M580 BMENOS0300

Network Option Switch
Installation and Configuration Guide

Original instructions

09/2020

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www.schneider-electric.com

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

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

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

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

Table of Contents

Safety Information

Important Information

NOTICE

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

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

PLEASE NOTE

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

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

BEFORE YOU BEGIN

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

⚠ WARNING

UNGUARDED EQUIPMENT

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

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

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

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

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

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

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

START-UP AND TEST

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

⚠ WARNING

EQUIPMENT OPERATION HAZARD

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

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

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

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

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

Before energizing equipment:

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

OPERATION AND ADJUSTMENTS

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

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

About the Book

At a Glance

Document Scope

PlantStruxure is a Schneider Electric program designed to address the key challenges of many different types of users, including plant managers, operations managers, engineers, maintenance teams, and operators, by delivering a system that is scalable, flexible, integrated, and collaborative.

This document presents one of the PlantStruxure features, using Ethernet as the backbone around the Modicon M580 offer and connecting an M580 *local rack* and M580 *RIO drops*.

NOTE: The specific configuration settings contained in this guide are intended to be used for instructional purposes only. The settings required for your specific configuration may differ from the examples presented in this guide.

Validity Note

This document is valid for an M580 system when used with EcoStruxure™ Control Expert 15.0 or later.

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

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

The characteristics that are described 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
Modicon M580 Standalone System Planning Guide for Frequently Used Architectures	HRB62666 (English), HRB65318 (French), HRB65319 (German), HRB65320 (Italian), HRB65321 (Spanish), HRB65322 (Chinese)
Modicon M580 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 M580, M340, and X80 I/O Platforms, Standards and Certifications	EIO0000002726 (English), EIO0000002727 (French), EIO0000002728 (German), EIO0000002730 (Italian), EIO0000002729 (Spanish), EIO0000002731 (Chinese)
Modicon M580, RIO Modules, Installation and Configuration Guide	EIO0000001584 (English), EIO0000001585 (French), EIO0000001586 (German), EIO0000001587 (Italian), EIO0000001588 (Spanish), EIO0000001589 (Chinese),

Title of Documentation	Reference Number
Modicon M580, Change Configuration on the Fly, User Guide	EIO0000001590 (English), EIO0000001591 (French), EIO0000001592 (German), EIO0000001594 (Italian), EIO0000001593 (Spanish), EIO0000001595 (Chinese)
Modicon X80, Discrete Input/Output Modules, User Manual	35012474 (English), 35012475 (German), 35012476 (French), 35012477 (Spanish), 35012478 (Italian), 35012479 (Chinese)
Modicon X80, BMXEHC0200 Counting Module, User Manual	35013355 (English), 35013356 (German), 35013357 (French), 35013358 (Spanish), 35013359 (Italian), 35013360 (Chinese)
Electrical installation guide	EIGED306001EN (English)
EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual	35006144 (English), 35006145 (French), 35006146 (German), 35013361 (Italian), 35006147 (Spanish), 35013362 (Chinese)
EcoStruxure™ Control Expert, System Bits and Words, Reference Manual	EIO0000002135 (English), EIO0000002136 (French), EIO0000002137 (German), EIO0000002138 (Italian), EIO0000002139 (Spanish), EIO0000002140 (Chinese)
EcoStruxure™ Control Expert, Operating Modes	33003101 (English), 33003102 (French), 33003103 (German), 33003104 (Spanish), 33003696 (Italian), 33003697 (Chinese)

Title of Documentation	Reference Number
EcoStruxure™ Control Expert, Installation Manual	35014792 (English), 35014793 (French), 35014794 (German), 35014795 (Spanish), 35014796 (Italian), 35012191 (Chinese)
Modicon Controllers Platform Cyber Security, Reference Manual	EIO0000001999 (English), EIO0000002001 (French), EIO0000002000 (German), EIO0000002002 (Italian), EIO0000002003 (Spanish), EIO0000002004 (Chinese)

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

Chapter 1
Introducing the M580 BMENOS0300 Network Option Switch

BMENOS0300 Module Features

Introduction

The BMENOS0300 Ethernet network option switch is a low-cost embedded switching module that simplifies the Ethernet architecture by reducing the use of external switches. You can install the module on a local or a remote BMEXBP•••• Ethernet rack in the Modicon M580 system.

NOTE: If you mount the BMENOS0300 switch on a BMX (X Bus only) backplane, the module will not power up. The module can obtain power only when installed on a BME (Ethernet) rack.

Ruggedized Version

The BMENOS0300C (coated) equipment is the ruggedized version of the BMENOS0300 (standard) equipment. It 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 modules BMENOS0300 and BMENOS0300C 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)*.

Ports

The BMENOS0300 module includes the following 100Base-T (RJ45) network ports:
- 2 network ports supporting RSTP redundant topologies
- 1 service port

The module also includes an internal backplane port, which is used to communicate to the embedded Ethernet backplane resident in the rack.

All ports support:
- 10/100 Mbps data rate
- Ethernet II frame type

The two network ports can support the following topologies:
- A DIO ring for distributed devices, including Advantys and TeSys T I/O devices
- An RIO sub-ring for (e)X80 RIO drops
- A non-redundant connection to DIO clouds consisting of distributed equipment

NOTE: Use the IP address of the CPU, and not the address of the BMENOS0300 switch, to communicate with the CPU.

The service port supports:
- Mirroring of all other ports, including the network ports, backplane port, and the internal port connecting the embedded switch to the module firmware.
- A non-looping daisy-chain of distributed equipment.
- General access, for example, by engineering tools performing firmware upgrades.

Configuration

Use the two rotary switches on the front of the BMENOS0300 module to configure the module. The position of these two switches determine the configurable module settings, other than the IP address.
- The left rotary switch configures the service port.
- The right rotary switch configures the two network ports.

The BMENOS0300 module includes a DHCP client, and receives its IP address in one of the following ways:
- From a DHCP server resident in the M580 CPU that has been configured to provide the module with its IP address.
- If no DHCP server is configured to provide an IP address to the BMENOS0300 module, the module configures itself with an IP address based on its MAC Address.

Ethernet Services

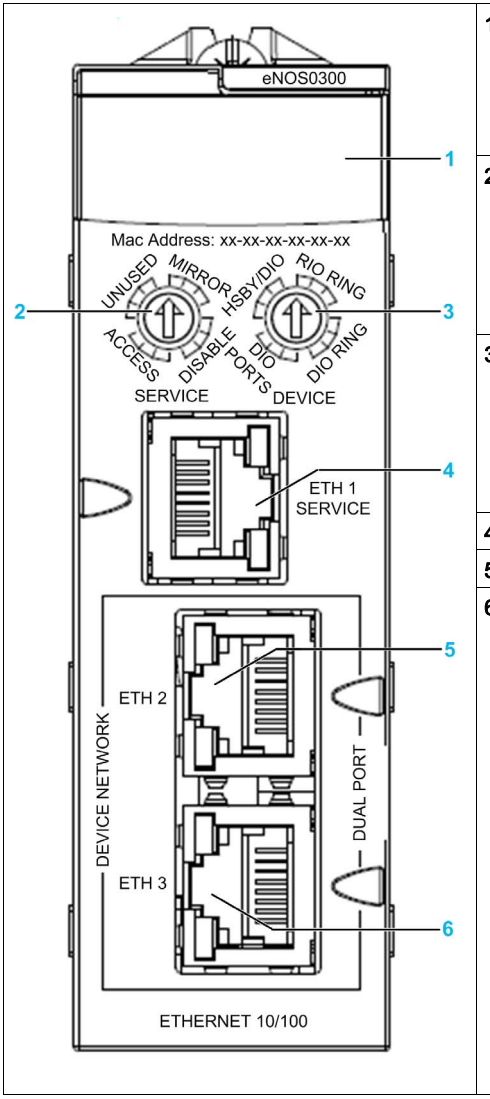
The BMENOS0300 module supports the following Ethernet services:

