Modicon M580

Remote I/O Modules
Installation and Configuration Guide

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Schneider Electric

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

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

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

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

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Safety Information

Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, 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.

BEFORE YOU BEGIN

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

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

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

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

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

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

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

START-UP AND TEST

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

⚠ **CAUTION**
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 injury or equipment damage.

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

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

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

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

OPERATION AND ADJUSTMENTS

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

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

About the Book

At a Glance

Document Scope

This document describes the adapter modules that can be used in X80 RIO drops.

This guide describes 3 adapter modules:
- BME CRA 312 10
- BMX CRA 312 10
- BMX CRA 312 00

NOTE: The specific configuration settings contained in this guide are for instructional purposes only. The settings required for your specific application can be different from the examples presented in this guide.

NOTE: The architectures described in this document have been tested and validated in various scenarios. If you intend to use architectures different than the ones described in this document, test and validate them thoroughly before implementing.

Validity Note

This document is valid for X80 remote I/O systems when used with Unity Pro 8.1 or later.

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

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

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

Related Documents

Title of Documentation	Reference Number
Modicon M580 System Planning Guide	HRB62666 (English), HRB65318 (French), HRB65319 (German), HRB65320 (Italian), HRB65321 (Spanish) HRB65322 (Chinese)
Modicon M580 Hardware Reference Manual	HRB62666 (English), HRB65318 (French), HRB65319 (German), HRB65320 (Italian), HRB65321 (Spanish) HRB65322 (Chinese)
Modicon M580 BME NOC 03•1 Ethernet Communication Module Installation and Configuration Guide	HRB62665 (English), HRB65311 (French), HRB65313 (German), HRB65314 (Italian), HRB65315 (Spanish), HRB65316 (Chinese)
Modicon M580 Change Configuration on the Fly User Guide	EIO0000001590 (English), EIO0000001591 (French), EIO0000001592 (German), EIO0000001594 (Italian), EIO0000001593 (Spanish), EIO0000001590 (Chinese)
Modicon M340/X80 BMX NRP 020• Fiber Optic Repeater Module User Guide	EIO0000001108 (English), EIO0000001109 (French), EIO0000001110 (German), EIO0000001111 Spanish), EIO0000001112 (Italian), EIO0000001113 (Chinese)
Modicon M340/X80 with Unity Pro Analog Input/Output Modules User Manual	35011978 (English), 35011979 (German), 35011980 (French), 35011981 (Spanish), 35011982 (Italian), 35011983 (Chinese)

Title of Documentation	Reference Number
Modicon M340/X80 with Unity Pro Discrete Input/Output Modules User Manual	35012474 (English), 35012475 (German), 35012476 (French), 35012477 (Spanish), 35012478 (Italian), 35012479 (Chinese)
Modicon M340/X80 with Unity Pro BMX EHC 0200 Counting Module User Guide	35013355 (English), 35013356 (German), 35013357 (French), 35013358 (Spanish), 35013359 (Italian), 35013360 (Chinese)
BMX ERT 1604 T Modicon M340 ERT Module User Manual	EIO0000001121 (English), EIO0000001122 (French), EIO0000001123 (German), EIO0000001124 (Spanish), EIO0000001125 (Italian), EIO0000001126 (Chinese)
System Time Stamping User Guide	EIO0000001217 (English), EIO0000001707 (French), EIO0000001708 (German), EIO0000001709 (Spanish), EIO0000001710 (Italian), EIO0000001711 (Chinese)
Applicative Time Stamping with Unity Pro User Guide	EIO0000001268 (English), EIO0000001702 (French), EIO0000001703 (German), EIO0000001704 (Spanish), EIO0000001705 (Italian), EIO0000001706 (Chinese)
Unity Pro Program Languages and Structure Reference Manual	35006144 (English), 35006145 (French), 35006146 (German), 35006147 (Spanish), 35013361 (Italian), 35013362 (Chinese)
Unity Pro Operating Modes	33003101 (English), 33003102 (French), 33003103 (German), 33003104 (Spanish), 33003696 (Italian), 33003697 (Chinese)

Title of Documentation	Reference Number
Unity Pro Installation Manual	35014792 (French), 35014793 (English), 35014794 (German), 35014795 (Spanish), 35014796 (Italian), 35012191 (Chinese)
Unity Pro Installation Manual Modicon X80 with Unity Pro HART Analog Input/Output Modules User Guide	EAV16400 (English), EAV28404 (French), EAV28384 (German), EAV28360 (Spanish), EAV28413 (Italian), EAV28417 (Chinese)

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

Chapter 1
Characteristics of Ethernet Remote I/O Modules

Introduction

This chapter describes the adapter modules that can be used in the remote drops of an X80 system. Specifically, these modules are:

- BME CRA 312 10
- BMX CRA 312 10
- BMX CRA 312 00

This chapter includes physical characteristics, port descriptions, and agency specifications for these modules.

What Is in This Chapter?

This chapter contains the following topics:

Adapter Module Descriptions

Introduction

A remote I/O drop consists of 1 or 2 racks of Modicon X80 I/O modules and/or third-party PME SWT 0100 modules. A remote I/O drop is connected to the daisy-chain loop on which the Ethernet remote I/O network resides. Each remote drop contains one BM• CRA 312 •0 adapter module. Each rack in a remote drop contains its own power supply module.

Remote adapter modules are available as Ethernet BME and X Bus BMX communicators. To use X80 I/O modules that require Ethernet, choose a BME-style adapter module. If your X80 I/O uses only X Bus for backplane communication, then you can use a BMX-style adapter module.

The adapter modules are:

Adapter	Description
X80 standard EIO adapter	The BMX CRA 312 00 is a basic adapter module that supports X Bus communications across the remote backplane, but not Ethernet. It does not support: ● more than 9 I/O modules ● an extension rack ● special-purpose or Ethernet I/O modules ● native timestamping ● service port ● I/O to be solved more than once per logic scan in the remote drop. (It only handles MAST *(see page 69)* tasks. Your application cannot assign FAST and AUX tasks in it.
X80 performance EIO adapter	The BMX CRA 312 10 adapter module supports X Bus communications across the remote backplane, but not Ethernet. It supports: ● up to 17 I/O modules ● an extension rack ● special-purpose modules ● native timestamping ● service port ● MAST *(see page 69)*, FAST *(see page 69)*, and AUX0 *(see page 69)*/AUX1 *(see page 70)* task customization of the I/O scanner service
eX80 performance EIO adapter	The BME CRA 312 10 adapter supports Ethernet and X Bus communications across the remote backplane. This adapter needs to be installed in an Ethernet backplane. It supports: ● the capabilities of a BMX CRA 312 10 adapter ● Ethernet I/O modules on rack slots connected to the Ethernet backplane in the remote drop, such as the BME AHI Hart-compatible analog module, BME AHO 0412 and, PME SWT 0100 modules

Functionality

The adapters exchange data via an I/O scanner service, which resides in the CPU on the main local rack of your PAC system:

● The input data from the remote I/O drop is collected and published to the I/O scanner.
● The output modules are updated with the data received from the I/O scanner.
● The protocol used for exchange is EtherNet/IP.
● The exchanges are deterministic, which means that the remote I/O logic is scanned regularly in a scheduled and predictable manner.

NOTE: Refer to your system hardware reference manual to select a CPU that supports the I/O scanner capability.

External Features

These adapter modules have the same dimensions and installation constraints as the other modules in the Modicon X80 product line:

BME CRA 312 10
BMX CRA 312 10   **BMX CRA 312 00**
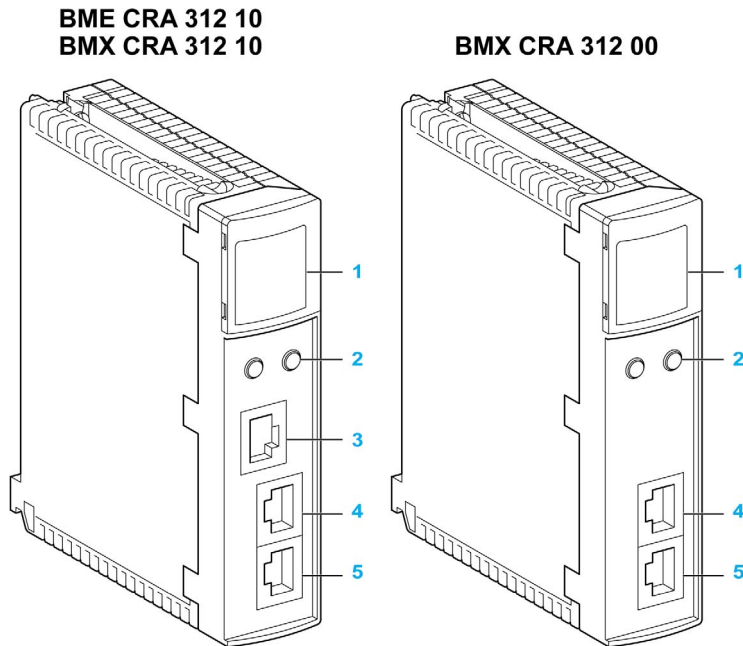
1 LED display
2 rotary switches
3 SERVICE port (ETH 1)
4 DEVICE NETWORK port (ETH 2)
5 DEVICE NETWORK port (ETH 3)

NOTE: Refer to the LEDs *(see page 17)*.

The Ethernet ports are labeled on the front of the modules.

NOTE: Insert dust covers into the unused Ethernet ports on the adapter modules:
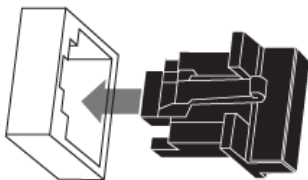
LED Indicators on Adapter Modules

Display

The LEDs are on the front of the adapter module:

● RUN ● I/O
● MS ● NS

Indications

LED conditions:

Module State[1]	Description	Run	IO	MS (Module Status)		NS (Network Status)	
		Green	Red	Green	Red	Green	Red
power-up sequence	Order of LEDs blinking	1	2	3	4	5	6
not configured	IP address not valid	-	-	flashing	off	off	off
	valid IP address, but invalid configuration	off	off	flashing	off	flashing	off
configured	no external error detected	flashing	off	-	-	flashing	off
	external error detected	flashing	on	-	-	flashing	off
I/O data communication established	STOP	flashing	(NOTE 1)	on	off	on	off
	RUN	on	(NOTE 2)	on	off	on	off
detected error states	recoverable error	-	-	off	flashing	-	-
	nonrecoverable error	flashing	on	off	on	-	-
	duplicate IP address	-	-	-	-	off	on
during OS firmware update		flashing	off	off	on	off	on

(1) For more information about the module states, refer to your system hardware reference manual.

NOTE 1 (STOP state):
● on: An input or output is a detected error that originates in a module, or a channel configuration or a channel configuration error has been detected.
● off: Operations are normal.

NOTE 2 (RUN state):
● on: External error is detected.
● off: External error is not detected.

Ethernet Port Indications
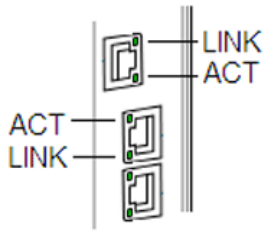
These LEDs report the status of the Ethernet port:

Name	Color	Status	Description
LINK	green	on	100 Mbps link detected
	yellow	on	10 Mbps link detected
	-	off	no detected link
ACT	green	blinking	active Ethernet link (transmit or receive)
	-	off	inactive Ethernet link

Adapter Ethernet Ports

Ethernet Port Descriptions

2 of the Ethernet ports allow implicit I/O exchanges with the I/O scanner in the CPU. (An implicit I/O exchange has a maximum frame size of 1400 bytes.) The ports can be implemented alone or in redundant mode.

You can use a maximum of 8 or 16 adapters in a single Ethernet remote I/O network depending on the CPU used. For network topology planning, refer to the planning guide for your system.

These adapter modules have 2 or 3 10/100 Base-T Ethernet ports:

Port	Description
SERVICE	The SERVICE port allows the diagnosis of Ethernet device network ports and provides access to external tools and devices (Unity Pro, ConneXium Network Manager, HMI, and so forth). 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 **NOTE:** ● The BMX CRA 312 00 does not have a SERVICE port. ● You can configure the SERVICE port either ONLINE or OFFLINE. ● In port mirroring mode, the SERVICE port acts like a read-only port. That is, you cannot access devices (ping, connection to Unity Pro, and so forth) through the SERVICE port. Refer to *Service Port Configuration (see page 52)*.
DEVICE NETWORK	The DEVICE NETWORK copper ports are used to put the drop on the simple daisy chain loop. They provide: ● connections for remote I/O communications ● 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.

Connecting a device with a speed in excess of 100 Mbit/s , the Ethernet link may not be established between the device and the module through its port.

BME CRA 312 10 Keying Pin

The BME CRA 312 10 adapter is designed to be installed on an Ethernet backplane in the main remote rack. The adapter supports the Modicon X80 I/O and partner modules with both Ethernet and X Bus connections. The 2 bus connectors are shown in items 1 and 2 below.

The adapter also has a keying pin (item 3 below) to keep it from being installed on a BME XBP PV 01 backplane.

Rear view of the adapter module:

BME CRA 312 10
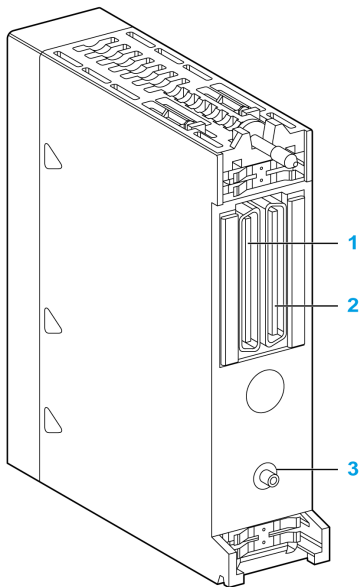
1 X Bus backplane connector
2 Ethernet backplane connector
3 Keying pin

Remote I/O Network Cable Installation

Introduction

Use a daisy chain loop network configuration that implements the RSTP service to establish redundant communications with at least one of the 2 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 network topology planning, refer to your system planning guide.

NOTE: Fiber optic ports are not available on the adapter modules. For fiber optic support use either a BMX NRP 0200 optic fiber conversion module or a pair of DRSs.

Remote I/O Simple Daisy Chain Loop

The CPU supports communications with remote I/O drops in a daisy chain loop:
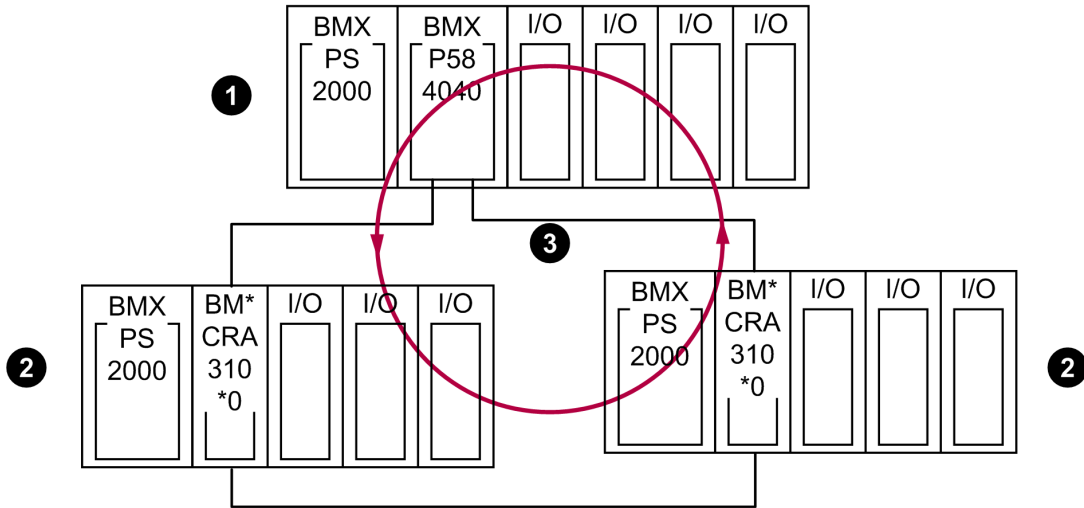
1 main local rack with a BME P58 ••40 CPU with the I/O scanner service
2 X80 remote I/O drops with a BM• CRA 312 •0 adapter module
3 the daisy chain loop

Modicon X80 I/O Modules

Introduction

The following I/O modules can be mounted in local racks or RIO drops in an M580 system.

