Modicon M580 Distributed PAC

Composite Automation Type Online Help

Original instructions



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Safety Information

Important Information

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 are 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:

(In case of divergence or contradiction between any translation and the English original, the original text in the English language will prevail.)

- 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 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

Document Scope

This guide describes the composite automation type (CAT) hardware libraries that are part of the Modicon X80 range – communication, expert function, and analog/digital input/output modules – and configured in a Modicon M580 distributed PAC system using EcoStruxure Automation Expert (EAE).

Validity Note

This documentation has been updated with the release of EcoStruxure™ Automation Expert 23.1 or later.

Available Languages of this Document

This document is available in these languages:

- English (EIO0000004216)

Related Documents

Document Title	Reference Number
Modicon M580 BMED581020 and BMED581020C Distributed PAC User Guide	EIO0000004215 (English), EIO0000005016 (French), EIO0000005017 (German), EIO0000005018 (Italian), EIO0000004694 (Portuguese), EIO0000004693 (Spanish), EIO0000004487 (Chinese)
EcoStruxure™ Automation Expert User Manual	EIO0000004459 (English), EIO0000004460 (French), EIO0000004461 (German), EIO0000004462 (Italian), EIO0000004685 (Portuguese), EIO0000004684 (Spanish), EIO0000004464 (Chinese)
EcoStruxure™ Automation Expert Getting Started	EIO0000004453 (English), EIO0000004748 (French), EIO0000004749 (German), EIO0000004750 (Italian), EIO0000004752 (Portuguese), EIO0000004751 (Spanish), EIO0000004458 (Chinese)
EcoStruxure™ Automation Expert SE.DPAC Library Guide	EIO0000004608 (English), EIO0000004609 (French), EIO0000004610 (German), EIO0000004611 (Italian), EIO0000004753 (Portuguese), EIO0000004612 (Spanish), EIO0000004613 (Chinese)
EcoStruxure™ Automation Expert Common Process Reference Manual	EIO0000004517 (English)
EcoStruxure™ Automation Expert Sequence Control Library User Guide	EIO0000004493 (English)
EcoStruxure™ Automation Expert Single Line Power Monitoring Reference Manual	EIO0000004678 (English)
EcoStruxure™ Automation Expert Water and Waste Water Reference Manual	EIO0000004683 (English)
Electrical Installation Guide	EIGED306001EN (ENG)
Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications	EIO0000002726 (English) EIO0000002727 (French) EIO0000002728 (German) EIO0000002730 (Italian) EIO0000002729 (Spanish) EIO0000002731 (Chinese)

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Cybersecurity Information

Information on cybersecurity is provided on the Schneider Electric website: https://www.se.com/ww/en/about-us/cybersecurity-data-protection/

Product Related Information

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

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

⚠⚠DANGER

POTENTIAL FOR EXPLOSION

- Only use this equipment in non-hazardous locations, or in locations that comply with Class I, Division 2, Groups A, B, C and D.
- Do not substitute components which would impair compliance to Class I Division 2.
- Do not connect or disconnect equipment unless power has been removed or the location is known to be non-hazardous.

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

⚠WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.[1]
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

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

1: For additional information, refer to NEMA ICS 1.1 (latest edition), Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), *Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive System* or their equivalent governing your particular location.

⚠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.
- Only use software approved by Schneider Electric for use with this equipment.
- Update your application program every time you change the physical hardware configuration.
- Follow all local and national safety codes and standards.

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

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in the information contained herein, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives, and general automation, this may include, but is not limited to, terms such as *safety*, *safety function*, *safe state*, *fault*, *fault reset*, *malfunction*, *failure*, *error*, *error message*, *dangerous*, etc.

Among others, these standards include:

Standard	Description
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2023	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
IEC 62061:2021	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2021	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

In addition, terms used in the information contained herein may tangentially be used as they are derived from other standards such as:

Standard	Description
IEC 60034 series	Rotating electrical machines
IEC 61800 series	Adjustable speed electrical power drive systems
IEC 61158 series	Digital data communications for measurement and control – Fieldbus for use in industrial control systems

Finally, the term *zone of operation* may be used in conjunction with the description of specific hazards, and is defined as it is for a hazard zone or danger zone in the Machinery Directive (2006/42/EC) and ISO 12100:2010.

NOTE: The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.

Information on Non-Inclusive or Insensitive Terminology

As a responsible, inclusive company, Schneider Electric is constantly updating its communications and products that contain non-inclusive or insensitive terminology. However, despite these efforts, our content may still contain terms that are deemed inappropriate by some customers.

Modicon M580 BMED581020(C) Distributed PAC

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BMED581020 and BMED581020C dPAC

What's in This Chapter

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Introduction

This chapter presents the BMED581020 and BMED581020C controller, the Modicon M580 distributed programmable automation controller (dPAC), which is configured with EcoStruxure™ Automation Expert software in a standalone M580 system that complies with the IEC 61499 standard.

NOTE: Use the same version number between EcoStruxure Automation Expert and the M580 dPAC. For example, only use version 23.1 of EcoStruxure Automation Expert with version 23.1 of M580 dPAC firmware and 23.0 software with 23.0 firmware.

BMED581020(C) sDefault

Abstract



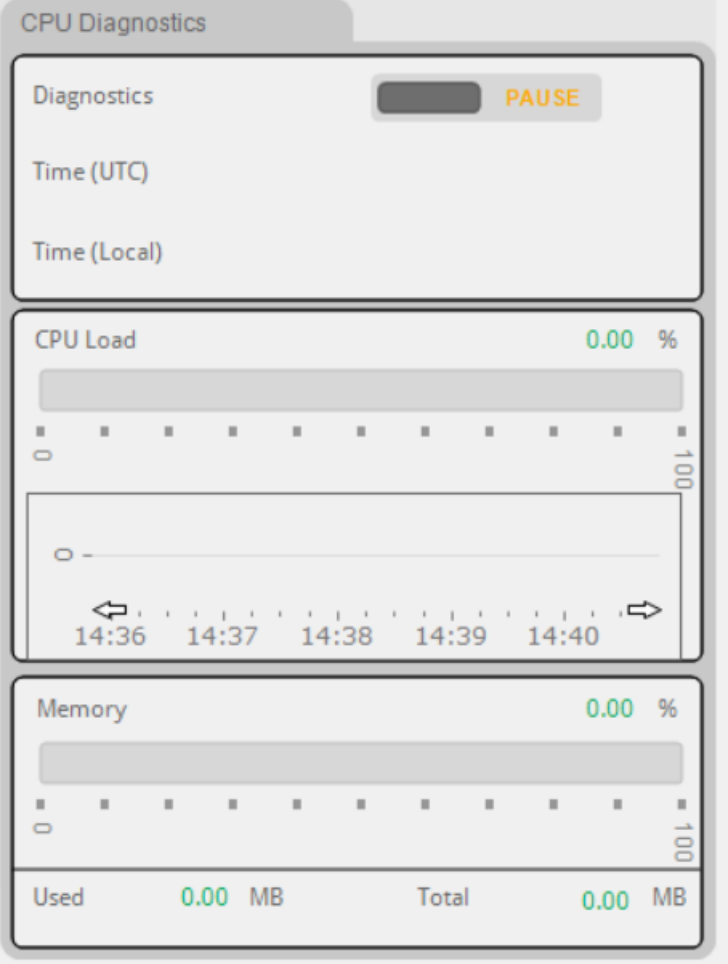
Description

Position on the Local Rack

The BMED581020Ccontroller is installed in the two-module slot position directly to the right of the power supply in the main local rack. The controller cannot be put in any other slot location or any other rack.

BMED581020(C) fpDefault

Abstract



Description

Controller Memory

Two types of memory are available in a BMED581020(C) controller:

- Non-persistent application RAM runs the application program and stores temporary data.
- Non-volatile backs up the application program.

Application Download to the controller Memory

controller memory involved during an application download from a programming terminal:

- An application is transferred into non-persistent application RAM.

- An application backup occurs in non-volatile memory only if the running application is saved as a boot project.

Application Online Modification Backup

An application program modification that is performed online in the controller :

- Online changes are performed in non-persistent memory of the running application.
- Online changes or an application backup in flash memory occur only when you save the running application.

⚠WARNING

UNEXPECTED EQUIPMENT BEHAVIOR

- Do not remove a module from the primary controller that is under power (Hot Swapping is not allowed in the primary controller of a hot standby system).

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

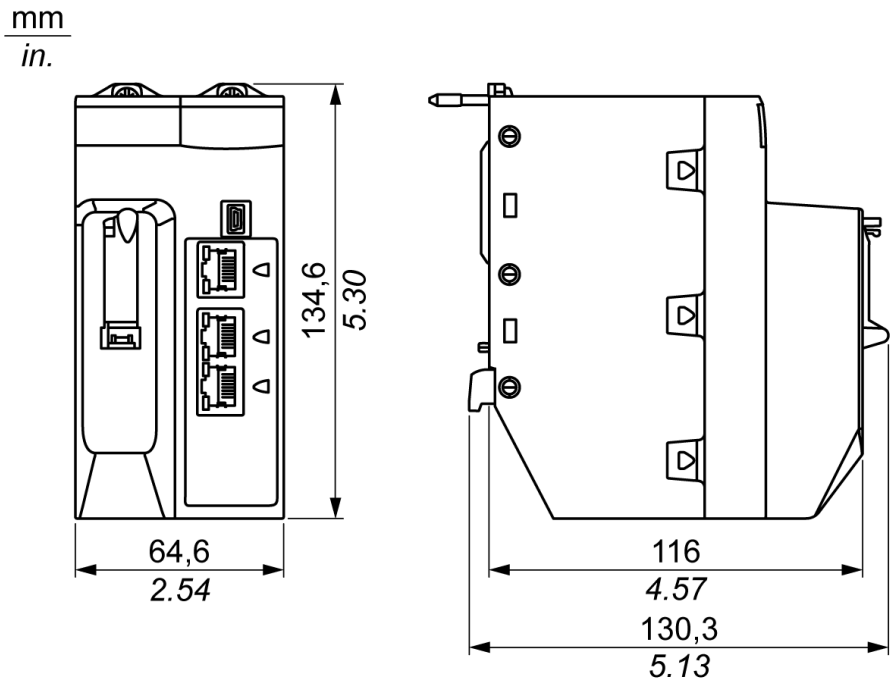
Physical Description

Position on the Local Backplane

The BMED581020 or BMED581020C controller is installed in the two-module slot position directly to the right of the power supply in the main local backplane. The controller cannot be put in any other slot location or any other backplane.

Dimensions

The following graphic shows the front and side dimensions of the controller:

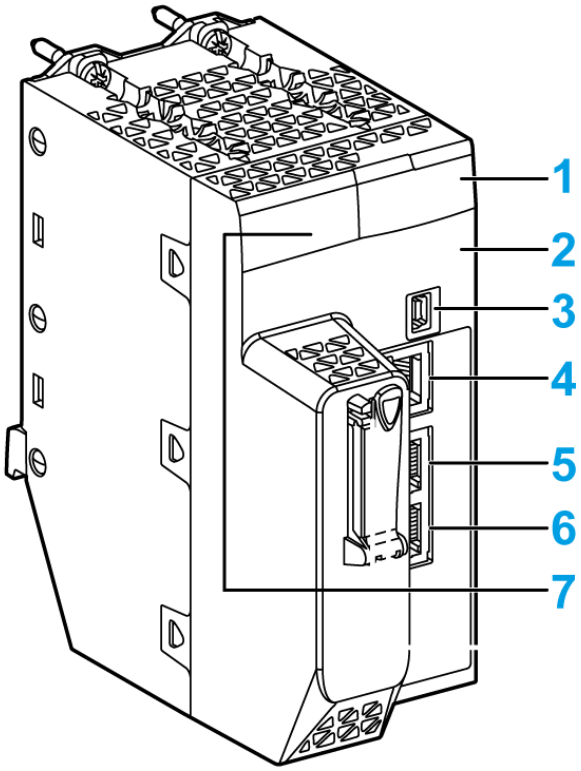


NOTE: Consider the height of the controller when you are planning the installation of the local backplane. The controller extends below the lower edge of the backplane by:

- 29.49 mm (1.161 in.) for an Ethernet backplane
- 30.9 mm (1.217 in.) for an X Bus backplane

Front Panel

Physical features:



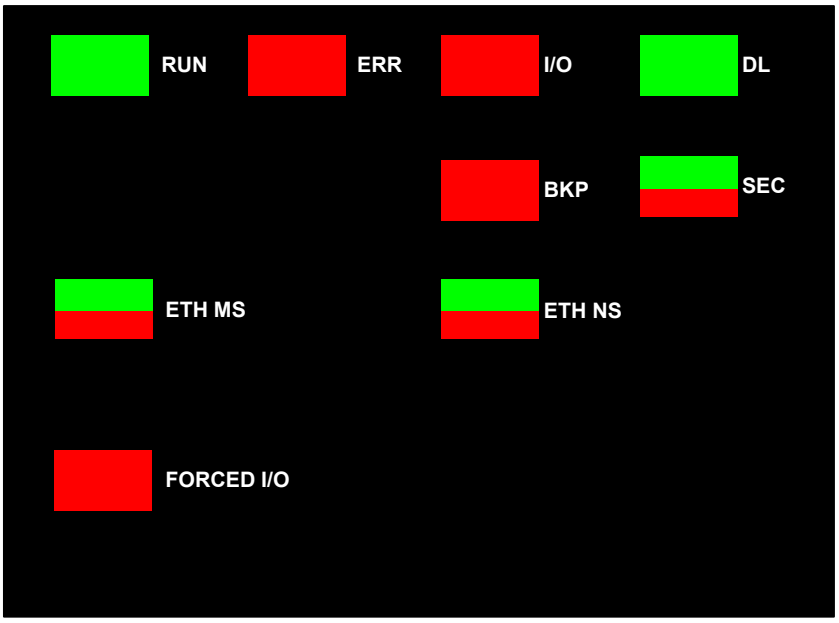
Legend:

Item	Marking	Description
1	–	LED Display, page 28 for controller status and diagnostics
2	**Eth MAC Address** **xx.xx.xx.xx.xx.xx**	Media Access Control (MAC) address assigned to the controller
	IP ADDRESS: ...	Blank space for you to write the IP address assigned to the controller **NOTE:** The default IP address starts with 10.10 and uses the last two bytes of the MAC address. When the last two octets of the MAC address (*MAC5.MAC6*) correspond to *0.0* in the default address, make a point-to-point cable connection between your computer and the controller, communication module, or other module.
3		Mini-B USB connector (used only for Schneider Electric Service Personnel)
4	**Service**	RJ45 Ethernet connector, page 34 for the service port
5	**Dual Port/Device Network**	Dual RJ45 Ethernet connectors, page 34 that support distributed equipment
6		
7	—	QR code

LED Display

LED Panel

The following LEDs are located on the front panel of the BMED581020 and BMED581020C controllers:



LED Descriptions

LED Indicator	Description
RUN	**ON**: The controller is in RUN state
ERR	**ON**: The controller or system has detected an error
I/O	**ON**: The controller or system has detected an error in one or more I/O modules
DL (*download*)	• **Flashing**: Firmware update in progress • **OFF**: No firmware update in progress
BKP	**ON** • The memory card or the controller flash memory is missing or inoperable • The memory card is not usable (incorrect format, unrecognized type) • The memory card or the controller flash memory content is inconsistent with the application • The memory card has been removed and reinserted • The **controller** performed a **Project Backup** and a **Backup Clear** command. The **BKP** LED stays **ON** until the project is successfully backed-up. **OFF**: The memory card or the controller flash memory is valid, and the application in the execution memory is identical
SEC	• **ON** (green): The cybersecurity features have been configured, and the controller is configured in **Secure** mode • **OFF** (red): The cybersecurity features have not been configured, and the controller is not configured in **Secure** mode For details, refer to the Cybersecurity Rotary Switch topic, page 36.
ETH MS	**Module Status** (green/red): Indicates the Ethernet port configuration status
ETH NS	Network Status (green/red): Indicates the Ethernet connection status
FORCED I/O	• **ON** (red): If I/O is forced • **OFF**: If I/O is not forced

The table below illustrates the LED indicator pattern symbols. These symbols are used to describe the LED patterns according to the controller states in the subsequent tables.

Symbol	Description	Symbol	Description
	Steady Green		Flashing Green
	Steady Red		Flashing Red
	Steady Orange		Flashing Orange
	Off	–	

Powering On

The table below illustrates the LED patterns when the controller is powering on:

Controller State	RUN	ERR	I/O	DL	ETH MS	ETH NS	FORCED I/O	SEC
Power off								
Power on: Phase 1								
Phase 2								
Phase 3								
Phase 4								
Phase 5: Auto-test								

I/O Data Communication Not Established (Not Configured)

The table below illustrates the LED patterns when the controller did not establish I/O data communication (Not configured):

Controller State	RUN	ERR	I/O	DL	ETH MS	ETH NS	FORCED I/O	SEC
Out of box, no configuration								 Cybersecurity not configured
CLEAN state		  Reboot after non-recoverable error						 Cybersecurity configured  Cybersecurity not configured

I/O Data Communication Established (Configured)

The table below illustrates the LED patterns when the controller has established I/O data communication (Configured):

Controller State	RUN	ERR	I/O	DL	ETH MS	ETH NS	FORCED I/O	SEC
STOP state						 EtherNet/IP configured  EtherNet/IP not configured		 Cybersecurity configured
RUN state						 EtherNet/IP configured	 I/O forced	 Cybersecurity configured

Controller State	RUN	ERR	I/O	DL	ETH MS	ETH NS	FORCED I/O	SEC
						 EtherNet/IP not configured	 I/O not forced	

Detected Error States

The table below illustrates the LED patterns when the controller has detected an error:

Controller State	RUN	ERR	I/O	DL	ETH MS	ETH NS	FORCED I/O	SEC
Recoverable error								Depends on configura-tion (OFF, red, green)
Non recoverable error								
Duplicate IP address	—	—	—	—				Depends on configura-tion (OFF, red, green)

Firmware Update

The table below illustrates the LED patterns on the controller during a firmware update done from the state NO CONFIGURATION or CLEAN:

Controller State	RUN	ERR	I/O	DL	ETH MS	ETH NS	FORCED I/O	SEC
Firmware update: Phase 1								 Cybersecurity not configured  Cybersecurity configured
Phase 2								Depends on configuration (OFF, red, green)
Phase 3								Depends on configuration (OFF, red, green)
Phase 4								Depends on configuration (OFF, red, green)

The table below illustrates the LED patterns on the controller during a firmware update done from the STOP state:

Controller State	RUN	ERR	I/O	DL	ETH MS	ETH NS	FORCED I/O	SEC
Firmware update: Phase 1						 EtherNet/IP configured  EtherNet/IP not configured		 Cybersecurity configured
Phase 2								Depends on configuration (OFF, red, green)
Phase 3								Depends on configuration (OFF, red, green)
Phase 4								Depends on configuration (OFF, red, green)

The table below illustrates the LED patterns on the controller during a firmware update done from a recoverable error state:

Controller State	RUN	ERR	I/O	DL	ETH MS	ETH NS	FORCED I/O	SEC
Firmware update: Phase 1								 Cybersecurity configured
Phase 2								Depends on configuration (OFF, red, green)
Phase 3								Depends on configuration (OFF, red, green)
Phase 4								Depends on configuration (OFF, red, green)

Ethernet Ports

Introduction

There are three RJ45 Ethernet ports on the front of the BMED581020 and BMED581020C controllers: one service port, and two device network ports. The ports share the characteristics described below.

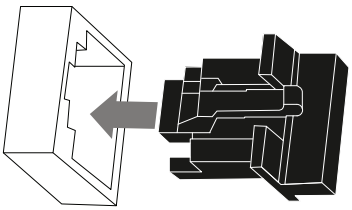
Common Characteristics

The three ports have the same RJ45 connector and use the same type of Ethernet cables.

NOTE: The three controller ports are connected to chassis ground, and the equipment requires an equipotential ground.

Dust Cover

To keep dust from entering the unused Ethernet ports, cover the unused ports with the stopper:

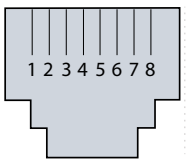


Ethernet Ports

Each RJ45 connector has a pair of LED indicators:



The pin positions, pinouts, and cable connections are the same on the three RJ45 Ethernet ports:

Pin	Description	
1	TD+	Pinout: 
2	TD-	
3	RD+	
4	not connected	
5	not connected	
6	RD-	
7	not connected	
8	not connected	
—	shell/chassis ground	

NOTE: The TD pins (pins 1 and 2) and the RD pins (pins 3 and 6) can be reversed to allow the exclusive use of straight-through cables.

The ports have an auto MDIX capability that automatically detects the direction of the transmission.

Choose from these Ethernet cables to connect to the Ethernet ports:

- TCSECN3M3M••••: Cat 5E Ethernet straight-through shielded cable, rated for industrial use, CE- or UL-compliant
- TCSECE3M3M••••: Cat 5E Ethernet straight-through shielded cable, rated for industrial use, CE-compliant
- TCSECU3M3M••••: Cat 5E Ethernet straight-through shielded cable, rated for industrial use, UL-compliant

The maximum length for a copper cable is 100 m. For distances greater than 100 m, use fiber optic cable. The controller does not have fiber ports on it. You may use BMXNRP•••• fiber converter modules to handle the copper-fiber conversion.

Ethernet Ports LED Status

On the BMED581020 and BMED581020C controllers, the **ACT** LED is green. The **LNK** LED is either green or yellow, depending on the status:

LED	LED Status	Description
ACT	OFF	No activity is indicated on the Ethernet connection.
	ON / flashing	Data is being transmitted and received on the Ethernet connection.
LNK	OFF	No link is established at this connection.
	ON green	A 100 Mbps link* is established at this connection.
	ON yellow	A 10 Mbps link* is established at this connection.
* The 10/100 Mbps links support both half-duplex and full-duplex data transfer and autonegotiation.		

Grounding Considerations

⚠⚠DANGER

ELECTRICAL SHOCK

Wear personal protective equipment (PPE) when working with shielded cables.

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

Follow all local and national safety codes and standards.

The backplane for the M580 dPAC is common with the functional ground (FE) plane and must be mounted to a properly grounded mounting panel or support.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Connect the backplane to the functional ground (FE) of your installation.

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

Cybersecurity Rotary Switch

Introduction

A four-position rotary switch is located on the back of the module. Set this rotary switch to configure a mode for the controler.

NOTE: A plastic screwdriver is provided for your convenience; use it, or an equivalent, to change the position of the rotary switch. Avoid using metal screwdrivers.

Rotary Switch Settings

⚠WARNING

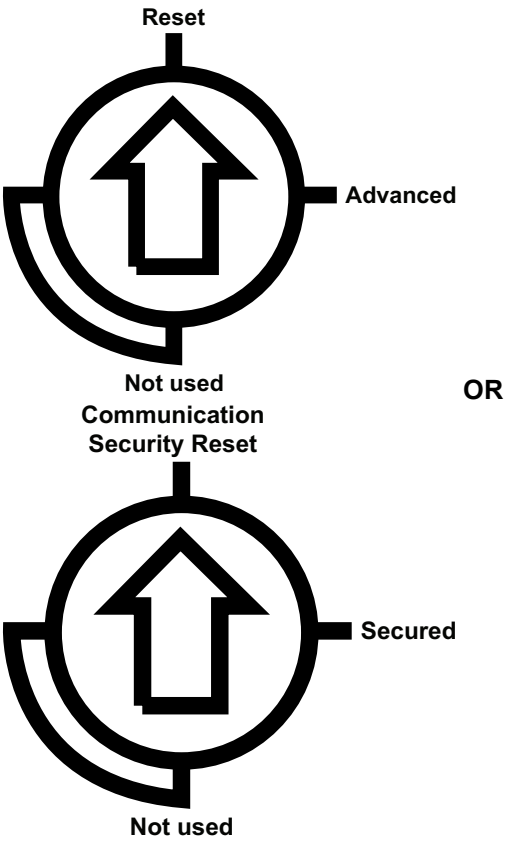
UNINTENDED EQUIPMENT OPERATION

Set the rotary switch only to the exact *clock position* that corresponds to your security configuration:

- *12 o'clock:* **Reset** or **Communication Security Reset**
- *3 o'clock:* **Advanced** or **Secured**
- *6 o'clock/9 o'clock:* **Not used**

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

A view of the four-position rotary switch on the back of the module, depending on the controller version:



Use the screwdriver to select a rotary switch position according to the table below:

Icon	Setting	Description
Reset or **Communication Security Reset**	Factory reset / out-of-box configuration is set.	The module resets to factory settings. The factory settings delete the boot project, the device configuration, and the persistent data. Then, the factory reset implements its out-of-box cybersecurity configuration.
Advanced or **Secured**	Advanced or Secured mode is on (default position).	The module is now in secured cybersecurity mode.
Not used		This rotary switch position is not used.

Changing the Rotary Switch Settings

Configure the mode for the module in the backplane:

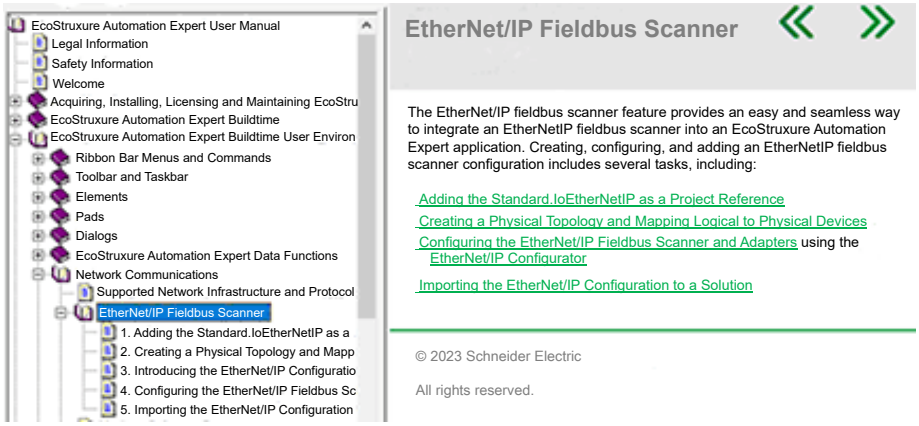
Step	Action
1	Remove power from the controller and remove it from the backplane.
2	Change the rotary switch position to **Reset** or **Communication Security Reset**
3	Re-insert the controller in the backplane, apply power and wait 1 minute before proceeding to the next step. **Result**: The module performs a factory reset and is done when the RUN LED is steady green. **NOTE:** Refer to *LED Display* chapter in the document for more information.
4	Remove power from the controller and remove it from the backplane.
5	Change the rotary switch position to **Advanced** or **Secured**.
6	Re-insert the module in the backplane and apply power. **Result**: After a successful factory reset, the expected state of the RUN LED is flashing.

EtherNet/IP Fieldbus Scanner

Using the EtherNet/IP Scanner

To perform the following tasks that use the controller's embedded EtherNet/IP fieldbus scanner, refer to the EAE main help:

- Add the Standard.IoEtherNetIP as a project reference to your solution.
- Create a physical topology and map logical devices to physical devices.
- Working with the EtherNet/IP configurator.
- Configure the EtherNet/IP scanner and adapters using the EtherNet/IP configurator.
- Import the EtherNet/IP configuration to a solution.

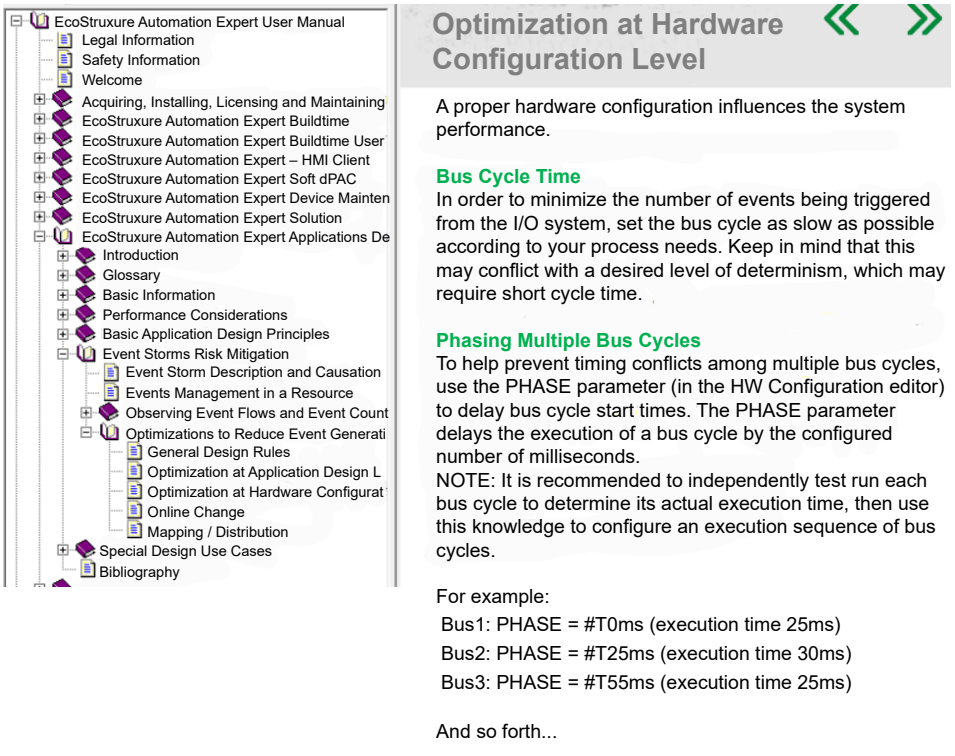


NOTE: EtherNet/IP explicit messaging is not supported on BMED581020 and BMED581020C configured with EcoStruxure Automation Expert software version 23.0 or earlier.

Bus Cycle

Introducing the Bus Cycle

Refer to the *EAE software main online help* for more information about the bus cycle and how to configure the time required to read or write a transaction.



Configuring the Bus Cycle

The following table presents the parameters used to configure the bus cycle:

Parameter	Value	Description	Data type
autoStart	Set the value to FALSE if the initialization is triggered by an event chain with the `HW_INIT` name. Set the value to TRUE if the initial event is taken from an E_RESTART function block.	If available, specifies the initialization behavior of the bus (else default value is FALSE)	BOOL
busCycleTime	Number and unit of time abbreviation	Total cycle time	TIME
busCycleTolerance		Overflow of additional time according to the*busCycleTime* in percentage	UINT
busCycleActionWhenMissed		Bus action when the cycle time is exceeded	UINT

NOTE: For more information, refer to the *IEC 61131 Data Types* topic in the EcoStruxure**TM** Automation Expert User Manual.

Messages in the FetchLog depend on the choice of *busCycleActionWhenMissing* (after deployment and compilation).

- INFO:
  - *FB:{RES0,BMXBUS(SEIoX80#BMXBUS)}:XBUSConfig: missed cycle (allowed range is [40000 — 60000] usec)* (written in green)

    NOTE: Messages are written in the CYCLIC log only once.
- DEBUG:
  - *XBUSConfig : missed cycle (observed cycle time = 1750002 usec , allowed range is [40000 — 60000] usec , drift = 1700002 usec)* (written in black)
  - *XBUSConfig : missed cycle (observed cycle time = 3599997 usec , allowed range is [40000 — 60000] usec , drift = 3549997 usec)* (written in black)

    NOTE: Messages are written in the DEVICE log each time there is a missed cycle. Performance may be impacted if too many messages are logged and stored in flash memory.
- ERROR_HALT:
  - *XBUSConfig : missed cycle (observed cycle time = 5750003 usec , allowed range is [40000 — 60000] usec , drift = 5700003 usec)* (written in red)
  - *stopping* (written in red)
  - *[ErrorStopped]* (written in red)

    NOTE: I/O modules will switch to their configured fallback value if either of these messages are logged.

NOTE: If you are using an old library version, the bus does not launch, and the FetchLog message tells you to update the library.

NOTICE

RISK OF UNINTENDED OPERATION

- Do not use more than one BMXBUS for each Modicon M580 distributed PAC (M580_dPAC).

Failure to follow these instructions can result in equipment damage.

Initialization of Communication Buses

Use the DPAC_FULLINIT function block to perform the initialization of communication buses at the application level. Several communication buses are provided for M580 dPAC in the following libraries, some of which have an autoStart parameter:

- XBUS in SE.IoX80 (no autoStart)
- EIPSCANNER in Standard.IoEthernetIP (autoStart default value = FALSE)
- MODBUS TCP in Standard.IoModbusSlave (autoStart default value = FALSE)

⚠WARNING

POTENTIAL I/O GLITCHES DURING INITIALIZATION

- When using multiple buses, make sure the autoStart parameter is left to default value for all buses, and that DPAC_FULLINIT function block is used to initialize the application.

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

Set the autoStart parameter to FALSE for all buses; otherwise, two kinds of adverse effects may occur, especially if several buses are used:

- An excessive amount of events may be triggered with simultaneous or overlapping bus initializations (event storms), and unintended input/output updates may occur.
- The input/output update is de-synchronized, and the application does not execute until all buses are initialized.

The autoStart parameter, when set to TRUE, can be useful if initialization is made by means other than DPAC_FULLINIT..

RSTP

About RSTP

Rapid Spanning Tree Protocol (RSTP) allows a network design to include spare (redundant) links that provide automatic backup paths if an active link stops working, without the need for loops or manual enabling/disabling of backup links.

RSTP functionality works in distributed equipment that support RSTP and require only a single (non-ring) copper wire connection to the network. They can be connected to copper ports on Dual-ring Switches (DRSs).

The RSTP service supports the inherent network communications redundancy provided by a daisy chain loop. The RIO communications automatically find an alternate path if a communication disruption occurs (for example, a cable breaks or a device becomes inoperable). This service does not require you to manually enable or disable the communication paths.

Access the RSTP Tab

Select the module in the EcoStruxure Automation Expert configuration.

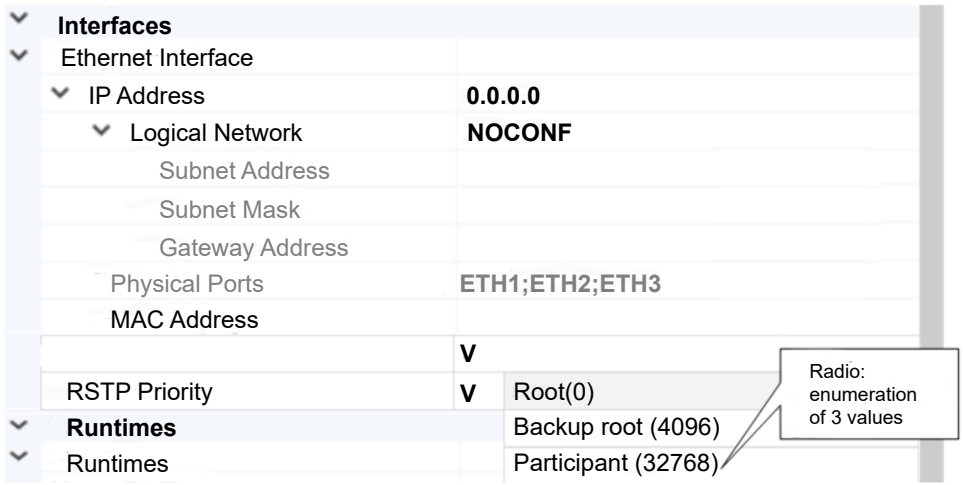
Click on the RSTP tab to access the settings and parameters to set the RSTP operation.

Select the device node from the topo manager.

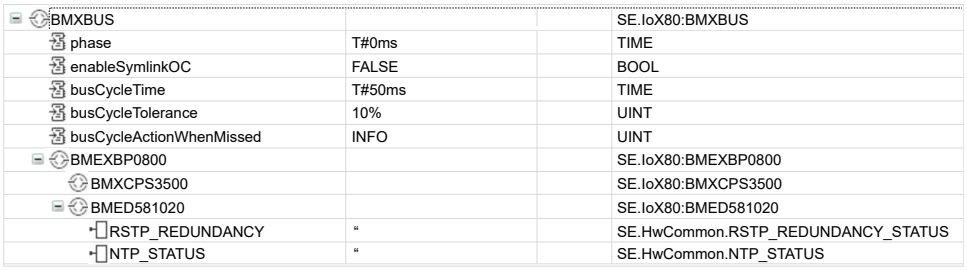
NOTE: Default configuration RSTP Priority set to Root(0), assigns the device the role of the root bridge, meaning it takes precedence over other devices in the network. Root(0) has the lowest bridge priority.

Edit RSTP default settings of the module, by selecting the bridge priority ; Root(0), Backup Root (4096), Participant(32768).

NOTE: Changes in RSTP parameters can affect sub-ring diagnostics, I/O determinism, and network recovery time.



A symlink exists in the hardware configuration under the BMED581020 controller HWCAT, as illustrated by the image below:



The functionality maintains uninterrupted service, if a cable is unplugged or severed, by providing distinct indications:

- In a properly wired Ethernet loop, the diagnostic system reports **LOOP_INTACT**.
- If a cable disconnects within the Ethernet loop, **LOOP_BREAK** is swiftly indicated.
- Upon cable reconnection, the diagnostic system promptly switches back to **LOOP_INTACT**.
- When using V23.1 (or later) libraries with a V23.0 (or earlier) firmware that lacks this functionality, the diagnostic system reports **SERVICE_UNAVAILABLE** to notify the end user of the missing function block.

Parameters

The table defines the Bridge Priority parameters corresponding to the RSTP Operational State of the devices below.

Bridge Priority	Bridge priority value	BMED581020 controller	Adapter module
Root	0	Default	—
Backup root	4096	Reserved	—
Participant	32768	—	Default

NOTE: Use the default value for the adapter modules

The table below describes the default parameters of RSTP instances, that manage different parts of the network when RSTP Priority is set to Root (0).

These parameters are non-modifiable in **EcoStruxure Automation Expert**.

Instance	Value	Description
Rstp_Instance_Id	1	ID of the Rstp instance
Rstp_Instance_Flags	127	Flag of the Rstp instance
Bridge_Force_Version	2	-
Bridge_Forward_Delay	21000	The time of the delay in a port state transition
Bridge_Max_Age	40000	Maximum length of time interval fir the bridge
Bridge_Transmit_Hold_Count	40	Number of BPDUs a bridge port can send per second
Bridge_Identifier_Priority	0	The bridge priority number
Bridge_Hello_Time	2000	Time between each bridge protocol data unit
Port_Count	2	Number of ports

NOTE: Device Ports **require** RSTP capable devices.

- If you use a device that has two Ethernet ports supporting RSTP, you can connect the device to the dual Ethernet ports of the controller in a star or a daisy chain loop, using a managed switch. In this instance, the device is isolated from RIO devices, if any.
- Specific types of distributed equipment which are configured with the controller, having two Ethernet ports that support RSTP, may also be connected directly to a sub-ring.
- Device Ports are tagged with VLAN. Devices unable to handle VLAN tags cannot establish connection to device port.
- To communicate with a device that doesn't support RSTP or VLAN, you can use a network router of level N2/N3 that supports RSTP and VLAN.
- The configuration RSTP of M580d is not delivered in 23.0 version but RIO ports are using RSTP (VLAN tags) by default.

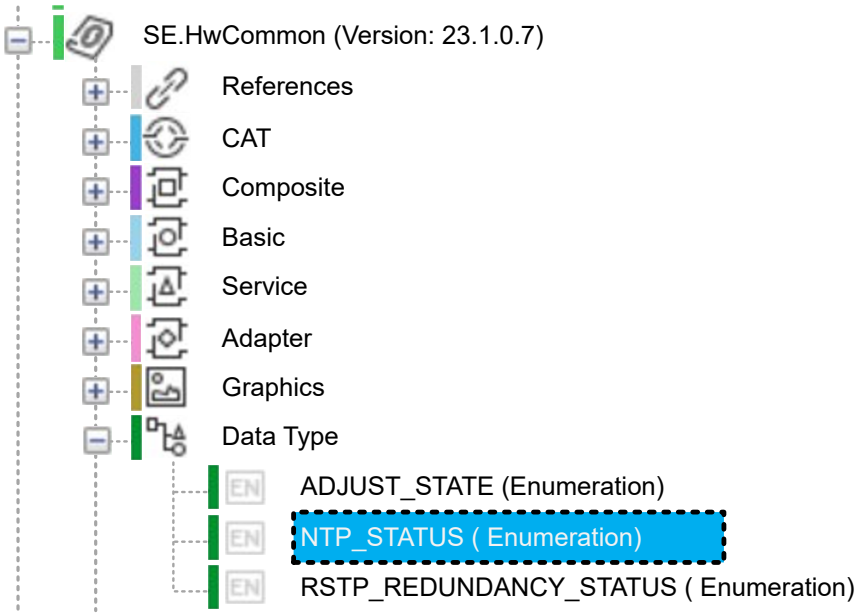
Time Setting Configuration

Introduction

The Time Setting Configuration for the m580 distributed PAC offers precise control over time synchronization by providing two flexible methods for configuring time settings ; manual configuration and integration with the Network Time Protocol (NTP) service.

Configuring NTP

When utilizing the NTP service with your M580d controller, ensure your device is well-synchronized with the server. A symlink feature, providing real-time status updates, exists in the hardware configuration under the BMED581020 HWCAT level, as illustrated by the image below :



The four states of the NTP status are :

- **SERVICE_UNAVAILABLE**: When using V23.1 (or later) libraries with a V23.0 (or newer) firmware that lacks this functionality, the diagnostic system reports SERVICE_ UNAVAILABLE to notify the end user of the missing function block.
- **NOT_OPERATING**: NTP service has not been started. You are using manual time settings.
- **SYNC_IN_PROGRESS**: NTP service is in the process of starting and is awaiting for synchronization with the server.
- **SYNCHRONIZED**: NTP has successfully started and is synchronized with the NTP server.

Library Versions

Confirm that you are using libraries that are of equal or later versions to the following versions:

- dPAC: v22.1.0.14
- HwCommon: v22.1.0.11
- IoX80: v22.1.0.11
- EIP: v22.1.0.15
- Modbus TCP/IP: v22.1.0.16
- Modbus slave TCP/IP: v22.1.0.12

If you do not align your libraries, you may encounter difficulties with starting your hardware.

For details regarding upgrading the libraries, refer to the *Dialogs, Installed Libraries* topic in the software online help.

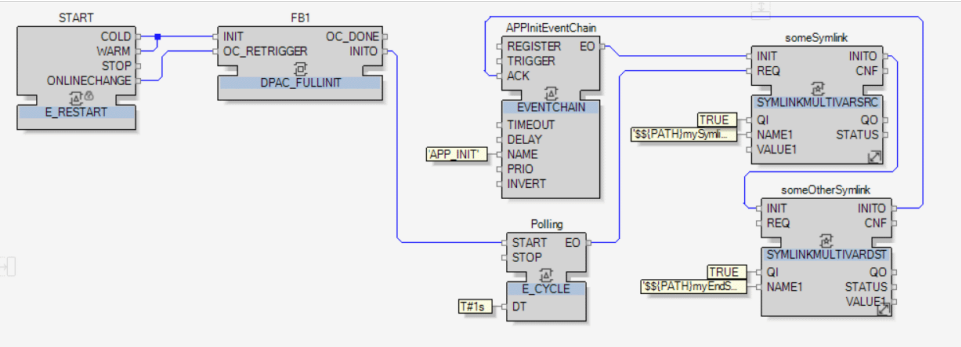
Initialization Sequence

Use the SE.DPAC.DPAC_FULLINIT function block to start up the application and hardware.

The starting sequence is divided into three groups:

- *HW_INIT* is used to initialize hardware.
- *APP_INIT* is used to initialize user applications.
- *Ready* is used to trigger hardware cycles.

The following diagram is an example of how to connect an *EVENTCHAIN* function block to start the application by minimizing the impact at startup. Connect the application *INIT* sequence to an *EVENTCHAIN* function block that is part of the *APP_INIT* group and connect the *SE.DPAC, DPAC_FULLINIT,* and *INITO* to the application starting/polling sequence (different than *INIT*).



For more information, refer to the *DPAC_FULLINIT Service Block* topic in the software online help.

Adding HART eX80 Analog I/O Modules

When the BMEAHI0812 or BMEAHO0412 modules are successfully added to the hardware configuration, a message appears in the EcoStruxture Automation Expert stating; **BMEAHIO module configured. TFTP, FTP and DHCP services will be enabled on the device.**

When the HART module is detected, the TFTP and DHCP services are automatically activated.

Hardware configuration	Services Enabled	Log Messages
HART modules **configured**	BMECRD0100 **starts** TFTP, FTP and DHCP services.	BMEAHIO module detected. TFTP, FTP and DHCP services are enabled.
HART modules **not configured**	BMECRD0100 **does not start** TFTP, FTP and DHCP services.	No log messages.

Diagnosing through fetchlog

In case of troubleshooting of the module, you can access and export the ECORT fetchlog and platform crashlog for diagnostic purposes from the topology manager. The diagnostic allows you to observe the error which can be due to ; VTQ of XBus IO channel, BM_RIO indicating coupler down, or BMECRD0100 hardware CAT HMI errors on module.

To export the log files,

Step	Action
1	Right-click on your BMECRD0100 or BMED581020 device in the physical view. Choose **Get log files**. Provide username and password if not authenticated.
2	Select **export log files** and save.
3	You will receive a confirmation message to notify the successful transfer and the location of your log files. You can find the decrypted files in the selected location.

NOTE: It is not possible to fetch log files when the ECORT is in RUNNING state.

Firmware Upgrade

To upgrade the firmware of the controller, refer to the *Firmware Update with EcoStruxure Automation Device Maintenance* chapter in the Modicon M580 distributed Programmable Automation Controller User Guide.

Standards and Certifications

Download

Click the link in the following table that corresponds to your preferred language to download standards and certifications (in PDF format) from www.se.com that apply to the modules in this product line.

Title	Languages
Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications	• English: EIO0000002726 • French: EIO0000002727 • German: EIO0000002728 • Italian: EIO0000002730 • Spanish: EIO0000002729 • Chinese: EIO0000002731

Modicon X80 Analog Input/Output Modules

What's in This Part

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BMXAMI0800 Analog Input Module 64
BMXAMI0810(H) Analog Input Module 84
BMXAMM0600(H) Analog Input/Output Module 105
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Analog Input/Output Module Installation 193
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BMXAMI0410(H) Analog Input Module

What's in This Chapter

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BMXAMI0410(H) fpDefault 48
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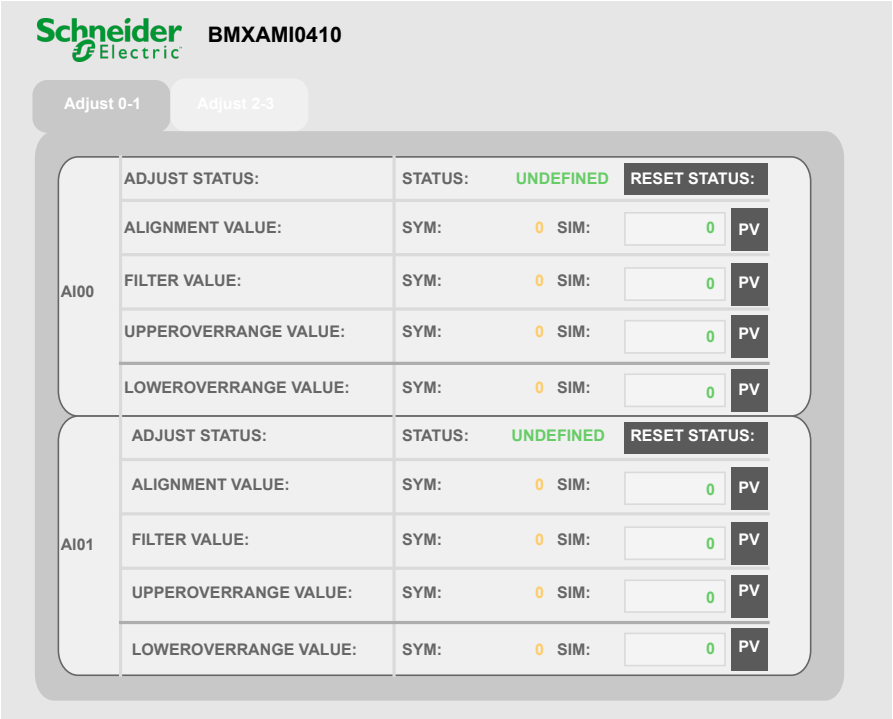
BMXAMI0410(H) sDefault

Abstract



BMXAMI0410(H) fpDefault

Abstract



Description

Element	Description
Range	Button to activate Range mode for HW, SIM/PV display.
Unit	Button to activate Unit mode when pressed. Displays Hardware, SIM, and Force units defined by the MODE.
FORCE	Blue indicates that at least one channel is forced.

Analog input channel description:

Element	Description
AI##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.
PV F	Value indicator: • PV indicates that the channel is not forced. • F indicates that the channel is forced.
MODE	Type configured for the channel.
STATUS	Channel status.

Presentation

Function

The BMXAMI0410 module is a high-level, 4-input industrial measurement device.

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

The BMXAMI0410 module offers the following range for each input, according to the selection made during configuration:

- Voltage +/-10 V/0..5 V/0..10 V/1..5 V/+/- 5 V
- Current 0..20 mA/4..20 mA/+/- 20 mA

The module operates with voltage inputs. It includes four read resistors connected to the terminal block to perform current inputs.

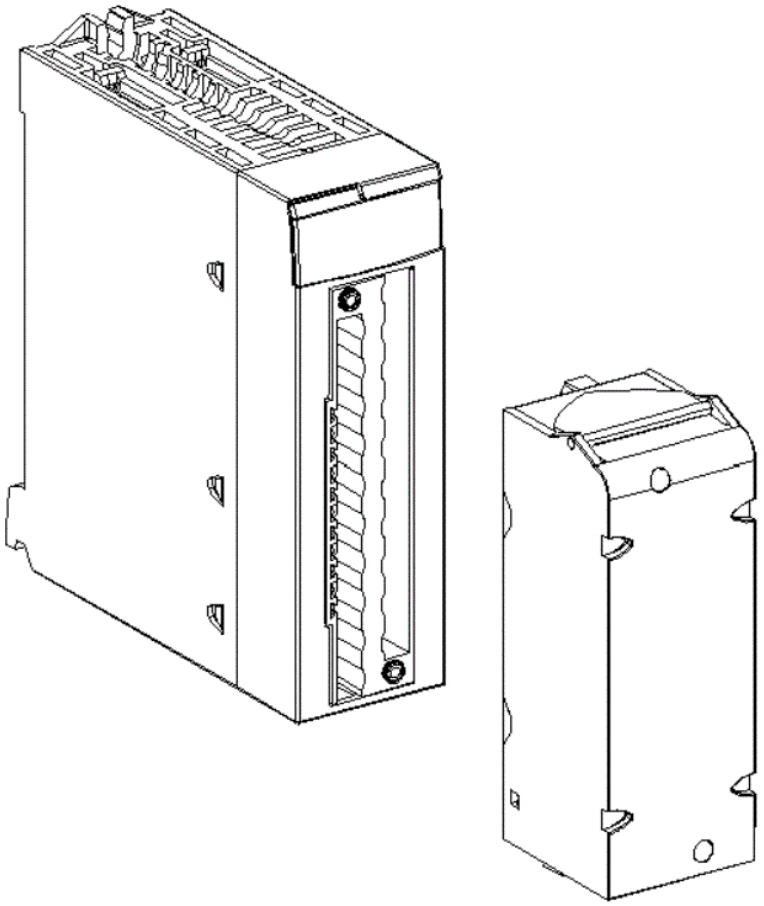
Ruggedized Version

The BMXAMI0410H (hardened) equipment is the ruggedized version of the BMXAMI0410 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration

BMXAMI0410 analog input module looks like this.



NOTE: The terminal block is supplied separately.

Characteristics

Altitude Operating Conditions

The characteristics in the tables below apply to the modules BMXAMI0410 and BMXAMI0410H for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Characteristics

The general characteristics for the BMXAMI0410 and BMXAMI0410H modules are as follows.

Operating temperature	BMXAMI0410	0...60 ºC (32...140 ºF)
	BMXAMI0410H	-25...70 ºC (-13...158 ºF)
Type of inputs		Isolated high level inputs

Nature of inputs		Voltage / Current
Number of channels		4
Acquisition cycle time:		
• Fast (periodic acquisition for the declared channels used)		1 ms + 1 ms x number of channels used
• Default (periodic acquisition for all channels)		5 ms
Display resolution		16-bit
Digital filtering		First order
Isolation: • Between channels • Between channels and bus • Between channels and ground		 +/-300 VDC 1400 VDC 1400 VDC
Maximum overload authorized for inputs:		Voltage inputs: +/- 30 VDC Current inputs: +/- 90 mA Protected for accidental: -19.2 - 30 VDC wiring
Power consumption (3.3 V)	**Typical**	0.32 W
	Maximum	0.48 W
Power consumption (24 V)	**Typical**	0.82 W
	Maximum	1.30 W

Measurement Range

The BMXAMI0410 and BMXAMI0410H analog inputs have the following measurement range characteristics:

Measurement range	**+/-10 V; +/-5 V** **0...10 V; 0...5 V; 1...5 V**	**+/- 20 mA** **0...20 mA; 4...20 mA**
Maximum conversion value	+/-11.4 V	+/-30 mA
Conversion resolution	0.35 mV	0.92 µA
Input impedance	10 MΩ	Internal conversion resistor (250 Ω) + Internal protection resistor (see note)
Precision of the internal conversion resistor	-	0.1% - 15 ppm/°C
Detected measurement errors for standard module BMXAMI0410:		
• At 25 °C • Maximum in the temperature range 0...60 °C (32...140 °F)	0.075% of FS(1) 0.1% of FS(1)	0.15% of FS(1)(2) 0.3% of FS(1)(2)
Detected measurement errors for Hardened module BMX AMI 0410H:		
• At 25 °C • Maximum in the temperature range -25...70 °C (-13...158 °F)	0.075% of FS(1) 0.2% of FS(1)	0.15% of FS(1)(2) 0.55% of FS(1)(2)
Temperature drift	15 ppm/°C	30 ppm/°C
Monotonicity	Yes	Yes
Common mode rejection (50/60 Hz)	90 dB	90 dB

Measurement range	**+/-10 V; +/-5 V** **0...10 V; 0...5 V; 1...5 V**	**+/- 20 mA** **0...20 mA; 4...20 mA**
Crosstalk between channels DC and AC 50/ 60Hz	> 80 dB	> 80 dB
Non-linearity	0.001% of FS(1)	0.001% of FS(1)
Repeatability @25 °C of 10 min. stabilization time	0.005% of FS(1)	0.007% of FS(1)
Long term stability after 1000 hours	< 0.004% of FS(1)	< 0.004% of FS(1)
(1) FS: Full Scale **(2)** Detected conversion resistor error		

NOTE: The internal protection resistor has a typical impedance of 25 Ω (min 3.6 Ω and max 50 Ω). The precision of the protection resistor does not impact the measured value.

NOTE: If nothing is connected on a BMXAMI0410 and BMXAMI0410H analog modules and if channels are configured (range 4...20 mA or 1...5 V), a broken wire causes a detected I/O error.

Functional Description

Function

The BMXAMI0410 module is a high-level, 4-input industrial measurement device.

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

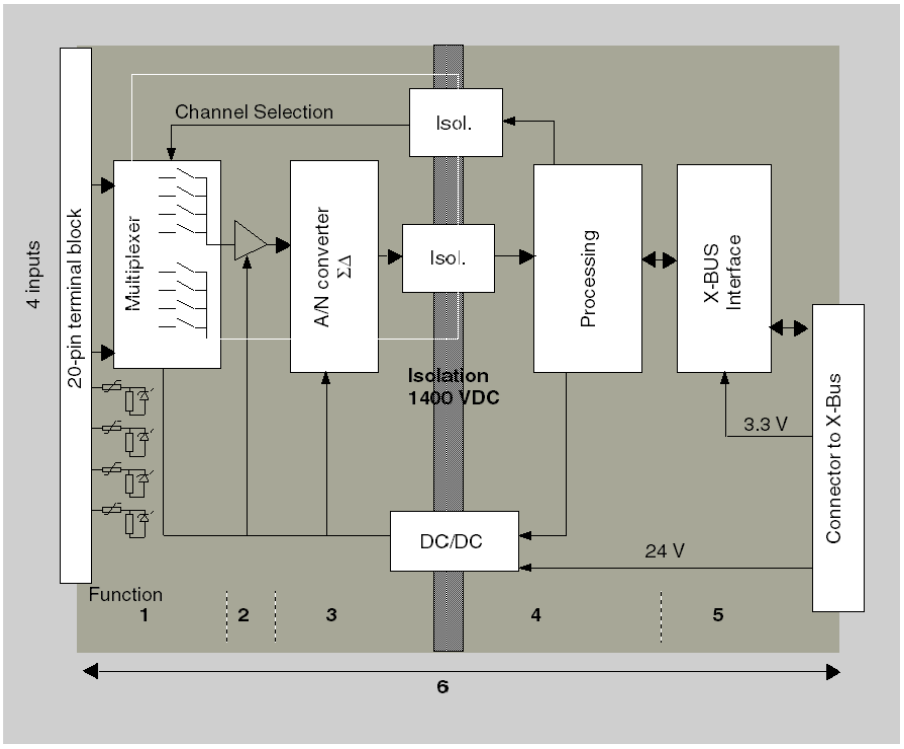
The BMXAMI0410 module offers the following range for each input, according to the selection made during configuration:

- +/-10 V
- 0..10 V
- 0..5 V / 0..20 mA
- 1..5 V / 4..20 mA
- +/- 5 V +/- 20 mA

The module operates with voltage inputs. It includes four read resistors connected to the terminal block to perform current inputs.

Illustration

The BMXAMI0410 module's illustration is as follows.



Description.

No.	Process	Function
1	**Adapting the Inputs and Multiplexing**	• Physical connection to the process through a 20-pin screw terminal block. • Protection of the module against overvoltages. • Protection of the current reading resistors using limiters and resettable fuses. • Input signal analog filtering. • Scan input channels using static multiplexing through opto-switches, in order to provide the possibility of common mode voltage of +/- 300 VDC.
2	**Amplifying Input Signals**	• Gain selecting, based on characteristics of input signals, as defined during configuration (unipolar or bipolar range, in voltage or current). • Compensation of drift in amplifier device.
3	**Converting**	• Conversion of analog Input signal into digital 24-bit signal using a ΣΔ converter.
4	**Transforming incoming values into workable measurements for the user.**	• Takes into account recalibration and alignment coefficients to be applied to measurements, as well as the module's self-calibration coefficients. • (Numeric) filtering of measurements, based on configuration parameters. • Scaling of measurements, based on configuration parameters.
5	**Communicating with the Application**	• Manages exchanges with controller. • topological addressing. • Receives configuration parameters from module and channels. • Sends measured values, as well as module status, to application.
6	**Module monitoring and sending detected error notification back to application.**	Conversion string test. Testing for range overflow on channels. Watchdog test.

Measurement Timing

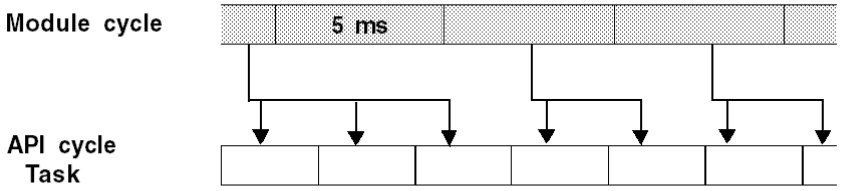
The timing of measurements is determined by the cycle selected during configuration: Normal or Fast Cycle.

- Normal Cycle means that the scan cycle duration is fixed.
- With the Fast Cycle, however, the system only scans the channels designated as being In Use. The scan cycle duration is therefore proportional to the number of channels In Use.

The cycle time values are based on the cycle selected.

Module	Normal Cycle	Fast Cycle
BMXAMI0410	5 ms	1 ms + (1 ms x N) where N: number of channels in use.

NOTE: Module cycle is not synchronized with the controller cycle. At the beginning of each controller cycle, each channel value is taken into account. If the bus cycle time is less than the module's cycle time, some values will not have changed.

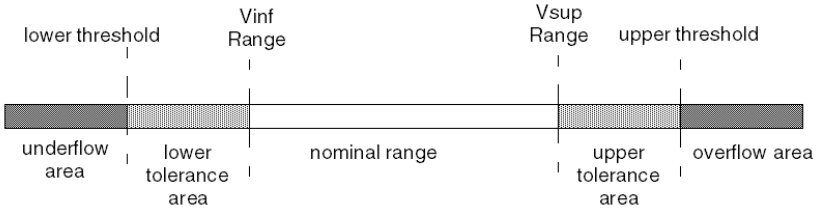


Overflow/Underflow Control

Module BMXAMI0410 allows the user to select between 6 voltage or current ranges for each input.

This option for each channel have to be configured in configuration windows. Upper and lower tolerance detection are always active regardless of overflow/ underflow control.

Depending on the range selected, the module checks for overflow: it verifies that the measurement falls between a lower and an upper threshold.



Description:

Designation	Description
Nominal range	measurement range corresponding to the chosen range
Upper Tolerance Area	varies between the values included between the maximum value for the range (for instance: +10 V for the +/-10 V range) and the upper threshold
Lower Tolerance Area	varies between the values included between the minimum value for the range (for instance: -10 V for the +/-10 V range) and the lower threshold

Designation	Description
Overflow Area	area located beyond the upper threshold
Underflow Area	area located below the lower threshold

The values of the thresholds are configurable independently from one another. They may assume integer values between the following limits.

Range	BMXAMI0410 Range									
	Underflow Area		Lower Tolerance Area		Nominal Range		Upper Tolerance Area		Overflow Area	
Unipolar										
0...10 V	-1,400	-1,001	-1,000	-1	0	10,000	10,001	11,000	11,001	11,400
0...5 V / 0...20 mA	-5,000	-1,001	-1,000	-1	0	10,000	10,001	11,000	11,001	15,000
1...5 V / 4...20 mA	-4,000	-801	-800	-1	0	10,000	10,001	10,800	10,801	14,000
Bipolar										
+/- 10 V	-11,400	-11,001	-11,000	-10,001	-10,000	10,000	10,001	11,000	11,001	11,400
+/- 5 V, +/- 20 mA	-15,000	-11,001	-11,000	-10,001	-10,000	10,000	10,001	11,000	11,001	15,000
User										
+/- 10 V	-32,768				User-defined	User-defined				32,767
0...10 V	-32,768				User-defined	User-defined				32,767

Measurement Display

Measurements may be displayed using standardized display (in %, to two decimal places).

Type of Range	Display
Unipolar range 0...10 V, 0...5 V, 1...5 V, 0...20mA, 4...20mA	from 0 to 10,000 (0 % at +100.00 %)
Bipolar range +/- 10 V, +/- 5 mV +/- 20 mA	from -10,000 to 10,000 (0% or -100.00% at +100.00 %)

For example, as all symlinks are expressed in percentages, the range:

- 0...10 V has the correspondences: 0 V = 0%,..., 3,2 V = 32%,..., 5,6 V = 56%,..., 10 V = 100%.
- +/- 10 V has the correspondences:- 10 V = 0%,..., - 5 V = 25%,..., 0 V= 50%,..., +5 V = 75%,..., +10 V = 100%.

Measurement Filtering

The type of filtering performed by the system is called "first order filtering". The filtering coefficient can be modified from a programming console or via the program.

The mathematical formula used is as follows:

$Meas_{f(n)} = \alpha \times Meas_{f(n-1)} + (1-\alpha) \times Val_{b(n)}$

where:

α = efficiency of the filter

$Meas_{f(n)}$ = measurement filtered at moment n

$Meas_{f(n-1)}$ = measurement filtered at moment n-1

$Val_{b(n)}$ = gross value at moment n

You may configure the filtering value from 7 possibilities (from 0 to 6). This value may be changed even when the application is in RUN mode.

NOTE: Filtering may be accessed in Normal or Fast Cycle.

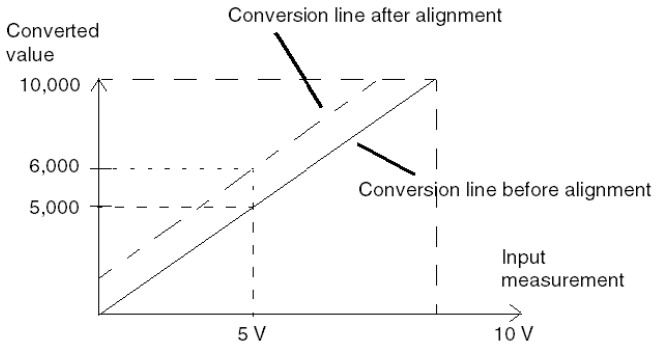
The filtering values depend on the T configuration cycle (where T = cycle time of 5 ms in standard mode):

Desired Efficiency	Required Value	Corresponding α	Filter Response Time at 63%	Cut-off Frequency (in Hz)
No filtering	0	0	0	0
Low filtering	1	0.750	4 x T	0.040 / T
	2	0.875	8 x T	0.020 / T
Medium filtering	3	0.937	16 x T	0.010 / T
	4	0.969	32 x T	0.005 / T
High filtering	5	0.984	64 x T	0.0025 / T
	6	0.992	128 x T	0.0012 / T

Sensor Alignment

The process of "alignment" consists of helping eliminate a systematic offset observed with a given sensor, around a specific operating point. This operation compensates for a detected error linked to the process. Replacing a module does not therefore require a new alignment. However, replacing the sensor or changing the sensor's operating point does require a new alignment.

Conversion lines are as follows:



The alignment value is editable from a programming console, even if the program is in RUN Mode. For each input channel, you can:

- view and modify the desired measurement value
- save the alignment value
- determine whether the channel already has an alignment

The alignment offset may also be modified through programming.

Channel alignment is performed on the channel in standard operating mode, without any effect on the channel's operating modes.

The maximum offset between measured value and desired (aligned) value may not exceed +/-1,500.

NOTE: To align several analog channels on the BMX ART/AMO/AMI/AMM modules, we recommend proceeding channel by channel. Test each channel after alignment before moving to the next channel in order to apply the parameters correctly.

Wiring Precautions

Introduction

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

Cable Shielding

Connect the cable shielding to the grounding bar. Clamp the shielding to the grounding bar on the module side. Use the shielding connection kit BMXXSP••••, page 234 to connect the shielding.

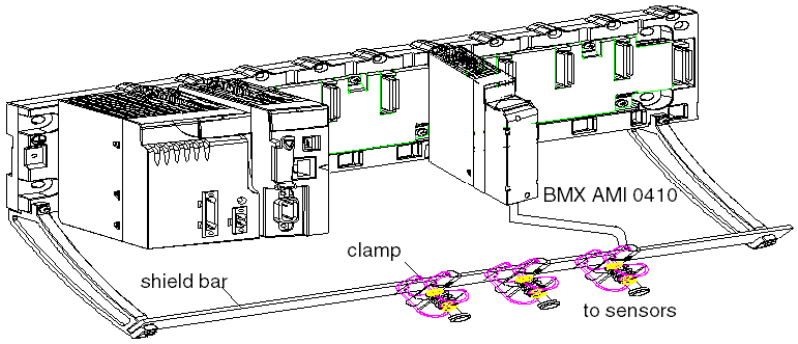
⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

While mounting / removing the modules:

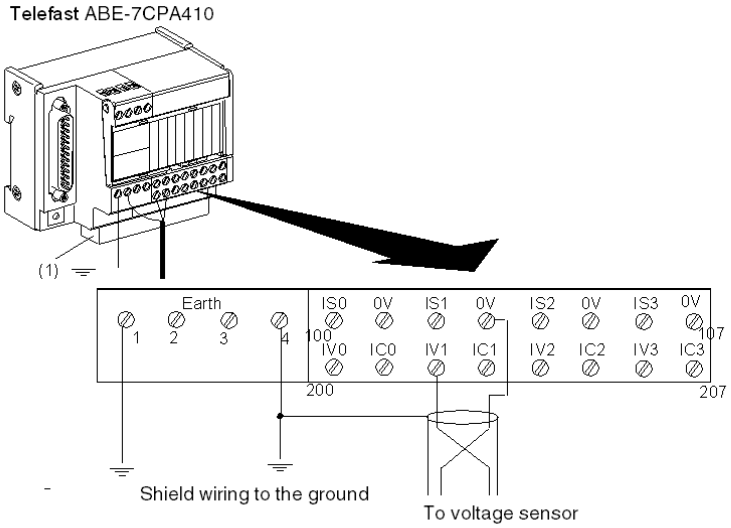
- Make sure that each terminal block is still connected to the shield bar.
- Disconnect voltage supplying sensors and pre-actuators.

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



- TELEFAST connection:

  Connect the sensor cable shielding to the terminals provided and the whole assembly to the cabinet ground.



(1) The grounding of cables is facilited using the ABE-7BV10 accessory.

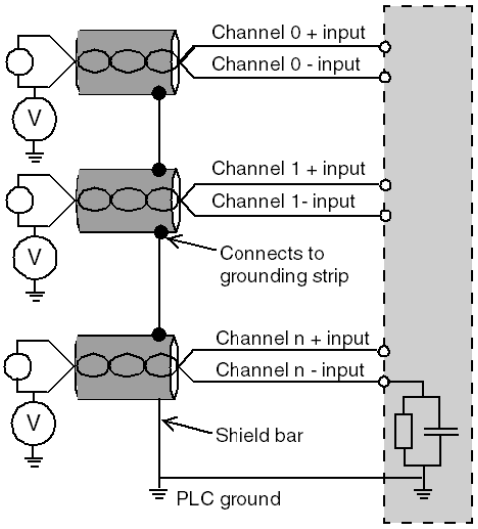
Reference of Sensors in Relation to the Ground

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

- Confirm that sensors are close together (a few meters).
- Confirm that all sensors are referenced to a single point, which is connected to the controller's ground.

Using the Sensors Referenced in Relation to the Ground

The sensors are connected as indicated in the following diagram:



If the sensors are referenced in relation to the ground, this may in some cases return a remote ground potential to the terminal block. Follow these rules:

- Confirm that the potential is less than the permitted low voltage: for example, 30 Vrms or 42.4 VDC.
- Setting a sensor point to a reference potential generates a leakage current. Check that all leakage currents generated do not disturb the system.

  NOTE: Sensors and other peripherals may be connected to a grounding point some distance from the module. Such remote ground references may carry considerable potential differences with respect to local ground.

⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Ensure that:

- sensors and other peripherals are not exposed through grounding points to voltage potential greater than acceptable limits.
- potentials greater than permitted low limits do not exist.
- induced currents do not affect the measurement or integrity of the system.

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

Electromagnetic Hazard Instructions

Electromagnetic perturbations may lead to an unexpected behavior of the application.

⚠CAUTION

UNEXPECTED APPLICATION BEHAVIOR

To reduce electromagnetic perturbations, use the shielding connection kit BMXXSP••••, page 234 to connect the shielding.

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

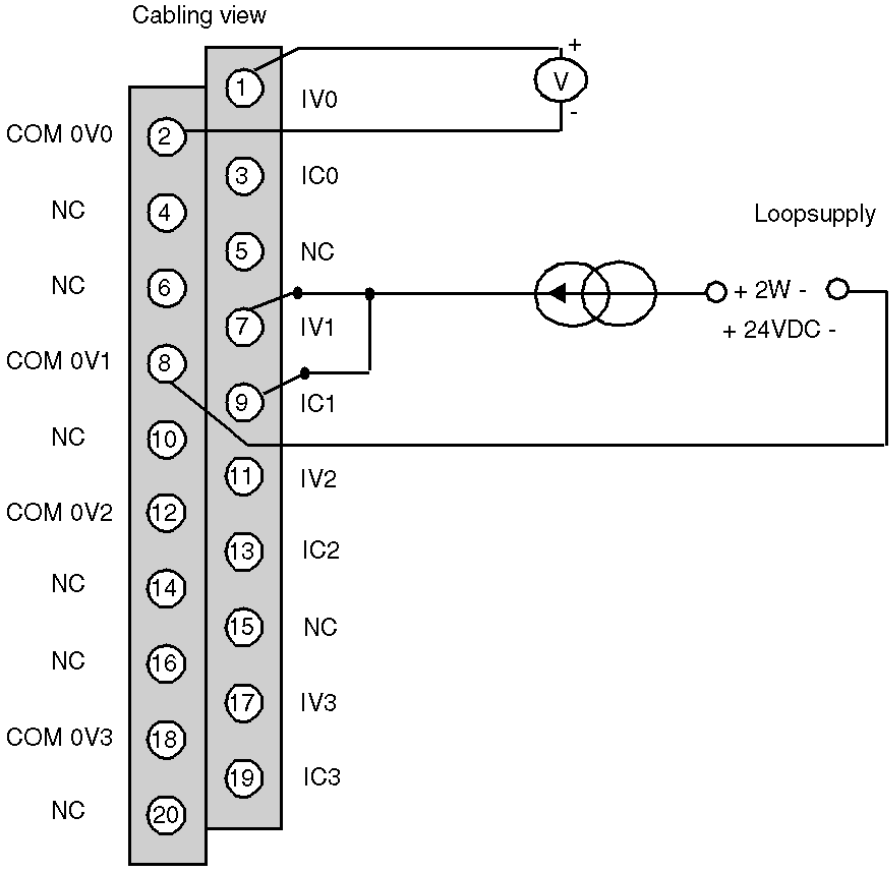
Wiring Diagram

Introduction

Module BMXAMI0410 is connected using the 20-point terminal block.

Illustration

The terminal block connection and the sensor wiring are as follows.



IVx + pole input for channel x

COM 0Vx - pole input for channel x

ICx current reading resistor + input

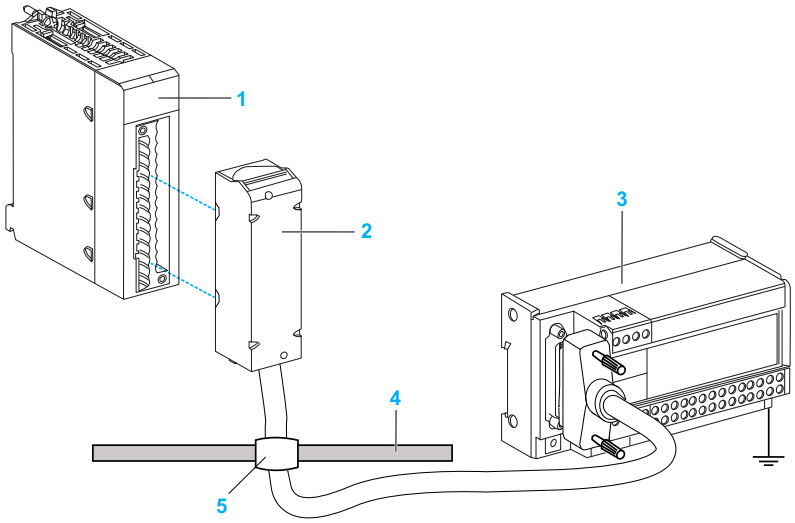
Channel 0 voltage sensor

Channel 1 2-wire current sensor

TELEFAST Wiring Accessories

Introduction

The TELEFAST pre-wired system consists of connecting cables and interface sub-bases as shown below:



1 BMXMI0410 module

2 BMXFCA••0 connecting cable

3 ABE-7CPA410 interface sub-base

4 Shield bar

5 Clamp

The TELEFAST ABE-7CPA410 accessory is a base unit used for the connection of sensors. It has the following functions:

- Extend the input terminals in voltage mode.
- Supply, channel by channel, the 0-20 mA or 4-20 mA sensors with a protected 24 V voltage, limited in current to 25 mA, while maintaining isolation between the channels.
- Help protect current reading resistors that are integrated in TELEFAST against over voltage.

Channels to channels isolation	750 Vdc
Channels to 24Vdc supply isolation	750 Vdc
Over voltage protection on current inputs	By Zener diodes 8,2V

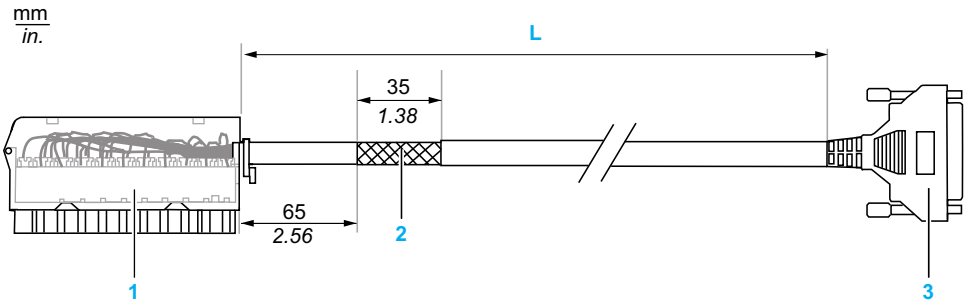
NOTE: When using current inputs, the TELEFAST 250 Ohm resistors are used, as opposed to those of the module. The BMXAMI0410 module operates in voltage mode.

BMXFCA••0 Connection Cables

The BMXFCA••0 cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 20-pin terminal block from which extend 1 cable sheath containing 20 wires,
- At the other end a 25-pin Sub-D connector.

The figure below shows the BMXFCA••0 cables:



1 BMXFTB2020 terminal block

2 Cable shielding

3 25-pin sub-D connector

L Length according to the part number

The cable comes in three different lengths:

- 1.5 m (4.92 ft): BMXFCA150
- 3 m (9.84 ft): BMXFCA300
- 5 m (16.40 ft): BMX FCA 500

The following table gives the characteristics of the BMXFCA••0 cables:

Characteristic		Value
Cable	Sheath material	PVC
	LSZH status	No
Environmental	Operating temperature	-25...70 °C (-13...158 °F)

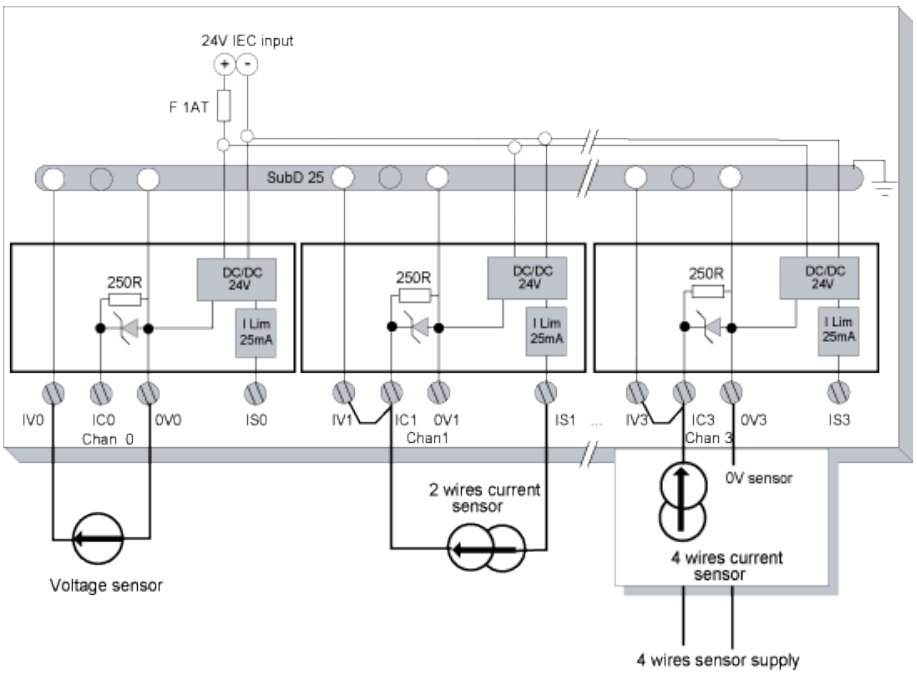
Connecting Sensors

Sensors may be connected to the ABE-7CPA410 accessory as shown in the illustration., page 225

The following table shows the ABE7-CPA410 and SUBD25 terminal numbers:

TELEFAST terminal block number	25-pin Sub-D connector pin number	Signal type	TELEFAST terminal block number	25-pin Sub-D connector pin number	Signal type
1	/	Earth	/		24 VDC Input
2	/	Earth	/		24 VDC Input
3	/	Earth	/		0V24 Input
4	/	COM 0	/		0V24 Input
100		Output IS 0	101	14	COM 0V0
102		Output IS 1	103	3	COM 0V1
104		Output IS 2	105	17	COM 0V2
106		Output IS 3	107	6	COM 0V3
200	1	Output IV 0	201		Input IC 0
202	15	Output IV 1	203		Input IC 1
204	4	Output IV 2	205		Input IC 2
206	18	Output IV 3	207		Input IC 3

Wiring diagram:



BMXAMI0800 Analog Input Module

What's in This Chapter

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BMXAMI0800 fpDefault 65
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Wiring Diagram 75
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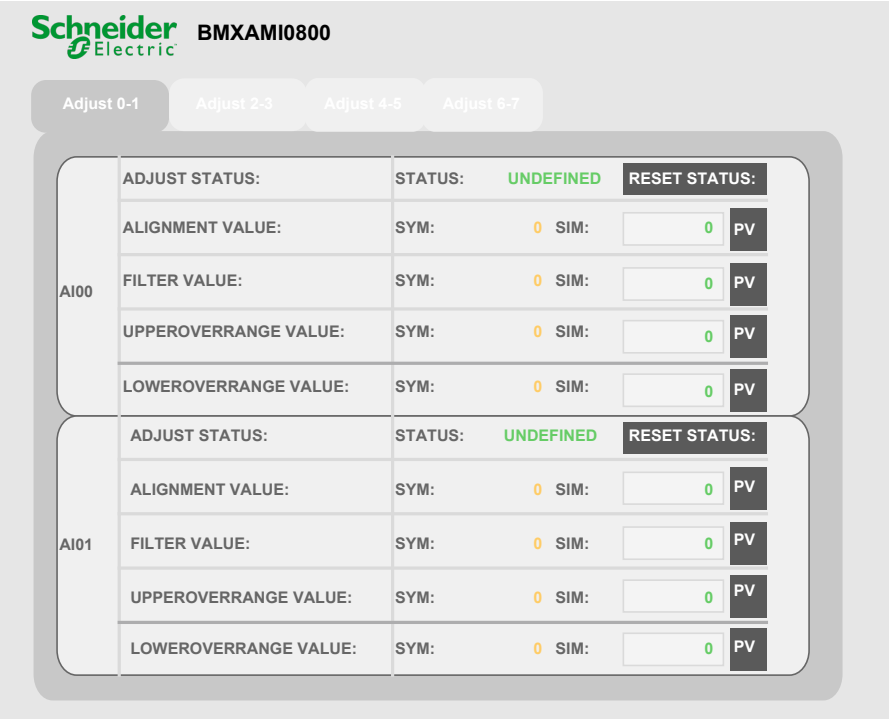
BMXAMI0800 sDefault

Abstract



BMXAMI0800 fpDefault

Abstract



Description

Element	Description
Range	Button to activate Range mode for HW, SIM/PV display.
Unit	Button to activate Unit mode when pressed. Displays Hardware, SIM, and Force units defined by the MODE.
FORCE	Blue indicates that at least one channel is forced.

Analog input channel description:

Element	Description
AI##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.
PV F	Value indicator: • PV indicates that the channel is not forced. • F indicates that the channel is forced.
MODE	Type configured for the channel.
STATUS	Channel status.

Presentation

Function

The BMXAMI0800 is a high density input analog module with 8 non-isolated channels.

This module is used in conjunction with sensors or transmitters; it performs monitoring, measurement, and continuous process control functions.

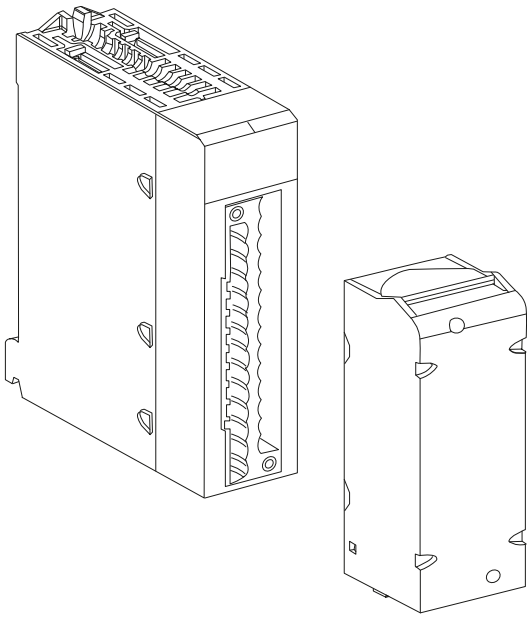
The BMX AMI 0800 module offers the following range for each input according to the selection made during configuration:

- Voltage +/-5 V/+/-10 V/0..5 V/0..10 V/1..5 V
- Current +/-20 mA/0..20 mA/4..20 mA

The module operates with voltage inputs. It includes eight read resistors connected to the terminal block to perform current inputs.

Illustration

The following graphic shows the BMXAMI0800 analog input module:



NOTE: The terminal block is supplied separately.

Characteristics

Altitude Operating Conditions

The characteristics in the tables below apply to the BMXAMI0800 module for use at altitude up to 2000 m (6560 ft). When the module operates above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Characteristics

This table shows the general characteristics for the BMXAMI0800 module:

Operating temperature		0...60 ºC (32...140 ºF)
Type of inputs		High level Fast inputs with common point
Nature of inputs		Voltage / Current
Number of channels		8
Acquisition cycle time: • Fast (periodic acquisition for the declared channels used) • Default (periodic acquisition for all channels)		1 ms + 1 ms x number of channels used 9 ms
Display resolution		16-bit
Digital filtering		First order
Isolation: • Between channels • Between channels and bus • Between channels and ground		Non-isolated 1400 VDC 1400 VDC
Maximum overload authorized for inputs:		Voltage inputs: +/- 30 VDC Current inputs: +/- 30 mA
Power consumption (3.3 V)	**Typical**	0.32 W
	Maximum	0.48 W
Power consumption (24 V)	**Typical**	0.90 W
	Maximum	1.10 W

Measurement Range

The BMXAMI0800 analog inputs have the following measurement range characteristics:

Measurement range	**+/- 10 V; +/- 5 V** **0...10 V; 0...5 V; 1...5 V**	**+/- 20 mA** **0...20 mA; 4...20 mA**
Maximum conversion value	+/-11.4 V	+/-30 mA
Conversion resolution	0.36 mV	1.4 µA
Input impedance	10 MΩ	250 Ω Internal conversion resistor
Precision of the internal conversion resistor	-	0.1% - 15 ppm/°C
Detected measurement help protect: • At 25°C • Maximum in the temperature range 0...60°C (32...140°F)	0.075% of FS(1) 0.1% of FS(1)	Typical 0.15% of FS(1)(2) 0.3% of FS(1)(2)
Temperature drift	30 ppm/°C	50 ppm/°C including conversion resistance
Monotonicity	Yes	Yes
Common mode rejection (50/60 Hz)	100 dB	100 dB

Measurement range	**+/- 10 V; +/- 5 V** **0...10 V; 0...5 V; 1...5 V**	**+/- 20 mA** **0...20 mA; 4...20 mA**
Crosstalk between channels DC and AC 50/60Hz	> 80 dB	> 80 dB
Non-linearity	0.001%	0.001%
Repeatability @25 °C of 10 min. stabilization time	0.005% of FS(1)	0.007% of FS(1)
Long term stability after 1000 hours	< 0.004% of FS(1)	< 0.004% of FS(1)
(1) FS: Full Scale **(2)** Detected conversion resistor error		

NOTE: If nothing is connected on a BMXAMI0800 analog module and if channels are configured (range of 4...20 mA or 1...5 V), there is a detected I/O error as if a wire is broken.

Functional Description

Function

The BMXAMI0800 module is a high density input analog module with 8 non-input channel.

This module is used in conjunction with sensors or transmitters; it performs monitoring, measurement, and continuous process control functions.

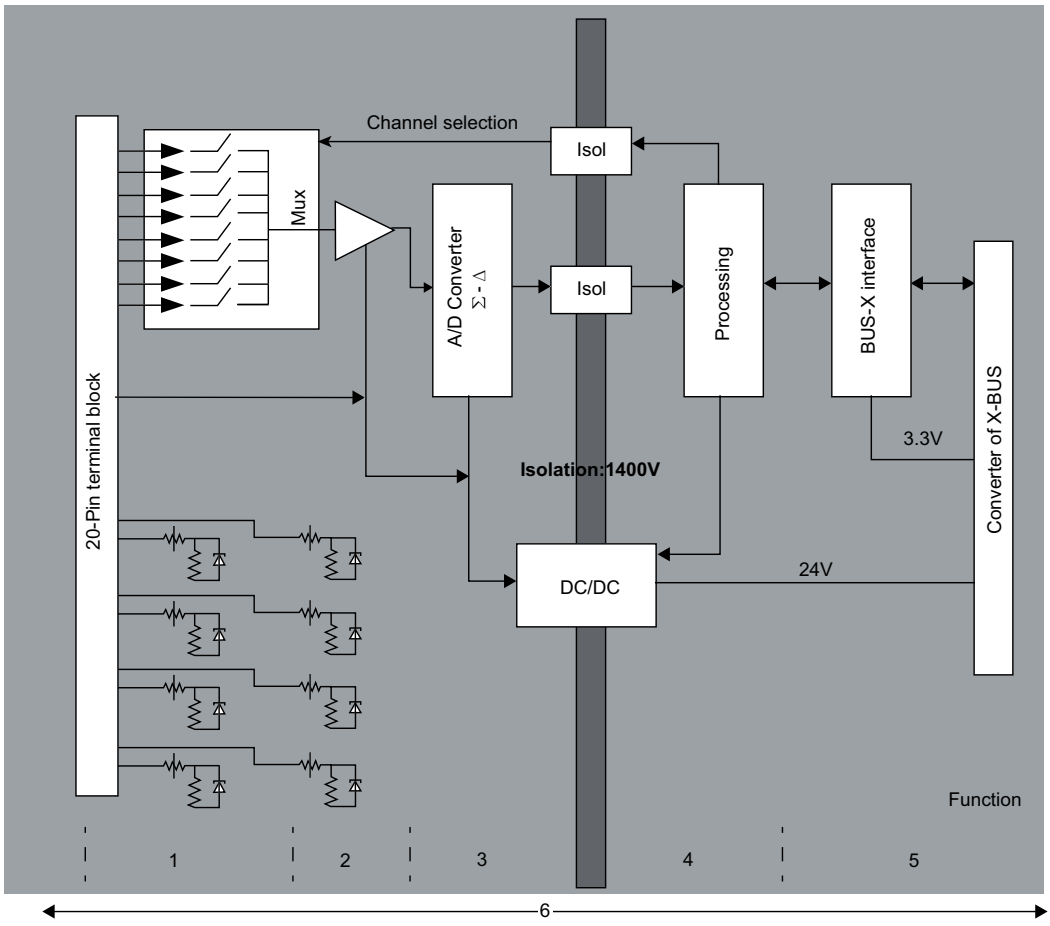
The BMXAMI0800 module offers the following range for each input according to the selection made during configuration:

- +/-10 V
- 0..10 V
- 0..5 V / 0..20 mA
- 1..5 V / 4..20 mA
- +/-5 V / +/-20 mA

The module operates with voltage inputs. It includes eight read resistors connected to the terminal block to perform current inputs.

Illustration

The BMXAMI0800 module's illustration:



Description:

No.	Process	Function
1	**Adapting the Inputs and Multiplexing**	• Physical connection to the process through a 28-pin screw terminal block • Protection of the module against overvoltages • Input signal analog filtering
2	**Amplifying Input Signals**	• Gain selecting, based on characteristics of input signals, as defined during configuration (unipolar or bipolar range, in voltage or current) • Compensation of drift in amplifier device
3	**Converting**	• Conversion of analog Input signal into digital 24-bit signal using a ΣΔ converter
4	**Transforming incoming values into workable measurements for the user.**	• Takes into account recalibration and alignment coefficients to be applied to measurements, as well as the module's self-calibration coefficients • (Numeric) filtering for measurements, based on configuration parameters • Scaling of measurements, based on configuration parameters
5	**Communicating with the Application**	• Manages exchanges with controller • Topological addressing • Receives configuration parameters from module and channels • Sends measured values, as well as module status, to application
6	**Module monitoring and sending detected error notification back to application.**	Conversion string test Testing for range overflow on channels Watchdog test

Measurement Timing

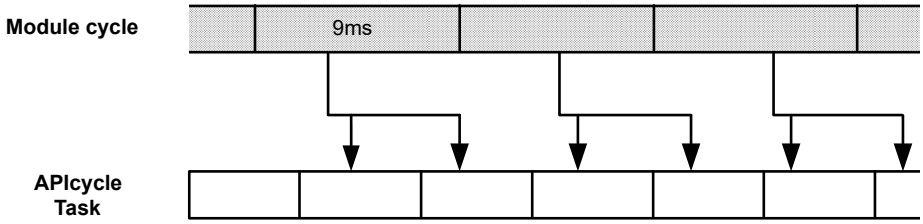
The timing of measurements is determined by the cycle selected during configuration (Normal or Fast Cycle):

- Normal Cycle means that the scan cycle duration is fixed.
- With the Fast Cycle, however, the system only scans the channels designated as being In Use. The scan cycle duration is therefore proportional to the number of channels In Use.

The cycle time values are based on the cycle selected:

Module	Normal Cycle	Fast Cycle
BMX AMI 0800	9 ms	1 ms + (1 ms x N) where N: number of channels in use.

NOTE: Module cycle is not synchronized with the controller cycle. At the beginning of each controller cycle, each channel value is taken into account. If the bus cycle time is less than the module's cycle time, some values will not have changed.

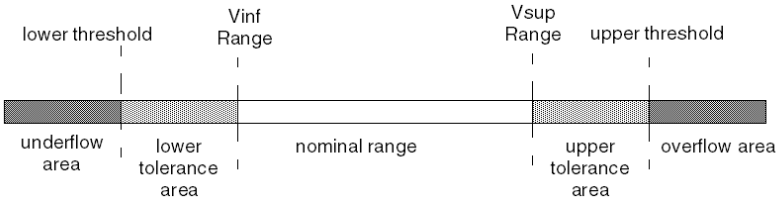


Overflow/Underflow Control

Module BMXAMI0800 allows the user to select between 6 voltage or current ranges for each input.

This option for each channel have to be configured in configuration windows. Upper and lower tolerance detection are always active regardless of overflow/ underflow control.

Depending on the range selected the module checks for overflow, it verifies that the measurement falls between a lower and an upper threshold:



Description:

Designation	Description
Nominal range	measurement range corresponding to the chosen range
Upper Tolerance Area	varies between the values included between the maximum value for the range (for instance: +10 V for the +/-10 V range) and the upper threshold
Lower Tolerance Area	varies between the values included between the minimum value for the range (for instance: -10 V for the +/-10 V range) and the lower threshold

Designation	Description
Overflow Area	area located beyond the upper threshold
Underflow Area	area located below the lower threshold

The values of the thresholds are configurable independently from one another. They may assume integer values between the following limits:

Range	BMXAMI0800 Range									
	Underflow Area		Lower Tolerance Area		Nominal Range		Upper Tolerance Area		Overflow Area	
Unipolar										
0...10 V	-1,500	-1,001	-1,000	-1	0	10,000	10,001	11,000	11,001	11,400
0...5 V / 0...20 mA	-5,000	-1,001	-1,000	-1	0	10,000	10,001	11,000	11,001	15,000
1...5 V / 4...20 mA	-4,000	-801	-800	-1	0	10,000	10,001	10,800	10,801	14,000
Bipolar										
+/- 10 V	-11,500	-11,001	-11,000	-10,001	-10,000	10,000	10,001	11,000	11,001	11,400
+/- 5 V, +/- 20 mA	-15,000	-11,001	-11,000	-10,001	-10,000	10,000	10,001	11,000	11,001	15,000
User										
+/- 10 V	-32,768				User-defined	User-defined				32,767
0...10 V	-32,768				User-defined	User-defined				32,767

Measurement Display

Measurements may be displayed using standardized display (in %, to two decimal places).

Type of Range	Display
Unipolar range 0...10 V, 0...5 V, 1...5 V, 0...20mA, 4...20mA	from 0 to 10,000 (0 % at +100.00 %)
Bipolar range +/- 10 V, +/- 5 mV +/- 20 mA	from -10,000 to 10,000 (0% or -100.00% at +100.00 %)

For example, as all symlinks are expressed in percentages, the range:

- 0...10 V has the correspondences: 0 V = 0%,..., 3,2 V = 32%,..., 5,6 V = 56%,..., 10 V = 100%.
- +/- 10 V has the correspondences:- 10 V = 0%,..., - 5 V = 25%,..., 0 V= 50%,..., +5 V = 75%,..., +10 V = 100%.

Measurement Filtering

The type of filtering performed by the system is called "first order filtering". The filtering coefficient can be modified from a programming console or via the program.

The mathematical formula used is as follows:

$Meas_{f(n)} = \alpha \times Meas_{f(n-1)} + (1-\alpha) \times Val_{b(n)}$

where:

α = efficiency of the filter

$Meas_{f(n)}$ = measurement filtered at moment n

$Meas_{f(n-1)}$ = measurement filtered at moment n-1

$Val_{b(n)}$ = gross value at moment n

You may configure the filtering value from 7 possibilities (from 0 to 6). This value may be changed even when the application is in RUN mode.

NOTE: Filtering may be accessed in Normal or Fast Cycle.

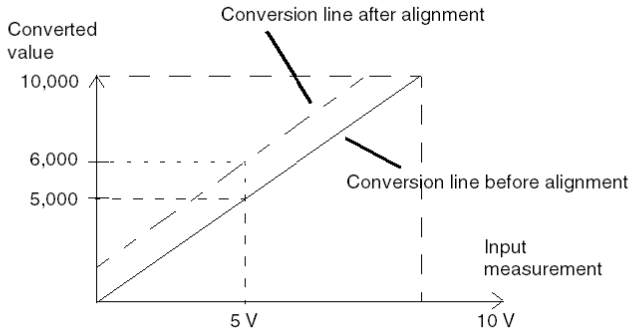
The filtering values depend on the T configuration cycle (where T = cycle time of 5 ms in standard mode):

Desired Efficiency	Required Value	Corresponding α	Filter Response Time at 63%	Cut-off Frequency (in Hz)
No filtering	0	0	0	0
Low filtering	1	0.750	4 x T	0.040 / T
	2	0.875	8 x T	0.020 / T
Medium filtering	3	0.937	16 x T	0.010 / T
	4	0.969	32 x T	0.005 / T
High filtering	5	0.984	64 x T	0.0025 / T
	6	0.992	128 x T	0.0012 / T

Sensor Alignment

The process of "alignment" consists of helping eliminate a systematic offset observed with a given sensor, around a specific operating point. This operation compensates for a detected error linked to the process. Replacing a module does not therefore require a new alignment. However, replacing the sensor or changing the sensor's operating point does require a new alignment.

Conversion lines are as follows:



The alignment value is editable from a programming console, even if the program is in RUN Mode. For each input channel, you can:

- view and modify the desired measurement value
- save the alignment value
- determine whether the channel already has an alignment

The alignment offset may also be modified through programming.

Channel alignment is performed on the channel in standard operating mode, without any effect on the channel's operating modes.

The maximum offset between measured value and desired (aligned) value may not exceed +/-1.500.

NOTE: To align several analog channels on the BMX ART/AMO/AMI/AMM modules, we recommend proceeding channel by channel. Test each channel after alignment before moving to the next channel in order to apply the parameters correctly.

Wiring Precautions

Introduction

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

Cable Shielding

Connect the cable shielding to the grounding bar. Clamp the shielding to the grounding bar on the module side. Use the shielding connection kit BMXXSP••••, page 234 to connect the shielding.

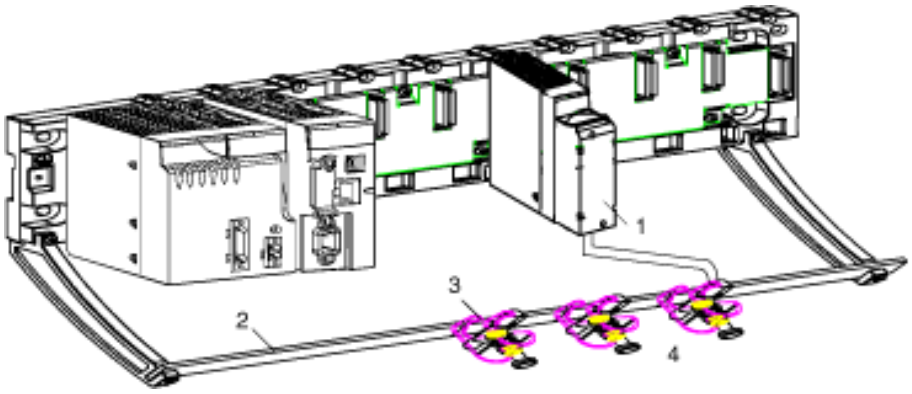
⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

While installing / removing the modules:

- Make sure that each terminal block is still connected to the shield bar.
- Disconnect voltage supplying sensors and pre-actuators.

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



1 BMXAMI0800

2 Shield bar

3 Clamp

4 To sensors

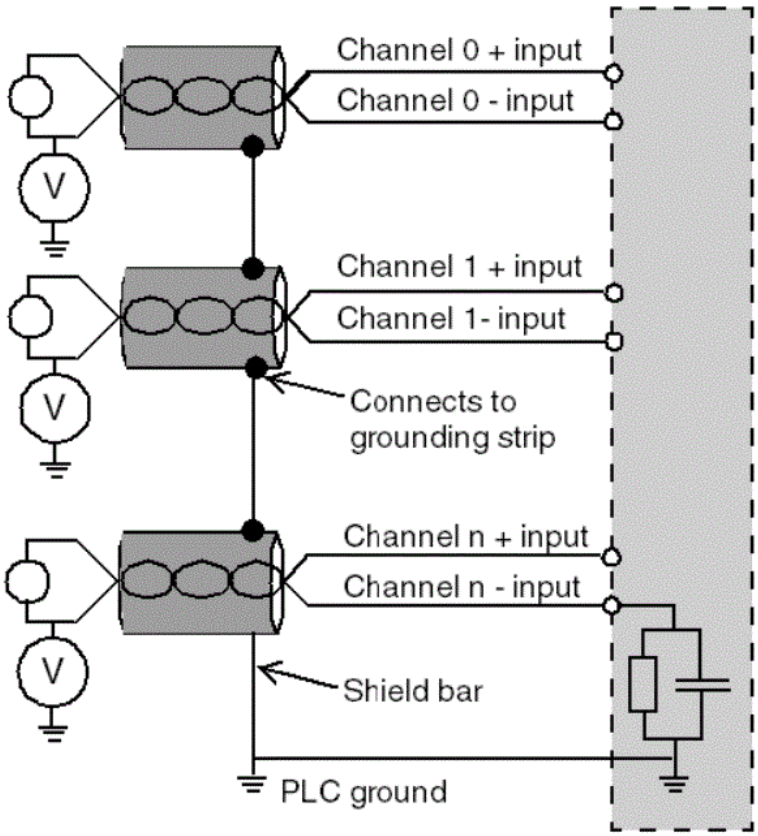
Reference of Sensors in Relation to the Ground

In order for the acquisition system to operate correctly, It is recommended to take in account the following precautions:

- Confirm that the sensors are close together (a few meters).
- Confirm that all sensors are referenced to a single point, which is connected to the controller's ground.

Using the Sensors Referenced in Relation to the Ground

The sensors are connected as indicated in the following diagram:



If the sensors are referenced in relation to the ground, in some cases this may return a remote ground potential to the terminal block. Follow these rules:

- Confirm that the potential is less than the permitted low voltage: for example, 30 Vrms or 42.4 VDC.
- Check that all leakage currents generated do not disturb the system. Setting a sensor point to a reference potential generates a leakage current.

NOTE: Sensors and other peripherals may be connected to a grounding point some distance from the module. Such remote ground references may carry considerable potential differences with respect to local ground.

⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Ensure that:

- sensors and other peripherals are not exposed through grounding points to voltage potential greater than acceptable limits.
- potentials greater than permitted low limits do not exist.
- induced currents do not affect the measurement or integrity of the system.

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

Electromagnetic Hazard Instructions

Electromagnetic perturbations may lead to an unexpected behavior of the application.

⚠CAUTION

UNEXPECTED APPLICATION BEHAVIOR

To reduce electromagnetic perturbations, use the shielding connection kit BMXXSP••••, page 234 to connect the shielding.

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

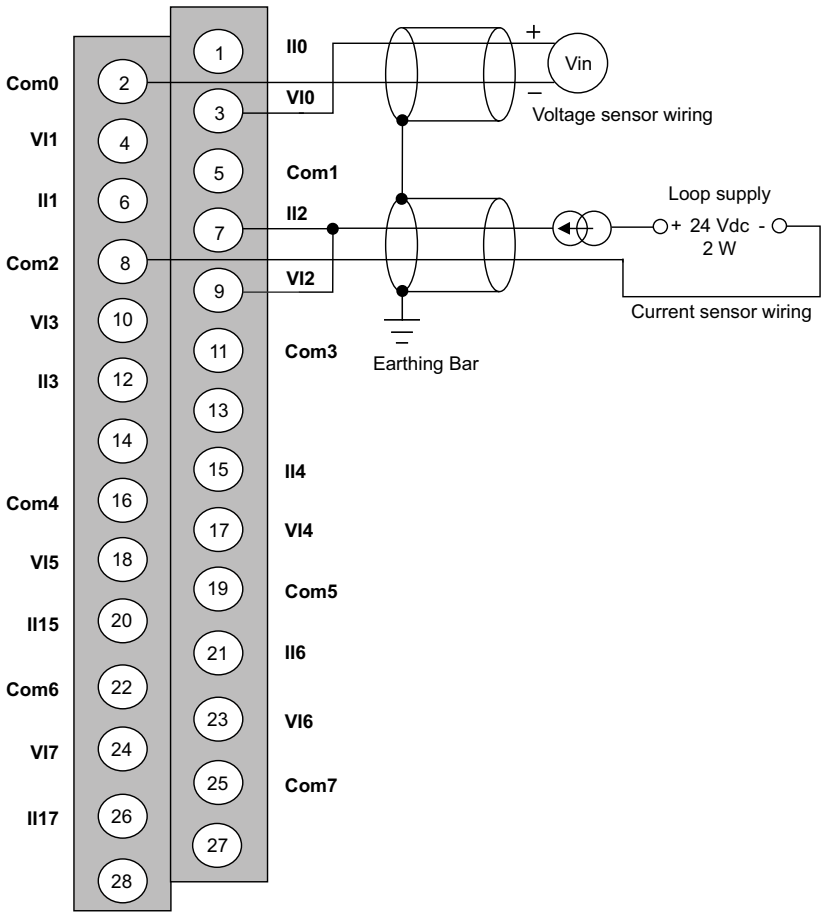
Wiring Diagram

Introduction

The BMXAMI0800 module is connected using the 28-pin terminal block.

Illustration

The terminal block connection and the sensor wiring are as follows:



VIx + pole input for channel x

COMx - pole input for channel x, COMx are connected together internally

IIx current reading resistor + input

Channel 0 voltage sensor

Channel 1 2-wire current sensor

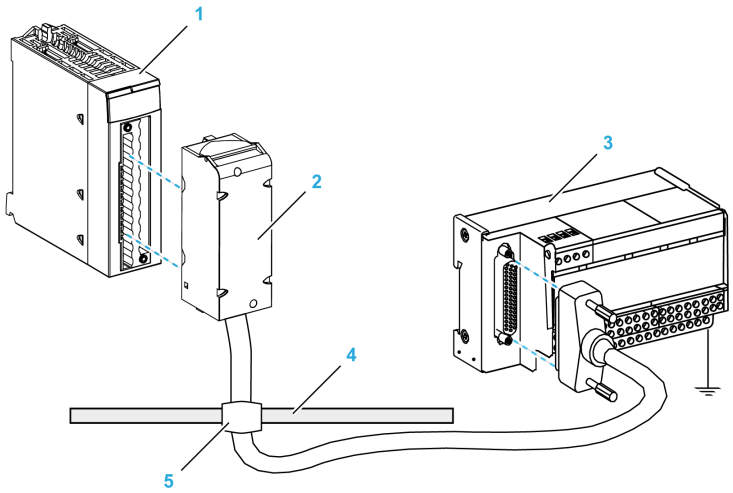
Wiring Accessories

For rapid connection to operative parts, the module can be connected to a TELEFAST pre-wired system, page 77.

Use of the TELEFAST Wiring Accessories

Introduction

The TELEFAST pre-wired system consists of connecting cables and interface sub-bases as shown below:



1 BMXAMI0800 module

2 BMXFTA••0 connecting cables

3 Interface sub-base

4 Shield bar

5 Clamp

The BMXAMI0800 module can be connected to the following interface sub-bases references:

- ABE-7CPA02
- ABE-7CPA03
- ABE-7CPA31
- ABE-7CPA31E

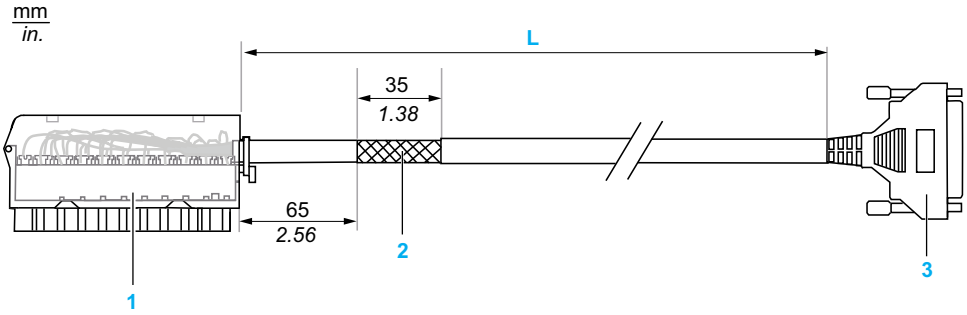
  NOTE: In case HART information is part of the signal to be measured, an ABE-7CPA31E interface sub-base has to be used in order to filter this information that would disrupt the analog value.

BMX FTA ••0 Connecting Cables

The BMX FTA ••0 cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 28-pin terminal block from which extend 1 cable sheath containing 24 wires,
- At the other end a 25-pin Sub-D connector.

The figure below shows the BMX FTA ••0 cables:



1 BMXFTB2820 Terminal block

2 Cable shielding

3 25-pin Sub-D connector

L Length according to the part number.

The cable comes in 2 different lengths:

- 1.5 m (4.92 ft): BMXFTA150
- 3 m (9.84 ft): BMXFTA300

The following table gives the characteristics of the BMXFTA ••0 cables:

Characteristic		**Value**
Cable	Sheath material	PVC
	LSZH status	No
Environmental	Operating temperature	-25...70 °C (-13...158 °F)

ABE-7CPA02 Sensor Connection

The following table shows the distribution of analog channels on TELEFAST terminal blocks with the interface sub-base ABE-7CPA02:

TELEFAST terminal block number	**25-pin Sub-D connector pin number**	**BMXA-MI0800 pin out**	**Signal type**	**TELEFAST terminal block number**	**25-pin Sub-D connector pin number**	**BMXA-MI0800 pin out**	**Signal type**
1	/		Ground	Supp 1	/		Ground
2	/		STD (1)	Supp 2	/		Ground
3	/		STD (1)	Supp 3	/		Ground
4	/		STD (2)	Supp 4	/		Ground
100	1	3	+IV0	200	14	2	COM0
101	2	1	+IC0	201	/		Ground
102	15	4	+IV1	202	3	5	COM1
103	16	6	+IC1	203	/		Ground
104	4	9	+IV2	204	17	8	COM2
105	5	7	+IC2	205	/		Ground
106	18	10	+IV3	206	6	11	COM3
107	19	12	+IC3	207	/		Ground
108	7	17	+IV4	208	20	16	COM4
109	8	15	+IC4	209	/		Ground
110	21	18	+IV5	210	9	19	COM5
111	22	20	+IC5	211	/		Ground

TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0800 pin out	Signal type	TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0800 pin out	Signal type
112	10	23	+IV6	212	23	22	COM6
113	11	21	+IC6	213	/		Ground
114	24	24	+IV7	214	12	25	COM7
115	25	26	+IC7	215	/		Ground

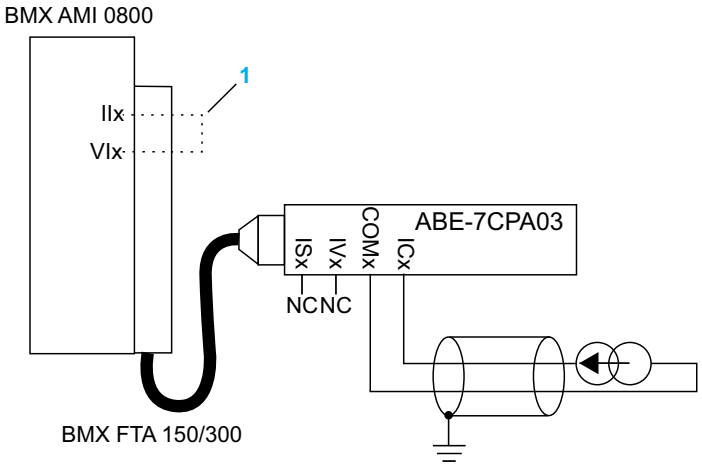
NOTE: On the ABE-7CPA02, the strap position is between pin 1 and pin 2.

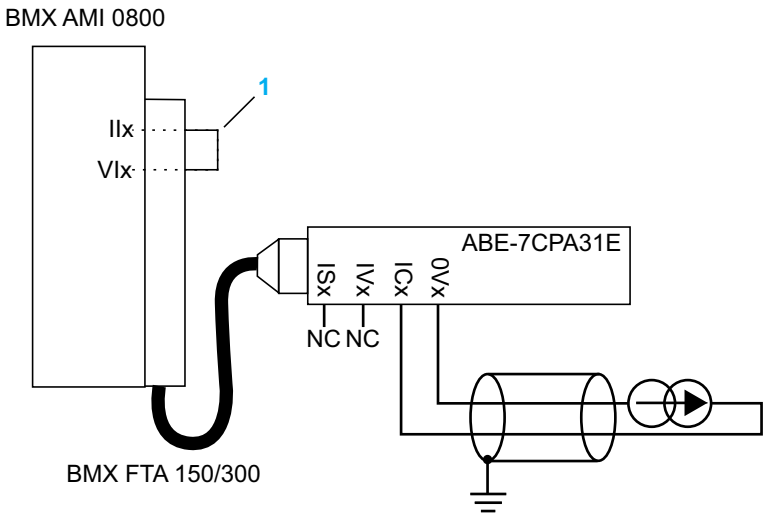
+IVx: + pole voltage input for channel x.

+ICx: + pole current input for channel x.

COMx: - pole voltage or current input for channel x.

NOTE: For current sensors connected on the TELEFAST ABE-7CPA02, confirm that a strap is made on the BMXAMI0800 terminal block between the current input and the voltage input as illustrated below.





1 Strap on the terminal block.

NOTE: For the ground connection use the additional terminal block ABE-7BV10/20.

ABE-7CPA03 Sensor Connection

The negative current is not supported by ABE-7CPA03

NOTICE

EQUIPMENT DAMAGE

Do not apply a negative current when BMXAMI0800 is associated with ABE-7CPA03.

Failure to follow these instructions can result in equipment damage.

The following table shows the distribution of analog channels on TELEFAST terminal blocks with the reference ABE-7CPA03:

TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0800 pin out	Signal type	TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0800 pin out	Signal type
1	/		0 V	Supp 1	/		24 V (sensor supply)
2	/		0 V	Supp 2	/		24 V (sensor supply)
3	/		0 V	Supp 3	/		0 V (sensor supply)
4	/		0 V	Supp 4	/		0 V (sensor supply)
100	/		+IS1	200	/		+IS0
101	15	4	+IV1	201	1	3	+IV0
102	16	6	+IC1	202	2	1	+IC0
103	/		Ground	203	14/3	2/5	COM0/COM1
104	/		+IS3	204	/		+IS2
105	18	10	+IV3	205	4	9	+IV2
106	19	12	+IC3	206	5	7	+IC2
107	/		Ground	207	17/6	8/11	COM2/COM3
108	/		+IS5	208	/		+IS4
109	21	18	+IV5	209	7	17	+IV4
110	22	20	+IC5	210	8	15	+IC4
111	/		Ground	211	20/9	16/19	COM4/COM5
112	/		+IS7	212	/		+IS6
113	24	24	+IV7	213	10	21	+IV6
114	25	26	+IC7	214	11	23	+IC6
115	/		Ground	215	23/12	22/25	COM6/COM7

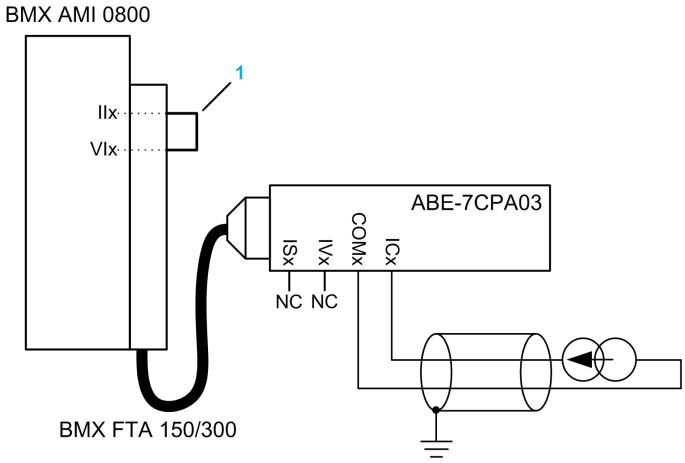
+ISx: 24 V channel power supply

+IVx: + pole voltage input for channel x

+ICx: + pole current input for channel x

COMx: - pole voltage or current input for channel x

NOTE: For current sensors connected on the TELEFAST ABE-7CPA03, confirm that a strap is made on the BMXAMI0800 terminal block between the current input and the voltage input as illustrated below.



1 Strap on the terminal block.

NOTE: For the ground connection use the additional terminal block ABE-7BV10/20.

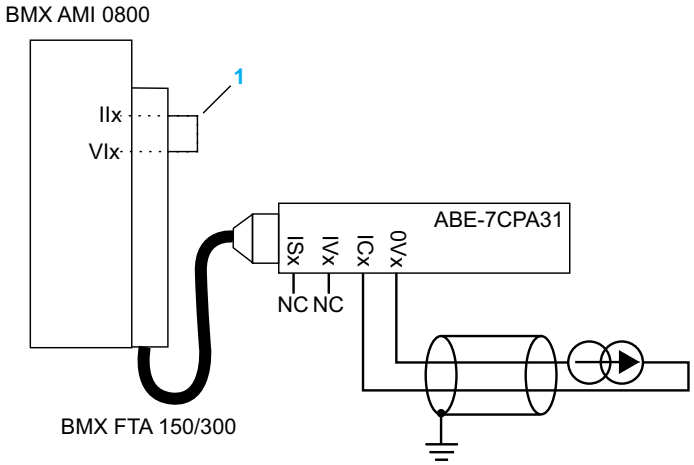
ABE-7CPA31 Sensor Connection

The following table shows the distribution of analog channels on TELEFAST terminal blocks with the reference ABE-7CPA31:

TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0800 pin out	Signal type	TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0800 pin out	Signal type
1	/		Ground	Supp 1	/		24 V (sensor supply)
2	/		Ground	Supp 2	/		24 V (sensor supply)
3	/		Ground	Supp 3	/		0 V (sensor supply)
4	/		Ground	Supp 4	/		0 V (sensor supply)
100	/		+IS0	116	/		+IS4
101	1	3	+IV0	117	7	17	+IV4
102	2	1	+IC0	118	8	15	+IC4
103	14	2	0 V	119	20	16	0 V
104	/		+IS1	120	/		+IS5
105	15	4	+IV1	121	21	18	+IV5
106	16	6	+IC1	122	22	20	+IC5
107	3	5	0 V	123	9	19	0 V
108	/		+IS2	124	/		+IS6
109	4	9	+IV2	125	10	23	+IV6
110	5	7	+IC2	126	11	21	+IC6
111	17	8	0 V	127	23	22	0 V
112	/		+IS3	128	/		+IS7
113	18	10	+IV3	129	24	24	+IV7
114	19	12	+IC3	130	25	26	+IC7

TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0800 pin out	Signal type	TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0800 pin out	Signal type
115	6	11	0 V	131	12	25	0 V
+ISx: 24 V channel power supply **+IVx:** + pole voltage input for channel x **+ICx:** + pole current input for channel x **COMx:** - pole voltage or current input for channel x.							

NOTE: For current sensors connected on the TELEFAST ABE-7CPA31, confirm that a strap is made on the BMXAMI0800 terminal block between the current input and the voltage input as illustrated below.



1 Strap on the terminal block.

NOTE: For the ground connection use the additional terminal block ABE-7BV10/20.

ABE-7CPA031E Sensor Connection

The following table shows the distribution of analog channels on TELEFAST terminal blocks with the reference ABE-7CPA31E:

TELEFAST terminal block number	Terminal	Signal type	TELEFAST terminal block number	Terminal	Signal type
1	/	Ground	Supp 1	/	24 V (sensor supply)
2	/	Ground	Supp 2	/	24 V (sensor supply)
3	/	Ground	Supp 3	/	0 V (sensor supply)
4	/	Ground	Supp 4	/	0 V (sensor supply)
100	/	+IS0	116	/	+IS4
101	/	T0	117	/	T4
102	/	+IC0	118	/	+IC4
103	/	0V0	119	/	0V4
104	/	+IS1	120	/	+IS5
105	/	T1	121	/	T5
106	/	+IC1	122	/	+IC5
107	/	0V1	123	/	0V5
108	/	+IS2	124	/	+IS6

TELEFAST terminal block number	Terminal	Signal type	TELEFAST terminal block number	Terminal	Signal type
109	/	T2	125	/	T6
110	/	+IC2	126	/	+IC6
111	/	0V2	127	/	0V6
112	/	+IS3	128	/	+IS7
113	/	T3	129	/	T7
114	/	+IC3	130	/	+IC7
115	/	0V3	131	/	0V7

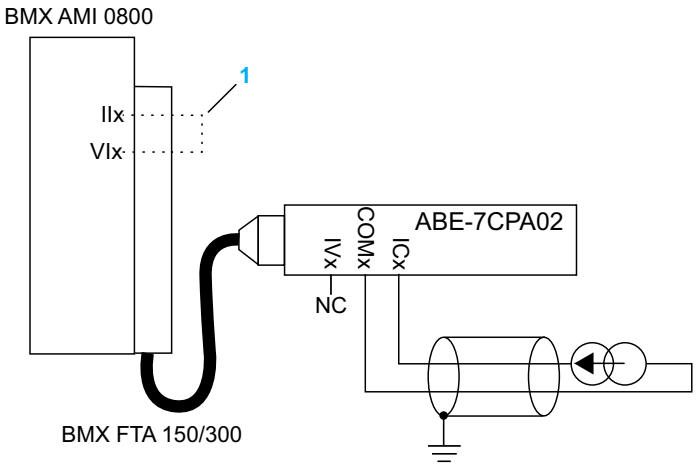
+ISx: 24 V channel power supply

Tx: Reserved test pin for HART function, it's internally connected with +ICx

+ICx: + pole current input for channel x

COMx: - pole voltage or current input for channel x

NOTE: For current sensors connected on the TELEFAST ABE-7CPA31E, confirm that a strap is made on the BMXAMI0800 terminal block between the current input and the voltage input as illustrated below.



1 Strap on the terminal block.

NOTE: For the ground connection use the additional terminal block ABE-7BV10/20.

BMXAMI0810(H) Analog Input Module

What's in This Chapter

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BMXAMI0810(H) fpDefault 85
Presentation 86
Characteristics 87
Functional Description 88
Dimensions 93
Wiring Precautions 95
Wiring Diagram 98
Use of the TELEFAST Wiring Accessories 100

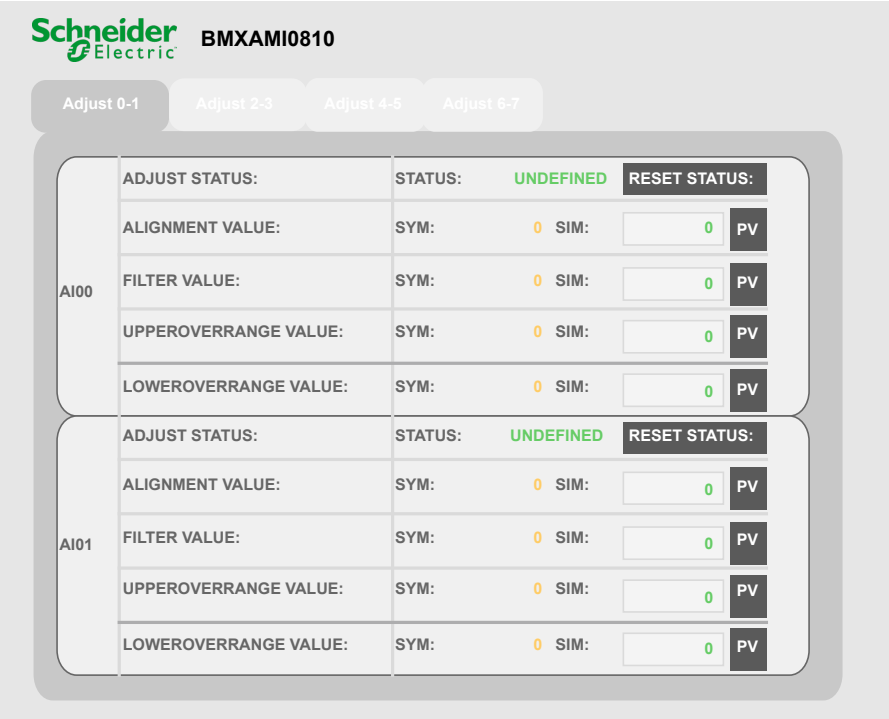
BMXAMI0810(H) sDefault

Abstract



BMXAMI0810(H) fpDefault

Abstract



Description

Element	Description
Range	Button to activate Range mode for HW, SIM/PV display.
Unit	Button to activate Unit mode when pressed. Displays Hardware, SIM, and Force units defined by the MODE.
FORCE	Blue indicates that at least one channel is forced.

Analog input channel description:

Element	Description
AI##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.
PV F	Value indicator: • PV indicates that the channel is not forced. • F indicates that the channel is forced.
MODE	Type configured for the channel.
STATUS	Channel status.

Presentation

Function

The BMXAMI0810 is a high density input analog module with 8 isolated channels.

This module is used in conjunction with sensors or transmitters; it performs monitoring, measurement, and continuous process control functions.

The BMXAMI0810 module offers the following range for each input according to the selection made during configuration:

- Voltage +/-5 V/+/-10 V/0..5 V/0..10 V/1..5 V
- Current +/-20 mA/0..20 mA/4..20 mA

The module operates with voltage inputs. It includes eight read resistors connected to the terminal block to perform current inputs.

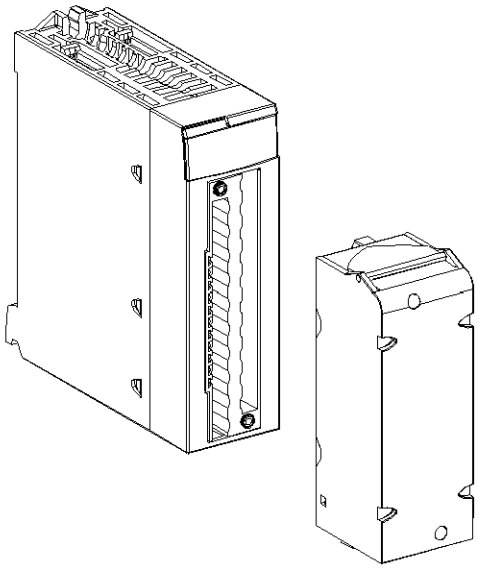
Ruggedized Version

The BMXAMI0810H (hardened) equipment is the ruggedized version of the BMXAMI0810 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration

The following graphic shows the BMXAMI0810 analog input module:



NOTE: The terminal block is supplied separately.

Characteristics

Altitude Operating Conditions

The characteristics in the tables below apply to the modules BMXAMI0810 and BMXAMI0810H for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Characteristics

The general characteristics for the BMXAMI0810 and BMXAMI0810H modules are as follows:

Operating temperature	BMXAMI0810	0...60 ºC (32...140 ºF)
	BMXA-MI0810H	-25...70 ºC (-13...158 ºF)
Type of inputs		High level isolated fast inputs
Nature of inputs		Voltage / Current
Number of channels		8
Acquisition cycle time: • Fast (periodic acquisition for the declared channels used) • Default (periodic acquisition for all channels)		1 ms + 1 ms x number of channels used 9 ms
Display resolution		16-bit
Digital filtering		First order
Isolation: • Between channels • Between channels and bus • Between channels and ground		+/-300 VDC 1400 VDC 1400 VDC
Maximum overload authorized for inputs:		Voltage inputs: +/- 30 VDC Current inputs: +/- 30 mA Help Protect against accidental wiring: -19.2 to 30VDC **NOTE:** The **Protected for accidental wiring** function is not supported when the module works with any Telefast interface.
Power consumption (3.3 V)	**Typical**	0.32 W
	Maximum	0.48 W
Power consumption (24 V)	**Typical**	1.06 W
	Maximum	1.50 W

Measurement Range

The BMXAMI0810 and BMXAMI0810H analog inputs have the following measurement range characteristics:

Measurement range	**+/- 10 V; +/- 5 V** **0...10 V; 0...5 V; 1...5 V**	**+/- 20 mA;** **0...20 mA; 4...20 mA**
Maximum conversion value	+/-11.4 V	+/-30 mA
Conversion resolution	0.36 mV	1.4 µA
Input impedance	10 MΩ	Internal conversion resistor (250 Ω) + Internal protection resistor (see note)
Precision of the internal conversion resistor	-	0.1% - 15 ppm/°C
Detected measurement errors for standard module :		
• At 25°C • Maximum in the temperature range 0...60°C (32...140°F)	0.075% of FS(1) 0.1% of FS(1)	Typical 0.15% of FS(1)(2) 0.3% of FS(1)(2)
Detected measurement errors for Hardened module:		
• At 25°C • Maximum in the temperature range -25...70°C (-13...158°F)	0.075% of FS(1) 0.2% of FS(1)	Typical 0.15% of FS(1)(2) 0.55% of FS(1)(2)
Temperature drift	30 ppm/°C	50 ppm/°C
Monotonicity	Yes	Yes
Common mode rejection (50/60 Hz)	80 dB	80 dB
Crosstalk between channels DC and AC 50/60Hz	> 80 dB	> 80 dB
Non-linearity	0.001%	0.001%
Repeatability @25°C of 10 min. stabilization time	0.005% of FS(1)	0.007% of FS(1)
Long term stability after 1000 hours	< 0.004% of FS(1)	< 0.004% of FS(1)
(1) FS: Full Scale **(2)** Detected conversion resistor error		

NOTE: The internal protection resistor has a typical impedance of 25 Ω (min 3.6 Ω and max 50 Ω). The precision of the protection resistor does not impact the measured value.

NOTE: If nothing is connected on a BMXAMI0810 and BMXAMI0810H analog module and if channels are configured (range 4...20 mA or 1...5 V), there is a detected I/O error as if a wire is broken.

Functional Description

Function

The BMXAMI0810(H)(H) is a high density input analog module with 8 isolated channels.

This module is used in conjunction with sensors or transmitters; it performs monitoring, measurement, and continuous process control functions.

The BMXAMI0810(H)(H) module offers the following range for each input according to the selection made during configuration:

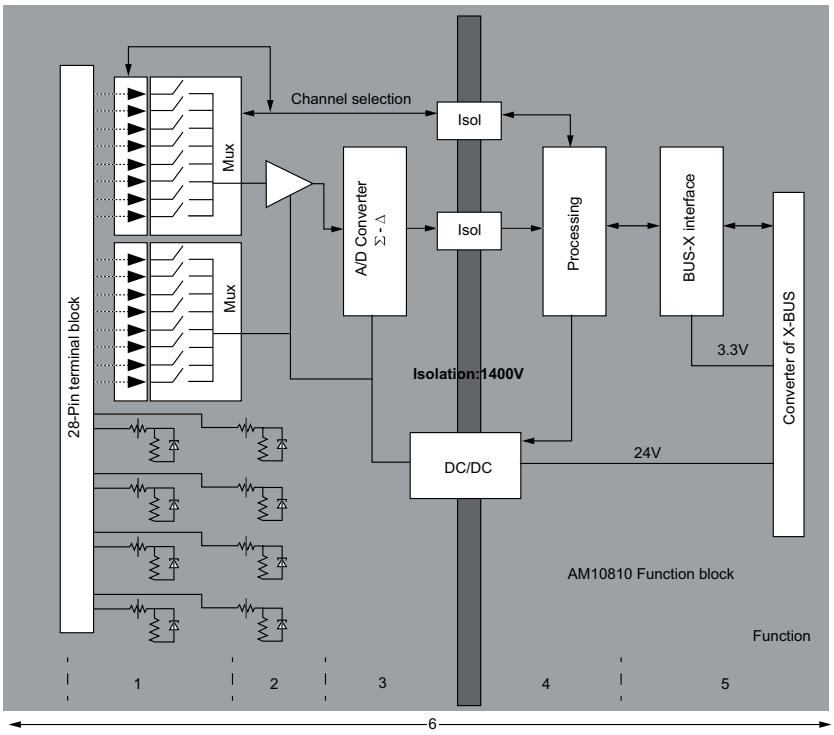
- +/-10 V
- 0..10 V
- 0..5 V / 0..20 mA
- 1..5 V / 4..20 mA

- +/-5 V / +/-20 mA

The module operates with voltage inputs. It includes eight read resistors connected to the terminal block to perform current inputs.

Illustration

The BMXAMI0810(H) illustration:



Description:

No.	Process	Function
1	**Adapting the Inputs and Multiplexing**	• Physical connection to the process through a 28-pin screw terminal block • Protection of the module against overvoltages • Protection of the current reading resistors using limiters and resettable fuses • Input signal analog filtering • Scan input channels using static multiplexing through opto-switches, in order to provide the possibility of common mode voltage of +/- 300 Vdc
2	**Amplifying Input Signals**	• Gain selecting , based on characteristics of input signals, as defined during configuration (unipolar or bipolar range, in voltage or current) • Compensation of drift in amplifier device
3	**Converting**	• Conversion of analog Input signal into digital 24-bit signal using a ΣΔ converter
4	**Transforming incoming values into workable measurements for the user.**	• Takes into account recalibration and alignment coefficients to be applied to measurements and the module's self-calibration coefficients • (Numeric) filtering for measurements, based on configuration parameters • Scaling of measurements, based on configuration parameters

No.	Process	Function
5	**Communicating with the Application**	• Manages exchanges with controller • Topological addressing • Receives configuration parameters from module and channels • Sends measured values, as well as module status, to application
6	**Module monitoring and sending detected error notification back to application.**	Conversion string test Testing for range overflow on channels Watchdog test

Measurement Timing

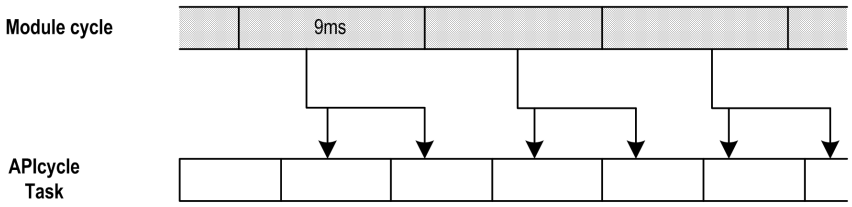
The timing of measurements is determined by the cycle selected during configuration (Normal or Fast Cycle):

- Normal Cycle means that the scan cycle duration is fixed.
- With the Fast Cycle, however, the system only scans the channels designated as being In Use. The scan cycle duration is therefore proportional to the number of channels In Use.

The cycle time values are based on the cycle selected:

Module	Normal Cycle	Fast Cycle
BMXAMI0810	9 ms	1 ms + (1 ms x N) where N: number of channels in use.

NOTE: Module cycle is not synchronized with the controller cycle. At the beginning of each controller cycle, each channel value is taken into account. If the bus cycle time is less than the module's cycle time, some values will not have changed.

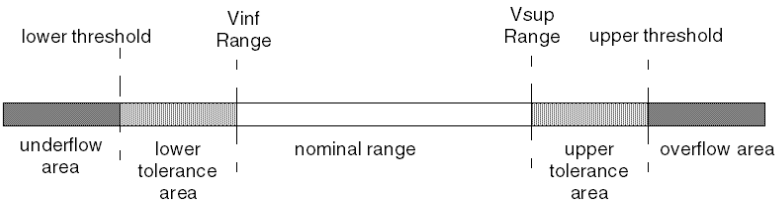


Overflow/Underflow Control

Module BMXAMI0810(H) allows the user to select between 6 voltage or current ranges for each input.

This option for each channel have to be configured in configuration windows. Upper and lower tolerance detection are always active regardless of overflow/underflow control.

Depending on the range selected the module checks for overflow, it verifies that the measurement falls between a lower and an upper threshold:



Description:

Designation	Description
Nominal range	measurement range corresponding to the chosen range
Upper Tolerance Area	varies between the values included between the maximum value for the range (for instance: +10 V for the +/-10 V range) and the upper threshold
Lower Tolerance Area	varies between the values included between the minimum value for the range (for instance: -10 V for the +/-10 V range) and the lower threshold
Overflow Area	area located beyond the upper threshold
Underflow Area	area located below the lower threshold

The values of the thresholds are configurable independently from one another. They may assume integer values between the following limits:

Range	BMXAMI0810 Range									
	Underflow Area		Lower Tolerance Area		Nominal Range		Upper Tolerance Area		Overflow Area	
Unipolar										
0...10 V	-1,500	-1,001	-1,000	-1	0	10,000	10,001	11,000	11,001	11,400
0...5 V / 0...20 mA	-5,000	-1,001	-1,000	-1	0	10,000	10,001	11,000	11,001	15,000
1...5 V / 4...20 mA	-4,000	-801	-800	-1	0	10,000	10,001	10,800	10,801	14,000
Bipolar										
+/- 10 V	-11,500	-11,001	-11,000	-10,001	-10,000	10,000	10,001	11,000	11,001	11,400
+/- 5 V, +/- 20 mA	-15,000	-11,001	-11,000	-10,001	-10,000	10,000	10,001	11,000	11,001	15,000
User										
+/- 10 V	-32,768				User-defined	User-defined				32,767
0...10 V	-32,768				User-defined	User-defined				32,767

Measurement Display

Measurements may be displayed using standardized display (in %, to two decimal places).

Type of Range	Display
Unipolar range 0...10 V, 0...5 V, 1...5 V, 0...20mA, 4...20mA	from 0 to 10,000 (0 % at +100.00 %)
Bipolar range +/- 10 V, +/- 5 mV +/- 20 mA	from -10,000 to 10,000 (0% or -100.00% at +100.00 %)

For example, as all symlinks are expressed in percentages, the range:

- 0...10 V has the correspondences: 0 V = 0%,..., 3,2 V = 32%,..., 5,6 V = 56%,..., 10 V = 100%.
- +/- 10 V has the correspondences:- 10 V = 0%,..., - 5 V = 25%,..., 0 V= 50%,..., +5 V = 75%,..., +10 V = 100%.

Measurement Filtering

The type of filtering performed by the system is called "first order filtering". The filtering coefficient can be modified from a programming console or via the program.

The mathematical formula used is as follows:

$Meas_{f(n)} = \alpha \times Meas_{f(n-1)} + (1-\alpha) \times Val_{b(n)}$

where:

α = efficiency of the filter

$Meas_{f(n)}$ = measurement filtered at moment n

$Meas_{f(n-1)}$ = measurement filtered at moment n-1

$Val_{b(n)}$ = gross value at moment n

You may configure the filtering value from 7 possibilities (from 0 to 6). This value may be changed even when the application is in RUN mode.

NOTE: Filtering may be accessed in Normal or Fast Cycle.

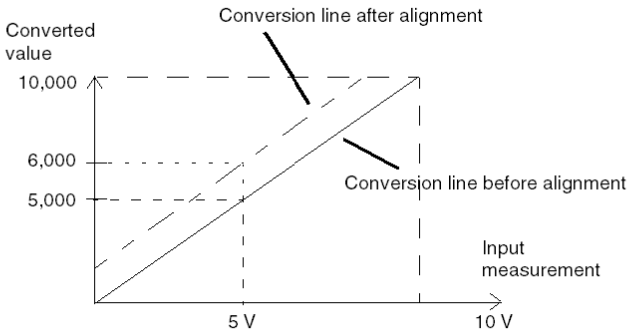
The filtering values depend on the T configuration cycle (where T = cycle time of 5 ms in standard mode):

Desired Efficiency	Required Value	Corresponding α	Filter Response Time at 63%	Cut-off Frequency (in Hz)
No filtering	0	0	0	0
Low filtering	1	0.750	4 x T	0.040 / T
	2	0.875	8 x T	0.020 / T
Medium filtering	3	0.937	16 x T	0.010 / T
	4	0.969	32 x T	0.005 / T
High filtering	5	0.984	64 x T	0.0025 / T
	6	0.992	128 x T	0.0012 / T

Sensor Alignment

The process of "alignment" consists of helping eliminate a systematic offset observed with a given sensor, around a specific operating point. This operation compensates for a detected error linked to the process. Replacing a module does not therefore require a new alignment. However, replacing the sensor or changing the sensor's operating point does require a new alignment.

Conversion lines are as follows:



The alignment value is editable from a programming console, even if the program is in RUN Mode. For each input channel, you can:

- view and modify the desired measurement value
- save the alignment value
- determine whether the channel already has an alignment

The alignment offset may also be modified through programming.

Channel alignment is performed on the channel in standard operating mode, without any effect on the channel's operating modes.

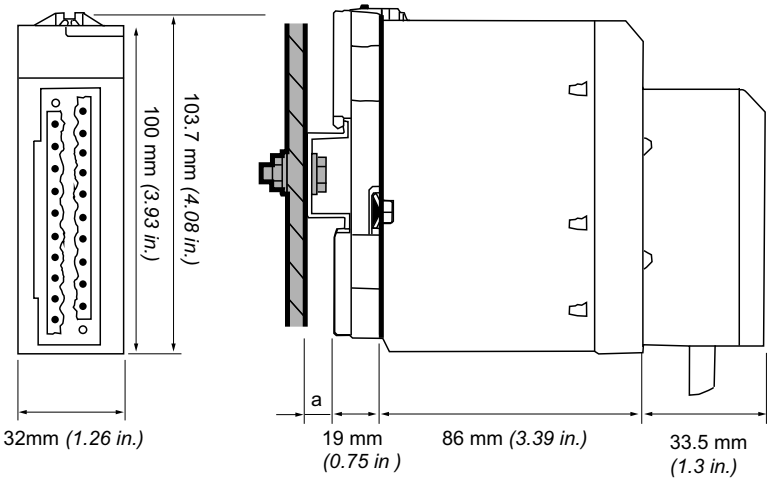
The maximum offset between measured value and desired (aligned) value may not exceed +/-1.500.

NOTE: To align several analog channels on the BMX ART/AMO/AMI/AMM modules, we recommand proceeding channel by channel. Test each channel after alignment before moving to the next channel in order to apply the parameters correctly.

Dimensions

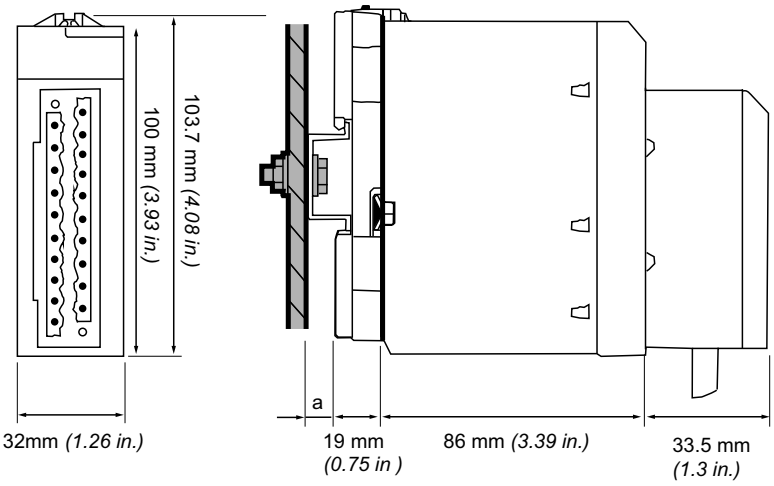
General Presentation

X80 Analog I/O module with a 20-pin removable terminal blocks :



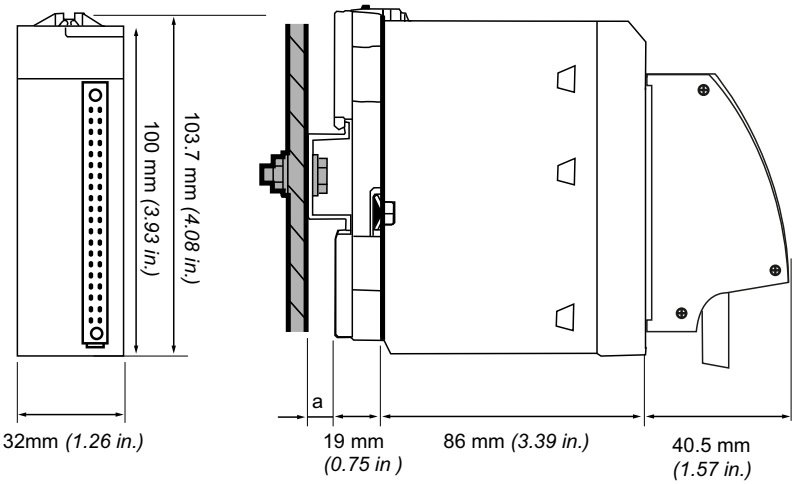
a backplane depth: the value depends on the backplane type used in your platform.

X80 Analog I/O module with a 28-pin removable terminal blocks :



a backplane depth: the value depends on the backplane type used in your platform. Refer to *Mounting the Racks*, page 659.

X80 Analog I/O module with a 40-pin FCN-type connector



a backplane depth: the value depends on the backplane type used in your platform.

Dimensions

Module reference	Module dimensions			Installation depth(1)
	Width	Height	Depth	
X80 Analog I/O Module with a 20-pin removable terminal block				
BMXAMI0410(H)	32 mm (1.26 in.)	103.7 mm (4.08 in.)	86 mm (3.39 in.)	119.5 mm (4.69 in.)(1)
BMXAMO0210(H)				
BMXAMO0410(H)				
BMXAMO0802(H)				
BMXAMM0600(H)				
X80 Analog I/O Module with a 28-pin removable terminal block				
BMXAMI0800(H)	32 mm (1.26 in.)	103.7 mm (4.08 in.)	86 mm (3.39 in.)	119.5 mm (4.69 in.)(1)
BMXAMI0810(H)				
X80 Analog I/O Module with a 40-pin FCN-type connector				

Module reference	Module dimensions			Installation depth(1)
	Width	Height	Depth	
BMXART0414(H)	32 mm (1.26 in.)	103.7 mm (4.08 in.)	86 mm (3.39 in.)	126.5 mm (4.96 in.)(1)
BMXART0814(H)				
(1) backplane depth (a) is not included.				

NOTE: Connectors that are delivered with the X80 Analog I/O modules (20-pin and 28-pin removable terminal blocks, and 40-pin FCN-type connector) and the corresponding pre-assembled cordsets (BMXFTW*01S, BMXFTW*08S, and BMXFCW*01S) have the same dimensions.

NOTE: Consider clearance for cable installation and spacing around the racks.

Wiring Precautions

Introduction

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

Cable Shielding

Connect the cable shielding to the grounding bar. Clamp the shielding to the grounding bar on the module side. Use the shielding connection kit BMXXSP••••, page 234 to connect the shielding.

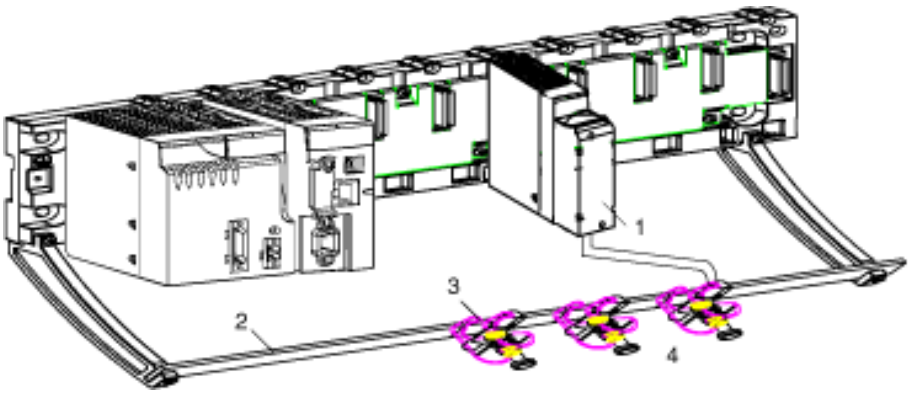
⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

While mounting / removing the modules:

- Make sure that each terminal block is still connected to the shield bar.
- Disconnect voltage supplying sensors and pre-actuators.

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



1 BMXAMI0810

2 Shield bar

3 Clamp

4 To sensors

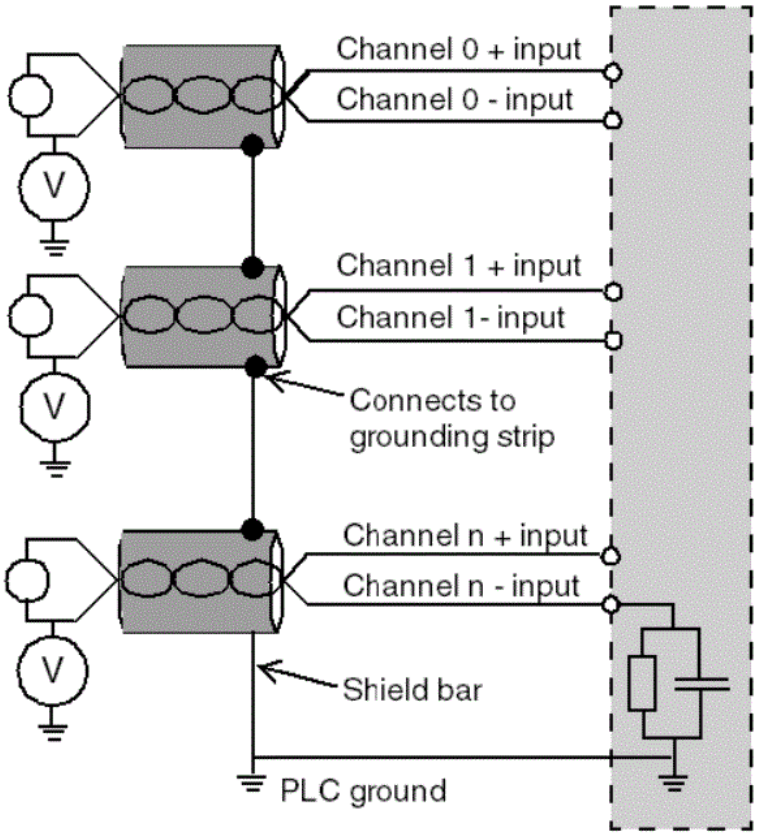
Reference of Sensors in Relation to the Ground

In order for the acquisition system to operate correctly, it is recommended to take in account the following precautions:

- Confirm that sensors are close together (a few meters).
- Confirm that all sensors are referenced to a single point, which is connected to the controller’s ground.

Using the Sensors Referenced in Relation to the Ground

The sensors are connected as indicated in the following diagram:



If the sensors are referenced in relation to the ground, in some cases this may return a remote ground potential to the terminal block. Follow these rules:

- Confirm that the potential is less than the permitted low voltage: for example, 30 Vrms or 42.4 VDC.
- Check that all leakage currents generated do not disturb the system. Setting a sensor point to a reference potential generates a leakage current.

  NOTE: Sensors and other peripherals may be connected to a grounding point some distance from the module. Such remote ground references may carry considerable potential differences with respect to local ground. Induced currents do not affect the measurement or integrity of the system.

⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Ensure that:

- sensors and other peripherals are not exposed through grounding points to voltage potential greater than acceptable limits.
- potentials greater than permitted low limits do not exist.
- induced currents do not affect the measurement or integrity of the system.

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

Electromagnetic Hazard Instructions

Electromagnetic perturbations may lead to an unexpected behavior of the application.

⚠CAUTION

UNEXPECTED BEHAVIOR OF APPLICATION

To reduce electromagnetic perturbations, use the shielding connection kit BMXXSP••••, page 234 to connect the shielding,

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

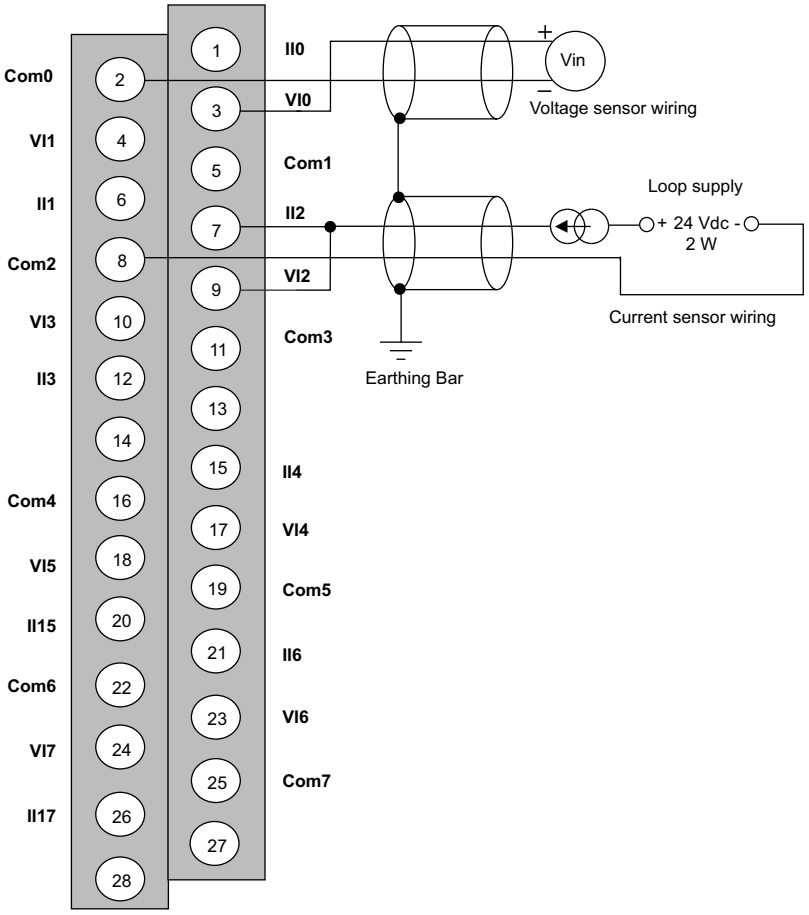
Wiring Diagram

Introduction

The BMXAMI0810 module is connected using the 28-pin terminal block.

Illustration

The terminal block connection and the sensor wiring are as follows:



VIx + pole input for channel x

COM x - pole input for channel x

IIx current reading resistor + input

Channel 0 voltage sensor

Channel 1 2-wire current sensor

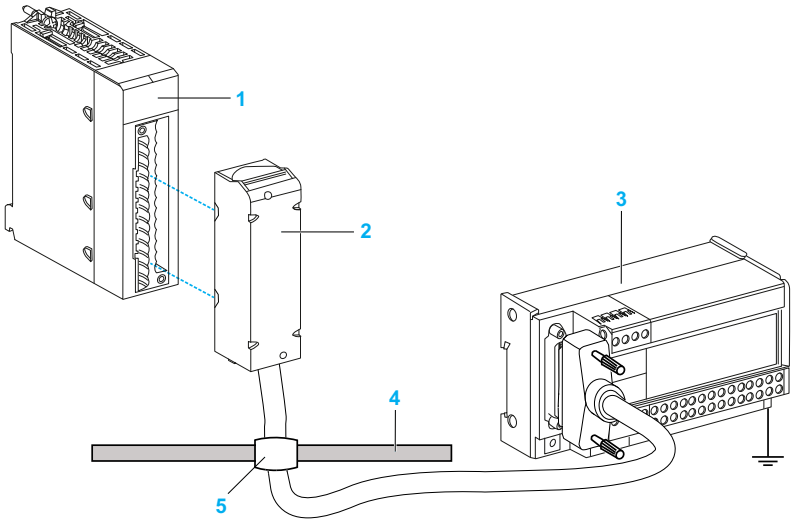
Wiring Accessories

For rapid connection to operative parts, the module can be connected to a TELEFAST pre-wired system, page 100.

Use of the TELEFAST Wiring Accessories

Introduction

The TELEFAST pre-wired system consists of connecting cables and interface sub-bases as shown below:



1 BMXAMI0810 module

2 BMXFTA••0 connecting cable

3 Interface sub-base

4 Shield bar

5 Clamp

The BMXAMI0810 module can be connected to the following interface sub-bases references:

- ABE-7CPA02
- ABE-7CPA31
- ABE-7CPA31E

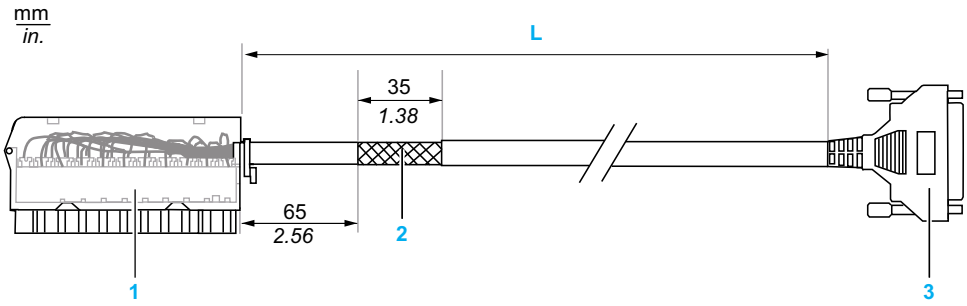
NOTE: In case HART information is part of the signal to be measured, use an ABE-7CPA31E interface sub-base in order to filter this information that would disrupt the analog value.

BMX FTA ••0 Connecting Cables

The BMXFTA ••0 cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 28-pin terminal block from which extend 1 cable sheath containing 24 wires,
- At the other end a 25-pin Sub-D connector.

The figure below shows the BMXFTA ••0 cables:



1 BMXFTB 2820 Terminal block

2 Cable shielding

3 25-pin Sub-D connector

L Length according to the part number.

The cable comes in 2 different lengths:

- 1.5 m (4.92 ft): BMXFTA150
- 3 m (9.84 ft): BMXFTA300

The following table gives the characteristics of the BMXFTA••0 cables:

Characteristic		**Value**
Cable	Sheath material	PVC
	LSZH status	No
Environmental	Operating temperature	-25...70 °C (-13...158 °F)

ABE-7CPA02 Sensor Connection

The following table shows the distribution of analog channels on TELEFAST terminal blocks with the reference ABE-7CPA02:

TELEFAST terminal block number	**25-pin Sub-D connector pin number**	**BMXA-MI0810 pin out**	**Signal type**	**TELEFAST terminal block number**	**25-pin Sub-D connector pin number**	**BMXA-MI0810 pin out**	**Signal type**
1	/		Ground	Supp 1	/		Ground
2	/		STD (1)	Supp 2	/		Ground
3	/		STD (1)	Supp 3	/		Ground
4	/		STD (2)	Supp 4	/		Ground
100	1	3	+IV0	200	14	2	COM0
101	2	1	+IC0	201	/		Ground
102	15	4	+IV1	202	3	5	COM1
103	16	6	+IC1	203	/		Ground
104	4	9	+IV2	204	17	8	COM2
105	5	7	+IC2	205	/		Ground
106	18	10	+IV3	206	6	11	COM3
107	19	12	+IC3	207	/		Ground
108	7	17	+IV4	208	20	16	COM4
109	8	15	+IC4	209	/		Ground
110	21	18	+IV5	210	9	19	COM5
111	22	20	+IC5	211	/		Ground
112	10	23	+IV6	212	23	22	COM6

TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0810 pin out	Signal type	TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0810 pin out	Signal type
113	11	21	+IC6	213	/		Ground
114	24	24	+IV7	214	12	25	COM7
115	25	26	+IC7	215	/		Ground

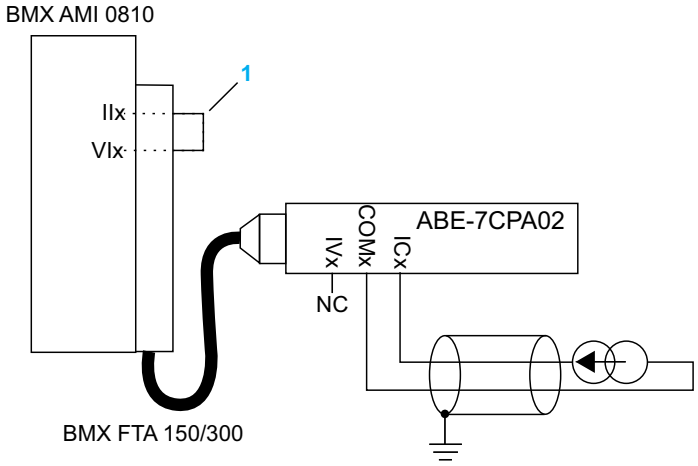
NOTE: On the ABE-7CPA02, the strap position is between pin 1 and pin 2.

+IVx: + pole voltage input for channel x.

+ICx: + pole current input for channel x.

COMx: - pole voltage or current input for channel x.

NOTE: For current sensors connected on the TELEFAST ABE-7CPA02, place a strap on the BMXAMI0810 terminal block between the current input and the voltage input as illustrated below.



1 Strap on the terminal block.

NOTE: For the ground connection use the additional terminal block ABE-7BV10/20.

ABE-7CPA31 Sensor Connection

The following table shows the distribution of analog channels on TELEFAST terminal blocks with the reference ABE-7CPA31:

TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0810 pin out	Signal type	TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0810 pin out	Signal type
1	/		Ground	Supp 1	/		24 V (sensor supply)
2	/		Ground	Supp 2	/		24 V (sensor supply)
3	/		Ground	Supp 3	/		0 V (sensor supply)
4	/		Ground	Supp 4	/		0 V (sensor supply)
100	/		+IS0	116	/		+IS4
101	1	3	+IV0	117	7	17	+IV4
102	2	1	+IC0	118	8	15	+IC4
103	14	2	0 V	119	20	16	0 V
104	/		+IS1	120	/		+IS5
105	15	4	+IV1	121	21	18	+IV5

TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0810 pin out	Signal type	TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MI0810 pin out	Signal type
106	16	6	+IC1	122	22	20	+IC5
107	3	5	0 V	123	9	19	0 V
108	/		+IS2	124	/		+IS6
109	4	9	+IV2	125	10	23	+IV6
110	5	7	+IC2	126	11	21	+IC6
111	17	8	0 V	127	23	22	0 V
112	/		+IS3	128	/		+IS7
113	18	10	+IV3	129	24	24	+IV7
114	19	12	+IC3	130	25	26	+IC7
115	6	11	0 V	131	12	25	0 V

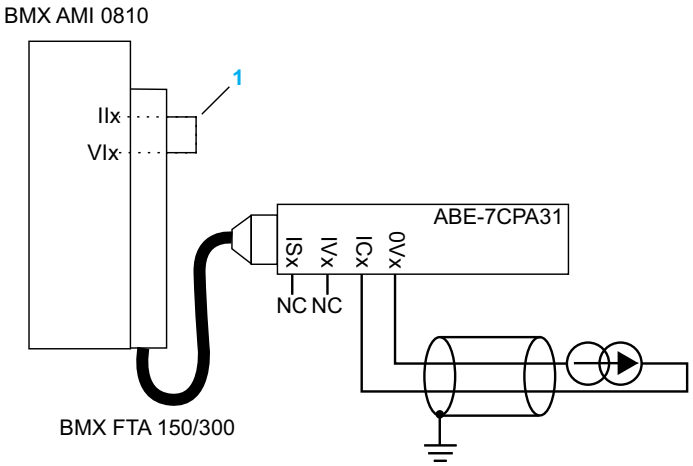
+ISx: 24 V channel power supply

+IVx: + pole voltage input for channel x

+ICx: + pole current input for channel x

COMx: - pole voltage or current input for channel x.

NOTE: For current sensors connected on the TELEFAST ABE-7CPA31, place a strap on the BMXAMI0810 terminal block between the current input and the voltage input as illustrated below.



1 Strap on the terminal block.

NOTE: For the ground connection use the additional terminal block ABE-7BV10/20.

ABE-7CPA31E Sensor Connection

The following table shows the distribution of analog channels on TELEFAST terminal blocks with the reference ABE-7CPA31E:

TELEFAST terminal block number	Terminal	Signal type	TELEFAST terminal block number	Terminal	Signal type
1	/	Ground	Supp 1	/	24 V (sensor supply)
2	/	Ground	Supp 2	/	24 V (sensor supply)
3	/	Ground	Supp 3	/	0 V (sensor supply)
4	/	Ground	Supp 4	/	0 V (sensor supply)

TELEFAST terminal block number	Terminal	Signal type	TELEFAST terminal block number	Terminal	Signal type
100	/	+IS0	116	/	+IS4
101	/	T0	117	/	T4
102	/	+IC0	118	/	+IC4
103	/	0V0	119	/	0V4
104	/	+IS1	120	/	+IS5
105	/	T1	121	/	T5
106	/	+IC1	122	/	+IC5
107	/	0V1	123	/	0V5
108	/	+IS2	124	/	+IS6
109	/	T2	125	/	T6
110	/	+IC2	126	/	+IC6
111	/	0V2	127	/	0V6
112	/	+IS3	128	/	+IS7
113	/	T3	129	/	T7
114	/	+IC3	130	/	+IC7
115	/	0V3	131	/	0V7

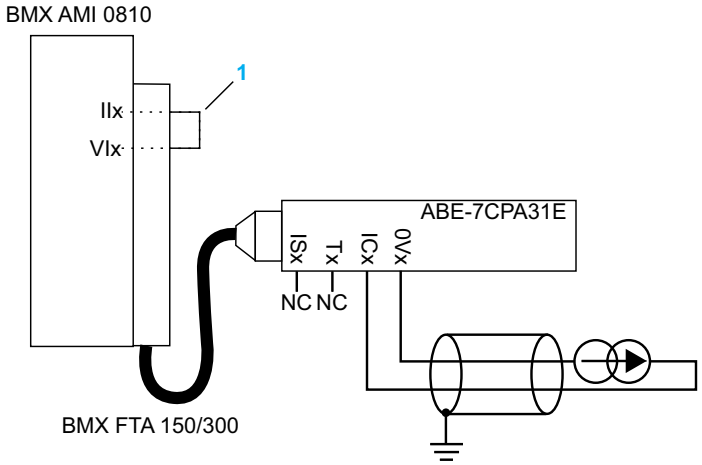
+ISx: 24 V channel power supply

Tx: Reserved test pin for HART function, it's internally connected with +ICx.

+ICx: + pole current input for channel x

COMx: - pole voltage or current input for channel x

NOTE: For current sensors connected on the TELEFAST ABE-7CPA31E, place a strap on the BMXAMI0810 terminal block between the current input and the voltage input as illustrated below.



1 Strap on the terminal block.

NOTE: For the ground connection use the additional terminal block ABE-7BV10/20.