- Web Access HTTP Server
- Network Management SNMP agent
- Message priority QoS tagging
- Diagnostic embedded web pages
- DHCP client
- FTP

Chapter 2
BMENOS0300 Physical Description

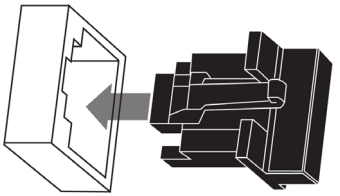
Module Description

Physical Description



1	LED array *(see page 68)*: ● RUN ● ERR ● MS ● NS
2	Rotary switch *(see page 30)* for configuring the ETH 1 service port: ● MIRROR ● DISABLE ● ACCESS ● UNUSED
3	Rotary switch *(see page 30)* for configuring the two device network ports (ETH 2 and ETH 3): ● RIO RING ● DIO RING ● DIO PORTS ● HSBY/DIO
4	ETH 1: Service port (Ethernet)
5	ETH 2: Device network port (Ethernet)
6	ETH 3: Device network port (Ethernet)

To help keep dust out of unused Ethernet ports, cover the ports with a stopper:



Chapter 3
BMENOS0300 Specifications

What Is in This Chapter?

This chapter contains the following topics:

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	• English: *EIO0000002726* • French: *EIO0000002727* • German: *EIO0000002728* • Italian: *EIO0000002730* • Spanish: *EIO0000002729* • Chinese: *EIO0000002731*

Current and Power

Current and Power Profiles

The BMENOC0301/11 module offers this power and current profile:

Parameter	Specification
Voltage rail	24V_BAC
Current at 25° C (77° F) ambient	135 mA
Power at 25° C (77° F) ambient	3.3 W
Current at 60° C (140° F) ambient	185 mA
Power at 60° C (140° F) ambient	4.5 W

Chapter 4
Installing the BMENOS0300 Module

Mounting a BMENOS0300 Module on an M580 Rack

Introduction

The BMENOS0300 Ethernet network option switch can be installed on a either a local or remote Ethernet backplane in the M580 system.

NOTE:

- Mount the BMENOS0300 switch only on a BME (Ethernet) backplane. The module powers up on a BME (Ethernet) backplane, but does not power up on a BMX (X-Bus) backplane.
- Schneider Electric recommends that you limit your system to two BMENOS0300 modules in an M580 rack for optimal system performance. If you install more than two BMENOS0300 modules per rack, calculate the bandwidth of your system so you do not overload the 100 Mbit/second backplane capacity.

Before Installing a Module

Before installing the module, remove the protective cap from the module connector on the rack.

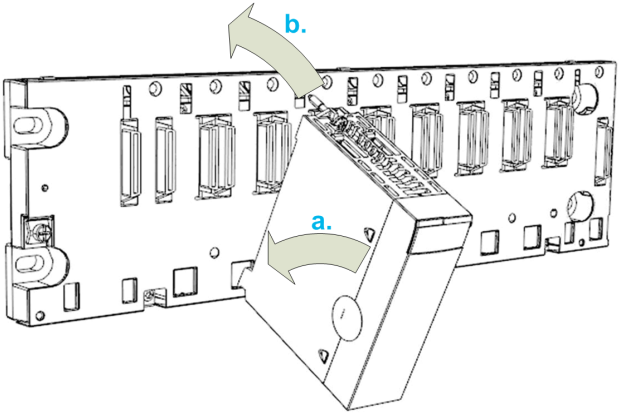
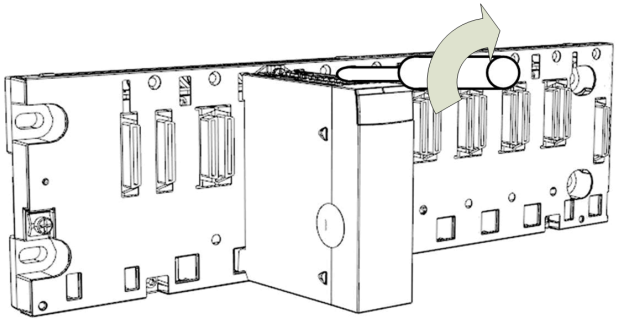
Selecting a Backplane

Install the BMENOS0300 module in a single slot on one of these Ethernet backplanes:

Backplane	Description
BMEXBP0400[1]	4-slot Ethernet backplane
BMEXBP0400(H)[1]	4-slot hardened Ethernet backplane
BMEXBP0800[1]	8-slot Ethernet backplane
BMEXBP0800(H)[1]	8-slot hardened Ethernet backplane
BMEXBP1200[1, 2]	12-slot Ethernet backplane
BMEXBP1200(H)[1, 2]	12-slot hardened Ethernet backplane
BMEXBP0602 (H)	10-slot hardened Ethernet and X Bus backplane
BMEXBP1002 (H)[3]	6-slot hardened Ethernet and X Bus backplane
1. In a local rack, slots 0 and 1 are reserved for the CPU. 2. In the 12-slot Ethernet backplane, slots 2, 8, 10, and 11 are X Bus only slots. 3. In the 10-slot Ethernet backplane, slots 2 and 8 are X Bus only slots.	

Installing the Module on the Rack

Mount the module in a single slot on the backplane:

Step	Action
1	Turn off the power supply to the rack.
2	Remove the protective cover from the module interface on the rack.
3	*a*: Insert the locating pins on the bottom of the module into the corresponding slots in the rack.  *b*: Use the locating pins as a hinge and pivot the module until it is flush with the rack. (The connector on the back of the module inserts into the Ethernet connector on the rack.)
4	Tighten the retaining screw to hold the module in place on the rack:  Tightening torque: 0.4...1.5 N•m (0.30...1.10 lbf-ft)

Grounding Considerations

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.

NOTE: Refer to the ground protection information provided in the *Electrical installation guide* and *Control Panel Technical Guide, How to protect a machine from malfunctions due to electromagnetic disturbance*.

Replacing a Module

Any BMENOS0300 module on the rack can be replaced at any time with another module with compatible firmware. The replacement module obtains its configuration settings as follows:

- Operating parameters (except for IP addressing settings) are set by the positions of the two rotary switches on the front of the module. When replacing a module, set the rotary switches on the replacement module to the same positions as the rotary switches on the original module.
- IP address settings for the BMENOS0300 module are configured in the CPU, in its role as DHCP server. Use Control Expert to configure the **Services → Address Server** page of the CPU DTM and add each BMENOS0300 module to the list of DHCP clients served IP address settings by the CPU. Refer to the topic Determining the Device Name *(see page 34)*.

Hot Swap

From the system point of view, during a hot swap of the BMENOS0300 module, when the module is removed the I/O values go to fallback values. When the new module is inserted and powers up, the I/O values reset to their values before the hot swap. Refer to the topic BMENOS0300 DDDT *(see page 79)* for information about module DDDT values.

Chapter 5
Configuring the BMENOS0300 Module

Overview

This chapter describes the configuration of the module, including its external Ethernet ports and IP address.