Some of these modules also contain embedded web pages that can be used for configuration and diagnostics. Web page descriptions are provided in the appropriate product documentation and in Unity Pro help.

NOTE: Conformally coated (hardened H) versions of many of these modules are also available.

Modicon X80 Analog and Discrete Modules

Modules that require Ethernet across the backplane can be installed only in main local or remote local racks. They cannot be installed in extended racks.

These I/O modules are supported in Modicon X80 local racks containing a CPU and RIO drops:

Type of Module	Module	Comments	Installation on...			
			Main Local Rack	**Extended Local Rack**	**Main Remote Rack**	**Extended Remote Rack**
Analog I/O Modules						
input	BME AHI 0812[(1)]	These require an Ethernet backplane and a BME CRA 312 10 eX80 performance EIO adapter module if they are inserted in a remote drop.	X	—	X	—
output	BME AHO 0412[(1)]		X	—	X	—
input	BMX AMI 0410	No backplane or EIO adapter module restrictions	X	X	X	X
input	BMX AMI 0800		X	X	X	X
input	BMX AMI 0810		X	X	X	X
input/output	BMX AMM 0600		X	X	X	X
1 These modules require an Ethernet backplane.						
2 In the CPU configuration screen in Unity Pro, you can configure a digital I/O module channel as a **RUN**/**STOP input** by selecting this check box. This can be performed on a local I/O channel in topological I/O data type only.						
3 Before installation of I/O modules that use a 125 Vdc power supply, refer to the temperature derating information in I/O module hardware guides for your platform.						
X allowed						
— not allowed						

Type of Module	Module	Comments	Installation on...			
			Main Local Rack	Extended Local Rack	Main Remote Rack	Extended Remote Rack
output	BMX AMO 0210		X	X	X	X
output	BMX AMO 0410		X	X	X	X
output	BMX AMO 0802		X	X	X	X
input	BMX ART 0414	The FAST task is not supported.	X	X	X	X
input	BMX ART 0814		X	X	X	X
Discrete I/O Modules[2]						
input	BMX DAI 0805		X	X	X	X
input	BMX DAI 1602		X	X	X	X
input	BMX DAI 1603		X	X	X	X
input	BMX DAI 1604		X	X	X	X
output	BMX DAO 1605		X	X	X	X
input	BMX DDI 1602		X	X	X	X
input	BMX DDI 1603		X	X	X	X
input	BMX DDI 1604[3]		X	X	X	X
input	BMX DDI 3202 K		X	X	X	X
input	BMX DDI 6402 K		X	X	X	X
input/ output	BMX DDM 16022		X	X	X	X
input/ output	BMX DDM 16025		X	X	X	X
input/ output	BMX DDM 3202 K		X	X	X	X
output	BMX DDO 1602		X	X	X	X
output	BMX DDO 1612		X	X	X	X
output	BMX DDO 3202 K		X	X	X	X
output	BMX DDO 6402 K		X	X	X	X
output	BMX DRA 0804[3]		X	X	X	X
output	BMX DRA 0805[3]		—	—	X	X
output	BMX DRA 1605		—	—	X	X
1 These modules require an Ethernet backplane.						
2 In the CPU configuration screen in Unity Pro, you can configure a digital I/O module channel as a **RUN/STOP input** by selecting this check box. This can be performed on a local I/O channel in topological I/O data type only.						
3 Before installation of I/O modules that use a 125 Vdc power supply, refer to the temperature derating information in I/O module hardware guides for your platform.						
X allowed						
— not allowed						

NOTE: Schneider Electric recommends that you use Unity Loader to upgrade the modules with the latest available version. (It is not necessary to update a BMX ART 0414 module, V2.1 or later, as it works correctly with a BM• CRA 312 •0X80 EIO adapter module.)

Intelligent and Special Purpose Modules

These intelligent/special purpose modules are supported in M580 local racks (containing a CPU with Ethernet I/O scanner service) and RIO drops that contain a BM• CRA 312 •0 X80 EIO adapter module:

Type	Module	Comment	Installation on...			
			Main Local Rack	Extended Local Rack	Main Remote Rack	Extended Remote Rack
communication	BMX NOM 0200[1][2][3]	The FAST task is not supported.	X	X	X	X
	BMX NOR 0200[1][2]	Not supported in RIO drops. The FAST task is not supported.	X	X	—	—
	BMX EIA 0100	A maximum of 4 AS-i modules per main/extended local racks is allowed. A maximum of 2 AS-i modules per drop is allowed. A maximum of 16 AS-I modules is allowed in the drops in an M580 system.	X	X	X	X

1 If a BMX NOM 0200 module and a BMX EIA 0100 module are included on the same RIO drop, only one of each module is allowed.
2 Only MAST tasks are supported.
3 The Modbus character mode is supported.
X allowed
— not allowed

NOTE: The maximum number of communication modules you can install on the local rack depends upon the CPU you choose.

Type	Module	Comment	Installation on...			
			Main Local Rack	Extended Local Rack	Main Remote Rack	Extended Remote Rack
counting	BMX EHC 0200		X	X	X	X
	BMX EHC 0800		X	X	X	X
	BMX EAE 0300	In RIO drops: • Events are not supported. If events are needed, move the module to the local rack. • A maximum of 36 channels can be configured.	X	X	X	X
time stamping	BMX ERT 1604T		X	X	X	X
fiber cable conversion	BMX NRP 0200		X	X	X	X
motion	BMX MSP 0200	It is not supported in RIO drops	X	X	—	—
weighing	PME SWT 0100(5)	This is an Ethernet weighing transmitter (1 channel).	X	—	X	—

1 If a BMX NOM 0200 module and a BMX EIA 0100 module are included on the same RIO drop, only one of each module is allowed.
2 Only MAST tasks are supported.
3 The Modbus character mode is supported.
X allowed
— not allowed

NOTE: The maximum number of communication modules you can install on the local rack depends upon the CPU you choose.

Modicon X80 Analog and Discrete Module Versions

When the following modules are used in a local rack (containing a CPU) and RIO drops, they require these versions:

Module	Product Version	Software Version
BMX AMI 0410	PV5	SV1.1
BMX AMM 0600	PV5 or later	SV1.2
BMX AMO 0210	PV7 or later	SV1.1

Module	Product Version	Software Version
BMX ART 0414	PV5, PV6	SV2.0
	PV7	SV2.1
BMX ART 0814	PV3, PV4	SV2.0
	PV5 or later	SV2.1
BMX EHC 0200	PV3	SV1.1
BMX EHC 0800	PV3	SV1.1

Hardened Modules

These hardened modules are supported in M580 local racks (containing a CPU) and RIO drops that contain a BM• CRA 312 •0 EIO adapter module. For details regarding hardened modules, refer to the manuals for each of these modules.

Type of Module	Module
counting	BMX ECH 0200 H
synchronous serial interface (SSI)	BMX EAE 0300 H
analog input	BMX ART 0414 H
	BMX ART 0814 H
	BMX AMI 0810 H
analog output	BMX AMP 0210 H
	BMX AMO 0410 H
	BMX AMO 0810 H
discrete input	BMX DDI 1602 H
	BMX DDI 1603 H
discrete output	BMX DAO 1602 H
	BMX DDO 1605 H
	BMX DDO 1612 H
	BMX DRA 0805 H
	BMX DRA 1605 H
discrete input/output	BMX DAI 1602 H
	BMX DAI 1603 H
	BMX DAI 1604 H
	BMX DDM 16022 H
	BMX DDM 16025 H
TELEFAST wiring accessories	ABE7 CPA 0410 H
	ABE7 CPA 0412 H

Hardened (H) Equipment

M580H

The hardened (H) equipment is a ruggedized version of the equipment in your system. It can be used at extended temperatures (-25...70ºC) (-13...158ºF) and in harsh chemical environments. This equipment is ATEX certified.

This treatment increases the isolation capability of the circuit boards and their resistance to:
● condensation
● dusty atmospheres (conducting foreign particles)
● chemical corrosion, in particular during use in sulphurous atmospheres (oil, refinery, purification plant and so on) or atmospheres containing halogens (chlorine and so on)

The hardened equipment, when within the standard temperature range (0...60ºC) (32...140ºF), has the same performance characteristics as the standard equipment.

If this equipment is operated outside the -25...70ºC (-13...158ºF) temperature range, the equipment can operate abnormally.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
Do not operate hardened equipment outside of its specified temperature range.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

Hardened equipment has a conformal coating applied to its electronic boards. This protection, when associated with appropriate installation and maintenance, allows it to be more robust when operating in harsh chemical environments.

Standards, Certifications and Operational Recommendations

Standards and Certifications

For this information, refer to Standards and Certifications *(see Modicon M580, Hardware, Reference Manual)*.

Operational and Environmental Recommendations

For this information, refer to Operational and Environmental Recommendations *(see Modicon M580, Hardware, Reference Manual)*.

Chapter 2
Installation

Overview

This chapter describes the hardware installation of an Modicon X80 remote I/O drop.

What Is in This Chapter?

This chapter contains the following sections:

Section 2.1
Installing Modicon X80 Modules

At a Glance

This section describes the installation of an Modicon X80 I/O adapter module.

What Is in This Section?

This section contains the following topics:

Maximum Configuration in Remote I/O Drops

Maximum Configuration

The maximum number of I/O modules in an Modicon X80 remote I/O drop (with both a main remote rack and an extension remote rack) using a BM• CRA 312 •0 adapter depends on the CPU used in the main local rack.

Refer to your system hardware reference manual toensure that you select a CPU that supports the number and types of I/O modules you need.

This table shows the maximum number of modules in a remote I/O drop with a remote extension rack:

Module Type	Number of Modules in a Drop
remote I/O adapter	1
power supply	2
bus extension[1]	2
I/O[2]	Depends on the CPU and platform used
(1) A bus extender attaches to the end of each rack and does not use a rack slot. **(2)** Refer to the list of modules that remote I/O installations support *(see page 22)*.	

Modicon X80 Backplane Considerations

Introduction

An X80 remote I/O drop can have 1 or 2 racks:

1. main remote I/O rack: BME XBP • •00 or BMX XBP • •0
   This rack is required in a drop and contains a BMX CRA 312 00, BME CRA 312 10, or
   BMX CRA 312 10 adapter, a power supply, and, optionally, I/O modules.
2. extended remote I/O rack: only BMX XBP • •0
   This rack is optional in a drop and contains only I/O modules.
   Extended remote racks must be PV 02 or higher backplane. This means that any modules that
   require Ethernet across the backplane must go in the main remote rack.
   NOTE: The BMX CRA 312 00 does not support an extended remote I/O rack.

NOTE: The mounting screws on the left side of the backplane may be accessible without
unplugging the power supply module. Mount the backplane using the far left fastening hole on the
panel.

Compatible Racks

The following racks can be used in an Modicon X80 remote I/O drop:

- X BUS (PV 02 or later) backplanes:
  - BMX XBP 0400
  - BMX XBP 0600
  - BMX XBP 0800
  - BMX XBP 1200
  - BMX XBP 0400 H
  - BMX XBP 0600 H
  - BMX XBP 0800 H
  - BMX XBP 1200 H

- Ethernet backplanes:
  - BME XBP 0400
  - BME XBP 0800
  - BME XBP 1200[1]
  - BME XBP 0400 H
  - BME XBP 0800 H
  - BME XBP 1200 H[1]

(1) The 12-slot Ethernet rack has 8 Ethernet-X Bus slots and 4 X Bus-only slots.

Rack Selection Considerations

A BME CRA 312 10 adapter:
- must be installed in an Ethernet rack.
- installed in a PV 02 or higher backplane, it is not damaged but it does not start.
- cannot be installed in a PV 01 backplane because of its keying pin *(see page 20)*.

For a BMX CRA 312 10 or a BMX CRA 312 00 adapter:
- install it in a PV 02 or higher backplane.
- if installed in an Ethernet backplane, it cannot handle any Ethernet modules. However, it can handle modules that is handles in a PV 02 or higher backplane.

Racks and Extensions

An Modicon X80 remote I/O drop can include 2 racks. In a 2-rack drop, the racks are linked with 2 bus extender modules and a cable:

Bus Extender Module	Cable
BMX XBE 1000	BMX XBC •••K (0.8 to 12 m)

Grounding Considerations

⚠⚠ **DANGER**

ELECTRICAL SHOCK HAZARD

- Switch off the power supply to the PAC at both ends of the connection before inserting or removing an Ethernet cable.
- Use suitable insulation equipment when inserting or removing all or part of this equipment.

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

Do not apply power to an Modicon X80 rack until connections are made at both ends of the Ethernet cable. For example, connect the cable to both the BME CRA 312 10 and another device (adapter module) or DRS before you turn on the power.

Refer to your system hardware reference manual for details about the DRSs.

Use fiber-optic cable to establish a communications link when it is not possible to master the potential between the 2 grounds.

Adapter and I/O Module Installation

Introduction

Observe the following guidelines when you install these adapter modules in an Modicon X80 remote I/O drop):
- BME CRA 312 10
- BMX CRA 312 10
- BMX CRA 312 00

Order of Module Installation

Install modules in the selected rack in Unity Pro in this order:
1. install the adapter module
2. install a power supply
3. install I/O modules

Grounding Considerations

> ### ⚠ ⚠ DANGER
>
> **ELECTRICAL SHOCK HAZARD**
> - Switch off the power supply to the PAC at both ends of the connection before inserting or removing an Ethernet cable.
> - Use suitable insulation equipment when inserting or removing all or part of this equipment.
>
> **Failure to follow these instructions will result in death or serious injury.**

Use fiber optic cable to establish a communications link when it is not possible to equalize the potentials between 2 grounds.

NOTE: Refer to the ground connection information in the *Grounding and Electromagnetic Compatibility of PLC Systems User Manual*.

Installation of the Adapter

Unity Pro automatically installs a BM• CRA 312 •0 adapter module in slot 0 in a remote I/O drop.

Select a Power Supply

Power consumption is 1.2 A on a 5 Vdc power rail on the backplane (6 W). The adapter module supports modules on 1 or 2 racks. (Power consumption has no relation to the number of installed rack modules.)

In Modicon X80 Ethernet remote I/O drops, insert the power supply only in the double-wide slot to the left of slot 0 marked **CPS**.

