

Modicon M580

RIO Modules

Installation and Configuration Guide

Original instructions

10/2019

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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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Table of Contents



	Safety Information	5
	About the Book	9
Chapter 1	Characteristics of Ethernet RIO Modules	15
	Adapter Module Descriptions	16
	LED Indicators on Adapter Modules	20
	Adapter Ethernet Ports	22
	RIO Network Cable Installation	24
	Modicon X80 I/O Modules	25
	Configuring the BMXNOM0200.4 Module in an X80 Drop	32
	Standards and Certifications	35
Chapter 2	Installation	37
2.1	Installing Modicon X80 Modules	38
	Maximum Configuration in RIO Drops	39
	Modicon X80 Backplane Considerations	40
	Adapter and I/O Module Installation	42
	Setting the Location of the Ethernet Remote I/O Drop	46
2.2	Remote I/O Infrastructure Cables	47
	Cable Installation	48
	Duplicate IP Address Checking	50
	Loss of I/O Connection	51
Chapter 3	Configuration and Programming with Control Expert	53
3.1	Creating a Control Expert Project	54
	Configuring the RIO Drop	54
3.2	Control Expert Configuration for Ethernet RIO Modules	57
	RSTP Bridge Configuration	58
	SNMP Agent Configuration	59
	Service Port Configuration	61
3.3	Control Expert Configuration for RIO Drops	62
	Configuring Remote Drop Parameters	63
	Time Stamping	66
	Device DDT Names for M580 RIO Adapters	68
Chapter 4	Implicit and Explicit Messaging	75
	Explicit Messaging	76
	Implicit I/O Exchanges	77

Chapter 5	Diagnostics	79
5.1	Service Port Management	80
	Service Port Configuration	80
5.2	Diagnostics Available through the CPU	81
	System Diagnostics	81
5.3	Diagnostics Available through Modbus/TCP	83
	Modbus Diagnostic Codes	83
5.4	Diagnostics Available through EtherNet/IP CIP Objects	84
	About CIP Objects	85
	Identity Object	86
	Assembly Object	88
	Connection Manager Object	90
	Quality of Service (QoS) Object	92
	TCP/IP Interface Object	94
	Ethernet Link Object	96
	EtherNet/IP Interface Diagnostics Object	101
	I/O Connection Diagnostics Object	104
	EtherNet/IP Explicit Connection Diagnostics Object	108
	EtherNet/IP Explicit Connection Diagnostics List Object	110
	RSTP Diagnostics Object	112
	Service Port Control Object	117
	SNTP Diagnostics Object	119
	Ethernet Backplane Diagnostics Object	123
5.5	Diagnostics Available through Control Expert	126
	Introduction to Control Expert Diagnostics	127
	Displaying I/O Memory Consumption	128
Chapter 6	Firmware Update	131
	EIO Adapter Firmware Update	131
Glossary		135
Index		155

Safety Information



Important Information

NOTICE

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



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



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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

PLEASE NOTE

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

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

BEFORE YOU BEGIN

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

 WARNING
UNGUARDED EQUIPMENT
<ul style="list-style-type: none">• Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.• Do not reach into machinery during operation.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

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

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

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

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

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

START-UP AND TEST

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

WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

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

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

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

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

Before energizing equipment:

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

OPERATION AND ADJUSTMENTS

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

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

About the Book



At a Glance

Document Scope

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

This guide describes these adapter modules:

- BMECRA31210
- BMXCRA31210
- BMXCRA31200

NOTE: This book discusses BM•CRA312•1 adapter modules in M580 systems. To use Quantum 140CRA312•0 adapter modules in an M580 system, refer to chapter *Characteristics of Ethernet Remote I/O Modules* (see *Quantum EIO, Remote I/O Modules, Installation and Configuration Guide*).

These CPUs support Quantum RIO drops that include a 140CRA312•0 adapter module:

- BMEP584040 (version 2.10 or later)
- BMEP585040
- BMEP586040
- BMEH584040
- BMEH586040

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. To configure RIO drops in an M580 Hot Standby system, refer to the chapter *M580 (e)X80 RIO Drops* (see *Modicon M580 Hot Standby, System Planning Guide for Frequently Used Architectures*).

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 RIO systems when used with EcoStruxure™ Control Expert 14.1 or later.

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

Step	Action
1	Go to the Schneider Electric home page www.schneider-electric.com .
2	In the Search box type the reference of a product or the name of a product range. <ul style="list-style-type: none">● Do not include blank spaces in the reference or product range.● To get information on grouping similar modules, use asterisks (*).
3	If you entered a reference, go to the Product Datasheets search results and click on the reference that interests you. If you entered the name of a product range, go to the Product Ranges search results and click on the product range that interests you.
4	If more than one reference appears in the Products search results, click on the reference that interests you.
5	Depending on the size of your screen, you may need to scroll down to see the datasheet.
6	To save or print a datasheet as a .pdf file, click Download XXX product datasheet .

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

Related Documents

Title of documentation	Reference number
Electrical installation guide	EIGED306001EN (English)
Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications	EIO0000002726 (English), EIO0000002727 (French), EIO0000002728 (German), EIO0000002730 (Italian), EIO0000002729 (Spanish), EIO0000002731 (Chinese)
Modicon M580 Standalone, System Planning Guide for Frequently Used Architectures	HRB62666 (English), HRB65318 (French), HRB65319 (German), HRB65320 (Italian), HRB65321 (Spanish), HRB65322 (Chinese)
Modicon M580 Standalone, System Planning Guide for Complex Topologies	NHA58892 (English), NHA58893 (French), NHA58894 (German), NHA58895 (Italian), NHA58896 (Spanish), NHA58897 (Chinese)
Modicon M580 Hot Standby, System Planning Guide for Frequently Used Architectures	NHA58880 (English), NHA58881 (French), NHA58882 (German), NHA58883 (Italian), NHA58884 (Spanish), NHA58885 (Chinese)
Modicon M580, Hardware, Reference Manual	EIO0000001578 (English), EIO0000001579 (French), EIO0000001580 (German), EIO0000001582 (Italian), EIO0000001581 (Spanish), EIO0000001583 (Chinese)
Modicon X80 Racks and Power Supplies, Hardware, Reference Manual	EIO0000002626 (English), EIO0000002627 (French), EIO0000002628 (German), EIO0000002630 (Italian), EIO0000002629 (Spanish), EIO0000002631 (Chinese)
Modicon X80, BMXERT1604T Time Stamp Module, User Guide	EIO0000001121 (English), EIO0000001122 (French), EIO0000001123 (German), EIO0000001125 (Italian), EIO0000001124 (Spanish), EIO0000001126 (Chinese)

Title of documentation	Reference number
Modicon X80, BMXNOM0200 Serial Link Module, User Manual	EIO0000002696 (English), EIO0000002697 (French), EIO0000002698 (German), EIO0000002699 (Italian), EIO0000002700 (Spanish), EIO0000002701 (Chinese)
Quantum EIO, Remote I/O Modules, Installation and Configuration Guide	S1A48978 (English), S1A48981 (French), S1A48982 (German), S1A48983 (Italian), S1A48984 (Spanish), S1A48985 (Chinese)
Quantum using EcoStruxure™ Control Expert, Hardware Reference Manual	35010529 (English), 35010530 (French), 35010531 (German), 35013975 (Italian), 35010532 (Spanish), 35012184 (Chinese)
Modicon M340 for Ethernet, Communications Modules and Processors, User Manual	31007131 (English), 31007132 (French), 31007133 (German), 31007494 (Italian), 31007134 (Spanish), 31007493 (Chinese)
System Time Stamping, User Guide	EIO0000001217 (English), EIO0000001707 (French), EIO0000001708 (German), EIO0000001710 (Italian), EIO0000001709 (Spanish), EIO0000001711 (Chinese)
EcoStruxure™ Control Expert, Applicative Time Stamping, User Guide	EIO0000001268 (English), EIO0000001702 (French), EIO0000001703 (German), EIO0000001705 (Italian), EIO0000001704 (Spanish), EIO0000001706 (Chinese)
EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual	35006144 (English), 35006145 (French), 35006146 (German), 35013361 (Italian), 35006147 (Spanish), 35013362 (Chinese)

Title of documentation	Reference number
EcoStruxure™ Control Expert, UnityLL984, Block Library	EIO0000000550 (English), EIO0000000807 (French), EIO0000000808 (German), EIO0000000809 (Italian), EIO0000000810 (Spanish), EIO0000000811 (Chinese)

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

Chapter 1

Characteristics of Ethernet RIO Modules

Introduction

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

- BMECRA31210
- BMXCRA31210
- BMXCRA31200

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

NOTE: This book describes the BM• CRA 312 •1 adapter modules. To use Quantum 140 CRA adapter modules in M580 systems, refer to the Quantum RIO Modules guide (*see Quantum EIO, Remote I/O Modules, Installation and Configuration Guide*).

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Adapter Module Descriptions	16
LED Indicators on Adapter Modules	20
Adapter Ethernet Ports	22
RIO Network Cable Installation	24
Modicon X80 I/O Modules	25
Configuring the BMXNOM0200.4 Module in an X80 Drop	32
Standards and Certifications	35

Adapter Module Descriptions

Introduction

An RIO drop consists of one or two racks of Modicon X80 I/O modules and/or third-party PME SWT 0100 modules. An RIO drop is connected to the daisy-chain loop on which the Ethernet RIO network resides. Each remote drop contains one BM•CRA312•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 BMXCRA31200 is a basic adapter module that supports X Bus communications across the remote backplane, but not Ethernet. It does not support: <ul style="list-style-type: none"> ● 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 (<i>see page 77</i>) tasks. Your application cannot assign FAST and AUX tasks in it.
X80 performance EIO adapter	The BMXCRA31210 adapter module supports X Bus communications across the remote backplane, but not Ethernet. It supports: <ul style="list-style-type: none"> ● an extension rack ● special-purpose modules ● native timestamping ● service port ● MAST (<i>see page 77</i>), FAST (<i>see page 77</i>), and AUX0 (<i>see page 78</i>)/AUX1 (<i>see page 78</i>) task customization of the Ethernet I/O scanner service
eX80 performance EIO adapter	The BMECRA31210 adapter supports Ethernet and X Bus communications across the remote backplane. This adapter needs to be installed in an Ethernet backplane. It supports: <ul style="list-style-type: none"> ● the capabilities of a BMXCRA31210 adapter ● Ethernet I/O modules on rack slots connected to the Ethernet backplane in the remote drop, such as the BMEAH0812 and BMEAH00412 HART-compatible analog modules, and PME SWT 0100 weighing module

NOTE: You can also use these BMECRA312•0 eX80 EIO adapter modules in a Quantum EIO system with a high-end CPU (140CPU6•••• (*see Quantum using EcoStruxure™ Control Expert, Hardware, Reference Manual*)) configured on the local rack.

RIO Drop Maximum Configuration

The maximum number of channels in an RIO drop depends on the eX80 EIO adapter module:

EIO adapter	Maximum number of Channels			
	Discrete	Analog	Expert	Sensor bus
BMXCRA31200	128	16	–	–
BMXCRA31210	1024	256	36	2
BMECRA31210	1024	256	36	2

NOTE: The number of available channels could differ from the maximum values shown because the values depend on the CPU reference and the other modules in the same drop. Refer to the description of Modicon X80 I/O Modules (*see page 25*).

To configure Quantum RIO drops, refer to the Quantum EIO installation and configuration guide.

Functionality

The adapters exchange data through the Ethernet I/O scanner service in the CPU on the main local rack of your PAC system:

- The input data from the RIO 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 RIO logic is scanned regularly in a scheduled and predictable manner.

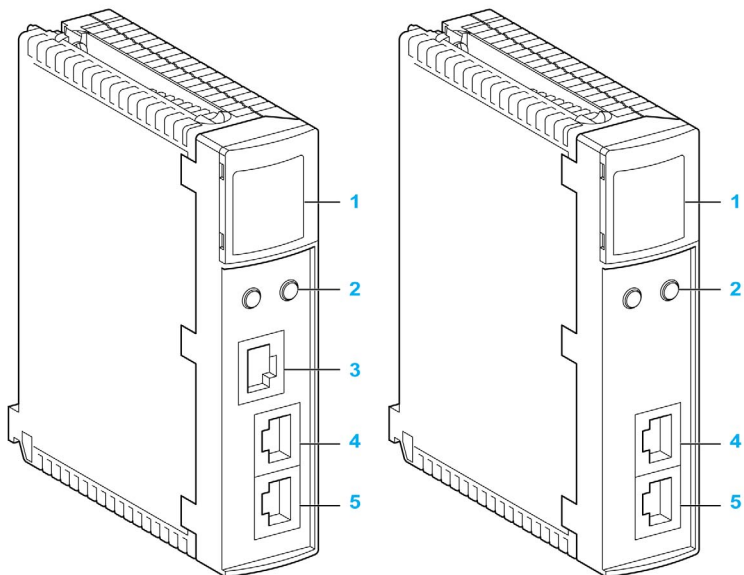
NOTE: Refer to your system hardware reference manual to select a CPU that supports the Ethernet I/O scanner service.