The BMENOS0300 module is compatible with the following related product versions

Product	Version
Control Expert / Unity Pro(1)	Version 11.0 or later
M580 CPU firmware	Version 2.10 or later
BMEXBP*xxxx* backplane firmware	Version 1.0 or later
ConneXium Network Manager software	Version 6.0 or later
(1) Unity Pro is the former name of Control Expert for version 13.1 or earlier.	

NOTE: The device configuration procedure is valid when configuring a project with Control Expert Classic. When you configure your device from a system project, some commands are disabled in the Control Expert editor. In this case, you need to configure these parameters at the system level by using the Topology Manager.

What Is in This Chapter?

This chapter contains the following topics:

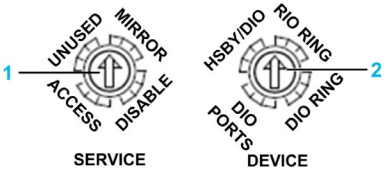
Configuring BMENOS0300 Ethernet Ports

Configuration Via Rotary Switches

Configuration of the BMENOS0300 module port settings is performed exclusively by means of the two rotary switches on the front of the module:

- The left switch configures the service port (ETH 1).
- The right switch configures the device network ports (ETH 2 and ETH 3).

Use a small flat head screwdriver to turn each rotary switch.



1 ETH 1 Service Port configuration switch
2 ETH 2 & 3 Device Network ports configuration switch

Use the rotary switches to configure the Ethernet ports, as described below.

Service Rotary Switch Configuration Positions

Use the Service rotary switch to configure the service port (ETH 1), as follows:

Switch Position	Configuration Setting Supports...
MIRROR	Port mirroring. Sends to ETH 1 a copy of Ethernet packets sent over all other Ethernet ports, including: ● ETH 2 ● ETH 3 ● Backplane port ● Internal port (connecting the three Ethernet ports on the front of the module to the module firmware)
ACCESS	General Ethernet communication to Ethernet devices, including: ● A PC running Automation Device Maintenance, for the purpose of performing a firmware upgrade. ● Distributed equipment in a non-looping Ethernet daisy chain.
DISABLE	No Ethernet packets pass through this port. This is the default setting.
UNUSED	The same behavior as the ACCESS switch position.

Device Rotary Switch Positions

Use the Device rotary switch to configure the network ports (ETH 2 and ETH 3).

NOTE: To enable RSTP, declare the BMENOS0300 module in Control Expert. To declare the module in Control Expert, add it to a rack in the **PLC Bus** or **EIO Bus** window.

Switch Position	Configuration Setting Supports...
HSBY/DIO	A non-deterministic distributed equipment Ethernet ring and RSTP, which employs two BMENOS0300 modules in a Hot Standby system as follows: • One module located in the primary Hot Standby local rack • One module located in the standby Hot Standby local rack. When HSBY/ DIO is selected: • The BMENOS0300 module in the Hot Standby rack with CPU “A” becomes the RSTP root bridge on the DIO ring, with a bridge identifier priority value set to 0. • The BMENOS0300 module in the Hot Standby rack with CPU “B” has its bridge identifier priority value set to 4096 (decimal). If you select HSBY/DIO, set the bridge identifier priority settings of the other devices in the DIO ring to a value greater than 0 so they will not attempt to become the root bridge.
RIO RING	A deterministic Ethernet RIO ring and RSTP. When RIO Ring is selected, the BMENOS0300 module becomes the RSTP root bridge on the RIO ring, with a bridge identifier priority value set to 0. If you select RIO Ring, set the bridge identifier priority settings of the other devices in the RIO ring to a value greater than 0 so they will not attempt to become the root bridge.
DIO RING	A non-deterministic distributed equipment Ethernet ring and RSTP. When DIO Ring is selected: • The BMENOS0300 module bridge identifier priority value is fixed at 61440 (decimal). • The port cost of each network port (ETH 2 and ETH 3) are set to 200,000,000. If you select DIO Ring, assign a bridge identifier priority to another device on the ring to a value less than 61440. As a result: • A device on the ring other than the BMENOS0300 module is the root bridge. • One of the network ports of the BMENOS0300 module is set to discarding state. This makes it possible to determine the health of the DIO ring by checking the status (discarding or forwarding) of module network ports.
DIO PORTS	Distributed equipment connected as DIO cloud or non-looping daisy chain. Does not support RSTP. This the default setting.

Applying Configuration Settings

Configuration settings take effect when the BMENOS0300 module powers up. Typically, you will configure switch settings when power to the module is turned off. Then, when you next apply power to the module, the settings you made are applied.

NOTE: Changing the switch positions while the BMENOS0300 module is operating has no immediate effect on the module. Any changes to switch positions made while the module is operating take affect only after power is turned off, and then turned back on.

Assigning an IP Address to the BMENOS0300 Module

Two Methods of Assignment

The BMENOS0300 module is a DHCP client that receives its IP address in one of two ways:

- From a DHCP server resident in the M580 CPU.
- If no DHCP server is configured to provide an IP address to the BMENOS0300 module, the module configures itself with an IP address based on its MAC Address.

BMENOS0300 as DHCP Client

To configure the BMENOS0300 module to receive IP address settings from, and be scanned by, the CPU, follow these steps:

Step	Action	
1	With your project offline in Control Expert, add a BMENOS0300 module to the rack:	
	a	In the **Project Browser** (structural view), select: **Configuration → PLC Bus**.
	b	Right click and select **Open**. The **PLC bus** window opens.
	c	Select a slot in rack where you want to add a BMENOS0300 module, right click, then select **New Device...**. The **New Device** window opens.
	d	In the **New Device** window, select **Modicon M580 local drop → Communication → BME NOS 0300**, then select **OK**.
	e	Click **Save**.
2	Open the **DTM Browser** (**Tools → DTM Browser**) to view the device DTM you are about to add:	
	a	In **DTM Browser**, right click the CPU and select **Open**.
	b	In the CPU DTM, select **Services → Address Server**. **NOTE:** You can add the new module as a DHCP client in either of two ways: ● In the **Manually Added Devices** area of the **Address Server** window, click **Add**, then enter IP addressing parameters for the BMENOS0300 module. Subsequently, the DHCP server in the CPU will send the module the IP address settings you input. However, the CPU will not scan the module. ● Follow steps 3...6 set forth below, to add the BMENOS0300 module to the list of **Automatically Added Devices**. Subsequently, the DHCP server in the CPU will send the module the IP address settings you input, and the CPU will scan the module parameters described in its DDDT *(see page 79)*.

