Management of Exchanges and Reports with Explicit Objects

At a Glance

When data is exchanged between the PCL memory and the module, the module may require several task cycles to acknowledge this information. All IODDTs use two words to manage exchanges:

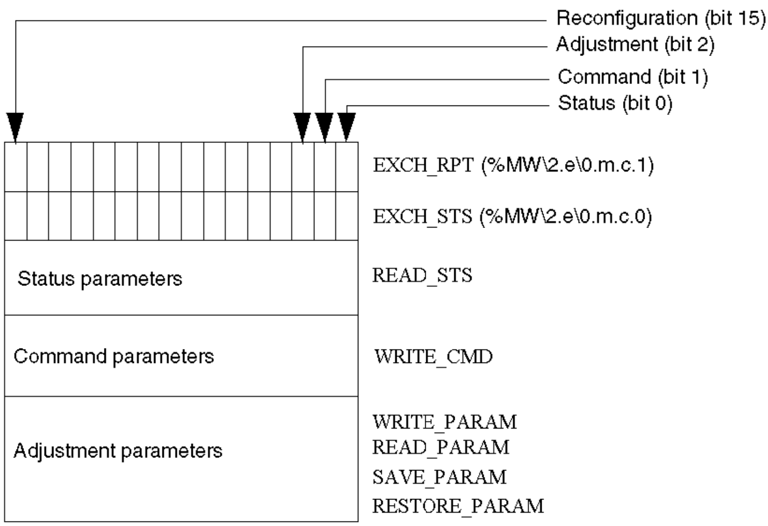
- `EXCH_STS` (%MW\2.e\0.m.c.0): exchange in progress
- `EXCH_RPT` (%MW\2.e\0.m.c.1): report

NOTE: Depending on the localization of the module, the management of the explicit exchanges `(%MW0.0.MOD.0.0 for example)will not be detected by the application:`

- For in-rack modules, explicit exchanges are done immediately on the local PLC Bus and are finished before the end of the execution task. So, the `READ_STS`, for example, is always finished when the `%MW0.0.MOD.0.0` bit is checked by the application.
- For remote bus (Fipio for example), explicit exchanges are not synchronous with the execution task. So, the detection is possible by the application.

Illustration

The illustration below shows the different significant bits for managing exchanges:



Description of the Significant Bits

Each bit of the words `EXCH_STS` (%MW\2.e\0.m.c.0) and `EXCH_RPT` (%MW\2.e\0.m.c.1) is associated with a type of parameter:

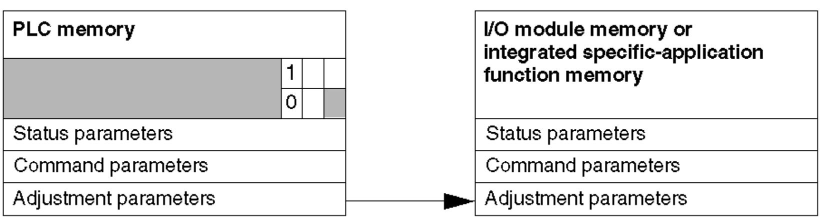
- Rank 0 bits are associated with the status parameters:
  - The `STS_IN_PROGR` bit (%MW\2.e\0.m.c.0.0) indicates whether a read request for the status words is in progress.
  - The `STS_ERR` bit (%MW\2.e\0.m.c.1.0) specifies whether a read request for the status words is refused by the module channel.
- Rank 1 bits are associated with the command parameters:
  - The `CMD_IN_PROGR` bit (%MW\2.e\0.m.c.0.1) indicates whether command parameters are being sent to the module channel.
  - The `CMD_ERR` bit (%MW\2.e\0.m.c.1.1) specifies whether the command parameters are refused by the module channel.
- Rank 2 bits are associated with the adjustment parameters:
  - The `ADJ_IN_PROGR` bit (%MW\2.e\0.m.c.0.2) indicates whether the adjustment parameters are being exchanged with the module channel (via `WRITE_PARAM, READ_PARAM, SAVE_PARAM, RESTORE_PARAM`).
  - The `ADJ_ERR` bit (%MW\2.e\0.m.c.1.2) specifies whether the adjustment parameters are refused by the module.
    If the exchange is correctly executed, the bit is set to 0.
- Rank 15 bits indicate a reconfiguration on channel c of the module from the console (modification of the configuration parameters + cold start-up of the channel).

NOTE: **m** stands for the position of the module; **c** stands for the channel number in the module.

NOTE: Exchange and report words also exist at module level `EXCH_STS` (%MW\2.e\0.m.MOD) and `EXCH_RPT` (%MW\2.e\0.m.MOD.1) in the IODDT type `T_GEN_MOD`.

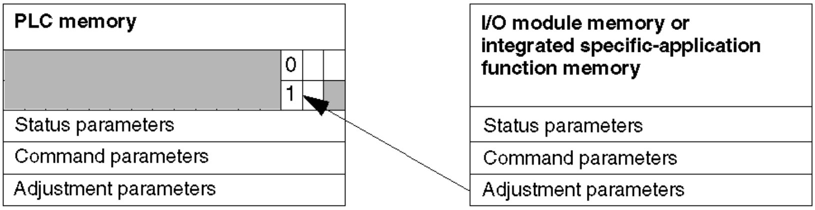
Example

Phase 1: Sending data by using the `WRITE_PARAM` instruction.



When the instruction is scanned by the PLC processor, the **Exchange in progress** bit is set to 1 in %MW\2.e\0.m.c.

Phase 2: Analysis of the data by the I/O module and report



When the data is exchanged between the PLC memory and the module, processing by the module is managed by the `ADJ_ERR` bit (%MW\2.e\0.m.c.1.2): Report (0 = correct exchange, 1 = faulty exchange).

NOTE: There is no adjustment parameter at module level.

Execution Indicators for an Explicit Exchange: EXCH_STS

The table below shows the control bits of the explicit exchanges: `EXCH_STS` (%MW\2.e\0.m.c.0).

Standard symbol	Type	Access	Meaning	Address
`STS_IN_PROGR`	BOOL	R	Reading of channel status words in progress	%MW\2.e\0m.c.0.0
`CMD_IN_PROGR`	BOOL	R	Command parameters exchange in progress	%MW\2.e\0m.c.0.1
`ADJ_IN_PROGR`	BOOL	R	Adjust parameters exchange in progress	%MW\2.e\0m.c.0.2
`RECONF_IN_PROGR`	BOOL	R	Reconfiguration of the module in progress	%MW\2.e\0.m.c.0.15

NOTE: If the module is not present or is disconnected, explicit exchange objects (Read_Sts for example) are not sent to the module (STS_IN_PROG (%MWr.m.c.0.0) = 0), but the words are refreshed.

Explicit Exchange Report: EXCH_RPT

The table below shows the report bits: `EXCH_RPT` (%MW\2.e\0.m.c.1).

Standard symbol	Type	Access	Meaning	Address
`STS_ERR`	BOOL	R	Error in reading status words of the channel (1 = failure)	%MW\2.e\0.m.c.1.0
`CMD_ERR`	BOOL	R	Error when exchanging command parameters (1 = failure)	%MW\2.e\0.m.c.1.1
`ADJ_ERR`	BOOL	R	Error when exchanging adjustment parameters (1 = failure)	%MW\2.e\0.m.c.1.2
`RECONF_ERR`	BOOL	R	Fault when reconfiguring the channel (1 = failure)	%MW\2.e\0.m.c.1.15

Section 32.2
IODDTs of the TBX Remote Input/Output Modules

Subject of this Section

This section presents the different IODDTs and language objects associated with the TBX remote input/output modules.

What Is in This Section?

This section contains the following topics:

Details of T_DIS_IN_GEN-Type IODDT Implicit Exchange Objects

At a Glance

This section presents implicit exchange objects of the `T_DIS_IN_GEN`-type IODDT applicable to all Discrete input modules.

Input Indicator

The following table presents the meaning of the `VALUE` bit (%I\2.e\0.m.c).

Standard symbol	Type	Access	Meaning	Number
`VALUE`	EBOOL	R	Indicates for input channel c that the output of the sensor controlling the input is activated.	%I\2.e\0.m.c

Error Bit

The following table presents the meaning of the error bit `CH_ERROR` (%I\2.e\0.m.c.ERR).

Standard symbol	Type	Access	Meaning	Number
`CH_ERROR`	BOOL	R	Indicates that input channel c is faulty.	%I\2.e\0.m.c.ERR

Details of T_DIS_IN_FIP_STD-Type IODDT Implicit Exchange Objects

At a Glance

This section presents `T_DIS_IN_FIP_STD`-type IODDT implicit exchange objects applicable to input modules and the inputs of mixed Discrete modules (TBX, IP67).

Input Indicator

The following table presents the meaning of the `VALUE` bit (%I\2.e\0.m.c).

Standard symbol	Type	Access	Meaning	Number
`VALUE`	EBOOL	R	Indicates for input channel c that the output of the sensor controlling the input is activated.	%I\2.e\0.m.c

Error Bit

The following table presents the meaning of the error bit `CH_ERROR` (%I\2.e\0.m.c.ERR).

Standard symbol	Type	Access	Meaning	Number
`CH_ERROR`	BOOL	R	Indicates that input channel c is faulty.	%I\2.e\0.m.c.ERR

Details of T_DIS_IN_FIP_STD-Type IODDT Explicit Exchange Objects

At a Glance

This section presents `T_DIS_IN_FIP_STD`-type IODDT explicit exchange objects applicable to input modules and the inputs of mixed Discrete modules (TBX, IP67). It includes the word type objects whose bits have a specific meaning. These objects are described in detail below.

Example of a declaration of a variable:

`IODDT_VAR1` of the `T_DIS_IN_FIP_STD` type.

NOTE: In general, the meaning of the bits is given for bit status 1. In specific cases an explanation is given for each status of the bit.

NOTE: Not all bits are used.

Execution Indicators for an Explicit Exchange: EXCH_STS

The table below presents the meanings of the exchange control bits of the channel `EXCH_STS` (%MW\2.e\0.m.c.0).

Standard symbol	Type	Access	Meaning	Number
`STS_IN_PROGR`	BOOL	R	Reading of channel status words in progress.	%MW\2.e\0.m.c.0.0
`CMD_IN_PROGR`	BOOL	R	Current command parameters exchange in progress.	%MW\2.e\0.m.c.0.1

Explicit Exchange Report: EXCH_RPT

The table below presents the meaning of the exchange report bits `EXCH_RPT` (%MW\2.e\0.m.c.1).

Standard symbol	Type	Access	Meaning	Number
`STS_ERR`	BOOL	R	Error in reading status words of the channel (1 = failure).	%MW\2.e\0.m.c.1.0
`CMD_ERR`	BOOL	R	Error during a command parameter exchange (1 = failure).	%MW\2.e\0.m.c.1.1

Standard Channel Faults, CH_FLT

The table below shows the meaning of the bits of the status word `CH_FLT` (%MW\2.e\0.m.c.2). Reading is performed by a `READ_STS` (`IODDT_VAR1`).

Standard symbol	Type	Access	Meaning	Number
TRIP	BOOL	R	External fault: tripping.	%MW\2.e\0.m.c.2.0
FUSE	BOOL	R	External fault: fuse.	%MW\2.e\0.m.c.2.1
BLK	BOOL	R	Terminal block fault.	%MW\2.e\0.m.c.2.2
EXT_PS_FLT	BOOL	R	External supply fault.	%MW\2.e\0.m.c.2.3
INTERNAL_FLT	BOOL	R	Internal fault: module not operational.	%MW\2.e\0.m.c.2.4
CONF_FLT	BOOL	R	Hardware or software configuration fault.	%MW\2.e\0.m.c.2.5
COM_FLT	BOOL	R	Communication fault with PLC.	%MW\2.e\0.m.c.2.6
SHORT_CIRCUIT	BOOL	R	External fault: short-circuit on a channel.	%MW\2.e\0.m.c.2.8
LINE_FLT	BOOL	R	External fault: line fault.	%MW\2.e\0.m.c.2.9

Details of the Implicit Exchange Objects of the IODDT of the T_DIS_OUT_GEN Type

At a Glance

This section presents implicit exchange objects of the T_DIS_OUT_GEN-type IODDT applicable to Discrete output modules.

Output Indicator

The following table presents the meaning of the VALUE bit (%Q\2.e\0.m.c).

Standard symbol	Type	Access	Meaning	Number
VALUE	EBOOL	R/W	Indicates that output channel c is activated.	%Q\2.e\0.m.c

Error Bit

The following table presents the meaning of the error bit CH_ERROR (%Ir.m.c.ERR).

Standard symbol	Type	Access	Meaning	Number
CH_ERROR	BOOL	R	Indicates that output channel c is faulty.	%I\2.e\0.m.c.ERR

Details of T_DIS_OUT_STD-Type IODDT Implicit Exchange Objects

At a Glance

This section presents implicit exchange objects of the `T_DIS_OUT_STD`-type IODDT applicable to Discrete output modules.

Output Indicator

The following table presents the meaning of the `VALUE` bit (%Q\2.e\0.m.c).

Standard symbol	Type	Access	Meaning	Number
`VALUE`	EBOOL	R/W	Indicates that output channel c is activated.	%Q\2.e\0.m.c

Error Bit

The following table presents the meaning of the error bit `CH_ERROR` (%I\2.e\0.m.c.ERR).

Standard symbol	Type	Access	Meaning	Number
`CH_ERROR`	BOOL	R	Indicates that output channel c is faulty.	%I\2.e\0.m.c.ERR

Details of T_DIS_OUT_STD-Type IODDT Explicit Exchange Objects

At a Glance

This section presents explicit exchange objects of the T_DIS_OUT_STD-type IODDT applicable to Discrete output modules. It includes the word type objects whose bits have a specific meaning. These objects are described in detail below.