Select a power supply that suits your system requirements. These power supplies, and their hardened *(see page 27)* versions, are supported:
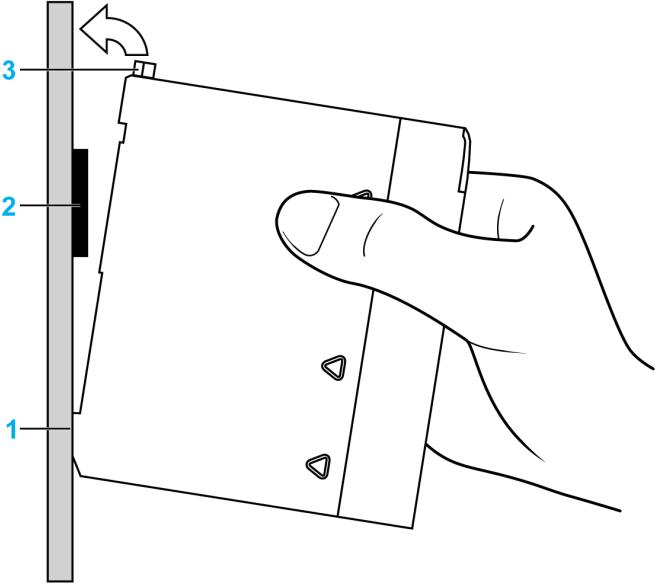
Power Supply Type	Modicon X80 Module
standalone	● BMX CPS 2010 ● BMX CPS 3020 ● BMX CPS 2000 ● BMX CPS 3500 ● BMX CPS 3540
redundant	● ABL 8RED 24400 ● ABL 8REM 24030 ● ABL 8RPS 24030

Select I/O Modules

Use the Unity Pro Hardware Catalog to select the I/O modules needed in your application in the main remote rack and, if available, the extended remote rack.

Mounting a Module

Use this procedure to install adapters and I/O modules in a rack:

Step	Action
1	Hold the module at an angle and mount it on the 2 hooks near the bottom of the backplane. The figure shows the correct way to hold the module:
2	Swing the module up so that the connector engages the backplane connector.
3	Use a phillips-head screw driver to tighten the screw at the top of the module 2...4 in-lbs (0.22 to 0.45 N•m) of torque.

Replacing a Module

You can replace an Modicon X80 module at any time using another module with compatible firmware. The replacement module obtains its operating parameters over the backplane connection from the CPU. The transfer occurs immediately at the next cycle to the device.

NOTE: The operating parameters that the CPU sends to a replacement module do not include any parameter values that were edited in the original module using explicit messaging **SET** commands.

Installation Results

Applying power to the main local rack after the adapter module is installed can result in either:
- Successful installation:
  - Initialization is finished.
  - Interconnections to other modules are validated (drop adapter module only).

- Unsuccessful installation:
  - Initialization does not finish.
  - Interconnections to other modules are not validated (drop adapter modules only).

You can see the status of the installation on the adapter LED display .

Setting the Location of the Ethernet Remote I/O Drop

Setting Rotary Switches

Set the location of the remote I/O drop on the network with the rotary switches on the front of the adapter module:
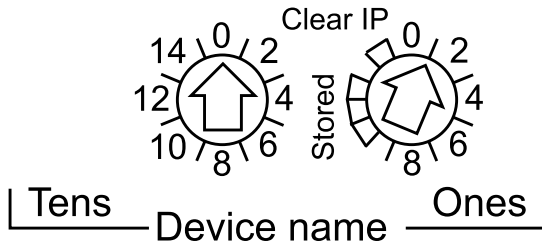
NOTE: Set the rotary switches before you apply power to the module and before you download the application.

The values you set are applied during a power cycle. If you change the switch settings after the module has powered up, the Module Status LED *(see page 17)* is activated and a mismatch message is logged in the module diagnostic.

If you want to return to the original setting of a modified rotary switch (and the other switch was changed), turn the switch until the Module Status LED goes from red to green.

New values on the rotary switches are implemented at the next power cycle. Set the value before starting the module (valid values: 00 ... 159).

The values on the rotary switches combine with the device prefix (for example, BMECRA_*xxx* or BMXCRA_*xxx*) to create the device name (where *xxx* represents the value of the rotary switches). The preceding figure shows the Tens switch set to 00 and the Ones switch set to 1, for a device name of BMECRA_001.

NOTES:
- The rotary switches can be manipulated with a small flat-tipped screwdriver.
- No software is required to configure or enable the rotary switches.
- Do not use the Stored and Clear IP settings on the Ones rotary switch as they do not apply to remote I/O installations.

Section 2.2
Remote I/O Infrastructure Cables

What Is in This Section?

This section contains the following topics:

Topic	Page
Cable Installation	40
Duplicate IP Address Checking	42
Loss of I/O Connection	43

Cable Installation

Introduction

A copper cable connection between 2 consecutive remote I/O drops cannot exceed 100 m. A fiber cable connection between 2 consecutive remote I/O drops cannot exceed 15 km (single mode) or 2.5 km (multi-mode).

For more information, refer to racks installation and assembly *(see Modicon M580, Hardware, Reference Manual)* and grounding and cabling *(see Grounding and Electromagnetic Compatibility of PLC Systems, Basic Principles and Measures, User Manual)*.

Connections Between Devices

This figure shows the distances between remote I/O drops in a high-capacity daisy chain loop:
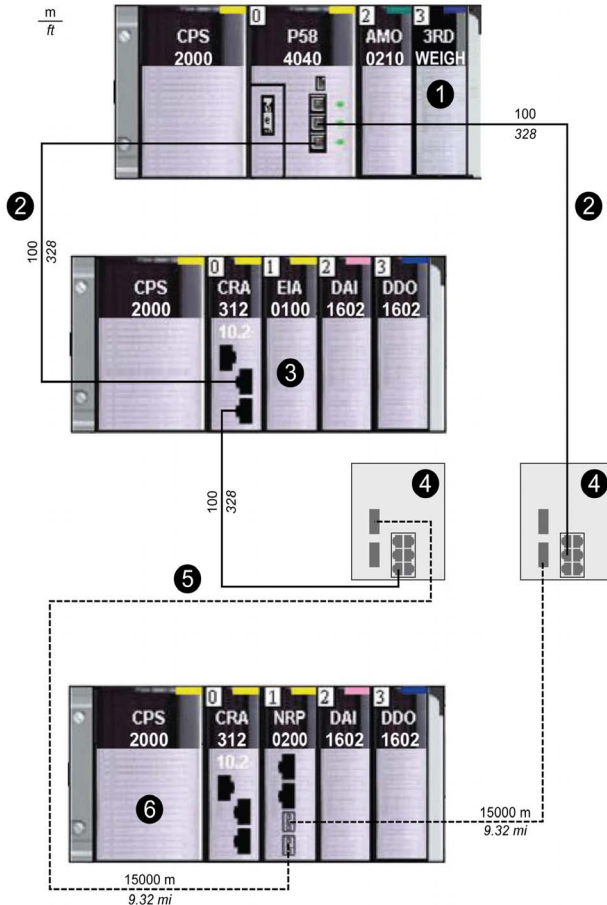
1   main local rack
2   copper cable (twisted pair)
3   remote I/O drop
4   DRSs (with copper and optic fiber ports): This DRS extends the distance between devices using fiber optic cable (up to 15 km).
5   fiber optic cable
6   remote I/O drop with a BMX NRP 0200 fiber converter module

NOTE: We recommend the use of shielded twisted pair CAT5e (10/100 Mbps) cables, especially ConneXium 490NTC•000•• cables.

Duplicate IP Address Checking

Introduction

Each adapter has a single IP address for its Ethernet ports. Therefore, the address conflict detection algorithm (duplicate IP checking) is performed based on the status (link up, link down) of the ports.

Link Down

These conditions apply when links are lost:

Link Status	Description
A transition has occurred from 1 connected link to all links down.	When no module ports are connected to a cable (all links are down), all services are reset. For example, I/O connections, Modbus connections, and explicit EtherNet/IP connections close, but low-level network services (like RSTP or switches) are not affected. The updated Net Status LED indicates the status.
There is 1 link down and at least 1 connected link.	There is no impact on services that are running in the module.

Link Up

These conditions apply when links are added:

Link Status	Description
A transition has occurred from no connected links to 1 connected link.	A duplicate IP check is performed: ● *no duplicate*: All services start. ● *duplicate*: I/O services stop. The BM• CRA 312 •0 adapter module gets new configuration and downloads the IP configuration again. The system goes to default IP and the I/O modules are set to the fallback mode.
A transition has occurred from at least 1 connected link to an additional connected link.	A duplicate IP check is performed: ● *no duplicate*: All services continue. ● duplicate: All services stop. **NOTE:** The updated Net Status LED *(see page 17)* indicates the status.

Loss of I/O Connection

Conditions

An I/O connection can be lost to a BME CRA 312 10 or BMX CRA 312 •0 under these conditions:
- Performing a hot swap by replacing an adapter module with the same type.
- There is no remote I/O cable connection.
- The I/O connection is closed while the CPU is reconfigured.

Remote Adapter Fallback

In some instances, the remote I/O adapter module can lose I/O connections for a period longer than the configured hold up time. During the hold up, the adapter tries to get IP and configuration parameters from the BME P58 ••40 CPU. If the adapter does not obtain those parameters during the hold up time, the following happens:
- *inputs*: retain last known values
- *outputs*: set to configured fallback value

NOTE: Configure the hold up time on the Unity Pro **Parameter** tab *(see page 54)*. For more information, refer to your system planning guide.

Adapter Hot Swap

From the system point of view, during an adapter hot swap, when the adapter is removed the I/O values go to fallback values. When the new adapter inserted and switches on and is configured, the I/O values reset to their values before the hot swap.

To reduce the number of transitions after a hot swap, set the configured fallback state the same as the default fallback state (module powered-on but not configured) before performing the hot swap.

Chapter 3
Configuration and Programming with Unity Pro

Introduction

Use Unity Pro to configure your remote drops for Ethernet communications.

What Is in This Chapter?

This chapter contains the following sections:

Section 3.1
Creating a Unity Pro Project

Configuring the Remote I/O Drop

Rack Considerations

Remote I/O rack considerations:
- The number of the first slot in a X80 rack is 0. Therefore, a 4-slot rack includes slot numbers 0, 1, 2, 3.
- You can cut or copy other devices in the remote drop and paste them in any rack of the same type, but you cannot move objects from a local rack to the drop or from a drop to the local rack. Also, you can only perform these actions (cut, copy, paste) in the same device editor.

Configuring a Remote Main Remote I/O Drops

When a BME P58 ••40 CPU module in the main local rack Unity Pro automatically creates a second bus, the **EIO Bus**.

Use these instructions to configure a main remote I/O drop (on a **EIO Bus**):

Step	Action	Comment
1	In the **Project Browser**, double-click **EIO Bus** to see the (empty) remote I/O local rack.	**Tools** →**Project Browser** → **Structural view** →**Project** → **Configuration** →**EIO Bus**
2	In the **EIO Bus** window, double-click the square link connector to access the available racks.	The **New Device** dialog appears.
3	Select a rack.	This example uses the 4-slot BME XBP 0400 rack: **New Device** → **Part Number** →**Modicon M580 remote drop** →**Rack** → **BME EEP 0400**.
4	In the `Drop end communicator` area, select a CRA adapter.	This example uses the default BME CRA 312 10 adapter.
5	Click **OK**.	The rack with the CRA adapter opens.
6	Click the rack to the left of the CRA adapter to add a power supply.	This example uses a `BMX CPS 2000`.
7	Double-click empty slots to add **Modicon M580 remote drop** modules to the **EIO Bus**.	For this example, none are added.
8	Save the file.	Click **File** →**Save**.

To add:
- another remote I/O drop, click the rounded square at the bottom of the dialog
- a remote drop extension rack, click the **>>** on the right side of the remote drop main rack
  NOTE: When physically installing a remote drop extension rack, add Bus Extender modules and cables *(see page 33)*.

Maximum Channel Configuration

The maximum number of channels that can be configured for an X80 Remote I/O drop is either:
- 1024 digital channels
- 1024 channels that include 256 analog channels

The number maximum of input channels that can be configured for analog modules is 236. In such a configuration, no other modules can be configured in the remote I/O drop.

NOTE: If a serial Modbus network is added to a remote I/O drop, take in to account the number of channels declared when calculating the number maximum of channel supported by the remote I/O drop.

Unity Pro Configuration Tabs

After you have placed your modules in the remote drop, double-click the remote I/O drop adapter module to see the available Unity Pro configuration tabs:
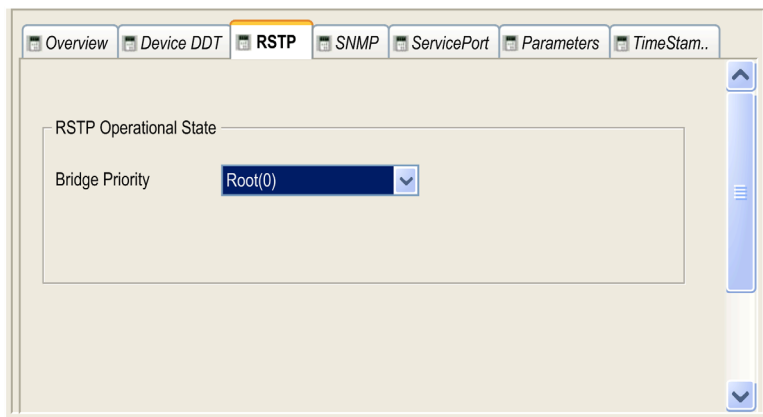
- Device DDT *(see page 59)*
- RSTP *(see page 49)*
- SNMP *(see page 50)*
- Service port *(see page 52)*
  The service port is not available on a drop with a BMX CRA 312 00 adapter.
- Parameters *(see page 54)*
- Time Stamping *(see page 57)*

Section 3.2
Unity Pro Configuration for Remote I/O Ethernet Modules

Overview

This section describes the module configuration tabs in Unity Pro. Use the parameters on these tabs to configure services for a BM• CRA 312 •0 adapter module in an Ethernet remote I/O drop.

What Is in This Section?

This section contains the following topics:

RSTP Bridge Configuration

About RSTP

The RSTP service supports the inherent network communications redundancy provided by a daisy chain loop. The remote I/O 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.

Changing RSTP parameters can affect subring diagnostics, I/O determinism, and network recovery times.

Access the RSTP Tab

Double-click the adapter module in the Unity Pro configuration to access the **RSTP** tab.

Parameters

This table shows the **Bridge priority** parameters for the **RSTP Operational State** on the Unity Pro **RSTP** tab:

Bridge Priority	Value	BME P58 ••40	Adapter Module
Root	0	default	-
Backup root	4096	Reserved	-
Participant	32768	-	default

NOTE: Use the default value for the adapter modules.

SNMP Agent Configuration

About SNMP

An SNMP V1 agent is a software component of the SNMP service that runs on an adapter modules and gives you access to diagnostic and management information for the modules. You can use SNMP browsers, network management software, and other tools to access this data.

In addition, the SNMP agent can be configured with the IP addresses of 1 or 2 devices (typically PCs that run network management software) to be the targets of event-driven trap messages. Such messages inform the management device of events like cold starts and the inability of the software to authenticate a device.

Access the SNMP Tab

Double-click the adapter module in the Unity Pro configuration to access the **SNMP** tab.

The SNMP agent can connect to and communicate with 1 or 2 SNMP managers. The SNMP service includes:
- authentication checking by the Ethernet adapter module of any SNMP manager that sends SNMP requests
- management of events or traps

SNMP Parameters

These parameters are found on the Unity Pro **SNMP** tab:

Field	Parameter	Description	Value
IP Address managers	IP Address manager 1	The address of the first SNMP manager to which the SNMP agent sends notices of traps.	0.0.0.0 ... 255.255.255.255 *(see page 51)*
	IP Address manager 2	The address of the second SNMP manager to which the SNMP agent sends messages of traps.	
Agent	Location (SysLocation)	device location	31 characters (maximum)
	Contact (SysContact)	information about the person to contact for device maintenance	
	Enable SNMP manager	*unchecked* (default): You can edit the **Location** and **Contact** parameters. *checked*: You cannot edit the **Location** and **Contact** parameters.	checked/unchecked
Community names	Set	password that the SNMP agent requires to read commands from an SNMP manager (default = **Public**)	15 characters (maximum)
	Get		
	Trap		

Field	Parameter	Description	Value
Security	Enable "Authentication failure" trap	*unchecked* (default): not enabled. *checked* (enabled): The SNMP agent sends a trap message to the SNMP manager if an unauthorized manager sends a **Get** or **Set** command to the agent.	checked/unchecked

Offline IP Address Verification

Offline tests are done to verify that the IP addresses of the managers do not include the following types of IP addresses:

- multicast: 224.0.0.0 or higher
- loopback: Any address that starts with 127
- broadcast: 255.255.255.255

Service Port Configuration

Access the Service Port Tab

The BM• CRA 312 10 adapter modules have a service port that can be configured for Ethernet communications or for port mirroring.