Step	Action	
3	Add a BMENOS0300 module to be scanned by and to receive right IP address settings from the CPU:	
	a	in the **DTM Browser**, right click the CPU and select **Add...**.
	b	Select **Advanced Generic EDS**, then click **Add DTM**.
	c	In the **Properties of device** dialog, type in a name and click **OK**. **NOTE:** The name entered in this step is a variable you can assign to the module that has relevance to your application (for example, “Local NOS” or “NOS_1‘”. It is not the **Device Name** identifier value used by the DHCP server to identify the device. The new; device is added to list of **Automatically Added Devices** in the **Services → Address Server** window of the CPU.
4	Assign IP address settings to the BMENOS0300 module:	
	a	In CPU DTM, select the new module in the **Device List**, then select the **Address Setting** tab.
	b	In the **IP Configuration** area, accept the default settings, or enter custom IP address settings. **NOTE:** f you are editing settings, confirm that the BMENOS0300 module is assigned to the same subnet as the CPU.
	c	In the **Address Server** section, enter the following settings: ● **DHCP for this device**: Select **Enabled**. ● **Identified by**: Select **Device Name**. ● **Identifier**: Enter the device name *(see page 34)* value.
	d	Click **Apply** to save your edits.
5	Configure the connection for the BMENOS0300 module to the CPU:	
	a	In **DTM Browser** navigate to the BMENOS0300 DTM, right click, then select **Open**.
	b	In the left pane of the BMENOS0300 DTM, select the connection. By default, the connection is of the type **Exclusive Owner**. Change the connection type to **Input Only**: **1.** Select the **Exclusive Owner** connection and press the **Remove Connection** button. **2.** Press the **Add Connection** button. **3.** Scroll to **Input Only** to add the connection and press **OK**. **4.** Select **Input Only**.
	c	Select the **General** tab for the new connection, and edit these settings: ● **RPI**: Accept the default (30 ms) or enter a different value. ● **Input size**: Enter **16** (bytes). ● **Input mode**: Select **Point to Point**.
	d	Select the **Configuration Settings** tab, and edit these settings: ● **Input instance**: Enter **101**. ● **Output instance**: Enter **198**. ● **Configuration instance**: Enter **100**. ● **Configuration**: Enter **00 00 00 00 00 00 00 00**.
	e	Click **Apply** to save your edits.
6	Click **Save**.	

Determining the Device Name

The device name identifier for the BMENOS0300 module is a concatenation of the following information that can be derived from the module's position in a rack:

```
head module abbreviation_slot number_module type
```

These three criteria can have the following values:

Criteria	Possible values
Head module abbreviation	For local racks: ● Mx80: Standalone M580 CPU ● M58A: Hot Standby CPU designated as A ● M58B: Hot Standby CPU designated as B For remote racks: ● Cxxx: CRA at drop xxx (for example "C001")
Slot number	Two digit slot number position of the BMENOS0300 module in the local or remote rack (for example "04")
Module type	A constant string value set to: ● BMENOS

Examples of device names include:

- Mx80_04_BMENOS: located in the fifth slot (04) of a local rack with a standalone M580 CPU.
- M58B_03_BMENOS: located in the fourth slot (03) of a local rack with a Hot Standby M580 CPU designated as CPU "B".
- C002_06_BMENOS: located in the seventh slot (06) of a remote rack identified as drop 2 with a CRA as its head module.

Default IP Address Assignment

If the DHCP server in the CPU is not configured to supply the BMENOS0300 module with an IP address, the module will assign itself an IP address based on its MAC address, as follows:

10.10.*x.x*

Where *x.x* represents the decimal version of the last two (fifth and sixth) octets of the MAC Address.

NOTE: After the module assigns itself an IP address based on its MAC address, it continues to broadcast requests for an IP address as a DHCP client.

Chapter 6
Supported Topologies

Overview

This chapter presents several topologies that support the use of the BMENOS0300 network option switch.

NOTE: The topologies presented in this chapter are recommended and supported by Schneider Electric. This chapter does not describe every possible topology, and specifically excludes topologies that could create broadcast storms.

What Is in This Chapter?

This chapter contains the following sections:

Section 6.1
Standalone PAC, Local Rack BMENOS0300 Topologies

What Is in This Section?

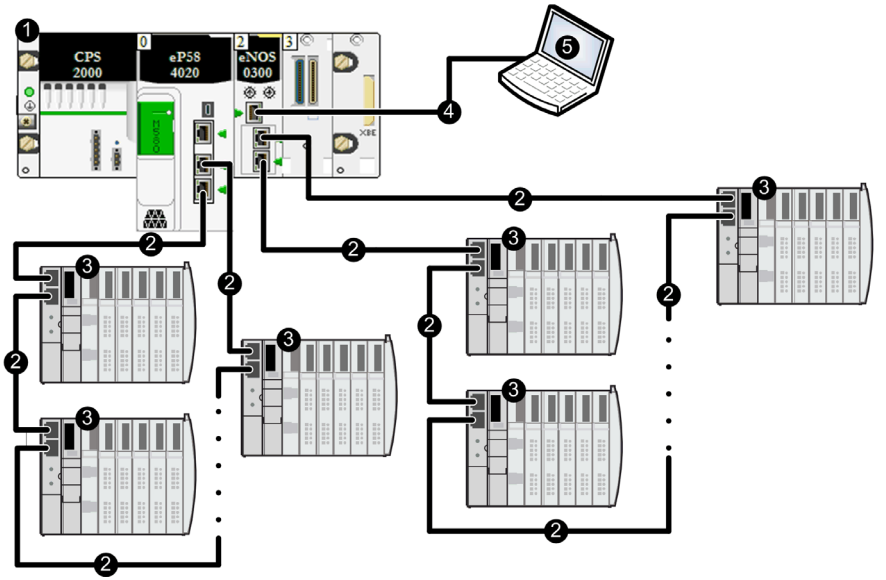
This section contains the following topics:

BMENOS0300 in Standalone PAC Local Rack in support of DIO Ring

Simple DIO Ring

In this topology, the BMENOS0300 network option switch is added to the main rack. This makes it possible to add a second DIO ring (in addition to the DIO ring connected to the CPU), and thereby extend the number of distributed equipment devices beyond the 40 devices supported by a single DIO ring. The ports of the BMENOS0300 module are used as follows:

- The two network ports are configured for a **DIO Ring**.
- The service port is configured as an **Access** port, and supports an engineering tool (for example, Control Expert) resident on a PC.
  NOTE: Instead of a PC, a DIO cloud could be connected to the service port.



1 Standalone PAC on local rack
2 Ethernet DIO ring
3 Distributed equipment
4 Ethernet non-looping daisy chain
5 Engineering tool resident on PC

NOTE:

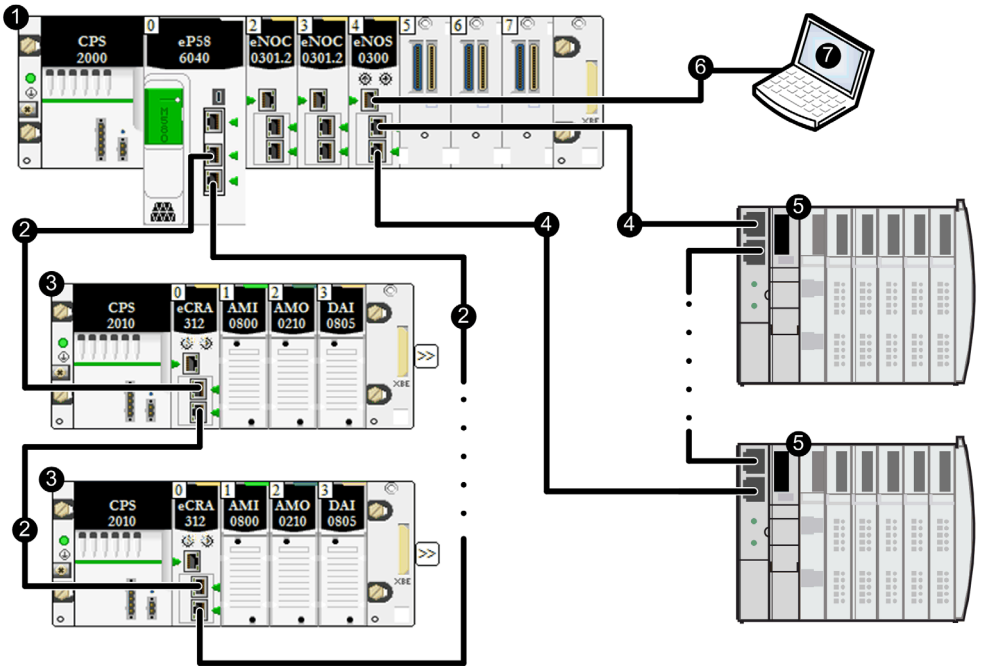
- To achieve acceptable recovery times, limit each DIO design to a single DIO main ring without sub-rings.
- RSTP limits the size of the DIO ring to a maximum of 40 switched devices, including the BMENOS0300 module.
- When you set the BMENOS0300 network rotary switch to **DIO Ring**, configure a distributed equipment Ethernet device to be the RSTP root bridge. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **DIO Ring**.