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

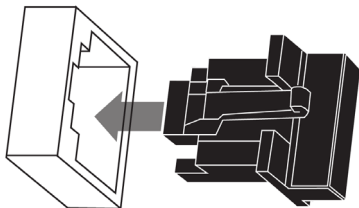


- 1 LED display
- 2 rotary switches
- 3 SERVICE port (ETH 1)
- 4 DEVICE NETWORK port (ETH 2)
- 5 DEVICE NETWORK port (ETH 3)

NOTE: Refer to the LEDs (*see page 20*).

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

NOTE: Insert dust covers into the unused Ethernet ports on the adapter modules:



Ruggedized Versions

The BMECRA31210C and BMXCRA31210C (coated) equipment are the ruggedized versions of the respectively BMECRA31210 and BMXCRA31210 (standard) equipment. They can be used at standard temperatures and in harsh chemical environments.

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

Altitude Operating Conditions

The characteristics apply to the eX80 EIO adapter modules BM•CRA312•0(C) for use at altitude up to 2000 m (6560 ft). When the modules operate above 2000 m (6560 ft), apply additional derating.

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

LED Indicators on Adapter Modules

Display

The LEDs are on the front of the adapter module:



Indications

NOTICE

UNINTENDED EQUIPMENT BEHAVIOR

Confirm that each module has a unique IP address. Duplicate IP addresses can cause unpredictable module/network behavior.

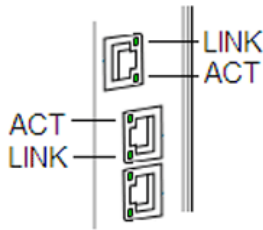
Failure to follow these instructions can result in equipment damage.

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	-	-
	One or more owner connections has timed out	-	-	-	-	-	flashing
	duplicate IP address	-	-	-	-	off	on

Module State ⁽¹⁾	Description	Run	IO	MS (Module Status)		NS (Network Status)	
		Green	Red	Green	Red	Green	Red
during OS firmware update		flashing	off	off	on	off	on
<p>(1) For more information about the module states, refer to your system hardware reference manual.</p> <p>NOTE 1 (STOP state):</p> <ul style="list-style-type: none"> ● 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. <p>NOTE 2 (RUN state):</p> <ul style="list-style-type: none"> ● 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

Two 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 31 adapters in a single Ethernet RIO network depending on the CPU used. For network topology planning, refer to the planning guide for your system.

These adapter modules have two or three 10/100 Base-T Ethernet ports:

Port	Description
SERVICE	<p>The SERVICE port allows the diagnosis of Ethernet device network ports and provides access to external tools and devices (Control Expert, ConneXium Network Manager, HMI, and so forth). The port supports these modes:</p> <ul style="list-style-type: none"> ● 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 <p>NOTE:</p> <ul style="list-style-type: none"> ● The BMXCRA31200 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 Control Expert, and so forth) through the SERVICE port. <p>Refer to <i>Service Port Configuration</i> (see page 61).</p>
DEVICE NETWORK	<p>The DEVICE NETWORK copper ports are used to put the drop on the simple daisy chain loop. They provide:</p> <ul style="list-style-type: none"> ● connections for RIO 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.

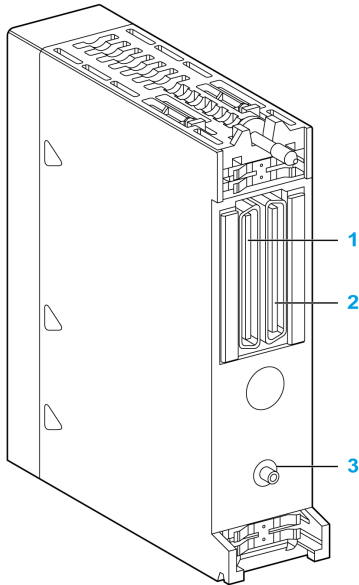
BMECRA31210 Keying Pin

The BMECRA31210 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 two 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 BMEXBP 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

RIO 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 two physical paths between:

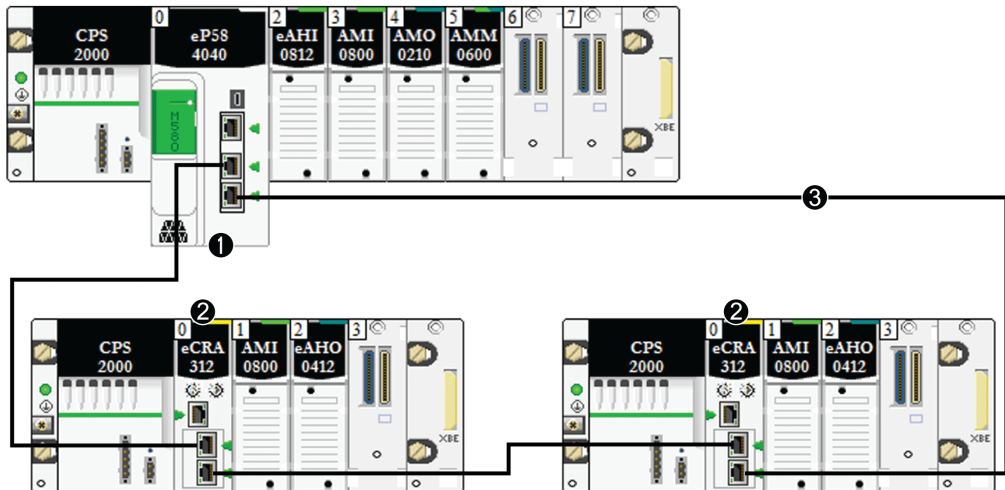
- the I/O scanner
- the adapter modules at each remote drop, dual ring switches (DRSs), or any product that has the capacity to be RIO scanned

For 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 BMXNRP020* optic fiber conversion module or a pair of DRSs.

RIO Simple Daisy Chain Loop

The CPU supports communications with RIO drops in a daisy chain loop:



- 1 main local rack with a BME•58••40 CPU with the Ethernet I/O scanner service
- 2 X80 RIO drops with a BM•CRA312•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.

Unless otherwise noted in the following tables, X80 I/O modules are supported on the following racks in RIO drops:

- an X Bus rack with a BMXCRA312•0 X80 EIO adapter module
- an Ethernet rack with a BMECRA312•0 eX80 EIO adapter module

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 Control Expert help.

NOTE: Conformally coated (hardened H) versions of many of these modules are also available. Refer to the specifications for hardened equipment in the *Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications* guide.

Modicon X80 Analog 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.

NOTE: Debug screens are not available for analog modules in RIO drops and the parameters can't be changed (Alignment, Filter, Offset...). If you need to modify the parameters, use the analog modules in local or local extended racks.

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

Type of Module	Module	Installation on...			
		Main Local Rack	Extended Local Rack	Main Remote Rack	Extended Remote Rack
input	BMXAMI••••	X ⁽³⁾	X ⁽³⁾	X	X
	BMXART•••• ⁽¹⁾	X ⁽³⁾	X ⁽³⁾	X	X
	BMEAH10812 ⁽²⁾	X ⁽³⁾	—	X ⁽⁴⁾	—
<p>1 The FAST task is not supported. 2 These modules require an Ethernet backplane. 3 Not supported in an M580 Hot Standby system. 4 When installed in an RIO drop, use a BM•CRA31210 (e)X80 performance EIO adapter module. These modules are not compatible with BM•CRA31200 (e)X80 standard EIO adapter modules. X allowed — not allowed</p>					

Type of Module	Module	Installation on...			
		Main Local Rack	Extended Local Rack	Main Remote Rack	Extended Remote Rack
output	BMXAMO****	X ⁽³⁾	X ⁽³⁾	X	X
	BMEAHO0412 ⁽²⁾	X ⁽³⁾	—	X ⁽³⁾	—
input/output	BMXAMM0600	X ⁽³⁾	X ⁽³⁾	X	X
<p>1 The FAST task is not supported. 2 These modules require an Ethernet backplane. 3 Not supported in an M580 Hot Standby system. 4 When installed in an RIO drop, use a BM•CRA31210 (e)X80 performance EIO adapter module. These modules are <u>not</u> compatible with BM•CRA31200 (e)X80 standard EIO adapter modules. X allowed — not allowed</p>					

NOTE: A maximum of 2 analog modules are allowed on an RIO drop that contains a BMXCRA31200.2 X80 EIO adapter module. These analog modules can have a maximum of 8 channels (16 for analog I/O modules).

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
BMXAMI0410	PV5	SV1.1
BMXAMM0600	PV5 or later	SV1.2
BMXAMO0210	PV7 or later	SV1.1
BMXART0414	PV5, PV6	SV2.0
	PV7	SV2.1
BMXART0814	PV3, PV4	SV2.0
	PV5 or later	SV2.1

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 BMXART0414 module, V2.1 or later, because it works correctly with a BM•CRA312•0 X80 EIO adapter module.)

Modicon X80 Discrete Modules

NOTE: In the CPU configuration screen in Control Expert, 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. (This configuration is not available in Hot Standby systems.)

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

Type of Module	Module	Installation on...			
		Main Local Rack	Extended Local Rack	Main Remote Rack	Extended Remote Rack
input	BMXDAI****	X ⁽²⁾	X ⁽²⁾	X	X
	BMXDDI**** ⁽¹⁾	X ⁽²⁾	X ⁽²⁾	X	X
output	BMXDAO****	X ⁽²⁾	X ⁽²⁾	X	X
	BMXDDO****	X ⁽²⁾	X ⁽²⁾	X	X
	BMXDRA**** ⁽¹⁾	X ⁽²⁾	X ⁽²⁾	X	X
	BMXDRC****	X ⁽²⁾	X ⁽²⁾	X	X
input/output	BMXDDM****	X ⁽²⁾	X ⁽²⁾	X	X
<p>1 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.</p> <p>2 Not supported in an M580 Hot Standby system.</p> <p>X allowed</p> <p>— not allowed</p>					

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 BMXART0414 module, V2.1 or later, because it works correctly with a BM•CRA312•0 X80 EIO adapter module.)

Communication Modules

NOTE: The maximum number of communication modules you can install on the local rack depends upon the CPU you choose (*see Modicon M580 Standalone, System Planning Guide for, Frequently Used Architectures*).

These communication modules are supported in M580 local racks (containing a CPU with Ethernet I/O communication server service) and RIO drops that contain a BM•CRA312•0 X80 EIO adapter module:

Module	Comment	Installation on...			
		Main Local Rack	Extended Local Rack	Main Remote Rack	Extended Remote Rack
BMXNOM0200 ⁽¹⁾	Only MAST task is supported. Additional restrictions are described in chapter <i>BMXNOM0200 Limitation and Implementation Rules</i> (<i>see Modicon X80, BMXNOM0200 Serial Link Module, User Manual</i>). Refer to the instruction to configure the BMXNOM0200 module in an X80 RIO drop (<i>see page 32</i>)	X ⁽³⁾	X ⁽³⁾	X ⁽⁴⁾	X
BMXNOR0200	Only MAST task is supported.	X ⁽³⁾	X ⁽³⁾	—	—
BMXNGD0100	Dedicated to global data. For configuration details, refer to the BMXNOE0100 user guide (3100713•) (<i>see Modicon M340 for Ethernet, Communications Modules and Processors, User Manual</i>). The BMXNGD0100 module has the same global data functionality as the BMXNOE0100, but it does not support these services: I/O scanning, address server, time synchronization, bandwidth monitoring, or web pages.	X ⁽³⁾	—	—	—
<ol style="list-style-type: none"> 1 If a BMXNOM0200 module and a BMXEIA0100 module are included on the same RIO drop, only one of each module is allowed. 2 Compatible with M580 CPUs V2.00 or later only. 3 Not supported in an M580 Hot Standby system. 4 When installed in an RIO drop, use a BM•CRA31210 (e)X80 performance EIO adapter module. These modules are not compatible with BM•CRA31200 (e)X80 standard EIO adapter modules. <p>X allowed — not allowed</p>					

Module	Comment	Installation on...			
		Main Local Rack	Extended Local Rack	Main Remote Rack	Extended Remote Rack
BMXEIA0100 ⁽¹⁾	<p>Only MAST task is supported.</p> <p>A maximum of 16 AS-i modules in an M580 configuration is allowed.</p> <p>A maximum of two AS-i modules on an RIO drop containing a BM•CRA3•• X80 EIO adapter is allowed.</p> <p>The following maximum number of AS-i modules on a local rack containing one of the following CPUs is allowed.</p> <ul style="list-style-type: none"> ● BMEP581020: two ● BMEP582020: four ● BMEP582040: four ● BMEP583020: six ● BMEP583040: six ● BMEP584020: eight ● BMEP584040: eight ● BMEP585040: eight ● BMEP586040: eight <p>A maximum of 16 AS-i modules is allowed in RIO drops in an M580 system that uses BME•585040 or BME•586040 CPUs.</p>	X ⁽³⁾	X ⁽³⁾	X ⁽⁴⁾	X
BMECXM0100 ⁽²⁾	<p>Connects an M580 CPU on an Ethernet network to CANopen fieldbus devices.</p> <p>Requires an Ethernet backplane.</p>	X ⁽³⁾	—	X	—
BMXNRP0200, BMXNRP0201	Fiber cable conversion	X	X	X	X
<p>1 If a BMXNOM0200 module and a BMXEIA0100 module are included on the same RIO drop, only one of each module is allowed.</p> <p>2 Compatible with M580 CPUs V2.00 or later only.</p> <p>3 Not supported in an M580 Hot Standby system.</p> <p>4 When installed in an RIO drop, use a BM•CRA31210 (e)X80 performance EIO adapter module. These modules are <u>not</u> compatible with BM•CRA31200 (e)X80 standard EIO adapter modules.</p> <p>X allowed — not allowed</p>					

Counting Modules

NOTE: When installed in an RIO drop, use a **BM•CRA31210** (e)X80 performance EIO adapter module. These modules are **not** compatible with **BM•CRA31200** (e)X80 standard EIO adapter modules.