Double-click the adapter module in the Unity Pro configuration to access the **Service Port** tab.

Service Port Parameters

These parameters are on the Unity Pro **Service Port** tab:

Field	Parameter	Value	Comment
Service Port	**Enabled**	—	Enable port and edit port parameters.
	Disabled	—	Disable port parameters.
Service Port Mode	**Access** (default)	—	This mode supports Ethernet communications.
	Mirroring	—	In port mirroring mode, data traffic from one or more of the other ports is copied to this port. A connected tool can monitor and analyze port traffic.
			NOTE: In this mode, the service port acts like a read-only port. That is, you cannot access devices (ping, connection to Unity Pro, etc.) through the service port.
			NOTE: This mode is not available on the BMX CRA 312 00.
Access Port Configuration	**Service Port Number**	ETH1	You cannot edit the value in the **Service Port Number** field.
Port Mirroring Configuration	**Source Port(s)**	**Ports**	Ethernet traffic through both remote I/O ports
		ETH2	Ethernet traffic through the first remote I/O port
		ETH3	Ethernet traffic through the second remote I/O port

Online Behavior

The **Service Port** parameters are stored in the application, however you can reconfigure (change) the parameters in the connected mode. Values that you reconfigure in the connected mode are sent to the remote drop adapter module or the CPU module in explicit messages. If the module does not respond to the explicit messages, a message appears.

NOTE: The changed values are not stored, so a mismatch can exist between the parameters that are being used and those that are in the stored application.

NOTE: The **Service Port** configuration can be read and modified online using the Service Port Control Object CIP object.

Section 3.3
Unity Pro Configuration for Remote I/O Drops

Introduction

This section discusses the use of Unity Pro to configure the Ethernet remote I/O drop and its adapter module. It includes descriptions of the parameters on the **Configuration**, **Parameter**, and **Device DDT** tabs in Unity Pro.

What Is in This Section?

This section contains the following topics:

Configuring Remote Drop Parameters

Introduction

In the Unity Pro **Parameter** dialog, you can:
- define or verify address information about the adapter module (name, IP address, and subnetwork mask)
- specify a hold-up time interval
- specify I/O refresh rates

Access the Parameter Dialog

To access the **Parameter** dialog in Unity Pro:

Step	Action	Comment
1	Expand (+) **EIO Bus** in the Unity Pro **Project Browser**.	**Project Browser** →**Configuration** → **EIO Bus** →**Modicon M580 remote drop** →**Installed BMX/BME rack**
2	Double-click the installed adapter.	The **X80 performance EIO adapter** window appears.
3	Select the **Parameter** tab.	The **Parameter** dialog appears.

Parameter Descriptions

Address information parameters:

Parameter	Comment
Device Name	The name of the adapter module includes a fixed prefix and a number provided by the rotary switch. Valid names conform to this structure: BM•CRA_*xxx*, where *xxx* equals the 3-digit value selected on the rotary switch. When the adapter is placed in the remote drop, the number is set to the device number. The device number does not change if the device moves to a new location. Each adapter needs to be assigned a unique number within the application. A message like this appears when analysis reveals a duplicate number: `{EIO Bus (2) BME CRA 312 00}: Device name is not unique`
IP Address	You cannot edit the `IP address` and `sub network` (mask) fields.
Sub Network	**NOTE:** The IP address is editable only in the **IP Configuration** tab of the CPU module. The value for `sub network` is deduced from the CPU sub-network mask.

Hold up time parameter:

Parameter	Comment
Hold up time	The hold up time represents the time (ms) that device outputs are maintained in their current states after a communication disruption and before taking their fallback values: ● **default value**: 1000 ms ● **valid value range**: 50...65,530 ms

If you assign a holdup time value that is less than the recommended minimum value, an I/O module may move to its fallback state. When communications are restored, the I/O module restarts and may not operate as anticipated.

⚠ **WARNING**

UNINTENDED EQUIPMENT OPERATION

Do not configure a holdup time value that is less than the recommended minimum values, which are:
● for a periodic application: 4.4 x PAC scan time
● for a cyclic application: configured watchdog value

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

Connection parameter:

Parameter	Comment
Scanner->CRA RPI	**Outputs:** Outputs are passed from the CPU I/O scanner service to the adapter. The default values are: ● *periodic mode*: default value = 1.1 * MAST period. ● *cyclic mode*: default value = 1/4 * watchdog timeout period. You cannot edit this value. The outputs are published synchronously or immediately at the end of the current MAST task. **NOTE:** The default value for the watchdog timer is 250 ms. If the MAST task does not finish within the watchdog period, the process times out. If the watchdog is greater than 4 times the MAST period, the drops could switch to fallback while the CPU is running. For example, MAST period = 20 ms, logic execution = 90 ms, watchdog time = 100 ms.

NOTE:

- When the **Periodic** mode is selected for the MAST task, the **Period** value allows the complete execution of the logic. (The MAST can overrun when its execution time exceeds this value.) Valid values: 1...255 ms (increment: 1 ms).
- When **Cyclic** mode is selected for the MAST task, the outputs are sent upon the completion of the task. The **Watch Dog** value (10 ... 1500 ms, increment: 10 ms, default = 250 ms) should be greater than the execution time.

Time Stamping

Remote I/O Drop Adapter Time Stamping Function

The BME CRA 312 10 and BMX CRA 312 10 adapter modules have a 10 ms time stamping function. The BMX CRA 312 00 does not support time stamping.

Time stamping of the I/O modules starts as soon as the adapter is configured.

To configure the time stamping buffer, double-click the adapter module and click the **TimeStamping** tab:
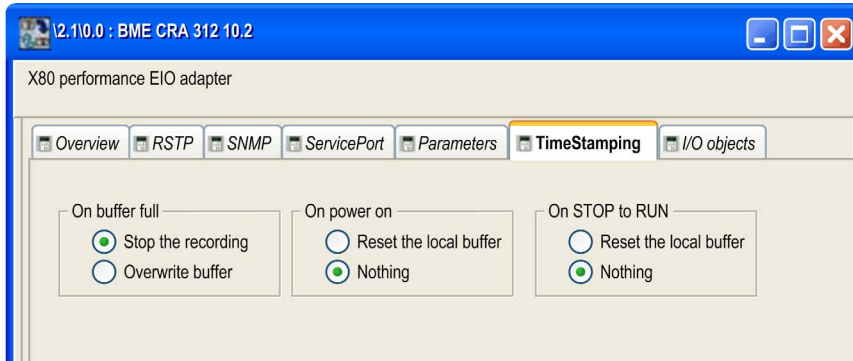
The **local buffer** refers to the buffer in the adapter module.

To configure the BM• CRA 312 10, refer to BMX CRA 1604 T Variables Settings in Unity Pro *(see System Time Stamping, User Guide)*.

When using 1 or 2 As-i Bus BMX EIA 0200 modules with other modules in a Modicon X80 remote I/O drop, the accuracy of the timestamps may be reduced.

Some examples:

Discrete I/O 32 Channels	Analog I/O 4 Channels	BMX EIA 0100	BMX NOM 0200	Stamping Accuracy	
				Dedicated High Accuracy NTP Server	Internal NTP Server Stamping Accuracy
6 modules	1 module	0	0	10 ms	10 ms
6 modules	1 module	1 module	1 module	12 ms	22 ms
16 modules	4 modules	1 module	1 module	14 ms	24 ms

1 ms Time Stamping with BMX ERT 1604T

Use a BMX ERT 1604T time stamp module for more accurate (1 ms) time stamping.

To configure the BMX ERT 1604T, refer to this manual *(see BMX ERT 1604 T, M340 ERT Module, User Manual)*.

For More Information about Remote Time Stamping

For more information about time stamping in a Modicon X80 remote I/O drop, refer to:

- *System Time Stamping User Guide*
- *Applicative Time Stamping with Unity Pro User Guide*

Device DDT Names for Modicon M580 Remote I/O Adapters

Introduction

The Device DDT name of the device DDT *(see Unity Pro, Program Languages and Structure, Reference Manual)* is in this format: MOD_COM_**#**. In Unity Pro, the **#** symbol represents the order of the instances of the Device DDT creations. The first created is named MOD_COM_1, the second created is named MOD_COM_2).

NOTE: These instructions assume that you have already added a drop to your Unity Pro project *(see page 31)*.

Access the Device DDT Tab

In Unity Pro:

Step	Action	Comment
1	Expand **EIO Bus** in the Unity Pro **Project Browser** to display the **Modicon M580 remote drop**	**Project Browser** →**Project** → **Configuration** →**EIO Bus** →**Modicon M580 remote drop**
2	Double-click the installed drop adapter in the Modicon X80 Remote drop.	The **X80 performance EIO adapter** dialog appears.
3	Select the **Device DDT** tab.	

The **Implicit device DDT** field contains a default name and type.
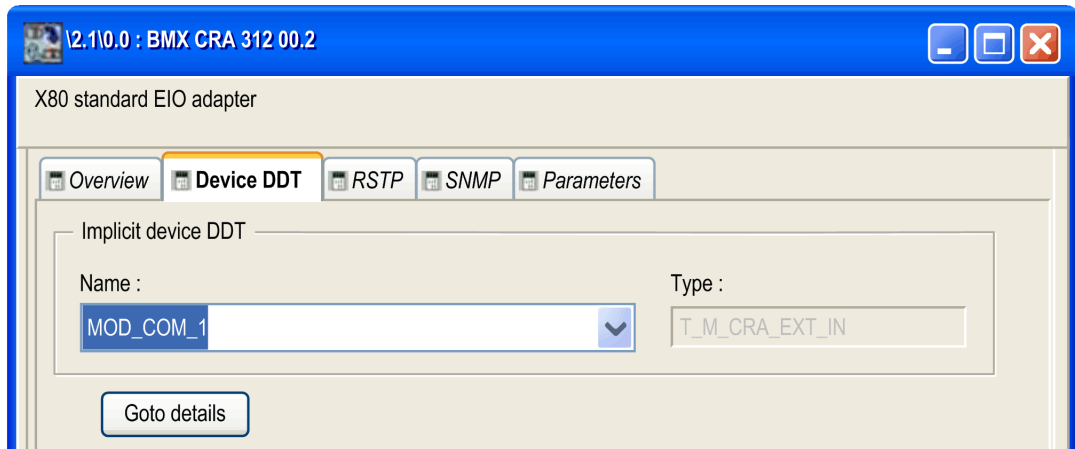
The I/O structure type for the adapter modules is T_M_CRA_EXT_IN.

Drop Parameters

In the Unity Pro **Device DDT** dialog you can configure these parameters for the remote I/O drop:

Parameter		Description
Implicit device DDT	Name	The default name of the device DDT includes the module type, the number of channels, and a suffix that indicates the insertion number. For example, MOD_TOR_16_128.
	Type	module type (cannot be edited)
Goto details		link to the Device DDT data editor screen
		NOTE: Clicking **Goto details** takes you to Variables tab in the Data Editor, which displays the drop diagnostic parameters in T_M_CRA_EXT_IN.

Diagnostic Parameters

This table contains the drop diagnostic parameters in T_M_CRA_EXT_IN for a remote I/O drop module:

Name	Type	Bit	Description
IO_HEALTH_RACK0	WORD	—	health bits of rack 0: slots 0...15
IO_HEALTH_RACK1	WORD	—	health bits of rack 1: slots 0...15
DEVICE_NAME	string[16]	—	device name of the remote I/O drop
VERSION	WORD	—	firmware version (Maj, Min) (4 digits coded in BCD)
ROTARY_SWITCHES	BYTE	—	rotary switch value at power up
CRA_STATE	BYTE	—	1: CRA module is idle.
			2: CRA module is stopped.
			3: CRA module is running.

Name		Type	Bit	Description
CRA_DIAGNOSTIC [WORD]	GLOBAL_IO_HEALTH	BOOL	0	0: At least one I/O module in the drop reports bad health.
	CCOTF_IN_PROGRESS	BOOL	1	CCOTF is in progress.
	CCOTF_INVALID_CONF	BOOL	2	CCOTF is not valid.
	IOPL_MISMATCH	BOOL	3	There is an output data mismatch.
	SWITCH_CHANGE	BOOL	4	The rotary switch settings have changed since the last power up. This bit is reset if the rotary switch is returned to its original setting.
	DROP_COM_HEALTH	BOOL	5	This bit shows the drop communication health (set to 1 when communication is established between the RIO drop and the I/O scanner).
CYCLE_CURR_TIME		UINT	—	This word indicates the execution time of the last CRA cycle. It has values between [0.65535] with a resolution of 0.01 ms, therefore, the last cycle time is between [0.655] ms.
CYCLE_MAX_TIME		UINT	—	This word indicates the longest CRA cycle execution time since the last start. It has values between [0.65535] with a resolution of 0.01 ms, therefore, the longest cycle time is between [0,655] ms.
CYCLE_MIN_TIME		UINT	—	This word indicates the shortest CRA cycle execution time since the last start. It has values between [0.65535] with a resolution of 0.01 ms, therefore, the shortest cycle time is between [0.655] ms.
TIME_STAMP_RECORDS		UINT	—	This word contains the number of records available in the local drop event buffer.
TS_DIAGNOSTIC_ FLAGS (WORD)	TIME_VALID	BOOL	0	The time is valid and synchronized.

Name		Type	Bit	Description
	CLOCK_FAILURE CLOCK_NOT_SYNC	BOOL	1 2	If ● bit 1 = 1 & bit 2 = 1, since power- on CRA adapter has not received a response from NTP server. ● bit 1 = 0 & bit 2 = 1, CRA adapter has received a response from NTP server in the past but is not currently receiving the time from the NTP server ● bit 1 = 0 & bit 2 = 0, Time is valid, CRA adapter is receiving responses from the NTP server.
	BUFF_FULL	BOOL	3	The local drop event buffer is full.
TS_BUF_FILLED_PCTAGE		BYTE	—	This byte reports the percentage of the local drop event buffer filled (0...100).
TS_EVENTS_STATE		BYTE	—	Refer to Main States *(see page 64)*.
ETH_STATUS (BYTE)	PORT1_LINK	BOOL	0	0 = Port 1 (ETH1) link is down.
				1 = Port 1 (ETH1) link is up.
	PORT2_LINK	BOOL	1	0 = Port 2 link is down.
				1 = Port 2 link is up.
	PORT3_LINK	BOOL	2	0 = Port 3 link is down.
				1 = Port 3 link is up.
	ETH_BKP_PORT_LINK	BOOL	3	0 = Ethernet backplane link is down.
				1 = Ethernet backplane link is up.
	RPI_CHANGE	BOOL	4	RPI change: EtherNet/IP RPI change is in progress (during CCOTF).
	(reserved bit)	—	6	—
	GLOBAL_STATUS **NOTE:** Refer to the **SERVICE_STATUS** byte below.	BOOL	7	0 = At least 1 service is not operating normally.
				1 = All services are operating normally.