BMENOS0300 in Standalone PAC Local Rack with Two BMENOC0301/11 Modules Supporting RIO and DIO Rings

RIO Main Ring and DIO Ring

In this topology, the BMENOS0300 network option switch is used in place of a BMENOC0301/11 to reduce cost. The ports of the BMEP58•040 CPU and the BMENOS0300 module are used as follows:

- The two network ports on the CPU support an RIO main ring.
- The two network ports on the BMENOS0300 switch are configured for a **DIO Ring**.
- The service port on the BMENOS0300 module is configured as an **Access** port, and supports an engineering tool (for example, Control Expert) resident on a PC.
  NOTE: Instead of a PC, a DIO cloud could be connected to the service port.



1 Standalone PAC on local rack
2 Ethernet main RIO ring
3 (e)X80 RIO drop
4 Ethernet DIO ring
5 Distributed equipment
6 Ethernet non-looping daisy chain
7 Engineering tool resident on PC

NOTE:

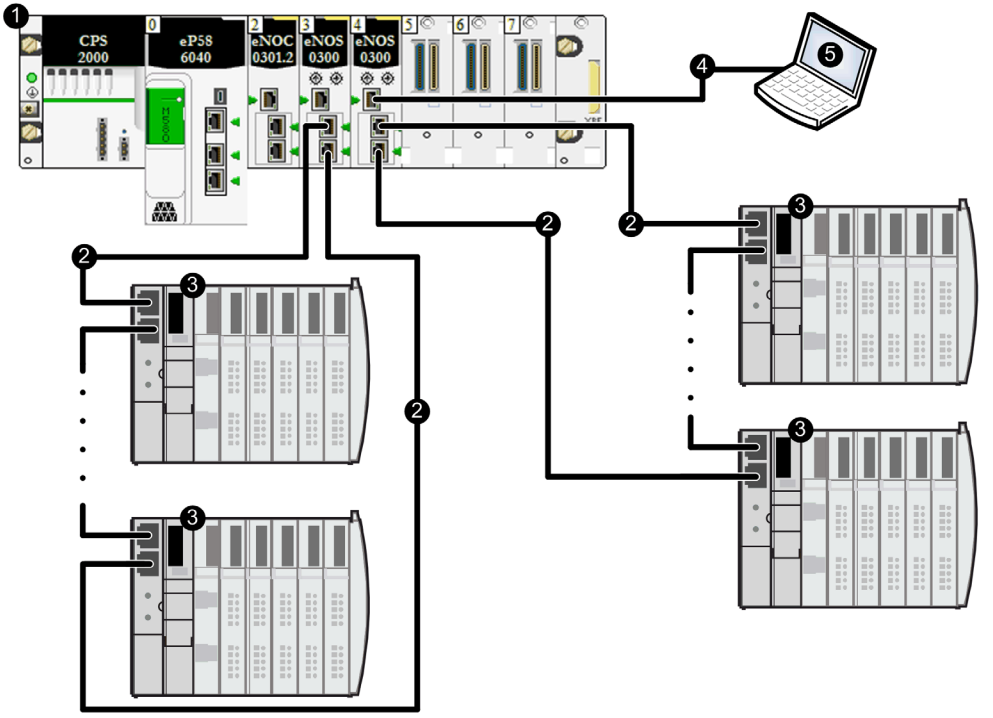
- To achieve acceptable recovery times, limit each DIO design to a single DIO main ring without sub-rings.
- RSTP limits the size of the DIO ring to a maximum of 40 switched devices, including the BMENOS0300 module.
- When you set the BMENOS0300 network rotary switch to **DIO Ring**, configure a distributed equipment Ethernet device to be the RSTP root bridge. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **DIO Ring**.

Two BMENOS0300 Modules in Standalone PAC Local Rack with BMENOC0301/11 Module in support of dual DIO Rings

Dual DIO Rings

In this topology, two BMENOS0300 network option switches are used in place of BMENOC0301/11 modules to reduce cost. The ports of two BMENOS0300 network option switches are configured as follows:

- The two network ports of each BMENOS0300 switch are configured for a **DIO Ring**.
- The service port of one BMENOS0300 switch is configured as an **Access** port, and supports an engineering tool (for example, Control Expert) resident on a PC.
  NOTE: Instead of a PC, a DIO cloud could be connected to the service port.



1 Standalone PAC on local rack
2 Ethernet DIO ring
3 Distributed equipment
4 Ethernet non-looping daisy chain
5 Engineering tool resident on PC

NOTE:

- To achieve acceptable recovery times, limit each DIO design to a single DIO main ring without sub-rings.
- RSTP limits the size of each DIO ring to a maximum of 40 switched devices, including the BMENOS0300 module.
- When you set the BMENOS0300 network rotary switch to **DIO Ring**, configure a distributed equipment Ethernet device to be the RSTP root bridge. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **DIO Ring**.
- Depending on the CPU you are using, the CPU can support up to a maximum number of 128 switched devices on all DIO rings.

Section 6.2
Standalone PAC, RIO Drop Topologies for the BMENOS0300

What Is in This Section?

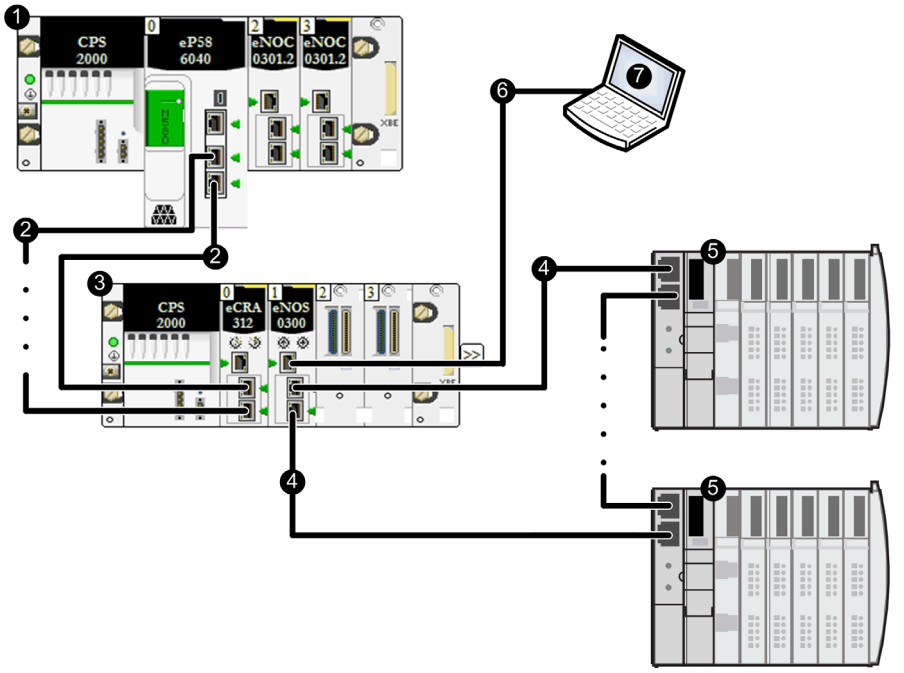
This section contains the following topics:

BMENOS0300 in RIO Drop of Standalone PAC in support of DIO Ring

Simple DIO Ring

In this topology, the BMENOS0300 network option switch is used in place of a BMENOC0301/11 to reduce cost. The ports of the BMENOS0300 module are used as follows:

- The two network ports are configured for a **DIO Ring**.
- The service port is configured as an **Access** port, and supports an engineering tool (for example, Control Expert) resident on a PC.
  NOTE: Instead of a PC, a DIO cloud could be connected to the service port.