NOTE: I/O event tasks are supported only through topological data type, not through device DDT.

These counting modules are supported in M580 local racks (containing a CPU with Ethernet I/O communication server service) and RIO drops that contain a BM•CRA31210 (e)X80 EIO performance adapter module:

Module	Comment	Installation on...			
		Main Local Rack	Extended Local Rack	Main Remote Rack	Extended Remote Rack
BMXEHC0200		X ⁽¹⁾	X ⁽¹⁾	X	X
BMXEHC0800	When configuring a BMXEHC0800 module, the dual phase counting mode function is not available in X80 EIO drops or when using device DDT in local racks. When configuring a BMXEHC0800.2 module the dual phase counting mode function is available in X80 EIO drops and when using device DDT in local racks. In this case the event feature is not available.	X ⁽¹⁾	X ⁽¹⁾	X	X
BMXEAE0300	In RIO drops: <ul style="list-style-type: none"> Events are not supported. If events are needed, move the module to the local rack. A maximum of 36 channels can be configured. 	X ⁽¹⁾	X ⁽¹⁾	X	X
1 Not supported in an M580 Hot Standby system. X allowed — not allowed					

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
BMXEHC0200	PV3	SV1.1
BMXEHC0800	PV3	SV1.1

NOTE: Schneider Electric recommends that you use Unity Loader to upgrade the modules with the latest available version.

Intelligent and Special Purpose Modules

These intelligent/special purpose modules are supported in M580 local racks (containing a CPU with Ethernet I/O communication server service) and RIO drops that contain a BM•CRA312•0 X80 EIO adapter module:

Module	Comment	Installation on...			
		Main Local Rack	Extended Local Rack	Main Remote Rack	Extended Remote Rack
BMXERT1604T	Limitations for the time stamping module are described in chapter <i>Compatibility and Limitations</i> (see <i>Modicon X80, BMXERT1604T/H Time Stamp Module, User Manual</i>).	X ⁽²⁾	X ⁽²⁾	X ⁽³⁾	X
PMXNOW0300	wireless multi-function access point/bridge	X ⁽²⁾	X ⁽²⁾	X	X
PMXCDA0400	diagnostic (machines, processes, and infrastructures)	X ⁽²⁾	X ⁽²⁾	X	X
PMESWT0100 ⁽¹⁾	This is an Ethernet weighing transmitter (1 channel) and requires an Ethernet backplane.	X ⁽²⁾	—	X	—
PMEUCM0302	universal communication This requires an Ethernet backplane.	X ⁽²⁾	—	X	—
PMEPXM0100	Profibus DP/DPV1 master module that requires an Ethernet backplane	X ⁽⁴⁾	X ⁽⁴⁾	X ⁽⁵⁾	X ⁽⁵⁾
BMENOR2200H	Modicon M580 BMENOR2200H Advanced RTU Module				
BMENUA0100	Ethernet communication module with embedded OPC UA server	X	—	—	—
<p>1 Scanned as a device by the DIO scanner in the CPU. 2 Not supported in an M580 Hot Standby system. 3 When installed in an RIO drop, use a BM•CRA31210 (e)X80 performance EIO adapter module. These modules are not compatible with BM•CRA31200 (e)X80 standard EIO adapter modules. 4 Not supported on a local rack in an M580 standalone system. 5 Not supported on an EIO remote drop in an M580 Hot Standby system. X allowed — not allowed</p>					

Configuring the BMXNOM0200.4 Module in an X80 Drop

Introduction

In X80 EIO drops, Modbus slave messages received by the BMXNOM0200 module are transferred to the X80 EIO adapter module (BMXCRA31210 or BMECRA31210). The adapter module forwards the message to the CPU.

To configure the BMXNOM0200 as a Modbus RS-485 RTU slave in an X80 drop, use these firmware versions and Control Expert **Hardware Catalog** devices:

Module	Firmware version	Control Expert Hardware Catalog device
BMXNOM0200	SV ≥ V1.5	BMXNOM0200.4
BMXCRA31210 or BMECRA31210	SV ≥ V2.14	BMXCRA31210 (SV >=2.10) or BMECRA31210 (SV >=2.10)

The BMXNOM0200 module is configured differently in an M580 X80 drop than Quantum RIO drop, and is compatible with M580 BME•58••40 CPUs.

Installing a BMXNOM0200.4 Module

To install a BMXNOM0200.4 module in an X80 drop, follow these steps:

Step	Action
1	Install the CPU module on the local rack.
2	Install the adapter module BMXCRA31210 (SV >=2.10) or BMECRA31210 (SV >=2.10) on an X80 drop.
3	Install the BMXNOM0200.4 module in the X80 drop.

Supported Protocols

For the BMXNOM0200.4 module:

- Channel 0 supports RS-232 or RS-485.
- Channel 1 supports only RS-485.

Declaring the BMXNOM0200 module as a BMXNOM0200.4 module in Control Expert allows you to configure the module for:

- Modbus RTU slave on RS-485

NOTE:

- Only Modbus RTU is supported as slave protocol.
- Only RS-485 is supported when Modbus slave is selected.
- Modbus Serial RTU and ASCII Master on RS-232 and RS-485
- Character mode

Hot Standby

The CPU Main IP address swaps in the case of a PAC switchover. The Modbus requests are still forwarded to the primary CPU.

NOTE: The Modbus client application manages the repetition of requests in case of a message loss that could occur during a PAC switchover.

Maximum Configuration

The maximum configuration of the BMXNOM0200.4 module includes the following elements:

Element	Maximum configuration
Master channel	Four (4) per configured drop with a maximum of 36 expert channels per drop. NOTE: Each configured channel of the BMXNOM0200.4 module counts as an expert channel.
Drop	Six (6) BMXNOM0200.4 per drop. NOTE: With M580 CPU OS version ≤ 2.40 , the maximum number of BMXNOM0200.4 per drop is limited to four (4).
M580 system	Thirty-one (31) BMXNOM0200.4
Modbus frame length	256 bytes

Supported Modbus Function Codes

This table lists the supported Modbus function codes (FC):

Binding to -> Modbus FC:	Variable type	Code	Function
01	%M	0X	Read coil status (output bit)
02	%M	1X	Read input status (input bit)
03	%MW	4X	Read holding registers
05	%M	0X	Force single coil
04	%MW	3X	Read input register
06	%MW	4X	Write single register
15	%M	0X	Write multiple coils
16	%MW	4X	Write multiple registers
23	%MW	4X	Read/write multiple registers

Accessing the Channel Configuration Screens

To access the channel configuration screens of the BMXNOM0200.4 module, follow these steps:

Step	Action
1	In the Control Expert Project Browser , open the BMXNOM0200.4 module.
2	Select the channel to configure. By default: <ul style="list-style-type: none"> ● Channel 0 is configured with the Character mode link function. ● Channel 1 is configured with the Modbus link function. NOTE: Some parameters are not accessible and are grayed out.

NOTE: Refer to the *Modicon X80, BMXNOM0200 Serial Link Module, User Manual* for details on these communication protocols.

Configuring Slave Modbus Link Communication

This table shows the default parameter values for the Modbus slave configuration screen:

Configuration parameter	Default value
Type	Slave
Slave number	1
Physical line	RS-485 only
Signals	RX/TX only
Transmission speed	19200 bits/s
Delay between frames	2 ms
Data	8 bits only
Stop	1 bit
Parity	Even

Standards and Certifications

Download

Click the link that corresponds to your preferred language to download standards and certifications (PDF format) that apply to the modules in this product line:

Title	Languages
Modicon M580, M340, and X80 I/O Platforms, Standards and Certifications	<ul style="list-style-type: none"> ● English: EIO0000002726 ● French: EIO0000002727 ● German: EIO0000002728 ● Italian: EIO0000002730 ● Spanish: EIO0000002729 ● Chinese: EIO0000002731

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	Topic	Page
2.1	Installing Modicon X80 Modules	38
2.2	Remote I/O Infrastructure Cables	47

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:

Topic	Page
Maximum Configuration in RIO Drops	39
Modicon X80 Backplane Considerations	40
Adapter and I/O Module Installation	42
Setting the Location of the Ethernet Remote I/O Drop	46

Maximum Configuration in RIO Drops

Maximum Configuration

The maximum number of I/O modules in an Modicon X80 RIO drop (with both a main remote rack and an extension remote rack) using a BM•CRA312•0 adapter depends on the CPU used in the main local rack.

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

This table shows the maximum number of modules in an RIO drop with a remote extension rack:

Module Type	Modules in a Drop	Comment
RIO adapter	1	—
power supply	2	—
bus extension	2	A bus extender attaches to the end of each rack and does not use a rack slot.
I/O	—	The number of modules depends on the CPU and the platform used. (Refer to the list of modules that RIO installations support (see page 25).

NOTE: Refer to the M580 Hot Standby guide for instructions to configure RIO drops in Hot Standby systems (*see Modicon M580 Hot Standby, System Planning Guide for, Frequently Used Architectures*).

Modicon X80 Backplane Considerations

Introduction

An X80 RIO drop can have one or two racks:

1. main RIO rack: BMEXBP**00 or BMXXBP**0

This rack is required in a drop and contains a BMXCRA31200, BMECRA31210, or BMXCRA31210 EIO adapter module, a power supply, and, optionally, I/O modules.

2. extended RIO rack: only BMXXBP**0

This rack is optional in a drop and contains only I/O modules.

Confirm that extended remote racks are PV 02 or later. Install modules that require Ethernet across the backplane on the main remote rack.

NOTE: The BMXCRA31200 does not support an extended RIO 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

Use these racks in an Modicon X80 RIO drops:

- X BUS (PV 02 or later) backplanes:

- BMXXBP0400
- BMXXBP0600
- BMXXBP0800
- BMXXBP1200
- BMXXBP0400H
- BMXXBP0600H
- BMXXBP0800H
- BMXXBP1200H

- Ethernet backplanes:

- BMEXBP0400
- BMEXBP0602
- BMEXBP0800
- BMEXBP1002⁽²⁾
- BMEXBP1200⁽¹⁾
- BMEXBP0400H
- BMEXBP0602H
- BMEXBP0800H
- BMEXBP1002⁽²⁾
- BMEXBP1200H⁽¹⁾

1. The 12-slot Ethernet rack has eight Ethernet-X Bus slots and four X Bus-only slots.
2. The 10-slot Ethernet rack has eight Ethernet-X Bus slots and two X Bus-only slots.

Rack Selection Considerations

A BMECRA31210 performance EIO adapter module:

- can be installed on an Ethernet rack only.
- can be installed on a PV 02 or later backplane, but it cannot manage Ethernet modules.
- cannot be installed in a PV 01 backplane because of its keying pin (*see page 23*)

A BMXCRA31210 or a BMXCRA31200 EIO adapter module:

- can be installed on a PV 02 or later backplane.
- can be installed on an Ethernet backplane, but it cannot manage Ethernet modules. However, it can manage modules that it manages on a PV 02 or later backplane.


Racks and Extensions

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

Bus Extender Module	Cable
BMXXBE1000	BMXXBC•••K (0.8 to 12 m)

Consideration of a Shielded Cable with an Accessible Metal Part

Follow all local and national safety codes and standards.