Name		Type	Bit	Description
SERVICE_STATUS (BYTE)	RSTP_SERVICE	BOOL	8	0 = RSTP service is not operating normally.
				1 = RSTP service is operating normally or disabled.
	SNTP_SERVICE (reserved)	BOOL	9	0 = SNTP service is not operating normally.
				1 = SNTP service is operating normally or disabled.
	PORT502_SERVICE	BOOL	10	0 = Port 502 service is not operating normally.
				1 = Port 502 service is operating normally or disabled.
	SNMP_SERVICE	BOOL	11	0 = SNMP service is not operating normally.
				1 = SNMP service is operating normally or disabled.
	(reserved bits)	—	4...7	—
ETH_PORT_STATUS (BYTE)	These combined 2-bit values indicate the port conditions.	WORD	1/0	Ethernet backplane port 1 function
			3/2	Ethernet port 1 RSTP role
			5/4	Ethernet backplane port 2 function
			7/6	Ethernet port 2 RSTP role
			9/8	Ethernet backplane port 3 function
			11/10	Ethernet port 3 RSTP role
			12/13	Ethernet backplane port 4 function
			14/15	Ethernet port 4 RSTP role
	port function	—	0	disabled
			1	access port
			2	port mirror
			3	remote I/O network port
	RSTP role	—	0	alternate
			1	backup
			2	designated
			3	root
NTP_UPDATE		UINT	—	elapsed time (100 ms) since last update from NTP server

Name	Type	Bit	Description
MAX_PACKET_INTERVAL	UINT	—	maximum packet interval (ms) for output packets (from scanner to adapter)
IN_BYTES	UINT	—	number of bytes (octets) received on interface
IN_ERRORS	UINT	—	number of inbound packets that contain detected errors
OUT_BYTES	UINT	—	number of bytes (octets) sent on interface
OUT_ERRORS	UINT	—	number of outbound packets that contain detected errors
SOE_UNCERTAIN	BOOL	—	The sequence of events SOE in the local drop event buffer is not known. The SOE_UNCERTAIN is reset when the sequence of events is OK.

Main States of the Time Stamp Source

The TS_EVENTS_STATE byte reports the main state of the source of the time stamp events:

Byte Value (hex)	Description
20	wait for client
31	ValuesSynchro requested and waiting for buffer below the threshold
32	ValuesSynchro started
40	event Stamping

Device DDT Types for I/O Modules

Refer to the following user guides for specific I/O module device DDT types:

I/O Module	User Guide Reference
Modicon X80 discrete input/output	*Modicon M340 Using Unity Pro Discrete Input/Output Modules User Manual*
Modicon X80 analog input/output	*Modicon M340 with Unity Pro Analog Input/Output Modules User Manual*
BMX EHC 0800	*Modicon M340 with Unity Pro Counting Module BMX EHC 0800 User Manual*
BMX EHC 0200	*Modicon M340 with Unity Pro Counting Module BMX EHC 0200 User Manual*
BMX NOM 0200	*Modicon M340 with Unity Pro Serial Link User Manual*
BMX ERT 1604T	*BMX ERT 1604T M340 ERT Module User Manual*

Chapter 4
Explicit and Implicit Messaging

What Is in This Chapter?

This chapter contains the following topics:

Explicit Messaging

Use of Explicit Messaging

The CPU uses explicit messaging for request-and-reply communications for non-real-time information (like configuration and diagnostic data).

EtherNet/IP uses the TCP/IP and UDP/IP protocols to implement explicit messaging over the high capacity daisy chain ring used in a Modicon M580 system.

Implicit Message Exchanges

Task Management

This topic explains implicit messaging and the relationship between the task configuration and the remote I/O implicit exchanges.

Implicit messaging maintains open connections for real-time communications of a predefined nature between consumers and producers. Implicit messages contain control data and a connection identifier.

EtherNet/IP uses the TCP/IP and UDP/IP protocols to implement implicit messaging.

Access the MAST Configuration

To view the **Properties of MAST**:

Step	Action
1	Go to the **Properties of MAST** dialog box in Unity Pro (**Tools** →**Project Browser** →**Project** →**Program** →**Tasks** →**MAST**).
2	Right-click **MAST** →**Properites** to open the **Properties of MAST** dialog.
3	Configure the parameters as needed.

Access the FAST Configuration

To view the **Properties of FAST**:

Step	Action
1	Go to the **Properties of FAST** dialog box in Unity Pro (**Tools** →**Project Browser** →**Project** →**Program** →**Tasks** →**FAST**).
2	Right-click **FAST** →**Properites** to open the **Properties of FAST** dialog.
3	Configure the parameters as needed.

Access the AUX0 Configuration

To view the **Properties of AUX0**:

Step	Action
1	Go to the **Properties of AUX0** dialog box in Unity Pro (**Tools** →**Project Browser** →**Project** →**Program** →**Tasks** →**AUX0**).
2	Right-click **AUX0** →**Properites** to open the **Properties of AUX0** dialog.
3	Configure the parameters as needed.

Access the AUX1 Configuration

To view the **Properties of AUX1**:

Step	Action
1	Go to the **Properties of AUX1** dialog box in Unity Pro (**Tools** →**Project Browser** →**Project** →**Program** →**Tasks** →**AUX1**).
2	Right-click **AUX1** →**Properites** to open the **Properties of AUX1** dialog.
3	Configure the parameters as needed.

Periodic and Cyclic Modes

The effect that periodic and cyclic modes have on implicit messages is explained in the description of the connection parameters *(see page 54)*.

I/O Management for Implicit I/O Exchanges

To assign state RAM addresses for Modicon M580 I/O data, refer to Device DDT Names for Quantum EIO adapters *(see page 59)*.

Chapter 5
Diagnostics

Overview

This chapter describes the diagnostics for the Modicon M580 modules. For details on diagnostics at the system level, refer to the systems diagnostics topic in your system planning guide.

What Is in This Chapter?

This chapter contains the following sections:

Section 5.1
Service Port Management

Service Port Configuration

Introduction

A BME P58 ••40 remote I/O scanner module and a remote I/O adapter modules (BM• CRA 312 10) support the configuration of the SERVICE port without requiring you to rebuild or download your application.

Adapter Modules

You can send explicit messages with an EtherNet/IP tool for the configuration of the SERVICE port on the BM• CRA 312 10 modules. For details, refer to information about EtherNet/IP CIP objects in your system hardware reference manual and SERVICE port configuration for adapter modules *(see page 52)*.

Cycling Power

The online configuration of the SERVICE port is volatile. The following may result when power is cycled to the adapter module while the application is being applied:
- The configuration can be lost.
- The configuration in the application can be applied to the SERVICE port.

Section 5.2
Diagnostics Available through the CPU

System Diagnostics

Introduction

System diagnostics are performed in 2 ways
1. with system bits (%S) and system words (%SW)
2. using Modbus/TCP *(see page 76)* or EtherNet/IP CIP *(see page 77)* requests

Remote I/O Drop Diagnostics

Certain Ethernet remote I/O drop diagnostics are accessible for the entire drop within system bits and words in the PAC (%S, %SW). Each drop is animated with a health bit display of the health bit status for:

● a drop node
● a module in a remote drop

The CPU I/O scanner monitors remote I/O drops and module health. The adapter modules in the remote I/O drops transmit detected errors in the drop modules to the CPU via implicit messages *(see page 69)*. The detected errors are stored in the global diagnostic buffers of the CPU and in the diagnostic buffer of the individual drop modules.

The CPU updates the detected error buffers. Health bits are updated in the CPU only if the adapter of the concerned drop communicates with the CPU. If these modules cannot communicate, the concerned health bits are set to 0.

System Bits and Words

This table describes the system bits and words for M580 that represent detected errors:

System Bits/Words	Symbol	Description
%S117	EIOERR	detected remote I/O error
%SW101	EIO_CCOTF_COUNT	CCOTF counting status register
%SW108	FORCED_DISCRETE_COUNT	forced bit counting status register
%SW109	FORCED_ANALOG_COUNT	forced bit counting status register

NOTE: Refer to the *Unity Pro Program Languages and Structure Reference Manual* complete explanations of the system bits and words.

Ethernet Diagnostics Using MB/TCP Requests

Ethernet Diagnostics from the BM• CRA 312 •0 adapter:

- Data rate on the Ethernet TCP/IP network[1][2]
  This is the link speed in Mbps.
- Ethernet Activity information[1][2]
  This is the counter of Ethernet frames transmitted and received by the BM• CRA 312 •0 adapter.
- Ethernet link status[1]
  For each Ethernet port, is its link up (1) or down (2). See also Duplicate IP Address Checking .
- Redundancy status
  Reserved for future use.
- Port 502 Status[1]
  Modbus port
- Half / Full duplex mode[1][2]
  This is the mode of the remote I/O network.
- Ethernet backplane configuration error[1]
  This is set 1 if either:
  - there is a detected error in the Ethernet backplane configuration
  - the Ethernet backplane firmware version is lower than the one required by the application

Legend:
(1) Accessible through explicit Modbus/TCP requests
(2) Accessible through explicit EtherNet/IP CIP requests

Viewing Diagnostics in Unity Pro

The bus editor in Unity Pro uses color animation to display the status of each drop, rack, or module on the **EIO Bus**.

The slot number of the drop/rack/module appears in red when a detected error is associated with that slot.

For a module, the red display indicates the module is missing, inoperable, or improperly configured.

This table relates a drop, rack, or module to its language object:

Drop	Status	Language Object	i	j
	drop (d)	%SWi.j	152 + [(d-1)/16]	(d-1)/16
BM• CRA 312 •0	rack (r), drop (d)	%SWi	641 + [(d-1)*2] + r	
	module (m), rack (r), drop (d)	%SWi.j	641 + [(d-1)*2] + r	15-m

NOTE:

Remember that the:
- 16 slots in a drop are numbed 0...15
- rack numbers for a drop are:

- remote drop main rack is 0
- remote drop extension rack is 1

Section 5.3
Diagnostics Available through Modbus/TCP

Modbus Diagnostic Codes

Supported Diagnostic Codes

The following Modicon M580 modules support these Modbus diagnostic codes:
- CPU with Ethernet I/O scanner service
- remote I/O adapter modules:
  - BME CRA 312 10
  - BMX CRA 312 10
  - BMX CRA 312 00

Diagnostic

Function code 8, subcode 22: Modbus function code 08 provides a variety of diagnostic functions:

Operation Code	Diag. Control	Description
0x01	0x0100	Network diagnostic data
	0x0200	Read the Ethernet port diagnostic data from the switch manager.
	0x0300	Read the Modbus TCP/port 502 diagnostic data from the Modbus server.
	0x0400	Read the Modbus TCP/port 502 connection table from the Modbus server.
	0x07F0	Read the data structure offset data from the Modbus server.
0x02	0x0100	Clears the basic network diagnostic data. **NOTE:** Only specific parameters of basic network diagnostic data are used to clear requests.
	0x0200	Clears the Ethernet port diagnostic data. **NOTE:** Only specific parameters of basic network diagnostic data are used to clear requests.
	0x0300	Clears the Modbus TCP/port 502 diagnostic data. **NOTE:** Only specific parameters of Modbus port 502 diagnostic data are used to clear requests.
	0x0400	Clears the Modbus TCP/port 502 connection table. **NOTE:** Only specific parameters of Modbus port 502 connection data are used to clear requests.
0x03	0	Clears the diagnostic data. **NOTE:** Only specific parameters of each diagnostic data are used to clear requests.

Section 5.4
Diagnostics Available through EtherNet/IP CIP Objects

Introduction

Modicon M580 applications use CIP within a producer/consumer model to provide communication services in an industrial environment. This section describes the available CIP objects for X80 modules in a Modicon M580 system.

What Is in This Section?

This section contains the following topics:

About CIP Objects

Overview

The remote I/O adapter module can access CIP data and services located in connected devices. The CIP objects and their content depend on the design of each device.

CIP object data and content are exposed and accessed hierarchically in the following nested levels:
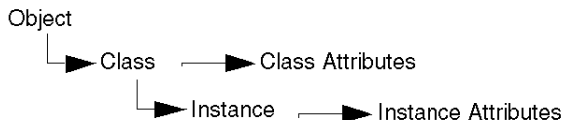
NOTE:

You can use explicit messaging to access these items:

- Access a collection of instance attributes by including only the class and instance values for the object in the explicit message.
- Access a single attribute by adding a specific attribute value to the explicit message with the class and instance values for the object.

When the local slave service for the adapter is activated, remote devices on the remote I/O drop can send explicit messages to the CIP object structure of the module. Then you can access module data or execute module commands.

This chapter describes the CIP objects that the adapter exposes to remote devices.

Identity Object

Class ID

01

Instance IDs

The Identity object presents 2 instances:
- 0: class
- 1: instance

Attributes

Identity object attributes are associated with each instance, as follows:

Instance ID = 0 (class attributes):

Attribute ID	Description	GET	SET
01	Revision	X	—
02	Max Instance	X	—
X = supported — = not supported			

Instance ID = 1 (instance attributes):

Attribute ID		Description	Type	GET	SET
hex	dec				
01	01	Vendor ID	UINT	X	—
02	02	Device type	UINT	X	—
03	03	Product code	UINT	X	—
04	04	Revision	STRUCT	X	—
		Major	USINT		
		Minor	USINT		
X = supported — = not supported					

Attribute ID		Description	Type	GET	SET
hex	**dec**				

05	05	Status
		bit 2:
		   0x01=the module is configured
		bits 4-7:
		   0x03=no I/O connections established
		   0x06=at least 1 I/O connection in run mode
		   0x07=at least 1 I/O connection established, all in IDLE mode
			Word	X	—

06	06	Serial number	UDINT	X	—
07	07	Product name	STRING	X	—
18	24	Modbus identity	STRUCT	X	—
X = supported — = not supported					

Services

The Identity object supports the following services:

Service ID		Description	Class	Instance	Notes
hex	**dec**				
01	01	Get_Attributes_All	X	X	Returns: • all class attributes (instance = 0) • instance attributes 1 to 7 (instance = 1)
0E	14	Get_Attribute_Single	X	X	Returns the value of the specified attribute.
X = supported — = not supported					

Assembly Object

Overview

You can send an explicit message to the Assembly object only when no other connections have been established that read from or write to this object. For example, you can send an explicit message to the Assembly object if a local slave instance is enabled, but no other module is scanning that local slave.

Class ID

04

Instance IDs

The Assembly object presents the following instance identifiers:
● 0: class
● 101, 102, 111, 112, 121, 122: instance

Attributes

The Assembly object consists of the following attributes:

Instance ID = 0 (class attributes):

Attribute ID	Description	GET	SET
01	Revision	X	—
02	Max Instance	X	—
03	Number of Instances	X	—
X = supported — = not supported			

Instance attributes:

Instance ID	Attribute ID	Description	Type	GET	SET
101	03	Local slave 1: T->O input data	Array of BYTE	X	—
102		Local slave 1: O>T	Array of BYTE	X	X
111		Local slave 2: T->O input data	Array of BYTE	X	—
112		Local slave 2: O>T	Array of BYTE	X	X
121		Local slave 3: T->O input data	Array of BYTE	X	—
122		Local slave 3: O>T	Array of BYTE	X	X
X = supported — = not supported					

Services

The Assembly object supports the following services:

Service ID		Description	Class	Instance	Notes
hex	**dec**				
0E	14	Get_Attribute_Single	X	X	Returns the value of the specified attribute.
10	16	Set_Attribute_Single[1]	—	X	Returns these values: 0E = attribute not settable: assembly is not o->T type 0F = permission denied: assembly is being used by an active connection 13 = config too small: the Set_Attribute_Single command contains partial data 15 = data too big: the Set_Attribute_Single command contains too much data
X = supported — = not supported					
1. When valid, the size of the data written to the Assembly object using the Set_Attribute_Single service equals the size of the Assembly object as configured in the target module.					