BMXAMM0600(H) Analog Input/Output Module

What's in This Chapter

BMXAMM0600(H) sDefault 105
BMXAMM0600(H) fpDefault 106
Presentation 107
Characteristics 108
Functional Description 111
Wiring Precautions 119
Wiring Diagram 122

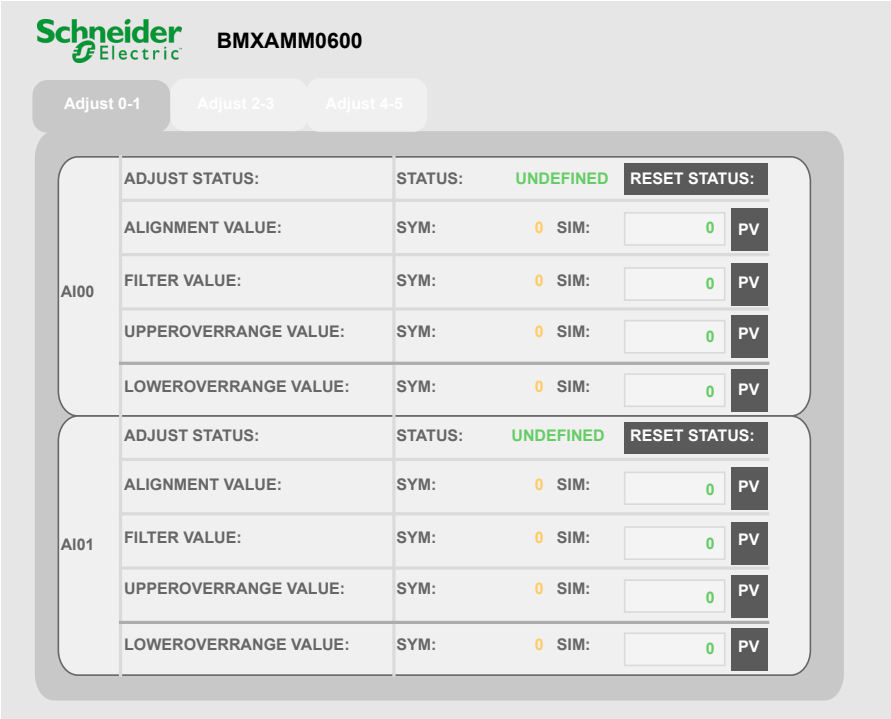
BMXAMM0600(H) sDefault

Abstract



BMXAMM0600(H) fpDefault

Abstract



Description

Element	Description
Range	Button to activate Range mode for HW, SIM/PV display.
Unit	Button to activate Unit mode when pressed. Displays Hardware, SIM, and Force units defined by the MODE.
FORCE	Blue indicates that at least one channel is forced.

Analog mixed input/output channel description:

Element	Description
AI## / AO##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.
PV	Indicates the program value from the Symlink.
SIM/HW	Simulated/Program value: • The SIM/HW and PV values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/HW value is equal to the forced value.
PV F	Value indicator: • PV indicates that the channel is not forced.

Element	Description
	• F indicates that the channel is forced.
MODE	Type configured for the channel.
STATUS	Channel status.

Presentation

Function

The BMX AMM 0600 Input/Output module combines 4 non-isolated analog inputs with 2 non-isolated analog outputs.

The BMX AMM 0600 module offers the following range, according to the selection made during configuration:

- Voltage input range +/-10 V/0..10 V/0..5 V/1..5 V
- Current input range 0...20 mA/4...20 mA
- Voltage output range +/-10 V
- Current output range 0...20 mA/4...20 mA

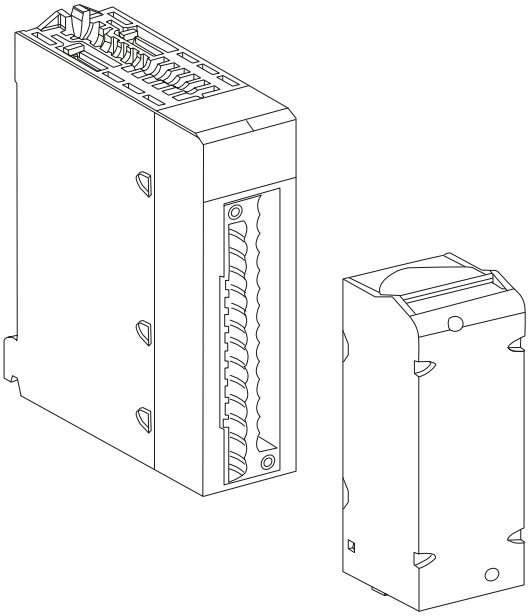
Ruggedized Version

The BMX AMM 0600H (hardened) equipment is the ruggedized version of the BMX AMM 0600 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration

BMX AMM 0600 analog input/output module looks like this.



NOTE: The 20-pin terminal block is supplied separately.

Characteristics

Altitude Operating Conditions

The characteristics in the tables below apply to the modules BMXAMM0600 and BMXAMM0600H for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Inputs Characteristics

The BMXAMM0600 and BMXAMM0600H general input characteristics are as follows:

Operating temperature	BMXAMM0600	0...60 ºC (32...140 ºF)
	BMXAMM0600H	-25...70 ºC (-13...158 ºF)
Type of inputs		Non-isolated single ended inputs
Nature of inputs		Voltage / Current
Number of channels		4 inputs
Acquisition cycle time:		
• fast (periodic acquisition for the declared channels used)		1 ms + 1 ms x number of channels used
• default (periodic acquisition for all channels)		5 ms
Resolution		14-bit in +/- 10 V 12-bit in 0...5 V
Digital filtering		First order
Isolation: • between inputs channels group and output channels group • between channels and bus • between channels and ground		750 VDC 1400 VDC 1400 VDC
Maximum overload authorized for inputs:		Voltage inputs: +/- 30 VDC Current inputs: +/- 90 mA
Power consumption (3.3 V)	**Typical**	0.35 W
	Maximum	0.48 W
Power consumption (24 V)	**Typical**	2.6 W
	Maximum	3.2 W

Input Measurement Range

The BMXAMM0600 and BMXAMM0600H have the following input measurement range characteristics:

Measurement range	**+/-10 V** **0...10 V; 0...5 V; 1...5 V**	**0...20 mA; 4...20 mA**
Maximum conversion value	+/-11.25 V	0...30 mA
Resolution	1.42 mV	5.7 µA
Input impedance	10 MΩ	250 Ω internal conversion resistor
Precision of the internal conversion resistor	-	0.1%-15 ppm/°C
Detected measurement error for inputs for standard modules:		
• At 25 °C (77 °F) • Maximum in the temperature range 0...60 °C (-32...140 °F)	0.25% of FS(1) 0.35% of FS(1)	0.35% of FS(1)(2) 0.50% of FS(1)(2)
Detected measurement error for inputs for hardened modules:		
• At 25 °C (77 °F) • Maximum in the temperature range -25...70 °C (-13...158 °F)	0.25% of FS(1) 0.40% of FS(1)	0.35% of FS(1)(2) 0.60% of FS(1)(2)
Input temperature drift	30 ppm/°C	50 ppm/°C
Monotonicity	Yes	Yes
Common mode rejection (50/60 Hz)	80 dB	80 dB
Crosstalk between channels DC and AC 50/60 Hz	> 70 dB	> 70 dB
Non linearity	0.10% of FS(1)	0.10% of FS(1)(2)
(1) FS: Full Scale **(2)** Detected conversion resistor error		

NOTE: If nothing is connected on BMXAMM0600 and BMXAMM0600H analog input/output module and if channels are configured (range 4...20 mA or 1...5 V) a broken wire causes a detected I/O error.

General Output Characteristics

The BMXAMM0600 and BMXAMM0600H general output characteristics are as follows:

Type of Outputs	2 Non-isolated Outputs
Range configuration	Voltage or self-powered current range selection by firmware

Voltage range

The BMXAMM0600 and BMXAMM0600H voltage range has the following characteristics:

Nominal variation range	+/-10 V
Maximum variation range	+/- 11.25 V
Voltage resolution	12 bits
Detected measurement error for standard module:	
• At 25 °C (77 °F)	0.25% of FS(1) 0.60% of FS(1)

• Maximum in the temperature range 0...60 °C (-32...140 °F)	
Detected measurement error for hardened module:	
• At 25 °C (77 °F) • Maximum in the temperature range -25...70 °C (-13...158 °F)	0.25% of FS(1) 0.80% of FS(1)
Temperature drift	100 ppm/°C
Monotonicity	Yes
Common mode rejection (50/60 Hz)	80 dB
Crosstalk between channels DC and AC 50/60 Hz	> 70 dB
Non linearity	0.1% of FS
AC output ripple	2 mV rms on 50 Ω BW < 25MHz
Load impedance	1 KΩ minimum
Detection type	Short circuits and overloads
(1) FS: Full Scale	

Current Range

The BMXAMM0600 and BMXAMM0600H current range has the following characteristics.

Nominal variation range	0...20 mA / 4...20 mA
Available maximum current	24 mA
Current resolution	11 bits
Detected measurement error: • at 25 °C (77 °F) • maximum in temperature range	 0.25% of FS(1) 0.60% of FS(1)
Temperature drift	100 ppm/°C
Monotonicity	Yes
Non linearity	0.1% of FS(1)
Common mode rejection (50/60 Hz)	80 dB
Crosstalk between channels DC and AC 50/60 Hz	> 70 dB
AC output ripple	2 mV rms on 50 Ω BW < 25MHz
Load impedance	600 Ω maximum
Detection type	Open circuit(2)(3)
(1) FS: Full Scale **(2)** The open circuit detection is physically detected by the module in range 4...20 mA. It is also detected if the target current value is different from 0 mA in range 0...20 mA. **(3)** Open circuit detection is enabled with the Wiring CTRL parameter.	

Response time of Outputs

The maximum delay between transmission of the output value on the controller bus and its effective positioning on the terminal block is less than 2 ms:

- internal cycle time = 1 ms for the two outputs
- digital/analog conversion response time = 1ms maximum for a 0-100% step.

Functional Description

Function

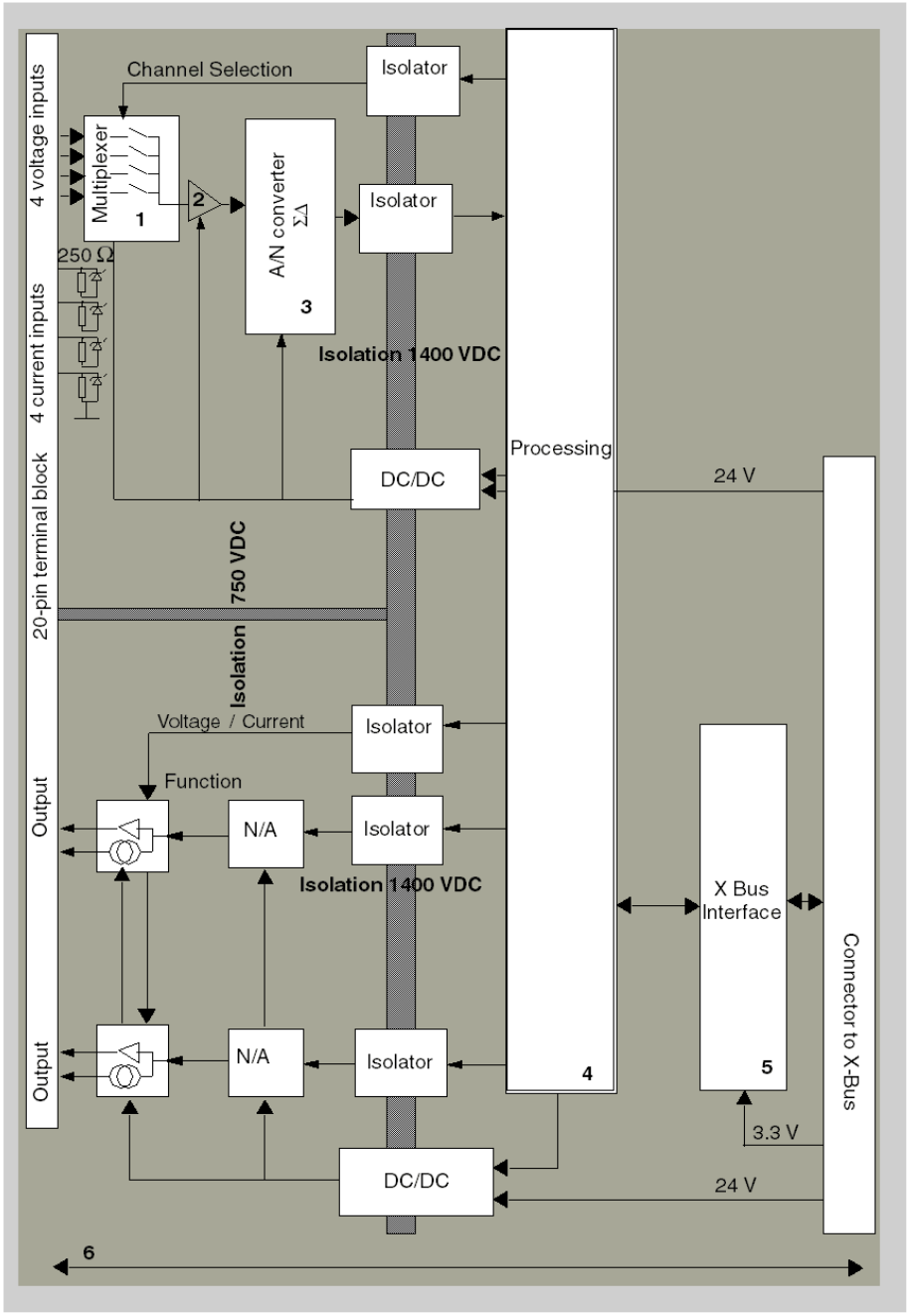
The BMXAMM0600(H) input/output module combines four non-isolated analog inputs with two non-isolated analog outputs. However, input and output blocks are isolated.

The BMXAMM0600(H) module offers the following range, according to the selection made during configuration:

- Voltage input range +/-10 V/0...10 V/0...5 V/1...5 V
- Current input range 0...20 mA/4...20 mA
- Voltage output range +/-10 V
- Current output range 0...20 mA/4...20 mA

Illustration

The BMXAMM0600(H) module's illustration is as follows.



Description.

Address	Process	Characteristics
1	Adaptation	• physical connection to the process through a 20-pin screw terminal block • helps protect the module against voltage spikes
2	Adapting the signal	• performed on voltage or current via software configuration
3	Converting	• performed on 13 bits with a polarity sign • reframing the data provided by the program is performed automatically and dynamically by the converter
4	Transforming application data into data directly usable by	• use of factory calibration parameters

Address	Process	Characteristics
	the digital/analog converter	
5	Communicating with the application	• manages exchanges with controller • topological addressing • receiving, from the application, configuration parameters for the module and channels, as well as numeric set points from the channels • sending module status back to application
6	Module monitoring and sending detected error notifications back to the application	• testing for range overflow on channels • testing for output open circuits or short-circuits • watchdog test • Programmable fallback capabilities

Input Functions: Measurement Timing

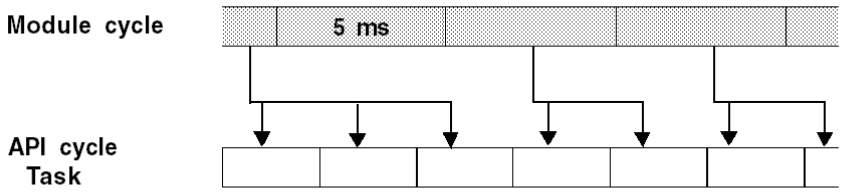
The timing of measurements is determined by the cycle selected during configuration: normal or fast cycle.

- Normal cycle means that the scan cycle duration is fixed.
- With the fast cycle, however, the system only scans the channels designated as being In use. The scan cycle duration is therefore proportional to the number of channels In use.

The cycle time values are based on the cycle selected.

Module	Normal cycle	Fast cycle
BMXAMM0600(H)	5 ms	1 ms + (1 ms x N) where N: number of channels in use.

NOTE: Module cycle is not synchronized with the controller cycle. At the beginning of each controller cycle, each channel value is taken into account. If the bus cycle time is less than the module's cycle time, some values will not have changed.

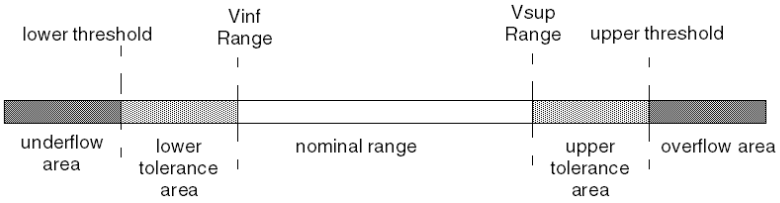


Input Functions: Overflow/Underflow Control

Module BMXAMM0600(H) allows the user to select between six voltage or current ranges for each input.

This option for each channel has to be configured in configuration windows. Upper and lower tolerance detection are always active regardless of overflow/underflow control.

Depending on the range selected, the module checks for overflow: it helps ensure that the measurement falls between a lower and an upper threshold.



Description:

Designation	Description
Nominal range	measurement range corresponding to the chosen range
Upper tolerance area	varies between the values included between the maximum value for the range (for instance: +10 V for the +/-10 V range) and the upper threshold
Lower tolerance area	varies between the values included between the minimum value for the range (for instance: -10 V for the +/-10 V range) and the lower threshold
Overflow area	area located beyond the upper threshold
Underflow area	area located below the lower threshold

The values of the thresholds are configurable independently from one another. They may assume integer values between the following limits.

	Range	BMXAMM0600(H) Inputs									
		Underflow area		Lower tolerance area		Nominal range		Upper tolerance area		Overflow area	
Unipolar	0...10 V	-1,250	-1,001	-1,000	-1	0	10,000	10,001	11,000	11,001	11,250
	0...5 V / 0...20 mA	-5,000	-1,001	-1,000	-1	0	10,000	10,001	11,000	11,001	15,000
	1...5 V / 4...20 mA	-4,000	-801	-800	-1	0	10,000	10,001	10,800	10,801	14,000
Bipolar	+/- 10 V	-11,250	-11,001	-11,000	-10,001	-10,000	10,000	10,001	11,000	11,001	11,250
User	+/- 10 V	-32,768				User-defined	User-defined				32,767
	0...10 V	-32,768				User-defined	User-defined				32,767

Input functions: Measurement Display

Measurements may be displayed using standardized display (in %, to two decimal places).

Type of Range	Display
Unipolar range 0...10 V, 0...5 V, 1...5 V, 0...20mA, 4...20mA	from 0 to 10,000 (0 % at +100.00 %)
Bipolar range +/- 10 V, +/- 5 mV +/- 20 mA	from -10,000 to 10,000 (0% or -100.00% at +100.00 %)

For example, as all symlinks are expressed in percentages, the range:

- 0...10 V has the correspondences: 0 V = 0%,..., 3,2 V = 32%,..., 5,6 V = 56%,..., 10 V = 100%.
- +/- 10 V has the correspondences:- 10 V = 0%,..., - 5 V = 25%,..., 0 V= 50%,..., +5 V = 75%,..., +10 V = 100%.

Input Functions: Measurement Filtering

The type of filtering performed by the system is called "first order filtering". The filtering coefficient can be modified from a programming console or via the program.

The mathematical formula used is as follows:

$Meas_{f(n)} = \alpha \times Meas_{f(n-1)} + (1–\alpha) \times Val_{b(n)}$

where:

α = efficiency of the filter

$Meas_{f(n)}$ = measurement filtered at moment n

$Meas_{f(n-1)}$ = measurement filtered at moment n-1

$Val_{b(n)}$ = gross value at moment n

You may configure the filtering value from seven possibilities (from 0 to 6). This value may be changed even when the application is in RUN mode.

NOTE: Filtering may be accessed in normal or fast cycle.

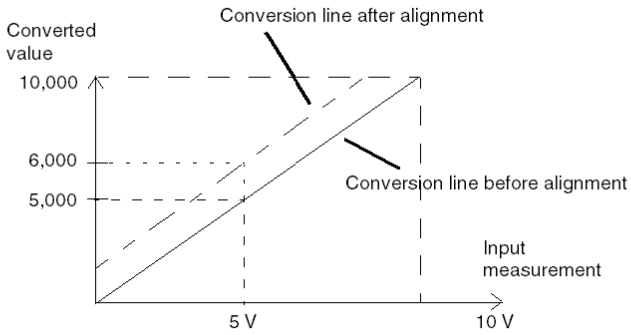
The filtering values depend on the T configuration cycle (where T = cycle time of 5 ms in standard mode):

Desired efficiency	Required value	Corresponding α	Filter response time at 63%	Cut-off frequency (in Hz)
No filtering	0	0	0	0
Low filtering	1	0.750	4 x T	0.040 / T
	2	0.875	8 x T	0.020 / T
Medium filtering	3	0.937	16 x T	0.010 / T
	4	0.969	32 x T	0.005 / T
High filtering	5	0.984	64 x T	0.0025 / T
	6	0.992	128 x T	0.0012 / T

Input Functions: Sensor Alignment

The process consists of helping eliminate a systematic offset observed with a given sensor, around a specific operating point. This operation compensates for a detected error linked to the process. Replacing a module does not therefore require a new alignment. However, replacing the sensor or changing the sensor's operating point does require a new alignment.

Conversion lines are as follows.



The alignment value is editable from a programming console, even if the program is in RUN mode. For each input channel, you can:

- view and modify the desired measurement value
- save the alignment value
- determine whether the channel already has an alignment

The alignment offset may also be modified through programming.

Channel alignment is performed on the channel in standard operating mode, without any effect on the channel's operating modes.

The maximum offset between measured value and desired (aligned) value may not exceed +/-1,500.

NOTE: To align several analog channels on the BMX AMO/AMI/AMM/ART modules, we recommend proceeding channel by channel. Test each channel after alignment before moving to the next channel to apply the parameters correctly.

Output Functions: Writing Outputs

Confirm that the application provides the outputs with values in the standardized format:

- -10,000 to +10,000 for the +/-10 V range
- 0 to +10,000 in 0-20 mV and 4-20 mA ranges

Digital/Analog Conversion

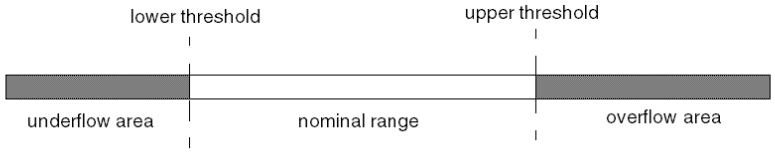
The digital/analog conversion is performed on:

- 12-bit in 0-20 mA, 4-20 mA ranges and for the +/-10 V range

Output Functions: Overflow Control

Module BMXAMM0600(H) allows an overflow control on voltage and current ranges.

The measurement range is divided in three areas.



Description:

Designation	Description
Nominal range	measurement range corresponding to the chosen range
Overflow area	area located beyond the upper threshold
Underflow area	area located below the lower threshold

Overflow values for the various ranges are as follows.

Range	BMXAMM0600(H) outputs					
	Underflow area		Nominal range		Overflow area	
+/- 10V	-11,250	-11,001	-11,000	11,000	11,001	11,250
0..20mA	-2,000	-1,001	-1,000	11,000	11,001	12,000
4..20mA	-1,600	-801	-800	10,800	10,801	11,600

You may also choose the flag for an overflow of the range upper value, for an underflow of the range lower value, or for both.

NOTE: Range under/overflow detection is optional.

Output Functions: Fallback/Maintain or Reset Outputs to Zero

In case an error is detected, and depending on its seriousness, the outputs:

- switch to fallback/maintain position individually or together,
- are forced to 0 (0 V or 0 mA).

Various behaviors of outputs:

Detected error	Behavior of voltage outputs	Behavior of current outputs
Task in STOP mode, or program missing	fallback/maintain (channel by channel)	fallback/maintain (channel by channel)
Communication interruption		
Configuration error	0 V (all channels)	0 mA (all channels)
Internal error in module		
Output value out-of-range (range under/overflow)	Value saturated at the defined limit (channel by channel)	Saturated value (channel by channel)
Output short circuit or open circuit	Short-circuit: Maintain (channel by channel)	Open circuit: Maintain (channel by channel)
Module hot swapping (processor in STOP mode)	0 V (all channels)	0 mA (all channels)
Reloading Program		

Fallback or maintain at current value is selected during the module configuration. Fallback value may be modified through a program.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

The fallback position should not be used as the sole safety method. If an uncontrolled position can result in a hazard, install an independent redundant system.

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

⚠WARNING

INPUT / OUTPUT TRANSITION TO INIT VALUES

Design the system and the application to support safely the transition of inputs and outputs to their INIT values each time the application enters the running state), including after (pending applicable settings values):

- Run command
- Deploy command
- Restart runtime command
- Load boot project
- Physical device power on
- Application error detection
- Boot project error detection

Refer to the Operating States to fully understand all potential occurrences of a transition to the Running state and the associated settings.

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

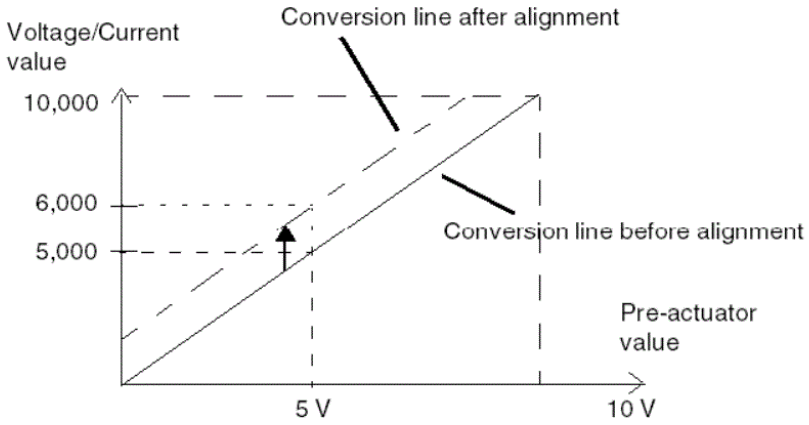
Output Functions: Behavior at Initial Power-Up and When Switched Off.

When the module is switched on or off, the outputs are set to 0 (0 V or 0 mA).

Output Functions: Actuator Alignment

The process consists of helping eliminate a systematic offset observed with a given actuator, around a specific operating point. This operation compensates for a detected error linked to the process. Therefore, replacing a module does not require a new alignment. However, replacing the actuator or changing the sensor's operating point does require a new alignment.

Conversion lines are as follows:



The alignment value is editable from a programming console, even if the program is in RUN mode. For each output channel, you can:

- view and modify the initial output target value
- save the alignment value
- determine whether the channel already has an alignment

The maximum offset between the measured value and the corrected output value (aligned value) may not exceed +/- 1.500.

NOTE: To align several analog channels on the BMXAMO/AMI/AMM/ART modules, we recommend proceeding channel by channel. Test each channel after alignment before moving to the next channel to apply the parameters correctly.

Wiring Precautions

Introduction

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

Cable Shielding

Connect the cable shielding to the grounding bar. Clamp the shielding to the grounding bar on the module side. Use the shielding connection kit BMXXSP••••, page 234 to connect the shielding.

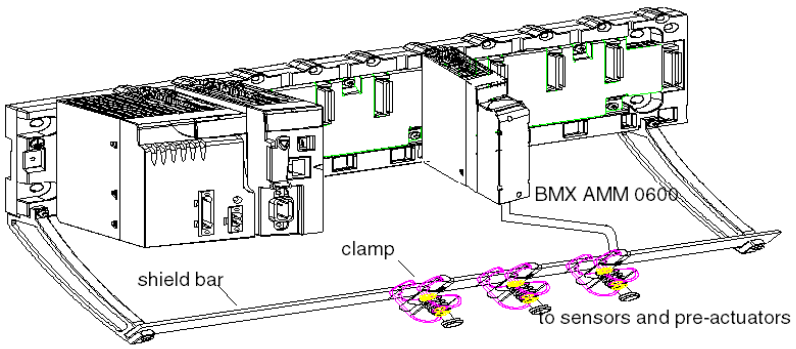
⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

While mounting / removing the modules:

- Make sure that each terminal block is still connected to the shield bar.
- Disconnect voltage supplying sensors and pre-actuators.

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



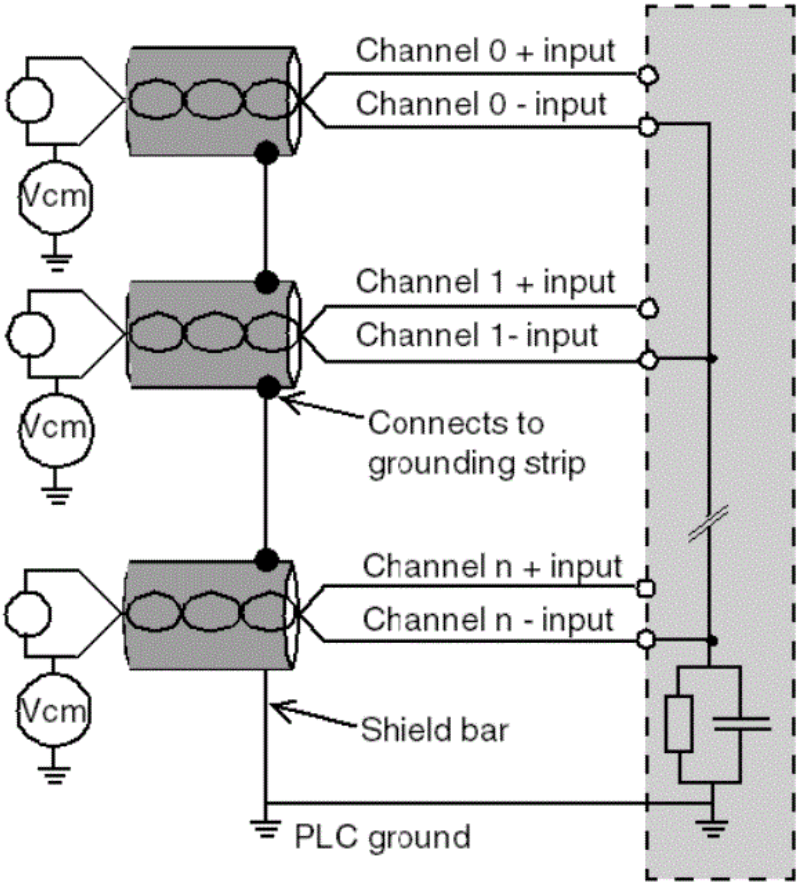
Reference of Sensors in Relation to the Ground

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

- Confirm that sensors are close together (a few meters).
- Confirm that all sensors are referenced to a single point, which is connected to the controller’s ground.

Using Sensors with non Isolated Inputs

The inputs of the module are not isolated between them and single ended type. They do not admit any common mode voltage. The sensors are connected as indicated in the following diagram:



If one or more sensors are referenced in relation to the ground, this may in some cases return a remote ground current to the terminal block and disturbs the measures. Follow these rules:

- Use isolated from ground sensors if distance from sensors is > 30 meters or if power equipment is located near controller.
- Confirm that the potential is less than the permitted low voltage: for example, 30 Vrms or 42.4 VDC between sensors and shield.
- Setting a sensor point to a reference potential generates a leakage current. Check that all leakage currents generated do not disturb the system.

Using Pre-Actuators Referenced in Relation to the Ground

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

NOTE: Sensors and other peripherals may be connected to a grounding point some distance from the module. Such remote ground references may carry considerable potential differences with respect to local ground. Induced currents do not affect the measurement or integrity of the system.

⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Ensure that sensors and others peripherals are not exposed through grounding points to voltage potential greater than acceptable limits.

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

Electromagnetic Hazards Instructions

Electromagnetic perturbations may cause the application to operate in an unexpected manner.

⚠WARNING

UNEXPECTED EQUIPEMENT OPERATION

Follow these instructions to reduce electromagnetic perturbations:

- Adapt the programmable filtering to the frequency applied at the inputs,
- Use the shielding connection kit BMXXSP••••, page 234 to connect the shielding,
- Use a specific 24 VDC supply to sensors and a shielded cable for connecting the sensors to the module.

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

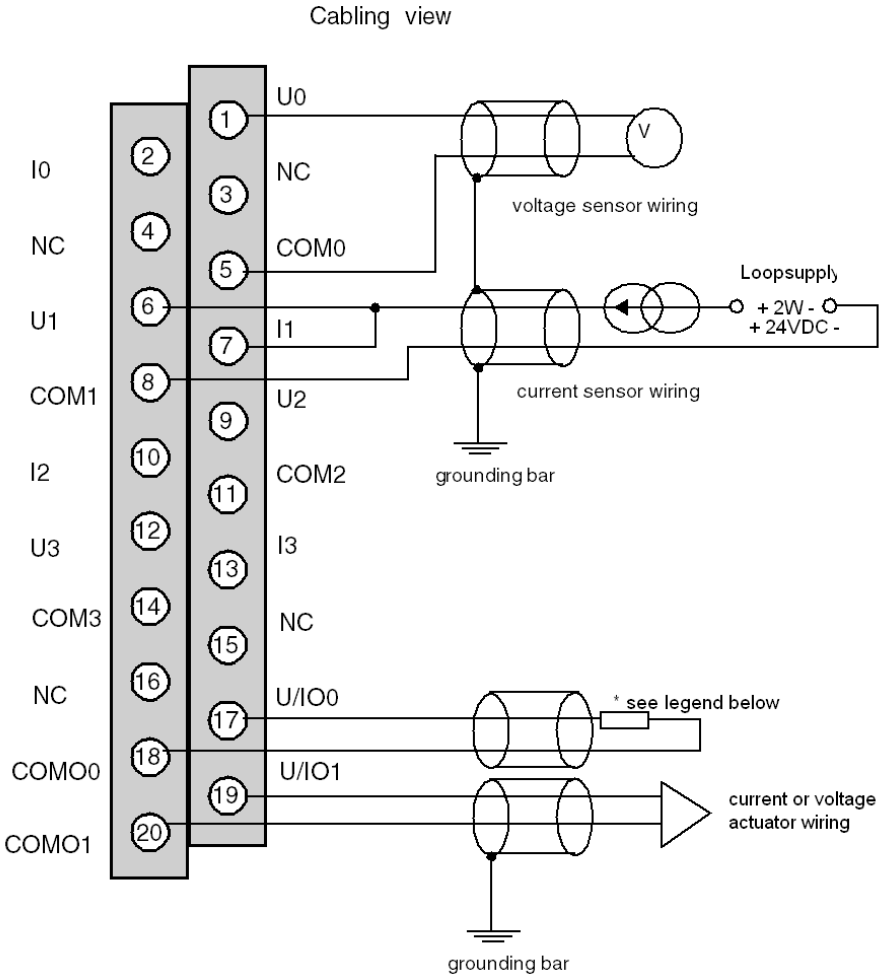
Wiring Diagram

Introduction

The actuators are connected using the 20-point terminal block.

Illustration

The terminal block connection, the sensors, and the actuators wiring are as follows.



Ux + pole input for channel x

COMx - pole input for channel x

U/IOx : + pole output for channel x

COMOx - pole output for channel x

***** The current loop is self-powered by the output and does not request any external supply.

BMXAMO0210(H) Analog Output Module

What's in This Chapter

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BMXAMO0210(H) fpDefault 125
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Wiring Diagram 134
Use of the TELEFAST Wiring Accessories 136

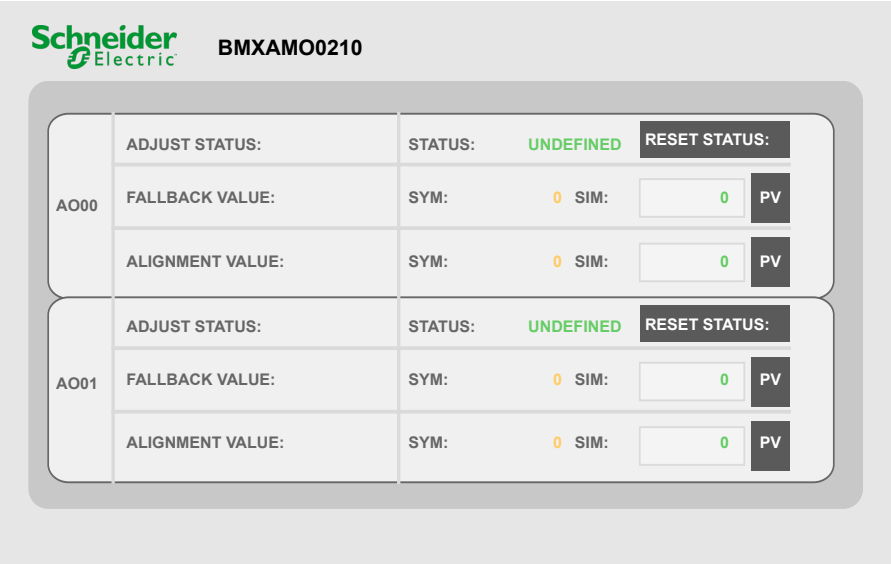
BMXAMO0210(H) sDefault

Abstract



BMXAMO0210(H) fpDefault

Abstract



Description

Element	Description
Range	Button to activate Range mode for HW, SIM/PV display.
Unit	Button to activate Unit mode when pressed. Displays Hardware, SIM, and Force units defined by the MODE.
FORCE	Blue indicates that at least one channel is forced.

Analog output channel description:

Element	Description
AO##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
PV	Indicates the program value from the Symlink.
SIM/HW	Simulated/Program value: • The SIM/HW and PV values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/HW value is equal to the forced value.
PV F	Value indicator: • PV indicates that the channel is not forced. • F indicates that the channel is forced.
MODE	Type configured for the channel.
STATUS	Channel status.

Presentation

Function

The BMX AMO 0210 is a module with two analog outputs isolated from one other. It offers the following ranges for each output:

- Voltage +/-10 V
- Current 0..20 mA and 4..20 mA

The range is selected during configuration.

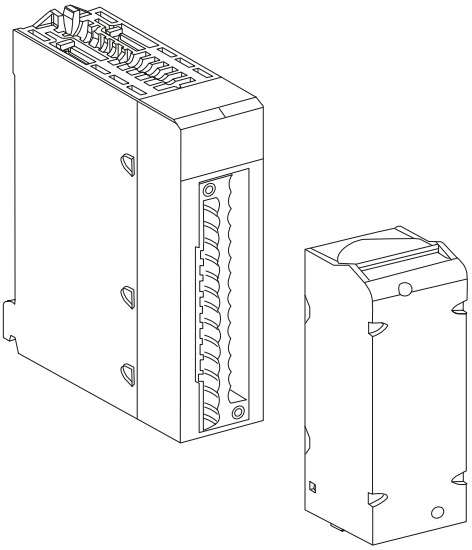
Ruggedized Version

The BMX AMO 0210H (hardened) equipment is the ruggedized version of the BMX AMO 0210 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration

The BMX AMO 0210 analog output module looks like this.



NOTE: The terminal block is supplied separately.

Characteristics

Altitude Operating Conditions

The characteristics in the tables below apply to the modules BMX AMO 0210 and BMX AMO 0210H for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Characteristics

The general characteristics for the BMX AMO 0210 and BMX AMO 0210H modules are as follows.

Operating temperature	BMX AMO 0210	0...60 ºC (32...140 ºF)
	BMX AMO 0210H	-25...70 ºC (-13...158 ºF)
Type of outputs		Isolated high level outputs
Nature of outputs		Voltage or Current configured by software
Number of channels		2
Analog/Digital converter resolution		15 bits + sign
Output refresh time		≤ 1 ms
Power supply for outputs		by the module
Types of protection		From short circuits and overloads (Voltage output)
Isolation: • Between channels • Between channels and bus • Between channels and ground		 750 VDC 1400 VDC 1400 VDC
Detected measurement error for standard module BMX AMO 0210: • At 25°C (77°F) • Maximum in the temperature range 0..60°C (32...140°F)		 0.10% of FS(1) 0.20% of FS(1)
Detected measurement error for ruggedized BMX AMO 0210H: • At 25°C (77°F) • Maximum in the temperature range - 25...70°C (-13...158°F)		 0.10% of FS(1) 0.45% of FS(1)
Temperature drift		30 ppm/°C
Monotonicity		Yes
Common mode rejection (50/60 Hz)		100 dB
Crosstalk between channels DC and AC 50/60Hz		> 90 dB
Non linearity		0.1% of FS(1)
AC output ripple		2 mV rms on 50 Ω
Power consumption (3.3 V)	**Typical**	0.35 W
	Maximum	0.48 W
Power consumption (24 V)	**Typical**	2.1 W
	Maximum	2.8 W
(1) FS: Full Scale		

Voltage Output

The BMX AMO 0210 and BMX AMO 0210H voltage outputs have the following characteristics.

Nominal variation range	+/-10 V
Maximum variation range	+/- 11.25 V
Analog resolution	0.37 mV
Load impedance	1 KΩ minimum
Detection type	Short circuits

Current Output

The BMX AMO 0210 and BMX AMO 0210H current outputs have the following characteristics.

Nominal variation range	0..20 mA, 4..20 mA
Available maximum current	24 mA
Analog resolution	0.74 µA
Load impedance	600 Ω maximum
Detection type	Open circuit(1)(2)
(1) The open circuit detection is physically detected by the module if the target current value is different of 0 mA. **(2)** Open circuit detection is enabled with the Wiring CTRL parameter.	

Response time of Outputs

The maximum delay between transmission of the output value on the controller bus and its effective positioning on the terminal block is less than 2 ms:

- internal cycle time = 1 ms for the two channels
- digital/analog conversion response time = 1 ms maximum for a 0-100% step.

NOTE: If nothing is connected on the BMX AMO 0210 analog module and the channels are configured in the range 4..20 mA, there is a detected I/O error as if a wire is broken.

For the 0..20 mA range, there is a detected I/O error as if a wire is broken only when the current is greater than 0 mA.

⚠ CAUTION

RISK OF INCORRECT DATA

If a signal wire is broken or disconnected, the last measured value is kept.

- Ensure that this does not cause a hazardous situation.
- Do not rely on the value reported. Check the input value at the sensor.

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

Functional Description

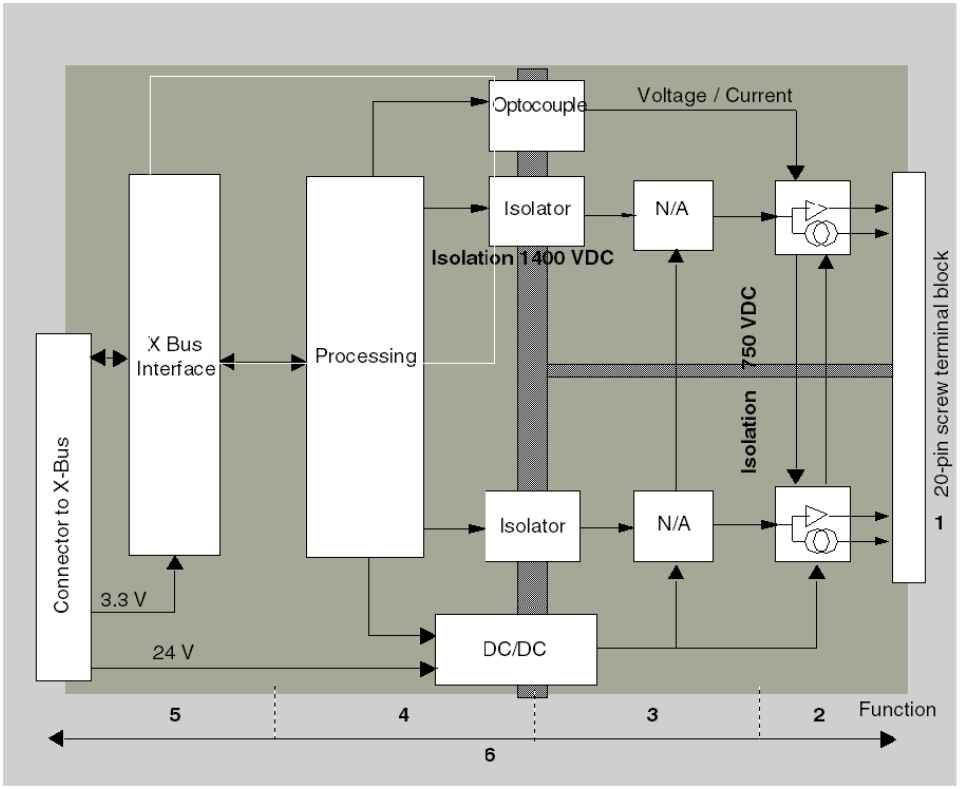
Function

The BMXAMO0210 is a module with two analog outputs isolated from each other. This module offers the following ranges for each output, according to the selection made during configuration:

- +/-10 V
- 0...20 mA
- 4...20 mA

Illustration

The BMXAMO0210 module's illustration is as follows.



Description.

Address	Process	Characteristics
1	Adapting the outputs	• physical connection to the process through a 20-pin screw terminal block • helps protect the module against voltage spikes
2	Adapting the signal to the Actuators	• performed on voltage or current via software configuration
3	Converting	• performed on 15 bits with a polarity sign • reframing the data provided by the program is performed automatically and dynamically by the converter
4	Transforming application data into data directly usable by the digital/analog converter	• use of factory calibration parameters

Address	Process	Characteristics
5	Communicating with the application	• manages exchanges with controller • topological addressing • receiving, from the application, configuration parameters for the module and channels, as well as numeric setpoints from the channels • sending module status back to application
6	Module monitoring and sending detected error notifications back to the application	• output power supply test • testing for range overflow on channels • testing for output open circuits and short-circuits • watchdog test • Programmable fallback capabilities

Writing Outputs

Confirm that the application provides the outputs with values in the standardized format:

- -10,000 to +10,000 for the +/-10 V range
- 0 to +10,000 in 0-20 mA and 4-20 mA ranges

Digital/Analog Conversion

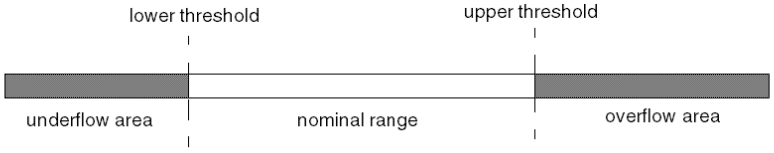
The digital/analog conversion is performed on:

- 16-bit for the +/-10 V range
- 15-bit in 0-20 mA and 4-20 mA ranges

Overflow Control

Module BMXAMO0210 allows an overflow control on voltage and current ranges.

The measurement range is divided in three areas.



Description:

Designation	Description
Nominal range	measurement range corresponding to the chosen range
Overflow area	area located beyond the upper threshold
Underflow area	area located below the lower threshold

Overflow values for the various ranges are as follows.

Range	BMX AMO 0210					
	Underflow area		Nominal range		Overflow area	
+/- 10V	-11,250	-11,001	-11,000	11,000	11,001	11,250
0..20mA	-2,000	-1,001	-1,000	11,000	11,001	12,000
4..20mA	-1,600	-801	-800	10800	10801	11,600

You may also choose the flag for an overflow of the range upper value, for an underflow of the range lower value, or for both.

NOTE: Range under/overflow detection is optional.

Fallback/Maintain or Reset Outputs to Zero

In case an error is detected, and depending on its seriousness, the outputs:

- switch to fallback/maintain position individually or together
- are forced to 0 (0 V or 0 mA).

Various behaviors of outputs:

Detected error	Behavior of voltage outputs	Behavior of current outputs
Task in STOP mode, or program missing	Fallback/maintain (channel by channel)	Fallback/maintain (channel by channel)
Communication interruption		
Configuration error	0 V (all channels)	0 mA (all channels)
Internal error in module		
Output value out-of-range (range under/overflow)	Value saturated at the defined limit (channel by channel)	Saturated value (channel by channel)
Output short or open circuit	Short-circuit: Maintain (channel by channel)	Open circuit: Maintain (channel by channel)
Module hot swapping (processor in STOP mode)	0 V (all channels)	0 mA (all channels)
Reloading program		

Fallback or Maintain at current value is selected during the configuration of the module. The fallback value may be modified through a program.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

The fallback position should not be used as the sole safety method. If an uncontrolled position can result in a hazard, an independent redundant system must be installed.

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

⚠WARNING

INPUT / OUTPUT TRANSITION TO INIT VALUES

Design the system and the application to support safely the transition of inputs and outputs to their INIT values each time the application enters the running state), including after (pending applicable settings values):

- Run command
- Deploy command
- Restart runtime command
- Load boot project
- Physical device power on
- Application error detection
- Boot project error detection

Refer to the Operating States to fully understand all potential occurrences of a transition to the Running state and the associated settings.

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

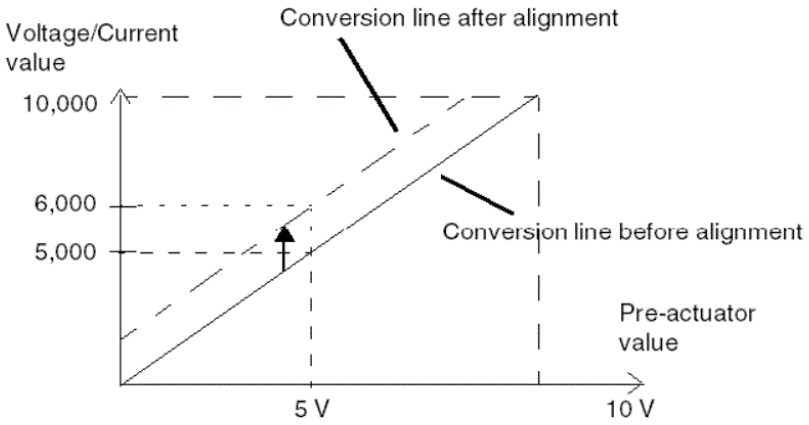
Behavior at Initial Power-Up and When Switched Off.

When the module is switched on or off, the outputs are set to 0 (0 V or 0 mA).

Actuator Alignment

The process of "alignment" consists of helping eliminate a systematic offset observed with a given actuator, around a specific operating point. This operation compensates for a detected error linked to the process. Therefore, replacing a module does not require a new alignment. However, replacing the actuator or changing the sensor's operating point does require a new alignment.

Conversion lines are as follows:



The alignment value is editable from a programming console, even if the program is in RUN mode. For each output channel, you can:

- view and modify the initial output target value
- save the alignment value
- determine whether the channel already has an alignment

The maximum offset between the measured value and the corrected output value (aligned value) may not exceed +/- 1.500.

NOTE: To align several analog channels on the BMXAMO/AMI/AMM/ART modules, we recommend proceeding channel by channel. Test each channel after alignment before moving to the next channel in order to apply the parameters correctly.

Wiring Precautions

Introduction

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

Cable Shielding

Connect the cable shielding to the grounding bar. Clamp the shielding to the shield bar on the module side. Use the shielding connection kit BMXXSP••••, page 234 to connect the shielding.

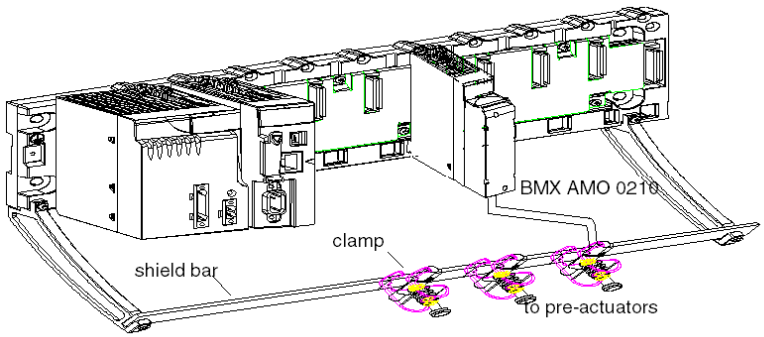
⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

While mounting / removing the modules:

- Make sure that each terminal block is still connected to the shield bar.
- Disconnect voltage supplying sensors and pre-actuators.

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



Using Pre-Actuators Referenced in Relation to the Ground

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

NOTE: Sensors and other peripherals may be connected to a grounding point some distance from the module. Such remote ground references may carry considerable potential differences with respect to local ground. Induced currents do not affect the measurement or integrity of the system

⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Ensure that sensors and others peripherals are not exposed through grounding points to voltage potential greater than acceptable limits.

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

Electromagnetic Hazard Instructions

NOTE: Electromagnetic perturbations may lead to an unexpected behavior of the application.

⚠CAUTION

UNEXPECTED BEHAVIOR OF APPLICATION

Follow those instructions to reduce electromagnetic perturbations, use the shielding connection kit BMXXSP••••, page 234 to connect the shielding without programmable filtering.

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

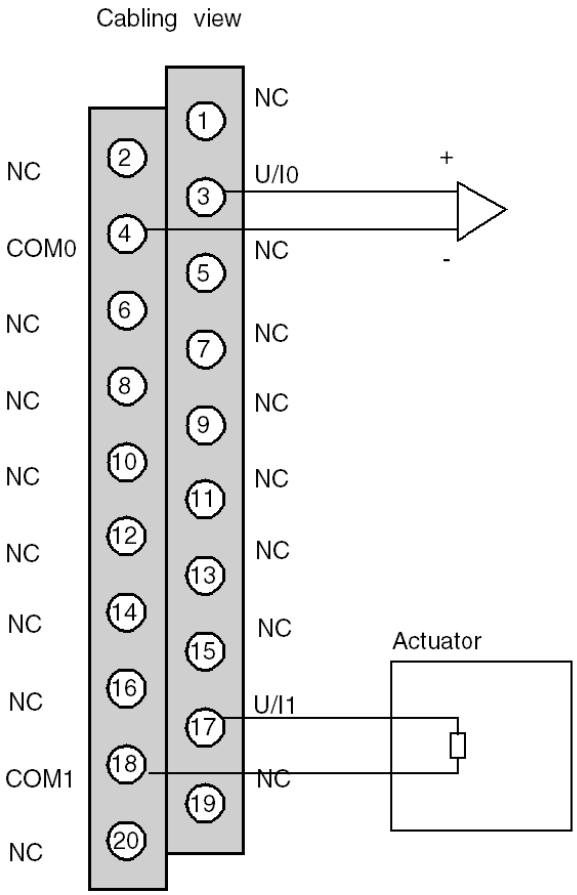
Wiring Diagram

Introduction

The actuators are connected using the 20-point terminal block.

Illustration

The current loop is self-powered by the output and does not request any external supply. The terminal block connection and the actuators wiring are as follows.



U/Ix + pole input for channel x

COMx - pole input for channel x

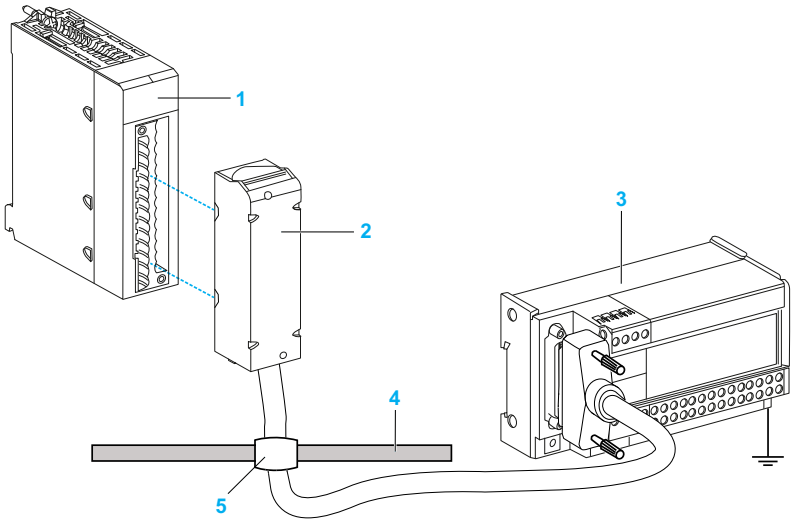
Channel 0: Voltage actuator

Channel 1: Current actuator

Use of the TELEFAST Wiring Accessories

Introduction

The TELEFAST pre-wired system consists of connecting cables and interface sub-bases as shown below:



1 BMX AMO 0210 module

2 BMXFCA••0 connecting cable

3 ABE-7CPA21 interface sub-base

4 Shield bar

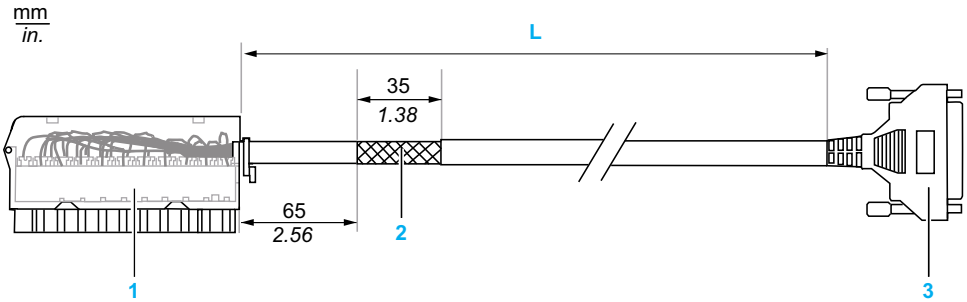
5 Clamp

BMX FCA ••0 Connecting Cables

The BMX FCA ••0 cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 20-pin terminal block from which extend 1 cable sheath containing 20 wires,
- At the other end a 25-pin Sub-D connector.

The figure below shows the BMX FCA ••0 cables:



1 BMX FTB 2020 Terminal block

2 Cable shielding

3 25-pin Sub-D connector

L Length according to the part number.

The cable comes in 3 different lengths:

- 1.5 m (4.92 ft): BMX FCA 150

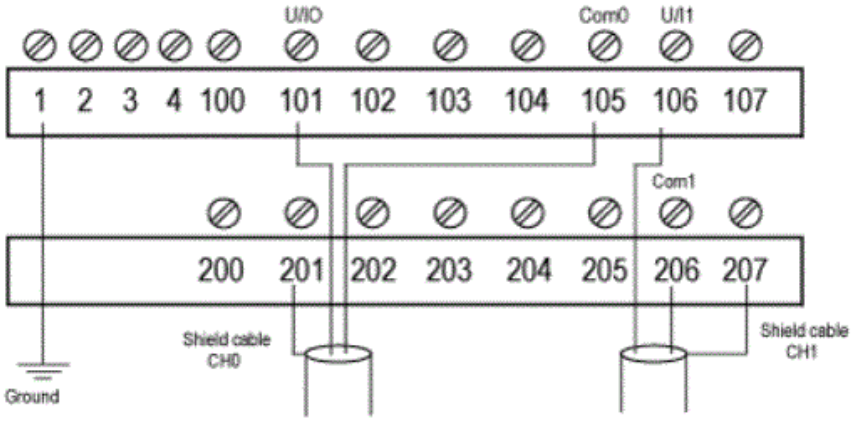
- 3 m (9.84 ft): BMX FCA 300
- 5 m (16.40 ft): BMX FCA 500

The following table gives the characteristics of the BMX FCA ••0 cables:

Characteristic		Value
Cable	Sheath material	PVC
	LSZH status	No
Environmental	Operating temperature	-25...70 °C (-13...158 °F)

Connecting Actuators

The BMX AMO 0210 analog outputs are accessible on the terminal block of the TELEFAST ABE-7CPA21 as follows:



The following table shows the distribution of analog outputs on the TELEFAST ABE-7CPA21 terminal block with a BMX FCA ••0 cable:

TELEFAST terminal block number	25-pin SubD connector pin number	BMXA-MO0210 pin out	Signal type	TELEFAST terminal block number	25-pin SubD connector pin number	BMXA-MO0210 pin out	Signal type
1	/		Ground	Supp 1	/		Ground
2	/		STD (1)	Supp 2	/		Ground
3	/		STD (1)	Supp 3	/		Ground
4	/		STD (2)	Supp 4	/		Ground
100	1			200	14		
101	2	3	U/I0	201	/		Ground
102	15		NC	202	3		
103	16		NC	203	/		Ground
104	4		NC	204	17		NC
105	5	4	COM 0	205	/		Ground
106	18	17	U/I1	206	6	18	Com 1
107	19		NC	207	/		Ground
NC: Not Connected							

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

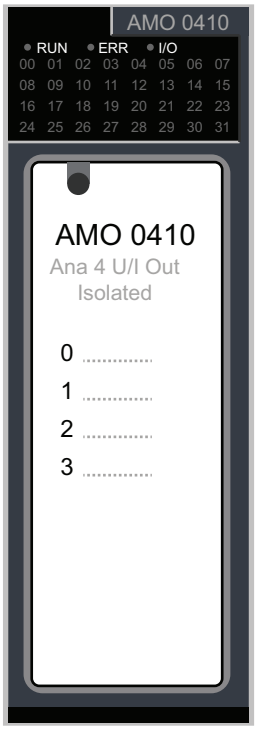
BMXAMO0410(H) Analog Output Module

What's in This Chapter

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Wiring Diagram 148
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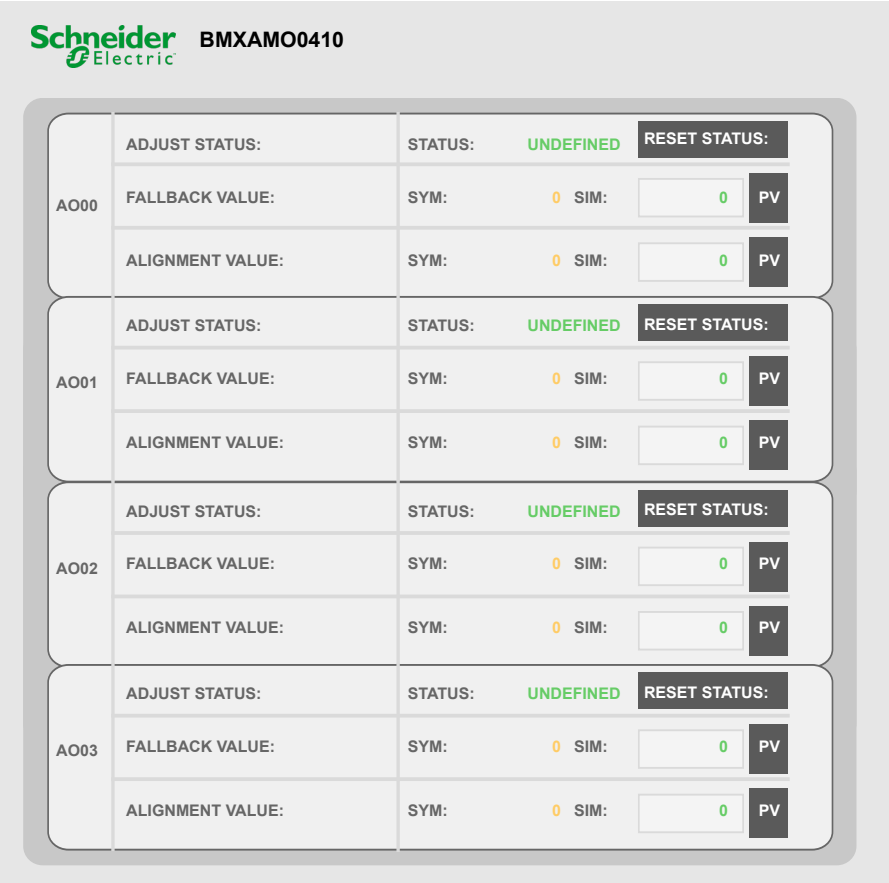
BMXAMO0410(H) sDefault

Abstract



BMXAMO0410(H) fpDefault

Abstract



Description

Element	Description
Range	Button to activate Range mode for HW, SIM/PV display.
Unit	Button to activate Unit mode when pressed. Displays Hardware, SIM, and Force units defined by the MODE.
FORCE	Blue indicates that at least one channel is forced.

Analog output channel description:

Element	Description
AO##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
PV	Indicates the program value from the Symlink.
SIM/HW	Simulated/Program value: • The SIM/HW and PV values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/HW value is equal to the forced value.
PV F	Value indicator: • PV indicates that the channel is not forced. • F indicates that the channel is forced.

Element	Description
MODE	Type configured for the channel.
STATUS	Channel status.

Presentation

Function

The BMXAMO0410 is a high density output analog module fitted with four isolated channels. It offers the following ranges for each output:

- Voltage +/-10 V
- Current 0..20 mA and 4..20 mA

The range is selected during configuration.

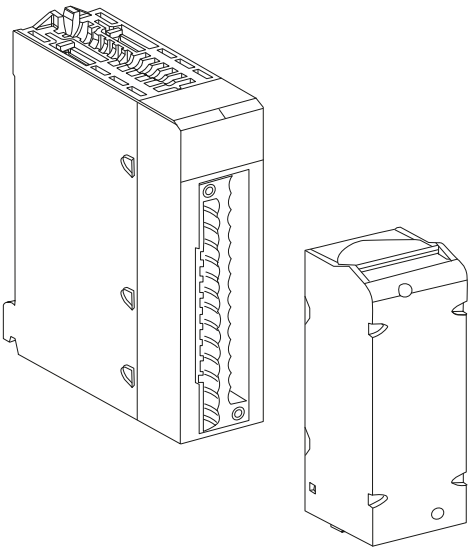
Ruggedized Version

The BMXAMO0410H (hardened) equipment is the ruggedized version of the BMXAMO0410 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration

The following graphic shows the BMXAMO0410 analog output module:



NOTE: The terminal block is supplied separately.

Characteristics

Altitude Operating Conditions

The characteristics in the tables below apply to the modules BMXAMO0410 and BMXAMO0410H for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Characteristics

The general characteristics for the BMXAMO0410 and BMXAMO0410H modules are as follows:

Operating temperature	BMXAMO0410	0...60 ºC (32...140 ºF)
	BMXAMO0410H	-25...70 ºC (-13...158 ºF)
Type of outputs		High level fast outputs
Nature of outputs		Voltage or current configured by software
Number of channels		4
Digital/Analog converter resolution		16 bits
Output refresh time		1 ms
Power supply for outputs		by the module
Types of protection		From short circuits and overloads (Voltage output)
Isolation: • Between channels • Between channels and bus • Between channels and ground		 750 VDC 1400 VDC 1400 VDC
Detected measurement error for standard module: • At 25°C (77°F) • Maximum in the temperature range 0...60°C (32...140°F)		 0.10% of FS(1) 0.20% of FS(1)
Detected measurement error for hardened module: • At 25°C (77°F) • Maximum in the temperature range -25...70°C (-13...158°F)		 0.10% of FS(1) 0.45% of FS(1)
Temperature drift		45 ppm/°C
Monotonicity		Yes
Common mode rejection (50/60 Hz)		100 dB
Crosstalk between channels DC and AC 50/60Hz		> 80 dB
Non linearity		0.1% of FS(1)
AC output ripple		2 mV rms on 50 Ω
Power consumption (3.3 V)	**Typical**	0.45 W
	Maximum	0.51 W
Power consumption (24 V)	**Typical**	3.0 W

	Maximum	3.6 W
(1) FS: Full Scale		

Voltage Output

The BMXAMO0410 and BMXAMO0410H voltage outputs have the following characteristics:

Nominal variation range	+/-10 V
Maximum variation range	+/- 10.50 V
Analog resolution	0.37 mV
Load impedance	1 KΩ minimum
Detection type	Short circuits

Current Output

The BMXAMO0410 and BMXAMO0410H current outputs have the following characteristics:

Nominal variation range	0..20 mA, 4..20 mA
Available maximum current	21 mA
Analog resolution	0.74 µA
Load impedance	500 Ω maximum
Detection type	Open circuit(1)(2)
(1) The open circuit detection is physically detected by the module if the target current value is different from 0 mA. **(2)** Open circuit detection is enabled with the Wiring CTRL parameter.	

Response Time of Outputs

The maximum delay between transmission of the output value on the controller bus and its effective positioning on the terminal block is less than 2 ms:

- Internal cycle time = 1 ms for the four channels
- Digital/Analog conversion response time = 1 ms maximum for a 0-100% step.

NOTE: If nothing is connected on the BMXAMO0410 analog module and the channels are configured in the range 4...20 mA, there is a detected I/O error as if a wire is broken.

For the 0...20 mA range, there is a detected I/O error as if a wire is broken only when the current is greater than 0 mA.

⚠CAUTION

RISK OF INCORRECT DATA

If a signal wire is broken or disconnected, the last measured value is kept.

- Ensure that this does not cause a hazardous situation.
- Do not rely on the value reported. Check the input value at the sensor.

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

Functional Description

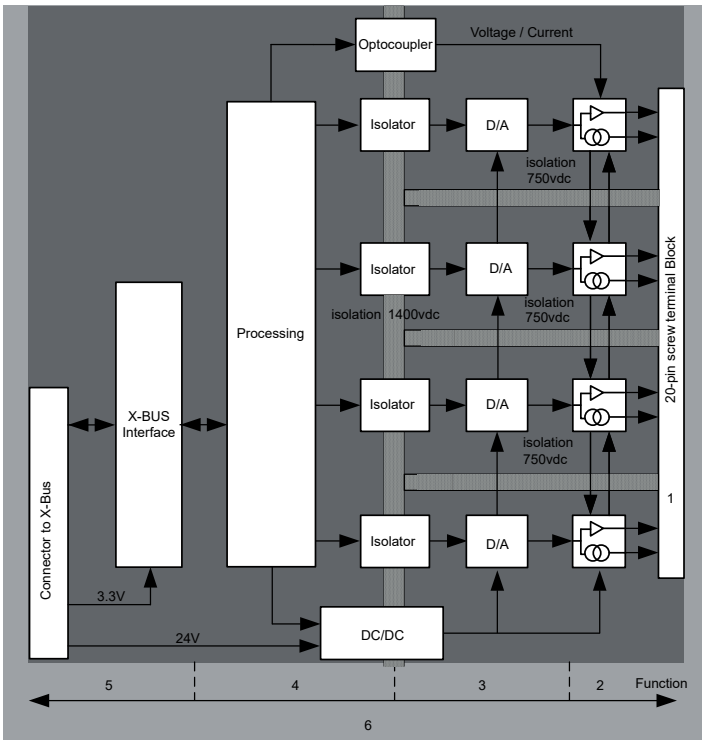
Function

The BMXAMO0410 is a high density output analog module fitted with four isolated channels. This module offers the following ranges for each output, according to the selection made during configuration:

- +/-10 V
- 0...20 mA
- 4...20 mA

Illustration

The BMXAMO0410 module's illustration is as follows:



Description:

Address	Process	Characteristics
1	Adapting the outputs	• physical connection to the process through a 20-pin screw terminal block • protecting the module against voltage spikes
2	Adapting the signal to the actuators	• the adaptation is performed on voltage or current via software configuration
3	Converting	• this conversion is performed on 15 bits with a polarity sign • reframing the data provided by the program is performed automatically and dynamically by the converter
4	Transforming application data into data directly usable by the digital/analog converter	• use of factory calibration parameters

Address	Process	Characteristics
5	Communicating with the application	• manages exchanges with controller • topological addressing • from the application, receiving the configuration parameters for the module and channels as well as numeric set points from the channels • sending module status back to application
6	Module monitoring and sending detected error notifications back to the application	• output power supply test • testing for range overflow on channels • testing for output open circuits and short-circuits • watchdog test • Programmable fallback capabilities

Writing Outputs

Confirm that the application provides the outputs with values in the standardized format:

- -10,000 to +10,000 for the +/-10 V range
- 0 to +10,000 in 0-20 mV and 4-20 mA ranges

Digital/Analog Conversion

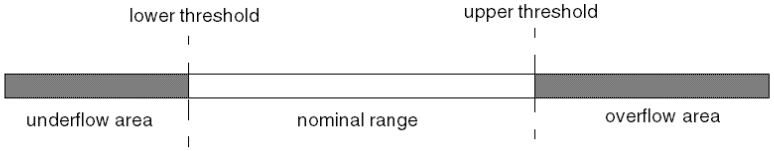
The digital/analog conversion is performed on:

- 16-bit for the +/-10 V range
- 15-bit in 0-20 mA and 4-20 mA ranges

Overflow Control

Module BMXAMO 410 allows an overflow control on voltage and current ranges.

The measurement range is divided in three areas:



Description:

Designation	Description
Nominal range	measurement range corresponding to the chosen range
Overflow area	area located beyond the upper threshold
Underflow area	area located below the lower threshold

Overflow values for the various ranges are as follows:

Range	BMXAMO0410					
	Underflow area		Nominal range		Overflow area	
+/- 10V	-10,500	-10,301	-10,300	10,300	10,301	10,500
0..20mA	-2,000	-1,001	-1,000	10,300	10,301	10,500
4..20mA	-1,600	-801	-800	10,300	10,301	10,500

You may also choose the flag for an overflow of the range upper value, for an underflow of the range lower value, or for both.

NOTE: Range under/overflow detection is optional.

Fallback/Maintain or Reset Outputs to Zero

If an error is detected, and depending on its seriousness, the outputs:

- switch to fallback/maintain position individually or together,
- are forced to 0 (0 V or 0 mA).

Various behaviors of outputs:

Detected error	Behavior of voltage outputs	Behavior of current outputs
Task in STOP mode, or program missing	Fallback/maintain (channel by channel)	Fallback/maintain (channel by channel)
Communication interruption		
Configuration error	0 V (all channels)	0 mA (all channels)
Internal error in module		
Output value out-of-range (range under/overflow)	Value saturated at the defined limit (channel by channel)	Saturated value (channel by channel)
Output short or open circuit	Short-circuit: Maintain (channel by channel)	Open circuit: Maintain (channel by channel)
Module hot swapping (processor in STOP mode)	0 V (all channels)	0 mA (all channels)
Reloading program		

Fallback or Maintain at current value is selected during the configuration of the module.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Do not use the fallback position as the sole safety method. If an uncontrolled position can result in a hazard, install an independent redundant system.

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

⚠WARNING

INPUT / OUTPUT TRANSITION TO INIT VALUES

Design the system and the application to support safely the transition of inputs and outputs to their INIT values each time the application enters the running state), including after (pending applicable settings values):

- Run command
- Deploy command
- Restart runtime command
- Load boot project
- Physical device power on
- Application error detection
- Boot project error detection

Refer to the Operating States to fully understand all potential occurrences of a transition to the Running state and the associated settings.

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

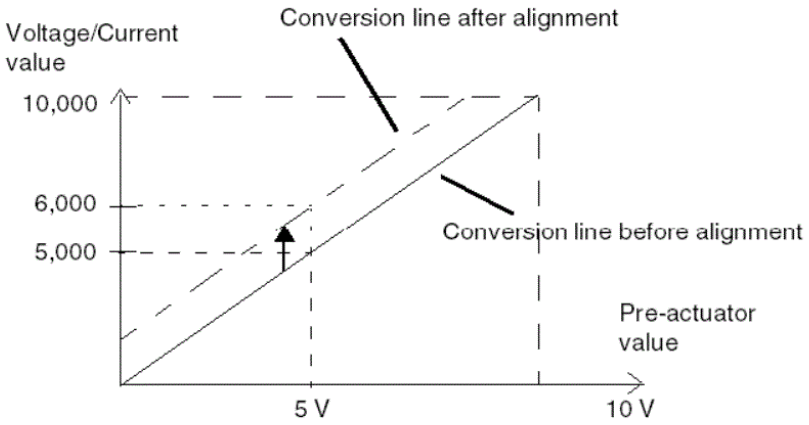
Behavior at Initial Power-Up and When Switched Off.

When the module is switched on or off, the outputs are set to 0 (0 V or 0 mA).

Actuator Alignment

The process consists of helping eliminate a systematic offset observed with a given actuator, around a specific operating point. This operation compensates for a detected error linked to the process. Therefore, replacing a module does not require a new alignment. However, replacing the actuator or changing the sensor's operating point does require a new alignment.

Conversion lines are as follows:



The alignment value is editable from a programming console, even if the program is in RUN mode. For each output channel, you can:

- view and modify the initial output target value
- save the alignment value
- determine whether the channel already has an alignment

The maximum offset between the measured value and the corrected output value (aligned value) may not exceed +/- 1.500.

NOTE: To align several analog channels on the BMXAMO/AMI/AMM/ART modules, we recommend proceeding channel by channel. Test each channel after alignment before moving to the next channel in order to apply the parameters correctly.

Wiring Precautions

Introduction

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

Cable Shielding

Connect the cable shielding to the grounding bar. Clamp the shielding to the shield bar on the module side. Use the shielding connection kit BMXXSP••••, page 234 to connect the shielding.

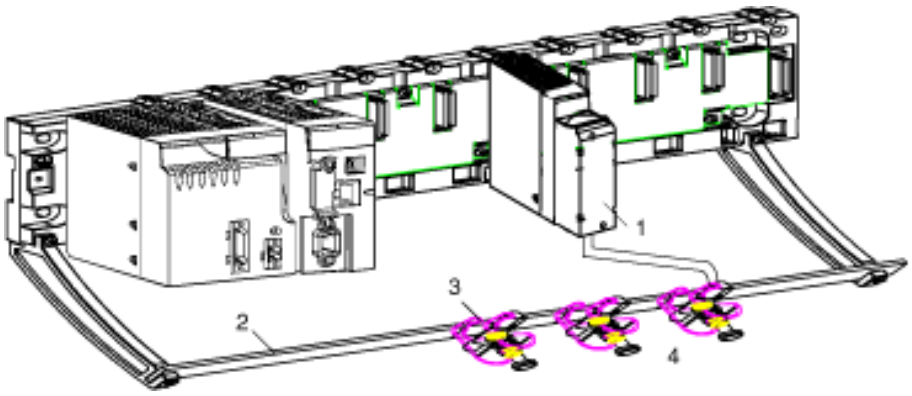
⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

While mounting / removing the modules:

- Make sure that each terminal block is still connected to the shield bar.
- Disconnect voltage supplying sensors and pre-actuators.

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



1 BMXAMO0410

2 Shield bar

3 Clamp

4 To pre-actuators

Using Pre-Actuators Referenced in Relation to the Ground

There are no specific technical constraints for referencing pre-actuators to the ground. It is nevertheless preferable to avoid returning a remote ground potential to the terminal that may be different to the ground potential close by.

NOTE: Sensors and other peripherals may be connected to a grounding point some distance from the module. Such remote ground references may carry considerable potential differences with respect to local ground.

⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Ensure that:

- Potentials greater than safety limits do not exist.
- Induced currents do not affect the measurement or integrity of the system.

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

Electromagnetic Hazard Instructions

Electromagnetic perturbations may lead to an unexpected behavior of the application.

⚠CAUTION

UNEXPECTED BEHAVIOR OF APPLICATION

To reduce electromagnetic perturbations, use the shielding connection kit BMXXSP••••, page 234 to connect the shielding without programmable filtering.

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

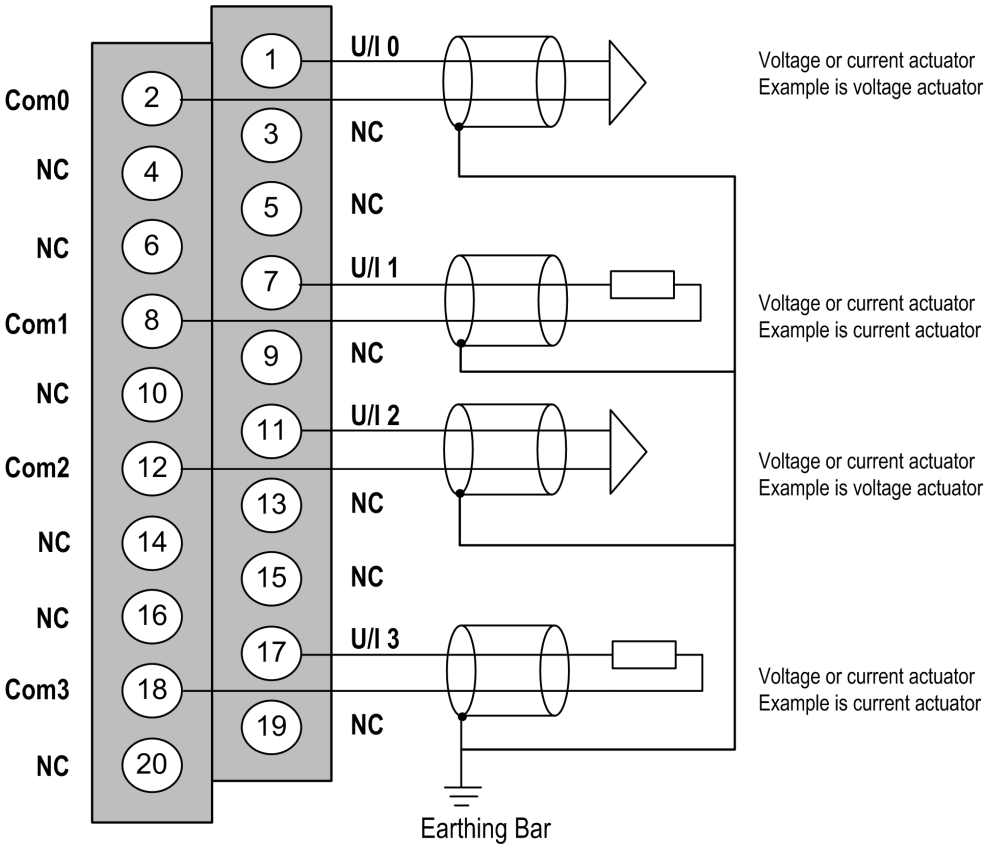
Wiring Diagram

Introduction

The actuators are connected using the 20-pin terminal block.

Illustration

The current loop is self-powered by the output and does not request any external supply. The terminal block connection and the actuators wiring are as follows:



U/Ix + pole input for channel x

COMx - pole input for channel x

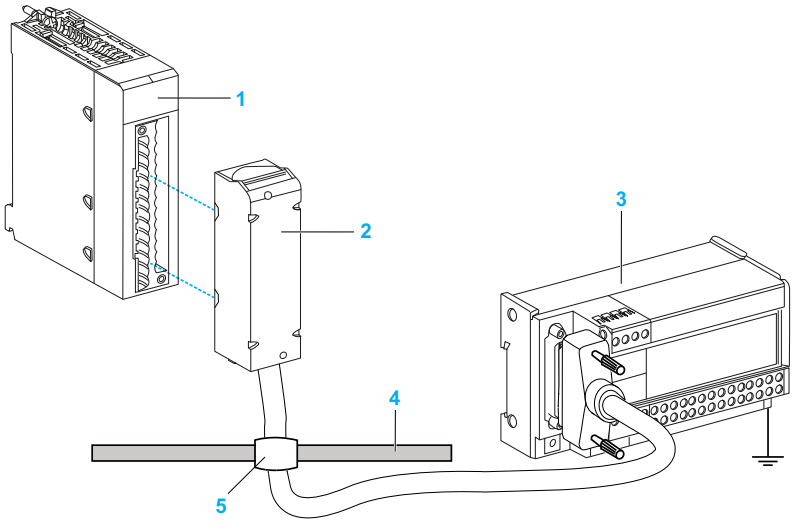
Channel 0: Voltage actuator

Channel 1: Current actuator

Use of the TELEFAST Wiring Accessories

Introduction

The TELEFAST pre-wired system consists of connecting cables and interface sub-bases as shown below:



1 BMXAMO0410 module

2 BMXFCA••0 connecting cable

3 ABE-7CPA21 interface sub-base

4 Shield bar

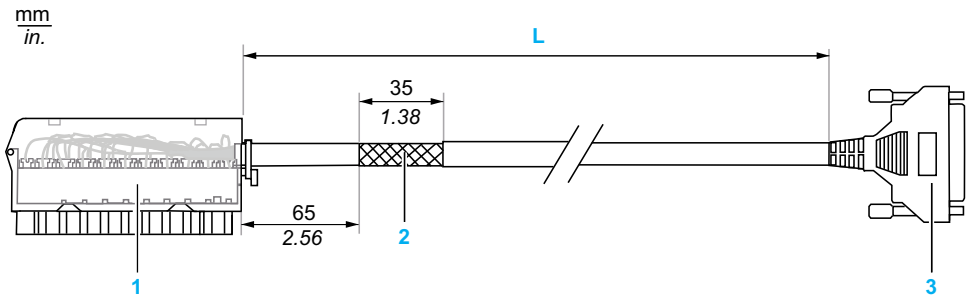
5 Clamp

BMX FCA ••0 Connecting Cables

The BMXFCA ••0 cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 20-pin terminal block from which extend 1 cable sheath containing 20 wires,
- At the other end a 25-pin Sub-D connector.

The figure below shows the BMXFCA ••0 cables:



1 BMXFTB 2020 Terminal block

2 Cable shielding

3 25-pin Sub-D connector

L Length according to the part number.

The cable comes in 3 different lengths:

- 1.5 m (4.92 ft): BMXFCA 150

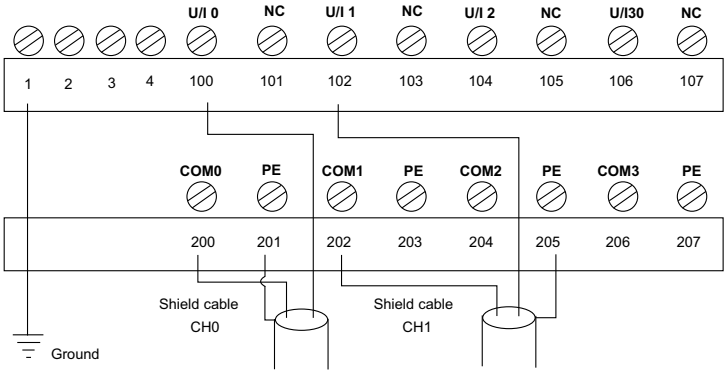
- 3 m (9.84 ft): BMXFCA 300
- 5 m (16.40 ft): BMXFCA 500

The following table gives the characteristics of the BMXFCA ••0 cables:

Characteristic		Value
Cable	Sheath material	PVC
	LSZH status	No
Environmental	Operating temperature	-25...70 °C (-13...158 °F)

Connecting Actuators

The analog outputs are accessible on the terminals of the TELEFAST ABE-7CPA21 as follows:



]

The following table shows the distribution of analog channels on the TELEFAST ABE-7CPA21 terminal block with a BMXFCA ••0 cable:

TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MO0410 pin out	Signal type	TELEFAST terminal block number	25-pin Sub-D connector pin number	BMXA-MO0410 pin out	Signal type
1	/		Ground	Supp 1	/		Ground
2	/		STD (1)	Supp 2	/		Ground
3	/		STD (1)	Supp 3	/		Ground
4	/		STD (2)	Supp 4	/		Ground
100	1	1	U/I0	200	14	2	Com 0
101	2		NC	201	/		Ground
102	15	7	U/I1	202	3	8	Com 1
103	16		NC	203	/		Ground
104	4	11	U/I2	204	17	12	Com 2
105	5		NC	205	/		Ground
106	18	17	U/I3	206	6	18	Com 3
107	19		NC	207	/		Ground
NC: Not Connected							

NOTE: Remove the strap with the ABE-7CPA21 from the terminal, otherwise the signal ground of channel 0 will be connected to earth.

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

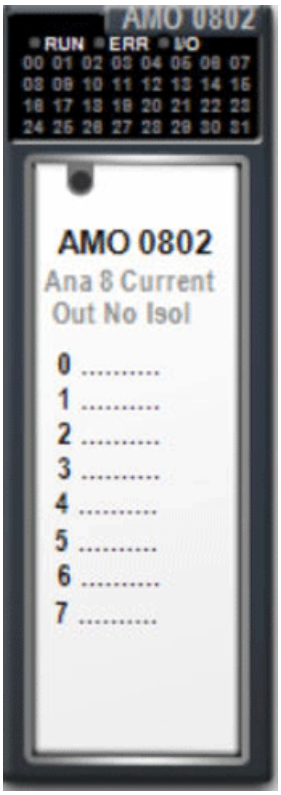
BMXAMO0802 Analog Output Module

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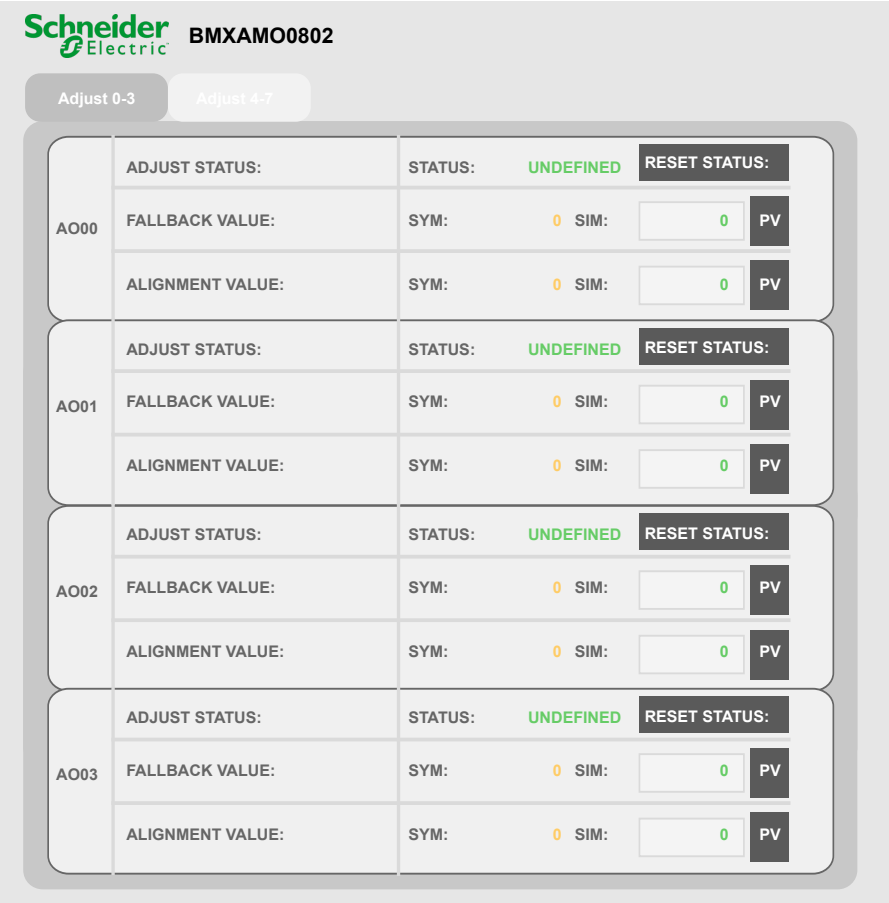
BMXAMO0802 sDefault

Abstract



BMXAMO0802 fpDefault

Abstract



Description

Element	Description
Range	Button to activate Range mode for HW, SIM/PV display.
Unit	Button to activate Unit mode when pressed. Displays Hardware, SIM, and Force units defined by the MODE.
FORCE	Blue indicates that at least one channel is forced.

Analog output channel description:

Element	Description
AO##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
PV	Indicates the program value from the Symlink.
SIM/HW	Simulated/Program value: • The SIM/HW and PV values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/HW value is equal to the forced value.
PV F	Value indicator: • PV indicates that the channel is not forced. • F indicates that the channel is forced.

Element	Description
MODE	Type configured for the channel.
STATUS	Channel status.

Presentation

Function

The BMXAMO0802 is a high density output analog module fitted with eight non-isolated channels. It offers the following current ranges for each output:

- 0..20 mA
- 4..20 mA

The range is selected during configuration.

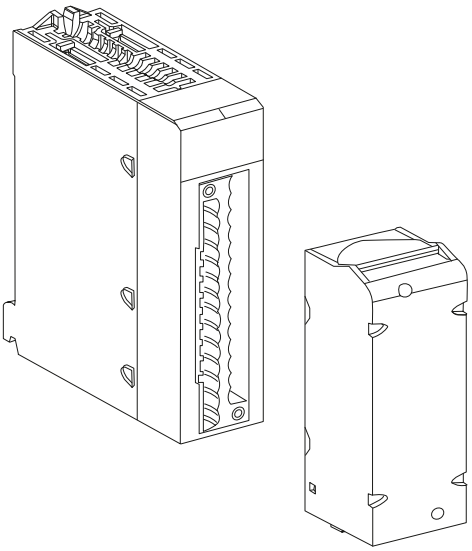
Ruggedized Version

The BMXAMO0802H (hardened) equipment is the ruggedized version of the BMXAMO0802 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration

The following graphic shows the BMXAMO0802 analog output module:



NOTE: The terminal block is supplied separately.

Characteristics

Altitude Operating Conditions

The characteristics in the tables below apply to the modules BMXAMO0802 and BMXAMO0802H for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Characteristics

The general characteristics for the BMXAMO0802 and BMXAMO0802H modules are as follows:

Operating temperature	BMXA-MO0802	0...60 ºC (32...140 ºF)
	BMXA-MO0802H	-25...70 ºC (-13...158 ºF)
Type of outputs		Non-isolated high level outputs with common point
Nature of outputs		Current
Number of channels		8
Digital/Analog converter resolution		16 bits
Output refresh time		4 ms
Power supply for outputs		by the module
Types of protection		Outputs help protect against to short circuits and permanent overloads
Isolation: • Between channels • Between channels and bus • Between channels and ground		 Non-isolated 1400 VDC 1400 VDC
Detected measurement error for standard module: • At 25 °C (77 °F) • Maximum in the temperature range 0...60 °C (32...140 °F)		 0.10% of FS(1) 0.25% of FS(1)
Detected measurement error for ruggedized: • At 25 °C (77 °F) • Maximum in the temperature range -25...70 °C (-13...158 °F)		 0.10% of FS(1) 0.45% of FS(1)
Temperature drift		45 ppm/°C
Monotonicity		Yes
Common mode rejection (50/60 Hz)		80 dB
Crosstalk between channels DC and AC 50/60Hz		> 80 dB
Non linearity		0.1% of FS(1)
AC output ripple		2 mV rms on 50 Ω
Power consumption (3.3 V)	**Typical**	0.35 W

	Maximum	0.48 W
Power consumption (24 V)	**Typical**	3.60 W
	Maximum	3.90 W
(1) FS: Full Scale		

Current Output

The BMXAMO0802 and BMXAMO0802H current outputs have the following characteristics:

Nominal variation range	0...20 mA, 4...20 mA
Available maximum current	21 mA
Analog resolution	0.74 µA
Load impedance	350 Ω maximum
Detection type	Open circuit(1)(2)
(1) The open circuit detection is physically detected by the module if the target current value is different from 0 mA. **(2)** Open circuit detection is enabled with the Wiring CTRL parameter.	

Response Time of Outputs

The maximum delay between transmission of the output value on the controller bus and its effective positioning on the terminal block is less than 5 ms:

- Internal cycle time = 4 ms for the eight channels
- Digital/Analog conversion response time = 1 ms maximum for a 0-100% step.

NOTE: If nothing is connected on the BMXAMO0802 analog module and the channels are configured in the range 4...20 mA, there is a detected I/O error as if a wire is broken.

For the 0...20 mA range, there is a detected I/O error as if a wire is broken only when the current is greater than 0 mA.

⚠CAUTION

RISK OF INCORRECT DATA

If a signal wire is broken or disconnected, the last measured value is kept.

- Ensure that this does not cause a hazardous situation.
- Do not rely on the value reported. Check the input value at the sensor.

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

Functional Description

Function

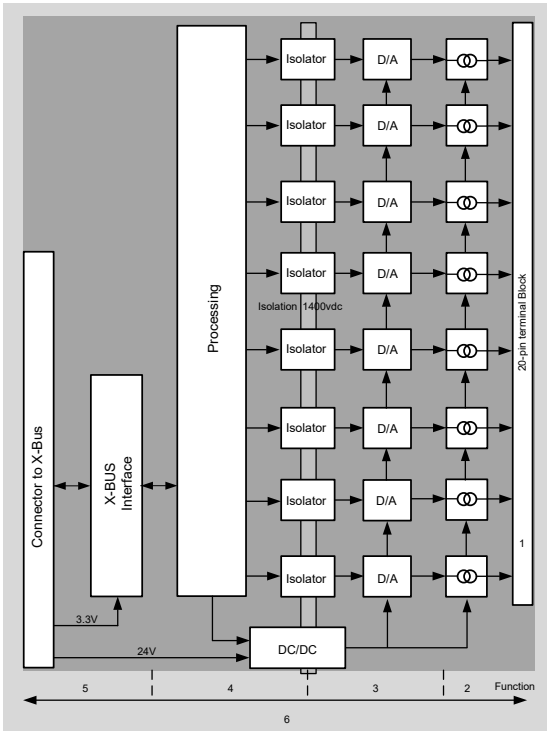
The BMXAMO0802 is a high density output analog module fitted with eight non-isolated channels. It offers the following current ranges for each output:

- 0..20 mA
- 4..20 mA

The range is selected during configuration.

Illustration

The BMXAMO0802 module's illustration is as follows:



Description:

Address	Process	Characteristics
1	Adapting the outputs	• physical connection to the process through a 20-pin screw terminal block • helps protect the module against voltage spikes
2	Adapting the signal to the actuators	• the adaptation is performed on current via software configuration
3	Converting	• this conversion is performed on 15 bits with a polarity sign • reframing the data provided by the program is performed automatically and dynamically by the converter
4	Transforming application data into data directly usable by the digital/analog converter	• use of factory calibration parameters
5	Communicating with the application	• manages exchanges with contoller • topological addressing • from the application, receiving the configuration parameters for the module and channels as well as numeric set points from the channels • sending module status back to application
6	Module monitoring and sending detected error notifications back to the application	• output power supply test • testing for range overflow on channels • testing for output open circuits and short-circuits • watchdog test • Programmable fallback capabilities

Writing Outputs

Confirm that the application provides the outputs with values in the standardized format: 0 to +10,000 in 0..20 mV and 4..20 mA ranges.

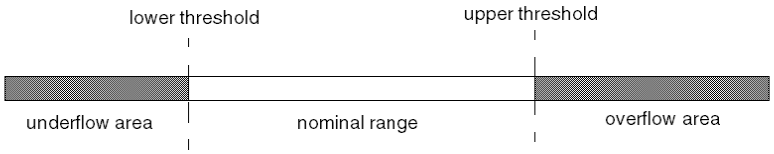
Digital/Analog Conversion

The digital/analog conversion is performed on: 15-bit in 0..20 mA and 4..20 mA ranges.

Overflow Control

Module BMXAMO0802 only allows an overflow control on current ranges.

The measurement range is divided in three areas:



Description:

Designation	Description
Nominal range	measurement range corresponding to the chosen range
Overflow area	area located beyond the upper threshold
Underflow area	area located below the lower threshold

Overflow values for the various ranges are as follows:

Range	BMXAMO0802					
	Underflow area		Nominal range		Overflow area	
0..20mA	-2,000	-1,001	-1,000	10,300	10,301	10,500
4..20mA	-1,600	-801	-800	10,300	10,301	10,500

You may also choose the flag for an overflow of the range upper value, for an underflow of the range lower value, or for both.

NOTE: Range under/overflow detection is optional.

Fallback/Maintain or Reset Outputs to Zero

If an error is detected, and depending on its seriousness, the outputs:

- switch to fallback/maintain position individually or together,
- are forced to 0 mA.

Various behaviors of outputs:

Detected error	Behavior of outputs
Task in STOP mode, or program missing	Fallback/Maintain (channel by channel)
Communication interruption	
Configuration error	0 mA (all channels)
Internal error in module	

Detected error	Behavior of outputs
Output value out-of-range (range under/ overflow)	Saturated value (channel by channel)
Output open circuit	Maintain (channel by channel)
Module hot swapping (processor in STOP mode)	0 mA (all channels)
Reloading program	

Fallback or Maintain at current value is selected during the configuration of the module.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Do not use the fallback position as the sole safety method. If an uncontrolled position can result in a hazard, install an independent redundant system.

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

⚠WARNING

INPUT / OUTPUT TRANSITION TO INIT VALUES

Design the system and the application to support safely the transition of inputs and outputs to their INIT values each time the application enters the running state), including after (pending applicable settings values):

- Run command
- Deploy command
- Restart runtime command
- Load boot project
- Physical device power on
- Application error detection
- Boot project error detection

Refer to the Operating States to fully understand all potential occurrences of a transition to the Running state and the associated settings.

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

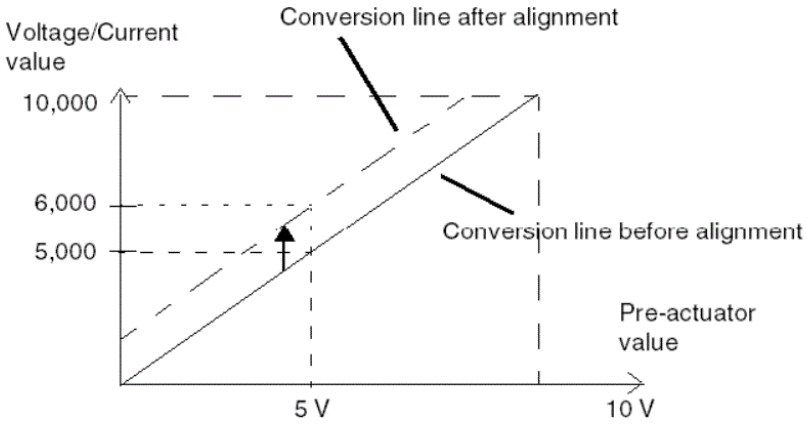
Behavior at Initial Power-Up and When Switched Off.

When the module is switched on or off, the outputs are set to 0 mA.

Actuator Alignment

The process consists of helping eliminate a systematic offset observed with a given actuator, around a specific operating point. This operation compensates for a detected error linked to the process. Therefore, replacing a module does not require a new alignment. However, replacing the actuator or changing the sensor's operating point does require a new alignment.

Conversion lines are as follows:



The alignment value is editable from a programming console, even if the program is in RUN mode. For each output channel, you can:

- view and modify the initial output target value
- save the alignment value
- determine whether the channel already has an alignment

The maximum offset between the measured value and the corrected output value (aligned value) may not exceed +/- 1.500.

NOTE: To align several analog channels on the BMXAMO/AMI/AMM/ART modules, we recommend proceeding channel by channel. Test each channel after alignment before moving to the next channel in order to apply the parameters correctly.

Wiring Precautions

Introduction

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

Cable Shielding

Connect the cable shielding to the grounding bar. Clamp the shielding to the shield bar on the module side. Use the shielding connection kit BMXXSP••••, page 234 to connect the shielding.

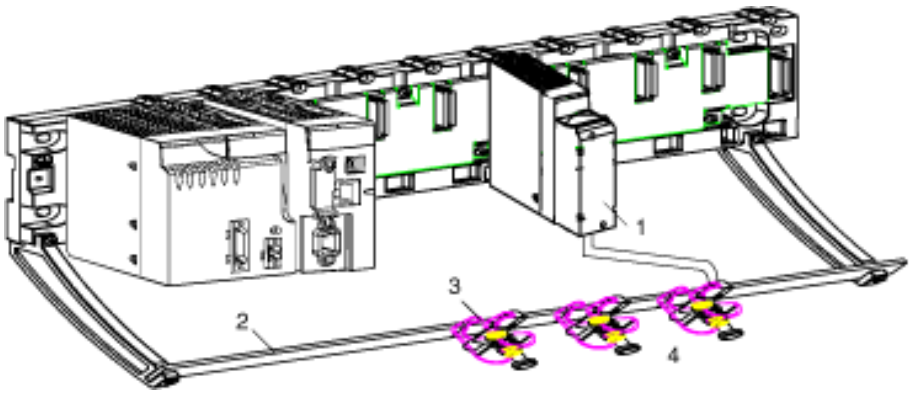
⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

While mounting / removing the modules:

- Make sure that each terminal block is still connected to the shield bar.
- Disconnect voltage supplying sensors and pre-actuators.

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



1 BMXAMO0802

2 Shield bar

3 Clamp

4 To pre-actuators

Using Pre-Actuators Referenced in Relation to the Ground

There are no specific technical constraints for referencing pre-actuators to the ground. It is nevertheless preferable to avoid returning a remote ground potential to the terminal that may be different to the ground potential close by.

NOTE: Sensors and other peripherals may be connected to a grounding point some distance from the module. Such remote ground references may carry considerable potential differences with respect to local ground. Induced currents do not affect the measurement or integrity of the system.

⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Ensure that sensors and other peripherals are not exposed through grounding points to voltage potential greater than acceptable limits.

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

Electromagnetic Hazard Instructions

Electromagnetic perturbations may lead to an unexpected behavior of the application.

⚠CAUTION

UNEXPECTED BEHAVIOR OF APPLICATION

To reduce electromagnetic perturbations, use the shielding connection kit BMXXSP••••, page 234 to connect the shielding without programmable filtering.

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

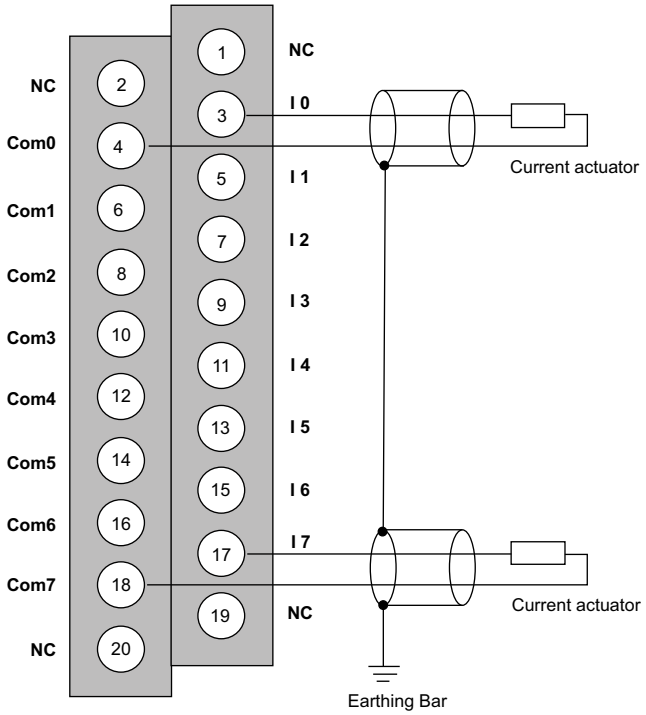
Wiring Diagram

Introduction

The actuators are connected using the 20-pin terminal block.

Illustration

The current loop is self-powered by the output and does not request any external supply. The terminal block connection and the actuators wiring are as follows:



Ix + pole input for channel x.

COMx - pole input for channel x, COMx are connected together internally.

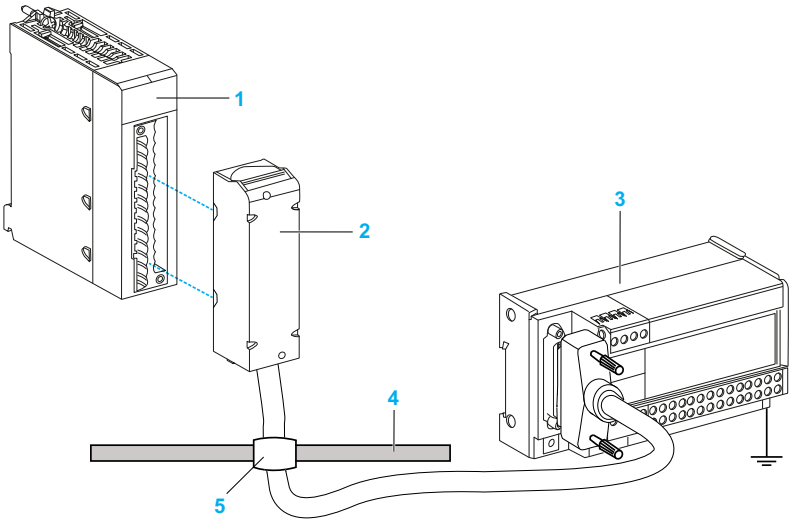
Wiring Accessories

Two BMXFTA152/302 cords are provided in two lengths (1.5m (4.92 ft) and 3m (9.84 ft)) to connect the module to a ABE7CPA02, page 163 Telefast interface.

Use of the TELEFAST Wiring Accessories

Introduction

The TELEFAST pre-wired system consists of connecting cables and interface sub-bases as shown below:



1 BMXAMO0802 module

2 BMXFTA••2 connecting cable

3 ABE-7CPA02 interface sub-base

4 Shield bar

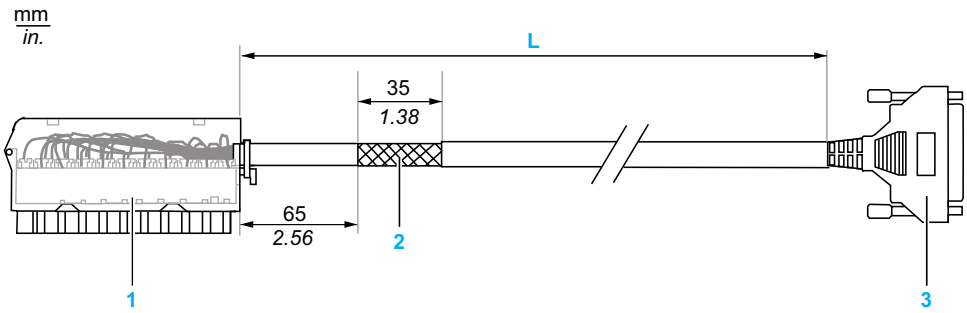
5 Clamp

BMX FTA ••2 Connecting Cables

The BMXFTA ••2 cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 20-pin terminal block from which extend 1 cable sheath containing 20 wires,
- At the other end a 25-pin Sub-D connector.

The figure below shows the BMXFTA ••2 cables:



1 BMXFTB2020 Terminal block

2 Cable shielding

3 25-pin Sub-D connector

L Length according to the part number.

The cable comes in 3 different lengths:

- 1.5 m (4.92 ft): BMXFTA152

- 3 m (9.84 ft): BMXFTA302

The following table gives the characteristics of the BMXFTA ••2 cables:

Characteristic		Value
Cable	Sheath material	PVC
	LSZH status	No
Environmental	Operating temperature	-25...70 °C (-13...158 °F)

Connecting Actuators

Actuators may be connected to the ABE-7CPA02 accessory as shown in the illustration, page 162.

The following table shows the distribution of analog channels on TELEFAST terminal blocks with the reference ABE-7CPA02:

TELEFAST terminal block number	25 pin Sub-D connector pin number	BMXA-MO0802 pin out	Signal type	TELEFAST terminal block number	25 pin Sub-D connector pin number	BMXA-MO0802 pin out	Signal type
1	/		Ground	Supp 1	/		Ground
2	/		STD (1)	Supp 2	/		Ground
3	/		STD (1)	Supp 3	/		Ground
4	/		STD (2)	Supp 4	/		Ground
100	1	3	I0	200	14	4	COM0
101	2		NC	201	/		Ground
102	15	5	I1	202	3	6	COM1
103	16		NC	203	/		Ground
104	4	7	I2	204	17	8	COM2
105	5		NC	205	/		Ground
106	18	9	I3	206	6	10	COM3
107	19		NC	207	/		Ground
108	7	11	I4	208	20	12	COM4
109	8		NC	209	/		Ground
110	21	13	I5	210	9	14	COM5
111	22		NC	211	/		Ground
112	10	15	I6	212	23	16	COM6
113	11		NC	213	/		Ground
114	24	17	I7	214	12	18	COM7
115	25		NC	215	/		Ground

Ix: + pole voltage input for channel x

COMx: - pole voltage or current input for channel x

NC: Not Connected

NOTE: Remove the strap from the ABE-7CPA02 terminal, otherwise the signal ground of channels will be connected with earth.

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

BMXART0814(H) Analog Input Module

What's in This Chapter

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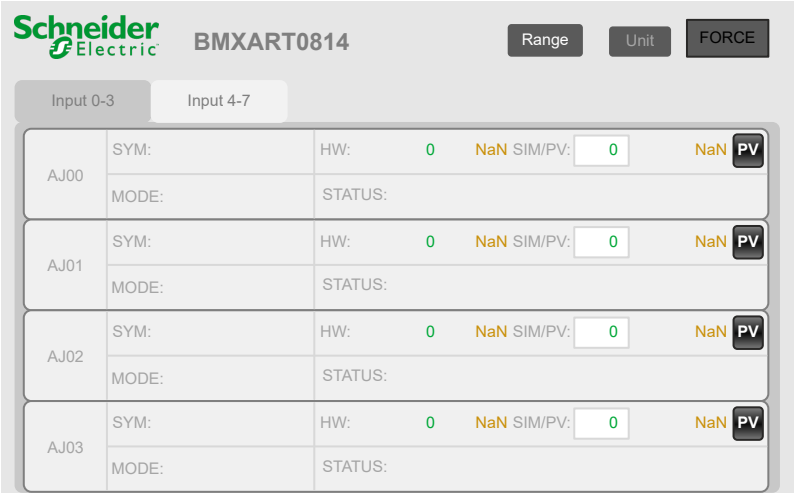
BMXART0814(H) sDefault

Abstract



BMXART0814H(H) fpDefault

Abstract



Description

NOTE: You cannot use your own range in the configuration process in EcoStruxure Automation Expert 21.1 or earlier. You can only use the **Manufacturing mode**.

Element	Description
Range	Button to activate Range mode for HW, SIM/PV display.
Unit	Button to activate Unit mode when pressed. Displays Hardware, SIM, and Force units defined by the MODE.
FORCE	Blue indicates that at least one channel is forced.

Analog input channel description:

Element	Description
AI##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.
PV F	Value indicator: • PV indicates that the channel is not forced. • F indicates that the channel is forced.
MODE	Type configured for the channel.
STATUS	Channel status.

Characteristics

Altitude Operating Conditions

The characteristics in the tables below apply to the modules BMXART0414(H) and BMXART0814(H) for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Characteristics

The general characteristics of the BMXART0414(H) and BMXART0814(H) modules are as follows:

Type of inputs		Isolated, RTD, thermocouple and voltage inputs
Nature of inputs		+/- 40 mV; +/- 80 mV; +/- 160 mV; +/- 320 mV; +/- 640 mV; 1.28 V
Operating temperature	**BMXART0414** **BMXART0814**	0...60 ºC (32...140 ºF)
	BMXART0414H **BMXART0814H**	-25...70 ºC (-13...158 ºF)
Number of channels	**BMXART0414(H)**	4
	BMXART0814(H)	8
Acquisition cycle time	**BMXART0414(H)**	400 ms / 4 channels
	BMXART0814(H)	400 ms / 8 channels
Conversion method		ΣΔ
Resolution		15-bit + sign
Isolation: • **Between channels** • **Between channels and bus** • **Between channels and ground**		• 750 Vdc • 1400 Vdc • 750 Vdc
Maximum authorized over voltage for inputs		+/- 7.5 Vdc
Cold junction compensation		• Internal compensation using the dedicated TELEFAST ABE-7CPA412 wiring accessory, including a sensor. • External compensation dedicating channel 0 to a 2/3-wires Pt100 for CJC. • External compensation using the CJC values of channels 4/7 for channels 0/3. In this case, only one sensor is needed.
Input filter		Low pass filter (1st order numerical)
Rejection in differential mode (50/60 Hz)		Typical 60 dB
Common mode rejection (50/60 Hz)		Typical 120 dB
BMXART0414(H)		
Power consumption (3.3 V)	**Typical**	0.32 W
	Maximum	0.48 W
Power consumption (24 V)	**Typical**	0.47 W
	Maximum	1.20 W

BMXART0814(H)		
Power consumption (3.3 V)	**Typical**	0.32 W
	Maximum	0.48 W
Power consumption (24 V)	**Typical**	1.00 W
	Maximum	1.65 W

Voltage Input Characteristics

The characteristics of the voltage inputs of the BMXART0414(H) and BMXART0814(H) modules are as follows:

Voltage range:	+/- 40 mV; +/- 80 mV; +/- 160 mV; +/- 320 mV; +/- 640 mV; 1.28 V
Input impedance:	Typical 10 MOhms
Maximum converted value:	+/- 102.4%
Maximum resolution:	2.4 µV in the range +/- 40 mV
Detected measurement error for standard module:	
• **At 25 °C (77 °F)**	0.05% of FS (1)
• **Maximum in the temperature range 0...60 °C (32...140 °F)**	0.15% of FS (1)
Detected measurement error for Hardened module:	
• **At 25 °C (77 °F)**	0.05% of FS (1)
• **Maximum in the temperature range -25...70 °C (-13...140 ° F)**	0.20% of FS (1)
Temperature drift:	
	30 ppm/°C
Legend: (1) FS: Full Scale	

RTD Input Characteristics

The characteristics of the RTD inputs of the BMXART0414(H) and BMXART0814 (H) modules are as follows:

RTD	**Pt100**	**Pt1000**	**Ni100**	**Ni1000**	**Cu10**	**CU50**	**CU100**
Measurement range	According to IEC -175... +825°C (-347...+1517°F) According to US/JIS: -87 +437°C (-125...+819°F)		-54...+174°C (-65...+345°F)		-91...+251°C (-132... +484°F)	-200...+200°C (-328...+392)	
Resolution	0.1°C (0.2°F)						
Detection type	Open circuit (detection on each channel)						
Detected error at 25 °C (77 °F) (1)	+/- 2.1 °C (+/- 3.8°F)		+/- 2.1 °C (+/- 3.8°F)	+/- 0.7°C (+/- 1.3°F)	+/- 4 °C (+/- 7.2°F)	+/- 2.1°C (+/- 3.8°F)	

RTD	Pt100	Pt1000	Ni100	Ni1000	Cu10	CU50	CU100
Maximum detected error for standard modules in the temperature range 0...60° C (32...140 ° F) (2)	+/- 3 °C (+/- 5.4°F)		+/- 3 °C (+/- 5.4°F)	+/- 0.7°C (+/- 1.3°F)	+/- 4 °C (+/- 7.2°F)	+/- 3°C (+/- 5.4°F)	
Maximum detected error for hardened modules in the temperature range -25...70 °C (-13...140 °F) (2)	+/- 3 °C (+/- 5.4°F)		+/- 3.5°C (+/- 6.3°F)	+/- 1.15°C (+/- 2.1°F)	+/- 4.5°C (+/- 8.1°F)	+/- 3.5°C (+/- 6.3°F)	
Maximum wiring resistance:							
• **4-wire**	50 Ω	500 Ω	50 Ω	500 Ω	50 Ω	50 Ω	
• **2/3-wire**	20 Ω	200 Ω	20 Ω	200 Ω	20 Ω	20 Ω	
Temperature drift:							
	30 ppm/°C						

Legend

(1) detected errors caused by the wiring, +/- 1°C (0.2°F) in the range -100...+200°C (-148...+392°F) for Pt100

(2) See detailed detected errors in the temperature point topic, page 185.

Thermocouple Input Characteristics

This table presents the general characteristics of the thermocouple inputs of the BMXART0414(H) and BMXART0814(H) modules:

Thermocouples	B	E	J	K	L
Measurement range	+171... +1,779°C (340... 3234°F)	-240... +970°C (-400... 1778°F)	-177... +737°C (-287... 1359°F)	-231... +1,331°C (-384... 2428°F)	-174... +874°C (-281... 1605°F)
Thermocouples	**N**	**R**	**S**	**T**	**U**
Measurement range	-232 +1,262°C (-386... 2304°F)	-9... +1,727°C (16... 3234°F)	-9... +1,727°C (-16... 141°F)	-254... +384°C (-425... 723°F)	-181... +581°C (-294... 1078°F)
Resolution	0.1°C (0.2°F)				
Detection type	Open circuit (detection on each channel)				
Detected error at 25°C	+/- 3.2°C for J, L, R, S and U types (see Thermocouple Ranges, page 187 for detailed detected errors at temperature point for each type); +/- 3.7°C for B, E, K, N and T types				
Maximum detected error for standard modules in the temperature range 0...60°C (32...140°F) (2)	+/- 4.5°C (+/-8.1°F) for types: J, L, R, S and U; +/- 5°C (+/-9°F) for types: B, E, K, N and T (using the TELEFAST accessory with its internal cold junction compensation).				
Maximum detected error for hardened modules in the temperature range -25...70 °C (-13...140 °F) (2)	+/- 5.5°C (+/-9°F) for types: J, L, R, S and U; +/- 6°C (+/-10.8°F) for types: B, E, K, N and T (using the TELEFAST accessory with its internal cold junction compensation).				
Temperature drift	30 ppm/°C				

Resistive Input Characteristics

The characteristics of the resistive inputs of the BMXART0414(H) and BMXART0814(H) are as follows:

Range	400 Ω; 4000 Ω
Type measurement	2, 3, 4 wires
Maximum resolution	12.5 mΩ in the range 400 Ω 125 mΩ in the range 4000 Ω
Detected measurement error for standard module:	
• **At 25 °C (77 °F)**	0.12% of FS (1)
• **Maximum in the temperature range 0...60 °C (32...140 °F)**	0.2% of FS (1)
Detected measurement error for ruggedized module:	
• **At 25 °C (77 °F)**	0.12% of FS (1)
• **Maximum in the temperature range -25...70 °C (-13...140 °F)**	0.3% of FS (1)
Temperature drift	25 ppm/°C
Legend: (1) FS: Full Scale	

Presentation

Function

The BMX ART 0414/0814 modules are multi-range acquisition devices with four inputs for the 0414 and eight inputs for the 0814. The inputs are isolated from each other. These modules offer the following ranges for each input, according to the selection made at configuration:

- RTD IEC Pt100/Pt1000, US/JIS Pt100/Pt1000, Cu10, Cu50, Cu100, Ni100/Ni1000 in 2, 3 or 4 wires
- thermocouple B, E, J, K, L, N, R, S, T, U
- voltage +/- 40 mV to 1.28 V.

Ruggedized Versions

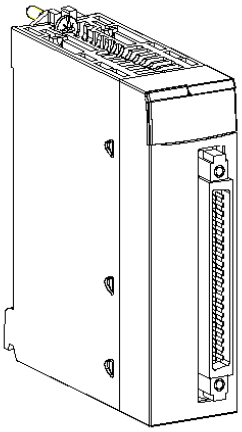
The BMXART0414H and BMXART0814H (hardened) equipment are respectively the ruggedized versions of the BMXART0414 and the BMXART0814 (standard) equipment. They can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

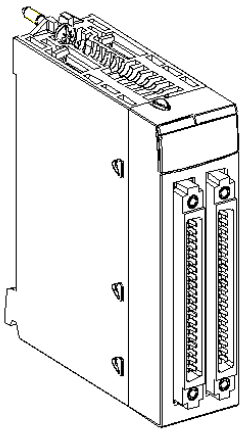
Illustration

The BMX ART 0414/0814 analog input modules looks like this:

BMX ART 0414



BMX ART 0814



Analog Input Values

Description

For RTD and TC sensors, the data is a multiple of 10 of the real temperature in °C or °F. The last digit represents 0.1°C or 0.1°F.

For millivoltmeter, the data ranges from 40 mV, 320 mV to 1280 mV and is also a multiple of 10 of the real measurement. The last digit represents 10 nV.

For millivoltmeter, the data range of 640 mV is a multiple of 100 of the real measurement. The last digit represents 100 nV.

RTD Ranges

The table below presents the ranges for the RTD sensors (values in brackets are in 1/10°F).

Range	Under flow	Lower scale	Upper scale	Over flow
Pt100 IEC 751-1995, JIS C1604-1997 (2/4 wires)	-1990 (-3260)	-1750 (-2830)	8250 (15170)	8490 (15600)
Pt1000 IEC 751-1995, JIS C1604-1997 (2/4 wires)	-1990 (-3260)	-1750 (-2830)	8250 (15170)	8490 (15600)
Ni100 DIN43760-1987 (2/4 wires)	-590 (-750)	-540 (-660)	1740 (3460)	1790 (3550)
Ni1000 DIN43760-1987 (2/4 wires)	-590 (-750)	-540 (-660)	1740 (3460)	1790 (3550)
Pt100 IEC 751-1995, JIS C1604-1997 (3 wires)	-1990 (-3260)	-1750 (-2830)	8250 (15170)	8490 (15600)

Range	Under flow	Lower scale	Upper scale	Over flow
Pt1000 IEC 751-1995, JIS C1604-1997 (3 wires)	-1990 (-3260)	-1750 (-2830)	8250 (15170)	8490 (15600)
Ni100 DIN43760-1987 (3 wires)	-590 (-750)	-540 (-660)	1740 (3460)	1790 (3550)
Ni1000 DIN43760-1987 (3 wires)	-590 (-750)	-540 (-660)	1740 (3460)	1790 (3550)
JPt100 JIS C1604-1981, JIS C1606-1989 (2/4 wires)	-990 (-1460)	-870 (-1240)	4370 (8180)	4490 (8400)
JPt1000 JIS C1604-1981, JIS C1606-1989 (2/4 wires)	-990 (-1460)	-870 (-1240)	4370 (8180)	4490 (8400)
JPt100 JIS C1604-1981, JIS C1606-1989 (3 wires)	-990 (-1460)	-870 (-1240)	4370 (8180)	4490 (8400)
JPt1000 JIS C1604-1981, JIS C1606-1989 (3 wires)	-990 (-1460)	-870 (-1240)	4370 (8180)	4490 (8400)
Cu10 (2/4 wires)	-990 (-1460)	-910 (-1320)	2510 (4840)	2590 (4980)
Cu10 (3 wires)	-990 (-1460)	-910 (-1320)	2510 (4840)	2590 (4980)

TC Ranges

The table below presents the ranges for the TC sensors (values in brackets are in (1/10°F).

Range	Under flow	Lower scale	Upper scale	Over flow
Type J	-1980 (-3260)	-1770 (-2870)	7370 (13590)	7580 (13980)
Type K	-2680 (-4500)	-2310 (-3830)	13310 (24270)	13680 (24940)
Type E	-2690 (-4510)	-2400 (-3990)	9700 (17770)	9990 (18290)
Type T	-2690 (-4520)	-2540 (-4250)	3840 (7230)	3990 (7500)
Type S	-500 (-540)	-90 (160)	17270 (29550)	17680 (30250)
Type R	-500 (-540)	-90 (160)	17270 (29550)	17680 (30250)
Type B	1320 (2700)	1710 (3390)	17790 (32000)	18170 (32000)
Type N	-2670 (-4500)	-2320 (-3860)	12620 (23040)	12970 (23680)

Range	Under flow	Lower scale	Upper scale	Over flow
Type U	-1990 (-3250)	-1810 (-2930)	5810 (10770)	5990 (11090)
Type L	-1990 (-3250)	-1740 (-2800)	8740 (16040)	8990 (16490)

Voltage Ranges

The table below presents the voltage ranges default values.

Range	Under flow	Lower scale	Upper scale	Over flow
+/- 40 mV	-4192	-4000	4000	4192
+/- 80 mV	-8384	-8000	8000	8384
+/- 160 mV	-16768	-16000	16000	16768
+/- 320 mV	-32000	-32000	32000	32000
+/- 640 mV	-6707	-6400	6400	6707
+/- 1280 mV	-13414	-12800	12800	13414

Resistance Ranges

The table below presents the resistance ranges default values.

Range	Under flow	Lower scale	Upper scale	Over flow
0-400 Ohms 2/4 wires	0	0	4000	4096
0-4000 Ohms 2/4 wires	0	0	4000	4096
0-400 Ohms 3 wires	0	0	4000	4096
0-4000 Ohms 3 wires	0	0	4000	4096

Functional Description

Introduction

The BMXART0414/814 modules are multi-range acquisition devices with:

- four inputs for the BMXART0414 module
- eight inputs for the BMXART0814 module

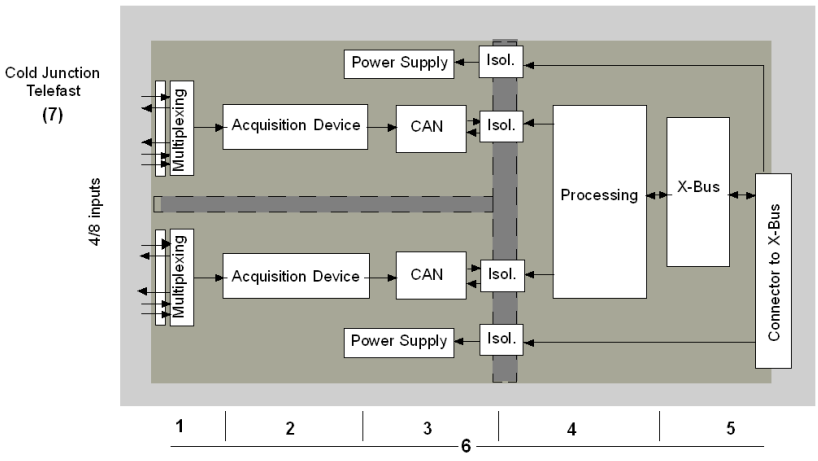
Both modules offer the following ranges for each input, according to the selection made during configuration:

- RTD: IEC Pt100, IEC Pt1000, US/JIS Pt100, US/JIS Pt1000, Copper CU10, Ni100 or Ni1000
- thermocouple: B, E, J, K, L, N, R, S, T, or U
- voltage: +/- 80 mV, +/- 80 mV, +/- 160 mV, +/- 320 mV, +/- 640 mV, +/- 1.28 V
- ohms: 0..400 Ω, 0..4000 Ω

NOTE: The TELEFAST2 accessory referenced **ABE-7CPA412** facilitates connection and provides a cold junction compensation device.

Illustration

The BMXART0414/0814 input modules perform the following functions.



Details of the functions are as follows.

Address	Element	Function
1	Adapting the inputs	Adaptation consists in a common mode and differential mode filter. Protection resistors on the inputs can withstand voltage spikes of up to +/- 7.5 V. A layer of multiplexing allows self-calibration of the acquisition device offset, as close as possible to the input terminal, as well as selecting the cold junction compensation sensor included in the TELEFAST housing.
2	Amplifying input signals	Built around a weak-offset amplifier internal to the A/N converter. A current generator helps ensure the RTD resistance measurement.
3	Conversion	The converter receives the signal issued from an input channel or from the cold junction compensation. Conversion is based on a Σ Δ 16 -bit converter. There is a converter for each input.
4	Transforming incoming values into workable measurements for the user	• recalibration and alignment coefficients to be applied to measurements, as well as the module's self-calibration coefficients • (numeric) filtering of measurements, based on configuration parameters • scaling of measurements, based on configuration parameters
5	Communicating with the application	• manages exchanges with controller • topological addressing • receiving configuration parameters from module and channels • sending measured values, as well as module status, to the application
6	Module monitoring and sending detected error notification back to application	• conversion string test • range under/overflow on channels and cold junction compensation process test • watchdog test
7	Cold junction compensation	• internal compensation using the TELEFAST ABE-7CPA412 • external compensation by Pt100 • external compensation using the CJC values of channels 4/7 for channels 0/3. In this case, only one sensor is needed

Display of Electrical Range Measurements

Measurements may be displayed using standardized display (in %, to two decimal places).

Type of Range	Display
Bipolar range	from -10,000 to +10,000 (-100.00 % to +100.00 %)

It is also possible to define the range of values within which measurements are expressed, by selecting:

- the lower threshold corresponding to the minimum value for the range -100.00 %
- the upper threshold corresponding to the maximum value for the range +100.00 %

These lower and upper thresholds are integers between -32,768 and 32,768.

Display of Temperature Range Measurements

Measurements provided to the application are directly usable. It is possible to choose either "In Temperature" Display or Standardized display:

- for "In Temperature" display mode, values are provided in tenths of a degree (Celsius or Fahrenheit, depending on the unit you have selected).
- for the user-specified display, you may choose a Standardized Display 0...10,000 (meaning from 0 to 100.00 %), by specifying the minimum and maximum temperatures as expressed in the 0 to 10,000 range.

Measurement Filtering

The type of filtering performed by the system is called *first order filtering*. The filtering coefficient can be modified from a programming console or via the program.

The mathematical formula used is as follows:

$Meas_{f(n)} = \alpha \times Meas_{f(n-1)} + (1–\alpha) \times Val_{b(n)}$

where:

α = efficiency of the filter

$Meas_{f(n)}$ = measurement filtered at moment n

$Meas_{f(n-1)}$ = measurement filtered at moment n-1

$Val_{b(n)}$ = gross value at moment n

You may configure the filtering value from seven possibilities (from 0 to 6). **This value may be changed even when the application is in RUN mode**.

NOTE: Filtering may be accessed in normal or fast cycle.

The filtering values are as follows. They depend on the sensor type. T is a cycle time of 200 ms for TC and mV. T is also a cycle time of 400 ms for RTD and Ohms.

Desired Efficiency	Required Value	Corresponding α	Filter Response Time at 63%	Cut-off Frequency (in Hz)
No filtering	0	0	0	0
Low filtering	1	0.750	4 x T	0.040 / T
	2	0.875	8 x T	0.020 / T
Medium filtering	3	0.937	16 x T	0.010 / T
	4	0.969	32 x T	0.005 / T
High filtering	5	0.984	64 x T	0.025 / T
	6	0.992	128 x T	0.012 / T

The values may be displayed using standardized display (in %, to two decimal places).

Type of Range	Display
Unipolar	from 0 to 10,000 (0 % at +100.00 %)
Bipolar	from -10,000 to 10,000 (-100.00 % to +100.00 %)

The user may also define the range of values within which measurements are expressed, by selecting:

- the lower threshold corresponding to the minimum value for the range -100.00 %
- the upper threshold corresponding to the maximum value for the range +100.00 %.

These lower and upper thresholds are integers between -32,768 and +32,767.

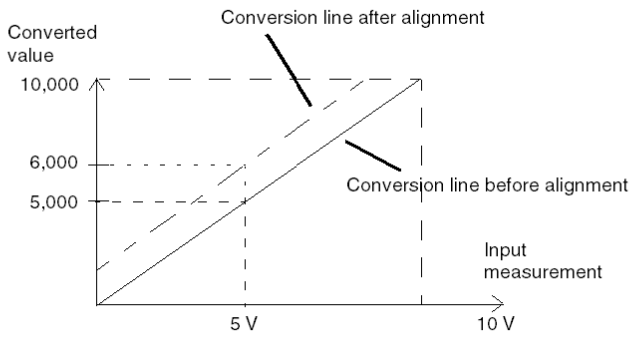
Frequency 50/60 Hz Rejection

Depending on the country, the user can configure the frequency rejection of main power harmonics by adapting the speed of sigma delta converter.

Sensor Alignment

The process of *alignment* consists of helping eliminate a systematic offset observed with a given sensor, around a specific operating point. This operation compensates for a detected error linked to the process. Therefore, replacing a module does not require a new alignment. However, replacing the sensor or changing the sensor's operating point does require a new alignment.

Conversion lines are as follows:



The alignment value is editable from a programming console, even if the program is in RUN mode. For each input channel, you can:

- View and modify the desired measurement value.
- Save the alignment value.
- Determine whether the channel already has an alignment.

The alignment offset may also be modified through programming.

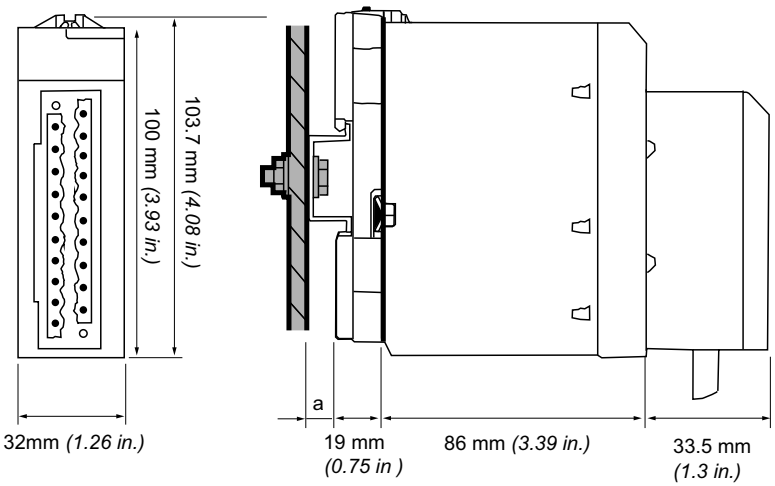
Channel alignment is performed on the channel in standard operating mode, without any effect on the channel's operating modes.

The maximum offset between measured value and desired (aligned) value may not exceed +/-1,500.

NOTE: To align several analog channels on the BMXART/AMO/AMI/AMM modules, we recommend proceeding channel by channel. Test each channel after alignment before moving to the next channel in order to apply the parameters correctly.

Dimensions

General Presentation



a Backplane depth: the value depends on the backplane type used in your platform.

Dimensions

Module reference	Module dimensions			Installation depth(1)
	Width	Height	Depth	
BMEAHI0812(H)	32 mm (1.26 in.)	103.7 mm (4.08 in.)	86 mm (3.39 in.)	119.5 mm (4.69 in.)(1)
BMEAHO0412(C)				
(1) backplane depth (a) is not included.				

NOTE: Connectors that are delivered with the X80 HART analog I/O modules (20-pin removable terminal blocks) and the corresponding pre-assembled cordsets (BMXFTW*01S) have the same dimensions.

NOTE: Consider clearance for cable installation and spacing around the racks.

Wiring Precautions

Introduction

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

Cable Shielding

- Connection at the FCN connectors:

  Given that there are a large number of channels, a cable of at least ten twisted pairs is used, with general shielding (outside diameter 10 mm maximum), fitted with one or two male 40-pin FCN connectors for direct connection to the module.

  Connect the cable shielding to the grounding bar. Clamp the shielding to the grounding bar on the module side. Use the shielding connection kit BMXXSP••••, page 234 to connect the shielding.

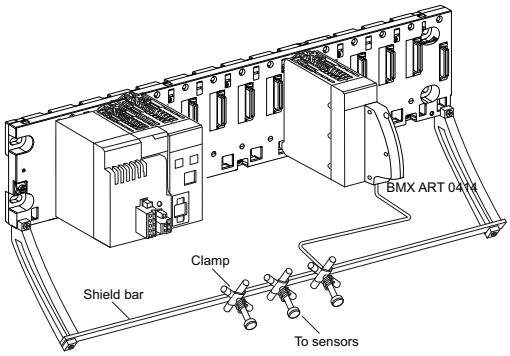
⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

While mounting / removing the modules:

- Make sure that each terminal block is still connected to the shield bar.
- Disconnect voltage supplying sensors and pre-actuators.

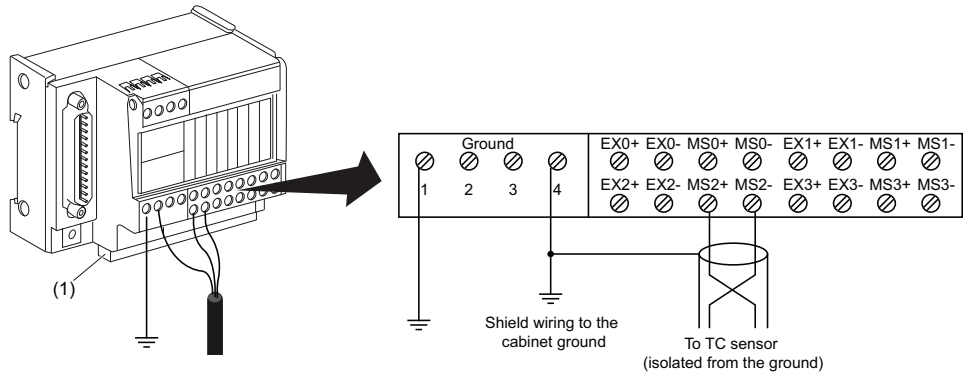
Failure to follow these instructions will result in death or serious injury.



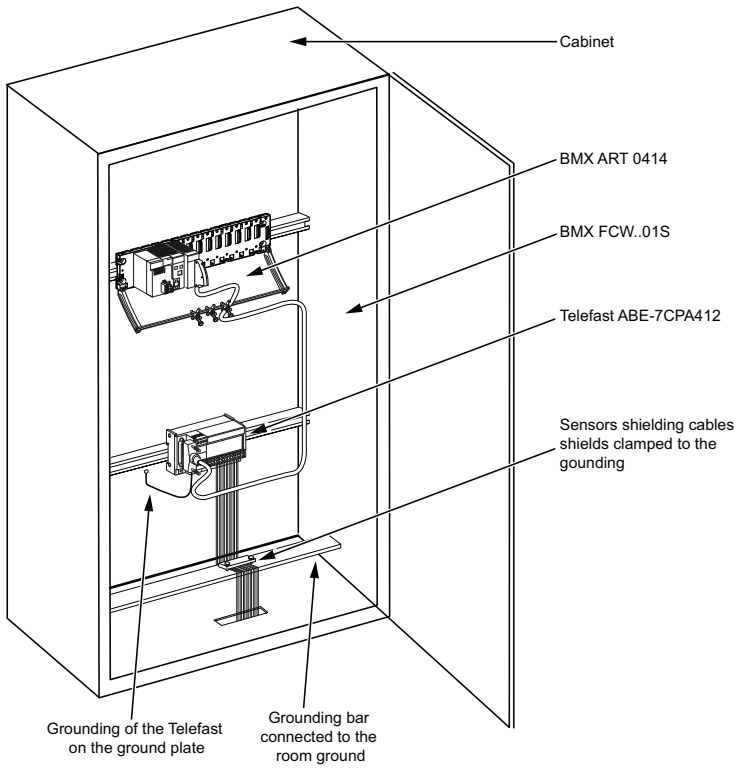
- TELEFAST connection:

  Connect the sensor cable shielding to the terminals provided and the whole assembly to the cabinet ground.

Telefast ABE-7CPA412



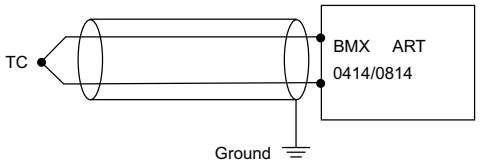
The grounding of cables is facilited using the ABE-7BV10 accessory.



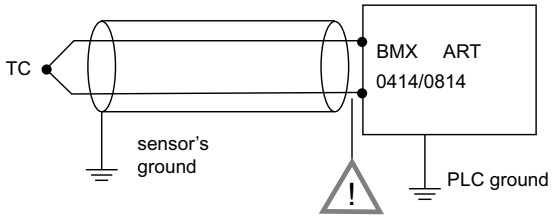
Sensors Shielding

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

- If sensors are isolated from ground, confirm that all the shields of the sensor cables are referenced to the Telefast/controller ground.

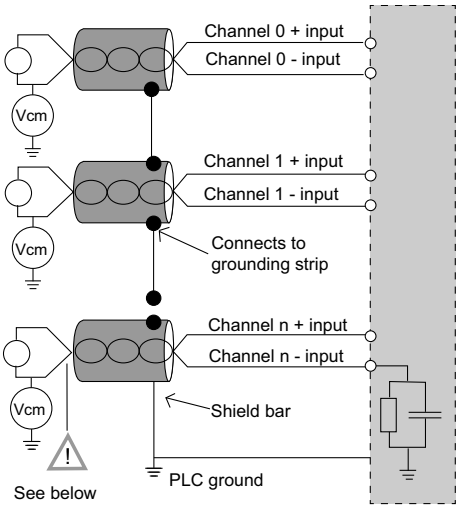


- if sensors are referenced to the sensor ground which is far from controller ground, confirm that all the shields of the sensor cables are referenced to the sensors ground to help eliminate the ground loop path.



Using the Sensors Isolated from the Ground

The sensors are connected according to the following diagram:



If the sensors are referenced in relation to the ground, this may in some cases return a remote ground potential to the terminals or the FCN connector. Follow these rules:

- Confirm that the potential is less than the permitted low voltage: for example, 30 Vrms or 42.4 VDC.
- Setting a sensor point to a reference potential generates a leakage current. Check that all leakage currents generated do not disturb the system.

NOTE: Sensors and other peripherals may be connected to a grounding point some distance from the module. Such remote ground references may carry considerable potential differences with respect to local ground. Induced currents do not affect the measurement or integrity of the system.

⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Ensure that sensors and others peripherals are not exposed through grounding points to voltage potential greater than acceptable limits.

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

Electromagnetic Hazard Instructions

NOTE: Electromagnetic perturbations may lead to an unexpected behavior of the application.

⚠CAUTION

UNEXPECTED BEHAVIOR OF APPLICATION

To reduce electromagnetic perturbations, use the shielding connection kit BMXXSP••••, page 234 to connect the shielding.

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

Wiring Diagram

Introduction

The BMXART0414 input module consists of a 40-pin FCN connector.

The BMXART0814 input module consists of two 40-pin FCN connectors.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Take every precaution at the installation to prevent any subsequent mistake in the connectors. Plugging the wrong connector would cause an unexpected behavior of the application.

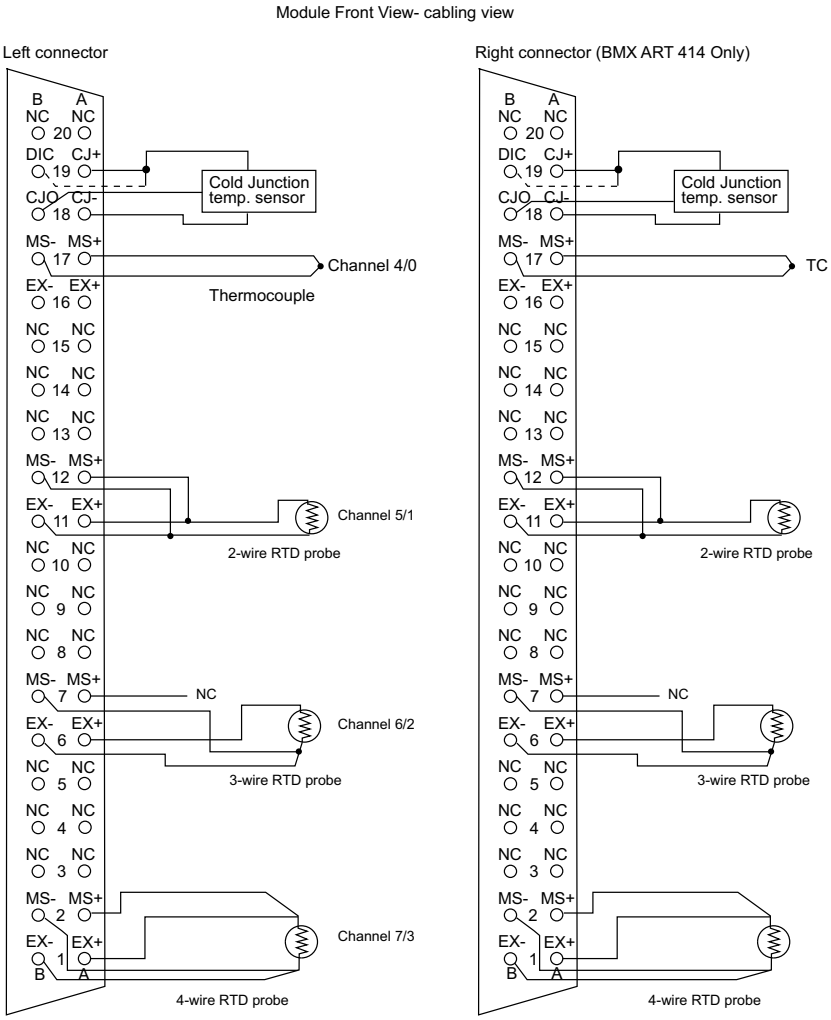
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Connector Pin Assignment and Sensors Wiring

This example uses a probe configuration with:

- Channel 0/4: Thermocouple
- Channel 1/5: 2-wire RTD
- Channel 2/6: 3-wire RTD
- Channel 3/7: 4-wire RTD

The pin assignment for the 40-pin FCN connector and the sensors wiring is shown below:



MS+: RTD Measure + input / Thermocouple + input

MS-: RTD Measure - input / Thermocouple - input

EX+: RTD probe current generator + output

EX-: RTD probe current generator - output

NC: Not connected

DtC: The CJC sensor detection input is connected to CJ+ if the sensor type is DS600. It is not connected (NC) if the sensor type is LM31.

NOTE: The CJC sensor is needed for TC only.

Cold Junction Compensation

For each block of 4 channels (channels 0 to 3 and channels 4 to 7), the external compensation of the module is performed in the TELEFAST ABE-7CPA412 accessory. This device provides a voltage in mV corresponding to:

Voltage = (6.45 mV * T) + 509 mV (where T = temperature in °C).

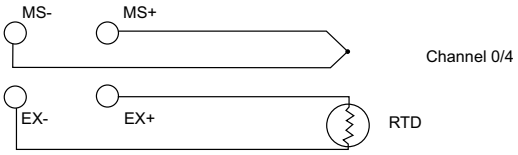
The overall margin of detected error when using this device is reduced to 1.2°C in the -5°C to +60°C temperature range.

It is possible to increase the precision of the compensation by using a 2/3-wires Pt100 probe directly connected to channels 0 and 4 (only for the BMXART0814) on the module or connected to the TELEFAST terminal blocks. Channel 0 is thus

dedicated to the cold junction compensation of channels 1, 2 and 3. channel 4 is thus dedicated to channels 4 to 7.

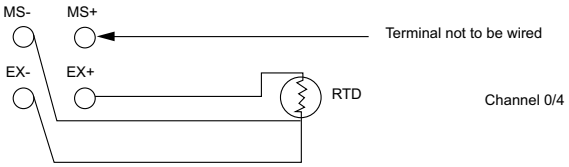
It is also possible, by using a 2-wire Pt100 probe, provided the initial length of the probe is limited, to maintain channel 0 as a thermocouple input.

The wiring would then look like this:



The wiring is only valid if the channel 0 is used. If the channel 0 is not used, select a cold junction with external Pt100. The range of the channel 0 is changed to a 3-wire Pt100 probe.

The wiring would then look like this:

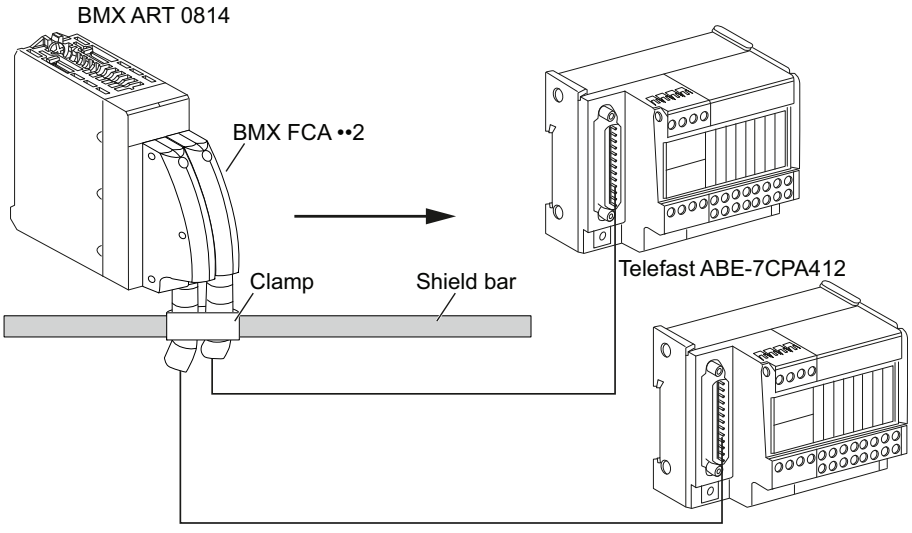


NOTE: For the BMXART0814 module, the CJC values of channels 4 to 7 can also be used for channels 0 to 3. Therefore, only one external CJC, page 183 sensor is wired on channel 4.

TELEFAST Wiring Accessories

Introduction

The TELEFAST pre-wired system consists of connecting cables and interface sub-bases as shown:



The TELEFAST ABE-7CPA412 accessory is a base unit used to connect 4-channel analog modules to screw terminal blocks.

NOTE: When the cabinet where the TELEFAST ABE-7CPA412 accessory is located and powered up, wait at least 45mn to achieve full precision of the CJC compensation. It is not necessary to wait 45 min if the compensation is performed by an external Pt100 probe.

When using the TELEFAST ABE-7CPA412's cold junction compensation, in order to help guarantee you achieve the indicated level of precision, confirm that the movement of air around the TELEFAST ABE-7CPA412 does not exceed 0.1 m/s. Confirm that temperature variations do not exceed 10°C/hour and the TELEFAST ABE-7CPA412 is placed at least 100mm away from all heat sources.

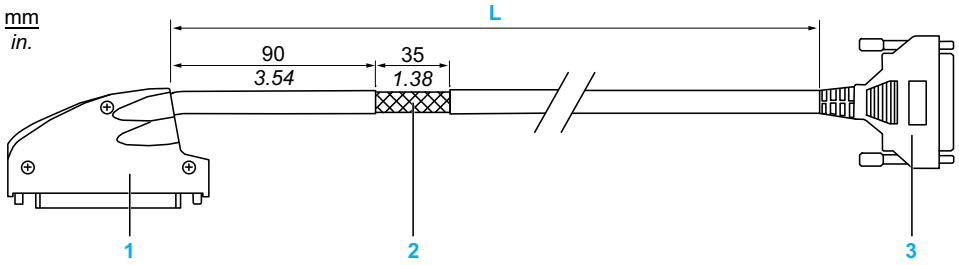
The TELEFAST ABE-7CPA412 can be operated from -40°C to +80°C external temperature.

Connecting Cables

The BMX FCA ••2 cables are pre-assembled cord set, made up of:

- At one end, a 40-pin connector (FCN type) from which extend 1 cable sheath containing 20 wires,
- At the other end a 25-pin Sub-D connector.

The figure below shows the BMX FCA ••2 cables:



1 40-pin connector, FCN type

2 Cable shielding

3 25-pin Sub-D connector

L Length according to the part number.

The cable comes in three different lengths:

- 1.5 m (4.92 ft): BMX FCA 152
- 3 m (9.84 ft): BMX FCA 302
- 5 m (16.40 ft): BMX FCA 502

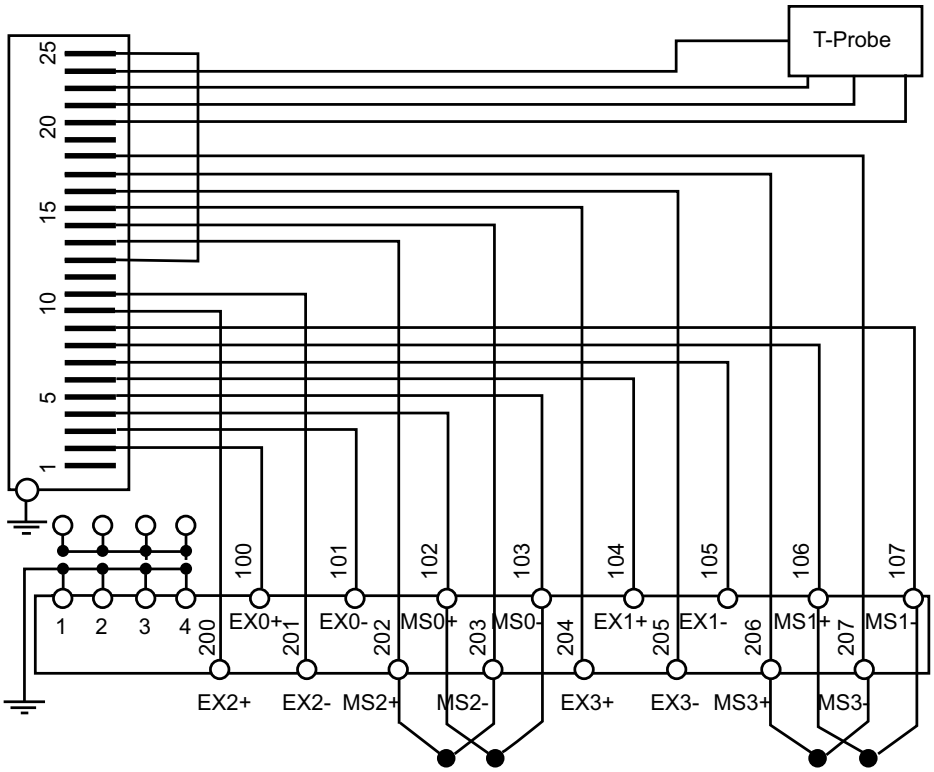
The following table gives the characteristics of the BMX FCA ••2 cables:

Characteristic		**Value**
Cable	Sheath material	PVC
	LSZH status	No
Environmental	Operating temperature	-25...70 °C (-13...158 °F)

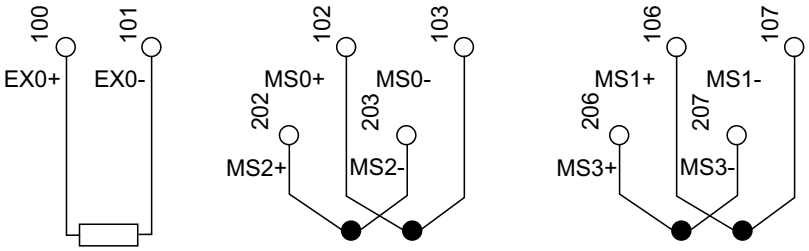
Connecting Sensors

Sensors may be connected to the TELEFAST ABE-7CPA412 accessory as shown in this illustration, page 177.

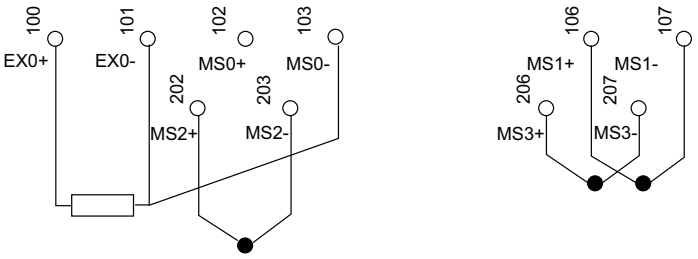
Wirings



Legend: Operating in TC mode with Telefast internal cold junction compensation.



Legend: Operating in TC mode with cold junction compensation using a 2-wire PT100 probe.



Legend: Operating in TC mode with cold junction compensation using a 3-wire PT100 probe.

RTD Ranges

Introduction

The following table presents the maximum margin of detected error, at 25°C, of the Pt100, Pt1000, and Ni1000 RTD ranges.

Temperature		Pt100 RTD	Pt1000 RTD	Ni1000 RTD
Display resolution		**0.1°C**	**0.1°C**	**0.1°C**
Detected maximum error at 25°C (1)				
Operating point	**-100°C**	0.8°C	1.6°C	0.4°C
	0°C	0.8°C	1.6°C	0.5°C
	100°C	0.8°C	1.6°C	0.7°C
	200°C	1.0°C	2°C	0.6°C
	300°C	1.2°C	2.4°C	
	400°C	1.3°C	2.8°C	
	500°C	1.5°C	3.3°C	
	600°C	1.7°C	3.6°C	
	700°C	1.9°C	4.1°C	
	800°C	2.1°C	4.5°C	
Input dynamic		-175..825°C -283..1,517°F	-175..825°C -283..1,517°F	-54..174°C -66..346°F
Legend:				
(1) Ambient temperature				

NOTE: The precision values are provided for a 3/4-wire connection and include the detected errors and drift of the 1.13 mA (Pt100) or 0.24 mA (Pt1000 or Ni1000) current source.

The effects of self-heating do not introduce any significant detected error to the measurement, whether the probe is in the air or under water.

The table below presents the maximum margin of detected error, between 0 and 60°C, of the Pt100, Pt1000, and Ni1000 RTD ranges.

Temperature		Pt100 RTD	Pt1000 RTD	Ni1000 RTD
Display resolution		**0.1°C**	**0.1°C**	**0.1°C**
Maximum detected error from 0 to 60°C				
Operating point	**-100°C**	1°C	2°C	0.8
	0°C	1°C	2°C	0.9°C
	100°C	1°C	2°C	1.1°C
	200°C	1.2°C	2.4°C	1.3°C
	300°C	1.5°C	3°C	
	400°C	1.8°C	3.6°C	
	500°C	2°C	4°C	
	600°C	2.3°C	4.6°C	
	700°C	2.5°C	5°C	
	800°C	2.8°C	5.6°C	
Input dynamic		-175..825°C -283..1,517°F	-175..825°C -283..1,517°F	-54..174°C -66..346°F

NOTE: The precision values are provided for 4-wire connection and include the detected errors and drift of the 1.13 mA (Pt100) or 0.24 mA (Pt1000 or Ni1000) current source.

The effects of self-heating do not introduce any significant detected error to the measurement, whether the probe is in the air or under water.

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

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

Reference standards:

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

Thermocouple Ranges in Degrees Celsius

Introduction

The following tables describe the measuring device errors that are detected for the various thermocouples B, E, J, K, N, R, S and T **in degrees Celsius**.

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

Thermocouples B, E, J, and K

The following table describes the maximum detected error values for thermocouples B, E, J, and K at 25°C.

Temperature		Thermocouple B		Thermocouple E		Thermocouple J		Thermocouple K	
Maximum detected error at 25°C (1)		TFAS-T	Pt100	TFAST	Pt100	TFAS-T	Pt100	TFAST	Pt100
Operating point	-200°C			3.7°C	2.5°C			3.7°C	2.5°C
	-100°C			2.6°C	2.4°C	2.6°C	2.4°C	2.6°C	2.4°C
	0°C			2.5°C	2.3°C	2.5°C	2.3°C	2.5°C	2.3°C
	100°C			2.6°C	2.4°C	2.6°C	2.4°C	2.6°C	2.4°C
	200°C	3.5°C	3.4°C	2.6°C	2.4°C	2.6°C	2.4°C	2.6°C	2.5°C
	300°C	3.2°C	3.0°C	2.7°C	2.5°C	2.7°C	2.5°C	2.6°C	2.4°C
	400°C	3.0°C	2.8°C	2.7°C	2.5°C	2.7°C	2.5°C	2.7°C	2.5°C
	500°C	3.0°C	2.8°C	2.8°C	2.6°C	2.8°C	2.6°C	2.8°C	2.6°C
	600°C	3.0°C	2.8°C	2.8°C	2.6°C	2.8°C	2.6°C	2.8°C	2.6°C
	700°C	3.0°C	2.8°C	2.8°C	2.6°C	2.8°C	2.6°C	2.9°C	2.7°C
	800°C	3.0°C	2.8°C	2.9°C	2.7°C			2.9°C	2.7°C
	900°C	3.0°C	2.8°C	2.9°C	2.7°C			3.0°C	2.8°C
	1,000°C	3.0°C	2.8°C					3.0°C	2.8°C
	1,100°C	3.0°C	2.8°C					3.1°C	2.9°C
	1,200°C	3.0°C	2.8°C					3.2°C	3.0°C

Temperature		Thermocouple B		Thermocouple E		Thermocouple J		Thermocouple K	
Maximum detected error at 25°C (1)		TFAS-T	Pt100	TFAST	Pt100	TFAS-T	Pt100	TFAST	Pt100
	1,300° C	3.0°C	2.8°C					3.3°C	3.1°C
	1,400° C	3.1°C	2.9°C						
	1,500° C	3.1°C	2.9°C						
	1,600° C	3.1°C	2.9°C						
	1,700° C	3.2°C	3.0°C						
	1,800° C	3.3°C	3.1°C						
Input dynamic		1710..17,790°C		-2,400..9,700°C		-7,770..7,370°C		-23,100..13.310° C	
Legend: (1) TFAST: Internal compensation by TELEFAST PT100: External compensation by Pt100 3 wires									

Reference standards: IEC 584-1, first edition, 1977 and IEC 584-2, second edition, 1989

Thermocouples L, N, R, and S

The following table describes the maximum detected precision error values for thermocouples L, N, R, and S at 25°C.

Temperature		Thermocouple L		Thermocouple N		Thermocouple R		Thermocouple S	
Maximum detected error at 25°C (1)		TFAST	Pt100	TFAST	Pt100	TFAST	Pt100	TFAST	Pt100
Operating point	-200° C			3.7°C	2.5°C				
	-100° C			2.6°C	2.4°C				
	0°C	2.5°C	2.3°C	2.5°C	2.3°C	2.5°C	2.3°C	2.5°C	2.3°C
	100°C	2.6°C	2.4°C	2.6°C	2.4°C	2.6°C	2.4°C	2.6°C	2.4°C
	200°C	2.6°C	2.4°C	2.6°C	2.4°C	2.6°C	2.4°C	2.6°C	2.4°C
	300°C	2.6°C	2.4°C	2.6°C	2.4°C	2.6°C	2.4°C	2.6°C	2.4°C
	400°C	2.7°C	2.5°C	2.7°C	2.5°C	2.7°C	2.5°C	2.7°C	2.5°C
	500°C	2.7°C	2.5°C	2.7°C	2.5°C	2.7°C	2.5°C	2.7°C	2.5°C
	600°C	2.8°C	2.6°C	2.8°C	2.6°C	2.8°C	2.6°C	2.7°C	2.5°C
	700°C	2.8°C	2.6°C	2.8°C	2.6°C	2.8°C	2.6°C	2.8°C	2.6°C
	800°C	2.9°C	2.7°C	2.9°C	2.7°C	2.8°C	2.6°C	2.8°C	2.6°C
	900°C	2.9°C	2.7°C	2.9°C	2.7°C	2.9°C	2.7°C	2.9°C	2.7°C
	1,000° C			3.0°C	2.8°C	2.9°C	2.7°C	2.9°C	2.7°C
	1,100° C			3.0°C	2.8°C	2.9°C	2.7°C	3.0°C	2.8°C
	1,200° C			3.1°C	2.9°C	3.0°C	2.8°C	3.0°C	2.8°C

Temperature		Thermocouple L		Thermocouple N		Thermocouple R		Thermocouple S	
Maximum detected error at 25°C (1)		TFAST	Pt100	TFAST	Pt100	TFAST	Pt100	TFAST	Pt100
	1,300° C					3.0°C	2.8°C	3.1°C	2.9°C
	1,400° C					3.1°C	2.9°C	3.1°C	2.9°C
	1,500° C					3.1°C	2.9°C	3.2°C	3.0°C
	1,600° C					3.2°C	3.0°C	3.2°C	3.0°C
	1,700° C					3.2°C	3.0°C	3.2°C	3.0°C
Input dynamic		-1,740..8,740°C		-2,320..12,620°C		-90..16,240°C		-90..16,240°C	
Legend: (1) TFAST: Internal compensation by TELEFAST. PT100: External compensation by Pt100 3 wires.									

Reference standards:

- Thermocouple L: DIN 43710, December 1985 edition
- Thermocouple N: IEC 584-1, second edition, 1989 and IEC 584-2, second edition, 1989
- Thermocouple R: IEC 584-1, first edition, 1977 and IEC 584-2, second edition, 1989
- Thermocouple S: IEC 584-1, first edition, 1977 and IEC 584-2, second edition, 1989

Thermocouples T and U

The following table describes the maximum detected precision error values for thermocouples T and U at 25°C.

Temperature		Thermocouple T		Thermocouple U	
Maximum detected error at 25°C (1)		TFAST	Pt100	TFAST	Pt100
Operating point	-200°C	3.7°C	2.5°C		
	-100°C	3.6°C	2.4°C		
	0°C	3.5°C	2.3°C	2.5°C	2.3°C
	100°C	2.6°C	2.4°C	2.6°C	2.4°C
	200°C	2.6°C	2.4°C	2.6°C	2.4°C
	300°C	2.6°C	2.4°C	2.6°C	2.4°C
	400°C	2.7°C	2.5°C	2.7°C	2.5°C
	500°C			2.7°C	2.5°C
	600°C			2.7°C	2.5°C
Input dynamic		-2,540..3,840°C		-1,810..5,810°C	
Legend: (1) TFAST: Internal compensation by TELEFAST PT100: External compensation by Pt100 3 wires					

Reference standards:

- Thermocouple U: DIN 43710, December 1985 edition

- Thermocouple T: IEC 584-1, first edition, 1977 and IEC 584-2, second edition, 1989

Thermocouple Ranges in Degrees Fahrenheit

Introduction

The following tables describe the detected errors of the measuring device for the various thermocouples B, E, J, K, N, R, S and T **in degrees Fahrenheit**.