DANGER

HAZARD OF ELECTRIC SHOCK

If you cannot prove that the end of a shielded cable is connected to the local ground, the cable must be considered as dangerous and personal protective equipment (PPE) must be worn.

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 BMECRA31210 performance EIO adapter module and another device (adapter module) or DRS before you turn on the power.

Refer to your system hardware reference manual for details about DRSS.

Adapter and I/O Module Installation

Introduction

Observe the following guidelines when you install these adapter modules in an Modicon X80 RIO drop):


- BMECRA31210
- BMXCRA31210
- BMXCRA31200
- 140CRA31908

Order of Module Installation

Install modules in the selected rack in Control Expert 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 at both ends of the PAC connection, and lock out and tag out both the power sources.
- In case lock out and tag out are not available, ensure that the power sources cannot be inadvertently switched on.
- 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.

NOTE: Refer to the ground connection information in [Electrical installation guide](#).

Consideration of a Shielded Cable with an Accessible Metal Part

Follow all local and national safety codes and standards.

 **DANGER**

HAZARD OF ELECTRIC SHOCK

If you cannot prove that the end of a shielded cable is connected to the local ground, the cable must be considered as dangerous and personal protective equipment (PPE) must be worn.

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

Installation of the Adapter

Control Expert automatically installs an adapter module in slot 0 in an RIO 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 RIO 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 versions) are supported:

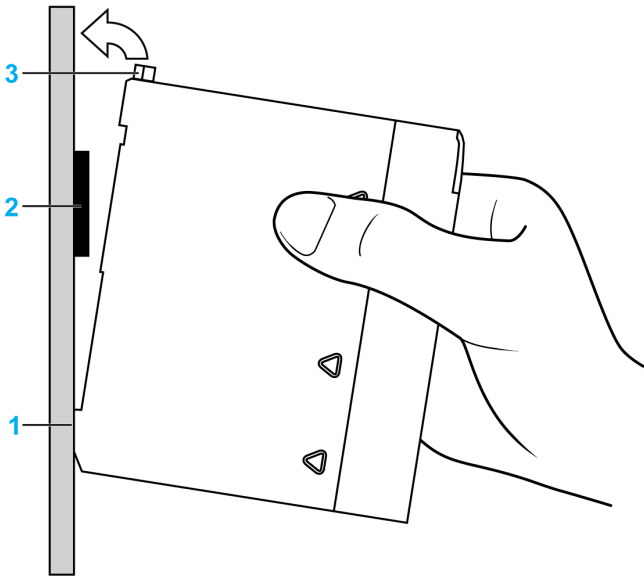
Power Supply Type	Modicon X80 Module
standalone	<ul style="list-style-type: none"> ● BMXCPS2010 ● BMXCPS3020 ● BMXCPS2000 ● BMXCPS3500 ● BMXCPS3540
redundant	<ul style="list-style-type: none"> ● BMXCPS4002 <p>NOTE: You can install BMXCPS4002 modules only on these dual-bus racks (Ethernet and X bus):</p> <ul style="list-style-type: none"> ● BMEXBP0602 ● BMEXBP1002

Select I/O Modules

Use the Control Expert 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	<p>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:</p> 
2	Swing the module up so that the connector engages the backplane connector.
3	Tighten the mounting screw so that the module is held in place on the rack. Tightening torque: 0.4...1.5 N•m (0.30...1.10 lbf-ft).

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:

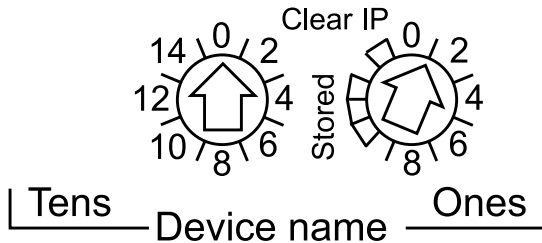
- Successful installation:
 - Initialization is finished.
 - Interconnections to other modules are validated (drop adapter module only).
- Unsuccessful installation:
 - Initialization does not finish.
 - Interconnections to other modules are not validated (drop adapter modules only).

You can see the status of the installation on the adapter LED display (*see page 20*).

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 20*) 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	48
Duplicate IP Address Checking	50
Loss of I/O Connection	51

Cable Installation

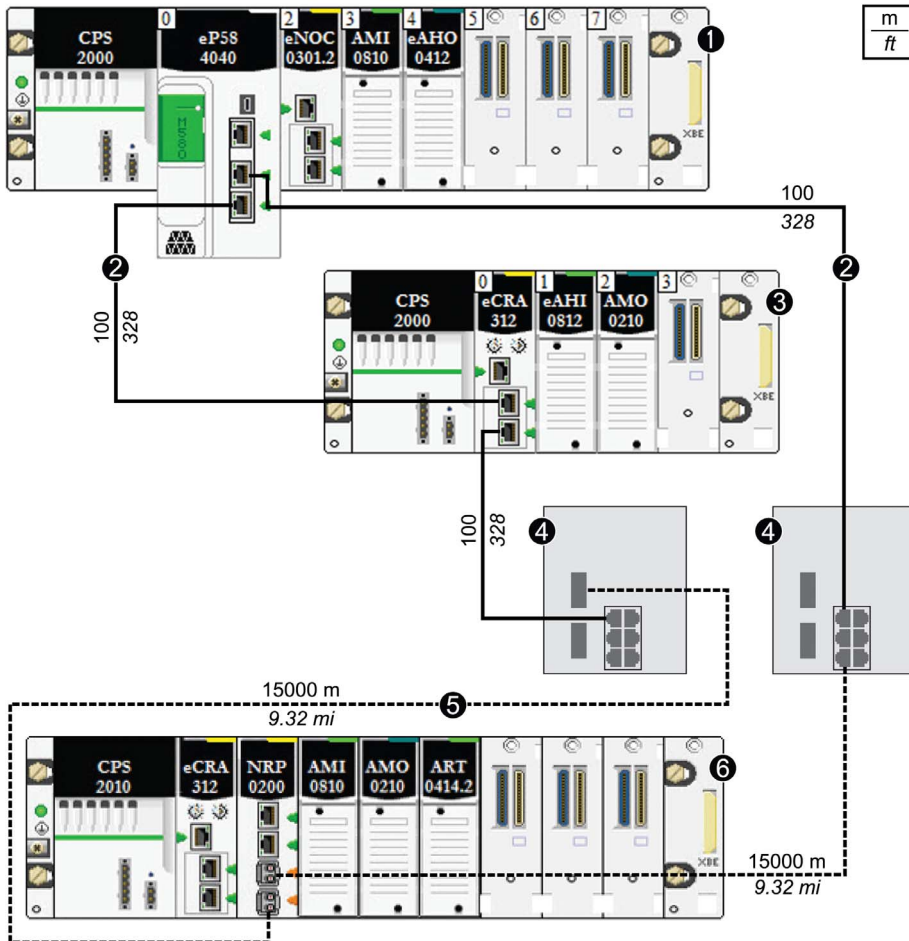
Introduction

A copper cable connection between two consecutive RIO drops cannot exceed 100 m. A fiber cable connection between two consecutive RIO drops cannot exceed 15 km (single mode) or 2.5 km (multi-mode).

For more information, refer to chapter *Modicon X80 Racks Installation* (see *Modicon X80, Racks and Power Supplies, Hardware Reference Manual*) and [Electrical installation guide](#).

Connections Between Devices

This figure shows the distances between RIO drops in a high-capacity daisy chain loop:



- 1 main local rack
- 2 copper cable (twisted pair)
- 3 RIO 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 RIO drop with a BMXNRP0200 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

NOTICE

UNINTENTIONAL EQUIPMENT BEHAVIOR

Confirm that each module has a unique IP address. Duplicate IP addresses can cause unpredictable module/network behavior.

Failure to follow these instructions can result in equipment damage.

Each adapter module 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: <ul style="list-style-type: none"> ● <i>no duplicate</i>: All services start. ● <i>duplicate</i>: I/O services stop. The BM•CRA312•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: <ul style="list-style-type: none"> ● <i>no duplicate</i>: All services continue. ● <i>duplicate</i>: All services stop. <p>NOTE: The updated Net Status LED (<i>see page 20</i>) indicates the status.</p>

Loss of I/O Connection

Conditions

An I/O connection can be lost to a BMECRA31210 or BMXCRA312•0 under these conditions:

- Performing a hot swap by replacing an adapter module with the same type.
- There is no RIO cable connection.
- The I/O connection is closed while the CPU is reconfigured.

Remote Adapter Fallback

In some instances, the RIO 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•58••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 Control Expert **Parameter** tab ([see page 63](#)). For more information, refer to your system planning guide.
- In hot standby systems, this situation occurs only when the adapter module loses the connection to the primary and secondary CPUs.

NOTE: Configure the hold up time on the Control Expert **Parameter** tab ([see page 63](#)). 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 is 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 Control Expert

Introduction

Use Control Expert to configure your remote drops for Ethernet communications.

What Is in This Chapter?

This chapter contains the following sections:

Section	Topic	Page
3.1	Creating a Control Expert Project	54
3.2	Control Expert Configuration for Ethernet RIO Modules	57
3.3	Control Expert Configuration for RIO Drops	62

Section 3.1

Creating a Control Expert Project

Configuring the RIO Drop

Introduction

Use these instructions to create a Control Expert project that allows communication between the I/O scanner and RIO modules.

Stages

Here are the basic stages of the Control Expert configuration:

Stage	Description
1	Select a CPU and a power supply to create a new Control Expert configuration. (Refer to the <i>Modicon M580 Hardware Reference Manual (see Modicon M580, Hardware, Reference Manual)</i>).
2	Configure a rack assembly for the RIO drop (in this section).

To help secure a Control Expert project against unwanted modifications, refer to the *Modicon M580 Hardware Reference Manual (see Modicon M580, Hardware, Reference Manual)*.

NOTE: These instructions assume that you have a working knowledge of Control Expert.

Rack Considerations

RIO 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 RIO Drops

When a BME•58••40 CPU module in the main local rack Control Expert automatically creates a second bus, the **EIO Bus**.

Use these instructions to configure a main RIO drop (on a **EIO Bus**):

Step	Action	Comment
1	In the Project Browser , double-click EIO Bus to see the (empty) RIO 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 BMEXBP0400 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 BMECRA31210 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 RIO 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 41*).

Maximum Channel Configuration

The maximum number of channels that can be configured for an X80 RIO drop is either:

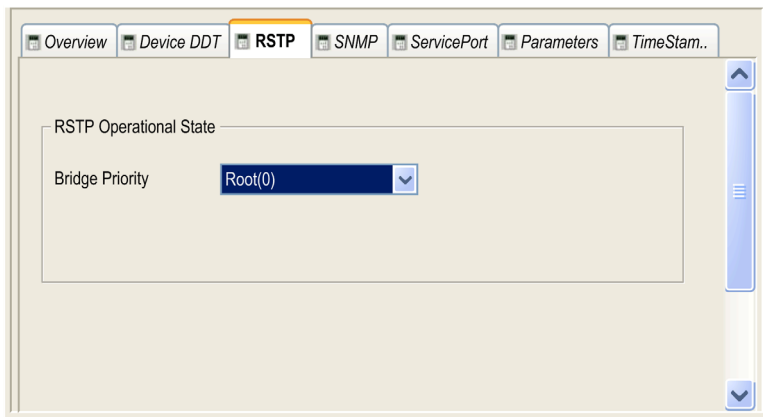
- 1024 digital channels
- 1024 channels that include 256 analog channels

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 RIO drop.

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

Control Expert Configuration Tabs

After you have placed your modules in the remote drop, double-click the RIO drop adapter module to see the available Control Expert configuration tabs:



- Device DDT (*see page 68*)
- RSTP (*see page 58*)
- SNMP (*see page 59*)
- Service port (*see page 61*)
The service port is not available on a drop with a BMXCRA31200 adapter.
- Parameters (*see page 63*)
- Time Stamping (*see page 66*)

Section 3.2

Control Expert Configuration for Ethernet RIO Modules

At a Glance

This section describes the module configuration tabs in Control Expert. Use the parameters on these tabs to configure services for a BM•CRA312•0 adapter module in an Ethernet RIO drop.

What Is in This Section?

This section contains the following topics:

Topic	Page
RSTP Bridge Configuration	58
SNMP Agent Configuration	59
Service Port Configuration	61

RSTP Bridge Configuration

About RSTP

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

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 Control Expert configuration to access the **RSTP** tab.

Parameters

This table shows the **Bridge priority** parameters for the **RSTP Operational State** on the Control Expert **RSTP** tab:

Bridge Priority	Value	BME•58••40 CPU	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 Control Expert 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 Control Expert **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 60)
	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	<i>unchecked</i> (default): You can edit the Location and Contact parameters. <i>checked</i> : 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	<i>unchecked</i> (default): not enabled. <i>checked</i> (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•CRA31210 adapter modules have a service port that can be configured for Ethernet communications or for port mirroring.