Connection Manager Object

Class ID

06

Instance IDs

The Connection Manager object presents 2 instance values:
- 0: class
- 1: instance

Attributes

Connection Manager object attributes are associated with each instance, as follows:

Instance ID = 0 (class attributes):

Attribute ID	Description	GET	SET
01	Revision	X	—
02	Max Instance	X	—
X = supported — = not supported			

Instance ID = 1 (instance attributes):

Attribute ID		Description	Type	GET	SET	Value
hex	dec					
01	01	Open Requests	UINT	X	X	Number of Forward Open service requests received.
02	02	Open Format Rejects	UINT	X	X	Number of Forward Open service requests that were rejected due to bad format.
03	03	Open Resource Rejects	UINT	X	X	Number of Forward Open service requests that were rejected due to lack of resources.
04	04	Open Other Rejects	UINT	X	X	Number of Forward Open service requests that were rejected for reasons other than bad format or lack of resources.
X = supported — = not supported						

Attribute ID		Description	Type	GET	SET	Value
hex	dec					
05	05	Close Requests	UINT	X	X	Number of Forward Close service requests received.
06	06	Close Format Requests	UINT	X	X	Number of Forward Close service requests that were rejected due to bad format.
07	07	Close Other Requests	UINT	X	X	Number of Forward Close service requests that were rejected for reasons other than bad format.
08	08	Connection Timeouts	UINT	X	X	Total number of connection timeouts that occurred in connections controlled by this connections manager
09	09	Connection Entry List	STRUCT	X	—	0 (Unsupported optional item)
0B	11	CPU_Utilization	UINT	X	—	0 (Unsupported optional item)
0C	12	MaxBuffSize	UDINT	X	—	0 (Unsupported optional item)
0D	13	BufSize Remaining	UDINT	X	—	0 (Unsupported optional item)
X = supported — = not supported						

Services

The Connection Manager object supports the following services:

Service ID		Description	Class	Instance	Notes
hex	dec				
01	01	Get_Attributes_All	X	X	Returns the value of all attributes.
0E	14	Get_Attribute_Single	X	X	Returns the value of the specified attribute.
X = supported — = not supported					

Quality of Service (QoS) Object

Overview

The QoS object implements the Differentiated Services Code Point (DSCP or *DiffServe*) values to prioritize Ethernet messages.

Class ID

48 (hex), 72 (decimal)

Instance IDs

The QoS object presents 2 instance values:
- 0: class
- 1: instance

Attributes

The QoS object consists of the following attributes:

Instance ID = 0 (class attributes):

Attribute ID	Description	GET	SET
01	Revision	X	—
02	Max Instance	X	—
X = supported — = not supported			

Instance ID = 1 (instance attributes):

Attribute ID	Description	Type	GET	SET	Value
04	DSCP Urgent	USINT	X	X	For CIP transport class 0/1 Urgent priority messages, default value = 55.
05	DSCP Scheduled	USINT	X	X	For CIP transport class 0/1 Scheduled messages, default value = 47.
06	DSCP High	USINT	X	X	For CIP transport class 0/1 High priority messages, default value = 43.
07	DSCP Low	USINT	X	X	For CIP transport class 0/1 Low priority messages, default value = 31.
X = supported — = not supported					

Attribute ID	Description	Type	GET	SET	Value
08	DSCP Explicit	USINT	X	X	For CIP explicit messages (transport class 2/3 and UCMM), default value = 27.
X = supported — = not supported					

NOTE: A change in the instance attribute value takes effect on device restart, for configurations made from flash memory.

Services

The QoS object supports the following services:

Service ID		Description	Class	Instance
hex	dec			
0E	14	Get_Attribute_Single	X	X
10	16	Set_Attribute_Single	—	X
X = supported — = not supported				

TCP/IP Interface Object

Class ID

F5 (hex), 245 (decimal)

Instance IDs

The TCP/IP interface object presents 2 instance values:
● 0: class
● 1: instance

Attributes

TCP/IP interface object attributes are associated with each instance, as follows:

Instance ID = 0 (class attributes):

Attribute ID	Description	GET	SET
01	Revision	X	—
02	Max Instance	X	—
X = supported — = not supported			

Instance ID = 1 (instance attributes):

Attribute ID	Description	Type	GET	SET	Value
01	Status	DWORD	X	—	0x01
02	Configuration capability	DWORD	X	—	0x01 = from BootP 0x11 = from flash 0x00 = other
03	Configuration control	DWORD	X	X	0x01 = out-of-box default
04	**Physical Link Object**	**STRUCT**	X	—	
	Path size	UINT			
	Path	Padded EPATH			
X = supported — = not supported					

Attribute ID	Description		Type	GET	SET	Value
05	**Interface Configuration**		**STRUCT**	X	X	0x00 = out-of-box default
		IP address	UDINT			
		Network mask	UDINT			
		Gateway address	UDINT			
		Name server	UDINT			
		Name server 2	UDINT			
		Domain name	STRING			
06	Host name		STRING	X	—	
X = supported — = not supported						

Services

The TCP/IP interface object supports the following services:

Service ID		Description	Class	Instance	Notes
hex	dec				
01	01	Get_Attributes_All	X	X	Returns the value of all attributes.
0E	14	Get_Attribute_Single	X	X	Returns the value of the specified attribute.
10	16	Set_Attribute_Single[1]	—	X	Sets the value of the specified attribute.
X = supported — = not supported					
1. The Set_Attribute_Single service can execute only when these preconditions are satisfied: ● Configure the Ethernet communication module to obtain its IP address from flash memory. ● Confirm that the PAC is in stop mode.					

Ethernet Link Object

Class ID

F6 (hex), 246 (decimal)

Instance IDs

The Ethernet Link object presents the following instance values (for an BME CRA 312 10):
- 0: class
- 1: port (ETH1 *(see page 15)*)
- 2: port (ETH2)
- 3: port (ETH3)
- 4: port (Internal backplane port 255)

Attributes

The Ethernet Link object presents the following attributes:

Instance ID = 0 (class attributes):

Attribute ID	Description	GET	SET
01	Revision	X	—
02	Max Instance	X	—
03	Number of Instances	X	—
X = supported — = not supported			

Instance ID = 1 (instance attributes):

Attribute ID		Description	Type	GET	SET	Value
hex	dec					
01	01	Interface speed	UDINT	X	—	Valid values include: 0, 10000000, 100000000
X = supported — = not supported						

Attribute ID		Description	Type	GET	SET	Value
hex	dec					
02	02	Interface flags	DWORD	X	—	Bit 0: link status 0 = Inactive 1 = Active
						Bit 1: duplex mode 0 = half duplex 1 = full duplex
						Bits 2—4: negotiation status 3 = successfully negotiated speed and duplex 4 = forced speed and link
						Bit 5: manual setting requires reset 0 = automatic 1 = device need reset
						Bit 6: local hardware detected error 0 = no event 1 = event detected
03	03	**Physical Address**	**ARRAY of 6 USINT**	X	—	module MAC address
X = supported — = not supported						

Attribute ID		Description	Type	GET	SET	Value
hex	**dec**					
04	04	**Interface Counters**	**STRUCT** of	X	—	
		In bytes	UDINT			bytes received on the interface
		In Ucast packets	UDINT			unicast packets received on the interface
		In NUcast packets	UDINT			non-unicast packets received on the interface
		In discards	UDINT			inbound packets received on the interface, but discarded
		In detected errors	UDINT			inbound packets with detected errors (does not include in discards)
		In Unknown Protocals	UDINT			inbound packets with unknown protocol
		Out bytes	UDINT			bytes sent on the interface
		Out Ucast packets	UDINT			unicast packets sent on the interface
		Out NUcast packets	UDINT			non-unicast packets sent on the interface
		Out discards	UDINT			outbound packets discarded
		Out detected errors	UDINT			outbound packets with detected errors
X = supported — = not supported						

Attribute ID		Description	Type	GET	SET	Value
hex	dec					
05	05	**Media Counters**	**STRUCT** of	X	—	
		Detected alignment errors	UDINT			frames that are not an integral number of bytes in length
		Detected FCS errors	UDINT			incorrect CRC: frames received do not pass the FCS check
		Single collisions	UDINT			successfully transmitted frames that experienced exactly 1 collision
		Multiple collisions	UDINT			successfully transmitted frames that experienced more than 1 collision
		SQE test errors	UDINT			number of times the SQE test error is generated
		Deferred transmissions	UDINT			frames for which first transmission attempt is delayed because the medium is busy
		Late collisions	UDINT			number of times a collision is detected later than 512-bit times into the transmission of a packet
		Excessive collisions	UDINT			frames that do not transmit due to excessive collisions
		MAC transmit detected errors	UDINT			frames that do not transmit due to a detected internal MAC sublayer transmit detected error
		Frame too long	UDINT			frames received that exceed the maximum permitted frame size
05	05	Detected MAC receive errors	UDINT	X	—	frames not received on an interface due to a detected internal MAC sublayer detected receive error
		Carrier sense detected errors	UDINT			times that the carrier sense condition was lost or not asserted when attempting to transmit a frame
X = supported — = not supported						

Attribute ID		Description	Type	GET	SET	Value
hex	dec					
06	06	**Interface Control**	**STRUCT** of	X	X	API of the connection
		Control bits	WORD			Bit 0: Auto-negotiation 0 = disabled 1 = enabled **Note:** When auto-negotiation is enabled, 0x0C (object state conflict) is returned when attempting to set either: ● forced interface speed ● forced duplex mode
						Bit 1: forced duplex mode (if auto-negotiation bit = 0) 0 = half duplex 1 = full duplex
		Forced interface speed	UINT			Valid values include: 10000000, 100000000 **Note:** Attempting to set any other value returns the detected error 0x09 (invalid attribute value)
10	16	Interface label	SHORT_S TRING	X	—	A fixed textual string identifying the interface that should include 'internal' for internal interfaces. Maximum number of characters is 64.
X = supported — = not supported						

Services

The Ethernet Link object supports the following services:

Service ID		Description	Class	Instance
hex	dec			
01	01	Get_Attributes_All	X	X
10	16	Set_Attribute_Single	—	X
0E	14	Get_Attribute_Single	X	X
4C	76	Get_and_Clear	—	X
X = supported — = not supported				

EtherNet/IP Interface Diagnostics Object

Class ID

350 (hex), 848 (decimal)

Instance IDs

The EtherNetP/IP Interface object presents 2 instance values:
- 0: class
- 1: instance

Attributes

EtherNet/IP Interface Diagnostics object attributes are associated with each instance, as follows:

Instance ID = 0 (class attributes):

Attribute ID	Description	GET	SET
01	Revision	X	—
02	Max Instance	X	—
X = supported — = not supported			

Instance ID = 1 (instance attributes):

Attribute ID	Description	Type	GET	SET	Values
01	Protocols Supported	UINT	X	—	0: supported1: not supported ● Bit 1: Modbus TCP/IP ● Bit 2: Modbus SL ● Bits 3-15: Reserved
X = supported — = not supported					

Attribute ID	Description	Type	GET	SET	Values
02	**Connection Diagnostics**	**STRUCT** of	X	—	
	Max CIP I/O connections opened	UINT			Number of Class 1 connections opened since the last reset
	Current CIP I/O connections	UINT			Number of Class 1 connections currently opened.
	Max CIP explicit connections opened	UINT			Number of Class 3 connections opened since the last reset.
	Current CIP explicit connections	UINT			Number of Class 3 connections currently opened.
	CIP connections opening detected errors	UINT			Increments each time a Forward Open is not successful (Originator and Target).
	CIP connections timeout detected errors	UINT			Increments when a connection times out (Originator and Target).
	Max EIP TCP connections opened	UINT			Number of TCP connections (used for EIP as client or server) opened since the last reset.
	Current EIP TCP connections	UINT			Number of TCP connections (used for EIP as client or server) currently open.
03	**I/O Messaging Diagnostics**	**STRUCT** of	X	X	
	I/O production counter	UDINT			Increments each time a Class 0/1 message is sent.
	I/O consumption counter	UDINT			Increments each time a Class 0/1 message is received.
	I/O productions send detected error counter	UINT			Increments each time a Class 0/1 message is not sent.
	I/O consumptions receive detected error counter	UINT			Increments each time a consumption is received with a detected error.
X = supported — = not supported					

Attribute ID	Description	Type	GET	SET	Values
04	**Explicit Messaging Diagnostics**	**STRUCT** of	X	X	
	Class 3 message sent counter	UDINT			Increments each time a Class 3 message is sent (client and server).
	Class 3 message received counter	UDINT			Increments each time a Class 3 message is received (client and server).
	UCMM message received counter	UDINT			Increments each time an UCMM message is sent (client and server).
	UCMM message received counter	UDINT			Increments each time an UCMM message is received (client and server).
X = supported — = not supported					

Services

The EtherNet/IP Interface Diagnostics object supports the following services:

Service ID		Description	Class	Instance	Notes
hex	dec				
01	01	Get_Attributes_All	X	X	Returns the value of all attributes.
0E	14	Get_Attribute_Single	—	X	Returns the value of the specified attribute.
4C	76	Get_and_Clear	—	X	Returns and clears the values of all instance attributes.
X = supported — = not supported					

I/O Connection Diagnostics Object

Class ID

352 (hex), 850 (decimal)

Instance IDs

The I/O Connection Diagnostics object presents the following instance values:
- 0: class
- 1...256: instances

Attributes

I/O Connection Diagnostics object attributes are associated with each instance, as follows:

Instance ID = 0 (class attributes):

Attribute ID	Description	GET	SET
01	Revision	X	—
02	Max Instance	X	—
X = supported — = not supported			

Instance ID = 1 to 256 (instance attributes):

Attribute ID	Description	Type	GET	SET	Value
01	**I/O Communication Diagnostics**	**STRUCT** of	X	X	
	I/O production counter	UDINT			Increments at each production.
	I/O consumption counter	UDINT			Increments at each consumption.
	I/O production sent detected error counter	UINT			Increments each time a production is not sent.
	I/O consumption received detected errors counter	UINT			Increments each time a consumption is received with a detected error.
	CIP connection timeout detected errors	UINT			Increments when a connection times out.
	CIP connection opening detected errors	UINT			Increments each time a connection is unable to open.
	CIP connection state	UINT			State of the connection bit
	CIP last detected error general status	UINT			General status of the last error detected on the connection
	CIP last detected error extended status	UINT			Extended status of the last error detected on the connection
	Input communication status	UINT			Communication status of the inputs (see table, below)
	Output communication status	UINT			Communication status of the outputs (see table, below)
X = supported — = not supported					

Attribute ID	Description	Type	GET	SET	Value
02	**Connection Diagnostics**	**STRUCT** of	X	X	
	Production connection ID	UDINT			Connection ID for production
	Consumption connection ID	UDINT			Connection ID for consumption
	Production RPI	UDINT			RPI for production (ms)
	Production API	UDINT			API for production
	Consumption RPI	UDINT			RPI for consumption
	Consumption API	UDINT			API for consumption
	Production connection parameters	UDINT			Connection parameters for production
	Consumption connection parameters	UDINT			Connection parameters for consumption
					NOTE: Refer to the ODVA standard:The CIP Networks LibraryVol. 1: Common Industrial ProtocolPublication number: PUB00001
	Local IP	UDINT			—
	Local UDP port	UINT			—
	Remote IP	UDINT			—
	Remote UDP port	UINT			—
	Production multicast IP	UDINT			Multicast IP address used for production. If unused, it is 0.
	Consumption multicast IP	UDINT			Multicast IP address used for consumption. If unused, it is 0.
	Protocols supported	UDINT			Protocols supported on the connection: 1 = EtherNet/IP
X = supported — = not supported					

The following values describe the structure of the instance attributes: *CIP connection state*, *Input Communication status*, and *Output communication status*:

Bit Number	Description	Values
15...3	*Reserved*	0
2	Idle	0 = no idle notification 1 = idle notification
1	Consumption inhibited	0 = consumption started 1 = no consumption
0	Production inhibited	0 = production started 1 = no production