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

Thermocouples B, E, J and K

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

Temperature		**Thermo-couple B**		**Thermocouple E**		**Thermocouple J**		**Thermocouple K**	
Maximum detected error at 77°F (1)		**TFA-ST**	**P-t10-0**	**TFAST**	**P-t100**	**TFAST**	**Pt100**	**TFAST**	**Pt100**
Operating point	**-300°F**			6.7°F	4.5°F			6.7°F	4.5°F
	-100°F			4.7°F	4.3°F	4.7°F	4.3°F	4.7°F	4.3°F
	0°F			4.5°F	4.1°F	4.5°F	4.1°F	4.5°F	4.1°F
	200°F			4.7°F	4.3°F	4.7°F	4.3°F	4.7°F	4.3°F
	400°F	6.3°F	6.1°F	4.7°F	4.3°F	4.7°F	4.3°F	4.7°F	4.3°F
	600°F	5.8°F	5.4°F	4.9°F	4.5°F	4.9°F	4.5°F	4.9°F	4.5°F
	700°F	5.4°F	5.0°F	4.9°F	4.5°F	4.9°F	4.5°F	4.9°F	4.5°F
	900°F	5.4°F	5.0°F	5.0°F	4.7°F	5.0°F	4.7°F	5.0°F	4.7°F
	1,100°F	5.4°F	5.0°F	5.0°F	4.7°F	5.0°F	4.7°F	5.0°F	4.7°F
	1,300°F	5.4°F	5.0°F	5.0°F	4.7°F	5.0°F	4.7°F	5.2°F	4.9°F
	1,500°F	5.4°F	5.0°F	5.2°F	4.9°F			5.2°F	4.9°F
	1,700°F	5.4°F	5.0°F	5.2°F	4.9°F			5.4°F	5.0°F
	1,800°F	5.4°F	5.0°F					5.4°F	5.0°F
	2,000°F	5.4°F	5.0°F					5.4°F	5.0°F

Temperature		Thermo-couple B		Thermocouple E		Thermocouple J		Thermocouple K	
Maximum detected error at 77°F (1)		TFA-ST	P-t10-0	TFAST	P-t100	TFAST	Pt100	TFAST	Pt100
	2,200°F	5.4°F	5.0°F					5.4°F	5.0°F
	2,400°F	5.4°F	5.0°F					5.4°F	5.0°F
	2,600°F	5.6°F	5.2°C						
	2,700°F	5.6°F	5.2°C						
	2,900°F	5.6°F	5.2°C						
	3,100°F	5.8°F	5.4°F						
	3,200°F	6.0°F	5.6°F						
Input dynamic		3,390..32,000°F		-3,990..17,770°F		-2,870..13,950°F		-3,830..24,270°F	
Legend: (1) TFAST: Internal compensation by TELEFAST PT100: External compensation by Pt100 3 wires									

Thermocouples L, N, R and S

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

Temperature		Thermocouple L		Thermocouple N		Thermocouple R		Thermocouple S	
Maximum detected error at 77°F (1)		TFA-ST	Pt100	TFA-ST	Pt100	TFA-ST	Pt100	TFAST	Pt100
Operating point	-300°F			6.7°F	4.5°F				
	-100°F			4.7°F	4.3°F				
	0°F	4.5°F	4.1°F	4.5°F	4.1°F	4.5°F	4.1°F	4.5°F	4.1°F
	200°F	4.7°F	4.3°F	4.7°F	4.3°F	4.7°F	4.3°F	4.7°F	4.3°F
	400°F	4.7°F	4.3°F	4.7°F	4.3°F	4.7°F	4.3°F	4.7°F	4.3°F
	600°F	4.7°F	4.3°F	4.7°F	4.3°F	4.7°F	4.3°F	4.7°F	4.3°F
	700°F	4.9°F	4.5°F	4.9°F	4.5°F	4.9°F	4.5°F	4.9°F	4.5°F
	900°F	4.9°F	4.5°F	4.9°F	4.5°F	4.9°F	4.5°F	4.9°F	4.5°F
	1,100°F	5.0°F	4.7°F	5.0°F	4.7°F	5.0°F	4.7°F	4.9°F	4.5°F
	1,300°F	5.0°F	4.7°F	5.0°F	4.7°F	5.0°F	4.7°F	5.0°F	4.7°F
	1,500°F	5.2°F	4.9°F	5.2°F	4.9°F	5.2°F	4.9°F	5.2°F	4.9°F
	1,700°F	5.2°F	4.9°F	5.2°F	4.9°F	5.2°F	4.9°F	5.2°F	4.9°F
	1,800°F					5.2°F	4.9°F	5.2°F	4.9°F
	2,000°F					5.2°F	4.9°F	5.4°F	5.0°F
	2,200°F					5.4°F	5.0°F	5.4°F	5.0°F
	2,400°F					5.4°F	5.0°F	5.6°F	5.2°F
	2,600°F					5.6°F	5.2°F	5.6°F	5.2°F
	2,700°F					5.6°F	5.2°F	5.8°F	5.4°F

Temperature		Thermocouple L		Thermocouple N		Thermocouple R		Thermocouple S	
Maximum detected error at 77°F (1)		TFA-ST	Pt100	TFA-ST	Pt100	TFA-ST	Pt100	TFAST	Pt100
	2,900°F					5.8°F	5.4°F	5.8°F	5.4°F
	3,000°F					5.8°F	5.4°F	5.8°F	5.4°F
Input dynamic (2)		-2,800..16,040°F		-3,860..23,040°F		-160..29,950°F		-160..29,950°F	

Legend:

(1) TFAST: Internal compensation by TELEFAST

PT100: External compensation by Pt100 3 wires

(2) Internal compensation: ambient temperature = 68°F

External compensation: ambient temperature = 86°F

Thermocouples T and U

The following table describes the maximum detected precision error values for thermocouples T and U at 77°F:

Temperature		Thermocouple T		Thermocouple U	
Maximum detected error at 77°F (1)		TFAST	Pt100	TFAST	Pt100
Operating point	-300°F	6.7°F	4.5°F		
	-100°F	6.5°F	4.3°F		
	0°F	6.3°F	4.1°F	4.5°F	4.1°F
	200°F	4.7°F	4.3°F	4.7°F	4.3°F
	400°F	4.7°F	4.3°F	4.7°F	4.3°F
	600°F	4.7°F	4.3°F	4.7°F	4.3°F
	700°F	4.9°F	4.5°F	4.9°F	4.5°F
	900°F			4.9°F	4.5°F
	1,100°F			4.9°F	4.5°F
Input dynamic (2)		-4,250..7,230°F		-2,930..10,770°F	

Legend:

(1) TFAST: Internal compensation by TELEFAST

PT100: External compensation by Pt100 3 wires

Analog Input/Output Module Installation

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Introduction

⚠ WARNING

UNEXPECTED I/O FALLBACK

- Make sure that the promptness value for outputs is set to at least the recommended value of 256 ms.
- Test the system under heavy network communication workload and check that Inputs and outputs do not go to fallback mode unexpectedly.

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

This chapter presents the rules and installation and configuration of analog input/output modules in an EcoStruxure™ Automation Expert application.

Installing Analog Input/Output Modules

At a Glance

The analog input/output modules are powered by the rack bus. The modules may be installed and uninstalled without turning off power supply to the rack, without causing any potential hazards and without there being any potential risk of damage or disturbance to the controller.

Fitting operations (installation, assembly and disassembly) are described below.

Installation Precautions

The Modicon X80 analog modules may be installed in any of the positions in the rack except:

- the positions reserved for the rack power supply modules (marked PS, PS1, and PS2)

- the positions reserved for extended modules (marked XBE)
- the positions reserved for the controller in the main local rack (marked 00 or marked 00 and 01 depending on the controller)
- the positions reserved for the (e)X80 adapter module in the main remote drop (marked 00)

Power is supplied by the bus at the bottom of the rack (3.3 V and 24 V).

Before installing a module, remove the protective cap from the module connector located on the rack.

⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

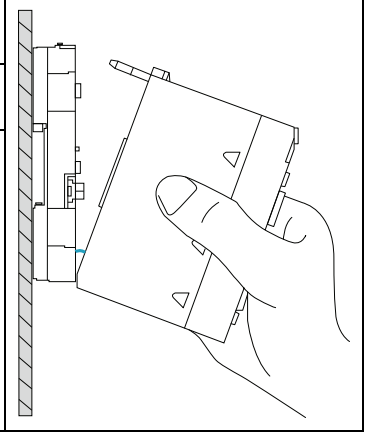
While mounting / removing the modules, make sure that the terminal block is still connected to the shield bar and disconnect the voltage of sensors and pre-actuators.

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

NOTE: All modules are calibrated at factory before being shipped. Generally it is not necessary to calibrate the module. However, for certain applications or because of standard requirements (e.g. in pharmaceuticals), it may be advisable or even necessary to re-calibrate the module in specified time intervals.

Module Installation

The following table presents the procedure for mounting the analog input/output modules on the rack:

Step	Action	
1	Remove the protective cover from the connector of the module slot on the Modicon X80 rack.	
2	Position the locating pins situated at the rear of the module (on the bottom part) in the corresponding slot in the rack.	
3	Swivel the module towards the top of the rack so that the module sits flush with the back of the rack.	
4	Tighten the mounting screw on top of the module to hold in place on the rack. Tightening torque: 0.4...1.5 N•m (0.30...1.10 lbf-ft).	

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Check that the mounting screw is securely tightened to ensure the module is firmly attached to the rack.

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

Connecting Analog Input/Output Modules

Introduction

Analog input/output modules are connected to sensors, pre-actuators or terminals using one of the following:

- a removable terminal block
- a pre-assembled cord sets
- a TELEFAST pre-wired system for rapid connection to operative parts

Removable Terminal Blocks Compatibility

The following table describes the compatibility between analog modules and removable terminal blocks:

Removable terminal blocks		**20-pin BMXFTB 20•0**	**28-pin BMXFTB 28•0**
Input modules	BMXAMI0410(H)	Yes	No
	BMXAMI0800	No	Yes
	BMXAMI0810(H)	No	Yes
	BMXART0414(H)	No	No
	BMXART0814(H)	No	No
Output modules	BMXAMO0210(H)	Yes	No
	BMXAMO0410(H)	Yes	No
	BMXAMO0802(H)	Yes	No
Mixed input/output module	BMXAMM0600(H)	Yes	No

NOTE: The BMXART•••• modules need of pre-assembled cord sets or TELEFAST accessories to connect sensors to the 40-pin FCN type connectors.

Pre-assembled Cord sets Compatibility

The following table describes the compatibility between analog modules and pre-assembled cord sets:

Pre-assembled cord set		**BMXFCW•01S**	**BMXFTW•01S**	**BMXFTW•08S**
Input modules	BMXAMI0410(H)	No	Yes	No
	BMXAMI0800	No	No	Yes
	BMXAMI0810(H)	No	No	Yes
	BMXART0414(H)	Yes	No	No
	BMXART0814(H)	Yes	No	No
Output modules	BMXAMO0210(H)	No	Yes	No
	BMXAMO0410(H)	No	Yes	No
	BMXAMO0802(H)	No	Yes	No
Mixed Input/output module	BMXAMM0600(H)	No	Yes	No

TELEFAST Wiring Accessories

The following table describes the compatibility between analog modules and TELEFAST wiring accessories:

TELEFAST accessories		Connecting cables	Interface Sub-Base
Input modules	BMXAMI0410(H)	BMXFCA••0	ABE-7CPA410
	BMXAMI0800	BMXFTA••0	Any one of: • ABE-7CPA02 • ABE-7CPA03 • ABE-7CPA31 • ABE-7CPA31E
	BMXAMI0810(H)	BMXFTA ••0	Any one of: • ABE-7CPA02 • ABE-7CPA31 • ABE-7CPA31E
	BMXART0414(H)	BMXFCA••2	ABE-7CPA412
	BMXART0814(H)	BMXFCA ••2	ABE-7CPA412
Output modules	BMXAMO0210(H)	BMXFCA••0	ABE-7CPA21
	BMXAMO0410(H)	BMXFCA••0	ABE-7CPA21
	BMXAMO0802(H)	BMXFTA••2	ABE-7CPA02
Mixed Input/ output module	BMXAMM0600(H)	-	-

NOTE: You cannot connect a BMXAMM0600 input/output module to TELEFAST wiring accessories.

20-pin Terminal Blocks: BMX FTB 20•0

At a Glance

There are three types of 20-pin terminal blocks:

- BMXFTB2010 screw clamp terminal blocks
- BMXFTB2000 caged terminal blocks
- BMXFTB2020 spring terminal blocks

Cable Ends and Contacts

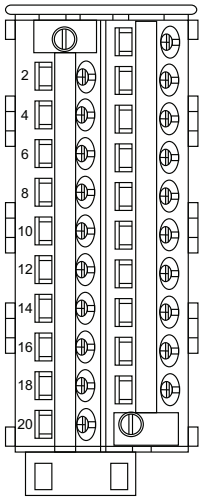
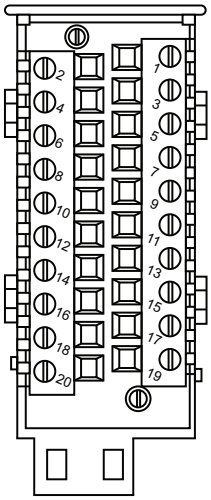
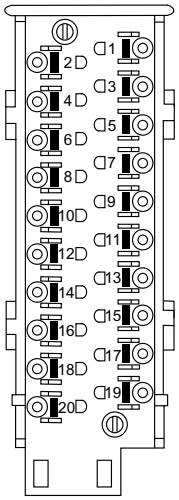
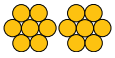
Each terminal block can accommodate:

- Bare wires
- Wires with:
  - DZ5-CE (ferrule) type cable ends: 
  - AZ5-DE (twin ferrule) type cable ends: 

NOTE: When using stranded cable, Schneider Electric strongly recommends the use of wire ferrules which are fitted with an appropriate crimping tool.

Description of the 20-pin Terminal Blocks

The following table describes the type of wires that fit each terminal block and the associated gauge range, wiring constraints, and tightening torque:

	Screw Clamp Terminal Blocks **BMXFTB2010**	**Caged Terminal Blocks** **BMXFTB2000**	**Spring Terminal Blocks** **BMXFTB2020**
Illustration			
1 solid conductor 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 solid conductors 	2 conductors of the same size: • AWG: 2 x 22...16 • mm²: 2 x 0.34...1.5	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
1 stranded cable 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 stranded cables 	2 conductors of the same size: • AWG: 2 x 22...16 • mm²: 2 x 0.34...1.5	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
1 stranded cable with ferrule 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 stranded cables with twin ferrule 	• AWG: 2 x 24...18 • mm²: 2 x 0.24...1	• AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	• AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
Minimum individual wire size in stranded cables when a ferrule is not used 	• AWG: 30 • mm²: 0.0507	• AWG: 30 • mm²: 0.0507	• AWG: 30 • mm²: 0.0507
Wiring constraints	Screw clamps have slots that accept: • Flat-tipped screwdrivers with a diameter of 5 mm. • Pozidriv PZ1 or Philips PH1 cross-tipped screwdrivers. Screw clamp terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	Caged terminal blocks have slots that accept: • Flat-tipped screwdrivers with a diameter of 3 mm. Caged terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	The wires are connected by pressing the button located next to each pin. To press the button, use a flat-tipped screwdriver with a maximum diameter of 3 mm.
Screw tightening torque	0.5 N•m (0.37 lbf-ft)	0.4 N•m (0.30 lbf-ft)	Not applicable

Connection of 20-pin Terminal Blocks

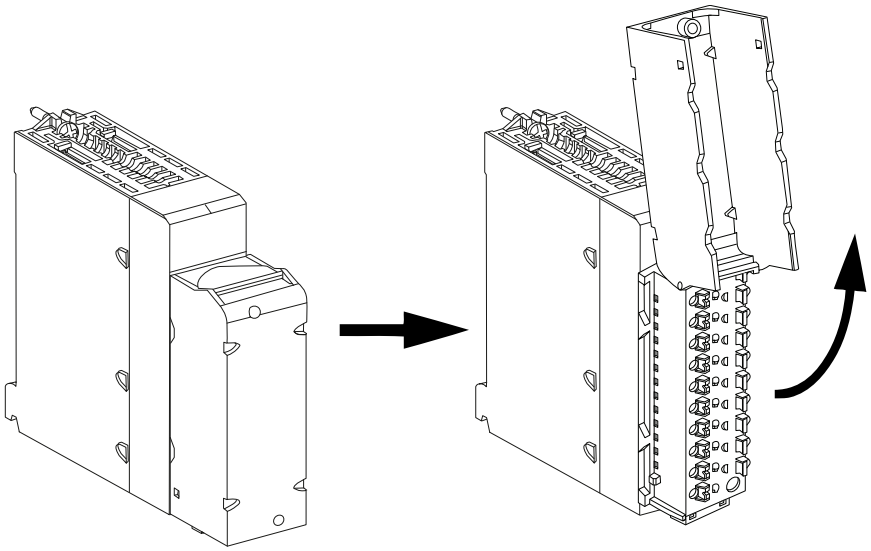
⚠⚠DANGER

ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connection or disconnection of the terminal block.

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

The following diagram shows the method for opening the 20-pin terminal block door so that it can be wired:



NOTE: The connection cable is installed and held in place by a cable clamp positioned below the 20-pin terminal block.

Labeling of 20-pin Terminal Blocks

Labels for the 20-pin terminal blocks are supplied with the module. They are to be inserted in the terminal block cover by the customer.

Each label has two sides:

- One side that is visible from the outside when the cover is closed. This side features the commercial product references, an abbreviated description of the module, as well as a blank section for customer labeling.
- One side that is visible from the inside when the cover is open. This side shows the terminal block connection diagram.

28-Pin Terminal Blocks: BMX FTB 28•0

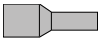
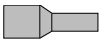
At a Glance

There are two types of 28-pin terminal blocks:

- BMXFTB2800 caged terminal blocks
- BMXFTB2820 spring terminal blocks

Cable Ends and Contacts

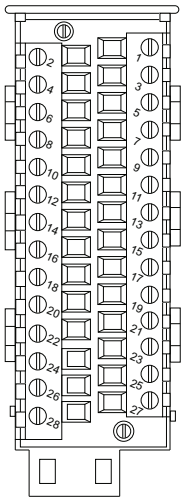
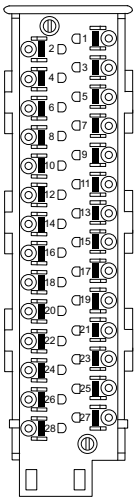
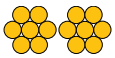
Each terminal block can accommodate:

- Bare wires:
  - Solid conductor
  - Stranded cable
- Wires with ferrules:
  - DZ5CE•••• single type cable ends: 
  - AZ5DE•••• twin type cable ends: 

NOTE: When using stranded cable, Schneider Electric strongly recommends the use of wire ferrules which are fitted with an appropriate crimping tool.

Description of the 28-pin Terminal Blocks

The following table describes the type of wires that fit each terminal block and the associated gauge range, wiring constraints, and tightening torque:

	Caged terminal blocks **BMXFTB2800**	**Spring terminal blocks** **BMXFTB2820**
Illustration		
1 solid conductor 	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 solid conductors 	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
1 stranded cable 	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 stranded cables 	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
1 stranded cable with ferrule 	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 stranded cables with twin ferrule 	• AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	• AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75

	Caged terminal blocks **BMXFTB2800**	**Spring terminal blocks** **BMXFTB2820**
Minimum individual wire size in stranded cables when a ferrule is not used 	• AWG: 30 • mm^2: 0.0507	• AWG: 30 • mm^2: 0.0507
Wiring constraints	Caged terminal blocks have slots that accept: • Flat-tipped screwdrivers with a diameter of 3 mm. Caged terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	The wires are connected by pressing the button located next to each pin. To press the button, you have to use a flat-tipped screwdriver with a maximum diameter of 3 mm.
Screw tightening torque	0.4 N•m (0.30 lbf-ft)	Not applicable

Connection of the 28-pin Terminal Blocks

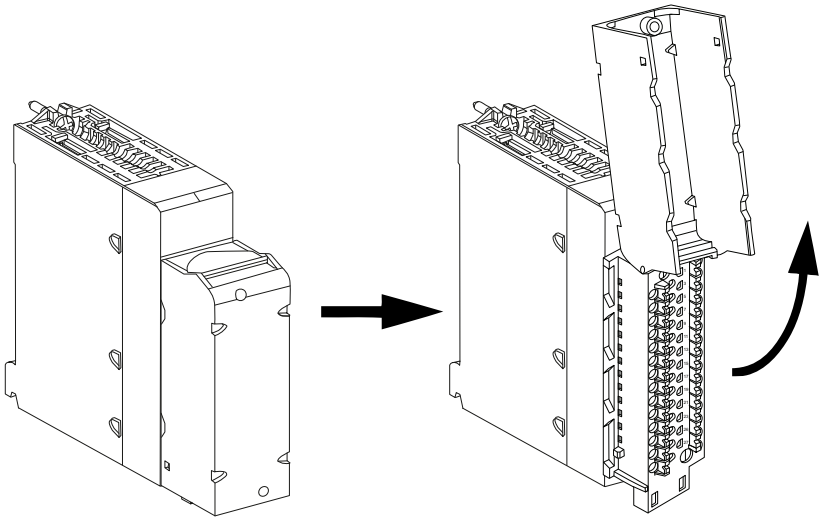
⚠⚠DANGER

ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connection or disconnection of the terminal block.

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

The following diagram shows the method for opening the terminal block cover so that it can be wired:



NOTE: The connection cable is installed and held in place by a cable clamp positioned below the 28-pin terminal block.

Labeling the Terminal Blocks

The labels for the terminal blocks are supplied with the module. They are to be inserted in the terminal block cover by the customer.

Each label has two sides:

- One side that is visible from the outside when the cover is closed. This side features the commercial product references, an abbreviated description of the module, as well as a blank section for customer labeling.

- One side that is visible from the inside when the cover is open. This side shows the terminal block connection diagram.

40-pin Terminal Blocks: BMXFTB40•0

Abstract

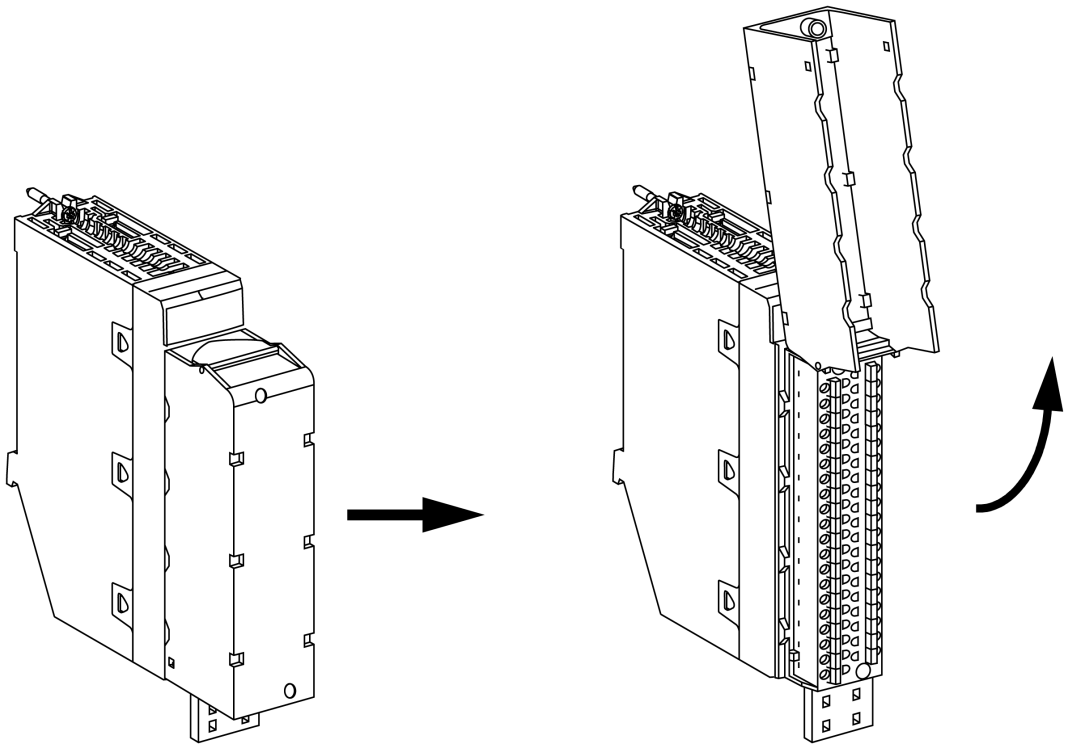
⚠⚠DANGER

ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connection or disconnection of the terminal block.

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

The following diagram shows the method for opening the terminal block cover so that it can be wired.



The connection cable is installed and held in place by cable clamps positioned below the terminal block.

NOTE: For installation where vibration can occur, do not allow the cable to hang loose. Tighten the cable to the bar of the shielding connection kit BMXXSP••00 or to the rear mounting plate using a cable clamp.

Description

There are two versions, each version available in two types of 40-pin terminal blocks:

Standard version	• BMXFTB4000 caged terminal block • BMXFTB4020 spring terminal block
Hardened version	• BMXFTB4000H caged terminal block with gold plating • BMXFTB4020H spring terminal block with gold plating

The hardened version of the terminal blocks are dedicated only to the hardened version of the modules.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not use the hardened version of the terminal block with a standard module.
- Do not use the standard version of the terminal block with a hardened module.

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

NOTE: If you mix hardened and standard versions when fitting the terminal block to the module, there is a potential risk of terminal pin corrosion and a signal deviation.

Pre-assembled cord sets are available for a BMXFTB4020 — a terminal block at one end and flying leads at the other. The cord sets are available under the BMXFTW••5 reference.

Cable Ends and Contacts

The 40-pin terminal blocks are designed for only one wire or one cable end.

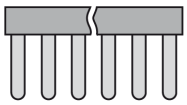
Each terminal block can accommodate:

- Bare wires:
  - Solid conductor
  - Stranded cable
- Wires with ferrule (DZ5CE••••/DZ5CA•••• single type cable ends): 

  NOTE: When using stranded cable, Schneider Electric strongly recommends the use of wire ferrules that are fitted with an appropriate crimping tool.

Jumper Bar

To facilitate the wiring, a 20-pin jumper bar with a plastic handle is provided with a 40-pin caged screw terminal block BMXFTB4000:



⚠CAUTION

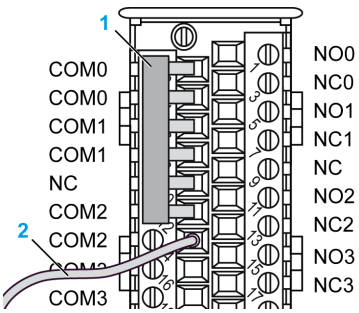
UNINTENDED EQUIPMENT OPERATION

Do not exceed the maximum capability of a single point of the terminal block when using it to carry the whole common current:

- 10 A maximum for a single point of the BMXFTB4000 terminal block
- 8 A maximum for a single point of the BMXFTB4020 terminal block

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

The following graphic shows an example of using the jumper bar for non-isolated wiring channel 0-2 with a BMXDRC0805 module:

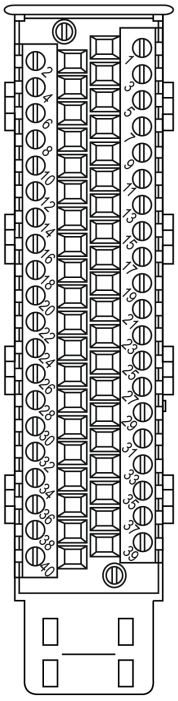
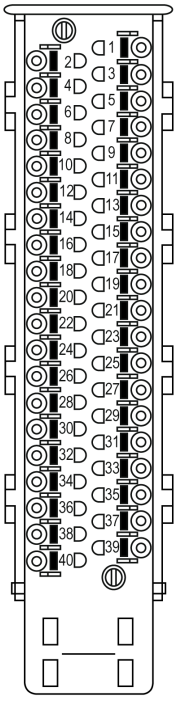


1 jumper bar

2 to common

Description of the 40-pin Terminal Block

The following table describes the type of wires that fit each terminal block and the associated gauge range, wiring constraints, and tightening torque:

	Caged Terminal Blocks **BMXFTB4000**	**Spring Terminal Blocks** **BMXFTB4020**
Illustration		
1 solid conductor 	• AWG: 26...18 • mm²: 0.13...1	• AWG: 26...18 • mm²: 0.13...1
1 stranded cable 	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
1 stranded cable with ferrule 	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
Minimum individual wire size in stranded cables when a ferrule is not used 	• AWG: 30 • mm²: 0.0507	• AWG: 30 • mm²: 0.0507

	Caged Terminal Blocks **BMXFTB4000**	**Spring Terminal Blocks** **BMXFTB4020**
Wiring constraints	Caged terminal blocks have slots that accept: • Flat-tipped screwdrivers with a diameter of 3 mm. Caged terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	The wires are connected by pressing the button located next to each pin. To press the button, use a flat-tipped screwdriver with a maximum diameter of 3 mm.
Screw tightening torque	0.4 N•m (0.30 lbf-ft)	Not applicable

Labeling the Terminal Block

The labels for the terminal blocks are supplied with the module.and are to be inserted in the terminal block cover.

Each label has two sides:

- One side that is visible from the outside when the cover is closed. This side features the commercial product references, an abbreviated description of the module, and a blank section for customer labeling.
- One side that is visible from the inside when the cover is open. This side shows the terminal block connection diagram.

BMXFTW•08S Cables

Introduction

28-pin connector modules are connected to sensors, pre-actuators or terminals using a cable designed to enable trouble-free direct wire-to-wire transition of the module inputs/outputs.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Take all precautions during installation to prevent any subsequent mistake in the connectors. Plugging the wrong connector causes an unexpected behavior of the application.

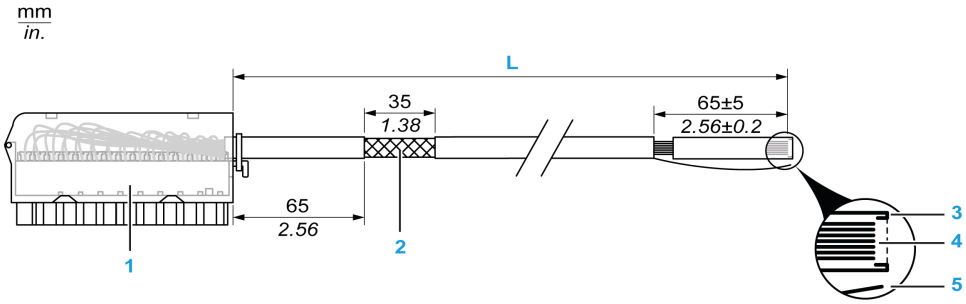
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Cable Description

The BMXFTW•08S cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 28-pin connector, from which extends one cable sheath, containing 24 wires
- At the other end, free wire ends differentiated by color code

The following figure shows the BMXFTW•08S cables:



1 BMXFTB2820 terminal block

2 Cable shielding

3 First of external sheath

4 Wires not stripped

5 Strand of nylon allowing the cable sheath to be stripped easily

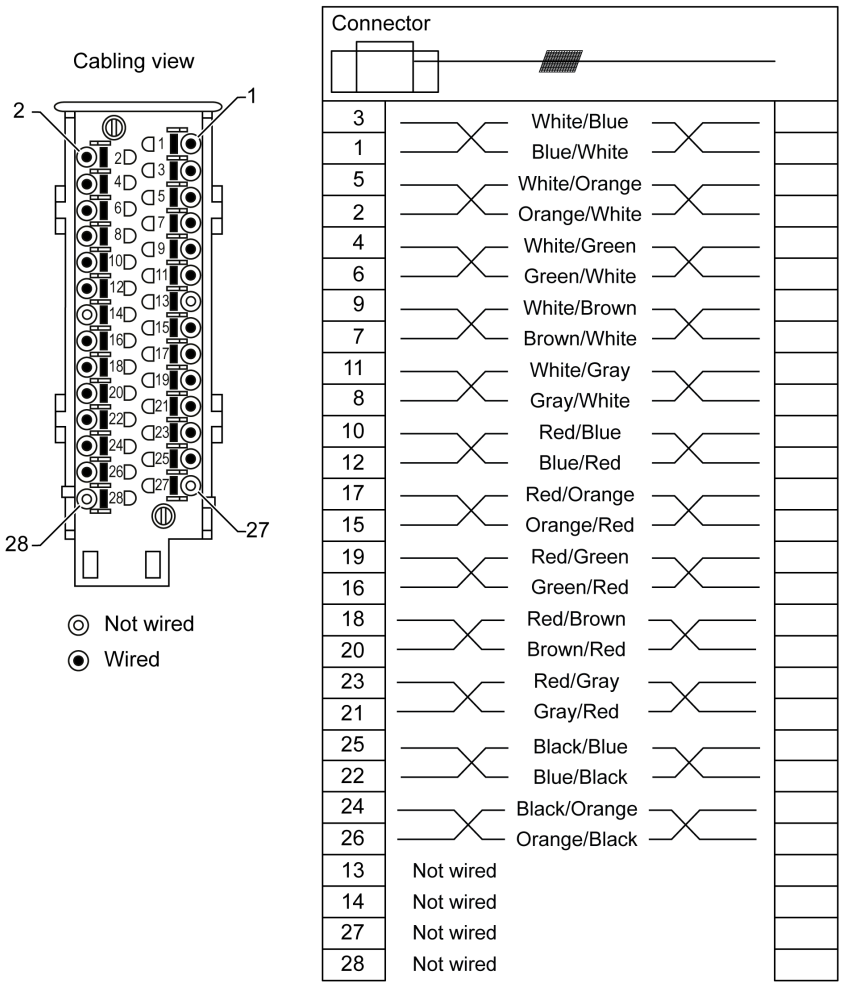
L Length according to the part number

The cables have two different lengths:

- 3 meters: BMXFTW308S
- 5 meters: BMXFTW508S

Pin Assignment

The following diagram shows the connection of BMXFTW•08S cables:



Characteristics

The following table describes the characteristics of the BMXFTW•08S cables:

Characteristic		Value
Cable	Sheath material	PVC
	LSZH status	No
Conductor description	Number of conductors	24
	Conductor cross section (Gauge)	0.34 mm^2 (22 AWG)
Environmental	Operating temperature	-25...70 °C (-13...158 °F)
Applicable standards		DIN47100

Cable Installation

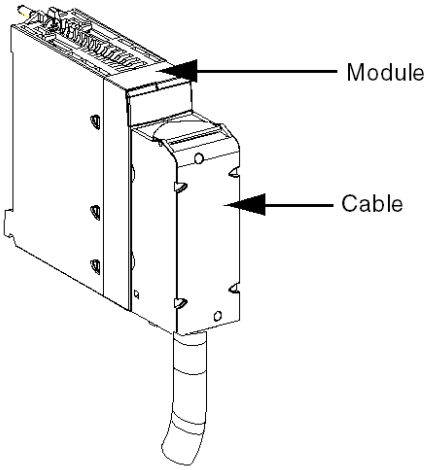
⚠⚠DANGER

ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connecting or disconnecting the terminal block.

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

The following diagram shows the connection of the cable to the module:

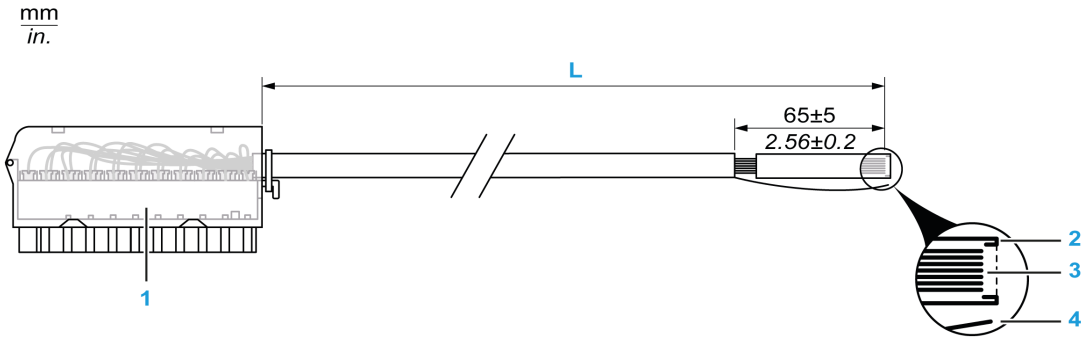


For more information, refer to the *Fitting a 28-pin Terminal Block to a Module* topic in this help file.

BMXFTW••1 Cable

Abstract

The following figure shows the BMXFTW•01 cables:



1 BMXFTB2020 terminal block

2 First of external sheath

3 Wires not stripped

4 Strand of nylon allowing the cable sheath to be stripped easily.

L Length according to the part number.

Description

20-pin connector modules are connected to sensors, pre-actuators, or terminals using a cable designed to enable direct wire-to-wire transition of the module's inputs/outputs.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Use only a connector that is designed for a specific module. Plugging the wrong connector can cause unexpected application behavior.

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

BMXFTW••1 Cable Description

The BMXFTW•01 cables are a pre-assembled cord set, made up of the following:

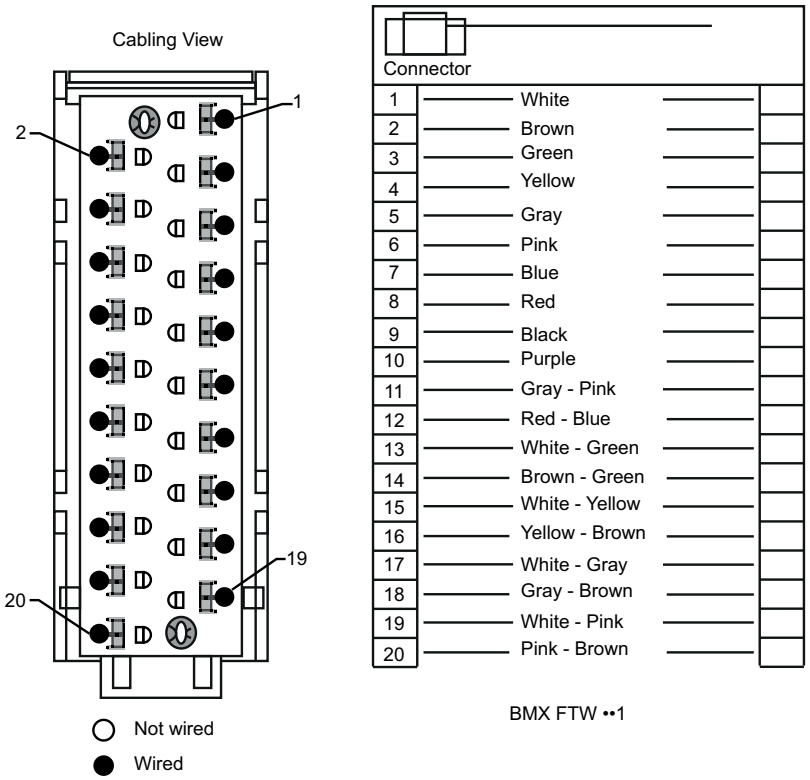
- At one end, a compound-filled 20-pin BMXFTB2020 terminal block from which extends one cable sheath containing 20 wires
- At the other end, free-wire ends differentiated by color code

The connection cables come in three different lengths:

- 3 m (9.84 ft): BMXFTW301
- 5 m (16.40 ft): BMXFTW501
- 10 m (32.80 ft): BMXFTW1001

BMXFTW••1 Cable Connection

The following diagram shows the connection of the BMX FTW ••1 cable:



BMXFTW••1 Cable Characteristics

This table presents the general characteristics:

Characteristics		Values
Cable	Sheath material	PVC
	LSZH status	No
Conductor description	Number of conductors	20
	Gauge	0.34 mm^2 (22 AWG)
	Material	Tinned copper
Environmental	Operating temperature	-25...70 °C (-13....158 °F)
Applicable standards		DIN47100

Cable Installation

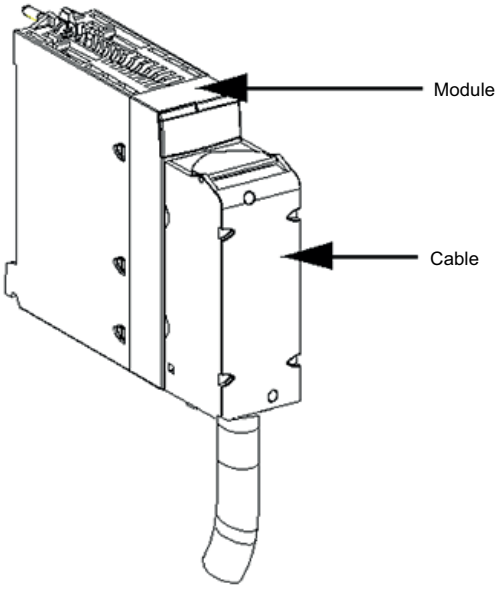
⚠⚠DANGER

ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power to sensor and pre-actuator devices before connecting or disconnecting the terminal block.

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

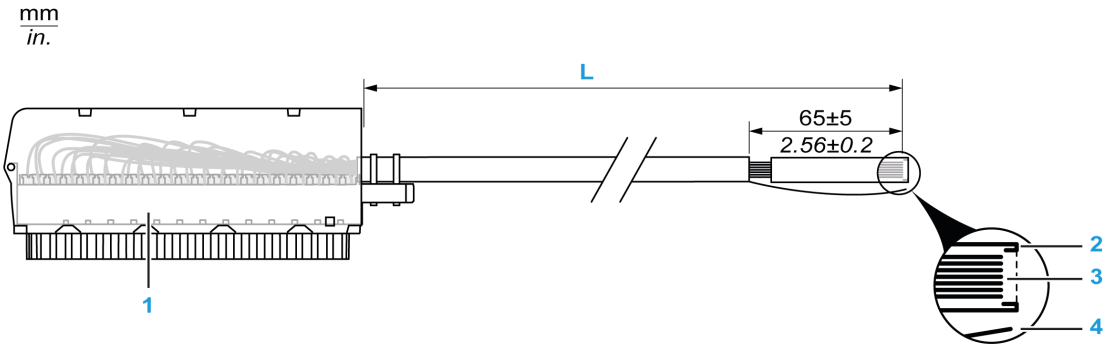
The following diagram shows the pre-assembled cable connected to the module:



BMXFTW••5 Cable

Abstract

The following figure shows the BMXFTW•05 cables:



1 BMX FTB 4020 Terminal block

2 First of external sheath

3 Wires not stripped

4 Strand of nylon allowing the cable sheath to be stripped easily

L Length according to the part number

Description

BMXFTW••5 Cable Description

40-pin connector modules are connected to sensors, pre-actuators or terminals using a cable designed to enable direct wire to wire transition of the module's inputs/outputs.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Use only a connector that is designed for a specific module. Plugging the wrong connector can cause an unexpected behavior of the application.

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

The BMX FTW ••5 cables are a pre-assembled cord set, made up of:

- At one end, a compound-filled 40-pin BMXFTB4020 terminal block (non-gold plated spring terminal block) from which extends one cable sheath containing 40 wires
- At the other end, free-wire ends, differentiated by color code

NOTE: This pre-assembled cord set is dedicated only to the standard module version.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Do not use BMXFTW••5 cables with hardened modules.

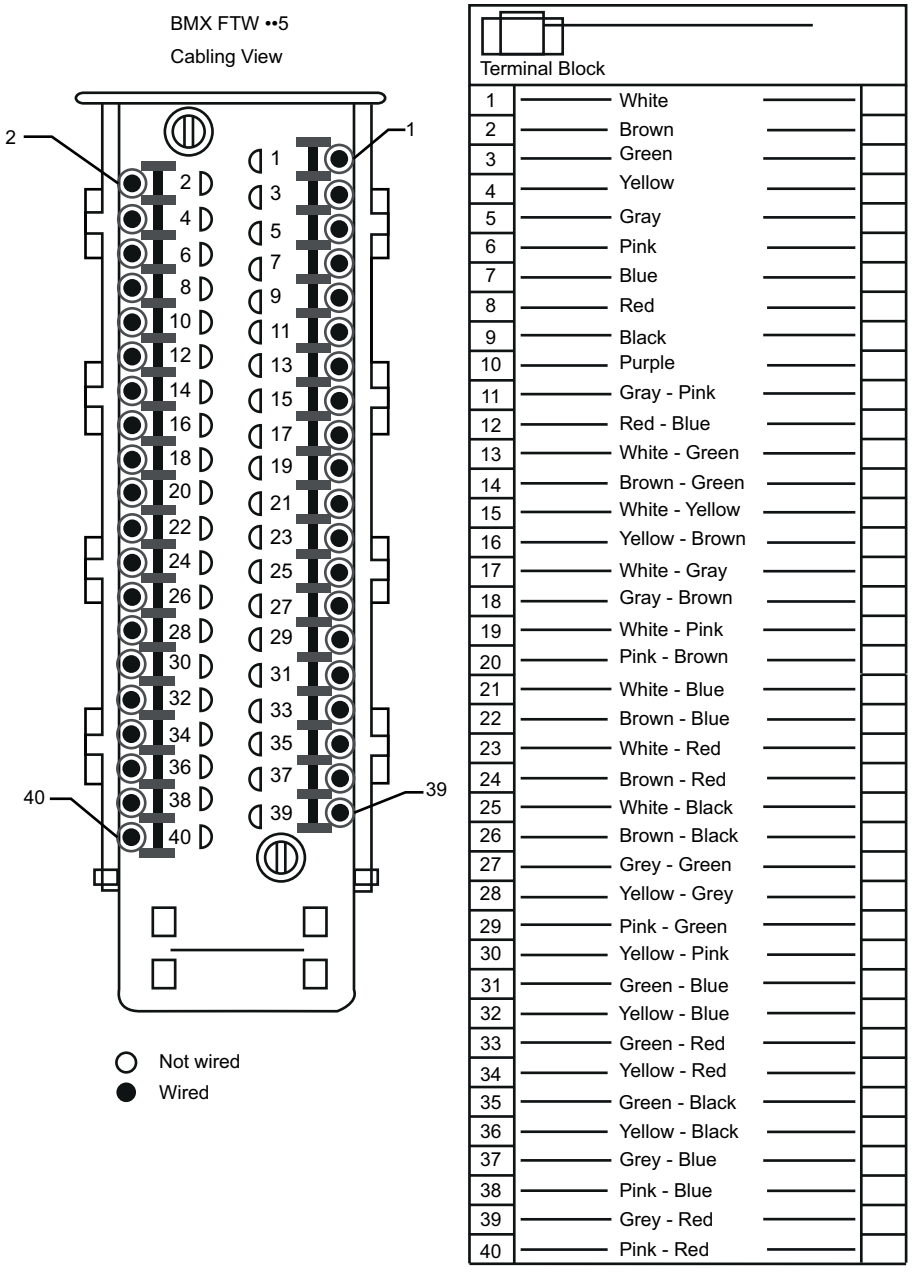
Failure to follow these instructions can result in death, serious injury, or equipment damage.

The connection cables come in two different lengths:

- 3 m (9.84 ft): BMXFTW305
- 5 m (16.40 ft): BMXFTW505

BMXFTW••5 Cable Connection

The following diagram shows the connections and the color-codes according to DIN47100:



BMXFTW••5 Cable Characteristics

This table presents the general characteristics:

Characteristics		**Values**
Cable	Sheath material	PVC
	LSZH status	No
Application type	Maximum voltage	300 Vrms
Conductor description	Number of conductors	40
	Gauge	0.34 mm^2 (22 AWG)
	Material	Tinned copper
	Maximum current	2 A below 30 °C (86 °F) 0.8 A below 70 °C (158 °F)
Electrical	Dielectric withstand	2500 V for 1 min.
Environmental	Operating temperature	-25...70 °C (-13....158 °F)
Applicable standards		DIN47100

BMXFTW••5 Cable Installation

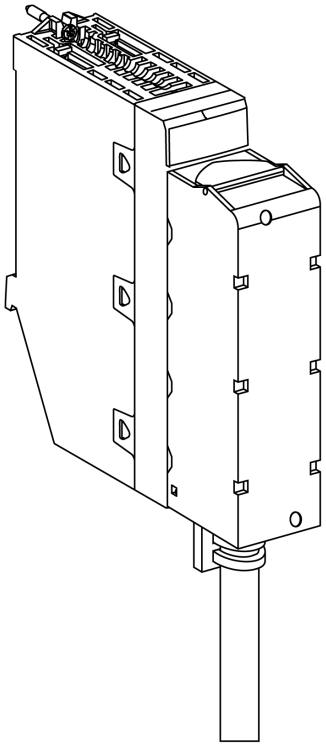
⚠⚠DANGER

ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connecting or disconnecting the terminal block.

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

The following diagram shows the pre-assembled cable connected to the module:



NOTE: For installation where vibration can occur, confirm that the BMXFTW••5 cable does not hang loose. Tighten the cable to the bar of the shielding connection kit BMXXSP••00 or to the rear mounting plate using a cable clamp.

BMXFCW•01S Cables

Introduction

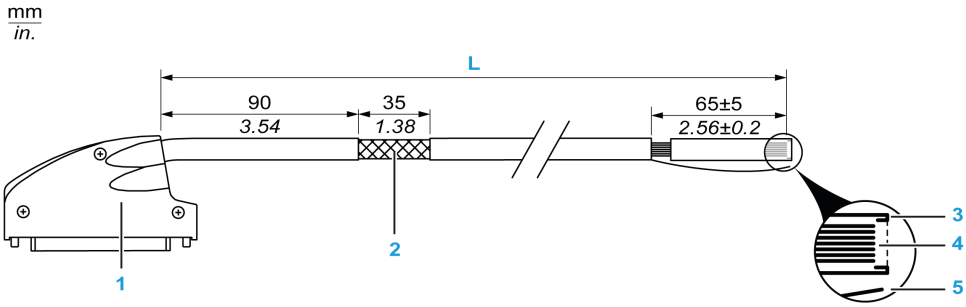
40-pin connector modules are connected to sensors, pre-actuators, or terminals using a cable designed to enable direct wire-to-wire transition of the module inputs/outputs.

Cable Description

The BMXFCW•01S cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 40-pin connector, from which extends one cable sheath, containing 20 wires
- At the other end, free wire ends differentiated by color code

The following figure shows the BMXFCW•01S cables:



1 40-pin connector, FCN type

2 Cable shielding

3 First of external sheath

4 Wires not stripped

5 Strand of nylon allowing the cable sheath to be stripped easily

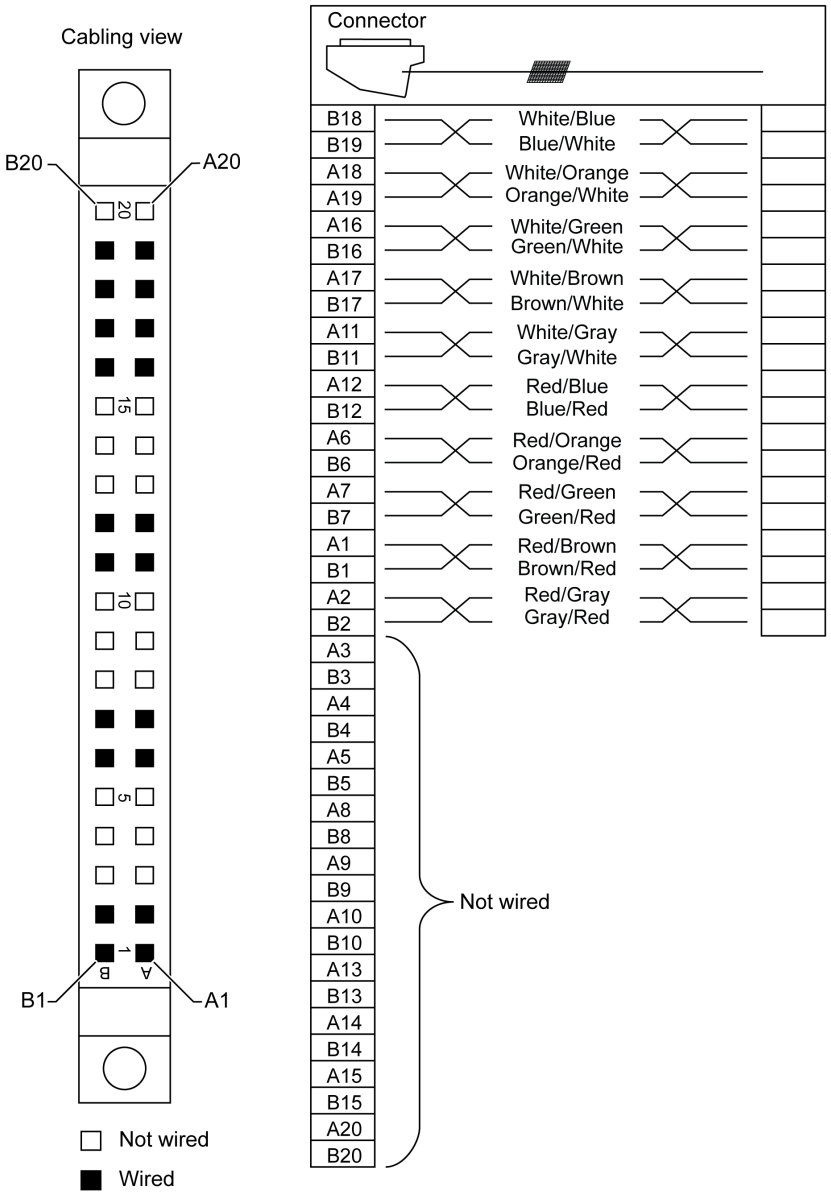
L Length according to the part number

The cables have two different lengths:

- 3 meters: BMXFCW301S
- 5 meters: BMXFCW501S

Pin Assignment

The following diagram shows the connection of the BMXFCW•01S cables:



Characteristics

The following table describes the characteristics of the BMXFCW•01S cables:

Characteristic		**Value**
Cable	Sheath material	PVC
	LSZH status	No
Conductor description	Number of conductors	20
	Conductor cross section (Gauge)	0.34 mm^2 (22 AWG)
Environmental	Operating temperature	-25...70 °C (-13...158 °F)
Applicable standards		DIN47100

Cable Installation

⚠⚠DANGER

ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connecting or disconnecting the terminal block.

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

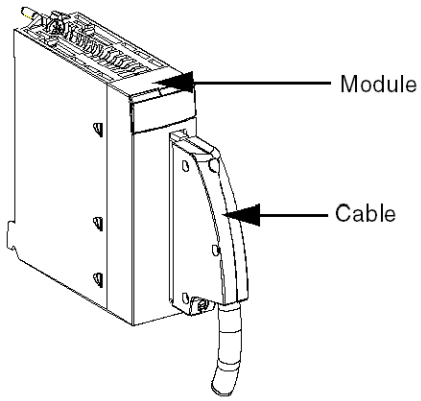
⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Take all precautions during installation to prevent any subsequent mistake in the connectors. Plugging the wrong connector causes an unexpected behavior of the application.

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

The following diagram shows the connection of the cable to the module:



For more information, refer to the *Fitting a 40-pin FCN Type to a Module topic*, page 221.

Fitting a 20-pin Terminal Block to a Module

At a Glance

The modules with 20-pin terminal block connections require the terminal block to be connected to the module. These fitting operations (assembly and disassembly) are described in the following figures and tables..

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Terminal block must be connected or disconnected with sensor and pre-actuator voltage switched off.

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

⚠CAUTION

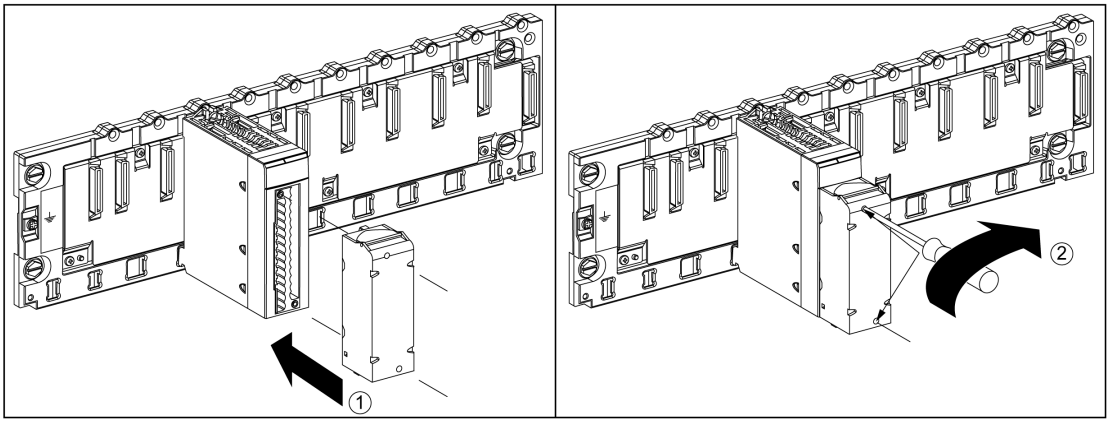
EQUIPMENT DAMAGE

Do not plug an AC terminal block into a DC module; it causes damage to the module.

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

Installing the Terminal Block

The following table shows the procedure for assembling the 20-pin terminal block onto a discrete input/output module.



Assembly Procedure

Step	Action
1	Once the module is in place on the rack, install the terminal block by inserting the terminal block encoder (the rear lower part of the terminal) into the module's encoder (the front lower part of the module), as previously shown. **NOTE:** The module connectors have indicators that show the proper direction to install the terminal block.
2	Fix the terminal block to the module by tightening the two mounting screws located on the lower and upper parts of the terminal block. Tightening torque: 0.4 N•m (0.30 lbf-ft).

NOTE: If the screws are not tightened, there is a potential risk that the terminal block will not be properly fixed to the module.

Coding the 20-Pin Terminal Block

⚠CAUTION

UNEXPECTED APPLICATION BEHAVIOR

Code the terminal block as described in the following instructions to prevent the terminal block from being mounted on another module. Plugging the wrong connector can cause unexpected application behavior.

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

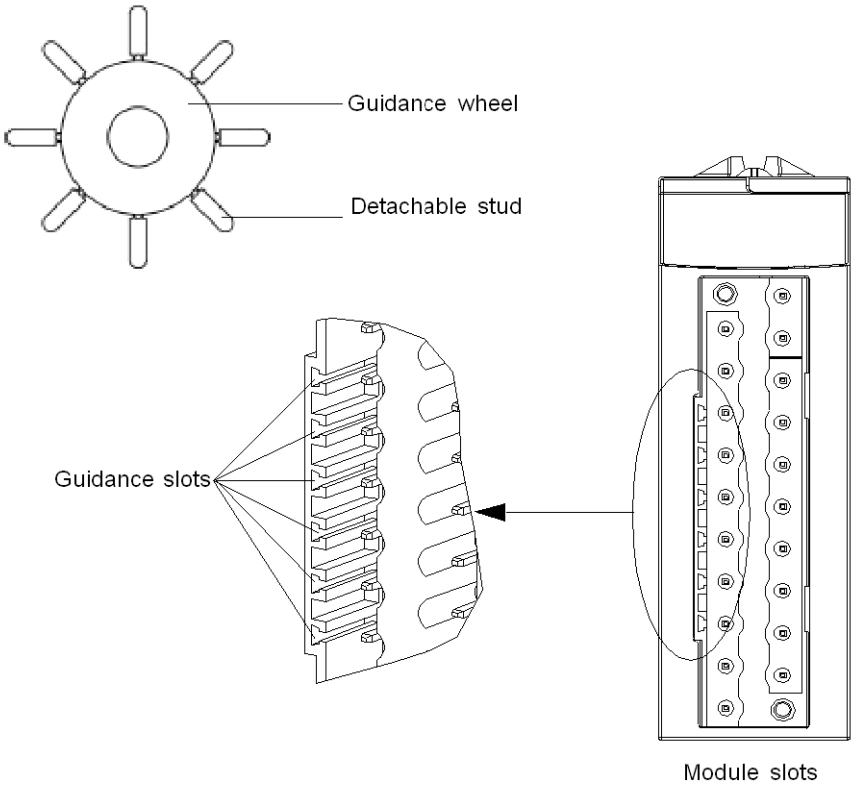
When a 20-pin terminal block is installed on a module dedicated to this type of terminal block, you can code the terminal block and the module using studs. The

studs help prevent the terminal block from being mounted on another module. Incorrect insertion can then be potentially avoided when replacing a module.

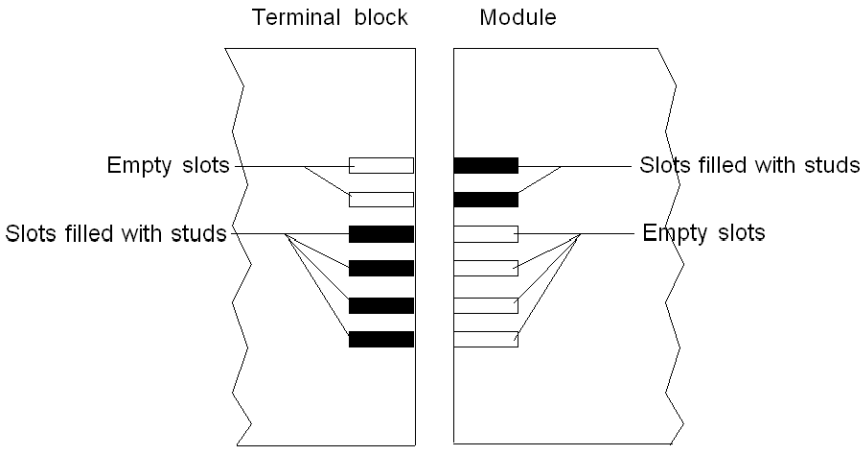
Coding is done by the user with the STBXMP7800 guidance wheel's studs. You can only fill the six slots in the middle of the left side (as seen from the wiring side) of the terminal block and the six guidance slots on the left side.

To fit the terminal block to the module, confirm that a module slot with a stud corresponds to an empty slot in the terminal block or a terminal block with a stud corresponds to an empty slot in the module. You can fill up to and including either of the six available slots as desired.

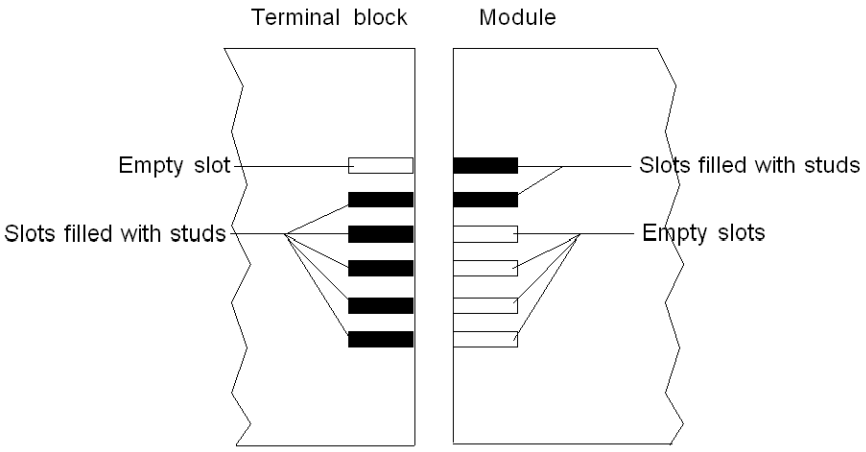
The following diagram shows a guidance wheel as well as the slots on the module used for coding the 20-pin terminal blocks.



The following diagram shows an example of a coding configuration that makes it possible to fit the terminal block to the module.



The diagram below shows an example of coding configuration with which it is not possible to fit the terminal block to the module.



Fitting a 28-pin Terminal Block to a Module

At a Glance

The modules with 28-pin terminal block connections require the latter to be connected to the module. These fitting operations (assembly and disassembly) are described below.

⚠⚠DANGER

ELECTRICAL SHOCK

Terminal block must be connected or disconnected with the sensor and pre-actuator voltage switched off.

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

⚠CAUTION

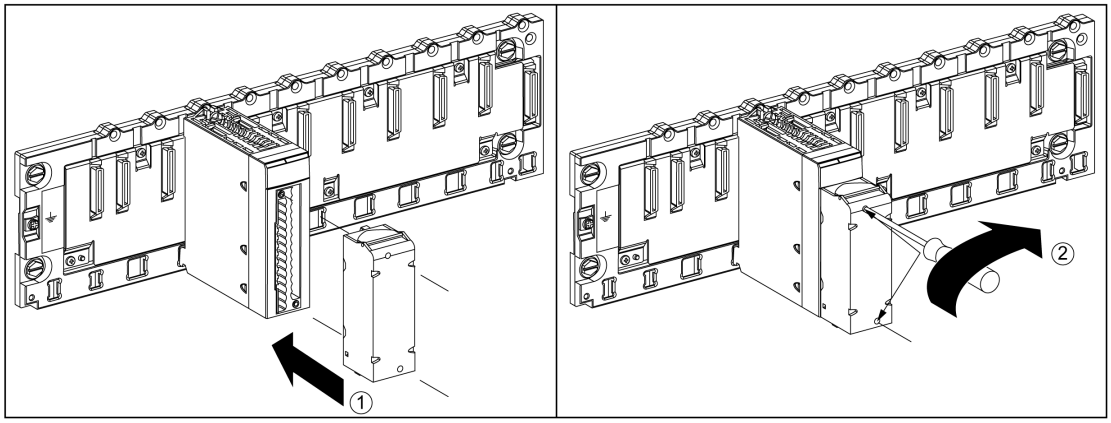
EQUIPMENT DAMAGE

Do not plug an AC terminal block into a DC module. This will cause damage to the module.

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

Installing the Terminal Block

The following table shows the procedure for assembling the 28-pin terminal block onto modules:



Assembly procedure:

Step	Action
1	Once the module is in place on the rack, install the terminal block by inserting the terminal block encoder (the rear lower part of the terminal) into the module's encoder (the front lower part of the module), as shown above.
2	Fix the terminal block to the module by tightening the 2 mounting screws located on the lower and upper parts of the terminal block. Tightening torque: 0.4 N•m (0.30 lbf-ft).

NOTE: If the screws are not tightened, there is a potential risk that the terminal block will not be properly fixed to the module.

Coding the Terminal Block

⚠CAUTION

UNEXPECTED APPLICATION BEHAVIOR

Code the terminal block as described above to prevent the terminal block from being mounted on another module. Plugging the wrong connector could cause unexpected application behavior.

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

NOTICE

MODULE DESTRUCTION

Code the terminal block as described above to prevent the terminal block from being mounted on an incorrect module. Plugging the wrong connector could cause the module to be destroyed.

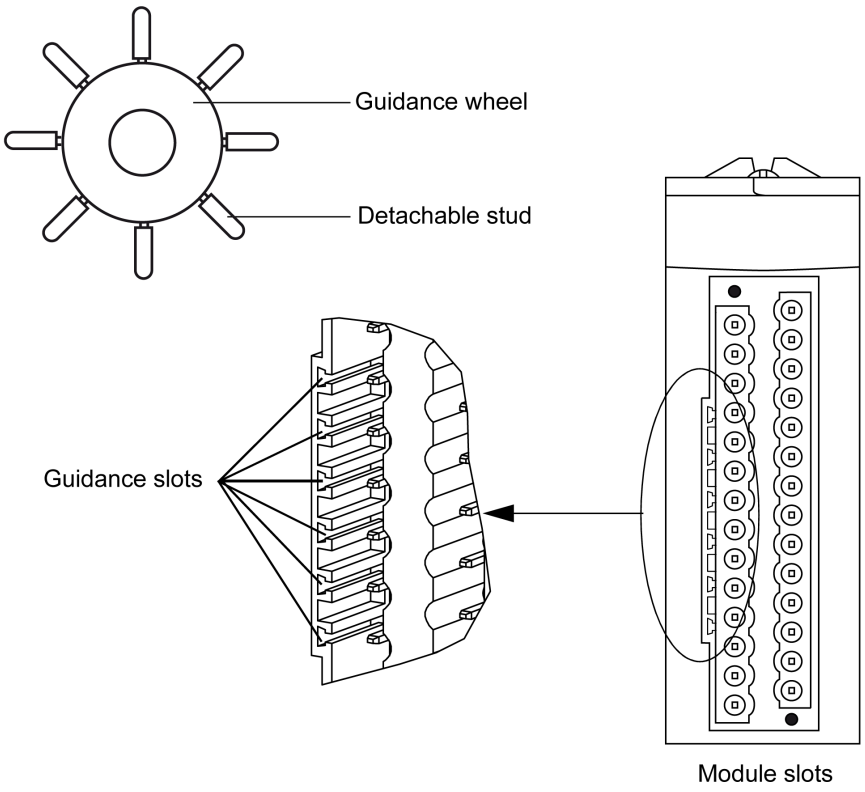
Failure to follow these instructions can result in equipment damage.

When a terminal block is installed on a module dedicated to this type of terminal block, you can code the terminal block and the module using studs. The purpose of the studs is to help prevent the terminal block from being mounted on another module. Handling detected errors can then be potentially avoided when replacing a module.

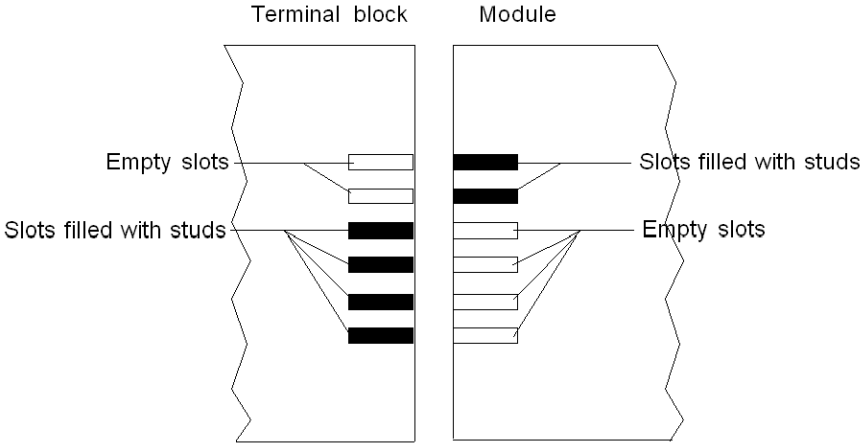
Coding is done by the user with the STB XMP 7800 guidance wheel's studs. You can only fill the 6 slots in the middle of the left side (as seen from the wiring side) of the terminal block, and can fill the module's 6 guidance slots on the left side.

To fit the terminal block to the module, confirm that a module slot with a stud corresponds to an empty slot in the terminal block, or a terminal block with a stud corresponds to an empty slot in the module. You can fill up to and including either of the six available slots as desired.

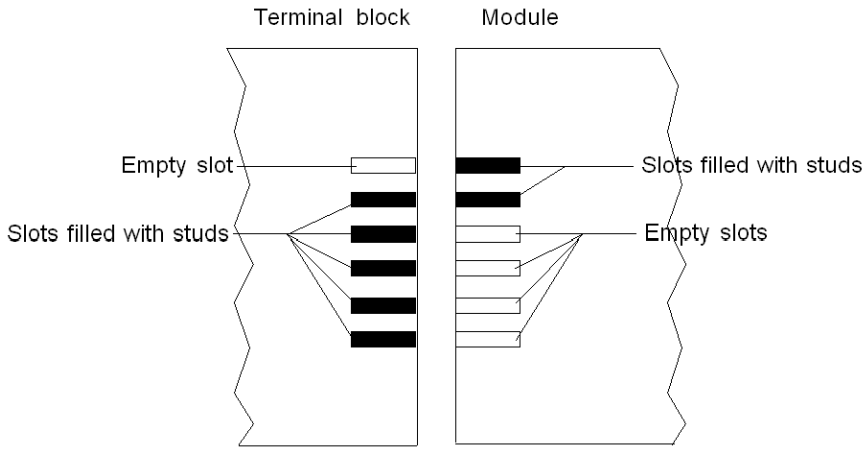
The following diagram shows a guidance wheel as well as the slots on the module used for coding a 28-pin terminal block:



The diagram below shows an example of a coding configuration that makes it possible to fit the terminal block to the module:



The diagram below shows an example of coding configuration with which it is not possible to fit the terminal block to the module:



NOTE: The module connector have indicators which show the proper direction to use for terminal block installation.

Fitting a 40-pin FCN Type Connector to a Module

At a Glance

The modules with 40-pin FCN type connections require the latter to be connected to the module. These fitting operations (assembly and disassembly) are described below.

⚠⚠DANGER

ELECTRICAL SHOCK

FCN type connector must be connected or disconnected with sensor and pre-actuator voltage switched off.

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

⚠CAUTION

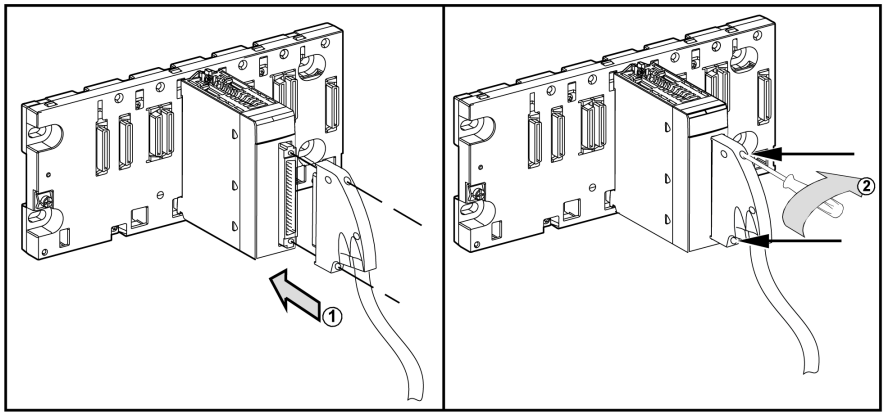
EQUIPMENT DAMAGE

Do not plug an AC connector on a DC module. This would cause equipment damage.

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

Installing the Connector

The following table shows the procedure for assembling the connector onto modules:



Assembly procedure:

Step	Action
1	Once the module is in place on the rack, insert the FCN connector of the cable into the module's connector, as shown above.
2	Fix the connector to the module by tightening the 2 mounting screws located on the lower and upper parts of the terminal block. Tightening torque: 0.4 N•m (0.30 lbf-ft).

NOTE: If the screws are not tightened, there is a potential risk that the terminal block will not be properly fixed to the module.

Choosing Power Supplies for Sensors and Pre-Actuators

Abstract

The different choices of power supply for sensors and pre-actuators linked to input/output modules require that you follow certain precautions.

External Direct Current Power Supplies

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

When using an external 24 VDC direct current power supply, use regulated power supplies or

non-regulated power supplies with:

- filtering of 1000 µF/A with full-wave single-phase rectification and 500 µF/A with tri-phase rectification
- a 5% maximum peak-to-peak ripple rate
- a maximum voltage variation of: -20% to +25% of the nominal voltage (including ripple)

Do not use rectified power supplies with no filtering. They are prohibited.

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

⚠CAUTION

OVERHEATING

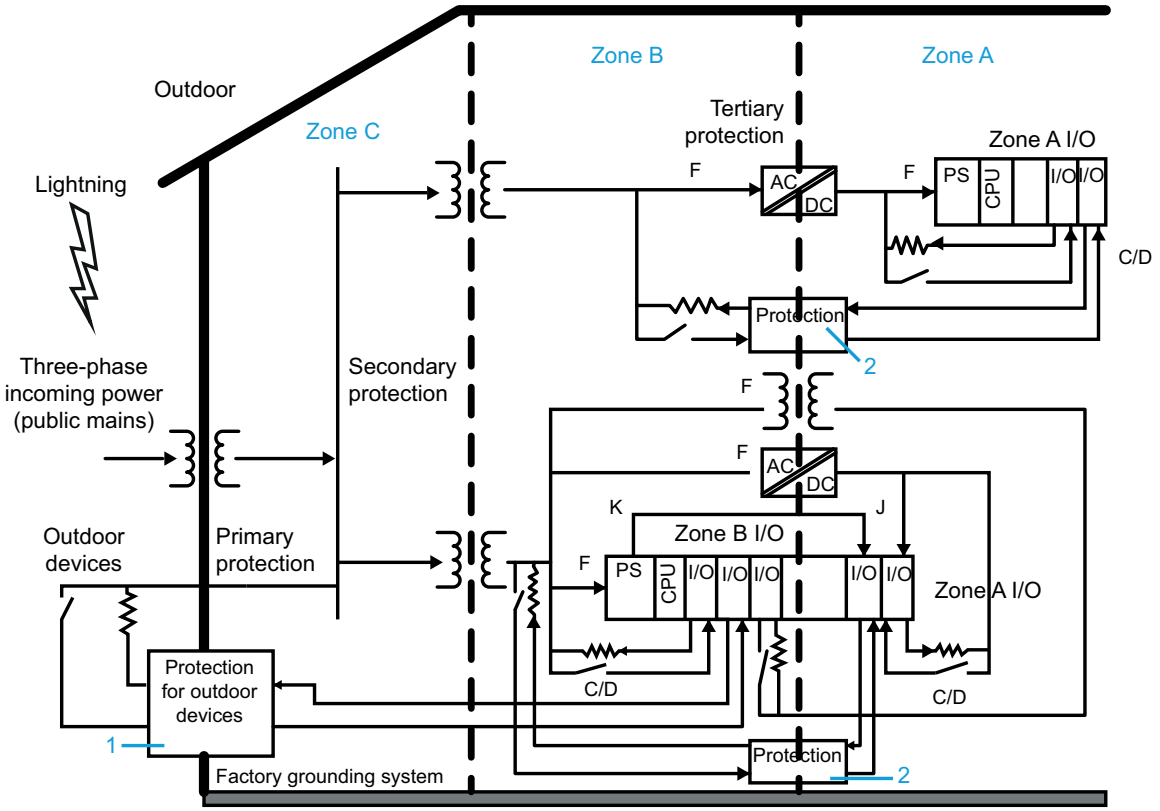
Consider the temperature derating of the discrete I/O modules during installation to prevent the device from overheating and/or deteriorating.

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

External AC Current Power Supplies

All BMXDAI••••, BMXDAO••••, BMXDRA••••, and BMXDRC•••• modules are designed for use in zone A and B defined in the IEC61131-2 PAC standard and the IEC 61000-6-2 generic EMC standard without any specific protection against surges.

The following figure shows the zones defined in the IEC 61131-2 PAC standard:



Zone A Local power distribution

Zone B Dedicated power distribution

Zone C Factory mains

1 Confirm that the protection network can appropriately reduce severity levels from outdoor to zone B.

2 Confirm that the protection network can appropriately reduce severity levels from zone A to zone B.

The immediate, previously-mentioned modules may also be installed in a power generation station/substation according to the IEC 61000-6-5 generic standard for interfaces type 1 and 2, without any specific protection against surges.

Description

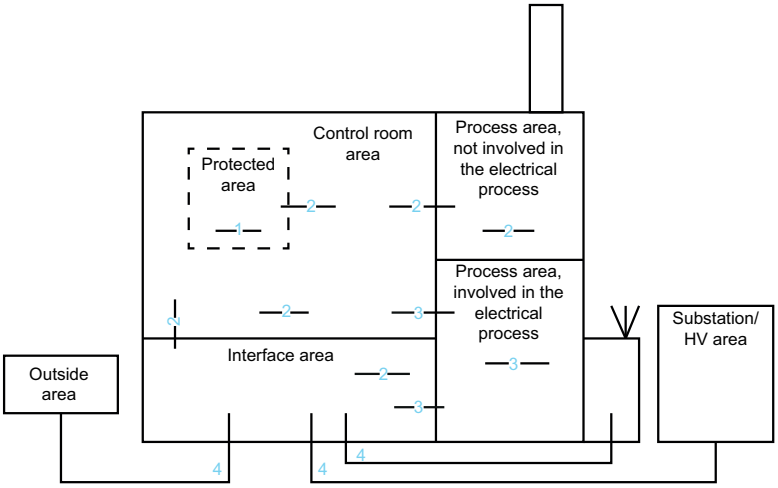
Ni-Cad Battery Power Supplies

Ni-Cad battery power supplies can be used to power sensors, pre-actuators, and all associated inputs/outputs that have a normal operating voltage of 30 VDC maximum.

While being charged, this type of battery can reach, for a duration of one hour, a voltage of 34 VDC. For this reason, all input/output modules with an operating voltage of 24 VDC can withstand this voltage (34 VDC) for up to one hour every 24 hours. This type of operation entails the following restrictions:

- At 34 VDC, confirm that the maximum current withstood by the outputs does not exceed the maximum current defined for a voltage of 30 VDC.
- Temperature downgrading imposes the following restrictions:
  - 80% of inputs/outputs at 1 up to 30°C
  - 50% of inputs/outputs at 1 up to 60°C

The following figure shows the interface types defined in the IEC61000-6-5 generic standard:



1 Inside protected area

2 Inside interface and/or control room and/or process area not involved in the electrical process

3 Inside or from process area involved in the electrical process

4 Connections from outside (HV area and external telecommunication)

Protection Against Surges of AC Power Lines for More Severe Environments

The design of these modules help ensure an immunity level for surges of 2 kV line-to-ground and 1 kV line-to-line and do not require any external protection on AC line branch.

If you plan to install the PAC and its AC I/O modules in a IEC 61131-2 zone C or an IEC 61000-6-5 type 3 or type 4 interface with primary protection only and severe interference coupling, it is the responsibility of the system integrator or the customer to manage the system and help protect it appropriately. You can, with proper mitigation measures, install the PAC and the I/O module in such an environment

For details, refer to the *Schneider Electrical Installation Guide*, which is available for download on www.se.com.

Adding a type 2/class II surge protection device (SPD), for example, an iQuick PRD20r modular surge arrester with voltage protection level (Up) ≤1.5 kV, will withstand surges of 4 kV line-to-ground and 2 kV line-to-line.

Wiring Precautions

Abstract

Input/output modules feature protective measures that help ensure a high resistance to industrial environmental conditions. Nevertheless, observe the following rule.

Description

External Power Supplies for Sensors and Pre-Actuators

Use quick-blow fuses to help protect external sensor and pre-actuator power supplies associated with input/output modules against short-circuits and overloads.

For 40-pin connector input/output modules, link the sensor/pre-actuator power supply to each connector, except in the event of the corresponding channels not in use and not assigned to any task.

⚠⚠DANGER

IMPROPER GROUNDING

- Install the 24V supply according to applicable codes.
- The 0V terminals of the 24V power supplies must be connected to metallic ground and safety ground as close as possible to the supply.
- These measures help ensure personnel safety in the event of a power phase coming into contact with the 24V supply.

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

NOTE: If an input/output module is present on the PAC, connect the sensor and pre-actuator power supply to the power supply of the module; otherwise, an external power supply error is detected, causing the input/output module's LED to flash.

Inputs

Recommendations for use concerning the inputs of modules are as follows:

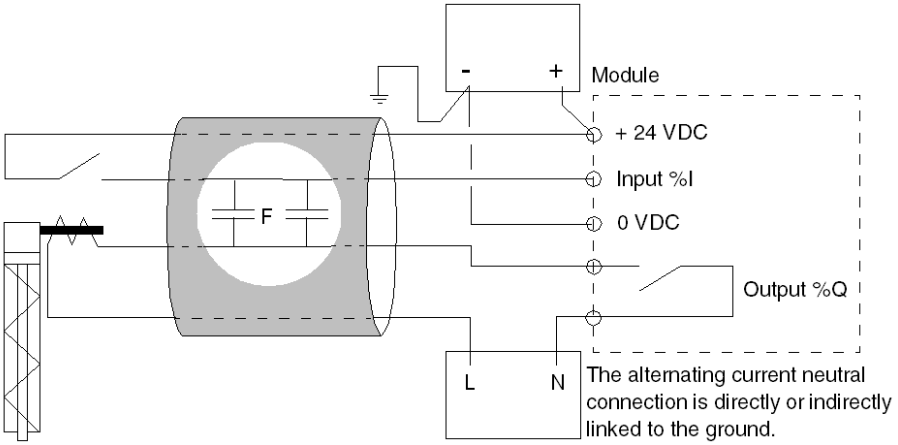
- **For 24 VDC inputs and line coupling with an alternating current network:**

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

- Avoid excessive coupling between AC cables and cables relaying signals intended for direct current inputs.
- Follow the cable routing rules.

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



This case (excessive coupling) is illustrated in the following circuit diagram.

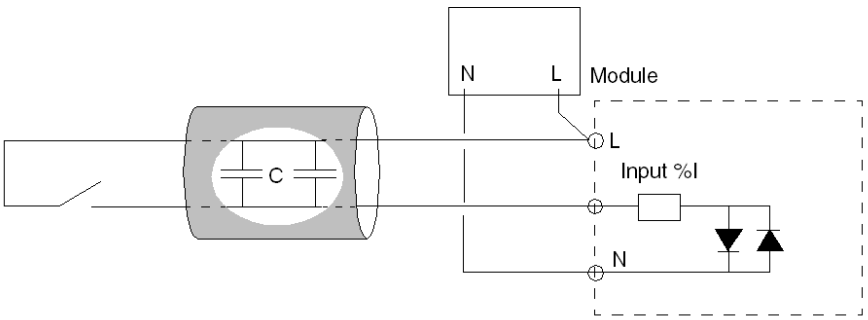
When the input contact is open, the alternating currents may induce a current in the input that might cause it to be set to 1.

For a 240 VAC/50 Hz line coupling, do not exceed the line capacitance values given in the summary table at the end of this section. For a coupling with a different voltage, use the following formula:

Capacitance tolerated = (Capacity at 240VAC x 240) / (Line voltage)

- **For 24 to 240 VAC inputs and line coupling:**

When the line that controls the input is open, the current passes according to the coupling capacitance of the cable (see the following circuit diagram).



Do not exceed the line capacitance values given in the following summary table.

The following summary table shows the acceptable line capacitance values.

Module	Maximum coupling capacitance
24 to 125 VDC inputs	
BMXDDI1602 BMXDDI1603	45 nF (1)

Module	Maximum coupling capacitance
BMXDDI1604T BMXDDM16022 BMXDDM16025	
BMXDDI3202 K BMXDDI6402 K BMXDDM3202 K	25 nF (1)
24 to 140 VAC inputs	
BMXDAI0805 BMXDAI1615	50 nF
BMXDAI1602	50 nF
BMXDAI1603	60 nF
BMXDAI0814 BMXDAI1614 BMXDAI1604	70 nF
(1) A maximum admissible coupling capacitance with a 240 VAC / 50 Hz line. **Example:** A standard cable of 1 m in length has a coupling capacity that falls within 100 and 150 pF.	

Outputs

For the outputs of I/O modules, observe the following recommendations.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Use wires of a sufficient diameter to avoid drops in voltage, overheating, and unexpected equipment operation.

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

Cable Routing

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Observe the following precautions for the wiring system:

- in order to reduce the number of alternating couplings, separate the power circuit cables (power supplies, power switches, etc.) from input cables (sensors) and output cables (pre-actuators), both inside and outside the equipment
- Outside the equipment, place the cables leading to inputs/outputs in covers that make them easily distinguishable from those containing wires relaying high energy levels. Place them in separate metal cable-ways that are grounded. Route these various cables at least 100 mm (4 in.) apart

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

Connecting 40-Pin Connector Modules

Abstract

40-pin connector modules are connected to sensors, pre-actuators, or terminals using a cable designed to enable direct wire-to-wire transition of the module's inputs/outputs.

⚠⚠DANGER

ELECTRIC SHOCK, ARC FLASH OR EXPLOSION

40-pin connectors must be connected or disconnected with the sensor and pre-actuator voltage switched off.

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

Plugging the wrong connector into a module will result in unexpected equipment operation.

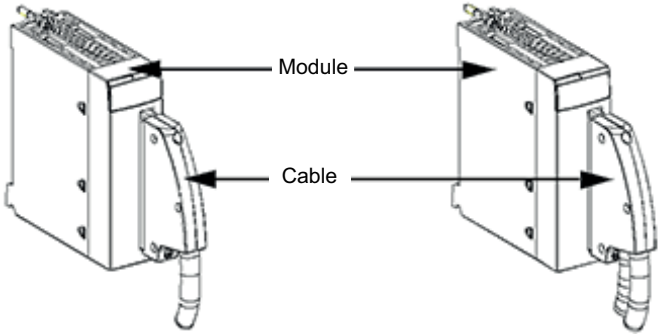
⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Use only a connector that is designed for a specific module.

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

The following diagram shows the connection of the cable to the module.



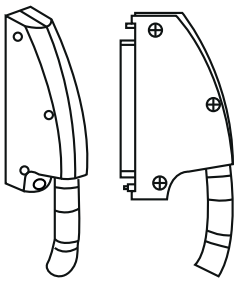
Description

BMXFCW••• Connection Cables

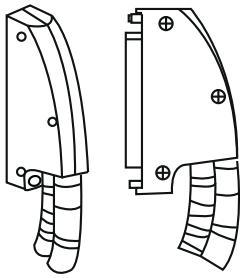
The connection cables are made up of:

- at one end, a compound-filled 40-pin connector from which extends one or two cables sheaths, each containing 20 wires with a cross-sectional area of 0.34 mm^2 (AWG 22)

- at the other end, free-wire ends, color coded



BMX FCW ••1

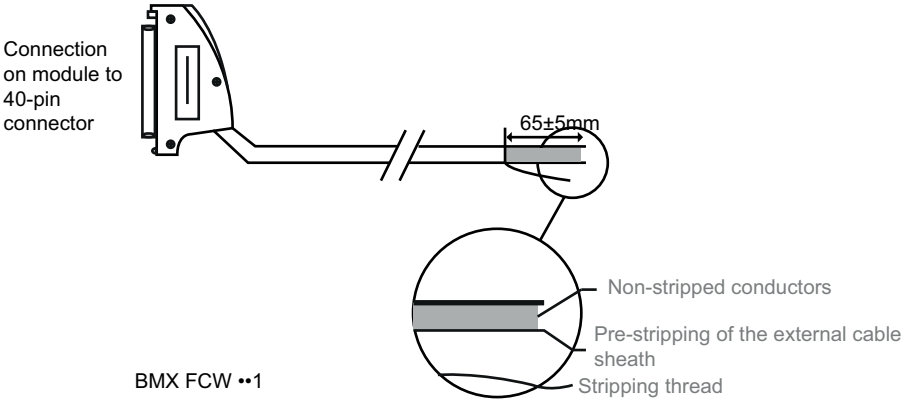


BMX FCW ••3

The cables with one cable sheath containing 20 wires designed to connect the 40-pin connectors to the sensors or pre-actuators come in three different lengths:

- 3 meters: BMXFCW301
- 5 meters: BMXFCW501
- 10 meters: BMXFCW1001

The following figure shows the BMXFCW••1 cables.



BMX FCW ••1

The cables with two cable sheaths containing 20 wires designed to connect the 40-pin connectors to the sensors or pre-actuators come in three different lengths:

- 3 meters: BMXFCW303
- 5 meters: BMXFCW503
- 10 meters: BMXFCW1003

Excessive torque may result in wire breakage, resulting in poor or intermittent connection.

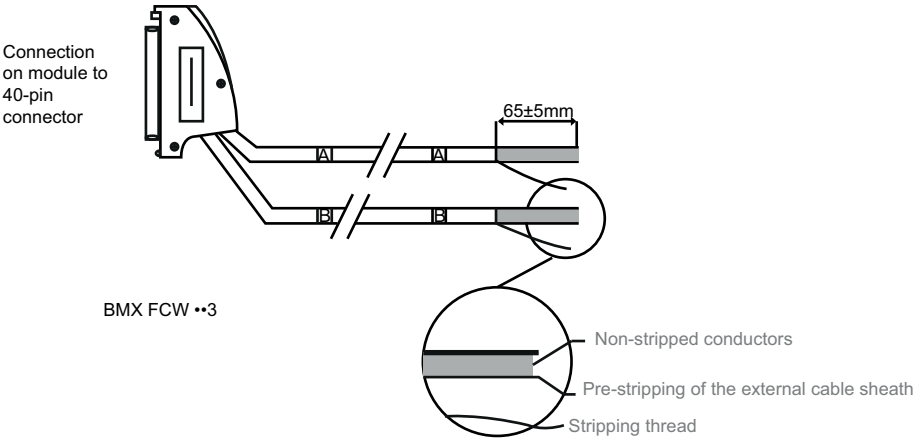
⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Do not exceed the maximum tightening torque.

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

The figure below shows the BMXFCW••3 cables.

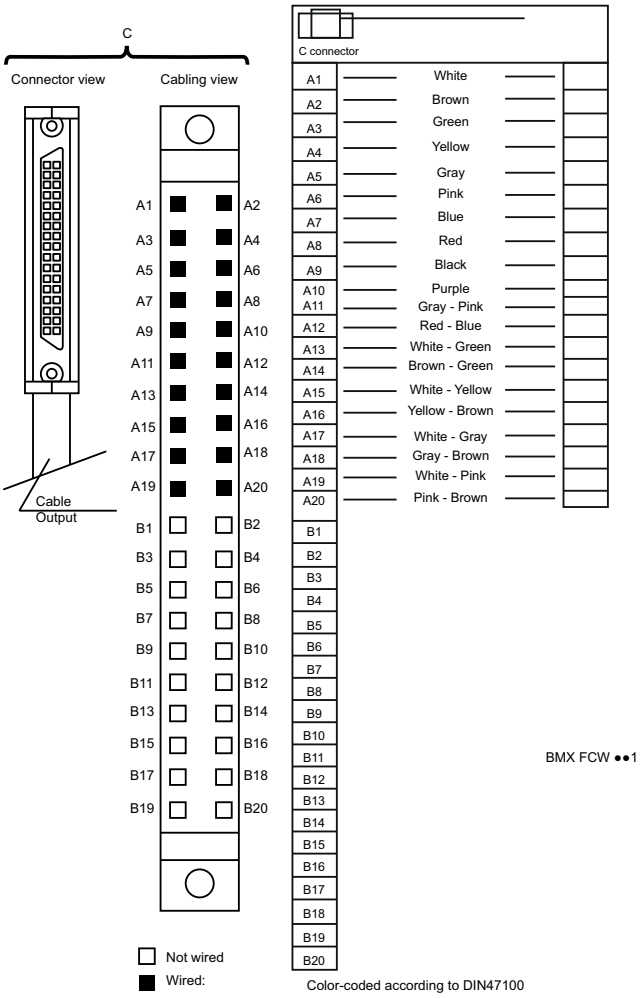


NOTE: A strand of nylon incorporated in the cable allows the cable sheath to be stripped with ease.

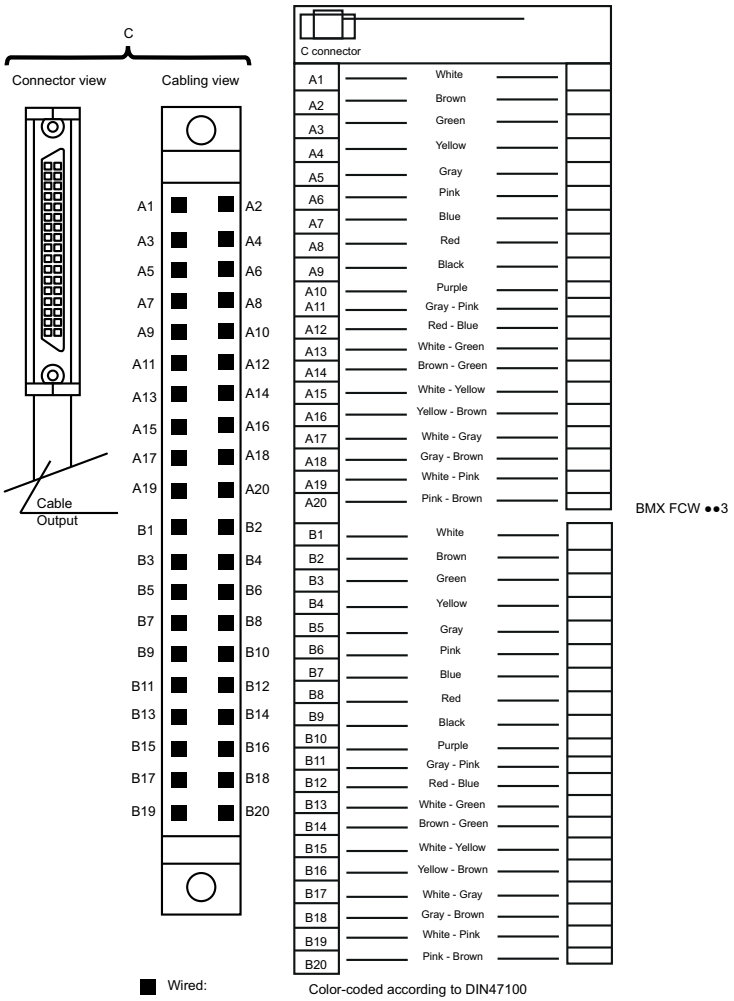
NOTE: The maximum torque for tightening BMXFCW••• cable connection screws is 0.8 N•m (0.59 lb-ft).

Connection of BMXFCW••• Cables

The following diagram shows the connection of BMXFCW••1 cables:



The following diagram shows the connection of BMXFCW••3 cables:



BMXFCW••• Cable Characteristics

This table presents the general characteristics:

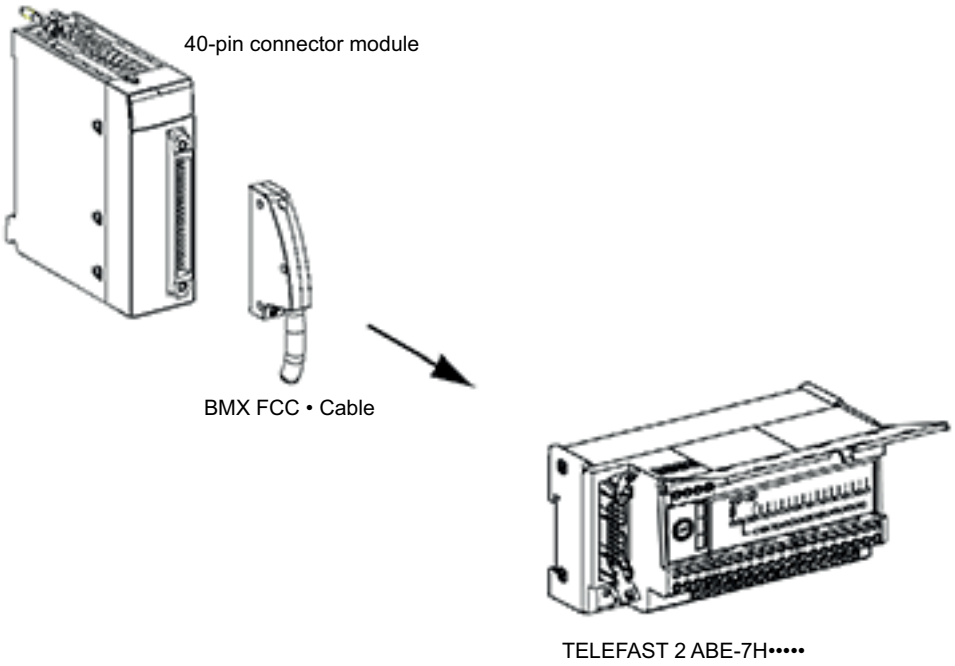
Characteristics		Values
Cable	Sheath material	PVC
	LSZH status	No
Conductor description	Number of conductors	• 20 for BMXFCW••1 • 40 for BMXFCW••3
	Gauge	0.34 mm^2 (22 AWG)
	Material	Tinned copper
Environmental	Operating temperature	-25...70 °C (-13....158 °F)
Applicable standards		DIN47100

Connecting 40-Pin Connector Modules to TELEFAST Interfaces

Abstract

The inputs/outputs of 40-pin connector modules are connected to TELEFAST quick-wiring connection and adaptation interfaces using specific cables for 40-pin to HE10 connectors.

The drawing below shows the connection of a discrete 40-pin connector module to a TELEFAST interface.



Description

BMXFCC••• Cable Descriptions

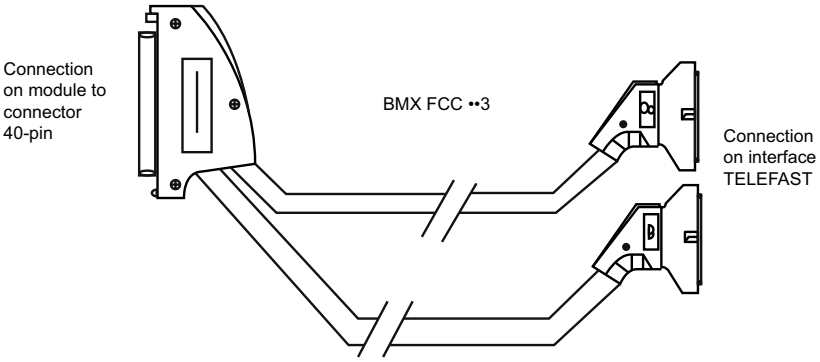
The cables designed for connecting 40-pin connectors to 1xHE10 come in six different lengths:

- 0.5 meters, 20 wires: BMXFCC051
- 1 meter, 20 wires: BMXFCC101
- 2 meters, 20 wires: BMXFCC201
- 3 meters, 20 wires: BMXFCC301
- 5 meters, 20 wires: BMXFCC501
- 10 meters, 20 wires: BMXFCC1001



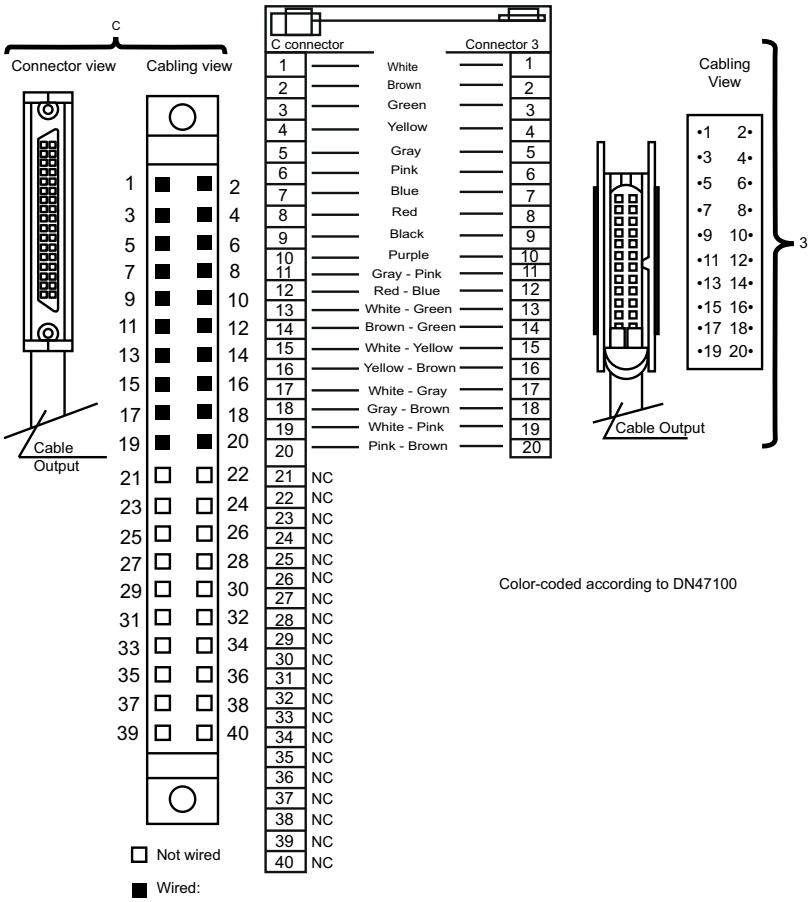
The cables designed for connecting 40-pin connectors to 2xHE10 come in six different lengths:

- 0.5 meters, 20 wires: BMXFCC053
- 1 meter, 20 wires: BMXFCC103
- 2 meters, 20 wires: BMXFCC203
- 3 meters, 20 wires: BMXFCC303
- 5 meters, 20 wires: BMXFCC503
- 10 meters, 20 wires: BMXFCC1003



BMXFCC••• Cable Connection

The following diagram shows the connection of BMXFCC••1 cables.



Excessive torque may result in wire breakage, resulting in poor or intermittent connection.

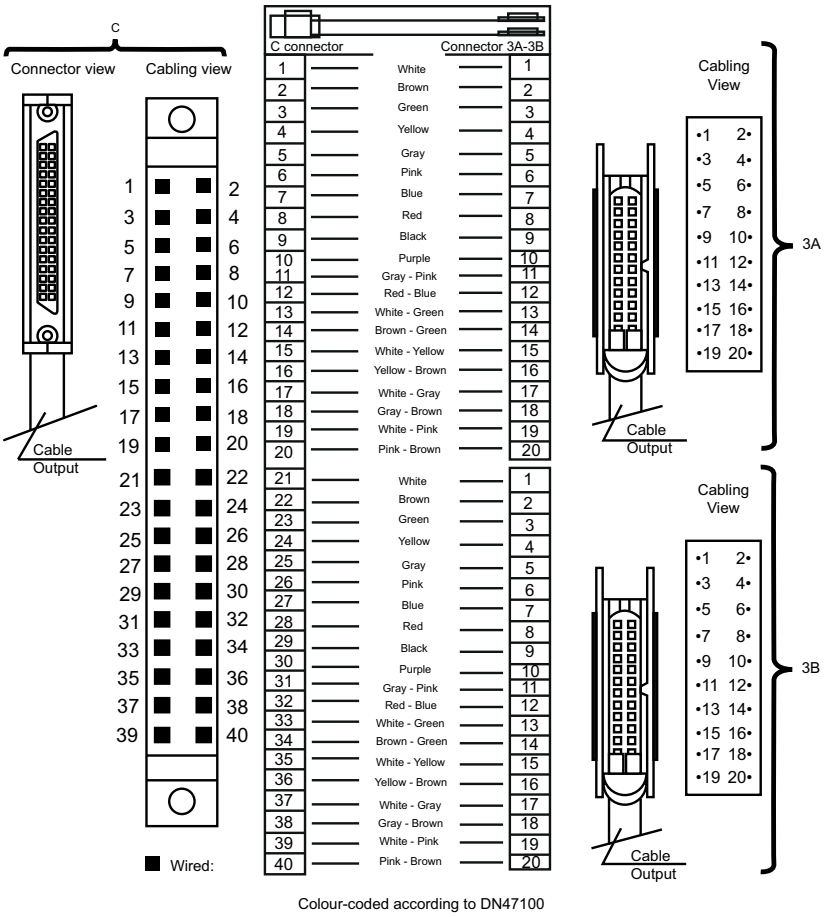
⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Do not exceed the maximum tightening torque.

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

The following diagram shows the connection of BMXFCC••3 cables.



NOTE: The maximum torque for tightening BMXFCC••• cable connection screws is 0,5 N•m (0.37 lb-ft).

BMXFCC••• Cable Characteristics

This table presents the general characteristics:

Characteristics		Values
Cable	Sheath material	PVC
	LSZH status	No
Conductor description	Number of conductors	• 20 for BMX FCC ••1 • 40 for BMX FCC ••3
	Gauge	0.34 mm^2 (22 AWG)
	Material	Tinned copper
Environmental	Operating temperature	-25...70 °C (-13....158 °F)
Applicable standards		DIN47100

Shielding Connection Kit

Introduction

The BMXXSP•••• shielding connection kit allows to connect the cable shielding directly to the ground and not to the module shielding to help protect the system from electromagnetic perturbations.

Connect the shielding on the cordsets for connecting:

- Analog module,

- Counter module,
- Encoder interface module,
- Motion control module,
- An XBT console to the processor (via shielded USB cable).

Kit References

Each shielding connection kit includes the following components:

- A metal bar
- Two sub-bases

The shielding connection kit reference is dependent on the size of the Modicon X80 rack::

X bus racks/Dual Ethernet and X bus racks	Number of slots	Shielding Connection Kit
BMXXBP0400(H)	4	BMXXSP0400
BMEXBP0400(H)		
BMXXBP0600(H)	6	BMXXSP0600
BMXXBP0800(H)	8	BMXXSP0800
BMEXBP0800(H)		
BMXXBP1200(H)	12	BMXXSP1200
BMEXBP1200(H)		

Redundant power supply racks	Number of slots	Shielding Connection Kit
BMEXBP0602(H)	6	BMXXSP0800
BMEXBP1002(H)	10	BMXXSP1200

Clamping Rings

Use clamping rings to connect the shielding on cordsets to the metal bar of the kit.

NOTE: The clamping rings are not included in the shielding connection kit.

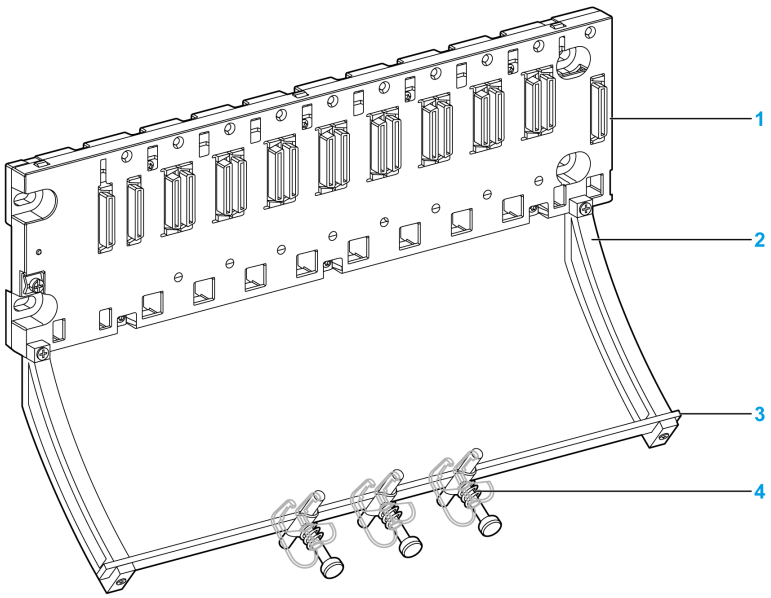
Depending on the cable diameter, the clamping rings are available under the following references:

- STBXSP3010: small rings for cables with cross-section 1.5...6 mm^2 (AWG16...10).
- STBXSP3020: large rings for cables with cross-section 5...11 mm^2 (AWG10...7).

Kit Installation

Installation of the shielding connection kit to the rack can be done with module already installed on the rack except for the BMXXBE0100 rack extender module.

Fasten the sub-bases of the kit at each end of the rack to provide a connection between the cable and the ground screw of the rack:



1 rack

2 sub-base

3 metallic bar

4 clamping ring

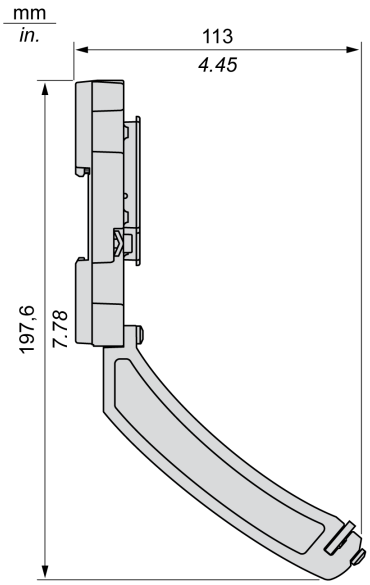
Tightening torques to install the shielding connection kit:

- For the screws fixing the sub-base to the Modicon X80 rack: Max. 0.5 N•m (0.37 lbf-ft)
- For the screws fixing the metallic bar to the sub-bases: Max. 0.75 N•m (0.55 lbf-ft)

NOTE: A shielding connection kit does not modify the volume required when installing and uninstalling modules.

Kit Dimensions

The following figure gives the dimensions (height and depth) of a Modicon X80 rack with its shielding connection kit:

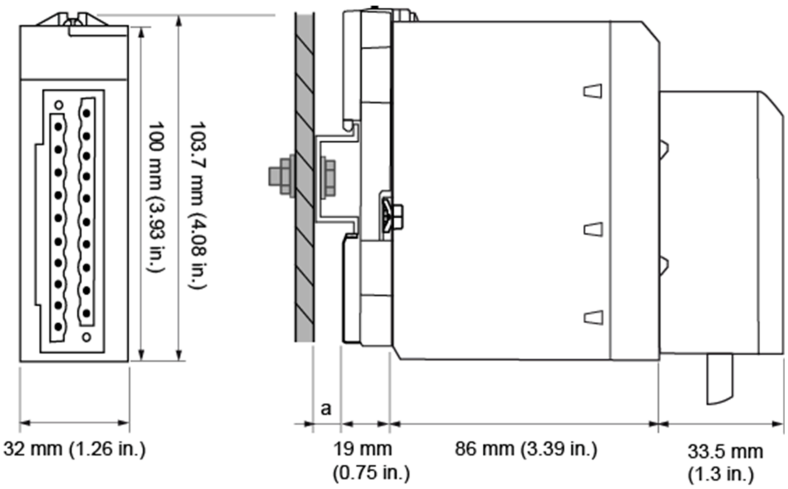


NOTE: The overall width equals to the width of the Modicon X80 rack.

Dimensions of X80 Analog I/O Modules

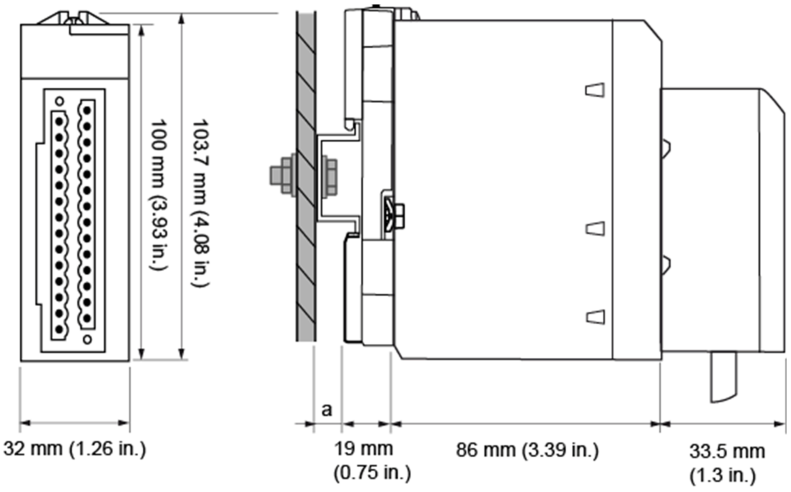
General Presentation of X80 Analog I/O Modules

X80 Analog I/O Module with a 20-pin removable terminal blocks :



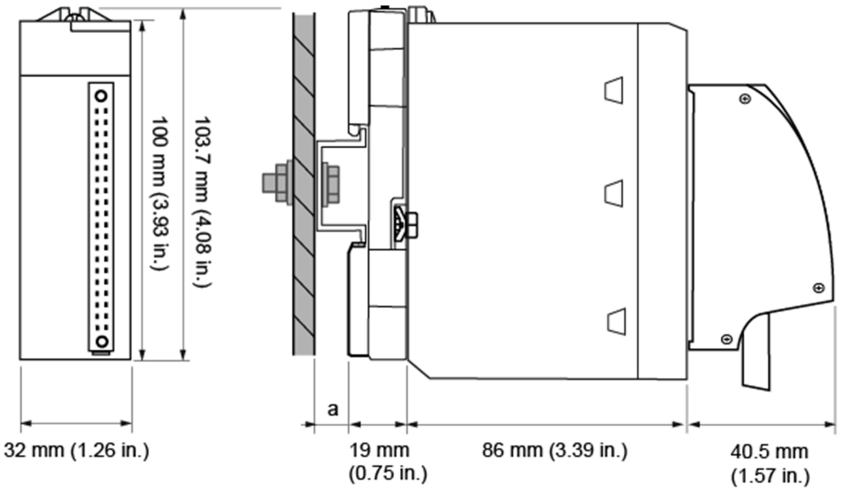
aBackplane depth: the value depends on the backplane type used in your platform.

X80 Analog I/O Module with a 28-pin removable terminal blocks :



a Backplane depth: the value depends on the backplane type used in your platform. Refer to *Mounting the Racks* (see Modicon X80, Racks and Power Supplies, Hardware Reference Manual).

X80 Analog I/O Module with a 40-pin FCN-type connector



a Backplane depth: the value depends on the backplane type used in your platform.

Dimensions of X80 Analog Modules

Module reference	Module dimensions			Installation depth(1)
	Width	Height	Depth	
X80 Analog I/O Module with a 20-pin removable terminal block				
BMXAMI0410(H)	32 mm (1.26 in.)	103.7 mm (4.08 in.)	86 mm (3.39 in.)	119.5 mm (4.69 in.)(1)
BMXAMO0210(H)				
BMXAMO0410(H)				
BMXAMO0802(H)				
BMXAMM0600(H)				
X80 Analog I/O Module with a 28-pin removable terminal block				
BMXAMI0800(H)	32 mm (1.26 in.)	103.7 mm (4.08 in.)	86 mm (3.39 in.)	119.5 mm (4.69 in.)(1)
BMXAMI0810(H)				
X80 Analog I/O Module with a 40-pin FCN-type connector				
BMXART0414(H)	32 mm (1.26 in.)	103.7 mm (4.08 in.)	86 mm (3.39 in.)	126.5 mm (4.96 in.)(1)
BMXART0814(H)				
(1) backplane depth (a) is not included.				

NOTE: Connectors that are delivered with the X80 Analog I/O modules (20-pin and 28-pin removable terminal blocks, and 40-pin FCN-type connector) and the corresponding pre-assembled cordsets (BMXFTW*01S, BMXFTW*08S, and BMXFCW*01S) have the same dimensions.

NOTE: Consider clearance for cable installation and spacing around the racks.

Adjust Configuration

Overview

For details about configuring Adjust parameters for analog input/output modules, refer to the Adjust screen for the BMXEHC0800 counting module, page 628

topic.

Sensor/Input and Pre-actuator/Output Compatibility

Abstract

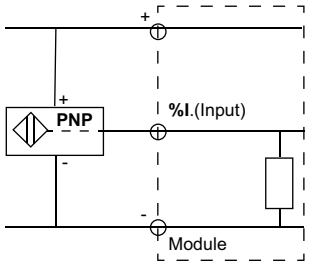
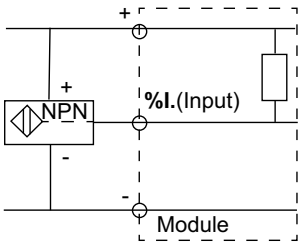
The compatibility between sensors and analog/discrete module inputs depends on the type of sensor used.

Similarly, the compatibility between pre-actuators and analog/discrete module outputs depends on the type of pre-actuator used.

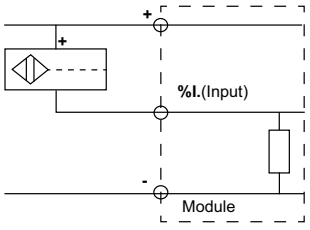
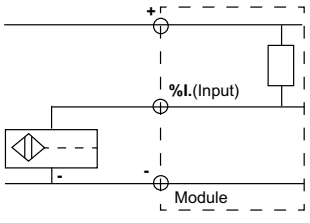
Description

Sensor/Input Compatibility

The following table presents the compatibility between 3-wire sensors and 24 VDC and 48 VDC inputs.

3-wire sensors and IEC 61131-2 compliant type 3 positive logic (sink) inputs: all 3-wire PNP inductive or capacitive proximity sensors and photo-electric detectors that have an operating voltage of 24 VDC and 48 VDC are compatible with all positive logic inputs.	
3-wire sensors and negative logic (source) inputs: all 3-wire NPN inductive or capacitive proximity sensors and photo-electric detectors that have an operating voltage of 24 VDC and 48 VDC are compatible with all negative logic inputs.	

The following table presents the compatibility between 2-wire sensors and 24 VDC and 48 VDC inputs.

2-wire sensors and IEC 61131-2 compliant type 1 positive logic (sink) inputs: all proximity sensors or other 2-wire sensors with an operating voltage of 24 VDC and 48 VDC and with the characteristics described in the next table are compatible with all positive logic 24 VDC inputs.	
2-wire sensors and negative logic (source) inputs: all proximity sensors or other 2-wire sensors with an operating voltage of 24 VDC are compatible with all negative logic 24 VDC inputs.	

Compatibility between 2-wire sensors and 24/48 VAC and 120 VAC inputs:

All IEC 60947-5-2 compliant 2-wire AC proximity sensors able to withstand 100...120 VAC are compatible with all IEC 61131-2 type 1 and type 3 compliant 110...20 VAC inputs.

The following tables provide a summary of compatibility between sensors and input/output module inputs.

Types of proximity sensor	**Types of input**			
	24 VDC **Positive logic**	**48 VDC** **Type 1** **Positive logic**	**24 VDC** **Type 3** **Positive logic**	**24/48 VDC** **Negative logic**
All PNP-type 3-wire (DC) proximity sensors	X	X	X	-
All NPN-type 3-wire (DC) proximity sensors	-	-	-	X
Telemecanique or other brand 2-wire (DC) proximity sensors with the following characteristics: • Voltage drop in closed state ≤ 7 V • Minimum switched current ≤ 2.5 mA • Residual current in open state ≤ 1.5 mA	-	X	X	-
Telemecanique or other brand 2-wire (DC) proximity sensors with the following characteristics: • Voltage drop in closed state ≤ 4 V • Minimum switched current ≤ 1 mA • Residual current in open state ≤ 0.5 mA	X	X	X	-
X compatible **-** not compatible **DC** voltage operation				

Types of proximity sensor	**Types of input**		
	24 VAC **Type 1**	**48 VAC** **Type 3**	**100-120 VAC** **Type 3**
2-wire (AC/DC) proximity sensor (see note)	X	X	X
2-wire (AC) proximity sensor	X	X	X
X compatible **AC** voltage operation **AC/DC** AC or DC voltage operation **NOTE:** 24 VDC inputs can be used in positive (sink) or negative (source) logic but are not IEC compliant.			

Pre-actuator/Output Compatibility

Excessive currents will shorten relay life.

⚠CAUTION

SHORTENED RELAY LIFE

Ensure that currents switched by the relay outputs do not exceed the relay ratings.

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

Compatibility of DC Pre-actuators with Outputs

Comply with the output's maximum current and maximum switching frequency as specified in the module characteristics.

NOTE: Where low consumption pre-actuators are used, pay special attention to the leakage current of the idle output, to help ensure that the maximum current is correctly calculated:

$I_{max} = I_{nominal} + I_{leakage}$

Given that:

$I_{nominal}$ = Current required to operate by the pre-actuator

$I_{leakage}$ = Maximum leakage current in idle output state

Compatibility of Tungsten Filament Lamps and Static Outputs (Static Current)

For outputs with protection against short circuits, confirm that the maximum power of the tungsten filament lamps specified in the module characteristics complies. If not, the lamp's pick-up current might cause a tripped output at the time of power-up.

Compatibility of AC Pre-actuators and Relay Outputs

Inductive AC pre-actuators have a pick-up current of up to 10 times their holding current for a duration of 2/F seconds (F = alternating current frequency). Relay outputs are therefore set to withstand these conditions (AC14 and AC15). The table of characteristics for relay outputs gives the maximum authorized running power (in AV) according to the number of operations.

Analog Input/Output Module Software Implementation

What's in This Chapter

Introduction to the Installation Phase 242
Configuration Screen of an Analog I/O Module 244
Parameters for Analog Input Modules 246
Parameters for Analog Output Modules 248
Forcing Analog Modules 248
Analog Input/Output Module States 249
Analog Input/Output Module Diagnostics 250

Introduction

This part describes general rules for implementing analog input/output modules with the EcoStruxure™ Automation Expert software program.

Introduction to the Installation Phase

Introduction

The software installation of application-specific modules is carried out from the various EcoStruxure™ Automation Expert editor:

- Offline mode
- Online mode

If you do not have a controller to which you can connect, EcoStruxure™ Automation Expert allows you to carry out an initial test using a simulator. In this case, the installation is different.

Follow the order of the installation phase.

Installation Phases When Using a Controller

The following table presents the various installation phases when using a controller.

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

Phase	Description	Mode
Documenta-tion	Creating a documentation file and printing of the miscellaneous information relating to the project	Online
Operation / Diagnostics	Display of the miscellaneous information required to supervise the project	Online
	Diagnostics of the project and modules	
(1) These phases may also be performed online.		

Installation Phases When Using a Simulator

The following table presents the various installation phases when using a simulator.

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

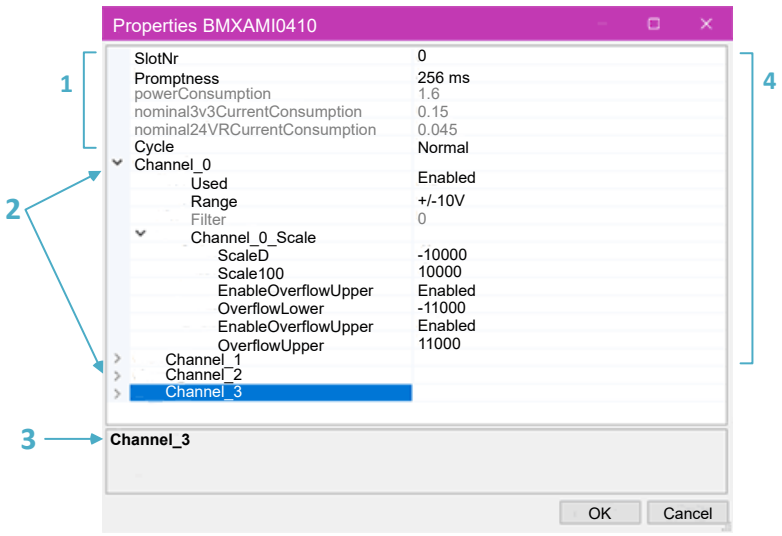
Module Configuration Phase

The configuration parameters may only be modified in the EcoStruxure™ Automation Expert software.

Adjustment parameters may be modified either in the EcoStruxure™ Automation Expert software (in debugging mode) or in the application.

Configuration Screen of an Analog I/O Module

Configuration Screen



Configuration Window

The following table presents the various parts of the preceding screenshot:

Number	Element	Function
1	**Module configuration**	Configurable parameters regarding rack placement and power for the specific analog module you selected.
2	**Channel configuration**	Configuration parameters for the various channels. The parameters vary depending on the analog module you selected
3	**Parameter description**	Description of the highlighted parameter you want to configure within the dialog box
4	**Parameter values**	Configurable parameter values that correspond to the analog module you selected. Some of the parameter values have drop-down lists from which you choose a value. Populate other parameter values with respective integers.

Configuration Parameters

Parameter	Description	Value
SlotNr	Slot position number on the rack	Enter a numeric value.
Promptness[1]	Promptness of the module (delay in ms to fallback state in case of communication loss). Default value = 256 ms[1]	Select an option from the list:[1] • No promptness • 16 ms • 32 ms • 64 ms • 256 ms (default) • 1 s • 4 s • 16 s • 64 s
powerConsumption[2]	Power consumption of the module (watts)[2]	Enter a numeric value.[2]

nominalVCurrentConsumption[2]	Maximum nominal current consumption in 3V3_BAC output (amper)[2]	Enter a numeric value.[2]
nominal24VRCurrentCon-sumptionEnter a numeric value.[2]	Maximum nominal current consumption in 24V_BAC output (amper)[2]	Enter a numeric value.[2]
Cycle	Select the outputs/channels to sample.	Select an option from the list: • Normal All channels are sampled. • Fast Only the inputs declared to be in use are sampled.
Channel_0		
Used	Select whether the analog channel is enabled/sampled.	Select an option from the list: • Enabled (default) • Disabled
Range	Select the input range.	Select an option from the list: • +/-10V (default) • 0...10V • 0...5V / 0...20mA • 1...5V / 4...20mA • +/_5V / +/-20mA
Filter[2]	Select the level of filtering[2]	Select an option from the list:[2] • 0: No filtering (default) • 1, 2: Low filtering • 3, 4: Medium filtering • 5, 6: High filtering
Channel_0_Scale		
Scale0		Set scale value for 0% PV. • For ranges with +/_, use —10,000. • For other ranges, use 0.
Scale100	Set scale value for 100% PV.	
EnableOverflowLower	Select whether the lower overflow is enabled or disabled.	Select an option from the list: • Enabled (default) • Disabled
OverflowLower		Set the lower overflow value (-11,000 default).
EnableOverflowUpper	Select whether the upper overflow is enabled or disabled.	Select an option from the list: • Enabled (default) • Disabled
OverflowUpper	Set upper overflow value.	Enter a numeric value (11,000 default).
...(Subsequent channels are configured similarly hereafter.)		
[1] The promptness value, which allows the system to compute the promptness according to the number of modules and their weights, is **not** available in this release.		
[2] This field is typically grayed out, disabled for configuration.		

Parameters for Analog Input Modules

At a Glance

Analog input modules include channel-specific parameters displayed in the module configuration screen.

Reference

The available parameters for each analog input module are as follows (parameters indicated in bold characters are part of the default configuration).

Parameter	BMXAMI0410	BMXAMI0800	BMXAMI0810
Number of input channels	4	8	8
Channel used (1)	**Active** / Inactive	**Active** / Inactive	**Active** / Inactive
Scan Cycle	**Normal** Fast	**Normal** Fast	**Normal** Fast
Range	**+/-10 V** 0..0.10 V 0..5 V / 0..20 mA 1..5 V / 4..20 mA +/- 5V +/- 20mA	**+/-10 V** 0..10 V 0..5 V / 0..20 mA 1..5 V / 4..20 mA +/- 5V +/- 20mA	**+/-10 V** 0..10 V 0..5 V / 0..20 mA 1..5 V / 4..20 mA +/- 5V +/- 20mA
Filter	**0**..6	**0**..6	**0**..6
Display	**%..** / User	**%..** / User	**%..** / User
Task associated to Channel	**MAST** / FAST	**MAST** / FAST	**MAST** / FAST
Group of channels affected by the task change	2 contiguous channels	2 contiguous channels	2 contiguous channels
Rejection	-	-	-
Wiring Control (1)	-	-	-
Cold junction compensation: channels 0-3	N/A	N/A	N/A
Lower Range Overflow Control (1)	**Active** / Inactive	**Active** / Inactive	**Active** / Inactive
Upper Range Overflow Control (1)	**Active** / Inactive	**Active** / Inactive	**Active** / Inactive
Lower Threshold Range Overflow (1)	-11,400	-11,400	-11,400
Upper Threshold Range Overflow (1)	11,400	11,400	11,400
(1) This parameter is available as a checkbox.			

Parameter	BMXAMM0600	BMXART0414	BMXART0814
Number of input channels	4	4	8
Channel used (1)	**Active** / Inactive	**Active** / Inactive	**Active** / Inactive
Scan Cycle	**Normal** Fast	-	-
Range	**+/-10 V** 0..0.10 V	**Thermo K** Thermocouple B	**Thermo K** Thermocouple B

Parameter	BMXAMM0600	BMXART0414	BMXART0814
	0..5 V / 0..20 mA 1..5 V / 4..20 mA	Thermocouple E Thermo J Thermo L Thermo N Thermo R Thermo S Thermo T Thermo U 0..400 Ohms 0..4000 Ohms Pt100 IEC/DIN Pt1000 IEC/DIN Pt100 US/JIS Pt1000 US/JIS Cu10 Copper Ni100 IEC/DIN Ni1000 IEC/DIN +/- 40 mV +/- 80 mV +/- 160 mV +/- 320 mV +/- 640 mV +/- 1.28 V	Thermocouple E Thermo J Thermo L Thermo N Thermo R Thermo S Thermo T Thermo U 0..400 Ohms 0..4000 Ohms Pt100 IEC/DIN Pt1000 IEC/DIN Pt100 US/JIS Pt1000 US/JIS Cu10 Copper Ni100 IEC/DIN Ni1000 IEC/DIN +/- 40 mV +/- 80 mV +/- 160 mV +/- 320 mV +/- 640 mV +/- 1.28 V
Filter	**0**..6	**0**..6	**0**..6
Display	**%..** / User	**1/10 °C** / 1/10 °F / %.. / User	**1/10 °C** / 1/10 °F / %.. / User
Task associated to Channel	**MAST** / FAST	**MAST**	**MAST**
Group of channels affected by the task change	2 contiguous channels	2 contiguous channels	2 contiguous channels
Rejection	-	**50 Hz** / 60 Hz	**50 Hz** / 60 Hz
Wiring Control (1)	-	Active / **Inactive**	Active / **Inactive**
Cold junction compensation: channels 0-3	N/A	• Internal by TELEFAST, • External by PT100.	• Internal by TELEFAST, • External by PT100, • Using the CJC values of channels 4/7 for channels 0/3.
Lower Range Overflow Control (1)	**Active** / Inactive	**Active** / Inactive	**Active** / Inactive
Upper Range Overflow Control (1)	**Active** / Inactive	**Active** / Inactive	**Active** / Inactive
Lower Threshold Range Overflow (1)	-11,250	-2,680	-2,680
Upper Threshold Range Overflow (1)	11,250	13,680	13,680
(1) This parameter is available as a checkbox.			

Parameters for Analog Output Modules

At a Glance

The analog output module includes channel-specific parameters displayed in the module configuration screen.

Reference

The following table shows the available parameters (default configuration is indicated in bold).

Module	BMXAMO0210	BMXAMO0410	BMXAMO0802	BMXAMM0600
Number of output channels	2	4	8	2
Range	**+/-10 V** 0...20 mA 4...20 mA	**+/-10 V** 0...20 mA 4...20 mA	**0...20 mA** 4...20 mA	**+/-10 V** 0...20 mA 4...20 mA
Task associated to Channel	**MAST** / FAST	**MAST** / FAST	**MAST** / FAST	**MAST** / FAST
Group of channels affected by the task change	All channels	All channels	All channels	All channels
Fallback	**Fallback to 0** / Maintain / Fallback to value	**Fallback to 0** / Maintain / Fallback to value	**Fallback to 0** / Maintain / Fallback to value	**Fallback to 0** / Maintain / Fallback to value
Lower Range Overflow Control (1)	**Active** / Inactive	**Active** / Inactive	**Active** / Inactive	**Active** / Inactive
Upper Range Overflow Control (1)	**Active** / Inactive	**Active** / Inactive	**Active** / Inactive	**Active** / Inactive
Wiring CTRL (1)(2)	Active / **Inactive**	Active / **Inactive**	Active / **Inactive**	Active / **Inactive**

(1) This parameter is available as a checkbox.

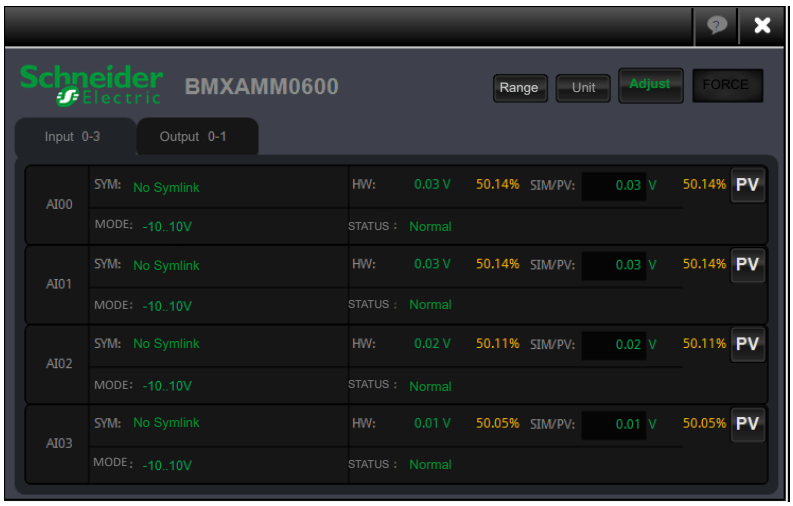
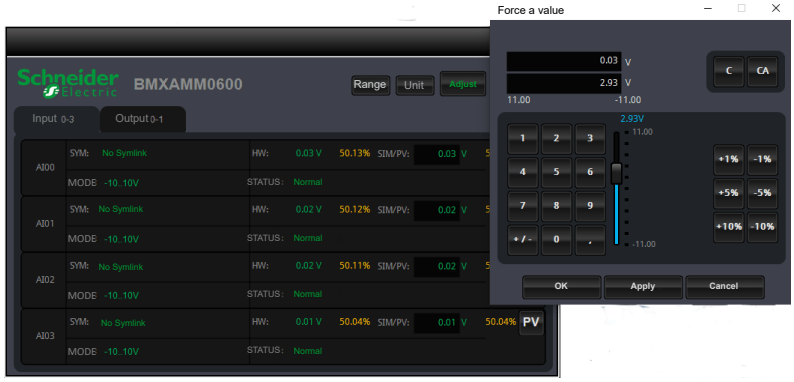
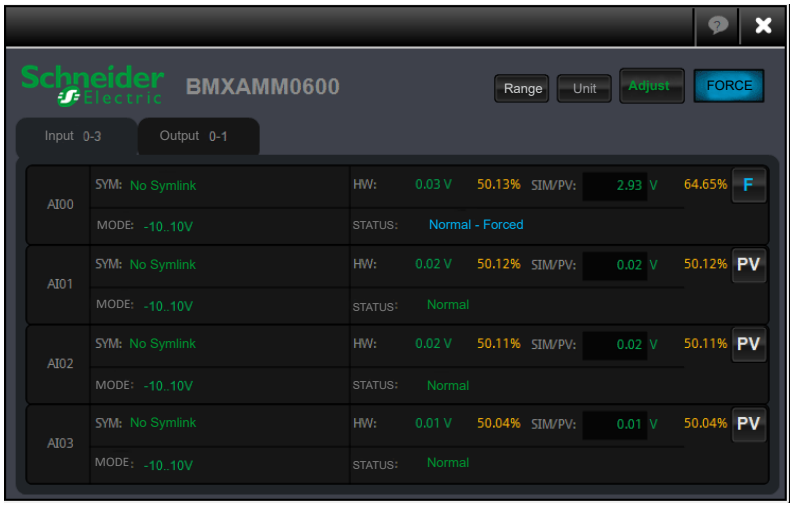
(2) The Wiring CTRL function detects for a broken wire.

Forcing Analog Modules

Forcing

The procedure to force a value is as follows:

Step	Action
1	Open the HMI.

	
2	Click on the indicator FORCE. Result: The Force value window is displayed. 
3	Result: The HMI is updated with the new value and status. The FORCE indicator flashes. 

NOTE: Upon closing and reopening the **Force a value** window, the forced value does not persist, yet it is preserved within the memory space.

Analog Input/Output Module States

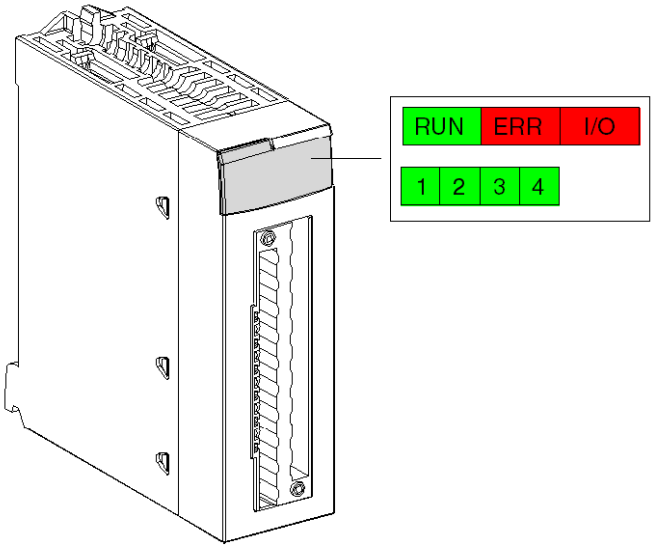
At a Glance

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

- Module status LEDs: RUN, ERR and I/O.
- Channels status LEDs: IN • (for input modules), OUT • (for output modules).

Description

The modules have several LEDs that indicate their status:



Description of the LEDs:

LED	Meaning
RUN (green)	Module operating status
ERR (red)	Internal detected error in the module or a conflict between the module and the remainder of the configuration.
I/O (red)	External error is detected

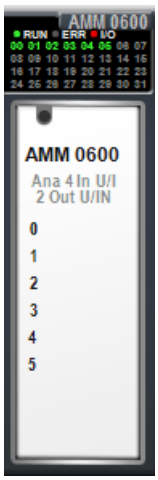
Analog Input/Output Module Diagnostics

Introduction

When an error is detected in an analog input/output module, the following events are possible:

- **Internal events**
  - Module malfunction detected
  - Self-testing error detected
- **External events**
  - Wiring control (broken wire, overload, or short-circuit)
  - Under/over range (outside the supported limit values)
- **Other events**
  - Configuration error detected
  - Module missing or off
  - Inoperative channel

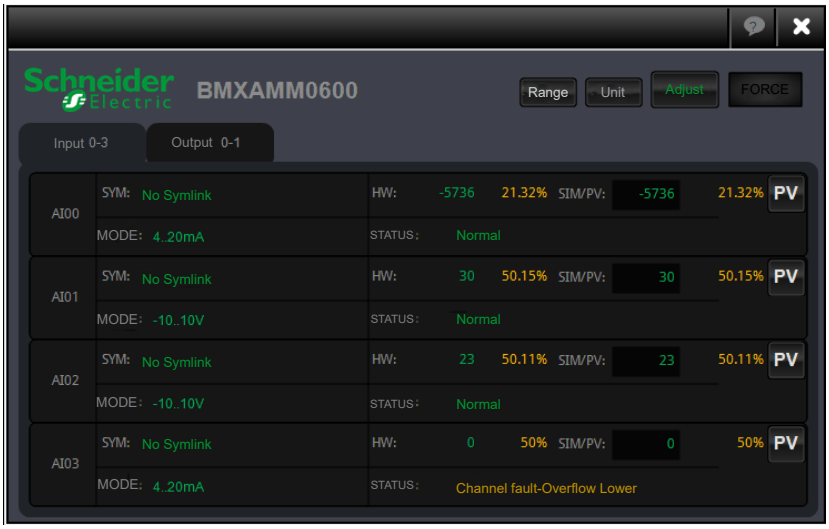
A detected error is indicated on the module LEDs: **I/O** and/or **ERR**



More information about diagnostics via the module LEDs is located in the *Analog Input/Output Module Diagnostics* topic

Procedure

The following table describes the procedure for accessing the module's **Fault** screen.

Step	Action
1	Open the module's faceplate screen.
2	You can view the status of each channel via the **Status** screen parameter to establish a diagnosis. 
3	The quality code is posted in the message log pad (or in the VTQ structure of the value) for each status information of analog modules. **Quality Code** / **Status** 0000 0000 — Normal 8000 0000 — Channel not available Error detected 0096 0000 — Local override 4000 0000 — Overflow upper Overflow lower Module mismatch

Step	Action
	<table><tr><td></td><td>Module unplugged</td></tr></table> **NOTE:** The quality code is a mask. The quality code of local override status can be superimposed on other quality codes. For instance, 4096 0000 for the status Overflow Upper - Local Override. **NOTE:** The faceplate display is crossed out with a red line to indicate a mismatched or unplugged module.
4	The status in the preceding step has the following meanings: • Channel not available : Wiring control, Inoperative channel, or configuration error detected • Error detected: Wiring control • Overflow upper: Under range • Overflow lower: Over range • Module mismatch: Module missing or off • Module unplugged: Module unplugged or off

Analog Input/Output Channel Parameters

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Selecting the Input Channel Scan Cycle 253
Selecting the Display Format for a Current or Voltage Input Channel 254
Selecting the Display Format for a Thermocouple or RTD Input Channel 255
Selecting the Input Channels' Filter Value 256
Selecting the Input Channel Usage 257
Selecting the Overflow Control Function 258
Selecting the Cold Junction Compensation 259
Selecting the Fallback Mode for Analog Outputs 260

Selecting the Range for Analog Input/Output Channels

Introduction

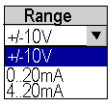
This parameter defines the range for the input or output channel.

Depending on the type of module, the input/output range may be:

- voltage
- current
- a thermocouple
- an RTD

Procedure

The following procedure defines the range assigned to an analog module's channels.

Step	Procedure
1	Access the hardware configuration screen for the appropriate module
2	In the range column, click the arrow of the pull-down menu pertaining to the channel you wish to configure. **Results** : The following list appears. 
3	Select the appropriate range.
4	Validate the change by clicking **Edit > Validate**.

Selecting the Input Channel Scan Cycle

At a Glance

This parameter defines the input channel scan cycle for analog modules.

The input scan cycle may be:

- **Normal**: Channels are sampled within the time period specified in the module's characteristics.
- **Fast**: Only those inputs declared to be **In Use** are sampled. The scan cycle is therefore determined by the number of channels in use and by the time period allocated for scanning one channel.

Input channel registers are updated at the beginning of the task to which the module is assigned.

NOTE: The **Normal** / **Fast** and **In Use** cycle parameters cannot be edited in online mode if the project has been transferred to the controller with the default values specified for these parameters (i.e. Normal cycle and All channels in use).

Instructions

The following table provides step-by-step instructions allowing you to define the scan cycle assigned to an analog module's inputs.

Step	Action
1	Access the hardware configuration screen for the appropriate module.
2	For the group of input channels you wish to configure, check the appropriate box (**Normal** or **Fast**) for the **Cycle** field of the **General Parameters** area. **Result**: The selected scan cycle will be assigned to the channels.
3	Validate the change by clicking **Edit > Validate**.

Selecting the Display Format for a Current or Voltage Input Channel

At a Glance

This parameter defines the display format for the measurement of an analog module channel whose range is configured for voltage or current.

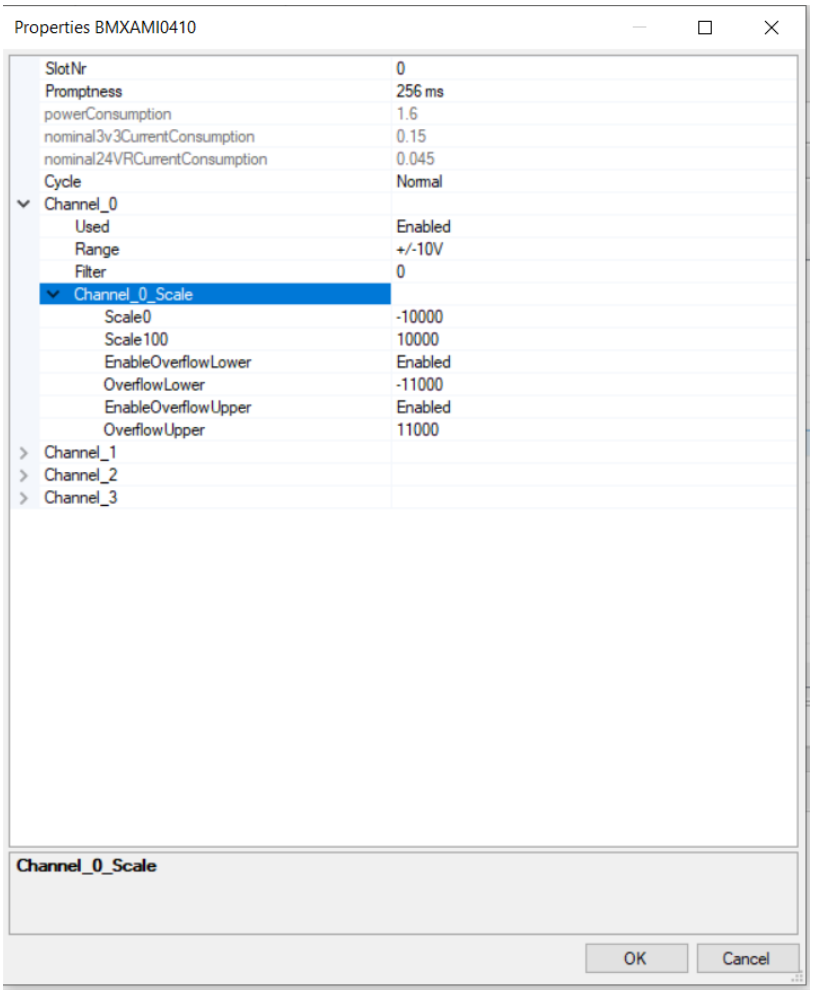
The display format may be:

- bipolar range : -10,000 to +10,000

Procedure

The following table provides step-by-step instructions defining the display scale assigned to an analog module channel.

Step	Action
1	Access the hardware configuration screen for the appropriate module.
2	Right-click **Module Properties** to configure.

Step	Action
3	**Result** : The **Channel Parameters** dialog box appears. 
4	Type in the values to be assigned to the channel in the two **Display** boxes located in the **Scale** zone.
5	Confirm your changes by clicking on **OK**

Selecting the Display Format for a Thermocouple or RTD Input Channel

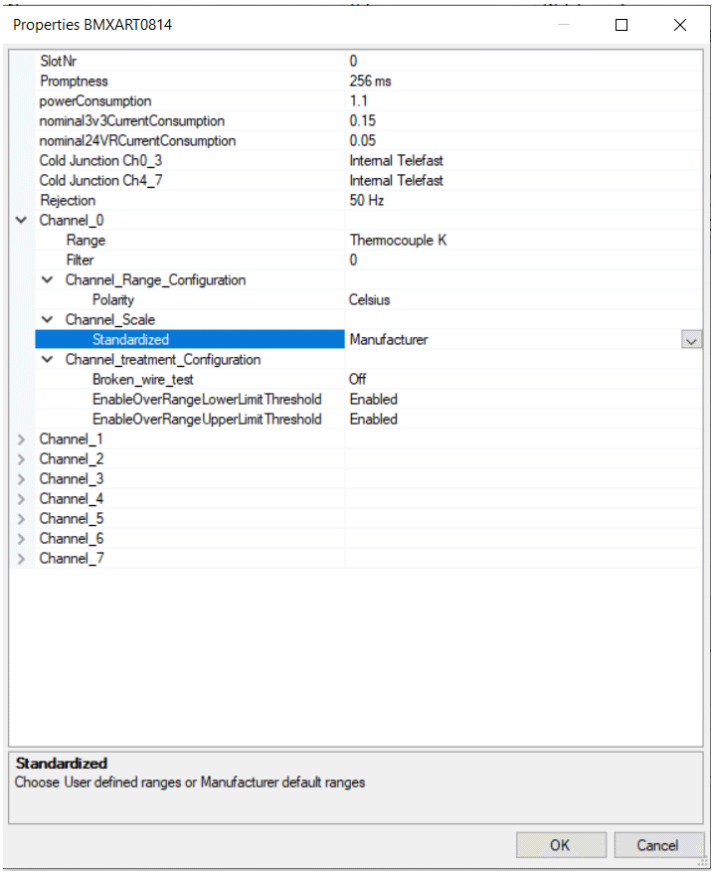
At a Glance

This parameter defines the display format for the measurement of an analog input module channel whose range is configured as thermocouple or RTD .

The available display formats are degrees Celsius (centigrade) or Fahrenheit, with the possibility of short-circuit or open circuit notification.

Procedure

Configure the display scale as follows:

Step	Action
1	Access the hardware configuration screen for the appropriate module.
2	Right-click **Module Properties** to configure..
3	Click the arrow in the Scale drop-down list for the channel you wish to configure. **Results** : The **Channel Parameters** dialog box appears.  **NOTE:** The **Standardized** and **Display** menu options are disabled. You cannot change them.
4	Select the **Broken Wire Test** check box if is you want to activate this function.
5	Select the temperature unit by checking **°C** or **°F**.
7	Confirm your changes by clicking on **OK**

Selecting the Input Channels' Filter Value

At a Glance

This parameter defines the type of filtering for the input channel selected for analog modules (see the Measurement Filtering topic, page 52).

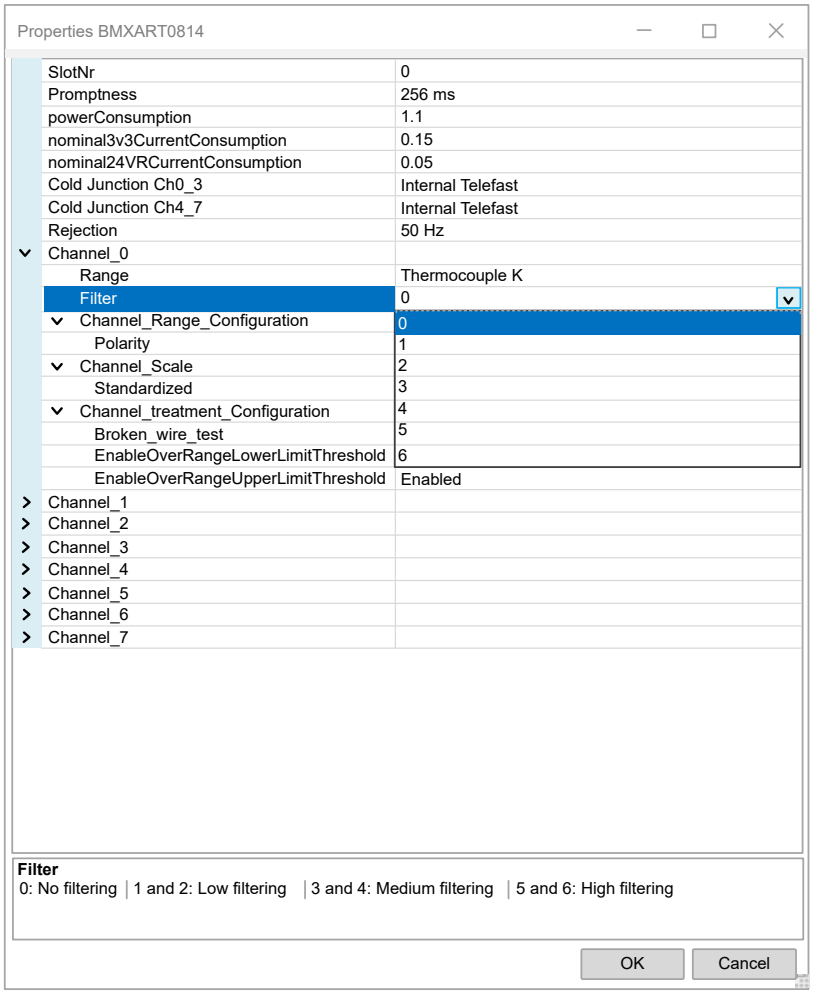
The available filtering values are:

- **0**: No filtering
- **1** and **2**: Low filtering
- **3** and **4**: Medium filtering
- **5** and **6**: High filtering

NOTE: Filtering is taken into account in both fast scan and normal cycles.

Procedure

The following table provides instructions for defining the filter value assigned to input channels for analog modules.

Step	Action
1	Access the hardware configuration screen for the appropriate module.
2	Right-click **Module Properties** to configure.
3	**Results**: The **Channel Parameters** dialog box appears. 
4	Click the arrow in the drop-down list for the **Channel** you want to configure.
5	Select the value of **Filter** from the drop-down list.
6	Confirm your changes by clicking on **OK**

NOTE: If filtering is performed using the HMI (Human-Machine Interface) or Adjusted field, where any value can be selected, the following technical rule applies: if the chosen value is less than 0, it will be automatically set to 0, and if the chosen value exceeds 6, it will be capped at 6, disregarding the specific value chosen.

Selecting the Input Channel Usage

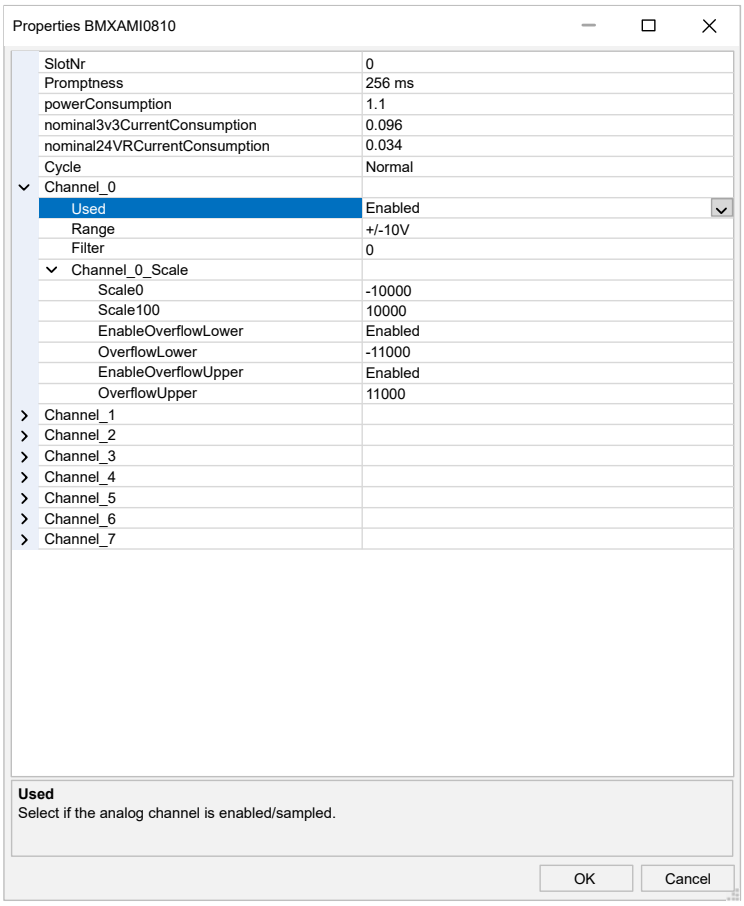
Introduction

A channel is declared to be ***used*** in a task when the measured values are ***sent back*** to the task assigned to the channel in question.

If a channel is not in use, the corresponding line is grayed out, the 0 value is sent back to the application program, and status indications specified for this channel (range overflow, etc.) are inactive.

Instructions

The following table provides specific instructions for modifying the usage status of a channel.

Step	Action
1	Access the hardware configuration screen for the appropriate module.
2	Right-click **Module Properties** to configure.
3	Click the arrow in the drop-down list for the **Channel** you want to configure. 
4	Click the arrow of the pull-down menu to enable or disable this function.
5	Confirm your changes by clicking on **OK**

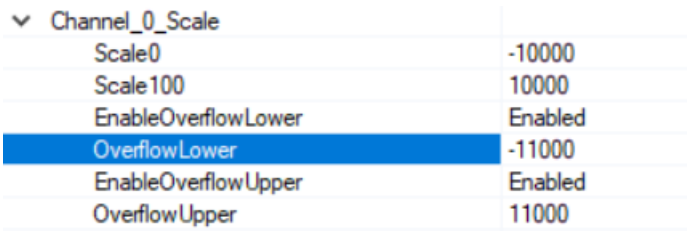
Selecting the Overflow Control Function

At a Glance

Overflow Control is defined by a monitored or unmonitored lower threshold, and by a monitored or unmonitored upper threshold.

Procedure

The procedure for modifying the Overflow Control parameters assigned to an analog module channel is as follows.

Step	Action
1	Access the hardware configuration screen for the appropriate module.
2	Right-click **Module Properties** to configure.
3	Click the arrow in the drop-down list for the **Channel** you want to configure.
4	Click the arrow in the cell of the **Channel Scale** column. **Results** : The **Channel Scale Parameters** dialog box appears. 
5	Type the value of Lower threshold in the Display box of **OverflowLower** zone.
6	Type the value of Upper threshold in the Display box of **OverflowUpper** zone.
7	Confirm your changes by clicking on **OK.**

Selecting the Cold Junction Compensation

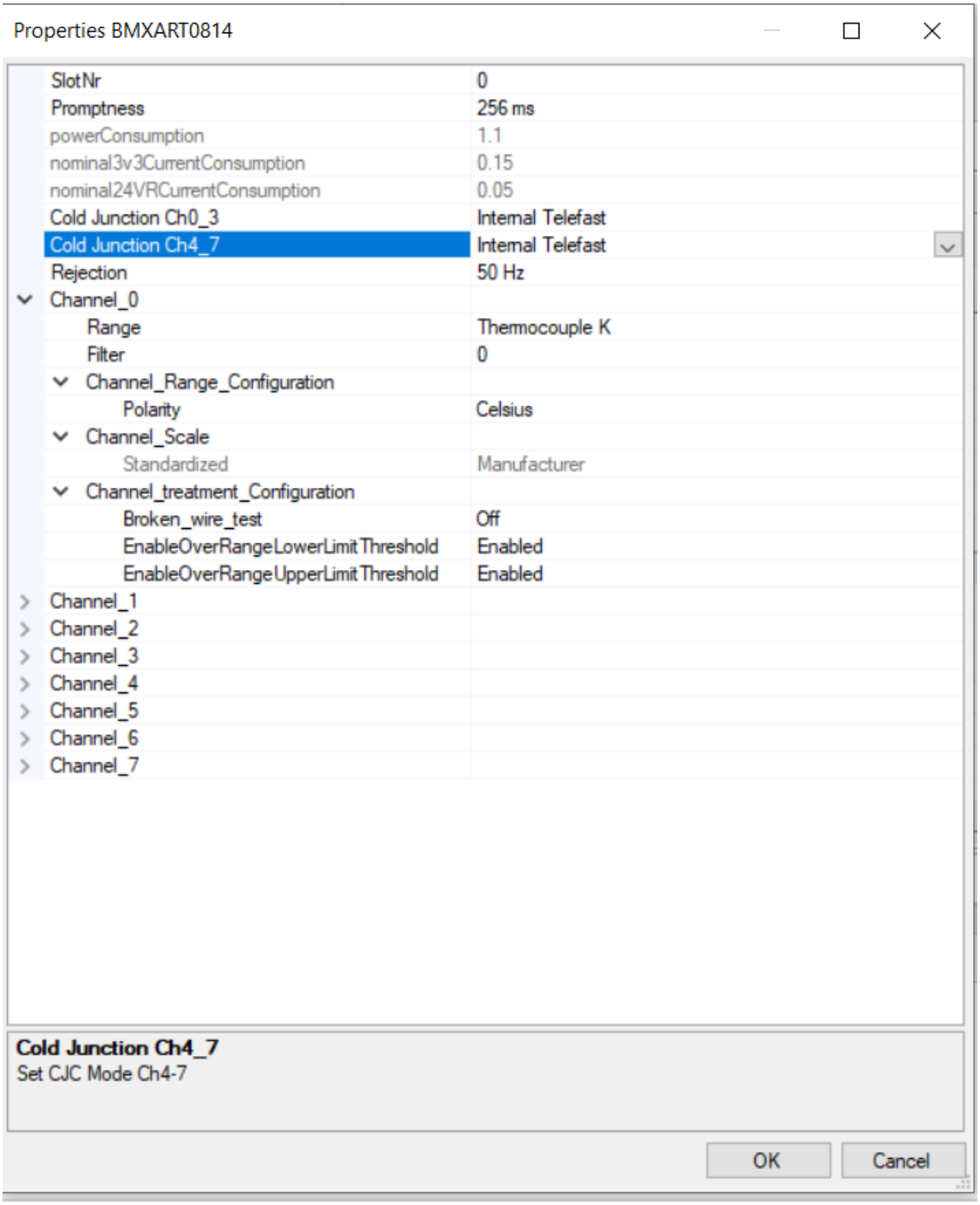
At a Glance

This function is available on the BMX ART 0814 analog input modules. It is carried out either by TELEFAST or by a Pt100 probe. An internal compensation by TELEFAST is proposed by default.

BMX ART 0814 Module

The procedure for modifying the cold junction compensation of the BMX ART 0814 modules is as follows.

Step	Action
1	Access the hardware configuration screen for the appropriate module.
2	Check the Internal by TELEFAST, the External by Pt100 or the Temperature from Ch4-7 bloc box in the Cold Junction Channel 0-3 field.
3	Validate the change with **Edit > Validate**.



Selecting the Fallback Mode for Analog Outputs

At a Glance

This parameter defines the behavior adopted by outputs when the controller switches to STOP or when there is a detected communication error.

The possible behavior types are:

- **Fallback**: Outputs are set to an editable value between scale0 and scale100 (0 is the default).
- **Maintain value**: Outputs remain in the state they were in before the controller switched to STOP.

Instructions

The following table provides instructions for defining the fallback behavior assigned to outputs of analog modules.

Step	Action
1	Access the hardware configuration screen for the appropriate module.
2	Check the box of the **Fallback** for the output you want to configure
3	Enter the desired value in the cell of the **Fallback Value**. **Result**: The selected fallback mode will be assigned to the selected output.
4	To select the **Maintain** mode instead, uncheck the box in the cell of the **Fallback**for the channel in question. **Result**: The maintain value behavior will be assigned to the selected output.
5	Validate the change by clicking in **OK.**

Analog Input/Output Module IODDT Objects

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IODDT Objects of BMXART0814 Analog Input Modules 262
IODDT Objects of Analog Output Modules 263

IODDT Objects of Analog Input Modules

Introduction

The following tables describe the IODDT objects applicable to BMXAMI0410, BMXAMI0800, and BMXAMI0810 analog input modules.

Input Measurement

The analog input measurement object is as follows.

Standard symbol	Type	Access	Meaning
AI00	VTQREAL	R	Analog input measurement.

Parameters

The following table describes queries that are associated with the `READ_PARAM` and `WRITE_PARAM` parameters.

Standard symbol	Type	R (read) / W (write)
AI00_ADJUST_ALIGNMENT	INT	W
AI00_ADJUST_FILTER	INT	W
AI00_ADJUST_UPPEROVERRANGETHRESHOLD	INT	W
AI00_ADJUST_LOWEROVERRANGETHRESHOLD	INT	W
AI00_ADJUST_STATE	SE.HwCommon.ADJUST_STATE	W
AI00_TRIGGER_READ_ADJUST	BOOL	R
AI00_READADJUST_ALIGNMENT	INT	R
AI00_READADJUST_FILTER	INT	R
AI00_READADJUST_UPPEROVERRANGETHRESHOLD	INT	R
AI00_READADJUST_LOWEROVERRANGETHRESHOLD	INT	R

IODDT Objects of BMXART0814 Analog Input Modules

Introduction

The following tables describe the IODDT objects applicable to BMXART0814 analog input modules.

Input Measurement

The analog input measurement object is as follows.

Standard symbol	Type	Access (R/W)	Meaning
AI00	VTQREAL	R	Analog input measurement.

Parameters

The following table describes queries that are associated with `READ_PARAM` and `WRITE_PARAM` parameters.

Standard symbol	Type	R (read) / W (write)
AI00_ADJUST_ALIGNMENT	INT	W
AI00_ADJUST_FILTER	INT	W
AI00_ADJUST_STATE	SE.HwCommon.ADJUST_STATE	W
AI00_TRIGGER_READ_ADJUST	BOOL	R
AI00_READADJUST_ALIGNMENT	INT	R
AI00_READADJUST_FILTER	INT	R

IODDT Objects of Analog Output Modules

Introduction

The following tables describe the IODDT objects applicable to BMXAMO0210, BMXAMO0410, and BMXAMO0802 analog output modules, as well as BMXAMM600 mixed modules.

Output Measurement

The analog output measurement object is as follows.

Standard symbol	Type	Access (R/W)	Meaning
AO00	VTQREAL	R	Analog output measurement

Parameters

The following table describes queries that are associated with `READ_PARAM` and `WRITE_PARAM` parameters:

Standard symbol	Type	R (read) / W (write)
AO00_ADJUST_ALIGNMENT	INT	W
AO00_ADJUST_FALLBACK	INT	W
AO00_ADJUST_STATE	SE.HwCommon.ADJUST_STATE	W
AO00_TRIGGER_READ_ADJUST	BOOL	R

Standard symbol	Type	R (read) / W (write)
AO00_READADJUST_ALIGNMENT	INT	R
AO00_READADJUST_FALLBACK	INT	R

Modicon X80 Discrete Input/Output Modules

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BMXDDM16025(H) Mixed Relay Input/Output Module 319
BMXDDM3202K Mixed Input/Output Module 329
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BMXDAI0814 Discrete Input Module

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BMXDAI0814 sDefault

Abstract



Description

The following table characteristics apply to the module for use at altitude up to 2000 m (6560 ft). When the module operates above 2000 m (6560 ft), apply additional derating.

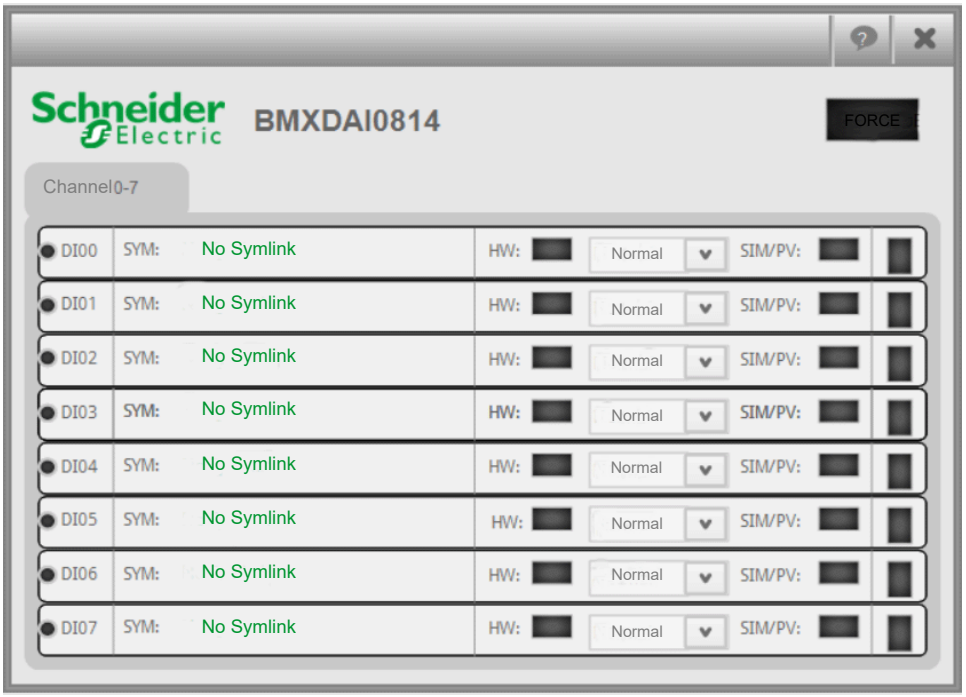
For detailed information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications* user guide.