Double-click the adapter module in the Control Expert configuration to access the **Service Port** tab.

Service Port Parameters

These parameters are on the Control Expert **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 Control Expert, etc.) through the service port. NOTE: This mode is not available on the BMXCRA31200.
Access Port Configuration	Service Port Number	ETH1	You cannot edit the value in the Service Port Number field.
Port Mirroring Configuration	Source Port(s)	Internal Port	Ethernet traffic through the internal port
		ETH2	Ethernet traffic through the first RIO port
		ETH3	Ethernet traffic through the second RIO port
		Backplane Port	Ethernet traffic through the backplane 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 (*see page 117*) CIP object.

Section 3.3

Control Expert Configuration for RIO Drops

At a Glance

This section discusses the use of Control Expert to configure the Ethernet RIO drop and its adapter module. Included are descriptions of the parameters on the **Configuration**, **Parameter**, and **Device DDT** tabs in Control Expert.

What Is in This Section?

This section contains the following topics:

Topic	Page
Configuring Remote Drop Parameters	63
Time Stamping	66
Device DDT Names for M580 RIO Adapters	68

Configuring Remote Drop Parameters

Introduction

In the Control Expert **Parameters** 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 **Parameters** dialog in Control Expert:

Step	Action	Comment
1	Expand (+) EIO Bus in the Control Expert 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.

Edit the **Device Name** in Control Expert:

Step	Action
1	In the X80 performance EIO adapter window, select the Parameter tab.
2	Click the Update IP/DHCP configuration hyperlink. NOTE: An Ethernet Network table that lists all RIO drops in the system appears.
3	Double-click the arrow in the Identifier column matching the desired RIO drop in the BME*58_ECPU_EXT column.
4	Edit the Device Name in the Identifier field to reflect the new name
5	Close the Ethernet Network window and validate your project.

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: <ul style="list-style-type: none"> ● default value: 1000 ms ● valid value range: 50...65,530 ms

If you assign a hold up 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.

There is only one hold up time for an RIO drop (not one for each task) based on the watchdog value.

One RPI per task = task period/2

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION
Do not configure a holdup time value that is less than the recommended minimum values, which are: <ul style="list-style-type: none"> ● for a periodic application: 6 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
Custom RPI	Select this to configure the CRA->Scanner RPI setting.
CRA->Scanner RPI	<p>Inputs: The RPI is the input refresh rate at which the adapter module sends inputs to the CPU with Ethernet I/O scanner service. The RPI is set in the subscribe field for the adapter on the remote I/O drop:</p> <ul style="list-style-type: none"> ● <i>periodic mode:</i> default value = 1/2 MAST period. ● <i>cyclic mode:</i> default value = 1/4 watchdog timeout period.
Scanner->CRA RPI	<p>Outputs: Outputs are passed from the CPU with Ethernet I/O scanner service to the adapter. The default values are:</p> <ul style="list-style-type: none"> ● <i>periodic mode:</i> default value = 1.1 * MAST period. ● <i>cyclic mode:</i> default value = 1/4 * watchdog timeout period. <p>You cannot edit this value. The outputs are published synchronously or immediately at the end of the current MAST task.</p> <p>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.</p>

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.

LL984 Function Blocks

Quantum RIO drops that are used in a Modicon M580 system can use LL984 function blocks. For details, refer to Unity Pro Enhanced LL984 Block Library (*see EcoStruxure™ Control Expert, UnityLL984, Block Library*).

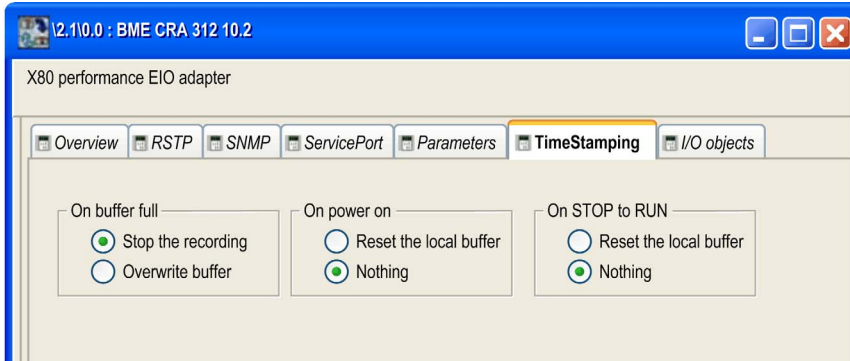
Time Stamping

RIO Drop Adapter Time Stamping Function

The BMXCRA31210 and BMXCRA31210 adapter modules have a 10 ms time stamping function. The BMXCRA31200 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•CRA31210, refer to BMX CRA 1604 T Variables Settings in Unity Pro (see *System Time Stamping, User Guide*).

When using one or two As-i Bus BMX EIA 0200 modules with other modules in a Modicon X80 RIO drop, the accuracy of the timestamps may be reduced.

Some examples:

Discrete I/O 32 Channels	Analog I/O 4 Channels	BMXEIA0100	BMXNOM0200	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 BMXERT1604T

Use a BMXERT1604T time stamp module for more accurate (1 ms) time stamping.

To configure the BMXERT1604T, refer to this manual (see *Modicon X80, BMXERT1604T/H Time Stamp Module, User Manual*).

For More Information about Remote Time Stamping

For more information about time stamping in a Modicon X80 RIO drop, refer to:

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

Device DDT Names for M580 RIO Adapters

Introduction

The Device DDT instance name can be defined manually but, when adding a module, a default device DDT instance name (*see EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual*) is defined by Control Expert.

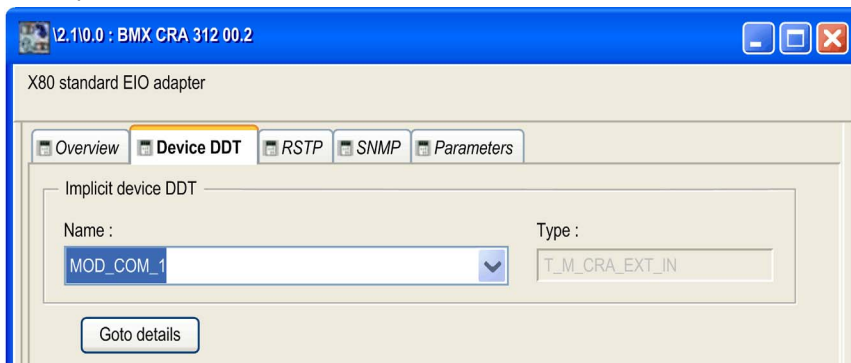
NOTE: These instructions assume that you have already added a drop to your Control Expert project (*see page 39*).

Access the Device DDT Tab

In Control Expert:

Step	Action	Comment
1	Expand EIO Bus in the Control Expert 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 name and a type.



Drop Parameters

In the Control Expert **Device DDT** dialog, you can configure these parameters for the RIO drop:

Parameter		Description
Implicit device DDT	Name	A default device DDT instance name (<i>see EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual</i>) is defined by Control Expert.
	Type	module type (read only)
Goto details		Click this link to the Device DDT Data Editor screen.

Diagnostic Parameters

Click the **Goto details** button on the **Device DDT** screen to view the **Variables** tab in the **Data Editor**. The bits indicates healthy (1) or unhealthy/unconfigured (0).

View the drop diagnostic parameters in T_M_CRA_EXT_IN for an RIO drop module:

Name	Type	Bit	Description
IO_HEALTH_RACK0	WORD	—	health bits of rack 0: slots 0...15 NOTE: Slot 0 is on the Least Significant bit of the Word.
IO_HEALTH_RACK1	WORD	—	health bits of rack 1: slots 0...15 NOTE: Slot 0 is on the Least Significant bit of the Word.
DEVICE_NAME	string[16]	—	device name of the RIO 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 on the drop managed by the CRA.
	CCOTF_INVALID_CONF	BOOL	2	CCOTF is not valid on the drop managed by the CRA.
	IOPL_MISMATCH	BOOL	3	The I/O configuration in the drop differs from that expected by the CPU for the current application.
	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).
	REDUNDANT_POWER_SUPPLY_STATUS	BOOL	6	This bit shows that redundant power is present (1) or not present (0).
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.

Name		Type	Bit	Description
TS_DIAGNOSTIC_FLAGS (WORD)	TIME_VALID	BOOL	0	The time is valid and synchronized.
	CLOCK_FAILURE CLOCK_NOT_SYNC	BOOL	1 2	If <ul style="list-style-type: none"> 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 (<i>see page 74</i>).
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).	
REDUNDANCY_OWNER	BOOL	6	1 = Redundant owner is present.	
			0 = Redundant owner is not present.	
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	0	0 = RSTP service is not operating normally. 1 = RSTP service is operating normally or disabled.
	SNTP_SERVICE (reserved)	BOOL	1	0 = SNTP service is not operating normally. 1 = SNTP service is operating normally or disabled.
	PORT502_SERVICE	BOOL	2	0 = Port 502 service is not operating normally. 1 = Port 502 service is operating normally or disabled.
	SNMP_SERVICE	BOOL	3	0 = SNMP service is not operating normally. 1 = SNMP service is operating normally or disabled.
	ETH_BKP_FAILURE	BOOL	5	0 = Ethernet backplane hardware status is not OK. 1 = Ethernet backplane hardware status is OK.
	ETH_BKP_ERROR	BOOL	6	0 = An error is detected on the Ethernet backplane.
				1 = No errors are detected on the Ethernet backplane.

Name		Type	Bit	Description
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
	RSTP role	—	3	RIO network port
			0	alternate
1			backup	
			2	designated
			3	root
NTP_UPDATE		UINT	—	elapsed time (100 ms) since last update from NTP server
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	<i>Modicon M340 Using Unity Pro Discrete Input/Output Modules User Manual</i>
Modicon X80 analog input/output	<i>Modicon M340 with Unity Pro Analog Input/Output Modules User Manual</i>
BMXEHC0800	<i>Modicon M340 with Unity Pro Counting Module BMXEHC0800 User Manual</i>
BMXEHC0200	<i>Modicon M340 with Unity Pro Counting Module BMXEHC0200 User Manual</i>
BMXNOM0200	<i>Modicon M340 with Unity Pro Serial Link User Manual</i>
BMXERT1604T	<i>BMXERT1604T M340 ERT Module User Manual</i>

Chapter 4

Implicit and Explicit Messaging

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Explicit Messaging	76
Implicit I/O Exchanges	77

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 I/O Exchanges

Task Management

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

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

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

M580 Implicit Messaging Communication Parameters

M580 implicit messaging communication parameters are automatically configured when you add a module to a project. To complete the configuration of implicit I/O exchanges to RIO modules, you need to assign a task to each I/O module. The availability of tasks that you can assign to a module – MAST, FAST, AUX0 or AUX1 – depends on:

- the location of the module (*see EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual*) (i.e. if it is placed on a local rack, is part of an RIO drop, or is a distributed device), and
- the tasks supported by the adapter module used in an RIO drop (*see page 16*).

Access the MAST Configuration

To view the **Properties of MAST**:

Step	Action
1	Go to the Properties of MAST dialog box in Control Expert (Tools → Project Browser → Project → Program → Tasks → MAST).
2	Right-click MAST → Properties 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 Control Expert (Tools → Project Browser → Project → Program → Tasks → FAST).
2	Right-click FAST → Properties 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 Control Expert (Tools → Project Browser → Project → Program → Tasks → AUX0).
2	Right-click AUX0 → Properties 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 Control Expert (Tools → Project Browser → Project → Program → Tasks → AUX1).
2	Right-click AUX1 → Properties 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 I/O is explained in the description of the connection parameters (*see page 63*).

I/O Management for Implicit I/O Exchanges

There are no state RAM addresses for (e)X80 I/O modules in RIO drops in an M580 system.

NOTE: State RAM is supported in Unity Pro v11.0 (and later) in M580 applications that contain Quantum RIO drops.

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	Topic	Page
5.1	Service Port Management	80
5.2	Diagnostics Available through the CPU	81
5.3	Diagnostics Available through Modbus/TCP	83
5.4	Diagnostics Available through EtherNet/IP CIP Objects	84
5.5	Diagnostics Available through Control Expert	126

Section 5.1

Service Port Management

Service Port Configuration

Introduction

A BME•58••40 RIO scanner module and an RIO adapter modules (BM•CRA31210) 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•CRA31210 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 61*).

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 by using:

- system bits (%S) and system words (%SW)
- Modbus/TCP (*see page 83*) or EtherNet/IP CIP (*see page 84*) requests
- diagnostic parameters in the T_CRA_EXT_IN (*see page 69*) DDT.