1 Standalone PAC on local rack
2 Ethernet RIO main ring
3 (e)X80 RIO drop
4 Ethernet DIO ring
5 Distributed equipment
6 Engineering tool resident on PC

NOTE:

- To achieve acceptable recovery times, limit each DIO design to a single DIO main ring without sub-rings.
- RSTP limits the size of the DIO ring to a maximum of 40 switched devices, including the BMENOS0300 module.
- When you set the BMENOS0300 network rotary switch to **DIO Ring**, configure a distributed equipment Ethernet device to be the RSTP root bridge. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **DIO Ring**.

BMENOS0300 in RIO Drop of Standalone PAC in support of DIO Clouds

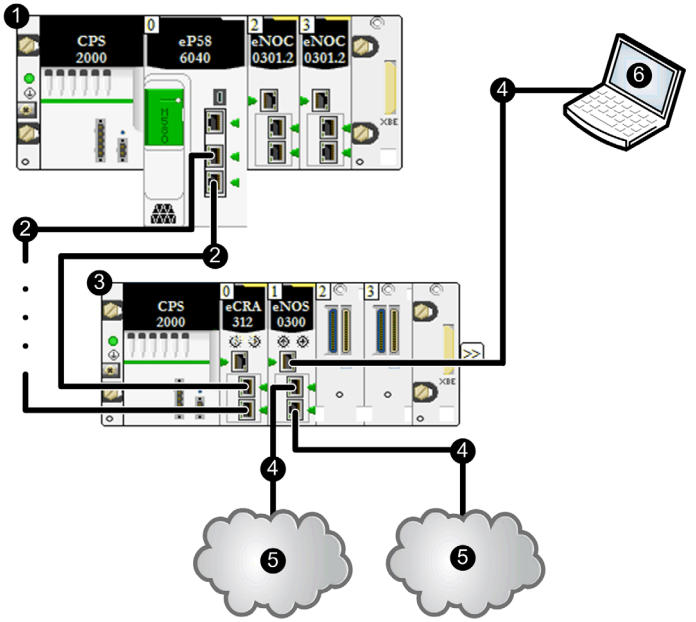
DIO Clouds

In this topology, the BMENOS0300 network option switch is used in place of a BMENOC0301/11 to reduce cost. The ports of the BMENOS0300 network option switch are used as follows:

- The two network ports are configured as **DIO Ports**.
- The service port is configured as an **Access** port, and supports an engineering tool (for example, Control Expert) resident on a PC.

⚠ CAUTION
RISK OF BROADCAST STORM Do not connect an Ethernet device in one DIO cloud to an Ethernet device in another DIO cloud. Connecting these devices can result in the occurrence of a broadcast storm, which can overload the network and delay or prevent intended network communications. **Failure to follow these instructions can result in injury or equipment damage.**

NOTE: Instead of a PC, a DIO cloud could be connected to the service port.



1 Standalone PAC on local rack
2 Ethernet RIO main ring
3 (e)X80 RIO drop
4 Ethernet daisy chain

5 DIO cloud
6 Engineering tool resident on PC

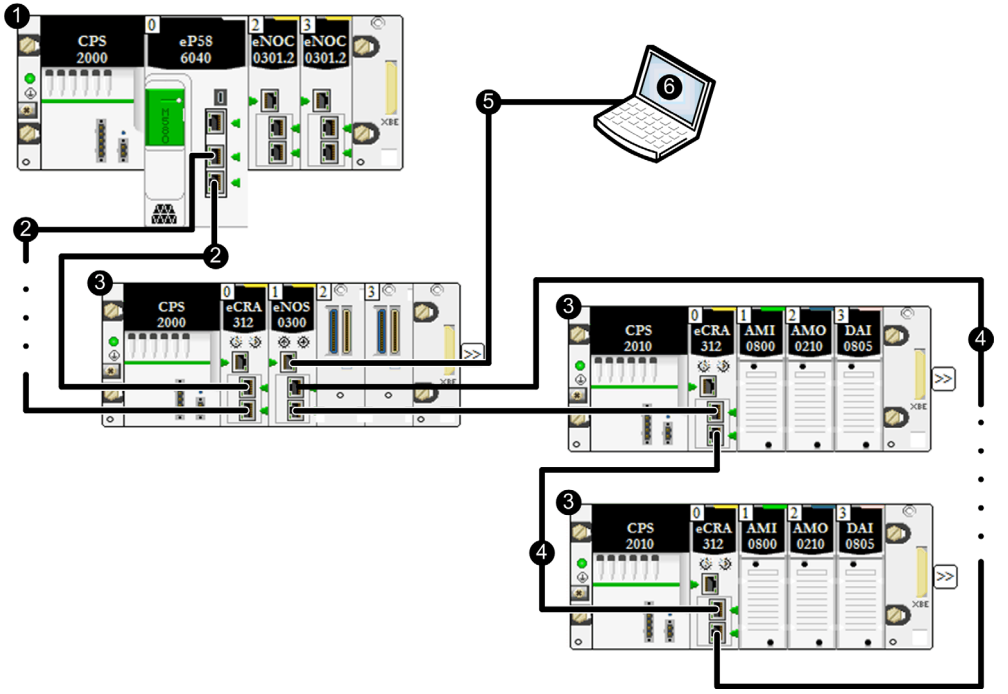
NOTE: Because RSTP is not enabled, there is no RSTP-based maximum device limit.

BMENOS0300 in RIO Drop of Standalone PAC in support of RIO Sub-Ring

Simple RIO Ring

In this topology, the BMENOS0300 network option switch is used in place of an external dual ring switch (DRS) to reduce cost. The BMENOS0300 network option switch resides in an RIO drop. Its ports are used as follows:

- The two network ports are configured for a **RIO Ring**.
- The service port is configured as an **Access** port, and supports an engineering tool (for example, Control Expert) resident on a PC.
  NOTE: Instead of a PC, a DIO cloud could be connected to the service port.