Example of a declaration of a variable:

IODDT_VAR1 of the T_DIS_OUT_STD type.

NOTE: In general, the meaning of the bits is given for bit status 1. In specific cases an explanation is given for each status of the bit.

NOTE: Not all bits are used.

Execution Indicators for an Explicit Exchange: EXCH_STS

The table below presents the meanings of the exchange control bits of the channel EXCH_STS (%MW\2.e\0.m.c.0).

Standard symbol	Type	Access	Meaning	Number
STS_IN_PROGR	BOOL	R	Reading of channel status words in progress.	%MW\2.e\0.m.c.0.0
CMD_IN_PROGR	BOOL	R	Current command parameters exchange in progress.	%MW\2.e\0.m.c.0.1

Explicit Exchange Report: EXCH_RPT

The table below presents the meaning of the exchange report bits EXCH_RPT (%MW\2.e\0.m.c.1).

Standard symbol	Type	Access	Meaning	Number
STS_ERR	BOOL	R	Error in reading status words of the channel (1 = failure).	%MW\2.e\0.m.c.1.0
CMD_ERR	BOOL	R	Error during a command parameter exchange (1 = failure).	%MW\2.e\0.m.c.1.1

Standard Channel Faults, CH_FLT

The table below shows the meaning of the bits of the status word `CH_FLT` (%MW\2.e\0.m.c.2). Reading is performed by a `READ_STS` (`IODDT_VAR1`).

Standard symbol	Type	Access	Meaning	Number
`TRIP`	BOOL	R	External fault: tripping.	%MW\2.e\0.m.c.2.0
`FUSE`	BOOL	R	External fault: fuse.	%MW\2.e\0.m.c.2.1
`BLK`	BOOL	R	Terminal block fault.	%MW\2.e\0.m.c.2.2
`EXT_PS_FLT`	BOOL	R	External supply fault.	%MW\2.e\0.m.c.2.3
`INTERNAL_FLT`	BOOL	R	Internal fault: module not operational.	%MW\2.e\0.m.c.2.4
`CONF_FLT`	BOOL	R	Hardware or software configuration fault.	%MW\2.e\0.m.c.2.5
`COM_FLT`	BOOL	R	Communication fault with PLC.	%MW\2.e\0.m.c.2.6
`SHORT_CIRCUIT`	BOOL	R	External fault: short-circuit on a channel.	%MW\2.e\0.m.c.2.8
`LINE_FLT`	BOOL	R	External fault: line fault.	%MW\2.e\0.m.c.2.9

Status word: CH_CMD

The table below shows the meaning of the bits of the status word `CH_CMD` (%MW\2.e\0.m.c.3). The command is made by a `WRITE_CMD` (`IODDT_VAR1`)

Standard symbol	Type	Access	Meaning	Address
`REAC_OUT`	BOOL	R/W	Reactivation of tripped outputs (protected outputs).	%MW\2.e\0.m.c.3.0
`PS_CTRL_DIS`	BOOL	R/W	Inhibition of the external supply control.	%MW\2.e\0.m.c.3.1
`PS_CTRL_EN`	BOOL	R/W	Validation of the external supply control.	%MW\2.e\0.m.c.3.2

NOTE: This object is specific to output modules with reactivation.

Chapter 33
Debug of the TBX Remote Input/Output Modules

Subject of this Chapter

This chapter describes the debug function and commands for remote Discrete modules on a Fipio bus.

What Is in This Chapter?

This chapter contains the following topics:

Introduction to the Debug Function of a Remote Discrete Module

Introduction

The Debug function is used for each TBX Discrete input/output module present in the application:

- To display the parameters of each of the channels (channel state, filtering vale, etc.),
- To access the diagnostics and adjustment functions for the selected channel (channel forcing, channel masking, etc.).

The function also provides access to module diagnostics in the event of a fault.

NOTE: This function is only available in online mode.

NOTE: Access to the Debug function is limited to four Fipio device screens (TBX Discrete, TBX Analog, IP67, etc.) opened simultaneously.

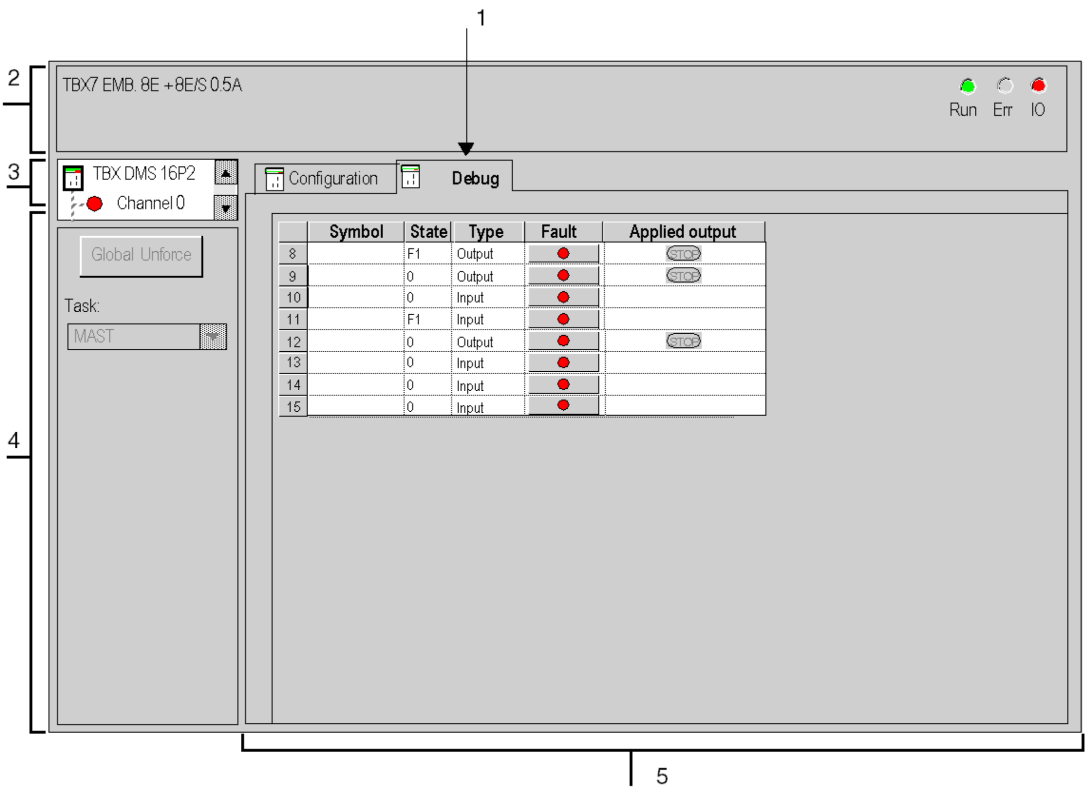
Description of the Debug Screen for a Discrete Remote Module

At a Glance

The debug screen displays the value and state of each of the selected module's channels in real time. It is also used to access the channel commands (forcing of the input/output value, etc.).

Illustration

The figure below represents a debug screen.



Description

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

Number	Element	Function
1	Tabs	The tab in the foreground indicates the mode in progress (**Debug** in this example). Every mode can be selected using the respective tab. ● **Debug** which can be accessed only in online mode. ● **Configuration**.
2	**Module** area	Specifies the abbreviated heading of the module. In the same area there are 3 LEDs which indicate the module's operating mode: ● **RUN** indicates the operating status of the module, ● **ERR** indicates an internal fault in the module, ● **I/O** indicates a fault from outside the module or an application fault.
3	**Channel** area	Is used: ● By clicking on the reference number, to display the tabs: ❍ **Description** which gives the characteristics of the device, ❍ **I/O Objects** *(see EcoStruxure™ Control Expert, Operating Modes)* which is used to presymbolize the input/output objects, ❍ **Fault** which shows the device faults (in online mode). ● By clicking on the **Channel**, to select the channel or group of channels (maximum 8) to debug. To the left of the symbol there is a copy of the **CHx** channel LED.
4	**General parameters** area	Gives a reminder of the channel setting: ● **Task:** specifies the **MAST** or **FAST** task configured. This heading is frozen. ● **Function:** the **Global Unforce** provides direct access to the channels' Global Unforce function.
5	**Parameters in progress** zone	This zone displays the state of the inputs and outputs, and the different parameters in progress. For each of the channels, there are five columns: ● The **Symbol** column displays the symbol associated with the channel when it has been defined by the user (using the variable editor), ● The **State** column displays the status of each of the module's channels and enables their forcing, ● The **Type** column for indicating the type (input or output), ● The **Fault** column creates direct access to the diagnostics for each channel when these are faulty (indicated by the indicator lamp built into the diagnostics access button, which turns red), ● The **Applied Outputs** column to indicate the output fallback *(see page 331)* position.

How to Access the Forcing/Unforcing Function

At a Glance

This function supports the modification of the state of all or some of the channels of a module.

The state of a forced output is fixed and can only be modified by the application after unforcing.

NOTE: However, in the event of a fault causing outputs to fallback, the statuses of these take the value defined on configuration of the **Fallback mode** parameter.

The different available commands are:

- For one or more channels:
  - Forcing to 1,
  - Forcing to 0,
  - Unforcing (when the selected channel or channels have been forced).
- For all the channels on the module (when at least one channel is forced):
  - Global unforcing of channels.

Procedure

The following table shows the procedure for forcing or unforcing all or some of the channels of a module:

Step	Action for one or more selected channels	Action for all channels
1	Access the module's debug screen.	
2	In the **State** column, right click on the cell of the required channel.	Click on the **Global Unforce** button in the module area.
3	Select the desired function. ● Force to 0, ● Force to 1, ● Unforce.	-

How to Access the SET and RESET Commands

At a Glance

These commands are used to modify the state of a module's outputs to 0 (RESET) or 1 (SET).

NOTE: The state of the output assigned by one of these commands is temporary and can be modified at any time by the application when the PLC is in RUN.

Procedure

The following table shows the procedure for assigning the value 0 or 1 to all or some of the channels of a module.

Step	Action for one channel
1	Access the module's debug screen.
2	In the **State** column, right click on the cell of the required channel.
3	Select the desired function. • **Set**, • **Reset**.

Chapter 34
Diagnostics of the Remote Input/Output Discrete TBX Modules

Subject of this Chapter

This chapter describes the diagnostics function and commands for Discrete remote modules on a Fipio bus.

What Is in This Chapter?

This chapter contains the following topics:

How to Access the Discrete Module Diagnostics Function

At a Glance

The Module diagnostics function displays current errors, where these exist, classed according to their category:

- **Internal faults:**
  - Module failures,
  - Self-tests running,
- **External faults:**
  - Terminal block fault,
- **Other faults:**
  - Configuration fault,
  - Module missing or off,
  - Faulty channel(s) *(see page 362)*.

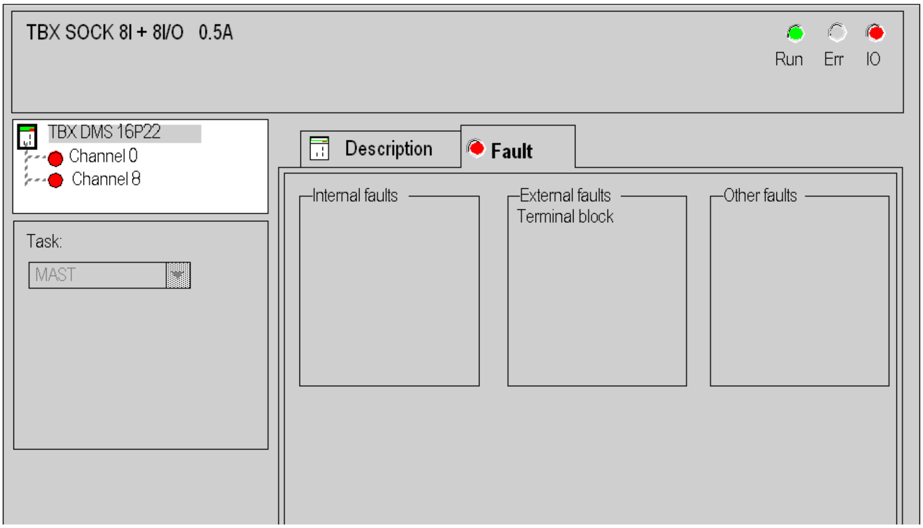
A module fault is indicated when certain LEDs change to red, such as:

- In the Fipio bus window:
  - The connection point number of the module on the Fipio bus is red.
- In all screens at module level:
  - The **I/O** LED according to the type of fault,
  - The **Channel** LED in the **Channel** field.
- A red LED on the **Fault** tab.

NOTE: If you disconnect a TBX extension module from the base module when this is configured, on power up the TBX base module will appear faulty on the Fipio bus and the **I/O** LED will turn red.

Procedure

The following table shows the procedure for accessing the Module fault screen.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Open the module on which you would like to perform diagnostics.</td></tr>
<tr><td>2</td><td>Click on the module reference in the channel zone and select the Fault tab.
Result: the list of module faults appears.