Ambient temperature	Storage		–40...85˚C (-40...185˚F)
	Operation		0...60˚C (32...140˚F)
Nominal input values		Voltage	100...120 VAC
		Current	5 mA
		Frequency	50/60 HZ
Threshold input values	At 1	Voltage	≥ 74 V
		Current	≥ 2.5 mA
	At 0	Voltage	≤ 20 V
		Current	≤ 1 mA
	Frequency		47 Hz to 63 Hz

	Sensor supply (including ripple)	85...132 V
	Peak of current on enabling (at nominal U and f = 55 Hz)	240 mA
Input impedance	at nominal U and f = 55 Hz	13 kΩ
Response time	Activation	10 ms
	Deactivation	20 ms
Input type		Capacitive
IEC 1131-2 compliance		Type 3
2-wire / 3-wire proximity sensor compatibility (IEC 60947–5–2 standard compliant)		2–wire (AC)
Reliability	MTBF for continuous operation in hours at ambient temperature [30° C (86°F)]	1700000
Fuse type	Internal	None
	External	Fast blow fuse of 0...25 A
Power consumption 3.3 V	Typical	61 mA
	Maximum	112 mA
Dielectric strength	Channel to bus	1780 V actual, 50/60 Hz for 1 min
	Channel to channel	
Resistance of insulation	Channel to bus	≥ 10 MΩ (below 500 VDC)
	Channel to channel	
Power dissipation		2.35 W maximum
Sensor voltage: monitoring threshold	OK	> 82 V
	Detected error	< 40 V
Sensor voltage: monitoring response time at 24 V (-15%...+2-%)	on appearance	20 ms < T < 50 ms
	on disappearance	5 ms < T < 15 ms
Sensor supply consumption	Typical	228 mA
	Maximum	510 mA

BMXDAI0814 fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Digital input channel description:

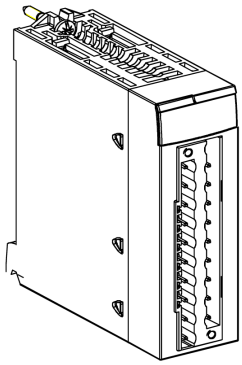
Element	Description
DI##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
Force Operation (see Modicon M251/M580 Distributed PACs and Altivar Drives with, EcoStruxure™ Automation Expert, Hardware Reference Guide)	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.

Introduction

Function

The BMXDAI0814 module is a 100...120 Vac discrete module connected via a 20-pin terminal block. The module has 8 isolated input channels that operate on alternating current.

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the table below apply to the module BMXDAI0814 for use at altitude up to 2000 m (6560 ft). When the module operates above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards, and Certifications* user guide.

General Characteristics

This table presents the general characteristics for the BMXDAI0814 module:

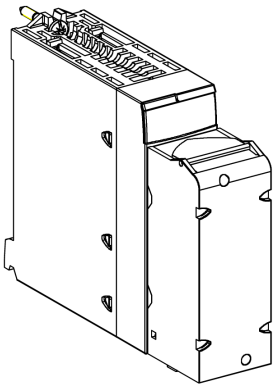
Module type			100...120 Vac inputs
Operating temperature			0...60 °C (32...140 °F)
Nominal input values		Voltage	100...120 Vac
		Current	5 mA
		Frequency	50/60Hz
Threshold input values	At 1	Voltage	≥ 74 V
		Current	≥ 2.5 mA
	At 0	Voltage	≤ 20 V
		Current	≤ 1 mA
	Frequency		47 Hz to 63 Hz
	Sensor supply (including ripple)		85...132 V
	Peak of current on enabling (at nominal U)		240 mA

Input impedance	at nominal U and f = 55 Hz	13 kΩ
Response time	Activation	10 ms
	Deactivation	20 ms
Input type		Capacitive
Input type in compliance with IEC 61131-2 standard		Type 3
2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2 standard compliant)		2-wire (AC), page 419
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)	1700000
Fuse type	Internal	None
	External	Fast blow fuse of 0.25 A
Power consumption 3.3 V	typical	61 mA
	maximum	112 mA
Dielectric strength	Channel to Bus	1780 V actual, 50 / 60 Hz for 1 min.
	Channel to Channel	1780 V actual, 50 / 60 Hz for 1 min.
Resistance of insulation	Channel to Bus	>10 MΩ (below 500 VDC)
	Channel to Channel	>10 MΩ (below 500 VDC)
Power dissipation		2.35 W max.

Connecting the Module

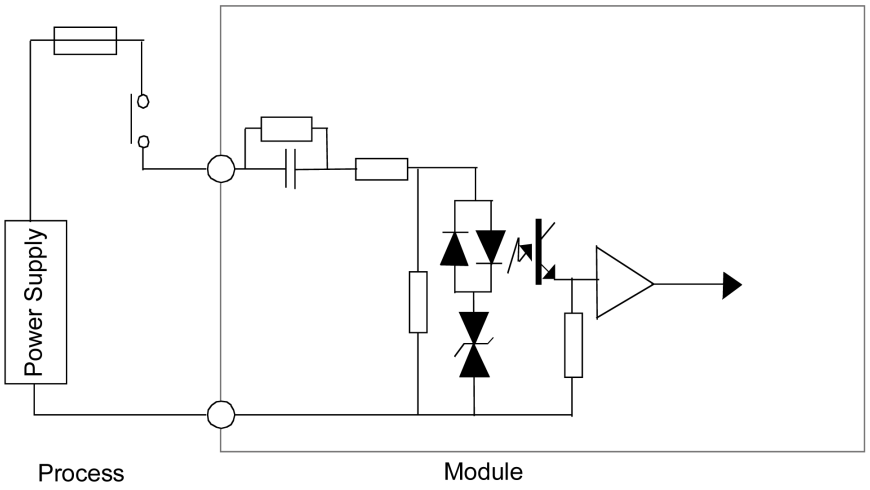
At a Glance

The BMXDAI0814 module is fitted with a removable 20-pin terminal block for the connection of eight input channels.



Input Circuit Diagram

The following diagram shows the circuit of an alternating current input.



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltages before connecting or disconnecting the module.

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

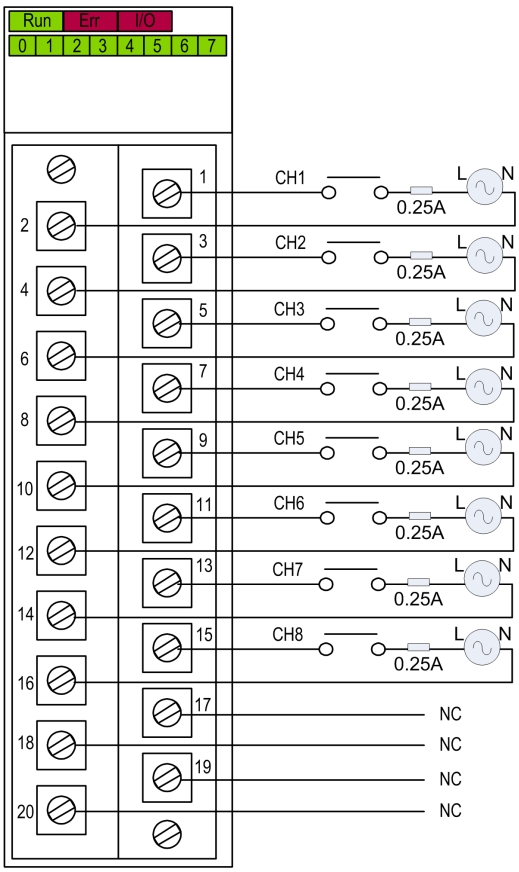
⚠CAUTION

LOSS OF INPUT FUNCTION

Install the correct type of fuse with the correct rating.

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

The following diagram shows the connection of the sensors to the module.



power supply: 100...120 VAC

fuse: fast blow fuse of 0.25A

NC not connected

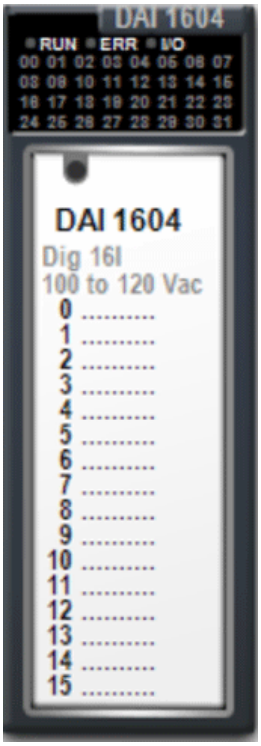
BMXDAI1604(H) Discrete Input Module

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Connecting the Module 277

BMXDAI1604(H) sDefault

Abstract



Description

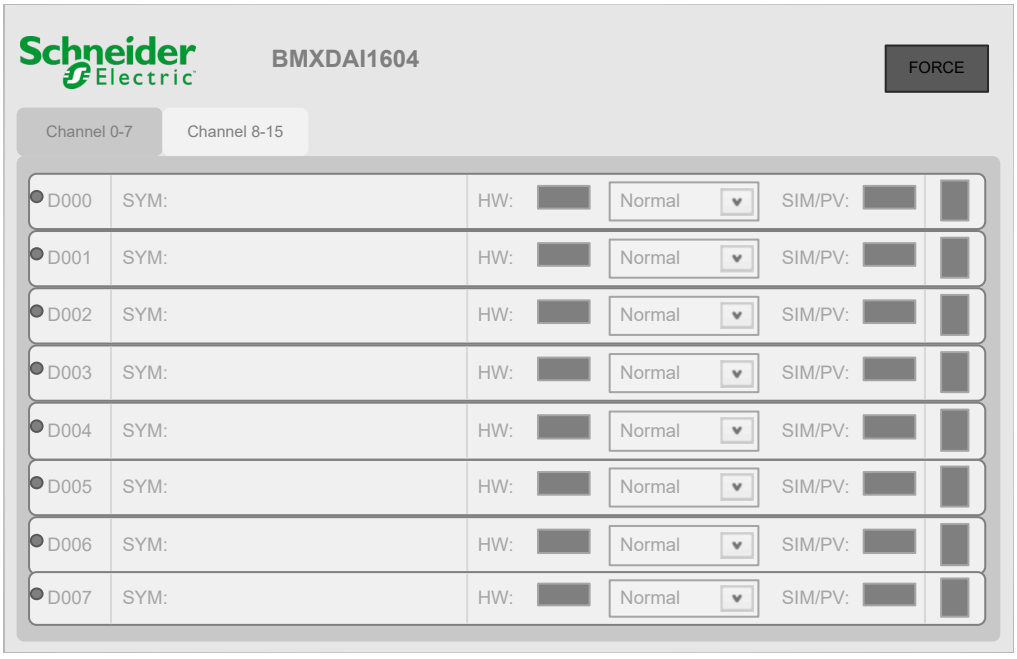
BMXDAI1604(H) Module			100...120 VAC inputs
Nominal input values		Voltage	100...120 VAC
		Current	5 mA
		Frequency	50/60 HZ
Threshold input values	At 1	Voltage	≥ 74 V
		Current	≥ 2.5 mA
	At 0	Voltage	≤ 20 V
		Current	≤ 1 mA
	Frequency		47 Hz to 63 Hz
	Sensor supply (including ripple)		85...132 V
	Peak of current on enabling (at nominal U and f = 55 Hz		240 mA

Input impedance	at nominal U and f = 55 Hz	13 kΩ
Type of input		Capacitive
Response time	Activation	10 ms
	Deactivation	20 ms
IEC 1131-2 compliance		Type 3
Reliability	MTBF for continuous operation in hours at ambient temperature (30° C (86°F)	1 303 067
2-wire / 3-wire proximity sensor compatibility		IEC 947-5-2
Dielectric strength		1500 V actual, 50/60 Hz for 1 min
Resistance of insulation		≥ 10 MΩ (below 500 VDC)
Sensor voltage: monitoring threshold	OK	> 82 V
	Error	< 40 V
Sensor voltage: monitoring response time at 24 V (-15%...+2-%)	on appearance	20 ms < T < 50 ms
	on disappearance	5 ms < T < 15 ms
Power consumption	typical	76 mA
	maximum	107 mA
Sensor supply consumption	typical	228 mA
	maximum	510 mA
Power dissipation		3.8 W max
Temperature derating for BMXDAI1604		None

NOTE: Over its extended -25...70°C (-13...158°F) temperature range, the BMXDAI1604H characteristics are the same as the BMXDAI1604 characteristics in the table.

BMXDAI1604(H) fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Digital input channel description:

Element	Description
DI##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
Force Operation (see Modicon M251/M580 Distributed PACs and Altivar Drives with, EcoStruxure™ Automation Expert, Hardware Reference Guide)	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.

Introduction

Function

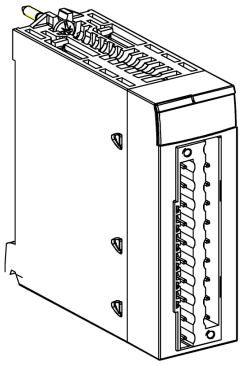
The BMXDAI1604 module is a 100...120 VAC discrete module connected via a 20-pin terminal block. This module has 16 input channels that operate on alternating current.

Ruggedized Version

The BMXDAI1604H (hardened) equipment is the ruggedized version of the BMXDAI1604 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the following table apply to the BMXDAO1604 and BMX AO1604H modules at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For more information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards, and Certifications* user guide.

General Characteristics

The following table describes the general characteristics for the BMXDAO1604 and BMXDAO1604H modules:

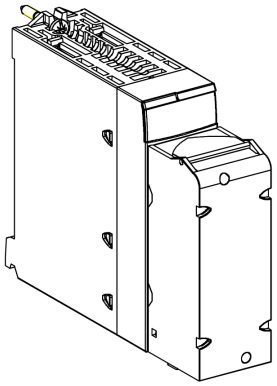
Module type			100...120 VAC inputs
Operating temperature	BMX DAI 1604		0...60 ºC (32...140 ºF)
	BMX DAI 1604H		-25...70 ºC (-13...158 ºF)
Nominal input values		Voltage	100...120 VAC
		Current	5 mA
		Frequency	50/60Hz
Threshold input values	At 1	Voltage	≥ 74 V
		Current	≥ 2.5 mA
	At 0	Voltage	≤ 20 V
		Current	≤ 1 mA
	Frequency		47 Hz to 63 Hz
	Sensor supply (including ripple)		85...132 V
	Peak of current on enabling (at nominal U)		240 mA
Input impedance	at nominal U and f = 55 Hz		13 kΩ
Response time	Activation		10 ms
	Deactivation		20 ms
Input type			Capacitive
Input type in compliance with IEC 61131-2 standard			Type 3

2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2 standard compliant)		2-wire (AC), page 419
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)	1 303 067
Dielectric strength		1500 V actual, 50 / 60 Hz for 1 min.
Resistance of insulation		>10 MΩ (below 500 VDC)
Fuse type	Internal	None
	External	Fast blow fuse of 0.5 A
Sensor voltage: monitoring threshold	OK	> 82 V
	Error	< 40 V
Sensor voltage: monitoring response time at 24 V (-15% ... +20%)	on appearance	20 ms < T < 50 ms
	on disappearance	5 ms < T < 15 ms
Power consumption 3.3 V	typical	76 mA
	maximum	107 mA
Sensor supply consumption	typical	228 mA
	maximum	510 mA
Power dissipation		3.8 W max.

Connecting the Module

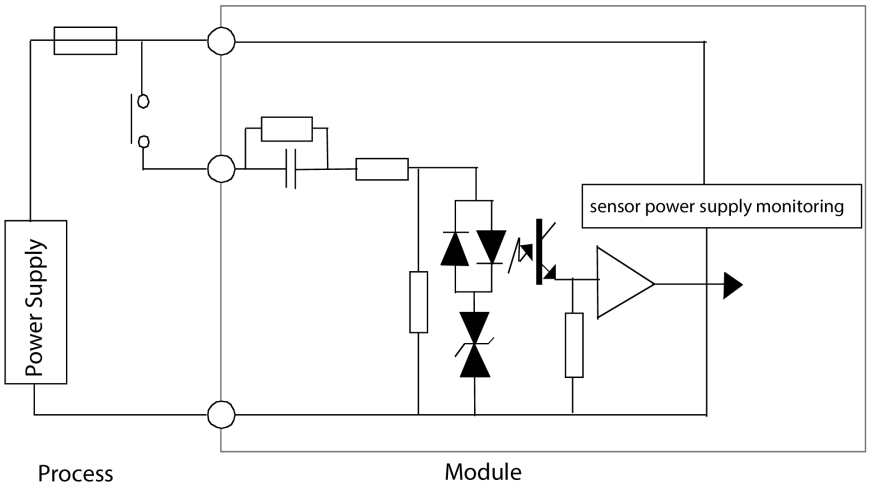
At a Glance

The BMXDAI1604 module is fitted with a removable 20-pin terminal block for the connection of sixteen input channels.



Input Circuit Diagram

The following diagram shows the circuit of an alternating current input.



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltages before connecting or disconnecting the module.

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

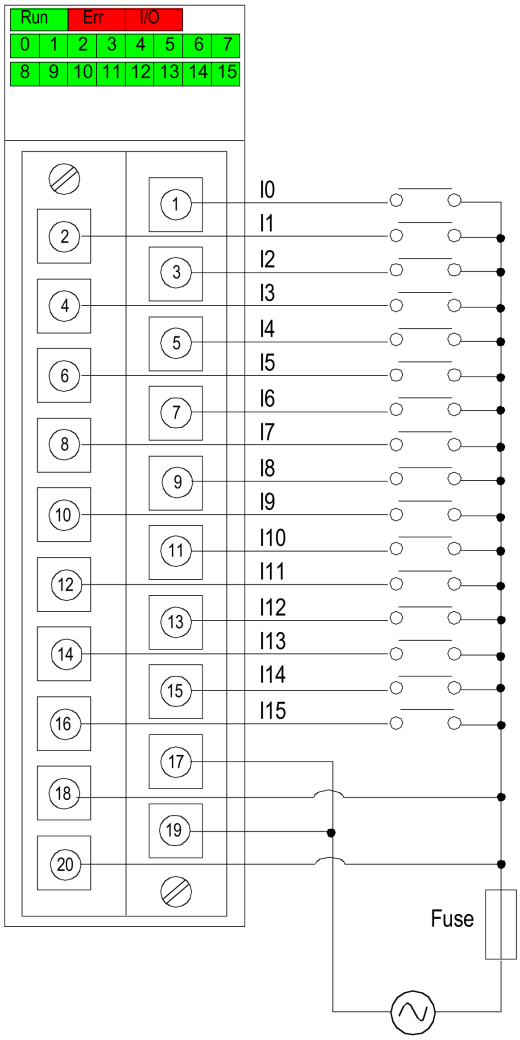
⚠CAUTION

LOSS OF INPUT FUNCTION

Install the correct type of fuse with the correct rating.

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

The following diagram shows the connection of the module to the sensors.



power supply: 100...120 VAC

fuse: fast blow fuse of 0.5A

BMXDAO1605(H) Discrete Output Module

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BMXDAO1605(H) sDefault 280
BMXDAO1605 fpDefault 282
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BMXDAO1605(H) sDefault

Abstract



Description

The characteristics in the following table below apply to the BMXDAO1605(H) modules for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications* user guide.

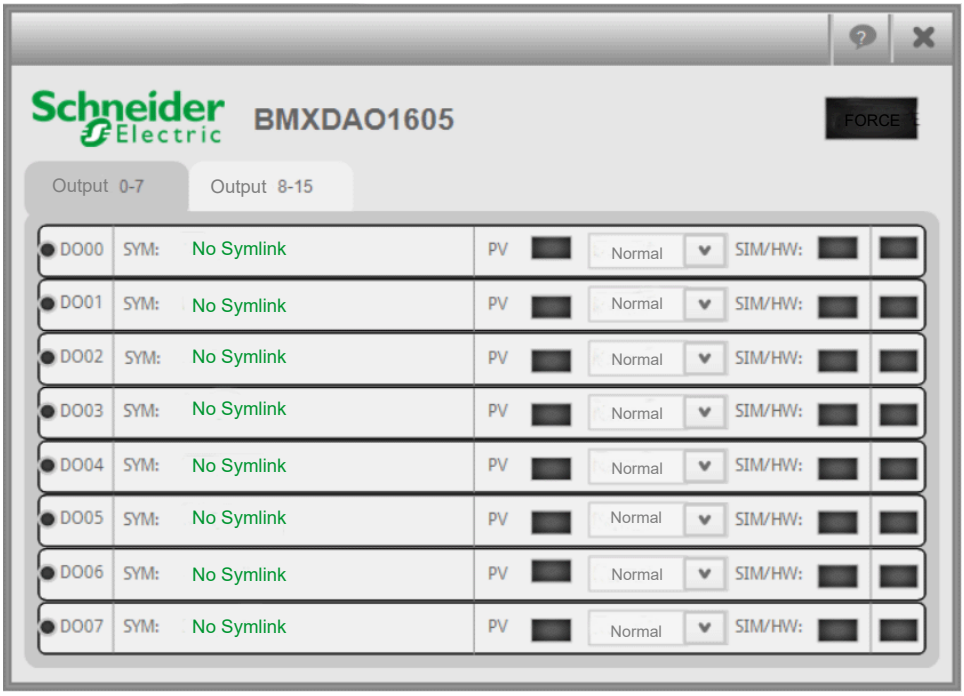
Module type		100...240 VCA outputs
Operating temperature	BMXDAO1605	0...60 ºC (32...140 ºF)
	BMXDAO1605H	—25...70ºC (-13...158ºF)
Temperature derating		Apply the temperature derating curve
Nominal values	Voltage	100...240 VCA
	Current	0.6 A / points
Threshold values	Voltage	100 mA at 24 VAC 25 mA at 100...240 VAC

	Current/channel	0.6 A
	Current/module	2.4 A max/common (4.8 A max for all commons)
Maximum inrush current		20 A / cycle or less
Power of tungsten filament lamp	Maximum	6 W
Leakage current	At state 0	≤ 3 mA (for 240 VAC, 60 Hz) ≤ 1.5 mA (for 120 VAC, 60 Hz)
Residual voltage	At state 1	≤ 1.5 VAC
Response time		≤ 1 ms + 1/(2xF)
Built-in protection	Against inductive over voltage in AC mode	None. Fit an RC circuit or a ZNO type over voltage limiter in parallel on each output appropriate to the voltage in use.
	Against inductive over voltage	None. Fit a discharge diode on each output.
	Against short-circuits and overloads	None. Fit a fast-blow fuse of 3 A on each channel or 4–channel group.
Command type		Zero crossing
Output protection		No protection
Dielectric maximum voltage		2830 VAC rms/1 min
Insulation resistance		≥ 10 MΩ (by insulation resistance meter)
Noise immunity		By noise simulator of noise voltage, 1 µs noise width and 1500 Vp-p 25...60 Hz noise frequency
Power consumption 3.3 V	Typical	79 mA
	Maximum	111 mA

NOTE: For the BMXDAO1605H module at 70°C (158°F), confirm that the maximum threshold current does not exceed 0.24 A per channel and the maximum module current does not exceed 1.92 A.

BMXDAO1605 fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Digital output channel description:

Element	Description
DO##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
PV	Indicates the real program value:
Force Operation	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/HW	Program input value: • The SIM/HW and PV values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/HW value is equal to the forced value.

Introduction

Function

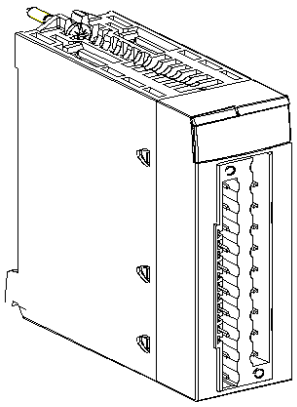
The BMXDAO1605 module is a 100...240 VAC discrete module connected via a 20-pin terminal block. Its 16 output channels operate on alternating current.

Ruggedized Version

The BMXDAO1605H (hardened) equipment is the ruggedized version of the BMXDAO1605 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the table below apply to the modules BMXDAO1605 and BMXDAO1605H for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards, and Certifications* user guide.

General Characteristics

This table presents the general characteristics for the BMXDAO1605 and BMXDAO1605H modules:

Module type		100...240 VAC outputs
Operating temperature	BMXDAO1605	0...60 ºC (32...140 ºF)
	BMXDAO1605H	-25...70 ºC (-13...158 ºF)
Temperature derating		Apply the temperature derating curve , page 393

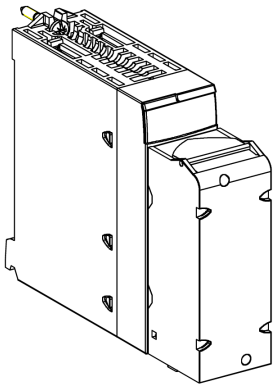
Nominal values	**Voltage**	100...240 VAC
	Current	0.6 A / points
Threshold values	**Voltage**	100 mA at 24 VAC 25 mA at 100...240 VAC
	Current/channel	0.6 A
	Current/module	2.4 A max/common (4.8 A max for all commons)
Maximum inrush current		20 A / cycle or less
Leakage current	**At state 0**	≤ 3 mA (for 240 VAC, 60 Hz) ≤ 1.5 mA (for 120 VAC, 60 Hz)
Residual voltage	**At state 1**	≤ 1.5 VAC
Response time		≤ 1 ms + 1/(2xF)
Built-in protection	**Against inductive over voltage in AC modes**	None. Fit an RC circuit or a ZNO type over voltage limiter in parallel on each output appropriate to the voltage in use
	Against inductive over voltage	None. Fit a discharge diode on each output.
	against short-circuits and overloads	None. Fit a fast-blow fuse of 3 A on each channel or 4-channel group.
Command type		Zero crossing
Output protection		no protection
Dielectric maximum voltage		2 830 VAC rms/1 min
Insulation resistance		≥ 10 MΩ (by insulation resistance meter)
Noise immunity		By noise simulator of noise voltage, 1 µs noise width and 1 500 Vp-p 25...60 Hz noise frequency
Power consumption 3.3 V	Typical	79 mA
	Maximum	111 mA

NOTE: For the BMXDAO1605H module, at 70 °C (158 °F), the maximum threshold current must not exceed 0.24 A per channel and the maximum module current must not exceed 1.92 A.

Connecting the Module

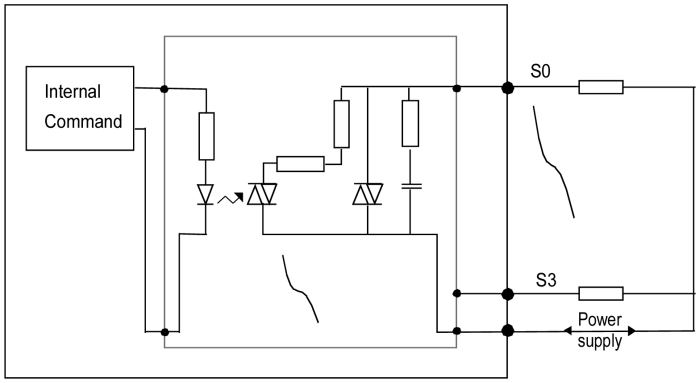
At a Glance

The BMXDAO1605 module is fitted with a removable 20-pin terminal block for the connection of sixteen output channels.



Output Circuit Diagram

The following diagram shows the circuit of a alternating current output.



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltage before connecting or disconnecting the module.

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

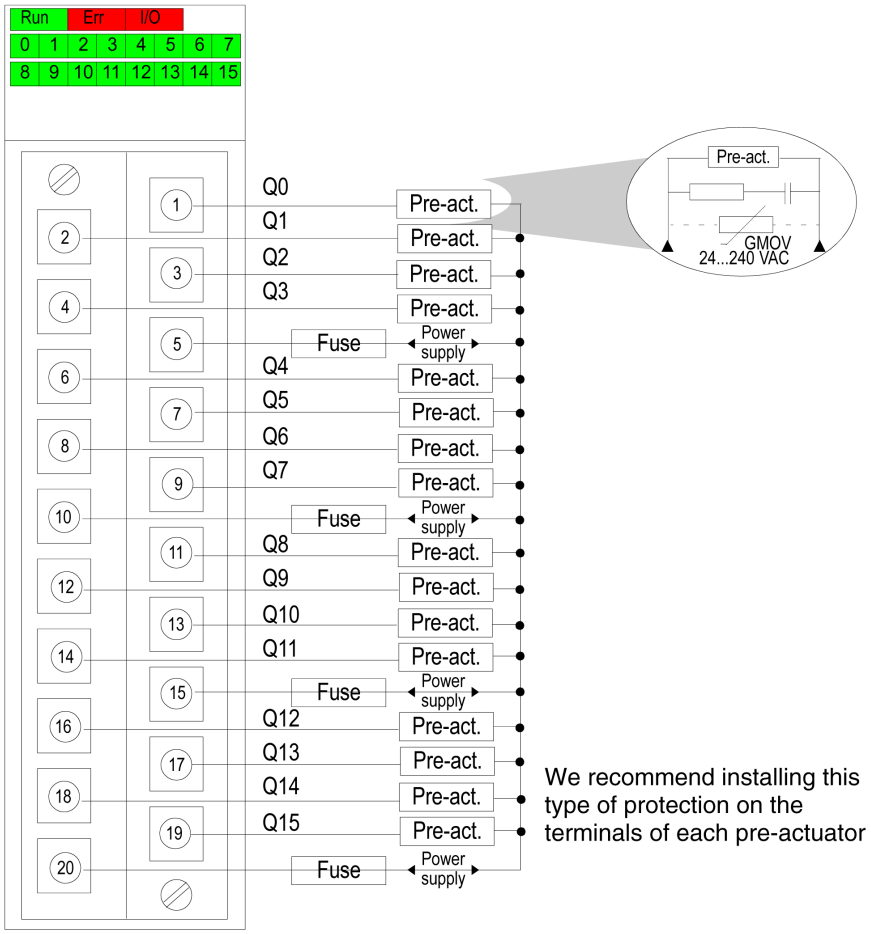
⚠CAUTION

LOSS OF OUTPUT FUNCTION

Install the correct rating and type of fuse.

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

The following diagram shows the connection of the module to the pre-actuators.



power supply: 100...240 VAC

fuse: 1 fast blow fuse of 3 A for each 4-channel group

BMXDDI1602(H) Discrete Input Module

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BMXDDI1602(H) fpDefault 288
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Connecting the Module 291

BMXDDI1602(H) sDefault

Abstract



Description

Altitude Operating Conditions

The characteristics in the following table apply to the BMXDDI1602(H) for use at altitude up to 2000 m (6560 ft). When the module operates above 2000 m (6560 ft), apply additional derating.

General Characteristics:

Module type			24 VDC positive logic inputs
Operating temperature	BMXDDI1602		0...60 °C (32...140 °F)
	BMXDDI1602H		-25...70 °C (-13...158 °F)
Nominal input values		Voltage	24 VDC
		Current	3.5 mA
Threshold input values	At 1	Voltage	≥ 11 V
		Current	> 2 mA (for U ≥ 11 V)

	At 0	Voltage	5 V
		Current	< 1.5 mA
Input impedance	At nominal U		6.8 kΩ
Response time	Typical		4 ms
	Maximum		7 ms
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)		738 749
Reverse polarity			Protected
Fuse type	Internal		None
	External		1 fast blow fuse of 0.5 A
Input type			Current sink
Input type in compliance with IEC 61131-2 standard			Type 3
2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2 standard compliant)			2-wire (DC), and 3-wire (DC) PNP any type
Dielectric strength			1500 V actual, 50 / 60 Hz for 1 min.
Resistance of insulation			>10 MΩ (below 500 VDC)
Paralleling of inputs(1)			Yes
Power consumption 3.3 V	Typical		76 mA
	Maximum		107 mA
Power dissipation			2.5 W max.
(1) This characteristic is used to connect several inputs to the same module in parallel or to different modules for input redundancy.			

BMXDDI1602(H) fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Digital input channel description:

Element	Description
DI##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
Force Operation (see Modicon M251/M580 Distributed PACs and Altivar Drives with, EcoStruxure™ Automation Expert, Hardware Reference Guide)	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.

Introduction

Function

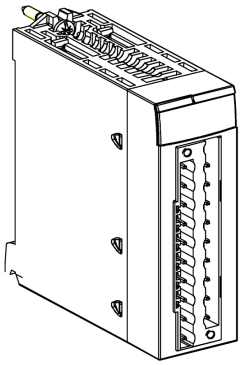
The BMXDDI1602 module is a 24 VDC discrete module connected via a 20-pin terminal block. It is a positive logic (or sink) module: its 16 input channels receive current from the sensors.

Ruggedized Version

The BMXDDI1602H (hardened) equipment is the ruggedized version of the BMXDDI1602 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the table below apply to the modules BMXDDI1602 and BMXDDI1602H for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards, and Certifications* user guide.

General Characteristics

This table presents the general characteristics for the BMXDDI1602 and BMXDDI1602H modules:

Module type			24 VDC positive logic inputs
Operating temperature	BMXDDI1602		0...60 ºC (32...140 ºF)
	BMXDDI1602H		-25...70 ºC (-13...158 ºF)
Nominal input values		Voltage	24 VDC
		Current	3.5 mA
Threshold input values	At 1	Voltage	≥ 11 V
		Current	> 2 mA (for U ≥ 11 V)
	At 0	Voltage	5 V
		Current	< 1.5 mA
	Sensor supply (including ripple for standard module)		19...30 V (possible up to 34 V, limited to 1 hour/day)
Input impedance	At nominal U		6.8 kΩ
Response time	Typical		4 ms
	Maximum		7 ms
Reliability	MTBF for continuous operation in hours at ambient temperature 30 ° C (86 °F)		738 749
Reverse polarity			Protected
Fuse type	Internal		None
	External		1 fast blow fuse of 0.5 A

Input type		Current sink
Input type in compliance with IEC 61131-2 standard		Type 3
2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2 standard compliant)		2-wire (DC), and 3-wire (DC) PNP any type, page 419
Dielectric strength		1500 V actual, 50 / 60 Hz for 1 min.
Resistance of insulation		>10 MΩ (below 500 VDC)
Paralleling of inputs(1)		Yes
Sensor voltage: monitoring threshold	OK	> 18 VDC
	Error	< 14 VDC
Sensor voltage: monitoring response time at 24 V (-15% ... +20%)	On appearance	1 ms < T < 3 ms
	On disappearance	8 ms < T < 30 ms
Power consumption 3.3 V	Typical	76 mA
	Maximum	107 mA
Sensor supply consumption	Typical	46 mA
	Maximum	73 mA
Power dissipation		2.5 W max.
(1) This characteristic is used to connect several inputs to the same module in parallel or to different modules for input redundancy.		

NOTE: For the BMXDDI1602H, confirm that the maximum value of the sensor power supply does not exceed 26.4 V when operated at 70 °C (158 °F).

⚠WARNING

OVERHEATING MODULE

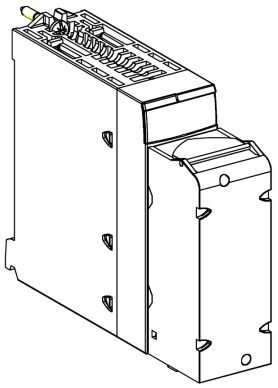
Do not operate the BMXDDI1602H at 70 °C (158 °F) if the sensor power supply is greater than 26.4 V or less than 21.1 V.

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

Connecting the Module

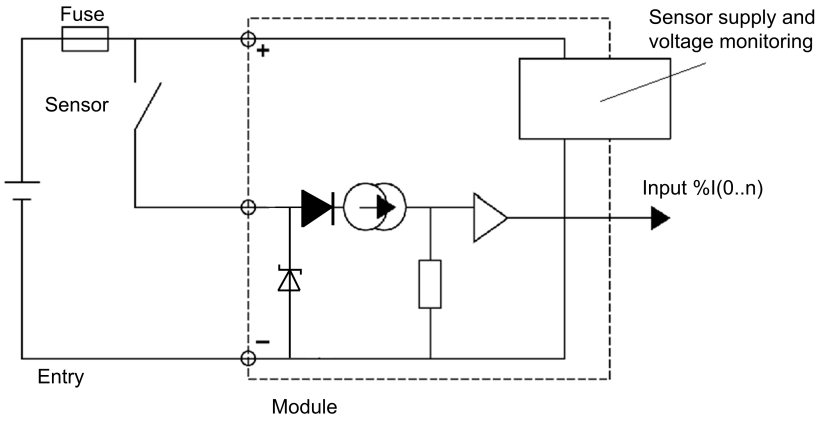
At a Glance

The BMXDDI1602 module is fitted with a removable 20-pin terminal block for the connection of sixteen input channels.



Input Circuit Diagram

The following diagram shows the circuit of a direct current input (positive logic).



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltages before connecting or disconnecting the module.

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

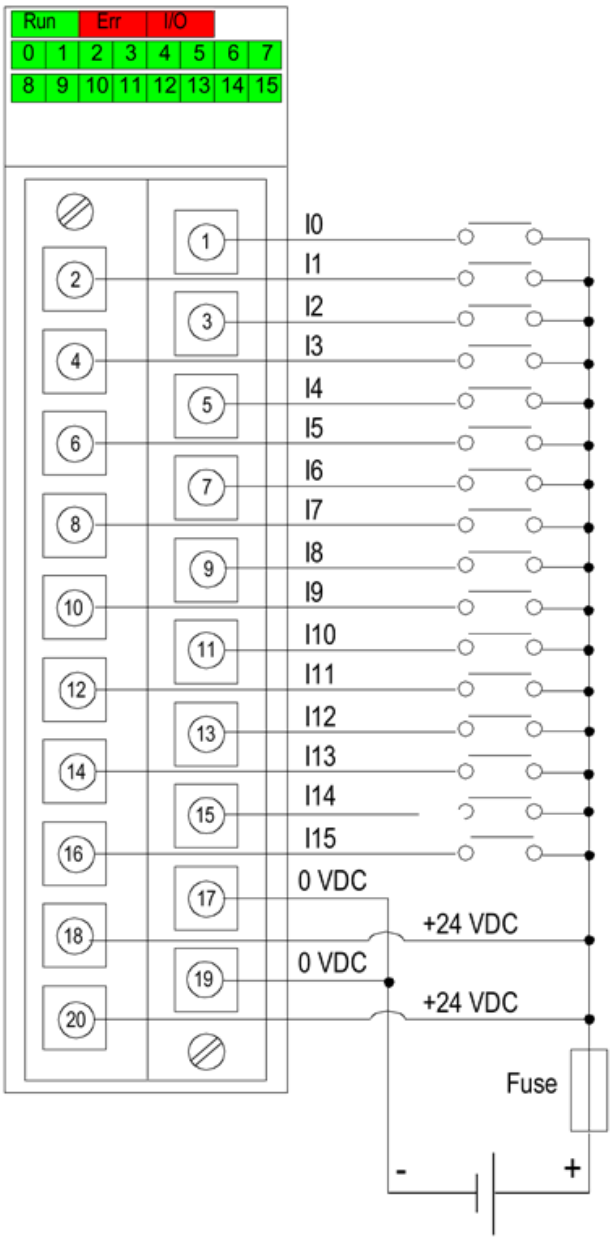
⚠CAUTION

LOSS OF INPUT FUNCTION

Install the correct rating and type of fuse.

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

The following diagram shows the connection of the module to the sensors.



power supply: 24 VDC

fuse: fast blow fuse of 0.5A

Sensor Power Outage

After the sensor power outage, the I/O (red) LED of the module switches on and the last recorded position of the sensor is displayed by the input channel status LED.

After a sensor power outage, the I/O error LED is on.

⚠WARNING

CHANNEL LED INFORMATION NOT MATCHING SENSORS POSITION

- Do not take into account the input LED information (they show the last recorded position of the sensors, not their real positions).
- Check the real positions on the sensors.

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

BMXDDI3202K Discrete Input Module

What's in This Chapter

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Connecting the Module 300

BMXDDI3202K(H) sDefault

Abstract



Description

Altitude Operating Conditions

The characteristics in the table below apply to the modules BMXDDI3202K and BMXDDI3202K(H) for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

General Characteristics

Module type			24 VDC positive logic inputs
Operating temperature	BMXDDI3202K		0...60 °C (32...140 °F)
	BMXDDI3202K(H)		-25...70 °C (-13...158 °F)
Nominal input values		Voltage	24 VDC
		Current	2.5 mA
Threshold input values	At 1	Voltage	≥ 11 V
		Current	> 2 mA (for U ≥ 11 V)

	At 0	Voltage	5 V
		Current	< 1.5 mA
	Sensor supply (including ripple)		19...30 V (possible up to 34 V, limited to 1 hour/ day)
Input impedance	at nominal U		9.6 kΩ
Response time	typical		4 ms
	maximum		7 ms
Input type			Current sink
Input type in compliance with IEC 61131-2 standard			Type 1
Reverse polarity			Protected
Fuse type	Internal		None
	External		1 fast blow fuse of 0.5 A for each 16-channel group
2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2 standard compliant)			2-wire (DC), and 3-wire (DC) PNP any type
Dielectric strength	Primary/Secondary		1500 V actual, 50 / 60 Hz for 1 min.
	Between channel groups		500 VDC
Resistance of insulation			>10 MΩ (below 500 VDC)
Paralleling of inputs			No
Reliability	MTBF in hours at ambient temperature 30 °C (86 °F)		696 320
Sensor voltage: monitoring threshold	OK		> 18 VDC
	Error		< 14 VDC
Sensor voltage: monitoring response time at 24 V (-15% ... +20%)	on appearance		1 ms < T < 3 ms
	on disappearance		8 ms < T < 30 ms
Power consumption 3.3 V	typical		121 mA
	maximum		160 mA
Sensor supply consumption	typical		92 mA
	maximum		145 mA
Power dissipation			3.9 W max.

BMXDDI3202K(H) fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Digital input channel description:

Element	Description
DI##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
Force Operation (see Modicon M251/M580 Distributed PACs and Altivar Drives with, EcoStruxure™ Automation Expert, Hardware Reference Guide)	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.

Introduction

Function

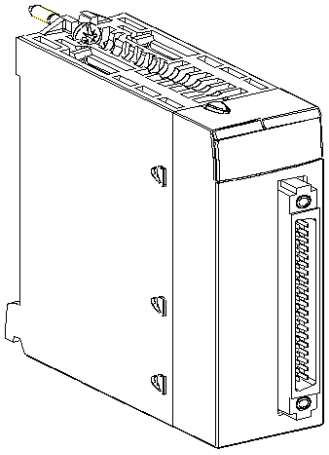
The BMXDDI3202K module is a 24 VDC discrete module connected via a 40-pin connector. It is a positive logic (or sink) module: its 32 input channels receive current from the sensors.

Ruggedized Version

The BMXDDI3202K(H) (hardened) equipment is the ruggedized version of the BMXDDI3202K (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the table below apply to the modules BMXDDI3202K and BMXDDI3202K(H) for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards, and Certifications* user guide.

General Characteristics

This table presents the general characteristics for the BMXDDI3202K and BMXDDI3202K(H) modules.

Module type		24 VDC positive logic inputs
Operating temperature	BMXDDI3202K	0...60 ºC (32...140 ºF)

	BMXDDI3202K(H)		-25...70 ºC (-13...158 ºF)
Nominal input values		Voltage	24 VDC
		Current	2.5 mA
Threshold input values	At 1	Voltage	≥ 11 V
		Current	> 2 mA (for U ≥ 11 V)
	At 0	Voltage	5 V
		Current	< 0.5 mA
	Sensor supply (including ripple)		19...30 V (possible up to 34 V, limited to 1 hour/ day)
Input impedance	at nominal U		9.6 kΩ
Response time	typical		4 ms
	maximum		7 ms
Input type			Current sink
Input type in compliance with IEC 61131-2 standard			Type 1
Reverse polarity			Protected
Fuse type	Internal		None
	External		1 fast blow fuse of 0.5 A for each 16-channel group
2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2 standard compliant)			2-wire (DC), and 3-wire (DC) PNP any type, page 419
Dielectric strength	Primary/Secondary		1500 V actual, 50 / 60 Hz for 1 min.
	Between channel groups		500 VDC
Resistance of insulation			>10 MΩ (below 500 VDC)
Paralleling of inputs			No
Reliability	MTBF in hours at ambient temperature 30 °C (86 °F)		696 320
Sensor voltage: monitoring threshold	OK		> 18 VDC
	Error		< 14 VDC
Sensor voltage: monitoring response time at 24 V (-15% ... +20%)	on appearance		1 ms < T < 3 ms
	on disappearance		8 ms < T < 30 ms
Power consumption 3.3 V	typical		121 mA
	maximum		160 mA
Sensor supply consumption	typical		92 mA
	maximum		145 mA
Power dissipation			3.9 W max.

NOTE: For the **BMXDDI3202K(H)**, confirm that the maximum value of the sensor power supply does not exceed 26.4 V and the minimum value is not less than 21.1 V when operated within 60...70 °C (140...158 °F).

⚠WARNING

OVERHEATING MODULE

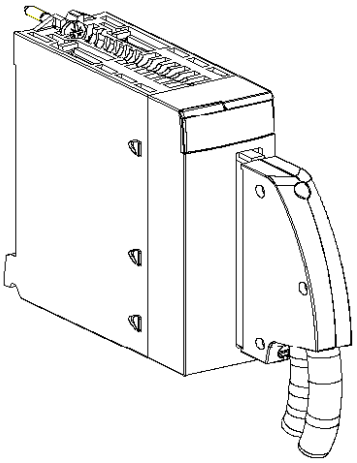
Do not operate the **BMXDDI3202K(H)** within 60...70 °C (140...158 °F) if the sensor power supply is greater than 26.4 V or less than 21.1 V.

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

Connecting the Module

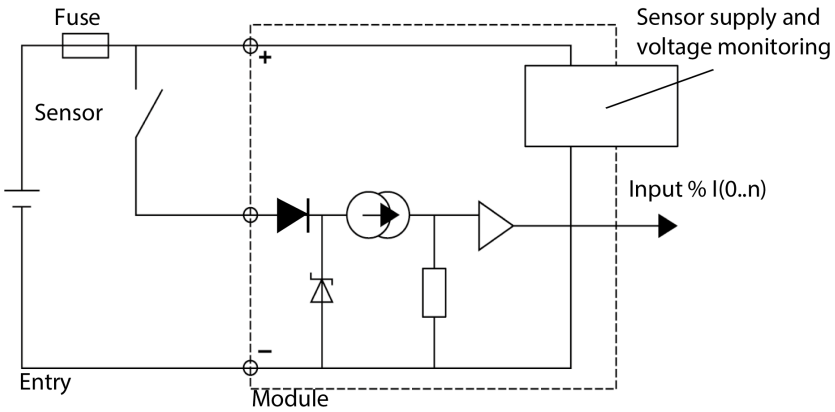
At a Glance

The BMXDDI3202K module is fitted with a 40-pin connector for the connection of 32 input channels.



Input Circuit Diagram

The following diagram shows the circuit of a direct current input (positive logic).



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltages before connecting or disconnecting the module.

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

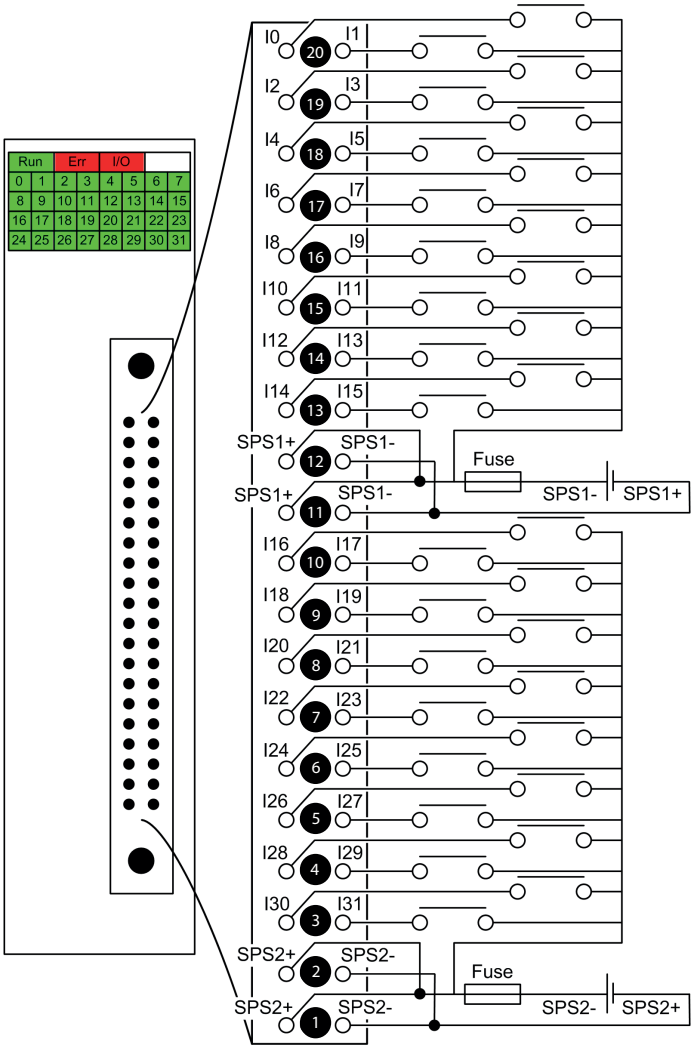
⚠CAUTION

LOSS OF INPUT FUNCTION

Install the correct rating and type of fuse.

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

The following diagram shows the connection of the module to the sensors.



power supply: 24 VDC

fuse: fast blow fuse of 0.5 A for each 16-channel group

SPS: sensor power supply

Sensor Power Outage

After the sensor power outage, the I/O (red) LED of the module switches on and the last recorded position of the sensor is displayed by the input channel status LED

After a sensor power outage, the I/O error LED is on..

⚠WARNING

CHANNEL LED INFORMATION NOT MATCHING SENSORS' POSITION

- Do not take into account the input LED information. (They show the last recorded position of the sensors, not their real positions.)
- Check the real positions on the sensors.

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

BMXDDI6402K(H) Discrete Input Module

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BMXDDI6402K(H) sDefault

Abstract



Description

Altitude Operating Conditions

The characteristics in the following table apply to the BMXDDI6402K(H) module for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

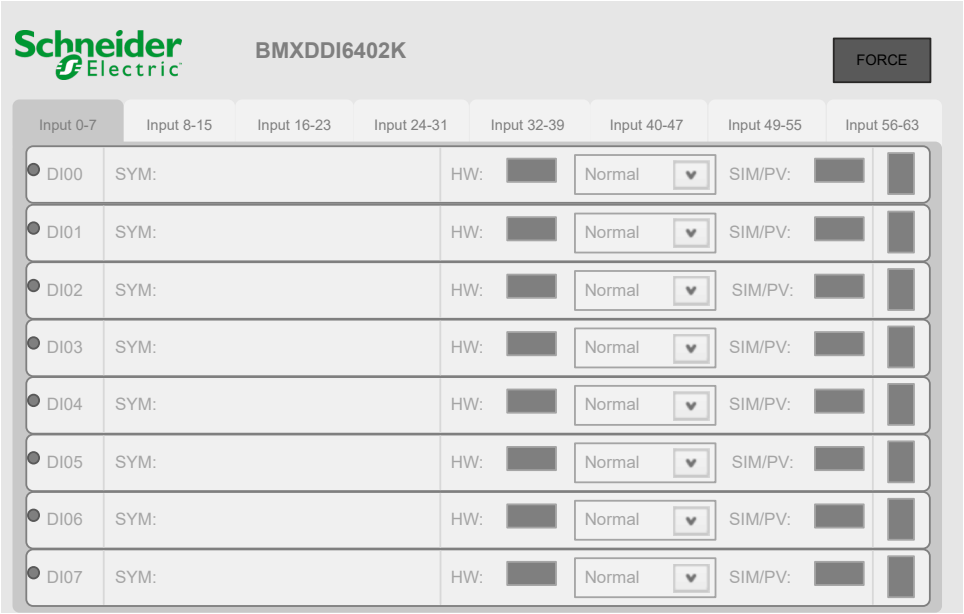
General Characteristics

Module type			24 VDC positive logic inputs
Operating temperature	BMXDDI6402K		0...60°C (32...140°F)
	BMXDDI6402KH		-25...70°C (-13...158°F)
Nominal input values		Voltage	24 VDC
		Current	1 mA
Threshold input values	At 1	Voltage	≥15 V
	At 0	Voltage	4 V

	Sensor supply (including ripple)	19...30 V (possible up to 34 V, limited to 1 hour/day)
Input impedance	At nominal U	24 kΩ
Response time	typical	4 ms
	maximum	7 ms
Reverse polarity		Protected
Fuse type	Internal	None
	External	1 fast blow fuse of 0.5 A for each 16-channel group
Type of input		Current sink
Input type in compliance with IEC 61131-2 standard		No type
2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2)		No compatibility (only one contact per sensor allowed)
Dielectric strength	Primary/ secondary	1500 V actual, 50 / 60 Hz for 1 min
	Between channel groups	500 VDC
Resistance of insulation		>10 MΩ (below 500 VDC)
Paralleling of inputs		No
Reliability	MTBF for continuous operation in hours at ambient temperature 30°C (86°F)	342 216
Sensor voltage: monitoring threshold	OK	>18 V
	Error	<14 V
Sensor voltage: monitoring response time at 24 V (-15%... +20%)	on appearance	1 ms < T < 30 ms
	on disappearance	8 ms < T < 30 ms
Power consumption 3.3 V	typical	160 mA
	maximum	226 mA
Sensor supply consumption	typical	96 mA
	maximum	125 mA
Power dissipation		4.3 W maximum

BMXDDI6402K(H) fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Digital input channel description:

Element	Description
DI##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
Force Operation (see Modicon M251/M580 Distributed PACs and Altivar Drives with, EcoStruxure™ Automation Expert, Hardware Reference Guide)	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.

Introduction

Function

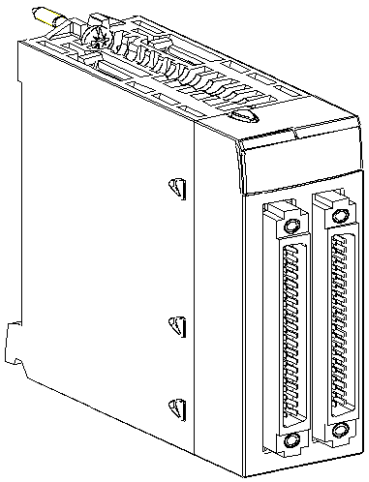
The BMXDDI6402K module is a 24 VDC discrete module connected via two 40-pin connectors. It is a positive logic (or sink) module: its 64 input channels receive current from the sensors.

Ruggedized Version

The BMXDDI6402K(H) (hardened) equipment is the ruggedized version of the BMXDDI6402 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the table below apply to the modules BMXDDI6402K and BMXDDI6402K(H) for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Characteristics

This table presents the general characteristics for the BMXDDI6402K and BMXDDI6402K(H) modules.

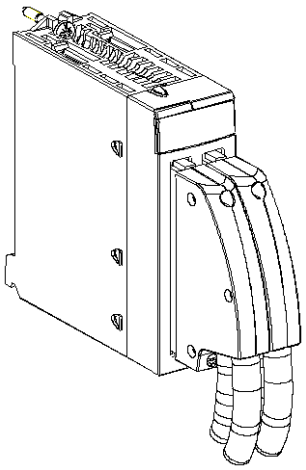
Module type		24 VDC positive logic inputs
Operating temperature	BMXDDI6402K	0...60 ºC (32...140 ºF)

	BMXDDI6402K(H)		-25...70 ºC (-13...158 ºF)
Nominal input values		Voltage	24 VDC
		Current	0.6 mA
Threshold input values	At 1	Voltage	≥ 15 V
	At 0	Voltage	≤ 4 V
	Sensor supply (including ripple)		19...30 V (possible up to 34 V, limited to 1 hour/day)
Input impedance	at nominal U		40 kΩ
Response time	typical		4 ms
	maximum		7 ms
Reverse polarity			Protected
Fuse type	Internal		None
	External		1 fast blow fuse of 0.5 A for each 16-channel group
Type of input			Current sink
Input type in compliance with IEC 61131-2 standard			No type
2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2 standard compliant)			No compatibility (only 1 contact per sensor allowed)
Dielectric strength	Primary/Secondary		1500 V actual, 50 / 60 Hz for 1 min
	Between channel groups		500 VDC
Resistance of insulation			>10 MΩ (below 500 VDC)
Paralleling of inputs			No
Reliability	MTBF for continuous operation in hours at ambient temperature 30 ° C (86 °F)		342 216
Sensor voltage: monitoring threshold	OK		> 18 V
	Error		< 14 V
Sensor voltage: monitoring response time at 24 V (-15% ... +20%)	on appearance		1 ms < T < 3 ms
	on disappearance		8 ms < T < 30 ms
Power consumption 3.3 V	typical		160 mA
	maximum		226 mA
Sensor supply consumption	typical		96 mA
	maximum		125 mA
Power dissipation			4.3 W max.

Connecting the Module

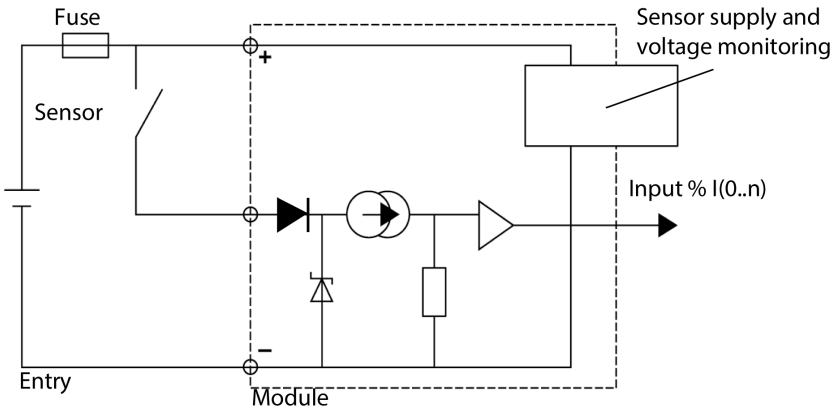
At a Glance

The BMXDDI402K module is fitted with two 40-pin connectors for the connection of 64 input channels.



Input Circuit Diagram

The following diagram shows the circuit of a direct current input (positive logic).



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltages before connecting or disconnecting the module.

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

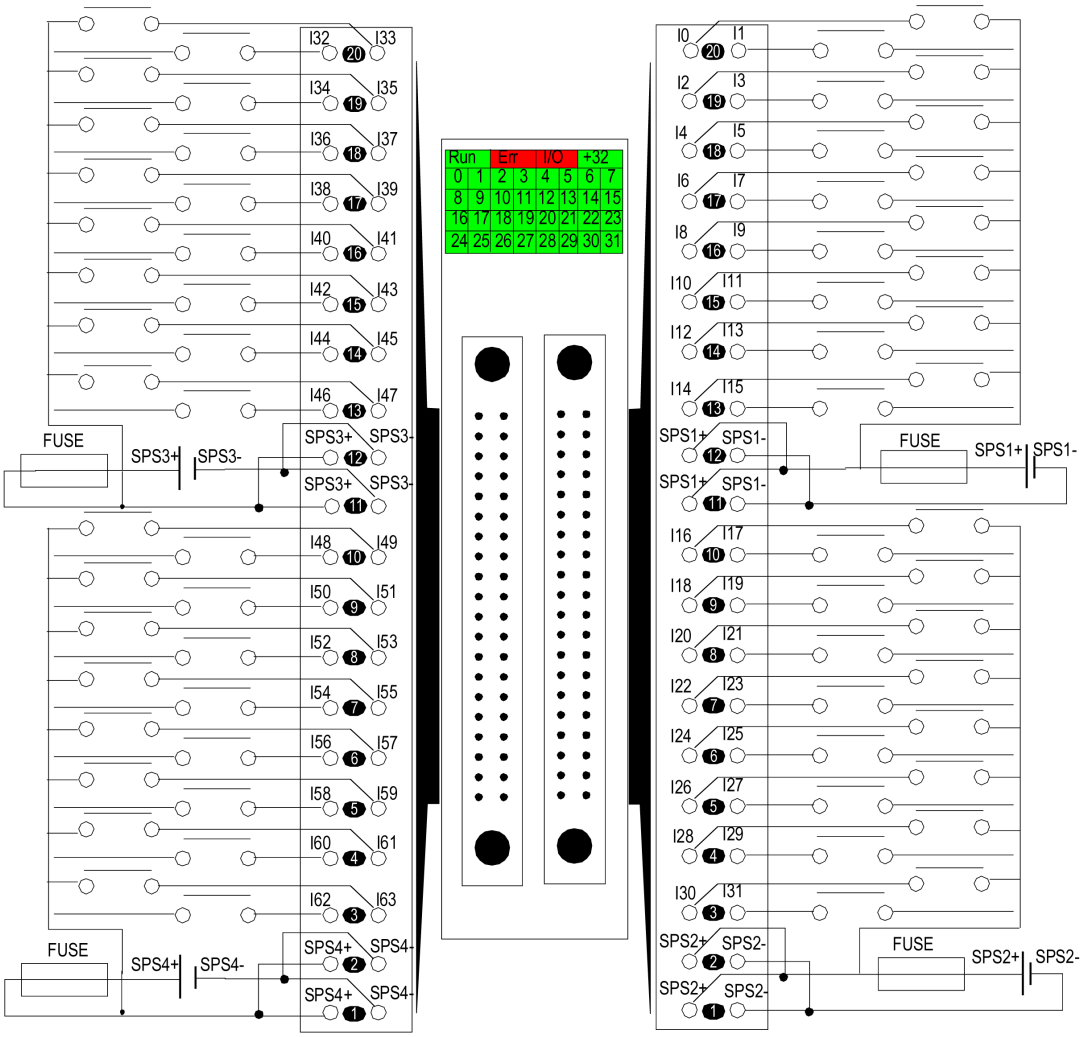
⚠CAUTION

LOSS OF INPUT FUNCTION

Install the correct rating and type of fuse.

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

The following diagram shows the connection of the module to the sensors.



power supply: 24 VDC

fuse: fast blow fuse of 0.5 A for each 16-channel group

SPS: sensor power supply

Sensor Power Outage

After the sensor power outage, the I/O (red) LED of the module switches on and the last recorded position of the sensor is displayed by the input channel status LED.

After a sensor power outage, the I/O error LED is on.

⚠WARNING

CHANNEL LED INFORMATION NOT MATCHING SENSORS' POSITION

- Do not take into account the input LEDs information. (They show the last recorded position of the sensors, not their real positions.)
- Check the real positions on the sensors.

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

BMXDDM16022(H) Discrete Input Module

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BMXDDM16022(H) sDefault

Abstract



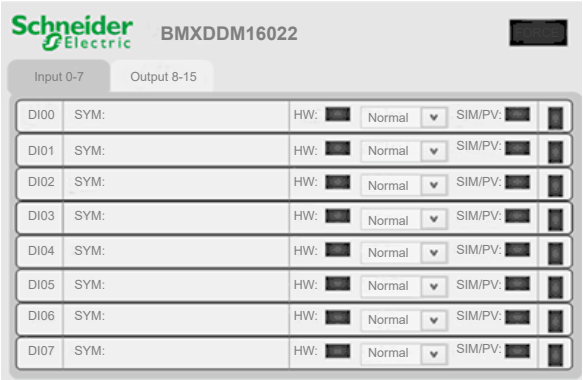
Description

The BMXDDM16022(H) module is a 24 VDC discrete module connected via a 20–pin terminal block. As a positive logic module, its eight input channels receive current from the sensors (sink) and its eight output channels provide current to the pre-actuators (source).

The BMXDDM16022H (hardened) module is the ruggedized version of the BMXDDM16022 (standard) module and can be used at extended temperatures and in harsh chemical environments.

BMXDDM16022(H) fpDefault

Abstract



Description

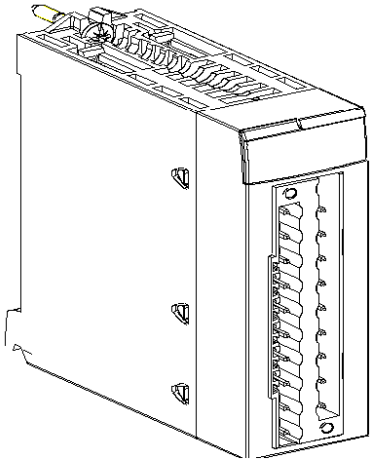
Digital mixed input/output channel description:

Element	Description
DI##	Channel name.(## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.

Element	Description
Force Operation	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.

Characteristics

Illustration



Altitude Operating Conditions

The characteristics in the tables below apply to the modules BMXDDM16022 and BMXDDM16022(H) for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards, and Certifications* user guide.

General Input Characteristics

The following table shows the general input characteristics of the BMXDDM16022 and BMXDDM16022(H) modules:

Input module type			24 VDC positive logic inputs
Operating temperature	BMXDDM16022		0...60 ºC (32...140 ºF)
	BMXDDM16022(H)		-25...70 ºC (-13...158 ºF)
Nominal input values		Voltage	24 VDC
		Current	3.5 mA
Threshold input values	At 1	Voltage	≥ 11 V

		Current	> 2 mA for U ≥ 11 V
	At 0	Voltage	5 V
		Current	≤ 1.5 mA
	Sensor supply (including ripple)		19...30 V (possibly up to 34 V, limited to 1 hour/day)
Input impedance	At nominal U		6.8 kΩ
Response time	Typical		4ms
	Maximum		7ms
Input type			Current sink
Input type in compliance with IEC 61131-2 standard			Type 3
Reverse polarity			Protected
Fuse type	Internal		None
	External		1 fast blow fuse of 0.5 A for 8-channel group
2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2 standard compliant)			2-wire (DC), and 3-wire (DC) PNP any type, page 419
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86°F)		427 772
Dielectric strength	Primary/secondary		1500 V actual, 50 / 60 Hz for 1 min.
	Between input/output groups		500 VCC
Resistance of insulation			>10 MΩ (below 500 VDC)
Paralleling of inputs			No
Sensor voltage: monitoring threshold	OK		> 18 V
	Error		< 14 V
Sensor voltage: monitoring response time at 24 V (-15% ... +20%)	On appearance		8 ms < T < 30 ms
	On disappearance		1 ms < T < 3 ms
Power consumption 3.3 V	Typical		79 mA
	Maximum		111 mA
24 V pre-actuator consumption (excluding load current)	Typical		59 mA
	Maximum		67 mA
Power dissipation			3.7 W max.

NOTE: These characteristics are available also for the **BMXDDM16022(H)** in the temperature range -25...60 °C (-13...140 °F). At +70 °C (158 °F). Confirm that the maximum voltage value of input sensor supply does not exceed 26.4 V.

⚠WARNING

LOSS OF INPUT FUNCTION

Do not operate the **BMX DDM 16022(H)** at 70 °C (158 °F) if the sensor power supply is greater than 29.0 V or less than 21.1 V. Overheating the module can cause the loss of the input function.

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

General Output Characteristics

The following table shows the general output characteristics of the BMXDDM16022 and BMXDDM16022(H) modules:

Output module type		24 VDC positive logic static outputs
Operating temperature	BMXDDM16022	0...60 ºC (32...140 ºF)
	BMXDDM16022(H)	-25...70 ºC (-13...158 ºF)
Temperature derating		Apply the temperature derating curve , page 393
Nominal values	Voltage	24 VDC
	Current	0.5 A
Threshold values	Voltage (including ripple)	19...30 V (34 V possible for 1 hour/day)
	Current/channel	0.625 A
	Current/module	5 A
Power of tungsten filament lamp	Maximum	6 W
Leakage current	At 0	< 0.5 mA
Voltage drop	At 1	< 1.2 V
Load impedance	Minimum	48 Ω
Response time(1)		1.2 ms
Max. overload time before internal damage		15 ms
Reliability	MTBF for continuous operation in hours at ambient temperature 30 ° C (86 °F)	427 772
Frequency of switching to inductive load		0.5 / LI^2 Hz
Paralleling of outputs		Yes (maximum of 2)
Compatibility with IEC 61131-2 DC direct inputs		Yes (type 3 and no type)
Built-in protection	Against over voltage	Yes, by Transil diode
	Against inversions	Yes, by inverted diode(2)
	Against short-circuits and overloads	Yes, by current limiter and electric circuit-breaker 1.5 In < Id < 2 In
Fuse type	Internal	None
	External	1 fast blow fuse of 6.3 A for 8-channel group
Pre-actuator voltage: monitoring threshold	OK	> 18 V
	Error	< 14 V
Pre-actuator voltage: monitoring response time at 24 V (-15% ... +20%)	On appearance	8 ms < T < 30 ms
	On disappearance	1 ms < T < 3 ms
Power consumption 3.3 V	Typical	79 mA
	Maximum	111 mA
24 V pre-actuator consumption (excluding load current)	Typical	59 mA
	Maximum	67 mA
Power dissipation		3.7 W max.
Dielectric strength	Output / ground or output / internal logic	1500 V actual, 50 / 60 Hz for 1 min.
Resistance of insulation		>10 MΩ (below 500 VDC)

(1) All outputs are equipped with fast demagnetization circuits for electromagnets. Electromagnet discharge time < L/R.

(2) Provide a 6.3 A fuse to the +24 V pre-actuator supply

NOTE: The characteristics in this table also apply to the **BMXDDM16022(H)** in the temperature range -25...60 °C (-13...140 °F).

At 70 °C (140 °F):

- Confirm that the maximum voltage of the pre-actuator power supply does not exceed 26.4 V.
- Confirm that the maximum output current does not exceed 0.55 A.

⚠WARNING

LOSS OF OUTPUT FUNCTION

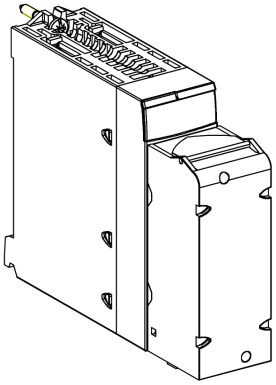
Do not operate the **BMX DDM 16022H** at 70 °C (158 °F) if the pre-actuator power supply is greater than 29.0 V or less than 21.1 V. Overheating the module can cause the loss of the output function.

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

Connecting the Module

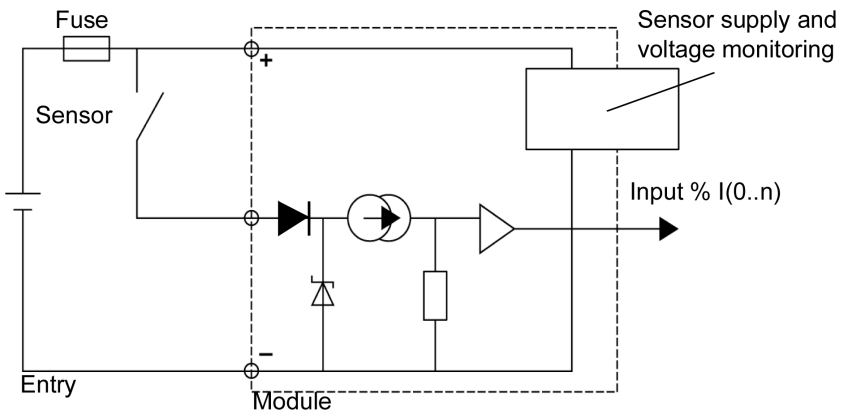
At a Glance

The BMXDDM16022(H) module is fitted with a removable 20-pin terminal block for the connection of 8 input channels and eight output channels.



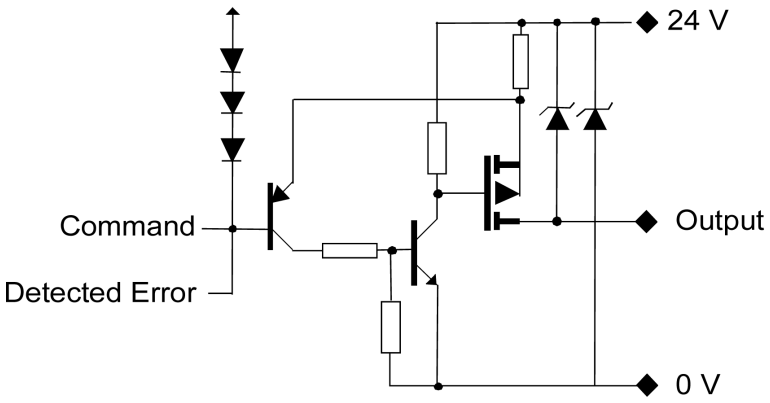
Input Circuit Diagram

The following diagram shows the circuit of a direct current input (positive logic).



Output Circuit Diagram

The following diagram shows the circuit of a direct current output (positive logic).



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltages before connecting or disconnecting the module.

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

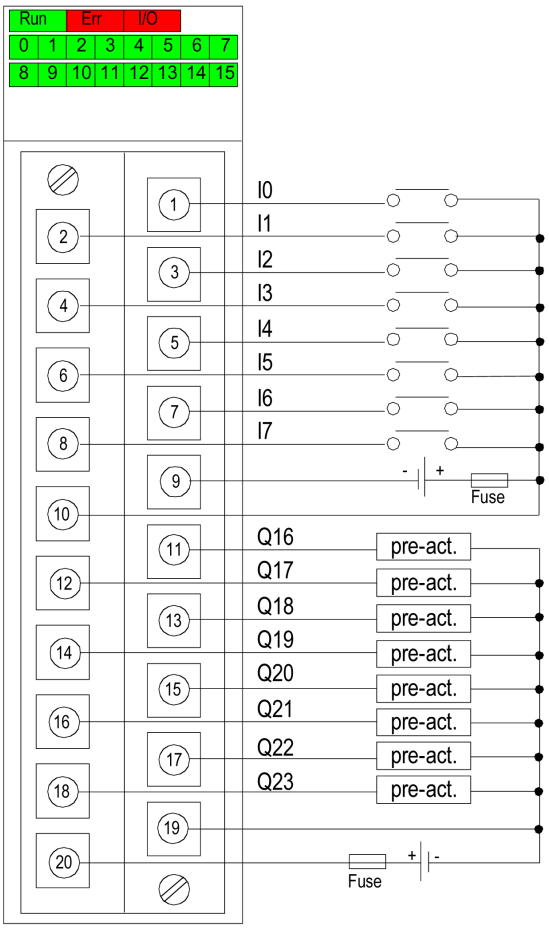
⚠CAUTION

LOSS OF INPUT FUNCTION

Install the correct rating and type of fuse.

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

The following diagram shows the connection of the module to the sensors and pre-actuators.



power supply: 24 VDC

input fuse: fast blow fuse of 0.5 A

output fuse: fast blow fuse of 6.3 A

pre-act: pre-actuator

Sensor Power Outage

After the sensor power outage, the I/O (red) LED of the module switches on and the last recorded position of the sensor is displayed by the input channel status LED.

After a sensor power outage, the I/O error LED is on.

⚠WARNING

CHANNEL LED INFORMATION NOT MATCHING SENSORS POSITION

- Do not take into account the input LEDs information. (They show the last recorded position of the sensors, not their real positions.)
- Check the real positions on the sensors.

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

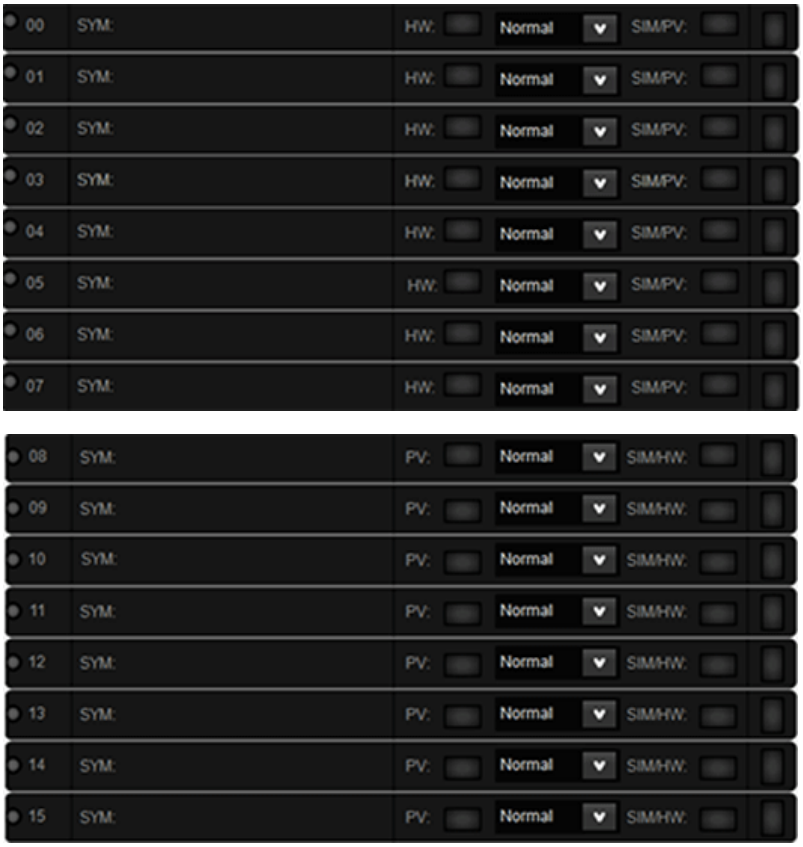
BMXDDM16025(H) Mixed Relay Input/Output Module

What's in This Chapter

BMXDDM16025(H) sDefault 319
BMXDDM16025(H) fpDefault 322
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Characteristics 323
Connecting the Module 326

BMXDDM16025(H) sDefault

Abstract



Description

Altitude Operating Conditions

The characteristics in the following tables apply to the BMXDDM16025(H) for us at altitude up to 2000 m (6560 ft). When the module operates above 2000 m (6560 ft), apply additional derating.

General Input Characteristics

⚠WARNING

LOSS OF INPUT FUNCTION

- Do not operate the BMXDDI16025H module at 70°C (158°F) if the sensor power supply is greater than 29.0 V or less than 21.1 V.
- Overheating the module can cause the loss of the input function.

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

Input module type			Eight 24 VDC positive logic inputs
Operating temperature	BMXDDM16025		0...60°C (32...140°F)
	BMXDDM16025H		-25...70°C (-13...158°F)
Nominal input values	Voltage		24 VDC
	Current		3.5 mA
Threshold input values	At 1	Voltage	≥11 V
		Current	≥ 2 mA for U ≥ 11 V
	At 0	Voltage	5 V
		Current	< 1.5 mA
	Sensor supply (including ripple)		19...30 V (possibly up to 34 V, limited to 1 hour/day)
Input impedance	At nominal U		6.8 kΩ
Response time	Typical		4 ms
	Maximum		7 ms
Input type			Current sink
Input type in compliance with IEC 61131-2 standard			Type 3
Reverse polarity			Protected
Fuse type	Internal		None
	External		1 fast blow fuse of 0.5 A for 8-channel group
2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2 standard compliant)			2-wire (DC) and 3-wire (DC) PNP any type
Reliability	MTBF for continuous operation in hours at ambient temperature 30°C (86°F)		835 303
Dielectric strength	Primary/secondary		1500 V actual, 50 /60 Hz for 1 min
	Between input/output groups		500 VDC
Resistance of insulation			> 10 mΩ (below 500 VDC)
Paralleling of inputs			No
Sensor voltage: monitoring threshold	OK		> 18 V
	Error		< 14 V
Sensor voltage: monitoring response time at 24 V (-15%... +20%)	On appearance		8 ms < T < 30 ms
	On disappearance		1 ms < T < 3 ms
Power consumption 3.3 V	Typical		35 mA
	Maximum		50 mA
24 V pre-actuator consumption (excluding load current)	Typical		79 mA
	Maximum		111 mA
Power dissipation			3.1 W maximum

NOTE: Confirm that the BMXDDM16025H module at 70C (158F) has a maximum pre-actuator power supply of 26.4 V.

General Output Characteristics

⚠WARNING

LOSS OF OUTPUT FUNCTION

- Do not operate the BMXDDM16025H at 70°C (158°F) if the pre-actuator power supply must not exceed 24 VA.
- Overheating the module can cause the loss of the output function.

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

Output module type		Eight 24 VDC / 24-240 VAC relay outputs
Operating temperature	BMXDDM16025	0...60°C (32...140°F)
	BMXDDM16025H	-26...70°C (-13...158°F)
Nominal values	Switching direct voltage	24 VDC resistive load
	Switching direct current	2 A resistive load
	Switching alternating voltage	220 VAC, Cos Φ = 1
	Switching alternating current	2 A, Cos Φ = 1
Minimum switching load	Voltage / current	5 VDC / 1 mA
Maximum switching load	Voltage	264 VAC / 125 VDC
Online module change		Possibility
Response time	Activation	≤8 ms
	Deactivation	≤10 ms
Mechanical service life	Number of switching	20 million or more
Reliability	MTBF for continuous operation in hours at ambient temperature 30°C (86°F)	835 303
Maximum switching frequency	Cycles per hour	3 600
Electrical service life		Switching voltage / current
		200 VAC / 1.5 A, 240 VAC / 1 A, Cos Φ = 0.7(1)
		200 VAC / 0.4 A, 240 VAC / 0.3 A, Cos Φ = 0.7(2)
		200 VAC / 1 A, 240 VAC / 0.5 A, Cos Φ = 0.35(1)
		200 VAC / 0.3 A, 240 VAC / 0.15 A, Cos Φ = 0.35(2)
		200 VAC / 1.5 A, 240 VAC / 1 A, Cos Φ = 0.7(1)
		200 VAC / 0.4 A, 240 VAC / 0.3 A, Cos Φ = 0.7(2)
Noise immunity		In noise simulation, 1500 V actual, width 1s and 25 to 60 Hz
Fuse type	Internal	None
	External	1 fast blow fuse of 12 A for 8-channel group
Power consumption 3.3 V	Typical	79 mA
	Maximum	111 mA
24 V pre-actuator consumption	Typical	36 mA
	Maximum	58 mA
Power dissipation		3.1 W maximum
Dielectric strength	Maximum voltage	2830 VAC ms / cycles

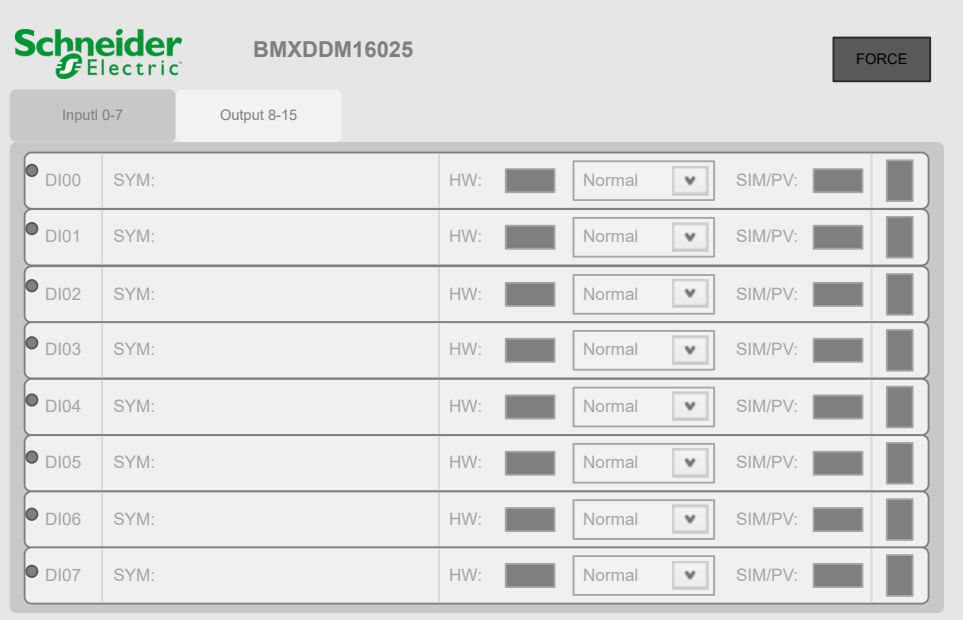
Resistance of insulation	10 mΩ

1. 1 x 10^5 cycles
2. 3 x 10^5 cycles

NOTE: Confirm that the BMXDDM16025H module at 70°C (158°F) has a maximum pre-actuator power supply of 24 VA.

BMXDDM16025(H) fpDefault

Abstract



Description

Digital mixed input/output channel description:

Element	Description
DI##	Channel name.(## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
Force Operation	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.

Introduction

Function

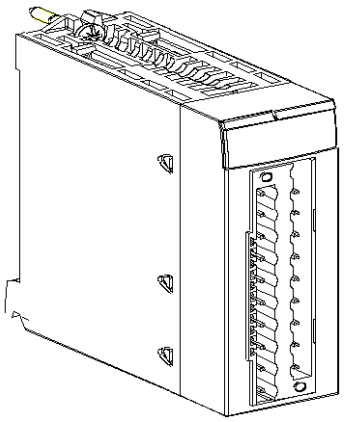
The BMXDDM16025 module is a 24 VDC discrete module connected via a 20-pin terminal block. It is a positive logic module: its 8 input channels receive current from the sensors (sink). The 8 isolated relay outputs operate either on direct current (24 VDC) or alternating current (24...240 VAC).

Ruggedized Version

The BMXDDM16025H (hardened) equipment is the ruggedized version of the BMXDDM16025 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the tables below apply to the modules BMXDDM16025 and BMXDDM16025(H) for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards, and Certifications* user guide.

General Input Characteristics

This table presents the general input characteristics for the BMXDDM16025 and BMXDDM16025(H) modules:

Input module type		Eight 24 VDC positive logic inputs
Operating temperature	BMXDDM16025	0...60 ºC (32...140 ºF)

	BMXDDM16025(H)		-25...70 ºC (-13...158 ºF)
Nominal input values		Voltage	24 VDC
		Current	3.5 mA
Threshold input values	At 1	Voltage	≥ 11 V
		Current	≥ 2 mA for U ≥ 11 V
	At 0	Voltage	5 V
		Current	< 1.5 mA
	Sensor supply (including ripple)		19...30 V (possibly up to 34 V, limited to 1 hour/day)
Input impedance	At nominal U		6.8 kΩ
Response time	Typical		4 ms
	Maximum		7 ms
Input type			Current sink
Input type in compliance with IEC 61131-2 standard			Type 3
Reverse polarity			Protected
Fuse type	Internal		None
	External		1 fast blow fuse of 0.5 A for 8-channel group
2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2 standard compliant)			2-wire (DC), and 3-wire (DC) PNP any type, page 419
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)		835 303
Dielectric strength	Primary/secondary		1500 V actual, 50 / 60 Hz for 1 min.
	Between input/output groups		500 VDC
Resistance of insulation			>10 MΩ (below 500 VDC)
Paralleling of inputs			No
Sensor voltage: monitoring threshold	OK		> 18 V
	Error		< 14 V
Sensor voltage: monitoring response time at 24V (-15% ... +20%)	On appearance		8 ms < T < 30 ms
	On disappearance		1 ms < T < 3 ms
Power consumption 3.3 V	Typical		35 mA
	Maximum		50 mA
24 V pre-actuator consumption (excluding load current)	Typical		79 mA
	Maximum		111 mA
Power dissipation			3.1 W max.

NOTE: For the **BMX DDM 16025H**, at 70 °C (158 °F) confirm that the maximum pre-actuator power supply does not exceed 26.4 V.

⚠WARNING

LOSS OF INPUT FUNCTION

Do not operate the **BMXDDI16025(H)** at 70 °C (158 °F) if the sensor power supply is greater than 29.0 V or less than 21.1 V. Overheating the module can cause the loss of the input function.

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

General Output Characteristics

The following table shows the general output characteristics of the BMXDDM16025 and BMXDDM16025(H) modules:

Output module type		Eight 24 VDC/24-240 VAC relay outputs
Operating temperature	BMXDDM16025	0...60 ºC (32...140 ºF)
	BMXDDM16025(H)	-25...70 ºC (-13...158 ºF)
Nominal values	Switching direct voltage	24 VDC resistive load
	Switching direct current	2 A resistive load
	Switching alternating voltage	220 VAC, Cos Φ = 1
	Switching alternating current	2 A, Cos Φ = 1
Minimum switching load	Voltage / Current	5 VDC / 1 mA.
Maximum switching load	Voltage	264 VAC / 125 VDC
On-line module change		Possibility
Response time	Activation	≤ 8 ms
	Deactivation	≤ 10 ms
Mechanical service life	Number of switching	20 million or more
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)	835 303
Max. switching frequency	Cycles per hour	3 600
Electrical service life		Switching voltage / current
		200 VAC / 1.5 A, 240 VAC / 1 A, Cos Φ = 0.7(1)
		200 VAC / 0.4 A, 240 VAC / 0.3 A, Cos Φ = 0.7(2)
		200 VAC / 1 A, 240 VAC / 0.5 A, Cos Φ = 0.35(1)
		200 VAC / 0.3 A, 240 VAC / 0.15 A, Cos Φ = 0.35(2)
		200 VAC / 1.5 A, 240 VAC / 1 A, Cos Φ = 0.7(1)
		200 VAC / 0.4 A, 240 VAC / 0.3 A, Cos Φ = 0.7(2)
Noise immunity		In noise simulation, 1500 V actual, width 1s and 25 to 60 Hz
Fuse type	Internal	None
	External	1 fast blow fuse of 12 A for 8-channel group
Power consumption 3.3 V	Typical	79 mA
	Maximum	111 mA
24 V pre-actuator consumption	Typical	36 mA
	Maximum	58 mA
Power dissipation		3.1 W max.
Dielectric strength	Max. voltage	2830 VAC rms / cycles
Resistance of insulation		10 MΩ

(1) 1 x 10^5 cycles

(2) 3 x 10^5 cycles

NOTE: For the **BMXDDM16025(H)**, at 70 °C (158 °F) confirm that the maximum pre-actuator power supply does not exceed 24 VA.

⚠WARNING

LOSS OF OUTPUT FUNCTION

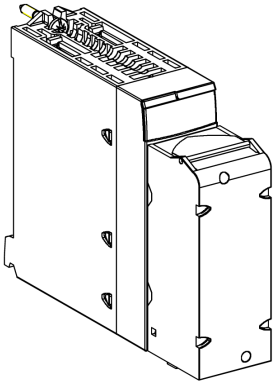
Do not operate the **BMXDDI16025(H)** at 70°C (158°F) if the pre-actuator power supply is greater than 28.8 V or less than 19.2 V. Overheating the module can cause the loss of the output function.

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

Connecting the Module

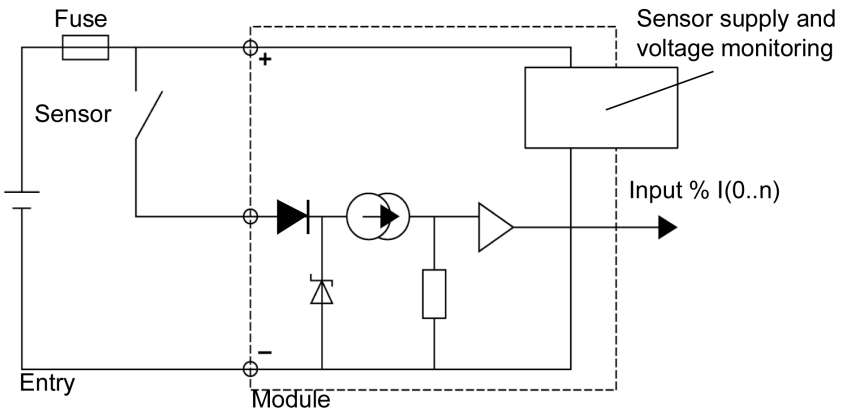
At a Glance

The BMXDDM16025(H) module is fitted with a removable 20-pin terminal block for the connection of 8 input channels and eight isolated relay output channels.



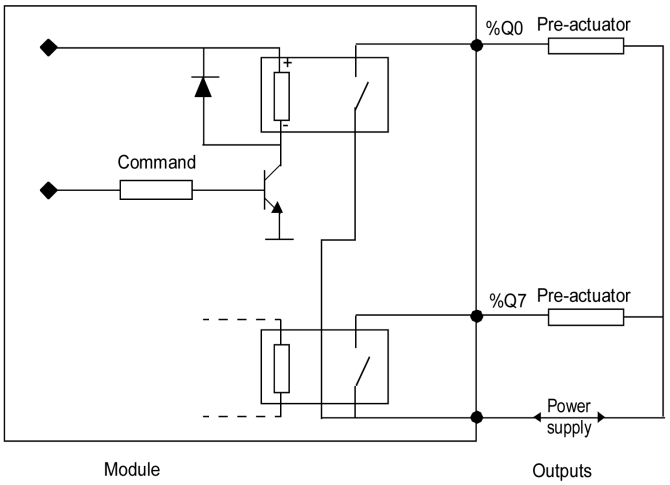
Input Circuit Diagram

The following diagram shows the circuit of a direct current input (positive logic).



Output Circuit Diagram

The following diagram shows the circuit of relay outputs.



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltages before connecting or disconnecting the module.

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

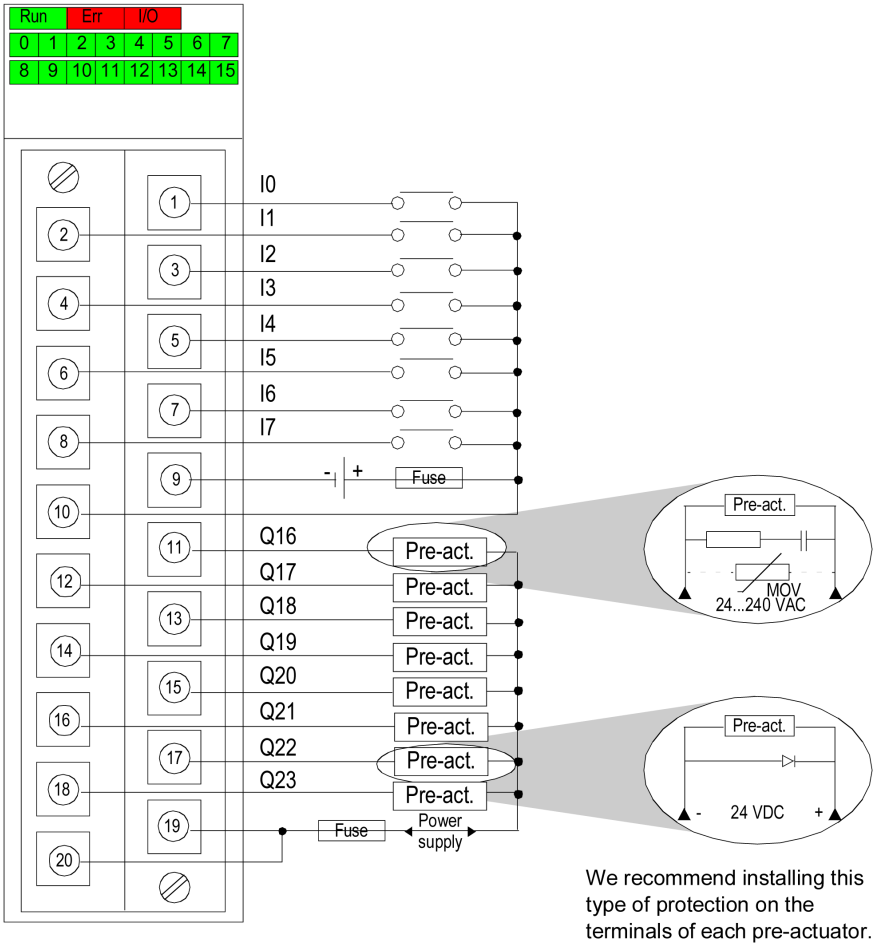
⚠CAUTION

LOSS OF INPUT FUNCTION

Install the correct rating and type of fuses.

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

The following diagram shows the connection of the module to the sensors and pre-actuators.



input power supply: 24 VDC

output power supply: 24 VDC or 24...240 VAC

input fuse: 1 fast blow fuse of 0.5 A

output fuse: 1 fast blow fuse of 12 A

pre-act: pre-actuator

Sensor Power Outage

After the sensor power outage, the I/O (red) LED of the module switches on and the last recorded position of the sensor is displayed by the input channel status LEDs.

After a sensor power outage, the I/O error LED is on.

⚠WARNING

CHANNEL LED INFORMATION NOT MATCHING SENSORS' POSITION

- Do not take into account the input LEDs information. (They show the last recorded position of the sensors, not their real positions.)
- Check the real positions on the sensors.

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

BMXDDM3202K Mixed Input/Output Module

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BMXDDM3202K sDefault

Abstract



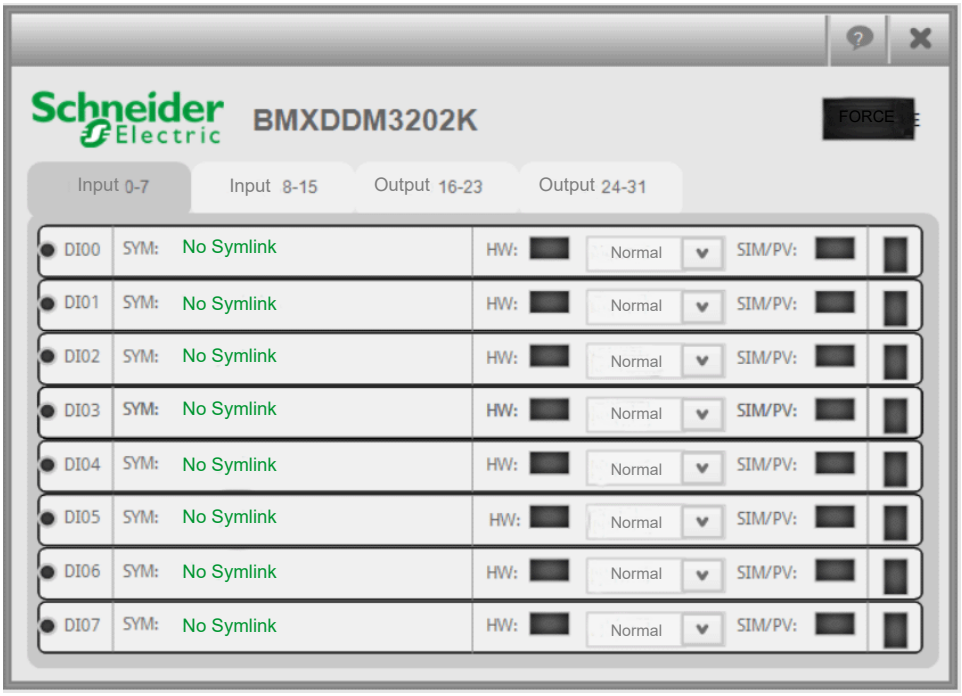
Description

The BMXDDM3202K module is a 24 VDC discrete module connected via a 20–pin terminal block. As a positive logic module, its sixteen input channels receive current from the sensors (sink) and its sixteen output channels provide current to the pre-actuators (source).

TheBMXDDM3202K (hardened) module is the ruggedized version of the BMXDDM3202K (standard) module and can be used at extended temperatures and in harsh chemical environments.

BMXDDM3202K fpDefault

Abstract



Description

Digital mixed input/output channel description:

Element	Description
DI##	Channel name.(## indicates the channel number)
SYM	Symlink associated to the channel.
HW	Indicates the real hardware value.
Force Operation	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/PV	Simulated/Program value: • The SIM/PV and HW values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/PV value is equal to the forced value.

Characteristics

Altitude Operating Conditions

The characteristics in the following tables apply to the BMXDDM3202K module for use at altitude up to 2000 m (6560 ft). When the module operates above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications* user guide.

General Input Characteristics

The following table shows the general input characteristics of the BMXDDM3202K module:

Input module type			24 VDC positive logic inputs
Operating temperature			0...60 ºC (32...140 ºF)
Nominal input values		Voltage	24 VDC
		Current	2.5 mA
Threshold input values	At 1	Voltage	≥ 11 V
		Current	> 2 mA for U ≥ 11 V
	At 0	Voltage	5 V
		Current	< 0.5 mA
	Sensor supply (including ripple)		19...30 V (possibly up to 34 V, limited to 1 hour/day)
Input impedance	At nominal U		9.6 kΩ
Response time	Typical		4 ms
	Maximum		7 ms
Input type			Current sink
Input type in compliance with IEC 61131-2 standard			Type 1
Reverse polarity			Protected
2-wire / 3-wire proximity sensor compatibility (IEC 60947-5-2 standard compliant)			2-wire (DC) and 3-wire (DC) PNP any type, page 419
Fuse type	Internal		None
	External		1 fast blow fuse of 0.5 A for 16-channel group
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)		650 614
Dielectric strength	Primary/secondary		1500 V actual, 50 / 60 Hz for 1 min.
	Between input/output groups		500 VDC
Resistance of insulation			>10 MΩ (below 500 VDC)
Paralleling of inputs			No
Sensor voltage: monitoring threshold	OK		> 18 V
	Error		< 14 V
Sensor voltage: monitoring response time at 24 V (-15% ... +20%)	On appearance		8 ms < T < 30 ms
	On disappearance		1 ms < T < 3 ms
Power consumption 3.3 V	Typical		125 mA
	Maximum		166 mA
24 V pre-actuator consumption (excluding load current)	Typical		69 mA
	Maximum		104 mA
Power dissipation			4 W max.

General Output Characteristics

The following table shows the general output characteristics of the BMXDDM3202K module:

Output module type		24 VDC positive logic static outputs
Operating temperature		0...60 ºC (32...140 ºF)
Temperature derating		Apply the temperature derating curve , page 393
Nominal values	Voltage	24 VDC
	Current	0.1 A
Threshold values	Voltage (including ripple)	19...30 V (34 V possible for 1 hour/day)
	Current/channel	0.125 A
	Current/module	3.2 A
Power of tungsten filament lamp	Maximum	1.2 W
Leakage current	at 0	100 µA for U = 30 V
Voltage drop	at 1	< 1.5 V for I = 0.1 A
Load impedance	Minimum	220 Ω
Response time(1)		1.2 ms
Max. overload time before internal damage		15 ms
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)	650 614
Frequency of switching to inductive load		0.5 / LI^2 Hz
Paralleling of outputs		Yes (maximum of 3)
Compatibility with IEC 61131-2 DC direct inputs		Yes (type 3 and no type)
Built-in protection	Against over voltage	Yes, by Transil diode
	Against inversions	Yes, by inverted diode(2)
	Against short-circuits and overloads	Yes, by current limiter and electric circuit-breaker 0.125 A < Id < 0.185 A
Fuse type	Internal	None
	External	1 fast blow fuse of 2 A for 16-channel group
Pre-actuator voltage: monitoring threshold	OK	> 18 V
	Error	< 14 V
Pre-actuator voltage: monitoring response time at 24 V (-15% ... +20%)	On appearance	8 ms < T < 30 ms
	On disappearance	1 ms < T < 3 ms
Power consumption 3.3 V	Typical	125 mA
	Maximum	166 mA
24 V pre-actuator consumption (excluding load current)	Typical	69 mA
	Maximum	104 mA
Power dissipation		4 W max.
Dielectric strength	Output / ground or output / internal logic	1500 V actual, 50 / 60 Hz for 1 min.
Resistance of insulation		>10 MΩ (below 500 VDC)

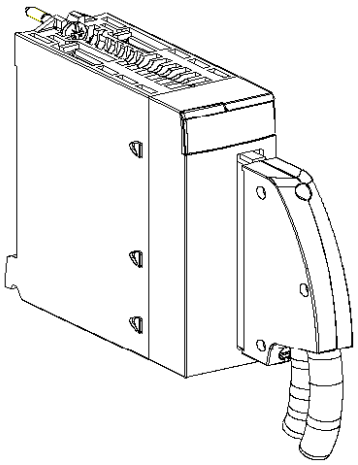
(1) All outputs are equipped with fast demagnetization circuits for electromagnet. Electromagnet discharge time < L/R.

(2) Provide a 2 A fuse to the +24 V pre-actuator supply.

Connecting the Module

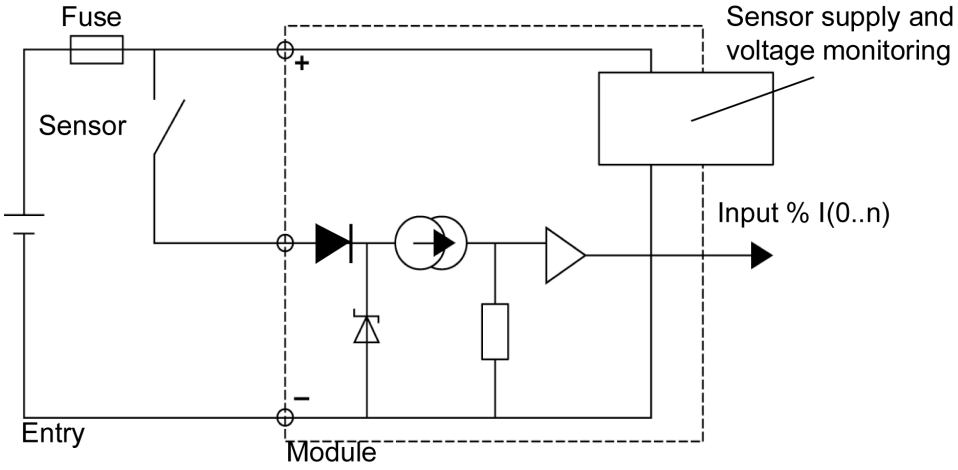
At a Glance

The BMXDDM3202K module is fitted with a 40-pin connector for the connection of sixteen input channels and sixteen output channels.



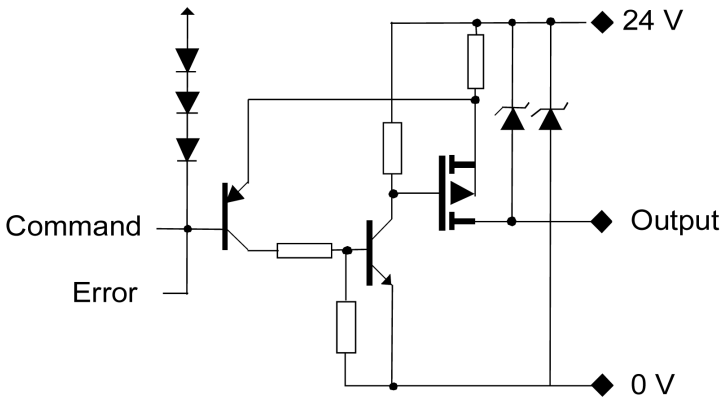
Input Circuit Diagram

The following diagram shows the circuit of a direct current input (positive logic).



Output Circuit Diagram

The following diagram shows the circuit of a direct current output (positive logic).



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltages before connecting or disconnecting the module.

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

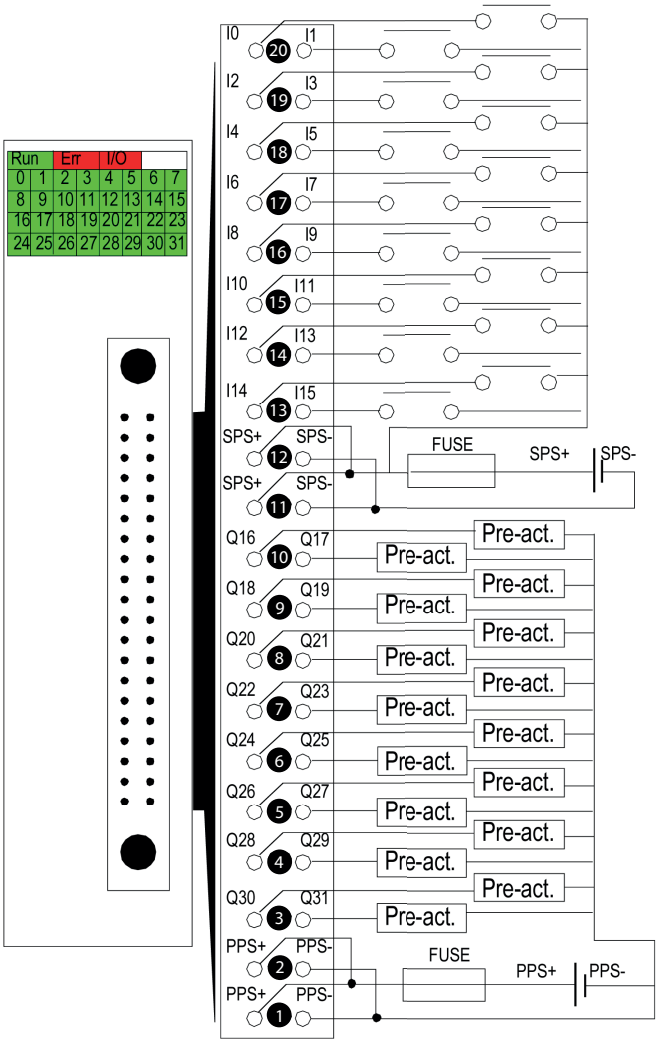
⚠CAUTION

LOSS OF INPUT FUNCTION

Install the correct rating and type of fuse.

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

The following diagram shows the connection of the module to the sensors and pre-actuators.



power supply: 24 VDC

input fuse: fast blow fuse of 0.5 A

output fuse: fast blow fuse of 2 A

pre-act: pre-actuator

SPS: sensor power supply

PPS: pre-actuator power supply

Sensor Power Outage

After a power sensor outage, if the **Supply monitoring** check box is not selected in the module configuration screen then the digital input can stay active.

⚠WARNING

DIGITAL INPUT STATE INACTIVE AFTER A SENSOR POWER OUTAGE

Do not click to clear the **Supply monitoring** check box in the module configuration screen to guarantee the digital input state inactive after sensor power outage.

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

To access the **Supply monitoring** check box, refer to chapter *How to Modify the External Power Supply Error Monitoring Parameter*, page 442.

After the sensor power outage, the I/O (red) LED of the module switches on and the last recorded position of the sensor is displayed by the input channel status LED's.

⚠WARNING

CHANNEL LED INFORMATION NOT MATCHING SENSORS POSITION

After a sensor power outage:

- The I/O error LED is on
- Do not take into account the input LEDs information (they show the last recorded position of the sensors, not their real positions)
- Check the real positions on the sensors.

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

BMXDDO1602(H) Discrete Output Module

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BMXDDO1602(H) sDefault

Abstract



Description

Altitude Operating Conditions

The characteristics in the table below apply to the modules BMXDDO1602 and BMXDDO1602(H) for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

General Characteristics

This table presents the general characteristics for the BMXDDO1602(H) module:

Module type		24 VDC positive logic static outputs
Operating temperature	BMXDDO1602	0...60 ºC (32...140 ºF)
	BMXDDO1602H	-25...70 ºC (-13...158 ºF)
Temperature derating		Apply the temperature derating curve
Nominal values	Voltage	24 VDC

	Current	0.5 A
Threshold values	Voltage (including ripple)	19...30 V (34 V possible for 1 hour/day)
	Current/channel	0.625 A
	Current/module	10 A
Power of tungsten filament lamp	Maximum	6 W
Leakage current	At 0	< 0.5 mA
Voltage drop	At 1	< 1.2 V
Load impedance	minimum	48 Ω
Response time(1)		1.2 ms
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86°F)	392 285
Frequency of switching to inductive load		0.5 / LI^2 Hz
Paralleling of outputs		Yes (maximum of 2)
Compatibility with IEC 61131-2 DC direct inputs		Yes (type 3 and no type)
Built-in protection	against over voltage	Yes, by Transil diode
	against inversions	Yes, by inverted diode(2)
	against short-circuits and overloads	Yes, by current limiter and electric circuit-breaker 1.5 In < Id < 2 In
Fuse type	Internal	None
	External	1 fast blow fuse of 6.3 A
Pre-actuator voltage: monitoring threshold	OK	> 18 V
	Error	< 14 V
Pre-actuator voltage: monitoring response time	on appearance	8 ms < T < 30 ms
	on disappearance	1 ms < T < 3 ms
Power consumption 3.3 V	typical	79 mA
	maximum	111 mA
24 V pre-actuator consumption (excluding load current)	typical	23 mA
	maximum	32 mA
Power dissipation		4 W max.
Dielectric strength	Output / ground or output / internal logic	1500 V actual, 50 / 60 Hz for 1 min.
Resistance of insulation		>10 MΩ (below 500 VDC)

(1) All outputs are equipped with fast demagnetization circuits for electromagnets. Electromagnet discharge time < L/R.

(2) Provide a fuse to the +24 V pre-actuator supply.

NOTE: For the **BMXDDO1602(H)** module, confirm that the maximum pre-actuator power supply does not exceed 26.4 V and the output current value does not exceed 0.55 A at 70 °C (158 °F).

BMXDDO1602(H) fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Digital output channel description:

Element	Description
DO##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
PV	Indicates the real program value:
Force Operation	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/HW	Program input value: • The SIM/HW and PV values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/HW value is equal to the forced value.

Introduction

Function

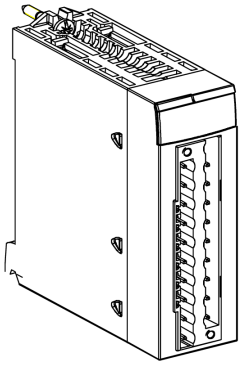
The BMXDDO1602 module is a 24 VDC discrete module connected via a 20-pin terminal block. It is a positive logic (or source) module: its 16 output channels provide current to the pre-actuators.

Ruggedized Version

The BMX DDO1602H (hardened) equipment is the ruggedized version of the BMXDDO1602 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the following table apply to the BMXDDO1602 and BMXDDO1602(H) modules for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards, and Certifications* user guide.

General Characteristics

The following table presents the general characteristics for the BMXDDO1602 and BMXDDO1602(H) modules:

Module type		24 VDC positive logic static outputs
Operating temperature	BMXDDO1602	0...60 ºC (32...140 ºF)
	BMXDDO1602(H)	-25...70 ºC (-13...158 ºF)

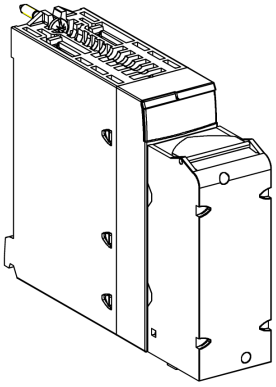
Temperature derating		Apply the temperature derating curve , page 393
Nominal values	Voltage	24 VDC
	Current	0.5 A
Threshold values	Voltage (including ripple)	19...30 V (34 V possible for 1 hour/day)
	Current/channel	0.625 A
	Current/module	10 A
Power of tungsten filament lamp	Maximum	6 W
Leakage current	At 0	< 0.5 mA
Voltage drop	At 1	< 1.2 V
Load impedance	Minimum	48 Ω
Response time(1)		1.2 ms
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86°F)	392 285
Frequency of switching to inductive load		0.5 / LI^2 Hz
Paralleling of outputs		Yes (maximum of 2)
Compatibility with IEC 61131-2 DC direct inputs		Yes (type 3 and no type)
Built-in protection	Against over voltage	Yes, by Transil diode
	Against inversions	Yes, by inverted diode(2)
	Against short-circuits and overloads	Yes, by current limiter and electric circuit-breaker 1.5 In < Id < 2 In
Fuse type	Internal	None
	External	1 fast blow fuse of 6.3 A
Pre-actuator voltage: monitoring threshold	OK	> 18 V
	Error	< 14 V
Pre-actuator voltage: monitoring response time	On appearance	8 ms < T < 30 ms
	On disappearance	1 ms < T < 3 ms
Power consumption 3.3 V	Typical	79 mA
	Maximum	111 mA
24 V pre-actuator consumption (excluding load current)	Typical	23 mA
	Maximum	32 mA
Power dissipation		4 W max.
Dielectric strength	Output / ground or output / internal logic	1500 V actual, 50 / 60 Hz for 1 min.
Resistance of insulation		>10 MΩ (below 500 VDC)
(1) All outputs are equipped with fast demagnetization circuits for electromagnets. Electromagnet discharge time < L/R. **(2)** Provide a fuse to the +24 V pre-actuator supply.		

NOTE: For the BMXDDO1602(H) module, confirm that the maximum pre-actuator power supply does not exceed 26.4 V and the output current value does not exceed 0.55 A at 70 °C (158 °F).

Connecting the Module

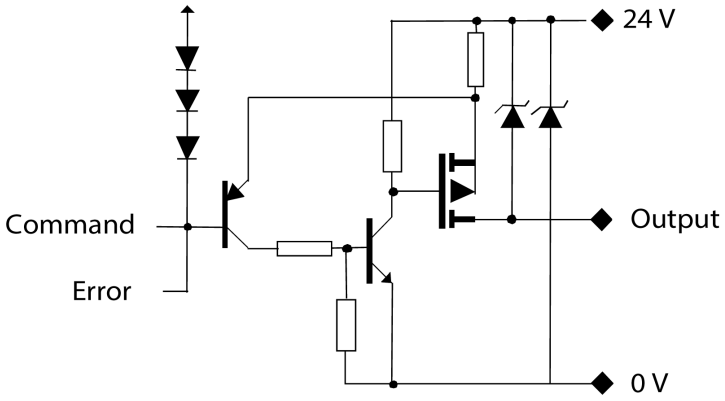
At a Glance

The BMXDDO1602 module is fitted with a removable 20-pin terminal block for the connection of sixteen output channels.



Output Circuit Diagram

The following diagram shows the circuit of a direct current output (positive logic).



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltage before connecting or disconnecting the module.

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

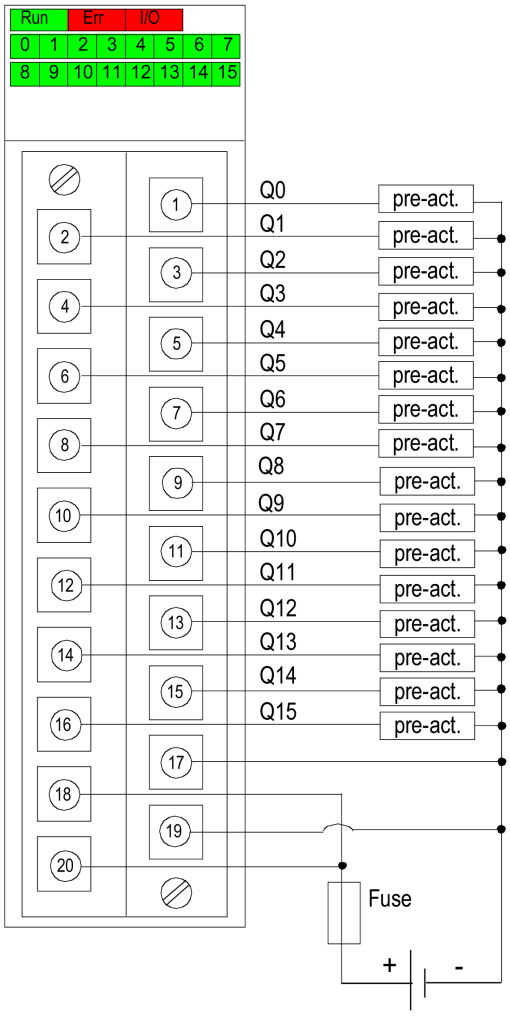
⚠CAUTION

LOSS OF OUTPUT FUNCTION

Install the correct rating and type of fuse.

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

The following diagram shows the connection of the module to the pre-actuators.



power supply: 24 VDC

fuse: fast blow fuse of 6.3 A

pre-act: pre-actuator

BMXDDO3202K Discrete Output Module

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BMXDDO3202K(C) sDefault

Abstract



Description

Altitude Operating Conditions

The characteristics in the following table apply to the BMXDDO3202K(C) module for use at altitude up to 2000 m (6560 ft). When the module operates above 2000 m (6560 ft), apply additional derating.

General Characteristics

This table presents the general characteristics for the BMXDDO3202K(C) module:

Module type		24 VDC positive logic static outputs
Operating temperature		0...60 ºC (32...140 ºF)
Temperature derating		Apply the temperature derating curve
Nominal values	Voltage	24 VDC
	Current	0.1 A
Threshold values	Voltage (including ripple)	19...30 V (34 V possible for 1 hour/day)

	Current/channel	0.125 A
	Current/module	3.2 A
Power of tungsten filament lamp	Maximum	1.2 W
Leakage current	At 0	100 µA for U = 30 V
Voltage drop	At 1	< 1.5 V for I = 0.1 A
Load impedance	Minimum	220 Ω
Response time(1)		1.2 ms
Max. overload time before internal damage		15 ms
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)	312 254
Frequency of switching to inductive load		0.5 / LI^2 Hz
Paralleling of outputs		Yes (maximum of 3)
Compatibility with IEC 61131-2 DC direct inputs		Yes (type 3 or no type)
Built-in protection	Against overvoltage	Yes, by Transil diode
	Against inversions	Yes, by inverted diode(2)
	Against short-circuits and overloads	Yes, by current limiter and electric circuit-breaker 0.125 A < Id < 0.185 A
Fuse type	Internal	None
	External	1 fast blow fuse of 2 A for each 16-channel group
Pre-actuator voltage: monitoring threshold	OK	> 18 V
	Error	< 14 V
Pre-actuator voltage: monitoring response time	On appearance	1 ms < T < 3 ms
	On disappearance	8 ms < T < 30 ms
Power consumption 3.3 V	Typical	125 mA
	Maximum	166 mA
24 V pre-actuator consumption	Typical	46 mA
(excluding load current)	Maximum	64 mA
Power dissipation		3.6 W max.
Dielectric strength	Output / ground or output / internal logic	1500 V actual, 50 / 60 Hz for 1 min
	Between channel groups	500 VDC
Resistance of insulation		>10 MΩ (below 500 VDC)

(1) All outputs are equipped with fast demagnetization circuits for electromagnet. Electromagnet discharge time < L/R.

(2) Provide a fuse to the +24 V pre-actuator supply

BMXDDO3202K(C) fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Digital output channel description:

Element	Description
DO##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
PV	Indicates the real program value:
Force Operation	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/HW	Program input value: • The SIM/HW and PV values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/HW value is equal to the forced value.

Introduction

Function

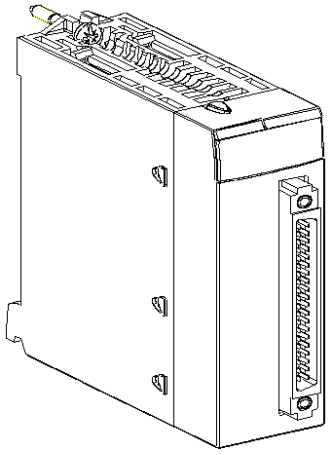
The BMX DDO3202K module is a 24 VDC discrete module connected via a 40-pin connector. It is a positive logic (or source) module: its 32 output channels provide current to the pre-actuators.

Ruggedized Version

The BMX DDO 3202 KC (coated) equipment is the ruggedized version of the BMXDDO3202K (standard) equipment. It can be used in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the following table apply to the BMXDDO3202K and BMXDDO3202KC modules for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For more information, refer to the *Operating and Storage Conditions* topic in the Modicon M580, M340, and X80 I/O Platforms, Standards, and Certifications user guide.

General Characteristics

The following table presents the general characteristics for the BMXDDO3202K and BMXDDO3202KC modules:

Module type	24 VDC positive logic static outputs
Operating temperature	0...60 ºC (32...140 ºF)

Temperature derating		Apply the temperature derating curve
Nominal values	Voltage	24 VDC
	Current	0.1 A
Threshold values	Voltage (including ripple)	19...30 V (34 V possible for 1 hour/day)
	Current/channel	0.125 A
	Current/module	3.2 A
Power of tungsten filament lamp	Maximum	1.2 W
Leakage current	At 0	100 µA for U = 30 V
Voltage drop	At 1	< 1.5 V for I = 0.1 A
Load impedance	Minimum	220 Ω
Response time(1)		1.2 ms
Max. overload time before internal damage		15 ms
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)	312 254
Frequency of switching to inductive load		0.5 / LI^2 Hz
Paralleling of outputs		Yes (maximum of 3)
Compatibility with IEC 61131-2 DC direct inputs		Yes (type 3 or no type)
Built-in protection	Against over voltage	Yes, by Transil diode
	Against inversions	Yes, by inverted diode(2)
	Against short-circuits and overloads	Yes, by current limiter and electric circuit-breaker 0.125 A < Id < 0.185 A
Fuse type	Internal	None
	External	1 fast blow fuse of 2 A for each 16-channel group
Pre-actuator voltage: monitoring threshold	OK	> 18 V
	Error	< 14 V
Pre-actuator voltage: monitoring response time	On appearance	8 ms < T < 30 ms
	On disappearance	1 ms < T < 3 ms
Power consumption 3.3 V	Typical	125 mA
	Maximum	166 mA
24 V pre-actuator consumption (excluding load current)	Typical	46 mA
	Maximum	64 mA
Power dissipation		3.6 W max.
Dielectric strength	Output / ground or output / internal logic	1500 V actual, 50 / 60 Hz for 1 min
	Between channel groups	500 VDC
Resistance of insulation		>10 MΩ (below 500 VDC)

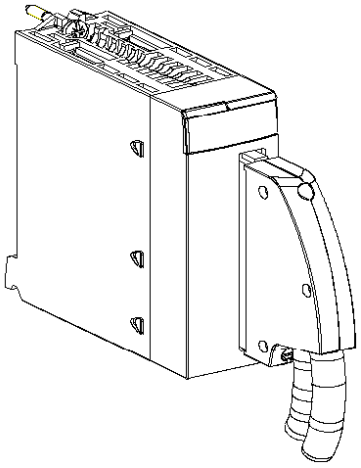
(1) All outputs are equipped with fast demagnetization circuits for electromagnet. Electromagnet discharge time < L/R.

(2) Provide a fuse to the +24 V pre-actuator supply.

Connecting the Module

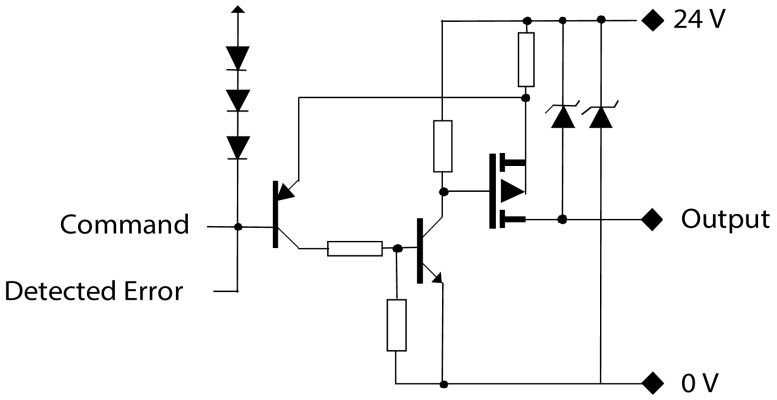
At a Glance

The BMXDDO3202K module is fitted with a 40-pin connector for the connection of thirty-two output channels.



Output Circuit Diagram

The following diagram shows the circuit of a direct current output (positive logic).



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltage before connecting or disconnecting the module.

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

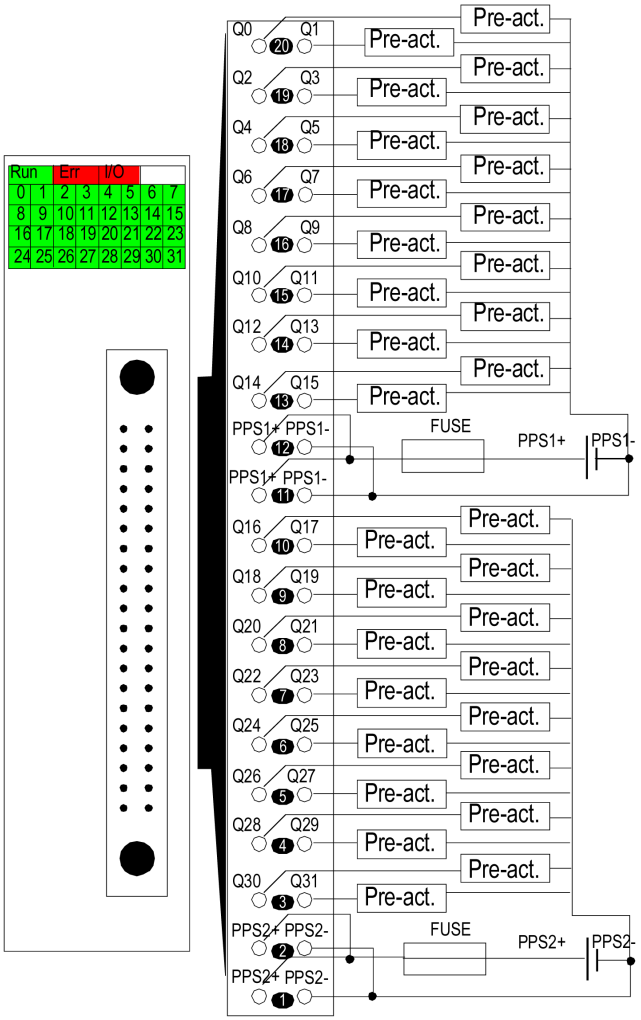
⚠CAUTION

LOSS OF INPUT FUNCTION

Install the correct rating and type of fuse.

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

The diagram below shows the connection of the module to the pre-actuators.



power supply: 24 VDC

fuse: fast blow fuse of 2 A for each 16-channel group

pre-act: pre-actuator

PPS: pre-actuator power supply

BMXDDO6402K Discrete Output Module

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BMXDDO6402K(C) sDefault

Abstract



Description

Altitude Operating Conditions

The characteristics in the following table apply to the BMXDDO6402K(C) for use at altitude up to 2000 m (6560 ft). When the module operates above 2000 m (6560 ft), apply additional derating.

General Characteristics

This table presents the general characteristics for the BMXDDO6402K(C) module:

Module type		24 VDC positive logic static outputs
Operating temperature		0...60 ºC (32...140 ºF)
Temperature derating		Apply the temperature derating curve
Nominal values	Voltage	24 VDC
	Current	0.1 A
Threshold values	Voltage (including ripple)	19...30 V (34 V possible for 1 hour/day)

	Current/channel	0.125 A
	Current/module	6.4 A
Power of tungsten filament lamp	Maximum	1.2 W
Leakage current	At 0	100 µA for U = 30 V
Voltage drop	At 1	< 1.5 V for I = 0.1 A
Load impedance	Minimum	220 Ω
Response time(1)		1.2 ms
Max. overload time before internal damage		15 ms
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)	159 924
Frequency of switching to inductive load		0.5 / LI^2 Hz
Paralleling of outputs		Yes (maximum of 3)
Compatibility with IEC 61131-2 DC direct inputs		Yes (type 3 and no type)
Built-in protection	Against over voltage	Yes, by Transil diode
	Against inversions	Yes, by inverted diode(2)
	Against short-circuits and overloads	Yes, by current limiter and electric circuit-breaker 0.125 A < Id < 0.185 A
Fuse type	Internal	None
	External	1 fast blow fuse of 2 A for each 16-channel group
Pre-actuator voltage: monitoring threshold	OK	> 18 V
	Error	< 14 V
Pre-actuator voltage: monitoring response time	On appearance	8 ms < T < 30 ms
	On disappearance	1 ms < T < 3 ms
Power consumption 3.3 V	Typical	160 mA
	Maximum	226 mA
24 V pre-actuator consumption (excluding load current)	Typical	92 mA
	Maximum	127 mA
Power dissipation		6.85 W max.
Dielectric strength	Output / ground or output / internal logic	1500 V actual, 50 / 60 Hz for 1 min
	Between channel groups	500 VDC
Resistance of insulation		>10 MΩ (below 500 VDC)

(1) All outputs are equipped with fast demagnetization circuits for electromagnet. Electromagnet discharge time < L/R.

(2) Provide a 2 A fuse to the +24 V pre-actuator supply.

BMXDDO6402K(C) fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Digital output channel description:

Element	Description
DO##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
PV	Indicates the real program value:
Force Operation	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/HW	Program input value: • The SIM/HW and PV values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/HW value is equal to the forced value.

Introduction

Function

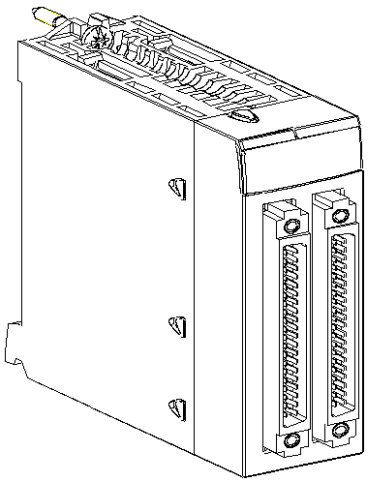
The BMX DDO6402K module is a 24 VDC discrete module connected via two 40-pin connectors. It is a positive logic (or source) module: its 64 output channels provide current to the pre-actuators.

Ruggedized Version

The BMXDDO6402KC (coated) equipment is the ruggedized version of the BMXDDO6402K (standard) equipment. It can be used in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the following table apply to the BMXDDO6402K and BMXDDO6402KC modules for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to the *Operating and Storage Conditions* topic in the *Modicon M580, M340, and X80 I/O Platforms, Standards, and Certifications* user guide.

General Characteristics

The following table presents the general characteristics for the BMXDDO6402K and BMXDDO6402KC modules:

Module type	24 VDC positive logic static outputs
Operating temperature	0...60 ºC (32...140 ºF)

Temperature derating		Apply the temperature derating curve , page 393
Nominal values	Voltage	24 VDC
	Current	0.1 A
Threshold values	Voltage (including ripple)	19...30 V (34 V possible for 1 hour/day)
	Current/channel	0.125 A
	Current/module	6.4 A
Power of tungsten filament lamp	Maximum	1.2 W
Leakage current	At 0	100 µA for U = 30 V
Voltage drop	At 1	< 1.5 V for I = 0.1 A
Load impedance	Minimum	220 Ω
Response time(1)		1.2 ms
Max. overload time before internal damage		15 ms
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)	159 924
Frequency of switching to inductive load		0.5 / LI^2 Hz
Paralleling of outputs		Yes (maximum of 3)
Compatibility with IEC 61131-2 DC direct inputs		Yes (type 3 and no type)
Built-in protection	Against over voltage	Yes, by Transil diode
	Against inversions	Yes, by inverted diode(2)
	Against short-circuits and overloads	Yes, by current limiter and electric circuit-breaker 0.125 A < Id < 0.185 A
Fuse type	Internal	None
	External	1 fast blow fuse of 2 A for each 16-channel group
Pre-actuator voltage: monitoring threshold	OK	> 18 V
	Error	< 14 V
Pre-actuator voltage: monitoring response time	On appearance	8 ms < T < 30 ms
	On disappearance	1 ms < T < 3 ms
Power consumption 3.3 V	Typical	160 mA
	Maximum	226 mA
24 V pre-actuator consumption (excluding load current)	Typical	92 mA
	Maximum	127 mA
Power dissipation		6.85 W max.
Dielectric strength	Output / ground or output / internal logic	1500 V actual, 50 / 60 Hz for 1 min
	Between channel groups	500 VDC
Resistance of insulation		>10 MΩ (below 500 VDC)

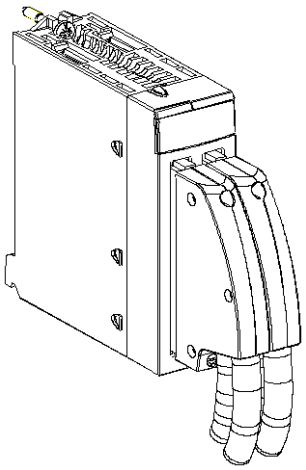
(1) All outputs are equipped with fast demagnetization circuits for electromagnet. Electromagnet discharge time < L/R.

(2) Provide a 2 A fuse to the +24 V pre-actuator supply.

Connecting the Module

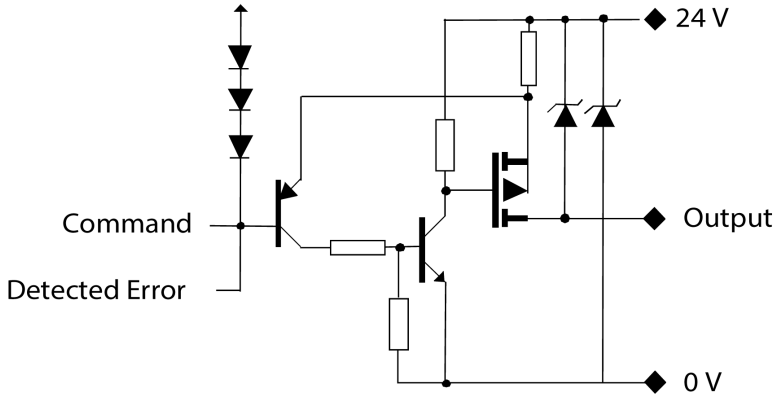
At a Glance

The BMXDDO6402K module is fitted with two 40-pin connectors for the connection of sixty-four output channels.



Output Circuit Diagram

The following diagram shows the circuit of a direct current output (positive logic).



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltage before connecting or disconnecting the module.

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

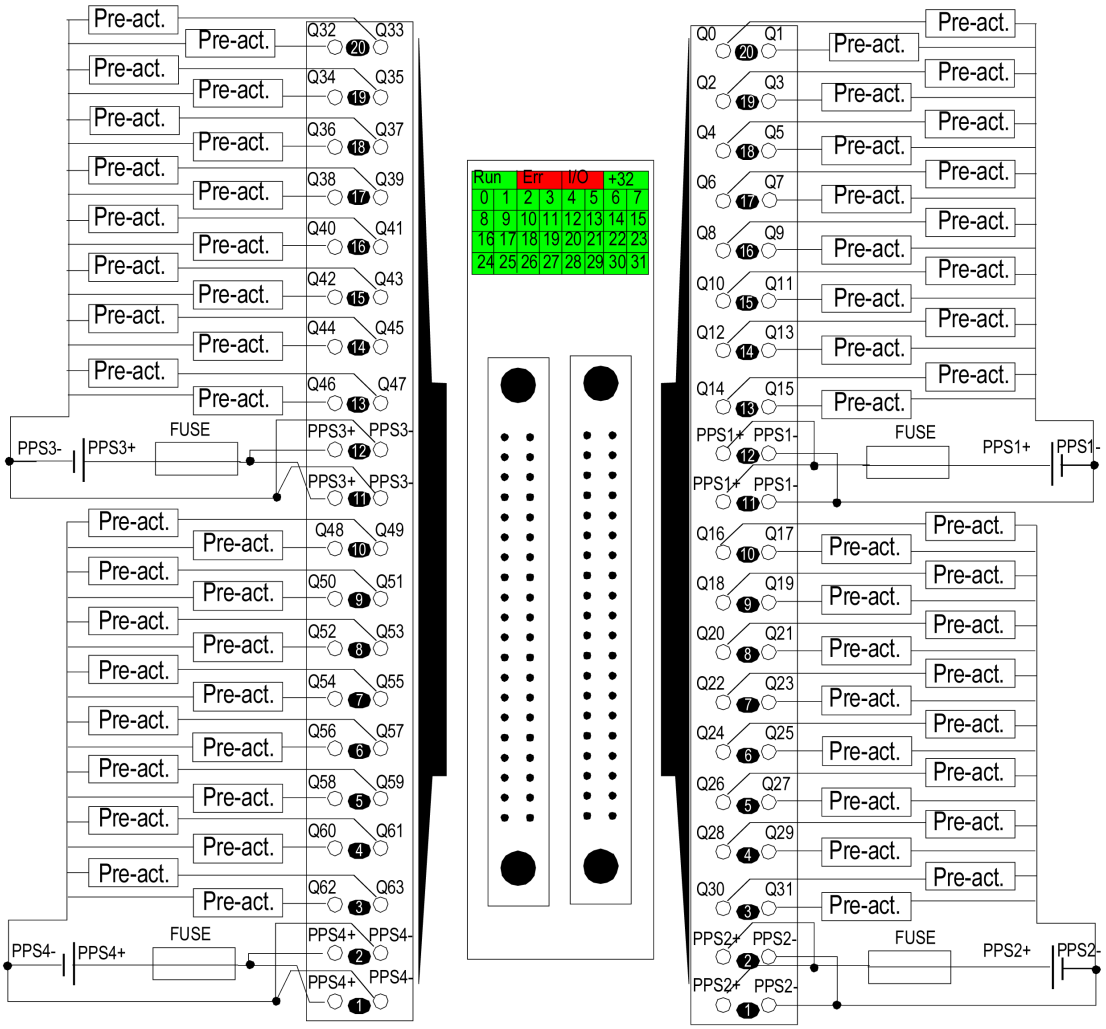
⚠CAUTION

LOSS OF INPUT FUNCTION

Install the correct rating and type of fuse.

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

The diagram below shows the connection of the module to the pre-actuators.



power supply: 24 VDC

fuse: fast blow fuse of 2 A for each 16-channel group

pre-act: pre-actuator

PPS: pre-actuator power supply

BMXDRA0805(H) Discrete Output Relay Module

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BMXDRA0805(H) sDefault

Abstract



Description

General Characteristics

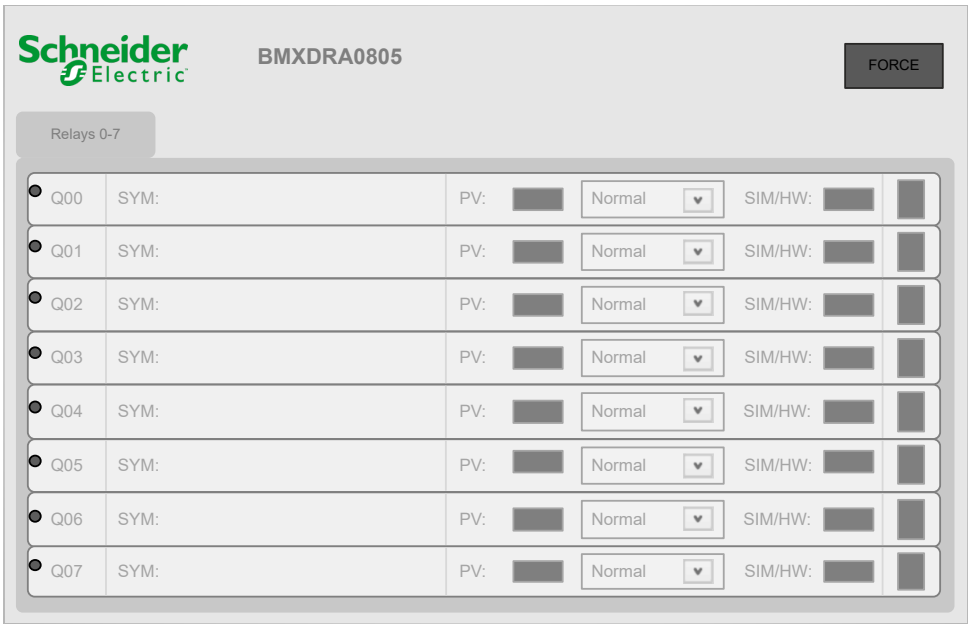
Module type		Relay outputs for alternating and direct current			
Operating temperature	BMXDRA0805	0...60°C (32...140°F)			
	BMXDRA0805H	-25...70°C (-13...158°F)			
Rated Voltage	Direct	24 VDC			
	Alternating	24...240 VAC			
Voltage range	Direct	10...34 VDC			
	Alternating	19...264 VAC (47...63 Hz)			
Thermal current		3 A			
Minimum switching load		5 VDC / 10 mA			
Alternating current load in resistive mode (AC12)	Voltage	24 VAC	48 VAC	100...120 VAC	200...240 VAC
	Power	50 VA(5)	50 VA(6)	110 VA(6)	220 VA(6)

			110 VA(4)	220 VA(4)	
	Maximum power of hardened module at 70°C (158°F)	30 VA(5)	30 VA(6) 66 VA(4)	66 VA(6) 132 VA(4)	132 VA(6)
Alternating current load in inductive mode (AC15)	Voltage	24 VAC	48 VAC	100...120 VAC	200...240 VAC
	Power	24 VA(4)	10 VA(10) 24 VA(8)	10 VA(11) 50 VA(7) 110 VA(2)	10 VA(11) 50 VA(9) 110 VA(6) 220 VA(1)
	Maximum power of hardened module at 70°C (158°F)	14.4 VA(4)	6 VA(10) 14.4 VA(8)	6 VA(11) 30 VA(7) 66 VA(2)	6 VA(11) 30 VA(9) 66 VA(6) 132 VA(1)
Direct current load in resistive mode (DC12)	Voltage		24 VDC		
	Power		24 W(6) 40 W(3)		
	Maximum power of hardened module at 70° C (158°F)		14.4 W(6) 24 W(3)		
Direct current load in inductive mode (DC13) (L:R=60 ms)	Voltage		24 VDC		
	Power		10 W(8) 24 W(6)		
	Maximum power of hardened module at 70° C (158°F)		6 W(8) 14.4 W(6)		
Response time	Activation		< 10 ms		
	Deactivation		< 8 ms		
Built-in protection	Against inductive over voltage in AC modes		None. Fit an RC circuit or a ZNO-type over voltage limiter in parallel on each output appropriate to the voltage in use.		
	Against inductive over voltage in DC modes		None. Fit a discharge diode on each output.		
	Against short-circuits and overloads		None. Fit a fast-blow fuse of 3 A for each relay.		
Reliability	MTBF for continuous operation in hours at ambient temperature (30°C (86°F)		2 119 902		
Power dissipation			2.7 W maximum		
Dielectric strength			2000 V actual		
Resistance of insulation			> 10 MΩ		
Power supply consumption	3.3 V	Typical	79 mA		
		Maximum	111 mA		
	24 V relay(12)	Typical	51 mA		
		Maximum	56 mA		

(1) 0.1 x 10^6 cycles, **(2)** 0.15 x 10^6 cycles,**(3)** 0.3 x 10^6 cycles, **(4)** 0.5 x 10^6 cycles, **(5)** 0.7 x 10^6 cycles, **(6)** 1 x 10^6 cycles, **(7)** 1.5 x 10^6 cycles, **(8)** 2 x 10^6 cycles, **(9)** 3 x 10^6 cycles, **(10)**) 5 x 10^6 cycles, **(11)** 10 x 10^6 cycles, **(12)** per channel at 1

BMXDRA0805(H) fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Discrete output channel description:

Element	Description
Q##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
PV	Indicates the real program value:
Force Operation	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/HW	Program input value: • The SIM/HW and PV values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/HW value is equal to the forced value.

Introduction

Function

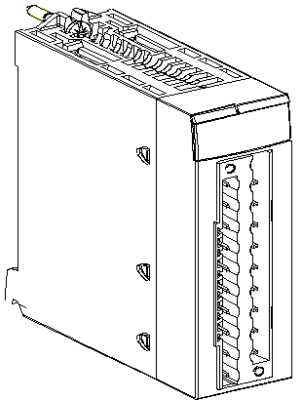
The BMXDRA0805 module is a 24 VDC or 24...240 VAC discrete module connected via a 20-pin terminal block. Its 8 relay output channels operate either on alternating current or direct current.

Ruggedized Version

The BMXDRA0805H (hardened) equipment is the ruggedized version of the BMXDRA0805 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the table below apply to the modules BMXDRA0805 and BMXDRA0805(H) for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Characteristics

This table presents the general characteristics for the BMXDRA0805 and BMXDRA0805(H) modules:

Module type		Relay outputs for alternating and direct current
Operating temperature	BMXDRA0805	0...60 ºC (32...140 ºF)
	BMXDRA0805(H)	-25...70 ºC (-13...158 ºF)
Rated voltage	Direct	24 VDC

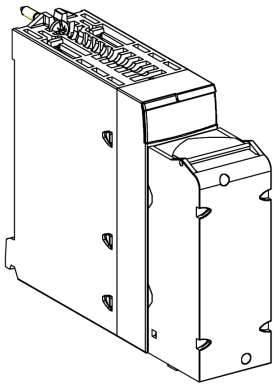
	Alternating	24...240 VAC			
Voltage range	Direct	10...34 VDC			
	Alternating	19...264 VAC (47...63 Hz)			
Thermal current		3 A			
Minimum switching load		5 VDC / 10 mA			
Alternating current load in resistive mode (AC12)	Voltage	24 VAC	48 VAC	100...120 VAC	200...240 VAC
	Power	50 VA(5)	50 VA(6) 110 VA(4)	110 VA(6) 220 VA(4)	220 VA(6)
	Maximum Power of Hardened module at 70°C (158°F)	30 VA(5)	30 VA(6) 66 VA(4)	66 VA(6) 132 VA(4)	132 VA(6)
Alternating current load in inductive mode (AC15)	Voltage	24 VAC	48 VAC	100...120 VAC	200...240 VAC
	Power	24 VA(4)	10 VA(10) 24 VA(8)	10 VA(11) 50 VA(7) 110 VA(2)	10 VA(11) 50 VA(9) 110 VA(6) 220 VA(1)
	Maximum Power of Hardened module at 70°C (158°F)	14.4 VA(4)	6 VA(10) 14.4 VA(8)	6 VA(11) 30 VA(7) 66 VA(2)	6 VA(11) 30 VA(9) 66 VA(6) 132 VA(1)
Direct current load in resistive mode (DC12)	Voltage	24 VDC			
	Power	24 W(6) 40 W(3)			
	Maximum Power of Hardened module at 70°C (158°F)	14.4 W(6) 24 W(3)			
Direct current load in inductive mode (DC13) (L:R=60 ms)	Voltage	24 VDC			
	Power	10 W(8) 24 W(6)			
	Maximum Power of Hardened module at 70°C (158°F)	6 W(8) 14.4 W(6)			
Response time	Activation	< 10 ms			
	Deactivation	< 8 ms			
Built-in protection	Against inductive over voltage in AC modes	None. Fit an RC circuit or a ZNO type over voltage limiter in parallel on each output appropriate to the voltage in use.			
	Against inductive over voltage in DC modes	None. Fit a discharge diode on each output.			
	against short-circuits and overloads	None. Fit a fast-blow fuse of 3 A for each relay.			
Reliability	MTBF for continuous operation in hours at ambient temperature 30°C (86°F)	2 119 902			
Power dissipation		2.7 W max.			
Dielectric strength (at 50/60 Hz for 1 min.)		2000 V actual			

Resistance of insulation (at 500 VDC)			>10 MΩ
Power supply consumption	3.3 V	Typical	79 mA
		Maxi-mum	111 mA
	24 V relay(12)	Typical	51 mA
		Maxi-mum	56 mA
(1):0.1 x 10^6 cycles, **(2)**: 0.15 x 10^6 cycles, **(3)**: 0.3 x 10^6 cycles, **(4)**: 0.5 x 10^6 cycles, **(5)**: 0.7 x 10^6 cycles, **(6)**: 1 x 10^6 cycles, **(7)**: 1.5 x 10^6 cycles, **(8)**: 2 x 10^6 cycles, **(9)**: 3 x 10^6 cycles, **(10)**: 5 x 10^6 cycles, **(11)**: 10 x 10^6 cycles, **(12)**: all channels at 1.			

Connecting the Module

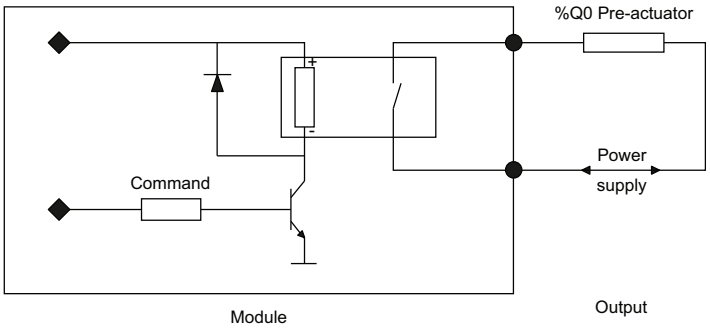
At a Glance

The BMXDRA0805 module is fitted with a removable 20-pin terminal block for the connection of eight relay output channels.



Output Circuit Diagram

The following diagram shows the circuit of a relay output.



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltages before connecting or disconnecting the module.

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

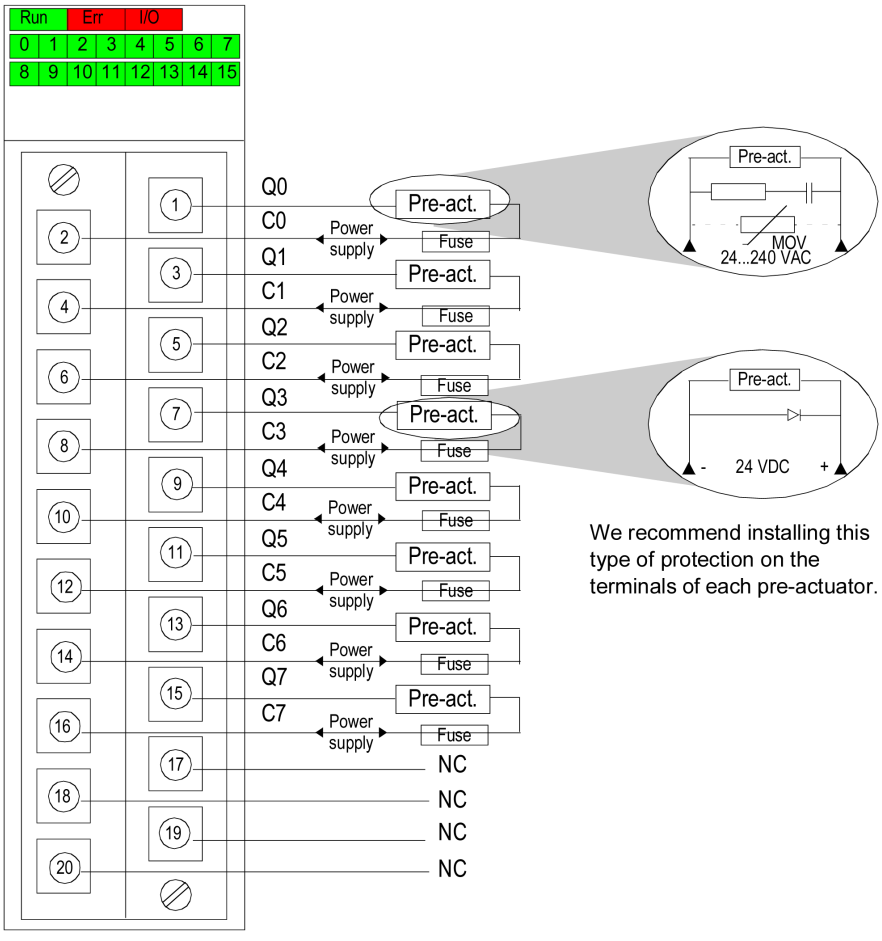
⚠CAUTION

LOSS OF OUTPUT FUNCTION

Install the correct rating and type of fuse.

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

The following diagram shows the connection of the module to the pre-actuators.



We recommend installing this type of protection on the terminals of each pre-actuator.

power supply: 24 VDC or 24...240 VAC

fuse: 1 fast blow fuse of 3 A for each relay

NC: not connected

BMXDRA0815(H) Discrete Output Relay Module

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BMXDRA0815(H) sDefault

Introduction

This section presents the BMXDRA0815(H) discrete output relay module, its characteristics, and explains how it is connected to the various sensors in an EcoStruxure™ Automation Expert application.

Abstract



Description

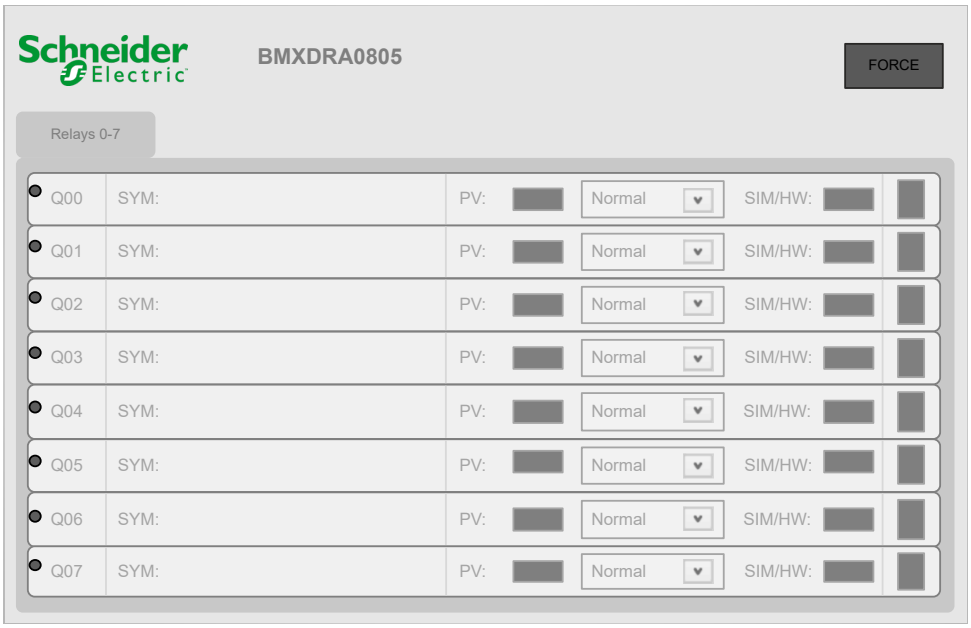
Product/Component type	Relay discrete output module
Discrete output number	Eight conforming to EN/IEC 61131–2
Discrete output logic	Positive
Discrete output voltage	24...240 V 19...264 V AC 24...125 V 5...150 V DC
Electrical connection	20–way terminal block
Network frequency	50/60 Hz

Network frequency limits	47...63 Hz
Sensor power supply	5...150 V 19...264 V
[Ith] Conventional free air thermal current	2 A
Insulation resistance	> 10 MOhm 500 V DC
Power dissipation in W	3.6 W
Response time on output	<= 10 ms activation <= 13 ms deactivation
Typical current consumption	40 mA at 3.3 V DC 101 mA at 24 V DC
MTBF reliability	2683411 H
Protection type	External short-circuit protection External overload protection External over-voltage protection, inductive AC network External over-voltage protection, inductive DC network
Output overload protection	1 fast blow fuse per channel or group of channels
Minimum switching current	1 mA 5 V DC
Electrical durability	AC-12: 200000 cycles at 48 VA 24 V at 0...60ºC AC-12: 300000 cycles at 48 VA 48 V at 0...60ºC AC-12: 150000 cycles at 96 VA 48 V at 0...60ºC AC-12: 300000 cycles at 110 VA 100...120 V at 0...60ºC AC-12: 150000 cycles at 220 VA 100...120 V at 0...60ºC AC-12: 300000 cycles at 220 VA 200...250 V at 0...60ºC AC-12: 150000 cycles at 500 VA 200...250 V at 0...60ºC AC-12: 700000 cycles at 10 VA 24 V at 0...60ºC (load factor 0.4) AC-12: 500000 cycles at 24 VA 24 V at 0...60ºC (load factor 0.4) AC-12: 200000 cycles at 48 VA 24 V at 0...60ºC (load factor 0.4) AC-12: 700000 cycles at 10 VA 48 V at 0...60ºC (load factor 0.4) AC-12: 500000 cycles at 24 VA 48 V at 0...60ºC (load factor 0.4) AC-12: 300000 cycles at 48 VA 48 V at 0...60ºC (load factor 0.4) AC-12: 100000 cycles at 96 VA 48 V at 0...60ºC (load factor 0.4) AC-12: 1000000 cycles at 10 VA 100...120 V at 0...60ºC (load factor 0.4) AC-12: 300000 cycles at 50 VA 100...120 V at 0...60ºC (load factor 0.4) AC-12: 200000 cycles at 110 VA 100...120 V at 0...60ºC (load factor 0.4) AC-12: 70000 cycles at 220 VA 100...120 V at 0...60ºC (load factor 0.4)

	AC-12: 1000000 cycles at 10 VA 200...250 V at 0...60ºC (load factor 0.4) AC-12: 500000 cycles at 50 VA 200...250 V at 0...60ºC (load factor 0.4) DC-12: 200000 cycles at 24 W 24 V at 0...60ºC DC-12: 150000 cycles at 48 W 24 V 200...250 V at 0...60ºC DC-12: 200000 cycles at 40 W 48...60 V at 0...60ºC DC-12: 150000 cycles at 45 W 100...125 V at 0...60ºC DC-12: 150000 cycles at 10 W 24 V at 0...60ºC DC-12: 60000 cycles at 24 W 24 V at 0...60ºC DC-12: 40000 cycles at 48 W 24 V at 0...60ºC DC-12: 40000 cycles at 40 W 48...60 V at 0...60ºC DC-12: 100000 cycles at 15 W 100...125 V at 0...60ºC
Status LED	1 LED (green) RUN 1 LED per channel (green) channel diagnostic 1 LED (red) ERR 1 LED (red) I/O
Net weight	0.169 kg
IP degree of protection	IP20
Dielectric strength	1780 V AC at 50/60 Hz 1 min
Vibration resistance	3 gn
Shock resistance	30 gn
Ambient air temperature for storage	-40...85ºC
Ambient air temperature for operation	0...60ºC
Relative humidity	0...95% at 60ºC without condensation
Operating altitude	0...2000 m 2000...5000 m with derating factor

BMXDRA0815(H) fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Discrete output channel description:

Element	Description
Q##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
PV	Indicates the real program value:
Force Operation	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/HW	Program input value: • The SIM/HW and PV values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/HW value is equal to the forced value.

Introduction

Function

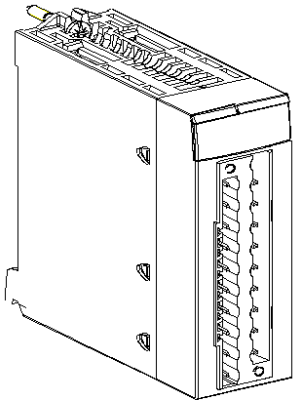
The BMXDRA0815 module is a 5...125 VDC or 24...240 VAC discrete module connected via a 20-pin terminal block. Its 8 relay output channels operate either on alternating current or direct current.

Ruggedized Version

The BMXDRA0815H (hardened) equipment is the ruggedized version of the BMXDRA0815 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

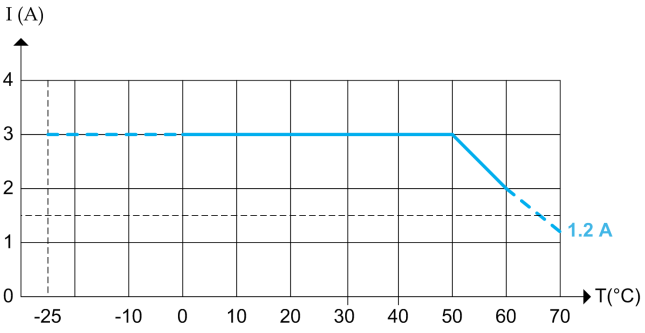
The characteristics in the table below apply to the modules BMXDRA0815 and BMXDRA0815(H) for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Characteristics

This table presents the general characteristics for the BMXDRA0815 and BMXDRA0815(H) modules:

Module type		Relay outputs for alternating and direct current
Rated range	Alternating	24...240 Vac
	Direct	24...125 Vdc
Voltage range	Alternating	19...264 Vac (47...63 Hz)

	Direct	5...150 Vdc			
Operating temperature	BMXDRA0815	0 °C to 60 °C (32 °F to 140 °F) with derating (see hereafter).			
	BMXDRA0815(H)	-25 °C to 70 °C (-13 °F to 158 °F) with derating (see hereafter).			
Thermal current	Apply the following derating curve to the thermal current (in A) versus ambient temperature (in °C): 				
Minimum switching load		5 Vdc / 10 mA			
Alternating current load in resistive mode (AC12)	Voltage	24 Vac	48 Vac	100...120 Vac	200...250 Vac
	Switching power below 60 °C (140 °F)	48 VA(7)	48 VA(8) 96 VA(6)	110 VA(8) 220 VA(6)	220 VA(8) 500 VA(6)
	Maximum switching power of hardened module at 60...70 °C (140...158 °F)	28.8 VA(7)	28.8 VA(8) 57.6 VA(6)	66 VA(8) 132 VA(6)	132 VA(8) 300 VA(6)
Alternating current load in inductive mode (AC15) **(Power factor = 0.4)**	Voltage	24 Vac	48 Vac	100...120 Vac	200...250 Vac
	Switching power below 60 °C (140 °F)	10 VA(10) 24 VA(9) 48 VA(6) 72 VA(4)(13)	10 VA(10) 24 VA(9) 48 VA(8) 96 VA(5) 144 VA(3)(13)	10 VA(11) 50 VA(8) 110 VA(7) 220 VA(4) 360 VA(2)(13)	10 VA(11) 50 VA(9) 110 VA(7) 220 VA(6) 500 VA(3) 750 VA(1)(13)
	Maximum switching power of hardened module at 60...70 °C (140...158 °F)	6 VA(10) 14.4 VA(9) 28.8 VA(6)	6 VA(10) 14.4 VA(9) 28.8 VA(8) 57.6 VA(5)	6 VA(11) 30 VA(8) 66 VA(7) 132 VA(4)	6 VA(11) 30 VA(9) 66 VA(7) 132 VA(6) 300 VA(3)
Direct current load in resistive mode (DC12) **(L:R = 1 ms**	Voltage	24 Vdc	48...60 Vdc	100...125 Vdc	
	Switching power below 60 °C (140 °F)	24 W(7) 48 W(6)	40 W(6)	45 W(5)	
	Maximum switching power of hardened module at 60...70 °C (140...158 °F)	14.4 W(7) 28.8 W(6)	24 W(6)	45 W(3)	
Direct current load in inductive mode (DC13) **(L:R = 15 ms)**	Voltage	24 Vdc	48...60 Vdc	110...125 Vdc	
	Switching power below 60 °C (140 °F)	10 W(5) 24 W(3) 48 W(1)	40 W(1)	15 W(5)	
	Maximum switching power of hardened module at 60...70 °C (140...158 °F)	6 W(5) 14.4 W(3) 28.8 W(1)	24 W(1)	15 W(1)	
Mechanical operations		20,000,000 minimum			
Response time	Activation	< 10 ms			

	Deactivation		< 13 ms
Surge current maximum	10 A capacitive		t = 10 ms
Built-in protection	Against inductive over voltage in AC modes		None. Fit an RC circuit or a ZNO type over voltage limiter in parallel on each output channel appropriate to the voltage in use.
	Against inductive over voltage in DC modes		None. Fit a discharge diode on each output channel.
	Against short-circuits and overloads		None. Fit a fast-blow fuse on each output channel or channel group. **NOTE:** The current capability of fuse depends on the maximum switching load.
Reliability	MTBF for continuous operation in hours at ambient temperature 30 °C (86 °F)		2,683,411
Power dissipation(12)			3.6 W + 0.03 x ($I1^2$ +$I2^2$ +...+ $I8^2$) Where I1, I2,...I8 is the load current for each channel.
Dielectric strength (at 50/60 Hz for 1 min.)	Channel to X-bus		3000 Vac
	Channel to channel		2000 Vac
	Channel to protective earth (PE)		2000 Vac
Resistance of insulation (at 500 Vdc)	Channel to X-bus		>10 MΩ
	Channel to channel		>10 MΩ
Power supply consumption	3.3 V	Typical	40 mA
		Maximum	75 mA
	24 V(12)	Typical	101 mA
		Maximum	137 mA

(1): 0.04 x 10^6 cycles, **(2)**: 0.05 x 10^6 cycles, **(3)**: 0.06 x 10^6 cycles, **(4)**: 0.07 x 10^6 cycles,

(5): 0.1 x 10^6 cycles, **(6)**: 0.15 x 10^6 cycles, **(7)**: 0.2 x 10^6 cycles, **(8)**: 0.3 x 10^6 cycles,

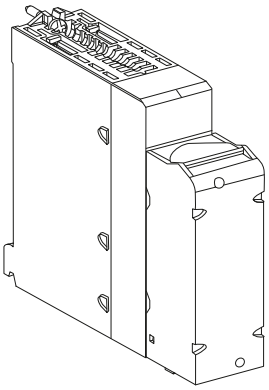
(9): 0.5 x 10^6 cycles, **(10)**: 0.7 x 10^6 cycles, **(11)**: 1 x 10^6 cycles,

(12): All channels at 1, **(13)**: Below 50 °C (122 °F)

Connecting the Module

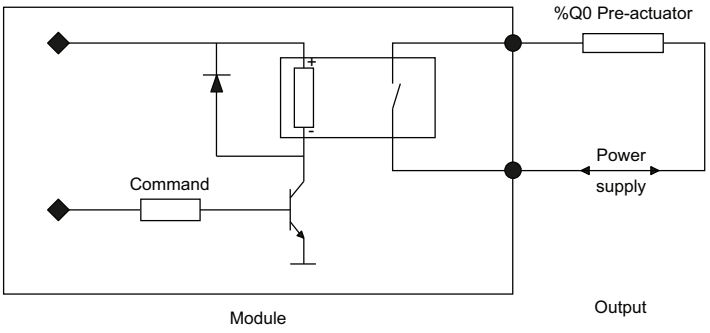
At a Glance

The BMXDRA0815 module is fitted with a removable 20-pin terminal block for the connection of eight relay output channels.