RIO Drop Diagnostics

Certain Ethernet RIO 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 RIO drops and module health. The adapter modules in the RIO drops transmit detected errors in the drop modules to the CPU via implicit messages (*see page 77*). 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 RIO 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•CRA312•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•CRA312•0 adapter.
- Ethernet link status⁽¹⁾: For each Ethernet port, is its link up (1) or down (2). See also Duplicate IP Address Checking (*see page 50*).
- redundancy_owner: This provides information about the presence of a redundant owner in Hot Standby systems.
- redundant_power_supply_status: This provides information about the redundancy of the power supply.
- Port 502 Status⁽¹⁾: Modbus port
- Half / Full duplex mode⁽¹⁾⁽²⁾: This is the mode of the RIO 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 (*see page 83*) requests

(2) Accessible through explicit EtherNet/IP CIP (*see page 84*) requests

Viewing Diagnostics in Control Expert

The bus editor in Control Expert 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	$152 + [(d-1)/31]$	$(d-1)/31$
BM• CRA 312 •0	rack (r), drop (d)	%SWi	$641 + [(d-1)*2] + r$	
	module (m), rack (r), drop (d)	%SWi.j	$641 + [(d-1)*2] + r$	30-m

NOTE: Remember:

- The slots in a drop are numbered 0...*n*.
- The rack numbers are used in remote drops:
 - 0: main rack in the RIO drop
 - 1: extended rack in the RIO drop

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
- RIO adapter modules:
 - BMECRA31210
 - BMXCRA31210
 - BMXCRA31200

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

At a Glance

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 an M580 system.

What Is in This Section?

This section contains the following topics:

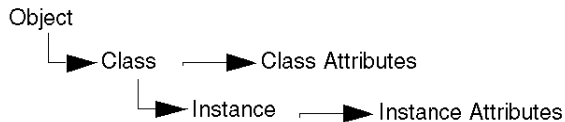
Topic	Page
About CIP Objects	85
Identity Object	86
Assembly Object	88
Connection Manager Object	90
Quality of Service (QoS) Object	92
TCP/IP Interface Object	94
Ethernet Link Object	96
EtherNet/IP Interface Diagnostics Object	101
I/O Connection Diagnostics Object	104
EtherNet/IP Explicit Connection Diagnostics Object	108
EtherNet/IP Explicit Connection Diagnostics List Object	110
RSTP Diagnostics Object	112
Service Port Control Object	117
SNTP Diagnostics Object	119
Ethernet Backplane Diagnostics Object	123

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: <ul style="list-style-type: none"> 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.
05	05	Close Requests	UINT	X	X	Number of Forward Close service requests received.
X = supported — = not supported						

Attribute ID		Description	Type	GET	SET	Value
hex	dec					
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:					
<ul style="list-style-type: none"> ● 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 BMECRA31210):

- 0: class
- 1: port (ETH1 (*see page 18*))
- 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
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 Protocols	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: <ul style="list-style-type: none"> forced interface speed forced duplex mode
		Forced interface speed	UINT			Bit 1: forced duplex mode (if auto-negotiation bit = 0) 0 = half duplex 1 = full duplex 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_STRING	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 EtherNet/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: supported 1: not supported <ul style="list-style-type: none"> ● Bit 1: Modbus TCP/IP ● Bit 2: Modbus SL ● Bits 3-15: Reserved
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

NOTE: The Instance ID number = the Connection ID. For M580 specifically, you can look up the Connection ID on the DTM Device List screen.

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 Library Vol. 1: Common Industrial Protocol Publication 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	<i>Reserved</i>	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

Overview

The EtherNet/IP Explicit Connection Diagnostics object presents the instances, attributes and services described below.

Class ID

353 (hex), 851 (decimal)

Instance IDs

The EtherNet/IP Explicit Connection Diagnostics object presents two instance values:

- 0: class
- 1...*N*: instance (*N* = maximum concurrent number of explicit connections)

Attributes

EtherNet/IP Explicit Connection Diagnostics 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... <i>N</i>	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	UINT	X	—	
03	Originator TCP Port	UDINT	X	—	
04	Target connection ID	UDINT	X	—	Target to originator connection ID
05	Target IP	UDINT	X	—	
06	Target TCP Port	UDINT	X	—	
07	Msg Send Counter	UDINT	X	—	Incremented each time a Class 3 CIP message is sent on the connection
08	Msg Receive 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 object performs the following services upon the listed object type:

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					

EtherNet/IP Explicit Connection Diagnostics List Object

Overview

The EtherNet/IP Explicit Connection Diagnostics List object presents the instances, attributes and services described below.

Class ID

354 (hex), 852 (decimal)

Instance IDs

The EtherNet/IP Explicit Connection Diagnostics List object presents two instance values:

- 0: class
- 1: instance

Attributes

EtherNet/IP Explicit Connection Diagnostics List 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 2 (instance attributes):

Attribute ID	Description	Type	GET	SET	Value
01	Number of connections	UINT	X	—	Total number of opened explicit connections
02	Explicit Messaging Connections Diagnostic List	ARRAY of STRUCT	X	—	
	Originator connection ID	UDINT			O->T connection ID
	Originator IP	UINT			—
	Originator TCP port	UDINT			—
	Target connection ID	UDINT			T->O connection ID
	Target IP	UDINT			—
	Target TCP port	UDINT			—
	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 performs the following services upon the listed object types:

Service ID		Description	Class	Instance	Notes
hex	dec				
01	01	Get_Attributes_All	X	—	Returns the value of all attributes.
08	08	Create	X	—	—
09	09	Delete	—	X	—
4B	75	Explicit_Connections_Diagnostic_Read	—	X	—
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: <ul style="list-style-type: none"> ● 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: <ul style="list-style-type: none"> ● 1: true ● 2: false Other values are not valid.
	Operartor edge port	UINT	X	—	This attribute indicates if this port is an edge port: <ul style="list-style-type: none"> ● 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: <ul style="list-style-type: none"> ● 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: <ul style="list-style-type: none"> ● all attributes of the class ● all attributes of the instance of the object
02	02	Get_Attribute_Single	X	X	This service returns: <ul style="list-style-type: none"> ● 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.
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 Control Expert, 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	—
<p>NOTE: All attributes are required in the implementation. X = supported — = not supported</p>			

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			<ul style="list-style-type: none"> ● 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): <ul style="list-style-type: none"> ● 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): <ul style="list-style-type: none"> ● 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	—	<ul style="list-style-type: none"> ● 1: Idle ● 2: Operational
NOTE: All attributes are required in the implementation. X = supported — = not supported					

Attribute ID (hex)	Description	Type	GET	SET	Value
3	Link to NTP server status	UDINT	X	—	<ul style="list-style-type: none"> ● 1: NTP server cannot be reached. ● 2: NTP server can be reached.
4	Current NTP server IP address	UDINT	X	—	
5	NTP server type	UDINT	X	—	Corresponds to the server identified in attribute 3: <ul style="list-style-type: none"> ● 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	—	<ul style="list-style-type: none"> ● 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	—	<ul style="list-style-type: none"> ● 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
<p>NOTE: All attributes are required in the implementation.</p> <p>X = supported — = not supported</p>					

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.
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 Control Expert

What Is in This Section?

This section contains the following topics:

Topic	Page
Introduction to Control Expert Diagnostics	127
Displaying I/O Memory Consumption	128

Introduction to Control Expert Diagnostics

Introduction

The Modicon M580 modules support online actions.

Tasks

Use online actions to perform these tasks:

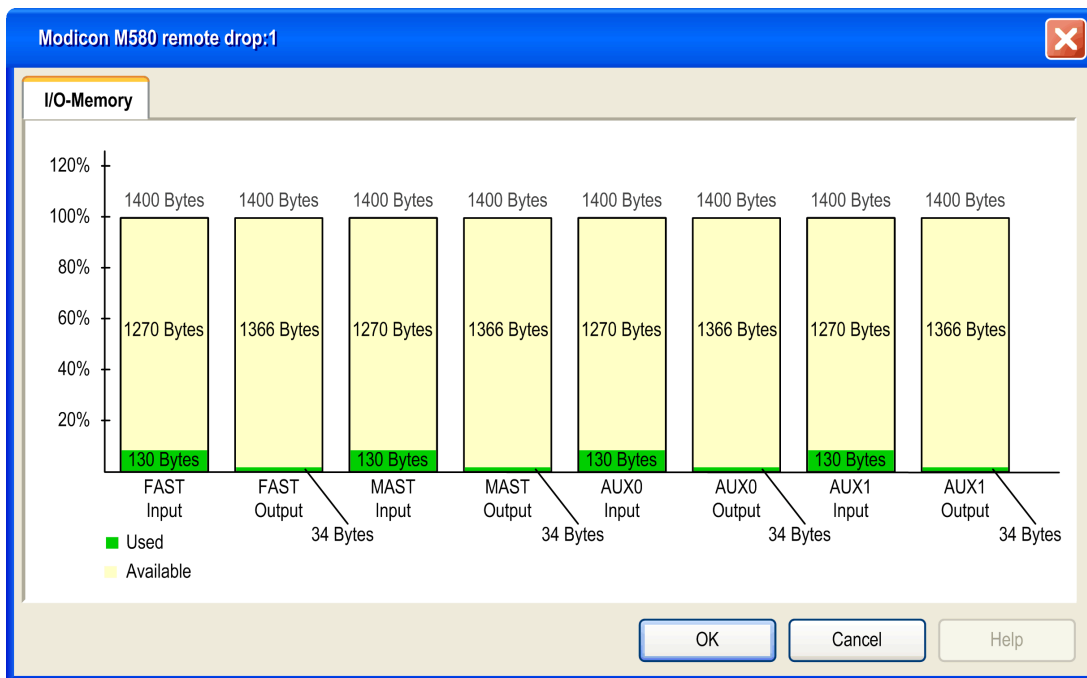
- Display EtherNet/IP objects for a remote EtherNet/IP device.
- Ping the CPU remote I/O scanner module, a remote EtherNet/IP, or a Modbus TCP device to confirm it is active on the Ethernet network.
- Connect to a remote device to perform these actions:
 - View the remote device's default parameter settings.
 - 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 Control Expert 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**.

This is an example of an **IO-Memory** tab:



NOTE: Quantum 140CRA31200 adapter modules *do not* support FAST and AUX0/AUX1 tasks. BMECRA312•0 adapter modules do.

Exceeding EIO Limitations

Control Expert 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.

NOTE: Modicon M580 BMECRA312•0 adapter modules support FAST and AUX• tasks (see *Quantum EIO, Remote I/O Modules, Installation and Configuration Guide*). Quantum 140CRA31200 adapter modules do not.

Chapter 6

Firmware Update

EIO Adapter Firmware Update

Overview

Use these procedures to update the firmware for the EIO adapter:

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

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

These instructions apply to the BMXCRA31200, BMXCRA31210, BMECRA31210, and 140CRA31908 modules.

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 <code>Enter</code> .
3	Examine the search results and select the appropriate entry for the Unity Loader software.
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 an explicit message to the TCP/IP Interface Object (<i>see page 94</i>) (Attribute ID 05: Interface Configuration).

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

Connect the Configuration PC to the EIO 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...

Update 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 update was unsuccessful.

To update the firmware for the EIO 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: <ul style="list-style-type: none"> • In the Media list, select Ethernet. • In the Address field, type in the IP address of the adapter, which is either: <ul style="list-style-type: none"> ○ <i>configured</i>: The adapter is already communicating on the network and the IP address for the module is configured in the application in the BME•58••40 CPU module. ○ <i>default</i>: The adapter 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 BMECRA31210, you can also update firmware for a BMEXBP••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 EIO 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.
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 update process takes approximately 3 minutes:

- firmware update (approximately 2 minutes)
- reboot, reestablish I/O connections (1 minute)

During the firmware update, the I/O communication with the adapter module is interrupted. After the hold up time (*see page 63*) expires, the output modules move to the pre-configured fallback setting (a value of 0, 1, or hold last value).



!

%I

According to the CEI standard, %I indicates a language object of type discrete IN.

%IW

According to the CEI standard, %IW indicates a language object of type analog IN.

%M

According to the CEI standard, %M indicates a language object of type memory bit.

%MW

According to the CEI standard, %MW indicates a language object of type memory word.

%Q

According to the CEI standard, %Q indicates a language object of type discrete OUT.

%QW

According to the CEI standard, %QW indicates a language object of type analog OUT.

%SW

According to the CEI standard, %SW indicates a language object of type system word.