Note: In the event of major failure, absence of the module, certain configuration faults, or a major configuration fault, access to the module diagnostics screen is not possible. The following message then appears on the screen: <code>The module is not present or different from the one configured in this position.</code></td></tr>
</table>

How to Access the Channel Diagnostics Function of a Discrete Module

At a Glance

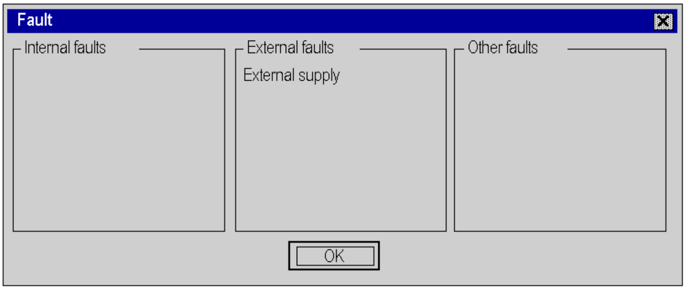
The Channel diagnostics module displays current errors, where these exist, classed according to their category:

- **Internal faults:**
  - Channel failure,
- **External faults:**
  - Link or sensor supply fault,
- **Other faults:**
  - Terminal block fault,
  - Configuration fault,
  - Communication fault.

A channel error appears in the **Debug** tab when the  LED, located in the **Fault** column, turns red.

Procedure

The following table shows the procedure for accessing the Channel fault screen.

Step	Action
1	Access the module's debug screen.
2	For the faulty channel, click on the button  situated in the **Fault** column. **Result:** the list of channel faults appears.  **Note:** Channel diagnostics information can also be accessed by program (`READ_STS` instruction).

Part III
Software Installation of Remote Analog Input/Output Modules on the Fipio Bus

Subject of this Part

This part presents the analog TBX modules, and describes their installation using Control Expert software.

What Is in This Part?

This part contains the following chapters:

Chapter 35
General Introduction to the Analog Application -Specific Function Applied to Remote TBX Modules

Overview

Introduction

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

- In offline mode,
- In online mode.

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

Installation Phases with Processor

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

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

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

Chapter 36
Remote TBX analog modules

Subject of this Chapter

This chapter presents the remote TBX analog modules.

What Is in This Chapter?

This chapter contains the following sections:

Section 36.1
TBX AES 400 Module

Subject of this section

This section introduces the TBX AES 400 remote module.

What Is in This Section?

This section contains the following topics:

Introducing the TBX AES 400 module

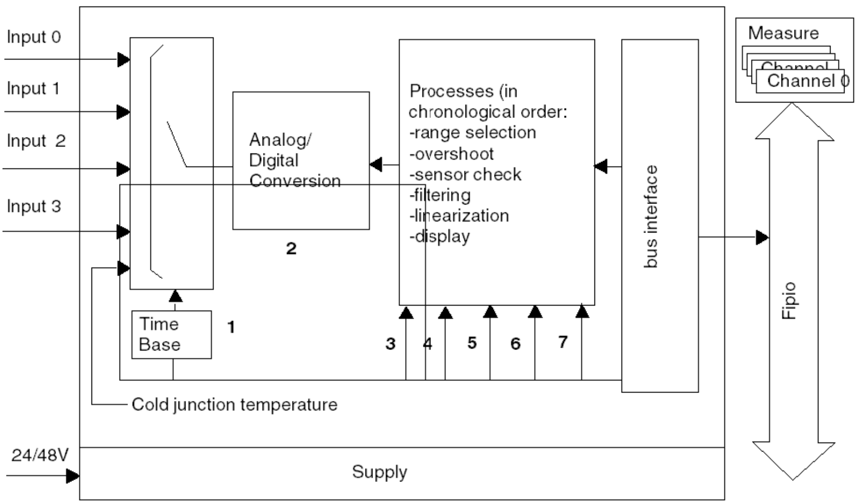
General

The TBX AES 400 base is an analog input module containing 4 insulated multiple range channels. It must be connected to a TBX LEP 030 communicator.

This module supports the following ranges on each input:
- High-level voltage,
- High-level current,
- Thermocouples (B, E ,J, K, N, R, S, T),
- Thermowells (Pt100, Pt1000, Ni1000).

Overview

TBX AES 400 input module connected to the TBX LEP 030 :



Description

The TBX AES 400 module connected to the TBX LEP 030 communicator supports the following functions:

Address	Function
1	• acquisition by relay multiplexing of the 4 channels with 50 Hz or 60 Hz rejection,
2	• 12 bit + sign analog digital conversion,
3	• range selection for each input: voltage, current or thermocouple,
4	• input under/overshoot check,
5	• sensor check,
6	• measurement filtering, • linearization and cold junction compensation for thermocouples, • linearization for thermowells,
7	• user-defined measurement formatting.

Timing of measurements

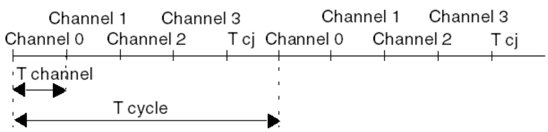
Introduction

The cycle length (time) for the TBX AES 400 module depends on the electricity network frequency (50Hz or 60Hz) and therefore on the rejection mode selected upon configuration.

The measurements are sequenced in the following manner: channel 0, channel 1, channel 2, channel 3 then acquisition of the module's cold junction temperature.

Breakdown of the cycle time

Illustration of the cycle time



T cj: time to acquire the cold junction temperature

The table below shows the various terms of the calculation.

Type of time	50 Hz rejection	60 Hz rejection
Scanning time for a channel	80 ms	68 ms
Acquisition time for the cold junction temperature	80 ms	68 ms
Acquisition time for a complete cycle	400 ms	340 ms

NOTE:
- The cycle is always identical, even when some channels are not in use,
- The time required for the program to access the measurements also depends on the transmission times on the Fipio bus and on the PLC task period.

Overflow Monitoring

Introduction

The **TBX AES 400** module gives a choice of voltage ranges, current ranges, thermocouple ranges and thermoprobe ranges for each of its inputs.

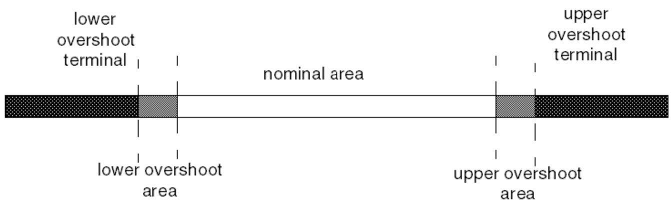
For the selected range, the module performs an overflow check: it checks that the measurement is between a lower and upper limit.

The Measurement Area

The measurement area is located in the nominal area.

Above the nominal area, the overflow is tolerated up to the overflow limits.

Illustration:



Under/Overflow Identifiers

If the values provided by the application are outside the limits, the value of the overshot limit is saturated and the overshoot is indicated.

The module continues to provide the converted value until saturation of the converter or the display format (+32767/-32768), even if the validity of the measurement is not guaranteed.

The user can, via the overflow bit, avoid taking these measurements into account.

Overflow Bit:

Address	Meaning
%I\2.e\0.m.c.ERR	If equal to 1, this indicates a range overflow on the channel.

Overflow Values of the Electrical Ranges

For voltage ranges, the module authorizes a 5% overflow for the positive electrical scope covered by the range.

Electrical ranges:

Range	Lower limit	Upper limit
+/-10 V	-10.5 V	+10.5 V
+/-5 V	-5.25 V	+5.25 V
0..20 mA	-1 mA	+21 mA
4..20 mA	+3.2 mA	+20.8 mA
-20..+20 mV	-21 mV	+21 mV
-50..+50 mV	-52.5 mV	+52.5 mV
-200..+200 mV	-210 mV	+210 mV
-500..+500 mV	-525 mV	+525 mV

Overflow Values of the Heat Ranges

Range overflow corresponds either to a dynamic overflow of the acquisition system, or to an overflow of the standard sensor measurement area, or to a dynamic overflow of the compensation temperature (-5°C to +85°C). The use of internal compensation in a standard environment (0°C to +60°C) is compatible with the thresholds -5°C to +85°C.

Thermocouple ranges:

Range	Lower limit	Upper limit
Thermo B	0°C (32°F)	+1802°C (+3276°F)
Thermo E	-270°C (-454°F)	+717°C (+1322°F)
Thermo J	-210°C (-346°F)	+935°C (+1715°F)
Thermo K	-270°C (-454°F)	+1338°C (+2440°F)
Thermo N	-270°C (-454°F)	+1300°C (+2372°F)
Thermo R	-50°C (-58°F)	+1769°C (+3216°F)
Thermo S	-50°C (-58°F)	+1769°C (+3216°F)
Thermo T	-270°C (-454°F)	+400°C (+752°F)

Thermoprobe ranges:

Range	Lower limit	Upper limit
Pt100	-200°C (-328°F)	+850°C (+1562°F)
Pt1000	-200°C (-328°F)	+850°C (+1562°F)
Ni1000	-60°C (-76°F)	+250°C (+482°F)

Sensor Link Monitoring

General

The module offers an option with which to check short-circuits and open circuits, for all ranges except the 0/20 mA range.

The result of the check is sent as a bit that can be used by the user program.

⚠ WARNING
UNEXPECTED APPLICATION BEHAVIOR The sensor link check must be inhibited on unused channels in order to avoid any risk of disturbance on the other channels. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Measurement Filtering

Introduction

The system uses first order filtering. The filtering coefficient can be modified from a programming console or via the program.

Mathematical Formula

The mathematical formula used is as follows:

$$Mesf(n) = \alpha \times Mesf(n-1) + (1-\alpha) \times Valb(n)$$

where:

α = efficiency of the filter,

Mesf(n) = measurement filtered at moment n,

Mesf(n-1) = measurement filtered at moment n-1,

Valg(n) = gross value at moment n.

On configuration, you can select the filtering value from a choice of 7 values.

Values for the Module TBX AES 400

The filtering values are as follows, and depend on mains voltage:

Effectiveness	Value	Corresponding α	Rejection time constant at 50 Hz	Rejection time constant at 60 Hz
No filtering	0	0	0	0
Low filtering	1 2	0.750 0.875	1.6 s 3.2 s	1.4s 2.7s
Medium filtering	3 4	0.937 0.969	6.4 s 12.8 s	5.4 s 10.8 s
High filtering	5 6	0.984 0.992	25.6 s 51.2 s	21.1 s 43.5 s

Displaying measurements

Introduction

This process is used to select the display format depending on which formats are provided in the user program.

It is necessary to differentiate between the electric ranges and the thermocouple or thermowell ranges.

Standardized display of electrical ranges

The values are displayed in standardized units (in % with 2 decimals, also with symbol °/ooo):

Type of range	Display
unipolar range 0-10V, 0-5V, 0-20mA, 4-20mA	from 0 to 10000 (0 °/ooo to 10000 °/ooo)
bipolar range +/-10V	from -10000 to +10000 (-10.000 °/ooo to +10.000 °/ooo)

User-defined display of electrical ranges

The user can select the value range in which the measurements are expressed, by selecting:

- the minimum limit corresponding to the range minimum: 0 (or - 10000 °/ooo),
- the maximum limit corresponding to the range maximum: + 10000 °/ooo .

The minimum and maximum limits are between -31128 and +31128.

Example:

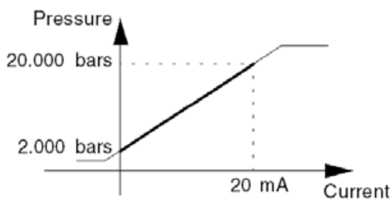
Use of a 2/20 bar pressure sensor supplying a 0/20 mA signal and having a linear characteristic.

The user is interested in the pressure rather than the current value. The best resolution is obtained by selecting user display:

- for minimum limit: 2000,
- for maximum limit: 20000.

The user-program then uses values expressed directly in the physical unit, the millibar.

Illustration



Displaying thermocouple and thermowell ranges

With the temperature display format, values are provided in tenths of a degree.

With user display, the user can select standardized display 0..10000 by specifying the minimum and maximum temperatures corresponding to 0 and 10000.

The measurement provided to the application can be applied directly by the user, who can choose between standardized and temperature display formats.

Example:

Thermocouple J connected to a TBX AES 400 module. The user wishes to monitor a temperature range from 200 °C to 600 °C and obtain a result expressed as a percentage of the dynamic range.

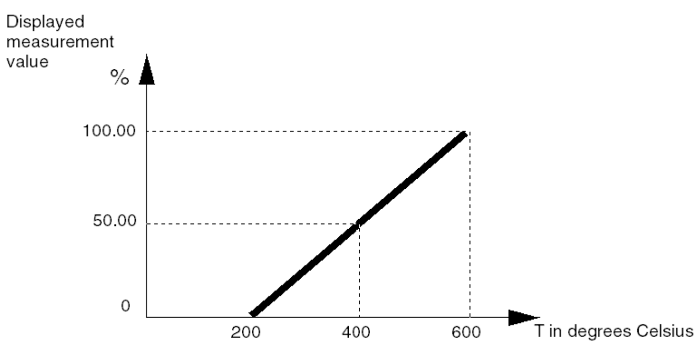
In order to do this, select a standardized display format and define the limits:

- lower limit = 2000,
- upper limit = 6000.

The measurement accessible by program then falls between 0 and 10000.

For a temperature of 400°C, the module supplies a digital value equal to 5000 as the measurement, i.e. 50 % of the input dynamic range.

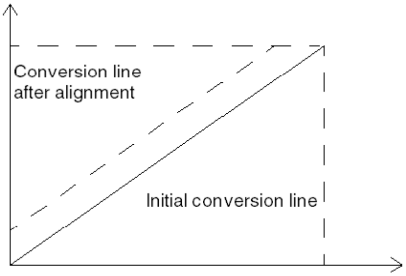
Illustration:



Sensor Alignment

Introduction

Alignment consists of eliminating a systematic shift observed with a given sensor, around a given operating point. This is used to compensate for an error linked to the process. For this reason, module replacement does not require a new alignment, though sensor replacement or a change in this sensor's operating point do require a new alignment.