Output Circuit Diagram

The following diagram shows the circuit of a relay output.



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltage before connecting or disconnecting the module.

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

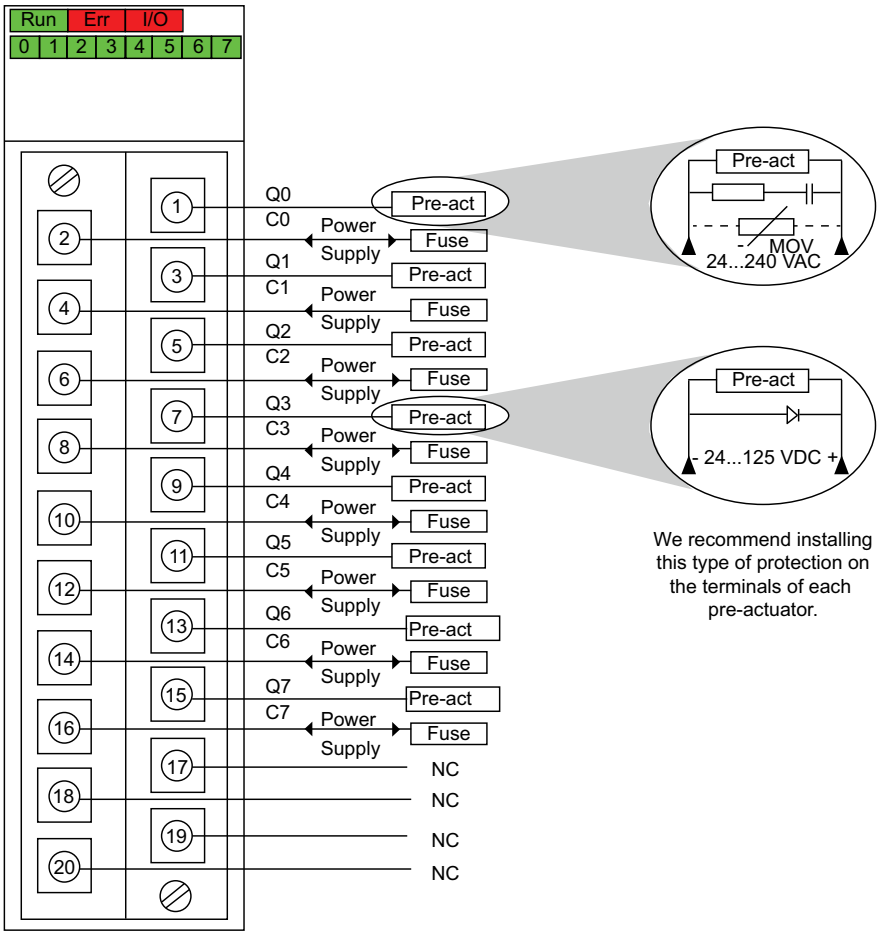
⚠CAUTION

LOSS OF OUTPUT FUNCTION

Install the correct rating and type of fuse.

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

The following diagram shows the connection of the module to the pre-actuators.



power supply: 24...125 VDC or 24...240 VAC

fuse: Use appropriate fast-blow fuse for each relay.

NC: not connected

BMXDRA1605K Discrete Output Module

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BMXDRA1605(H) sDefault

Abstract



Description

Altitude Operating Conditions

The characteristics in the following table apply to the BMXDRA1605(H) module for use at altitude up to 2000 m (6560 ft). When the module operates above 2000 m (6560 ft), apply additional derating.

General Characteristics

This table presents the general characteristics for the BMXDRA1605(H) module:

Module type		Relay outputs for alternating and direct current
Operating temperature	BMXDRA1605	0...60 ºC (32...140 ºF)
	BMXDRA1605(H)	-25...70 ºC (-13...158 ºF)
Rated voltage	Direct	24 VDC
	Alternating	24...240 VAC / 2 A, Cos ϕ = 1
Voltage range	Direct	24 VDC / 2 A (resistive load)

	Alternating		19...264 VAC / 2 A, Cos ϕ = 1			
Minimum switching load			5 VDC / 1 mA.			
Maximum switching load			264 VAC / 125 VDC			
Mechanical service life	Number of switching		20 million or more			
Alternating current load in resistive mode (AC12)	Voltage		24 VAC	48 VAC	100...120 VAC	200...240 VAC
	Power		50 VA(2)	50 VA(1) 80 VA(2)	80 VA(1) 200 VA(2)	200 VA(1)
Alternating current load in inductive mode (AC15)	Voltage		24 VAC	48 VAC	100...120 VAC	200...240 VAC
	Power		36 VA(1) 72 VA(1) 120 VA(2)	36 VA(1) 72 VA(1) 120 VA(2)	36 VA(1) 72 VA(1) 120 VA(2)	36 VA(1) Cos ϕ = 0,35 72 VA(1) Cos ϕ = 0,7 120 VA(2) Cos ϕ = 0,35 240 VA(2) Cos ϕ = 0,7
Direct current load in resistive mode (DC12)	Voltage		24 VDC		48 VDC	
	Power		24 W(2)		24 W(4)	
Direct current load in inductive mode (DC13)	Voltage		24 VDC		48 VDC	
	Power (L/R = 7 ms)		3 W(1) 10 W(2)		3 W(1) 10 W(2)	
	Power (L/R = 20 ms)		24 W(3)		24 W(3)	
Response time	Activation		< 8 ms			
	Deactivation		< 10 ms			
On-line module change			Possible			
Built-in protection	Against alternating current inductive over voltage		None. Fit an RC circuit or a ZNO type over voltage limiter in parallel on each output appropriate to the voltage in use.			
	Against direct current inductive over voltage		None. Fit a discharge diode on each output.			
	Against short-circuits and overloads		None. Fit a fast-blow fuse of 12 A for each 8-channel group.			
Maximum switching frequency			3 600 cycles per hour			
Power dissipation			3 W max			
Dielectric strength (at 50/60 Hz for 1 min.)			2000 V actual			
Resistance of insulation (at 500 VDC)			> 10 MΩ			
Noise immunity			In noise simulation below 1500 V actual, noise width of 1s and frequency of 25 to 60 Hz			
Reliability	MTBF for continuous operation in hours at ambient temperature 30°C (86°F)		1 357 810			
Power supply consumption	3.3 V	Typical	79 mA			
		Maximum	111 mA			
	24 V relay(5)	Typical	89 mA			
		Maximum	100 mA			
(1): 3 x 10^5 cycles, **(2)**: 1 x 10^5 cycles, **(3)**: 7 x 10^3 cycles, **(4)**: 5 x 10^4 cycles, **(5)**: per channel at 1.						

NOTE: For the **BMXDRA1605(H)** module, confirm that the maximum power does not exceed 24 VA per channel when operated at 70 °C (158 °F).

BMXDRA1605(H) fpDefault

Abstract



Description

The following table describes the button on a digital module:

Element	Description
FORCE	Blue indicates that at least one channel is forced.

Digital output channel description:

Element	Description
DO##	Channel name. (## indicates the channel number)
SYM	Symlink associated to the channel.
PV	Indicates the real program value:
Force Operation	Value indicator: • Normal indicates that the channel is not forced. • Invert indicates that the channel is forced to reverse value. • Force 0 indicates that the channel is forced to value FALSE. • Force 1 indicates that the channel is forced to value TRUE.
SIM/HW	Program input value: • The SIM/HW and PV values are the same if the current value of the channel is not forced. • If the current value of the channel is forced, the SIM/HW value is equal to the forced value.

Introduction

Function

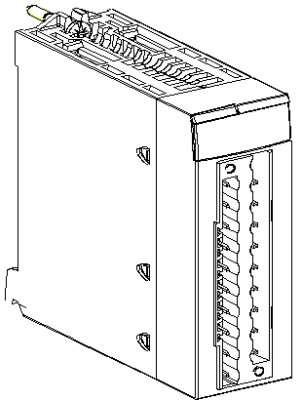
The BMXDRA1605 module is a 24 VDC or 24...240 VAC discrete module connected via a 20-pin terminal block. Its 16 non-isolated relay output channels operate either on alternating current or direct current.

Ruggedized Version

The BMXDRA1605H (hardened) equipment is the ruggedized version of the BMXDRA1605 (standard) equipment. It can be used at extended temperatures and in harsh chemical environments.

For more information, refer to chapter *Installation in More Severe Environments* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Illustration



Characteristics

Altitude Operating Conditions

The characteristics in the table below apply to the modules BMXDRA1605 and BMXDRA1605(H) for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

General Characteristics

This table presents the general characteristics for the BMXDRA1605 and BMXDRA1605(H) modules:

Module type		Relay outputs for alternating and direct current
Operating temperature	BMXDRA1605	0...60 ºC (32...140 ºF)
	BMXDRA1605(H)	-25...70 ºC (-13...158 ºF)
Rated voltage	Direct	24 VDC

	Alternating	24...240 VAC / 2 A, Cos ϕ = 1			
Voltage range	Direct	24 VDC / 2 A (resistive load)			
	Alternating	19...264 VAC / 2 A, Cos ϕ = 1			
Minimum switching load		5 VDC / 1 mA.			
Maximum switching load		264 VAC / 125 VDC			
Mechanical service life	Number of switching	20 million or more			
Alternating current load in resistive mode (AC12)	Voltage	24 VAC	48 VAC	100...120 VAC	200...240 VAC
	Power	50 VA(2)	50 VA(1) 80 VA(2)	80 VA(1) 200 VA(2)	200 VA(1)
Alternating current load in inductive mode (AC15)	Voltage	24 VAC	48 VAC	100...120 VAC	200...240 VAC
	Power	36 VA(1) 72 VA(1) 120 VA(2)	36 VA(1) 72 VA(1) 120 VA(2)	36 VA(1) 72 VA(1) 120 VA(2)	36 VA(1) Cos ϕ = 0,35 72 VA(1) Cos ϕ = 0,7 120 VA(2) Cos ϕ = 0,35 240 VA(2) Cos ϕ = 0,7
Direct current load in resistive mode (DC12)	Voltage	24 VDC		48 VDC	
	Power	24 W(2)		24 W(4)	
Direct current load in inductive mode (DC13)	Voltage	24 VDC		48 VDC	
	Power (L/R = 7 ms)	3 W(1) 10 W(2)		3 W(1) 10 W(2)	
	Power (L/R = 20 ms)	24 W(3)		24 W(3)	
Response time	Activation	< 8 ms			
	Deactivation	< 10 ms			
On-line module change		Possible			
Built-in protection	Against alternating current inductive over voltage	None. Fit an RC circuit or a ZNO type over voltage limiter in parallel on each output appropriate to the voltage in use.			
	Against direct current inductive over voltage	None. Fit a discharge diode on each output.			
	Against short-circuits and overloads	None. Fit a fast-blow fuse of 12 A for each 8-channel group.			
Maximum switching frequency		3 600 cycles per hour			
Power dissipation		3 W max			
Dielectric strength (at 50/60 Hz for 1 min.)		2000 V actual			
Resistance of insulation (at 500 VDC)		> 10 MΩ			
Noise immunity		In noise simulation below 1500 V actual, noise width of 1s and frequency of 25 to 60 Hz			
Reliability	MTBF for continuous operation in hours at ambient temperature 30°C (86°F)	1 357 810			
Power supply consumption	3.3 V	Typical	79 mA		
		Maximum	111 mA		
	24 V relay(5)	Typical	89 mA		
		Maximum	100 mA		

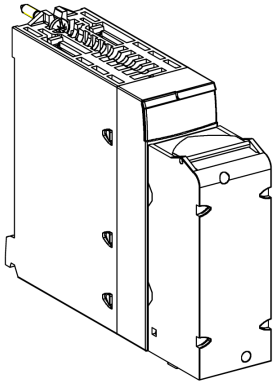
(1): 3 x 10^5 cycles, **(2)**: 1 x 10^5 cycles, **(3)**: 7 x 10^3 cycles, **(4)**: 5 x 10^4 cycles, **(5)**: per channel at 1.

NOTE: For the **BMXDRA1605(H)** module, confirm that the maximum power does not exceed 24 VA per channel when operated at 70 °C (158 °F).

Connecting the Module

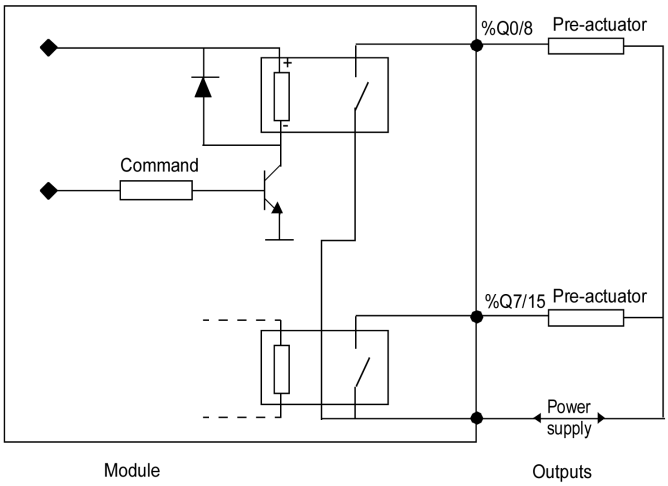
At a Glance

The BMXDRA1605 module is fitted with a removable 20-pin terminal block for the connection of sixteen non-isolated relay output channels.



Output Circuit Diagram

The following diagram shows the circuit of relay outputs.



Module Connection

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Switch off the sensor and pre-actuator voltages before connecting or disconnecting the module.

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

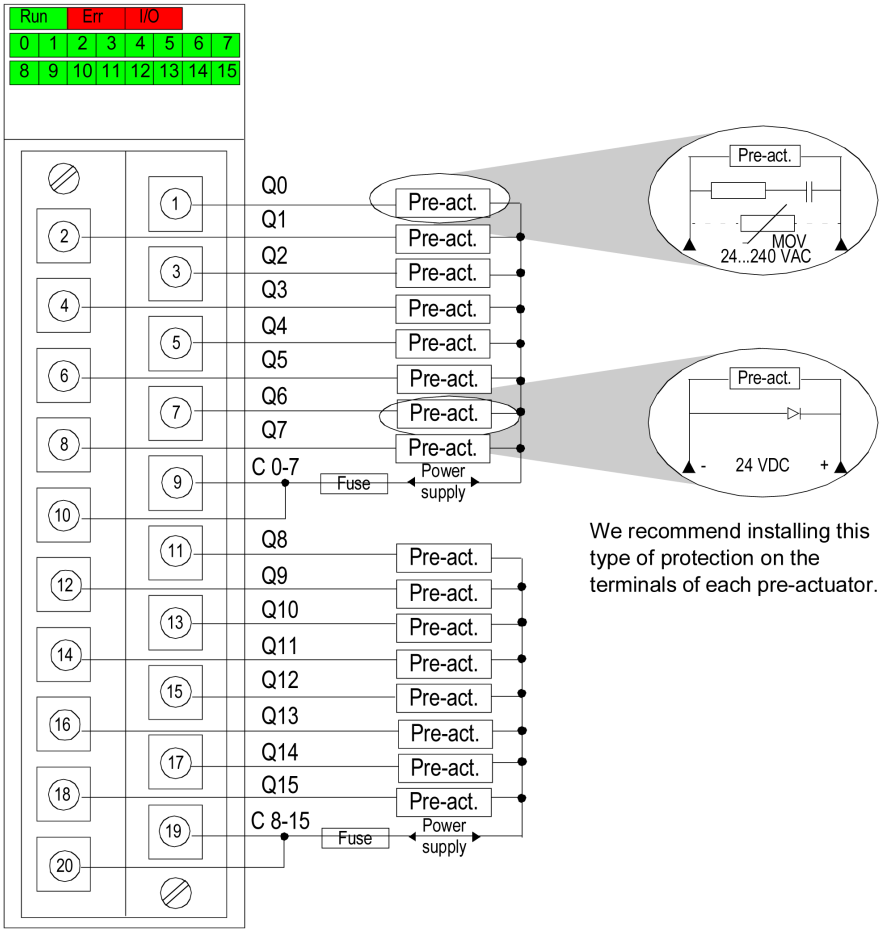
⚠CAUTION

LOSS OF OUTPUT FUNCTION

Install the correct rating and type of fuse.

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

The following diagram shows the connection of the module to the pre-actuators.



We recommend installing this type of protection on the terminals of each pre-actuator.

power supply: 24 VDC or 24...240 VAC

fuse: 1 fast blow fuse of 12 A for each 8-channel group

Discrete Input/Output Module Installation

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Overview

⚠WARNING

UNEXPECTED I/O FALLBACK

- Make sure that the promptness value for outputs is set to at least the recommended value of 256ms.
- Test the system under heavy network communication workload and check that inputs and outputs do not go to fallback mode unexpectedly.

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

This chapter presents the rules and guidelines for installation and configuration of discrete input/output modules in an EcoStruxure Automation Expert application.

Introduction

Introduction

The Modicon X80 discrete input/output modules are standard format modules (occupying one single position), fitted with one of the following:

- one 20-pin terminal block
- one 40-pin terminal block
- one or two 40-pin connectors

For modules fitted with 40-pin connector outputs, a series of products known as TELEFAST 2 is available that enables discrete input/output modules to be quickly connected to operational parts.

A wide range of discrete inputs and outputs make it possible to meet the following requirements:

- functional: direct or alternating inputs/outputs, with positive or negative logic
- modularity: 8, 16, 32, or 64 channels per module

Inputs

Inputs receive signals from the sensors and carry out the following functions:

- acquisition
- adaptation
- galvanic insulation
- filtering
- protection against interference

Outputs

Outputs store the orders given by the processor, in order to control pre-actuators via decoupling and amplification circuits.

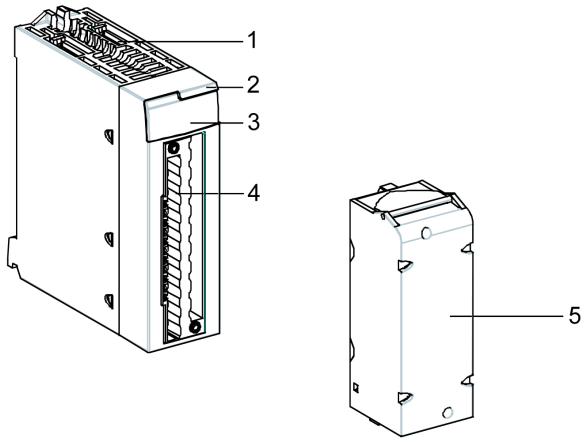
20-pin Terminal Block Connection

Introduction

Discrete input/output modules are housed in plastic cases that provide IP20 protection for its electronic parts.

Illustration

The following diagram shows a 20-pin discrete module and a 20-pin terminal block.



Elements

The following table describes the elements of discrete input/output modules with 20-pin terminal block connections.

Number	Description
1	Rigid structure that supports and protects the electronic card
2	Module reference label **Note:** A label is visible on the right-hand side of the module.
3	Channel status display panel
4	Connector housing the 20-pin terminal block
5	20-pin terminal block, used to connect sensors or pre-actuators

NOTE: Terminal blocks are supplied separately.

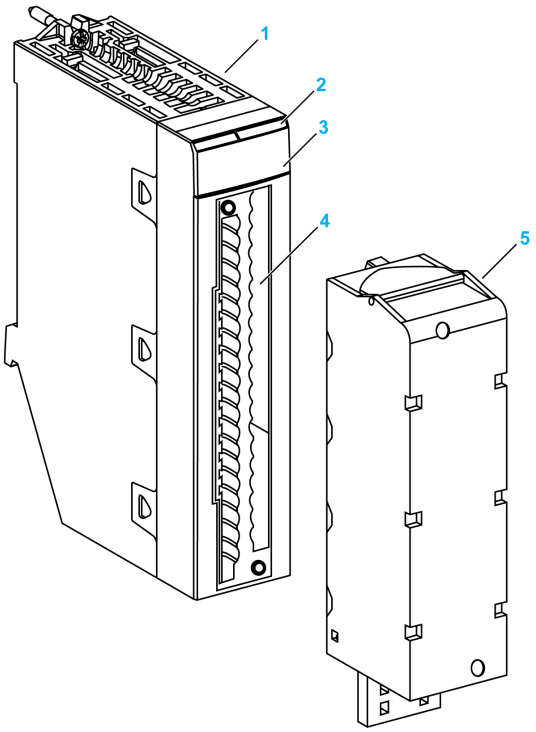
40-pin Terminal Block Connection

Introduction

Discrete input/output modules are housed in plastic cases that provide IP20 protection for its electronic parts.

Illustration

The following diagram shows a 40-pin discrete module and a 40-pin terminal block.



Elements

The following table describes the elements of discrete input/output modules with 40-pin terminal block connections.

Number	Description
1	Rigid structure that supports and protects the electronic card
2	Module reference label **Note:** A label is visible on the right-hand side of the module.
3	Channel status display panel
4	Connector housing the 40-pin terminal block
5	40-pin terminal block, used to connect sensors or pre-actuators

NOTE: Terminal blocks are supplied separately.

Discrete Input Modules Catalog

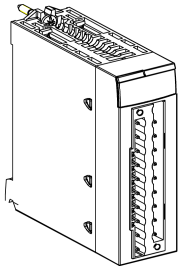
Introduction

The following tables present the two catalogs of discrete input modules:

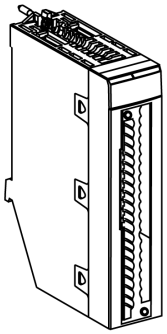
- with 20-pin and 40-pin terminal blocks
- with 40-pin connectors

Catalog of Terminal Block Input Modules

Catalog of discrete input modules with 20-pin terminal block connection

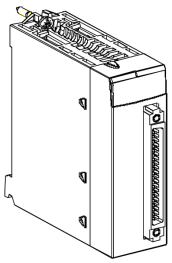
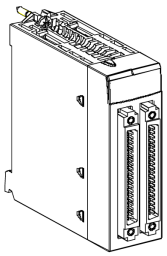
Type of module / Interface	Discrete input module / 20-pin terminal block								
Illustration									
Number of channels	16 inputs	16 inputs	16 inputs	16 inputs		16 inputs	16 inputs	8 inputs	8 inputs
Range	24 VDC	48 VDC	125 VDC	24 VAC	24 VDC	48 VAC	100...-120 VAC	100...-120 VAC	200...-240 VAC
Insulation	Insulated inputs	Insulated inputs	Insulated inputs	Insulated inputs		Insulated inputs	Insulated inputs	channel to channel isolated inputs	Insulated inputs
IEC 61131-2 compliance	Type 3	Type 1	N/A	Type 1	N/A	Type 3	Type 3	Type 3	Type 2
Logic	Positive	Positive	Positive	N/A	Positive or Negative	N/A	N/A	N/A	N/A
Proximity sensor compatibility	2-wire DC and 3-wire PNP proximity sensor (IEC 60947-5-2 standard compliant)				N/A	2-wire DC and 3-wire PNP proximity sensor (IEC 60947-5-2 standard compliant)			
Response time	4 ms	4 ms	5 ms	15 ms		10 ms	10 ms	10 ms	10 ms
Reference	BMX-DD-I1602	BMX-DD-I1603	BMX-DD-I1604-T	BMXDAI1602		BMX-DA-I1603	BMX-DA-I1604	BMXD-AI0814	BMX-DA-I0805

Catalog of discrete input modules with 40-pin terminal block connection

Type of module / Interface	Discrete input module / 40–pin terminal block			
Illustration				
Number of channels	16 inputs	16 inputs	32 inputs	32 inputs
Range	100...120 VAC	200...240 VAC	48 VDC	12/24 VDC
Insulation	channel to channel isolated inputs	channel to channel isolated inputs	Inputs insulated per group of 16 channels	Inputs insulated per group of 16 channels
IEC 61131-2 compliance	Type 1	Type 1	Type 3	Type 3 (24 VDC input)
Logic	N/A	N/A	Positive	Positive or Negative
Proximity sensor compatibility	2-wire and 3-wire proximity sensor (IEC 60947-5-2 standard compliant)		2-wire proximity sensor 3-wire PNP proximity sensor	N/A
Response time	10 ms	10 ms	4 ms	4 ms
Reference	BMXDAI1614	BMXDAI1615	BMXDDI3203	BMXDDI3232

Catalog of 40-pin Connector Input Modules

Catalog of discrete input modules with 40-pin connectors

Type of module / Interface	Discrete input module / 40–pin connector(s)	
Illustration		Discrete input module 
Number of channels	32 inputs	64 inputs
Range	24 VDC	24 VDC
Insulation	Inputs insulated per group of 16 channels	Inputs insulated per group of 16 channels
IEC 61131-2 compliance	Type 1	No type
Logic	Positive	Positive
Proximity sensor compatibility	2-wire proximity sensor 3-wire PNP proximity sensor	3-wire PNP proximity sensor
Response time	4 ms	4 ms
Reference	BMX DDI 3202 K	BMX DDI 6402 K

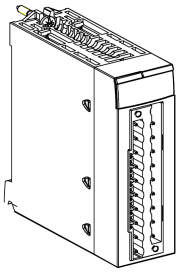
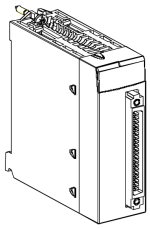
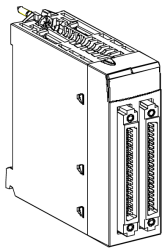
Discrete Output Modules Catalog

Introduction

The following tables show the catalogs of static and relay output modules.

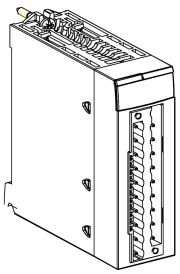
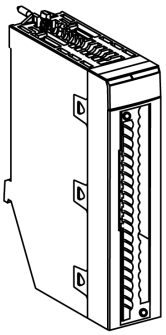
Catalog of Output Modules

Catalog of discrete static output modules with connection via 20-pin terminal blocks and 40-pin connectors

Type of module	Static outputs with 20-pin terminal block connections		Static outputs with 40-pin connectors	
Illustration	Discrete output module 		Discrete output module 	Discrete output module 
Number of channels	16 outputs	16 outputs	32 outputs	64 outputs
Range	24 VDC	24 VDC	24 VDC	24 VDC
Insulation	Insulated outputs	Insulated outputs	Outputs insulated per group of 16 channels	
Current	0.5 A	0.5 A	0.1 A	0.1 A
Overload protection	Outputs protected against short-circuits and overloads with automatic or controlled reactivation and fast electromagnet demagnetization circuit.			
Logic	Positive	Negative	Positive	Positive
Response time	1.2 ms	1.2 ms	1.2 ms	1.2 ms
Type of Interface	20-pin terminal block	20-pin terminal block	1 x 40-pin connector	2 x 40-pin connectors
Reference	BMXDDO1602	BMXDDO1612	BMXDDO3202K	BMXDDO6402K

Catalog of Relay Output Modules

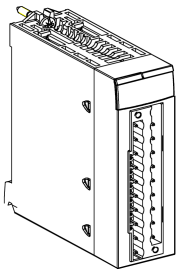
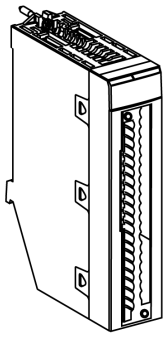
Catalog of discrete relay output modules with 20-pin and 40-pin terminal block connection

Type of module	Relay outputs with 20-pin terminal block connections				Relay outputs with 40-pin terminal block connections
Illustration	Discrete output module 				Discrete output module 
Number of channels	8 outputs	8 outputs	8 outputs	16 outputs	8 NO/NC outputs
Range	125 VDC	24 VDC or 24...240 VAC	5...125 VDC or 24...240 VAC	24...48 VDC or 24...240 VAC	5...125 VDC or 24...240 VAC
Insulation	Outputs insulated from ground	Outputs insulated from ground	Outputs insulated from ground	Outputs insulated from ground	Outputs insulated from ground

Type of contact	8 insulated channels	8 insulated channels	8 insulated channels	1 common per group of 8 channels	8 insulated channels
Thermal current per channel	3 A	3 A	2 A	2 A	4 A
Overload protection	No protection	No protection	No protection	No protection	No protection
Logic	Positive/ negative	Positive/ negative	Positive/ negative	Positive/ negative	Positive/negative
Response time	10 ms max	10 ms max	13 ms max	10 ms max	13 ms max
Type of Interface	20-pin terminal block	20-pin terminal block	20-pin terminal block	20-pin terminal block	40-pin terminal block
Reference	BMXDR-A0804T	BMXDR-A0805	BMXDR-A0815	BMXDR-A1605	BMXDRC0805

Catalog of Triac Output Module

Catalog of discrete triac output module with connection via 20-pin and 40-pin terminal blocks

Type of module	Triac outputs with 20-pin terminal block connections	Triac outputs with 40-pin terminal block connections
Illustration	Discrete output module 	Discrete output module 
Number of channels	16 outputs	16 outputs
Range	100...240 VAC	24...240 VAC
Insulation	Outputs insulated by group of 4 channels	Outputs individually insulated
Current	max: 0.6 A / points (with derating)	max: 3 A per channel (with derating)
Overload protection	Snubber circuit and varistor	Snubber circuit and varistor
Logic	-	-
Response time	1 ms + 0.5 x (1/F) (where F = frequency in Hz)	max: 0.5 x (1/F) (where F = frequency in Hz)
Type of Interface	20-pin terminal block	40-pin terminal block
Reference	BMXDAO1605	BMXDAO1615

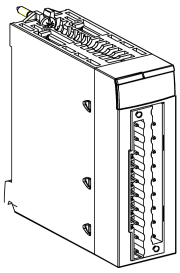
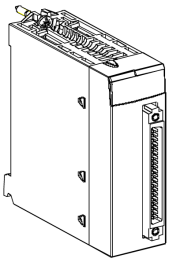
Discrete Mixed Input/Output Modules Catalog

Introduction

The following table presents the catalog of discrete mixed input/output modules with connections by 20-pin terminal block and by 40-pin connectors.

Catalog

Catalog of discrete mixed input/output modules with connection via 20-pin terminal blocks and 40-pin connectors

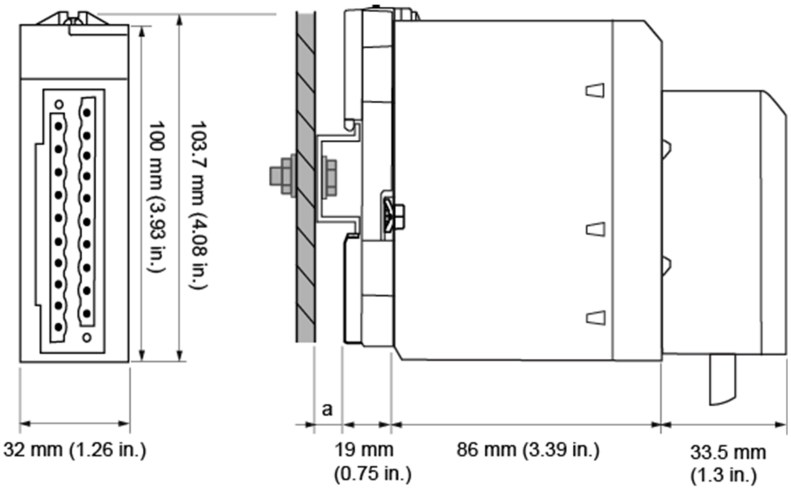
	Type of module	Mixed inputs/outputs with 20-pin terminal block connections		Mixed inputs/outputs with 40-pin terminal block connections
	Illustration	Discrete mixed input/output modules 		Discrete mixed input/output modules 
	Number of channels	8 inputs 8 outputs	8 inputs 8 outputs	16 inputs 16 outputs
Inputs	**Range**	24 VDC	24 VDC	24 VDC
	Insulation	Insulated inputs	Insulated inputs	Insulated inputs
	IEC 61131-2 compliant	Type 3	Type 3	Type 1
	Logic	Positive	Positive	Positive
	Response time	4 ms	4 ms	4 ms
Outputs	**Range**	Static outputs 24 VDC	Relay outputs 24 VDC or 24...240 VAC	Static outputs 24 VDC
	Insulation	Outputs insulated from ground	Outputs insulated from ground 1 common per group of 8 channels	Outputs insulated from ground
	Current	0.5 A	2 A	0.1 A
	IEC 61131-2 compliant	Yes	Yes	Yes
	Overload protection	Outputs are protected against overloads and short-circuits.	N/A	Outputs are protected against overloads and short-circuits.
	Logic	Positive	N/A	Positive
	Response time	1.2 ms	10 ms max	1.2 ms
	Connections	20-pin terminal block	20-pin terminal block	1 x 40-pin connector

	Reference	BMXDDM16022	BMXDDM16025	BMXDDM3202K

Dimensions

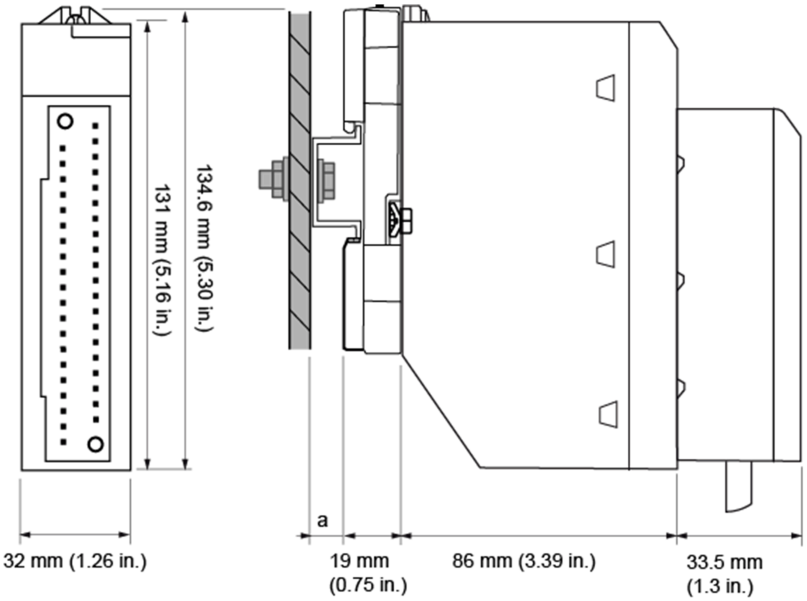
Introduction

X80 Discrete I/O module with a 20-pin removable terminal block



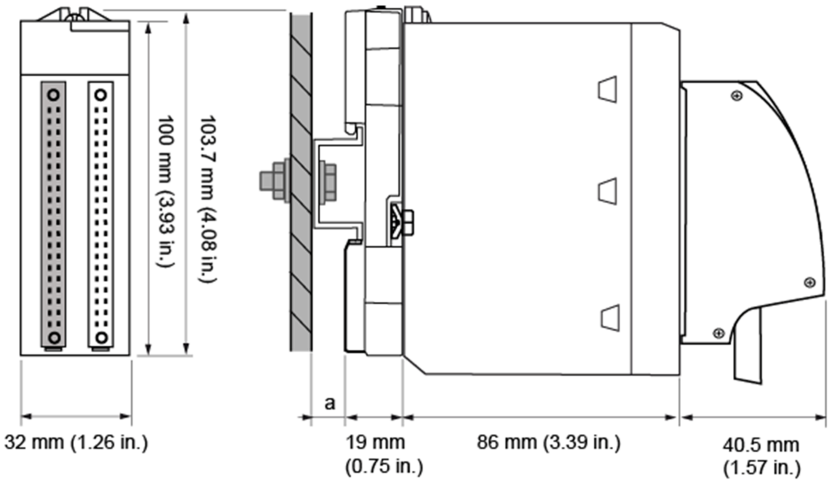
a backplane depth: The value depends on the backplane type used in your platform.

X80 Discrete I/O module with a 40-pin removable terminal block



a backplane depth: The value depends on the backplane type used in your platform. Refer to *Mounting the Racks* (see Modicon X80, Racks and Power Supplies, Hardware Reference Manual).

X80 Discrete I/O Module with 40-pin FCN-type connectors



a backplane depth: the value depends on the backplane type used in your platform.

Dimensions of X80 Discrete Modules

Module reference	Module dimension			Installation depth(1)
	Width	Height	Module alone	
X80 Discrete I/O Modules with a 20-pin removable terminal block				
BMXDDI1602(H)	32 mm (1.26 in.)	103.7 mm (4.08 in.)	86 mm (3.39 in.)	119.5 mm (4.69 in.)(1)
BMXDDI1603(H)				
BMXDDI1604T				
BMXDAI1602(H)				
BMXDAI1603(H)				
BMXDAI1604(H)				
BMXDAI0805(H)				
BMXDAI0814				
BMXDDO1602(H)				
BMXDDO1612(H)				
BMXDRA0804T				
BMXDRA0805(H)				
BMXDRA0815(H)				
BMXDRA1605(H)				
BMXDAO1605(H)				
BMXDDM1622(H)				
BMXDDM1625(H)				
X80 Discrete I/O Modules with a 40-pin removable terminal block				

Module reference	Module dimension			Installation depth(1)
	Width	Height	Module alone	
BMXDDI3232(H)	32 mm (1.26 in.)	134.6 mm (5.30 in.)	86 mm (3.39 in.)	119.5 mm (4.69 in.)(1)
BMXDDI3203(H)				
BMXDAI1614(H)				
BMXDAI1615(H)				
BMXDRC0805(H)				
BMXDAO1615(H)				
BMXDDO3202(H)				
X80 Discrete I/O Modules with 1 or 2 40-pin FCN-type connectors				
BMXDDI3202K	32 mm (1.26 in.)	103.7 mm (4.08 in.)	86 mm (3.39 in.)	126.5 mm (4.96 in.)(1)
BMXDDI3202K(H)				
BMXDDO3202K				
BMXDDO3202K(C)				
BMXDDM3202K				
BMXDDI6402K				
BMXDDI6402K(H)				
BMXDDO6402K				
BMXDDO6402(KC)				
(1) backplane depth (a) is not included.				

NOTE: Connectors that are delivered with the X80 Discrete I/O modules (20-pin and 40-pin removable terminal blocks) and the corresponding pre-assembled cordsets (BMXFTW**1 and BMXFTW**5) have the same dimensions.

NOTE: Consider clearance for cable installation and spacing around the racks.

Temperature Derating

At a Glance

The characteristics are specified for a load rate of 60% of the channels.

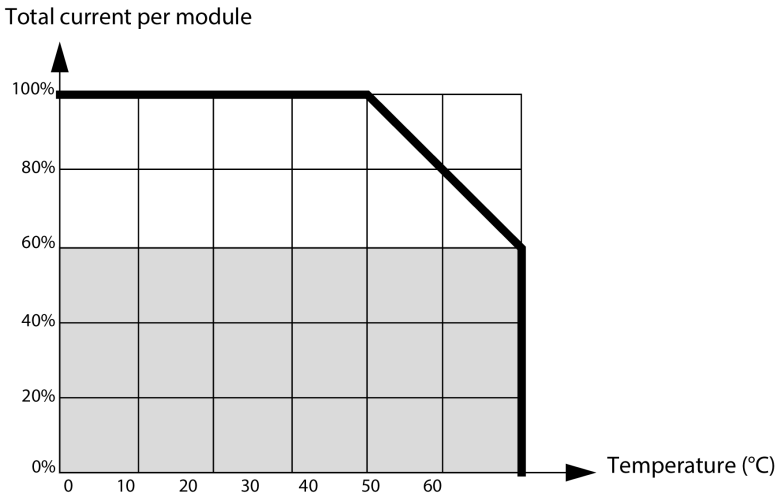
⚠CAUTION

OVERHEATING

Take into account the temperature derating of the discrete I/O modules at the installation to prevent the device from overheating and/or deteriorating.

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

If the rate is greater than 60%, confirm that the following downgrade curve is taken into consideration.



NOTE: There is no temperature derating for relay modules. Check that the overall consumption of the 24 VDC power supply is sufficient.

NOTE: For static outputs, temperature derating is carried out on the basis of the maximum current produced by the active outputs.

Altitude Operating Conditions

The temperature derating applies to the modules for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating. For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Examples

- **BMXDDO1602**

  Suppose the BMXDDO1602 module with sixteen 24 VDC/0.5 A outputs produces 0.5 A per channel. For an ambient temperature reading of between 0°C and 40°C, the maximum admissible current in the module is equal to 16 x 0.5 = 8 A. Above 40°C, confirm that the downgrading curve is applied. At 60° C, confirm that the maximum current in 24 VDC does not exceed 8 x 60% = 4.8 A. This value corresponds to 10 outputs at 0.5 A or 16 outputs at 0.3 A or other combinations.

- **BMXDDO6402**

  Suppose the BMXDDO6402 K module with sixty-four 24 VDC/0.1 A outputs produces 0.1 A per channel. For an ambient temperature reading of between 0°C and 40°C, the maximum admissible current in the module is equal to 64 x 0.1 = 6.4 A. Above 40°C, confirm that the downgrading curve isapplied. At 60° C, confirm that the maximum current in 24 VDC does not exceed 6.4 x 60% = 3.8 A. This value corresponds to 38 outputs at 0.1 A or 64 outputs at 0.05 A or other combinations.

- **BMXDAO1605**

  Suppose the BMXDAO1605 module with sixteen 220 VAC outputs producing 0.3 A per channel. For an ambient temperature reading of between 0°C and 40°C, the maximum admissible current in the module is equal to 16 x 0.3 A = 4.8 A (2,4 A per 8-channel group maximum). Above 40°C, confirm that the downgrading curve isapplied. At 60°C, confirm that the maximum current in 220 Vac does not exceed 4.8 A x 0.6 = 2.9 A (1.5 A per 8-channel group maximum). This value corresponds to 10 outputs at 0.3 A or to 16 outputs at 0.18 A.

Fitting of the Modules

At a Glance

The discrete input/output modules are powered by the bus of the rack. The modules may be handled without turning off power supply to the rack, without damage or disturbance to the controller.

Fitting operations (installation, assembly and disassembly) are described below.

Installation Precautions

The Modicon X80 discrete modules may be installed in any of the positions in the rack except:

- the positions reserved for the rack power supply modules (marked PS, PS1, and PS2)
- the positions reserved for extended modules (marked XBE)
- the positions reserved for the controller in the main local rack (marked 00 or marked 00 and 01 depending on the controller)

Power is supplied by the bus at the bottom of the rack (3.3 V and 24 V).

Before installing a module, remove the protective cap from the module connector located on the rack.

⚠⚠DANGER

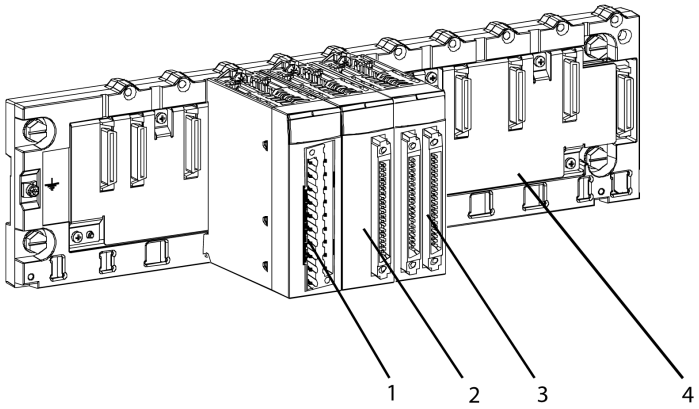
ELECTRIC SHOCK, EXPLOSION OR ARC FLASH

Disconnect the power to the sensors and pre-actuators and disconnect the terminal block to carry out assembly and disassembly of the modules.

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

Installation

The diagram below shows some discrete input/output modules mounted on the rack.

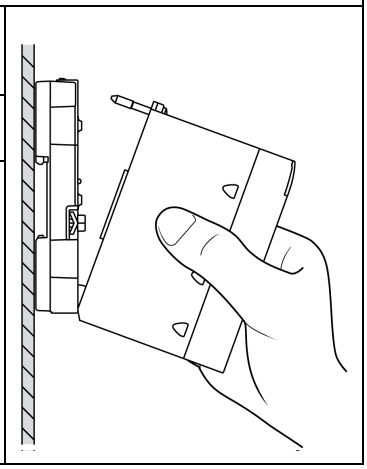


The following table describes the different elements which make up the assembly below.

Number	Description
1	20-pin terminal block module
2	40-pin connector module
3	2 x 40-pin connector module
4	Standard rack

Installing the Module on the Rack

The table below presents the procedure for mounting the discrete input/output modules on the rack:

Step	Action	
1	Remove the protective cover from the connector of the module slot on the Modicon X80 rack.	
2	Position the locating pins situated at the rear of the module (on the bottom part) in the corresponding slot in the rack.	
3	Swivel the module towards the top of the rack so that the module sits flush with the back of the rack.	
4	Tighten the mounting screw on top of the module to hold in place on the rack. Tightening torque: 0.4...1.5 N•m (0.30...1.10 lbf-ft).	

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Check that the mounting screw is securely tightened to ensure the module is firmly attached to the rack.

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

20-pin Terminal Blocks: BMXFTB20•0

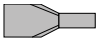
At a Glance

There are three types of 20-pin terminal blocks:

- BMXFTB2010 screw clamp terminal blocks
- BMXFTB2000 caged terminal blocks
- BMXFTB2020 spring terminal blocks

Cable Ends and Contacts

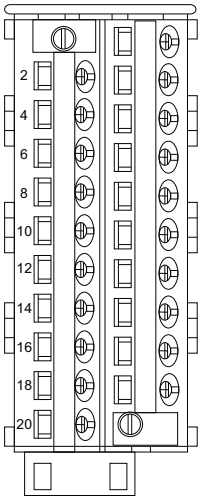
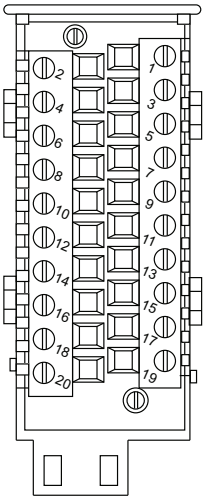
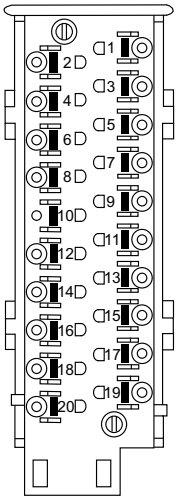
Each terminal block can accommodate:

- Bare wires
- Wires with:
  - DZ5-CE (ferrule) type cable ends: 
  - AZ5-DE (twin ferrule) type cable ends: 

  NOTE: When using stranded cable, Schneider Electric strongly recommends the use of wire ferrules which are fitted with an appropriate crimping tool.

Description of the 20-pin Terminal Blocks

The following table describes the type of wires that fit each terminal block and the associated gauge range, wiring constraints, and tightening torque:

	Screw Clamp Terminal Blocks **BMXFTB2010**	**Caged Terminal Blocks** **BMXFTB2000**	**Spring Terminal Blocks** **BMXFTB2020**
Illustration			
1 solid conductor 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 solid conductors 	2 conductors of the same size: • AWG: 2 x 22...16 • mm²: 2 x 0.34...1.5	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
1 stranded cable 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 stranded cables 	2 conductors of the same size: • AWG: 2 x 22...16 • mm²: 2 x 0.34...1.5	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
1 stranded cable with ferrule 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 stranded cables with twin ferrule 	• AWG: 2 x 24...18 • mm²: 2 x 0.24...1	• AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	• AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
Minimum individual wire size in stranded cables when a ferrule is not used 	• AWG: 30 • mm²: 0.0507	• AWG: 30 • mm²: 0.0507	• AWG: 30 • mm²: 0.0507
Wiring constraints	Screw clamps have slots that accept: • Flat-tipped screwdrivers with a diameter of 5 mm. • Pozidriv PZ1 or Philips PH1 cross-tipped screwdrivers. Screw clamp terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	Caged terminal blocks have slots that accept: • Flat-tipped screwdrivers with a diameter of 3 mm. Caged terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	The wires are connected by pressing the button located next to each pin. To press the button, use a flat-tipped screwdriver with a maximum diameter of 3 mm.
Screw tightening torque	0.5 N•m (0.37 lbf-ft)	0.4 N•m (0.30 lbf-ft)	Not applicable

Connection of 20-pin Terminal Blocks

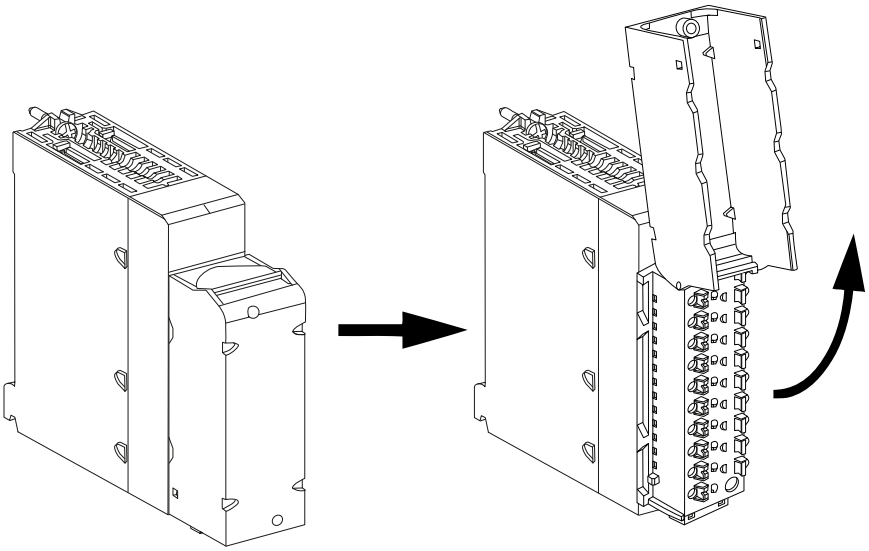
⚠⚠DANGER

ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connection or disconnection of the terminal block.

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

The following diagram shows the method for opening the 20-pin terminal block door so that it can be wired:



NOTE: The connection cable is installed and held in place by a cable clamp positioned below the 20-pin terminal block.

Labeling of 20-pin Terminal Blocks

Labels for the 20-pin terminal blocks are supplied with the module. They are to be inserted in the terminal block cover by the customer.

Each label has two sides:

- One side that is visible from the outside when the cover is closed. This side features the commercial product references, an abbreviated description of the module, as well as a blank section for customer labeling.
- One side that is visible from the inside when the cover is open. This side shows the terminal block connection diagram.

40-pin Terminal Blocks: BMXFTB40•0

At a Glance

There are two versions, available in two types of 40-pin terminal blocks:

Standard version	• BMXFTB4000 caged terminal block • BMXFTB4020 spring terminal block
Hardened version	• BMXFTB4000H caged terminal block with gold plating • BMXFTB4020H spring terminal block with gold plating

The hardened version of the terminal blocks are only dedicated to the hardened version of the modules.

NOTE: If you mix hardened and standard versions when fitting the terminal block to the module, there is a risk of terminal pin corrosion and a signal deviation.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Do not use the hardened version of the terminal block with a standard module.
- Do not use the standard version of the terminal block with a hardened module.

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

There are also pre-assembled cordsets with a BMXFTB4020 terminal block at one end and flying leads at the other. The cordsets are available as reference BMXFTW••5, page 405.

Cable Ends and Contacts

The 40-pin terminal blocks are designed for only one wire or one cable end.

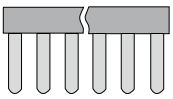
Each terminal block can accommodate:

- Bare wires:
  - Solid conductor
  - Stranded cable
- Wires with ferrule (DZ5CE••••/DZ5CA•••• single type cable ends): 

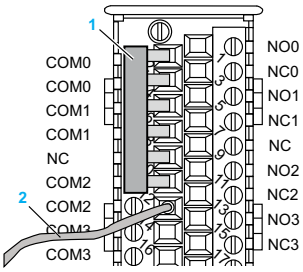
  NOTE: When using stranded cable, Schneider Electric strongly recommends the use of wire ferrules which are fitted with an appropriate crimping tool.

Jumper bar

To facilitate the wiring, a 20-pin jumper bar with plastic handle is provided with 40-pin caged screw terminal block BMXFTB4000:



The following graphic shows an example of using the jumper bar for non-isolated wiring channel 0-2 with on a BMXDRC0805 module:



1 Jumper bar

2 to common

⚠CAUTION

UNINTENDED EQUIPMENT OPERATION

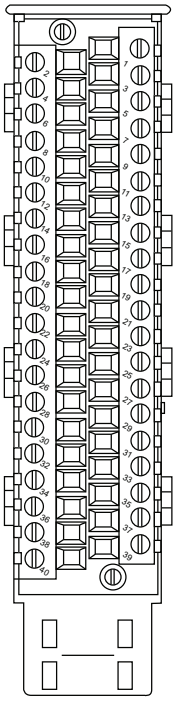
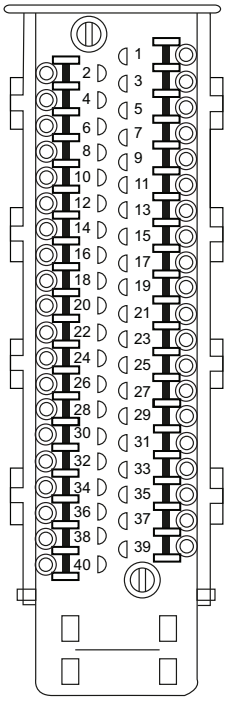
Do not exceed the maximum capability of a single point of the terminal block when using it to carry the whole common current:

- 10 A maximum for a single point of the BMXFTB4000 terminal block
- 8 A maximum for a single point of the BMXFTB4020 terminal block

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

Description of the 40-pin Terminal Blocks

The following table describes the type of wires that fit each terminal block and the associated gauge range, wiring constraints, and tightening torque:

	Caged Terminal Blocks BMXFTB4000	**Spring Terminal Blocks BMXFTB4020**
Illustration		
1 solid conductor 	• AWG: 26...18 • mm²: 0.13...1	• AWG: 26...18 • mm²: 0.13...1
1 stranded cable 	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
1 stranded cable with ferrule 	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
Minimum individual wire size in stranded cables when a ferrule is not used 	• AWG: 30 • mm²: 0.0507	• AWG: 30 • mm²: 0.0507

	Caged Terminal Blocks **BMXFTB4000**	**Spring Terminal Blocks** **BMXFTB4020**
Wiring constraints	Caged terminal blocks have slots that accept: • Flat-tipped screwdrivers with a diameter of 3 mm. Caged terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	The wires are connected by pressing the button located next to each pin. To press the button, use a flat-tipped screwdriver with a maximum diameter of 3 mm.
Screw tightening torque	0.4 N•m (0.30 lbf-ft)	Not applicable

Connection of 40-pin Terminal Blocks

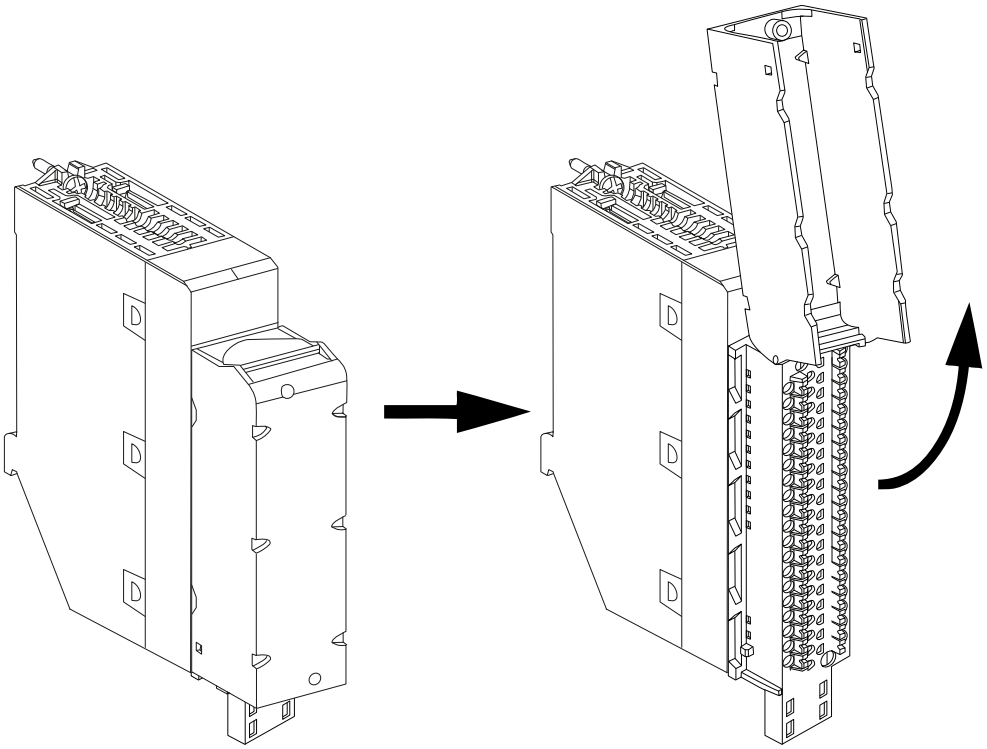
⚠⚠DANGER

ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connection or disconnection of the terminal block.

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

The following diagram shows the method for opening the terminal block cover so that it can be wired.



The connection cable is installed and held in place by cable clamps positioned below the terminal block.

NOTE: For installation where vibration can occur, do not let the cable loose from movement. Tighten cable to the bar of the shielding connection kit BMXXSP••00 or to rear mounting plate using cable clamp.

Labeling the Terminal Blocks

The labels for the terminal blocks are supplied with the module. They are to be inserted in the terminal block cover by the customer.

Each label has two sides:

- One side that is visible from the outside when the cover is closed. This side features the commercial product references, an abbreviated description of the module, as well as a blank section for customer labeling.
- One side that is visible from the inside when the cover is open. This side shows the terminal block connection diagram.

BMXFTW••1 Cable

Introduction

20-pin connector modules are connected to sensors, pre-actuators or terminals using a cable designed to enable direct wire to wire transition of the module's inputs/outputs.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

- Use only a connector that is designed for a specific module.
- Plugging the wrong connector can cause an unexpected behavior of the application.

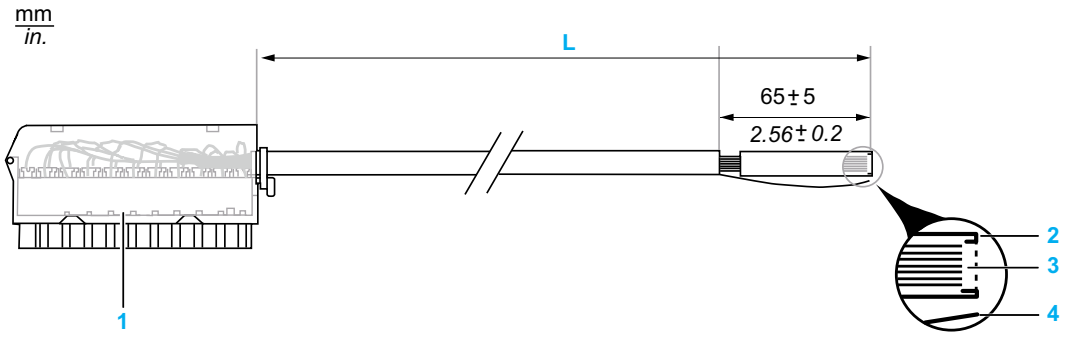
Failure to follow these instructions can result in death, serious injury, or equipment damage.

BMXFTW••1 Cable Description

The BMXFTW•01 cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 20-pin BMXFTB2020 terminal block, from which extends one cable sheath containing 20 wires
- At the other end, free wire ends differentiated by color code

The following figure shows the BMXFTW•01 cables:



1 BMXFTB2020 terminal block

2 First of external sheath

3 Wires not stripped

4 Strand of nylon allowing the cable sheath to be stripped easily

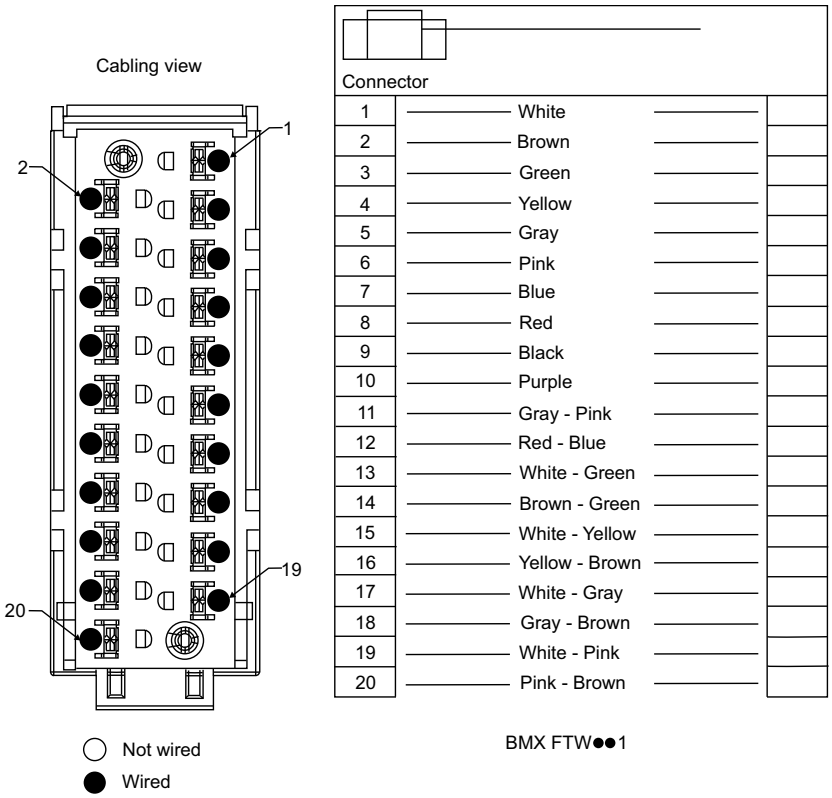
L Length according to the part number

The connection cables have three different lengths:

- 3 m (9.84 ft): BMXFTW301
- 5 m (16.40 ft): BMXFTW501
- 10 m (32.80 ft): BMXFTW1001

Connection of BMXFTW••1 Cables

The following diagram shows the connection of the BMXFTW••1 cable:



BMXFTW••1 Cable Characteristics

The following table presents the general characteristics:

Characteristics		**Values**
Cable	Sheath material	PVC
	LSZH status	No
Conductor description	Number of conductors	20
	Gauge	0.34 mm^2 (22 AWG)
	Material	Tinned copper
Environmental	Operating temperature	-25...70 °C (-13....158 °F)
Applicable standards		DIN47100

Cable Installation

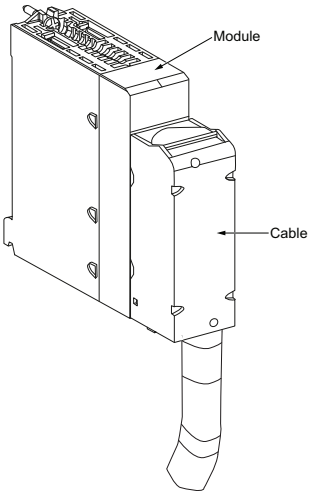
⚠⚠DANGER

ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connecting or disconnecting the terminal block.

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

The following diagram shows the pre-assembled cable connected to the module:



For more information, refer to the *Fitting a 20-pin Terminal Block to a Module topic*, page 408.

BMXFTW••5 Cable

Introduction

40-pin connector modules are connected to sensors, pre-actuators or terminals using a cable designed to enable direct wire to wire transition of the module's inputs/outputs.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

- Use only a connector that is designed for a specific module.
- Plugging the wrong connector can cause an unexpected behavior of the application.

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

BMXFTW••5 Cable Description

The BMXFT ••5 cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 40-pin BMXFTB4020 terminal block (non-gold plated spring terminal block), from which extends one cable sheath containing 40 wires
- At the other end, free wire ends differentiated by color code

NOTE: This pre-assembled cord set is only dedicated to standard module version.

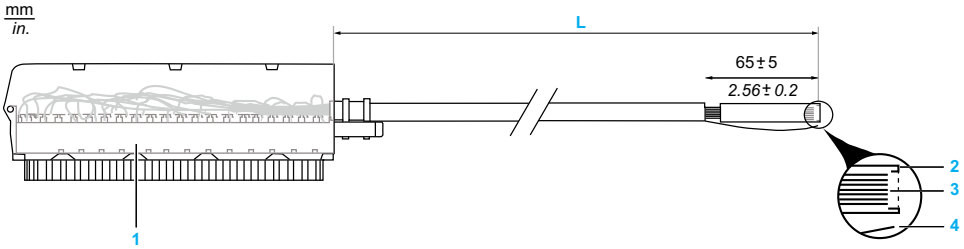
⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Do not use BMXFTW••5 cables with hardened module.

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

The following figure shows the BMXFTW••05 cables:



1 BMXFTB4020 terminal block

2 First of external sheath

3 Wires not stripped

4 Strand of nylon allowing the cable sheath to be stripped easily

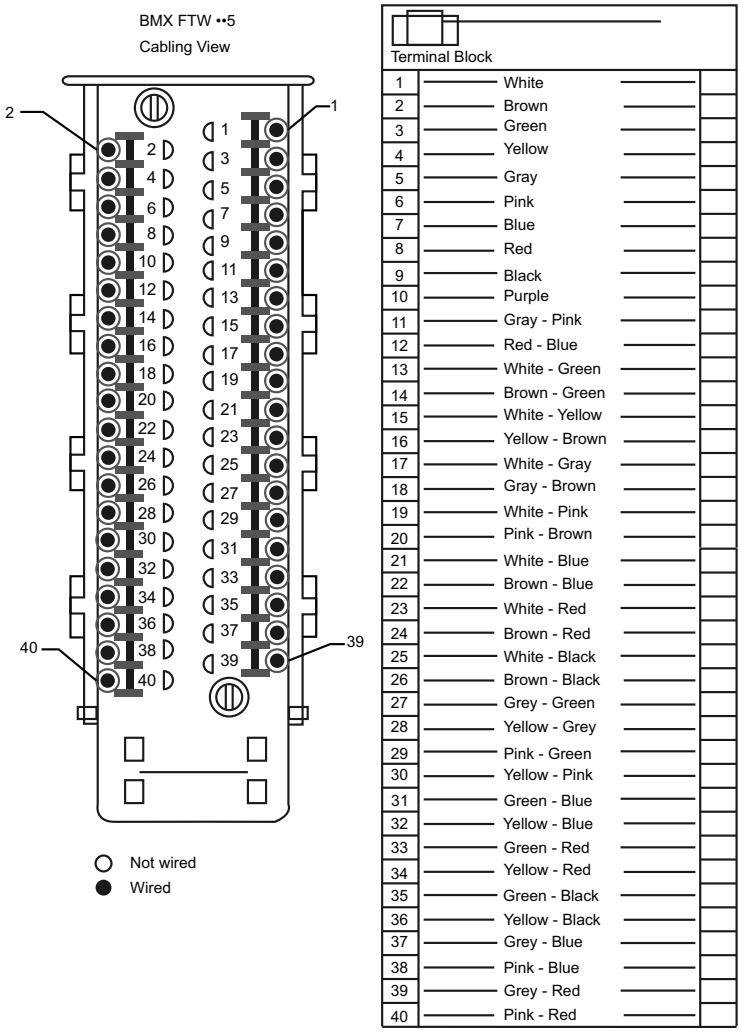
L Length according to the part number

The connection cables have two different lengths:

- 3 m (9.84 ft): BMXFTW305
- 5 m (16.40 ft): BMXFTW505

BMXFTW••5 Cable Connection

The following diagram shows the connections and the color-coded according to DIN47100:



BMXFTW••5 Cable Characteristics

The following table presents the general characteristics:

Characteristics		**Values**
Cable	Sheath material	PVC
	LSZH status	No
Application type	Maximum voltage	300 Vrms
Conductor description	Number of conductors	40
	Gauge	0.34 mm^2 (22 AWG)
	Material	Tinned copper
	Maximum current	2 A below 30 °C (86 °F) 0.8 A below 70 °C (158 °F)
Electrical	Dielectric withstand	2500 V for 1 min.
Environmental	Operating temperature	-25...70 °C (-13....158 °F)
Applicable standards		DIN47100

BMXFTW••5 Cable Installation

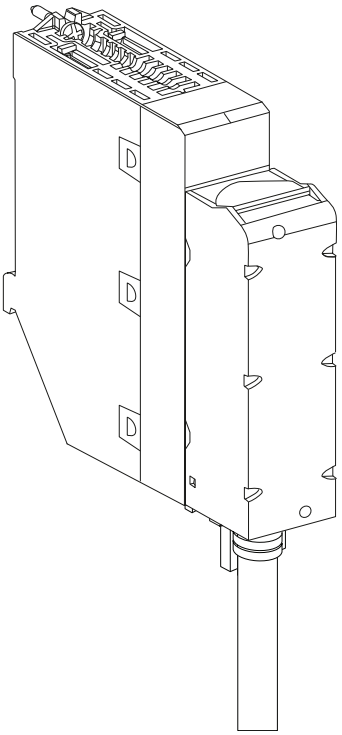
⚠⚠DANGER

ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connecting or disconnecting the terminal block.

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

The following diagram shows the pre-assembled cable connected to the module:



For more information, refer to the *Fitting a 40-pin Terminal Block to a Module topic*, page 411.

NOTE: For installation where vibration can occur, do not let the BMXFTW••5 cable loose from movement. Tighten cable to the bar of the BMXXSP••00 shielding connection kit or to rear mounting plate using cable clamp.

Fitting a 20-pin Terminal Block to a Module

At a Glance

The modules with 20-pin terminal block connections require the terminal block to be connected to the module. These fitting operations (assembly and disassembly) are described below.

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Terminal block must be connected or disconnected with sensor and pre-actuator voltage switched off.

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

⚠CAUTION

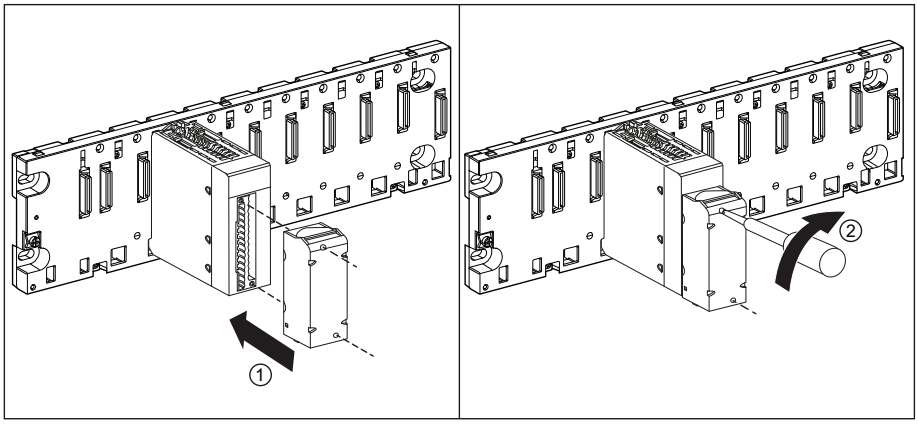
EQUIPMENT DAMAGE

Do not plug an AC terminal block into a DC module. This will cause damage to the module.

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

Installing the Terminal Block

The following table shows the procedure for assembling the 20-pin terminal block onto a discrete input/output module.



Related Topics:

Assembly Procedure

Step	Action
1	Once the module is in place on the rack, install the terminal block by inserting the terminal block encoder (the rear lower part of the terminal) into the module's encoder (the front lower part of the module), as shown above. **NOTE:** The module connector have indicators which show the proper direction to use for terminal block installation.
2	Fix the terminal block to the module by tightening the 2 mounting screws located on the lower and upper parts of the terminal block. Tightening torque: 0.4 N•m (0.30 lbf-ft).

NOTE: If the screws are not tightened, there is a risk that the terminal block will not be properly fixed to the module.

Coding the 20-Pin Terminal Block

⚠WARNING

UNEXPECTED BEHAVIOR OF APPLICATION

Code the terminal block as described below to prevent the terminal block from being mounted on another module. Plugging the wrong connector could cause unexpected behavior of the application.

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

⚠CAUTION

DESTRUCTION OF THE MODULE

Code the terminal block as described below to prevent the terminal block from being mounted on another module. Plugging the wrong connector could cause the module to be destroyed.

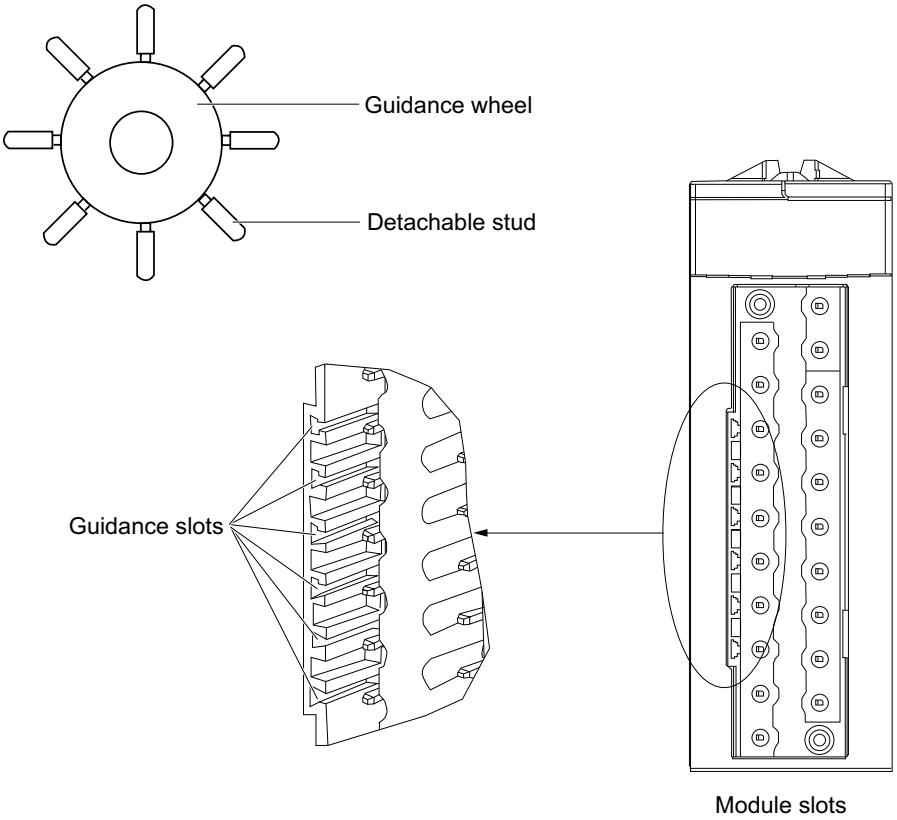
Failure to follow these instructions can result in injury or equipment damage.

When a 20-pin terminal block is installed on a module dedicated to this type of terminal block, you can code the terminal block and the module using studs. The purpose of the studs is to prevent the terminal block from being mounted on another module. Incorrect insertion can then be avoided when replacing a module.

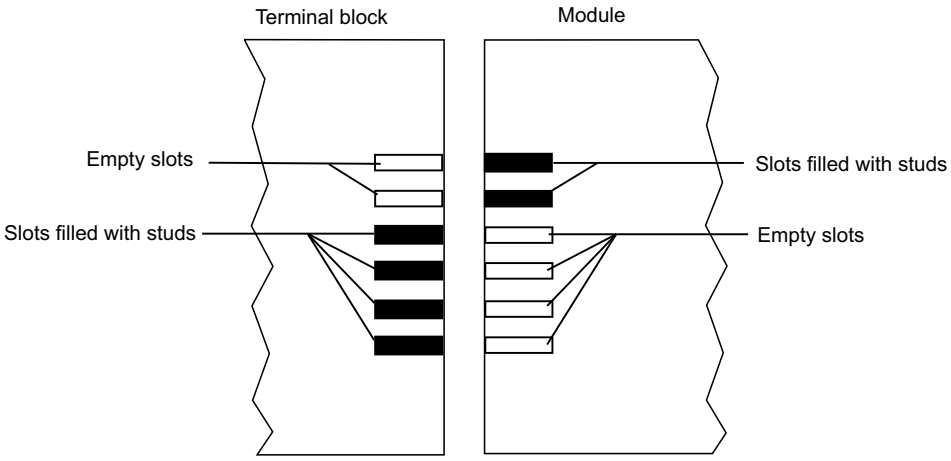
Coding is done by the user with the STB XMP 7800 guidance wheel's studs. You can only fill the 6 slots in the middle of the left side (as seen from the wiring side) of the terminal block, and can fill the module's 6 guidance slots on the left side.

To fit the terminal block to the module, a module slot with a stud must correspond to an empty slot in the terminal block, or a terminal block with a stud must correspond to an empty slot in the module. You can fill up to and including either of the 6 available slots as desired.

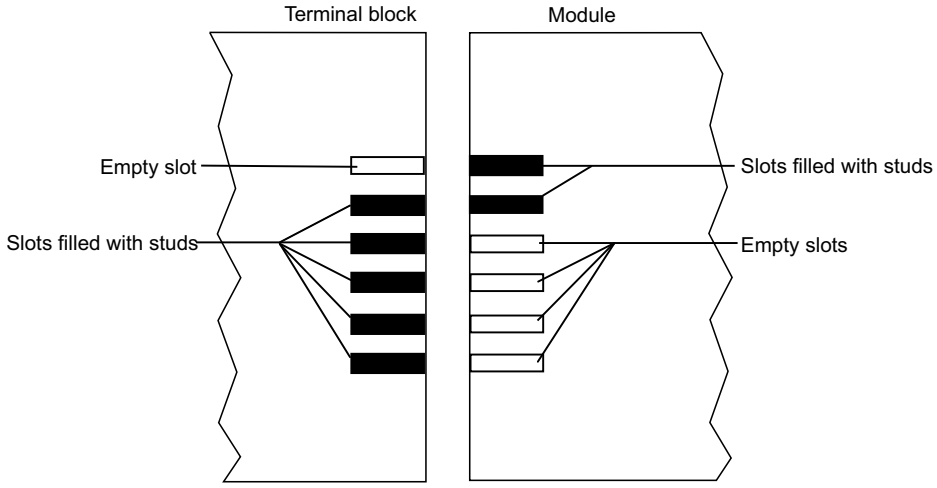
The diagram below shows a guidance wheel as well as the slots on the module used for coding the 20-pin terminal blocks.



The diagram below shows an example of a coding configuration that makes it possible to fit the terminal block to the module.



The diagram below shows an example of coding configuration with which it is not possible to fit the terminal block to the module.



Fitting a 40-Pin Terminal Block to a Module

At a Glance

The modules with 40-pin terminal block connections require the terminal block to be connected to the module. These fitting operations (assembly and disassembly) are described below.

⚠⚠DANGER

ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Terminal blocks must be connected or disconnected with sensor and pre-actuator voltage switched off.

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

⚠CAUTION

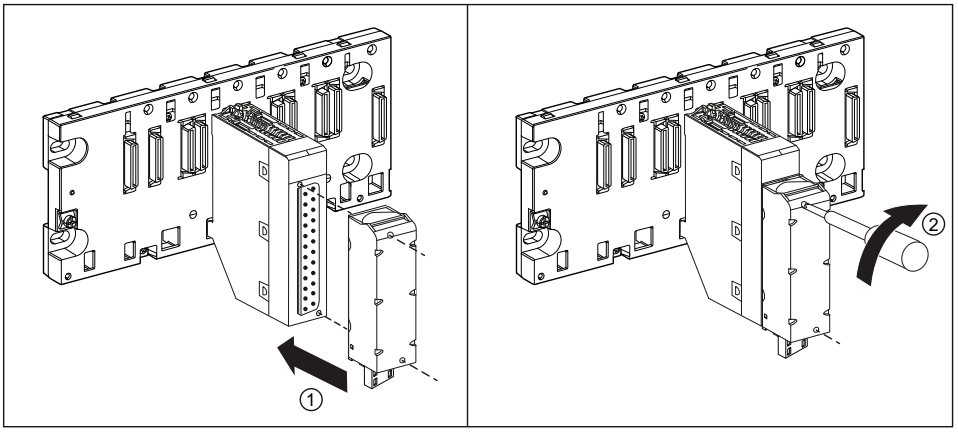
EQUIPMENT DAMAGE

Do not plug an AC terminal block into a DC module. This will cause damage to the module.

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

Installing the 40-Pin Terminal Block

The following table shows the procedure for assembling the 40-pin terminal block onto a discrete input/output module.



Assembly Procedure

Step	Action
1	Once the module is in place on the rack, install the terminal block by inserting the terminal block encoder (the rear lower part of the terminal) into the module's encoder (the front lower part of the module), as shown above. **NOTE:** The module connector have indicators which show the proper direction to use for terminal block installation.
2	Fix the terminal block to the module by tightening the 2 mounting screws located on the lower and upper parts of the terminal block. Tightening torque: 0.4 N•m (0.30 lbf-ft).

NOTE: If the screws are not tightened, there is a risk that the terminal block will not be properly fixed to the module.

Coding the 40-Pin Terminal Block

⚠WARNING

UNEXPECTED BEHAVIOR OF APPLICATION

Code the terminal block as described below to prevent the terminal block from being mounted on another module. Plugging the wrong connector could cause unexpected behavior of the application.

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

⚠CAUTION

DESTRUCTION OF THE MODULE

Code the terminal block as described below to prevent the terminal block from being mounted on another module. Plugging the wrong connector could cause the module to be destroyed.

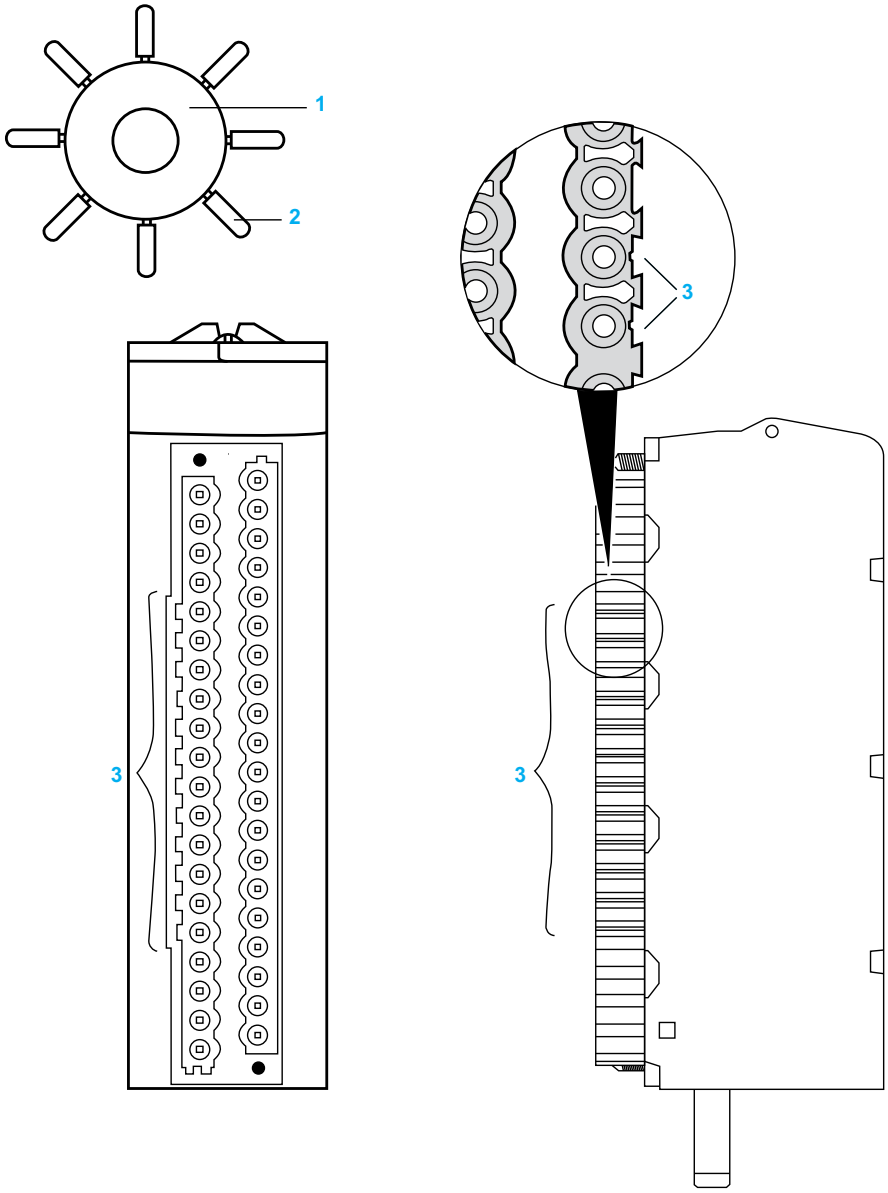
Failure to follow these instructions can result in injury or equipment damage.

When a 40-pin terminal block is installed on a module dedicated to this type of terminal block, you can code the terminal block and the module using studs. The purpose of the studs is to prevent the terminal block from being mounted on another module. Incorrect insertion can then be avoided when replacing a module.

Coding is done by the user with the STB XMP 7800 guidance wheel's studs. You can only fill the 12 slots in the middle of the left side (as seen from the wiring side) of the terminal block, and can fill the module's 12 guidance slots on the left side.

To fit the terminal block to the module, a module slot with a stud must correspond to an empty slot in the terminal block, or a terminal block with a stud must correspond to an empty slot in the module. You can fill up to and including either of the 12 available slots as desired.

The diagram below shows a guidance wheel as well as the slots on the module used for coding the 40-pin terminal blocks.

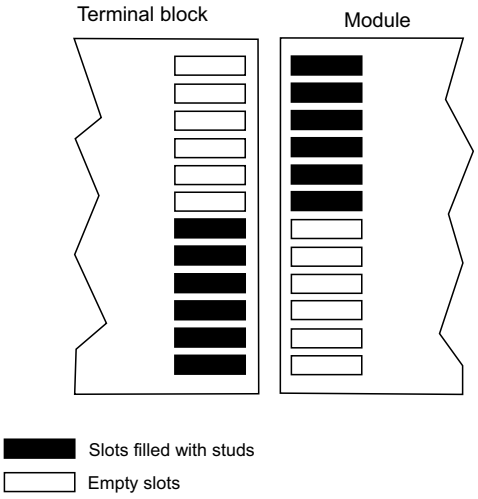


1 Guidance wheel

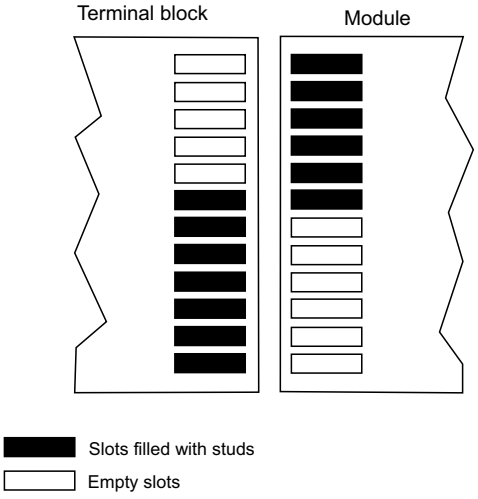
2 Detachable stud

3 Guidance slots

The diagram below shows an example of a coding configuration that makes it possible to fit the terminal block to the module.



The diagram below shows an example of coding configuration with which it is not possible to fit the terminal block to the module.



Fitting a 40-pin FCN Type Connector to a Module

At a Glance

The modules with 40-pin FCN type connections require the latter to be connected to the module. These fitting operations (assembly and disassembly) are described below.

⚠⚠DANGER

ELECTRICAL SHOCK

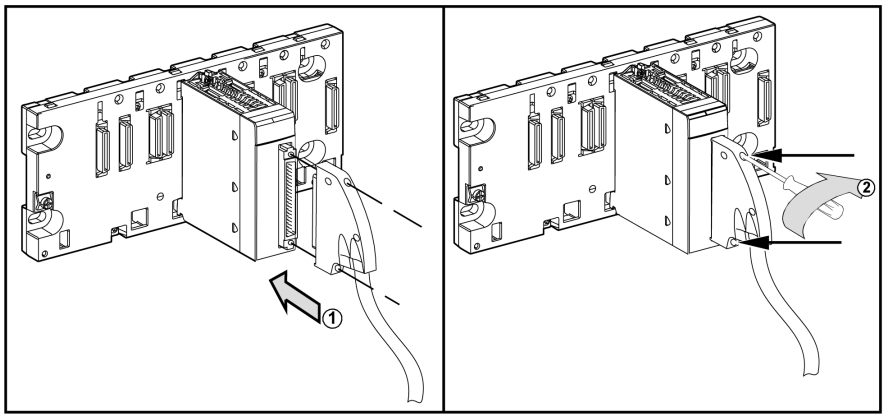
FCN type connector must be connected or disconnected with sensor and pre-actuator voltage switched off.

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

⚠ CAUTION
EQUIPMENT DAMAGE Do not plug an AC connector on a DC module. This would cause equipment damage. **Failure to follow these instructions can result in injury or equipment damage.**

Installing the Connector

The following table shows the procedure for assembling the connector onto modules:



Assembly procedure:

Step	Action
1	Once the module is in place on the rack, insert the FCN connector of the cable into the module's connector, as shown above.
2	Fix the connector to the module by tightening the 2 mounting screws located on the lower and upper parts of the terminal block. Tightening torque: 0.4 N•m (0.30 lbf-ft).

NOTE: If the screws are not tightened, there is a risk that the terminal block will not be properly fixed to the module.

Choosing Power Supplies for Sensors and Pre-Actuators

Introduction

The different choices of power supply for sensors and pre-actuators linked to discrete input/output modules require certain usage precautions.

External Direct Current Power Supplies

Rectified power supplies with no filtering are prohibited.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

When using an external 24 VDC direct current power supply, use one of the following:

- regulated power supplies
- non-regulated power supplies with:
- *filtering of 1000 µF/A with full-wave single phase rectification and 500 µF/A with tri-phase rectification*
- *5% maximum peak to peak ripple rate*
- *maximum voltage variation of: -20% to +25% of the nominal voltage (including ripple)*

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

Ni-Cad Battery Power Supplies

Ni-Cad battery power supplies can be used to power sensors and pre-actuators and all associated inputs/outputs that have a normal operating voltage of 30 VDC maximum.

While being charged, this type of battery can reach, for a duration of one hour, a voltage of 34 VDC. For this reason, all input/output modules with an operating voltage of 24 VDC can withstand this voltage (34 VDC) for up to one hour every 24 hours. This type of operation entails the following restrictions:

- At 34 VDC, confirm that the maximum current withstood by the outputs does not exceed the maximum current defined for a voltage of 30 VDC.
- Temperature downgrading imposes the following restrictions:
  - 80% of inputs/outputs at 1 up to 30°C
  - 50% of inputs/outputs at 1 up to 60°C

⚠CAUTION

OVERHEATING

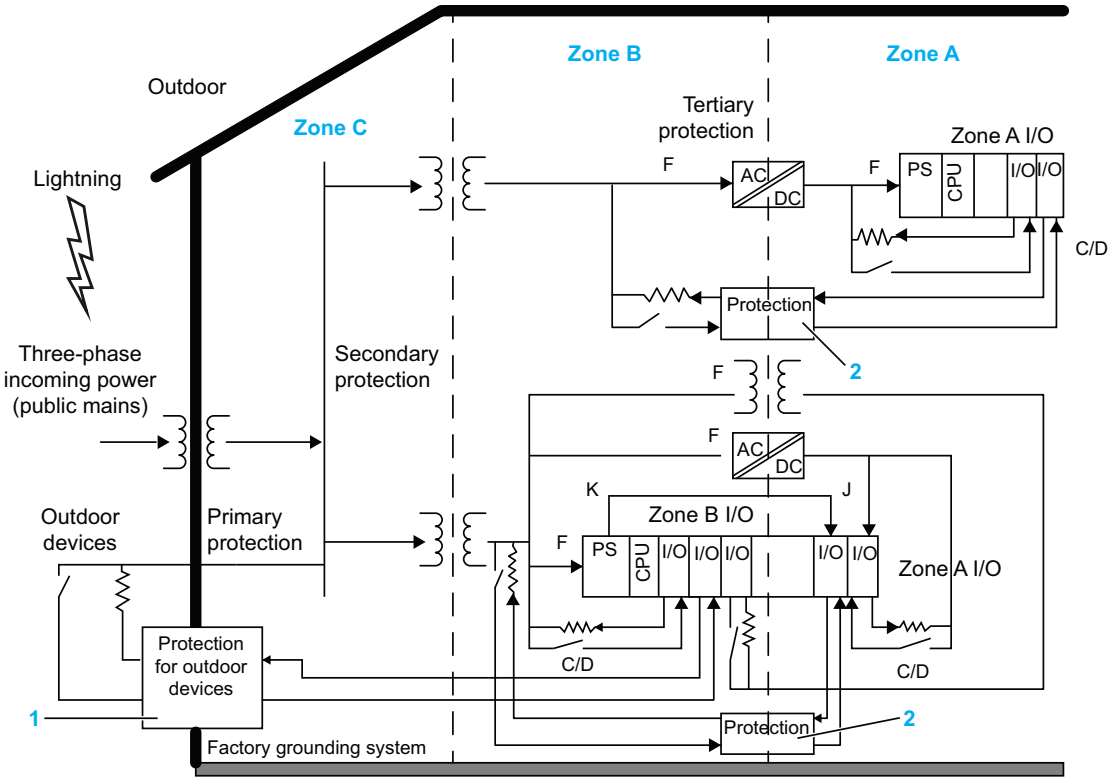
Consider the temperature derating of the discrete I/O modules at the installation to prevent the device from overheating and/or deteriorating.

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

External AC Current Power Supplies

All BMXDAI••••, BMXDAO••••, BMXDRA••••, and BMXDRC•••• modules are designed for use in zone A and B defined in the controller standard IEC 61131-2 and the generic EMC standard IEC 61000-6-2 without any specific protection against surges.

The following figure shows the zones defined in the controller standard IEC 61131-2:



Zone A Local power distribution

Zone B Dedicated power distribution

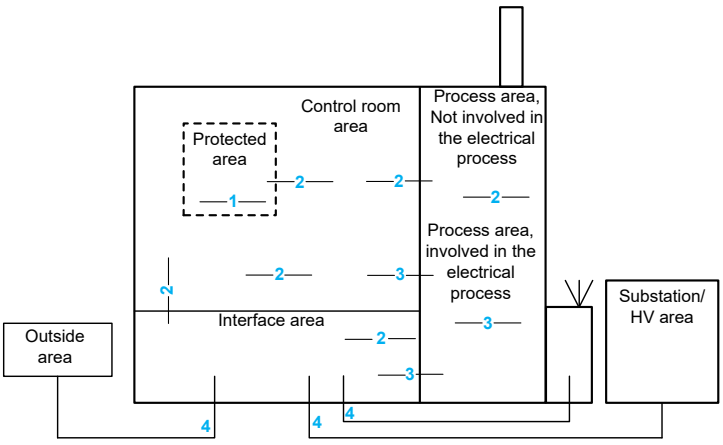
Zone C Factory mains

1 Protection network should be appropriate to reduce Severity Levels from those of outdoor to Zone B.

2 Protection network should be appropriate to reduce Severity Levels from those of Zone A to Zone B

These modules are also suited to be installed in a power generation station/ substation according to the generic standard IEC 61000-6-5 for interfaces type 1 and 2 without any specific protection against surges.

The following figure shows the interface types defined in the generic standard IEC 61000-6-5:



1 Inside protected area

2 Inside interface and/or control room and/or process area not involved in the electrical process

3 Inside or from process area involved in the electrical process

4 Connections from outside (HV area and external telecommunication)

Protection Against Surges of AC Power Lines for More Severe Environments

The design of these modules helps ensure an immunity level for surges of 2 kV Line to ground and 1 kV line to line. They do not require any external protection on AC line branch.

If you want to install the controller and its AC I/Os in a IEC 61131-2 zone C or to a IEC 61000-6-5 type 3 or type 4 interface, use primary protection provided only and severe interference coupling. The system integrator is responsible to take care of the system and help protect it properly

Providing mitigation measures, you can install the controller and the IO module in a such environment.

All the installation requirements are detailed in the chapter J - Overvoltage protection of the Schneider Electrical Installation Guide. This documentation is available for download on www.se.com.

Adding a type 2/class II surge protection device (SPD), for example an iQuick PRD20r modular surge arrester with voltage protection level (Up) ≤1.5 kV, withstand surges of 4 kV Line to ground and 2 kV line to line.

Sensor/Input Compatibility and Pre-actuator/Output Compatibility

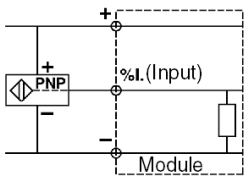
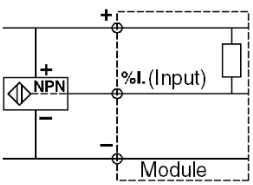
At a Glance

The compatibility between sensors and discrete module inputs depends on the type of sensor used.

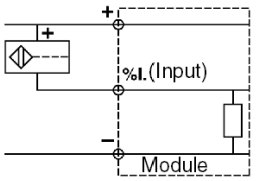
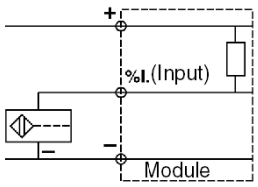
Similarly, the compatibility between pre-actuators and discrete module outputs depends on the type of pre-actuator used.

Sensor/Input Compatibility

The following table presents the compatibility between 3-wire sensors and 24 VDC and 48 VDC inputs.

3-wire sensors and IEC 61131-2 compliant type 3 positive logic (sink) inputs: all 3-wire PNP inductive or capacitive proximity sensors and photo-electric detectors which have an operating voltage of 24 VDC and 48 VDC are compatible with all positive logic inputs.	
3-wire sensors and negative logic (source) inputs: all 3-wire NPN inductive or capacitive proximity sensors and photo-electric detectors which have an operating voltage of 24 VDC and 48 VDC are compatible with all negative logic inputs.	

The following table presents the compatibility between 2-wire sensors and 24 VDC and 48 VDC inputs.

2-wire sensors and IEC 61131-2 compliant type 1 positive logic (sink) inputs: all proximity sensors or other 2-wire sensors with an operating voltage of 24 VDC and 48 VDC and with the characteristics described in the next table are compatible with all positive logic 24 VDC inputs.	
2-wire sensors and negative logic (source) inputs: all proximity sensors or other 2-wire sensors with an operating voltage of 24 VDC are compatible with all negative logic 24 VDC inputs.	

Compatibility between 2-wire sensors and 24/48 VAC and 120 VAC inputs:

All IEC 60947-5-2 compliant 2-wire AC proximity sensors able to withstand 100...120 VAC are compatible with all IEC 61131-2 type 1 and type 3 compliant 110...20 VAC inputs.

The following tables provide a summary of compatibility between sensors and discrete input/output module inputs.

Types of proximity sensor	**Types of input**			
	24 VDC **Positive logic**	**48 VDC** **Type 1** **Positive logic**	**24 VDC** **Type 3** **Positive logic**	**24/48 VDC** **Negative logic**
All PNP-type 3-wire (DC) proximity sensors	X	X	X	-
All NPN-type 3-wire (DC) proximity sensors	-	-	-	X
Telemecanique or other brand 2-wire (DC) proximity sensors with the following characteristics: • Voltage drop in closed state ≤ 7 V • Minimum switched current ≤ 2.5 mA • Residual current in open state ≤ 1.5 mA	-	X	X	-
Telemecanique or other brand 2-wire (DC) proximity sensors with the following characteristics: • Voltage drop in closed state ≤ 4 V • Minimum switched current ≤ 1 mA • Residual current in open state ≤ 0.5 mA	X	X	X	-
X compatible **-** not compatible **DC** DC voltage operation				

Types of proximity sensor	Types of input		
	24 VAC Type 1	48 VAC Type 3	100-120 VAC Type 3
2-wire (AC/DC) proximity sensor (see note)	X	X	X
2-wire (AC) proximity sensor	X	X	X

X compatible

AC AC voltage operation

AC/DC AC or DC voltage operation

NOTE: 24 VDC inputs can be used in positive (sink) or negative (source) logic but are not IEC compliant.

Compatibility of Pre-Actuators with Outputs

Compatibility of DC Pre-actuators with Outputs:

Comply with the output's maximum current and maximum switching frequency as specified in the module characteristics.

NOTE: Where low consumption pre-actuators are used, pay special attention to the leakage current of the idle output, to ensure that the maximum current is correctly calculated:

$I_{max} = I_{nominal} + I_{leakage}$

Given that:

$I_{nominal}$ = Current required to operate by the pre-actuator

$I_{leakage}$ = Maximum leakage current in idle output state

Compatibility of Tungsten Filament Lamps and Static Outputs (Static Current):

For outputs with protection against short circuits, confirm that the maximum power of the tungsten filament lamps specified in the module characteristics complies. If not, the lamp's pick-up current might cause a tripped output at the time of power-up.

Compatibility of AC Pre-actuators and Relay Outputs:

Inductive AC pre-actuators have a pick-up current of up to 10 times their holding current for a duration of 2/F seconds (F = alternating current frequency). Relay outputs are therefore set to withstand these conditions (AC14 and AC15). The table of characteristics for relay outputs gives the maximum authorized running power (in AV) according to the number of operations.

⚠CAUTION

SHORTENED RELAY LIFE

Ensure that currents switched by the relay outputs do not exceed the relay ratings. Excessive currents will shorten relay life.

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

Wiring Precautions

At a Glance

Discrete inputs/outputs feature protective measures that ensure a high resistance to industrial environmental conditions. Nevertheless, follow the rules described below.

External Power Supplies for Sensors and Pre-Actuators

Use quick-blow fuses to protect external sensor and pre-actuator power supplies associated with discrete input/output modules against short-circuits and overloads.

For 40-pin connector discrete input/output modules, link the sensor/pre-actuator power supply to each connector, except in the event where the corresponding channels are not in use and are not assigned to any task.

⚠⚠DANGER

IMPROPER GROUNDING HAZARD

Install the 24V supply according to applicable codes. Connect the 0V terminals of the 24V power supplies to metallic ground and safety ground as close as possible to the supply. This is to ensure personnel safety in the event of a power phase coming into contact with the 24V supply.

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

NOTE: If an input/ouput module is present on the controller, connect the sensor and pre-actuator power supply to the power supply of the module otherwise, an external power supply error occurs causing the input/output LED to flash.

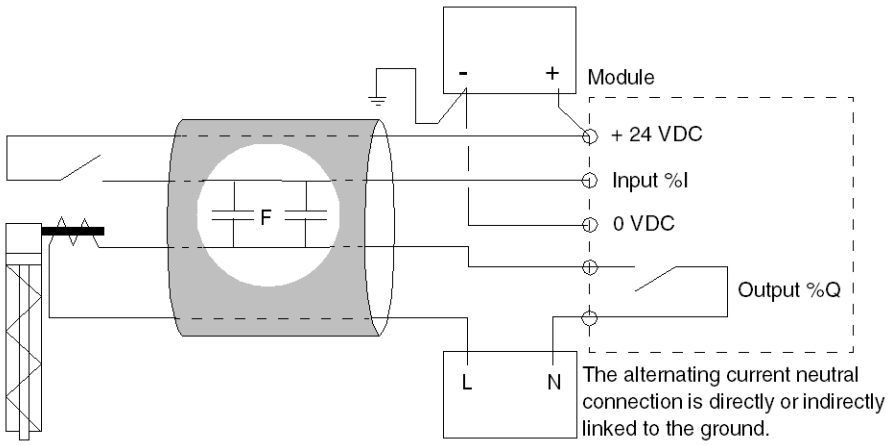
Inputs

Recommendations for use concerning the inputs of discrete modules are as follows:

- **for 24 VDC inputs and line coupling with an alternating current network:**

⚠WARNING
UNEXPECTED EQUIPMENT OPERATION • Avoid excessive coupling between AC cables and cables relaying signals intended for direct current inputs. • Follow the cable routing rules. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

This case (excessive coupling) is illustrated in the following circuit diagram.



When the input contact is open, the alternating currents may induce a current in the input which might cause it to be set to 1.

For a 240 VAC/50 Hz line coupling, do not exceed the line capacitance values given in the summary table at the end of this section. For a coupling with a different voltage, use the following formula:

Capacitance tolerated = (Capacity at 240VAC x 240) / (Line voltage)

- **for 24 to 240 VAC inputs and line coupling:**

When the line that controls the input is open, the current passes according to the coupling capacitance of the cable (see circuit diagram below).

Do not exceed the line capacitance values given in the summary table below.

The following summary table shows the acceptable line capacitance values.

Module	Maximum coupling capacitance
24 to 125 VDC inputs	
BMXDDI1602 BMXDDI1603	45 nF (1)

Module	Maximum coupling capacitance
BMXDD-I1604T BMXDD-M16022 BMXDD-M16025	
BMXDD-I3202K BMXDD-I6402K BMXDD-M3202K	25 nF (1)
24 to 140 VAC inputs	
BMXDAI0805 BMXDAI1615	50 nF
BMXDAI1602	50 nF
BMXDAI1603	60 nF
BMXDAI0814 BMXDAI1614 BMXDAI1604	70 nF
(1) max. admissible coupling capacitance with a 240 VAC / 50 Hz linemax. admissible coupling capacitance with a 240 VAC / 50 Hz line	

Example: A standard cable of 1 m in length has a coupling capacity that falls within 100 and 150 pF.

Outputs

For the outputs of discrete I/O modules, follow the recommendations described here.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Use wires of a sufficient diameter to avoid drops in voltage, overheating, and unexpected equipment operation.

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

Cable Routing

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Observe the precautions below for the wiring system.

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

Precautions for use to be taken concerning the wiring system are as follows:

- in order to reduce the number of alternating couplings, separate the power circuit cables (power supplies, power switches, etc.) from input cables (sensors) and output cables (pre-actuators) both inside and outside the equipment
- outside the equipment, place the cables leading to inputs/outputs in covers that make them easily distinguishable from those containing wires relaying high energy levels. Place them in separate metal cableways which are grounded. Route these various cables at least 100 mm (4 in.) apart

How to Connect Discrete Input/Output Modules: Connecting 40-Pin Connector Modules

Introduction

40-pin connector modules are connected to sensors, pre-actuators, or terminals using a cable designed to enable trouble-free direct wire to wire transition of the module's inputs/outputs.

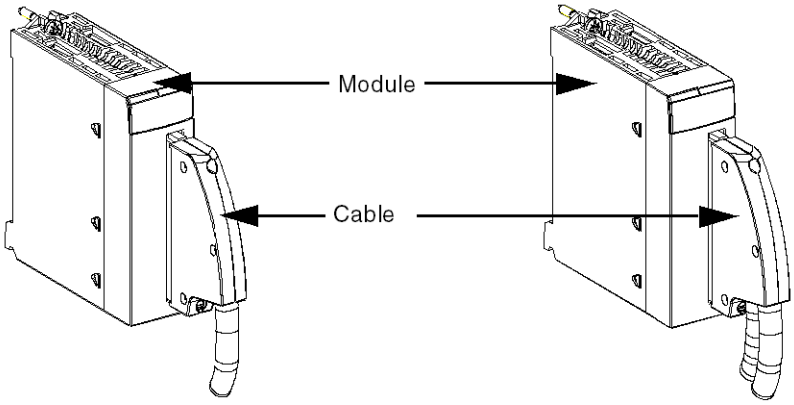
⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, ARC FLASH OR EXPLOSION

40-pin connectors must be connected or disconnected with sensor and pre-actuator voltage switched off.

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

The following diagram shows the connection of the cable to the module.



⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

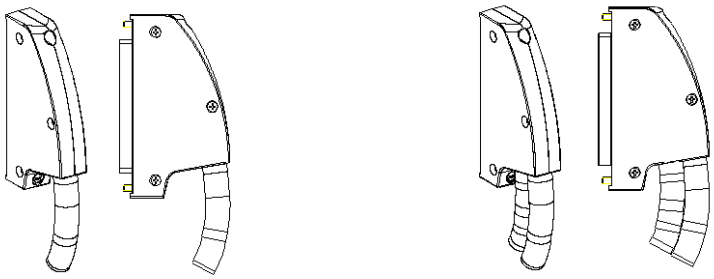
During the installation process, ensure that the connectors are identified with the corresponding modules so that incorrect connection cannot occur. Plugging the wrong connector into a module will result in unexpected equipment operation.

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

BMXFCW••• Connection Cables

They are made up of:

- at one end, a compound-filled 40-pin connector from which extend 1 or 2 cable sheaths, each containing 20 wires with a cross-sectional area of 0.34 mm² (AWG 22)



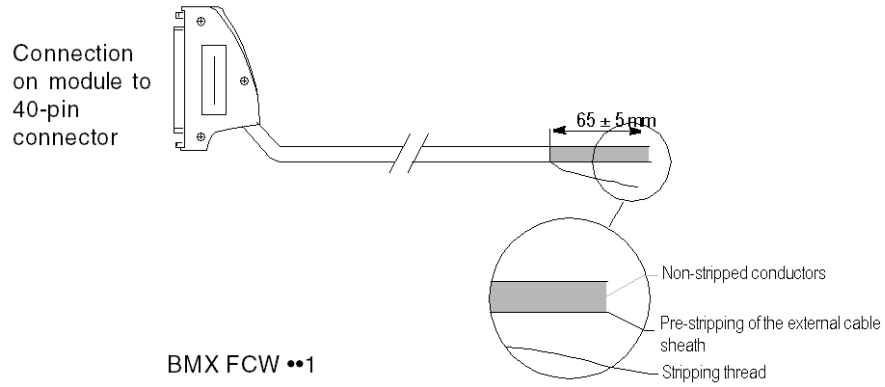
BMX FCW ••1 BMX FCW ••3

- at the other end, free wire ends color coded

The cables with 1 cable sheath containing 20 wires designed to connect the 40-pin connectors to the sensors or pre-actuators come in 3 different lengths:

- 3 meters: BMXFCW301
- 5 meters: BMXFCW501
- 10 meters: BMXFCW1001

The figure below shows the BMX FCW ••1 cables.

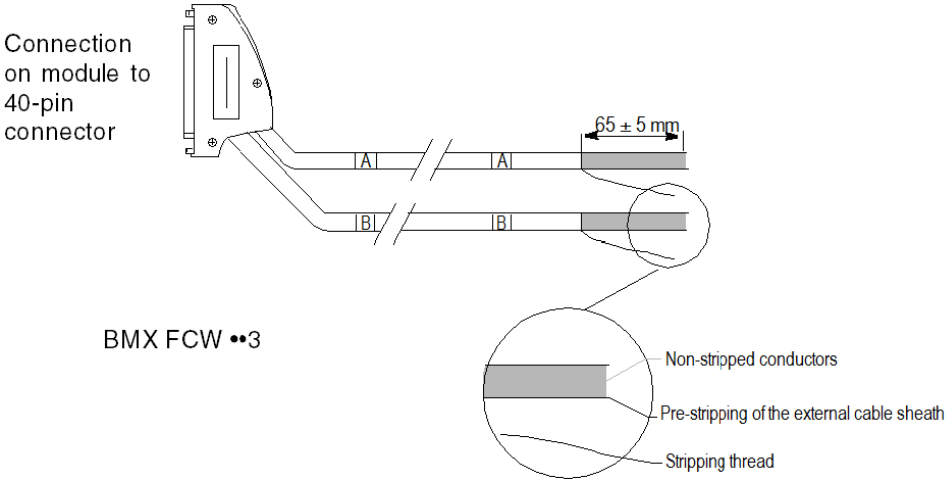


BMX FCW ••1

The cables with 2 cable sheaths containing 20 wires designed to connect the 40-pin connectors to the sensors or pre-actuators come in 3 different lengths:

- 3 meters: BMXFCW303
- 5 meters: BMXFCW503
- 10 meters: BMXFCW1003

The figure below shows the BMXFCW••3 cables.



BMX FCW ••3

NOTE: A strand of nylon incorporated in the cable allows the cable sheath to be stripped with ease.

NOTE: The maximum torque for tightening BMXFCW••• cable connection screws is 0.8 N•m (0.59 lb-ft).

⚠WARNING

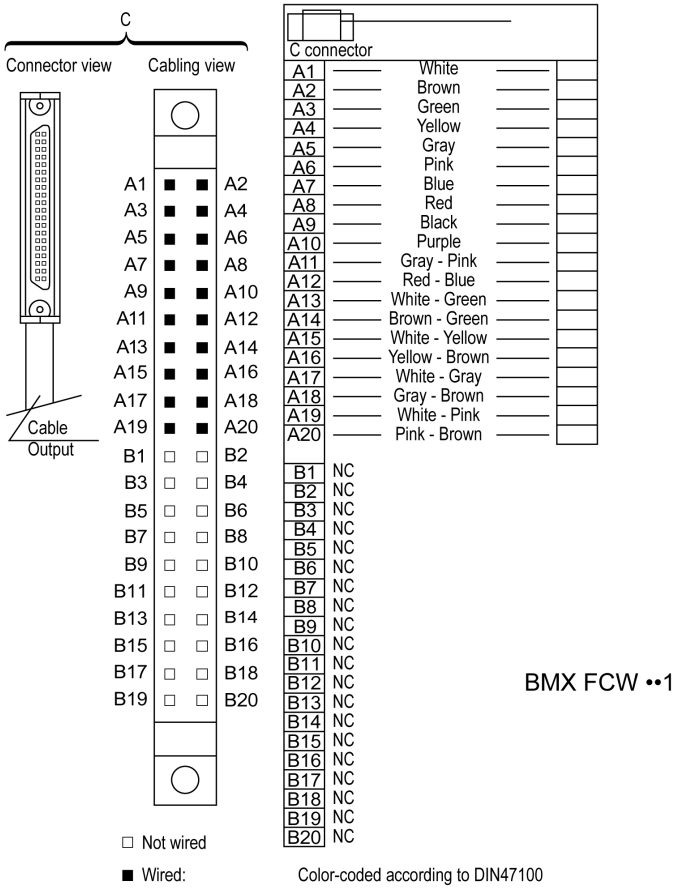
UNEXPECTED EQUIPMENT OPERATION

Do not exceed the maximum tightening torque. Excessive torque may result in wire breakage, resulting in poor or intermittent connection.

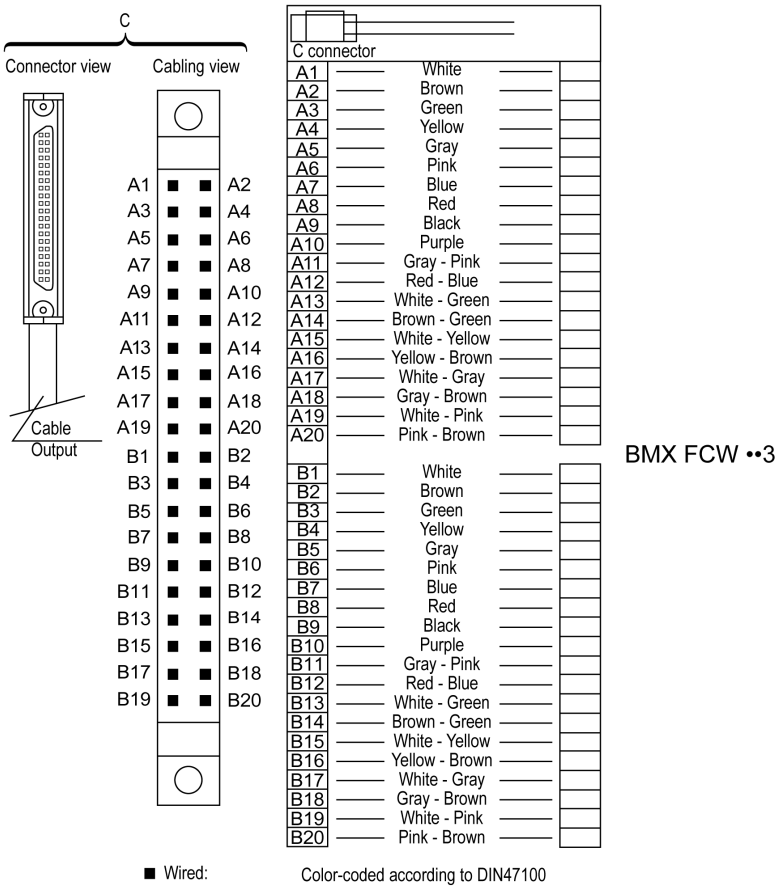
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Connection of BMXFCW••• Cables

The diagram below shows the connection of BMXFCW••1 cables:



The diagram below shows the connection of BMXFCW••3 cables:



BMXFCW••• Cables Characteristics

This table presents the general characteristics:

Characteristics		**Values**
Cable	Sheath material	PVC
	LSZH status	No
Conductor description	Number of conductors	• 20 for BMXFCW••1 • 40 for BMXFCW••3
	Gauge	0.34 mm^2 (22 AWG)
	Material	Tinned copper
Environmental	Operating temperature	-25...70 °C (-13....158 °F)
Applicable standards		DIN47100

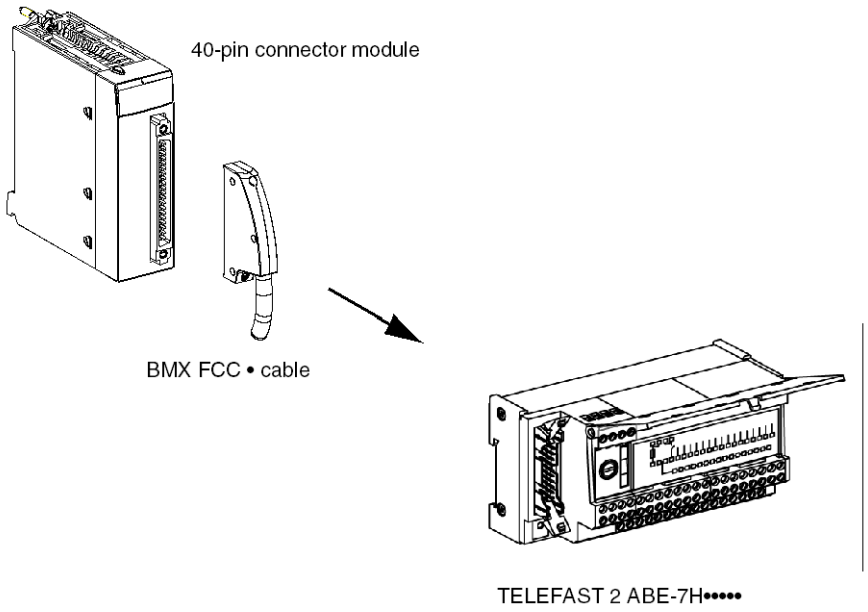
How to Connect Discrete Input/Output Modules: Connecting 40-Pin Connector Modules to TELEFAST Interfaces

Introduction

The inputs/outputs of discrete 40-pin connector modules are connected to TELEFAST quick-wiring connection and adaptation interfaces using specific cables for 40-pin to HE10 connectors.

Illustration

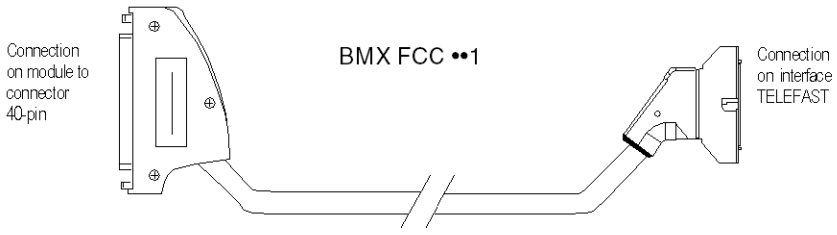
The drawing below shows the connection of a discrete 40-pin connector module to a TELEFAST interface.



BMXFCC••1 Connection Cables

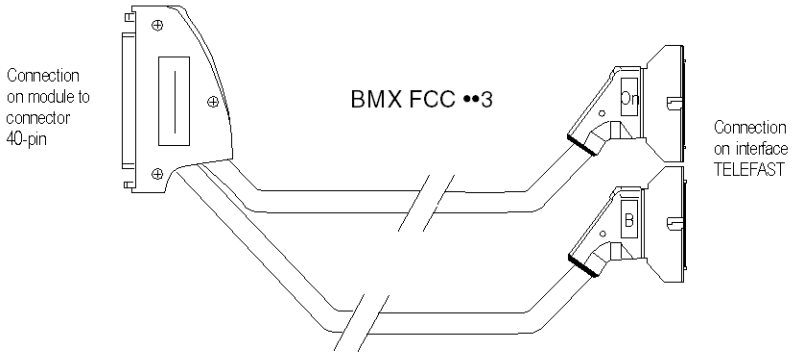
The cables designed for connecting 40-pin connectors to 1xHE10 come in 6 different lengths:

- 0.5 meters, 20 wires: BMXFCC051
- 1 meter, 20 wires: BMXFCC101
- 2 meters, 20 wires: BMXFCC201
- 3 meters, 20 wires: BMXFCC301
- 5 meters, 20 wires: BMXFCC501
- 10 meters, 20 wires: BMXFCC1001



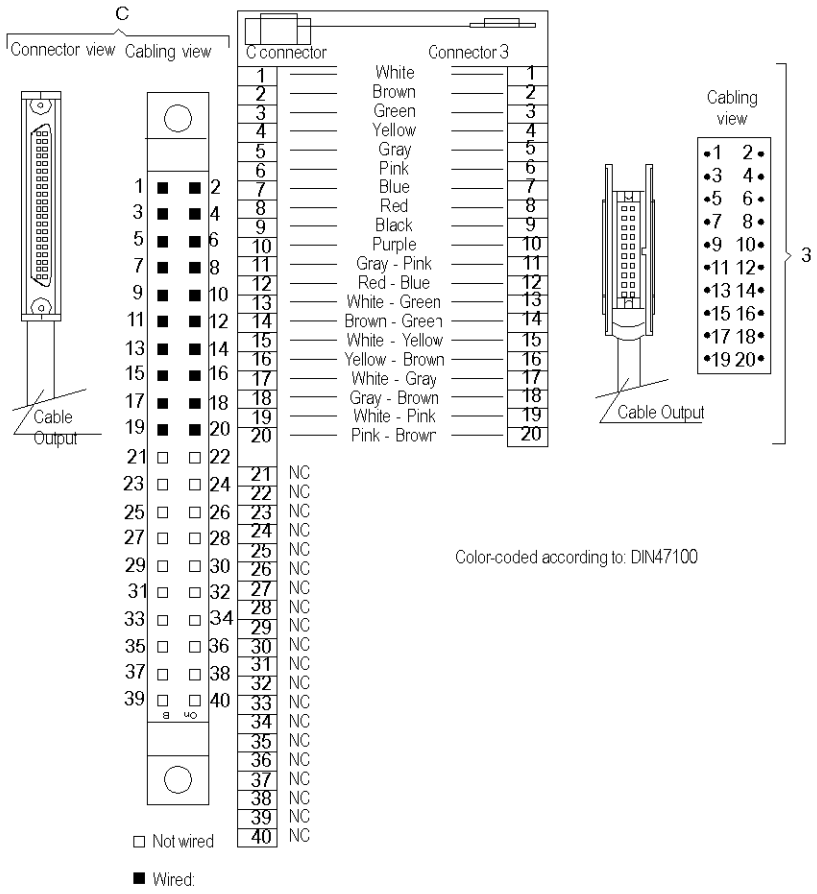
The cables designed for connecting 40-pin connectors to 2xHE10 come in 6 different lengths:

- 0.5 meters, 20 wires: BMXFCC053
- 1 meter, 20 wires: BMXFCC103
- 2 meters, 20 wires: BMXFCC203
- 3 meters, 20 wires: BMXFCC303
- 5 meters, 20 wires: BMXFCC503
- 10 meters, 20 wires: BMXFCC1003

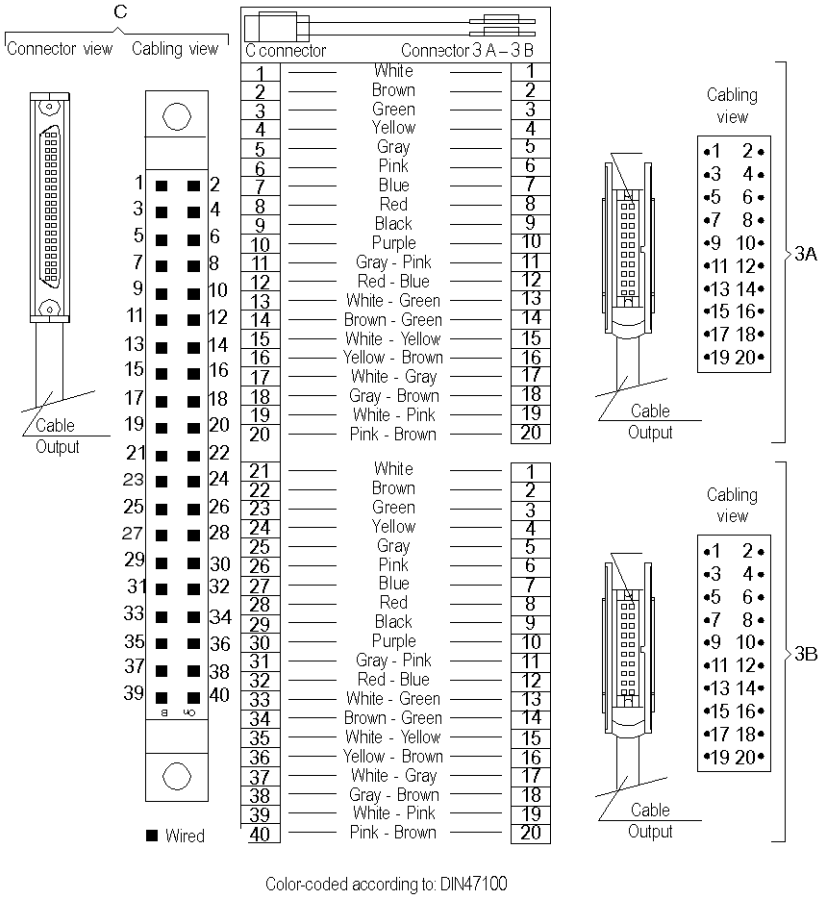


BMXFCC••1 Cable Connection

The diagram below shows the connection of BMXFCC••1 cables.



The diagram below shows the connection of BMXFCC••3 cables.



NOTE: The maximum torque for tightening BMXFCC••• cable connection screws is 0,5 N•m (0.37 lb-ft).

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Do not exceed the maximum tightening torque. Excessive torque may result in wire breakage, resulting in poor or intermittent connection.

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

BMXFCC••• Cables Characteristics

This table presents the general characteristics:

Characteristics		**Values**
Cable	Sheath material	PVC
	LSZH status	No
Conductor description	Number of conductors	• 20 for BMXFCC••1 • 40 for BMXFCC••3
	Gauge	0.34 mm^2 (22 AWG)
	Material	Tinned copper
Environmental	Operating temperature	-25...70 °C (-13....158 °F)
Applicable standards		DIN47100

General Protective Measures

At a Glance

Some general protective measures are integrated into the channels of discrete input/ouput direct current modules.

DC Outputs

Every static output (except where specifically labeled "Non-Protected"), features a protective device which allows the following to be detected when an output is active:

- **An overload or short circuit**. Events such as these cause the output to be deactivated (tripped) and the event to be indicated on the display on the front panel of the module (the LED corresponding to the channel flashes, the **I/O** LED comes on).
- **Reversal of polarity**. An event such as this causes the power supply to short circuit without damaging the module. In order to obtain optimal protection, install a quick-blow fuse on the power supply and upstream from the pre-actuators.
- **Inductive overvoltage**. Each output is individually protected against inductive overvoltage and has a fast electro-magnet demagnetization circuit using a zener diode which allows the mechanical cycle of certain fast machines to be reduced.

DC Inputs

24 VDC and 48 VDC inputs are of constant current type. The input current is constant for a voltage greater than:

- 15 V for 24 VDC inputs
- 25 V for the 48 VDC inputs

This characteristic has the following advantages:

- guaranteed minimum current in active state in accordance with IEC standards
- limited consumed current when input voltage increases, to avoid the module overheating unnecessarily
- reduced consumed current to the power supply sensor supplied by the controller power supply or a process power supply

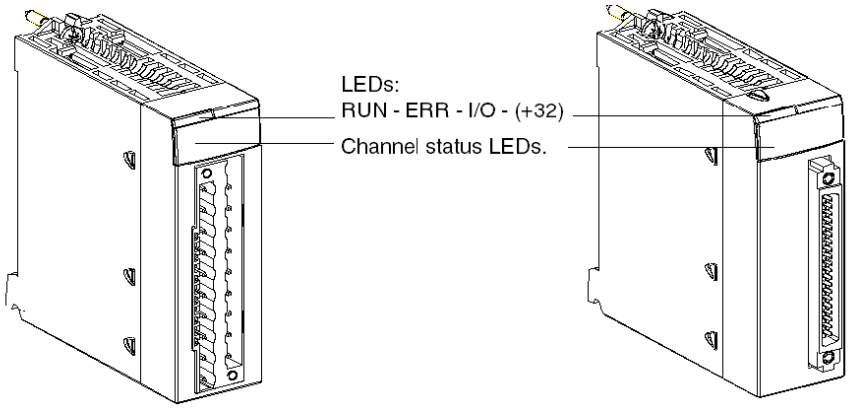
Module and Channel Status Display

Introduction

Discrete I/O modules are equipped with a display block featuring LEDs that displays the module’s channel status and the overall module status.

Illustration

The following figure shows the position of the channel status display LEDs as well as the 3 (or 4) module status LEDs, on the front panel of the discrete I/O modules.



Description

The following table explains how the LEDs located on the discrete I/O display block operate.

LEDs	**Continually Lit** ●	**Flashing** ⊗	**Off** ○
RUN (green)	module operating normally	N/A	module inoperative or off
ERR (red)	internal event: Module analysis needed	Communication loss between the discrete module and the controller	no detected internal error
I/O (red)	external event: overload, short circuit, sensor/pre-actuator voltage error	Terminal block incorrectly wired	no detected external error
+32 Green	selection of channels 32 to 63	N/A	selection of channels 0 to 31
Chan-nel status	channel at 1	channel error, overload, short circuit, or open wire detected(1)	channel at 0

(1) When channel status is open wire detected, the flashing timing is the following:

- 64 ms ON
- 64 ms OFF
- 64 ms ON
- 2000 ms OFF

NOTE: The **+32** LED is only present on the 64-channel modules. It is enabled/disabled with a push-button located on the top of the module. By default, the first 32 channels are displayed.

NOTE: For a mixed input/output module, the first line of channel status LEDs represents the inputs (for example, for a mixed 16 input/16 output module, LEDs 0 to 15 represent the inputs and LEDs 16 to 31 represent the outputs).

NOTE: After the sensor power outage, the I/O (red) LED of the following modules switch on and the last recorded position of the sensor is displayed by the input channel status LED's:

- BMXDDI1602
- BMXDDI1603
- BMXDDI1604T
- BMXDDI3202K
- BMXDDI6402K
- BMXDDM16022
- BMXDDM3202K
- BMXDDM16025

⚠WARNING

CHANNEL LED INFORMATION NOT MATCHING SENSORS POSITION

After a sensor power outage:

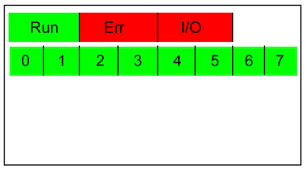
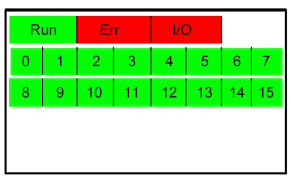
- The I/O error LED is on.
- Do not take into account the input LEDs information. (They show the last recorded position of the sensors, not their real positions.)
- Check the real positions on the sensors.

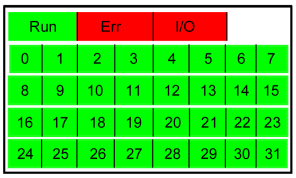
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Display Panels

When a voltage is present on an input or output, the corresponding LED is lit.

Display of internal or external events is only effective once the module has been configured. After powering-up or a cold start, all the LEDs flash twice (for 2 seconds) to show that the module is operational. When an event is detected, the channel status is recorded until the cause of the event is cleared.

Modules	Display Panel illustration	Description
BMXDAI0805 BMXDAI0814 BMXDRA0804T BMXDRA0805 BMXDRA0815 BMXDRC0805		These modules have: • 3 module status LEDs: **RUN** - **ERR** - **I/O** • 8 channel status LEDs
BMXDDI1602 BMXDDI1603 BMXDDI1604T BMXDAI1602 BMXDAI1603 BMXDAI1604 BMXDAI1614 BMXDAI1615 BMXDDO1602 BMXDDO1612 BMXDRA1605		These modules have: • 3 module status LEDs: **RUN** - **ERR** - **I/O** • 16 channel status LEDs

Modules	Display Panel illustration	Description
BMXDAO1605 BMXDAO1615		
BMXDDI3203 BMXDDI3232 BMXDDI3202K BMXDDO3202 BMXDDO3202K BMXDDM3202K BMXDDM16022 (1) BMXDDM16025 (1)		These modules have: • 3 module status LEDs: **RUN** - **ERR** - **I/O** • 32 channel status LEDs
BMXDDI6402K BMXDDO6402K		These modules have: • 3 module status LEDs: **RUN** - **ERR** - **I/O** • a **+32** LED to display channels 32 to 63 • 32 channel status LEDs • a switch to display channels 32 to 63
(1) The BMXDDM16022 and BMXDDM16025 mixed input/output modules have 2 groups of 8 channels. The input group is represented by channels 0 to 7 and the output group is represented by channels 16 to 23.		

There are several display blocks depending on the type of discrete I/O module.

Diagnostics

At a Glance

The diagnostics function detects any conditions that may affect module operation. Three diagnostic groups can be identified:

- internal events
- external events
- other events

Internal Events

Internal events concern all internal module conditions and all communication loss occurrences that prevent a discrete input/output module from operating correctly.

A communication loss can be caused by:

- a hardware detected fault at rack bus level
- a processor malfunction or power cable circuit open or short
- a power cable circuit open or short

External Events

External events include:

- **Overload and Short-Circuit**: Static output modules contain a device for checking the load status. In the event of an overload or short-circuit of one or more outputs, they are tripped to open circuit. The status will be shown on the front panel of the module - the LEDs corresponding to the tripped outputs will flash and the red **I/O** LED will light up.
- **Detected Sensor Voltage Error**: All input modules contain a device for checking sensor voltage for all module channels. This device checks that sensor and module power supply voltages are of a sufficiently high level for correct operation of the module's input channels. When sensor voltage is less than or equal to the defined threshold, the status is shown by the **I/O** LED lighting up on front panel of the module.
- **Detected Pre-actuator Voltage Error**: All 24 VDC and 48 VDC transistor output modules contain a device for checking the pre-actuator voltage of all module channels. This device checks that pre-actuator and module power supply voltages are of a sufficiently high level for correct operation of the module's output channels. Confirm that this voltage is greater than 18 V (24 VDC supply) or 36 V (48 VDC supply) for modules with direct current static outputs. In the event of pre-actuator voltage being less than or equal to this threshold, the error is shown by the **I/O** LED lighting up on the front panel of the module.
- **Open wire Error**: Some modules (for example BMXDAI1614/DAI1615) can detect the open wire error by checking the leakage current in the loop. In order to get the appropriate leakage current, an external resistor might be required. See details in the characteristic page of the specific module.

  NOTE: The sensor/pre-actuator voltage check is unique to terminal block modules. In 32 or 64-channel connector modules, there is one checking device per connector (equivalent to one per group of 16 channels).

  A sensor or pre-actuator voltage error leads to all the inputs and outputs of the group affected by the error (i.e. groups of 8 or 16 channels for a terminal block module and the group of 16 channels for a 32 or 64-channel connector module) to be set to inactive.

  NOTE: Relay output modules do not contain pre-actuator voltage checking devices.

Other Events

The category of other detected errors includes loss of power to the modules.

Description

The following table can be used to determine the module's status on the basis of the LEDs located on the discrete input/output modules' display panel.

State of module		**LEDs**		
		RUN (green)	**ERR (red)**	**I/O (red)**
Normal operation		●	○	○
Internal events	Module analysis needed	○	●	○
	Controller communication interruption	●	⊗	○
External events	Overload, short circuit, sensor/ pre-actuator voltage error, open wire	●	○	●
Configuration	Self-test of the module at start-up	⊗	⊗	⊗

State of module		LEDs		
		RUN (green)	ERR (red)	I/O (red)
	Not configured module	○	⊗	○
Other events	Module loss of power	○	○	○
Key:				
●		LED on		
⊗		LED flashing		
○		LED off		

NOTE: After the sensor power outage, the I/O (red) LED of the following modules switch on and the last recorded position of the sensor is displayed by the input channel status LED's:

- BMXDDI1602
- BMXDDI1603
- BMXDDI1604T
- BMXDDI3202K
- BMXDDI6402K
- BMXDDM16022
- BMXDDM3202K
- BMXDDM16025

After a sensor power outage, the I/O error LED is on.

⚠WARNING

CHANNEL LED INFORMATION NOT MATCHING SENSORS POSITION

- Do not take into account the input LED information, which shows the last recorded position of the sensors, not their real positions.
- Check the real positions on the sensors.

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

Checking the Connection

At a Glance

In order to check the discrete I/O connection, confirm that:

- Sensor data is registered by the corresponding inputs and by the processor.
- Control orders from the processor are registered by the outputs and transmitted to the corresponding pre-actuators.

Active outputs can activate machine movements.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

All power must be turned off before this check is carried out:

1. Remove power fuses from the motor controls.

2. Turn off the power of hydraulic and pneumatic units.

3. Power up the PAC fitted with its discrete I/O modules.

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

Description

After this, it is possible to check the connection of the discrete I/O modules:

- **without a terminal**: Activate each sensor and check whether the corresponding input LED changes. If it remains unchanged, check the wiring and correct operation of the sensor.
- **with a terminal** (more in-depth check on the connection of the inputs/outputs). An application with configured I/Os in the PAC is required, even if it is empty.
  - This check can be carried out with the PAC in **RUN** mode, from a PC equipped with software that gives access to force/adjust functions.
  - This check can also be carried out with an entire application loaded in the memory. In this case, stop the processing of the program.

Input Check

The following table shows the procedure for checking input connections.

Step	Action
1	Activate each sensor and check that the corresponding input LED changes status.
2	Check on the terminal screen that the corresponding input bit also changes status.

Output Check

The following table shows the procedure for checking output connections.

Step	Action
1	From the terminal, set each bit that corresponds to an output to 1 then 0.
2	Check that the corresponding output LED turns on then off and that the corresponding pre-actuator activates then de-activates.

Discrete Input/Output Module Availability

What's in This Chapter

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Discrete Input Module Parameters

Introduction

The discrete input module includes different parameters per channel. The channels are divided into blocks of 8 or 16 consecutive channels.

Input Parameters

The following table displays the parameters available for each in-rack discrete input module.

Reference module	Number of Inputs	Function (8-channel group)	Supply monitoring (16-channel group)	Wiring check (input by input)
BMXDAI0805	8	**Discrete inputs**	**Active** / Inactive	–
BMXDAI0814	8	**Discrete inputs**	–	–
BMXDAI1602(H)	16	**Discrete inputs** / None	**Active** / Inactive	–
BMXDAI1603(H)	16	**Discrete inputs** / None	**Active** / Inactive	–
BMXDAI1604(H)	16	**Discrete inputs** / None	**Active** / Inactive	–
BMXDAI1614	16	**Discrete inputs** / None	**Inactive** / Active	**Inactive** / Active
BMXDAI1615	16	**Discrete inputs** / None	**Inactive** / Active	**Inactive** / Active
BMXDDI1602(H)	16	**Discrete inputs** / None	**Active** / Inactive	–
BMXDDI1603(H)	16	**Discrete inputs** / None	**Active**/ Inactive	–
BMXDDI1604T	16	**Discrete inputs** / None	**Active** / Inactive	–
BMXDDI3202K(H)	32	**Discrete inputs** / None	**Active** / Inactive	–
BMXDDI3203	32	**Discrete inputs** / None	**Active** / Inactive	–
BMXDDI3232	32	**Discrete inputs** / None	**Active** / Inactive	–
BMXDDI6402KH	64	**Discrete inputs** / None	**Active** / Inactive	–
BMXDDM16022(H) [1]	8	**Discrete inputs**	**Active** / Inactive	–
BMXDDM16025(H) [1]	8	**Discrete inputs**	**Active** / Inactive	–

Reference module	Number of Inputs	Function (8-channel group)	Supply monitoring (16-channel group)	Wiring check (input by input)
BMXDDM3202K [1]	16	**Discrete inputs** / None	**Active** / Inactive	–

[1] The BMXDDM16022(H), BMXDDM16025(H), and BMXDDM3202K discrete mixed input/output modules have two groups of eight channels. The input group is represented by channels 0 to 7, and the output group is represented by channels 16 to 23.

NOTE: Parameters indicated in bold characters are part of the default configuration.

Discrete Output Module Parameters

Introduction

The discrete output module includes different parameters per channel. The channels are divided into blocks of 8 or 16 consecutive channels.

Output Parameters

The following table displays the parameters available for each in-rack discrete output module.

		8-channel group			16-channel group	Channel by channel
Reference module	**Number of outputs**	**Reset**	**Fallback mode**	**Function**	**Supply monitoring**	**Fallback value**
BMXDAO1605	16	Automatic	**Fallback** / maintain	**Discrete outputs** / none	**Active** / inactive	**0** / 1
BMXDAO1615	16	Automatic	**Fallback** / maintain	**Discrete outputs** / none	**Active** / inactive	**0** / 1
BMXDDM16022 [1]	8	Automatic	**Fallback** / maintain	**Discrete outputs** / none	**Active** / inactive	**0** / 1
BMXDDM16025 [1]	8	-	**Fallback** / maintain	**Discrete outputs** / none	**Active** / inactive	**0** / 1
BMXDDM3202K [1]	16	Automatic	**Fallback** / maintain	**Discrete outputs** / none	**Active** / inactive	**0** / 1
BMXDDO1602	16	Automatic	**Fallback** / maintain	**Discrete outputs** / none	**Active** / inactive	**0** / 1
BMXDDO1612	16	Automatic	**Fallback** / maintain	**Discrete outputs** / none	**Active** / inactive	**0** / 1
BMXDDO3202	32	Automatic	**Fallback** / maintain	**Discrete outputs** / none	**Active** / inactive	**0** / 1
BMXDDO3202K	32	Automatic	**Fallback** / maintain	**Discrete outputs** / none	**Active** / inactive	**0** / 1
BMXDDO6402K	64	Automatic	**Fallback** / maintain	**Discrete outputs** / none	**Active** / inactive	**0** / 1
BMXDRA0804T	8	-	**Fallback** / maintain	**Discrete outputs**	-	**0** / 1
BMXDRA0805	8	-	**Fallback** / maintain	**Discrete outputs**	-	**0** / 1
BMXDRA0815	8	-	**Fallback** / maintain	**Discrete outputs**	-	**0** / 1
BMXDRA1605	16	-	**Fallback** / maintain	**Discrete outputs** / none	-	**0** / 1
BMXDRC0805	8	-	**Fallback** / maintain	**Discrete outputs**	-	**0** / 1

[1] The BMXDDM16022(H), BMXDDM16025(H), and BMXDDM3202K discrete mixed input/output modules have two groups of eight channels. The input group is represented by channels 0 to 7, and the output group is represented by channels 16 to 23.

NOTE: Parameters indicated in bold characters are part of the default configuration.

Configuration of Discrete Module Parameters

Introduction

This section presents general rules for implementing various configuration parameters for discrete input/output channels.

How to Modify the External Power Supply Error Monitoring Parameter

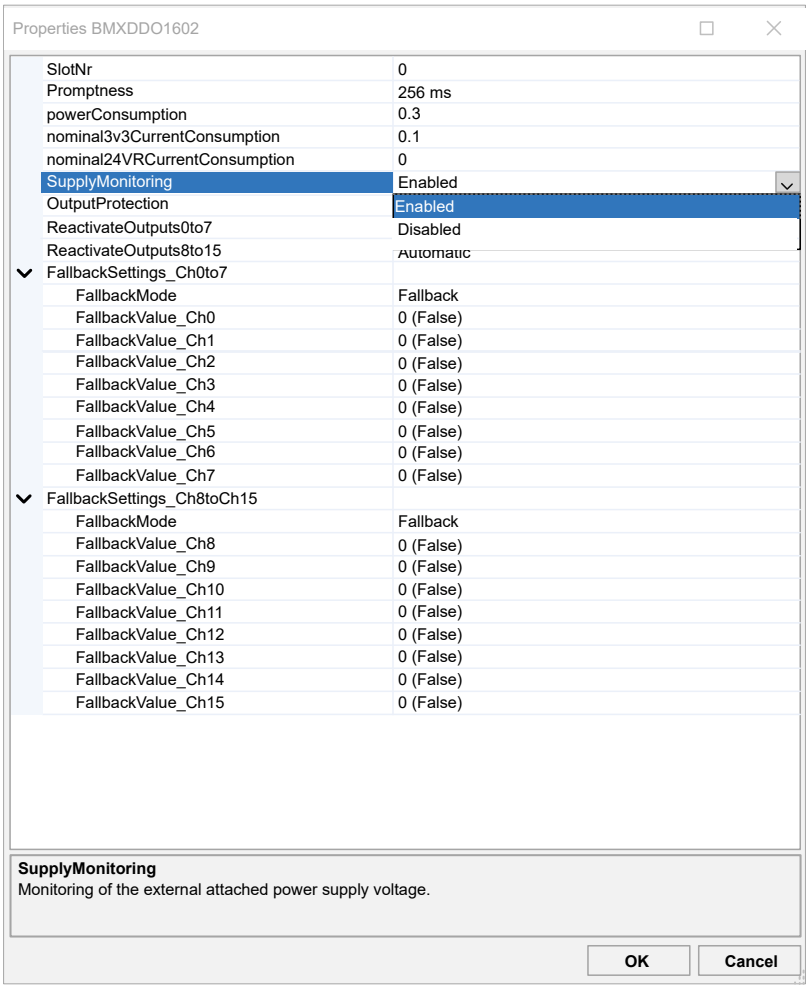
Introduction

The external power supply error monitoring parameter, which runs in groups of 16 consecutive channels, describes the status (activation or deactivation) of the power supply errors and is activated by default.

Procedure

The following table describes how to disable or enable the external power supply monitoring function.

Step	Action
1	Access the hardware configuration screen for the appropriate module.
2	Right-click **Module Properties** to configure.
3	**Result**: The **Supply Monitoring Parameters** dialog box appears.

Step	Action
	
4	Click the arrow of the pull-down menu to enable or disable this function.
5	Confirm your changes by clicking on **OK**

How to Modify the Fallback Mode Parameter

Introduction

The fallback mode parameter describes the fallback mode adopted by outputs when the PAC switches to **STOP** mode due to one of the following:

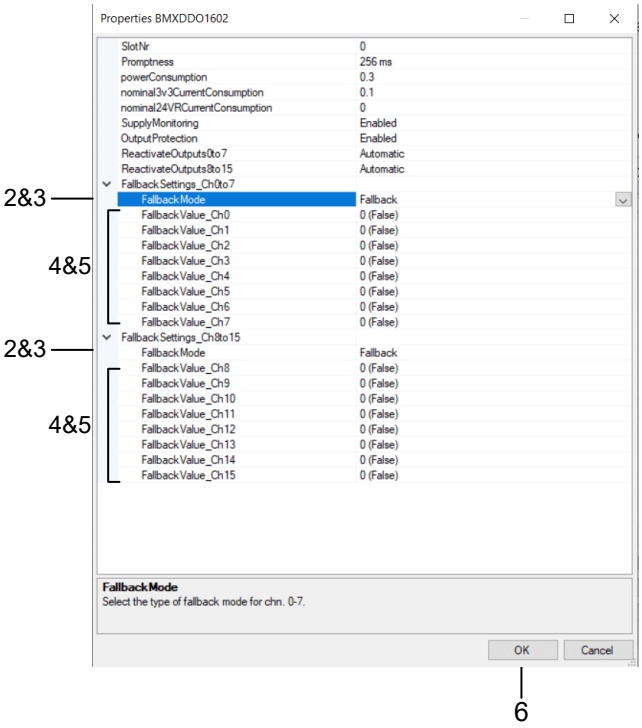
- a detected processor error
- a detected rack connection error
- a detected inter-rack cable connection error
- a STOP command

The parameters are as follows:

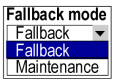
Mode	Meaning
Fallback	Channels are set to 0 or 1 according to the defined fallback value for the corresponding 8-channel group.
Maintenance	The outputs remain in the status they were in before switching to **Stop** mode .

NOTE: The fallback settings apply to a group of channels of the same logical node. For example, fallback settings cannot be applied separately for channels 0 and 1, which belong to the same logical node. However, channel 0 and channel 8 can have different fallback settings.

Procedure



The following table describes the procedure for defining the fallback mode and assigning it to a channel group.

Step	Action
1	Open the desired module configuration screen.
2	For the desired channel group, click the drop-down arrow of the **Fallback mode** menu. **Result** : The following list appears.  **NOTE: Fallback mode** applies to eight channels in the channel group (for discrete modules in this example).
3	Select the desired fallback mode.
4	For **Fallback mode** , configure each channel of the selected group. To do this, click the drop-down arrow of the channel menu you wish to configure, which is located in **Fallback Value_Ch XX** .
5	Click the desired value (0 or 1).
6	Confirm the modification by clicking **OK**.

How to Modify the Output Reset Parameter

Introduction

This parameter defines the reactivation mode of disconnected outputs.

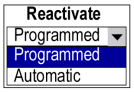
The modes are as follows.

Mode	Meaning
Programmed	Reactivation is executed with a command from the controller application or through the appropriate debug screen. **Remark**: In order to avoid repeated reactivations, the module ensures an automatic 10s delay between two resets.
Automatic	The reactivation is executed automatically every 10s until the error disappears.

The reactivation mode is defined for 8-channel groups.

Procedure

The following table shows the procedure for defining the module output channel reset mode.

Step	Action
1	Open the desired module configuration screen.
2	For the desired channel group, click on the arrow of the **Reactivate** drop-down menu. **Result** : The following list appears. 
3	Select the required reactivation mode.
4	Validate the modification by clicking **Edit** > **Confirm**.

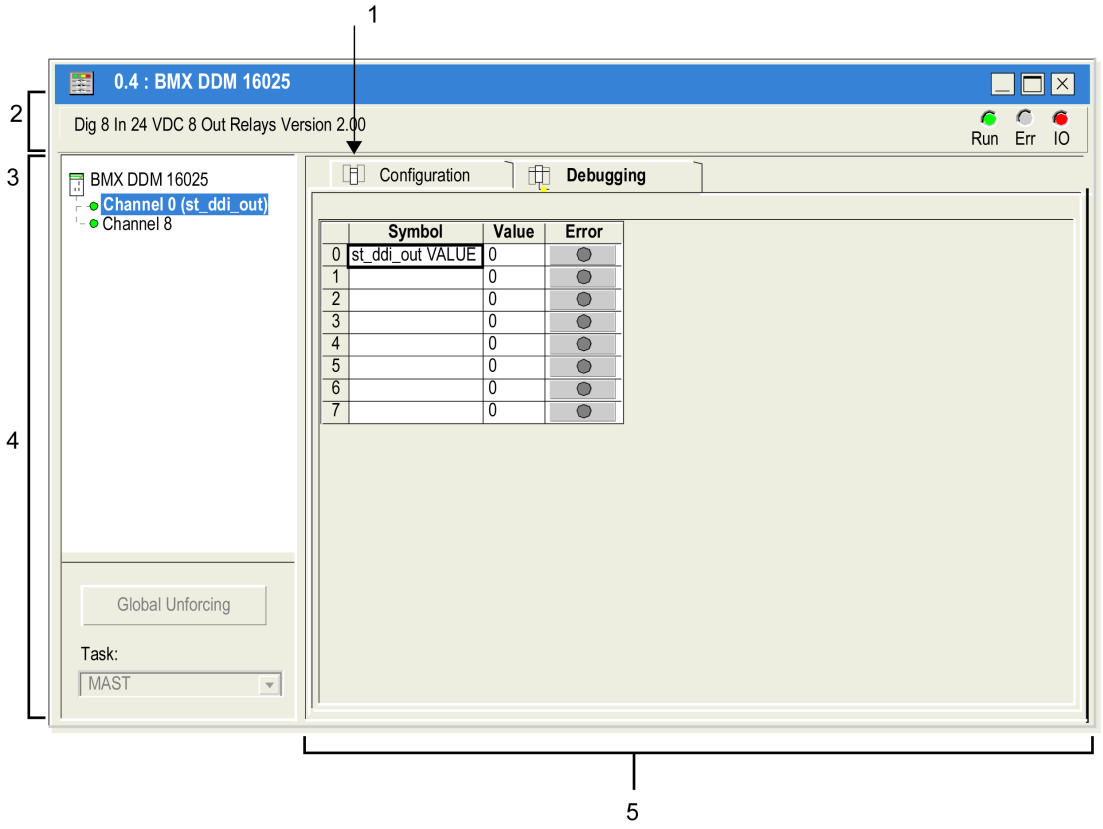
How to Debug Discrete Input/Output Channels

Introduction

The debugging screen describes, in real time, the value and state of each channel of the selected module. It also allows access to the channel commands (forcing of the input or output value, reactivation of outputs, etc.).

Illustration

The following figure shows a sample debugging screen.



Description

The following table shows the various parts of the debugging 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	Contains the abbreviated title of the module. In the same area there are three LEDs which indicate the module's operating mode: • **RUN** indicates the operating status of the module. • **ERR** indicates an internal event in the module. • **I/O** indicates an event from outside the module or an application issue.
3	**Channel** area	Allows you to: • Display the tabs by clicking on the reference number: ◦ **Description** provides the characteristics of the device. ◦ **I/O Objects** is used to pre-symbolize the input/output objects ◦ **Fault** shows the device status (in on-line mode). • Select a channel. • Display the **Symbol**, name of the channel defined by the user (using the variable editor).

Number	Element	Function
4	**General parameters** area	Specifies the parameters of the channel: • **Function:** Specifies the function configured. This heading is frozen. The **Global unforcing** button provides direct access to the global unforcing of channels function.
5	**Parameters in progress** field	This field displays the state of inputs and outputs and the various current parameters. For each channel, four items of information are available: • **Symbol** displays the symbol associated with the channel when it has been defined by the user (using the variable editor). • **Value** displays the state of each channel of the module. • **Error** provides direct access to channel by channel diagnostics when these are inoperable (indicated by the LED built into the diagnostics access, which turns red).

How to Access the Forcing/Unforcing Function

At a Glance

This function allows you to modify the state of all or part of the channels of a module.

The various commands available are:

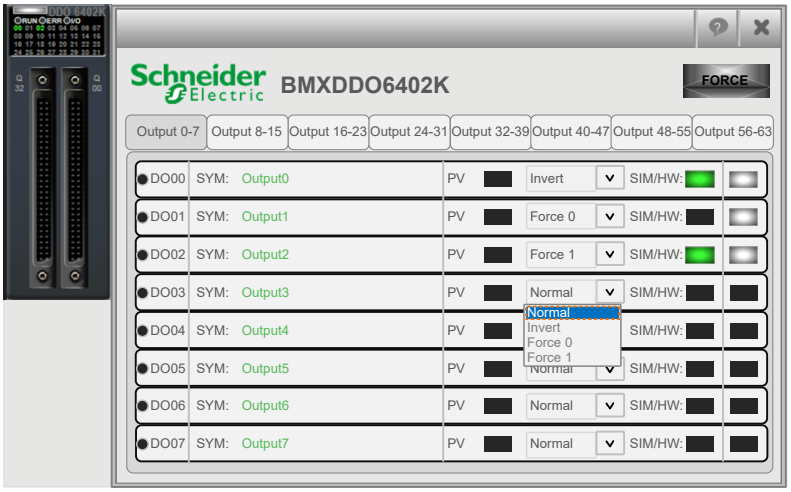
- Normal (by default)
- Invert
- Force 0
- Force 1

Procedure

Forcing / Unforcing values can be done in two ways:

- Using the Watch / Force application of symLink function block.

- Using the HMI and faceplate HMI of the module.

Step	Action for all channels
1	Open the HMI. 
2	Click the arrow of the pull-down menu and select the desired state.

NOTE: Using **FORCE** button, all channels states will be unforced and changed to **Normal**.

How to Access the Reactivation of Outputs Command

At a Glance

When an event has caused a tripped output, a command is used to reactivate the output if no error is detected at its terminals.

Reset is defined by a group of 8 channels. It has no effect on an inactive channel or channel without a detected error.

Procedure

The following table shows the procedure for reactivating tripped outputs.

Step	Action
1	Access the module's debugging screen.
2	For the chosen group of channels, click the **Reset** button situated in the **General parameters** field.

How to Access the Diagnostics Function

At a Glance

When an error is detected in a discrete input/output module, the following events are possible:

- **Internal events**:
  - module inoperable
  - self-tests running
- **External events**
- **Other events**:
  - configuration error
  - module missing or off
  - inoperative channel(s)

Procedure

Debugging can be done in two ways:

- Using the HMI and faceplate HMI of the module.

Step	Action
1	Open the HMI.
2	A detected error is indicated on the module LEDs: **I/O** and/or **ERR** 

- Using VTQ quality for a specific channel.

Step	Action
1	Using EcoStruxure Automation Expert, open the Hardware configuration screen.
2	Watch the quality code. The quality code is posted in the VTQ structure of the value. **Quality Code** / **Description** 0000 0000 / Good 8000 0000 / Error 4000 0000 / Undefined 0096 0000 / Good and Forced

How to Access the Channel Diagnostics Function of a Discrete Module

Introduction

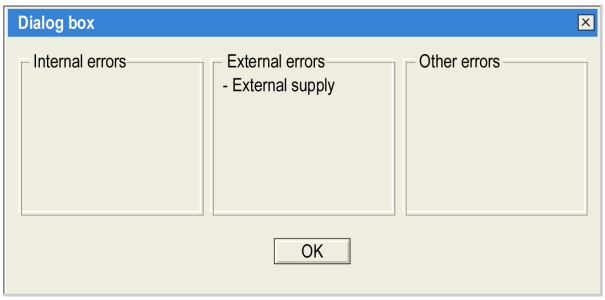
The **Channel diagnostics** function displays current errors and where they exist. Errors are classified according to their category:

- **Internal events**:
  - inoperative channel
- **External events:**
  - link or sensor supply fault
- **Other events:**
  - terminal block incorrectly wired
  - configuration error
  - communication interruption

A channel error appears in the **Debug** tab when the  LED, located in the **Error** column, turns red.

Procedure

The following table shows the procedure for accessing the **Channel error** screen.

Step	Action
1	Access the module's debugging screen.
2	Click the button  situated in the **Error** column of the inoperative channel. **Result**: The list of channel errors appears.  **Note:** Channel diagnostics information can also be accessed by program using the `READ_STS` instruction.

Applied Outputs of a Discrete Module

Introduction

This check (red **Stop** LED lit) informs the user that a given group of output channels is not correctly applied by the PAC (fallback status).

The possible causes are:

- processor error
- rack connection error

- inter-rack link connection error

Modicon X80 Remote I/O Adapter Module

What’s in This Part

BMECRD0100 Adapter Module 453

BMECRD0100 Adapter Module

What's in This Chapter

Module Description 453
LED Indicators 455
Ethernet Port LEDs 460
Configuring the Adapter Module 461
Modicon X80 I/O Modules 464
Operating States 466
Debugging and Diagnostics 467

Introduction

This bookmap describes the BMECRD0100 adapter module that can be used in a remote I/O drop in a Modicon M580 dPAC high availability system. The topics describe the module's physical description, module LEDs, Ethernet port LEDs, and agency specifications of the module.

Module Description

Introduction

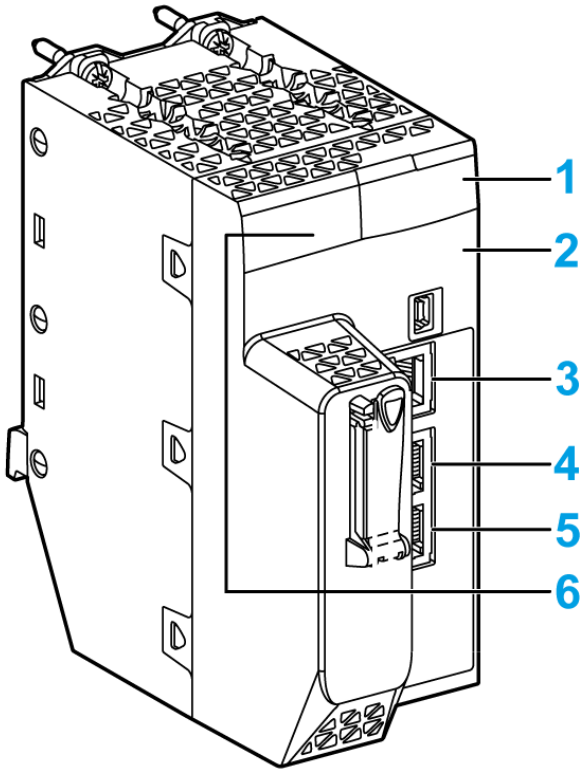
Use a BMECRD0100 adapter module to communicate with remote I/O modules in an EcoStruxure Automation Expert high availability configuration, which uses an HA Soft_dPAC. The adapter module itself does not offer redundancy.

The module is installed on a remote drop that consists of one or two Ethernet backplanes and supports Ethernet and X Bus communication.

The module supports:

- An extended backplane
- Service port functionality
- Native time stamping with the controller
- Ethernet I/O modules on backplane slots in the remote drop, such as the BMEAHI0812 and BMEAHO0412 HART-compatible analog modules

Physical Description



Item	Marking	Description
1	–	LED display for controller status and diagnostics
2	**Eth MAC Address** **xx.xx.xx.xx.xx.xx**	Media Access Control (MAC) address assigned to the controller
	IP Adress	Blank space for you to write the IP address assigned to the controller **NOTE:** The default IP address starts with 10.10 and uses the last 2 bytes of the MAC address.
3	**Service**	RJ45 Ethernet connector for service port functionality
4	**Dual Port/Device Network**	Dual RJ45 Ethernet connectors that support distributed equipment and remote I/O modules **NOTE:** Device Ports are tagged with VLAN. Devices unable to handle VLAN tags cannot establish connection to device port.
5		
6	—	QR code

RIO Drop Maximum Configuration

The following table describes the maximum number of channels in a remote drop with a BMECRD0100 module:

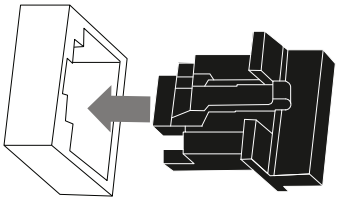
RIO module	Maximum number of channels			
	Discrete	Analog	Specific	Sensor bus
BMECRD0100	1024	256	36	–

Functionality

The BMECRD0100 module exchanges data through the BM_RIO service:

- The input data from the RIO drop is collected and published to the BM_RIO service.
- The output modules are updated with the data received from the BM_RIO service.
- The protocol used for exchange is UDP.
- The exchanges are deterministic, which means that the RIO logic is scanned regularly in a scheduled and predictable manner.

NOTE: Insert dust covers into the unused Ethernet ports on the adapter modules:



Altitude Operating Conditions

Refer to the Operating and Storage Conditions topic in the Modicon M580, M340, and X80 Platforms, Standards, and Certifications for the operating conditions of theBMECRD0100 module when used at an altitude up to 2000 m (6560 ft). When the module operates above 2000 m (6560 ft), apply additional derating.

LED Indicators

LED Panel

An HMI screen lets you see and interact with the BMECRD0100 adapter module and the status of various components through LED indicators, ensuring everything is working as it should. The following graphic displays the BMECRD0100 module LED panel on the front of the module:



LED Conditions

The following table illustrates the LED indicator pattern symbols. These symbols are used to describe the LED patterns according to the different operating modes and Ethernet port's LED status, in the following tables.

Symbol	Description	Symbol	Description
	Steady Green		Flashing Green
	Steady Red		Flashing Red
	Steady Orange		Flashing Orange
	Steady Yellow		Off

LED patterns according to operating mode :

Operating mode	LED's name	Run LED	I/O LED	MS LED (module status)	NS LED (network status)	DL LED	Secure LED
	LED's Color	Green	Red	Green / Red / Orange	Green / Red / Orange	Green	Green / Red / Orange
Power off							
Power on	Phase 1						
	Phase 2 : All LEDs ON						
	Phase 3: All LEDs OFF						
	Phase 4						

Operating mode	LED's name	Run LED	I/O LED	MS LED (module status)	NS LED (network status)	DL LED	Secure LED
	LED's Color	**Green**	**Red**	**Green / Red / Orange**	**Green / Red / Orange**	**Green**	**Green / Red / Orange**
IO Data communication not established (**not configured**)	Out Of Box / No Conf						 CS not configured
	CLEAN state						 CS configured
IO Data communication established (**configured**)	STOP state				 EIP configured  EIP not configured		 CS configured
	RUN state				 EIP configured  EIP not configured		 CS configured

Operating mode	LED's name	Run LED	I/O LED	MS LED (module status)	NS LED (network status)	DL LED	Secure LED
	LED's Color	**Green**	**Red**	**Green / Red / Orange**	**Green / Red / Orange**	**Green**	**Green / Red / Orange**
Detected error states	Recoverable error						-
	Non recoverable error						 CS not configured  CS configured
	Duplicate IP address	-	-			-	-
	Plugged in any other slot than 0 or 1. Refer to **PLCRED-556 Authenticate** to see issue details						

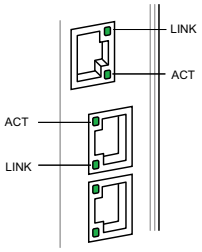
Operating mode	LED's name	Run LED	I/O LED	MS LED (module status)	NS LED (network status)	DL LED	Secure LED
	LED's Color	Green	Red	Green / Red / Orange	Green / Red / Orange	Green	Green / Red / Orange
OS Firmware Update	Phase 1 (from NO CONF or CLEAN)						 CS not configured  CS configured
	Phase 1 (from STOP)				 If EIP configured  If EIP not configured		 CS configured
	Phase 1 (from Recoverable error)						 CS configured
	Phase 2						Depends on configura-tion (ON, OFF, flashing, red, green)
	Phase 3						Depends on configura-tion (ON, OFF, flashing, red, green)
	Phase 4						Depends on configura-tion (ON, OFF, flashing, red, green)

Ethernet Port LEDs

Introduction

The BMECRD0100 adapter module used for RIO drops has three 10/100 Base-T Ethernet ports:

Two of the Ethernet ports on the module allow implicit I/O exchanges with the I/O scanner in the controller. (An implicit I/O exchange has a maximum frame size of 1400 bytes.)



Ethernet port's LED status description :

LED's Name	LED's Color	Status	Description
LINK	Green		100 Mbps link detected
	Yellow		10 Mbps link detected
	-		No link detected
ACT	Green		Active Ethernet link (transmit or receive)
	-		Inactive Ethernet link

Port	Description
SERVICE	The SERVICE port allows the diagnosis of Ethernet device network ports and provides access to external tools and devices. The port supports these modes: • access port (default): This mode supports Ethernet communications. • port mirroring: In this mode, data traffic from one of the other 2 ports is copied to this port. This allows a connected management tool to monitor and analyze the port traffic. • disabled
DEVICE NET-WORK	The DEVICE NETWORK ports are used to connect to remote drops and distributed equipment that form simple daisy chain loop. These ports also provide cable redundancy.

⚠CAUTION

ETHERNET CONNECTION NON-OPERATIONAL

Do not connect a device with a speed in excess of 100 Mbit/s to any adapter port.

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

If you connect a device with a speed in excess of 100 Mbit/s to the device network ports, the Ethernet link may not be established between the device and the module.

NOTE: EtherNet/IP explicit messaging is not supported on BMECRD0100 configured with EcoStruxure Automation Expert software version 23.0 or earlier.