Services

The EtherNet/IP Interface Diagnostics object supports the following services:

Service ID		Description	Class	Instance	Notes
hex	dec				
01	01	Get_Attributes_All	X	X	Returns the value of all attributes.
0E	14	Get_Attribute_Single	—	X	Returns the value of the specified attribute.
4C	76	Get_and_Clear	—	X	Returns and clears the values of all instance attributes.
X = supported — = not supported					

EtherNet/IP Explicit Connection Diagnostics Object

Class ID

354 (hex), 852 (decimal)

Instance IDs

The EtherNet/IP Explicit Connection Diagnostics object presents the following instance values:
- 0: class
- 1...64: instances

Attributes

The EtherNet/IP Explicit Connection Diagnostics object attributes are associated with each instance, as follows:

Instance ID = 0 (class attributes):

Attribute ID	Description	GET	SET
01	Revision	X	—
02	Max Instance	X	—
X = supported — = not supported			

Instance ID = 1 to 64 (instance attributes):

Attribute ID	Description	Type	GET	SET	Value
01	Number of connections	UINT	X	—	total number of opened explicit connections
X = supported — = not supported					

Attribute ID	Description	Type	GET	SET	Value
02	**Explicit Messaging Connections Diagnostic List**	**STRUCT** of	X	—	
	Originator connection ID	UDINT			O->T connection ID
	Originator IP	UDINT			—
	Originator TCP port	UINT			—
	Target connection ID	UDINT			T->O connection ID
	Target IP	UDINT			—
	Target TCP port	UINT			—
	Msg Send counter	UDINT			Increments each time a Class 3 CIP message is sent on the connection.
	Msg Receive counter	UDINT			Increments each time a Class 3 CIP message is received on the connection.
X = supported — = not supported					

Services

The EtherNet/IP Explicit Connection Diagnostics object supports the following services:

Service ID		Description	Class	Instance	Notes
hex	dec				
01	01	Get_Attributes_All	X	—	Returns the value of all attributes.
09	09	Delete	—	X	—
4B	75	Explicit_Connections_Diagnostic_Read	—	X	—
X = supported — = not supported					

EtherNet/IP Explicit Connection Diagnostics List Object

Class ID

353 (hex), 851 (decimal)

Instance IDs

The EtherNet/IP Explicit Connection Diagnostics List object presents the following instance values:
- 0: class
- 1...N: instance

Attributes

EtherNet/IP Explicit Connection Diagnostics List object attributes are associated with each instance, as follows.

Instance ID = 0 (class attributes):

Attribute ID hex	Description	Value	GET	SET
01	Revision	1	X	—
02	Max Instance	0...N	X	—
X = supported — = not supported				

Instance ID = 1 to N (instance attributes):

Attribute ID hex	Description	Type	GET	SET	Value
01	Originator connection ID	UDINT	X	—	Originator to target connection ID
02	Originator IP	UDINT	X	—	
03	Originator TCP port	UINT	X	—	
04	Target connection ID	UDINT	X	—	Target to originator connection ID
05	Target IP	UDINT	X	—	
06	Target TCP port	UINT	X	—	
06	Messages sent counter	UDINT	X	—	Incremented each time a Class 3 CIP message is sent on the connection
X = supported — = not supported					

Attribute ID hex	Description	Type	GET	SET	Value
07	Messages received counter	UDINT	X	—	Increments each time a Class 3 CIP message is received on the connection
X = supported — = not supported					

Services

The EtherNet/IP Explicit Connection Diagnostics List object supports the following services:

Service ID		Description	Class	Instance	Notes
hex	dec				
01	01	Get_Attributes_All	X	X	Returns the value of all attributes.
X = supported — = not supported					

RSTP Diagnostics Object

Class ID

355 (hex), 853 (decimal)

Instance IDs

The RSTP Diagnostics object presents these instance values:
- 0: class
- 1... *N*: instance

Attributes

RSTP Diagnostics object attributes are associated with each instance.

Instance ID = 0 (class attributes):

Attribute ID	Description	Type	GET	SET
01	Revision: This attribute specifies the current revision of the RSTP Diagnostic object. The revision is increased by 1 at each new update of the object.	UINT	X	—
02	Max Instance: This attribute specifies the maximum number of instances that may be created for this object on a per device basis (for example, an RSTP bridge). There is 1 instance for each RSTP port on a device.	UINT	X	—
X = supported — = not supported				

Instance ID = 1 to *N* (instance attributes):

Attribute ID	Description	Type	GET	CLEAR	Value
01	**Switch status**	**STRUCT** of	X	—	—
	Protocol specification	UINT	X	—	Refer to RFC-4188 for attribute definitions and value range. In addition, the following value is defined: [4]: the protocol is IEEE 802.1D-2004 and IEEE 802.1W.
	Bridge priority	UDINT	X	—	Refer to RFC-4188 for attribute definitions and value range.
	Time since topology change	UDINT	X	—	
	Topology change count	UDINT	X	—	Refer to RFC-4188 for attribute definitions and value range.
	Designated root	String	X	—	Refer to RFC-4188 for attribute definitions and value range.
	Root cost	UDINT	X	—	
	Root port	UDINT	X	—	
	Maximum age	UINT	X	—	
	Hello time	UINT	X	—	
	Hold time	UDINT	X	—	
	Forward delay	UINT	X	—	
	Bridge maximum age	UINT	X	—	
	Bridge hello time	UINT	X	—	
	Bridge forward delay	UINT	X	—	
X = supported — = not supported					

Attribute ID	Description	Type	GET	CLEAR	Value
02	**Port status**	STRUCT	X	X	—
	Port	UDINT	X	X	Refer to RFC-4188 for attribute definitions and value range.
	Priority	UDINT	X	X	
	State	UINT	X	X	
	Enable	UINT	X	X	
	Path cost	UDINT	X	X	
	Designated root	String	X	X	
	Designated cost	UDINT	X	X	
	Designated bridge	String	X	X	
	Designated port	String	X	X	
	Forward transitions count	UDINT	X	X	Refer to RFC-4188 for attribute definitions and value range. Services: ● Get_and_Clear: The current value of this parameter is returned with the response message. ● other services: The current value of this parameter is returned without being cleared.
X = supported — = not supported					

Attribute ID	Description	Type	GET	CLEAR	Value
03	**Port mode**	**STRUCT** of	X	—	—
	Port number	UINT	X	—	This attribute indicates the port number for a data query. The value range is configuration-dependent. For a 4-port Ethernet device, as an instance, the valid range is 1...4.
	Admin edge port	UINT	X	—	This attribute indicates if this is a user-configured edge port: ● 1: true ● 2: false Other values are not valid.
	Operartor edge port	UINT	X	—	This attribute indicates if this port is an edge port: ● 1: true ● 2: false Other values are not valid.
	Auto edge port	UINT	X	—	This attribute indicates if this port is a dynamically determined edge port: ● 1: true ● 2: false Other values are not valid.
X = supported — = not supported					

Services

The RSTP Diagnostics object performs these services:

Service ID		Description	Class	Instance	Notes
hex	dec				
01	01	Get_Attributes_All	X	X	This service returns: ● all attributes of the class ● all attributes of the instance of the object
02	02	Get_Attribute_Single	X	X	This service returns: ● the contents of a single attribute of the class ● the contents of the instance of the object as specified Specify the attribute ID in the request for this service.
X = supported — = not supported					

Service ID		Description	Class	Instance	Notes
hex	dec				
32	50	Get_and_Clear	—	X	This service returns the contents of a single attribute of the instance of the object as specified. Then the relevant counter-like parameters within the specified attribute are cleared. (Specify the attribute ID in the request for this service.)
X = supported — = not supported					

Service Port Control Object

Class ID

400 (hex), 1024 (decimal)

Instance IDs

The Service Port Control object presents these instance values:
- 0: class
- 1: instance

Attributes

Service Port Control object attributes are associated with each instance.

Required class attributes (instance 0):

Attribute ID	Description	Type	Get	Set
01	Revision	UINT	X	—
02	Max Instance	UINT	X	—
X = supported — = not supported				

Required instance attributes (instance 1):

Attribute ID		Description	Type	Get	Set	Value
hex	dec					
01	01	Port control	UINT	X	X	0 (default): disabled 1: access port 2: port mirroring 3: extended port
02	02	Mirror	UINT	X	X	bit 0 (default): ETH2 port bit 1: ETH3 port bit 2: ETH4 port bit 3: internal port
X = supported — = not supported						

NOTE:
- If the SERVICE port is not configured for port mirroring, the mirror attribute is ignored. If the value of a parameter request is outside the valid range, the service request is ignored.
- In port mirroring mode, the SERVICE port acts like a read-only port. That is, you cannot access devices (ping, connection to Unity Pro, and so on) through the SERVICE port.

Services

The Service Port Control object supports these services:

Service ID		Name	Class	Instance	Description
hex	dec				
01	01	Get_Attributes_All	X	X	Get all attributes in a single message.
02	02	Set_Attributes_All	—	X	Set all attributes in a single message.
0E	14	Get_Attribute_Single	X	X	Get a single specified attribute.
10	16	Set_Attribute_Single	—	X	Set a single specified attribute.
X = supported — = not supported					

SNTP Diagnostics Object

Class ID

405 (hex), 1029 (decimal)

Instance IDs

The SNTP diagnostics list object presents the following instance values:
- 0: class
- 1: instance

Attributes

SNTP diagnostics object attributes are associated with each instance.

Instance ID = 0 (class attributes):

Attribute ID	Description	GET	SET
01	Revision: Increased by 1 at each new update of the object	X	—
02	Max Instance: Maximum number of instances of the object	X	—
NOTE: All attributes are required in the implementation.			
X = supported — = not supported			

Instance ID = 1 (instance attribute):

Attribute ID (hex)	Description	Type	GET	SET	Value
01	**Network Time Service Configuration**	**STRUCT** of:	X	—	
	Primary NTP server IP address	UDINT			
	Polling period	USINT			In seconds
	Update CPU with module time	USINT			• 0: Do not update CPU time. • 1: Update CPU time.
	Time zone	UDINT			Depends on the operating system of the configuration software. Refer to reference DTM Requirements.
	Time zone offset	INT			In minutes
	Daylight saving time bias	USINT			
	Daylight saving start date - month	USINT			
	Daylight saving start date-week, day of week	USINT			MSB (4 bits): week number LSB (4 bits): • 0: Sunday • 1: Monday • ... • 6: Saturday
	Daylight saving start time	UDINT			Seconds elapsed since midnight
	Daylight saving end date - month	USINT			
	Daylight saving end date - week, day of week	USINT			MSB (4 bits): week number LSB (4 bits): • 0: Sunday • 1: Monday • ... • 6: Saturday
	Daylight saving end time	UDINT			Seconds elapsed since midnight
	Reserved	UDINT[15]			
2	Network time service status	UDINT	X	—	• 1: Idle • 2: Operational
3	Link to NTP server status	UDINT	X	—	• 1: NTP server cannot be reached. • 2: NTP server can be reached.
NOTE: All attributes are required in the implementation. X = supported — = not supported					

Attribute ID (hex)	Description	Type	GET	SET	Value
4	Current NTP server IP address	UDINT	X	—	
5	NTP server type	UDINT	X	—	Corresponds to the server identified in attribute 3: ● 1: Primary ● 2: Secondary
6	NTP server time quality	UDINT	X	—	Current jitter of the clock/time in microseconds/second
7	Number of NTP requests sent	UDINT	X	—	
8	Number of detected communication detected errors	UDINT	X	—	
9	Number of NTP responses received	UDINT	X	—	
A	Last detected error	UINT	X	—	● 0: NTP_NO_ERROR ● 1: NTP_ERROR_CONF_BAD_PARAM ● 2: NTP_ERROR_CONF_BAS_CONF ● 3: NTP_ERROR_CREATE_SERVICE ● 4: NTP_ERROR_WRONG_STATE ● 5: NTP_ERROR_NO_RESPONSE
B	Current date and time	DATE_AND_TIME	X	—	{time_of_day UDINT, date UINT} (see CIP specification)
C	Daylight savings status	UDINT	X	—	● 1: Daylight savings are enabled and the current date/time is within the applicable period. ● 2: NTP daylight savings are not enabled or enabled but not within the applicable period.
D	Time since last update	DINT	X	—	Amount of time elapsed since a valid response from the NTP server (in 100 ms increments) -1: not updated
NOTE: All attributes are required in the implementation. X = supported — = not supported					

Services

The SNTP diagnostics object support the following services:

Service ID		Description	Class	Instance	Notes
hex	dec				
01	01	Get_Attributes_All	Required	Required	To gather all attributes into one message
0E	14	Get_Attribute_Single	Required	Required	To get a single specified attribute
32	50	Clear_All	—	Required	Clears data in attributes: 6, 7, 8, 9, 10, 13
X = supported — = not supported					

Ethernet Backplane Diagnostics Object

Class ID

407 (hex), 1031(decimal)

Instance IDs

The Ethernet Backplane Diagnostics object presents the following instance values:
- 0: class
- 1: instance

Attributes

Ethernet Backplane Diagnostics object attributes are associated with each instance, as follows:

Instance ID = 0 (class attributes):

Attribute ID hex	Needed in Implementation	Description	Value	Data Type	GET
01	Required	Revision of this object	The current value assigned to this attribute is 1.	UNIT	X
02	Conditional[1]	Maximum instances	The largest number of instances of a created object at this class hierarchy level.	UNIT	X
03	Conditional[1]	Number of instances	The number of object instances at this class hierarchy level.	UNIT	X
(1) Required if the number of instances is greater than 1					
X = supported					

Instance ID = 1 (instance attributes):

Attribute ID hex	Needed in Implementation	Description	Type	NV	GET	Value
01	Required	Backplane Ethernet port status (link status/health of each module on the backplane)	UINT	V	X	Refer to Attribute 1 below.
02	Required	Extended health (status) of Ethernet backplane	UINT	V	X	Refer to Attribute 2 below.
X = supported						

Attribute ID hex	Needed in Implementation	Description	Type	NV	GET	Value
02	Conditional[1]	**Connection Diagnostics**	**STRUCT** of		X	
		Maximum CIP I/O connections opened	UINT			Number of Class 1 connections opened since the last reset
	Needed in implementation	Current CIP I/O connections	UINT			Number of Class 1 connections currently opened.
	Required	Maximum CIP explicit connections opened	UINT			Number of Class 3 connections opened since the last reset.
	Conditional[1]	Current CIP explicit connections	UINT			Number of Class 3 connections currently opened.
	Conditional[1]	CIP detected connections opening errors	UINT			Increments each time a Forward Open is not successful (Originator and Target).
		CIP detected connection timeout errors	UINT			Increments when a connection times out (Originator and Target).
	Needed in implementation	Maximum EIP TCP connections opened	UINT			Number of TCP connections (used for EIP as client or server) opened since the last reset.
	Required	Current EIP TCP connections	UINT			Number of TCP connections (used for EIP as client or server) currently open.
X = supported						

Attribute ID hex	Needed in Implementation	Description	Type	NV	GET	Value
03	Conditional[1]	**I/O Messaging Diagnostics**	**STRUCT** of		X	
	Conditional[1]	I/O production counter	UDINT			Increments each time a Class 0/1 message is sent.
		I/O consumption counter	UDINT			Increments each time a Class 0/1 message is received.
	Needed in implementation	I/O detected production sent errors counter	UINT			Increments each time a Class 0/1 message is not sent.
	Required	I/O detected consumption receive errors counter	UINT			Increments each time a consumption is received with a detected error.
04	Conditional[1]	**Explicit Messaging Diagnostics**	**STRUCT** of		X	
	Conditional[1]	Class 3 messages sent counter	UDINT			Increments each time a Class 3 message is sent (client and server).
		Class 3 messages received counter	UDINT			Increments each time a Class 3 message is received (client and server).
	Needed in implementation	UCMM messages sent counter	UDINT			Increments each time a UCMM message is sent (client and server).
	Required	UCMM messages received counter	UDINT			Increments each time a UCMM message is received (client and server).
X = supported						

Section 5.5
Diagnostics Available through Unity Pro

What Is in This Section?