Example

Let us suppose that a pressure sensor linked to a conditioner (1mV/mB) shows 3200 mB, when the actual pressure is 3210 mB.

The value measured by the module on a standardized scale will be 3200 (3.20 V). You can align your measurement to the value 3210 (required value).

After this alignment procedure, the measurement channel will apply a systematic offset of +10. The alignment value to enter is 3210.

Alignment Values

The alignment value can be modified from the Control Expert screen, even if the program is in RUN.

For each input channel, the user can:

- Display and modify the required measurement value,
- Save the alignment value,
- See whether the channel already has an alignment.

The alignment offset can also be modified for each program.

The alignment is performed for each channel operating normally, with no influence on the operating modes of the module channel. The maximum variation between the measured value and the required value (aligned value) must not exceed 1000.

The alignment offset is stored in the word %MW\2.e\0.m.c.8.

Section 36.2
TBX ASS 200 Module

Subject of this section

This section introduces the TBX ASS 200 rack-based module.

What Is in This Section?

This section contains the following topics:

Introducing the TBX ASS 200 module

General

The TBX ASS 200 base unit is an analog output module containing 2 insulated channels. It must be associated with a TBX LEP 030 communicator. This module offers the following ranges for each of its outputs:

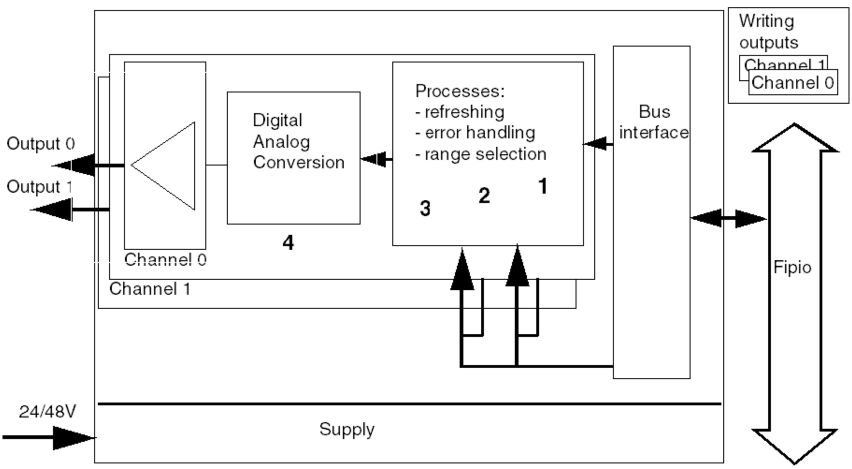
- Voltage: 10V,
- Current: 0/20 mA and 4/20 mA.

Overview

The TBX ASS 200 module associated with the TBX LEP 030 communicator supports the following functions:

- refreshing the digital values corresponding to the analog output values transmitted by the PLC,
- processing dialog errors with the PLC,
- range selection for each output: voltage, current,
- digital analog conversion.

Overview of the TBX ASS 200 module associated with the TBX LEP 030 communicator:



Description

The TBX ASS 200 module associated with the TBX LEP 030 communicator supports the following functions:

Address	Function
1	refreshing the digital values transmitted by the processor,
2	processing PLC dialog faults,
3	range selection for each output: voltage, current,
4	digital analog conversion.

NOTE: One channel can only be used in a single range, i.e. current or voltage.

Output characteristics for the TBX ASS 200 module

Writing outputs

The user can access two words via the program (1 word of 16 bits per channel), where the analog output values are given.

- from 0 to 10000 (or 0 °/◦◦◦ à 10000 °/◦◦◦) for unipolar ranges 0/20 mA and 4/20 mA,
- from -10000 to +10000 (-10.000 °/◦◦◦ to +10.000 °/◦◦◦) for bipolar range +/-10 V.

Refreshing the outputs via the module

The outputs are refreshed every 5 ms

The response time between the output write via the program and updating the output at the module terminals depends on the period of the PLC task where the module is configured.

Fault handling

Dialog faults with the PLC

This type of handling groups together:

- setting the PLC to STOP mode (or the task in which the module is configured),
- a PLC fault,
- a link fault between the PLC and the module.

In the above cases, the user has two options for each output:

- maintain the output at the current value,
- fallback to a defined value. The value must be selected between the normal display limits (0/10000) for unipolar ranges or –10000/10000 for the voltage range. By default, the module is configured in fallback to 0 mode.

Internal errors in the module

When the module has an internal error the outputs are forced to 0.

Overflow Monitoring for Module TBX ASS 200

Introduction

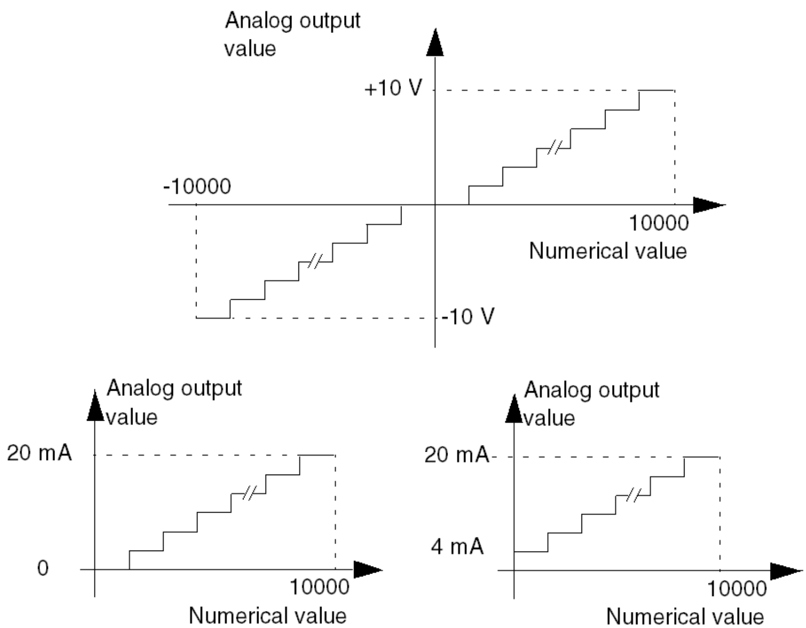
Module **TSX ASS 200** includes an overflow monitoring device.

Range Specifications

The limits and accuracies of the different ranges are as follows:

Range	Lower limit	Upper limit	Accuracy
+/- 10V	-10000	+10000	Conversion over 11 bits + sign from -2048 to +2047 points
0.20mA	0	+10000	Conversion over 11 bits from 0 to +2047 points
4.20mA	0	+10000	Conversion over 11 bits from 0 to +2047 points

Illustration



Under/Overflow Identifiers

If the values provided by the application are outside the limits, the value of the overshot limit is saturated. The overflow is indicated by:

Bit name	Meaning
%I\b.e\r.m.c.ERR	If equal to 1, this indicates a range overflow on the channel.

Section 36.3
TBX AMS 620 Module

Subject of this section

This section introduces the TBX AMS 620 remote module.

What Is in This Section?

This section contains the following topics:

Introducing the TBX AMS 620 module

General

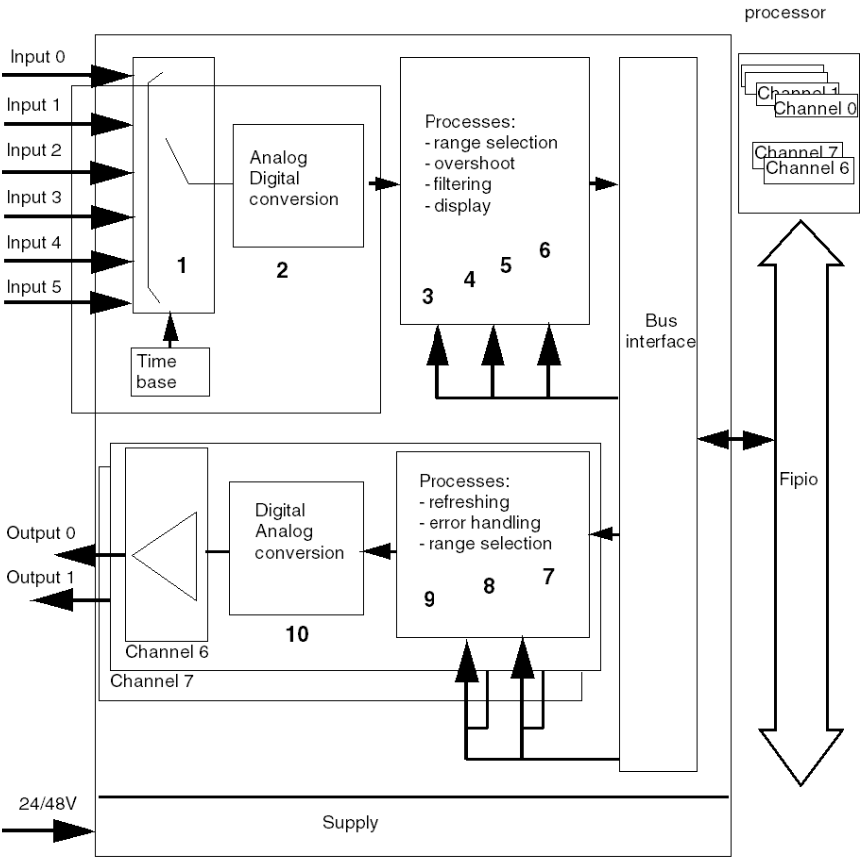
The TBX AMS 620 base unit is an analog output module containing 6 high-level non-insulated channels and 2 insulated outputs. It must be associated to a TBX LEP 030 communicator.

This module supports the following ranges on each input :
- High-level voltage,
- High-level current.

This module supports the following ranges on each output :
- High-level voltage,
- High-level current.

Overview

Overview of the TBX AMS 620 module associated to the TBX LEP 030 communicator:



Description

The TBX AMS 620 module associated with the TBX LEP 030 communicator supports the following input functions :

Address	Function
1	• acquisition of the 6 channels using multiplexing,
2	• 12 bit + sign analog digital conversion,
3	• range selection for each input: voltage, current, thermocouple,
4	• input under/overshoot monitoring,
5	• measurement filtering,
6	• user-defined measurement formatting.

The TBX AMS 620 module associated with the TBX LEP 030 communicator supports the following output functions:

Address	Function
7	refreshing the digital values transmitted by the processor,
8	processing PLC dialog faults,
9	range selection for each output: voltage, current,
10	digital analog conversion.

Timing of measurements on inputs

Introduction

The cycle time for the TBX AMS 620 module is fixed at 42.4 ms.

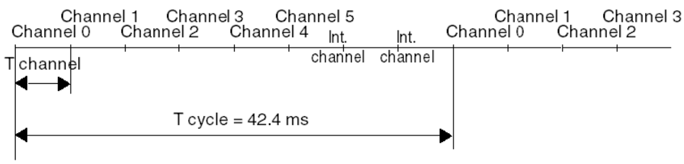
The measurements are sequenced in the following manner: channel 0, channel 1, channel 2, channel 3, channel 4, channel 5 then acquisition of two internal reference voltage channels, required for cyclical calibration.

Breakdown of the cycle time

Scanning time values:

Type of time	Time
Scanning time for a channel	• 5.3 ms,
Acquisition time for a complete cycle	• 42.4 ms.

Illustration:



NOTE:
- The cycle is always identical, even when some channels are not in use,
- The time required for the program to access the measurements also depends on the transmission times on the Fipio bus and on the PLC task period.

Under/Overshoot Monitoring on Inputs

Introduction

The **TBX AMS 620** module provides a choice between voltage and current ranges.

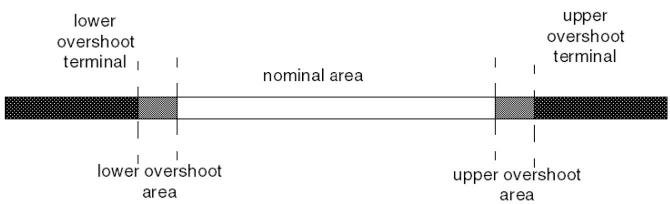
For the selected range, the module performs an overflow check: it checks that the measurement is between a lower and upper limit.

Measurement Areas

The measurement area is located in the nominal area.

Above the nominal area, the overflow is tolerated up to the overflow limits.

Illustration:



Under/Overflow Identifiers

If the values provided by the application are outside the limits, the value of the overshot limit is saturated.

The module continues to provide the converted value until saturation of the converter or the display format (+32767/-32768), even though the validity of the measurement is not guaranteed.

The user can, via the overflow bit, avoid taking these measurements into account.

Overflow bit:

Bit name	Meaning
%I\2.e\0.m.c.ERR	If equal to 1, this indicates a range overflow on the channel.

Overflow Values of the Electrical Ranges

For voltage ranges, the module authorizes a 5% overflow for the positive electrical scope covered by the range.

Overflow values according to input type

Range	Lower limit	Upper limit
+/-10 V	-10.5 V	+10.5 V
0..5 V	0 V: this overflow is not detected	+5.25 V
0..20 mA	0 V: this overflow is not detected	+21 mA
4..20 mA	+3.2 mA	+20.8 mA

Filtering Measurements on Inputs

Introduction

The system uses first order filtering. The filtering coefficient can be modified from a programming console or via the program.

Mathematical Formula

The mathematical formula used is as follows:

$$Mesf(n) = \alpha \times Mesf(n-1) + (1-\alpha) \times Valb(n)$$

where:

α = efficiency of the filter,

Mesf(n) = measurement filtered at moment n,

Mesf(n-1) = measurement filtered at moment n-1,

Valg(n) = gross value at moment n.

On configuration, you can select the filtering value from a choice of 7 values.