Configuring the Adapter Module

Introduction

Use a daisy chain loop network configuration that implements the RSTP service to establish redundant communications with at least one of the two physical paths between:

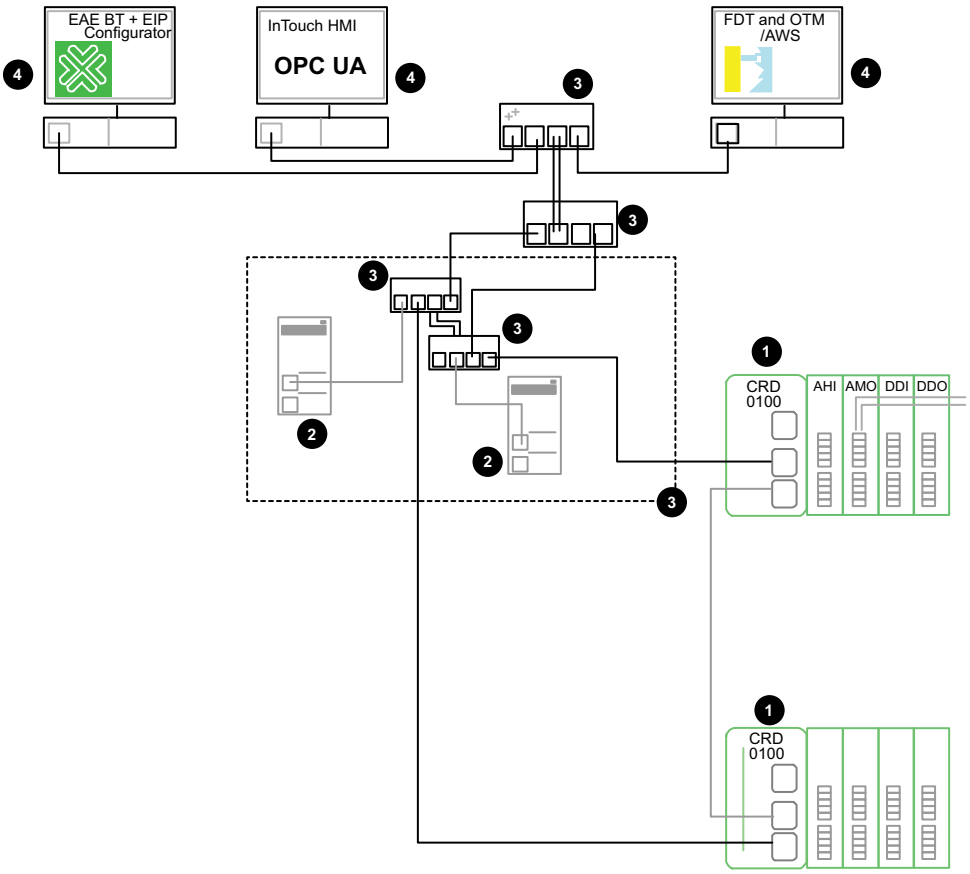
- the I/O scanner
- the adapter modules at each remote drop, dual ring switches (DRSs), or any product that has the capacity to be RIO scanned

For frequently used topology planning with M580, refer to *Modicon M580 Standalone System Planning Guide for Frequently Used Architectures*. For complex topology planning, refer to *Modicon M580 System Planning Guide for Complex Topologies*.

NOTE: Fiber optic ports are not available on the adapter modules. For use of fiber optic cabling in your system to convert copper cable to fiber for distances greater than 100 m (328 ft), use either a BMXNRP020• optic fiber conversion module or a pair of dual-ring switches (DRSs).

RIO Simple Daisy Chain Loop

The following graphic shows how the controller supports communications with RIO drops:



Legend marker	Description
1	Remote drop configured with a BMECRD0100 adapter module to allow for redundancy
2	Dual-ring switch (DRS) connecting the remote drop to the Modicon M580 dPAC
3	HMI device connected to the remote drop through a DRS
4	Control network: • PC running EcoStruxure Automation Expert software • PC monitoring OPC UA functionality • PC configuring devices through Device Type Manager (DTM) / Field Device Technology (FTD)

Configuring RSTP

Select the adapter module in the EcoStruxure Automation Expert configuration.

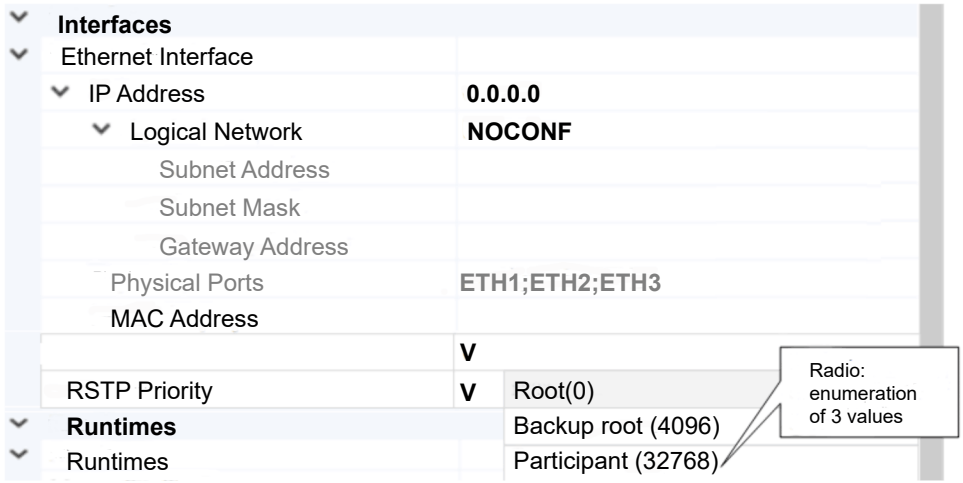
Click the RSTP tab to access the settings and parameters to set the RSTP operation.

Select the module node from the topo manager.

NOTE: Default configuration RSTP Priority set to Root(0), assigns the module the role of the root bridge, meaning it takes precedence over other modules in the network. Root(0) has the lowest bridge priority.

Edit RSTP default settings of module, by selecting the bridge priority ; Root(0), Backup Root (4096), Participant(32768).

NOTE: Changes in RSTP parameters can affect sub-ring diagnostics, I/O determinism, and network recovery time.



A symlink exists in the HW configuration under the controller HWCAT, as illustrated by the image below

BMXBUS			SE.IoX80:BMXBUS
phase	T#0ms		TIME
enableSymlinkOC	FALSE		BOOL
busCycleTime	T#50ms		TIME
busCycleTolerance	10%		UINT
busCycleActionWhenMissed	INFO		UINT
BMEXBP0800			SE.IoX80:BMEXBP0800
BMXCPS3500			SE.IoX80:BMXCPS3500
BMED581020			SE.IoX80:BMED581020
RSTP_REDUNDANCY	“		SE.HwCommon.RSTP_REDUNDANCY_STATUS
NTP_STATUS	“		SE.HwCommon.NTP_STATUS

The functionality maintains uninterrupted service, if a cable is unplugged or severed, by providing distinct indications:

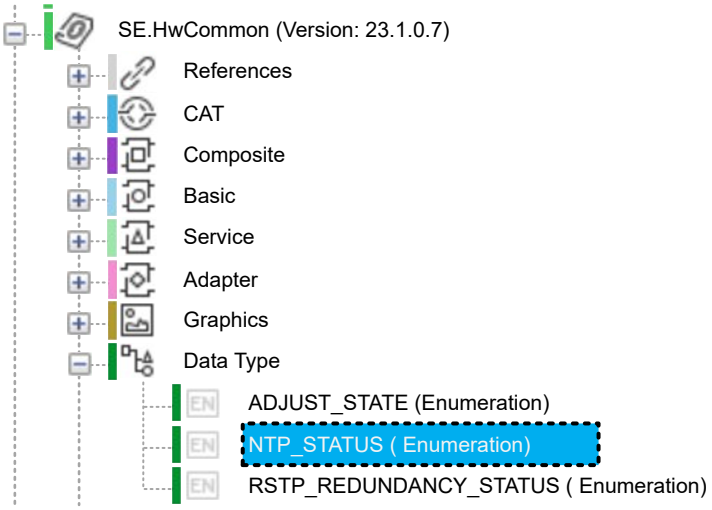
- In a properly wired Ethernet loop, the diagnostic system reports **LOOP_ INTACT**.
- If a cable disconnects within the Ethernet loop, **LOOP_BREAK** is indicated.
- Upon cable reconnection, the diagnostic system promptly switches back to **LOOP_INTACT**.
- When using EAE V23.1 (or later) libraries with a V23.0 (or earlier) firmware that lacks this functionality, an error during deployment notifies the end user of the missing function block.

Configuring NTP

A symLink feature, providing real-time status updates of NTP service, exists in the hardware configuration under the BMED581020 hardware CAT level, as illustrated by the image below :

BMXBUS			SE.IoX80:BMXBUS
phase	T#0ms		TIME
enableSymlinkOC	FALSE		BOOL
busCycleTime	T#50ms		TIME
busCycleTolerance	10%		UINT
busCycleActionWhenMissed	INFO		UINT
BMEXBP0800			SE.IoX80:BMEXBP0800
BMXCPS3500			SE.IoX80:BMXCPS3500
BMED581020			SE.IoX80:BMED581020
RSTP_REDUNDANCY	“		SE.HwCommon.RSTP_REDUNDANCY_STATUS
NTP_STATUS	“		SE.HwCommon.NTP_STATUS

The status, represented by an ENUM, has states and can be accessed via the SE. HwCommon library using a data type namedSE.HwCommon.NTP_ STATUS, in the following graphic:



The four states of the NTP status are :

- **SERVICE_UNAVAILABLE**: When using V23.1 (or later) libraries with V23.0 (or earlier) firmware that lacks this functionality, the diagnostic system reports SERVICE_ UNAVAILABLE to notify the end user of the missing function block
- **NOT_OPERATING**: NTP service has not been started. You are using manual time settings.
- **SYNC_IN_PROGRESS**: NTP service is in the process of starting and is awaiting for synchronization with the server.
- **SYNCHRONIZED**: NTP has successfully started and is synchronized with the NTP server

Modicon X80 I/O Modules

Analog I/O Modules

The following table describes the **X80 analog I/O modules** compatible with the **BMECRD0100 adapter module**.

Compatible analog modules	Module Type	Number of channels	Type of channels	Voltage Current
BMEAHI0812	Input	8	High density isolated fast input Features a dual-channel configuration; supports both **HART** communication protocol and analog signals.	4 - 20 mA
BMXAMI0800	Input	8	High density input with 8 non-isolated channels	+/-5 V, +/-10 V, 0-5 V, 0-10 V, 1-5 V +/-20 mA, 0-20 mA, 4-20 mA
BMEA-HO0412	Output	4	High density output Features a dual-channel configuration; supports both **HART** communication protocol and analog signals.	4 - 20 mA

Compatible analog modules	Module Type	Number of channels	Type of channels	Voltage Current
BMXA-MO0802	Output	8	High density output with 8 non-isolated channels	0...20 mA / 4...20 mA
BMXAM-M0600	Input/Output	6	4 non-isolated inputs and 2 non-isolated outputs	+/-10 V 0-20 mA ,4-20 mA

Discrete I/O Modules

The following table describes the **X80 discrete I/O modules** compatible with the **BMECRD0100 adapter module**.

Compatible discrete modules	Module Type	Number of channels	Type of channels	Voltage Current
BMXDDI3202-K	Input	32	Positive logic static outputs	24 VDC 2.5 mA
BMXDAI0814	Input	8	8 isolated input channels	100...120 VAC 5 mA
BMXDAI1604	Input	16	16 input channels operating on alternating current	100...120 VAC 5 mA
BMXDA-O1605	output	16	16 output channels operatIng on alternating current	100...240 VCA 0.6 A / points
BMXDD-O3202K	output	32	32 positive logic static outputs	24 VDC 0.1 mA
BMXDR-A0805	output	8	8 relay output channels operating on alternating current or direct current	24 VDC or 24...240 VAC
BMXDRA0815	output	8	8 relay output channels operating on alternating current or direct current	5...125 VDC or 24...240 VAC
BMXDRA1605	output	16	16 non-isolated relay output channels operating on alternating current or direct current	24 VDC or 24...240 VAC
BMXDD-M16022	Input/output	16	8 positive logic inputs and 8 positive logic static output	24 VDC 3.5 mA
BMXDD-M16025	Input/output	16	8 positive logic inputs and 8 isolated relay outputs	24 VDC 3.5 mA
BMXDD-M3202K	Input/output	32	16 positive logic inputs and 16 positive logic static outputs	24 VDC 2.5 mA

Operating States

Introduction

This topic describes the operating states of the BMECRD0100 adapter module used in a High Availability Soft dPAC system for the BM_XBUS IO module.

Operating States

The BMECRD0100 adapter module, High Availability Soft dPAC module, and theXBUS I/O module obtain the following transition states when configured in conjunction with one another.

High Availability Soft dPAC	BMECRD0100 ECORT initial state	BMECRD0100 ECORT	XBUS I/O Module	Description
Clean or Stopped > Running	Clean	Clean > Running	Reset > Active	When the High Availability Soft dPAC reaches **Running** state , the **BMECRD0100 ECORT** will transition from **Clean** to **Running**, which implies that **XBUS I/O Module** will transition to **Reset** and then immediately to **Active**. *The final state of the XBUS I/O module depends on the detection time of the Error Halt state. If this state is detected before any configuration, such as parsing errors or configuration errors, then the XBUS I/O module state will remain in **Reset**; otherwise, the module reaches its configured **Fallback** state. **The origin of the XBUS I/O module state depends on the type of the Error Halt.
		Clean > Error Halt	Reset > Fallback*	
			Reset*	
	Error Halt	Error Halt > Clean > Running	Reset** > Active	
			Fallback** > Reset > Running	
		Error Halt > Clean > Error Halt	Reset*	
			Reset > Fallback*	
	Running	Running > Clean > Running	Active > Reset > Active	
		Running > Clean > Error Halt	Active > Reset*	
			Active > Reset > Fallback*	
Running > Stopped or Clean	Clean	Clean	Reset	When the High Availability Soft dPAC reaches **Stopped** or **Clean** state the BMRIO stops refreshing I/O. At this time the BMECRD0100 ECORT remains in its initial state. **The origin of the XBUS I/O module state depends on the type of Error Halt. ***The XBUS I/O module is no longer refreshed.
	Error Halt	Error Halt	Reset or Fallback**	
	Running	Running	Active > Fallback***	
Stopped > Clean	Clean	Clean	Reset	The BMECRD0100 ECORT stays in its current state. **The origin of the XBUS I/O module state depends on the type of Error Halt. ***The XBUS I/O module is no longer refreshed.
	Error Halt	Error Halt	Reset or Fallback**	
	Running	Running	Active > Fallback***	
Running > Error Halt	Clean	Clean	Reset	The BMECRD0100 ECORT stays in its current state. **The origin of the XBUS I/O module state depends on the type of Error Halt. ***The XBUS I/O module is no longer refreshed..
	Error Halt	Error Halt	Reset or Fallback**	
	Running	Running	Active > Fallback***	

Even if the BMECRD0100 embeds an ECORT, it is not a logical device and remains a remote I/O concentrator.

The XBUS I/O modules are autonomous; their state depends on the XBUS messages received and their applied configuration.

NOTE: Each High Availability Soft dPAC is described by a combination of its state and role. Refer to the *High Availability Operating Modes topic in the EcoStruxure Automation Expert User Guide.*

NOTE: If the two connections between the High Availability Soft dPAC and the BMECRD0100 module are interrupted by one or more RIO cycles, this causes the BMECRD0100 ECORT to remain in **Running** state and the XBUS I/O module goes into the **FALLBACK** state.

NOTE: If rebooting (Configure Device Settings, Reset CS, FW Upgrade) required while BMECRD0100 module is operating in the RUN state, make sure to clean the High Availability Soft dPAC and reboot a BMECRD0100 module by pressing **RESET CPS** or **TURN OFF & ON** power supply.

NOTE: BMECRD0100 module functions independently of BCRIO and can be rebooted from EAE topology manager, only when BMRIO function is **offline**.

Debugging and Diagnostics

Adding HART eX80 Analog I/O Modules

When the BMEAHI0812 or BMEAHO0412 modules are successfully added to the hardware configuration, a message appears in the EAE software stating; **BMEAHIO module configured. TFTP, FTP and DHCP services will be enabled on the device.**

When the HART module is detected, the TFTP and DHCP services are automatically activated.

Hardware configuration	Services Enabled	Log Messages
HART modules **configured**	BMECRD0100 **starts** TFTP, FTPand DHCP services.	BMEAHIO module detected. TFTP, FTP and DHCP services are enabled.
HART modules **not configured**	BMECRD0100 **does not start** TFTP, FTP and DHCP services.	No log messages.

NOTE: The BMECRD0100 adapter module will disable TFTP, FTP and DHCP services, during its **clean** transition state.

Debugging BMECRD0100 Module

When an error is detected, the module's fault screen can be accessed through the module's faceplate screen.

The following table describes the procedure to access the module's **Fault** screen.

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1</td><td>Open the module's faceplate screen.</td></tr>
<tr><td>2</td><td>You can view the status of each channel via the Status screen parameter to establish a diagnosis.</td></tr>
<tr><td>3</td><td>The statuses are reflected within the quality field of each VTQ Input by the quality code, as shown below.
<table>
<tr><th>Quality Code</th><th>Status</th></tr>
<tr><td>0000 0000</td><td>Normal</td></tr>
<tr><td>8000 0000</td><td>Channel not available</td></tr>
<tr><td>8005 0000</td><td>RIO Communication failure</td></tr>
<tr><td>0096 0000</td><td>Local override</td></tr>
<tr><td rowspan="2">4000 0000</td><td>Overflow upper</td></tr>
<tr><td>Overflow lower</td></tr>
</table>
NOTE: The quality code is a mask. The quality code of local override status can be superimposed on other quality codes. For instance, 4096 0000 for the status Overflow Upper - Local Override.
NOTE: Quality code 8005 0000 indicating RIO Communication failure status is relevant only for the BMECRD0100 adapter module, running on SE.IoX80 library.</td></tr>
<tr><td>4</td><td>The status in the preceding step has the following meanings:
Channel not available :
• Wiring control
• Inoperative channel
• configuration error detected
RIO Communication failure :
• SoftdPAC / SofdPAC HA cannot establish connection with the hardware BMECRDO100 adapter module, over Ethernet Link.
• BMECRD0100 adapter module encountered a malfunction, causing it to be unresponsive to the SoftdPAC / SofdPAC HA commands.
• BMECRD0100 is in a STOPPED or ERRORHALT state and discontinued its cycles execution.
Overflow upper :
• Under range
Overflow upper :
• Over range</td></tr>
</table>

Debugging can also be done by incorporating the module's FB Network into the system file, as described below.

Step	Action
1	Click on the **Display CRD FB Network** option.
2	Copy the displayed CRD FB network built and paste into the designated section of the system file.

Diagnosing through HMI

A BMECRD0100 adapter module displays a message on the HMI whenever there is an RIO communication interruption.

The displayed message is triggered by analyzing the data quality using the VTQ structure. If the quality is assessed as BAD, indicating unreliable data, the system overlays a notification on the HMI, indicating that the displayed values are not current or accurate.

The XBUS HWCATs for BMECRD0100 and IO modules, indicate if the status displayed is invalid due to the following cases :

Type	Description
Network failure	Indicates invalid status due to network communication failure.
Hardware failure	Indicates invalid status due to **RIO** failure.
Offline	Indicates invalid status when the BMECRD0100 module is offline.

Diagnosing through fetchlog

In case of troubleshooting of the module, you can access and export the ECORT fetchlog and platform crashlog for diagnostic purposes from the topology manager. The diagnostic allows you to observe the error which can be due to ; VTQ of XBus IO channel, BM_RIO indicating coupler down, or BMECRD0100 hardware CAT HMI errors on module.

To export the log files,

Step	Action
1	Right-click on your BMECRD0100 or BMED581020 device in the physical view. Choose **Get log files**. Provide username and password if not authenticated.
2	Select **export log files** and save.
3	You will receive a confirmation message to notify the successful transfer and the location of your log files. You can find the decrypted files in the selected location.

NOTE: It is not possible to fetch log files when the ECORT is in RUNNING state.

Monitoring CPU Load and Memory Usage of Module

The CPU load and memory usage of the module are visible through EAE HMI and corresponding OPCUA variables.

To access the data,

Step	Action
1	Open the EAE HMI faceplate screen.
2	Click on the OPCUA or HMI variable for real-time updates on the module's CPU load and memory usage.
3	Access the BM_RIO SFB to find CPU load and memory usage, in the DIAGNOSTIC string for coupler or device

Modicon X80 HART Analog I/O Modules

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Introducing the eX80 HART Analog I/O Modules 476
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Firmware Update 510
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Configuring BMEAHI0812(H) and BMEAHO0412(C) DTMs 531
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Introducing the HART Protocol

What's in This Chapter

Introducing HART 471
HART Multiplexer Communication 472
HART Multiplexer Commands 473

Overview

This chapter introduces the *Highway Addressable Remote Transducer* (HART) protocol, and describes the embedded HART multiplexer functionality in both the BMEAHI0812(H) analog input module and the BMEAHO0412(C) analog output module.

Introducing HART

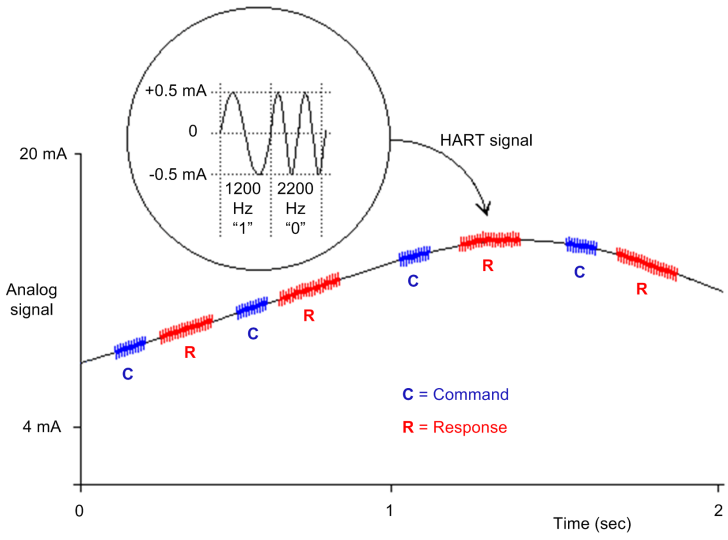
HART

The *Highway Addressable Remote Transducer* (HART) protocol provides digital communication to microprocessor-based analog process control instruments.

HART uses the Bell 202 frequency-shift-keying (FSK) standard to superimpose a digital signal on top of the 4-20mA current loop analog signal:

- the analog signal communicates the primary measured process variable value
- the digital signal communicates additional instrument information including instrument status, additional process variables, configuration data, and diagnostics

The digital signal shifts between a frequency of 1200 Hz (representing a binary 1) and a frequency of 2200 Hz (representing a binary 0):



These digital signal frequencies are higher than the typical analog signaling frequency range of 0...10 Hz. The digital signal is typically isolated using a passive high-pass filter with a cut-off frequency in the range of 400...800 Hz. The analog signal is likewise isolated using a passive low-pass filter.

The separation in frequency between HART and analog signaling allows both signals to coexist on the same current loop. Because the HART digital signal is phase continuous, the HART digital signal:

- does not interfere with the 4-20 mA signal, and
- allows the analog process to continue operating during HART digital communication

Half-duplex Communication Protocol

HART communication is half-duplex in design, which means that a HART-compliant instrument does not simultaneously transmit and receive.

Primary — Secondary Protocol

HART is a primary-secondary protocol. A HART-secondary instrument responds only when commanded by a HART primary instrument. Examples of HART-compliant instruments include:

- HART primary:
  - asset management software (AMS) running on a PC
  - a HART interface module, for example, the HART modem feature of both the BMEAHI0812(H) input module and the BMEAHO0412(C) output module when communicating with a HART process control instrument (such as a HART-compliant sensor or actuator)
  - a hand-held device temporarily attached to the network
- HART secondary:
  - a HART process control instrument
  - a HART interface module, for example, the HART modem feature of both the BMEAHI0812(H) input module and the BMEAHO0412(C) output module when operating as a secondary instrument with asset management software (AMS) or a HART server

HART Multiplexer Communication

Embedded HART Multiplexer

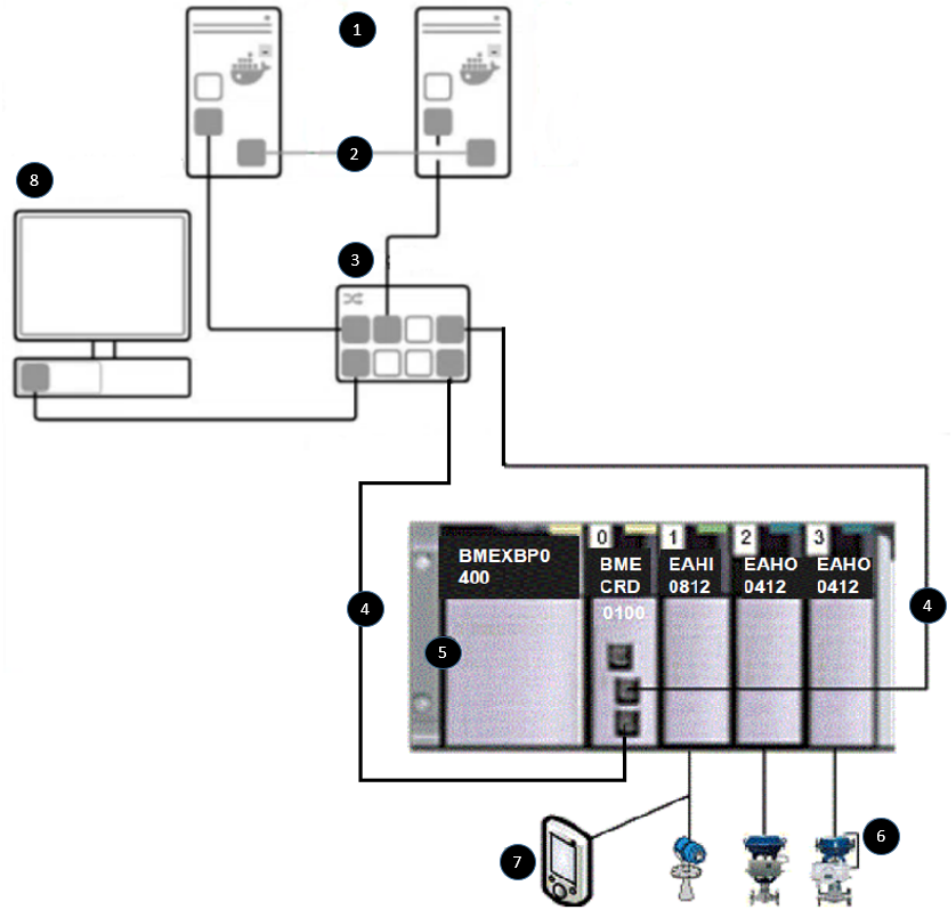
Both the BMEAHI0812(H) input module and the BMEAHO0412(C) output module include an embedded HART multiplexer. The multiplexer facilitates the transmission of HART field instrument data by providing:

- one-to-many HART communication between a single HART primary instrument and multiple HART field devices.
- HART instrument data to a PLC primary device, as part of the periodic scan.

HART Primary and Secondary Instruments

A HART primary instrument can be either:

- a configuration PC running EcoStruxure Automation Expert or asset management software
- PC running SCADA as HART server
- a secondary instrument, such as a hand-held device that can be temporarily connected directly to the current loop between an I/O module and the HART field instrument



Legend

1	Soft dPAC or High Availability Soft dPAC (HA Soft dPAC).
2	HA Interlink: 1GB/s NIC/connection.
3	Managed switch connecting the Maintenance PC hosts to the Remote I/O ring.
4	Remote I/O main ring.
5	Non-redundant remote I/O drop with BMECRD0100 module.
6	HART-enabled field instruments connected to I/O via 4-20 mA current loop wiring.
7	Hand-held HART secondary device.
8	Maintenance PC operating as HART primary instrument (running, for example, EcoStruxure Automation Expert configuration software or asset management software) or SCADA.

The HART multiplexer supports one HART field instrument per I/O channel.

HART Multiplexer Commands

Overview

The HART multiplexer within the HART analog I/O modules support the following HART multiplexer commands.

Universal Commands

Command	Description
1	Read primary variable
2	Read loop current and percentage of range

Command	Description
3	Read dynamic variables and loop current
6	Write polling address
7	Read loop configuration
8	Read dynamic variable classifications
9	Read device variables with status
11	Read unique identifier associated with tag
12	Read message
13	Read tag, descriptor, and date
14	Read primary variable transducer information
15	Read device information
16	Read final assembly number
17	Write message
18	Write tag, descriptor, and date
19	Write final assembly number
20	Read long tag
21	Read unique identifier associated with long tag
22	Write long tag
38	Reset configuration changed flag
48	Read additional device status

Common Practice Commands

Command	Description
42	Perform device reset
59	Write number of response preambles
106	Flush delayed response

ARCOM Multiplexer Common Practice Commands

Command	Description
128	Read parameters
129	Read loop status
130	Read instrument list from index
131	Read instrument static data
132	Write instrument static data
133	Remove instrument from instrument list
134	Read scan list from index
135	Read instrument dynamic data
136	Read instrument scan status
137	Write instrument scan status
138	Read instrument cumulative responses
139	Reset instrument cumulative responses

Command	Description
140	Read instrument tries and failures
141	Reset instrument tries and failures
142	Read counts of host communications
143	Reset counts of host communications
144	Read retry limits
145	Write retry limits
146	Read scan command
147	Write scan command
148	Read scan status
149	Write scan status
150	Read gender
151	Write gender
152	Read loop search type
153	Write loop search type
154	Rebuild loops
155	Copy command and reply (pass-through)

Introducing the eX80 HART Analog I/O Modules

What's in This Chapter

Adding HART eX80 Analog I/O to a Modicon X80 Network 476

Overview

This chapter introduces the BMEAHI0812, BMEAHI0812H, BMEAHO0412, and BMEAHO0412C eX80 HART analog I/O modules, and indicates how to position them in a Modicon X80 network configuration.

Adding HART eX80 Analog I/O to a Modicon X80 Network

Positioning HART Analog eX80 I/O Modules in a Network

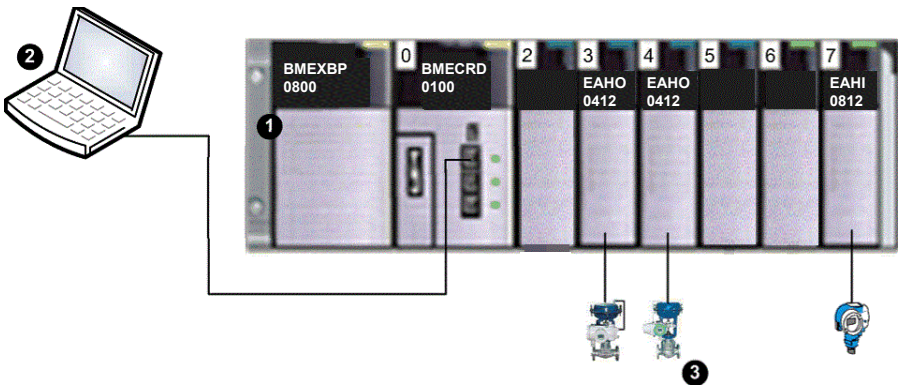
You can use the HART analog eX80 I/O module as a local I/O in the main local BMEXBP••00 Ethernet backplane.

NOTE: You can mount a HART analog eX80 I/O module only in the main segment of a local rack. You cannot mount a HART analog eX80 I/O module in a rack extension.

Local I/O

You can add up to 6 HART analog I/O modules to a main local rack containing a BMECRD0100 adapter module.

An example of a single local rack installation:



1 Local rack containing a BMECRD0100 adapter module, power supply, and 3 I/O modules.

2 Maintenance PC, operating as HART primary master, connected to the local rack via Ethernet copper cable.

3 HART field instruments connected to I/O via 4-20 mA current loop wiring.

For more information about selecting a backplane, refer to chapter *Installing Analog I/O Modules*, page 514

BMEAHI0812 HART Analog Input Module

What's in This Chapter

Physical Description 477
BMEAHI0812 and BMEAHI0812H Specifications 478
Functional Description 480
Using EMC Kits 484
Wiring Diagrams 485
Using the TELEFAST Wiring Accessory 487

Overview

This chapter describes the BMEAHI0812 HART analog input module for eX80 platforms, and shows you how to connect it to input sensors.

Physical Description

Analog plus HART Communication

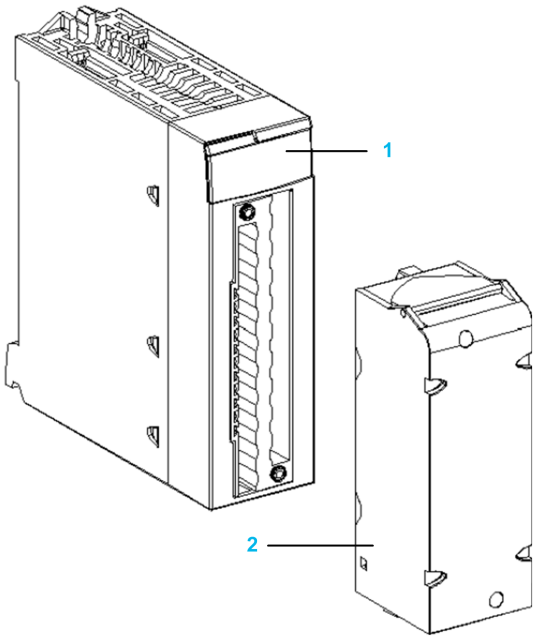
The BMEAHI0812 module is a high-density input module that includes 8 isolated analog channels. Each channel supports HART digital communication.

Use the module with sensors or transmitters. The module uses a 4-20 mA analog signal to perform monitoring and measurement functions.

The module also supports the HART protocol, which superimposes a digital signal on top of the analog signal. The HART digital signal communicates additional instrument information including instrument status, additional process variables, configuration data, and diagnostics.

Illustration

The BMEAHI0812 analog input module with a 20-pin terminal block accessory:



1 LED display

2 20-pin terminal block accessory

NOTE: The terminal block accessory is supplied separately.

BMEAHI0812 and BMEAHI0812H Specifications

Ruggedized Version of the Module

The BMEAHI0812H (hardened) equipment is a ruggedized version of the BMEAHI0812 (standard) equipment. It can be used at extended temperatures -25...70 ºC (-13...158 ºF) and in harsh chemical environments.

The BMEAHI0812H equipment, when within the standard temperature range 0...60 ºC (32...140 ºF), has the same performance characteristics as the standard BMEAHI0812 equipment.

At the temperature extremes -25...0 ºC and 60...70 ºC (-13...32 ºF and 140...158 ºF) the hardened versions can have downgraded analog input accuracy.

If this equipment is operated outside the -25...70 ºC (-13...158 ºF) temperature range, the equipment can operate abnormally.

⚠CAUTION

UNINTENDED EQUIPMENT OPERATION

Do not operate this equipment outside of its specified temperature range.

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

For more information, refer to chapter *Installation in More Severe Environments*.

Altitude Operating Conditions

The characteristics in the tables below apply to the modules BMEAHI0812 and BMEAHI0812H for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions*.

General Module Specifications

The eX80 HART analog input BMEAHI0812 and BMEAHI0812H modules possess the following general characteristics:

Head module compatibility		• Local rack: BME P58 x0x0 CPU • Remote I/O drop: BME CRA 312 10 adapter
Isolation:	• between channels	1000 Vdc (1 minute duration)
	• between channels and bus	1400 Vdc (1 minute duration)
	• between channels and ground	1400 Vdc (1 minute duration)
Operating ambient temperature:	• BMEAHI0812	0...60 °C (32...140 °F)
	• BMEAHI0812H	-25...70 °C (-13...158 °F)
Vibration		10 mm / 3 g / x10 (per IEC60068-2-6)
Shock		30 g / 11 ms / x3 (per IEC60068-2-27)
Power consumption (3.3V)		400 mA
Power consumption (24V)		34 mA
Field device support		2-wire / 4-wire
Maximum overload authorized for inputs		• Voltage: +/– 30 Vdc • Current: +/– 90 mA
Hot-swap support?		Yes

Analog Specifications

The eX80 HART analog input BMEAHI0812 and BMEAHI0812 modules possess the following analog characteristics:

Number of channels		8
Type of inputs		High-density isolated fast inputs
Nominal range (full scale)		4-20 mA
Maximum conversion range		0.16...29.92 mA
Measurement accuracy for module:	• Accuracy at 25 °C	0.15% of full scale(1)
	• Accuracy at 0...60 °C	0.3% of full scale(1)
	• Accuracy at -25...70 °C	0.55% of full scale(1)
Temperature drift		50 ppm / °C
Display resolution		15-bit plus sign bit
Least significant bit weight		0.458 µA
Refresh time:	• per module	4 ms(2)

	• per channel	4 ms(2)
Response time:	• with HART enabled (without digital filter)	50 ms
	• with HART disabled (without digital filter)	4 ms
Input impedance		Internal conversion resistor (250 Ω) + Internal protection resistor (see note)
Detection type		broken wire
Monotonicity?		Yes
Common mode rejection (50/60 Hz)		80 dB
Crosstalk between channels DC and AC 50/60 Hz		> 80 dB
Non-linearity		0.02% of full scale
Repeatability at 25 °C of 10 minutes stabilization time		0.01% of full scale
Digital filtering		1st order
(1) Includes conversion resistor detected error. **(2)** Refresh times are for only the module internal buffer, and are impacted by PLC cycle time.		

NOTE: The internal protection resistor has a typical impedance of 25 Ω (min 3.6 Ω and max 50 Ω). The precision of the protection resistor does not impact the measured value.

HART Specifications

The eX80 HART analog input BMEAHI0812 and BMEAHI0812H modules possess the following HART characteristics:

HART protocols supported(2)	HART versions 5, 6 and 7
Number of channels	8
Scan time:	–
• Typical(1)	1 s
• Maximum(1)	5 s
Detection time for a non-responsive device	= (scan time) + (timeouts)
HART command system	ARCOM (interface to a HART primary)
Topology	Point-to-point
HART I/O mapping?	Yes
(1) Scan time is the same for each channel and for the module. The scan time depends on the byte length of the command. The scan time values do not include PLC cycle time. Add the values to determine overall scan time. **(2)** The eX80 HART input module supports HART up to versions 7.2 and 7.3.	

Functional Description

Introduction

The BMEAHI0812 eX80 HART analog input module supports 4-20 mA analog communication and HART digital communication on each of 8 input channels. The

module operates with voltage inputs and includes 8 read resistors connected to the terminal block to convert current inputs.

The eX80 HART analog input module is powered by the backplane.

NOTE: The backplane does not provide power to the 4-20 mA current loop or to any sensor, transmitter, or other device connected to the current loop. You need to provide a source of 24 Vdc power to the current loop, as described in the wiring topic.

Measurement Timing

The BMEAHI0812 eX80 HART analog input module measurement refresh rate is 4 ms. This refresh rate remains constant, no matter how many channels are enabled (or disabled).

NOTE: The module measurement refresh task is not synchronized with the PLC scan. Therefore, you need to include the PLC scan time when estimating an overall application refresh rate.

Overflow/Underflow Control

Each input on the BMEAHI0812 eX80 HART analog input module operates over a range of 4-20 mA. You can map up to five current ranges for each input.

Upper and lower tolerance detections are enabled regardless of overflow/underflow control.

Depending on the range specified, the module checks for overflow and verifies that the measurement falls between a lower and an upper threshold:

Designation	Description
Nominal range	The specified measurement range
Upper tolerance area	The range of values between the maximum value for the nominal range (20 mA) and the upper threshold
Lower tolerance area	The range of values between the minimum value for the nominal range (4 mA) and the lower threshold
Overflow area	The range of values located above the upper threshold
Underflow area	The range of values located below the lower threshold

NOTE: Monitoring of values in the overflow and underflow area can be enabled or disabled. Monitoring of the lower and upper tolerance areas is enabled and cannot be disabled.

The values of the thresholds are configurable independently from one another. Both the default values, and the maximum and minimum configurable values are as follows:

Range	BMEAHI0812 Range									
	Underflow Area		Lower Tolerance Area		Nominal Range		Upper Tolerance Area		Overflow Area	
Default setting	–2,400	–801	–800	–1	0	10,000	10,001	10,800	10,801	16,200
Minimum / Maximum	–32,768	...	...	...	...	...	...	...	...	32,767

Measurement Display

Measurements may be displayed using standardized display (in %, to two decimal places).

Type of Range	Display
0...10 V, 0...5 V, 1...5 V, 0...20mA, 4...20mA	from 0 to 10,000 (0 % at +100.00 %)

For example, as all symlinks are expressed in percentages, the range: 0...10 V has the correspondences: 0 V = 0%,..., 3,2 V = 32%,..., 5,6 V = 56%,..., 10 V = 100%

HART Filtering

When the HART function is enabled for the channel, the HART signal is filtered by the low pass filter in the BMEAHI0812 eX80 HART analog input module before being read by the analog input. The 3 dB cut-off frequency is about 10.0 Hz.

Digital Filtering

The type of filtering performed by the system is called *first order filtering*. The filtering coefficient can be modified from a programming console or via the program.

The mathematical formula used is as follows:

$Meas_{f(n)} = \alpha \times Meas_{f(n-1)} + (1-\alpha) \times Val_{b(n)}$

α = efficiency of the filter

$Meas_{f(n)}$ = measurement filtered at moment n

$Meas_{f(n-1)}$ = measurement filtered at moment n-1

$Val_{b(n)}$ = gross value at moment n

You may configure the filtering value from 7 possibilities (from 0 to 6). This value may be changed even when the application is in RUN mode.

The filtering values depend on the T configuration cycle (where T = module refresh time):

Desired Efficiency	Required Value	Corresponding α	Filter Response Time at 63%	Cut-Off Frequency (in Hz)
No filtering	0	0	0	0
Low filtering	1	0.750	4 x T	0.040 / T
	2	0.875	8 x T	0.020 / T

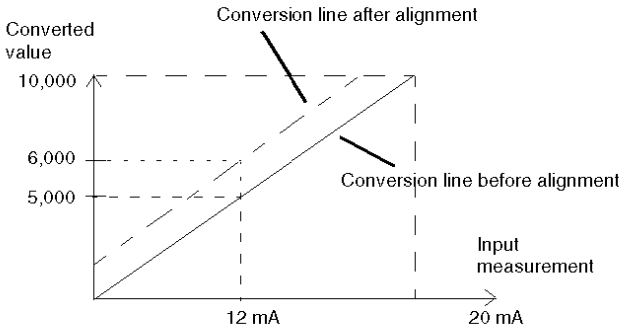
Desired Efficiency	Required Value	Corresponding α	Filter Response Time at 63%	Cut-Off Frequency (in Hz)
Medium filtering	3	0.937	16 x T	0.010 / T
	4	0.969	32 x T	0.005 / T
High filtering	5	0.984	64 x T	0.0025 / T
	6	0.992	128 x T	0.0012 / T

NOTE: When HART communication is enabled, operation of both the HART filter and the digital filter may cause excessive latency.

Sensor Alignment

The process of alignment involves the elimination of an observed systematic offset, around a specific operating point, for a given sensor. Sensor alignment compensates for a detected variation that is linked to the process. Replacing a module does not require a new alignment. However, replacing the sensor or changing the sensor operating point requires a new alignment.

Conversion lines are as follows:



The alignment value is editable from a programming console, even if the program is in RUN mode. For each input channel, you can:

- view and modify the desired measurement value
- save the alignment value
- determine whether the channel already has an alignment

The alignment offset may also be modified through programming.

Channel alignment is performed on the channel in standard operating mode, without any effect on the channel operating modes.

The maximum offset between measured value and desired (aligned) value may not exceed +/-1,500.

NOTE: To align multiple analog channels on the BMEAHI0812 eX80 HART analog input module, proceed channel by channel, aligning one channel at a time. Test each channel after aligning it before proceeding to align the next channel.

Using EMC Kits

Introduction

To help shield the BMEAHI0812 eX80 HART analog input module from electro-magnetic and radio interference, use EMC kits to ground the shielded cables connected to the module.

Cable Shielding

⚠CAUTION

UNEXPECTED BEHAVIOR OF APPLICATION

- To reduce electromagnetic perturbations, use a BMX XSP 0400/0800/1200 EMC kit to connect the shielding.
- Electromagnetic perturbations may lead to an unexpected behavior of the application.

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

Connect the cable shielding to the grounding bar. Clamp the shielding to the grounding bar on the module side. Use the following EMC kits to make these connections:

- BMX XSP 0400 EMC kit, for use with the BME XBP 0400 rack
- BMX XSP 0800 EMC kit, for use with the BME XBP 0800 rack
- BMX XSP 1200 EMC kit, for use with the BME XBP 1200 rack

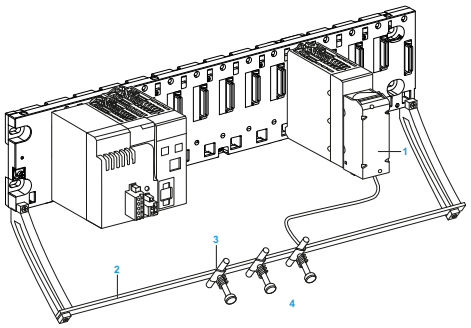
⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

While mounting / removing the modules:

- Confirm that each terminal block is still connected to the shield bar.
- Disconnect voltage supplying sensors and pre-actuators.

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



1 BMEAHI0812

2 Shield bar

3 Clamp

4 To sensors

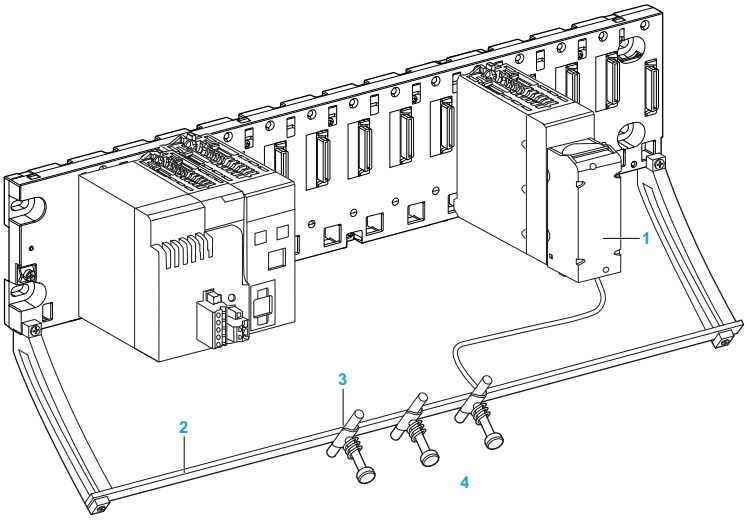
Reference of Sensors in Relation to the Ground

In order for the acquisition system to operate correctly, it is recommended to consider taking the following steps:

- place sensors close together (not more than a few meters apart)
- reference each sensor to a single point, which is connected to the protective ground

Using the Sensors Referenced in Relation to the Ground

The sensors are connected as indicated in the following diagram:



If the sensors are referenced in relation to the ground, this can return a remote ground potential to the terminal block. To help avoid this situation, follow these rules:

- The potential needs to be less than the permitted low voltage of ± 500 Vdc.
- Setting a sensor point to a reference potential generates a leakage current. Check that leakage currents generated do not disturb the system.

  NOTE: Sensors and other peripherals may be connected to a grounding point some distance from the module. Such remote ground references may carry considerable potential differences with respect to local ground. Induced currents do not affect the measurement or integrity of the system.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK

Confirm that sensors and other peripherals are not exposed through grounding points to voltage potential greater than acceptable limits.

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

Wiring Diagrams

Point-to-Point Connections

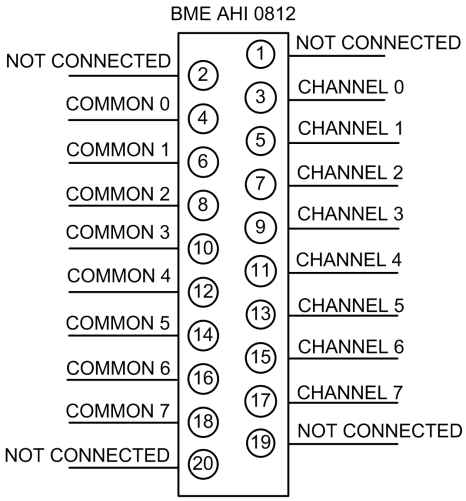
The BMEAHI0812 eX80 HART analog input module supports point-to-point 4-20 mA wiring connections to field instruments, including sensors and transmitters. You can make the connection to the input module using a 20-pin terminal block

(BMX FTB 20•0), a pre-assembled cord set (BMX FTW •01S), or TELEFAST accessories.

The input module does not provide 4-20 mA current loop power. You need to include an external power supply in your network that can provide current loop power.

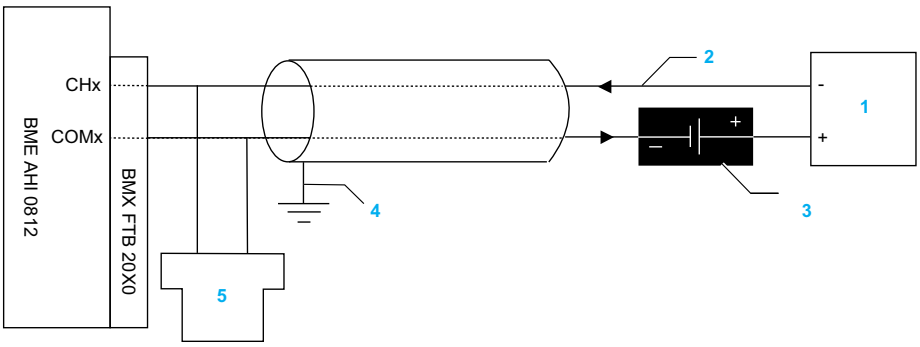
Input Module Pinout

The BMEAHI0812 eX80 HART analog input module present the following 20-pin design, to which you can connect a terminal block, a pre-assembled cord set, or TELEFAST cable:



BMEAHI0812 with 2-Wire Transmitter

The following illustration shows you how to connect the input module to a 2-wire transmitter. Field power is supplied directly to the 4-20 mA current loop:



1 2-wire transmitter

2 4-20 mA current loop, with arrows indicating direction of current flow

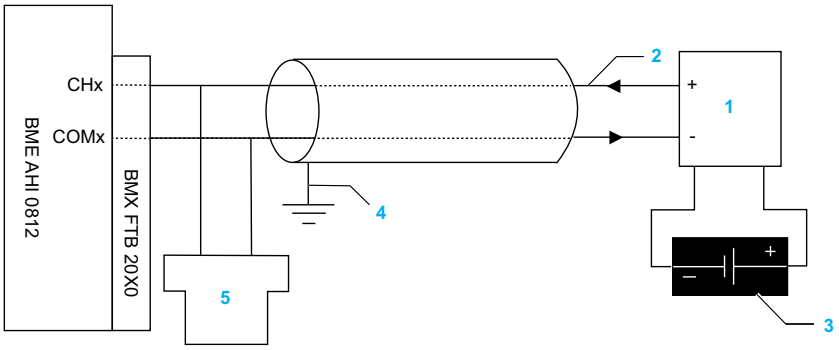
3 Field power supply

4 Protective ground

5 Secondary HART (hand-held)

BMEAHI0812 with 4-Wire Transmitter

This example illustrates how to connect the input module to a 4-wire transmitter. Field power is provided to the 4-20 mA current loop via the transmitter:



1 4-wire transmitter

2 4-20 mA current loop, with arrows indicating direction of current flow

3 Field power supply

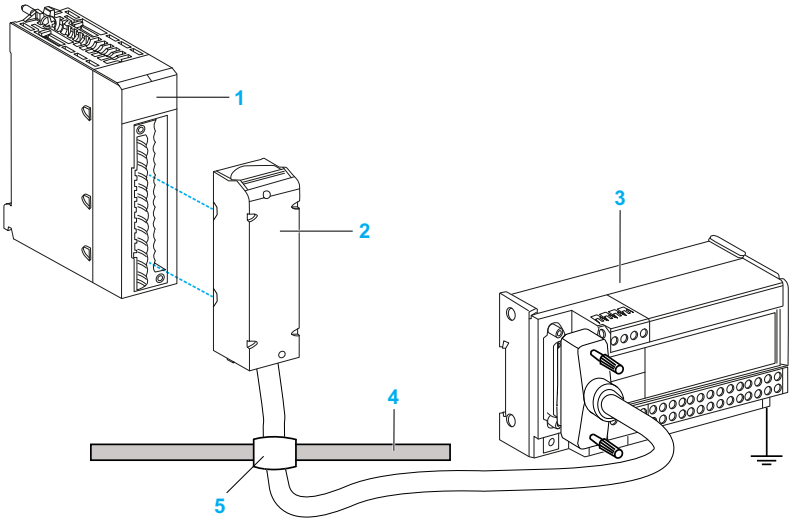
4 Protective ground

5 Secondary HART (hand-held)

Using the TELEFAST Wiring Accessory

Introduction

The TELEFAST pre-wired system consists of connecting cables and interface sub-bases as shown below:



1 BMEAHI0812 module

2 BMXFTA••22 connecting cables

3 Interface sub-base ABE7CPA31

4 Shield bar

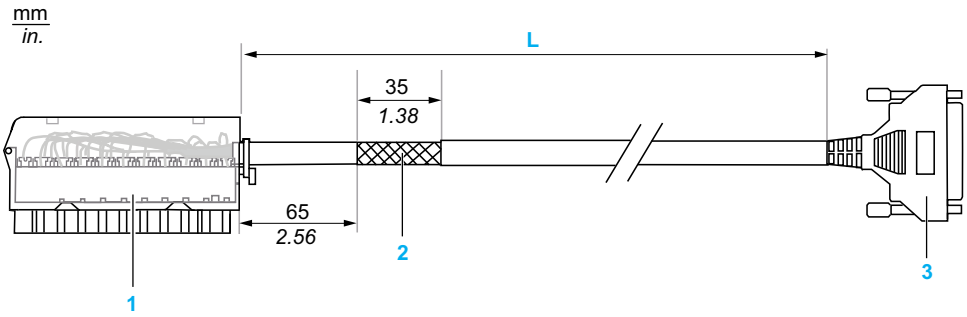
5 Clamp

BMXFTA••22 Connecting Cables

The BMXFTA••22 cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 20-pin terminal block from which extend 1 cable sheath containing 20 wires,
- At the other end a 25-pin Sub-D connector.

The figure below shows the BMXFTA••22 cables:



1 BMXFTB2020 Terminal block

2 Cable shielding

3 25-pin Sub-D connector

L Length according to the part number.

The cable comes in 2 different lengths:

- 1.5 m (4.92 ft): BMXFTA1522
- 3 m (9.84 ft): BMXFTA3022

The following table gives the characteristics of the BMXFTA••22 cables:

Characteristic		Value
Cable	Sheath material	PVC
	LSZH status	No
Environmental	Operating temperature	-25...70 °C (-13...158 °F)

Connecting Sensors

Sensors may be connected to the ABE7CPA31 accessory as depicted in the Wiring Diagram, page 122 topic.

The distribution of analog channels on TELEFAST terminal blocks with the reference ABE7CPA31 are as follows:

TELEFAST terminal block number	BMEA-HI0812 pin out	Signal type	TELEFAST terminal block number	BMEA-HI0812 pin out	Signal type
1	NC	Ground	Supp 1	NC	+24 Vdc (sensor supply)
2	NC	Ground	Supp 2	NC	+24 Vdc (sensor supply)
3	NC	Ground	Supp 3	NC	0 Vdc (sensor supply)
4	NC	Ground	Supp 4	NC	0 Vdc (sensor supply)
100	NC	+IS0	116	NC	+IS4
101	NC	NC	117	NC	NC
102	3	+IC0	118	11	+IC4

TELEFAST terminal block number	BMEA-HI0812 pin out	Signal type	TELEFAST terminal block number	BMEA-HI0812 pin out	Signal type
103	4	0 V0	119	12	0 V4
104	NC	+IS1	120	NC	+IS5
105	NC	NC	121	NC	NC
106	5	+IC1	122	13	+IC5
107	6	0 V1	123	14	0 V5
108	NC	+IS2	124	NC	+IS6
109	NC	NC	125	NC	NC
110	7	+IC2	126	15	+IC6
111	8	0 V2	127	16	0 V6
112	NC	+IS3	128	NC	+IS7
113	NC	NC	129	NC	NC
114	9	+IC3	130	17	+IC7
115	10	0 V3	131	18	0 V7
+ICx: + pole current input for channel x +ISx: - pole voltage or current input for channel x COMx: Common pin for channel x NC: Not Connected					

NOTE: The grounding of cables is facilitated using the ABE7BV•0 wiring accessory.

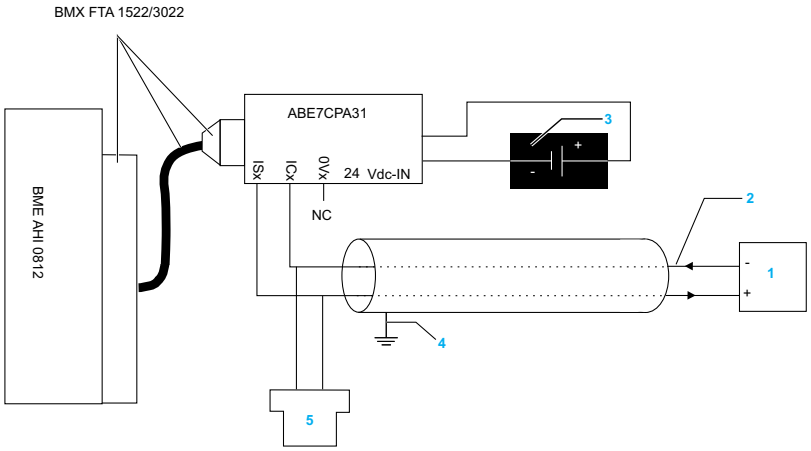
BMEAHI0812 with 2-Wire or 4-Wire Transmitter, TELEFAST Connector with Power Supply

These examples illustrate how to connect the input module to a 2-wire or 4-wire transmitter using a TELEFAST wiring accessory and cable. The cable includes a 20-pin terminal block. 24 Vdc power is supplied to the 4-20 mA current loop:

- via the TELEFAST wiring accessory in the 2-wire design
- via the transmitter in the 4-wire design

NOTE: To provide 4-20 mA power to the current loop, connect only the ISx and the ICx pins on the TELEFAST wiring accessory ABE7CPA31. The 0Vx pins are not connected.

2-wire design:



1 2-wire transmitter

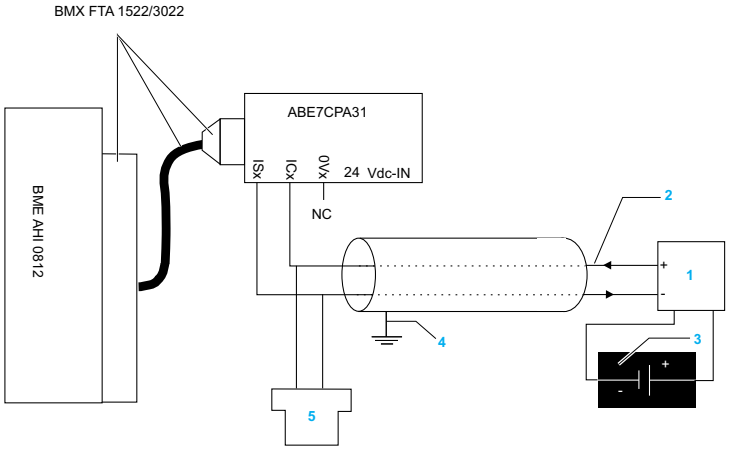
2 4-20 mA current loop, with arrows indicating direction of current flow

3 24 Vdc power supply

4 Protective ground

5 Secondary HART (hand-held)

4-wire design:



1 4-wire transmitter

2 4-20 mA current loop, with arrows indicating direction of current flow

3 Field power supply

4 Protective ground

5 Secondary HART (hand-held)

HART Network Cable Characteristics and Lengths

The *HART Communication Foundation* has developed documentation describing recommended types and diameters of cable for HART networks. This documentation also includes instructions on how to calculate maximum cable lengths for a HART network.

To obtain a copy of this documentation, visit the *HART Communication Foundation* website at www.hartcomm.org, and download the document *FSK Physical Layer Specification* (document number HFD_SPEC-054). HART network cable characteristics and lengths information can be found at section 7.5 of this document.

For a BMEAHI0812 HART analog input module that uses loop power provided by a TELEFAST ABE7CPA31 wiring accessory, the maximum cable length between the sensor and wiring accessory is limited by the following calculation (in addition to the maximum cable length limits recommended by the *HART Communication Foundation*:

	ABE7CPA31
Maximum capacitance	0.206 µF
Maximum cable length	(0.206 µF) / (Capacitance/unit)
Maximum length if Cap/unit = 55pF/feet	3745 ft (1141 m)

BMEAHO0412(C) HART Analog Output Module

What's in This Chapter

Physical Description 492
BMEAHO0412(C) and BMEAHO0412C Specifications 493
Functional Description 495
Using EMC Kits 498
Wiring Diagrams 500
Using the TELEFAST Wiring Accessory 501

Overview

This chapter describes the BMEAHO0412(C) HART analog output module for eX80 platforms, and shows you how to connect it to actuators.

Physical Description

Analog plus HART Communication

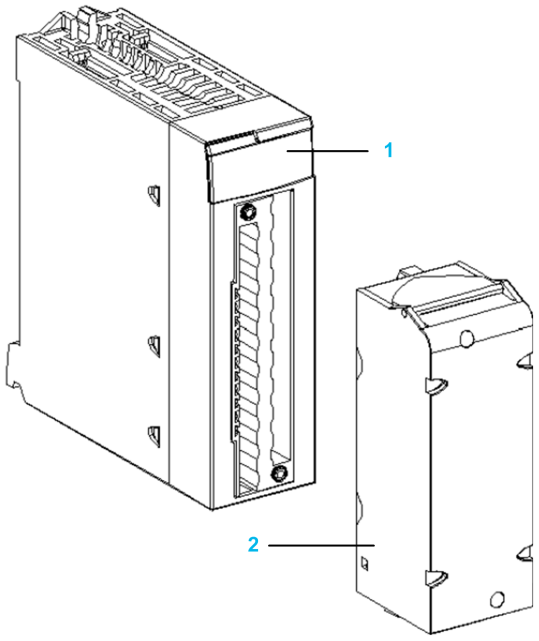
The BMEAHO0412(C) module is a high-density output module that includes 4 isolated analog channels. Each channel supports HART digital communication.

Use the module with actuators. The module uses a 4-20 mA analog signal to perform continuous process control functions.

The module also supports the HART protocol, which superimposes a digital signal on top of the analog signal. The HART digital signal communicates additional instrument information including instrument status, additional process variables, configuration data, and diagnostics.

Illustration

The BMEAHO0412(C) analog output module with a 20-pin terminal block accessory:



1 LED display

2 20-pin terminal block accessory

NOTE: The terminal block accessory is supplied separately.

BMEAHO0412(C) and BMEAHO0412C Specifications

Ruggedized Version of the Module

The BMEAHO0412C (coated) equipment is a ruggedized version of the BMEAHO0412(C) (standard) equipment. It can be used at standard temperatures -25...60 ºC (-13...140 ºF) and in harsh chemical environments.

The BMEAHO0412C equipment has the same performance characteristics as the standard BMEAHO0412(C) equipment.

If this equipment is operated outside the -25...60 ºC (-13...140 ºF) temperature range, the equipment can operate abnormally.

⚠ CAUTION
UNINTENDED EQUIPMENT OPERATION Do not operate this equipment outside of its specified temperature range. **Failure to follow these instructions can result in injury or equipment damage.**

For more information, refer to chapter *Installation in More Severe Environments*.

Altitude Operating Conditions

The characteristics in the tables below apply to the modules BMEAHO0412(C) and BMEAHO0412C for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions*.

General Module Specifications

The eX80 HART analog output BMEAHO0412(C) and BMEAHO0412C modules possess the following general characteristics:

Head module compatibility	• Local rack: BME P58 x0x0 CPU • Remote I/O drop: BME CRA 312 10 adapter
Isolation:	–
• between channels	1000 Vdc (1 minute duration)
• between channels and bus	1400 Vdc (1 minute duration)
• between channels and ground	1400 Vdc (1 minute duration)
Operating ambient temperature	• BMEAHO0412(C): 0...60° C (32...140 °F) • BMEAHO0412C: -25...60° C (-13...140 °F)
Vibration	10 mm / 3 g / x10 (per IEC60068-2-6)
Shock	30 g / 11 ms / x3 (per IEC60068-2-27)
Power consumption (3.3 V)	380 mA
Power consumption (24 V)	137 mA
Field device support	2-wire / 4-wire
Hot-swap support?	Yes

Analog Specifications

The eX80 HART analog output BMEAHO0412(C) and BMEAHO0412C modules possess the following analog characteristics:

Number of channels	4
Type of outputs	Current configured by software
Nominal range (full scale)	4-20 mA
Maximum conversion range	0...21 mA
Measurement accuracy for BMEAHO0412(C) module:	–
• Accuracy at 25 °C	0.1% of full scale
• Accuracy at 0...60 °C	0.2% of full scale
Measurement accuracy for BMEAHO0412C module:	–
• Accuracy at 25 °C	0.1% of full scale
• Accuracy at - 25...60 °C	0.45% of full scale
Temperature drift	45 ppm / °C
Display resolution	15-bit plus sign bit
Least significant bit weight	0.366 µA

Refresh time:	–
• per module	2 ms(1)
• per channel	2 ms(1)
Response time:	–
• with HART enabled	20 ms
• with HART disabled	2 ms
Maximum load impedance	• 600 Ω (0...20 mA) • 570 Ω (0...21 mA)
Detection type	broken wire
Monotonicity?	Yes
Common mode rejection (50/60 Hz)	90 dB
Crosstalk between channels DC and AC 50/60 Hz	> 70 dB
Non-linearity	0.1% of full scale
(1) Refresh times are for only the module internal buffer, and are impacted by PLC cycle time.	

HART Specifications

The eX80 HART analog output BMEAHO0412(C) and BMEAHO0412C modules possess the following HART characteristics:

HART protocols supported(2)	HART versions 5, 6 and 7
Number of channels	4
Scan time:	–
• Typical(1)	1 s
• Maximum(1)	5 s
Detection time for a non-responsive device	= (scan time) + (timeouts)
HART command system	ARCOM (interface to a HART primary)
Topology	Point-to-point
HART I/O mapping?	Yes
(1) Scan time is the same for each channel and for the module. The scan time depends on the byte length of the command. The scan time values do not include PLC cycle time. Add the values to determine overall scan time. **(2)** The eX80 HART output module supports HART up to versions 7.2 and 7.3.	

Functional Description

Introduction

The BMEAHO0412(C) eX80 HART analog output module supports 4-20 mA analog communication and HART digital communication on each of 4 output channels.

Both the eX80 HART analog output module and the 4-20 mA current loop are powered by the backplane.

NOTE: Because the output module passes 24 Vdc power from the backplane to the current loop, an external power supply is not required for the current loop.

Output Slew Rate

When the HART function is enabled, the slew rate of each analog output is automatically limited. As a result, the output slew does not unintentionally trigger the HART receiver.

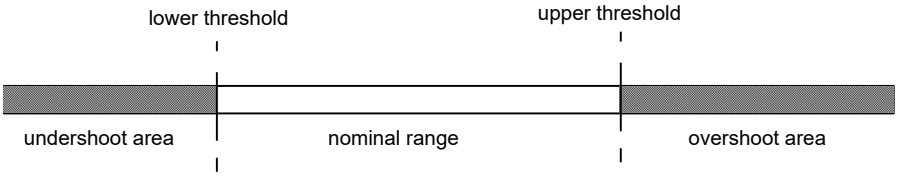
When HART is...	The output slew rate is automatically set to...
Enabled	0,8...0,9 mA/ms
Disabled	• >1500 mA/ms (non-inductive load) • >300 mA/ms (1 mH inductive load)

Overshoot/Undershoot Control

Each output on the BMEAHO0412(C) eX80 HART analog output module operates over a range of 4-20 mA. You can map up to three current ranges for each output.

Upper and lower tolerance detections are enabled regardless of overflow/underflow control.

Depending on the range specified, the module checks for overflow and verifies that the measurement falls between a lower and an upper threshold:



Designation	Description
Nominal range	The specified measurement range
Overshoot area	The range of values located above the upper threshold
Undershoot area	The range of values located below the lower threshold

NOTE: Monitoring of values in the overshoot and undershoot areas can be enabled or disabled.

The values of the thresholds are configurable independently from one another. Both the default values, and the maximum and minimum configurable values are as follows:

Range	BMEAHO0412(C) Range					
	Undershoot Area		Nominal Range		Overshoot Area	
Default setting	–2,500	–801	–800	10,300	10,301	10,625
Minimum / Maximum	–32,768	...	...	...	...	32,767

Writing Outputs

The application can provide the outputs with values using the standard display (in %, to 2 decimal places):

Type of Range	Display
4-20 mA	from 0 to 10,000 (0% to 100%)

It is also possible to define the range of values within which measurements are expressed, by selecting:

- the minimum nominal value corresponding to the minimum value for the range: 0 %.
- the maximum nominal value corresponding to the maximum value for the range (100 %).

The lower and upper thresholds can be integers between –32,768 and +32,767.

Output Behavior on Program Interruption

In the event the BMEAHO0412(C) HART analog module detects an event that stops program execution, depending upon the seriousness of the interruption, each of the outputs undertakes one of the following responses:

- apply its fallback/maintain position
- be forced to 0 mA

Output behaviors:

If the detected event is...	The output response is...
Task in STOP mode, or program missing	Fallback/Maintain (channel by channel)
Communication interruption	Fallback/Maintain (channel by channel)
Configuration detected error	0 mA (all channels)
Internal detected error in module	0 mA (all channels)
Output value out of range (undershoot/ overshoot)	Value saturated at the defined limit (channel by channel)
Open circuit	Maintain (channel by channel)
Module hot swapping (processor in STOP mode)	0 mA (all channels)
Reloading program	0 mA (all channels)
Behavior during initial power-up and power off	0 mA (all channels)

⚠WARNING

INOPERABLE EQUIPMENT

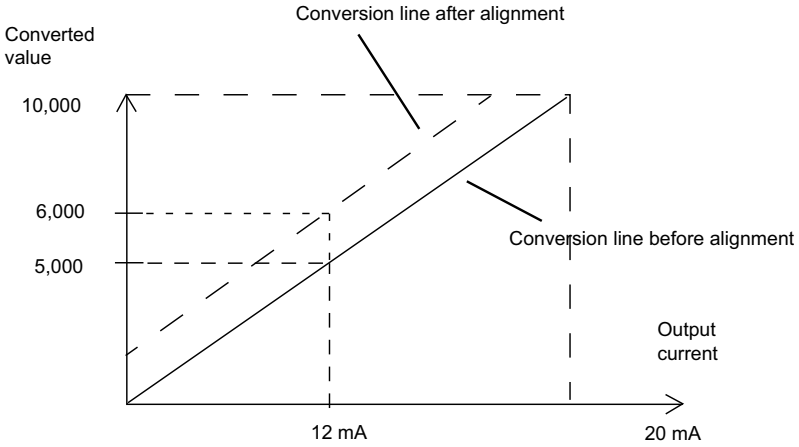
- Upgrade the BMEAHI0812 HART Analog Input Module with the latest available FW version.
- Upgrade the BMEAHO0412 HART Analog Output Module with the latest available FW version (equal or greater than v1.5).

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

Actuator Alignment

The process of alignment involves the elimination of an observed systematic offset, around a specific operating point, for a given actuator. Actuator alignment compensates for a detected variation that is linked to the process. Replacing a module does not require a new alignment. However, replacing the actuator or changing the actuator operating point requires a new alignment.

Conversion lines are as follows:



The alignment value is editable from a programming console, even if the program is in RUN mode. For each output channel, you can:

- view and modify the desired measurement value
- save the alignment value
- determine whether the channel already has an alignment

The alignment offset may also be modified through programming.

Channel alignment is performed on the channel in standard operating mode, without any effect on the channel operating modes.

The maximum offset between measured value and desired (aligned) value may not exceed +/-1,500.

NOTE: To align multiple analog channels on the BMEAHO0412(C) eX80 HART analog output module, proceed channel by channel, aligning one channel at a time. Test each channel after aligning it before proceeding to align the next channel.

Using EMC Kits

Introduction

To help shield the BMEAHO0412(C) signals from outside interference induced in series mode and interference in common mode, use EMC kits to ground the shielded cables connected to the module.

Cable Shielding

Connect the cable shielding to the grounding bar. Clamp the shielding to the shield bar on the module side. Use the BMX XSP 0400/0800/1200 EMC kit to connect the shielding.

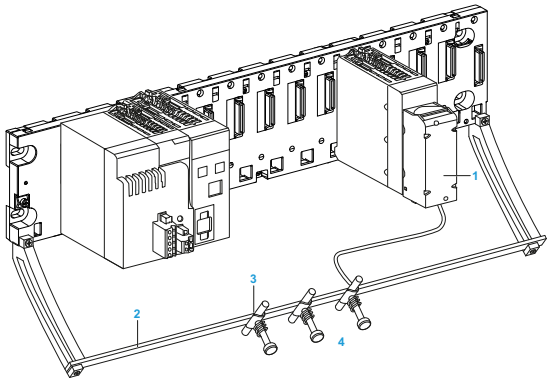
⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

While mounting / removing the modules:

- confirm that each terminal block is connected to the shield bar and
- disconnect voltage supplying sensors and pre-actuators.

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



1 BME AHO 0412

2 Shield bar

3 Clamp

4 To pre-actuators

Using Pre-Actuators Referenced in Relation to the Ground

There are no specific technical constraints for referencing pre-actuators to the ground. It is nevertheless preferable to avoid returning a remote ground potential to the terminal that may be different to the ground potential close by.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK

Sensors and other peripherals may be connected to a grounding point some distance from the module. Such remote ground references may carry considerable potential differences with respect to local ground. Confirm that:

- potentials greater than safety limits cannot exist,
- induced currents do not affect the measurement or integrity of the system.

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

Electromagnetic Hazard Instructions

⚠ CAUTION

UNEXPECTED BEHAVIOR OF APPLICATION

- To reduce electromagnetic perturbations, use the BMX XSP 0400/0800/1200 EMC kit to connect the shielding without programmable filtering.
- Electromagnetic perturbations may lead to an unexpected behavior of the application.

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

Wiring Diagrams

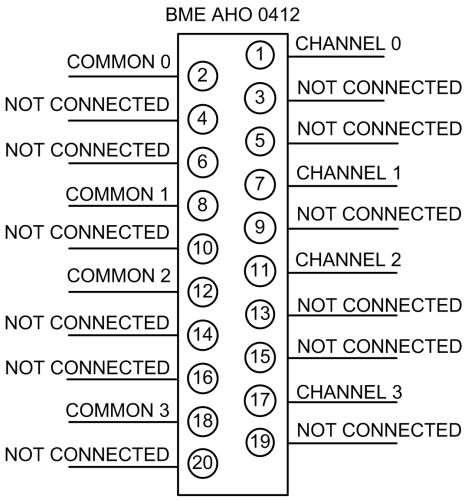
Point-to-Point Connections

The BMEAHO0412(C) eX80 HART analog output module supports point-to-point 4-20 mA wiring connections to field instruments, including actuators and transmitters. You can make the connection to the input module using a 20-pin terminal block (BMX FTB 20•0), a pre-assembled cord set (BMX FTW •01S), or TELEFAST accessories.

The output module provides 4-20 mA current loop power.

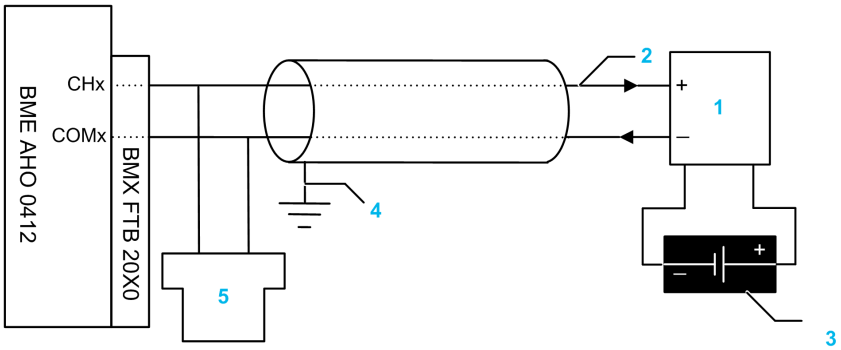
Output Module Pinout

The BMEAHO0412(C) eX80 HART analog output module present the following 20-pin design, to which you can connect a terminal block, a pre-assembled cord set, or TELEFAST cable:



BMEAHO0412(C) with 2-Wire or 4-Wire Transmitter

This example illustrates how to connect the output module to a either a 2-wire or a 4-wire transmitter. Field power is provided to the transmitter only in the 4-wire design:



1 2-wire or 4-wire transmitter

2 4-20 mA current loop, with arrows indicating direction of current flow

3 Field power supply (for 4-wire design only)

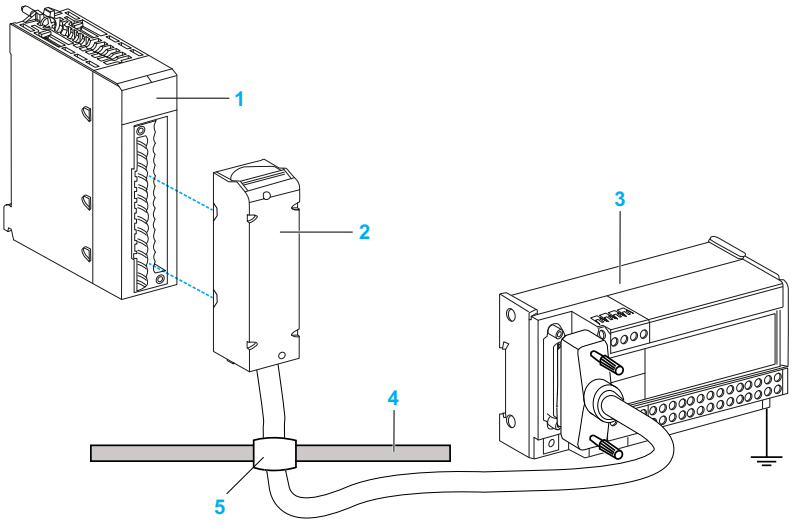
4 Protective ground

5 Secondary HART (hand-held)

Using the TELEFAST Wiring Accessory

Introduction

The TELEFAST pre-wired system consists of connecting cables and interface sub-bases as shown below:



1 BMEAHO0412(C) module

2 BMXFCA••0 connecting cables

3 Interface sub-base ABE7CPA21

4 Shield bar

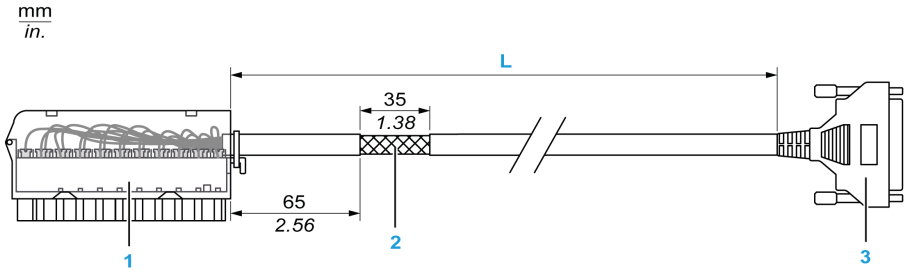
5 Clamp

BMXFCA••0 Connecting Cables

The BMXFCA••0 cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 20-pin terminal block from which extend 1 cable sheath containing 20 wires,
- At the other end a 25-pin Sub-D connector.

The figure below shows the BMXFCA••0 cables:



1 BMXFTB2020 Terminal block

2 Cable shielding

3 25-pin Sub-D connector

L Length according to the part number.

The cable comes in 2 different lengths:

- 1.5 m (4.92 ft): BMXFCA150
- 3 m (9.84 ft): BMXFCA300
- 5 m (16.40 ft): BMXFCA300

The following table gives the characteristics of the BMXFCA••0 cables:

Characteristic		**Value**
Cable	Sheath material	PVC
	LSZH status	No
Environmental	Operating temperature	-25...70 °C (-13...158 °F)

Connecting Sensors

Actuators may be connected to the ABE7CPA21 wiring accessory as depicted in the Wiring Diagram, page 122 topic.

The distribution of analog channels on TELEFAST terminal blocks with the reference ABE7CPA21 are as follows:

TELEFAST terminal block number	**BMEA-HO0412 pinout**	**Signal type**	**TELEFAST terminal block number**	**BMEAHO0412 pinout**	**Signal type**
1	NC	Ground	Supp 1	NC	Ground
2	NC	STD(1)	Supp 2	NC	Ground
3	NC	STD(1)	Supp 3	NC	Ground
4	NC	STD(2)	Supp 4	NC	Ground
100	1	CH0	200	2	COM0
101	NC	NC	201	NC	Ground
102	7	CH1	202	8	COM1
103	NC	NC	203	NC	Ground

TELEFAST terminal block number	BMEA-HO0412 pinout	Signal type	TELEFAST terminal block number	BMEAHO0412 pinout	Signal type
104	11	CH2	204	12	COM2
105	NC	NC	205	NC	Ground
106	17	CH3	206	18	COM3
107	NC	NC	207	NC	Ground
COMx: Common pin for channel x NC: Not connected					

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK

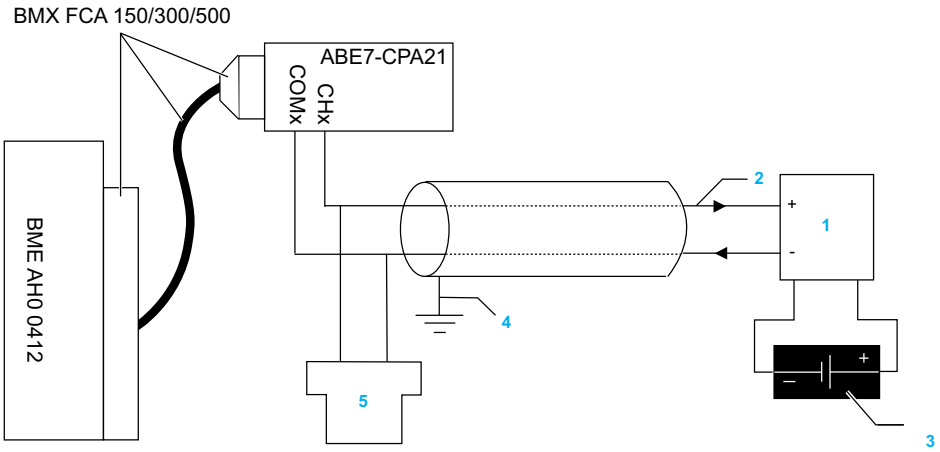
Confirm that the strap for the ABE7CPA21 is removed.

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

NOTE: The grounding of cables is facilitated using the ABE7BV•0 wiring accessory.

BMEAHO0412(C) with 2-Wire or 4-Wire Transmitter, TELEFAST Connector

This example illustrates how to connect the output module to either a 2-wire or a 4-wire transmitter using a TELEFAST wiring accessory and cable. The cable includes a 20-pin terminal block. Field power is supplied to the transmitter only for the 4-wire design.



1 2-wire or 4-wire transmitter

2 4-20 mA current loop, with arrows indicating direction of current flow

3 Field power supply (for 4-wire design only)

4 Protective ground

5 Secondary HART (hand-held)

HART Network Cable Characteristics and Lengths

The *HART Communication Foundation* has developed documentation describing recommended types and diameters of cable for HART networks. This

documentation also includes instructions on how to calculate maximum cable lengths for a HART network.

To obtain a copy of this documentation, visit the *HART Communication Foundation* website at www.hartcomm.org, and download the document *FSK Physical Layer Specification* (document number HFD_SPEC-054). HART network cable characteristics and lengths information can be found at section 7.5 of this document.

LED Diagnostics

What's in This Chapter

LED Diagnostics 505
eX80 Analog I/O Module Diagnostics 506

Overview

This chapter describes how to use module LEDs to diagnose the BMEAHI0812 and BMEAHO0412 HART analog I/O.

LED Diagnostics

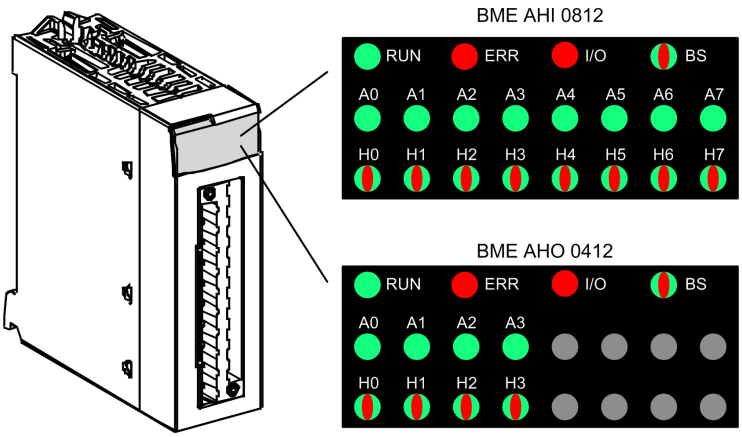
LED Indicators

The BMEAHI0812 and BMEAHO0412 HART eX80 analog I/O modules include LEDs that indicate the operating status of the module:

- module status:
  - RUN (green)
  - ERR (red)
  - I/O (red)
- bus status: BS (red/green)
- analog channel status (green):
  - A0...A7 (for the BMEAHI0812 module)
  - A0...A3 (for the BMEAHO0412 module)
- HART channel status (red/green):
  - H0...H7 (for the BMEAHI0812 module)
  - H0...H3 (for the BMEAHO0412 module)

Illustration

The modules have several LEDs that indicate module operating status:



eX80 Analog I/O Module Diagnostics

LED Diagnostics

Use the combined states of the RUN, ERR, I/O, BS, An and Hn LEDs to diagnose the channel and module status for the BMEAHI0812 and BMEAHO0412 modules:

LED						Description
RUN	**ERR**	**I/O**	**BS**	**A0...An**	**H0...Hn**	
OFF	OFF	OFF	OFF	All OFF	All OFF	Module has no power, or has stopped operating.
BLK green	BLK red	BLK red	BLK red & green	All OFF	All OFF	Module is performing self-test on power-up.
OFF	BLK red	OFF	X	All OFF	All OFF	The module is not yet configured, or is in the process of configuring its channels.
ON green	BLK red	X[1]	X	X	X	No communication between the output module and the head module. **NOTE:** The module retains the previous I/O status.
ON green	OFF	OFF	X	ON green	X	Analog channel is operational.
ON green	OFF	OFF	X	OFF	X	Analog channel is disabled.
ON green	ON red	OFF	X	OFF	X	Analog to digital conversion detected error, or power supply detected error on channel.
ON green	OFF	ON red	X	FLK	X	Overflow or underflow error detected on channel.
ON green	OFF	ON red	X	BLK	X	Broken wired detected on input sensor channel or output actuator channel.
ON green	OFF	ON red	X	OFF	X	Calibration error detected on output channel.
ON green	OFF	ON red	X	X	ON red	No response from HART device on channel.
ON green	OFF	OFF	X	X	BS red	A HART device has been detected with a major difference from the device that is configured for the channel.
ON green	OFF	OFF	X	X	FLK red	A HART device has been detected with a minor difference from the device that is configured for the channel.
ON green	OFF	OFF	X	X	ON green	A HART device has been detected that is the same as the device configured for the channel, or a device with a detected major or minor difference has been accepted.
ON green	OFF	OFF	X	X	BLK green	The HART channel is connecting to a device.
ON green	OFF	OFF	X	X	OFF	HART communication disabled for the channel.
BLK green	OFF	OFF	BLK green	X	X	The I/O module is downloading firmware.
X	X	X	OFF	X	X	The module has not been assigned an IP address.
X	X	X	BLK green	X	X	The module has no established EIP Forward Open connections, but has an IP address.
X	X	X	ON green	X	X	The module has established an Ethernet connection.
X	X	X	BLK red	X	X	The module Ethernet connection has timed out. This is cleared only when the timed out connection is re-established or if the module is reset.
OFF	X	X	ON red	X	X	The module has detected that its IP address is already in use.

ON	LED is steady on.
OFF	LED is off.

FLK	Flickering: ON for 50 ms, OFF for 50 ms, repeat.
BLK	Blinking: ON for 200 ms, OFF for 200 ms, repeat.
BS	Blinking Sequence: ON for 200 ms, OFF for 1,200 ms, repeat.
X	This LED is not used in determining the channel or module status.

Ethernet Services

What's in This Chapter

Fast Device Replacement 508

Overview

This chapter presents the Ethernet services supported by the BMEAHI0812(H) and BMEAHO0412(C) HART analog I/O modules.

Fast Device Replacement

Introduction

The fast device replacement (FDR) service employs a central FDR server to store the following parameters for a BMEAHI0812(H) or BMEAHO0412(C) analog I/O module:

- IP addressing parameters, and
- Module configuration parameters.

When you replace a module, the server automatically configures the replacement module with the identical parameters as the replaced module. The FDR service removes the need for service personnel to maintain configuration records and reduces the possibility of human error in entering the new configuration.

FDR Server

The M580 Ethernet CPU includes an FDR server. The server is a passive device that stores both IP addressing and configuration parameters for the modules on the network. Each network module is identified by its *device name*. After the FDR service is enabled, the server responds to requests from the FDR clients.

FDR Client

The BMEAHI0812(H) and BMEAHO0412(C) analog I/O modules are FDR clients. They use the FDR server to facilitate replacement of the module. Each client is assigned a device name that uniquely identifies it from other modules on the network. After the module is connected to the network, it receives a copy of its operating parameters from the FDR server. These parameter settings enable a replacement module to operate exactly as the original client.

How FDR Works

When it is time to replace a module, the following occurs:

Sequence	Event
1	Your service personnel needs to assign the device name of the original module to the replacement module.
2	Your service personnel places the new module on the network, which is configured to use the DHCP client service.
3	The module automatically sends a request to the server for a set of IP parameters that is used by a module with this device name.

Sequence	Event
4	The module receives the IP parameters and then connects to the FDR server and downloads a copy of its operating parameters.
5	After the parameters are downloaded, the module implements the parameters and resumes operation.

Firmware Update

What's in This Chapter

Firmware Update with Automation Device Maintenance 510
Firmware Update with Unity Loader 510

Overview

The chapter describes the two available tools to update the firmware: Automation Device Maintenance and Unity Loader.

Firmware Update with Automation Device Maintenance

Overview

The EcoStruxure™ Automation Device Maintenance is a standalone tool that allows and simplifies the firmware update of devices in a plant (single or multiple).

The tool supports the following features:

- Automatic device discovery
- Manual device identification
- Certificate management
- Firmware update for multiple devices simultaneously

NOTE: For a description of the download procedure, refer to the *EcoStruxure™ Automation Device Maintenance, User Guide*.

⚠WARNING

INOPERABLE EQUIPMENT

- Upgrade the BMEAHI0812 HART Analog Input Module with the latest available FW version.
- Upgrade the BMEAHO0412 HART Analog Output Module with the latest available FW version (equal or greater than v1.5).

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

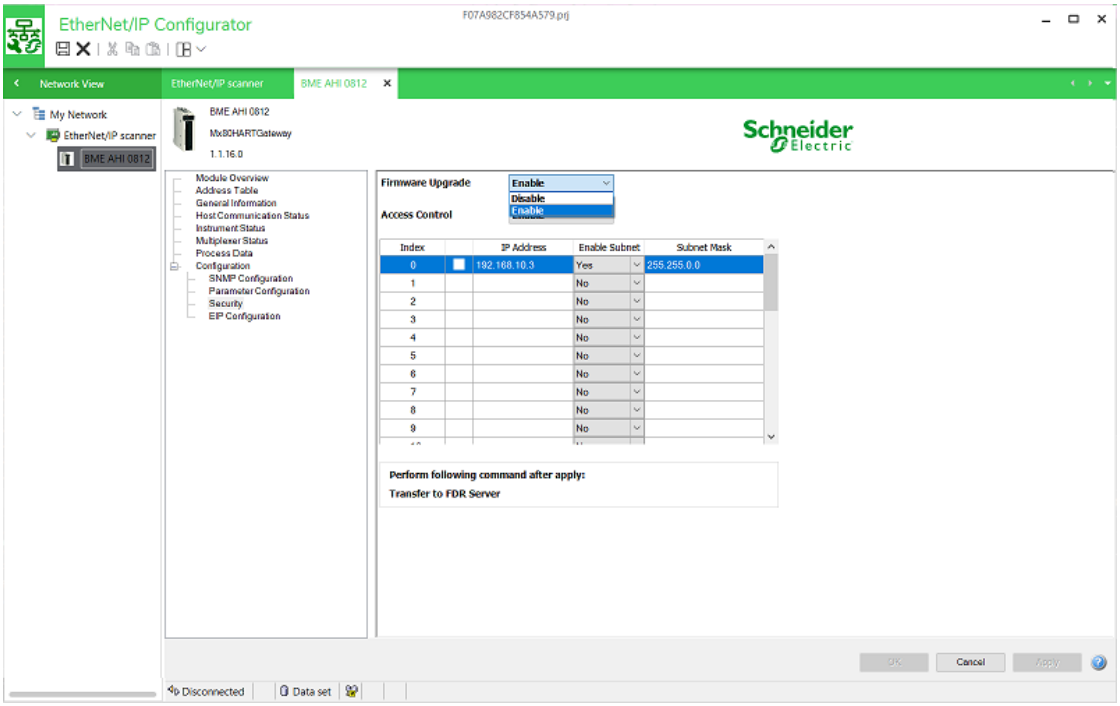
Firmware Update with Unity Loader

Using Unity Loader

Use Unity Loader to install firmware upgrades for the HART analog I/O modules. Unity Loader is a stand-alone utility that ships with your EcoStruxure™ Automation Expert software.

Before you can upgrade firmware, you first follow the procedure below:

Step	Action
1	Access the hardware configuration screen for the appropriate module in EcoStruxure™ Automation Expert.
2	Add a new DTM to the **DTM Browser**. For more information, refer to topic *Adding a DTM to the DTM Browser*, page 531.

3	Enable **Firmware upgrade** in the **Security** page for the gateway DTM, then save the project and export the configuration. 
4	Import the EtherNet/IP configuration into the solution. For more information, refer to the *EcoStruxure Automation Expert User Manual*, *EtherNet/IP Fieldbus Scanner* chapter
5	In the **Deploy and Diagnostic** editor, **Compile**, **Deploy** and **Run** the solution.

NOTE:

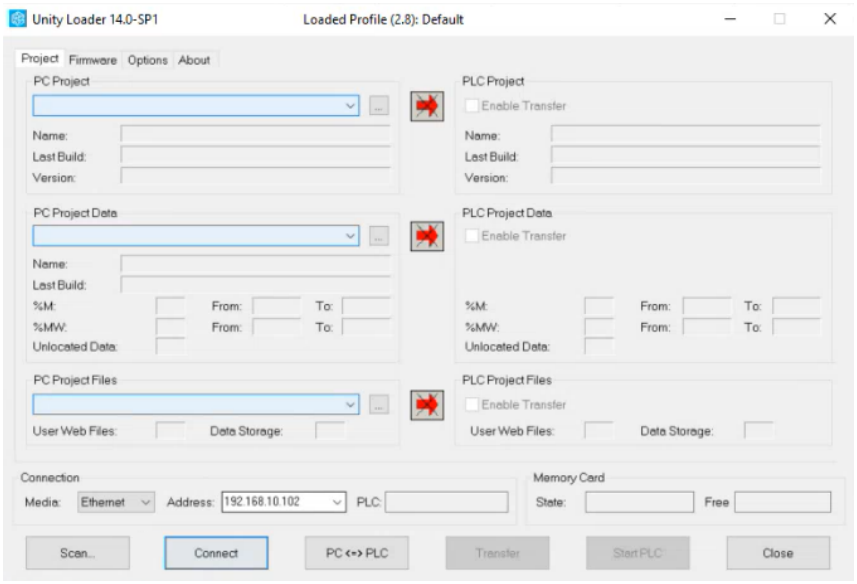
Before beginning a firmware upgrade, deploy the hardware configuration for the first time.

Physically Connecting to the Module

After an IP address has been assigned to the module, the next step is to connect your maintenance PC to the module. You can either directly connect your PC to the module, or merely connect your PC to the Ethernet network to which your module is connected.

Connecting Unity Loader to the module

To establish a connection between Unity Loader and the module, follow these steps:

Step	Action
1	Open Unity Loader on your PC: **Start** > **Programs** > **Schneider Electric** > **Unity Loader**. Unity Loader opens and displays the **Project** tab: 
2	In the **Connection** part of the page, make the following settings: • **Media**: select **Ethernet.** • **Address**: type in the module IP address. **NOTE:** Confirm that you are using the IP address for the HART I/O module, and not the CPU.
3	Click **Connect**.

Performing the Upgrade

The firmware upgrade for a module is contained in a file with an .LDX extension. The single .LDX file contains the necessary module firmware upgrades.

Before upgrading the firmware, Unity Loader confirms that the firmware upgrade file is compatible with your module.

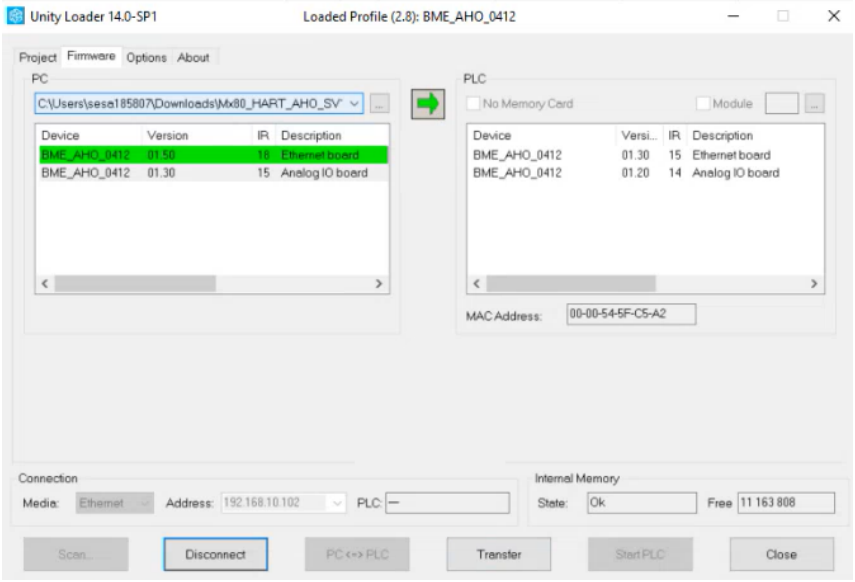
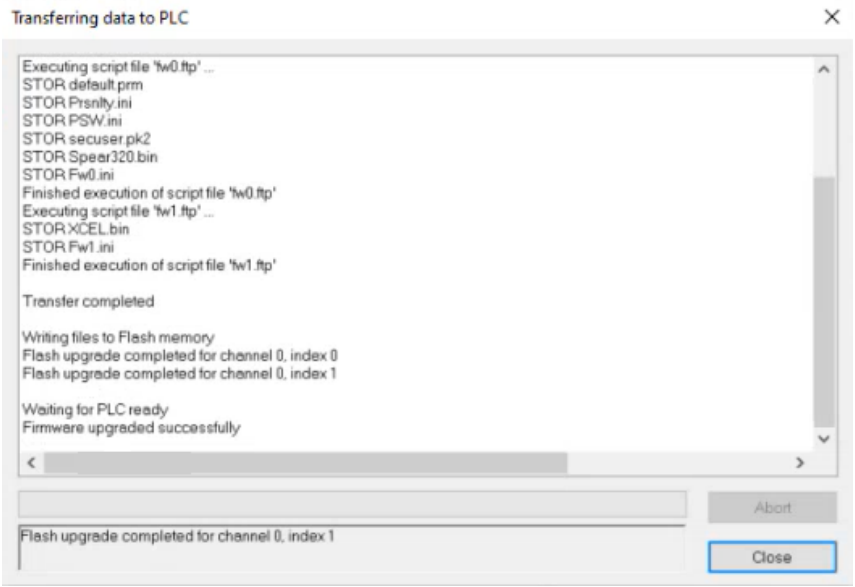
Do not interrupt the firmware download process:

- Do not allow an interruption to the power or the communications during the firmware upgrade process.
- Do not shut down the Unity Loader software during the upgrade.

If the firmware download process is interrupted, the new firmware is not installed and the adapter continues to use the old firmware. If an interruption occurs, cycle power to the HART module and restart the process.

Open Unity Loader on your PC and upgrade the firmware for the remote I/O adapter:

Step	Action
1	After Unity Loader has connected to the module, click the **Firmware** tab.
2	In the **PLC** area of the **Firmware** tab, confirm that the **Module** check-box is de-selected.
3	In the **PC** area, click the ellipsis (**...**) button to open a dialog where you can navigate to and select the firmware file for your module. The firmware is contained in a Unity Loader file (.ldx extension).

Step	Action
	After you select the firmware file and close the dialog, the selected revision of this firmware is displayed in the list on the left, and the current version of the firmware is displayed in the list on the right. 
4	When the arrow in the middle of the screen (above) is green, click **Transfer**. **NOTE:** Only click **Transfer** if the arrow is green. A yellow arrow indicates that the firmware file on your computer is the same version or newer than the file selected for transfer; a red arrow indicates that the firmware on the computer is not compatible with the module.
5	Click **yes** on the 2 dialogs that appear. A third dialog appears (below), which indicates the transfer status with the blue bars at the bottom of the screen. After the message “Firmware upgraded successfully” is displayed (below), click **Close**. 
6	In the Unity Loader software, click **Disconnect** and close the window. The module reboots itself on completion of the firmware upgrade.

NOTE: After the firmware has been upgraded, use EcoStruxure™ Automation Expert for disable **Firmware upgrade** in the **Security** page for the gateway DTM, and redeploy the solution.

Unity Loader includes its own user documentation. Refer to *Unity Loader, User Guide* for assistance when you perform the firmware upgrade.

Installing HART Analog I/O Modules

What's in This Chapter

Installing Analog I/O Modules 514
How to Connect BMEAHI0812 and BMEAHO0412 HART Analog Modules 516
20-pin Terminal Blocks: BMX FTB 20•0 516
BMX FTW •01S Cable 519
Fitting a 20-pin Terminal Block to a Module 521

Overview

This chapter describes the installation of the HART analog I/O modules, including:

- mounting the module on the backplane
- fitting a 20-pin terminal block to the module
- connecting 20-pin terminal blocks
- selecting TELEFAST wiring accessories

Installing Analog I/O Modules

At a Glance

The analog I/O modules are powered by the rack bus. The modules may be installed and uninstalled without turning off power supply to the rack.

Fitting operations (installation, assembly, and disassembly) are described below.

Before Installing a Module

Before installing a module, take off the protective cap from the module connector located on the rack.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Before mounting / removing the modules:

- confirm that the terminal block is still connected to the shield bar
- disconnect the voltage of sensors and pre-actuators

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

⚠WARNING

INOPERABLE EQUIPMENT

- Upgrade the BMEAHI0812 HART Analog Input Module with the latest available FW version.
- Upgrade the BMEAHO0412 HART Analog Output Module with the latest available FW version (equal or greater than v1.5).

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

Selecting a Backplane

Install the analog I/O modules on one of the following Ethernet backplanes:

Backplane	Description
BME XBP 0400[1]	4-slot Ethernet backplane
BME XBP 0800[1]	8-slot Ethernet backplane
BME XBP 1200[1]	12-slot Ethernet backplane
1. The following reserved slots are not available for module installation: • In a local rack, slots 0 and 1 are reserved for the CPU. • In a remote I/O drop, slot 0 and 1 are reserved for a BMECRD0100 adapter module.	

The HART analog modules may be installed only on the principal Rack.

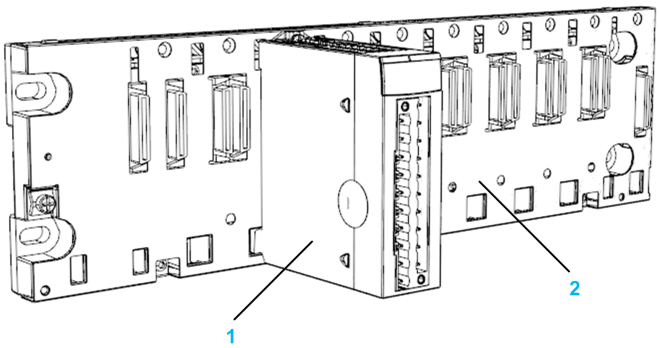
The HART analog modules may be installed in the below slots:

- 2 and 3 in the backplane BMEXBP0400.
- 2 to 7 in the backplane BMEXBP0800.
- 3 to 7 and/or 9 in the backplane BMEXBP1200.

Power is supplied to the I/O modules by the bus at the bottom of the rack (3.3 V and 24 V).

Installation

The diagram below shows a HART analog I/O module mounted on the rack.

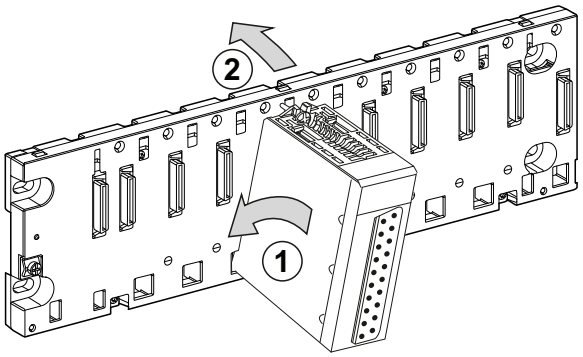
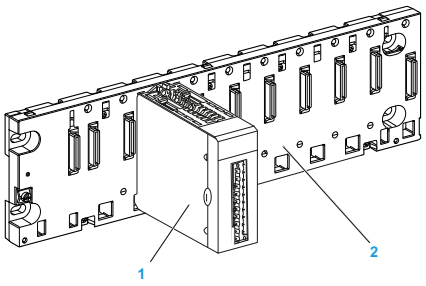


The assembly includes the following components:

Number	Description
1	20-pin terminal block module
2	8 slot Ethernet backplane

Installing the Module on the Rack

To mount the analog I/O modules on the backplane, follow these steps:

Step	Action	Illustration
1	Position the locating pins situated at the rear of the module (on the bottom part) in the corresponding slots in the rack. **NOTE:** Before positioning the pins, remove the protective cover.	Steps 1 and 2 
2	Swivel the module towards the top of the rack so that the module sits flush with the back of the rack. It is now set in position.	
3	Tighten the retaining screw to hold the module in place on the rack. Tightening torque: 0.4...1.5 N•m (0.30...1.10 lbf-ft).	Step 3 

How to Connect BMEAHI0812 and BMEAHO0412 HART Analog Modules

Overview

HART Analog input/output modules are connected to sensors, pre-actuators or terminals using:

- a removable terminal block, or
- a pre-assembled cord sets, or
- TELEFAST pre-wired system for rapid connection to operative parts.

		BMEAHI0812	BMEAHO0412
Removable terminal block	BMX FTB 20•0	Yes	Yes
Pre-assembled cord sets	BMX FTW •01S	Yes	Yes
TELEFAST accessories	ABE-7CPA21	No	Yes(2)
	ABE-7CPA31	Yes(1)	No
(1) with BMX FTA ••22 connecting cables. **(2)** with BMX FCA ••0 connecting cables.			

20-pin Terminal Blocks: BMX FTB 20•0

At a Glance

There are three types of 20-pin terminal blocks:

- BMX FTB 2010 screw clamp terminal blocks
- BMX FTB 2000 caged terminal blocks
- BMX FTB 2020 spring terminal blocks

Cable Ends and Contacts

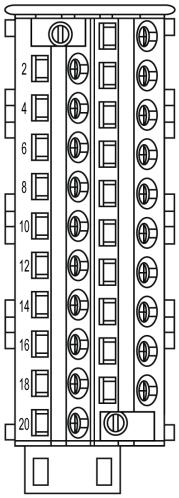
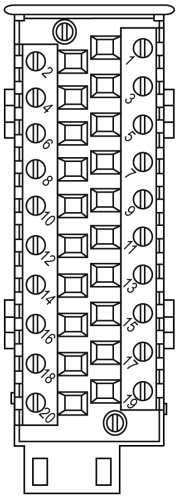
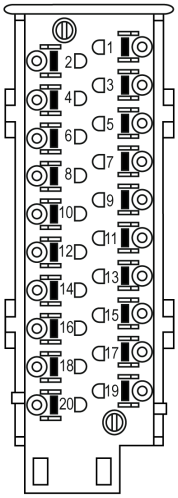
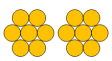
Each terminal block can accommodate:

- Bare wires
- Wires with:
  - DZ5-CE (ferrule) type cable ends: 
  - AZ5-DE (twin ferrule) type cable ends: 

NOTE: When using stranded cable, Schneider Electric strongly recommends the use of wire ferrules which are fitted with an appropriate crimping tool.

Description of the 20-pin Terminal Blocks

The following table describes the type of wires that fit each terminal block and the associated gauge range, wiring constraints, and tightening torque:

	Screw Clamp Terminal Blocks **BMX FTB 2010**	**Caged Terminal Blocks** **BMX FTB 2000**	**Spring Terminal Blocks** **BMX FTB 2020**
Illustration			
1 solid conductor 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 solid conductors 	2 conductors of the same size: • AWG: 2 x 22...16 • mm²: 2 x 0.34...1.5	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
1 stranded cable 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 stranded cables 	2 conductors of the same size: • AWG: 2 x 22...16 • mm²: 2 x 0.34...1.5	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
1 stranded cable with ferrule 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1

	Screw Clamp Terminal Blocks **BMX FTB 2010**	**Caged Terminal Blocks** **BMX FTB 2000**	**Spring Terminal Blocks** **BMX FTB 2020**
2 stranded cables with twin ferrule 	• AWG: 2 x 24...18 • mm^2: 2 x 0.24...1	• AWG: 2 x 24...20 • mm^2: 2 x 0.24...0.75	• AWG: 2 x 24...20 • mm^2: 2 x 0.24...0.75
Minimum individual wire size in stranded cables when a ferrule is not used 	• AWG: 30 • mm^2: 0.0507	• AWG: 30 • mm^2: 0.0507	• AWG: 30 • mm^2: 0.0507
Wiring constraints	Screw clamps have slots that accept: • Flat-tipped screwdrivers with a diameter of 5 mm. • Pozidriv PZ1 or Philips PH1 cross-tipped screwdrivers. Screw clamp terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	Caged terminal blocks have slots that accept: • Flat-tipped screwdrivers with a diameter of 3 mm. Caged terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	The wires are connected by pressing the button located next to each pin. To press the button, use a flat-tipped screwdriver with a maximum diameter of 3 mm.
Screw tightening torque	0.5 N•m (0.37 lbf-ft)	0.4 N•m (0.30 lbf-ft)	Not applicable

Connection of 20-pin Terminal Blocks

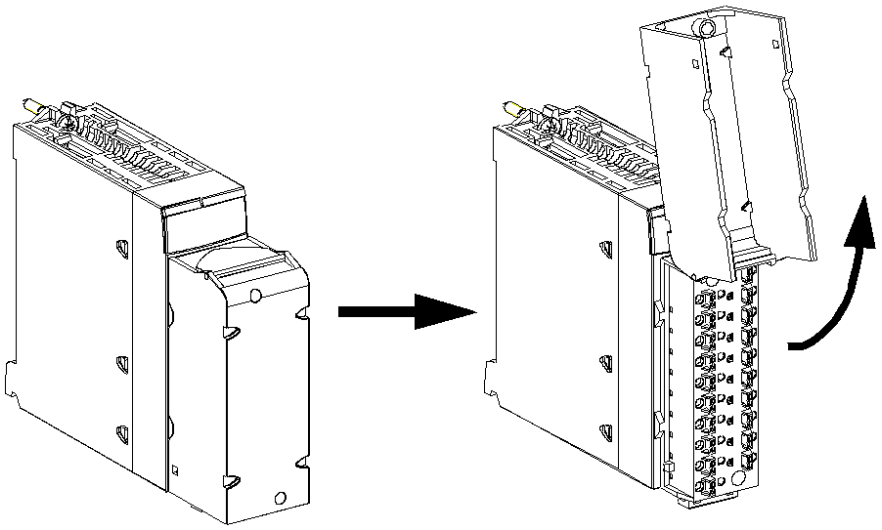
⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connection or disconnection of the terminal block.

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

The following diagram shows the method for opening the 20-pin terminal block door so that it can be wired:



NOTE: The connection cable is installed and held in place by a cable clamp positioned below the 20-pin terminal block.

Labeling of 20-pin Terminal Blocks

Labels for the 20-pin terminal blocks are supplied with the module. They are to be inserted in the terminal block cover by the customer.

Each label has two sides:

- One side that is visible from the outside when the cover is closed. This side features the commercial product references, an abbreviated description of the module, as well as a blank section for customer labeling.
- One side that is visible from the inside when the cover is open. This side shows the terminal block connection diagram.

BMX FTW •01S Cable

Introduction

20-pin connector modules are connected to sensors, pre-actuators or terminals using a cable designed to enable direct wire to wire transition of the module's inputs/outputs.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Use only a connector that is designed for a specific module. Plugging the wrong connector can cause an unexpected behavior of the application.

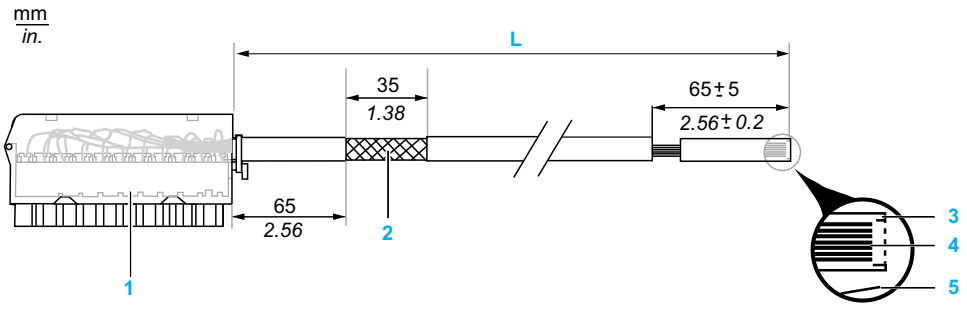
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Cable Description

The BMX FTW •01S cables are pre-assembled cord set, made up of:

- At one end, a compound-filled 20-pin terminal block from which extend 1 cable sheath containing 20 wires,
- At the other end, free wire ends differentiated by color code.

The figure below shows the BMX FTW •01S cables:



1 BMX FTB 2020 Terminal block

2 Cable shielding

3 First of external sheath

4 Wires not stripped

5 Strand of nylon allowing the cable sheath to be stripped easily.

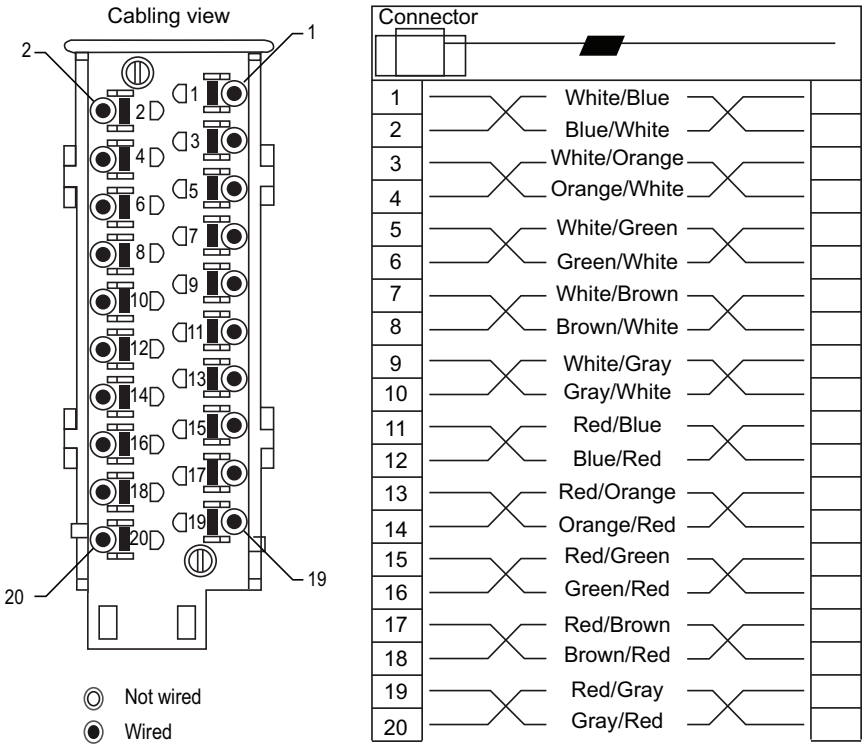
L Length according to the part number.

The cable comes in 2 different lengths:

- 3 m (9.84 ft): BMX FTW 301S;
- 5 m (16.40 ft): BMX FTW 501S;

Pin Assignment

The diagram below shows the connection of BMX FTW •01S cable:



Characteristics

The following table gives the characteristics of the BMX FTW •01S cables:

Characteristic		Value
Cable	Sheath material	PVC
	LSZH status	No
Conductor description	Number of conductors	20
	Conductor cross section (Gauge)	0.34 mm^2 (22 AWG)
Environmental	Operating temperature	-25...70 °C (-13...158 °F)
Applicable standards		DIN47100

Cable Installation

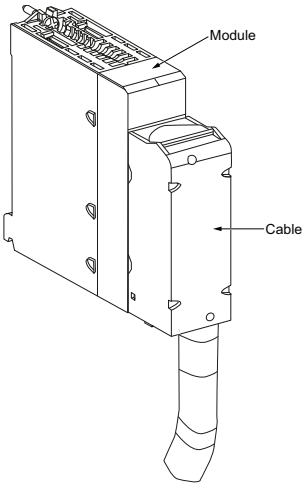
⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK

Turn off all power to sensor and pre-actuator devices before connection or disconnection of the terminal block.

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

The following diagram shows the pre-assembled cable connected to the module:



For more detailed information, refer to the topic *Fitting a 20-pin Terminal Block to a Module*, page 521.

Fitting a 20-pin Terminal Block to a Module

At a Glance

The modules with 20-pin terminal block connections require the terminal block to be connected to the module. These fitting operations (assembly and disassembly) are described below.

⚠⚠DANGER

HAZARD OF ELECTRICAL SHOCK, EXPLOSION OR ARC FLASH

Terminal block must be connected or disconnected with sensor and pre-actuator voltage switched off.

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

⚠CAUTION

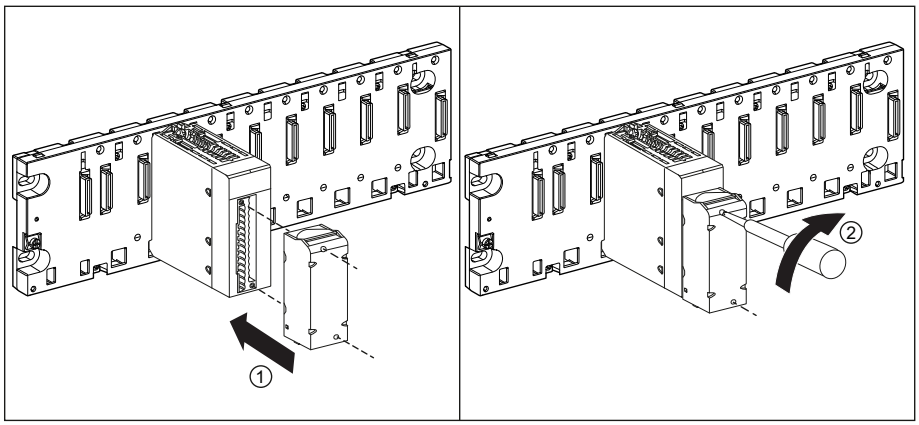
EQUIPMENT DAMAGE

Do not plug an AC terminal block into a DC module. This will cause damage to the module.

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

Installing the Terminal Block

The following table shows the procedure for assembling the 20-pin terminal block onto a discrete input/output module.



Assembly Procedure

Step	Action
1	Once the module is in place on the rack, install the terminal block by inserting the terminal block encoder (the rear lower part of the terminal) into the module's encoder (the front lower part of the module), as shown above. **NOTE:** The module connector have indicators which show the proper direction to use for terminal block installation.
2	Fix the terminal block to the module by tightening the 2 mounting screws located on the lower and upper parts of the terminal block. Tightening torque: 0.4 N•m (0.30 lbf-ft).

NOTE: If the screws are not tightened, there is a potential risk that the terminal block will not be properly fixed to the module.

Coding the 20-Pin Terminal Block

⚠WARNING

UNEXPECTED BEHAVIOUR OF APPLICATION

- Code the terminal block as described below to prevent the terminal block from being mounted on another module.
- Plugging the wrong connector could cause unexpected behaviour of the application.

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

⚠CAUTION

DESTRUCTION OF THE MODULE

- Code the terminal block as described below to prevent the terminal block from being mounted on another module.
- Plugging the wrong connector could cause the module to be destroyed.

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

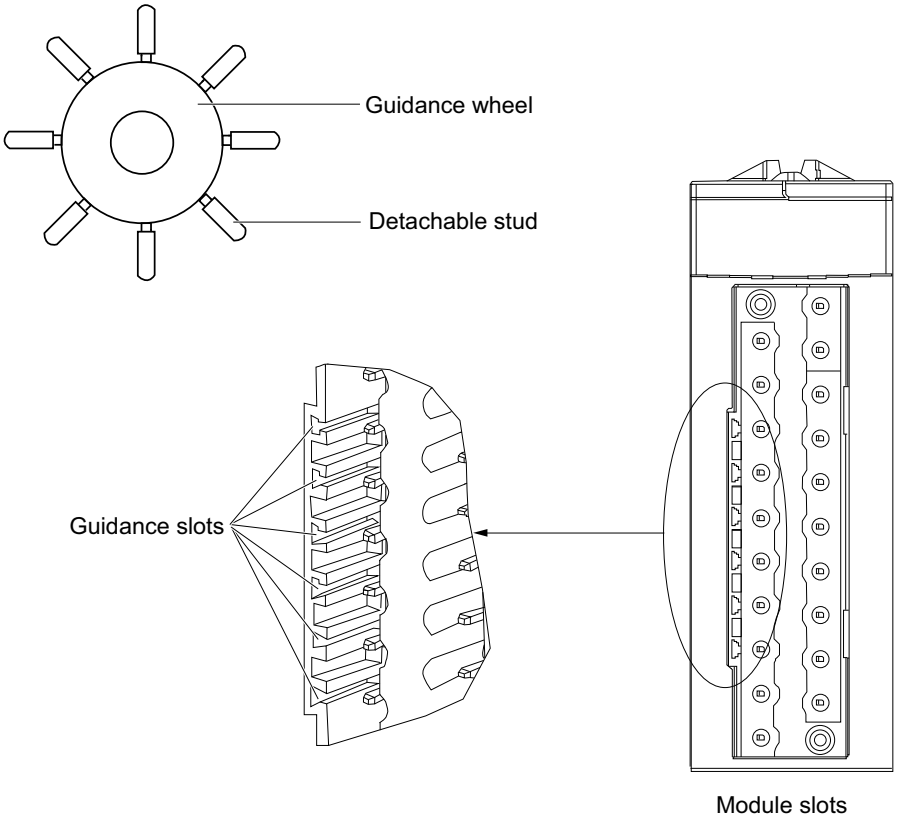
When a 20-pin terminal block is installed on a module dedicated to this type of terminal block, you can code the terminal block and the module using studs. The

purpose of the studs is to help prevent the terminal block from being mounted on another module. Incorrect insertion can then be avoided when replacing a module.

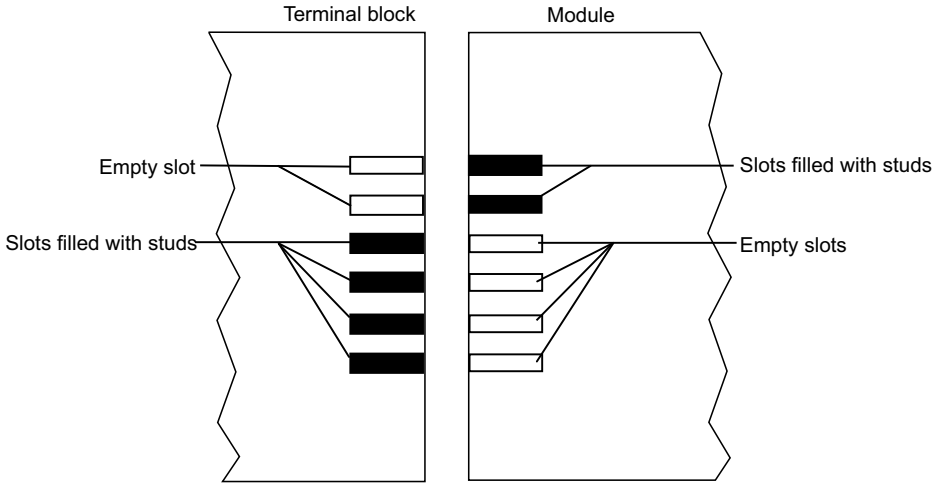
Coding is done by the user with the STB XMP 7800 guidance wheel's studs. You can only fill the 6 slots in the middle of the left side (as seen from the wiring side) of the terminal block, and can fill the module's 6 guidance slots on the left side.

To fit the terminal block to the module, confirm that a module slot with a stud corresponds to an empty slot in the terminal block or a terminal block with a stud corresponds to an empty slot in the module. You can fill up to and including either of the six available slots as desired.

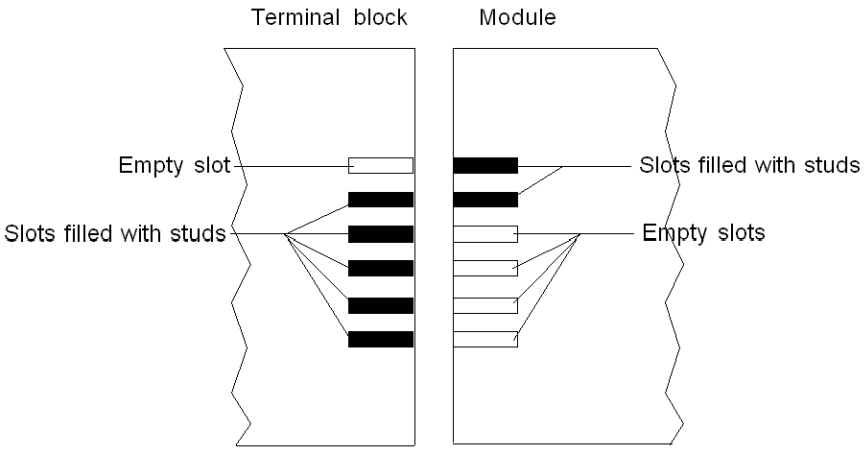
The diagram below shows a guidance wheel as well as the slots on the module used for coding the 20-pin terminal blocks.



The diagram below shows an example of a coding configuration that makes it possible to fit the terminal block to the module.



The diagram below shows an example of coding configuration with which it is not possible to fit the terminal block to the module.



Configuring HART Analog I/O Modules

What's in This Chapter

Adding and Configuring HART Analog I/O 525

Overview

This chapter describes how to add a HART analog I/O module to your application.

Adding and Configuring HART Analog I/O

Introduction

This section describes how to add a HART analog I/O module to the **PLC Bus**, and then configure the module using EcoStruxure Automation Expert screens that you can access from the **PLC Bus**.

Adding HART Analog I/O Modules to the Project

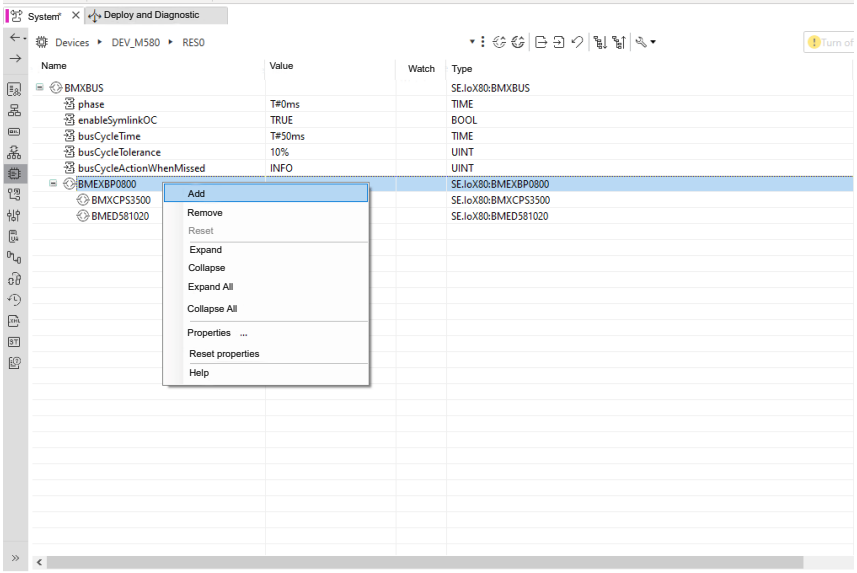
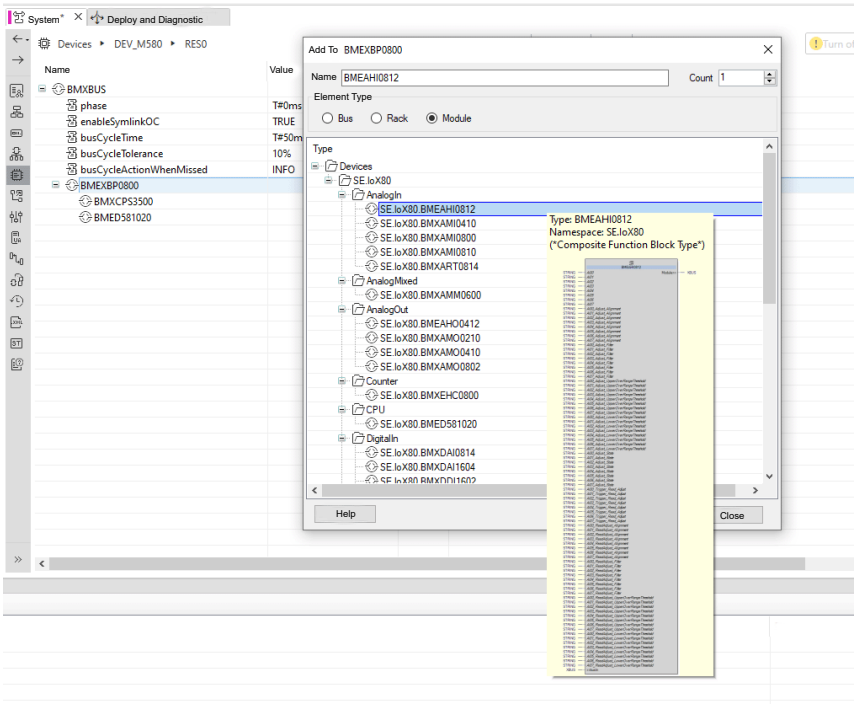
Before You Begin

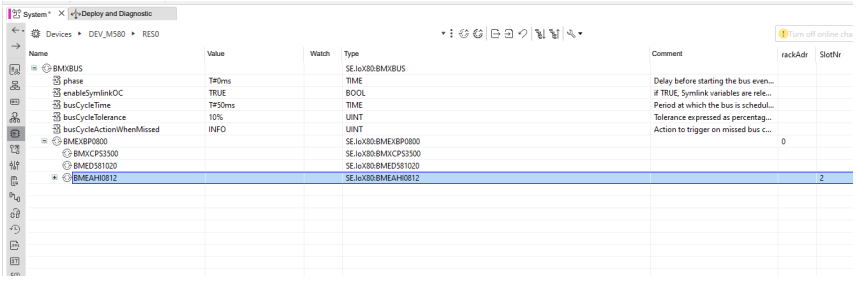
You can add a BMEAHI0812(H) input module or a BMEAHO0412(C) output module only to a rack that includes a BM**E**XBP•••• Ethernet backplane. If that rack is a remote rack, it needs to include a BMECRD0100 adapter.

Adding a New HART Analog I/O Module

To add a new HART analog I/O module to the project, follow these steps:

Step	Action
1	Open the **System** tab, then select **Hardware Configuration** screen in EcoStruxure™ Automation Expert.
2	Right click on the editor background and select **Add** from the context menu to open the **Add Bus** dialog.
3	Select the **SE.IoX80:BMXBUS** as the **Type** and click **OK**.
4	Right-click on **BMXBUS** device and select **Add**.
5	Select the **SE.IoX80:BMEXBP0800** as the **Type** and click **OK**.

Step	Action
6	Right-click on **BMEXBP0800** device and a context menu opens: 
7	Select **New Device...**. The **New Device** dialog opens: 

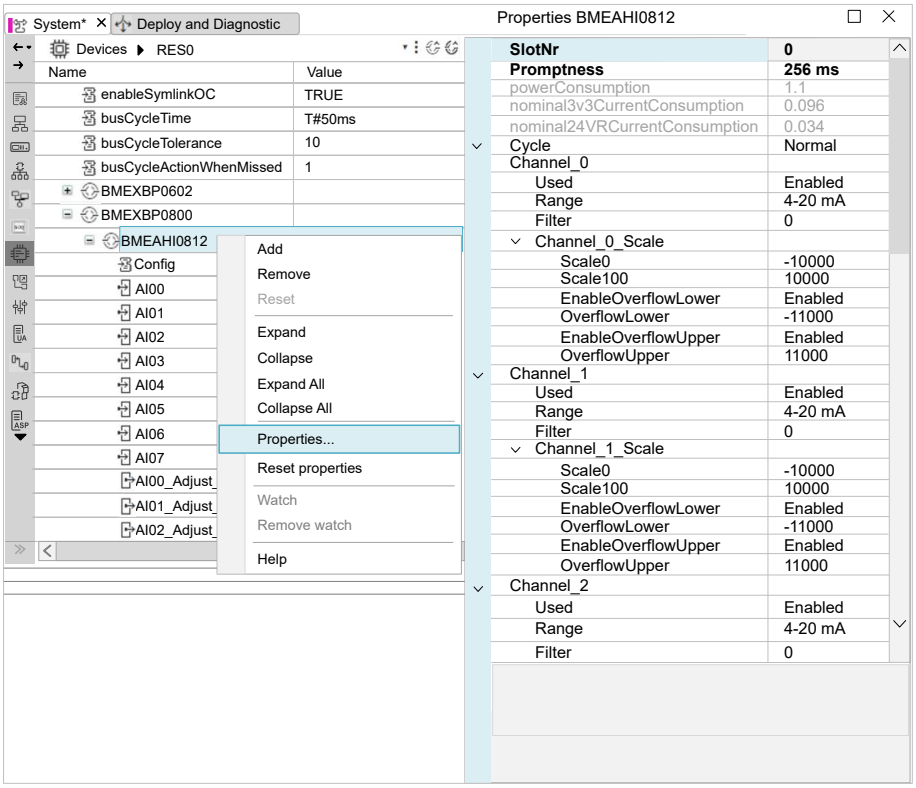
Step	Action
8	In the **New Device** dialog, make the following selections: • Select a HART analog I/O module (in this example, a BMEAHI0812(H) input module); then • For this local rack, select the I/O data type for your module, either: ◦ Topological: supports only analog data ◦ Device DDT (default): supports both analog and HART data **NOTE:** For a remote rack, Device DDT is pre-selected.
9	Click **OK**. The selected module is added to the **Hardware Configuration** screen:  **NOTE:** If you add a module to the remote rack, it appears beneath **EIO Bus**.

NOTE: In addition to adding a new HART Analog I/O Module, you need to add the DTM for that module to the **DTM Browser**. For more information, refer to adding a DTM to the DTM Browser, page 531.

Configuring Analog Input Channels for the BMEAHI0812(H)

Analog Input Channels

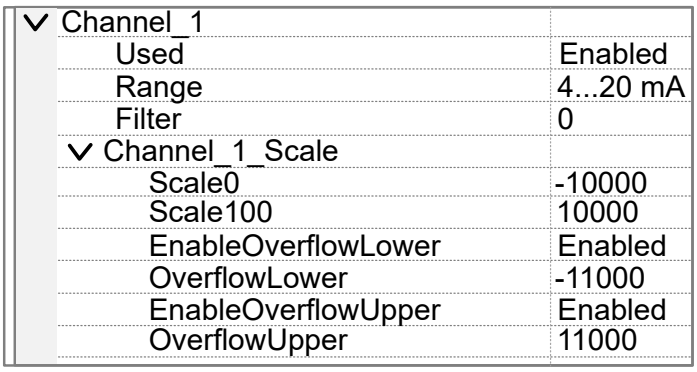
The BMEAHI0812(H) HART analog input module includes 8 input channels. To open the module for configuration in Ecostruxure ™Automation Expert, open the **System** tab, select **Hardware Configuration** screen for the appropriate module, then right-click on it to open the **Properties** pad.



Channel Parameters

To configure an input channel, click the arrow in the drop-down list for the **Channel** you want to configure.

Example:



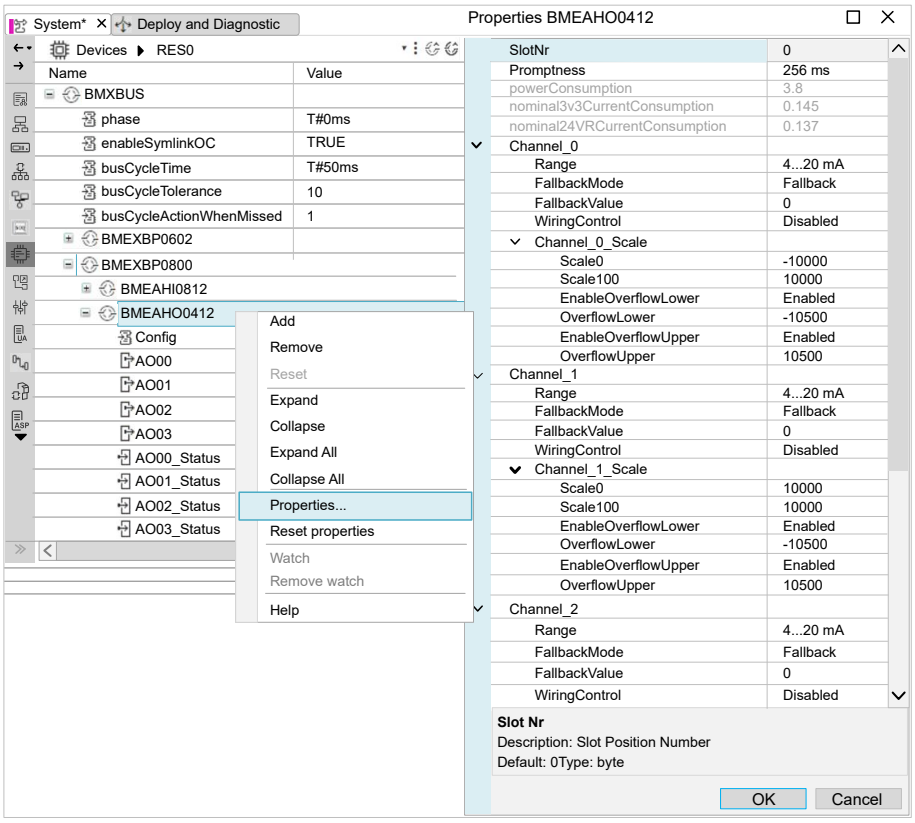
You can edit the following parameters for each of the 8 channels:

Parameter	Description		Value
Used	Select whether the analog channel is enabled/disabled.		Select an option from the list: • Enabled (by default) • Disabled
Range	Select the input range.		Displays the current loop range of 4...20 mA (Read only).
Filter	Select the level of filtering.		Select an option from the list: • 0: No filtering (by default) • 1, 2: Low filtering • 3, 4: Medium filtering • 5, 6: High filtering **NOTE:** If filtering is performed using the HMI (Human-Machine Interface) or Adjusted field, where any value can be selected, the following technical rule applies: if the chosen value is less than 0, it will be automatically set to 0, and if the chosen value exceeds 6, it will be capped at 6, disregarding the specific value chosen.
Scale	Scale0		Input the percentage scaling value for 4 mA current (default = -10000).
	Scale100	Set scale value for 100% PV.	Input the percentage scaling value for 20 mA current (default = 10,000).
	EnableOverflowLower	Select whether the lower overflow is enabled or disabled.	Select an option from the list: • Enabled (by default) • Disabled
	OverflowLower		Set the lower overflow value (-11,000, by default).
	EnableOverflowUpper	Select whether the upper overflow is enabled or disabled.	Select an option from the list: • Enabled (default) • Disabled
	OverflowUpper	Set upper overflow value.	Enter a numeric value (11,000, by default).

Configuring Analog Output Channels for the BMEAHO0412(C)

Analog Output Channels

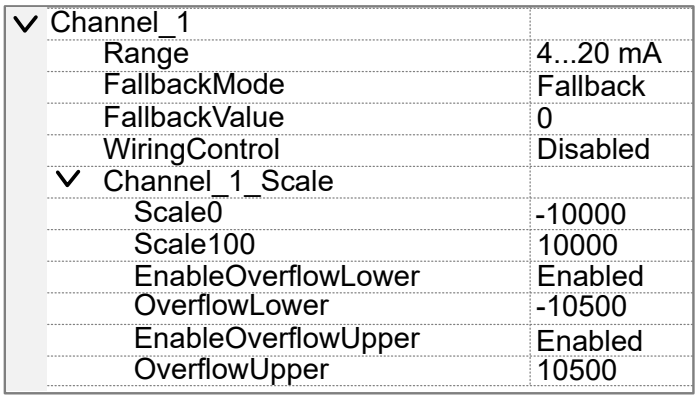
The BMEAHO0412(C) HART analog output module includes 4 output channels. To open the module for configuration in Ecostruxure ™Automation Expert, open the **System** tab, select **Hardware Configuration** screen for the appropriate module, then right-click on it to open the **Properties** pad.



Channel Parameters

To configure an output channel, click the arrow in the drop-down list for the **Channel** you want to configure.

Example:



You can edit the following parameters for each of the 4 channels:

Parameter	Description		Value
Range	Select the input range.		Displays the current loop range of 4...20 mA (read only)
Fallback mode	Use this check box to specify the behavior of the output when the controller is in STOP mode or if communication between the controller and the output module has stopped: • Fallback: channels are set to 0 or 1 according to the defined fallback value for the corresponding 4 - channel group. • Maintain: The outputs remain in the status they were in before switching to **Stop** mode.		Select an option from the list: • Fallback (by default) • Maintain
Fallback value			If the fallback parameter is selected, this value is assigned to the output on fallback. The range of available values is defined by the 0%...100% scaling settings.
Wiring control	The wiring control function checks for a broken wire.		Select an option from the list: • Disabled (by default) • Enabled
Scale	Scale0		Input the percentage scaling value for 4 mA current (by default = -10000).
	Scale100	Set scale value for 100% PV.	Input the percentage scaling value for 20 mA current (by default = 10,000).
	EnableOverflowLower	Select whether the lower overflow is enabled or disabled.	Select an option from the list: • Enabled (by default) • Disabled
	OverflowLower		Set the lower overflow value (-10500, by default).
	EnableOverflowUpper	Select whether the upper overflow is enabled or disabled.	Select an option from the list: • Enabled (by default) • Disabled
	OverflowUpper	Set upper overflow value.	Enter a numeric value (10500, by default).

Configuring BMEAHI0812(H) and BMEAHO0412(C) DTMs

What's in This Chapter

Adding a DTM to the DTM Browser 531
Configuring the Module IP Address 534
Configuring the Module DTM 537

Overview

This chapter describes how to add a HART analog I/O module DTM to the **DTM Browser** for a new module, and then configure that DTM using dialogs you can access from the **DTM Browser**.

Adding a DTM to the DTM Browser

Introduction

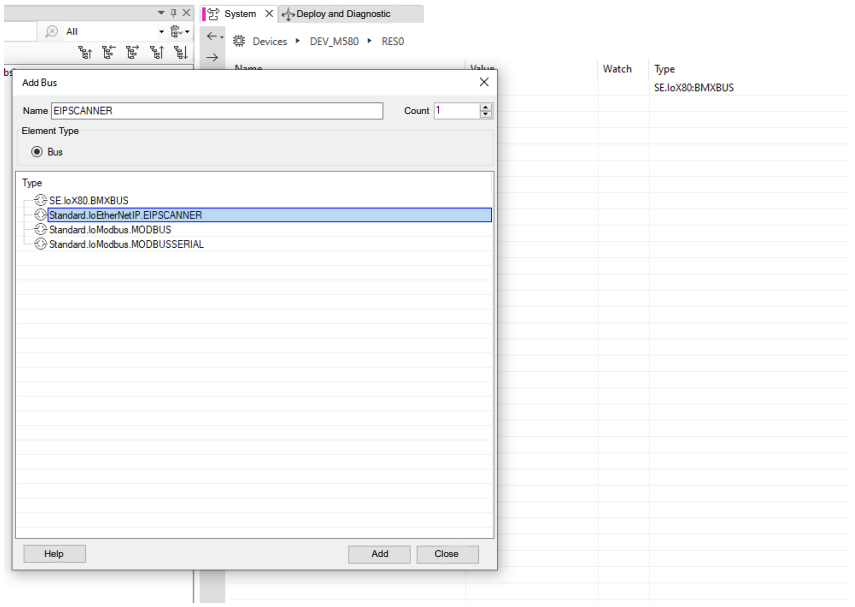
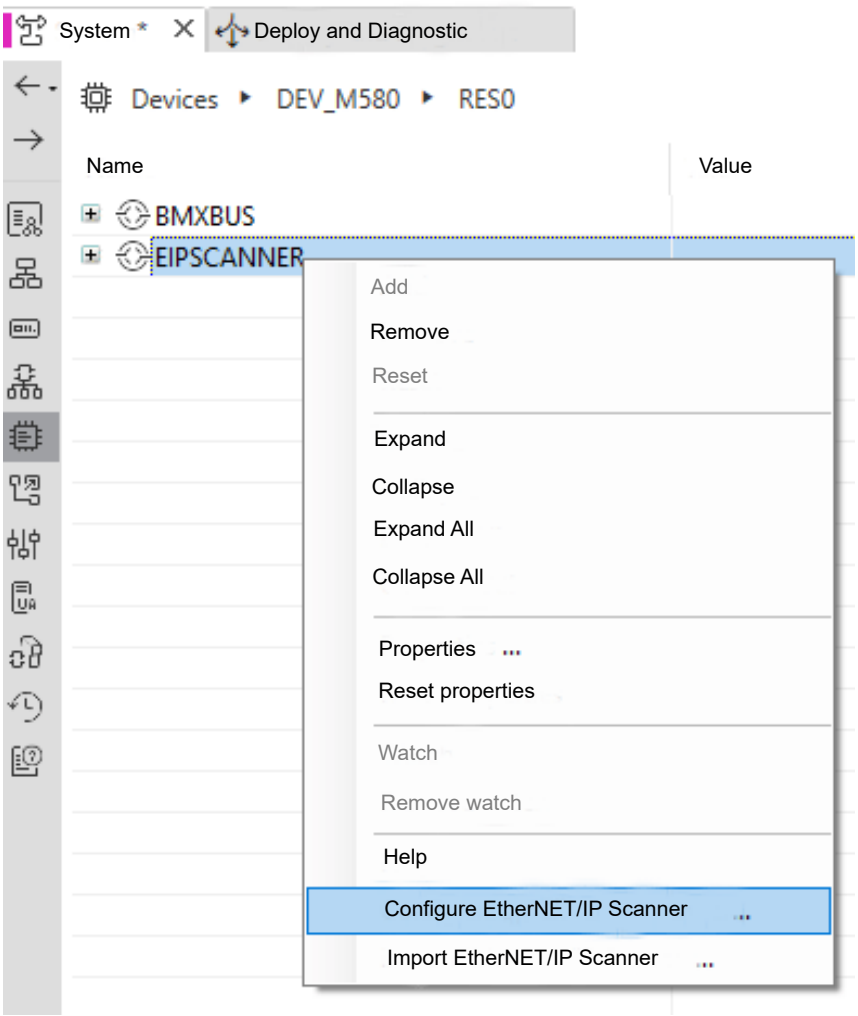
In addition to adding a new HART Analog I/O Module, page 525, you need to add the DTM for that module to the **DTM Browser**. After a module DTM has been added to the **DTM Browser**, you can use Ecostruxure ™Automation Expert to:

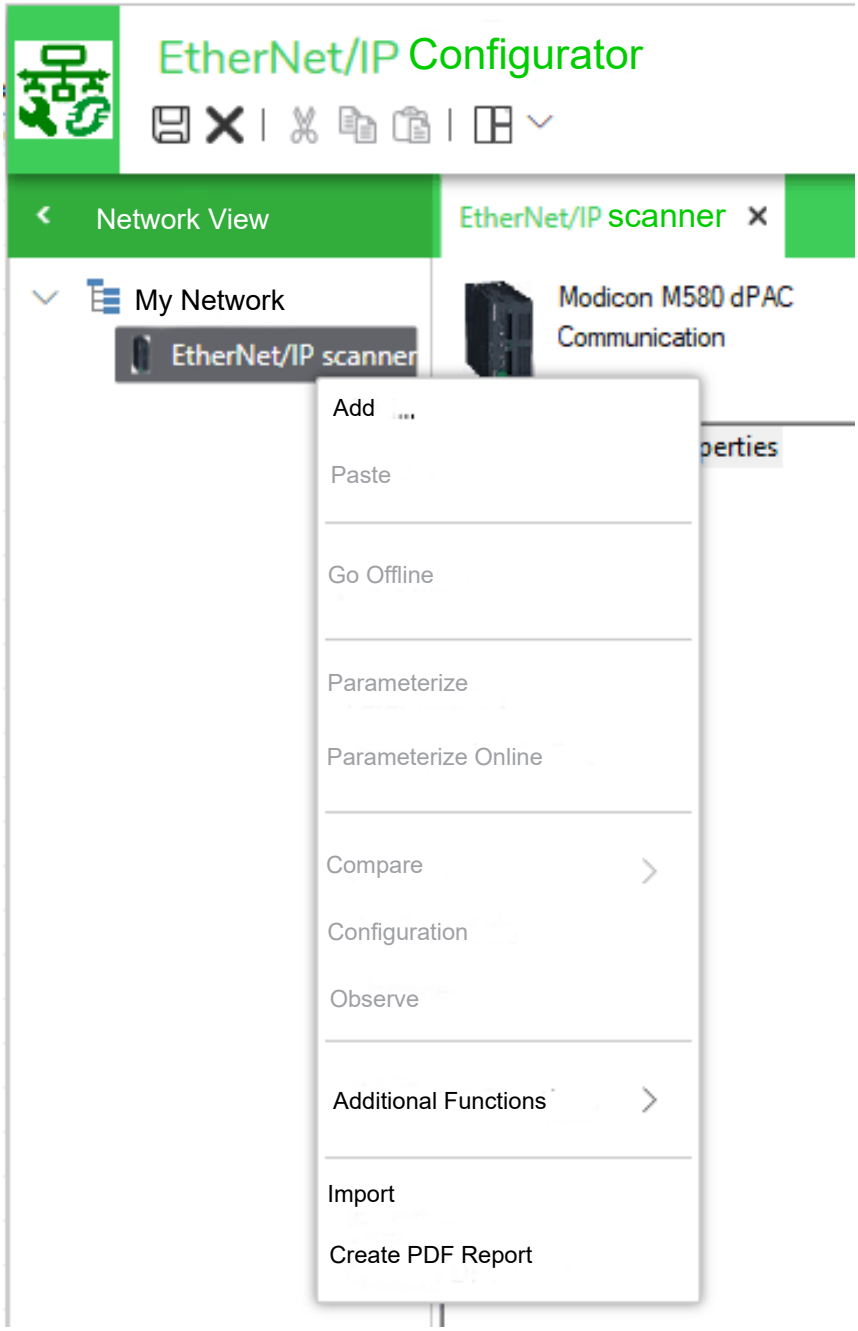
- configure DTM properties
- monitor dynamic DTM properties during run-time

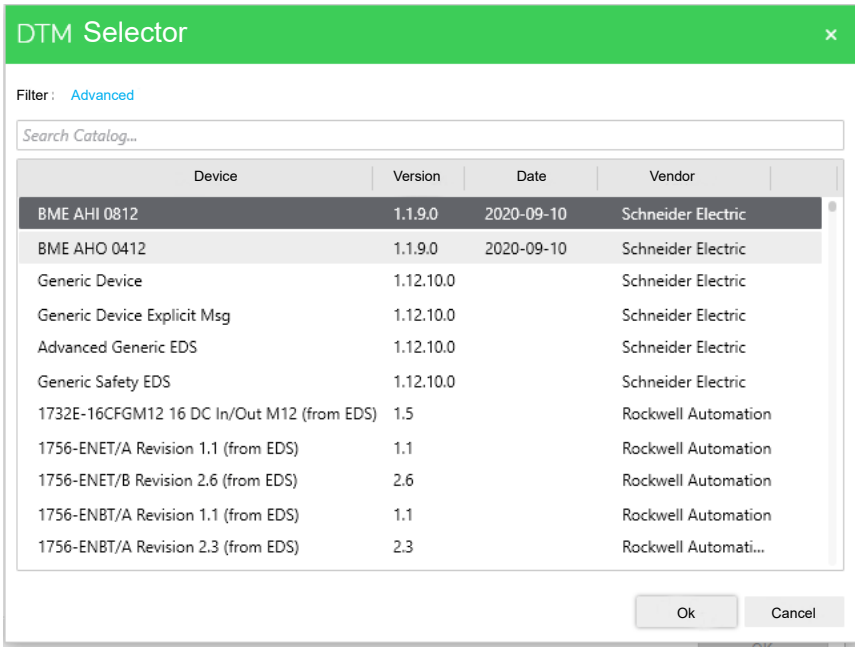
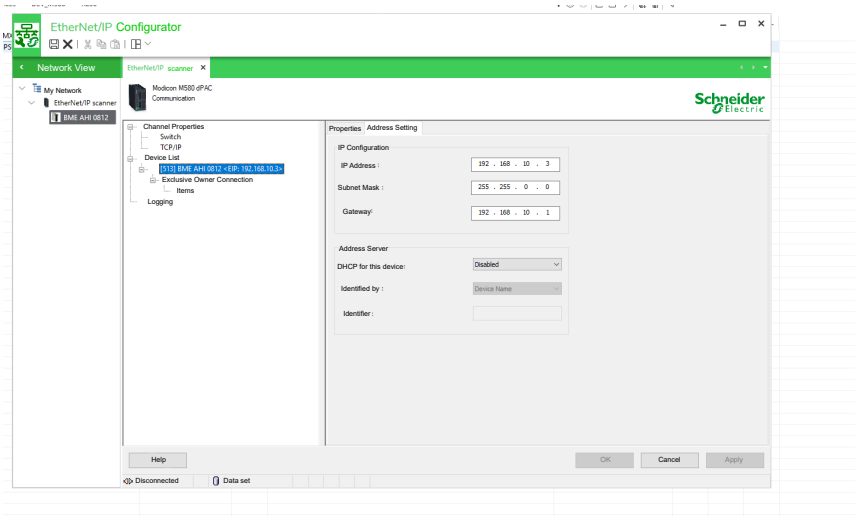
Adding a New DTM to the DTM Browser

To add a new DTM to the **DTM Browser**, follow these steps:

Step	Action
1	Open the **System** tab, then select **Hardware Configuration** screen in EcoStruxure™ Automation Expert.
2	Right click on the editor background and select **Add** from the context menu to open the **Add Bus** dialog.
3	Select the **Standard.IoEtherNetIP.EIPSCANNER** as the **Type** and click **OK**.

Step	Action
	
4	Select the *EIPSCANNER*, and click the right mouse button. A context menu opens to select “Configure *EtherNet/IP Scanner*: 

Step	Action
5	Select **Add**. The **DTM Selector** dialog opens: 
6	Select an input or output module that you previously added to the **Bus**, and then click **Ok**.

Step	Action
	
7	Ecostruxure ™Automation Expert adds a new module to the **DTM Browser**: 

Configuring the Module IP Address

Overview

This section shows you how to configure module IP address settings.

Assigning IP Addressing Parameters

IP Addressing Parameters

When a new BMEAHI0812(H) or BMEAHO0412(C) module is shipped from the factory, it does not come with pre-configured IP address settings. IP address settings include:

- IP address

- subnet mask
- default gateway

You need to configure the module to receive IP address settings from a DHCP server.

First Power-Up

When you first connect the module to an Ethernet network and power it up, it transmits a request for IP address settings. The request can be handled by a DHCP server.

If both of the following conditions exist, the server assigns the module its IP address settings:

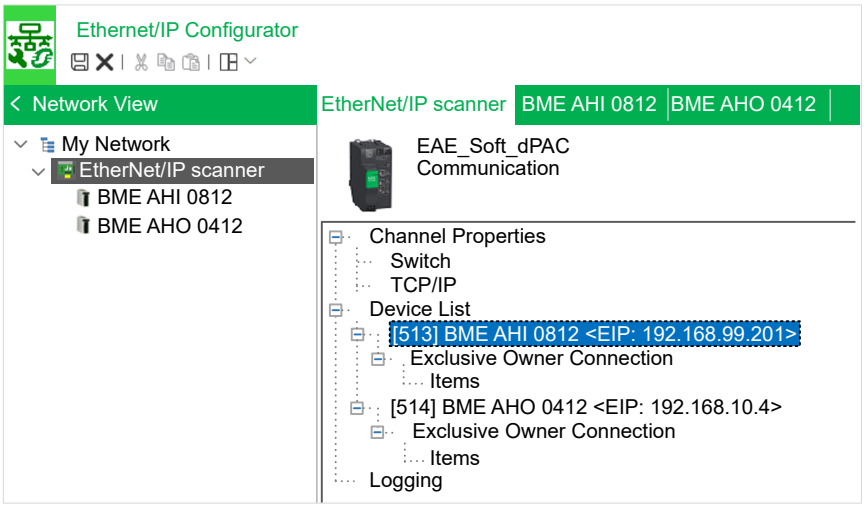
- DHCP server exists on the network.
- The server is configured to recognize the module by its device name.

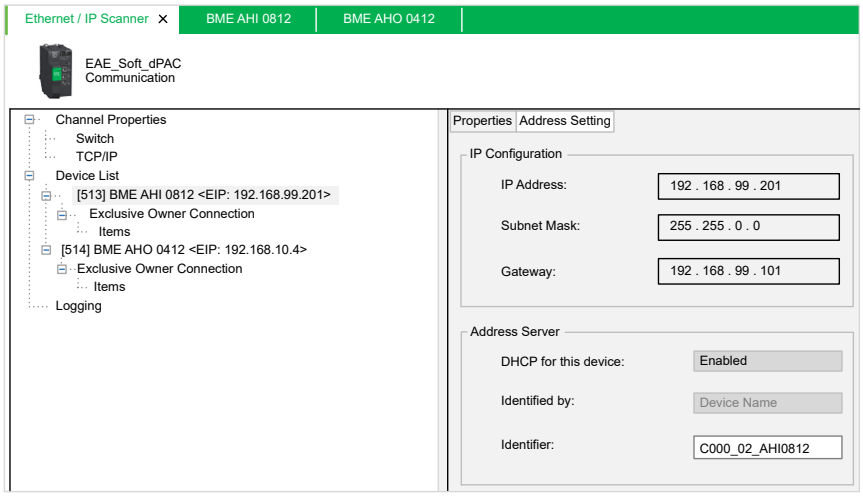
  NOTE: Consult with your system administrator to determine if a DHCP server exists on your network. Your system administrator can help you configure the server to maintain the module IP address settings.

Configuring IP Address Settings

Accessing Module IP Address Properties

Follow these steps to access the **Address Settings** page for the HART analog I/O module, where you can input IP address settings:

Step	Action
1	In the **Network View**, select **EtherNet/IP scanner**.
2	Select **Device List > BME AHI 0812**. **NOTE:** Use the tree control on the left side of the **EtherNet/IP Scanner DTM** configuration window to navigate to a HART analog I/O module that you previously added in the EtherNet/IP Configurator, page 531. 

Step	Action	
3	Select the **Address Setting** tab to access the IP address configuration settings: 	
4	Use the following fields to configure IP address settings for the selected HART analog I/O module:	
	IP Address	Enter the IP address that the FDR server in the controller serves to the selected HART analog I/O module.
	Subnet Mask:	Accept the default value.
	Gateway:	Enter the IP address of the controller (the default value when the HART module is added).
	DHCP for this device	Select **Enabled**.
	Identified by	Select **Device Name**.
	Identifier	Enter the **Device Name** identifier for the selected HART analog I/O module. **NOTE:** Refer to the following topic: Creating a Device Name for DHCP, page 536.
5	Click **Apply**.	
6	Select **Channel Properties** in the navigation tree.	
7	Confirm that the **Source IP Address** is correct. **NOTE:** Ecostruxure ™Automation Expert uses this IP address to communicate with the controller.	

Creating a Device Name for DHCP

When the DHCP client service is enabled, the HART analog I/O module uses the **Device Name** identifier to request an IP address from the FDR server in the controller. Create the **Device Name** identifier by concatenating the Rack ID and Slot Number values to the Module Name, as follows:

Device Name = **Rack ID_Slot Number_Module Name**

NOTE: When inputting Rack ID and Slot Number values, confirm that the values you input describe the actual module position in the rack.

The components of the concatenated **Device Name** include the following:

Parameter	Description
Rack ID	A 4-character field that identifies the rack used for the module: • AAA is the alpha-numeric user-defined Rackid. • 0 is a required character.
Slot Number	A field that identifies the position of the module in the rack.
Module Name	Use the following module names for the purpose of generating a **Device Name**: • the string **AHI0812** for the BMEAHI0812(H) module • the string **AHO0412** for the BMEAHO0412(C) module

Sample device name identifiers could be the C010_02_AHI0812 for a BMEAHI0812(H) module located at rack 1, slot 2 of a remote I/O rack.

Configuring the Module DTM

Overview

This section describes how to access the module DTM, and configure DTM properties.

FDT/DTM Configuration

Navigating the DTM

Use EcoStruxure Automation Expert as a Field Device Tool (FDT) to configure Device Type Manager files (DTMs). A DTM defines the device-specific configuration software of each BMEAHI0812(H) HART analog input module, and BMEAHO0412(C) HART analog output module.

> **NOTE:** You can use a third-party FDT to configure the module DTM including, for example, *FieldCare Asset Management Software* by Endress+Hauser or *PACTware* a free download from the PACTware Consortium. If you elect to use a third-party FDT, not all of the device configuration dialogs will be accessible.

To open a DTM for configuration, right-click a device DTM in the **DTM Browser** and select **Open** from the context menu. The **fdtConfiguration** window opens for the selected DTM.

Use the tree control on the left of the window to navigate the following device configuration dialogs:

- Module Overview
- Address Table
- General Information
- Host Communication Status
- Instrument Status
- Multiplexer Status
- Process Data
- Configuration:
  - SNMP Configuration
  - Parameter Configuration
  - Security
  - EIP Configuration

The following topics explain how to use these DTM configuration screens.

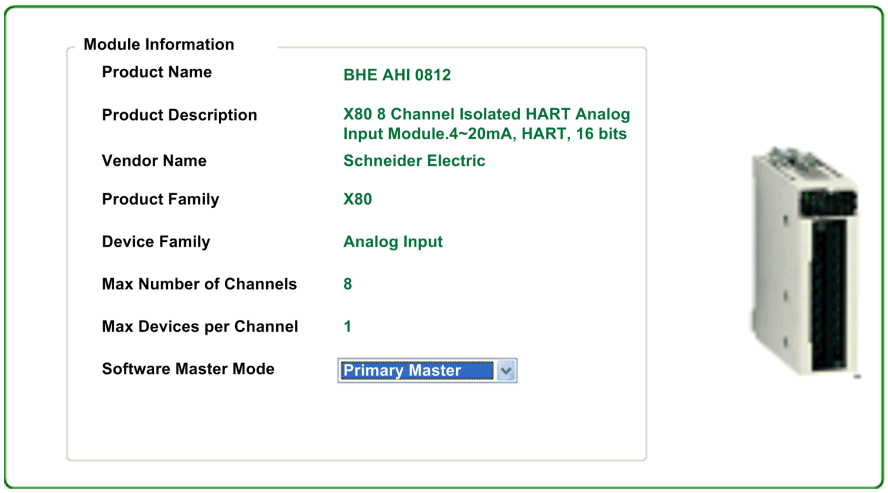
Module Overview

Module Information

Use the **Module Overview** dialog to:

- view static, self-explanatory module information, and
- view and edit the **Software Primary Mode** setting for the gateway DTM

The **Module Overview** dialog for the BMEAHI0812(H):



Primary vs. Secondary

Two HART primary devices can operate simultaneously: one primary and one secondary. Use the **Software Primary Mode** setting to specify the relationship between the gateway DTM and the HART analog I/O multiplexer resident in the module, either:

- **Primary**: Select this if the gateway DTM is the primary of the HART multiplexer.
- **Secondary**: Select this if this DTM is configured as the secondary of the HART multiplexer.

  NOTE: When the module is configured as a secondary:

  - the **Configuration** parameters in the **General Information** dialog are read-only
  - the **Address Table**, **Host Communication Status**, **Instrument Status**, and **Multiplexer Status** dialogs are not available

Address Table

Viewing DTMs for Field Instruments

Use the **Address Table** dialog to view a list of HART field instruments that have been added in the **DTM Browser**. Each channel links to only one instrument.

The **Address Table** includes the following properties for each detected field instrument:

Property	Type	Description
Channel	Read/write	The channel number to which the field instrument is linked.
Matched State	Read-only	Indicates the identity of the field instrument detected on the channel: • Equal: indicates the device ID and the vendor ID in the project configuration match the values in the field device.

Property	Type	Description
		• Not Equal: indicates the device ID and/or the vendor ID in the project configuration do not match the values in the field device.
Device Name	Read/write	The name of the field instrument. The initial name is provided by the field instrument DTM.
Version	Read-only	The version of the field instrument, provided by the field instrument DTM.
Vendor	Read-only	The vendor of the field instrument, provided by the field instrument DTM.
Date	Read-only	The date of the field instrument DTM.
Description	Read-only	The description of the field instrument, provided by the field instrument DTM.

The **Address Table** dialog display refreshes at the rate of one channel per second. When a DTM for a new HART field device is added, the **Address Table** dialog automatically assigns the new instrument a channel number. Use the **Select channel** dialog to change the channel assignment so that it indicates the channel to which the instrument is connected.

Use the **Rescan** button to perform a scan of each connected field instrument DTM, and update the **Matched State** field for each channel.

General Information

Overview

Use the **General Information** dialog to:

- input static descriptive module information in the **Configuration** area
- input module addressing information in the **Rack and Slot Information** area
- view static settings – in the **Diagnostics** area – that describe the module, including:
  - the number of command preambles
  - unique module ID number
  - hardware, software, and command versions supported by the module
  - a description of the module and its manufacturer

  NOTE: A DHCP server can assign an IP address to the module only if the DHCP service is enabled for the module, and a device name identifier is created, in the Configuring IP Address Settings, page 535.

  In the primary DTM, use the **Address Setting** tab for the specified module to enable the DHCP service. Then specify that a device name (and not MAC address) will be used, and enter the value for the device name identifier.