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.

advanced mode

In Control Expert, advanced mode is a selection that displays expert-level configuration properties that help define Ethernet connections. Because these properties should be edited only by people with a good understanding of EtherNet/IP communication protocols, they can be hidden or displayed, depending upon the qualifications of the specific user.

applicative time stamping

Use the applicative time stamping solution to access time stamp event buffers with a SCADA system that does not support the OPC DA interface. In this case, function blocks in the Control Expert PLC application read events in the buffer and formats them to be sent to the SCADA system.

architecture

Architecture describes a framework for the specification of a network that is constructed of these components:

- physical components and their functional organization and configuration
- operational principles and procedures
- data formats used in its operation

ARRAY

An **ARRAY** is a table containing elements of a single type. This is the syntax: **ARRAY** [**<limits>**] **OF** **<Type>**

Example: **ARRAY** [1..2] **OF** **BOOL** is a one-dimensional table with two elements of type **BOOL**.

ARRAY [1..10, 1..20] **OF** **INT** is a two-dimensional table with 10x20 elements of type **INT**.

ART

(*application response time*) The time a CPU application takes to react to a given input. **ART** is measured from the time a physical signal in the CPU turns on and triggers a write command until the remote output turns on to signify that the data has been received.

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**BCD**

(*binary-coded decimal*) Binary encoding of decimal numbers.

BOOL

(*boolean type*) This is the basic data type in computing. A **BOOL** variable can have either of these values: 0 (**FALSE**) or 1 (**TRUE**).

A bit extracted from a word is of type **BOOL**, for example: **%MW10.4**.

BOOTP

(*bootstrap protocol*) A UDP network protocol that can be used by a network client to automatically obtain an IP address from a server. The client identifies itself to the server using its MAC address. The server, which maintains a pre-configured table of client device MAC addresses and associated IP addresses, sends the client its defined IP address. The **BOOTP** service utilizes UDP ports 67 and 68.

broadcast

A message sent to all devices in a broadcast domain.

C

CCOTF

(*change configuration on the fly*) A feature of Control Expert that allows a module hardware change in the system configuration while the system is operating. This change does not impact 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.

class 1 connection

A CIP transport class 1 connection used for I/O data transmission via implicit messaging between EtherNet/IP devices.

class 3 connection

A CIP transport class 3 connection used for explicit messaging between EtherNet/IP devices.

connected messaging

In EtherNet/IP, connected messaging uses a CIP connection for communication. A connected message is a logical relationship between two or more application objects on different nodes. The connection establishes a virtual circuit in advance for a particular purpose, such as frequent explicit messages or real-time I/O data transfers.

connection

A virtual circuit between two or more network devices, created prior to the transmission of data. After a connection is established, a series of data is transmitted over the same communication path, without the need to include routing information, including source and destination address, with each piece of data.

connection originator

The EtherNet/IP network node that initiates a connection request for I/O data transfer or explicit messaging.

connectionless

Describes communication between two network devices, whereby data is sent without prior arrangement between the two devices. Each piece of transmitted data also includes routing information, including source and destination address.

control network

An Ethernet-based network containing PACs, SCADA systems, an NTP server, PCs, AMS, switches, etc. Two kinds of topologies are supported:

- flat: All modules and devices in this network belong to same subnet.
- 2 levels: The network is split into an operation network and an inter-controller network. These two networks can be physically independent, but are generally linked by a routing device.

CPU

(*central processing unit*) The CPU, also known as the processor or controller, is the brain of an industrial manufacturing process. It automates a process as opposed to relay control systems. CPUs are computers suited to survive the harsh conditions of an industrial environment.

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.

Device DDT (DDDT)

A Device DDT is a DDT predefined by the manufacturer and not modifiable by user. It contains the I/O language elements of an I/O module.

device network

An Ethernet-based network within a remote I/O network that contains both remote I/O and distributed I/O devices. Devices connected on this network follow specific rules to allow remote I/O determinism.

device network

An Ethernet-based network within an RIO network that contains both RIO and distributed equipment. Devices connected on this network follow specific rules to allow RIO determinism.

DFB

(*derived function block*) DFB types are function blocks that can be defined by the user in ST, IL, LD or FBD language.

Using these DFB types in an application makes it possible to:

- simplify the design and entry of the program
- make the program easier to read
- make it easier to debug
- reduce the amount of code generated

DHCP

(*dynamic host configuration protocol*) An extension of the BOOTP communications protocol that provides for the automatic assignment of IP addressing settings, including IP address, subnet mask, gateway IP address, and DNS server names. DHCP does not require the maintenance of a table identifying each network device. The client identifies itself to the DHCP server using either its MAC address, or a uniquely assigned device identifier. The DHCP service utilizes UDP ports 67 and 68.

DIO

(distributed I/O) Also known as distributed equipment. DRSs use DIO ports to connect distributed equipment.

DIO cloud

A group of distributed equipment that is not required to support RSTP. DIO clouds require only a single (non-ring) copper wire connection. They can be connected to some of the copper ports on DRSs, or they can be connected directly to the CPU or Ethernet communications modules in the *local rack*. DIO clouds **cannot** be connected to *sub-rings*.

DIO network

A network containing distributed equipment, in which I/O scanning is performed by a CPU with DIO scanner service on the local rack. DIO network traffic is delivered after RIO traffic, which takes priority in an RIO network.

distributed equipment

Any Ethernet device (Schneider Electric device, PC, servers, or third-party devices) that supports exchange with a CPU or other Ethernet I/O scanner service.

DNS

(domain name server/service) A service that translates an alpha-numeric domain name into an IP address, the unique identifier of a device on the network.

domain name

An alpha-numeric string that identifies a device on the internet, and which appears as the primary component of a web site's uniform resource locator (URL). For example, the domain name *schneider-electric.com* is the primary component of the URL *www.schneider-electric.com*.

Each domain name is assigned as part of the domain name system, and is associated with an IP address.

Also called a host name.

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.

DSCP

(differentiated service code points) This 6-bit field is in the header of an IP packet to classify and prioritize traffic.

DST

(daylight saving time) DST is also called *summer time* and is a practice consisting of adjusting forward the clock near the start of spring and adjusting it backward near the start of autumn.

DT

(*date and time*) The **DT** type, encoded in BCD in a 64-bit format, contains this information:

- the year encoded in a 16-bit field
- the month encoded in an 8-bit field
- the day encoded in an 8-bit field
- the time encoded in an 8-bit field
- the minutes encoded in an 8-bit field
- the seconds encoded in an 8-bit field

NOTE: The eight least significant bits are not used.

The **DT** type is entered in this format:

DT#<Year>-<Month>-<Day>-<Hour>:<Minutes>:<Seconds>

This table shows the upper/lower limits of each field:

Field	Limits	Comment
Year	[1990,2099]	Year
Month	[01,12]	The leading 0 is displayed; it can be omitted during data entry.
Day	[01,31]	For months 01/03/05/07/08/10/12
	[01,30]	For months 04/06/09/11
	[01,29]	For month 02 (leap years)
	[01,28]	For month 02 (non-leap years)
Hour	[00,23]	The leading 0 is displayed; it can be omitted during data entry.
Minute	[00,59]	The leading 0 is displayed; it can be omitted during data entry.
Second	[00,59]	The leading 0 is displayed; it can be omitted during data entry.

DTM

(*device type manager*) A DTM is a device driver running on the host PC. It provides a unified structure for accessing device parameters, configuring and operating the devices, and troubleshooting devices. DTMs can range from a simple graphical user interface (GUI) for setting device parameters to a highly sophisticated application capable of performing complex real-time calculations for diagnosis and maintenance purposes. In the context of a DTM, a device can be a communications module or a remote device on the network.

See FDT.

E**EDS**

(*electronic data sheet*) EDS are simple text files that describe the configuration capabilities of a device. EDS files are generated and maintained by the manufacturer of the device.

EF

(elementary function) This is a block used in a program which performs a predefined logical function.

A function does not have any information on the internal state. Several calls to the same function using the same input parameters will return the same output values. You will find information on the graphic form of the function call in the [*functional block (instance)*]. Unlike a call to a function block, function calls include only an output which is not named and whose name is identical to that of the function. In FBD, each call is indicated by a unique [number] via the graphic block. This number is managed automatically and cannot be modified.

Position and configure these functions in your program to execute your application.

You can also develop other functions using the SDKC development kit.

EFB

(elementary function block) This is a block used in a program which performs a predefined logical function.

EFBs have states and internal parameters. Even if the inputs are identical, the output values may differ. For example, a counter has an output indicating that the preselection value has been reached. This output is set to 1 when the current value is equal to the preselection value.

EIO network

(Ethernet I/O) An Ethernet-based network that contains three types of devices:

- local rack
- X80 remote drop (using a BM•CRA312•0 adapter module), or a BMENOS0300 network option switch module
- ConneXium extended dual-ring switch (DRS)

NOTE: Distributed equipment may also participate in an Ethernet I/O network via connection to DRSs or the service port of X80 remote modules.

EN

EN stands for **EN**able; it is an optional block input. When the **EN** input is enabled, an **ENO** output is set automatically.

If **EN** = 0, the block is not enabled; its internal program is not executed, and **ENO** is set to 0.

If **EN** = 1, the block's internal program is run and **ENO** is set to 1. If a runtime error is detected, **ENO** is set to 0.

If the **EN** input is not connected, it is set automatically to 1.

ENO

ENO stands for **Error NOT**ification; this is the output associated with the optional input **EN**.

If **ENO** is set to 0 (either because **EN** = 0 or if a runtime error is detected):

- The status of the function block outputs remains the same as it was during the previous scanning cycle that executed correctly.
- The output(s) of the function, as well as the procedures, are set to 0.

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 DIO scanner service

This embedded DIO scanner service of M580 CPUs manages distributed equipment on an M580 device network.

Ethernet I/O scanner service

This embedded Ethernet I/O scanner service of M580 CPUs manages distributed equipment **and** RIO drops on an M580 device network.

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.

explicit messaging client

(*explicit messaging client class*) The device class defined by the ODVA for EtherNet/IP nodes that only support explicit messaging as a client. HMI and SCADA systems are common examples of this device class.

F

FAST

A 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.

FBD

(function block diagram) An IEC 61131-3 graphical programming language that works like a flowchart. By adding simple logical blocks (AND, OR, etc.), each function or function block in the program is represented in this graphical format. For each block, the inputs are on the left and the outputs on the right. Block outputs can be linked to inputs of other blocks to create complex expressions.

FDR

(fast device replacement) A service that uses configuration software to replace an inoperable product.

FDT

(field device tool) The technology that harmonizes communication between field devices and the system host.

FTP

(file transfer protocol) A protocol that copies a file from one host to another over a TCP/IP-based network, such as the internet. FTP uses a client-server architecture as well as separate control and data connections between the client and server.

full duplex

The ability of two networked devices to independently and simultaneously communicate with each other in both directions.

function block diagram

See FBD.

G**gateway**

A gateway device interconnects two different networks, sometimes through different network protocols. When it connects networks based on different protocols, a gateway converts a datagram from one protocol stack into the other. When used to connect two IP-based networks, a gateway (also called a router) has two separate IP addresses, one on each network.

GPS

(global positioning system) The GPS standard consists of a space-based positioning, navigation, and timing signals delivered worldwide for civil and military use. Standard positioning service performance depends on satellite broadcast signal parameters, GPS constellation design, the number of satellites in sight, and various environmental parameters.

H

harsh environment

Resistance to hydrocarbons, industrial oils, detergents and solder chips. Relative humidity up to 100%, saline atmosphere, significant temperature variations, operating temperature between -10°C and +70°C, or in mobile installations. For hardened (H) devices, the relative humidity is up to 95% and the operating temperature is between -25°C and +70°C.

HART

(highway addressable remote transducer) A bi-directional communication protocol for sending and receiving digital information across analog wires between a control or monitoring system and smart devices.

HART is the global standard for providing data access between host systems and intelligent field instruments. A host can be any software application from a technician's hand-held device or laptop to a plant's process control, asset management, or other system using any control platform.

high-capacity daisy chain loop

Often referred to as HCDL, a high-capacity daisy chain loop uses dual-ring switches (DRSs) to connect device sub-rings (containing RIO drops or distributed equipment) and/or DIO clouds to the Ethernet RIO network.

HMI

(human machine interface) System that allows interaction between a human and a machine.

Hot Standby

A Hot Standby system uses a primary PAC (PLC) and a standby PAC. The two PAC racks have identical hardware and software configurations. The standby PAC monitors the current system status of the primary PAC. If the primary PAC becomes inoperable, high-availability control is maintained when the standby PAC takes control of the system.

HTTP

(hypertext transfer protocol) A networking protocol for distributed and collaborative information systems. HTTP is the basis of data communication for the web.

I

I/O scanner

An Ethernet service that continuously polls I/O modules to collect data, status, event, and diagnostics information. This process monitors inputs and controls outputs. This service supports both RIO and DIO logic scanning.

IEC 61131-3

International standard: programmable logic controllers

Part 3: programming languages

IGMP

(internet group management protocol) This internet standard for multicasting allows a host to subscribe to a particular multicast group.