Values for the Module TSX AMS 620

The filter values are as follows:

Effectiveness	Value to be selected	Time constant	Corresponding α
No filtering	0	0 s	0
Low filtering	1 2	170 ms 339 ms	0.750 0.875
Medium filtering	3 4	678 ms 1.35 s	0.937 0.969
High filtering	5 6	2.71 s 5.42 s	0.984 0.992

Displaying measurements on inputs

Introduction

This process is used to select the display format depending on which formats are provided in the user program.

Standardized display of electrical ranges

The values are displayed in standardized units (in % with 2 decimals, also with symbol °/ooo):

Type of range	Display
unipolar range 0-10V, 0-5V, 0-20mA, 4-20mA	from 0 to 10000 (0 °/ooo to 10000 °/ooo).
bipolar range +/-10V	from -10000 to +10000 (-10.000 °/ooo to +10.000 °/ooo).

User-defined display of electrical ranges

The user can select the value range in which the measurements are expressed, by selecting:

- the minimum limit corresponding to the range minimum: 0 (or - 10000 °/ooo),
- the maximum limit corresponding to the range maximum: + 10000 °/ooo .

The minimum and maximum limits are between -31128 and +31128.

Example:

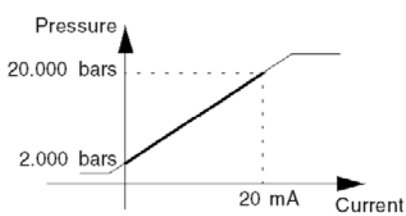
Use of a 2/20 bar pressure sensor supplying a 0/20 mA signal and having a linear characteristic.

The user is interested in the pressure rather than the current value. The best resolution is obtained by selecting user display:

- for minimum limit: 2000,
- for maximum limit: 20000.

The user-program then uses values expressed directly in the physical unit, the millibar.

Illustration:



Characteristics of the outputs

Output writing

The user has access via the program to 2 words (1 16-bit word per channel) in which the values of the analog outputs are given.

- from 0 to 10000 (that is 0 °/ooo to 10000 °/ooo) for unipolar ranges 0/20 mA and 4/20 mA,
- from -10000 to +10000 (-10000 °/ooo to +10000 °/ooo) for bipolar range +/-10 V.

Refreshing outputs via the module

Outputs are refreshed every 5 ms

The response time between writing the output via the program and updating the outputs to the module limits depends on the PLC task period in which the module is configured.

Fault handling

Dialog faults with the PLC

This type of handling groups together:

- setting the PLC to STOP mode (or the task in which the module is configured),
- a PLC fault,
- a link fault between the PLC and the module.

In the above cases, the user has two options for each output:

- maintain the output at the current value,
- fallback to a defined value. The value must be selected between the normal display limits (0/10000) for unipolar ranges or –10000/10000 for the voltage range. By default, the module is configured in fallback to 0 mode.

Internal errors in the module

When the module has an internal error the outputs are forced to 0.

Output Overflow Monitoring for Module TBX AMS 620

Introduction

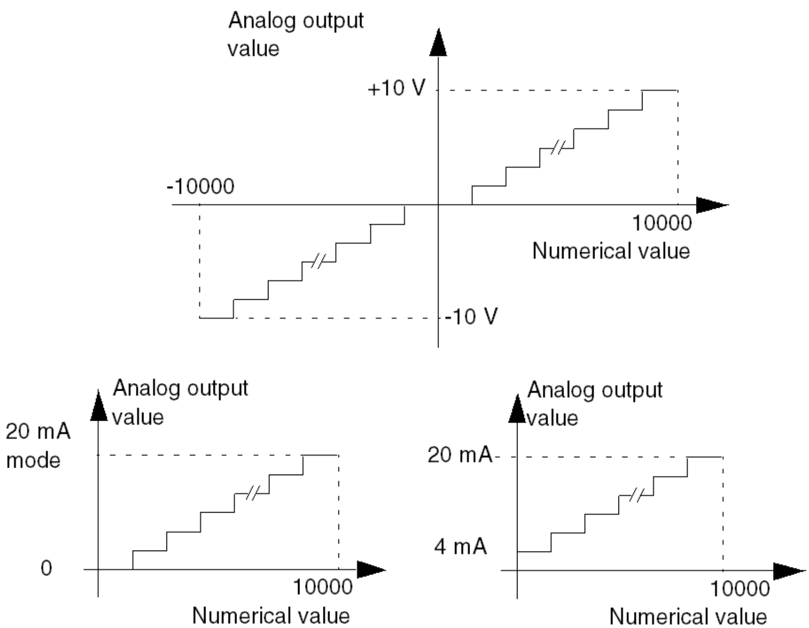
Module **TBX AMS 620** includes an overflow monitoring device.

Range Specifications

The limits and accuracies of the different ranges are as follows:

Range	Lower limit	Upper limit	Accuracy
+/- 10V	-10000	+10000	Conversion over 11 bits + sign from -2048 to +2047 points
0.20mA	0	+10000	Conversion over 11 bits from 0 to +2047 points
4.20mA	0	+10000	Conversion over 11 bits from 0 to +2047 points

Illustration



Under/Overflow Identifiers

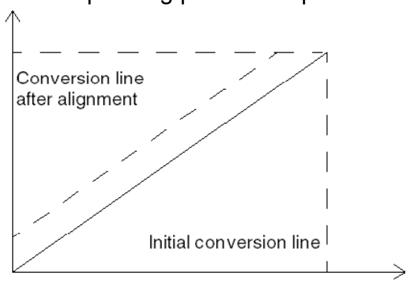
If the values provided by the application are outside the limits, the value of the overshot limit is saturated. The overflow is indicated by:

Bit name	Meaning
%I\b.e\r.m.c.ERR	If equal to 1, this indicates a range overflow on the channel.

Sensor Alignment

Introduction

Alignment consists of eliminating a systematic shift observed with a given sensor, around a given operating point. This is used to compensate for an error linked to the process. For this reason, module replacement does not require a new alignment, though sensor replacement or a change in this sensor's operating point do require a new alignment.



Example

Let us suppose that a pressure sensor linked to a conditioner (1mV/mB) shows 3200 mB, when the actual pressure is 3210 mB.

The value measured by the module on a standardized scale will be 3200 (3.20 V). You can align your measurement to the value 3210 (required value).

After this alignment procedure, the measurement channel will apply a systematic offset of +10. The alignment value to enter is 3210.

Alignment Values

The alignment value can be modified from the Control Expert screen, even if the program is in RUN.

For each input channel, you can:

- Display and modify the required measurement value,
- Save the alignment value,
- See whether the channel already has an alignment.

The alignment offset can also be modified for each program.

The alignment is performed for each channel operating normally, with no influence on the operating modes of the module channel. The maximum variation between the measured value and the required value (aligned value) must not exceed 1000.

The alignment offset is stored in the word %MW\2.e\0.m.c.8.

Chapter 37
Configuring the Analog Application

Subject of this Chapter

This chapter describes the Configuration aspect of the installation of the analog application applied to remote TBX modules.

What Is in This Chapter?

This chapter contains the following sections:

Section 37.1
Configuring a Remote TBX Analog Module: General

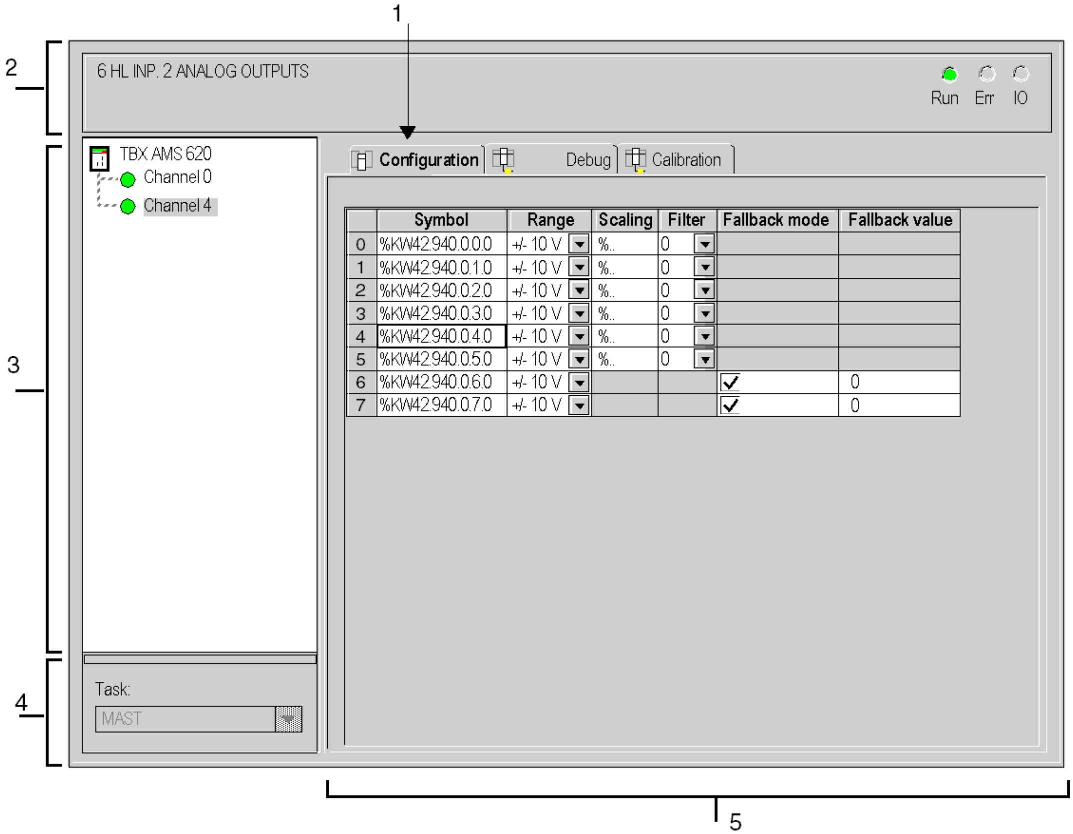
Description of the Configuration Screen of an Analog TBX Module

At a Glance

The module configuration screen, selected on the Fipio bus, displays the parameters associated with the Analog input or output channels

Illustration

The figure below represents a configuration screen.



Description

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

Number	Element	Function
1	Tabs	The tab in the foreground indicates the mode in progress (**Configuration** in this example). Every mode can be selected using the respective tab. The available modes are: ● **Configuration**, ● **Debug** which can be accessed only in online mode, ● **Calibration** which can be accessed only in online mode.
2	**Module** area	Gives a reminder of the device's shortened name.
3	**Channel** area	Is used: ● By clicking on the reference number, to display the tabs: ❍ **Description** which gives the characteristics of the device. ❍ **I/O Objects** *(see EcoStruxure™ Control Expert, Operating Modes)* which is used to presymbolize the input/output objects, ❍ **Fault**, which shows the device faults (in online mode only). ● By clicking on the **Channel**, to select the channel or group of channels (maximum 4) to configure. To the right of the **Channel** is the **Symbol**. This is the name of the channel defined by the user (using the variable editor).
4	**General parameters** area	This area is used to define the task (**MAST** or **FAST**) in which the channel implicit exchange objects will be exchanged.
5	**Configuration** area	This area is used to configure the devices.

Section 37.2
Analog Input/Output Channel Parameters

Subject of this Section

This section presents the different input/output channel parameters of the remote TBX analog modules.

What Is in This Section?

This section contains the following topics:

Input Parameters for Remote Analog TBX Modules

At a Glance

Remote analog input TBX modules have parameters for each channel displayed in the module configuration screen.

Parameters

Parameters for each of the modules (the default parameters are in bold in the tables).

Parameter	TBX AES 400	TBX AMS 620
Number of input channels	4	6
Range	**+/-10 V** +/-5 V 0..20 mA 4..20 mA Pt100 / Pt1000 / Ni1000 Thermo B / Thermo E / Thermo J /Thermo K / Thermo L / Thermo N / Thermo R / Thermo S / Thermo T +/-20 mV, +/-50 mV +/-200 mV, +/-500 mV	**+/-10 V** 0..5 V 0..20 mA 4..20 mA
Filtering	**0**..6	**0**..6
High level display	‱ User	‱ User
Display Thermoprobes Thermocouples	**1/10°C** 1/10°F ‱	-
Task associated with the channel	**MAST** FAST	**MAST** FAST
Rejection	**50Hz** / 60Hz	-

Output Parameters for Remote TBX Analog Modules

At a Glance

Remote analog output modules have parameters for each channel displayed in the module configuration screen.

Parameters

Parameters for each of the modules (the default parameters are in bold in the tables).

Module	TBX AMS 620	TBX ASS 200
Number of output channels	2	2
Range	**+/-10 V** 0..20 mA 4..20 mA	**+/-10 V** 0..20 mA 4..20 mA
Display	‱	‱
Task associated with the channel	**Mast** / Fast	**Mast** / Fast
Fallback	**Fallback** or Maintain Fallback value	**Fallback** or Maintain Fallback value

Section 37.3
Configuration of Analog Parameters

Subject of this Section

This section describes the implementation of the different configuration parameters for remote TBX analog modules.

What Is in This Section?

This section contains the following topics:

Modification of the Range for an Input or Output of an Analog Module

At a Glance

This parameter defines the range of the input or output channel.

Depending on the module type, the input can be:

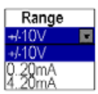
- In electrical voltage,
- In electrical intensity,
- Thermocouple,
- Thermoprobe.

Depending on the module type, the output can be:

- In electrical voltage,
- In electrical intensity.

Procedure

The table below shows the procedure for defining the range assigned to the channels of an analog module.