This section contains the following topics:

Introduction to Unity Pro Diagnostics

Introduction

The Modicon M580 modules support online actions.

Tasks

Use online actions to perform these tasks:
- Display EtherNet/IP objects for a remote EtherNet/IP device.
- Ping the CPU remote I/O scanner module, a remote EtherNet/IP, or a Modbus TCP device to confirm it is active on the Ethernet network.
- Connect to a remote device to perform these actions:
  - View the remote device's default parameter settings.
  - View the remote device's current parameter settings.
  - Edit and download to the remote device its editable parameter settings.

Displaying I/O Memory Consumption

Displaying Memory Consumption

In Unity Pro you can monitor the I/O memory consumption by viewing the adapter properties. In the **Project Browser**, double-click **Configuration** →**EIO Bus** →**Modicon M580 remote drop**. Then right-click **Modicon M580 remote drop** and select **Properties**.

The **IO-Memory** tab looks like this:
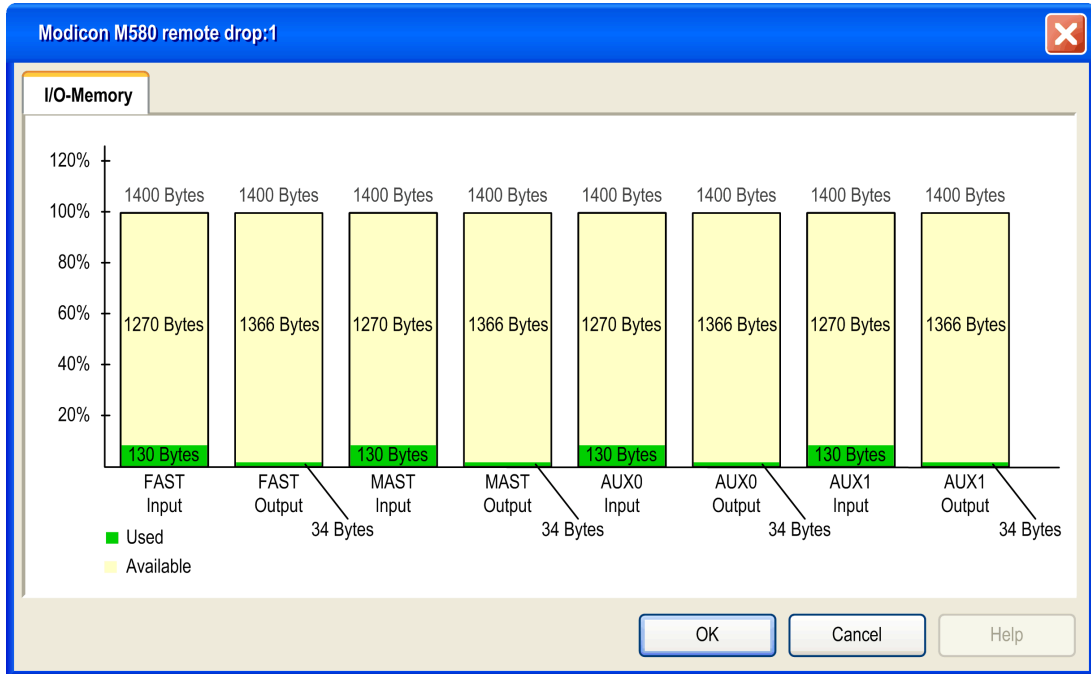
Exceeding EIO Limitations

Unity Pro displays a detected **error** in the log window if one of these events occurs:
- The size of the RIO drop memory for the MAST task exceeds 1400 input bytes or 1400 output bytes.
- The size of the RIO drop memory for the FAST task exceeds 1400 input bytes or 1400 output bytes.
- The size of the RIO drop memory for an AUX task exceeds 1400 input bytes or 1400 output bytes.

Chapter 6
Firmware Upgrade

Adapter Firmware Upgrade

Overview

Use these procedures to upgrade the firmware for the remote I/O adapter:

Stage	Description
1	Download and install Unity Loader software.
2	Configure and store IP parameters (optional).
3	Connect your configuration PC to the remote I/O adapter.
4	Transfer the firmware upgrade to the remote I/O adapter or the Ethernet backplane.

The minimum required version of Unity Loader is V8.0.

Upgrading the BMX CRA 312 10 and the BME CRA 312 10 are done the same way.

Downloading and Installing Unity Loader

Download the Unity Loader software to your PC:

Step	Action
1	Enter the web address for Schneider Electric (www.schneider-electric.com) in an Internet browser.
2	In the **Search from input field**, enter the phrase **Unity Loader** and press `Enter`.
3	Examine the search results and select the appropriate entry for the Unity Loader software. **NOTE:** You can select the **Download →Softwares** menu command to filter the results.
4	Follow the on-screen instructions to download both the Unity Loader installation software and any necessary installation instructions.
5	Run the Unity Loader setup file and follow the instructions (on the screen and in the downloaded documentation) to install Unity Loader.

Default Address Configurations

If the CRA IP address is not configured, you can temporarily use its default IP address by setting the rotary switch to Stored. This default IP address is overwritten when you configure and store valid IP parameters.

The adapter uses these default address configurations:

Parameter	Description
Default IP Address	The default IP address starts with 10.10 and uses the last 2 bytes of the MAC address. As an example, a device with the MAC address of 00:00:54:10:8A:05 has a default IP address of 10.10.138.5 (0x8A=138, 0x05=5).
Default Sub-Network Mask	The default mask is 255.0.0.0 (a class A mask).
Default Gateway Address	The default gateway address is identical to the default IP address.

The default address is based on the adapter MAC address. This makes it possible for several Schneider Electric devices to use their default network configurations on the same network.

To configure and store IP parameters that are not the default values for the remote drop adapter:

Step	Action
1	Start or re-start the adapter with the rotary switch set to**Stored**.
2	Store the IP address by sending a explicit message to the TCP/IP Interface Object *(see page 87)* (Attribute ID 05: Interface Configuration).

NOTE: The adapter uses the stored IP parameters only after a power cycle.

Connect the Configuration PC to the Remote I/O Adapter

Connect your configuration PC (that is running Unity Loader) directly to the adapter module via an Ethernet port.

Verify that communications are established between the PC and the adapter by issuing a Ping command from the PC:

Step	Action	Comment
1	Open a command window on the PC.	**Start →Run**.
2	In the **Run** dialog, type in **cmd**.	
3	Click **OK**.	
4	At the command prompt, type in the ping command and the device IP address.	Example: `C:\>ping 192.168.21.38:`
5	The command window verifies that a connection is established.	Example: `Reply from 192.168.21.38...`

Upgrade Procedure

Do not interrupt the firmware download process by:
- allowing an interruption to the power or communications
- closing the Unity Loader software

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, restart the process.

NOTE: If the download is not completed, there is a message saying that the upgrade was unsuccessful.

To update the firmware for the remote I/O adapter:

Step	Action
1	Open Unity Loader on your PC. (**Start** →**Programs** →**Schneider Electric** → **Unity Loader**) **Result:** Unity Loader opens and displays the **Project** tab.
2	At the bottom of the tab in the **Connection** area, connect to the module: ● In the **Media** list, select **Ethernet**. ● In the **Address** field, type in the IP address of the adapter, which is either: 　● *configured*: The adapter is already communicating on the network and the IP address for the module is configured in the application in the BME P58 ••40 module. 　● *default*: The adapter's rotary switch position is **Stored** and you did not already store valid IP parameters. ● Click **Connect**.
3	After Unity Loader has connected to the module, click the **Firmware** tab in the **Unity Loader** dialog.
4	In the **PC** area, click the ellipsis (**...**) button to open a dialog where you can navigate to and select the firmware file for the adapter module. The firmware is contained in a Unity Loader file (.LDX extension). **NOTE:** When using the BME CRA 312 10, you can also update firmware for a BME XBP ••00. 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.
5	When the arrow in the middle of the **Unity Loader** dialog 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 remote I/O adapter.
6	Click **Yes** on the 2 dialogs that appear.
7	The **Transferring data to PLC** opens, which indicates the transfer status with the blue bars at the bottom of the screen.

Step	Action
8	After the transfer is complete, click **Close**.
9	In the Unity Loader software, click **Disconnect** and close the window.
10	Reboot the module to finalize the firmware update.

From 1 instance of Unity Loader, you can only update 1 device. To update several devices at the same time, open additional instances of Unity Loader. In this case, additional dialogs. Click **Yes** to close each dialog.

The upgrade process takes approximately 3 minutes:
- firmware upgrade (approximately 2 minutes)
- reboot, reestablish I/O connections (1 minute)

During the firmware upgrade, the I/O communications with the adapter module is interrupted. After the hold up time *(see page 54)* expires, the I/O modules move to the security mode, that is, their I/O values = 1.

Glossary

A

adapter

An adapter is the target of real-time I/O data connection requests from scanners. It cannot send or receive real-time I/O data unless it is configured to do so by a scanner, and it does not store or originate the data communications parameters necessary to establish the connection. An adapter accepts explicit message requests (connected and unconnected) from other devices.

AUX

An (AUX) task is an optional, periodic processor task that is run through its programming software. The AUX task is used to execute a part of the application requiring a low priority. This task is executed only if the MAST and FAST tasks have nothing to execute. The AUX task has two sections:
- IN: Inputs are copied to the IN section before execution of the AUX task.
- OUT: Outputs are copied to the OUT section after execution of the AUX task.

B

broadcast

A message sent to all devices in the subnet.

C

CCOTF

(*change configuration on the fly*) A feature of Unity Pro that allows a CPU hardware change in the system configuration while the system is operating and not impacting other active operations.

CIP™

(*common industrial protocol*) A comprehensive suite of messages and services for the collection of manufacturing automation applications (control, safety, synchronization, motion, configuration and information). CIP allows users to integrate these manufacturing applications with enterprise-level Ethernet networks and the internet. CIP is the core protocol of EtherNet/IP.

D

DDT

(*derived data type*) A derived data type is a set of elements with the same type (ARRAY) or with different types (structure).

determinism

> For a defined application and architecture, you can predict that the delay between an event (change of value of an input) and the corresponding change of a controller output is a finite time *t*, smaller than the deadline required by your process.

DRS

> (*dual-ring switch*) A ConneXium extended managed switch that has been configured to operate on an Ethernet network. Predefined configuration files are provided by Schneider Electric to downloaded to a DRS to support the special features of the main ring / sub-ring architecture.

E

Ethernet

> A 10 Mb/s, 100 Mb/s, or 1 Gb/s, CSMA/CD, frame-based LAN that can run over copper twisted pair or fiber optic cable, or wireless. The IEEE standard 802.3 defines the rules for configuring a wired Ethernet network; the IEEE standard 802.11 defines the rules for configuring a wireless Ethernet network. Common forms include 10BASE-T, 100BASE-TX, and 1000BASE-T, which can utilize category 5e copper twisted pair cables and RJ45 modular connectors.

EtherNet/IP™

> A network communication protocol for industrial automation applications that combines the standard internet transmission protocols of TCP/IP and UDP with the application layer common industrial protocol (CIP) to support both high speed data exchange and industrial control. EtherNet/IP employs electronic data sheets (EDS) to classify each network device and its functionality.

explicit messaging

> TCP/IP-based messaging for Modbus TCP and EtherNet/IP. It is used for point-to-point, client/server messages that include both data, typically unscheduled information between a client and a server, and routing information. In EtherNet/IP, explicit messaging is considered class 3 type messaging, and can be connection-based or connectionless.

F

FAST

> An event-triggered (FAST) task is an optional, periodic processor task that identifies high priority, multiple scan requests, which is run through its programming software. A FAST task can schedule selected I/O modules to have their logic solved more than once per scan. The FAST task has two sections:
> - IN: Inputs are copied to the IN section before execution of the FAST task.
> - OUT: Outputs are copied to the OUT section after execution of the FAST task.

I

implicit messaging

UDP/IP-based class 1 connected messaging for EtherNet/IP. Implicit messaging maintains an open connection for the scheduled transfer of control data between a producer and consumer. Because an open connection is maintained, each message contains primarily data, without the overhead of object information, plus a connection identifier.

IP address

The 32-bit identifier, consisting of both a network address and a host address assigned to a device connected to a TCP/IP network.

L

local rack

An M580 rack containing the CPU and a power supply. A local rack consists of one or two racks: the main rack and the extended rack, which belongs to the same family as the main rack. The extended rack is optional.

M

MAST

A master (MAST) task is a deterministic processor task that is run through its programming software. The MAST task schedules the RIO module logic to be solved in every I/O scan. The MAST task has two sections:

- IN: Inputs are copied to the IN section before execution of the MAST task.
- OUT: Outputs are copied to the OUT section after execution of the MAST task.

multicast

A special form of broadcast where copies of the packet are delivered to only a specified subset of network destinations. Implicit messaging typically uses multicast format for communications in an EtherNet/IP network.

P

PAC

programmable automation controller. The PAC is the brain of an industrial manufacturing process. It automates a process as opposed to relay control systems. PACs are computers suited to survive the harsh conditions of the industrial environment.

port 502

Port 502 of the TCP/IP stack is the well-known port that is reserved for Modbus TCP communications.

port mirroring

In this mode, data traffic that is related to the source port on a network switch is copied to another destination port. This allows a connected management tool to monitor and analyze the traffic.

R

RIO drop

One of the three types of RIO modules in an Ethernet RIO network. A RIO drop is an M580 rack of I/O modules that are connected to an Ethernet RIO network and managed by an Ethernet RIO adapter module. A drop can be a single rack or a main rack with an extended rack.

RIO network

An Ethernet-based network that contains 3 types of RIO devices: a local rack, an RIO drop, and a ConneXium extended dual-ring switch (DRS). Distributed equipment may also participate in an RIO network via connection to DRSs.

RSTP

(*rapid spanning tree protocol*) Allows a network design to include spare (redundant) links to provide automatic backup paths if an active link stops working, without the need for loops or manual enabling/disabling of backup links.

S

service port

A dedicated Ethernet port on the M580 RIO modules. The port may support the following major functions (depending on the module type):
● port mirroring: for diagnostic use
● access: for connecting HMI/Unity Pro/ConneXview to the CPU
● extended: to extend the device network to another subnet
● disabled: disables the port, no traffic is forwarded in this mode

T

TCP

(*transmission control protocol*) A key protocol of the internet protocol suite that supports connection-oriented communications, by establishing the connection necessary to transmit an ordered sequence of data over the same communication path.

TCP/IP

Also known as *internet protocol suite*, TCP/IP is a collection of protocols used to conduct transactions on a network. The suite takes its name from two commonly used protocols: transmission control protocol and internet protocol. TCP/IP is a connection-oriented protocol that is used by Modbus TCP and EtherNet/IP for explicit messaging.

trap

A trap is an event directed by an SNMP agent that indicates one of these events:
- A change has occurred in the status of an agent.
- An unauthorized SNMP manager device has attempted to get data from (or change data on) an SNMP agent.

U

UDP

(*user datagram protocol*) A transport layer protocol that supports connectionless communications. Applications running on networked nodes can use UDP to send datagrams to one another. Unlike TCP, UDP does not include preliminary communication to establish data paths or provide data ordering and checking. However, by avoiding the overhead required to provide these features, UDP is faster than TCP. UDP may be the preferred protocol for time-sensitive applications, where dropped datagrams are preferable to delayed datagrams. UDP is the primary transport for implicit messaging in EtherNet/IP.

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