IL

(instruction list) An IEC 61131-3 programming language that contains a series of basic instructions. It is very close to assembly language used to program processors. Each instruction is made up of an instruction code and an operand.

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.

INT

(INTEger) (encoded in 16 bits) The upper/lower limits are as follows: $-(2 \text{ to the power of } 15)$ to $(2 \text{ to the power of } 15) - 1$.

Example: -32768, 32767, 2#1111110001001001, 16#9FA4.

inter-controller network

An Ethernet-based network that is part of the control network, and provides data exchange between controllers and engineering tools (programming, asset management system (AMS)).

IODDT

(input/output derived data type) A structured data type representing a module, or a channel of a CPU. Each application expert module possesses its own IODDTs.

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.

IPsec

(internet protocol security) An open set of protocol standards that make IP communication sessions private and secure for traffic between modules using IPsec, developed by the internet engineering task force (IETF). The IPsec authentication and encryption algorithms require user-defined cryptographic keys that process each communications packet in an IPsec session.

isolated DIO network

An Ethernet-based network containing distributed equipment that does not participate in an RIO network.

L**LD**

(ladder diagram) An IEC 61131-3 programming language that represents instructions to be executed as graphical diagrams very similar to electrical diagrams (contacts, coils, etc.).

literal value of an integer

A literal value of an integer is used to enter integer values in the decimal system. Values may be preceded by the "+" and "-" signs. Underscore signs (_) separating numbers are not significant.

Example:

-12, 0, 123_456, +986

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.

local slave

The functionality offered by Schneider Electric EtherNet/IP communication modules that allows a scanner to take the role of an adapter. The local slave enables the module to publish data via implicit messaging connections. Local slave is typically used in peer-to-peer exchanges between PACs.

M

M580 Ethernet I/O device

An Ethernet device that provides automatic network recovery and deterministic RIO performance. The time it takes to resolve an RIO logic scan can be calculated, and the system can recover quickly from a communication disruption. M580 Ethernet I/O devices include:

- local rack (including a CPU with Ethernet I/O scanner service)
- RIO drop (including an X80 adapter module)
- DRS switch with a predefined configuraton

main ring

The main ring of an Ethernet RIO network. The ring contains RIO modules and a local rack (containing a CPU with Ethernet I/O scanner service) and a power supply module.

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.

MB/TCP

(Modbus over TCP protocol) This is a Modbus variant used for communications over TCP/IP networks.

MIB

(management information base) A virtual database used for managing the objects in a communications network. See SNMP.

Modbus

Modbus is an application layer messaging protocol. Modbus provides client and server communications between devices connected on different types of buses or networks. Modbus offers many services specified by function codes.

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.

N**network**

There are two meanings:

- In a ladder diagram:
 - A network is a set of interconnected graphic elements. The scope of a network is local, concerning the organizational unit (section) of the program containing the network.
- With expert communication modules:
 - A network is a set of stations that intercommunicate. The term *network* is also used to define a group interconnected graphic elements. This group then makes up part of a program that may comprise a group of networks.

network time service

Use this service to synchronize computer clocks over the Internet to record events (sequence events), synchronize events (trigger simultaneous events), or synchronize alarms and I/O (time stamp alarms).

NIM

(*network interface module*) A NIM resides in the first position on an STB island (leftmost on the physical setup). The NIM provides the interface between the I/O modules and the fieldbus master. It is the only module on the island that is fieldbus-dependent — a different NIM is available for each fieldbus.

NTP

(*network time protocol*) Protocol for synchronizing computer system clocks. The protocol uses a jitter buffer to resist the effects of variable latency.

O**O->T**

(*originator to target*) See originator and target.

ODVA

(*Open DeviceNet Vendors Association*) The ODVA supports network technologies that are based on CIP.

OFS

(*OPC Factory Server*) OFS enables real-time SCADA communications with the Control Expert family of PLCs. OFS utilizes the standard OPC data access protocol.

OPC DA

(*OLE for Process Control Data Access*) The Data Access Specification is the most commonly implemented of the OPC standards that provide specifications for real-time data communications between clients and servers.

operation network

An Ethernet-based network containing operator tools (SCADA, client PC, printers, batch tools, EMS, etc.). Controllers are connected directly or through routing of the inter-controller network. This network is part of the control network.

originator

In EtherNet/IP, a device is considered the originator when it initiates a CIP connection for implicit or explicit messaging communications or when it initiates a message request for un-connected explicit messaging.

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 an 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.

PTP

(*precision time protocol*) Use this protocol to synchronize clocks throughout a computer network. On a local area network, PTP achieves clock accuracy in the sub-microsecond range, making it suitable for measurement and control systems.

Q

QoS

(*quality of service*) The practice of assigning different priorities to traffic types for the purpose of regulating data flow on the network. In an industrial network, QoS is used to provide a predictable level of network performance.

R

rack optimized connection

Data from multiple I/O modules are consolidated in a single data packet to be presented to the scanner in an implicit message in an EtherNet/IP network.

ready device

Ethernet ready device that provides additional services to the EtherNet/IP or Modbus module, such as: single parameter entry, bus editor declaration, system transfer, deterministic scanning capacity, alert message for modifications, and shared user rights between Control Expert and the device DTM.

RIO drop

One of the three types of RIO modules in an Ethernet RIO network. An 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 or BMENOS0300 network option switch modules.

RPI

(requested packet interval) The time period between cyclic data transmissions requested by the scanner. EtherNet/IP devices publish data at the rate specified by the RPI assigned to them by the scanner, and they receive message requests from the scanner at each RPI.

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

S908 RIO

A Quantum RIO system using coaxial cabling and terminators.

SCADA

(supervisory control and data acquisition) SCADA systems are computer systems that control and monitor industrial, infrastructure, or facility-based processes (examples: transmitting electricity, transporting gas and oil in pipelines, and distributing water).

scanner

A scanner acts as the originator of I/O connection requests for implicit messaging in EtherNet/IP, and message requests for Modbus TCP.

scanner class device

A scanner class device is defined by the ODVA as an EtherNet/IP node capable of originating exchanges of I/O with other nodes in the network.

service port

A dedicated Ethernet port on the M580 RIO modules. The port may support these major functions (depending on the module type):

- port mirroring: for diagnostic use
- access: for connecting HMI/Control Expert/ConneXview to the CPU
- extended: to extend the device network to another subnet
- disabled: disables the port, no traffic is forwarded in this mode

SFC

(*sequential function chart*) An IEC 61131-3 programming language that is used to graphically represent in a structured manner the operation of a sequential CPU. This graphical description of the CPU's sequential behavior and of the various resulting situations is created using simple graphic symbols.

SFP

(*small form-factor pluggable*). The SFP transceiver acts as an interface between a module and fiber optic cables.

simple daisy chain loop

Often referred to as SDCL, a simple daisy chain loop contains RIO modules only (no distributed equipment). This topology consists of a local rack (containing a CPU with Ethernet I/O scanner service), and one or more RIO drops (each drop containing an RIO adapter module).

SMTP

(*simple mail transfer protocol*) An email notification service that allows controller-based projects to report alarms or events. The controller monitors the system and can automatically create an email message alert with data, alarms, and/or events. Mail recipients can be either local or remote.

SNMP

(*simple network management protocol*) Protocol used in network management systems to monitor network-attached devices. The protocol is part of the internet protocol suite (IP) as defined by the internet engineering task force (IETF), which consists of network management guidelines, including an application layer protocol, a database schema, and a set of data objects.

SNTP

(*simple network time protocol*) See NTP.

SOE

(*sequence of events*) The process of determining the order of events in an industrial system and correlating those events to a real-time clock.

ST

(*structured text*) An IEC 61131-3 programming language that presents structured literal language and is a developed language similar to computer programming languages. It can be used to organize a series of instructions.

TFTP

(*trivial file transfer protocol*) A simplified version of *file transfer protocol* (FTP), TFTP uses a client-server architecture to make connections between two devices. From a TFTP client, individual files can be uploaded to or downloaded from the server, using the user datagram protocol (UDP) for transporting data.

TIME_OF_DAY

See **TOD**.

TOD

(*time of day*) The **TOD** type, encoded in BCD in a 32-bit format, contains this information:

- the hour encoded in an 8-bit field
- the minutes encoded in an 8-bit field
- the seconds encoded in an 8-bit field

NOTE: The eight least significant bits are not used.

The TOD type is entered in this format: xxxxxxxx: **TOD#**<Hour>:<Minutes>:<Seconds>

This table shows the upper/lower limits of each field:

Field	Limits	Comment
Hour	[00,23]	The leading 0 is displayed; it can be omitted during data entry.
Minute	[00,59]	The leading 0 is displayed; it can be omitted during data entry.
Second	[00,59]	The leading 0 is displayed; it can be omitted during data entry.

Example: **TOD#23:59:45**.

TR

(*transparent ready*) Web-enabled power distribution equipment, including medium- and low-voltage switch gear, switchboards, panel boards, motor control centers, and unit substations. Transparent Ready equipment allows you to access metering and equipment status from any PC on the network, using a standard web browser.

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.

UMAS

(Unified Messaging Application Services) UMAS is a proprietary system protocol that manages communications between Control Expert and a controller.

UTC

(coordinated universal time) Primary time standard used to regulate clocks and time worldwide (close to former GMT time standard).

V

variable

Memory entity of type `BOOL`, `WORD`, `DWORD`, etc., whose contents can be modified by the program currently running.

VLAN

(virtual local area network) A local area network (LAN) that extends beyond a single LAN to a group of LAN segments. A VLAN is a logical entity that is created and configured uniquely using applicable software.



0-9

140CRA31908
grounding, 42
installation, 42

A

assembly object, 88
AUX0 task, 77
AUX1 task, 77

B

backplane considerations, 40
BMECRA31210
Control Expert configuration, 54, 57, 62
description, 16, 22
external features, 18
firmware update, 131
firmware upgrade, 131
functionality, 17
grounding, 42
installation, 38, 42
Modbus diagnostic codes, 83
NTP configuration, 15
rack extension, 41
BMECRA31210C
description, 16
BMXCRA31200
Control Expert configuration, 54, 57, 62
description, 16, 22
firmware update, 131
firmware upgrade, 131
functionality, 17
grounding, 42
installation, 38, 42
Modbus diagnostic codes, 83
NTP configuration, 15
rack extension, 41

BMXCRA31210
Control Expert configuration, 54, 57, 62
description, 16, 22
external features, 18, 18
firmware update, 131
firmware upgrade, 131
functionality, 17
grounding, 42
installation, 38, 42
Modbus diagnostic codes, 83
NTP configuration, 15
rack extension, 41
BMXCRA31210C
description, 16
BMXNGD0100
global data, 28

C

CANopen modules
X80, 28
certifications, 35
CIP objects, 85
communication modules
X80, 28
connection manager object, 90

D

device DDT
RIO adapters, 68
T_M_CRA_EXT_IN, 68
diagnostic module
X80, 31
diagnostics
Modbus codes, 83
system, 81

E

ethernet backplane diagnostics object, 123

ethernet link object, *96*
Ethernet remote I/O
 Control Expert configuration, *53*
 diagnostics, *79*
Ethernet RIO
 cabling, *48*
EtherNet/IP
 explicit messaging, *76*
 implicit messaging, *77*
 interface diagnostics object, *101*
EtherNet/IP explicit connection diagnostics
object, *108, 110*
exchange
 implicit I/O, *77*

F

FAST task, *77*
fiber cable converter modules
 X80, *28*

G

global data
 BMXNGD0100, *28*
grounding, *42*

I

I/O
 exchanges, implicit, *77*
I/O connection diagnostics object, *104*
I/O modules, *25*
identity object, *86*
implicit I/O exchanges, *77*
installation, *42*

M

MAST task, *77*
mounting a module, *44*

O

online diagnostics, *127*

P

PMESWT0100, *31*
PMXCDA0400, *31*
PMXNOW0300, *31*

Q

QoS object, *92*

R

replacing module, *44*
rotary switches, *46*
RSTP diagnostics object, *112*

S

setting rotary switches, *46*
SNTP diagnostics object, *119*
standards, *35*

T

T_M_CRA_EXT_IN, *68*
TCP/IP interface object, *94*
time stamping, *66*
 BMXERT1604 module, *66*
 RIO drop adapters, *66*
time stamping modules
 X80, *31*

W

weighing module
 X80, *31*
wireless module
 X80, *31*

X

X80

- CANopen modules, *28*
- communication modules, *28*
- diagnostic module, *31*
- fiber cable converter modules, *28*
- time stamping modules, *31*
- weighing module, *31*
- wireless module, *31*

X80 I/O modules, *25*

- analog, *25*
- discrete, *27*
- intelligent, *31*
- special purpose, *31*