Parameters

The **General Information** dialog presents the following parameters:

The **Configuration area** includes the following parameters. Each parameter (except for **Device Name** is read/write. Parameters have the following initial factory default values:

Parameter	Description
Tag	A short (up to 8-character) text field that identifies the module. Default values are: • for the BMEAHI0812(H): AHI0812 • for the BMEAHO0412(C): AHO0412
Long Tag	A longer (up to 32-character) text field that identifies the module. Default values are: • for the BMEAHI0812(H): HART ANALOG INPUT BMEAHI0812 • for the BMEAHO0412(C): HART ANALOG OUTPUT BMEAHO0412
Description	A text field (up to 32-characters) that describes the module. Default values are: • for the BMEAHI0812(H): HART AI AHI0812 • for the BMEAHO0412(C): HART AO AHO0412
Message	A text field (up to 32-characters) that contains a module-related message. Default values are: • for the BMEAHI0812(H): HART ANALOG INPUT BMEAHI0812 • for the BMEAHO0412(C): HART ANALOG OUTPUT BMEAHO0412
Polling Address	An integer from 0...63 representing the HART client address for the module. A HART primary device uses this address when making its first communication with the module. **NOTE:** For subsequent communications, the HART primary uses a Long Address, which is a hexadecimal concatenation of: • the module *Device Type*, which is: ◦ 0xE287 for the BMEAHI0812(H) module ◦ 0xE288 for the BMEAHO0412(C) module • the module *Unique ID*, described below as a **Diagnostic** parameter.

The **Rack and Slot Information area** includes the following non-configurable (read-only) parameters:

Parameter	
Rack ID	A 4-character field that identifies the rack used for the module. **NOTE:** Use only the Mx80for a main local rack.
Slot Number	The position of the module in the rack.
Device Name	This read-only value is input in the Configuring IP Address Settings, page 535, and is a concatenation of the following 3 values, separated by an underscore (_): • Rack ID • Slot Number • Module name, where: ◦ AHI0812 represents the BMEAHI0812(H) HART analog input module ◦ AHO0412 represents the BMEAHO0412(C) HART analog output module

Diagnostics area parameters include:

Parameter	Description
Manufactory Name	The name of the manufacturer.
Number of command preambles	The length of the preamble used by the module for HART messaging: a value from 5...20 bytes.
Manufactory device types	A string ID for the module: • for the BMEAHI0812(H): BMEAHI0812 • for the BMEAHO0412(C): BMEAHO0412
Universal command revision	The highest revision number of HART universal commands supported by the module
Software Version	The software version number of the module
Hardware Version	The hardware version number of the module

Parameter	Description
Flag	The module protocol type. For both the BMEAHI0812(H) and BMEAHO0412 (C) the value is: • 4 - Protocol Bridge Device
Unique ID Number	A unique hexadecimal identifier equal to the last 3 bytes of the module MAC address.

Host Communication Status

Monitoring Host Communications

Use the **Host Communication Status** dialog when operating online to view counts of HART communication transmissions between the HART multiplexer in the BMEAHI0812(H) or BMEAHO0412(C) and a host.

In the **Host Communication Status** dialog the:

- **Host Asking** area describes HART transmissions between the module and the gateway (or primary) DTM, including:
  - **Number of commands** from the gateway DTM to the module, and
  - **Number of responses** from the module to the gateway DTM
- **Other Host** area describes HART transmissions between the module and any other HART primary – such as asset management software or Ecostruxure ™Automation Expert software – including:
  - **Number of commands** from the HART primary to the module
  - **Number of responses** from the module to the HART primary

Use the **Reset** button to reset to 0 the counting parameter values.

Instrument Status

Diagnosing HART Field Instrument Operations

Use the **Instrument Status** dialog while operating online to monitor the operation of HART field instruments connected to channels of the HART analog I/O module.

This dialog lists connected HART field instruments, and displays variable values for field instruments that are included in the scan. Scans are performed, and the dialog display refreshed, on 1 second intervals.

Place a check mark in the **Scan** column to include that instrument in the scan. Remove the check mark from the **Scan** column to remove that instrument from the scan.

Parameters

The **Instrument Status** dialog includes an upper table that lists the HART field instruments connected to a module channel, and a lower table that displays variable values for each scanned instrument. The parameters displayed vary depending on the **Scan Command** value selected in the **Multiplexer Status** page.

The channel-related parameters can include:

Parameter	Description
Channel	The channel number of the HART analog I/O module.
Manufacturer	The manufacturer of the HART field instrument.

Parameter	Description
Device Type ID	A hexadecimal value indicating the HART field instrument type.
Unique ID	The serial number of the HART field instrument.
Communication Status	The status of the HART field instrument communications, which can be: • Buffer overflow – the message size exceeded the receive buffer of the instrument. • Longitudinal parity mismatch – the longitudinal parity calculated by the instrument does not match the Check Byte at the end of the message. • Framing error detected – The Stop Bit of one or more bytes received by the instrument was not detected by the HART (for example, a mark or a 1 was detected when a stop bit was expected). • Overrun error detected – at lease 1 byte of date in the receive buffer was overwritten before it was read. • Vertical parity error detected – the parity of one or more of the bytes received by the instrument was odd. • Multi-Error detected with code displayed.
Device Status	The status of the HART field instrument: • Primary variable out of limits – the primary variable is beyond its operating limit. • Non-primary variable out of limits – an instrument variable not mapped to the PV is beyond its operating limit. • Loop current saturated – loop current has reached its upper (or lower) endpoint limit and cannot increase (or decrease) any further. • Loop current fixed – the loop current is being held at a fixed value and is not responding to process variations. • More status available – additional status information is available via command 48 (read additional status information). • Cold start – a power interruption or reset has occurred. • Configuration changed – an operation was performed that changed the instrument configuration. • Instrument not operational
Tries	The number of times the multiplexer attempted to connect to the field instrument.
Failures	The number of times the multiplexer did not receive a response from the field instrument.
Communication State	The scan status of HART field instruments:: • Searching – The scanner is searching for the HART instrument. • Disappeared – There is no reply from the HART instrument. • Appeared – The HART instrument sends a reply. The device information in the response matches the original device information. • Mismatched – The device information in the reply from the connected instrument does not match the original device information.
Scan	Select this to display dynamic values in the table below.

The variable-related parameters can include:

Parameter	Description
PV[1]	The primary variable value.
SV[1]	The secondary variable value.
TV[1]	The tertiary variable value.
QV[1]	The quarternary variable value.
PV Loop Current	The primary variable loop current in mA.
PV Percent of Range	The primary variable value as a percent of the value range.
1. The content of each variable is instrument-specific, as determined by the manufacturer.	

Click **Reset** to set to 0 the counting statistics of the channel-related parameters, and to update the **Device Status** value of each connected HART field instrument.

Multiplexer Status

Multiplexer Scanning

Use the **Multiplexer Status** dialog to:

- perform the following offline configuration tasks:
  - enable and disable scanning by the multiplexer of HART field instruments
  - specify a **Scan Mode**
  - set maximum limits for both **Communication Count** and **Busy Retry Count**
- monitor statistical data describing the operation of the HART multiplexer
- diagnose the multiplexer status using status LEDs

HART Port Parameters

The following HART port parameters can be accessed in the **Multiplexer Status** dialog:

Parameter	Description
Scan Command	Specify a scan command: • Read PV • Read Current (mA) and % of Range • Read Current (mA), PV, SV, TV and QV
Scanning	Specify a scan mode: • ON: enable scan • OFF: disable scan
Communication Retry Count	Type in the number of times the HART interface module resends a command to a non-responsive HART instrument. Valid values = 0...5. Default = 0.
Busy Retry Count	Type in the number of times the HART module resends a command after receiving a busy reply from a HART instrument. Valid values = 0...5. Default = 0.
Gender	• primary (default) • secondary
Search Algorithm	Type of search performed for instruments on the loop: • Poll Address 0 Only • Poll Address 0 to 15 (default) • Poll Address 0 to 63
Max Instruments Connected	The maximum number of instruments that can be connected to the multiplexer.
Instruments on Instrument List	The number of instruments on the instruments list.

Multiplexer Status

The **Multiplexer Status** dialog indicates the status of the multiplexer as a whole, and monitors the existence or absence of several multiplexer states. The status of each state is indicated by the LED color, as follows:

- Red indicates the existence of a detected event of the specified type.
- Green indicates normal operations.
- Gray indicates the DTM is offline and is not communicating with the device.

The **Multiplexer Status** dialog displays the following multiplexer status states:

State	Description
Device Malfunction	A detected error rendered the instrument non-operational.
Configuration Changed	An operation occurred that changed the instrument configuration. **NOTE:** Click **Reset** to clear detected faults and update module status.
Cold Start	The instrument was reset, or power was cycled off then on.
More Status Available	Additional instrument information is available via HART command 48 (Read Additional Status Information).

Process Data

Mapping I/O Data to the HART Multiplexer Scan

Use the **Process Data** dialog to:

- add selected HART I/O data items to the multiplexer scan, and
- remove HART I/O data items from the scan

Place a check mark in the **I/O** column next to each item you want to include in the HART multiplexer scan. Remove a check mark to remove that item from the scan. To help select or de-select items, you can click:

- **Select All** to place a check mark next to all input and output items, or
- **Restore to Defaults** to select only those input and output items that the application selects by default.

NOTE: When you select an item in the **Process Data** dialog, you also add a corresponding *Device DDT* variable to the **Data Editor** in Control Expert.

I/O Data Items

These input items can be included in the HART multiplexer scan:

Input Data Item	Data Type	Mapped by Default?	Is Default Mapping Editable?	Bytes
Module Status	Word	Yes	No	4
Channel Status: 0...(N-1)	DWord	Yes	No	8 (BMEAHI0812(H)) 4 (BMEAHO0412(C))
Channel 0...(N-1) Input Data:				
Instrument Status	32 bit unsigned	No	Yes	4
Primary Variable	Float	Yes	No	4
Secondary Variable	Float	Yes	Yes	4
Tertiary Variable	Float	Yes	Yes	4
Quaternary Variable	Float	Yes	Yes	4
Current Value	Float	No	Yes	4
Percent Value	Float	No	Yes	4
Update Counter	32 bit unsigned	No	Yes	4

These output items can be included in the HART multiplexer scan:

Output Data Item[1]	Data Type	Mapped by Default?	Is Default Mapping Editable?	Bytes
CH-ResetChanged	Byte	Yes	No	–
CH-Enable	Byte	No	Yes	–

1. When an output data item in the **Process Data** dialog is:
   - *Selected*: the item is added to the list of Device Derived Data Types (DDDT) in the **Parameter Configuration** dialog, where program logic dynamically controls the item value during run-time.
   - *De-selected*: the item is removed from the DDDT list. Program logic does not control the item value during run-time. The user can assign a static value to the item which is applied at start-up.

Module Status

The **Module Status** word presents a snapshot of the overall health of the HART analog I/O module and its channels.

Bit Number	Name	Description
0	Global Status	= 1 if the HART multiplexer has detected one or more of the following conditions: • one or more HART channels are disconnected (bit 1 (Disconnected) = 1) • a HART channel is connected to a field device that is materially different from the device configured for that channel; for example, a device of different device type or made by a different manufacturer. (bit 3 (Instrument Changed, Major) = 1) • an internal communication event—ICE—has occurred (bit 4 (ICE) = 1)
1	Disconnected	= 1 if any channel is in the disconnected (CH-Disconnected) state
2	Instrument Changed, Minor	=1 if any channel is in the instrument changed, minor (CH-MinorDiff, page 545) state
3	Instrument Changed, Major	=1 if any channel is in the instrument changed, major (CH-MajorDiff, page 545) state
4...6	—	= 0 (not used)
7	ICE	= 1 on the occurrence of an *internal communication event*
8...15	—	= 0 (not used)

Channel Status

The **Channel Status** words report the status of each of the module channels. **Channel Status** values are as follows:

Value	Name	Description
0	CH-Disabled	The channel is disabled.
1	CH-Connecting	The module is searching for, and attempting to connect with, a HART instrument on the channel.
2	CH-Connected	The channel is connected to a HART instrument.
3	CH-MinorDiff	One or more minor differences, page 548 exist between the connected HART instrument and the instrument description in the multiplexer island configuration.
4	CH-MajorDiff	One or more major differences, page 548 exist between the connected HART instrument and the instrument description in the multiplexer island configuration.

Value	Name	Description
5	CH-Disconnected	This state indicates either: • The module discovered no HART instrument on the channel after performing 2 scans of the specified address range. • The module discovered a HART instrument on the channel, but the connection was lost. The module continues to search for a HART instrument on this channel.
6...31	—	(not used)

Channel 0...(N-1) HART Instrument Specific Data Items

The module can also receive from a HART instrument, and add to the multiplexer scan, the following data items for each HART channel

Data Item	Description	
Primary Variable (PV)	Manufacturer defined	
Instrument Status	Reports one of the following conditions:	
	Value hex (bit)	**Condition Description**
	0x80 (bit 7)	Device malfunction: a detected error rendered the instrument non-operational
	0x40 (bit 6)	Configuration changed: an operation occurred that changed the instrument configuration
	0x20 (bit 5)	Cold start: the instrument was reset, or power was cycled off then on
	0x10 (bit 4)	More status available: additional instrument information is available via HART command 48 (Read Additional Status Information)
	0x08 (bit 3)	Loop current fixed: current on the HART channel is being held at a fixed value, and is not responding to process variations
	0x04 (bit 2)	Loop current saturated: current on the HART channel has reached its upper or lower limit, and cannot increase or decrease further
	0x02 (bit 1)	Non-primary variable out of limits: the value of an instrument variable, other than the Primary Variable (PV), has traveled beyond its operating limits
	0x01 (bit 0)	Primary variable out of limits: the value of the instrument Primary Variable (PV) has traveled beyond its operating limits
Secondary Variable (SV)	Manufacturer defined	
Current Value	The actual reading of loop current, from 4...20 mA	
Percent Value	The actual reading of loop current, expressed as a percent of the 16 mA range	
Update Counter	A counter that is incremented on each scan	

Check the documentation for your specific HART instrument to determine which of the above data items it offers.

CH-ResetChanged

Use the **CH-ResetChanged** data item to accept a HART instrument that the module has detected to be different from the instrument that previously was connected to the same channel. In this case, the channel has a **Module Status** value of either **Instrument Changed, Minor** or **Instrument Changed, Major**.

When a bit in this register transitions from 0 to 1, a HART instrument on that channel is accepted as the current instrument.

The **CH-ResetChanged** word includes the following bits:

Bit Number	Name	Description
0	CH-0 Reset	The 0 to 1 transition clears the changed instrument flag, and accepts the detected HART instrument as the identified instrument for that channel,
1	CH-1 Reset	
2	CH-2 Reset	
3	CH-3 Reset	
4	CH-4 Reset	
5	CH-5 Reset	
6	CH-6 Reset	
7	CH-7 Reset	
8...15	—	(not used)

NOTE: The number of available channels is determined by the specific module.

CH-Enable

The **CH-Enable** output item reports and controls the state—enabled or disabled—of each of the channels of the HART I/O module. Every channel is disabled by default.

The bits in the **CH-Enable** word:

Bit Number	Name	Description
0	CH-0 Enable	• 0 = disabled (by default) • 1 = enabled
1	CH1 Enable	
2	CH-2 Enable	
3	CH-3 Enable	
4	CH-4 Enable	
5	CH-5 Enable	
6	CH-6 Enable	
7	CH-7 Enable	
4...15	—	Set to a value of 0.

NOTE: The number of available channels is determined by the specific module.

Major and Minor Differences

When the module establishes connection with a HART instrument, it checks whether the present connection is the first connection made on the channel.

If there was a previous connection, the module checks whether the connected instrument matches the previously connected instrument. It does this by comparing the instrument-defining elements in the presently connected instrument with those recorded for the previously connected instrument.

The module gathers data from the HART instrument in the same manner whether the instrument is connected, connected with major differences, or connected with minor differences.

NOTE:

- To see which instrument-defining element has changed, you can use HART command 0 (Read Unique Identifier) to examine the definition of the presently connected HART field device.
- To accept a connected HART field instrument that has either major differences or minor differences, set the value of the **CH-ResetChanged** parameter to 1 for the appropriate channel.

Major Differences

Differences in the following definitions of a HART field instrument are described as major:

- Expanded Device Type
- Device Revision Level: only if the major revision number is different
- Software Revision Level of this device: only if the major revision number is different
- Flags
- Manufacturer Identification Code
- Private Label Distributor Code
- Device Profile

Minor Differences

The following differences in the definition of a HART field instrument are described as minor:

- HART Protocol Major Revision Number implemented by this device: for HART revision 7, this is the number 7.
- Device Revision Level: only if the minor revision number is different
- Software Revision Level of this device: only if the minor revision number is different (most significant 5 bits)
- Hardware Revision Level of the electronics in this device: does not necessarily trace individual component changes.
- Device ID: this number needs to be different for every device manufactured with a given Device Type.

SNMP Configuration

SNMP Agent

The module includes an SNMP v1 agent. An SNMP agent is a software component that allows access to the processor diagnostic and management information via the SNMP service.

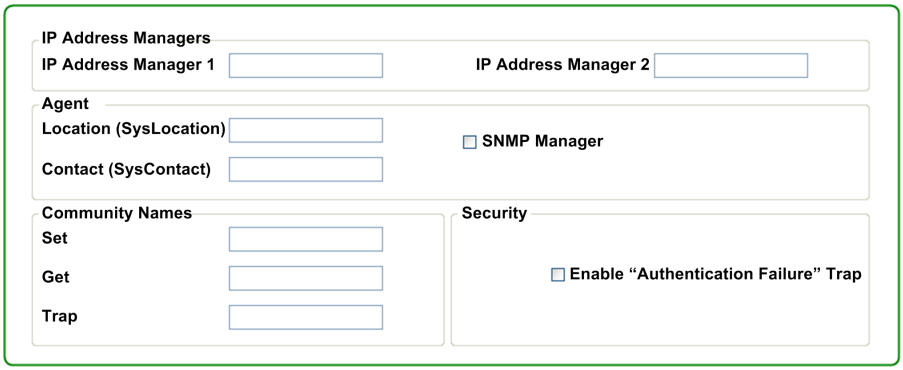
SNMP browsers, network management software, and other tools typically use SNMP to access this data. In addition, the SNMP agent can be configured with the IP address of up to 2 devices–typically PCs running network management software–to be the target of event driven trap messages. These trap messages inform the management device of events such as cold start, and detected authentication failures.

Use the **SNMP** tab to configure the SNMP agent in the processor. The SNMP agent can connect to and communicate with up to 2 SNMP managers as part of an SNMP service. The SNMP service includes:

- authentication checking, by the processor, of any SNMP manager that sends SNMP requests

- management of event, or trap, reporting by the processor

The **SNMP Configuration** dialog:



Configuring SNMP Properties

The module includes the following SNMP properties:

Property	Description
IP address managers:	
IP address manager 1	The IP address of the first SNMP manager to which the SNMP agent sends notices of traps.
IP address manager 2	The IP address of the second SNMP manager to which the SNMP agent sends notices of traps.
Agent:	
Location	The device location (32 characters maximum)
Contact	Information describing the person to contact for device maintenance (32 characters maximum).
SNMP manager	When this checkbox is: • selected: The location and contact information are not editable in this page. The module is able to restore the last location and contact set by SNMP manager. • de-selected: Location and contact settings are editable in this page. Default = de-selected.
Community names:	
Get	Password required by the SNMP agent before executing read commands from an SNMP manager. 16 characters maximum. Default = **public**.
Set	Password required by the SNMP agent before executing write commands from an SNMP manager. 16 characters maximum. Default = **private**
Trap	Password an SNMP manager requires from the SNMP agent before the manager will accept trap notices from the agent. 16 characters maximum. Default = **alert** **NOTE:** • Traps are sent via UDP port 161. • You may need to configure trap settings on the SNMP manager, consistent with trap settings on the processor.
Security:	
Enable “Authentication Failure” trap	If an unauthorized manager sends a Get or Set command to the SNMP agent, the agent sends a trap notification message to the manager. Default = de-selected.

Parameter Configuration

Configuring Channel Properties

Use the **Parameter Configuration** dialog to configure the HART channels. In this dialog, you can:

- enable or disable each of the HART channels
- for each enabled channel specify:
  - the minimum number of preambles the module uses to communicate with a HART instrument
  - the value assigned to the primary variable if communication between the module and the HART instrument is disrupted

Create the module configuration settings offline, and then download them – along with the rest of the project configuration settings.

Configuring Parameters

You can configure the following parameters for the HART analog I/O module:

Parameter Name	Description
CH-Enable	The state of the HART channels. The **CH-Enable** value equals the sum of the binary values of every channel that is enabled. **NOTE:** The **CH-Enable** parameters can be enabled or disabled in this dialog only if **CH-Enable** is de-selected in the **Process Data** dialog.
• Channel 0...(N-1)	Sets the status of the selected channel to one of the following settings: • 0 = disabled • 1 = enabled (default)
Channel 0...(N-1) Settings	
• Number of Preambles	The minimum number of preambles the HART module uses to communicate with a HART instrument. If the HART instrument requires: • more preambles, the HART interface module sends more preambles • fewer preambles, the HART interface module sends the minimum number configured by this setting Default = 5.
• Fallback Mode Setting	If the HART instrument on this channel is disconnected, or if there is no HART instrument, this setting determines the value that is assigned to the primary variable (**PV**): • Set to 0 • Hold Last Value • Not a Number (NaN) Default = NaN

Restore Default Values

You can click the **Restore to Defaults** button to reset the modified values in this dialog to their default values.

Downloading Configuration Settings

To download an edited parameter configuration, follow these steps:

Step	Action
1	In the **DTM Browser**, right click on the HART gateway DTM.
2	In the context menu, select **Additional Functions > Transfer to FDR Server**.
3	When the transfer is complete, the message “Transfer to FDR Server is Successful” displays. Click **OK**.

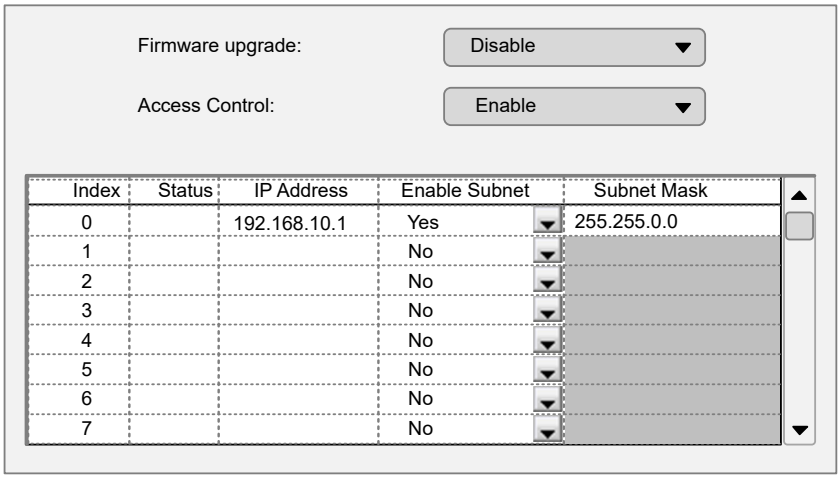
Security

Controlling Module Access

Use the **Security** page to restrict access to the module, as follows:

- Temporarily enable the module to receive Firmware Update with Automation Device Maintenance, page 510via FTP. When the firmware upgrade is complete, it is recommend that you disable the ability of the module to receive FTP transfers of firmware upgrades.
- Enable Ethernet access control; then restrict module access to up to 32 hosts per subnet on the Ethernet network. When access control is disabled, the module accepts Ethernet communications from any IP address.

The **Security** dialog:



IP Addresses to Be Added

When access control is enabled, add the following IP addresses to the list:

- Any network host that may send an Ethernet transmission to the module
- Your own maintenance PC so that you can communicate with the module via Ecostruxure ™Automation Expert to configure and diagnose your application

NOTE: By default, the setting for index item 0 is the subnet of the HART multiplexer with subnet mask 255.255.0.0, which means the HART multiplexer can be accessed by a host in the same subnetwork.

Security Commands

You can set the following flags in the **Security** dialog:

Parameter	Description
Firmware Upgrade	Select either: • Enable: Select this for a brief time to allow FTP access to the module for performing a firmware upgrade. • Disable: When a firmware upgrade is not currently being performed by an authorized individual, select this to help protect the module against an unauthorized firmware upgrade.
Access Control	Select either: • Enable: Select this to activate Ethernet access control. When access control is enabled, only hosts with IP addresses added to the list may access the module. • Disable: When access control is disabled, any host may access the module via Ethernet.

Adding and Removing IP Addresses in the Authorized Access List

To add IP addresses to the **Authorized Access** list, follow these steps:

Step	Action
1	In the **Security** field, set **Access Control** to **Enabled**.
2	In the **Authorized Addresses** area, click in the **IP Address** field in the next empty row.
3	Enter the IP address you wish to add to the list.
4	If the IP address requires a subnet mask, do the following: In the **Enable Subnet** column, do one of the following: • If the IP address requires a subnet mask, select **Yes**, then enter the subnet mask into the **Subnet Mask** field. • If the IP address does not require a subnet mask, select **No**.
5	Repeat steps 2...4 for each IP address you want to add to the list.

To remove an IP address from the list, highlight the row and press the **Delete** key on your keyboard.

EIP Configuration

EtherNet/IP Implicit I/O Connections

Use the **EIP Configuration** dialogs to configure EtherNet/IP connections for the HART analog I/O module. You can configure the module for the following types of implicit I/O connections:

- None (no connection – if selected, the settings on this page become read-only)
- Exclusive Owner Connection
- Listen Only Connection

Configuring EIP Connections

The following parameters can be configured for an EtherNet/IP connection

Parameter	Description
RPI	The refresh period for this connection. Set this parameter to a value from 20...1000 ms. Default = 20 ms.
Input T->O	

Parameter	Description
Input size	(read-only) The number of bytes reserved for input data. The number is calculated by the DTM, based on the settings entered in the **Process Data** page. The default value depends on the module: • BMEAHI0812(H) = 140 bytes • BMEAHO0412(C) = 72 bytes **NOTE:** Ecostruxure ™Automation Expert reserves input data in increments of 2 bytes (1 word).
Input mode	The transmission type: • Point to point: Transmission from adapter to scanner. • Multicast: Transmission from a scanner to a multicast IP address (default). **NOTE:** An Exclusive Owner connection can be either point to point or multicast. A Listen Only connection is multicast.
Input type	Ethernet packet type – fixed or variable length – to be transmitted. Only fixed-length packets are supported.
Input priority	The transmission priority. Values can include: • Scheduled (default) • Low • High
Input trigger	The transmission trigger. Values can include: • Cyclic (default) • Change of State
Output O->T **NOTE:** Output group parameters are configured only for Exclusive Owner connections. Listen Only connections do not send output.	
Output size	(read-only) The number of bytes reserved for output data. The number is calculated by the DTM, based on the settings entered in the **Process Data** page. The default value for both the BMEAHI0812(H) and the BMEAHO0412(C) is 1 byte. **NOTE:** Control Expert reserves output data in increments of 2 bytes (1 word).
Output mode	The transmission type. For output transmissions over Exclusive Owner connections, only Point to point is supported.
Output type	Ethernet packet type – fixed or variable length – to be transmitted. Only fixed length packets are supported.
Output priority	The transmission priority. Values can include: • Scheduled (default) • Low • High

Completing the Project Configuration

Overview

This section describes how to add HART field device DTMs, enable HART channels, and generate the project configuration files.

Manually Adding a Field Instrument DTM

Overview

After you add a HART gateway DTM to the **DTM Browser**, you can then add a field instrument DTM.

NOTE: Before you can add a field instrument DTM, you need to confirm that the device DTM has been installed on your PC. If the desired field instrument DTM has not yet been installed, follow the manufacturer instructions for installation of the DTM.

When you next open Ecostruxure ™Automation Expert, a message is displayed indicating the DTM catalog is out of date. Click **Yes** to update the DTM catalog, and add the newly installed field instrument DTM to the list of available DTMs.

After a field instrument DTM has been added to the **DTM Browser**, you can use Ecostruxure ™Automation Expert to:

- configure DTM properties
- monitor dynamic DTM properties during run-time

Adding a Field Instrument DTM to the DTM Browser

To add a field instrument DTM to the **DTM Browser**, follow these steps:

Step	Action
1	If it is not already open, open the **DTM Browser** by selecting **Tools > DTM Browser** in the Control Expert main menu.
2	In the **DTM Browser**, navigate to and select a HART gateway DTM–for example, the DTM for the BMEAHI0812(H)–then click the right mouse button. A context menu opens.
3	Select **Add**. The **Add** dialog opens. **NOTE:** If the DTM for the field instrument you want to add to the project has been installed, it appears in the **Add** dialog. If the DTM does not appear in the list, you need to install the DTM for the desired field instrument.
4	In the **Add** dialog, select the DTM for the field instrument you want to add (for example, the KROHNE TT51 field instrument) to the project, then click **Add DTM**. The **Field bus discovery** dialog opens.
5	In the **Field bus discovery** dialog, select the **Channel** setting for the newly added HART field instrument, then click **OK**. The **Properties of device** dialog opens.
6	In the **Properties of device** dialog, either accept the default **Alias name** or enter a new one; then click **OK**. The selected DTM appears in the **DTM Browser** beneath the previously selected HART gateway DTM.
7	In the **DTM Browser**, select the HART gateway DTM that is connected to the field instrument DTM that was added above; click the right mouse button; then select **Open** from the context menu. The **fdtConfiguration** window opens for the selected HART gateway DTM.
8	In the navigation control on the left side of the **fdtConfiguration** window, navigate to and select **Address Table** to display a list of field instruments that are connected to the HART gateway module.
9	In the navigation control on the left side of the **fdtConfiguration** window, navigate to and select **Configuration > Parameter Configuration** to display a list of configurable parameters.
10	Expand the **CH-Enable** parameter; select **Enable** for the channel to which the new field instrument is connected; then click **Apply**. **NOTE:** If you cannot edit the **CH-Enable** channel settings, it is because this parameter is selected in the **Process Data** page and channels are dynamically enabled or disabled by operation of program logic. To enable a channel in the **Parameter Configuration** page, open the **Process Data** page, de-select the **CH-Enable** output parameter, then click **Apply**.

Field Bus Discovery Service

Overview

The field bus discovery service is available for BMEAHI0812(H) and BMEAHO0412(C) gateway DTMs that are connected to field devices. Only the first level devices below the gateway DTMs are detected – recursive scanning is not supported.

NOTE: A device that is connected on the field bus can be detected if:

- Its DTM is installed on the PC.
- The DTM hardware catalog is up-to-date with the DTM installed.

Field Bus Discovery Use

The results of the scanning process are compared to the registered DTMs in the DTM catalog of the host PC. If a match is found in the DTM catalog for a scanned device, the results include a **Match** property that describes the precision of the match.

The **Match** property displays one the following values:

- Exact:

  All identification attributes are matching. The correct device type was found.
- Generic:

  At least the Manufacturer ID and Device Type ID attributes match. The support level of DTM is “Generic Support”.
- Uncertain:

  At least the Manufacturer ID and Device Type ID attributes match. The support level of DTM is **not** “Generic Support”.

The following procedure explains how to use the Field Bus Discovery service:

Step	Action
1	In the **DTM Browser**, select either BMEAHI0812(H) or a BMEAHO0412(C) gateway DTM.
2	If the gateway DTM is not connected to its field devices, right-click to open the contextual menu and select **Connect**.
3	With the gateway DTM selected, right-click to open the contextual menu and select **Field bus discovery**. The **Field bus discovery** channel selection dialog opens.
4	In the **Field bus discovery** channel selection dialog, select a channel for discovery and click **OK**. The service and performs discovery for the selected channel.
5	If at least one matched device has been found, the Field Bus Discovery dialog opens listing the scanned and matched devices.
6	Use the 3 buttons (Add one, Add all, Remove), described below to select and add matched devices that are added to the **DTM Browser**.
7	Click **OK** to insert the selected device DTMs into the **DTM Browser**. The **On Line Modification Authorization** message box opens, informing you that you need to rebuild the project offline. Click **Yes** to continue.
8	If there are one or more devices in the **Selected DTMs** list with the same address as a device that is already included in the **DTM Browser**, a message box opens asking if you want to continue. If you click **OK**, each pre-existing device with an address that is the same as a selected device is deleted and replaced by the DTM selected in the **Selected DTMs** list.
9	After the project is rebuilt, the discovered and selected field devices appear in the **DTM Browser** beneath the selected gateway DTM.

Field Bus Discovery Dialog

If at least one matched device has been discovered, the **Field bus discovery** dialog is displayed listing the scanned and matched devices. Select the matched devices to be added to the **DTM Browser**. The device you select appear in the **Selected DTMs** list. This dialog has three lists:

List	Description
Scanned Devices	Displays all the devices (matched and unmatched) found during the scan.
Matched DTMs	Displays the matched DTM found in the workstation DTM catalog for the selected device in the **Scanned Devices** list. Each time a scanned device is selected in the **Scanned Devices** list, the contents of the **Matched Devices** list is updated to display the matched device DTM found for the selected scanned device. The matching process can yield one or more matched devices for a given scanned device. In this case, select one among the matched DTMs found.
Selected DTMs	Displays the device DTMs selected to be added to the **DTM Browser**.

The lists present a colored icon for each item:

Color	Description
Green	The device has been selected
Yellow	The device has been matched
Red	The device has **not** been matched
Black	Information about the address of the scanned device: • In the **Scanned Devices** list, the device has an address identical to one of the DTMs in the Control Expert project. • In the **Matched DTMs** list, the device is assigned an address identical to one of the DTMs in the Control Expert project.

The **Matched DTMs** and **Selected DTMs** lists present these 3 buttons:

Button	Use this button to...
Add all 	Automatically add the most closely matched device DTM for each discovered device in the **Matched DTMs** list to the **Selected DTMs** list.
Add one 	Add the matched device DTM selected in the **Matched DTMs** list to the **Selected DTMs** list.
Remove 	Remove one or more devices from the **Selected DTMs** list.

Transferring the Configuration to the CPU

Overview

After you have completed configuring the modules and field instruments that you have added to the project, the next task is to transfer the project to the FDR server in the CPU.

The new configuration will be deployed by EcoStruxure Automation Expert when deploying and running the application.

The configuration is stored permanently when the project is set as a boot project.

Accessing Field Instrument Data in Ecostruxure ™Automation Expert

Overview

This topic describes how to access the HART field instrument and its data.

Preliminary Tasks

Before you can access the HART field instrument and its data, you first need to complete the following preliminary tasks:

- create a project in Ecostruxure ™Automation Expert
- add a HART gateway module to the project
- add a HART gateway module DTM to the project
- assign an IP address to the HART gateway module
- enable FTP and TFTP for the CPU and **Validate** the project (see referenced steps 7, 8 and 9)
- configure the HART gateway module DTM
- add the HART field instrument DTM to the project
- build the project file, connect to the CPU, then transfer the project to the CPU
- transfer the HART gateway module configuration to the CPU

Using an Animation Table to Connect to the HART Device

If the following output variables are selected in the **Process Data** page of the HART gateway module DTM, you may need to use an animation table to manually edit their settings:

- **G_Enable_ID**: if the channel for a HART field instrument is not enabled, you need to enable that channel.
- **G_ResetChanged_ID**: if the HART field instrument detected on the HART channel is different from the instrument previously specified for that channel, you need to accept the instrument actually detected on the channel.

To manually enable a channel for a HART field instrument, and accept the instrument detected on that channel, follow these steps:

Step	Action
1	In the **Project Browser**, navigate to **Project > Animation Tables** and click the right mouse button.
2	Select **New Animation Table**. A dialog of the same name opens.
3	In the **New Animation Table** dialog, accept the default **Name** or type in a new name, then click **OK**. The new animation table opens.
4	In the new animation table, double-click in the first cell of the first row. An ellipsis (...) appears.
5	Click on the ellipsis to open an **Instance Selection** dialog.
6	In the **Instance Selection** dialog, select the instance of the HART gateway module (for example a BMEAHI0812(H) module) and click **OK**. The selected object appears in the first row of the animation table.
7	In the animation table, expand the nodes for the module and outputs. **NOTE:** If CH-Enable and CH-ResetChanged are selected in the **Process Data** page, the **G_Enable_ID** and **G_ResetChanged_ID** objects are displayed.
8	Check the HART gateway module Analog and HART channel LEDs for the HART field instrument.
9	To enable every HART gateway module channel, for the object **G_Enable_ID**: • click **Modification** in the animation table • type **255** in the **Value** field • click **Enter** The channels for the HART gateway module are enabled.

Step	Action
10	Again, check the HART gateway module Analog and HART channel LEDs for the HART field instrument. If the HART channel LED for the field instrument is flickering red, that field instrument is not recognized by the HART gateway module.
11	If you need to accept the field instruments detected by the HART gateway module on every channel, for the object **G_ResetChanged_ID**: • click **Modification** in the animation table • type **255** in the **Value** field • click **Enter** The field instruments detected by the HART gateway module are accepted.

Accessing HART Field Instrument Data

Follow these steps to connect to a field instrument and access its data. This procedure uses the example of the KIROHNE TT51 HART field instrument.

Step	Action
1	In the **DTM Browser**, navigate to and right click on the HART field instrument, which is located beneath a HART gateway module. A context menu opens.
2	Select **Connect** to establish a connection between Ecostruxure ™Automation Expert and the field instrument. **NOTE:** When a connection is established, the HART field instrument is displayed in **bold text**.
3	If necessary, select **PLC > Disconnect** to disconnect Ecostruxure ™Automation Expert from the PLC.
4	In the **DTM Browser**, right click on the HART field instrument. A context menu opens.
5	Select **Load data from device** to load data from the HART field instrument into Ecostruxure ™Automation Expert.
6	In the **DTM Browser**, right click on the HART field instrument. A context menu opens.
7	Select **Device menu > Observe** (in this example) to load data from the HART field instrument into Ecostruxure ™Automation Expert
8	Select the HART field instrument in the **DTM Browser**, then right click and select **Open** in the context menu. Basic HART data for the selected HART field instrument is now available from the DTM user interface.

Working with Field Instrument Management Tools

Overview

This section describes how to access HART data from field instruments using a variety of field instrument management tools.

NOTE: Before you begin, the HART gateway module needs to be properly configured in Control Expert, and the channel to each HART field instrument needs to be enabled.

Working with FieldCare

Connecting FieldCare to a HART Field Instrument

NOTE: The following example describes third-party software. Refer to the manufacturer product documentation for detailed operating instructions.

Follow these steps to connect *FieldCare Asset Management Software* to a HART field instrument:

Step	Action
1	Follow the manufacturer instructions and install the FieldCare software. The installation needs to include the most recent FieldCare software patch, and each necessary DTM–including the DTM for the HART gateway module, and the HART field instrument.
2	Start the FieldCare software. If it displays a message indicating the DTM catalog is not up to date, click **Update**.
3	If the **Update DTM Catalog** dialog opens: • Select each DTM that you need to add in the **Device Types not part of DTM Catalog** list (on the left). • Click **Move>>**. The selected DTMs move to the **Device Types in DTM Catalog** list (on the right). • Click **OK** to close the dialog.
4	When the FieldCare software starts, make the following selections: • In the **1. Select the communication protocol:** list, select **EtherNetIP**. • In the **2. Select the Communication DTM to be used:** list, select **EtherNet/IP Comm Adapter** by Schneider Electric. • Click **Next**.
5	In the **Configuration** tab, for the **Host Address** select the IP address for the host PC running the FieldCare software. **NOTE:** The Host IP Address needs to be in the same subnet as the HART gateway module.
6	If FieldCare software displays a message indicating that it cannot scan the network for connected devices, click **OK** to close the message box.
7	In the **Network** window, right-click on the **Host PC > EtherNet/IP Comm Adapter** DTM; then select **Add Device...** from the context menu. The **Add New Device** window opens.
8	In the **Add New Device** window, select the HART gateway module DTM (for example, the BMEAHI0812(H) or the BMEAHO0412(C)), then click **OK**.
9	In the **Network** window, double-click the **EtherNet/IP Comm Adapter** DTM to open it.
10	In the **AddressTable** tab, input the IP **Address** for the HART gateway DTM (for example, the BMEAHI0812(H) or the BMEAHO0412(C) you selected in step 8, then click **OK**. **NOTE:** Confirm the IP address you input is the address of the HART gateway module, and not the BMECRD0100 adapter module.
11	In the **Network** window, right-click on the HART gateway module DTM; then in the context menu select **Add Device...** The **Add New Device** dialog opens.
12	In the **Add New Device** window, select the DTM for the HART field instrument; then click **OK**.
13	In the **Assign Device to Channel** dialog, select the HART channel to which the field instrument is connected; then click **OK**.
14	In the **Network** window, right-click on the HART field instrument DTM; then in the context menu, select **Connect**. The HART field instrument is now ready to be accessed in the FieldCare software.
15	To view data from the HART field instrument, in the **Network** window right-click the HART field instrument DTM, then select **Observe** (for example) from the context menu. Data from the instrument is displayed and cyclically updated.

Working with PACTware

Connecting PACTware to a HART Field Instrument

NOTE: The following example describes third-party software. Refer to the manufacturer product documentation for detailed operating instructions.

Follow these steps to connect *PACTware* to a HART field instrument:

Step	Action
1	Follow the manufacturer instructions, and install the PACTware software. The installation needs to include each necessary DTM–including the HART gateway module DTM, and the HART field instrument DTM (for example, the TT51 device by KROHNE).
2	Run PACTware. If any updates are detected, follow the steps (if any) presented by PACTware to update the DTM library.

Step	Action
3	In the **Project** window, right-click on **HOST PC**; then select **Add device** from the context menu. The **Device for** dialog opens.
4	In the **Device for** dialog, select the **EtherNet/IP Comm Adapter** by Schneider Electric; then click **OK**.
5	In the **Project** window, right-click on **EtherNet/IP Comm Adapter**; then select **Add device** from the context menu. The **Device for** dialog opens.
6	In the **Device for** dialog, select the HART gateway module DTM (for example, the BMEAHI0812(H) or the BMEAHO0412(C)); then click **OK**.
7	In the **Project** window, right-click on the HART gateway module DTM (for example, the BMEAHI0812(H) or the BMEAHO0412(C)); then select **Add device** from the context menu. The **Device for** dialog opens.
8	In the **Device for** dialog, select the HART field instrument DTM (for example, the TT51 device by KROHNE); then click **OK**.
9	In the **Device for** dialog, double-click on the **EtherNet/IP Comm Adapter** to open its DTM.
10	In the **Configuration** tab, for the **Host Address** select the IP address for the host PC running the PACTware software. **NOTE:** The Host IP Address needs to be in the same subnet as the HART gateway module.
11	In the **AddressTable** tab, input the IP **Address** for the HART gateway DTM (for example, the BMEAHI0812(H) or the BMEAHO0412(C) you selected in step 8, then click **OK**. **NOTE:** Confirm the IP address you input is the address of the HART gateway module, and not the BMECRD0100 adapter module.
12	In the **Project** window, double-click on the HART gateway module to open its DTM.
13	In the **Address Table** page, input the HART channel to which the field instrument is connected; then click **OK**
14	In the **Project** window, right-click the HART field instrument DTM; then select **Connect** from the context menu.
15	In the **Project** window, right-click the HART field instrument DTM; then select **Load from device** from the context menu. The HART field instrument is now ready to be accessed in the PACTware software.
16	To view data from the HART field instrument, in the **Project** window right-click the HART field instrument DTM, then select **Measured value** from the context menu. Data from the instrument is displayed and cyclically updated.

Analog Module Debugging

What's in This Chapter

Debug Function of an Analog Module 561

Overview

This chapter shows you how to use the debugging tools in Ecostruxure ™Automation Expert.

Debug Function of an Analog Module

Introduction

For each input/output module of the project, it can be used to:

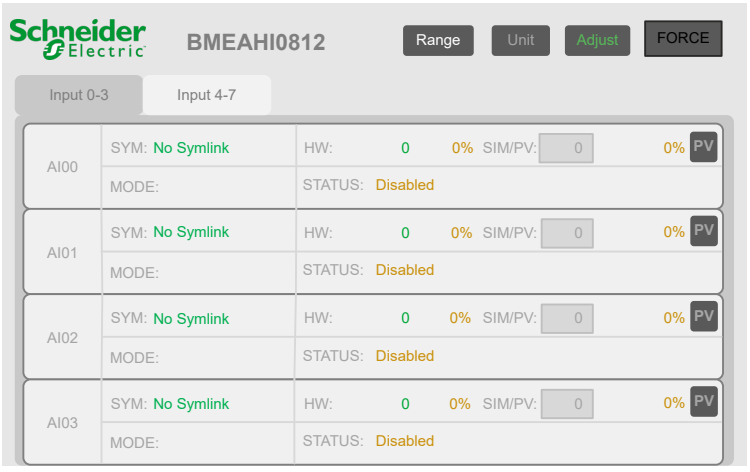
- display measurements
- display the parameters of each channel
- access the diagnostics and adjustment of the selected channel

The function also gives access to the module diagnostics in the case of an event.

Procedure

Debugging can be done in two ways:

- Using the HMI and faceplate HMI of the module.

Step	Action
1	Open the module's faceplate screen.
2	You can view the status of each channel via the **Status** screen parameter to establish a diagnosis. 

- Using VTQ quality for a specific channel.

Step	Action
1	Using EcoStruxure Automation Expert, open the Hardware configuration screen.
2	Watch the quality code. The quality code is posted in the VTQ structure of the value.

Quality code	**Description**
0000 0000	Good
8000 0000	Error
4000 0000	Undefined
0096 0000	Good and Forced

Analog Module Diagnostics

What's in This Chapter

Diagnostic of an Analog Module 563

Overview

This chapter shows you how to use the diagnostic tools in Ecostruxure ™Automation Expert.

NOTE: The **Fault** tab, described in the following topics, appears only for analog I/O modules placed in the main rack. This tab does not appear for analog I/O modules placed in remote drops.

Diagnostic of an Analog Module

Introduction

When an error is detected in an analog input/output module, the following events are possible:

- **Internal events**:
  - module malfunction detected
  - self-testing error detected
- **External events**:
  - wiring control (broken-wire, overload, or short-circuit)
  - under range/over range (outside the supported limit values)
- **Other detected errors**:
  - configuration detected error
  - module missing or off
  - inoperative channel

A detected module error is indicated by a number of LEDs changing to red, such as:

- in the rack-level configuration editor:
  - the LED of the rack number
  - the LED of the slot number of the module on the rack
- in the module-level configuration editor:
  - the **Err** and **I/O** LEDs, depending on the type of detected error
  - the **Channel** LED in the **Channel** field

Procedure

The table below shows the procedure for accessing the module Fault screen.

Step	Action
1	Open the HMI.
2	A detected error is indicated on the module LEDs: **I/O** and/or **ERR**. 

Modicon X80 Expert Function Module

What's in This Part

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BMXEHC0800 Counting Module

What's in This Chapter

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Fitting a 20-Pin Terminal Block....583
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BMXEHC0800 Module

⚠WARNING

UNEXPECTED I/O FALLBACK

- Make sure that the promptness value for outputs is set to at least the recommended value of 256ms.
- Test the system under heavy network communication workload and check that inputs and outputs do not go to fallback mode unexpectedly.

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

BMXEHC0800(H) sDefault

Abstract



Description

Fault Diagnostics
Detailed diagnostic information about the module's LED panel can be found here, page 572.

BMXEHC0800(H) fpDefault

Abstract



Description

Element	Description
Force	Blue indicates that at least one channel is forced.
Signed SYM	Symlink variable that can hold negative and positive values (-*n*.....*n*) associated with the channel.
Unsigned SYM	Symlink variable that can hold only positive values (0.....*n*).
Mode	Type configured for the channel.
HW	Indicates the real hardware value.
SIM	Indicates the simulated program value.
PV	Indicates the real program value.
Status	Channel status (IN A, IN B, IN AUX).

Element		Description
	IN_A	With a sensor: clock input for measurement or single up-counting With an encoder: for signal A
	IN_B	With a sensor: second clock input for differential counting or measurement With an encoder: for signal B
	IN_AUX	With a sensor, multi-function input user for: • synchronization • preset and start • reset and record • capture • counting direction (up-counting/down-counting mode) With an encoder: for signal Z, used for preset
Valid		The current numerical value is valid. Or, Indicates that the counter current value (frequency) and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is invalid.
Sync		Synchronizes the counter operation upon a transition to the IN_AUX physical input or the force_sync bit set to 1. This function is used in the following counting modes: • dual phase counting • modulo loop counter • one shot counter • event counting • up and down counting (using the force_sync bit only)
Modulo		Modulo flag: • dual phase counting: When the counter rolls over its limits. • up and down counting: When the counter rolls over its limits. • modulo loop counter: When the counter rolls over the modulo or 0. Modulo loop: one of the five counting modes associated with the 16-bit structure of a counter channel • intervals of 5 ms • counter reloading or resetting to 0 • counting direction change • counter stops • crossing of threshold Modulo adjust: • value: edit • default value: 0xFFFF
Low		The current numerical value is locked at the lower threshold value.
High		The current numerical value is locked at the upper threshold value.
Force Sync		Counting function synchronization and start.
Force Enable		Implementation of counter.
Force Reset		Reset counter.

Introduction

Introduction

The BMXEHC0800 counting module is a standard format module that enable pulses from a sensor to be counted at a maximum frequency of 10 KHz.

The module has eight channels as well as:

- counting-related functions (comparison, capture, homing, reset to 0)

- event generation functions designed for the application program
- outputs for actuator use (contacts, alarms, relays)

The main characteristics of this module are as follows:

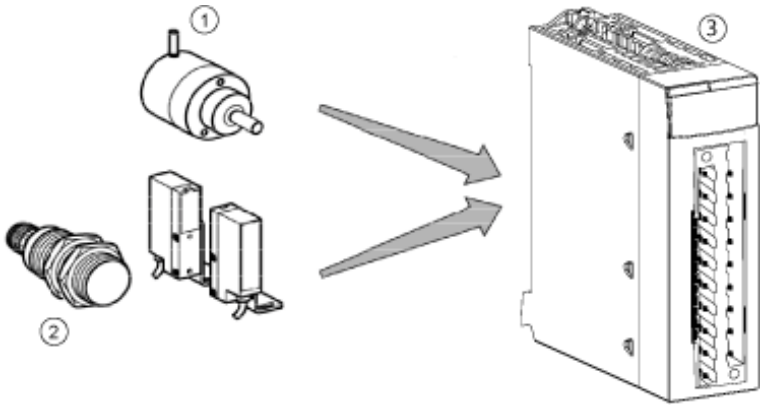
Type	Application	Number of channels per module	Number of physical inputs per channel	Number of physical outputs per channel	Maximum frequency
BMXEHC0800	• Counting • Down-counting • Frequency meter • Encoder interface	8	2 in single mode 3 in special dual phase mode	0	10 KHz

Sensors Used

The sensors used on each channel may be:

- 24 VDC two-wire proximity sensors
- 24 VDC three-wire proximity sensors
- Incremental signal encoders with 10/30 VDC output and push-pull outputs.

Illustration



1 Incremental encoder

2 Proximity sensors

3 BMXEHC0800 counting module

Presentation

At a Glance

The counting function enables fast counting using couplers, software screens and specialized language objects.

In order to implement the counting, define the physical context in which it will be executed (rack, supply, processor, modules etc.) and to help ensure the software implementation.

This second aspect is performed from the different software editors:

- in offline mode

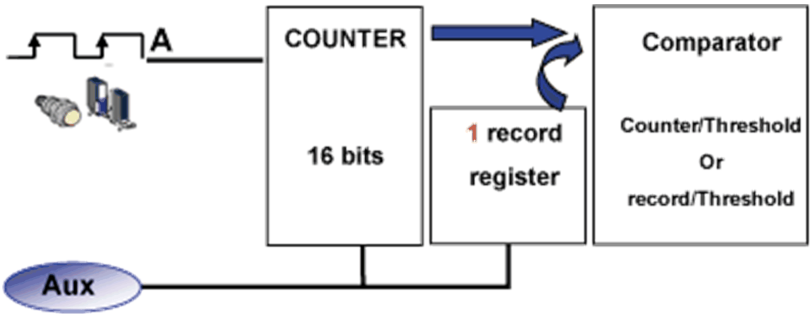
- in online mode

The BMXEHC0800 module enables the counting or down-counting of pulses to be performed and has the following functions:

- enable
- capture
- comparison
- load to preset value or reset to 0

16–Bit Structure

The following illustration shows the 16–bit structure of a counter channel:

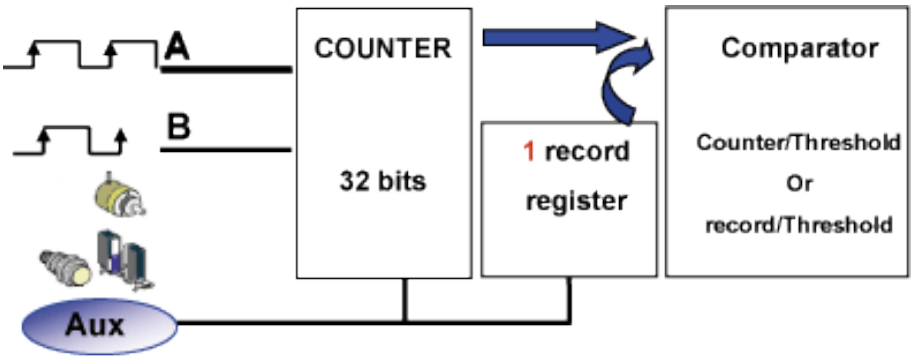


The diagram above is applicable for the following 5 counting modes:

- Frequency mode
- Event counting mode
- One shot counter mode
- Modulo loop counter mode
- Up and down counter mode

32–Bit Structure

The following illustration shows the 32–bit structure using two channels:



The preceding illustration is only applicable for the dual-phase counter mode.

In this mode with the counting module, it is possible to merge two single channels into one dual-phase channel, making it possible to build up to four encoder interfaces.

Functionalities

Introduction

This part presents the different types of user applications for the BMXEHC0800 module.

Measurement

The following table presents the measurement functionality for the BMXEHC0800 module:

User application type	Mode
Speed measurement/stream measurement	Frequency
Random events monitoring	Event counting

Counting

The following table presents the counting functionality of the BMXEHC0800 module:

User application type	Mode
Grouping	One shot counter
Level 1 packaging/labeling	Modulo loop counter
Accumulator	Up and down counting
Encoder interface	Dual phase counting

NOTE: In case of a user application such as level 1 packaging/labeling, the machine makes constant spacing between parts.

Interface

The BMXEHC0800module may be interfaced with the following components:

- mechanical switch
- 24 VDC two-wire proximity sensor
- 24 VDC three-wire proximity sensor
- 10/30 VDC encoder with push-pull outputs

Display and Diagnostics

Introduction

The BMXEHC0800(H) module has LEDs that enable the following to be viewed:

- the status of the module: RUN, ERR, I/O
- the input status of every channel

Illustration

The following drawing shows the display screen of the BMXEHC0800 module:



Fault Diagnostics

The following table enables the diagnostics of errors according to the various LEDs.

Module status	**LED indicators**										
	RUN	**ERR**	**I/O**	**C0**	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**
The module is inoperative or switched off	○										
The module has an error	○	●	○								
The module is not configured	○	◍	○								
The module has lost communication	●	◍									
The sensors have a supply error	●	○	●	⊗							
The channels are operational	●	○	○								
The voltage is present at input IN_A of counter 0				●							
The voltage is present at input IN_A of counter 1					●						
The voltage is present at input IN_A of counter 2						●					
The voltage is present at input IN_A of counter 3							●				
The voltage is present at input IN_A of counter 4								●			
The voltage is present at input IN_A of counter 5									●		
The voltage is present at input IN_A of counter 6										●	
The voltage is present at input IN_A of counter 7											●
Module status	**LED indicators**										
	RUN	**ERR**	**I/O**	**A0**	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**
The channels are operational	●	○	○								
The voltage is present at input IN_AUX of counter 0				●							

The voltage is present at input IN_AUX of counter 1					●						
The voltage is present at input IN_AUX of counter 2						●					
The voltage is present at input IN_AUX of counter 3							●				
The voltage is present at input IN_AUX of counter 4								●			
The voltage is present at input IN_AUX of counter 5									●		
The voltage is present at input IN_AUX of counter 6										●	
The voltage is present at input IN_AUX of counter 7											●
Legend											
● LED on											
○ LED off											
⊗ LED flashing slowly											
⊘ LED flashing fast											
An empty cell indicates that the state of the LED(s) is not taken into account											

Module Wiring

Introduction

The BMXEHC0800 counting module uses a standard BMXFTB2000/2010/2020 20-pin connector (wiring terminal).

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power to sensor and pre-actuator devices before connection or disconnection of the terminal block.
- Remove the terminal block before plugging / unplugging the module on the rack.

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

Field Sensors

The module has type 3 inputs that support signals from mechanical switching equipment such as contact relays, push-buttons, limit switch sensors, and two or three-wire switches that have:

- a voltage drop of less than 8 V
- current when ON more than or equal to 2 mA
- current when OFF up to 1.5 mA

The module complies with all encoders that have a 10...30 Vdc supply and push-pull outputs. Shielding is required if there is no filtering.

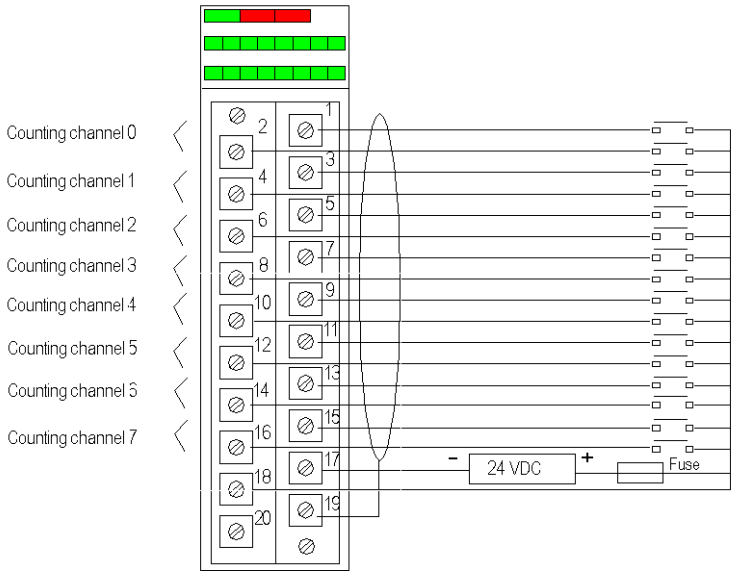
Pin Assignments

The following table describes the assignment of the 20-pin wiring terminal:

IN_A input for channel 0	2	1	IN_AUX input for channel 0
IN_A input for channel 1 or IN_B input for channel 0	4	3	IN_AUX input for channel 1
IN_A input for channel 2	6	5	IN_AUX input for channel 2
IN_A input for channel 3 or IN_B input for channel 2	8	7	IN_AUX input for channel 3
IN_A input for channel 4	10	9	IN_AUX input for channel 4
IN_A input for channel 5 or in_B input for channel 4	12	11	IN_AUX input for channel 5
IN_A input for channel 6	14	13	IN_AUX input for channel 6
IN_A input for channel 7 or IN_B input for channel 6	16	15	IN_AUX input for channel 7
Vdc + power supply for sensors	18	17	Return + 24 V power supply for sensors
Functional earth, for shield continuation	20	19	Functional earth, for shield continuation

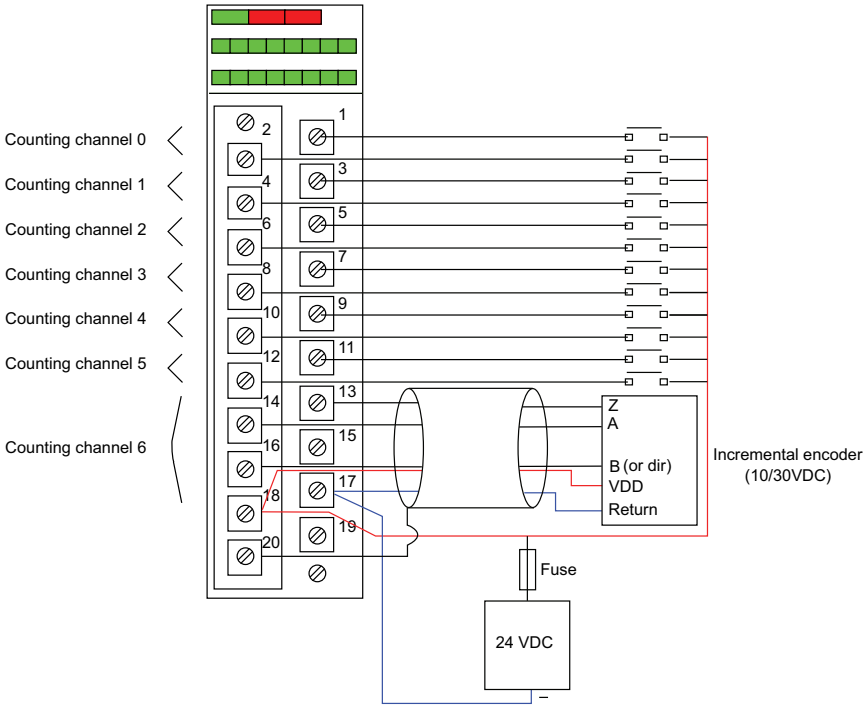
Sensor Connection Example

The following example shows the most complete application using sensors:



Encoder Connection Example

The following example shows an incremental encoder connection used for axis control connected to the counter channel 6 used in dual-phase counting mode:



3.642in

Channels 0 to 5 are still used in single mode.

Channel 7 is no longer available.

Safety Instructions

Electromagnetic perturbations may cause the application to operate in an unexpected manner.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Follow these instructions to reduce electromagnetic perturbations:

- Adapt the programmable filtering to the frequency applied at the inputs.
- Use a shielded cable (connected to the functional ground) connected to pins 15 and 16 of the connector when using an encoder or a fast detector.

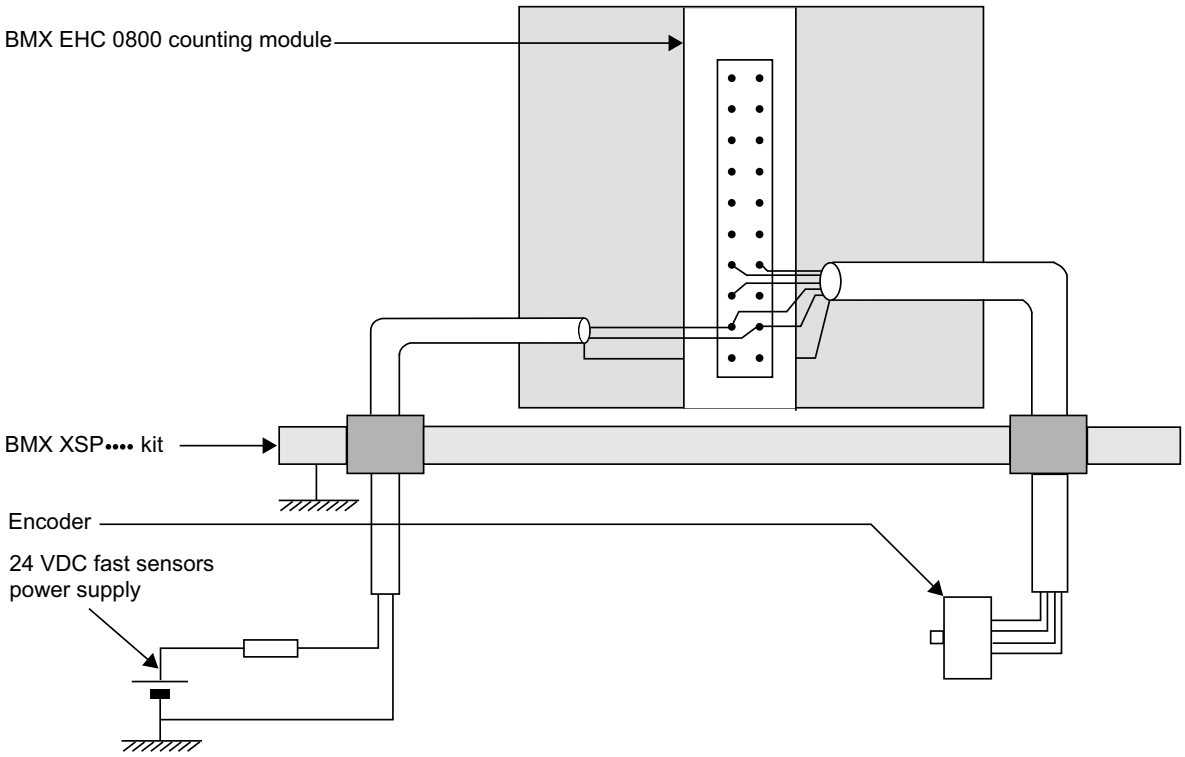
In a highly disturbed environment:

- Use the BMXXSP•••• shielding connection kit, page 662 to connect the shielding without programmable filtering.
- Use a specific 24 Vdc supply for inputs and a shielded cable for connecting the supply to the module.

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

NOTICE
MODULE DAMAGE Use fast acting fuses to protect the electronic components of the module from over-current and reverse polarity of the input/output supplies. **Failure to follow these instructions can result in equipment damage.**

The following figure shows the recommended circuit for a highly disturbed environment using the shielding connection kit:



Improper fuse selection could result in damage to the module.

Shielding Connection Kit

Introduction

The BMXXSP•••• shielding connection kit allows to connect the cable shielding directly to the ground and not to the module shielding to help protect the system from electromagnetic perturbations.

Connect the shielding on the cordsets for connecting:

- Analog module
- Counter module
- Encoder interface module
- Motion control module
- An XBT console to the processor (via shielded USB cable)

Kit References

Each shielding connection kit includes the following components:

- A metal bar

- Two sub-bases

The reference is dependent on the number of slots on the rack:

Modicon X80 rack	Number of slots	Shielding Connection Kit
BMXXBP0400(H) BMEXBP0400(H)	4	BMXXSP0400
BMXXBP0600(H) BMEXBP0600(H)	6	BMXXSP0600
BMXXBP0800(H) BMEXBP0800(H) BMEXBP0602(H)	8	BMXXSP0800
BMXXBP1200(H) BMEXBP1200(H) BMEXBP1002(H)	12	BMXXSP1200

Clamping Rings

Use clamping rings to connect the shielding on cordsets to the metal bar of the kit.

NOTE: The clamping rings are not included in the shielding connection kit.

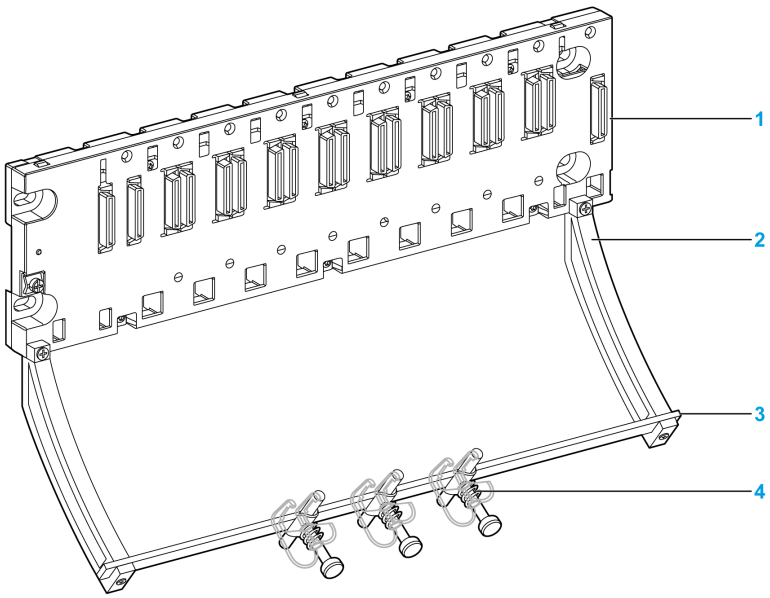
Depending on the cable diameter, the clamping rings are available under the following references:

- STBXSP3010: small rings for cables with cross-section 1.5...6 mm^2 (AWG16...10).
- STBXSP3020: large rings for cables with cross-section 5...11 mm^2 (AWG10...7).

Kit Installation

Installation of the shielding connection kit to the rack can be done with module already installed on the rack except for the BMXXBE0100 rack extender module.

Fasten the sub-bases of the kit at each end of the rack to provide a connection between the cable and the ground screw of the rack:



1 rack

2 sub-base

3 metallic bar

4 clamping ring

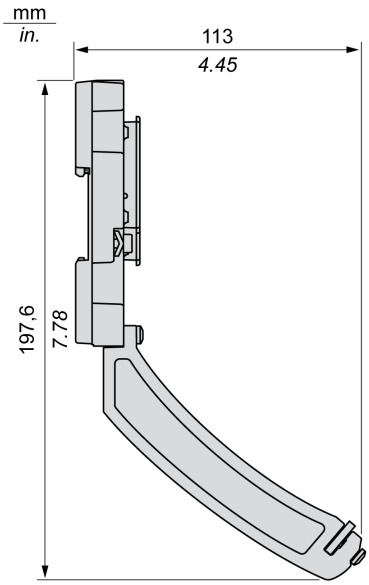
Tightening torques to install the shielding connection kit:

- For the screws fixing the sub-base to the Modicon X80 rack: Max. 0.5 N•m (0.37 lbf-ft)
- For the screws fixing the metallic bar to the sub-bases: Max. 0.75 N•m (0.55 lbf-ft)

NOTE: A shielding connection kit does not modify the volume required when installing and uninstalling modules.

Kit Dimensions

The following figure gives the dimensions (height and depth) of a rack with its shielding connection kit:

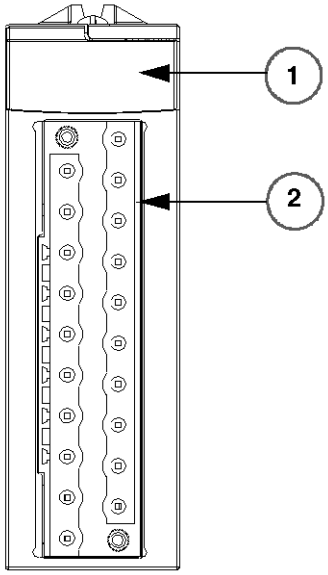


NOTE: The overall width equals the width of the rack.

Physical Description

Illustration

The following figure presents the BMXEHC0800 counting module.



BMX EHC 0800

Physical Elements

The following table presents the elements of the counting module:

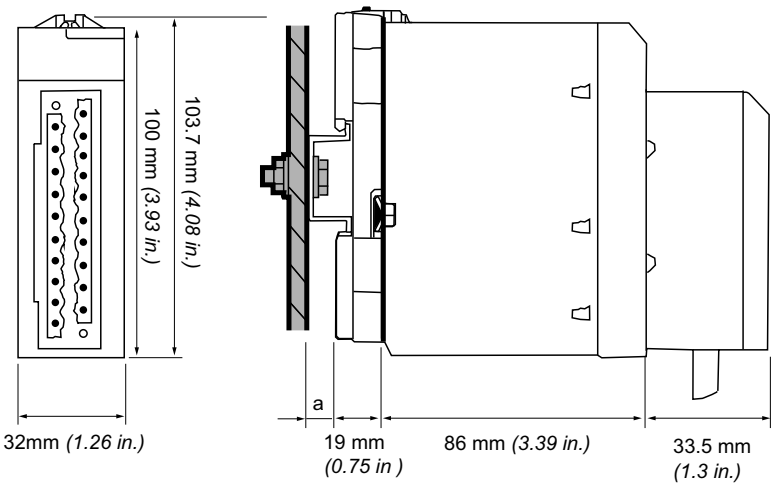
Module	Number	Description
BMXEHC0800	1	Module state LEDs: • at module level • at channel level
	2	20-pin connector compatible with a BMX FTB 20•0 terminal block

Accessories

The BMXEHC0800 module requires a BMXFTB20•0 terminal block and a BMXXSP•••• shielding connection kit, page 662.

Dimensions

Introduction



a backplane depth: the value depends on the backplane type used in your platform.

Dimensions

Module Reference	Module dimensions			Installation depth(1)
	Width	Height	Depth	
BMXEHC0800(H)	32 mm (1.26 in.)	103.7 mm (4.08 in.)	86 mm (3.39 in.)	119.5 mm (4.69 in.) (1)
1 backplane depth (a) is not included.				

NOTE: Connectors that are delivered with BMXEHC0800(H) modules (20-pin removable terminal blocks) and the corresponding pre-assembled cordsets (BMXFTW*01S) have the same dimensions.

NOTE: Consider clearance for cable installation and spacing around the racks.

Fitting of the Module

At a Glance

The counting module is powered by the rack bus. The module may be handled without turning off the power supply to the rack, without causing any danger or disturbance to the PAC if you follow recommendations described in this manual for fitting operations (installation, assembly, and disassembly).

Installation Precautions

You can install the counting module in any of the positions in the rack except:

- the positions reserved for the rack power supply modules (marked PS, PS1 and PS2)
- the position reserved for the extended module (marked XBE)

- the positions reserved for the controller in the main local rack (marked 00 or marked 00 and 01 depending on the controller)

Power is supplied by the bus at the bottom of the rack (3.3 V and 24 V).

Before installing a module, remove the protective cap from the module connector located on the rack.

⚠⚠DANGER

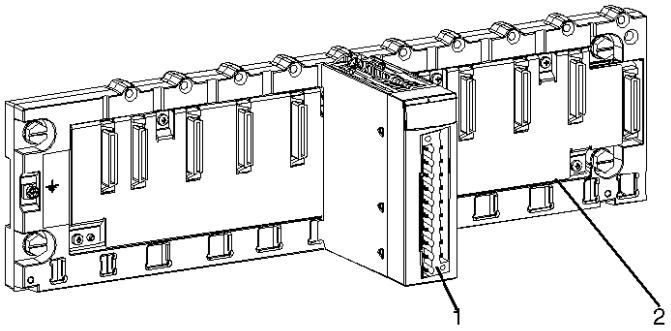
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Turn off all power to sensor and pre-actuator devices before connection of disconnection of the terminal block.
- Remove the terminal block before plugging / unplugging the module on the rack.

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

Installation

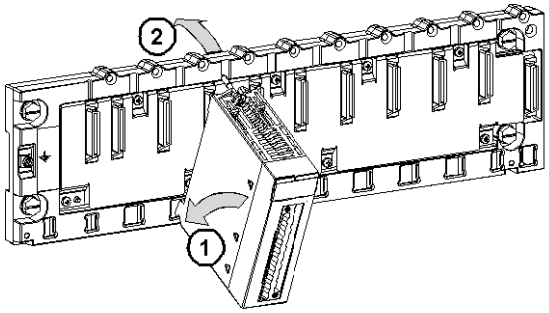
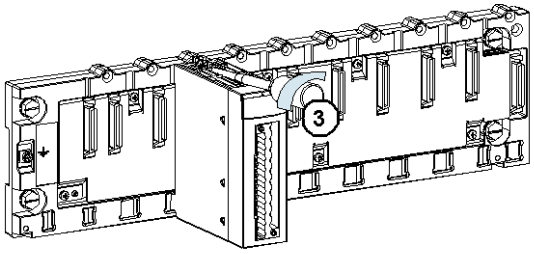
The following diagram shows the module mounted on the rack:



This table describes the different elements that make up the rack assembly:

Number	Description
1	BMXEHC0800 counting module
2	Standard rack

The following table shows the procedure for mounting the counting module on the rack:

Step	Action	Illustration
1	Position the locating pins situated at the rear of the module (on the bottom part) in the corresponding slots in the rack. **NOTE:** Before positioning the pins, confirm that you have removed the protective cover.	Steps 1 and 2 
2	Swivel the module towards the top of the rack so that the module sits flush with the back of the rack. It is now set in position.	
3	Tighten the mounting screw to ensure that the module is held in place on the rack. Tightening torque: 0.4...1.5 N•m (0.30...1.10 lbf-ft).	Step 3 

Fitting a 20-Pin Terminal Block

Introduction

The BMXEHC0800 module with 20-pin terminal block connections require the latter to be connected to the module. These fitting operations (assembly and disassembly) are described below.

Installing

⚠⚠DANGER

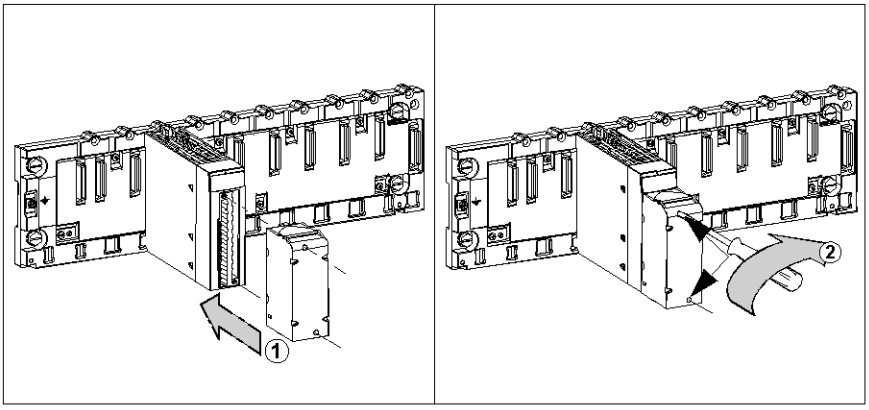
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power to sensor and pre-actuator devices before connection or disconnection of the terminal block.

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

NOTE: The module connector has indicators that show the proper direction to use for terminal block installation.

The following table shows the procedure for assembling the 20-pin terminal block onto a BMXEHC0800 module:



Step	Action
1	Once the module is in place on the rack, install the terminal block by inserting the terminal block encoder (the rear lower part of the terminal) into the module encoder (the front lower part of the module), as shown above.
2	Fix the terminal block to the module by tightening the two mounting screws located on the lower and upper parts of the terminal block. Tightening torque: 0.4 N.m.

NOTE: If the screws are not tightened, there is a potential risk that the terminal block will not be properly fixed to the module.

Coding

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power to sensor and pre-actuator devices before connection or disconnection of the terminal block.

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

⚠CAUTION

UNEXPECTED APPLICATION BEHAVIOR

Code the terminal block as described above to prevent the terminal block from being mounted on another module. Plugging the wrong connector could cause unexpected behavior of the application.

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

NOTICE

MODULE DAMAGE

Code the terminal block as previously described to help prevent the terminal block from being mounted on another module. Plugging the wrong connector could cause the module to be damaged.

Failure to follow these instructions can result in equipment damage.

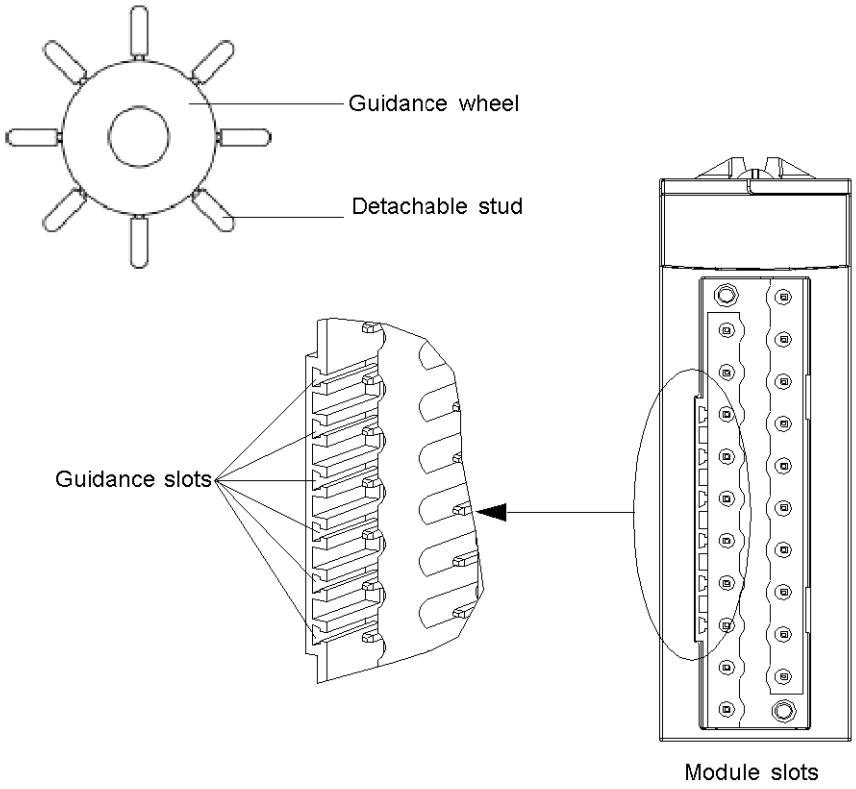
When a 20-pin terminal block is installed on a module dedicated to this type of terminal block, you can code the terminal block and the module using studs. The

purpose of the studs is to help prevent the terminal block from being mounted on another module. Handling detected errors can then be avoided when replacing a module.

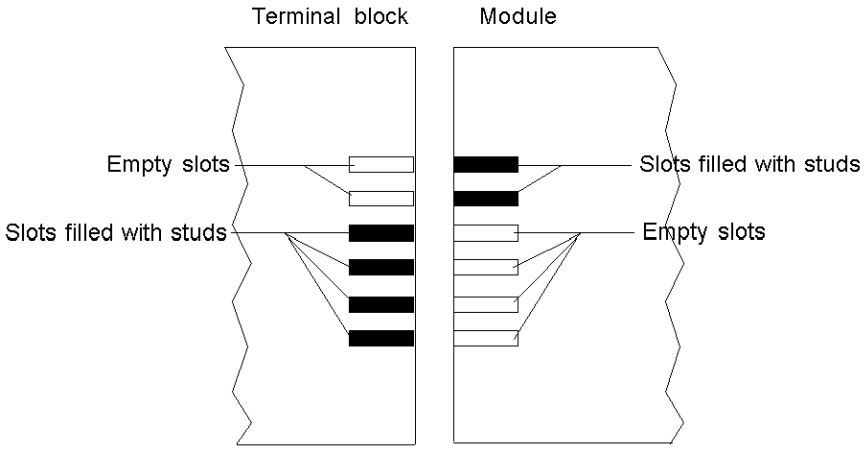
Coding is done by the user with the STBXMP7800 guidance wheel studs. You can fill only the six slots in the middle of the left side (as seen from the wiring side) of the terminal block, and can fill the module six guidance slots on the left side.

To fit the terminal block to the module, confirm that a module slot with a stud corresponds to an empty slot in the terminal block, or a terminal block with a stud corresponds to an empty slot in the module. You can fill up to and including either of the six available slots as desired.

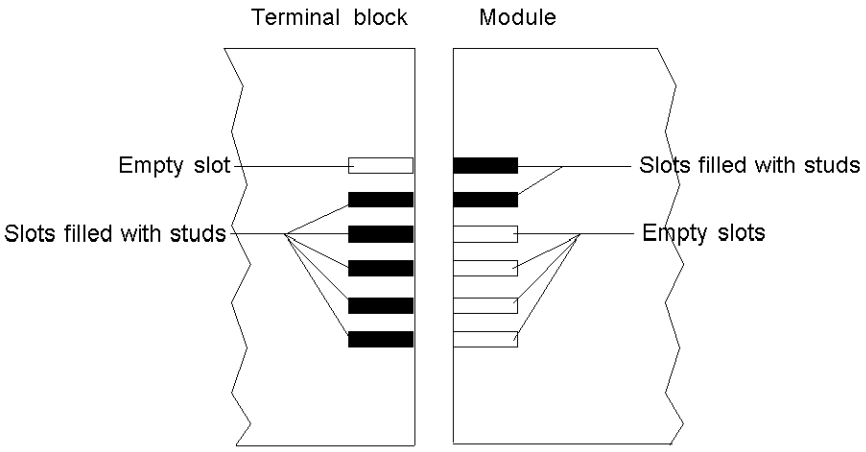
The following diagram shows a guidance wheel as well as the slots on the module used for coding the 20-pin terminal blocks:



The following diagram shows an example of a coding configuration that makes it possible to fit the terminal block to the module:



The following diagram shows an example of coding configuration with which it is not possible to fit the terminal block to the module:



Installation Methodology

At a Glance

The software installation of the BMXEHC**** module is carried out from the various software editors:

- in offline mode
- in online mode

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

Installation Phases

The following table shows the different installation phases:

Phase	Description	Mode
Declaration of variables	Declaration of 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	
	Entering the configuration parameters **Note:** All parameters are configurable online except the `event` parameter.	Offline(1)
Association	Association with the channels configured (variable editor)	Offline(1)
Build	Project generation (analysis and editing of links)	Offline
Transfer	Transfer project to PAC	Online
Adjustment/ Forcing	Adjust/force project from adjust/force screens	Online
	Forcing 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
	Diagnostics of project and modules	
Key:		
(1)	These various phases can also be performed in online mode.	

Connecting a 20-Pin Terminal Block

Introduction

There are three types of 20-pin terminal blocks:

- BMXFTB2010 screw clamp terminal blocks
- BMXFTB2000 caged terminal blocks
- BMXFTB2020 spring terminal blocks

Cable Ends and Contacts

Each terminal block can accommodate:

- Bare wires
- Wires with:
  - DZ5-CE (ferrule) type cable ends: 
  - AZ5-DE (twin ferrule) type cable ends: 

  NOTE: When using stranded cable, Schneider Electric strongly recommends the use of wire ferrules, which are fitted with an appropriate crimping tool.

Description

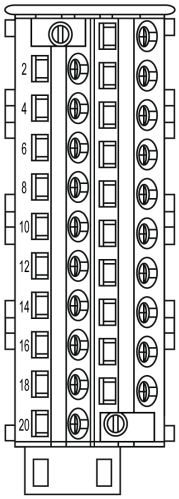
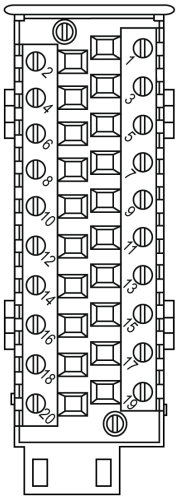
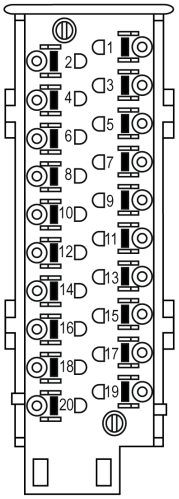
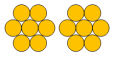
⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Turn off all power to sensor and pre-actuator devices before connection or disconnection of the terminal block.

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

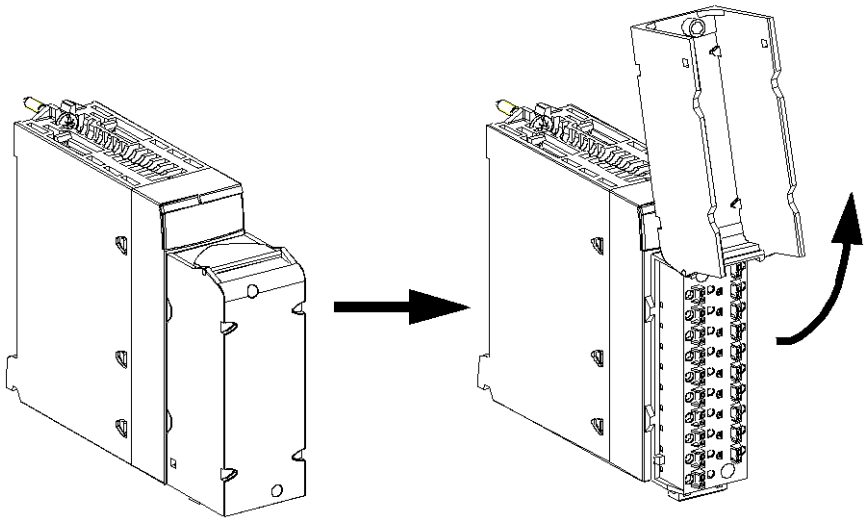
The following table describes the type of wires that fit each terminal block and the associated gauge range, wiring constraints, and tightening torque:

	Screw Clamp Terminal Blocks **BMXFTB2010**	**Caged Terminal Blocks** **BMXFTB2000**	**Spring Terminal Blocks** **BMXFTB2020**
Illustration			
1 solid conductor 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 solid conductors 	2 conductors of the same size: • AWG: 2 x 22...16 • mm²: 2 x 0.34...1.5	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
1 stranded cable 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 stranded cables 	2 conductors of the same size: • AWG: 2 x 22...16 • mm²: 2 x 0.34...1.5	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	Only possible with twin ferrule: • AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
1 stranded cable with ferrule 	• AWG: 22...16 • mm²: 0.34...1.5	• AWG: 22...18 • mm²: 0.34...1	• AWG: 22...18 • mm²: 0.34...1
2 stranded cables with twin ferrule 	• AWG: 2 x 24...18 • mm²: 2 x 0.24...1	• AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75	• AWG: 2 x 24...20 • mm²: 2 x 0.24...0.75
Minimum individual wire size in stranded cables when a ferrule is not used 	• AWG: 30 • mm²: 0.0507	• AWG: 30 • mm²: 0.0507	• AWG: 30 • mm²: 0.0507

	Screw Clamp Terminal Blocks BMXFTB2010	Caged Terminal Blocks BMXFTB2000	Spring Terminal Blocks BMXFTB2020
Wiring constraints	Screw clamps have slots that accept: • Flat-tipped screwdrivers with a diameter of 5 mm. • Pozidriv PZ1 or Philips PH1 cross-tipped screwdrivers. Screw clamp terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	Caged terminal blocks have slots that accept: • Flat-tipped screwdrivers with a diameter of 3 mm. Caged terminal blocks have captive screws. On the supplied blocks, these screws are not tightened.	The wires are connected by pressing the button located next to each pin. To press the button, use a flat-tipped screwdriver with a maximum diameter of 3 mm.
Screw tightening torque	0.5 N•m (0.37 lb-ft)	0.4 N•m (0.30 lb-ft)	Not applicable

Connection

The following diagram shows the method for opening the 20-pin terminal block door so that it can be wired:



NOTE: The wires are installed and held in place by a cable clamp positioned below the 20-pin terminal block.

Labeling

The labels for the 20-pin terminal blocks are supplied with the module. They are to be inserted in the terminal block cover by the customer.

Each label has two sides:

- One side that is visible from the outside when the cover is closed. This side features the commercial product references, an abbreviated description of the module as well as a blank section for customer labeling.
- One side that is visible from the inside when the cover is open. This side shows the terminal block connection diagram.

Diagnostic Screens

At a Glance

The diagnostic screens on the module or channel are only accessible in connected mode. Unmasked detected errors that appear are reported.

- in the configuration screen of the rack, with the presence of a red square in the position of the inoperative counting module
- in all screens at module level
  - in the module field with the LED
- in all channel level screens
  - in the module zone with the LED
  - in the channel zone with the detected error LED
- in the fault screen that is accessed by the **Fault** where the fault diagnostics are described.

The dedicated language object: CH_HEALTH_CH allows to see state of the system

NOTE: Even if the detected error is masked, it is reported by the flashing of the input/output LED and in the fault screen.

Mode Configuration

What's in This Chapter

Frequency Mode 591
Event Counter Mode 591
One Shot Counter Mode 592
Modulo Loop Counter Mode 593
Up and Down Counting Mode 594
Dual Phase Counting Mode 594

Frequency Mode

At a Glance

The configuration of a counting module is stored in the configuration constants.

Configuration Objects

The following table presents the frequency mode configurable elements.

Label	Configurable values
Counting mode	Frequency mode. The value of the least significant byte of this word is 1.
IN_A input filter	The least significant byte can take the following values: • 0: none • 1: low • 2: medium • 3: high
Input power supply error	General input/output error (bit set to 0) Local (bit set to 1)
Scale factor	Edit (value in the range 1...255)

Event Counter Mode

Introduction

The configuration of a counter module is stored in the configuration constants.

Configuration Objects

The following table presents the event counter mode configurable elements.

Label	Configurable values
Counting mode	Event counting mode. The value of the least significant byte of this word is 2.
IN_A input filter	The least significant byte can take the following values: • 0: none • 1: low • 2: medium

Label	Configurable values
	• 3: high
IN_AUX input filter	The least significant byte can take the following values: • 0: none • 1: low • 2: medium • 3: high
Input power supply error	General input/output error (bit set to 0) Local (bit set to 1)
Synchronization edge	Rising edge at the IN_SYNC input (bit set to 0) Falling edge at the IN_SYNC input (bit set to 1)
Time base	This word can take the following values: • 0: 0.1 s • 1: 1 s • 2: 10 s • 3: 1 min
Event Event number	Activated (If activated is selected, the entered event number is coded on the most significant byte of this word.) Deactivated (All bits of the most significant byte of this word are set to 1.)

One Shot Counter Mode

At a Glance

The configuration of a counting module is stored in the configuration constants.

Configuration Objects

The following table presents the one shot counter mode configurable elements.

Label		Configurable values
Counting mode	One shot counter mode. The value of the least significant byte of this word is 3.	
IN_A input filter		The least significant byte can take the following values: • 0: none • 1: low 2: medium • 3: high
IN_AUX input filter		The least significant byte can take the following values: • 0: none • 1: low • 2: medium • 3: high
IN_EN input filter		The most significant byte can take the following values: • 0: none • 1: low

Label		Configurable values
		• 2: medium • 3: high
Input power supply error		General input/output error (bit set to 0) Local (bit set to 1)
Scale factor	Edit (value in the range 1...255)	
Synchronization edge		Rising edge (bit set to 0) Falling edge (bit set to 1)
Event Event number		Activated (If activated is selected, the entered event number is coded on the most significant byte of this word.) Deactivated (All bits of the most significant byte of this word are set to 1.)

Modulo Loop Counter Mode

At a Glance

The configuration of a counting module is stored in the configuration constants.

Configuration Objects

The following table presents modulo loop counter mode configurable elements.

Label	Configurable values
Counting mode	Modulo loop counter mode. The value of the least significant byte of this word is 4.
IN_A input filter	The least significant byte can take the following values: • 0: none • 1: low • 2: medium • 3: high
IN_AUX input filter	The least significant byte can take the following values: • 0: none • 1: low • 2: medium • 3: high
Input power supply error	General input/output error (bit set to 0) Local (bit set to 1)
Scale factor	Edit (value in the range 1...255)
Synchronization edge	Rising edge (bit set to 0) Falling edge (bit set to 1)
Event Event number	Activated (If activated is selected, the entered event number is coded on the most significant byte of this word.) Deactivated (All bits of the most significant byte of this word are set to 1.)

Up and Down Counting Mode

At a Glance

The configuration of a counting module is stored in the configuration constants.

Configuration Objects

The following table presents the up and down counting mode configurable elements.

Label	Configurable values
Counting mode	Up and down counting mode. The value of the least significant byte of this word is 5.
IN_A input filter	The least significant byte can take the following values: • 0: none • 1: low • 2: medium • 3: high
IN_AUX input filter	The least significant byte can take the following values: • 0: none • 1: low • 2: medium • 3: high
Input power supply error	General input/output error (bit set to 0) Local (bit set to 1)
Counting operation	Overrun locking (bit set to 0) Reversal (bit set to 1)
Synchronization edge	Rising edge (bit set to 0) Falling edge (bit set to 1)
Event Event number	Activated (If activated is selected, the entered event number is coded on the most significant byte of this word.) Deactivated (All bits of the most significant byte of this word are set to 1.)

Dual Phase Counting Mode

At a Glance

The configuration of a counting module is stored in the configuration constants.

Configuration Objects

The following table presents the dual phase counting mode configurable elements.

Label		Configurable values
Counting mode		Dual phase counting mode. The value of the least significant byte of this word is 6.
IN_A input filter		The least significant byte can take the following values: • 0: none • 1: low • 2: medium • 3: high
IN_B input filter		The most significant byte can take the following values: • 0: none • 1: low • 2: medium • 3: high
IN_AUX input filter		The least significant byte can take the following values: • 0: none • 1: low • 2: medium • 3: high
Input power supply error		General input/output error (bit set to 0) Local (bit set to 1)
Input mode		This word can take the following values: • 0: A = High, B = Low • 1: A = Pulse, B = Direction • 2: normal quadrature 1 • 3: normal quadrature 2 • 4: normal quadrature 4 • 5: inverse quadrature 1 • 6: inverse quadrature 2 • 7: inverse quadrature 4
Scale factor		Edit (value in the range 1...255)
Synchronization edge		Rising edge (bit set to 0) Falling edge (bit set to 1)
Counting operation		Overrun locking (bit set to 0) Reversal (bit set to 1)
Event Event number		Activated (If activated is selected, the entered event number is coded on the most significant byte of this word.) Deactivated (All bits of the most significant byte of this word are set to 1.)

Operation Modes

What's in This Chapter

Frequency Mode 596
Event Counter Mode 597
One Shot Counter Mode 598
Modulo Loop Counter Mode 600
Upcounter and Downcounter Mode 602
Dual-Phase Counter Mode 605

Frequency Mode

At a Glance

Using the frequency counting mode allows you to measure the flow frequency, speed, rate, and control.

Basic Principle

In this mode, the module monitors the pulses applied only to the IN_A input and calculates the number of pulses in time intervals of 1s. The current frequency is then shown in number of events per second (Hertz). The counting register is updated at the end of each 10 ms interval.

Counter Status Bits

The following table shows the composition of the counter's status word in frequency mode.

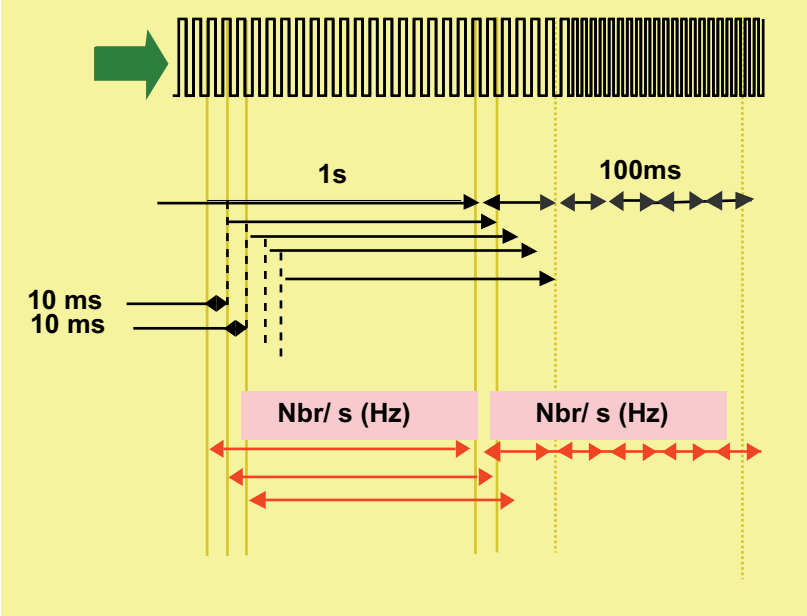
Label	Description
VALIDITY	Validity bit is used to indicate that the counter current value (frequency) and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.
HIGH_LIMIT	The bit is set to 1 when the input frequency signal is out of range.

Operating Limits

The maximum frequency that the module can measure on the IN_A input is 10 kHz. Beyond 10 kHz, the counting register value may decrease until it reaches 0.

At 10 KHz, the duty cycle is 40% to 60%.

NOTE: You have to check the `validity` bit before taking into account the numerical values such as the counter and the capture registers. Only the `validity` bit at the high level (set to 1) helps guarantee that the mode will operate correctly within the limits.



Event Counter Mode

Introduction

Use the event counter mode to determine the number of events received in a scattered manner.

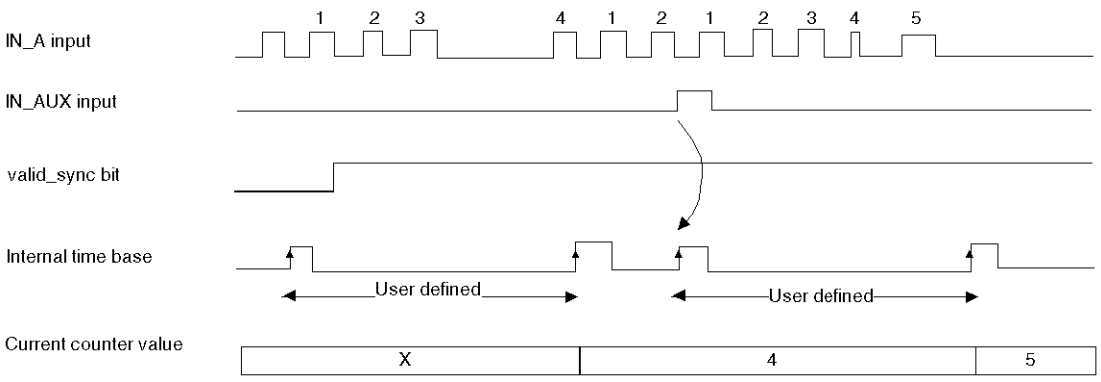
Basic Principle

In this mode, the counter assesses the number of pulses applied at the IN_A input, at time intervals defined by the user. The counter register is updated at the end of each interval with the number of events received.

You can optionally use the IN_AUX input over a time interval, provided that the validation bit is set to 1. This leads to restarting the event counter for a new predefined time interval. Depending on the selection made by the user, the time interval starts at the rising edge or at the falling edge on the IN_AUX input.

Operation

The trend diagram illustrates the counter process in event counter mode



When the synchronization occurs, the application can react using one of the following:

- SYNC_REF_FLAG input, page 624
- EVT_SYNC_PRESET input, page 625.

Counter Status Bits in Event Counter Mode

The following table shows the composition of the counter's status word in event counter mode.

Label	Description
SYNC_REF_FLAG	The bit is set to 1 when the internal time base has been synchronized. The bit is set to 0 when the `sync_reset` command is received (rising edge of the bit).
VALIDITY	Validity bit is used to indicate that the counter current value (events number) and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.
HIGH_LIMIT	The bit is set to 1 when the number of received events exceeds the counter size. The bit is reset to 0 at the next period if the limit is not reached.
LOW_LIMIT	The bit is set to 1 when more than one synchronization is received within 25 ms period. The bit is reset to 0 at the next period if the limit is not reached.

In this mode, use the variables unsigned. For example:`COUNTER_VALUE_US_CH`

Operating Limits

The module counts the pulses applied at the IN_A input every time the pulse is at least 50 µs (without de-bounce filter).

Pulses within 100 ms from synchronization are lost.

Do not perform the synchronization of the counter more than one time per 25 ms.

NOTE: Check the `validity` bit before taking into account the numerical values such as the counter and the capture registers. Only the `validity` bit at the high level (set to 1) helps guarantee that the mode will operate correctly within the limits.

One Shot Counter Mode

At a Glance

Using the one shot counter mode allows you to quantify a group of parts.

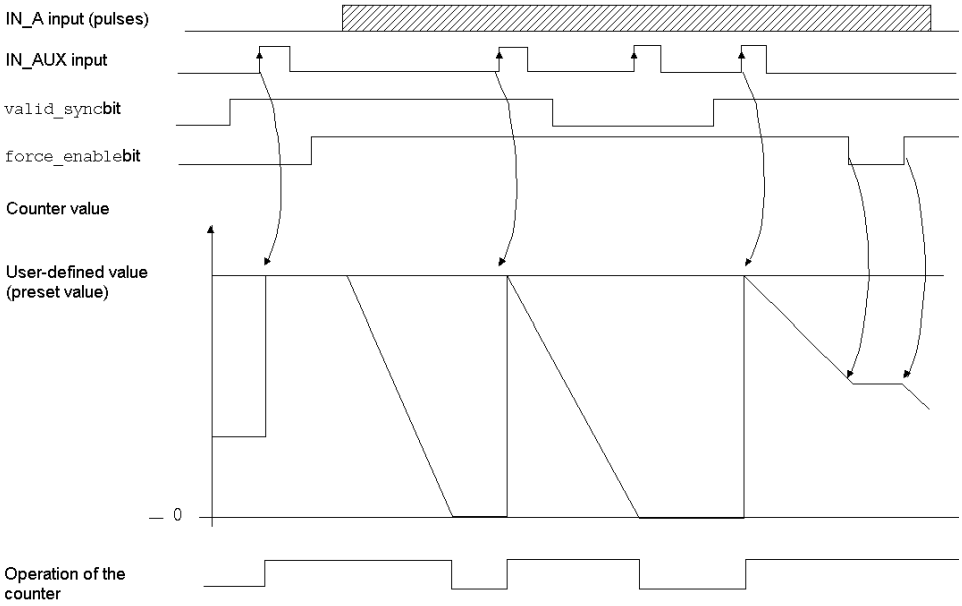
Basic Principle

In this mode, activating the synchronization function starts the counter, which, starting from a value defined by the user in the adjust screen (`preset value`), decreases with every pulse applied to the IN_A input until it reaches the value 0.

Down-counting is possible when the enable function is activated. The counting register is updated every 5 ms.

Operation

The trend diagram illustrates the one shot counter mode process:



In the preceding trend diagram, the counter starts down-counting at the IN_AUX input's rising edge. The counter loads the value defined by the user and decrements the counting register with every pulse applied to the IN_A input. When the register is set to 0, the counter awaits a new signal from the IN_AUX input. The IN_A input pulses have no effect on the register value as long as the counter is set to 0.

Confirm that the `force_enable` command is at the high level during the counting. When this command is at the low level, the last value reported in the counting register is maintained and the counter ignores the pulses applied to the IN_A input. However, it does not ignore the IN_AUX input status. In all cases, the counting resumes when the command reverts to the high level.

Counter Status Bits in One shot Counter Mode

The following table shows the composition of the counter's status word in one shot counter mode:

Label	Description
RUN	The bit is set to 1 when the counter is running. The bit is set to 0 when the counter is stopped.
SYNC_REF_FLAG	The bit is set to 1 when the counter has been set to the preset value and (re)started. The bit is reset to 0 when the `sync_reset` command is received (rising edge of the bit).
VALIDITY	Validity bit is used to indicate that the counter current value and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.

In this mode, use the variables unsigned. For example :COUNTER_VALUE_US_CH

Operating Limits

The maximum frequency that can be applied to the IN_AUX input is 1 pulse every 25 ms.

The maximum preset value is 65,535.

NOTE: Check the validity bit before taking into account the numerical values such as the counter and the capture registers. Only the validity bit at the high level (set to 1) helps guarantee that the mode will operate correctly within the limits.

Modulo Loop Counter Mode

Introduction

The modulo loop counter mode is recommended for packaging and labeling applications in which actions are repeated in series of moving objects.

Basic Principle

The counter increases with every pulse applied to the IN_A input until it reaches the modulo value -1, the modulo value being defined by the user. At the following pulse, the counter is reset to 0, and the counting resumes.

In the modulo loop counter mode, confirm that the counter is synchronized at least one time to operate. The current counter value is cleared each time the synchronization occurs.

You can record the current counter value in the capture 0 register, page 621 when the condition of synchronization occurs.

The modulo value you define is contained in the modulo_value word. To change this value, specify the value of this word:

- in the adjust screen
- in the application, using the WRITE_PARAM function

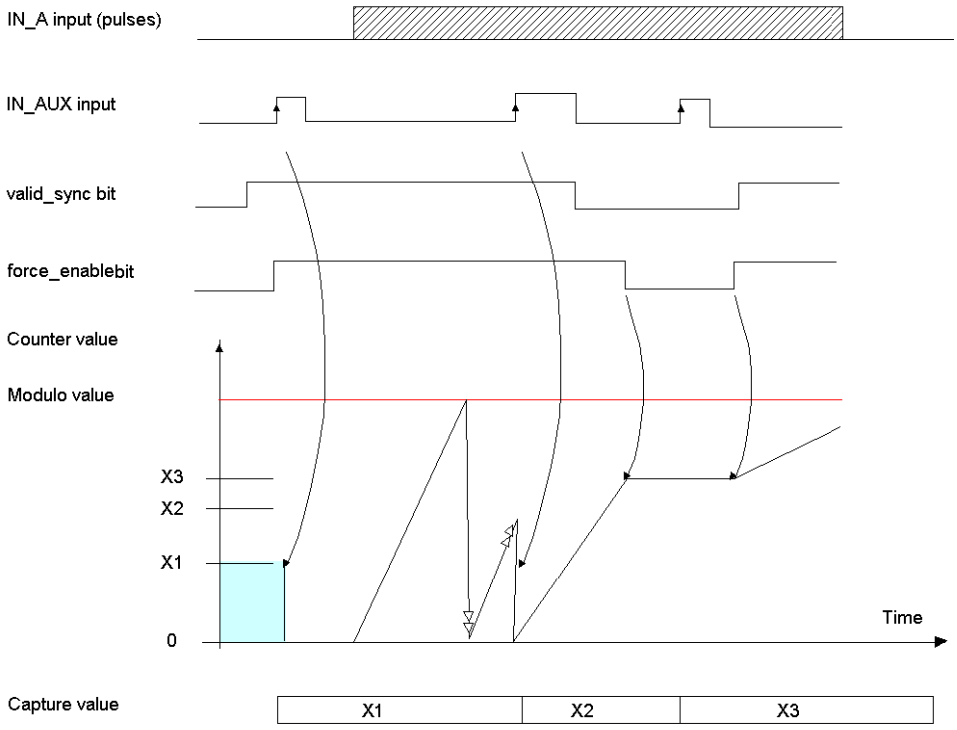
Confirm that the force_enable command is at the high level during the counting. When this command is at the low level, the last value reported in the counter register is maintained, and the counter ignores the pulses applied to the IN_A input. However, it does not ignore the IN_AUX input status. In all cases, the counter resumes when the command reverts to the high level.

In this mode, the counter register is updated at 25 ms intervals.

Unlike the BMXEHC0200 module, there is no down-counting.

Operation

The following trend diagram illustrates the modulo counter process:



Counter Status Bits in Modulo Loop Counter Mode

The following table describes the composition of the counter's status word in modulo loop counter mode:

Label	Description
MODULO_FLAG	The bit is set to 1 when the counter rollovers the modulo. The bit is reset to 0 when the command `MODULO_RESET` is received (rising edge of the `MODULO_RESET` bit).
SYNC_REF_FLAG	The bit is set to 1 when the counter is set to 0 and (re)started. The bit is reset to 0 when the command `SYNC_RESET` is received (rising edge of the `SYNC_RESET` bit).
VALIDITY	Validity bit is used to indicate that the counter current value and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.

In this mode, use the unsigned variables. For example :`COUNTER_VALUE_US_CH`

Operating Limits

The maximum frequency applied to the IN_A input is 10 kHz.

The shortest pulse applied to the IN_AUX input varies according to the level of filtering selected.

The maximum frequency that can be applied to the IN_AUX input is 1 pulse every 25 ms.

The maximum frequency for the modulo event is once every 25 ms.

The minimum acceptable modulo value varies according to the frequency at the IN_A input. For a frequency of 10 kHz applied to the IN_A input, confirm that the modulo is greater than 50.

The maximum modulo value is 65,535.

NOTE: When the modulo value is configured to 0, it is possible to count up to 65,536.

NOTE: Confirm the `validity` bit before considering the numerical values such as the counter and the capture registers. Only the `validity` bit at the high level (set to 1) helps guarantee that the mode will operate correctly within the limits.

Upcounter and Downcounter Mode

At a Glance

Using the upcounter and downcounter mode allows for an accumulation, upcounting or downcounting operation on a single input.

Basic Principle

In this mode, the counting starts with the `force_sync` software command. On the rising edge, the counting register is updated with the preset value predefined by the user. The preset value is contained in the `preset_value` word. The user may change this value by specifying the value of this word:

- in the adjust screen
- in the application, using the `WRITE_PARAM` function.

The following processing occurs at each pulse applied to the IN_A input:

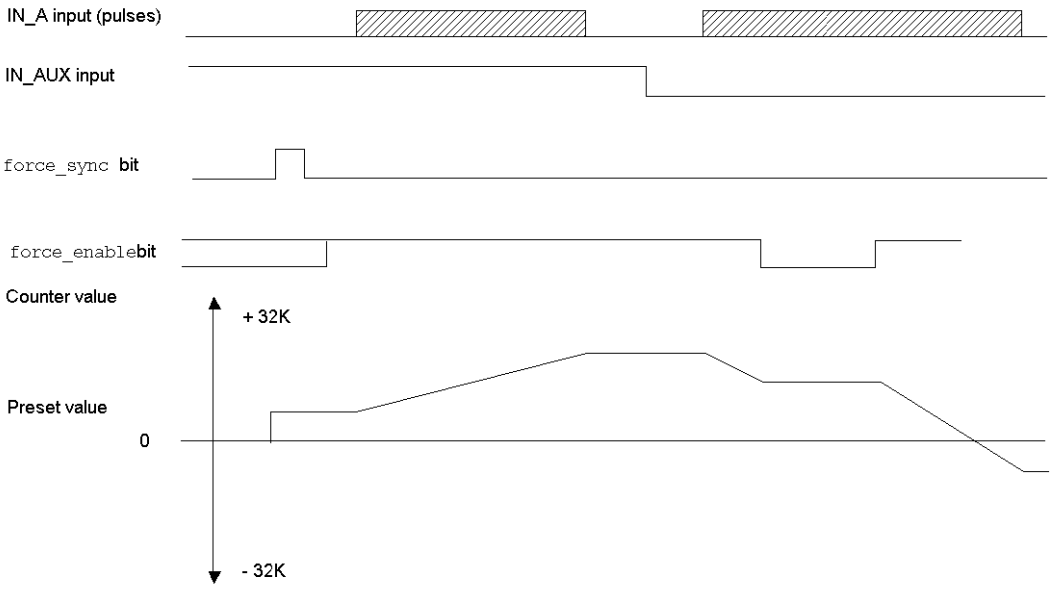
- Pulse counting if the IN_AUX input is high
- Pulse downcounting if the IN_AUX input is low

Confirm that he `force_enable` software command is at the high level during the counting. When this command is at the low level, the last value reported in the counting register is maintained and the counter ignores the pulses applied to the IN_A input. The counting resumes when the command reverts to the high level.

Counting values vary between –32,768 and +32,767.

Operation

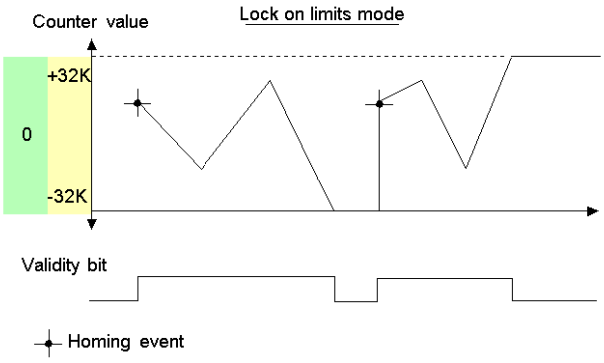
The following trend diagram illustrates the modulo up and down counting mode process:



Behavior at the Counting Limits

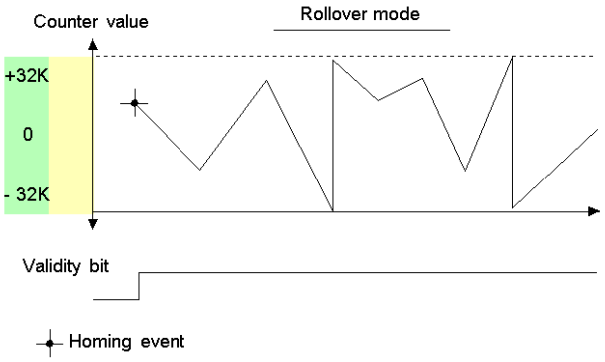
When the upper or lower limit is exceeded, the counter behaves differently according to its configuration.

In the lock on limits sub-mode, the counting register maintains the limit value and the counting validity bit changes to 0:



NOTE: Overflow and underflow are indicated by two bits `LOW_LIMIT` and `HIGH_LIMIT` until the application reloads the counting value predefined by the user (`force_sync` bit set to 1 or preset condition true). The upcounting or downcounting may, therefore, be resumed.

In the rollover sub-mode, the counting register automatically switches to the limit value opposed to overflow:



Counter Status Bits in Up and Down Counting Mode

The following table shows the composition of the counter's status word in up and down counting mode:

Label	Description
MODULO_FLAG	The bit status changes in the rollover mode. The bit is set to 1 when the counter rollovers its limits (-32,768 or +32,767). The bit is reset to 0 when the command `MODULO_RESET` is received (rising edge of the `MODULO_RESET` bit).
SYNC_REF_FLAG	The bit is set to 1 when the counter have been set to the preset value and (re)started. The bit is reset to 0 when the command `SYNC_RESET` is received (rising edge of the `SYNC_RESET` bit).
VALIDITY	Validity bit is used to indicate that the counter current value and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.
HIGH_LIMIT	The bit status changes in the lock on limits mode. The bit is set to 1 when the counter reaches +32,767. The bit is reset to 0 when the counter presets or resets.
LOW_LIMIT	The bit status changes in the lock on limits mode. The bit is set to 1 when the counter reaches -32,768. The bit is reset to 0 when the counter presets or resets.

In this mode, use the variables signed. For example :`COUNTER_VALUE_S_CH`

Operating Limits

The maximum frequency applied to the IN_A input is 10 kHz.

Pulses applied at the IN_A input, after a change of direction, are only upcounted or downcounted after a delay that corresponds to the delay in acknowledging the IN_AUX input status due to the level of filtering programmable on this input.

Confirm that reset value is between –32,768 and +32,767.

NOTE: Check the `validity` bit before taking into account the numerical values such as the counter and the capture registers. Only the `validity` bit at the high level (set to 1) helps guarantee that the mode will operate correctly within the limits.

Dual-Phase Counter Mode

At a Glance

The dual-phase counter mode is available for channels 0, 2, 4, and 6. (Channels 1, 3, 5 and 7 become inactive.) This mode behaves like the up and down counter mode, and uses up to three physical inputs. It enables simultaneous upcounter and downcounter modes.

Basic Principle

In the dual-phase counter mode, confirm that the counter is synchronized at least one time to operate. The current counter value is preset each time the synchronization occurs. The current counter value can be recorded into the `capture 0` register when the condition of synchronization occurs.

For more information, refer to the synchronization function, page 621 and the capture function.

Confirm that the `force_enable` software command is at the high level during the counting. When this command is at the low level, the last value reported in the counter register is maintained, and the counter ignores the pulses applied to the IN_A and IN_B inputs. The counter resumes when the command reverts to the high level.

Counter values vary between the limits -2,147,483,648 and +2,147,483,647 (31-bit word and one sign bit).

The preset value is predefined by the user, and is contained in the `preset_value` word. Specify the value of this word to change it:

- in the adjust screen
- in the application, using the `WRITE_PARAM` function.

Counter Configurations

In this mode, select one of the following counter configurations:

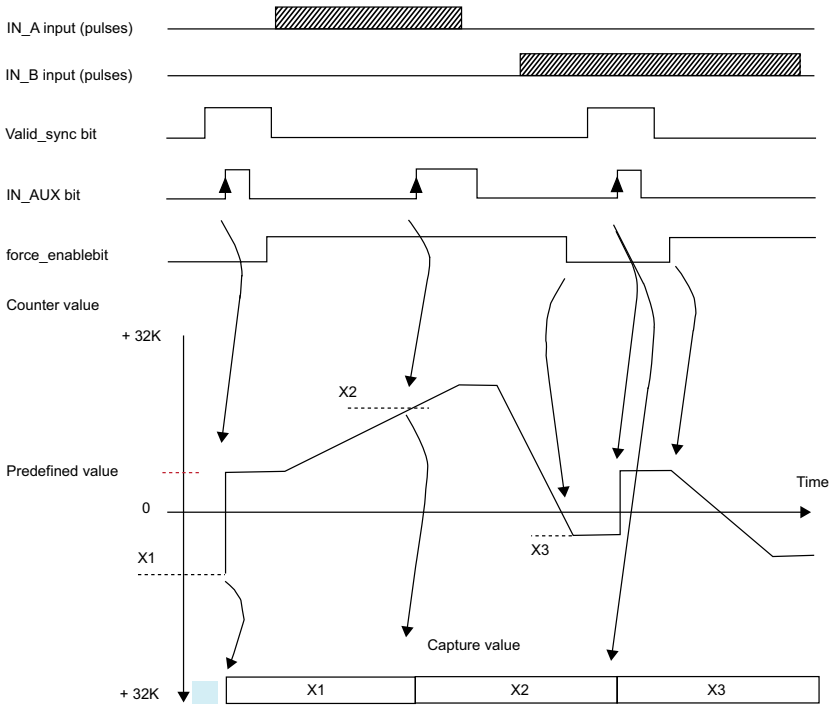
- A = up, B = down (default configuration)
- A = impulse, B = direction
- Normal quadrature X1
- Normal quadrature X2
- Normal quadrature X4
- Reverse quadrature X1
- Reverse quadrature X2
- Reverse quadrature X4.

The following table describes the upcounter and downcounter principle according to the selected configuration:

Selected configuration	Upcounter condition	Downcounter condition
A = up, B = down	Rising edge at the IN_A input	Rising edge at the IN_B input
A = impulse, B = direction	Rising edge at the IN_A input and low state at the IN_B input	Rising edge at the IN_A input and high state at the IN_B input
Normal quadrature X1	Rising edge at the IN_A input and low state at the IN_B input	Falling edge at the IN_A input and low state at the IN_B input
Normal quadrature X2	Rising edge at the IN_A input and low state at the IN_B input Falling edge at the IN_A input and high state at the IN_B input.	Falling edge at the IN_A input and low state at the IN_B input Rising edge at the IN_A input and high level at the IN_B input
Normal quadrature X4	Rising edge at the IN_A input and low state at the IN_B input High state at the IN_A input and rising edge at the IN_B input Falling edge at the IN_A input and high state at the IN_B input Low state at the IN_A input and falling edge at the IN_B input	Falling edge at the IN_A input and low state at the IN_B input Low state at the IN_A input and rising edge at the IN_B input Rising edge at the IN_A input and high level at the IN_B input High state at the IN_A input and falling edge at the IN_B input
Reverse quadrature X1	Falling edge at the IN_A input and low state at the IN_B input	Rising edge at the IN_A input and low state at the IN_B input
Reverse quadrature X2	Falling edge at the IN_A input and low state at the IN_B input Rising edge at the IN_A input and high level at the IN_B input	Rising edge at the IN_A input and low state at the IN_B input Falling edge at the IN_A input and high state at the IN_B input
Reverse quadrature X4	Falling edge at the IN_A input and low state at the IN_B input Low state at the IN_A input and rising edge at the IN_B input Rising edge at the IN_A input and high level at the IN_B input High state at the IN_A input and falling edge at the IN_B input	Rising edge at the IN_A input and low state at the IN_B input High state at the IN_A input and rising edge at the IN_B input Falling edge at the IN_A input and high state at the IN_B input Low state at the IN_A input and falling edge at the IN_B input

Operation

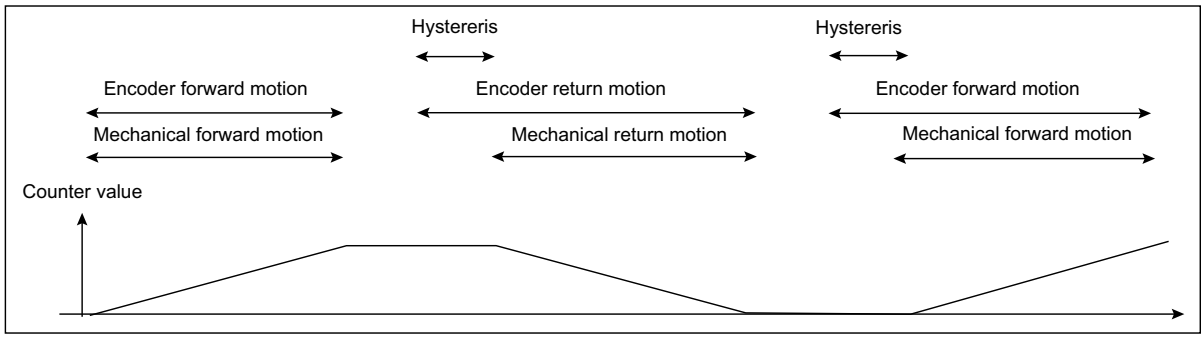
The following trend diagram illustrates the counter process for the dual-phase counter mode in default configuration:



Slack Delete

In the free large counter mode, the counter may apply a hysteresis if the rotation is inverted. The `hysteresis` parameter configured with the adjust screen defines the number of points that are not acknowledged by the counter during the rotation inversion, which accounts for the slack between the encoder/motor axis and the mechanical axis (example:. an encoder measuring the position of a mat).

This behavior is described in the following figure:



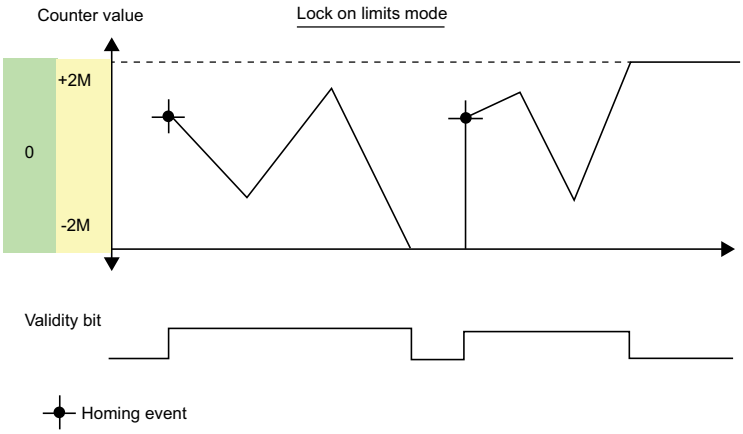
To change the value of the `Hysteresis (slack)`, specify the value of this word (this value is from 0 to 255):

- in the adjust screen
- in the application by using the `WRITE_PARAM`f function

Behavior at the Counter Limits

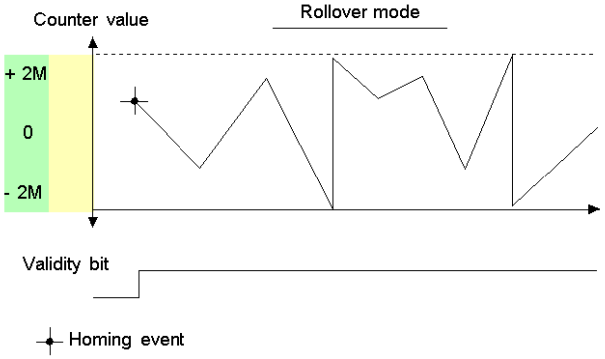
When the upper or lower limit is exceeded, the counter behaves differently according to its configuration.

In the lock on limits default configuration, the counter register maintains the limit value, and the counter validity bit changes to 0 until the next preset condition occurs:



NOTE: Overflow and underflow are indicated by the `LOW_LIMIT` and `HIGH_LIMIT` bits until the application reloads the counter value predefined by the user (`force_ref` bit set to 1 or preset condition true). The upcounter or downcounter can now resume.

In the rollover configuration, the counter register automatically switches to the limit value opposed to overflow



Counter Status Bits in Dual-Phase Counter Mode

The following table describes the composition of the counter's status word in dual-phase counter mode:

Label	Description
MODULO_FLAG	The bit status changes in the rollover mode. The bit is set to 1 when the counter rolls over its limits (-2,147,483,648 or +2,147,483,647). The bit is reset to 0 when the command `MODULO_RESET` is received (rising edge of the `MODULO_RESET` bit).
SYNC_REF_FLAG	The bit is set to 1 when the counter has been set to the preset value and restarted. The bit is reset to 0 when the command `SYNC_RESET`is received (rising edge of the `SYNC_RESET` bit).
VALIDITY	The validity bit is used to indicate that the counter current value and compare status registers contain valid data. If the bit is set to 1, the data is valid. If the bit is set to 0, the data is not valid.

Label	Description
HIGH_LIMIT	The bit status changes in the lock on limits mode. The bit is set to 1 when the counter reaches +2,147,483,647. The bit is reset to 0 when the counter presets.
LOW_LIMIT	The bit status changes in the lock on limits mode. The bit is set to 1 when the counter reaches -2,147,483,648. The bit is reset to 0 when the counter presets.

In this mode, use the unsigned variables. For example :`COUNTER_VALUE_S_CH`

Operating Limits

The maximum frequency applied to the IN_A and IN_B inputs is 10 kHz.

The shortest pulse applied to the IN_AUX input is defined according to the level of filtering applied to the input.

The maximum loading frequency for the value predefined by the user is once every 25 ms.

NOTE: Check the `validity` bit before accounting for the numerical values such as the counter and the capture registers. Only the `validity` bit at the high level (set to 1) helps guarantee that the mode will operate correctly within the limits.

Configuration

What's in This Chapter

Configuration Screen 610
Input Interface Blocks 618
Programmable Filtering 618
Comparison 619
Diagnostics 620
Synchronization, Enable, Reset to 0, and Capture Functions 621
Modulo Flag and Synchronization Flag 624
Counter Events Sent to the Application 625

Configuration Screen

Introduction

The various available configuration screens for the BMXEHC0800 counting module are:

- Channel screen
- Adjust screen



- Basic screen



- Advanced screen



For more information, refer to the **fpDefault** screen, page 568.

The **Adjust** screen, page 628 topic describes the **Adjust** screen parameters.

Description

To access the configuration screen for one of the **Channels**, right-click the **BMXEHC0800** module in the **System** tree structure in the **HW Configuration** tab (sub-tab of the **Network** tab). The following figure describes the configuration for one counter as an example. You can configure up to seven counters.

Parameters

The following table describes the parameters of the BMXEHC0800 module configuration screen.

When you highlight a parameter, its description appears in the bottom left section of the dialog box.

The following table describes the configuration for one counter as an example. You can configure up to seven counters.

Select OK when done configuring.

Parameter		Description
SlotNr	-	Enter the rack position number for the BMXEHC0800 module.
Promptness	-	Promptness of the module (delay in ms to fallback in case of communication loss). Promptness is directly linked the BUS_Cycle. Select a value from the drop-down list • No Promptness • 16 ms • 32 ms • 64 ms • 256 ms • 1 s • 4 s • 16 s • 64 s **NOTE:** `No promptness` means that the module does not check for communication loss and therefore does not switch to a fallback state. Please note that `No promptness` may also impact the threshold used to detect jitter (For more information on `ErrorHaltOncycleJitter`, refer to the *Workflow from Error Halt State* topic in the EcoStruxure Automation Expert main help)
powerConsumption	-	A value in watts.
nominal3v3CurrentConsumption	-	A value for the maximum nominal current consumption in 3V3_BAC output (Amper).
nominal24VRCurrentConsumption	-	A value for the maximum nominal current consumption in 24V_BAC output (Amper).
Counter_0	-	-
-	Channel Operation Mode	Select the channel counting mode from the drop-down list: • Reserved • Frequency Mode • Event Counting Mode • One Shot Counter Mode • Modulo Loop Counter Mode • Upcounting and Downcounting Mode • Dual Phase Counting Mode
-	Input A Filter	Select a value for the clock input for the measurement or single upcounting from the drop-down list: • Without

Parameter		Description
		• Low • Medium • High
-	Input B Filter	Select a value for the second clock input for the different counting or measurement from the drop-down list: • Without • Low • Medium • High
-	Input AUX Filter	Select a value for the multi-function input AUX filter from the drop-down list: • Without • Low • Medium • High
-	Input Supply Fault	Select a value for the input supply fault from the drop-down list: • General IO fault • Local
-	Counting Interface	Select a value from the drop-down list: • A: Up, B: Down • A: Impulse, B: Direction • Nominal Quadrature X1 • Nominal Quadrature X2 • Nominal Quadrature X4 • Reserve Quadrature X1 • Reserve Quadrature X2 • Reserve Quadrature X4
-	Scaling Factor	Enter a value in the range 1...255.
-	Synchro Edge	Select a value from the drop-down list: • Rising edge on AUX • Falling edge on AUX
-	Counting Behavior	Select a value from the drop-down list: • Lock on limits • Rollover
-	Time Base	Select a value from the drop-down list: • 0.1 s • 1 s • 10 s • 1 mn

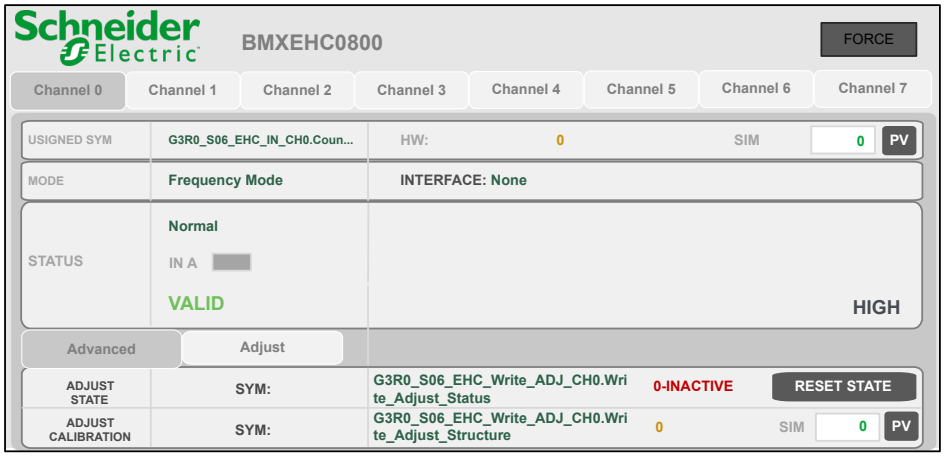
Function Blocks

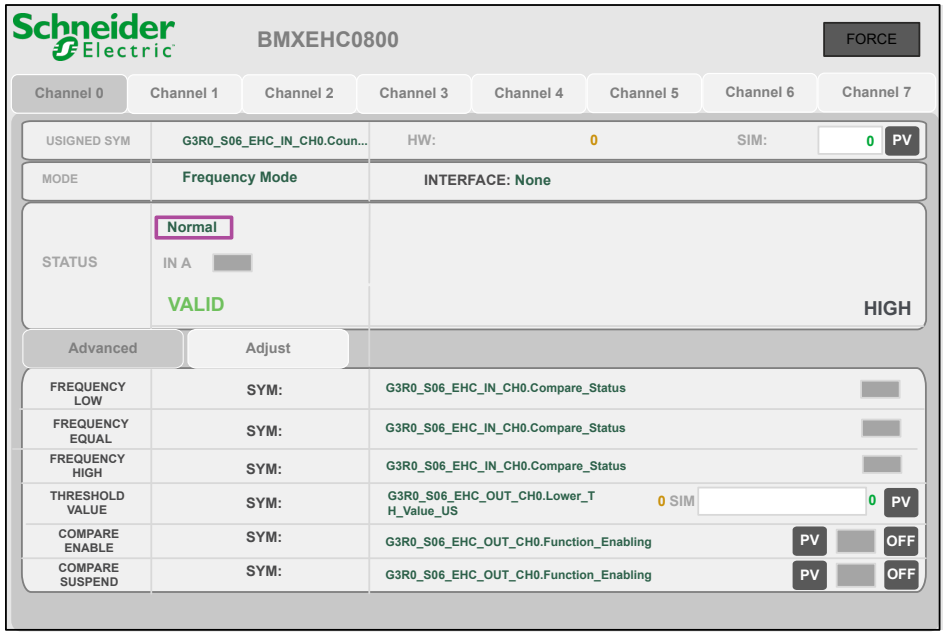
Enter values for the following function blocks based on their type. The following table describes the function blocks for one counter as an example. You can configure up to seven counters.

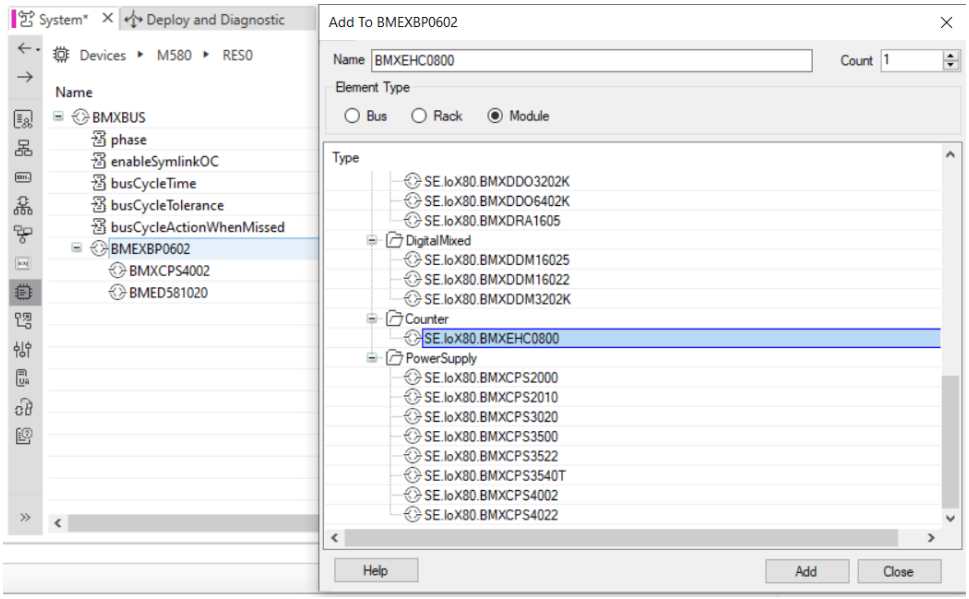
Function Block	Type	Description
FCT_TYPE_CH0	WORD	Function Type for Channel 0
CH_HEALTH_CH0	VTQBOOL	Health for Channel 0
ST_INPUT_A_CH0	BOOL	State of Input A for Channel 0
ST_INPUT_B_CH0	BOOL	State of Input B for Channel 0
ST_INPUT_SYNC_CH0	BOOL	State of Input SYNCfor Channel 0
COUNTER_STATUS_CH0	WORD	Counter Status Validity for Channel 0
COMPARE_STATUS_CH0	WORD	Field of Comparison result bits for Channel 0
COUNTER_VALUE_S_CH0	VTQDINT	Counter Value signed for Channel 0
COUNTER_VALUE_US_CH0	VTQUDINT	Counter Value unsigned for Channel 0
CAPT_0_VALUE_S_CH0	VTQDINT	Capture 0 Value signed for Channel 0
CAPT_0_VALUE_US_CH0	VTQUDINT	Capture 0 Value unsigned for Channel 0
WRITE_ADJUST_STATE_ CH0	ADJUST_STATE	Status of the last ADJUST command (0 = FAILURE, 1 = SUCCESS, 2 = IN PROGRESS)
READ_ADJUST_MODULO_ CH0	DINT	Read Current Modulo Adjust Value
READ_ADJUST_PRESET_ CH0	DINT	—
READ_ADJUST_ CALIBRATION_CH0	INT	—
READ_ADJUST_ HYSTERESIS_CH0	INT	—
FORCE_SYNC_CH0	BOOL	Start Counting
FORCE_ENABLE_CH0	BOOL	Enable Counting
FORCE_RESET_CH0	BOOL	Reset Enable and Start
RESET_SYNC_CH0	BOOL	Reset SYNC_REF_FLAG
RESET_,MODULO_CH0	BOOL	Reset MODULO_FLAG
FUNCTIONS_ENABLING_ CH0	WORD	Field of Enable Function bits
LOWER_TH_VALUE_S_CH0	DINT	Value of The Lower Threshold
LOWER_TH_VALUE_US_ CH0	UDINT	Value of The Lower Threshold
WRITE_ADJUST_MODULO_ CH0	DINT	Modulo Adjust Value
WRITE_ADJUST_PRESET_ CH0	DINT	—
WRITE_ADJUST_ CALIBRATION_CH0	INT	—
WRITE_ADJUST_ HYSTERESIS_CH0	INT	—
WRITE_ADJUST_SET_ STATE_CH0	ADJUST_STATE	Status of the last ADJUST command (0 = FAILURE, 1 = SUCCESS, 2 = IN PROGRESS)
READ_ADJUST_TRIGGER_ CH0	BOOL	Read Request For Adjust Value

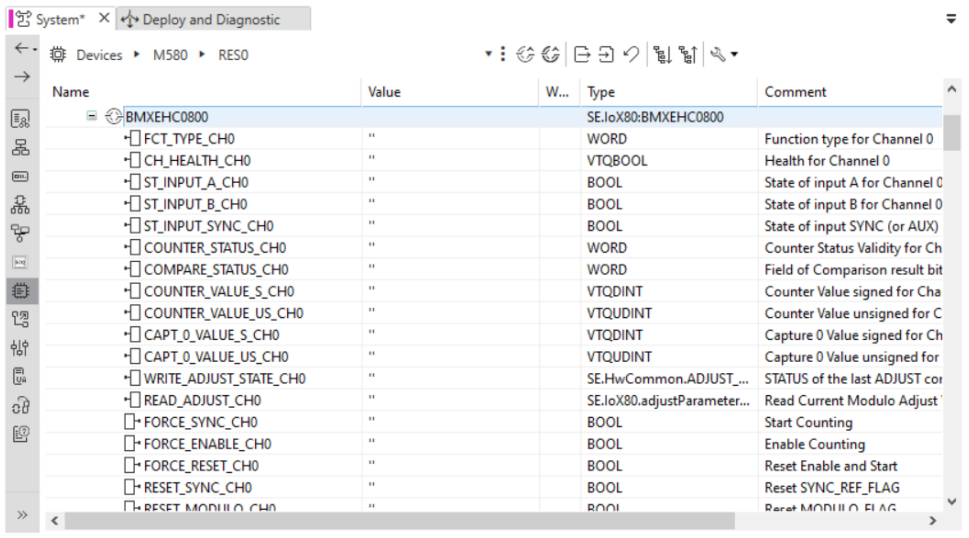
Sample Configuration

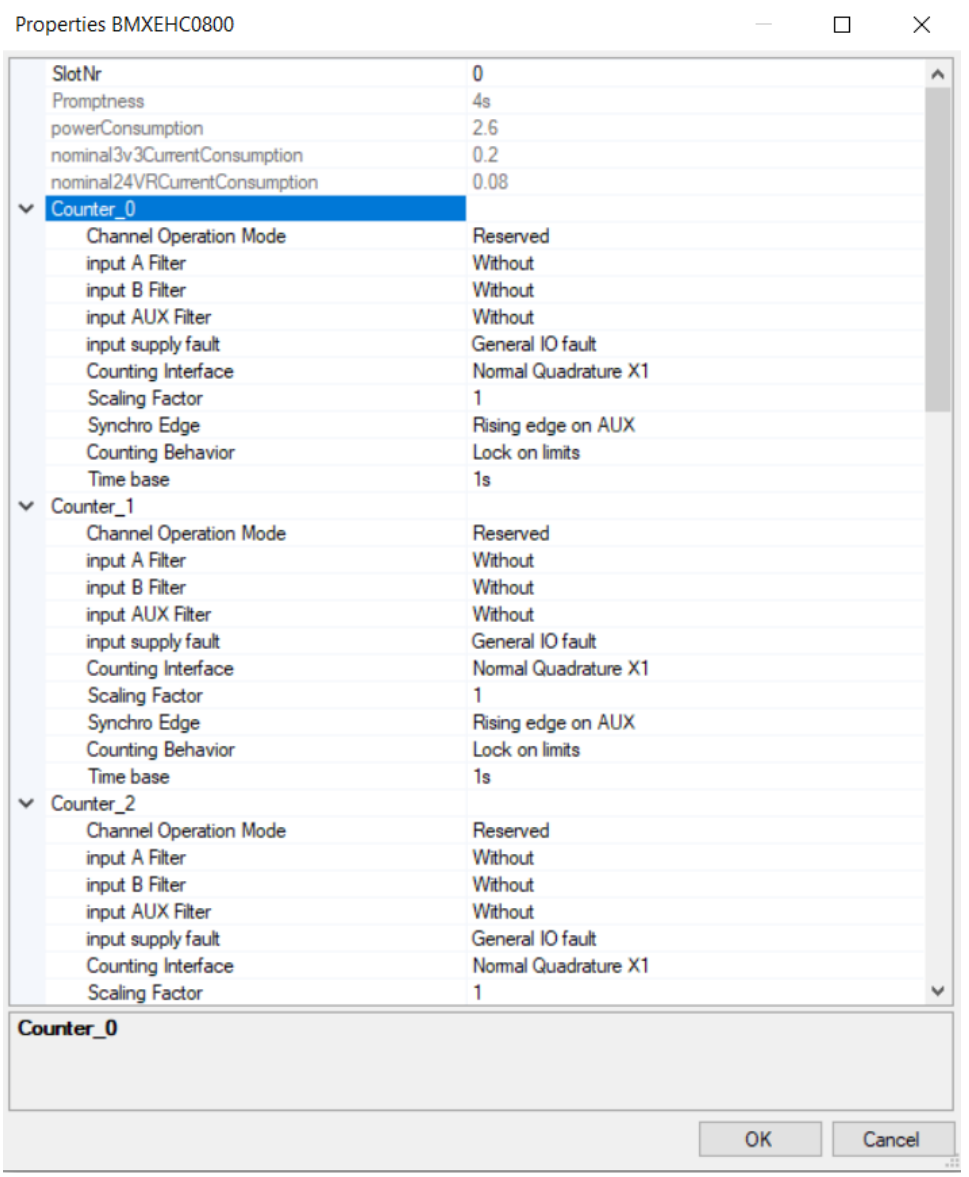
These figures describe example configurations of the BMXEHC0800 in Frequency mode.

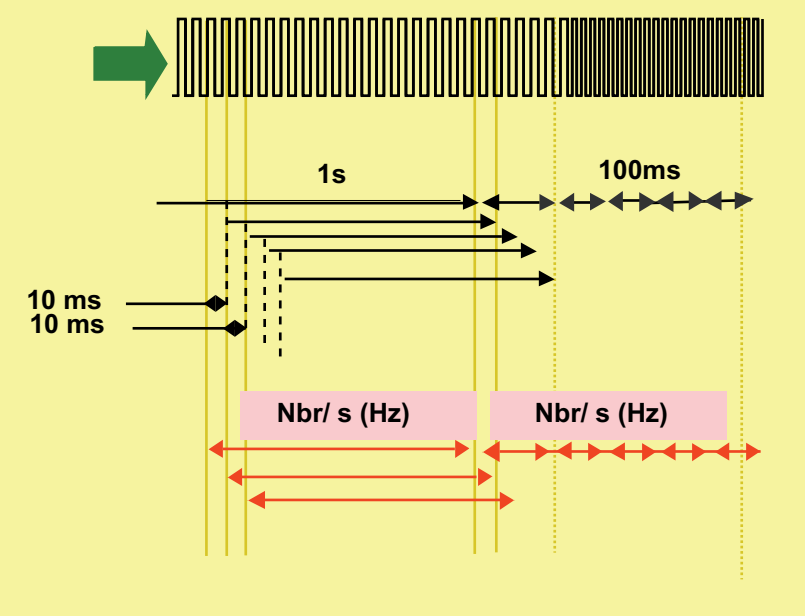







System*
Deploy and Diagnostic
Devices ▸ M580 ▸ RES0
Name
Value
W...
Type
Comment
BMXEHC0800
SE.IoX80:BMXEHC0800
FCT_TYPE_CH0
WORD
Function type for Channel 0
CH_HEALTH_CH0
VTQBOOL
Health for Channel 0
ST_INPUT_A_CH0
BOOL
State of input A for Channel 0
ST_INPUT_B_CH0
BOOL
State of input B for Channel 0
ST_INPUT_SYNC_CH0
BOOL
State of input SYNC (or AUX)
COUNTER_STATUS_CH0
WORD
Counter Status Validity for Ch
COMPARE_STATUS_CH0
WORD
Field of Comparison result bit
COUNTER_VALUE_S_CH0
VTQDINT
Counter Value signed for Cha
COUNTER_VALUE_US_CH0
VTQUDINT
Counter Value unsigned for C
CAPT_0_VALUE_S_CH0
VTQDINT
Capture 0 Value signed for Ch
CAPT_0_VALUE_US_CH0
VTQUDINT
Capture 0 Value unsigned for
WRITE_ADJUST_STATE_CH0
SE.HwCommon.ADJUST_...
STATUS of the last ADJUST co
READ_ADJUST_CH0
SE.IoX80.adjustParameter...
Read Current Modulo Adjust
FORCE_SYNC_CH0
BOOL
Start Counting
FORCE_ENABLE_CH0
BOOL
Enable Counting
FORCE_RESET_CH0
BOOL
Reset Enable and Start
RESET_SYNC_CH0
BOOL
Reset SYNC_REF_FLAG


Properties BMXEHC0800
SlotNr
0
Promptness
4s
powerConsumption
2.6
nominal3v3CurrentConsumption
0.2
nominal24VRCurrentConsumption
0.08
Counter_0
Channel Operation Mode
Reserved
input A Filter
Without
input B Filter
Without
input AUX Filter
Without
input supply fault
General IO fault
Counting Interface
Normal Quadrature X1
Scaling Factor
1
Synchro Edge
Rising edge on AUX
Counting Behavior
Lock on limits
Time base
1s
Counter_1
Channel Operation Mode
Reserved
input A Filter
Without
input B Filter
Without
input AUX Filter
Without
input supply fault
General IO fault
Counting Interface
Normal Quadrature X1
Scaling Factor
1
Synchro Edge
Rising edge on AUX
Counting Behavior
Lock on limits
Time base
1s
Counter_2
Channel Operation Mode
Reserved
input A Filter
Without
input B Filter
Without
input AUX Filter
Without
input supply fault
General IO fault
Counting Interface
Normal Quadrature X1
Scaling Factor
1
Counter_0
OK
Cancel



Input Interface Blocks

Description

The BMXEHC0800 counting module has three fast inputs:

Fast Inputs

The following table presents the module's fast inputs.

Input	Use with available sensors	Use with an encoder
IN_A input	Clock input for measurement or single upcounting	For signal A
IN_B input From the following channel	Second clock input for differential counting or measurement	For signal B
IN_AUX input	Multi-function input used for: • synchronization • preset and start • reset and record • capture • counting direction (upcounting/ downcounting mode)	For signal Z Used for preset

Programmable Filtering

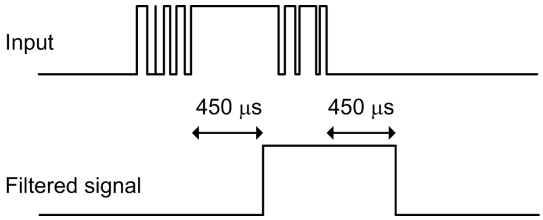
Introduction

The BMXEHC0800 counting module's two (or three) inputs are compatible with the use of mechanical switches.

A programmable de-bounce filter with three levels (low, medium and high) is available at every input.

De-bounce Filter Diagram

The following figure shows the de-bounce filter in low mode:



In this mode, the system delays all transitions until the signal is stable for 450 µs.

Filter Level

The following table specifies the characteristics of each input for the selected level of filtering:

Filtering level	Input	Minimum pulse	Maximum frequency
None	IN_A, IN_B	50 µs	10 KHz
	IN_AUX	50 µs	40 Hz
Low	IN_A, (IN_B)	450 µs	1 KHz
for bounces > 2 KHz	IN_AUX	450 µs	40 Hz
Resource	IN_A, IN_B	1.25 ms	350 Hz
for bounces > 1 KHz	IN_AUX	1.25 µs	40 Hz
High	IN_A, IN_B	4.2 ms	100 Hz
for bounces > 250 Hz	IN_AUX	4.2 ms	40 Hz

Comparison

At a Glance

The comparison block operates automatically when it is enabled. It is available in all the BMXEHC0800 module's counting modes.

It compares the current value of the counter together with the capture value at the defined threshold.

Comparison Threshold

The comparison block has one threshold only. Its value is contained in the `lower_th_value` double word.

The threshold format is identical to the counter value format.

Comparison Status Register

The result of the comparison is stored in the comparison status register.

The value of the capture register and the current value of the counter are compared with the thresholds.

The possible results are:

- Low: The counter value is less than the lower threshold value.
- Equal: The counter value is equal to the threshold.
- High: The counter value is greater than the threshold.

The comparison status register consists of:

Position of the status register bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Compared element											Capture			Counter		
Comparison result											High	Equal	Low	High	Equal	Low

Update

When the `compare_enable_bit` is set to 0, the comparison status register is deleted.

When the `compare_suspend_bit` is set to 1, the comparison status register is frozen at its last value.

The comparison with capture register value is performed every time the registers are loaded.

The comparison with the counter current value is performed as follows:

Counting mode	**Comparison register update**
Frequency	Period intervals of 10 ms
Event counting	Period intervals defined by the user
Modulo loop counter One shot counter dual phase counting Up and down counting	One of the following conditions: • intervals of 5 ms • counter reloading or resetting to 0 • counting direction change • counter stops • crossing of threshold

Diagnostics

Consistency Rules for Input Interface

The input interface requires that the sensor power supply remains active for counting operations.

When the sensor power supply interrupt lasts 1 ms or less, the counter remains stable.

If the power interrupt is greater than 1 ms, all counter values are disabled.

I/O Data

All input/output statuses are provided in the channel data bits.

The following table describes the channel data bits:

I/O data field	Designation
IN_A, signal A with an encoder	Electrical state of IN_A input
IN_B, signal B with an encoder	Electrical state of IN_B input
IN_AUX, signal Z with an encoder	Electrical state of IN_AUX input

Synchronization, Enable, Reset to 0, and Capture Functions

Introduction

This topics presents the functions used by the various counting modes of the BMXEHC0800 module:

- Synchronization function
- Enable function
- Reset to 0 function
- Capture function

Each function uses at least one of the following two bits:

- `valid_(function)` bit: Setting this bit to 1 allows you to take into account the occurrence of an external event which activates the function. If this bit is set to 0, the event is not taken into account and does not activate the function. The `functions_enabling` word contains all the `valid_(function)` bits.
- `force_(function)` bit: Setting this bit to 1 allows you to activate the function irrespective of the status of the external event.

Synchronization Function

The synchronization function is used to synchronize the counter operation upon a transition applied to the IN_AUX physical input or the `force_sync` bit set to 1.

This function is used in the following counting modes:

- Dual phase counting
- Modulo loop counter
- One shot counter
- Event counting
- Up and down counting (using the `force_sync` bit only)

In all of the counting modes specified above, with the exception of the up and down counting mode, the user may configure the `synchro edge` parameter in the configuration screen by choosing from the following two possibilities to configure the external event:

- Rising edge of the IN_AUX input
- Falling edge of the IN_AUX input

The following table presents the `force_sync` bit in bold which is an element of the output command word:

Standard symbol	Meaning
OUTPUT_0	Forces OUTPUT_0 to level 1
OUTPUT_1	Forces OUTPUT_1 to level 1
OUTPUT_BLOCK_0_ENABLE	Implementation of output 0 function block
OUTPUT_BLOCK_1_ENABLE	Implementation of output 1 function block

Standard symbol	Meaning
FORCE_SYNC	**Counting function synchronization and start**
FORCE_REF	Set to preset counter value
FORCE_ENABLE	Implementation of counter
FORCE_RESET	Reset counter
SYNC_RESET	Reset SYNC_REF_FLAG
MODULO_RESET	Reset MODULO_FLAG

The following table presents the `valid_sync` bit in bold, which is an element of the function enabling word:

Standard symbol	Meaning
VALID_SYNC	**Synchronization and start authorization for the counting function via the IN_SYNC input**
VALID_REF	Operation authorization for the internal preset function
VALID_ENABLE	Authorization of the counter enable via the IN_EN input
VALID_CAPT_0	Capture authorization in the capture0 register
VALID_CAPT_1	Capture authorization in the capture1 register
COMPARE_ENABLE	Comparators operation authorization
COMPARE_SUSPEND	Comparator frozen at its last value

The following table presents the synchronization principle:

Edge	Status of the `valid_sync` bit	Status of the counter
Rising or falling edge on IN_AUX (depending on the configuration)	Set to 0	Not synchronized
Rising or falling edge on IN_AUX (depending on the configuration)	Set to 1	Synchronized
Rising edge on `force_sync` bit	Set to 0 or 1	Synchronized

When the synchronization occurs, the application can react using one of the following:

- SYNC_REF_FLAG input, page 624
- EVT_SYNC_PRESET input, page 625.

Enable Function

This function is used to authorize changes to the counter value via software command.

This function is used in the following counting modes:

- Dual phase counting
- Up and down counting
- Modulo loop counter
- One shot counter

The following table presents the `force_enable` bit in bold, which is an element of the output command word:

Standard symbol	Meaning
OUTPUT_0	Forces OUTPUT_0 to level 1
OUTPUT_1	Forces OUTPUT_1 to level 1
OUTPUT_BLOCK_0_ENABLE	Implementation of output 0 function block
OUTPUT_BLOCK_1_ENABLE	Implementation of output 1 function block
FORCE_SYNC	Counting function synchronization and start
FORCE_REF	**Set to preset counter value**
FORCE_ENABLE	**Implementation of counter**
FORCE_RESET	Reset counter
SYNC_RESET	Reset SYNC_REF_FLAG
MODULO_RESET	Reset MODULO_FLAG

The function is activated by setting the `force_enable` bit to 1. There is no `valid_enable` bit because the function is not activated by any physical input.

Reset to 0 Function

This function is used to load the value 0 into the counter via software command.

This function is used in the following counting modes:

- Dual phase counting
- Up and down counting
- Modulo loop counter
- One shot counter

The following table presents the `force_reset` bit in bold, which is an element of the output command word:

Standard symbol	Meaning
OUTPUT_0	Forces OUTPUT_0 to level 1
OUTPUT_1	Forces OUTPUT_1 to level 1
OUTPUT_BLOCK_0_ENABLE	Implementation of output 0 function block
OUTPUT_BLOCK_1_ENABLE	Implementation of output 1 function block
FORCE_SYNC	Counting function synchronization and start
FORCE_REF	Set to preset counter value
FORCE_ENABLE	Implementation of counter
FORCE_RESET	**Reset counter**
SYNC_RESET	Reset SYNC_REF_FLAG
MODULO_RESET	Reset MODULO_FLAG

The function is activated by the rising edge of the `force_reset` bit. There is no `valid_reset` bit because the function is not activated by any physical input.

Capture Function

This function is used to load the current counter value into the `capt_0_val` register at the same condition defined by the synchro edge parameter configured in the configuration screen, page 621.

Each BMXEHC0800 module channel has one capture register.

This function is used in the following counting modes:

- Dual phase counting
- Modulo loop counter

The synchronization and capture functions may be enabled independently:

Status of the `valid_capt_0` bit	Status of the `valid_sync` bit	Behavior while the capture condition (condition defined by the `synchro edge` parameter) is true	
		Current counter value	`Capture` register value
Set to 0	Set to 0	No change	No change
Set to 0	Set to 1	Reload or clear	No change
Set to 1	Set to 0	No change	Reload with current counter value
Set to 1	Set to 1	Reload or clear	Reload with current counter value. The storage occurs before resetting the counter value.

Modulo Flag and Synchronization Flag

Introduction

This topic presents the operation of the bits relating to the following events:

- Counter synchronization event
- Counter rollovers the modulo or its limits in forward or reverse.

The following table presents the counter modes that may activate synchronization and modulo events:

Flag	Counter mode concerned
`sync_ref_flag` bit	• Dual phase counter: The counter presets and (re) starts. • Up and down counter: The counter presets and (re) starts. • Modulo loop counter: The counter resets. • One shot counter: The counter presets and (re) starts. • Event counter: The internal time base restarts to the beginning.
`modulo_flag` bit	• Dual phase counter: The counter rollovers its limits. • Up and down counter: The counter rollovers its limits. • Modulo loop counter: The counter rollovers the modulo or 0.

You can use these two flags without declaring any event task in configuration screen. These two flag bits are refreshed by the task declared with the module channel.

Operation of the Flag Bits

The synchronization event's flag bit is set to 1 when a counter synchronization occurs.

The modulo event's flag bit can be set to 1 in the following counter modes:

- Dual phase counter: The flag bit is set to 1 when the counter rolls over its limits in forward or reverse.

- Up and down counter: The flag bit is set to 1 when the counter rolls over its limits in forward or reverse.
- Modulo loop counter: The flag bit is set to 1 when the counter rolls over the modulo.

Location of the Flag Bits

The following table presents the `modulo_flag` and `sync_ref_flag` bits which are elements of the status word:

Standard symbol	Meaning
RUN	The counter operates in one shot mode only.
MODULO_FLAG	**Flag set to 1 by a modulo switch event**.
SYNC_REF_FLAG	**Flag set to 1 by a preset or synchronization event**.
VALIDITY	The current numerical value is valid.
HIGH_LIMIT	The current numerical value is locked at the upper threshold value.
LOW_LIMIT	The current numerical value is locked at the lower threshold value.

Resetting the Flag Bits to 0

Confirm that the application resets the flag bit to 0 (if it is active) by using the appropriate command bit from the following two bits:

- `sync_reset` bit to reset the synchronization event's flag bit to 0
- `modulo_reset` bit to reset the modulo event's flag bit to 0

Location of Reset to 0 Commands

The following table presents the `sync_reset` and `modulo_reset` bits which are elements of the output command word:

Standard symbol	Meaning
OUTPUT_0	Forcing of OUTPUT_0 to level 1
OUTPUT_1	Forcing of OUTPUT_1 to level 1
OUTPUT_BLOCK_0_ENABLE	Implementation of output 0 function block
OUTPUT_BLOCK_1_ENABLE	Implementation of output 1 function block
FORCE_SYNC	counter function synchronization and start
FORCE_REF	Set to preset counter value
FORCE_ENABLE	Implementation of counter
FORCE_RESET	Reset counter
SYNC_RESET	**Reset SYNC_REF_FLAG**
MODULO_RESET	**Reset MODULO_FLAG**

Counter Events Sent to the Application

Introduction

Confirm that an event task number is declared in the module configuration screen to send the event to the application.

Standard symbol	Description	Counter mode concerned
EVT_RUN	Event due to start of counter	One-shot counter mode
EVT_MODULO	Event due to counter being equal to modulo value - 1 or equal to value 0	• Modulo loop counter mode • Up and down counter mode • Dual-phase counter mode
EVT_SYNC_ PRESET	Event due to a synchronization or counter homing.	• Event counter mode • Shot counter mode • Modulo loop counter mode • Dual-phase counter mode
EVT_ COUNTER_ LOW	Event due to counter being less than threshold.	• Frequency counter mode • Event counter mode • One-shot counter mode • Modulo loop counter mode • Up and down counter mode • Dual-phase counter mode
EVT_ COUNTER_ WINDOW	Event due to counter being equal to threshold.	This event cannot be used with a BMXEHC0800 module.
EVT_ COUNTER_ HIGH	Event due to counter being greater than threshold.	• Frequency counter mode • Event counter mode • One-shot counter mode • Modulo loop counter mode • Up and down counter mode
EVT_CAPT_0	Event due to capture 0.	• Modulo loop counter mode • Up and down counter mode • Dual-phase counter mode
EVT_CAPT_1	Event due to capture 1.	This event cannot be used with a BMXEHC0800 module
EVT_ OVERRUN	Event due to overrun.	• Frequency counter mode • Event counter mode • One-shot counter mode • Modulo loop counter mode • Up and down counter mode • Dual-phase counter mode

All the events sent by the module, whatever their source, call the same single event task in the PAC.

There is normally only one type of event indicated per call.

Operating Limits

Each counter channel can produce a maximum of 1 event per millisecond, but this flow may be slowed down by simultaneously sending events to several modules on the controller bus.

Each counter channel has a two slot transmission buffer which can be used to store several events while waiting to be sent.

If the counter channel is unable to send all of the internally produced events, the `overrun_evt` bit of the `events_source` word is set to 1.

Consider the following two points before using the *Counter equal*, *Counter high*, and *Counter low* events:

- For frequency mode: Due to the accuracy (+/-1 Hz), a frequency near the threshold can cause redundant events.
- For counter function modes: When the counter matches the threshold value, confirm that the input frequency is lower than 200 Hz in order to detect the event.

Adjust Screen

What's in This Chapter

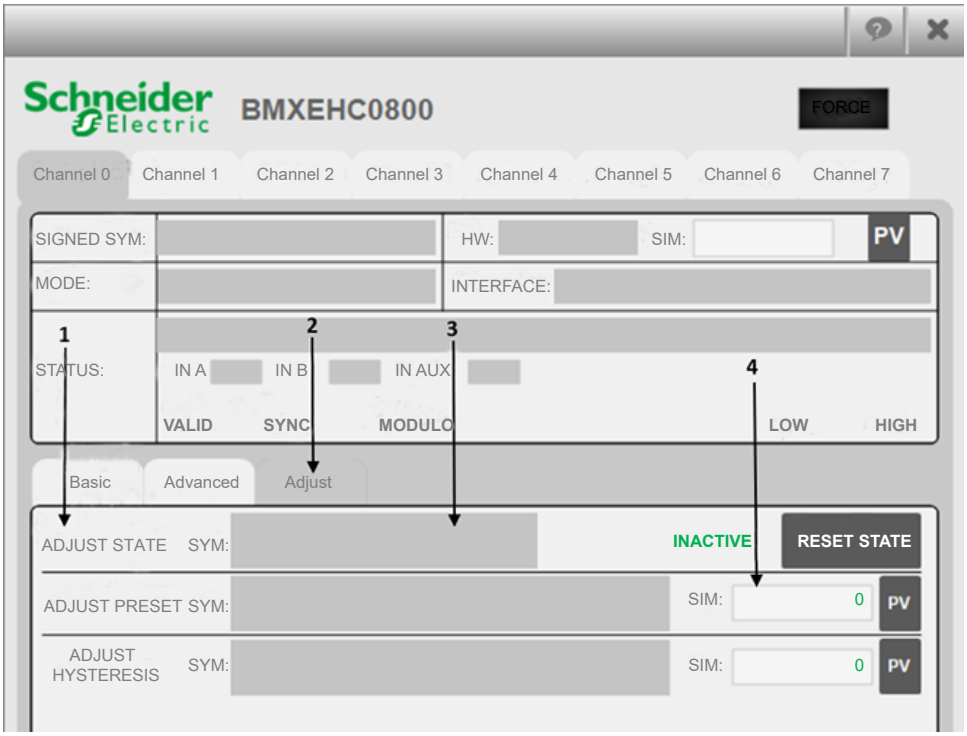
Adjust Screen 628
Preset Value Adjust 629
Calibration Factor Adjust 629
Modulo Adjust 629
Hysteresis Value Adjust 630

Adjust Screen

Introduction

This section presents the adjust screen for the BMXEHC0800 module.

Illustration



Description of the Screen

The following table presents the various parts of the above screen:

Number	Element	Function
1	**Label** field	This field contains the name of each variable that may be adjusted. This field may not be modified and can be accessed in both local and online modes.
2	Tab	The tab in the foreground indicates the current mode. The current mode is therefore the adjust mode in this example.

Num-ber	Element	Function
3	**Symbol** field	This field contains the mnemonics of the variable. This field may not be modified and can be accessed in both offline and online modes.
4	**Value** field	The function of this field depends on the mode in which the user is working: • **In offline mode**: this field is used to adjust the variable. • **In online mode**: this field is used to display the current value of the variable.

Preset Value Adjust

Introduction

The preset value concerns the following counting modes:

- for the BMXEHC0800 module:
  - dual phase counting mode
  - up and down-counting mode

Description

The following table shows the preset value adjust:

Number	Value	Default value
Preset value	Edit	0

Calibration Factor Adjust

Introduction

The calibration factor concerns the frequency mode for the BMXEHC0800 module.

Description

The following table shows the calibration factor adjust:

Number	Value	Default value
Calibration factor	Edit	0

Modulo Adjust

Introduction

The modulo concerns the modulo loop counter modes for the BMXEHC**** modules.

Description

The following table shows the modulo adjust:

Number	Value	Default value
Modulo	Edit	0xFFFF

Hysteresis Value Adjust

Introduction

The hysteresis value concerns the dual phase counting mode for the BMXEHC0800 module.

Description

The following table shows the adjust for the hysteresis value:

Number	Value	Default value
Hysteresis (release value)	Edit	0

Debugging

What's in This Chapter

Frequency Mode Force/Adjust 631
Event Counting Mode Force/Adjust 631
One Shot Counter Mode Force/Adjust 632
Modulo Loop Counter Mode Force/Adjust 632
Up and Down Counting Mode Force/Adjust 633
Dual Phase Counting Mode Force/Adjust 634

Frequency Mode Force/Adjust

At a Glance

The following table presents the frequency mode force/adjust elements:

Label	Type
Frequency value	Digital
Frequency valid	Binary
Frequency low	Binary
Frequency equal	Binary
Frequency high	Binary
Frequency in high limit	Binary
Input A state	Binary
Threshold value	Digital
Compare enable	Binary
Compare suspend	Binary

Event Counting Mode Force/Adjust

At a Glance

The following table presents the event counting mode force/adjust elements.