1 Standalone PAC on local rack
2 Ethernet RIO main ring
3 (e)X80 RIO drop
4 Ethernet RIO sub-ring
5 Ethernet daisy chain
6 Engineering tool resident on PC

NOTE:
To achieve desired RSTP-based network response time targets, the longest path that an Ethernet RIO packet would have to travel in the case of a cable break is 32 switched devices, including:

- the CPU
- the remote adapter (BMECRA312•0)
- the embedded switch in the Ethernet rack on which the BMENOS0300 is installed
- the BMENOS0300

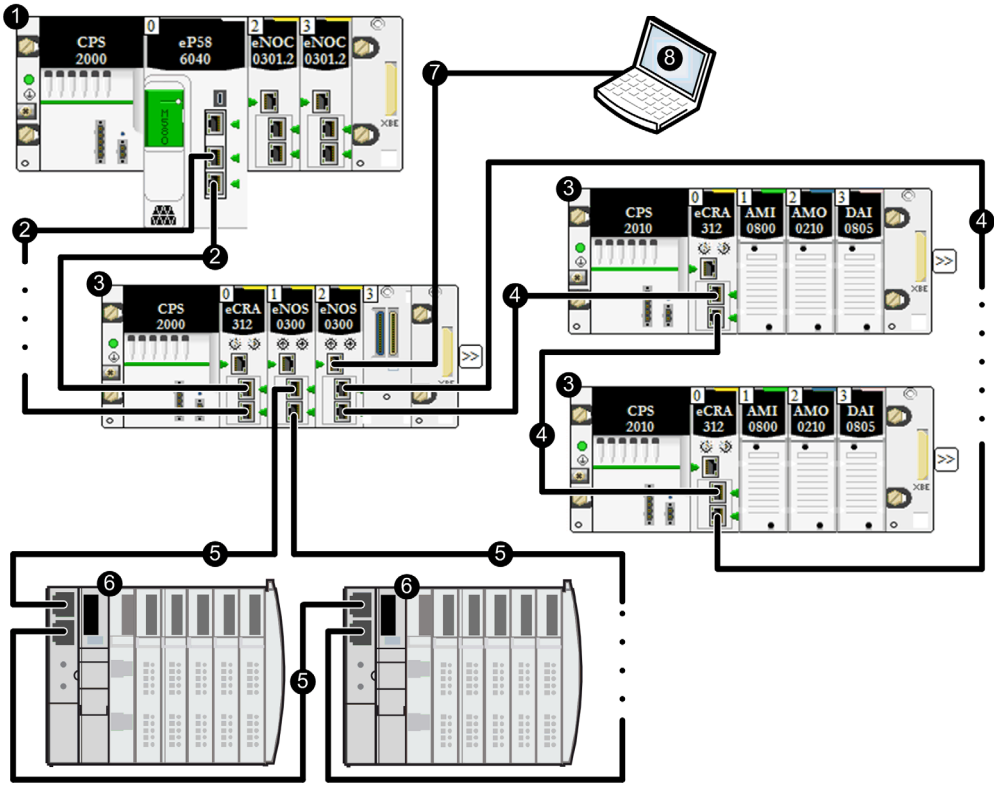
NOTE: When you set the BMENOS0300 network rotary switch to **RIO Ring**, configure RSTP bridge identifier priority settings for other devices in the RIO sub-ring to values greater than 0. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **RIO Ring**.

Two BMENOS0300 Modules in RIO Drop of Standalone PAC Supporting RIO Sub-Ring and DIO Ring

RIO Sub-Ring and DIO Ring

In this topology, two BMENOS0300 network option switches are used in place of external dual ring switches (DRSs) to reduce cost. The two BMENOS0300 network option switch modules reside in an RIO drop. The ports of these modules are used as follows:

- Two network ports of one BMENOS0300 module are configured for an **RIO Ring**, and support an RIO sub-ring.
- The service port of the same module is configured as an **Access** port, and supports an engineering tool (for example, Control Expert) resident on a PC.
  NOTE: Instead of a PC, a DIO cloud could be connected to the service port.
- The two network ports of the other BMENOS0300 module are configured for a **DIO Ring**.



1 Standalone PAC on local rack
2 Ethernet main RIO ring
3 (e)X80 RIO drop
4 Ethernet RIO sub-ring

5 Ethernet DIO ring
6 Distributed equipment
7 Ethernet daisy chain
8 Engineering tool resident on PC

NOTE:

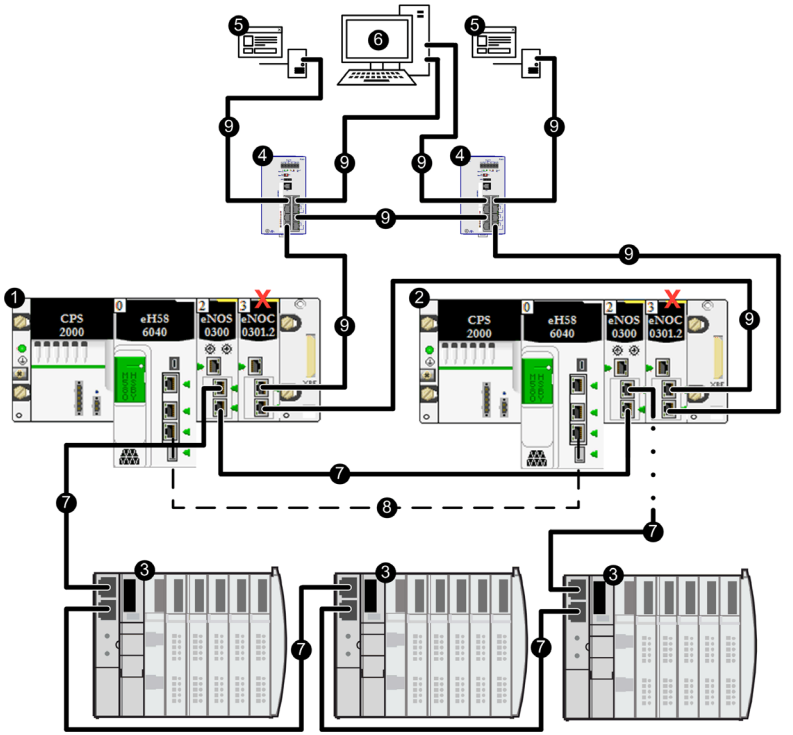
- To achieve desired RSTP-based network response time targets, the longest path that an Ethernet RIO packet would have to travel in the case of a cable break is 32 switched devices, including:
  - the CPU
  - the remote adapter (BMECRA312•0)
  - the embedded switch in the Ethernet rack on which the BMENOS0300 modules are installed
  - the BMENOS0300 module
- When you set the BMENOS0300 network rotary switch to **RIO Ring**, configure the RSTP bridge identifier priority settings of other devices in the RIO sub-ring to values greater than 0. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **RIO Ring**.
- To achieve acceptable recovery times, limit the DIO design to a single DIO main ring without sub-rings.
- When you set the BMENOS0300 network rotary switch to **DIO Ring**, configure a distributed equipment Ethernet device to be the RSTP root bridge. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **DIO Ring**.
- RSTP limits the size of the DIO ring to a maximum of 40 switched devices, including the BMENOS0300 module.

Section 6.3
Hot Standby PAC, Local Rack BMENOS0300 Topologies

BMENOS0300 in Local Rack of Hot Standby PACs in support of DIO Ring

Hot Standby DIO Ring

In this Hot Standby topology, two BMENOS0300 network option switches are used in place of BMENOC0301/11 modules to reduce cost. The network ports of two BMENOS0300 network option switch modules – one in the primary and one in the standby – are configured for a **HSBY/DIO**.