<table>
<tr><th>Step</th><th>Procedure</th></tr>
<tr><td>1</td><td>Access the hardware configuration screen of the required module.</td></tr>
<tr><td>2</td><td>For the required channel, click the drop-down menu button in the Range column.
Result: a drop-down list appears.


</td></tr>
<tr><td>3</td><td>Select the required range.</td></tr>
<tr><td>4</td><td>Confirm the configuration.</td></tr>
</table>

Modification of the Task Associated with an Analog Module Channel

At a Glance

This parameter defines the task in which inputs are acquired and outputs are updated.

The task is defined:

- For all the channels of a Fipio connection point,
- For a group of 2 or 4 consecutive channels.

The possible choices are as follows:

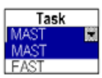
- The **MAST** task,
- The **FAST** task.

Note: It is essential not to assign to the **FAST** task more than 2 analog modules, each with 4 channels in use. Any more may lead to system problems.

NOTE: The **FAST** task is assigned to the input channels only in fast service routine.

Procedure

The table below shows the procedure for defining the type of task assigned to the channels of an analog module.

Step	Action
1	Access the hardware configuration screen of the required module.
2	Select, in the **Channel** area, the group of channels to configure.
3	In the **General parameters** area, click on the drop-down menu button in the **Task** field. **Result**: a drop-down list appears: 
4	Select the required task.
5	Confirm the configuration.

Modification of the Display Format for a Voltage or Current Channel

At a Glance

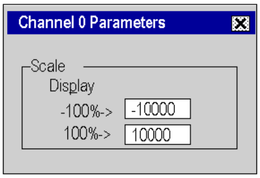
This parameter defines the measurement display format for an analog module channel, for which the range is configured in voltage or current.

The display format can be:

- Standardized, in which the scale is by default 0..10000 or +10000 (**%**),
- User-defined, in which the default scale can be modified by the user.

Procedure

The table below shows the procedure for defining the scale assigned to an analog module channel.

Step	Action
1	Access the hardware configuration screen of the required module.
2	Click in the cell of the **Scale** column of the channel to set. **Result**: the **Channel Parameters** dialog box appears: 
3	Enter the values to assign to the channel into one of the two **Display** boxes in the **Scale** area.
4	Validate the choice by closing the dialog box. Note: if the default values have been selected (standardized display), the corresponding cell in the **Scale** area shows **%.** Otherwise it will show **User** (user display).
5	Validate the modification by clicking **Edit** → **Confirm**.

Modification of the Display Format for a Thermocouple or Thermoprobe Channel

At a Glance

This parameter defines the measurement display format for an analog module channel, for which the range is configured in thermocouple or thermoprobe.

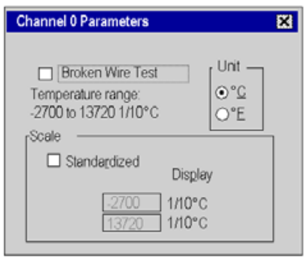
The display format can be for a display in **degrees Celsius** or in **degrees Fahrenheit**, with possible short-circuit or open circuit display.

The display format can be:

- Standardized, in which the scale is by default for the selected thermocouple or thermoprobe, defined in tenths of a degree (for example: -600 to +1100 ° C for a Ni1000 probe) (1/10 ° F or 1/10 ° C),
- User-defined, in which the default scale can be modified by the user.

Procedure

The table below shows the procedure for defining the scale assigned to an analog module channel.

Step	Action
1	Access the configuration screen of the required module.
2	Click in the cell of the **Scale** column of the channel to set. **Result**: an arrow appears.
3	Click on the arrow in the cell of the **Scale** column of the channel to set. **Result** : the **Channel Parameters** dialog box appears. 
4	Check the **Broken Wire Test** box is you want to activate this function.
5	Select the temperature unit by checking **°C** or **°F**.
6	Check the **Standardized** box for a standardized display.
7	Validate the choice by closing the dialog box. **Caution**: if the default values have been selected (Standardized display), the corresponding cell in the **Scale** column shows **%..** regardless of selected temperature unit. Otherwise it will show **User** (user display).
8	Validate the modification by clicking **Edit** → **Confirm**.

Modification of the Filtering Value for Analog Module Channels

At a Glance

This parameter defines the type of filtering for the selected input channel of analog modules.

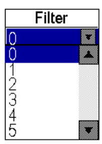
The available filtering values are:

- **0**: no filtering,
- **1** and **2**: low filtering,
- **3** and **4**: medium filtering,
- **5** and **6**: high filtering.

NOTE: If the fast scan cycle is selected, filtering is not taken into account.

Procedure

The following table shows the procedure for defining the filtering value assigned to the analog module inputs.

Step	Action
1	Access the hardware configuration screen of the required module.
2	Click, for each input channel required, on the arrow of the drop-down menu in the **Filter** column.
3	**Result**: The drop-down menu appears: 
4	Select the filtering value to assign to the selected channel.
5	Validate the modification by clicking **Edit** → **Confirm**.

Modification of the Fallback Mode for Analog Outputs

At a Glance

This parameter sets the fallback mode which outputs take on when the PLC switches to STOP or if there is a communication fault.

The possible modes are as follows:

- **Fallback**: outputs are set to a value that can be set between -10000 and 10000 (0 by default),
- **Maintain**: the outputs remain in the state in which they were before the change to STOP.

⚠ WARNING
UNEXPECTED APPLICATION BEHAVIOR Ensure that the extension module is connected to the base module via the connection cable, else the extension module outputs would not switch to fallback mode. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Procedure

The following table shows the procedure for defining the fallback mode assigned to the outputs of the analog modules.

Step	Action
1	Access the configuration screen of the required module.
2	Check the box in the cell of the **Fallback mode** column of the channel to configure.
3	Enter, in the cell corresponding to the **Fallback value** column, the required value. **Result**: the selected fallback mode will therefore be assigned to the selected channel.
4	For a **Maintain**, uncheck the box in the cell of the **Fallback mode** column of the channel to configure. **Result**: the value maintain will be assigned to the selected channel.
5	Validate the modification by clicking **Edit** → **Confirm**.

Chapter 38
Presentation of Analog Application Language Objects

Subject of this Chapter

This chapter describes the language objects associated with the analog application using different IODDTs.

What Is in This Chapter?

This chapter contains the following sections:

Section 38.1
Remote TBX Analog Module Language Objects and IODDTs

Presentation of Language Objects of the Analog Application Function Associated with Remote Modules

General

Analog modules have different associated IODDTs.

The IODDTs are predefined by the manufacturer. They contain input/output language objects belonging to a channel of an application-specific module.

NOTE: IODDT variables can be created in two different ways:
- Using the **I/O objects** *(see EcoStruxure™ Control Expert, Operating Modes)* tab,
- Using the Data Editor *(see EcoStruxure™ Control Expert, Operating Modes)*.

There are four types of IODDT for the analog application:

- `T_ANA_IN_GEN`,
- `T_ANA_IN_STD`,
- `T_ANA_OUT_GEN`,
- `T_ANA_OUT_STD`.

Language Object Types

Each IODDT contains a group of language objects which are used to control them and check their operation.

There are two types of language object:

- **Implicit exchange objects**, which are automatically exchanged on each cycle of the task associated with the module *(see page 336)*,
- **Explicit exchange objects**, which are exchanged when requested to do so by the project, using explicit exchange instructions *(see page 337)*.

Implicit exchanges concern the module inputs/outputs: process value results, information and commands.

Explicit exchanges are used to set up the module's parameters and for module diagnostics *(see page 339)*.

Creating an IODDT-Type Data Instance

In the software installation principle, you must create an IODDT-type instance, associate the IODDT instance with the module and generate the project *(see EcoStruxure™ Control Expert, Operating Modes)*.

Section 38.2
Analog Module IODDTs

Subject of this Section

This section presents the different IODDTs and language objects associated with the remote analog TBX modules.

NOTE: The `T_GEN_MOD`-type IODDT is associated with all Premium PLC modules *(see Premium and Atrium Using EcoStruxure™ Control Expert, Fipio Bus, Setup Manual)*.

What Is in This Section?

This section contains the following topics:

Detail of the Language Objects of the IODDT of the T_ANA_IN_GEN Type

At a Glance

The tables below present the implicit exchange objects for the T_ANA_IN_GEN-type IODDT that are applicable to all analog input modules.

Input Value

The following table shows the analog value.

Standard symbol	Type	Access	Meaning	Address
VALUE	INT	R	Analog input value.	%IW\2.e\0.m.c.0

Error bit %I\2.e\0.m.c.ERR

The table below presents the error bit %I\2.e\0.m.c.ERR..

Standard symbol	Type	Access	Meaning	Address
CH_ERROR	BOOL	R	Analog channel error bit.	%I\2.e\0.m.c.ERR

Details of T_ANA_IN_STD-Type IODDT Implicit Exchange Objects

At a Glance

The tables below present the implicit exchange objects for the `T_ANA_IN_STD`-type IODDT that are applicable to all analog input modules.

Input Value

The following table shows the analog value.

Standard symbol	Type	Access	Meaning	Address
`VALUE`	INT	R	Analog input value	%IW\2.e\0.m.c.0

Error bit %I\2.e\0.m.c.ERR

The table below presents the error bit %I\2.e\0.m.c.ERR..

Standard symbol	Type	Access	Meaning	Address
`CH_ERROR`	BOOL	R	Analog channel error bit	%I\2.e\0.m.c.ERR

Details of T_ANA_IN_STD-Type IODDT Explicit Exchange Objects

At a Glance

This section presents the explicit exchange objects for the `T_ANA_IN_STD`-type IODDT applicable to all Analog input modules. It includes the word type objects whose bits have a specific meaning. These objects are described in detail below.

Example of declaration of a variable: `IODDT_VAR1` of the `T_ANA_IN_STD` type.

Observations

- In general, the meaning of the bits is given for bit status 1. In specific cases an explanation is given for each status of the bit.
- Not all bits are used.

Execution Indicators of an Explicit Exchange: EXCH_STS

The table below presents the meanings of the exchange control bits of the channel `EXCH_STS` (%MW\2.e\0.m.c.0).

Standard symbol	Type	Access	Meaning	Address
`STS_IN_PROGR`	BOOL	R	Reading of channel status words in progress.	%MW\2.e\0.m.c.0.0
`CMD_IN_PROGR`	BOOL	R	Current command parameters exchange in progress.	%MW\2.e\0.m.c.0.1
`ADJ_IN_PROGR`	BOOL	R	Adjustment parameters exchange in progress.	%MW\2.e\0.m.c.0.2

Explicit Exchange Report: EXCH_RPT

The table below presents the meaning of the exchange report bits `EXCH_RPT` (%MW\2.e\0.m.c.1).

Standard symbol	Type	Access	Meaning	Address
`STS_ERR`	BOOL	R	Reading error for channel status words.	%MW\2.e\0.m.c.1.0
`CMD_ERR`	BOOL	R	Error during a command parameter exchange (1 = failure).	%MW\2.e\0.m.c.1.1
`ADJ_ERR`	BOOL	R	Error during adjustment parameters exchange.	%MW\2.e\0.m.c.1.2
`RECONF_ERR`	BOOL	R	Fault when reconfiguring the channel (1 = failure).	%MW\2.e\0.m.c.1.15

Standard Channel Faults, CH_FLT

The table below shows the meaning of the bits of the status word CH_FLT (%MW\2.e\0.m.c.2). Reading is performed by a READ_STS (IODDT_VAR1).

Standard symbol	Type	Access	Meaning	Address
SENSOR_FLT	BOOL	R	Sensor link fault.	%MW\2.e\0.m.c.2.0
RANGE_FLT	BOOL	R	Range overshoot fault.	%MW\2.e\0.m.c.2.1
BLK	BOOL	R	Terminal block fault.	%MW\2.e\0.m.c.2.2
EXT_PS_FLT	BOOL	R	External supply fault.	%MW\2.e\0.m.c.2.3
INTERNAL_FLT	BOOL	R	Channel failure.	%MW\2.e\0.m.c.2.4
CONF_FLT	BOOL	R	Different hardware and software configurations.	%MW\2.e\0.m.c.2.5
COM_FLT	BOOL	R	Communication fault with PLC.	%MW\2.e\0.m.c.2.6
APPLI_FLT	BOOL	R	Application fault (adjustment or configuration error).	%MW\2.e\0.m.c.2.7
NOT_READY	BOOL	R	Channel not ready.	%MW\2.e\0.m.c.2.8
COLD_JUNCTION_FLT	BOOL	R	Cold junction compensation fault.	%MW\2.e\0.m.c.2.9
CALIB_FLT	BOOL	R	Calibration fault.	%MW\2.e\0.m.c.2.10
RANGE_UNF	BOOL	R	Recalibrated channel or lower range overshoot.	%MW\2.e\0.m.c.2.14
RANGE_OVF	BOOL	R	Aligned channel or upper range overshoot.	%MW\2.e\0.m.c.2.15

Parameters

The table below shows the meaning of the words (%MW\2.e\0.m.c.7 and %MW\2.e\0.m.c.8). The requests used are those associated with the parameters (READ_PARAM and WRITE_PARAM).

Standard symbol	Type	Access	Meaning	Address
FILTER_COEFF	INT	R/W	Value of filter coefficient.	%MW\2.e\0.m.c.7
ALIGNMENT_OFFSET	INT	R/W	Alignment offset value.	%MW\2.e\0.m.c.8

Detail of the Language Objects of the IODDT of the T_ANA_OUT_GEN Type

At a Glance

The tables below present the implicit exchange objects for the `T_ANA_OUT_GEN`-type IODDT that are applicable to all analog output modules.

Value of the output

The following table shows the analog output.