Label	Type
Counter value	Digital
Counter valid	Binary
Counter low	Binary
Counter equal	Binary
Counter high	Binary
Counter in low limit	Binary
Counter in high limit	Binary
Input A state	Binary
Input AUX state	Binary
SYNC enable	Binary

Label	Type
SYNC force	Binary
SYNC state	Binary
SYNC reset	Binary
Threshold value	Digital
Compare enable	Binary
Compare suspend	Binary

One Shot Counter Mode Force/Adjust

At a Glance

The following table presents the one shot counter mode force/adjust elements:

Label	Type
Counter value	Digital
Counter valid	Binary
RUN	Binary
Counter reset	Binary
Counter enable	Binary
Counter low	Binary
Counter equal	Binary
Counter high	Binary
Input A state	Binary
Input AUX state	Binary
SYNC enable	Binary
SYNC force	Binary
SYNC state	Binary
SYNC reset	Binary
Threshold value	Digital
Compare enable	Binary
Compare suspend	Binary

Modulo Loop Counter Mode Force/Adjust

At a Glance

The following table presents the modulo loop counter mode force/adjust elements:

Label	Type
Counter value	Digital
Counter valid	Binary
Counter reset	Binary

Label	Type
Counter enable	Binary
Counter low	Binary
Counter equal	Binary
Counter high	Binary
Capture value	Digital
Capture low	Binary
Capture equal	Binary
Capture high	Binary
Capture enable	Binary
Input A state	Binary
Input AUX state	Binary
SYNC enable	Binary
SYNC force	Binary
SYNC state	Binary
SYNC reset	Binary
Threshold value	Digital
Compare enable	Binary
Compare suspend	Binary
Modulo state	Binary
Modulo reset	Binary

Up and Down Counting Mode Force/Adjust

At a Glance

The following table presents the up and down counting mode force/adjust elements:

Label	Type
Counter value	Digital
Counter valid	Binary
Counter reset	Binary
Counter enable	Binary
Counter low	Binary
Counter equal	Binary
Counter high	Binary
Counter in low limit	Binary
Counter in high limit	Binary
Input A state	Binary
Input AUX state	Binary
SYNC force	Binary
SYNC state	Binary
SYNC reset	Binary

Label	Type
Threshold value	Digital
Compare enable	Binary
Compare suspend	Binary
Modulo state	Binary
Modulo reset	Binary

Dual Phase Counting Mode Force/Adjust

At a Glance

The following table presents the dual phase counting mode force/adjust elements:

Label	Type
Counter value	Digital
Counter valid	Binary
Counter reset	Binary
Counter enable	Binary
Counter low	Binary
Counter equal	Binary
Counter high	Binary
Counter in low limit	Binary
Counter in high limit	Binary
Capture value	Digital
Capture low	Binary
Capture equal	Binary
Capture high	Binary
Capture enable	Binary
Input A state	Binary
Input B state	Binary
Input AUX state	Binary
SYNC enable	Binary
SYNC force	Binary
SYNC state	Binary
SYNC reset	Binary
Threshold value	Digital
Compare enable	Binary
Compare suspend	Binary
Modulo state	Binary
Modulo reset	Binary

Language Objects and IODDT

What's in This Chapter

Introducing Language Objects for Application-Specific Counting 635
Implicit Exchange Language Objects Associated with the Application-Specific Function 635
Explicit Exchange Language Objects Associated with the Application-Specific Function 636
Explicit Exchange and Report Management 636
Details of Implicit Exchange Objects 637

Introducing Language Objects for Application-Specific Counting

Language Object Types

There are two types of language objects:

- **Implicit Exchange Objects:** These objects are automatically exchanged on each cycle revolution of the task associated with the module.
- **Explicit Exchange Objects:** These objects are exchanged on the application's request, using explicit exchange instructions.

Implicit exchanges concern the inputs/outputs of the module (measurement results, information and commands). These exchanges enable the debugging of the counting modules.

Explicit exchanges enable the module to be set and diagnosed.

Implicit Exchange Language Objects Associated with the Application-Specific Function

At a Glance

An integrated application-specific interface or the addition of a module automatically enhances the language objects application used to program this interface or module.

These objects correspond to the input/output images and software data of the module or integrated application-specific interface.

Reminders

The module inputs are updated in the PAC memory while the PAC is in RUN or STOP mode.

The outputs are updated only when the PAC is in RUN mode.

NOTE: 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).

Explicit Exchange Language Objects Associated with the Application-Specific Function

Introduction

You can request explicit exchanges in your application by using one of the following:

-
-

These exchanges apply to a set of %MW objects of the same type (status, commands, or parameters) that belong to a channel.

These objects can:

- provide information about the module (for example, type of error detected in a channel)
- have command control of the module (for example, switch command)
- define the module's operating modes (save and restore adjustment parameters in the process of application)

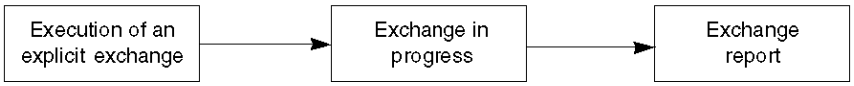
Managing Exchanges

During an explicit exchange, check the performance to see that the data is only taken into account when the exchange has been correctly executed.

The following information is available:

- data regarding the exchange in progress, page 636
- exchange report, page 636

The following diagram describes the management principle for an exchange.



Explicit Exchange and Report Management

Introduction

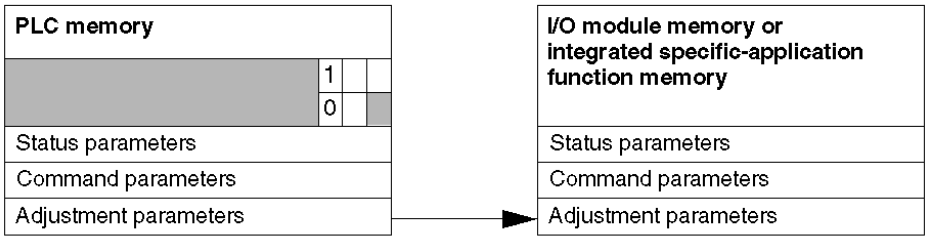
When data is exchanged between the PAC memory and the module, the module may require several task cycles to acknowledge this information.

NOTE: Depending on the module localization, the application does not detect the management of explicit exchanges.

- For in-rack modules, explicit exchanges are done immediately on the local PAC bus and are finished before the end of the execution task.
- For remote bus (Fipio for example), explicit exchanges are not synchronous with the execution task, so the application can detect the exchanges.

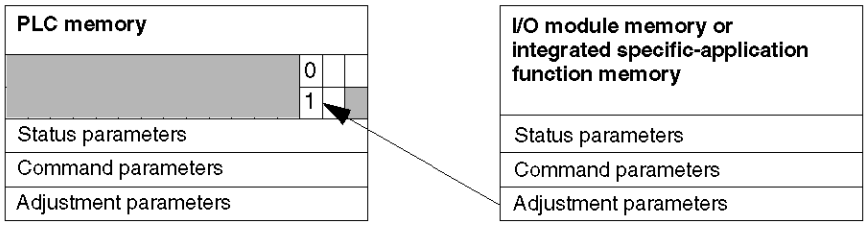
Example

Phase 1: Send data by using the `WRITE_ADJUST` instruction



When the instruction is scanned by the PAC, the **Exchange in progress** bit is set to 1.

Phase 2: Analysis of the data by the I/O module and report



NOTE: There is no adjustment parameter at module level.

Counter Module Use

The following table describes the relationship between a counter module and the system after a power-on.

Stage	Process
1	The system is powered on.
2	The system sends the configuration parameters to the counter module.
3	The system sends the adjust parameters to the counter module via WRITE_ADJUST.

Details of Implicit Exchange Objects

At a Glance

The following tables present the implicit exchange objects that are applicable to all **BMXEHC••••** counting modules.

Counter Value and Sensor Values

The following table presents the various implicit exchange objects:

Standard symbol	Type	Access	Meaning
COUNTER_VALUE_S	VTQDINT	R	Current counter value signed
CAPT_0_VALUE_S	VTQDINT	R	Capture value 0 signed

Standard symbol	Type	Access	Meaning
COUNTER_VALUE_US	VTQDINT	R	Current counter value unsigned
CAPT_0_VALUE_US	VTQDINT	R	Capture value 0 unsigned

Channel Status

The following table presents the meanings of the module's channel status:

Standard symbol	Type	Access	Meaning
ST_INPUT_A	EBOOL	R	Physical state of IN_A input
ST_INPUT_B	EBOOL	R	Physical state of IN_B input
ST_INPUT_SYNC	EBOOL	R	Physical state of the IN_SYNC input (or IN_AUX)

Counter Status

The following table presents the meanings of the counter status bits:

Standard symbol	Type	Access	Meaning
RUN	BOOL	R	The counter operates in counting mode only
MODULO	BOOL	R	Flag set to 1 by a modulo switch event
SYNC	BOOL	R	Flag set to 1 by a preset or synchronization event
VALIDITY	BOOL	R	The current numerical value is valid
HIGH_LIMIT	BOOL	R	The current numerical value is locked at the upper threshold value
LOW_LIMIT	BOOL	R	The current numerical value is locked at the lower threshold value

Comparison Status

The following table presents the meanings of the comparison status bits

Standard symbol	Type	Access	Meaning
COUNTER_LOW	BOOL	R	Current counter value less than lower threshold
COUNTER_EQ	BOOL	R	Current counter value is between lower threshold and upper threshold
COUNTER_HIGH	BOOL	R	Current counter value greater than upper threshold
CAPTURE_0_LOW	BOOL	R	Value captured in register 0 is less than lower threshold
CAPTURE_0_EQ	BOOL	R	Value captured in register 0 is between lower threshold and upper threshold
CAPTURE_0_HIGH	BOOL	R	Value captured in register 0 is greater than upper threshold

Output Thresholds and Frequency

The following table presents the various implicit exchange objects:

Standard symbol	Type	Access	Meaning
LOWER_TH_VALUE_S	DINT	R/W	Lower threshold value
LOWER_TH_VALUE_US	UDINT	R/W	Upper threshold value

Function Status

The following table presents the meanings of the function status bits:

Standard symbol	Type	Access	Meaning
FORCE_SYNC	BOOL	R/W	Counting function synchronization and start
FORCE_ENABLE	BOOL	R/W	Implementation of counter
FORCE_RESET	BOOL	R/W	Reset counter
RESET_SYNC	BOOL	R/W	Reset SYNC_REF_FLAG
RESET_MODULO	BOOL	R/W	Reset MODULO_FLAG

FUNCTIONS_ENABLING

The following table presents the meanings of the functions_enabling bits:

Standard symbol	Type	Access	Meaning
VALID_SYNC	BOOL	R/W	Synchronization and start authorization for the counting function via the IN_SYNC input
VALID_ENABLE	BOOL	R/W	Authorization of the counter enable via the IN_EN input
VALID_CAPT_0	BOOL	R/W	Capture authorization in the capture0 register
COMPARE_ENABLE	BOOL	R/W	Comparators operation authorization
COMPARE_SUSPEND	BOOL	R/W	Comparator frozen at its last value

EVENT_SOURCES_ENABLING

The following table presents the meanings of the event_sources_enabling bits:

Standard symbol	Type	Access	Meaning
EVT_RUN_ENABLE	BOOL	R/W	EVENT task call at start of the counting function
EVT_MODULO_ENABLE	BOOL	R/W	EVENT task call when there is a counter reversal
EVT_REF_ENABLE	BOOL	R/W	EVENT task call during counter synchronization or preset
EVT_COUNTER_LOW_ENABLE	BOOL	R/W	EVENT task call when the counter value is less than lower threshold
EVT_COUNTER_WINDOW_ENABLE	BOOL	R/W	EVENT task call when the counter is between the lower and upper threshold
EVT_COUNTER_HIGH_ENABLE	BOOL	R/W	EVENT task call when the counter value is greater than the upper threshold
EVT_CAPT_0_ENABLE	BOOL	R/W	EVENT task call during capture in register 0
EVT_CAPT_1_ENABLE	BOOL	R/W	EVENT task call during capture in register 1

Device DDTs

What's in This Chapter

Device DDT for the Counter Module.....640
MOD_FLT Byte Description.....645

Device DDT for the Counter Module

Introduction

This topic describes the device DDT for the counter module.

The name of a device DDT contains the following information:

- platform with M for Modicon X80 module
- device type (CPT for counter)
- function (STD for standard)
- direction (IN / OUT)
- max channel (2 or 8)

Example: A Modicon X80 counter module with two standard inputs: T_M_CPT_STD_IN_2

Adjustment Parameter Limitation

If you modify the adjustment parameters of a channel during an online operation, the channel may be re-initialized. The concerned parameters are:

- `PRESET_VALUE`
  Preset value
- `CALIBRATION_FACTOR`
  Calibration factor
- `MODULO_VALUE`
  Modulo value
- `SLACK_VAL` (Hysteresis)
  Offset value

Implicit Device DDT

The following table describes the implicit device DDT and their **X80** modules:

Device DDT	Modicon X80 modules
`T_M_CPT_STD_IN_2`	BMXEHC0200
`T_M_CPT_STD_IN_8`	BMXEHC0800

The following table describes the `T_M_CPT_STD_IN_x` status word bits:

Standard symbol	Type	Meaning	Access
MOD_HEALTH	BOOL	0 = The module has a detected error.	Read
		1 = The module is operating properly.	
MOD_FLT	BYTE	The module has a detected internal error byte, page 645 .	Read
CPT_CH_IN	ARRAY [0...x-1] of T_M_CPT_STD_CH_IN	Array of structure	

The following table describes the T_M_CPT_STD_CH_IN_x [0...x-1] status word bits:

Standard symbol		Type	Meaning	Access
FCT_TYPE		WORD	1 = Frequency	Read
			2 = EvtCounting	
			3 = PeriodMeasuring	
			4 = Ratio1	
			5 = Ratio2	
			6 = OneShotCounter	
			7 = ModuleLoopCounter	
			8 = FreeLargeCounter	
			9 = PulseWidthModulation	
			10 = UpDownCounting	
			11 = DualPhaseCounting	
CH_HEALTH		BOOL	0 = The channel has a detected error.	Read
			1 = The channel is operating properly.	
ST_OUTPUT_0_ECHO		EBOOL	Logical state of output 0	Read
ST_OUTPUT_1_ECHO		EBOOL	Logical state of output 1	Read
ST_OUTPUT_BLOCK_0		EBOOL	Status of physical counting output block 0	Read
ST_OUTPUT_BLOCK_1		EBOOL	Status of physical counting output block 1	Read
ST_INPUT_A		EBOOL	Status of physical counting input A	Read
ST_INPUT_B		EBOOL	Status of physical counting input B	Read
ST_INPUT_SYNC		EBOOL	Physical state of the IN_SYNC input (or IN_AUX)	Read
ST_INPUT_EN		EBOOL	Physical state of IN_EN input (enable)	Read
ST_INPUT_REF		EBOOL	Physical state of the IN_REF input (preset)	Read
ST_INPUT_CAPT		EBOOL	Physical state of IN_CAP input (capture)	Read
COUNTER_STATUS [INT]	RUN	BOOL	The counter operates in counting mode only.	Read
	MODULO_FLAG	BOOL	The flag is set to 1 by a modulo switch event.	Read
	SYNC_REF_FLAG	BOOL	The flag is set to 1 by a preset or synchronization event.	Read
	VALIDITY	BOOL	The current numerical value is valid.	Read

Standard symbol		Type	Meaning	Access
	HIGH_ LIMIT	BOOL	The current numerical value is locked at the upper threshold value.	Read
	LOW_ LIMIT	BOOL	The current numerical value is locked at the lower threshold value.	Read
COMPARE_ STATUS [INT]	COUN- TER_LOW	BOOL	The current counter value is less than the lower threshold (LOWER_TH_VALUE).	Read
	COUN- TER_WIN	BOOL	The current counter value is between the lower threshold (LOWER_TH_VALUE) and the upper threshold (UPPER_TH_VALUE).	Read
	COUN- TER_ HIGH	BOOL	The current counter value is greater than the upper threshold (UPPER_TH_VALUE).	Read
	CAPT_0_ LOW	BOOL	The value captured in register 0 is less than the lower threshold (LOWER_TH_VALUE).	Read
	CAPT_0_ WIN	BOOL	The value captured in register 0 is between the lower threshold (LOWER_TH_VALUE) and the upper threshold (UPPER_TH_ VALUE).	Read
	CAPT_0_ HIGH	BOOL	The value captured in register 0 is greater than the upper threshold (UPPER_TH_ VALUE).	Read
	CAPT_1_ LOW	BOOL	The value captured in register 1 is less than the lower threshold (LOWER_TH_VALUE).	Read
	CAPT_1_ WIN	BOOL	The value captured in register 1 is between the lower threshold (LOWER_TH_VALUE) and the upper threshold (UPPER_TH_ VALUE).	Read
	CAPT_1_ HIGH	BOOL	The value captured in register 1 is greater than the upper threshold (UPPER_TH_ VALUE).	Read
COUNTER_CURRENT_ VALUE_S(1)		DINT	Current counter value during event	Read
CAPT_0_VALUE_S(1)		DINT	Value captured in register 0.	Read
CAPT_1_VALUE_S(1)		DINT	Value captured in register 1.	Read
COUNTER_CURRENT_ VALUE_US(2)		UDIN- T	Current counter value during event	Read
CAPT_0_VALUE_US(2)		UDIN- T	Value captured in register 0.	Read
CAPT_1_VALUE_US(2)		UDIN- T	Value captured in register 1.	Read
OUTPUT_0		EBO- OL	Forces OUTPUT_0 to level 1.	Read / write
OUTPUT_1		EBO- OL	Forces OUTPUT_1 to level 1.	Read / write
OUTPUT_BLOCK_0_ ENABLE		EBO- OL	Output 0 function block implemented.	Read / write
OUTPUT_BLOCK_1_ ENABLE		EBO- OL	Output 1 function block implemented.	Read / write
FORCE_SYNC		EBO- OL	Counting function synchronized and started.	Read / write
FORCE_REF		EBO- OL	Set to preset counter value.	Read / write
FORCE_ENABLE		EBO- OL	Counter Implemented.	Read / write
FORCE_RESET		EBO- OL	Reset counter.	Read / write
SYNC_RESET		EBO- OL	Reset SYNC_REF_FLAG.	Read / write
MODULO_RESET		EBO- OL	Reset MODULO_FLAG.	Read / write

Standard symbol		Type	Meaning	Access
FUNC-TIONS_ ENABLING [INT]	VALID_ SYNC	BOOL	Synchronization and start is authorized for the counting function via the IN_SYNC input.	Read / write
	VALID_ REF	BOOL	Operation is authorized for the internal preset function.	Read / write
	VALID_ ENABLE	BOOL	Counter enable is authorized via the IN_EN input.	Read / write
	VALID_ CAPT_0	BOOL	Capture is authorized in the capture 0 register.	Read / write
	VALID_ CAPT_1	BOOL	Capture is authorized in the capture 1 register.	Read / write
	COM-PARE_ ENABLE	BOOL	Comparators operation is authorized.	Read / write
	COM-PARE_ SUSPEND	BOOL	Comparator is frozen at its last value.	Read / write
LOWER_TH_VALUE_S(1)		DINT	Lower threshold value	Read / write
UPPER_TH_VALUE_S(1)		DINT	Upper threshold value	Read / write
PWM_FREQUENCY_S(1)		DINT	Output frequency value (unit = 0.1 Hz)	Read / write
LOWER_TH_VALUE_US(2)		UDIN-T	Lower threshold value	Read / write
UPPER_TH_VALUE_US(2)		UDIN-T	Upper threshold value	Read / write
PWM_FREQUENCY_US(2)		UDIN-T	Output frequency value (unit = 0.1 Hz)	Read / write
PWM_DUTY		INT	Duty cycle value of the output frequency (unit = 5%)	Read / write

(1) Use only a signed application specific function (ASF).

(2) Use only an unsigned application specific function (ASF).

The following are signed ASF that are used with a BMXEHC0200 module:

- Free large counter mode
- Ratio 1
- Ratio 2

The following are unsigned ASF that are used with a BMXEHC0200 module:

- Event counting mode
- Frequency mode
- Modulo loop counter mode
- One-shot counter mode
- Period measuring mode
- Pulse width modulation mode

The following are signed ASF that are used with a BMXEHC0800 module:

- Up / down counting mode

The following are unsigned ASF that are used with a BMXEHC0800 module:

- Event counting mode
- Frequency mode
- Modulo loop counter mode
- One-shot counter mode

Derived DDT Description

The following table describes the derived data type (DDT) used to perform an explicit exchange:

DDT	Description	
T_M_CPT_STD_CH_STS	Structure to read the channel status of a counting module	Depending on the module location, the DDT can be connected to the *STS* output parameter of the EFB: READ_STS_MX
T_M_SIGN_CPT_STD_CH_PRM	Structure for adjustment parameters of a channel of a counting module (signed application specific function) in an M580 local rack	The DDT can be connected to the *PARAM* output parameter of the EFB: • READ_ADJUST to read module parameters • WRITE_ADJUST to write module parameters
T_M_UNSIGN_CPT_STD_CH_PRM	Structure for adjustment parameters of a channel of a counting module (unsigned application specific function) in an M580 local rack	

The following table describes the structure of the T_M_CPT_STD_CH_STS DDT:

Standard symbol		Type	Meaning	Access
CH_FLT [INT]	EXTERNAL_FLT_INPUTS	BOOL	External error is detected at inputs.	Read
	EXTERNAL_FLT_OUTPUTS	BOOL	External error is detected at outputs.	Read
	INTERNAL_FLT	BOOL	Internal error is detected; channel is inoperative.	Read
	CONF_FLT	BOOL	Hardware or software configuration has a detected error.	Read
	COM_FLT	BOOL	Bus communication has a detected error.	Read
	APPLI_FLT	BOOL	Application has a detected error.	Read
	COM_EVT_FLT	BOOL	Communication event has a detected fault	Read
	OVR_EVT_CPU	BOOL	Controller overflow event	Read
	OVR_CPT_CH	BOOL	Counter channel overflow	Read
CH_FLT_2 [INT]	SENSOR_SUPPLY	BOOL	Low input power supply for the sensors	Read
	ACTUATOR_SUPPLY_FLT	BOOL	Output power supply loss	Read
	SHORT_CIRCUIT_OUT_0	BOOL	Short–circuit on output 0	Read
	SHORT_CIRCUIT_OUT_1	BOOL	short circuit on output 1	Read

The following table describes the structure of the T_M_SIGN_CPT_STD_CH_PRM DDT:

Standard symbol	Type	Bit	Meaning	Access
MODULO_VALUE	DINT	–	Modulo value	Read / write
PRESET_VALUE	DINT	–	Preset value	Read / write

Standard symbol	Type	Bit	Meaning	Access
CALIBRA-TION_ FACTOR	INT	–	Adjust the value from – 10 % to + 10 %, unit = 0.1 %	Read / write
SLACK_VAL	INT	–	Hysteresis	Read / write

The following table describes the structure of the T_M_UNSIGN_CPT_STD_CH_ PRM DDT:

Standard symbol	Type	Bit	Meaning	Access
MODULO_ VALUE	UINT	–	Modulo value	read/write
PRESET_ VALUE	UINT	–	Preset value	read/write
CALIBRA-TION_ FACTOR	INT	–	Adjust the value from – 10 % to + 10 %, unit = 0.1 %	read/write
SLACK_VAL	INT	–	Hysteresis	read/write

MOD_FLT Byte Description

MOD_FLT Byte in Device DDT

MOD_FLT byte structure:

Bit	Symbol	Description
0	MOD_FAIL	• **1:** Internal error or module failure is detected. • **0:** No error is detected.
1	CH_FLT	• **1:** Channels are inoperative. • **0:** Channels are operative.
2	BLK	• **1:** Terminal block error is detected. • **0:** No error is detected. **NOTE:** This bit cannot be managed.
3	–	• **1:** Module is in self-test. • **0:** Module is not in self-test. **NOTE:** This bit cannot be managed.
4	–	Not used.
5	CONF_FLT	• **1:** Hardware or software configuration error is detected. • **0:** No error is detected.
6	NO_MOD	• **1:** Module is missing or inoperative. • **0:** Module is operating. **NOTE:** This bit is managed only by modules located in a remote rack with a BMECRA31210 eX80 adapter module. Modules located in the local rack do not manage this bit that remains at 0.
7	–	Not used.

Modicon X80 Racks & Power Supplies

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Modicon X80 Racks and Power Supplies

What's in This Chapter

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Introduction

Introduction

The Modicon X80 racks serve as a common base for automation platforms by adding a dedicated M580d processor.

Functionalities

The racks have the following functions:

Mechanical function	The racks enable all PAC station modules to be fastened (power supply module, processor, discrete/analog input/output modules, application-specific modules). These racks may be fastened on various mountings: • in cabinets • in the machine housings • on panels
Electrical function	The racks provide the: • required power supply for each module on a single rack • buses for communication • service signals and data for the entire PAC station

Types of Racks and Terminology

One key role of a rack is to provide a communication bus for the modules installed on the rack.

The **X bus backplane** is present on all racks and all module slots have connections to the X bus backplane.

A subset of the rack is an additional **Ethernet backplane**. The number of module slots with connection to the Ethernet backplane is limited to eight. So, for the racks with more than eight module slots, some module slots have only a connection to the X bus backplane.

An Ethernet backplane is used for:

- eX80 I/O modules, which require an Ethernet bus on the rack in order to exchange data (for example, X80 HART modules)
- Third-party modules that require Ethernet
- Ethernet communication modules (interlinked to the controller)

For any of these cases, use a rack with dual Ethernet and X bus backplanes. In other cases, a rack with only an X bus backplane is allowed. If you use an X Bus rack for any of the cases above, the Ethernet capabilities of the modules do not work, and the modules do not perform as expected.

A second key role of a rack is to provide power to the modules in the rack. A subset of the racks contains an additional power supply slot to provide **power redundancy**.

Based on these distinct characteristics, three types of racks are available:

X80 Rack	X bus backplane	Ethernet backplane	Power redundancy
BMXXBP•••• (X bus racks)	Yes	No	No
BMEXBP••00 (Dual Ethernet and X bus racks)	Yes	Yes	No
BMEXBP••02 (Redundant power supply racks)	Yes	Yes	Yes

Rack References

NOTE: The racks are available in standard or industrially hardened versions. A hardened version has the letter **H** appended to the reference.

This table shows the number of available slots for the power supply modules (CPS) and modules (controller and Modicon X80 modules) for each rack reference:

Reference		CPS slots	Module slots		
			Total	Ethernet and X bus	X bus (only)
X bus racks	BMXXBP0400(H)	1	4	–	4
	BMXXBP0600(H)	1	6	–	6
	BMXXBP0800(H)	1	8	–	8
	BMXXBP1200(H)	1	12	–	12
Dual Ethernet and X bus racks	BMEXBP0400(H)	1	4	4	0
	BMEXBP0800(H)	1	8	8	0
	BMEXBP1200(H)	1	12	8	4(1)
Redundant power supply racks	BMEXBP0602(H)	2	6	6	0
	BMEXBP1002(H)	2	10	8	2(2)

(1) X bus connector only for the module slot number **02**, **08**, **10**, and **11**.

(2) X bus connector only for the module slot number **02**, and **08**.

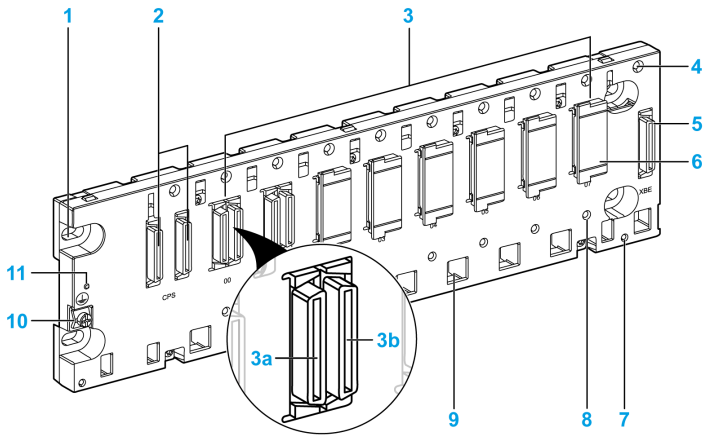
Compatibilities

The compatibility rule for the racks is platform and/or module dependent:

M340 platforms	Preferentially, the BMXXBP•••• racks because even though an Ethernet backplane is not used, all references are possible.
M580 platforms	BMEXBP•••• racks (dual Ethernet and X bus racks and redundant power supply racks) **NOTE:** If an Ethernet backplane is not necessary, use the BMXXBP•••• with PV:02 or later. The earlier versions do not work with M580 controllers.
X80 I/O drop	All rack references depending on the adapter module

Rack Description

Front View



1 Panel mounting hole (x4)

2 Power supply module slot connectors

3 Module slot connectors

3a Ethernet connector (depending on reference)

3b X bus connector

4 Tapped hole for locking screw on each module

5 40-pin female connector for a rack extender module

6 Protective cap

7 Screw hole (X2) for shielding connection kit

8 Keying hole for Ethernet module (depending on reference)

9 Holes for anchoring the module pins

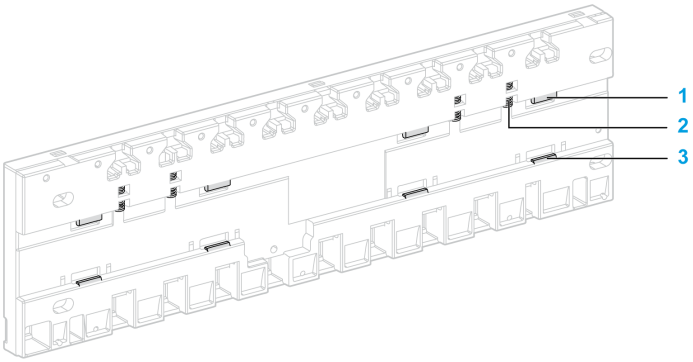
10 Protective earth screw

11 Rack status LED (depending on reference)

NOTE: The rack is supplied with covers that protect the connectors against moisture and dust. Remove the covers before installing the modules.

Rear View

The following figure shows the backplane locking mechanism at the rear of the racks:



1 Upper locking

2 Spring

1 Lower locking

NOTE: The 10-slot (BMEXBP1002(H)), 12-slot (BMXXBP1200(H), and BMEXBP1200(H)) racks do not have springs like the ones shown in the preceding legend (item 2). These racks cannot be mounted on a backplane.

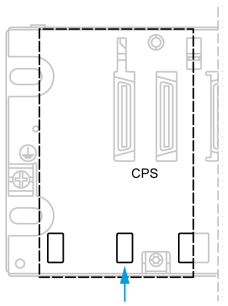
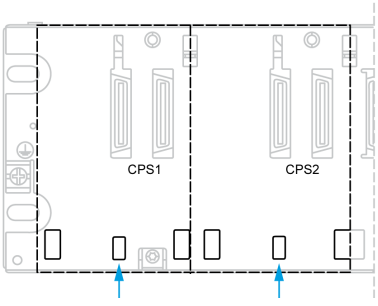
Power Supply Slots

The power supply slots are located the furthest left on the racks.

Each power supply slot has two connectors marked:

- **CPS** on standalone power supply racks (BMXXBP•••• and BMEXBP••00)
- **CPS1** and **CPS2** on redundant power supply racks (BMEXBP••02)

The size of the center hole for anchoring the power supply modules on the racks is different depending on the type of rack. This mechanical keying helps prevent the insertion of a standalone power supply module on redundant power supply racks. Conversely, you can install a redundant power supply module on standalone power supply racks.

Standalone power supply racks: • **BMXXBP••••** • **BMEXBP••00**	**Redundant power supply racks:** • **BMEXBP••02**
	

NOTE: Power supply slots are reserved for the power supply modules, and no other module types can be installed here.

Exception: You can install BMXCPS4002 power supply modules only on the following dual-bus racks (Ethernet and X bus):

- BMEXBP0602
- BMEXBP1002

Module Slots

The module slots, which are to the right of one or two power supply slots, are labeled numerically starting at **00**.

The number of module slots and the presence or absence of an Ethernet connector at each module slot depends on the Modicon X80 rack reference, page 647.

A keying hole (item 10 of the front view, page 649) is present on each module slot for the following rack references:

- BMXXBP•••• (PV0.2 or later)
- BMEXBP••00
- BMEXBP••02

Some modules (such as M580 controllers and eX80 modules) have a pin at the rear side to help prevent the insertion of an unsupported rack. For example, installing an M580 controller on an X bus rack requires a BMXXBP•••• (PV0.2 or later) rack.

Refer to the documentation of the module to check module and rack compatibility.

Rack Extender Module Slot

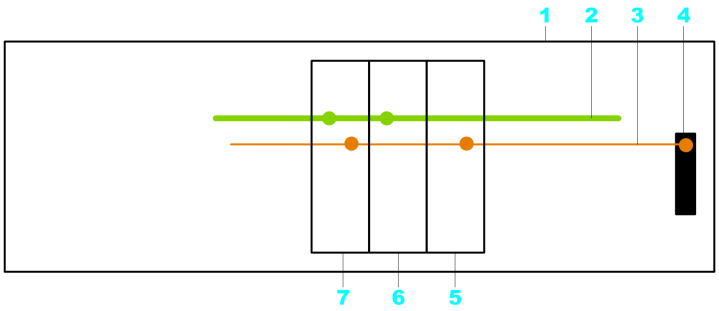
The module slot labeled **XBE** (far right module slot of the rack) is not a standard module slot. It is reserved for a BMXXBE1000 rack extender module. No other module type can be installed in the **XBE** slot.

Ethernet and X Bus Connections

All racks have an X bus connector at every module slot. Many X80 I/O modules need only X bus to support communication across the backplane.

An Ethernet communication bus is embedded in the backplane of the BMEXBP••00 and BMEXBP••02 racks.

The following illustration shows an example of module connections with a BMEXBP•••• rack:



1 Rack

2 Ethernet communication bus on the backplane

3 X bus communication bus on the backplane

4 X bus extender connector

5 Modicon X80 module

6 Ethernet only module

7 Module with Ethernet and X bus connectors

NOTE: The X bus extender connector is linked only to the X bus backplane.

Ethernet Rack Status LED

A green status LED marked **OK** is present on Ethernet racks but not on X bus racks. The LED indicates if the rack is working properly.

When this LED is ON, these conditions (which are internal to the rack) have been fulfilled:

- The power rail voltages are in the rated range.
- The X bus diagnostic is working properly.
- The Ethernet switch diagnostic is working properly.

When the LED is OFF, the backplane is not operational.

Module Addressing

Introduction

For all racks, the module address is geographic. It is based on its position on the rack.

Module Addressing

The following table shows the module addresses depending on the rack used.

Rack reference	Number of slots available for the modules	Module address
BMXXBP0400(H) BMEXBP0400(H)	4	00 - 03
BMXXBP0600(H) BMEXBP0602(H)	6	00 - 05
BMXXBP0800(H) BMEXBP0800(H)	8	00 - 07
BMEXBP1002(H)	10	00 - 09
BMXXBP1200(H) BMEXBP1200(H)	12	00 - 11

Electrical Characteristics

Introduction

The power supply modules, page 674 installed in the X80 rack deliver two voltages (3.3 Vdc and 24 Vdc) to supply the backplane and connected modules.

Rack Power Consumption

Rack reference	Rack average current consumption	
	3.3 Vdc supply power	24 Vdc supply power
BMXXBP0400(H)	304 mA (1 W)	–
BMXXBP0600(H)	455 mA (1.5 W)	–
BMXXBP0800(H)	607 mA (2 W)	–
BMXXBP1200(H)	225 mA (0.74 W)	–
BMEXBP0400(H)	49 mA (162 mW)	118 mA (2.8 W)
BMEXBP0800(H)	64 mA (211 mW)	164 mA (3.9 W)
BMEXBP1200(H)	86 mA (283 mW)	164 mA (3.9 W)
BMEXBP0602(H)	86 mA (283 mW)	164 mA (3.9 W)
BMEXBP1002(H)	86 mA (283 mW)	164 mA (3.9 W)

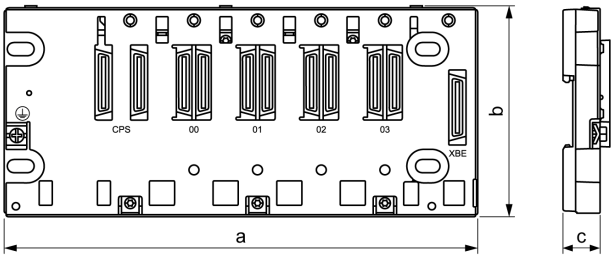
Mean Time Between Failures

The rack MTBF is a component of the global system MTBF:

Rack reference	MTBF (hours at 30 °C continuous)
BMXXBP0400(H)	
BMXXBP0600(H)	
BMXXBP0800(H)	
BMXXBP1200(H)	
BMEXBP0400(H)	2000000
BMEXBP0800(H)	1700000
BMEXBP1200(H)	1500000
BMEXBP0602(H)	1770000
BMEXBP1002(H)	201000

Dimensions

Height, Width, and Depth



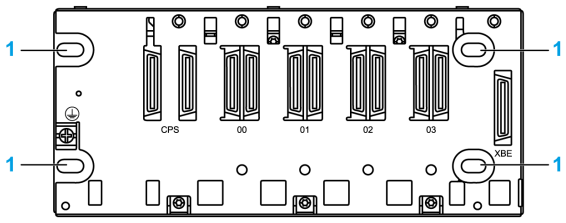
Rack Type		a	b	c
X bus racks	BMXXBP0400(H)	242.4 mm (9.543 in.)	103.7 mm (4.08 in.)	19 mm (0.748 in.)

Rack Type		a	b	c
	BMXXBP0600(H)	307.6 mm (12.11 in.)		
	BMXXBP0800(H)	372.8 mm (14.677 in.)		
	BMXXBP1200(H)	503.2 mm (19.811 in.)		
Ethernet and X bus racks	BMEXBP0400(H)	242.4 mm (9.543 in.)	105.11 mm (4.138 in.)	19 mm (0.748 in.)
	BMEXBP0800(H)	372.8 mm (14.677 in.)		
	BMEXBP1200(H)	503.2 mm (19.811 in.)		
Redundant power supply racks	BMEXBP0602(H)	375.8 mm (14.795 in.)		
	BMEXBP1002(H)	506.2 mm (19.929 in.)		

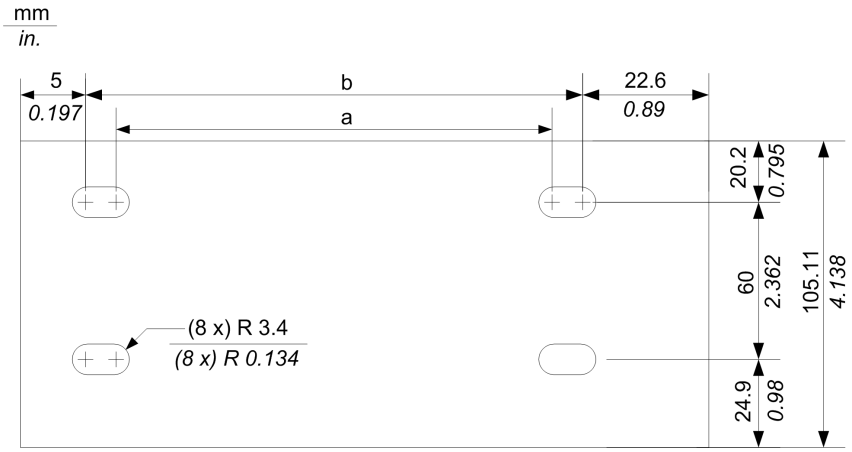
NOTE: Depending on the modules installed on the rack, the overall size of the X80 I/O platforms (rack with modules installed) may be higher than dimension of the rack itself. Refer to the section *Planning the Installation of Modicon X80 Racks*, page 655 to estimate the overall size.

Panel Fastening Holes Dimension and Location

Fastening holes are located at the 4 corners of the rack.



1 Fastening holes



NOTE: You can use M4, M5, M6, or UNC #6 screws in the fastening holes.

This table shows the values that correspond to measurements **a** and **b** in the illustration above:

Rack Type		a	b
X bus racks	BMXXBP0400(H)	202.1 mm (7.957 in.)	214.8 mm (8.457 in.)
	BMXXBP0600(H)	267.5 mm (10.50 in.)	280 mm (10.99 in.)
	BMXXBP0800(H)	332.5 mm (13.09 in.)	345.2 mm (13.59 in.)
	BMXXBP1200(H)	462.9 mm (18.224 in.)	475.6 mm (18.724 in.)
Ethernet and X bus racks	BMEXBP0400(H)	202.1 mm (7.957 in.)	214.8 mm (8.457 in.)
	BMEXBP0800(H)	332.5 mm (13.09 in.)	345.2 mm (13.59 in.)
	BMEXBP1200(H)	462.9 mm (18.224 in.)	475.6 mm (18.724 in.)
Redundant power supply racks	BMEXBP0602(H)	332.5 mm (13.09 in.)	345.2 mm (13.59 in.)
	BMEXBP1002(H)	462.9 mm (18.224 in.)	475.6 mm (18.724 in.)

Firmware Update with Automation Device Maintenance

Overview

The EcoStruxure™ Automation Device Maintenance is a standalone tool that allows and simplifies the firmware update of devices in a plant (single or multiple).

The tool supports the following features:

- Automatic device discovery
- Manual device identification
- Certificate management
- Firmware update for multiple devices simultaneously

NOTE: For a description of the download procedure, refer to the *EcoStruxure™ Automation Device Maintenance, User Guide*.

Local Rack Installation

Introduction

The size and number of racks and the kinds of modules installed on the racks are significant considerations when you are planning an installation. That installation may be either inside or outside an enclosure. The height, width, and depth of the installed system head as well as the spacing between the local and the extender racks need to be well understood.

Modules such as the power supply, controller, and I/O are cooled by natural convection.

To maintain the necessary thermal cooling, respect the:

- Mounting position
- Clearance around the racks
- Ambient temperature for each rack

Correct Mounting Position

The Modicon X80 racks must be mounted horizontally on a vertical plane to facilitate ventilation.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Install the Modicon X80 racks horizontally on a vertical plane.

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

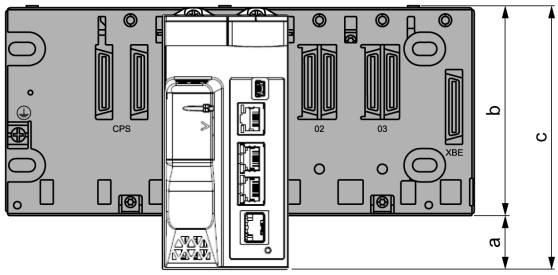
NOTE: Other rack mounting positions may cause overheating and unexpected equipment operation.

Clearance Around the Racks

When you are planning the clearance around the racks, you need to consider the overall size of your Modicon X80 I/O platform.

Add additional clearance at the bottom of the rack to accommodate the height of modules higher than the racks such as M580 controller or redundant power supplies.

The following figure shows an example with an M580 controller:



a Additional space below the rack to accommodate the height of the controller.

b The height of the rack.

c Overall height is 134.6 mm (5.299 in.).

NOTE: Add additional clearance of 1.2 mm (0.05 in.) at the right of the rack if you plan to install a rack extender module.

Thermal Considerations Inside an Enclosure

For non-vented equipment mounted inside a cabinet, cooled by natural air convection, the ambient temperature is the air temperature at a point not more than 50 mm (1.97 in.) and not less than 25 mm (0.98 in.) away from the

equipment, on a horizontal plane located at the vertical mid-point below the equipment.

Spacing Requirements

⚠WARNING

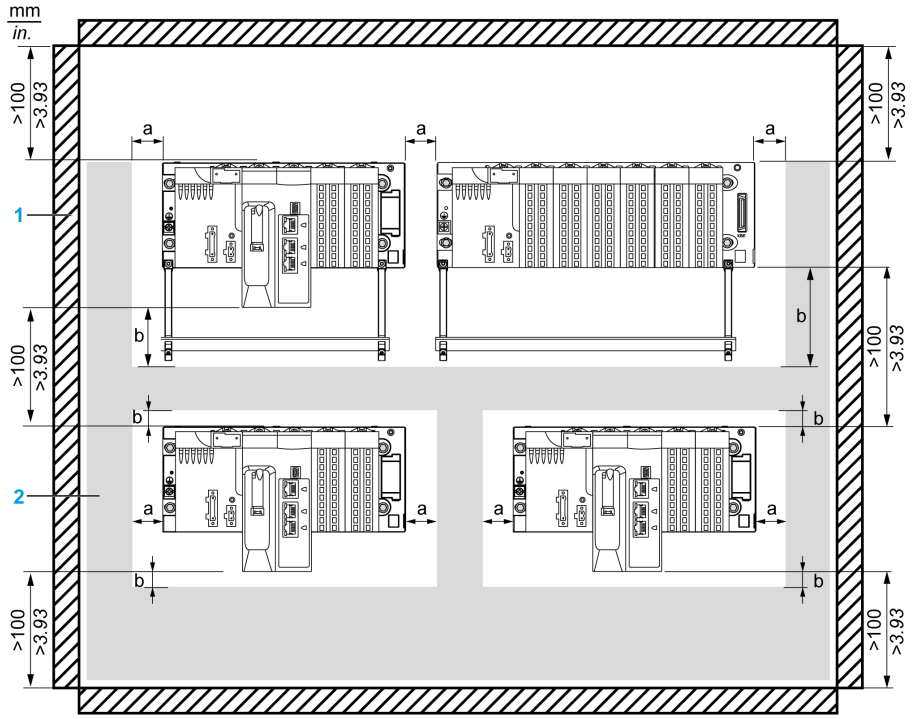
OVERHEATING AND UNEXPECTED EQUIPMENT OPERATION

Maintain proper thermal clearances when installing the racks.

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

For optimal cooling and air circulation, an adequate clearance must be respected between your Modicon X80 I/O platform and surrounding objects (such as wire ducts, inside surface of an enclosure, machinery).

This illustration shows the rules of a typical installation in a cabinet with ducts:



1 installation or casing

2 wiring duct or tray

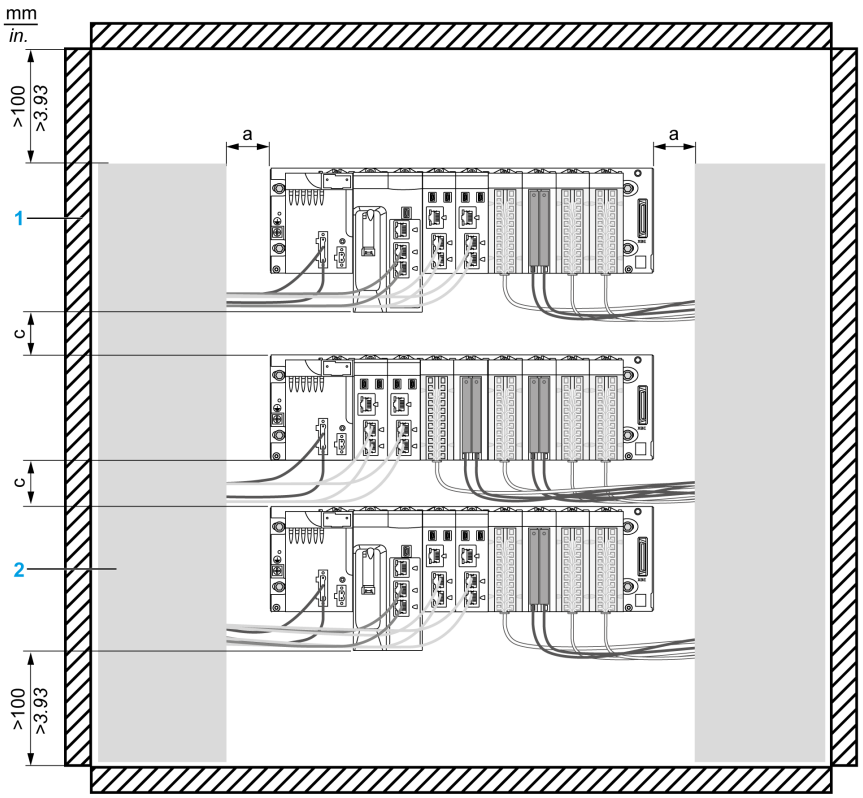
a side clearance: > 40 mm (1.57 in.)

b top and bottom clearance with surrounding objects: > 20 mm (0.79 in.)

NOTE: In order to rise the density, a lower spacing between racks is acceptable if:

- there is no shielding bar, nor ducts between racks
- the spacing between racks is not lower than 40 mm (1.57 in.)
- you apply a 5 °C (9 °F) derating to the maximum ambient temperature allowed. That is 55 °C (131 °F) for standard and coated modules versions and 65 °C (149 °F) for hardened modules.

This illustration shows the rules of an installation in a cabinet without horizontal ducts between two racks:



1 installation or casing

2 wiring duct or tray

a side clearance: > 40 mm (1.57 in.)

c top and bottom clearance between two racks: > 40 mm (1.57 in.)

The cables pass by the front of the controller to join the vertical ducts on the side of the cabinet.

NOTE: As the shielding bar accessory is removed, the EMC protection (shields of cables clamping to earth) shall be done on copper bars located at the arrival of cables from field, usually at the bottom of the cabinet.

Clearance for Cable Installation

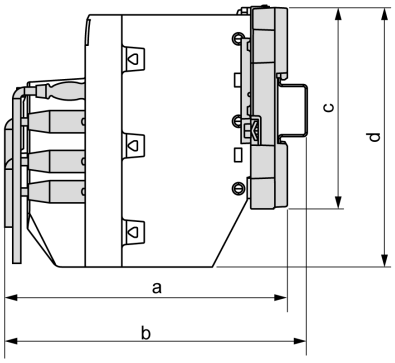
When you plan to install the racks inside an enclosure, leave a minimum space in front of the modules. The dimensions of each type of X80 modules are provided in Appendix B.

The minimum depth of the enclosure is:

- 200 mm (7.874 in.) if the rack is fastened to a plate
- 210 mm (8.268 in.) if the rack is mounted on a 15 mm (0.59 in.) backplane

NOTE: If BMXXBE1000 rack extender modules are connected, the use of BMXXBC•••K cables with connectors angled at 45° is recommended.

Here is a side view of a rack on a backplane with modules and cables mounted in an enclosure:



a wiring + module + backplane depth: > 200 mm (7.874 in.)

b wiring + module + backplane + backplane depth: > 210 mm (8.268 in.)

c rack height

d module height

Rack Mount

Introduction

Modicon X80 racks can be mounted inside or outside of an enclosure on a:

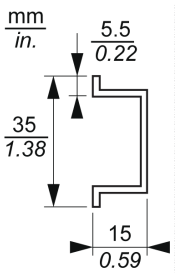
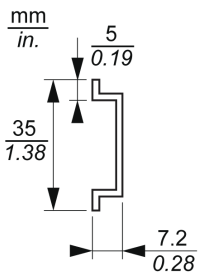
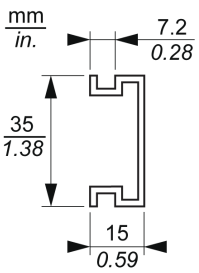
- 35 mm (1.38 in) wide backplane
- Panel or mounting plate

When mounted on a backplane, the system is more susceptible to mechanical stress (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

NOTE: Mount the racks on a properly grounded metallic surface to allow the PAC to operate correctly in the presence of electromagnetic interference.

Backplane

You can mount the rack on one of the following backplanes:

Symmetric Backplane		**Double-profile Backplane**
Type A	**Type B**	
		

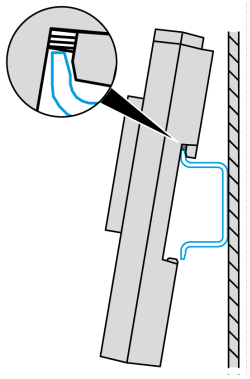
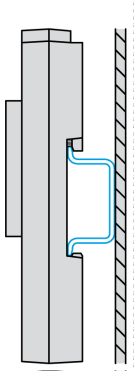
NOTE: When mounted on a type B symmetric backplane, the rack withstands less mechanical stress.

Mounting on a backplane

Racks longer than 400 mm (15.75 in.) that support more than 8 module slots are not compatible with backplane mounting.

NOTICE
EQUIPMENT DAMAGE Do not mount BMXXBP1200(H), BMEXBP1200(H), and BMEXBP1002(H) racks on a backplane. **Failure to follow these instructions can result in equipment damage.**

Mounting a rack on a backplane:

Step	Action	Illustration
1	Position the upper backplane locking mechanism at the rear of the rack as illustrated. Press down on the rear section of the rack in order to compress the springs.	
2	Rotate the rack to the backplane until it clicks.	

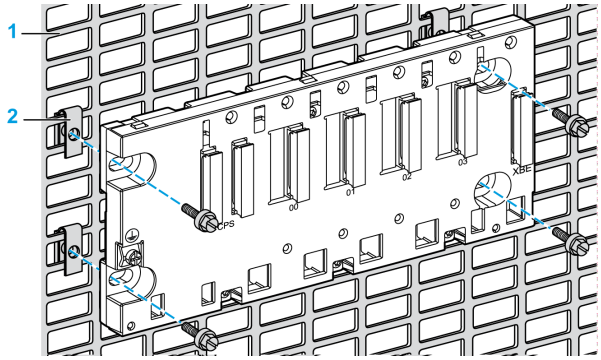
To remove a rack from a backplane:

Step	Action
1	Press down the top of the rack to compress the springs in contact with the backplane.
2	Tilt the bottom of the rack forward to disengage it from the backplane.
3	Release the freed rack.

Mounting on a Panel or Mounting Plate

You can mount the rack on a panel or a plain mounting plate with M4, M5, M6, or UNC #6-32 screws inserted in the fastening holes, page 654.

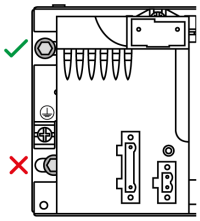
You can also mount a rack on a Telequick mounting plate NSYMR•• using clip-on nuts:



1 Telequick plate

2 Clip-on nuts (references AF1EA4 to AF1EA6)

Place the two left side screws (near the power supply) as close as possible to the left edge of the rack. This enables you to access the screws after the power supply is mounted.



NOTE: The two right side screws are accessible until there is no rack extender module installed.

Protective Cover for Unused Module Slots

Introduction

If a rack has unused module slots, install a BMXXEM010 cover to keep dust and other objects out of the slots and to comply with IP20 ingress protection requirements.

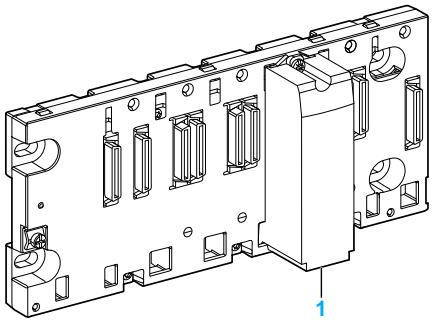
BMXXEM010 covers are sold in sets of 5.

Installation

Position the locating pin at the rear of the protective cover (lower part of the module) in the centering hole of the unused module slot.

- Swivel the protective cover towards the top of the rack so that it sits flush with the rack.
- Tighten the mounting screw to hold the protective cover in place on the rack.
- Tightening torque: 0.4...1.5 N•m (0.30...1.10 lbf-ft).

A cover is placed on an unused module slot in a rack as follows:



1 BMXXEM010 cover

Shielding Connection Kit

Introduction

The BMXXSP•••• shielding connection kit allows to connect the cable shielding directly to the ground and not to the module shielding to help protect the system from electromagnetic perturbations.

Connect the shielding on the cordsets for connecting:

- Analog module,
- Counter module,
- Encoder interface module,
- Motion control module,
- An XBT console to the processor (via shielded USB cable).

Kit References

Each shielding connection kit includes the following components:

- A metal bar
- Two sub-bases

The shielding connection kit reference is dependent on the size of the Modicon X80 rack::

X bus racks/Dual Ethernet and X bus racks	Number of slots	Shielding Connection Kit
BMXXBP0400(H)	4	BMXXSP0400
BMEXBP0400(H)		
BMXXBP0600(H)	6	BMXXSP0600
BMXXBP0800(H)	8	BMXXSP0800
BMEXBP0800(H)		
BMXXBP1200(H)	12	BMXXSP1200
BMEXBP1200(H)		

Redundant power supply racks	Number of slots	Shielding Connection Kit
BMEXBP0602(H)	6	BMXXSP0800
BMEXBP1002(H)	10	BMXXSP1200

Clamping Rings

Use clamping rings to connect the shielding on cordsets to the metal bar of the kit.

NOTE: The clamping rings are not included in the shielding connection kit.

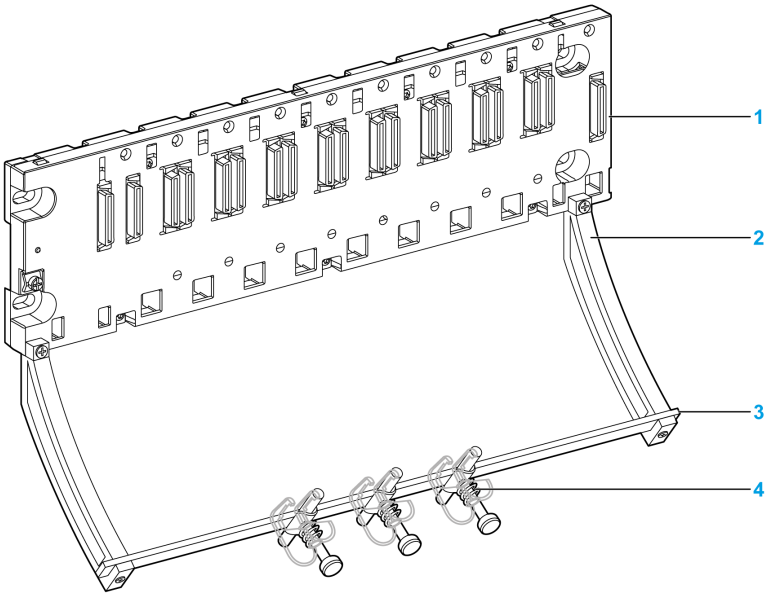
Depending on the cable diameter, the clamping rings are available under the following references:

- STBXSP3010: small rings for cables with cross-section 1.5...6 mm^2 (AWG16...10).
- STBXSP3020: large rings for cables with cross-section 5...11 mm^2 (AWG10...7).

Kit Installation

Installation of the shielding connection kit to the rack can be done with module already installed on the rack except for the BMXXBE0100 rack extender module.

Fasten the sub-bases of the kit at each end of the rack to provide a connection between the cable and the ground screw of the rack:



1 rack

2 sub-base

3 metallic bar

4 clamping ring

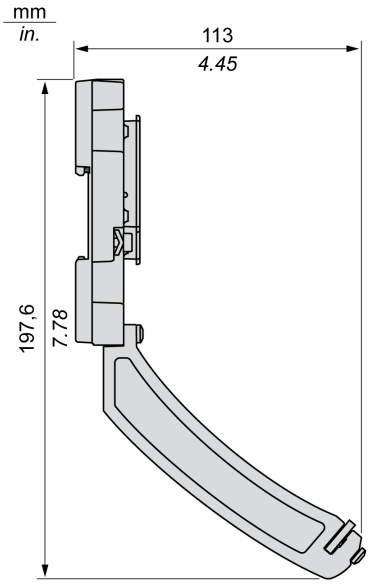
Tightening torques to install the shielding connection kit:

- For the screws fixing the sub-base to the Modicon X80 rack: Max. 0.5 N•m (0.37 lbf-ft)
- For the screws fixing the metallic bar to the sub-bases: Max. 0.75 N•m (0.55 lbf-ft)

  NOTE: A shielding connection kit does not modify the volume required when installing and uninstalling modules.

Kit Dimensions

The following figure gives the dimensions (height and depth) of a Modicon X80 rack with its shielding connection kit:



NOTE: The overall width equals to the width of the Modicon X80 rack.

Extended Racks

Overview

You may extend the number of racks in order to:

- Increase the number of modules.
- Extend the area covered by the rack so that I/O modules can be installed closer to the different machines they are controlling.

  NOTE: Only the X bus is extended across extended racks connected in a daisy chain. Modules that require connection to the Ethernet bus do not operate when installed in extended racks.

You can use any of the Modicon X80 racks as an extended rack. For X80 racks with an Ethernet backplane (BMEXBP••00 and BMEXBP••02) the Ethernet connections of the module slots are disabled.

M580d Local Rack Extension

NOTE: Extension of the M580d local rack in Hot Standby/redundant configuration is not allowed.

The number of extended racks allowed in the M580d local rack depends on the controller that you select:

controller	Maximum number of X80 extended racks
BMEP581020	3
BMEP582020	
BMEP582040	

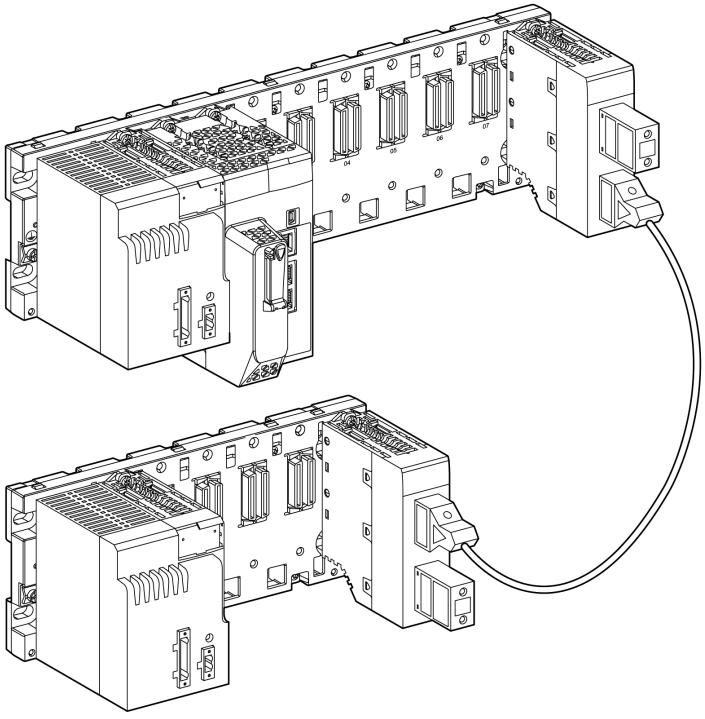
controller	Maximum number of X80 extended racks
BMEP583020	7
BMEP583040	
BMEP584020	
BMEP584040	
BMEP585040	
BMEP586040	

In a M580d multi-rack configuration, the racks (main local rack and extended racks) are connected to each other in a daisy chain using X bus extension cables, page 668, connected to the BMXXBE1000 rack expansion modules.

NOTE: In the daisy chain of X80 racks, the maximum cumulative length of X bus cables is 30 m (98,42 ft).

Example of Topology

This is an example of a main local rack with one extended local rack:



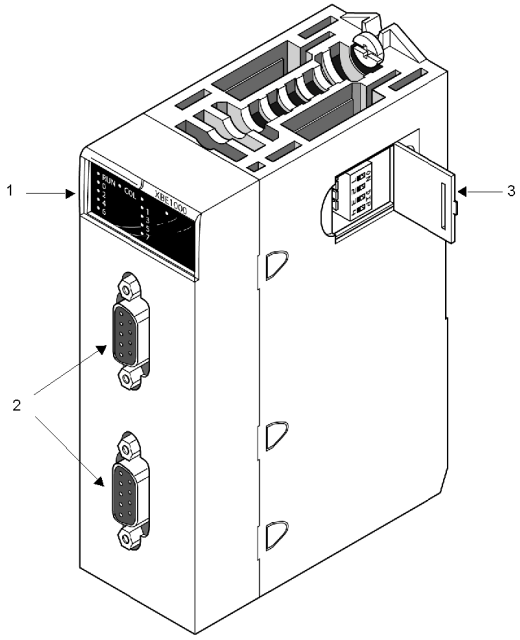
NOTE:

- Each rack has a power supply and a BMXXBE1000 extender module.
- An extender cable (in this case a BMXXBC•••K cable) connects the two extender modules.
- The unused ports on the two extender modules are terminated with a TSXTLYEX line terminator.

Extender Module

Physical Description

A BMXXBE1000(H) rack extender module contains an LED diagnostic panel, a pair of connectors for the X bus extender cables, and a set of switches for addressing the X80 extended racks.



1 rack extender module LEDs

2 female 9-pin SUB-D connectors for bus cables

3 rack address switches

Rack Address Switches

Assign a unique address to each X80 extended rack. Use the four micro-switches on the side of the rack extender module to set each rack address.

Switch	Rack Address							
	0	1	2	3	4	5	6	7
1	OFF	OFF	OFF	OFF	ON	ON	ON	ON
2	OFF	OFF	ON	ON	OFF	OFF	ON	ON
3	OFF	ON	OFF	ON	OFF	ON	OFF	ON
4	Not used							

By default, the rack extender module is set to address **0** (all switches **OFF**). Address **0** is reserved for the main rack, which contains the controller or an adapter module (CRA module) in the case of X80 RIO drops. You can assign addresses **1** through **7** to the X80 extended racks in any order. Assign a unique rack address to each extended rack.

NOTE: A *collision* can occur if you assign:

- the same rack address to more than one X80 extended rack
- address **0** to any rack other than the main local rack

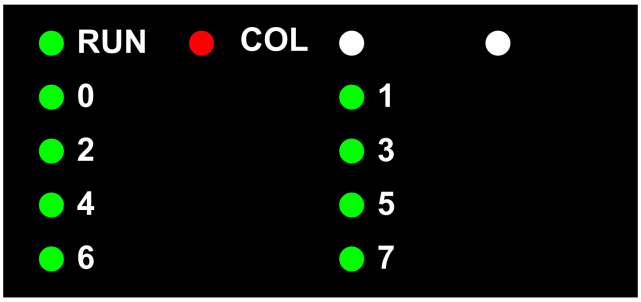
When a collision happens, one of the racks with the duplicate rack address does not operate.

To recover from a collision:

Step	Action
1	Turn OFF the power supplies in the racks that have an address mismatch.
2	Set unique, correct rack addresses via the address switches on the rack extender module.
3	Reapply power to the racks.

Rack Extender Module LEDs

The LEDs on the rack extender module provide information about the rack in which it resides:



LED	Pattern	Indication
RUN (green)	ON	Module is functioning normally.
	OFF	• The power supply is no longer present. • An error has been detected in the extender module.
COL (red)	ON	Rack address collision detected: • Two or more racks have been assigned the same rack address. • A rack that does not contain the controller has been assigned address **0**.
	OFF	Each extended rack has a unique address.
0 to **7** (green):	ON or OFF	Rack address. Confirm that each extender module has only one address LED set to ON.

Rack Extender Module Consumption

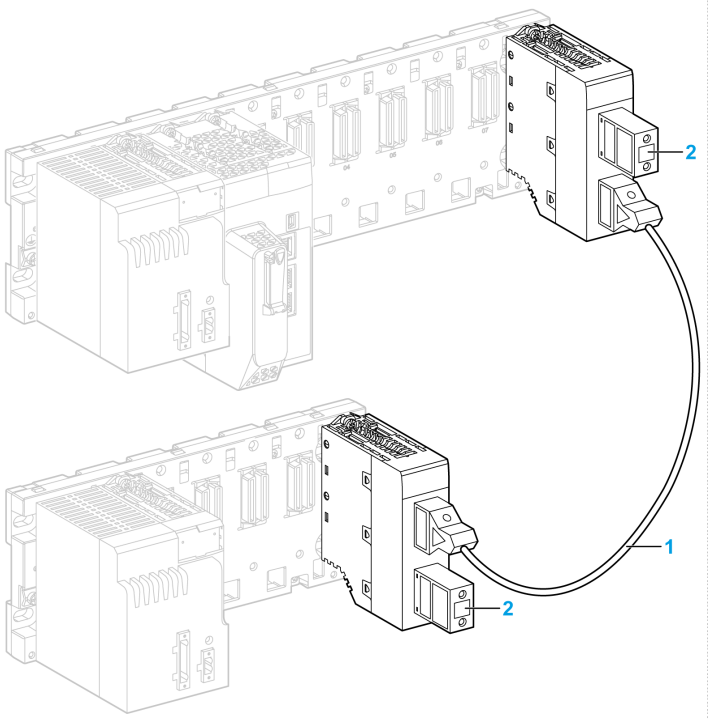
This table shows the power consumed by the BMXXBE1000 extender module:

Consumption/Power Type	Description
consumption on 3.3 Vdc power supply	22 mA
dissipated power on the 3.3 Vdc rack power supply	73 mW
consumption on 24 Vdc rack power supply	160 mA
dissipated power on the 24 Vdc rack power supply	3.84 W

Rack Extender Module Accessories

Introduction

The following figure illustrates accessories used to connect BMXXBE0100 modules of a main local rack and an extended rack:



1 extension cable

2 line terminators

Extension Cables

⚠CAUTION

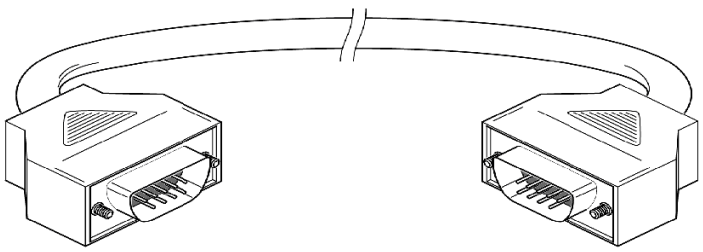
INRUSH CURRENT

Insertion and extraction of an extension cable must only be done with all the station elements switched off (racks, PC, etc.)

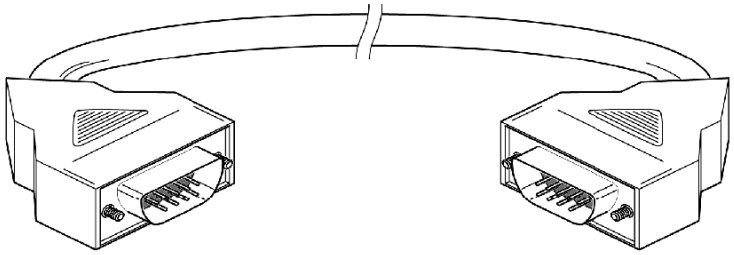
Failure to follow these instructions can result in injury or equipment damage.

The extension cables TSXCBY•••K or BMXXBC•••K are equipped at each end with a male 9-pin SUB D connector, which connects to the female 9-pin SUB D connector on the rack extender modules.

The TSXCBY•••K cables use straight connectors:



The BMXXBC•••K cables use connectors angled at 45°:



NOTE: To connect two rack extender modules located in an enclosure, the use of BMX XBC •••K cables with connectors angled at 45° is recommended.

The predetermined length of extension cables is given by the 3 figures in the cable reference:

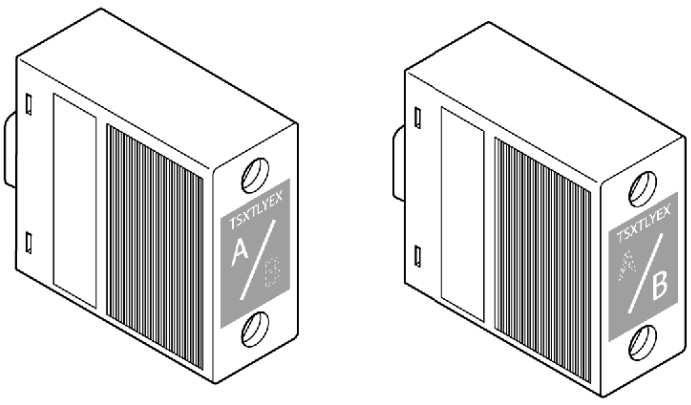
Cable reference		**Length**
Straight connectors	TSXCBY**010**K	**1 m** (3.28 ft)
	TSXCBY**030**K	**3 m** (9.84 ft)
	TSXCBY**050**K	**5 m** (16.40 ft)
	TSXCBY**120**K	**12 m** (39.37 ft)
	TSXCBY**180**K	**18 m** (59.05 ft)
	TSXCBY**280**KT	**28 m** (91.86 ft)
Angled connectors	BMXXBC**008**K	**0.8 m** (2.63 ft)
	BMXXBC**015**K	**1.5 m** (4.92 ft)
	BMXXBC**030**K	**3 m** (9.84 ft)
	BMXXBC**050**K	**5 m** (16.40 ft)
	BMXXBC**120**K	**12 m** (39.37 ft)

Line Terminators TSXTLYEX

The extended bus must be fitted with a line terminator at each end.

Line terminators are made up of a 9-pin SUB D connector and a cover containing the adaptation components. They are mounted on the 9-pin SUB D connector on the extension module at each end of the line.

Illustration



⚠CAUTION

INRUSH CURRENT

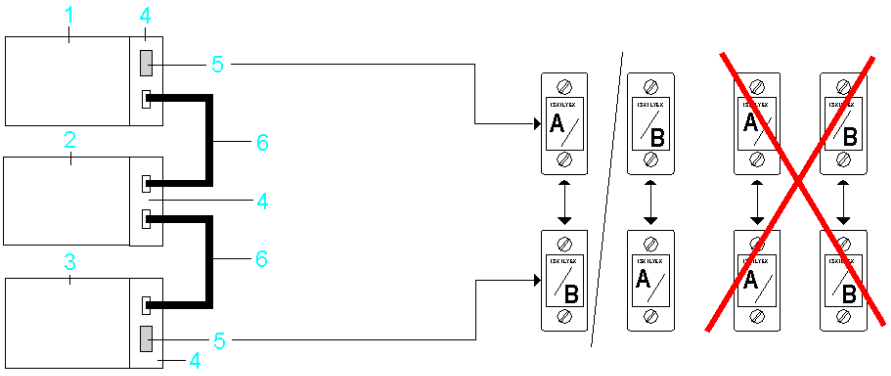
Insertion or extraction of a line terminator must only be done with all the station racks switched off.

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

Line terminators are labeled **A/** or **/B**. An extended rack needs to use one line terminator labeled **A/** and one labeled **/B**. If you terminate the unused connector in the main rack with an**A/** terminator, then you need to terminate the unused connector in the last rack with a **/B** terminator.

The following figures illustrates the possible choices to install the TSXTLYEX line terminators according to their label in different bus extensions.

Line terminators with Modicon X80 racks only:



1 X80 main rack

2 first X80 extended rack

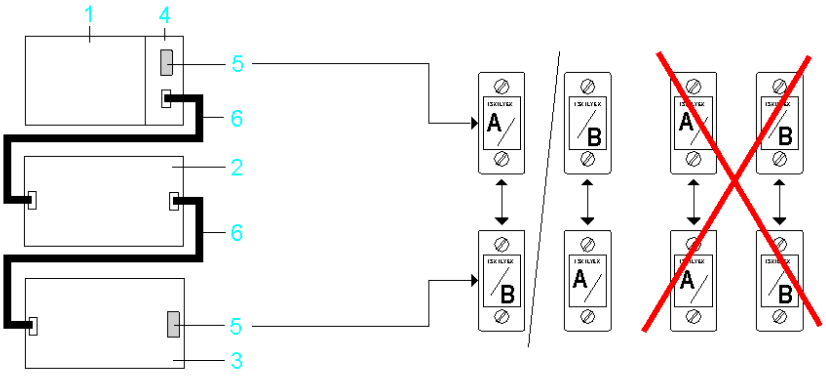
3 last X80 extended rack

4 BMXXBE1000 modules in each rack

5 TSXTLYEX line terminator in the main rack and the last rack

6 BMXXBC•••K or TSXCBY•••K extension cables between each rack

Line termintors with both Modicon X80 and Premium extended racks:



1 X80 main rack

2 first Premium extended rack

3 last Premium extended rack

4 BMXXBE1000 module

5 TSXTLYEX line terminator in the main rack and the last rack

6 BMXXBC•••K or TSXCBY•••K extension cables between each rack

Extender Module Installation

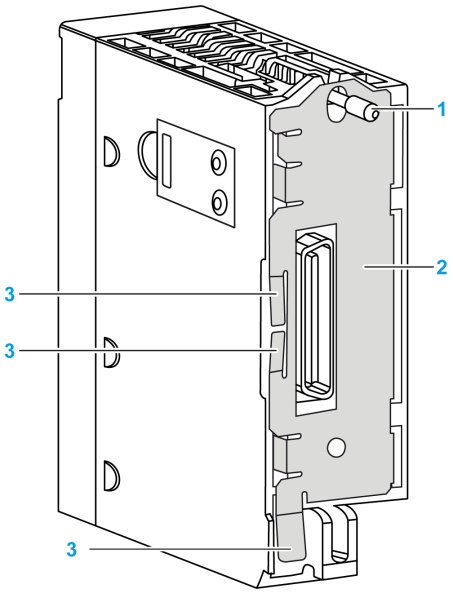
Introduction

The BMXXBE1000 rack extender module is installed similarly to the other modules in the rack with these special considerations:

- The BMXXBE1000 rack extender module cannot be installed in any slot other than the **XBE** slot.
- If a BMXXBE1000 rack extender module is not present in the main extended rack, none of the extended racks are operational.
- If a BMXXBE1000 rack extender module is not present in an extended rack, that rack is not operational.

Extender Module Grounding

The BMXXBE1000 rack extender module is equipped with a grounding plate at the rear for grounding purposes:



1 Mounting screw

2 Grounding plate

3 Contact strips

When the module is correctly installed on the rack, the contact strips connect the grounding bus of the module to the grounding bus of the rack, page 698.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK

Check that ground contact strips are available and not bent out of shape.

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

NOTE: If ground contacts strips are bent or not available, do not use the module and contact your Schneider Electric representative.

Extender Module Installation

⚠⚠DANGER

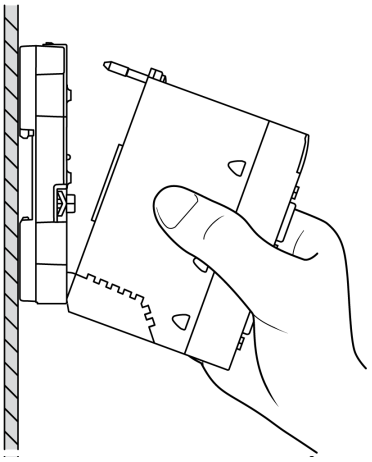
HAZARD OF ELECTRIC SHOCK

Remove all power sources before installing the rack extender module.

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

Install a rack extender module in a rack:

Step	Action
1	Remove all power sources to the rack.
2	Using the microswitches on the side of the rack extender module, set a unique address for that rack from 00 to 08, page 666. Confirm that the address assigned to each extended rack is unique with respect to all other extended racks.
3	Remove the protective cover from the connector of the module slot labeled **XBE** (rightest module slot of the rack).

Step	Action	
4	Position the locating pin at the rear of the module (lower part of the module) in the centering hole of the module slot labeled located **XBE**. Swivel the module towards the top of the rack so that the module sits flush with the rack. Tighten the mounting screw to hold the module in place on the rack. Tightening torque: 0.4...1.5 N•m (0.30...1.10 lbf-ft)	
5	**⚠WARNING** **UNINTENDED EQUIPMENT OPERATION** Check that the mounting screw is securely tightened to ensure the module is firmly attached to the rack. **Failure to follow these instructions can result in death, serious injury, or equipment damage.** Connect each extended rack to the rack immediately before it and immediately after it using the appropriate extension cable.	
6	Terminate the unused connector on the extender module in the main extended rack and the unused connector on the last extended rack. Use a line terminator labeled **A/** on one end of the extended rack and a line terminator labeled **/B** on the other end of the extended rack.	

X80 Power Supplies

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Power Supply Modules

Introduction

The BMXCPS•••• power supply modules convert the primary power line into voltages distributed through the backplane to supply the rack and the modules plugged in it:

- 24 Vdc so called 24V_BAC
- 3.3 Vdc so called 3V3_BAC

In addition to these voltages some power supply modules provide a 24 Vdc voltage for sensors connected to modules installed on the rack:

- 24 Vdc for sensors so called 24V_SENSORS

Power Supply References

The choice of power supply module depends on the distributed network (alternating or direct current) and the power required.

A subset of the power supply modules has the redundancy functionality.

Some power supply modules are available in standard and industrially hardened versions:

- The standard version is designed to operate at standard temperature range 0...60 °C (32...140 °F).
- The hardened version is designed to operate at extended temperature range -25...70 °C (-13...158 °F). The hardened version of the device has a letter H appended to the reference.

For more information, refer to the *Installation in more Severe Environments*topic. (See the*Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications* user guide on www.se.com.).

NOTE: Power supply modules have no thermal disjunction capability.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Do not operate a Modicon X80 power supply module outside of its specified temperature range.

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

Based on these distinct functionalities, the following table provides an inventory of power supply module references:

–	Alternating Current	Direct Current		
	(100...240 Vac)	(24 Vdc)	(24...48 Vdc)	(125 Vdc)
Standalone Power Supply	BMXCPS2000 BMXCPS3500 BMXCPS3500H	BMXCPS2010	BMXCPS3020 BMXCPS3020H	BMXCPS3540T(1)
Redundant Power Supply	BMXCPS4002 BMXCPS4002H	–	BMXCPS4022 BMXCPS4022H	BMXCPS3522 BMXCPS3522H

(1) This power supply module is specially designed for extended temperature -25...70 °C (-13...158 °F) and the product reference include the suffix “T”.

Product Temperature Monitoring

NOTE: The product temperature monitoring is only available for redundant power supply modules.

To measure the product temperature of a redundant power supply:

- Install the redundant power supply module in a redundant power supply rack (BMEXBP•••2).
- Use internal diagnostics via the PWS_DIAG function block in your application. This function block is available in the power supply management library. (See EcoStruxure™ Control Expert, System Block Library.).

Physical Description

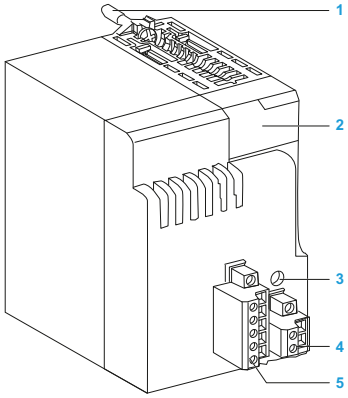
Introduction

The general shape of the power supply modules is almost similar between standalone and redundant modules.

The redundant power supply modules are wider and higher than the standalone power modules. Anyway the physical features described below are located at the same place.

The power supply modules are delivered with two removable terminal blocks.

Front View



1 Mounting screw

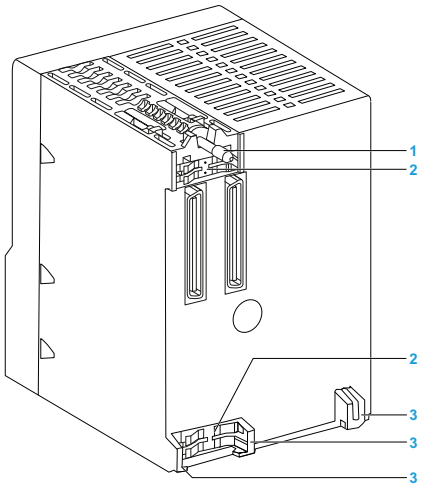
2 LED display

3 **RESET** button

4 Input/output 5-pin removable terminal block

5 Alarm relay 2-pin removable terminal block

Rear View



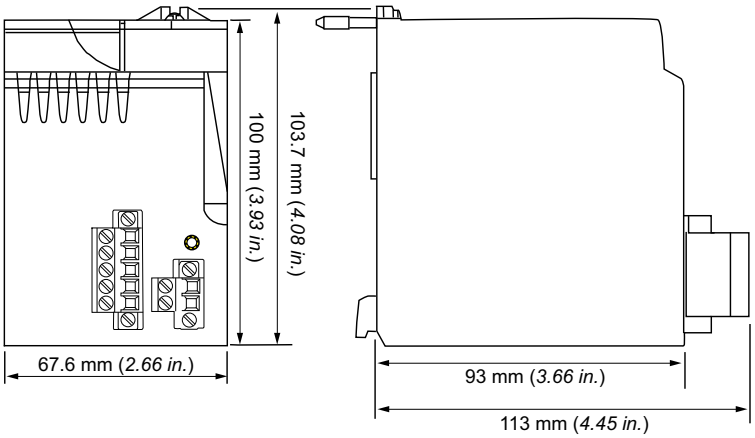
1 Mounting screw

2 Contact strips for EMC

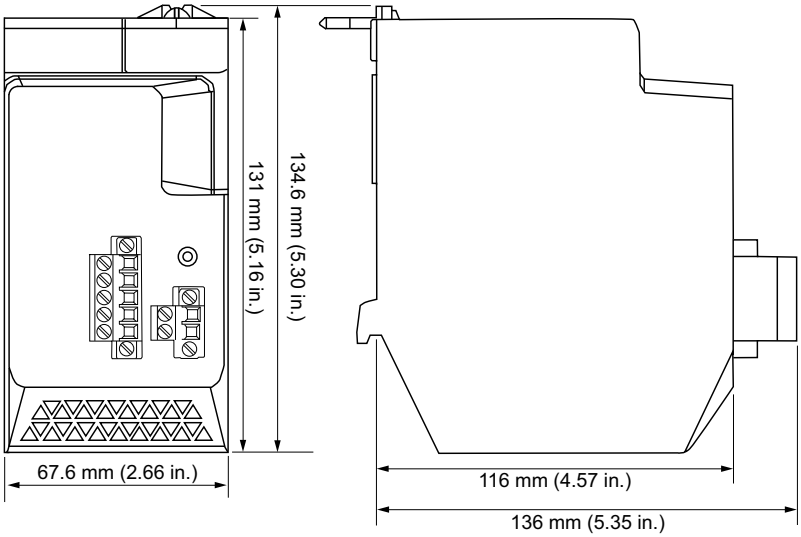
3 Locating pins

Modules Dimensions

This figure shows the dimensions of a standalone power supply module:



This figure shows the dimensions of a redundant power supply module:



Terminal Blocks

The power supply module removable terminal blocks allow the following elements to be connected:

5-pin terminal block	• Main input voltage • Functional Ground (FG) • 24 Vdc sensor supply (depending on power supply module reference).
2-pin terminal block	Alarm relay

NOTE: The power supply module is delivered with caged clamp terminal blocks. Spring terminal blocks type can be ordered separately with a removable connector kit.

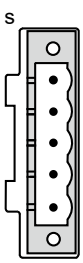
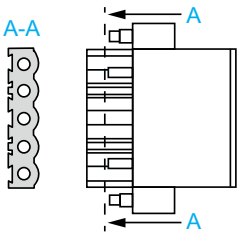
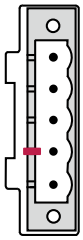
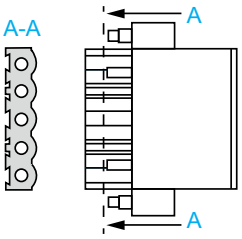
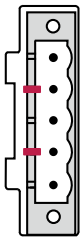
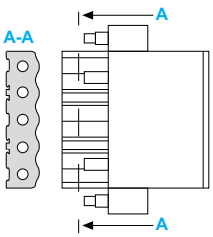
Characteristics:

screw tightening torque	0.5 N•m (0.37 lb-ft)
wire capability	0.2...4.0 mm^2 (AWG24....AWG12) Refer to the chapter Wiring Rules.
temperature range of wires	Use 60/75 or 75 °C copper (CU) wire.

Guidance System

The connector and associated 5-pin terminal block shipped with the product are keyed at the factory. This guidance system helps to prevent from inserting the 5-pin terminal block wired for a power line to a power supply module designed for another current network voltage.

To illustrate the guidance system, the following table presents the placement of the keys on the connectors and a cross-section view of the associated terminal blocks:

Power line	Power supply module reference	Power supply connector	Terminal block (cross-section view)
Alternating current (100...240 Vac)	BMXCPS2000 BMXCPS3500 BMXCPS3500H BMXCPS4002 BMXCPS4002H		
Direct current (125 Vdc)	BMXCPS3540T BMXCPS3522 BMXCPS3522H		
Direct current (24 Vdc) and (24...48 Vdc)	BMXCPS2010 BMXCPS3020 BMXCPS3020H BMXCPS4022 BMXCPS4022H		

NOTE: If you use terminal blocks from a removable connector kit, you need to key them yourself.

Power Supply Redundancy Mode

Introduction

To create redundancy, install two redundant power supply modules in the first two slots of a BMEXBP••02 rack.

All other cases are considered as degraded mode.

Configuration	Monitor and save power supply data	Manage redundancy (power control and LED diagnostic)	Provide data to the application
Two redundant power supplies in a main rack including a M580 controller or a CRA module	✓	✓	✓
Two redundant power supplies in an extension rack	✓	✓	–
One redundant power supply	✓	–	–
✓ Yes – No			

Redundancy Principle

The redundancy principle is based on:

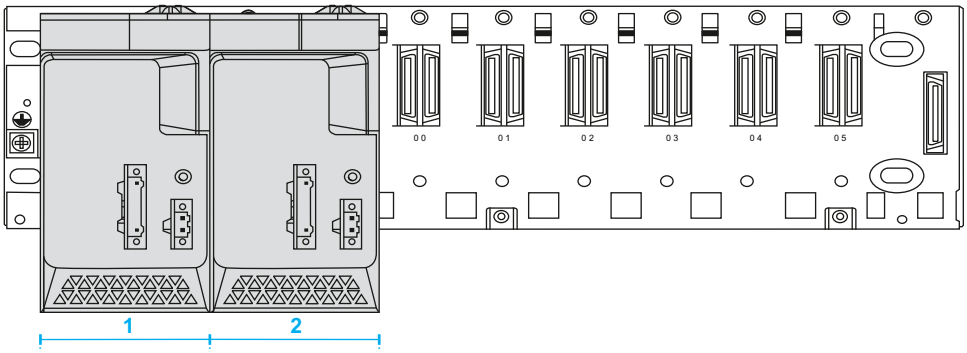
- Each of the two redundant power supply modules in a rack is either the master or the slave.
- An internal diagnostic (voltage and current) for each of the power supply modules.
- An inter-communication between the two redundant power supply modules in a rack to increase the diagnostic level.
- A redundancy status sends to the M580 controller or CRA module.

Master and Slave Positions

Each of the two redundant power supply modules in a rack is either the master or the slave:

Mode	Description
Master	The master power supply module provides power to the backplane for both voltages (24Vdc and 3.3Vdc).
Slave	The other power supply module (not the master) is the slave.

After an initial power-up, the left-most power supply is the master:



1 Redundant power supply in the master position (after power-up).

2 Redundant power supply in the slave position (after power-up).

After the slave power supply assumes the role of master, it keeps the master configuration even if the other power supply is physically replaced. When a current master stops performing the role of master, the other power supply retrieves the master role. That is, the slave becomes the master when the original master stops

providing power to the backplane. (Power is continuously supplied to the rack during this transition.)

NOTICE
EQUIPMENT DAMAGE Power off the redundant power supply module before you plug it in to or remove it from the backplane. **Failure to follow these instructions can result in equipment damage.**

Detecting Lost Redundancy

This Redundancy_Lost_N signal associated with the redundant power supply module is set to low when one of these conditions is true:

- Master 24 Vdc is out of range.
- Master 3.3 Vdc is out of range.
- Slave 24 Vdc is out of range.
- Slave 3.3 Vdc is out of range.
- Master is not powered or absent.
- Slave is not powered or absent.
- Master current capability is insufficient.
- Slave current capability is insufficient.

auto-test: An automatic test checks that the redundant power supply module is configured as the slave (S) power supply. During the test, the ACTIVE and RD LEDs flash continuously.

NOTE: Each redundant power supply module monitors whether the 24 Vdc and 3.3 Vdc supplies are within the acceptable range before providing power to the backplane. If either supply is not in the acceptable range, the Redundancy_Lost_N signal is sent from the backplane to the controller or the BMECRA312•0 module. The Redundancy_Lost_N signal describes the redundancy status of redundant power supply module when two such modules are connected on the backplane. This signal is active low and only used for controller modules or BMECRA312•0 modules.

If the redundant power supply module is on a remote rack using an (e)x80 BM•CRA312•0 adapter module, the redundancy information is in the REDUNDANT_POWER_SUPPLY_STATUS field of T_M_CRA_EXT_IN. If the power supply is on a local rack, the redundancy information is reflected in %S124 and it is accounted for in %S10.

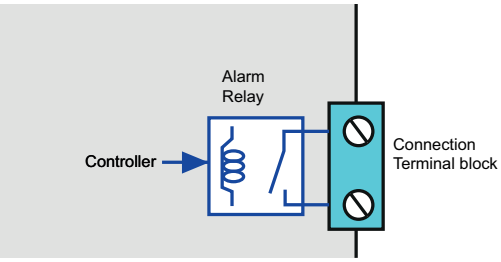
NOTE:

- The power converter remains on after you press the **RESET** button.
- Extract more diagnostics from the power supply with the PWS_DIAG function block. You can send commands to the power supply with the PWS_CMD function block. These function blocks are available in the power supply management library (see EcoStruxure™ Control Expert, System, Block Library).

Alarm Relay

Description

The alarm relay, located in each power supply module, has a potential free contact accessible on a 2-pin removable terminal block, as illustrated below.



Relay Alarm Operation

⚠DANGER

LOSS OF ABILITY TO PERFORM SAFETY FUNCTIONS

Always use a redundant device when using the alarm relay in a functional safety application.

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

Relay's Status	Conditions
Closed: The alarm relay is closed when *all* of these conditions are met.	24V_BAC is OK.
	3V3_BAC is OK.
	ALARM_controller_N is high(1) or there is no controller.
	The RESET button is not activated.
Open: The alarm relay is opened when *any* of these conditions is met: **NOTE:** Relay opens when the controller is in the **STOP**, **CLEAN**, **Error Halt** and **Unrecoverable error state**.	24V_BAC is not OK.
	3V3_BAC is not OK.
	ALARM_CPU_N is low.(2)
	The RESET button is activated.
(1) No controller blocking errors are detected and the controller is in RUN mode. **(2)** A controller blocking error is detected or the controller is in STOP mode.	

Alarm Relay Characteristics

Characteristic	Description
Rated switching voltage/ current	24 Vdc 2 A (resistive load)
	240 Vac 2 A (cos Φ = 1) point
Minimum switching load	5 Vdc 1 mA
Maximum switching voltage	62.4 Vdc
	264 Vac
Contact type	Normally open
Contact time	**OFF > ON:** 10 ms or less

Characteristic	Description
	ON > OFF: 12 ms or less
Built-in protection against overload or short circuits:	None **NOTE:** Fit a fast-blow fuse.
Built-in protection against inductive overvoltage in alternating current:	None **NOTE:** Fit an RC circuit or a MOV [ZNO] suppressor that is appropriate to the voltage in parallel to the terminals of each pre-actuator.
Built-in protection against inductive overvoltage in direct current:	None **NOTE:** Fit a discharge diode to the terminals of each pre-actuator.
Dielectric strength	Contact vs. Ground: 3000 Vrms, 50 Hz, 1 min.(altitude = 0…2000 m)
Insulation resistance	100 MΩ or more under 500 Vdc

Alarm Relay Service Life

Electrical	Alternating current	200 Vac / 1.5 A 240 Vac / 1 A cos Φ = 0.7	≥ 100,000 cycles
		200 Vac / 0.4 A 240 Vac / 0.3 A cos Φ = 0.7	≥ 300,000 cycles
		200 Vac / 1 A 240 Vac / 0.5 A cos Φ = 0.35	≥ 100,000 cycles
		200 Vac / 0.3 A 240 Vac / 0.15 A cos Φ = 0.35	≥ 300,000 cycles
	Direct current	24 Vdc / 1 A 48 Vdc / 0.3 A L/R = 7 ms	≥ 100,000 cycles
		24 Vdc / 0.3 A 48 Vdc / 0.1 A L/R = 7 ms	≥ 300,000 cycles
Mechanical	20 million cycles		

LED Display

Introduction

The status and performance of the Modicon X80 power supplies are monitored and reported through the LED display on the front of the module.

LED Status for Standalone Power Supply

All standalone power supply modules have a (green) **OK** LED that indicates this diagnostic information:

LED	Status Indication	
OK	ON	Module operations are normal.
	OFF	One of these conditions exists: • The rack power supply output voltage is below the threshold. • The **RESET** button is pressed

The BMXCPS2000, BMXCPS3500, and BMXCPS3540T power supplies also have a (green) **24 V** LED, which indicates this diagnostic information:

LED	Status Indication	
24 V	ON	Module operations are normal.
	OFF	The 24 Vdc sensor voltage from the power supply is not present.

LED Status for Redundant Power Supply

The redundant power supply module has (green) LEDs that indicate these diagnostic information:

LED	Status Indication	
OK	ON	Module operations are normal, that is: • The rack power supply output voltages are in the acceptable range, and • The **RESET** button is not pressed
	OFF	The **RESET** button is pressed
	Blinking	The **RESET** button is not pressed and one of the rack power supply output voltages (24 Vdc or 3.3 Vdc) is below the threshold.
ACTIVE	ON	The power supply performs the role of master and the **RESET** button is not pressed.
	OFF	The power supply performs the role of slave or the **RESET** button is pressed.
RD	ON	The redundancy functionality is operational: • The power supply module is installed in a redundant configuration (with another redundant power supply that operates normally in the same redundant power supply rack), and • The rack power supply output voltages of both redundant power supply modules are in the acceptable range, and • The communication between both redundant power supplies through the backplane is operating, and • None of both **RESET** button are pressed.
	OFF	One of these conditions exists: • The power supply module is installed in a redundant configuration but the other redundant power supply is not operating. • The power supply module is installed in a standalone configuration (without another redundant power supply in the rack). • The 24 Vdc output voltage of the power supply is out of range. • The 3.3 Vdc output voltage of the power supply is out of range. • Communication through the backplane is interrupted. • The **RESET** button is pressed.

LED	Status Indication	
	Blinking	The redundancy current measurement failed. The power supply module is installed in a redundant configuration but one of these conditions exists: • The current capability on the 24 Vdc output voltage of at least one of the redundant power supplies is insufficient. • The current capability on the 3.3 Vdc output voltage of at least one of the redundant power supplies is insufficient.

Reset Button

Pressing the Reset Button

The power supply module has a **Reset** button on its front panel.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK

- Do not touch the **Reset** button directly.
- Use an insulated tool to press the **Reset** button.

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

NOTE: The power is still present on the backplane when pressing **Reset** button.

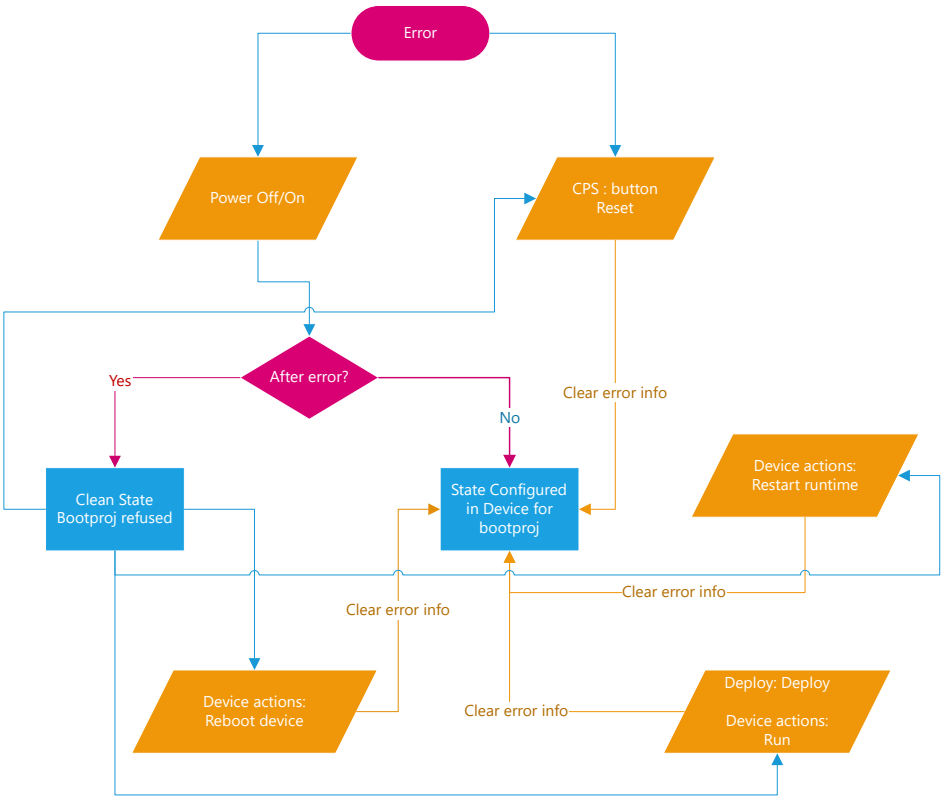
Reset Following Error Detection

In the event of a detected error, the device must be restarted by either removing power from the power supply, or performing a reset by pressing the **Reset** button.

The behavior of the device after restart depends on the method that is used. When power is removed from the power supply, at the next restart the device will not automatically start the boot project with a message in the device log. In order to return to the operational state defined by the user configuration:

- Log in and perform a Restart runtime, standard deployment and running, Reboot device, or press the **Reset** button.

When the **Reset** button is pressed, the device will return to the operational state defined by the user configuration.



BMXCPS2000 Power Supply Module

Introduction

The BMXCPS2000 module is an alternating current power supply module.

Altitude Operating Conditions

The characteristics in the table below apply to the BMXCPS2000 power supply module for use at altitude up to 2000 m (6560 ft). When the power supply module operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Characteristics

Characteristics of the primary block	Nominal voltage		100 – 120 Vac/200 – 240 Vac
	Voltage range		85 - 264 Vac
	Nominal frequency/frequency range		50-60 Hz/47-63 Hz
	Power		70 VA
	Nominal current consumption		0.61 A at 115 Vac 0.31 A at 240 Vac
	Initial power-up at 25 °C(1)	InRush current I	≤ 30 A at 120 Vac ≤ 60 A at 240 Vac
		I^2t	≤ 0.5 A^2s at 120 Vac

		at locking	≤ 2 A^2s at 240 Vac
		It at locking	≤ 0.03 As at 120 Vac ≤ 0.06 As at 240 Vac
	Acceptable duration of power interruptions		≤ 10 ms
	Built-in over-current protection	By internal, inaccessible fuse	
Characteristics of the secondary block	Total usable power		20 W
	Maximum usable power at the two outputs, 3V3_BAC and 24V_BAC		16.5 W
	3V3_BAC output	Nominal voltage	3.3 Vdc
		Nominal current	2.5 A
		Power (typical)	8.3 W
	24V_BAC output	Nominal voltage	24 Vdc
		Nominal current	0.7 A
		Power (typical)	16.5 W
	24V_SENSORS output	Nominal voltage	24 Vdc
		Nominal current	0.45 A
		Power (typical)	10.8 W
	3V3_BAC, 24V_BAC and 24V_ SENSORS output protection	Against overload, short circuits and over-voltage	
Maximum Dissipated Power			8.5 W
Characteristics of the auxiliary functions	Alarm relay	Normally open dry contacts	
	Display	Front panel LED	
	Back-up battery	No	
Isolation	Dielectric strength at 50 Hz-1mn	Primary/secondary (24V_BAC/ 3V3_BAC)	1,500 Vrms
		Primary/secondary (24V_ SENSORS)	2,300 Vrms
		Primary/ground	1,500 Vrms
		24V_SENSORS/ground output	500 Vrms
	Insulation resistance	Primary/secondary	≥ 100 MΩ
		Primary/ground	≥ 100 MΩ
Operating temperature		0...60 °C (32...140 °F)	
(1) These values are to be taken into account for the start-up of several devices simultaneously or for establishing the size of the protection devices.			

BMXCPS2010 Power Supply Module

Introduction

The BMXCPS2010 module is a direct current (24 Vdc) power supply module.

Altitude Operating Conditions

The characteristics in the table below apply to the BMXCPS2010 power supply module for use at altitude up to 2000 m (6560 ft). When the power supply module operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Characteristics

Characteristics of the primary block	Nominal voltage		24 Vdc
	Voltage range		19.2 - 31.2 Vdc
	Nominal current consumption		1 A at 24 Vdc
	Initial power-up at 25 °C(1)	InRush current I	30 A at 24 Vdc
		I^2t at locking	≤ 0.6 A^2s at 24 Vdc
		It at locking	≤ 0.15 As at 24 Vdc
	Acceptable duration of power interruptions		≤ 1 ms
	Built-in over-current protection	By internal, inaccessible fuse	
Characteristics of the secondary block	Total usable power		17 W
	3V3_BAC output	Nominal voltage	3.3 Vdc
		Nominal current	2.5 A
		Power (typical)	8.3 W
	24V_BAC output	Nominal voltage	24 Vdc
		Nominal current	0.7 A
		Power (typical)	16.5 W
	3V3_BAC and 24V_BAC output protection	Against overload, short circuits and over-voltage	
Maximum Dissipated Power			8.5 W
Characteristics of the auxiliary functions	Alarm relay	Normally open dry contacts	
	Display	Front panel LED	
	Back-up battery	No	
Isolation	Dielectric resistance at 50 Hz-1mn	Primary/secondary (24V_BAC/ 3V3_BAC)	1,500 Vrms
		Primary/ground	1,500 Vrms
	Insulation resistance	Primary/secondary	≥ 10 MΩ
		Primary/ground	≥ 10 MΩ
Operating temperature		0...60 °C (32...140 °F)	

(1) These values are to be taken into account for the start-up of several devices simultaneously or for establishing the size of the protection devices.

BMXCPS3020 Power Supply Module

Introduction

The BMXCPS3020 module is a direct current (24 - 48 Vdc) power supply module.

Altitude Operating Conditions

The characteristics in the table below apply to the BMXCPS3020 power supply module for use at altitude up to 2000 m (6560 ft). When the power supply module operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Characteristics

Characteristics of the primary block	Nominal voltage		24 - 48 Vdc
	Voltage range		19.2 - 62.4 Vdc
	Nominal current consumption		1.65 A at 24 Vdc 0.83 A at 48 Vdc
	Initial power-up at 25 °C(1)	InRush current I	30 A at 24 Vdc 60 A at 48 Vdc
		I^2t at locking	≤ 1 A^2s at 24 Vdc ≤ 3 A^2s at 48 Vdc
		It at locking	≤ 0.2 As at 24 Vdc ≤ 0.3 As at 48 Vdc
	Acceptable duration of power interruptions at: • full load, and • full temperature range		≤ 1 ms
	Acceptable duration of power interruptions at: • 18 W load, and • 20.4 Vdc input voltage, and • temperature range 0 °C to maximum		≤ 10 ms
	Built-in over-current protection	By internal, inaccessible fuse	
Characteristics of the secondary block	Total usable power		32 W
	3V3_BAC output	Nominal voltage	3.3 Vdc
		Nominal current	4.5 A
		Power (typical)	15 W
	24V_BAC output	Nominal voltage	24 Vdc
		Nominal current	1.3 A
		Power (typical)	31.2 W
	3V3_BAC and 24V_BAC output protection	Against overload, short circuits and over-voltage	
Maximum Dissipated Power			8.5 W
Characteristics of the auxiliary functions	Alarm relay	Normally open dry contacts	
	Display	Front panel LED	
	Back-up battery	No	
Isolation	Dielectric resistance at 50 Hz-1mn	Primary/secondary (24V_BAC/ 3V3_BAC)	1,500 Vrms
		Primary/ground	1,500 Vrms
	Insulation resistance	Primary/secondary	≥ 10 MΩ
		Primary/ground	≥ 10 MΩ

Operating temperature	0...60 °C (32...140 °F)
(1) These values are to be taken into account for the start-up of several devices simultaneously or for establishing the size of the protection devices.	

BMXCPS3500 Power Supply Module

Introduction

The BMXCPS3500 module is alternating current power supply module.

Altitude Operating Conditions

The characteristics in the table below apply to the BMXCPS3500 and BMXCPS3500H power supply modules for use at altitude up to 2000 m (6560 ft). When the power supply modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Characteristics

Characteristics of the primary block	Nominal voltage		100 - 120 Vac/200 - 240 Vac
	Voltage range		85 - 264 Vac
	Nominal frequency / frequency range		50-60 Hz/47-63 Hz
	Power		120 VA
	Nominal current consumption		1.04 A at 115 Vac 0.52 A at 240 Vac
	Initial power-up at 25 °C(1)	InRush current I	≤ 30 A at 120 Vac ≤ 60 A at 240 Vac
		I^2t at locking	≤ 1 A^2s at 120 Vac ≤ 3 A^2s at 240 Vac
		It at locking	≤ 0.05 As at 120 Vac ≤ 0.07 As at 240 Vac
	Acceptable duration of power interruptions		≤ 10 ms
	Built-in over-current protection	By internal, inaccessible fuse	
Characteristics of the secondary block	Total useful power		36 W
	Maximum useful power at the two outputs, 3V3_BAC and 24V_BAC		31.2 W
	3V3_BAC output	Nominal voltage	3.3 Vdc
		Nominal current	4.5 A
		Power (typical)	15 W
	24V_BAC output	Nominal voltage	24 Vdc
		Nominal current	1.3 A
		Power (typical)	31.2 W
	24V_SENSORS output	Nominal voltage	24 Vdc
		Nominal current	0.9 A

		Power (typical)	21.6 W
	3V3_BAC, 24V_BAC and 24V_ SENSORS output protection	Against overload, short circuits and over-voltage	
Maximum Dissipated Power			8.5 W
Characteristics of the auxiliary functions	Alarm relay	Normally open dry contacts	
	Display	Front panel LED	
	Back-up battery	No	
Isolation	Dielectric resistance at 50 Hz-1mn	Primary/secondary (24V_BAC/ 3V3_BAC)	1,500 Vrms
		Primary/secondary (24V_ SENSORS)	2,300 Vrms
		Primary/ground	1,500 Vrms
		24V_SENSORS/ground output	500 Vrms
	Insulation resistance	Primary/secondary	≥ 100 MΩ
		Primary/ground	≥ 100 MΩ
Operating temperature	BMXCPS3500	0...60 °C (32...140 °F)	
	BMXCPS3500H	-25...70 °C (-13...158 °F)	
(1) These values are to be taken into account for the start-up of several devices simultaneously or for establishing the size of the protection devices.			

BMXCPS3522 Power Supply Module

Introduction

The BMXCPS3522 module is a redundant direct current (125 Vdc) power supply module.

Altitude Operating Conditions

The characteristics in the table below apply to the BMXCPS3522 and BMXCPS3522H power supply modules for use at altitude up to 2000 m (6560 ft). When the power supply modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Characteristics

Characteristics of the primary block	Nominal voltage		125 Vdc
	Voltage range		100...150 Vdc
	Power		40 W
	Nominal current consumption		0.6 A at 125 Vdc
	Initial power-up at 25 °C(1)	InRush current I	≤ 60 A at 125 Vdc
		I^2t at locking	≤ 0.15 A^2s at 125 Vdc
		It at locking	≤ 0.025 As at 125 Vdc

	Acceptable duration of power interruptions at: • full load, and • minimum input voltage (i.e. 100 Vdc), and • full temperature range		≤ 1 ms
	Acceptable duration of power interruptions at: • full load, and • nominal input voltage (i.e. 125 Vdc), and • full temperature range		≤ 10 ms
	Built-in over-current protection	By internal, inaccessible fuse	
Characteristics of the secondary block	Total useful power		40 W on 24V BAC only
	3V3_BAC output	Nominal voltage	3.3 Vdc
		Nominal current	5 A
		Power (typical)	16.5 W
	24V_BAC output	Nominal voltage	24 Vdc
		Nominal current	1.67 A
		Power (typical)	40 W
	3V3_BAC and 24V_BAC output protection	Against overload, short circuits and over-voltage	
Characteristics of the auxiliary functions	Alarm relay	Normally open dry contacts	
	Display	Front panel LED	
	Back-up battery	No	
Isolation	Dielectric resistance at 50 Hz-1mn	Primary/ secondary (24V_ BAC/3V3_BAC)	3,000 Vrms
		Primary/ground	1,500 Vrms
	Insulation resistance	Primary/ secondary	≥ 100 MΩ
		Primary/ground	≥ 100 MΩ
Operating temperature	BMXCPS3522	0...60 °C (32...140 °F)	
	BMXCPS3522H	-25...70 °C (-13...158 °F)	
(1) These values are to be taken into account for the start-up of several devices simultaneously or for establishing the size of the protection devices.			

BMXCPS3540T Power Supply Module

Introduction

The BMXCPS3540T module is a direct current (125 Vdc) power supply module.

Altitude Operating Conditions

The characteristics in the table below apply to the BMXCPS3540T power supply module for use at altitude up to 2000 m (6560 ft). When the power supply module operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Characteristics

Characteristics of the primary block	Nominal voltage		125 Vdc
	Voltage range		100-150 Vdc
	Power		45 W
	Nominal current consumption		0.36 A at 125 Vdc
	Initial power-up at 25 °C(1)	InRush current I	≤ 30 A at 125 Vdc
		I^2t at locking	≤ 2 A^2s at 125 Vdc
		It at locking	≤ 0.05 As at 125 Vdc
	Acceptable duration of power interruptions		≤ 10 ms
	Built-in over-current protection	By internal, inaccessible fuse	
Characteristics of the secondary block	Total useful power		36 W
	Maximum useful power at the two outputs, 3V3_BAC and 24V_BAC		31.2 W
	3V3_BAC output	Nominal voltage	3.3 Vdc
		Nominal current	4.5 A
		Power (typical)	15 W
	24V_BAC output	Nominal voltage	24 Vdc
		Nominal current	1.3 A
		Power (typical)	31.2 W
	24V_SENSORS output	Nominal voltage	24 Vdc
		Nominal current	0.9 A
		Power (typical)	21.6 W
	3V3_BAC, 24V_BAC and 24V_ SENSORS output protection	Against overload, short circuits and over-voltage	
Maximum Dissipated Power			8.5 W
Characteristics of the auxiliary functions	Alarm relay	Normally open dry contacts	
	Display	Front panel LED	
	Back-up battery	No	
Isolation	Dielectric resistance at 50 Hz-1mn	Primary/secondary (24V_BAC/ 3V3_BAC)	3,000 Vrms
		Primary/secondary (24V_ SENSORS)	3,000 Vrms
		Primary/ground	2,000 Vrms
		24V_SENSORS/ground output	500 Vrms
	Insulation resistance	Primary/secondary	≥ 100 MΩ
		Primary/ground	≥ 100 MΩ
Operating temperature		-25...70 °C (-13...158 °F)	

(1) These values are to be taken into account for the start-up of several devices simultaneously or for establishing the size of the protection devices.

NOTE: In order to restart the power supply after a detected output overload, short circuit, or over-voltage condition on the 24V_BAC, you must switch the primary power line to the off state, wait 1 minute, and then switch the primary power line back to the on state.

BMXCPS4002 Power Supply Module

Introduction

The BMXCPS4002 module is a redundant alternating current power supply module.

Altitude Operating Conditions

The characteristics in the table below apply to the BMXCPS4002 and BMXCPS4002H power supply modules for use at altitude up to 2000 m (6560 ft). When the power supply modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Characteristics

Characteristics of the primary block	Nominal voltage		100...240 Vac
	Voltage range		85...132 Vac 170...264 Vac
	Nominal frequency/frequency range		50...60 Hz / 47...63 Hz
	Power		130 VA
	Nominal current consumption		1.1 A at 115 Vac 0.55 A at 230 Vac
	Initial power-up at 25 °C(1)	InRush current I	≤ 30 A at 115 Vac ≤ 60 A at 230 Vac
		I^2t at locking	≤ 1 A^2s at 115 Vac ≤ 4 A^2s at 230 Vac
		It at locking	≤ 0.1 As at 115 Vac ≤ 0.15 As at 230 Vac
	Acceptable duration of power interruptions		≤ 10 ms
	Built-in over-current protection	By internal, inaccessible fuse	
Characteristics of the secondary block	Total useful power		40 W on 24V BAC only
	3V3_BAC output	Nominal voltage	3.3 Vdc
		Nominal current	5.5 A
		Power (typical)	16.5 W
	24V_BAC output	Nominal voltage	24 Vdc
		Nominal current	1.67 A
		Power (typical)	40 W
	3V3_BAC and 24V_BAC output protection	Against overload, short circuits and over-voltage	
Characteristics of the auxiliary functions	Alarm relay	Normally open dry contacts	
	Display	Front panel LED	
	Back-up battery	No	

Isolation	Dielectric resistance at 50 Hz-1mn	Primary/ secondary (24V_ BAC/3V3_BAC)	3,000 Vrms
		Primary/ground	1,500 Vrms
	Insulation resistance	Primary/ secondary	≥ 100 MΩ
		Primary/ground	≥ 100 MΩ
Operating temperature	BMXCPS4002	0...60 °C (32...140 °F)	
	BMXCPS4002H	-25...70 °C (-13...158 °F)	
(1) These values are to be taken into account for the start-up of several devices simultaneously or for establishing the size of the protection devices.			

Exception: You can install BMXCPS4002(H) power supply modules only on the following dual-bus racks (Ethernet and X bus):

- BMEXBP0602
- BMEXBP1002

BMXCPS4022 Power Supply Module

Introduction

The BMXCPS4022 module is a redundant direct current (24 - 48 Vdc) power supply module.

Altitude Operating Conditions

The characteristics in the table below apply to the BMXCPS4022 and BMXCPS4022H power supply modules for use at altitude up to 2000 m (6560 ft). When the power supply modules operate above 2000 m (6560 ft), apply additional derating.

For detailed information, refer to chapter *Operating and Storage Conditions* (see Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications).

Characteristics

Characteristics of the primary block	Nominal voltage		24 - 48 Vdc
	Voltage range		19.2 - 62.4 Vdc
	Nominal current consumption		1.9 A at 24 Vdc 1.0 A at 48 Vdc
	Initial power-up at 25 °C(1)	InRush current I	≤ 60 A at 24 Vdc ≤ 60 A at 48 Vdc
		I^2t at locking	≤ 0.4 A^2s at 24 Vdc ≤ 1.9 A^2s at 48 Vdc
		It at locking	≤ 0.05 As at 24 Vdc ≤ 0.08 As at 48 Vdc
	Acceptable duration of power interruptions at: • full load, and • full temperature range		≤ 10 ms

	Acceptable duration of power interruptions at: • 18 W load, and • 20.4 Vdc input voltage, and • temperature range 0 °C to maximum		≤ 10 ms
	Built-in over-current protection	By internal, inaccessible fuse	
Characteristics of the secondary block	Total usable power		40 W on 24V_BAC only
	3V3_BAC output	Nominal voltage	3.3 Vdc
		Nominal current	5 A
		Power (typical)	16.5 W
	24V_BAC output	Nominal voltage	24 Vdc
		Nominal current	1.67 A
		Power (typical)	40 W
	3V3_BAC and 24V_BAC output protection	Against overload, short circuits and over-voltage	
Maximum Dissipated Power			8.5 W
Characteristics of the auxiliary functions	Alarm relay	Normally open dry contacts	
	Display	Front panel LED	
	Back-up battery	No	
Isolation	Dielectric resistance at 50 Hz-1mn	Primary/secondary (24V_BAC/ 3V3_BAC)	3,000 Vrms
		Primary/ground	1,500 Vrms
	Insulation resistance	Primary/secondary	≥ 10 MΩ
		Primary/ground	≥ 10 MΩ
Operating temperature	BMXCPS4022	0...60 °C (32...140 °F)	
	BMXCPS4022H	-25...70 °C (-13...158 °F)	
(1) These values are to be taken into account for the start-up of several devices simultaneously or for establishing the size of the protection devices.			

X80 Power Supply Module Installation

What's in This Chapter

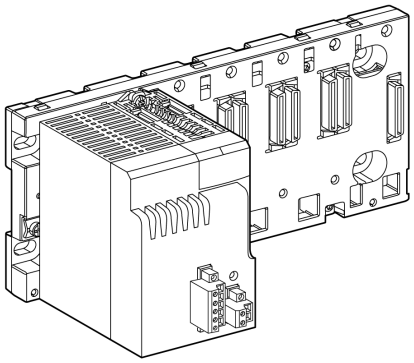
Installation 696
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Alternating Current Network 715
Sensor and Pre-actuator Power Supply 718
Removable Connectors Kit 720

Installation

Introduction

Install the power supply module in the first two slots of each rack marked **CPS**.

Example of power supply module installed in a BMEXBP0400 rack:



NOTE: The power supply module design only allows it to be placed in the dedicated slots.

Power Supply Module Installation

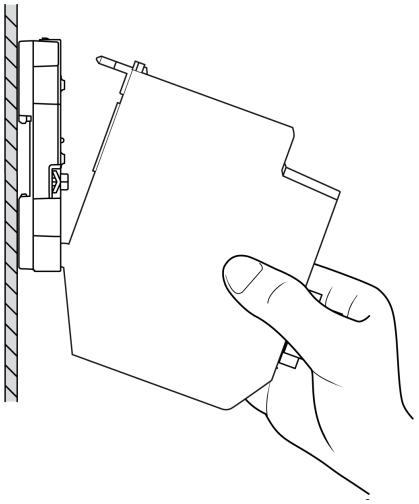
⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK

Remove all power sources to the terminal block before installing the power supply module.

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

Install an X80 power supply module in a rack:

Step	Action	
1	Remove the protective cover from the two connectors of the power supply module labeled **CPS**, **CPS1**, or **CPS2**	
2	Position the locating pins situated at the rear of the module (on the bottom part) in the corresponding slots in the rack.	
3	Swivel the module towards the top of the rack so that the module sits flush with the rack.	
4	Tighten the mounting screw on top of the power supply module to hold the module in place on the rack. Tightening torque: 0.4...1.5 N•m (0.29...1.10 lbf-ft).	

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Check that the mounting screw is securely tightened to ensure the module is firmly attached to the rack.

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

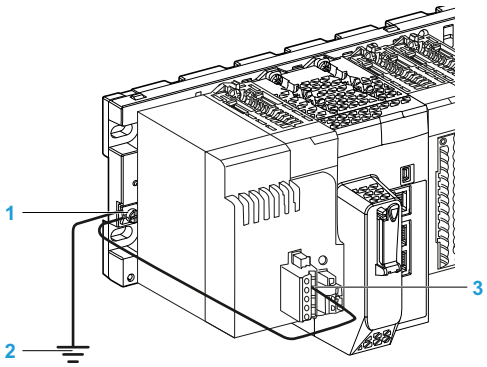
Characteristics

Pseudo topic: Topic id "D-SA-0021447" not found in topic "x-wc://file=0000960333.xml#D-SA-0021447" for "Main Map", element "topicref" at line 447

Grounding

Overview

The following illustration shows how to ground the rack and power supply module:



1 Protective earth screw of the rack

2 Earthing of the installation (i.e., cabinet)

3 Functional ground (**FG**) terminal of the power supply module

NOTE: Ground every rack and power supply module in the PAC system.

Grounding Rules

To ground the rack and power supply module:

- Connect a ground cable between the earthing of the installation and the protective earth screw of the rack.
- Connect a ground cable between the functional ground (FG) terminal of the power supply module and the protective earth screw of the rack. Use the shortest cable possible.

  NOTE: For redundant power supply modules in the same rack, do not chain the functional ground (FG) terminal of the modules together.

The protective earth screw of the rack is located on the left-hand side of the rack, close to the power supply module.

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK

Connect the protective earth screw of the rack to the earthing of the installation.

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

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK

- Connect the functional ground (FG) terminal of the power supply module directly to the protective earth screw of the rack.
- Do not chain the function ground (FG) terminals of redundant power supply modules together.
- Do not connect anything else to the functional ground (FG) terminal of the power supply module.

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

Confirm that the ends of the cables connected to the protective earth screw of the rack have ring or spade connectors that maintain an electrical connection when the screw is loose.

The tightening torque for the protective earth screw is 1.2 N•m (0.88 lbf-ft).

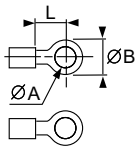
⚠⚠DANGER

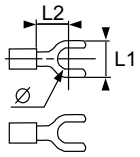
LOOSE WIRING CAUSES ELECTRIC SHOCK

- Use only cables with ring or spade lugs to connect the protective earth screw of the rack and check that there is a good ground connection.
- Make sure that the protective earth screw of the rack is tightened properly.

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

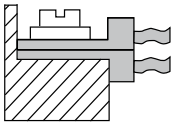
The following table describes the ring and spade lug that connect ground cables to the M4 protective earth screw of the rack:





	øA	øB	L(*)	ø	L1	L2(*)
mm	4.34	≤ 8.8	≥ 6.2	4.34	≤ 9.8	≥ 6.2
in.	*0.171*	*≤ 0.346*	*≥ 0.245*	*0.171*	*≤ 0.385*	*≥ 0.245*

(*)



For more information, refer to the *Wiring Rules* topic for power supply terminal block connections.

Equipotential Grounding System

When developing an M580 Hot Standby system, confirm that all equipment is grounded to the same potential. This includes, for example, the primary and the standby Hot Standby local racks, plus all connected RIO drops and distributed equipment. To accomplish this, confirm that you have an equipotential grounding system in place.

NOTE: Refer to the ground protection information provided in the *Electrical installation guide* and the *Control Panel Technical Guide, How to protect a machine from malfunctions due to electromagnetic disturbance*.

Protection Devices

Introduction

It is recommended that you install a protection device at the start of the line on the power supply network, including these elements:

- circuit breaker
- fuse

Choice of Line Circuit Breaker

Consider these factors when you choose the size of the line circuit breaker:

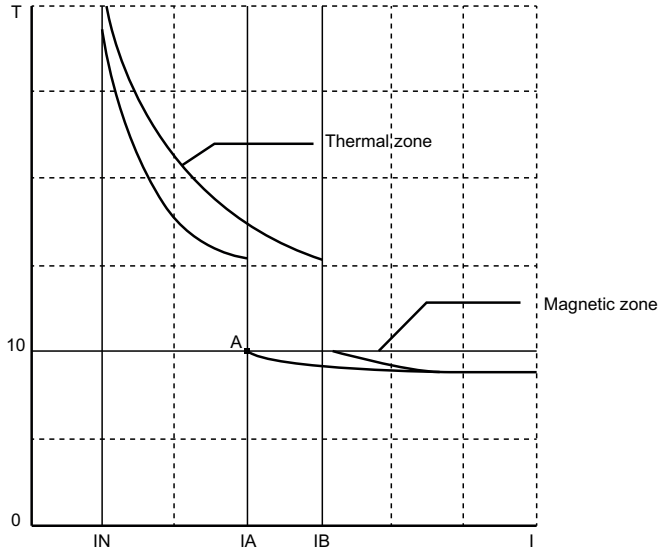
- nominal input current (Irms)
- signaling current (I)
- current characteristic (It)

The choice of minimum circuit breaker size is made according to these rules:

- IN circuit breaker size greater than the power supply nominal input current (Irms)
- maximum circuit breaker size greater than the power supply signaling current (I)
- current characteristic (It) at point A of the curve greater than the power supply current characteristic (It)

NOTE: Protect all poles of the main power line by at least fuses or breakers rated 15 A for North America and 16 A for other countries.

This graph shows an example of characteristics provided by a circuit breaker manufacturer:



Choice of Line Fuse

When you choose the size of the line fuse, consider:

- current characteristic (I^2t)

The choice of minimum fuse size is made according to these rules:

- IN fuse size greater than 3 times the power supply nominal input current Irms
- fuse current characteristic I^2t greater than 3 times the power supply current characteristic I^2t

Power Supply Characteristics

This table gives a synthesis of the current characteristics needed to define the minimum size of the circuit breaker and fuse for a given power supply module:

Power Supply Module		**nominal input current Irms**	**signaling current I(1)**	**current characteristic**	
				It	**I^2t**
BMXCPS2000	at 115 Vac	0.61 A	–	–	–
(100...240 Vac)	at 120 Vac	–	30 A	0.03 As	0.5 A^2s

Power Supply Module		nominal input current Irms	signaling current I(1)	current characteristic	
				It	I²t
	at 240 Vac	0.31 A	60 A	0.06 As	2 A²s
BMXCPS2010 (24 Vdc)	at 24 Vdc	1 A	30 A	0.15 As	0.6 A²s
BMXCPS3020 (H) (24...48 Vdc)	at 24 Vdc	1.65 A	30 A	0.2 As	1 A²s
	at 48 Vdc	0.83 A	60 A	0.3 As	3 A²s
BMXCPS3500 (H) (100...240 Vac)	at 115 Vac	1.04 A	–	–	–
	at 120 Vac	–	30 A	0.05 As	1 A²s
	at 240 Vac	0.52 A	60 A	0.07 As	3 A²s
BMXCPS3540T (125 Vdc)	at 125 Vdc	0.36 A	30 A	0.05 As	2 A²s
BMXCPS4002 (H) (100...240 Vac)	at 115 Vac	1.1 A	30 A	0.1 As	1 A²s
	at 120 Vac	–	–	–	–
	at 240 Vac	0.55 A	60 A	0.15 As	4 A²s
BMXCPS4022 (H) (24...48 Vdc)	at 24 Vdc	1.9 A	60 A	0.05 As	0.4 A²s
	at 48 Vdc	1 A	60 A	0.08 As	1.9 A²s
BMXCPS3522 (H) (125 Vdc)	at 125 Vdc	0.6 A	60 A	0.025 As	0.15 A²s
(1) Values at initial power-up and at 25 °C (77 °F).					

Usable Power

Introduction

When the power requirements for a rack have been calculated, use the following tables to select the appropriate power supply module to be installed on the rack.

Usable Power Table

Power supply reference	Maximum available power		
	3V3_BAC	24V_BAC	24V_SENSORS
BMXCPS2000 (100...240 Vac)	8.3 W (2.5 A)	16.5 W (0.7 A)	10.8 W (0.45 A)
	3V3_BAC and 24V_BAC cumulated = 16.5 W		
	3V3_BAC, 24V_BAC, and 24V_SENSORS cumulated = 20 W		
BMXCPS2010 (24 Vdc)	8.3 W (2.5 A)	16.5 W (0.7 A)	–
	3V3_BAC and 24V_BAC cumulated = 16.5 W		
BMXCPS3020 (24...48 Vdc)	15 W (4.5 A)	31.2 W (1.3 A)	–
	3V3_BAC and 24V_BAC cumulated = 31.2 W		
BMXCPS3020H(1) (24...48 Vdc)	15 W (4.5 A) **11.25 W (3.375 A)**	31.2 W (1.3 A) **23.4 W (0.975 A)**	–
	3V3_BAC and 24V_BAC cumulated = 31.2 W **(23.4 W)**		

Power supply reference	Maximum available power		
	3V3_BAC	**24V_BAC**	**24V_SENSORS**
BMXCPS3500 (100...240 Vac)	15 W (4.5 A)	31.2 W (1.3 A)	21.6 W (0.9 A)
	3V3_BAC and 24V_BAC cumulated = 31.2 W		
	3V3_BAC, 24V_BAC, and 24V_SENSORS cumulated = 36 W		
BMXCPS3500H(1) (100...240 Vac)	15 W (4.5 A) **11.25 W (3.375 A)**	31.2 W (1.3 A) **23.4 W (0.975 A)**	21.6 W (0.9 A) **16.2 W (0.5 A)**
	3V3_BAC and 24V_BAC cumulated = 31.2 W **(23.4 W)**		
	3V3_BAC, 24V_BAC, and 24V_SENSORS cumulated = 36 W **(27 W)**		
BMXCPS3540T(1) (125 Vdc)	15 W (4.5 A) **11.25 W (3.375 A)**	31.2 W (1.3 A) **23.4 W (0.975 A)**	21.6 W (0.9 A) **16.2 W (0.5 A)**
	3V3_BAC and 24V_BAC cumulated = 31.2 W **(23.4 W)**		
	3V3_BAC, 24V_BAC, and 24V_SENSORS cumulated = 36 W **(27 W)**		
BMXCPS4002H(2) (100...240 Vac)	16.5 W (5 A)	40 W (1.67 A)	–
	3V3_BAC and 24V_BAC cumulated = 40 W		
BMXCPS4022(H)(2) (24...48 Vdc)	16.5 W (5 A)	40 W (1.67 A)	–
	3V3_BAC and 24V_BAC cumulated = 40 W		
BMXCPS3522(H)(2) (125 Vdc)	16.5 W (5 A)	40 W (1.67 A)	–
	3V3_BAC and 24V_BAC cumulated = 40 W		

(1) For the power supply modules that can operate in an extended temperature range, the usable powers are subject to derating (written in **bold**) in the temperature range of 60...70 °C (140...158 ° F).

(2) There is no derating for the redundant power supply modules.

24V_SENSORS Output

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Do not exceed the 24V_SENSORS output power rating.

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

Excessive load on the 24V_SENSORS output causes limitation of the available current. Reduce the current consumption on the 24V_SENSORS output.

The 24V_SENSORS output is the 24 Vdc sensor power supply output and is only available on the following modules:

- BMXCPS2000
- BMXCPS3500(H)
- BMXCPS3540T

Power Limits

Excessive load can cause the power supply to trip.

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Do not exceed the total useful power rating of the module.

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

NOTICE

RECOVERY TIME AFTER TRIPPING

After tripping, remove the power to the power supply module and wait 5 minutes before applying the power again.

Failure to follow these instructions can result in equipment damage.

The redundant power supplies are not summable. The global power of the rack cannot exceed the capacity of a single supply.

Follow these rules to establish the power used by power supply modules:

- Do not let the power absorbed on each output (3V3_BAC, 24V_BAC, and 24V_SENSORS) exceed the maximum usable power for each output respectively.
- Do not let the sum of the power absorbed on the 3V3_BAC and 24V_BAC outputs exceed the maximum usable power for 3V3_BAC and 24V_BAC cumulated.
- Do not let the sum of the power absorbed on the 3V3_BAC, 24V_BAC, and 24V_SENSORS outputs exceed the maximum usable power of the module.

Once a power supply has tripped, disconnect the power supply from its power source for five minutes in order to restore its internal circuit breaker.

Power Consumption

Calculation Table

Required rack power depends on the type of modules installed.

NOTE: Two redundant power supplies on the same rack are not summable.

Calculate the global power consumption to define the power supply module to be installed on the rack:

Power	Calculation	Result
P 3.3 V rack = power required on the 3V3_BAC output	current absorbed on the 3V3_BAC output by all modules (mA) x 10^{-3} x 3.3	=.....W
P 24 V rack = power required on the 24V_BAC output	current absorbed on the 24V_BAC output by all modules (mA) x 10^{-3} x 24	=.....W
P 24 V sensors = power required on the 24V_SENSORS output	current absorbed on the 24V_SENSORS output by all modules (mA) x 10^{-3} x 24	=.....W
total power required	**P 3.3 V rack** + **P 24 V rack** + **P 24 V sensors**	=.....W

The following tables give the average power consumption per module. The average value is calculated regarding the maximum and typical consumptions.

Rack and Extender Module Consumption

Rack family	Rack reference	Average current consumption (mA)	
		3V3_BAC output	24V_BAC output
X bus rack	BMXXBP0400(H)	340	–
	BMXXBP0600(H)	510	–
	BMXXBP0800(H)	670	–
	BMXXBP1200	50	–
	BMXXBP1200(H)	250	–
Dual Ethernet and X bus rack	BMEXBP0400(H)	49	118
	BMEXBP0800(H)	64	164
	BMEXBP1200(H)	86	164
Redundant power supply rack	BMEXBP0602(H)	86	164
	BMEXBP1002(H)	86	164

Module reference	Description	Average current consumption (mA)	
		3V3_BAC output	24V_BAC output
BMXXBE1000	Rack extender module	22	160

M580 Controller Consumption

Module		Average current consumption (mA)		
Reference	Description	3V3_BAC Output	24V_BAC output	24V_SENSORS output
BMEP581020 BMEP582020 BMEP582040	Standalone controller Ethernet distributed IO	–	270	–
BMEP583020	Standalone controller Ethernet distributed IO	–	295	–
BMEP583040	Standalone controller Ethernet remote and distributed IO	–	295	–
BMEP584020	Standalone controller Ethernet distributed IO	–	295	–
BMEP584040	Standalone controller Ethernet remote and distributed IO	–	295	–
BMEP585040 BMEP586040	Standalone controller Ethernet remote and distributed IO	–	300	–
BMEH582040	HSBY controller Ethernet remote and distributed IO	–	270 or 335(1)	–

Module		Average current consumption (mA)		
Reference	**Description**	**3V3_BAC Output**	**24V_BAC output**	**24V_SENSORS output**
BMEH584040	HSBY controller Ethernet remote and distributed IO	–	295 or 360(1)	–
BMEH586040	HSBY controller Ethernet remote and distributed IO	–	295 or 365(1)	–
(1) with a copper SFP				

M340 Controller Consumption

Module		Average power consumption (mA)		
Reference	**Description**	**3V3_BAC output**	**24V_BAC output**	**24V_SENSORS output**
BMXP341000	Controller 340-10 Modbus	-	72	-
BMXP342000	Controller 340-20 Modbus	-	72	-
BMXP342010 BMXP3420102	Controller 340-20 Modbus CANopen	-	90	-
BMXP342020	Controller 340-20 Modbus Ethernet	-	95	-
BMXP342030 BMXP3420302	Controller 340-20 Ethernet CANopen	-	135	-

X80 EIO Adapter Module Consumption

Module		Average current consumption (mA)		
Reference	**Description**	**3V3_BAC output**	**24V_BAC output**	**24V_SENSORS output**
BMXCRA31200	X80 standard EIO adapter	1,200	–	–
BMXCRA31210 (C)	X80 performance EIO adapter	1,200	–	–
BMECRA31210 (C)	eX80 performance EIO adapter	1,800	–	–
BMECRA31310 (H)	X80 performance Dual EIO adapter	1,800	–	–

X80 DIO Adapter Module Consumption

Module		Average current consumption (mA)		
Reference	**Description**	**3V3_BAC output**	**24V_BAC output**	**24V_SENSORS output**
BMXPRA0100	DIO drop adapter	-	95	-

X80 Analog I/O Module Consumption

Module		Average current consumption (mA)		
Reference	**Description**	**3V3_BAC output**	**24V_BAC output**	**24V_SENSORS output**
BMXAMI0410	4 isolated high-speed analog inputs	121	45	–
BMXAMI0800	8 non-isolated high-speed analog inputs	121	41	–
BMXAMI0810	8 isolated high-speed analog inputs	121	54	–
BMXAMM0600	4 channel analog inputs	126	120	–
BMXAMO0210	2 isolated analog outputs	126	102	–
BMXAMO0410	4 isolated high-speed analog outputs	145	137	–
BMXAMO0802	8 non-isolated high-speed analog outputs	126	156	–
BMXART0414	4 isolated analog inputs	150	40	–
BMXART0814	8 isolated analog inputs	220	50	–
BMEAHI0812	8 high-density isolated fast analog inputs	400	34	–
BMEAHO0412	4 channel analog inputs	380	137	–

X80 Communication Module Consumption

Module		Average current consumption (mA)		
Reference	**Description**	**3V3_BAC output**	**24V_BAC output**	**24V_SENSORS output**
BMXNOE0100 (H)	Ethernet 1 port 10/100 RJ45	-	90	-
BMXNOE0110	Ethernet 1 port 10/100 RJ45	-	90	-
BMXNOC0401	Ethernet 4 ports 10/100 RJ45	555	–	–
BMENOR2200H	Ethernet 2 ports 10/100 RJ45	–	120	–
BMXNOR0200	Ethernet 2 ports 10/100 RJ45	–	95	–
BMENOC0301	Ethernet 3 ports 10/100 RJ45	PV<13: 1,800(1) PV>=13: 900	–	–
BMENOC0311		PV<14: 1,800(1) PV>=14: 900		
BMENOC0321	Ethernet 3 ports 10/100/1000 RJ45	1,250	–	–

Module		Average current consumption (mA)		
Reference	**Description**	**3V3_BAC output**	**24V_BAC output**	**24V_SENSORS output**
BMXEIA0100	sub-D connector AS-interface master	160	–	–
BMXNRP0200	Multimode fiber converter	–	200	–
BMXNRP0201	Single-mode fiber converter	–	200	–

(1) Current consumption is at a temperature above 50 °C (122 °F). At a temperature of 30°C (86 °F) the current consumption is 1,200 mA.

NOTE: To lower the current consumption of the BMENOC0301/11 module, you can disable unused communication ports. This applies only to PV<13 for the BMENOC0301 module and PV<14 for the BMENOC0311 module.

X80 Counting Module Consumption

Module		Average current consumption (mA)		
Reference	**Description**	**3V3_BAC output**	**24V_BAC output**	**24V_SENSORS output**
BMXEHC0200	2–channel high speed counter	200	40	80
BMXEHC0800	8–channel high speed counter	200	–	80

X80 Discrete Input Module Consumption

Module		Average current consumption (mA)		
Reference	**Description**	**3V3_BAC output**	**24V_BAC output**	**24V_SENSORS output**
BMXDAI0805	8 discrete 200...240 Vac inputs	103	13	–
BMXDAI1602	16 discrete 24Vac/24Vdc inputs	90	–	60
BMXDAI1603	16 discrete 48 Vac inputs	90	–	60
BMXDAI1604	16 discrete 100...120 Vac inputs	90	–	–
BMXDDI1602	16 discrete 24 Vdc inputs	90	–	60
BMXDDI1603	16 discrete 48 Vdc inputs	75	–	135
BMXDDI1604T	16 discrete 125 Vdc inputs	75	–	135
BMXDDI3202K	32 discrete 24 Vdc inputs	140	–	110
BMXDDI6402K	64 discrete 24 Vdc inputs	200	–	110

X80 Discrete Output Module Consumption

Module		Average current consumption (mA)		
Reference	**Description**	**3V3_BAC output**	**24V_BAC output**	**24V_SENSORS output**
BMXDAO1605	16 discrete outputs	100	95	–
BMXDDO1602	16 discrete 0.5 A outputs	100	–	–
BMXDDO1612	16 discrete outputs	100	–	–
BMXDDO3202	32 discrete 0.5 A outputs	150	–	–
BMXDDO3202K	32 discrete 0.1 A outputs	150	–	–
BMXDDO6402K	64 discrete 0.1 A outputs	240	–	–
BMXDRA0804T	8 discrete isolated outputs	100	110	–
BMXDRA0805	8 discrete isolated outputs	100	55	–
BMXDRA1605	16 discrete outputs	100	95	–

X80 Discrete I/O Module Consumption

Module		Average current consumption (mA)		
Reference	**Description**	**3V3_BAC output**	**24V_BAC output**	**24V_SENSORS output**
BMXDDM16022	8 discrete 24 Vdc inputs and 8 discrete outputs	100	–	30
BMXDDM16025	8 discrete 24 Vdc inputs and 8 discrete outputs	100	50	30
BMXDDM3202K	16 discrete 24 Vdc inputs and 16 discrete outputs	150	–	55

X80 Motion Module Consumption

Module		Average current consumption (mA)		
Reference	**Description**	**3V3_BAC output**	**24V_BAC output**	**24V_SENSORS output**
BMXMSP0200	2 independent pulse train output channels	200	150	–

Wiring Rules

Wiring Recommendations

⚠⚠DANGER

LOOSE WIRING CAUSES ELECTRIC SHOCK

Do not insert more than one wire per connector of the terminal block without a twin cable end.

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

⚠⚠DANGER

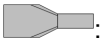
FIRE HAZARD

Use only the recommended wire sizes.

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

The power supply terminal block can accommodate:

- Bare wires:
  - Solid conductor
  - Stranded cable

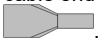
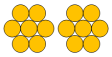
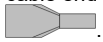
    NOTE: Without cable ends, the minimum individual wire size  in stranded cable is AWG 30 (0,0507 mm²).
- Wires with cable ends:
  - Single cable end  : DZ5CE••••/DZ5CA••••
  - Twin cable end  : AZ5DE••••

The caged connectors of the terminal blocks are designed for only one wire or one cable end. Install two wires to the same connector with a twin cable end to help prevent loosening.

NOTE: When using stranded cable, Schneider Electric strongly recommends that you use cable ends that are fitted with an appropriate tool.

Cable Sizes

The following table provides the size of cables to use with 5-pin caged terminal blocks:

Cable type	 one solid conductor	 one stranded cable(1)	 one stranded cable with single cable end	 two solid conductors, only with twin cable end 	 two solid conductors, only with twin cable end 
AWG	24...12	22...14	22...14	2x24...2x16	2x22...2x16
mm²	0,205…3,310	0,357…2,285 (2)	0,324…2,285 (2)	2x0,205… 2x0,82	2x0,324… 2x1,44(2)
AWG	24...12	22...14	22...14	2x24...2x16	2x22...2x16

(1) Minimum individual wire size in stranded cable without cable end is AWG 30 (0,0507 mm²).

(2) Depending on stranding.

NOTE: When using a cable end, confirm that the overall section does not exceed wire capability of the terminal block $(4.0\ mm)^2$.

Sensor Power Supply

When available, power supply modules have a built-in power supply providing a voltage of 24 Vdc which is used to supply power to the sensors.

Confirm that sensors connected to the modules of one rack are powered from this rack or from an external power supply. Using power from a different rack causes unintended equipment operation and incorrect activation of outputs, and may damage the power supply module.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

Do not power sensors connected to the modules of one rack with the power supply of another rack.

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

Direct Current Network

Direct current power supply modules (BMXCPS2010, BMXCPS3020(H), and BMXCPS4022(H)) have strong signaling currents, and we recommend that you do not use these modules on direct current networks that have a fold-back current limiting protection.

NOTE: If the power supply module is connected to a direct current network, the length of the power supply cable must be limited in order to avoid transmission losses.

The following table gives the maximum length of power supply cables:

Power supply module	Copper wire size	
	2.5 mm^2 (12 AWG)	1.5 mm^2 (14 AWG)
BMXCPS2010	30 m (98.4 ft)	20 m (65.6 ft)
BMXCPS3020(H) BMXCPS4022(H)	15 m (49.2 ft)	10 m (32.8 ft)

NOTE: You can double the maximum length for “there and back.”

Alternating Current Power Supply Modules

power supplyalternating current

Introduction

This section presents the connection of BMXCPS2000, BMXCPS3500, and BMXCPS4002 alternating current power supply modules.

Line Protection

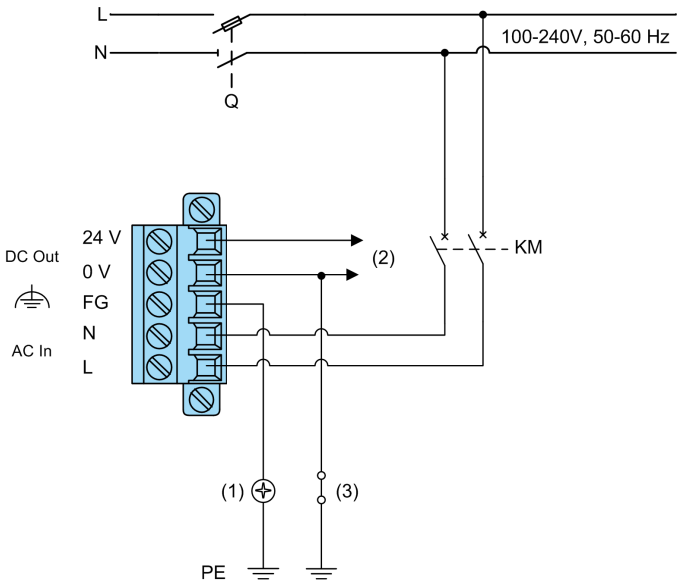
The power supply module is intended for use in low-voltage installations, in which the main power branch is protected on both wires by devices as fuses or breakers that limit the current to 15 A for North America and 16 A for the rest of the world. For details, refer to the description of standards and certifications.

NOTE: The alternating current power supply modules are already equipped with a protective fuse. This fuse, connected at the input phase of the alternating current network, is inside the module and is not accessible.

Wiring Diagrams

BMXCPS2000 / BMXCPS3500

The following diagram shows the 5-pin terminal block connections on to alternating current network:



(1) Ground screw of the rack

(2) Sensor power supply

(3) Shielding connector kit

FG Functional ground

PE Protective earth

N Neutral

L Phase

Q General isolator

KM Line contactor or circuit breaker

NOTE: To connect the functional ground (FG) to the protective earth (PE), refer to the *Grounding the Rack and the Power Supply Module*, page 698 topic.

BMXCPS4002

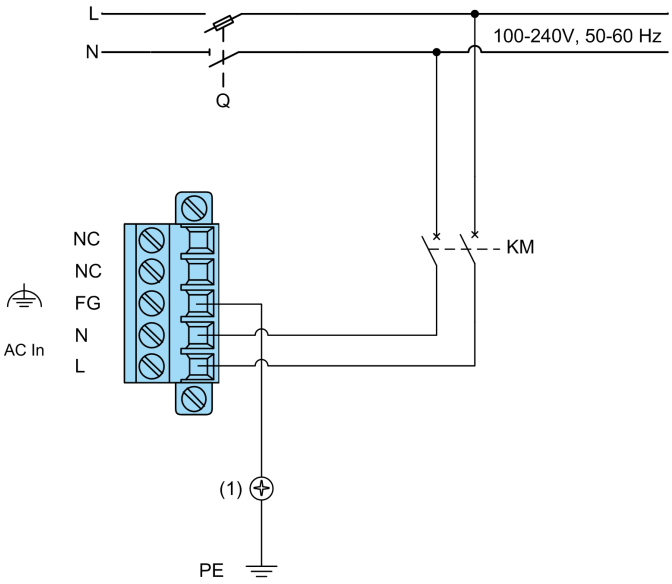
⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Do not connect any wiring to connections designated as No connection (NC).

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

The following diagram details the 5-pin terminal block connections on to alternating current network:



(1) Ground screw of the rack

NC No connection

FG Functional ground

PE Protective earth

N Neutral

L Phase

Q General isolator

KM Line contactor or circuit breaker

NOTE: To connect the functional ground (FG) to the protective earth (PE), refer to the *Grounding the Rack and the Power Supply Module*, page 698 topic.

Floating Direct Current Network

connecting to a floating direct current networkdirect currentpower suppliespower supplies

Introduction

For a floating (non-grounded) assembly used in specific applications, marine applications in particular, confirm that you choose an insulated power supply module among the following references:

- BMXCPS2010 (24 Vdc)

- BMXCPS3020 (24...48 Vdc)
- BMXCPS4022 (24...48 Vdc)
- BMXCPS3540T (125 Vdc)
- BMXCPS3522 (125 Vdc)

A device can permanently measure the degree of 24 Vdc, 48 Vdc, or 125 Vdc insulation in relation to the ground and give an alert if the degree of insulation is abnormally low. All input/output modules in the Modicon X80 range are insulated.

Line Protection

The power supply module is intended for use in low-voltage installations, in which the main power branch is protected on both wires by devices as fuses or breakers that limit the current to 15 A for North America and 16 A for the rest of the world. For details, refer to the *standards and certifications* topic.

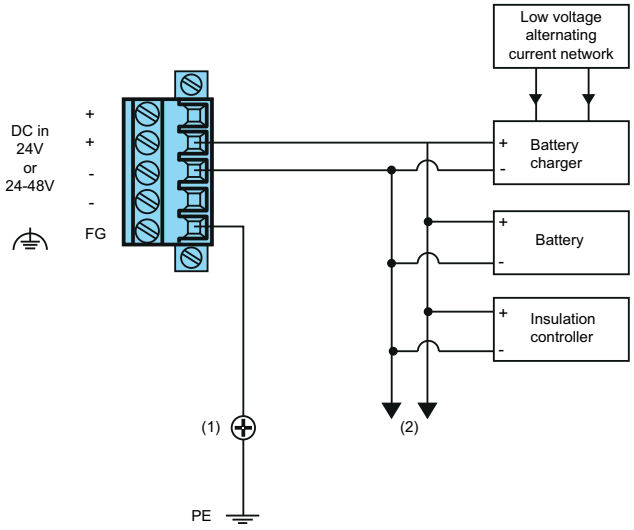
NOTE: The direct current power supply modules are already equipped with a protective fuse. This fuse, connected at input voltage, is inside the module and is not accessible.

Wiring Diagrams

power supplies

BMXCPS2010 / BMXCPS3020 / BMXCPS4022

The following diagram shows the 5-pin terminal block connections on to a floating direct current network:



(1) Ground screw of the rack

(2) Floating network for the power supply of sensors, actuators and input/output modules

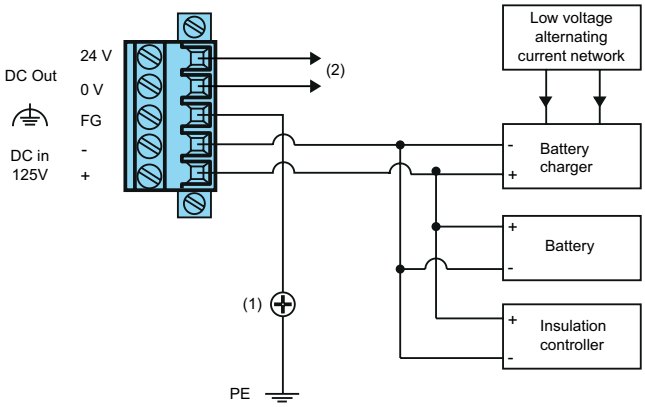
FG Functional ground

PE Protective earth

NOTE: To connect the functional ground (FG) to the protective earth (PE), refer to the *Grounding* topic.

BMXCPS3540T Wiring Diagram

The following diagram shows the 5-pin terminal block connections on to a floating direct current network:



(1) Ground screw of the rack

(2) 24 Vdc sensor power supply.

FG Functional ground

PE Protective earth

NOTE: To connect the functional ground (FG) to the protective earth (PE), refer to the *Grounding* topic.

BMXCPS3522 Wiring Diagram

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Do not connect any wiring to connections designated as No connection (NC).

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

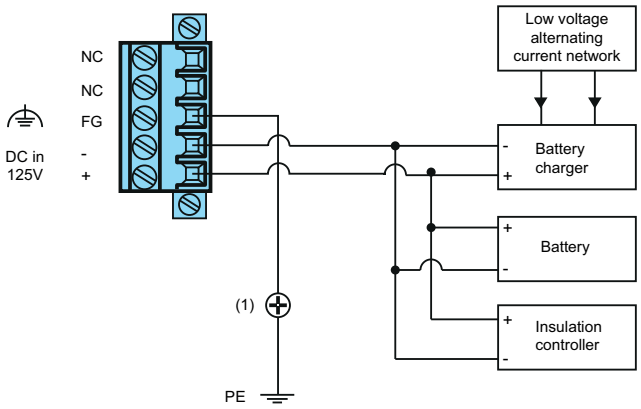
⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

Do not connect any wiring to connections designated as No connection (NC).

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

The following diagram shows the 5-pin terminal block connections on to a floating direct current network:



(1) Ground screw of the rack

NC No connection

FG Functional ground

PE Protective earth

NOTE: To connect the functional ground (FG) to the protective earth (PE), refer to the *Grounding* topic.

Alternating Current Network

Introduction

This section presents the connection of direct current power supply modules to an alternating current network:

- BMXCPS2010 (24 Vdc)
- BMXCPS3020 (24...48 Vdc)
- BMXCPS4022 (24...48 Vdc)
- BMXCPS3540T (125 Vdc)
- BMXCPS3522 (125 Vdc)

Line Protection

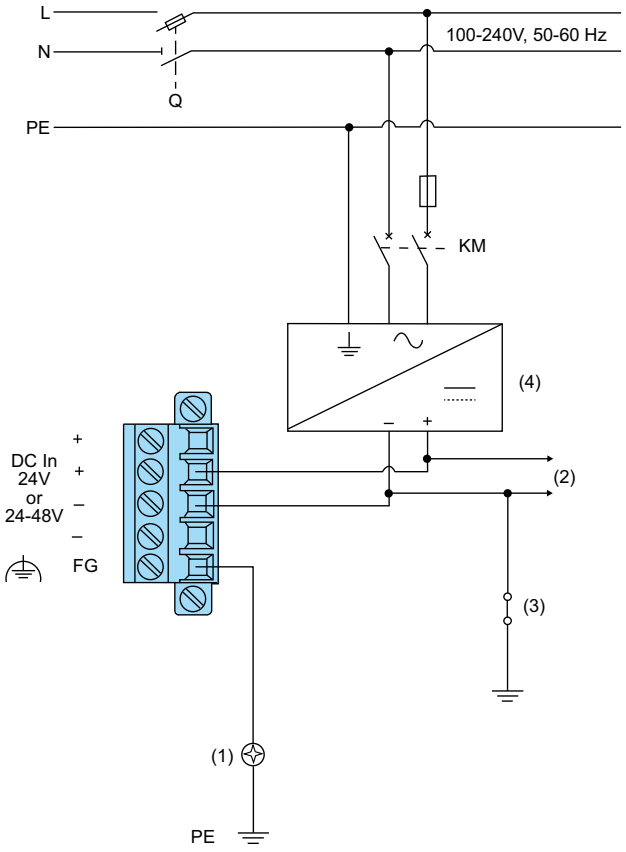
The power supply module is intended for use in low-voltage installations, in which the main power branch is protected on both wires by devices as fuses or breakers that limit the current to 15 A for North America and 16 A for the rest of the world. For details, refer to the description of *standards and certifications*.

NOTE: The direct current power supply modules are already equipped with a protective fuse. This fuse, connected at input voltage, is inside the module and is not accessible.

Wiring Diagrams

BMXCPS2010 / BMXCPS3020 / BMXCPS4022

The following diagram shows the 5-pin terminal block connections on to a grounded alternating current network:



(1) Ground screw of the rack

(2) Sensor power supply

(3) Shielding connector kit

(4) Minimum basic insulation AC/DC converter

FG Functional ground

PE Protective earth

N Neutral

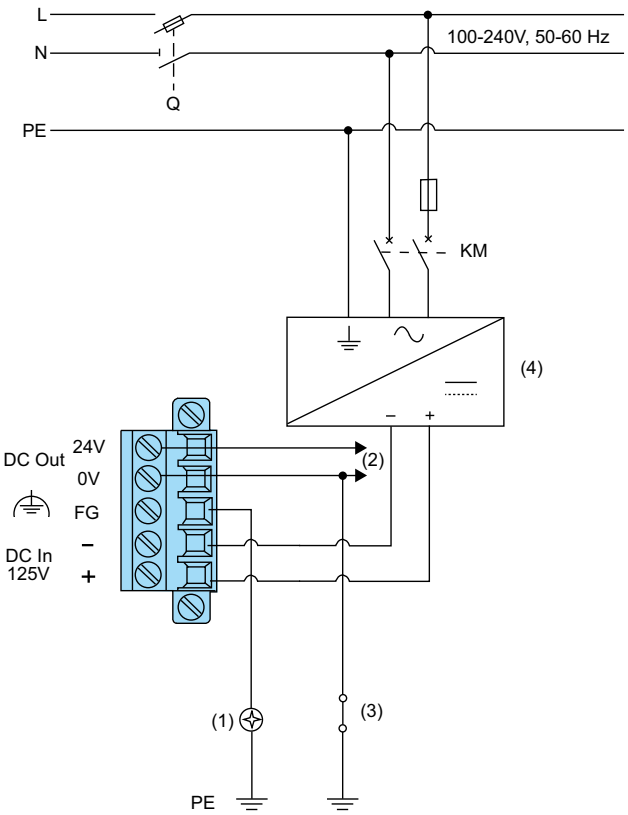
L Phase

Q General isolator

KM Line contactor or circuit breaker

NOTE: To connect the functional ground (FG) to the protective earth (PE), refer to the *Grounding* topic.

BMXCPS3540T



(1) Ground screw of the rack

(2) Sensor power supply

(3) Shielding connector kit

(4) Minimum basic insulation AC/DC converter

FG Functional ground

PE Protective earth

N Neutral

L Phase

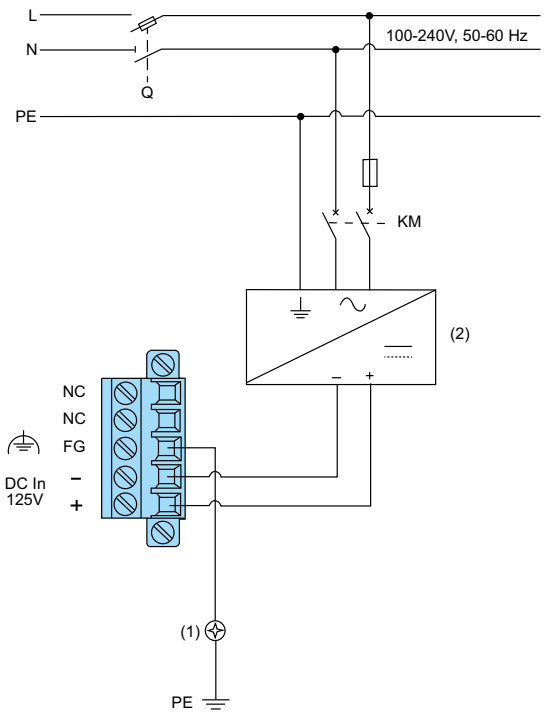
Q General isolator

KM Line contactor or circuit breaker

NOTE: To connect the functional ground (FG) to the protective earth (PE), refer to the *Grounding* topic.

BMXCPS3522

The following diagram shows the 5-pin terminal block connections on to a grounded alternating current network:



(1) Ground screw of the rack

(2) Minimum basic insulation AC/DC converter

NC Not connected

FG Functional ground

PE Protective earth

N Neutral

L Phase

Q General isolator

KM Line contactor or circuit breaker

NOTE: To connect the functional ground (FG) to the protective earth (PE), refer to the *Grounding* topic.

Sensor and Pre-actuator Power Supply

How to Set Up Sensor and Pre-actuator Power Supply

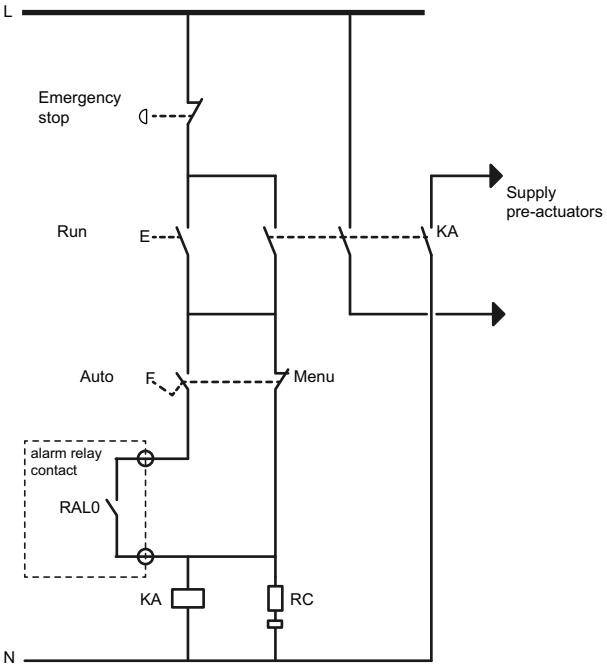
It is recommended that control of the different power supplies is set up in the following sequence.

Step	Action
1	Switch on the power supply to the PAC and the inputs (sensors), using the contactor KM (see diagram, page 711).
2	When the PAC is in RUN mode and running on MANU/AUTO, switch on the output power supply (pre-actuators), using the contactor KA. Only in AUTO, this is controlled by the alarm relay contact in each power supply. **Note:** In alternating current, the contactor KA controls the supply sensors. In direct current, the contactor KA controls the supply pre-actuators and the supply sensors.

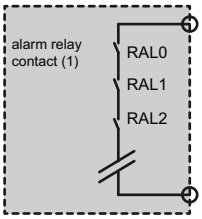
NOTE: Before restarting the installation following a stop (caused by a power outage or an emergency stop), observe the recommendations given in the *General Safety Instructions* topic.

Example 1

The following diagram shows a PAC station supplied by alternating current:



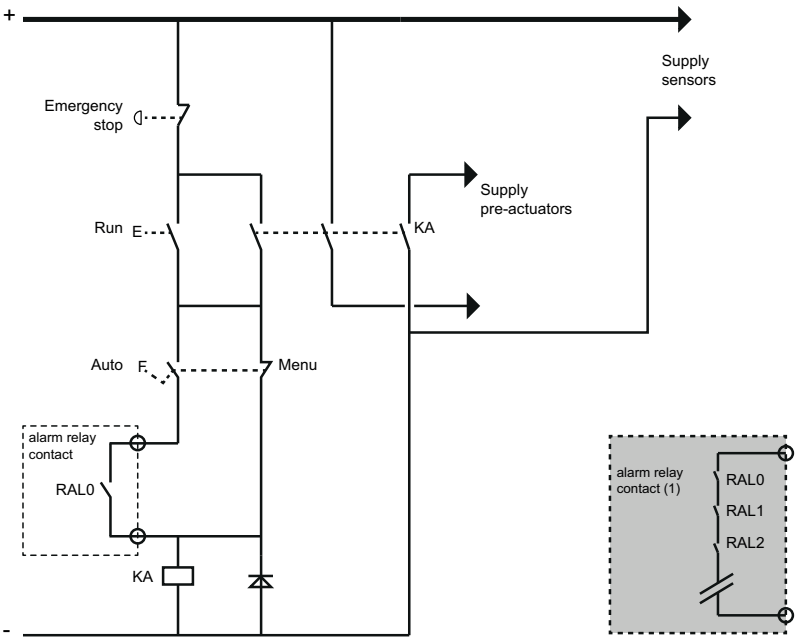
KA: contact controlled by alarm relay from supply module in AUTO run mode.



(1) When the PLC station is composed of several racks, set all the “alarm relay” contacts in series (RAL0, RAL1, RAL2, etc.).

Example 2

The following diagram shows a PAC station supplied by direct current:



KA: contact controlled by alarm relay from supply module in AUTO run mode.

(1) When the PLC station is composed of several racks, set all the “alarm relay” contacts in series (RAL0, RAL1, RAL2, etc.).

Removable Connectors Kit

General

Power supply modules are supplied with cage clamp removable terminal blocks (one 5-pin and one 2-pin). To be ordered separately, two kits are on sale:

Kit reference	Terminal block type
BMXXTSCPS10	Cage clamp
BMXXTSCPS20	Spring

Each kit contains the following equipment:

- one 5-pin terminal block
- one 2-pin terminal block
- one guidance system

⚠⚠DANGER

HAZARD OF ELECTRIC SHOCK

Disconnect the power cable of the power supply module before plugging/unplugging its terminal block.

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

Guidance System

The guidance system prevents from inserting the 5-pin terminal block wired for a power line to a power supply module designed for another current network voltage.

⚠⚠DANGER

HAZARD OF ELECTRICAL SHOCK

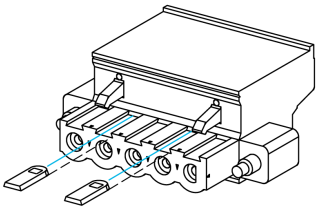
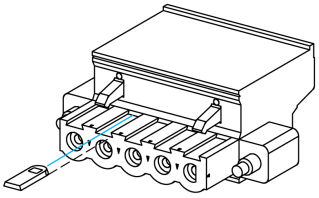
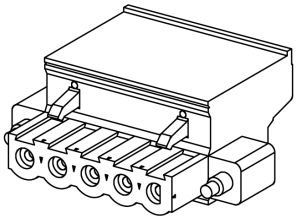
Ensure that the 5-pin terminal block of the power supply module is correctly keyed.

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

The guidance system prevents from connecting:

- a 5-pin terminal block wired for an alternating power line to a power supply module designed for a direct current network voltage.
- a 5-pin terminal block wired for a 125 Vdc power line to a power supply module designed for a 24 Vdc direct current network voltage.

The following table give the instructions to install the coding keys on 5-pin terminal blocks for each power supply module types:

Power line	Power Supply Module Reference	Instruction	Illustration
Alternating current (100...240 Vac)	BMXCPS2000 BMXCPS3500 BMXCPS3500H BMXCPS4002 BMXCPS4002H	Mount 2 coding keys in position 2 and 4.	
Direct current (125 Vdc)	BMXCPS3540T BMXCPS3522 BMXCPS3522H	Mount 1 coding key in position 2.	
Direct current (24 Vdc) and (24...48 Vdc)	BMXCPS2010 BMXCPS3020 BMXCPS3020H BMXCPS4022 BMXCPS4022H	No coding key	

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