Standard symbol	Type	Access	Meaning	Address
`VALUE`	INT	R	Value of the analog output.	%QW\2.e\0.m.c.0

Error Bit % Ir.m.c.ERR

The table below presents the error bit %I\2.e\0.m.c.ERR..

Standard symbol	Type	Access	Meaning	Address
`CH_ERROR`	BOOL	R	Analog channel error bit.	%I\2.e\0.m.c.ERR

Details of T_ANA_OUT_STD-Type IODDT Implicit Exchange Objects

At a Glance

The tables below present the implicit exchange objects for the `T_ANA_OUT_STD`-type IODDT that are applicable to all analog output modules.

Value of The Output

The following table shows the analog output.

Standard symbol	Type	Access	Meaning	Address
`VALUE`	INT	R	Measurement of the analog output.	%QW\2.e\0.m.c.0

Error bit %I\2.e\0.m.c.ERR

The table below presents the error bit %I\2.e\0.m.c.ERR..

Standard symbol	Type	Access	Meaning	Address
`CH_ERROR`	BOOL	R	Analog channel error bit.	%I\2.e\0.m.c.ERR

Details of T_ANA_OUT_STD-Type IODDT Explicit Exchange Objects

At a Glance

This section presents the explicit exchange objects for the T_ANA_OUT_STD-type IODDT applicable to all Analog output modules. It includes the word type objects whose bits have a specific meaning. These objects are described in detail below.

Example of a declaration of a variable: IODDT_VAR1 of the T_ANA_OUT_STD type.

Observations

- In general, the meaning of the bits is given for bit status 1. In specific cases an explanation is given for each status of the bit.
- Not all bits are used.

Execution Indicators of an Explicit Exchange: EXCH_STS

The table below presents the meanings of the exchange control bits of the channel EXCH_STS (%MW\2.e\0.m.c.0).

Standard symbol	Type	Access	Meaning	Address
STS_IN_PROGR	BOOL	R	Reading of channel status words in progress.	%MW\2.e\0.m.c.0.0
CMD_IN_PROGR	BOOL	R	Current command parameters exchange in progress.	%MW\2.e\0.m.c.0.1
ADJ_IN_PROGR	BOOL	R	Adjustment parameters exchange in progress.	%MW\2.e\0.m.c.0.2

Explicit Exchange Report: EXCH_RPT

The table below presents the meaning of the exchange report bits EXCH_RPT (%MW\2.e\0.m.c.1).

Standard symbol	Type	Access	Meaning	Address
STS_ERR	BOOL	R	Reading error for channel status words.	%MW\2.e\0.m.c.1.0
CMD_ERR	BOOL	R	Error during a command parameter exchange (1 = failure).	%MW\2.e\0.m.c.1.1
ADJ_ERR	BOOL	R	Error during adjustment parameters exchange.	%MW\2.e\0.m.c.1.2
RECONF_ERR	BOOL	R	Fault when reconfiguring the channel (1 = failure).	%MW\2.e\0.m.c.1.15

Standard Channel Faults, CH_FLT

The following table shows the meaning of the bits of the status word CH_FLT (%MW\2.e\0.m.c.2). Reading is performed by a READ_STS (IODDT_VAR1).

Standard symbol	Type	Access	Meaning	Address
PS_FLT	BOOL	R	24 V supply fault.	%MW\2.e\0.m.c.2.0
RANGE_FLT	BOOL	R	Range overshoot fault.	%MW\2.e\0.m.c.2.1
BLK	BOOL	R	Terminal block fault.	%MW\2.e\0.m.c.2.2
RANGE_OVERRUN	BOOL	R	Range overshoot fault by higher value if the %MW\2.e\0.m.c.2.1 bit is set to 1.	%MW\2.e\0.m.c.2.3
INTERNAL_FLT	BOOL	R	Channel failure.	%MW\2.e\0.m.c.2.4
CONF_FLT	BOOL	R	Different hardware and software configurations.	%MW\2.e\0.m.c.2.5
COM_FLT	BOOL	R	Communication fault with PLC.	%MW\2.e\0.m.c.2.6
APPLI_FLT	BOOL	R	Application fault (adjustment or configuration error).	%MW\2.e\0.m.c.2.7
NOT_READY	BOOL	R	Channel not ready.	%MW\2.e\0.m.c.2.8

Chapter 39
Debug of the Remote TBX Analog Modules

Subject of this Chapter

This chapter describes the debug function and commands for remote Analog modules on a Fipio bus.

What Is in This Chapter?

This chapter contains the following topics:

Presentation of the Debug Function for a Remote Analog Module

Introduction

The Debug function is used for each TBX Analog input/output module present in the application:

- To display the parameters of each of the channels (channel state, filtering vale, etc.),
- To access the diagnostics and calibration of the selected channel.

The function also provides access to module diagnostics in the event of a fault.

NOTE: This function is only available in online mode.

NOTE: Access to the Debug function is limited to four Fipio device screens (TBX Discrete, TBX Analog, IP67, etc.) opened simultaneously.

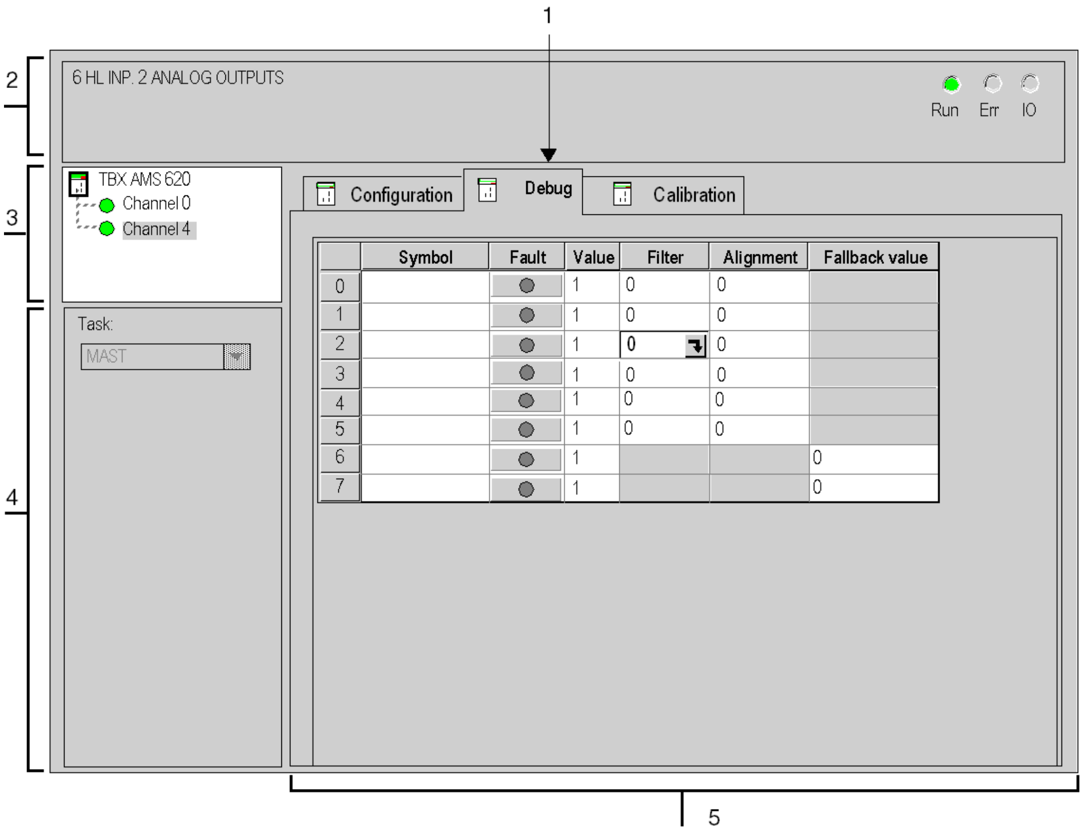
Description of the Debug screen of an Analog TBX Module

At a Glance

The debug screen displays the value and state of each of the selected module's channels in real time.

Illustration

The figure below represents a debug screen.



Description

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

Number	Element	Function
1	Tabs	The tab in the foreground indicates the mode in progress (**Debug** in this example). Each mode can be selected using the respective tab. ● **Debug** which can be accessed only in online mode, ● **Calibration** which can be accessed only in online mode, ● **Configuration**.
2	**Module** area	Specifies the abbreviated heading of the module. In the same area there are 3 LEDs which indicate the module's operating mode: ● **RUN** indicates the operating status of the module, ● **ERR** indicates an internal fault in the module, ● **I/O** indicates a fault from outside the module or an application fault.
3	**Channel** area	Is used: ● By clicking on the reference number, to display the tabs: ❍ **Description** which gives the characteristics of the device. ❍ **I/O Objects** *(see EcoStruxure™ Control Expert, Operating Modes)* which is used to presymbolize the input/output objects. ❍ **Fault** which shows the device faults (in online mode). ● By clicking on the **Channel**, to select the channel or group of channels (maximum 4) to debug. To the left of the symbol there is a copy of the **CHx** channel LED.
4	**General parameters** area	Gives a reminder of the channel setting: ● **Task:** specifies the **MAST** or **FAST** task configured. This heading is frozen.
5	**Parameters in progress** area	This area displays the state of the inputs and outputs, and the different parameters in progress. For each of the channels, there is a maximum of six columns: ● The **Symbol** column displays the symbol associated with the channel when it has been defined by the user (using the variable editor), ● The **Fault** column creates direct access to the diagnostics for each channel when these are faulty (indicated by the indicator lamp built into the diagnostics access button, which turns red), ● The **Value** column displays the status of each of the channels of the module, ● The **Filter** column indicates the filtering value, ● The **Align** column indicates the alignment value, ● The **Fallback Value** column indicates the fallback value.

Modification of the Channel Filtering Value

At a Glance

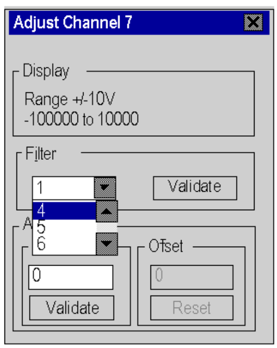
This function is used to modify the filtering value for one or more channels of an analog module.

The available commands are:

- **0**: no filtering,
- **1** and **2**: low filtering,
- **3** and **4**: medium filtering,
- **5** and **6**: high filtering.

Procedure

The table below shows the procedure for changing a Filtering value.

Step	Action for one channel
1	Access the Debug screen.
2	Select the channel to modify in the **Parameters in progress** area and double-click on the corresponding box in the **Filter** column. **Result**: the **Adjust Channel** dialog box appears. 
3	Click on the small arrow in the **Filter** field of the **Adjust Channel** dialog box, and define in the drop-down menu the new selected value.
4	Confirm the selection by clicking **Validate** and closing the **Adjust Channel** dialog box.
5	The new filtering value then appears in the box corresponding to the selected channel, in the **Filter** column of the **Parameters in progress** area.

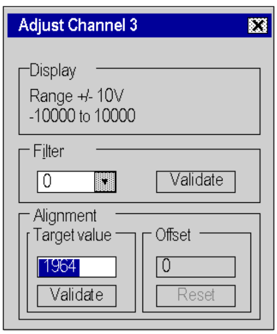
Input Channel Alignment

At a Glance

The alignment procedure for an input allows an offset value to be added to the value measured by this input in order to compensate for a sensor shift (for example, adjusting the current value to 0°C of a Pt100 probe plunged into a bucket of ice for adjustment purposes).

Procedure

The following table describes the procedure used to align an input channel:

Step	Action for one channel
1	Access the Debug screen.
2	Select the channel to align in the **Parameters in progress** area and double-click on the corresponding box in the **Alignment** column.
3	Click on the check box in the **Target value** field in the **Adjust channel** dialog box, and enter the new alignment value.
4	Confirm this new alignment value by clicking the **Validate** button. **Result**: the new offset value is applied and appears in the **Alignment** column. 
5	Close the **Channel Adjust** dialog box.

Notes

NOTE: When the offset alignment is modified by program using the `WRITE_PARAM` instruction, its value must fall between +1500 and -1500.

NOTE: The calculated offset value only acknowledges "keyboard" user commands. Simultaneous execution of the program (RUN) also adjusting the alignment will make the offset erroneous.

Chapter 40
Calibration of the Remote TBX Analog Modules

Subject of this Chapter

This chapter describes the calibration function and commands for Analog remote modules on a Fipio bus.

What Is in This Chapter?

This chapter contains the following topics:

Calibration Function for a Remote Analog TBX Module

Introduction

This function is only available in online mode. It is used to recalibrate the channels of each input analog TBX module of an application.

Calibration can be used to correct long-term module drifts. It can also optimize the precision of the measurement at an ambient temperature other than 25°C.

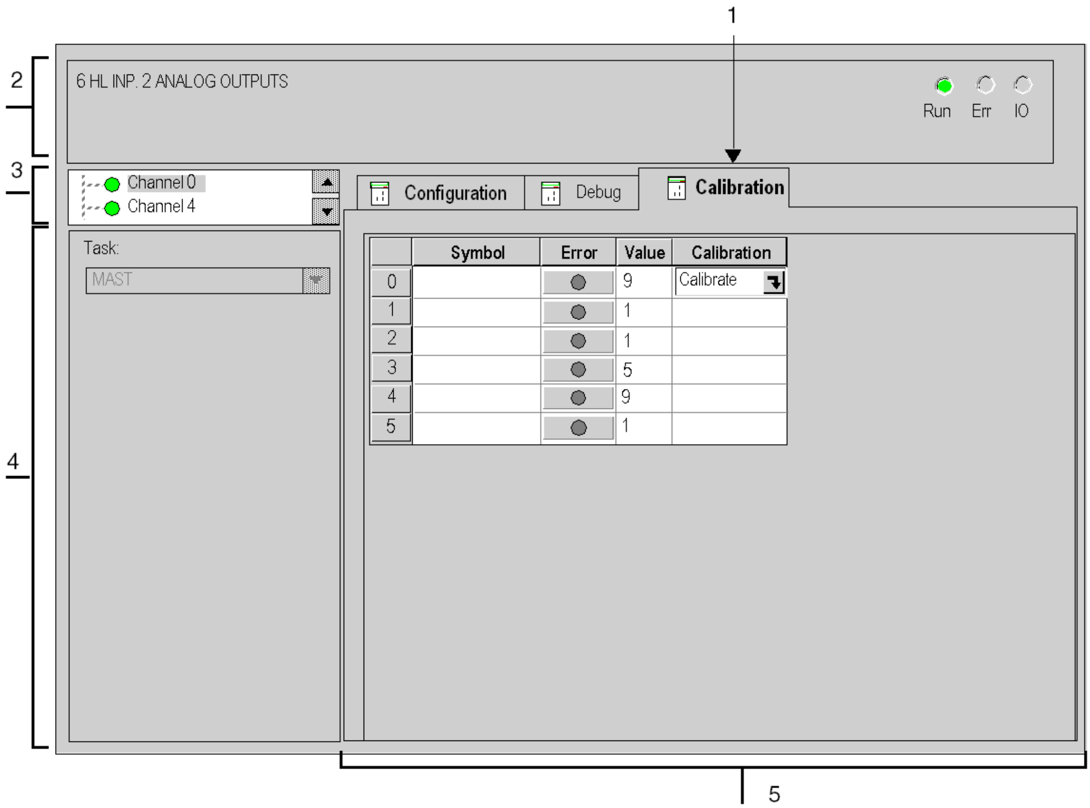
Procedure

Procedure for accessing the **Calibration** function:

Step	Action
1	Access the Fipio bus configuration screen.
2	Double-click on the analog TBX to calibrate.
3	Select the **Calibration** tab. **Result**: the **Calibration** screen appears.

Illustration

The figure below shows an example of a calibration screen.



Description

The table below shows the different elements in the calibration screen and their functions.

Number	Element	Function
1	Tabs	The tab in the foreground indicates the mode in progress (**Calibration** in this example). Every mode can be selected using the respective tab. The available modes are: ● **Calibration** which can be accessed only in online mode, ● **Debug** which can be accessed only in online mode, ● **Configuration**.
2	**Module** area	Specifies the abbreviated heading of the module. In the same area there are 3 LEDs which indicate the status of the module in online mode: ● **RUN** indicates the operating status of the module, ● **ERR** indicates an internal fault in the module, ● **I/O** indicates a fault from outside the module or an application fault.
3	**Channel** area	Is used: ● By clicking on the reference number, to display the tabs: ❍ **Description** which gives the characteristics of the device. ❍ **I/O Objects** *(see EcoStruxure ™ Control Expert, Operating Modes)* which is used to presymbolize the input/output objects. ❍ **Fault** which shows the device faults (in online mode). ● By clicking on the **Channel**, to select the channel or group of channels (maximum 4) to debug. To the left of the symbol there is a copy of the **CHx** channel LED.
4	**General parameters** area	Specifies the **MAST** or **FAST** task configured. This heading is frozen.
5	**Display** area	During calibration, all measurements are invalid, filtering and alignments are inhibited.

NOTE: All unavailable LEDs and commands are grayed out.

List

Calibration procedures differ according to the type of TBX AES 400 *(see page 437)* and TBX AMS 620 *(see page 439)* module.

TBX AES 400 Module Calibration

Introduction

Calibration is performed globally for the module on channel 0.

You are advised to calibrate the module with no application loaded. Calibration can take place with the PLC task connected to the channel, in RUN or in STOP.

Calibration includes two stages:
- Calibration of zero
- Full-scale calibration.

Calibration of Zero

It is recommended to calibrate zero for the +/-20mV and +/-50mV ranges, and the thermocouple ranges. This involves calibrating zero for each of the channels simultaneously in the +/- 20 mV range at the required ambient temperature, by placing shunts directly on the input terminals of the base.

Full-Scale Calibration

Full-scale calibration is performed on channel 0, by placing the calibration source adjusted to full scale +/-0.01% directly on the input terminals of channel 0 of the base.

Precautions

In calibration mode, the measurement of all of the module’s channels are declared invalid, filtering and alignments are inhibited, and channel acquisition cycles may be lengthened.

With inputs other than channel 0 no longer acquired during calibration, the value sent to the application for the other channels is the last measured value before switching to calibration.

How to Calibrate the Module

The following table shows the procedure for calibrating the module:

Step	Action
1	Access the calibration adjustment screen
2	Double-click on channel 0. **Result**: the question ‘Switch to recalibration mode?’ appears.
3	Answer **Yes** to the above question. **Result**: the question ‘Perform 0 calibration?’ appears.
4	Place a shunt on all inputs of the module to perform 0 calibration, and answer **Yes** to the above question. Otherwise, answer **No** not to perform 0 calibration.

Step	Action
5	You can then perform full scale calibration. Depending on the range to calibrate, connect a reference voltage to the voltage input of channel 0: ● Reference voltage = 10 V (precision +/- 0.01%) to calibrate the module for ranges 10 V and 0..10 V, ● Reference voltage = 5 V (precision +/- 0.01%) to calibrate the module for ranges 0..5 V, 1..5V, 0..20 mA and 4..20 mA, ● Reference voltage = 2 V (precision +/- 0.01%) to calibrate the module for ranges Pt1000 and Ni1000, ● Reference voltage = 500 mV (precision +/- 0.01%) to calibrate the module for the 500 mV range, ● Reference voltage = 200 mV (precision +/- 0.01%) to calibrate the module for ranges Pt100 and +/- 200 mV, ● Reference voltage = 50 mV (precision +/- 0.01%) to calibrate the module for ranges +/- 200 mV and thermocouples E, J, K and N, ● Reference voltage = 20 mV (precision +/- 0.01%) to calibrate the module for ranges +/- 200 mV and thermocouples B, R, S and T, Warning: the reference 5 V is used to recalibrate the entire measurement string for ranges 0..20 mA and 4..20 mA, except for the 250 Ohm current shunt on the current input.
6	Once the reference is connected to the voltage input (for example 10 V), use the **Reference** drop-down list to select this value. You may have to wait while the connected reference voltage stabilizes, then confirm the selection by clicking the command button **Confirm**. The ranges connected to this reference voltage (for example 10 V and 0..10 V) are calibrated automatically.
7	You may have to calibrate the module for the other ranges. The command button **Return To Factory Parameters** is used to cancel all calibrations previously performed and return to the initial factory calibration.
8	Press the command button **Save** to acknowledge and save the new calibration to the module. When you quit the calibration screen without saving, a message appears to inform you that the calibration operations will be lost

TBX AMS 620 Module Calibration

Introduction

Calibration is performed globally for the module on channel 0.

You are advised to calibrate the module with no application loaded. Calibration can take place with the PLC task connected to the channel, in RUN or in STOP. Calibration is full-scale calibration.

Full-Scale Calibration

Full-scale calibration is performed on channel 0, by placing the calibration source adjusted to full scale +/-0.01% directly on the input terminals of channel 0 of the base.

Precautions

In calibration mode, the measurement of all of the module’s channels are declared invalid, filtering and alignments are inhibited, and channel acquisition cycles may be lengthened.

With inputs other than channel 0 no longer acquired during calibration, the value sent to the application for the other channels is the last measured value before switching to calibration.

How to Calibrate the Module

The following table shows the procedure for calibrating the module:

Step	Action
1	Access the calibration adjustment screen
2	Double-click on channel 0. **Result**: the question ‘Switch to recalibration mode?’ appears.
3	Answer **Yes** to the above question. **Result**: the calibration window appears.
4	You can then perform full scale calibration. Depending on the range to calibrate, connect a reference voltage to the voltage input of channel 0: ● Reference voltage = 10 V (precision +/- 0.01%) to calibrate the module for ranges +/-10 V, ● Reference voltage = 5 V (precision +/- 0.01%) to calibrate the module for ranges 0..5 V.
5	Once the reference is connected to the voltage input (for example 10 V), use the **Reference** drop-down list to select this value. You may have to wait while the connected reference voltage stabilizes, then confirm the selection by clicking the command button **Validate**. The ranges connected to this reference voltage are calibrated automatically.
6	You may have to calibrate the module for the other ranges. The command button **Return To Factory Parameters** is used to cancel all calibrations previously performed and return to the initial factory calibration.
7	Press the command button **Save** to acknowledge and save the new calibration to the module. When you quit the calibration screen without saving, a message appears to inform you that the calibration operations will be lost.

Chapter 41
Diagnostics of the Remote Analog TBX Modules

Subject of this Chapter

This chapter describes the diagnostics function and commands for Analog remote modules on a Fipio bus.

What Is in This Chapter?

This chapter contains the following topics:

Diagnostics of an Analog Module

At a Glance

The module Diagnostics function displays the current faults, if there are any, classified according to their category:

- **internal faults**:
  - Module failures,
  - Self-testing in progress,
- **external faults**:
  - Terminal block fault,
- **other faults**:
  - Configuration fault,
  - Module missing or off,
  - Faulty channel *(see page 444)*.

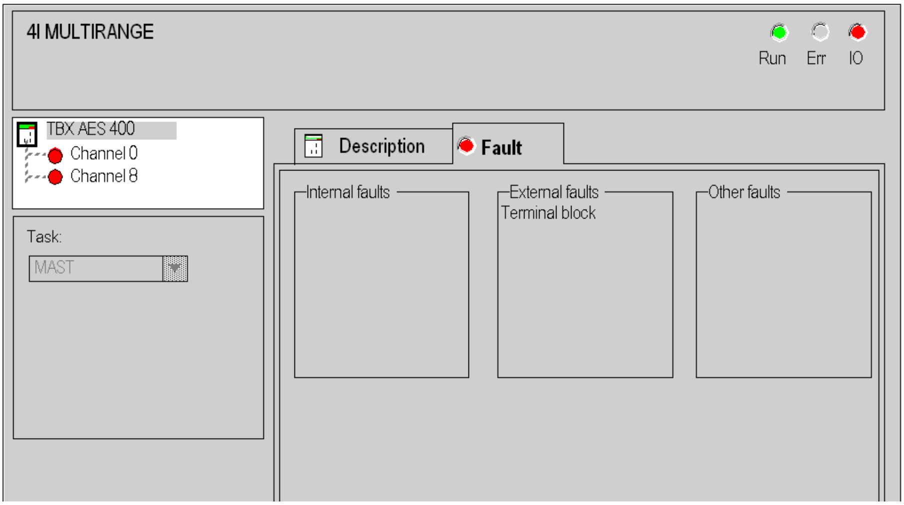
A module fault is indicated when certain LEDs change to red, such as:

- In the Fipio bus window:
  - The connection point number of the module on the Fipio bus is red.
- In all screens at module level:
  - The **Err** and **I/O** LEDs, according to the type of fault,
  - The **Channel** LED in the **Channel** field.
- The red LED on the Fault tab.

NOTE: If you disconnect an extension module from the base module when this is configured, on power up the base module will appear faulty on the Fipio bus and the **I/O** LED will turn red.

Procedure

The following table shows the procedure for accessing the Module fault screen.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Open the module on which you would like to perform diagnostics.</td></tr>
<tr><td>2</td><td>Click on the module reference in the channel zone and select the Fault tab.
Result: the list of module faults appears.


Note: In the event of major failure, absence of the module, certain configuration faults, or a major configuration fault, access to the module diagnostics screen is not possible. The following message then appears on the screen: "<code>The module is not present or different from the one configured in this position.</code>"</td></tr>
</table>

Detailed Diagnostics of an Analog Channel

At a Glance

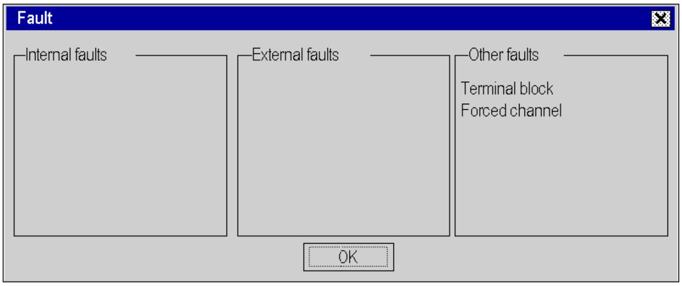
The Channel diagnostics function displays current errors, where these exist, classed according to their category:

- **Internal faults:**
  - Channel failure,
- **External faults:**
  - Sensor link fault,
  - Terminal block fault,
  - Range overshoot or undershoot fault,
  - Calibration fault,
  - Cold junction compensation fault,
- **Other errors:**
  - Terminal block fault,
  - Configuration fault,
  - Communication fault,
  - Application fault,
  - 24 V power supply fault,
  - Values outside limits,
  - Channel not ready.

A channel error appears in the **Debug** tab when the  LED, located in the **Fault** column, turns red.

Procedure

The following table shows the procedure for accessing the Channel fault screen.

Step	Action
1	Access the Module debug screen.
2	For the faulty channel, click on the button  situated in the **Fault** column. **Result:** the list of channel faults appears.  **Note:** Channel diagnostics information can also be accessed by program (`READ_STS` instruction).

Glossary

D

Debug

Debug is a Unity Pro service enabling a direct module check to be made in online mode.

Discrete

Discrete inputs/outputs.

F

Fipio

Field bus used to connect sensor or actuator type devices.

I

IODDT

Input/Output Derived Data Type.

T

TBX

I/O modules remoted on the Fipio bus.

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