1 Primary Hot Standby PAC
2 Standby Hot Standby PAC
3 Distributed equipment
4 ConneXium dual ring Ethernet managed switches
5 SCADA server
6 Engineering workstation with dual network interface cards

7 Ethernet DIO ring
8 Hot Standby communication link
9 Ethernet control network
X BMENOC0301/11 communication module with backplane port disabled

NOTE:

- In this design, confirm that the backplane port of each BMENOC0301/11 communication module is disabled. The backplane port is disabled by default.

⚠ CAUTION
RISK OF BROADCAST STORM Do not enable the Ethernet backplane ports of the primary and standby BMENOC0301/11 communication modules. Enabling these ports can result in the occurrence of a broadcast storm, which can prevent the Hot Standby network from transporting intended network communications. **Failure to follow these instructions can result in injury or equipment damage.**

- To achieve acceptable recovery times, limit each DIO design to a single DIO main ring without sub-rings.
- RSTP limits the size of the DIO ring to a maximum of 40 switched devices, including the two BMENOS0300 modules.
- When you set the BMENOS0300 network rotary switch to **HSBY/DIO**, assign RSTP bridge identifier priority values greater than 4096 (decimal) to other distributed equipment Ethernet devices in the DIO ring. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **HSBY/DIO**.

Section 6.4
Hot Standby PAC, RIO Drop Topologies for the BMENOS0300

What Is in This Section?

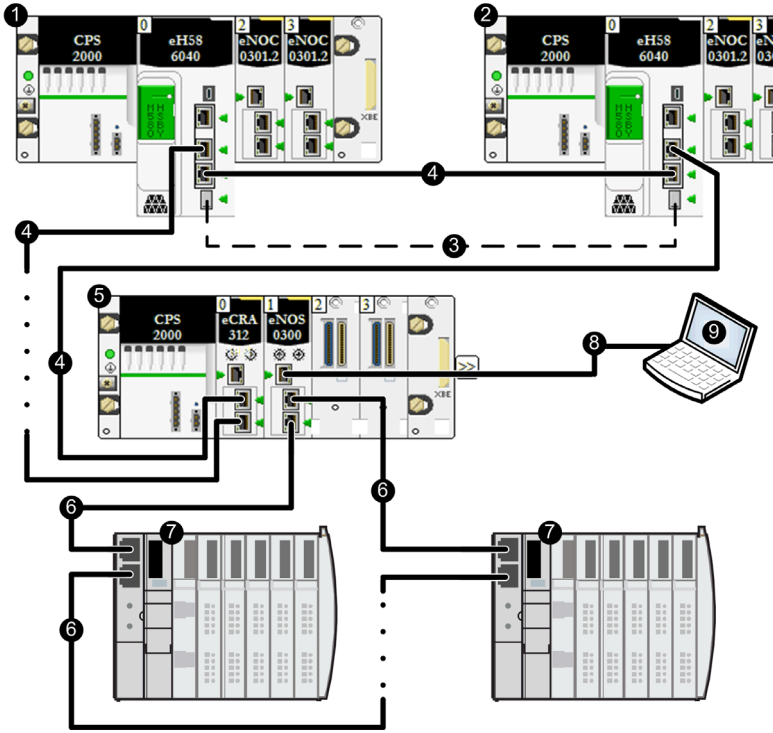
This section contains the following topics:

BMENOS0300 in RIO Drop of Hot Standby PACs in support of DIO Ring

Simple DIO Ring

In this Hot Standby topology, the BMENOS0300 network option switch is used in place of a BMENOC0301/11 to reduce cost. The BMENOS0300 network option switch is located in an RIO drop. Its ports are used as follows:

- The two network ports are configured for a **DIO Ring**.
- The service port is configured as an **Access** port, and supports an engineering tool (for example, Control Expert) resident on a PC.
  NOTE: Instead of a PC, a DIO cloud could be connected to the service port.



1 Primary Hot Standby PAC
2 Standby Hot Standby PAC
3 Hot Standby communication link
4 Ethernet RIO main ring
5 (e)X80 RIO drop
6 Ethernet DIO ring
7 Distributed equipment
8 daisy chain
9 Engineering tool resident on PC

NOTE:

- To achieve acceptable recovery times for the DIO ring, limit its design to a single DIO main ring without sub-rings.
- RSTP limits the size of the DIO ring to a maximum of 40 switched devices, including the BMENOS0300 module.
- When you set the BMENOS0300 network rotary switch to **DIO Ring**, configure a distributed equipment Ethernet device to be the RSTP root bridge. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **DIO Ring**.

BMENOS0300 in RIO Drop of Hot Standby PACs in support of DIO Clouds

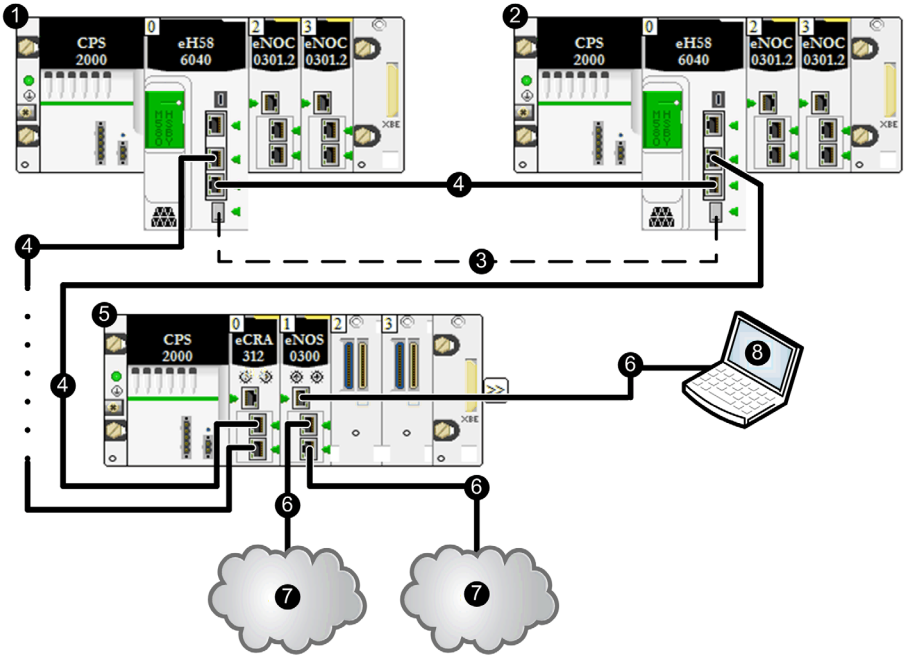
RIO Main Ring with DIO Clouds

In this Hot Standby topology, the BMENOS0300 network option switch is used in an RIO drop. It is used instead of a BMENOC0301/11 module to reduce cost. Its ports are used as follows:

- The two network ports are configured as **DIO Ports**.
- The service port is configured as an **Access** port, and supports an engineering tool (for example, Control Expert) resident on a PC.

⚠ CAUTION
RISK OF BROADCAST STORM Do not connect an Ethernet device in one DIO cloud to an Ethernet device in another DIO cloud. Connecting these devices can result in the occurrence of a broadcast storm, which can overload the network and delay or prevent intended network communications. **Failure to follow these instructions can result in injury or equipment damage.**

NOTE: Instead of a PC, a DIO cloud could be connected to the service port.



1 Primary Hot Standby PAC
2 Standby Hot Standby PAC
3 Hot Standby communication link

4 Ethernet RIO main ring
5 (e)X80 RIO drop
6 Ethernet non-looping daisy chain
7 DIO cloud
8 Engineering tool resident on PC

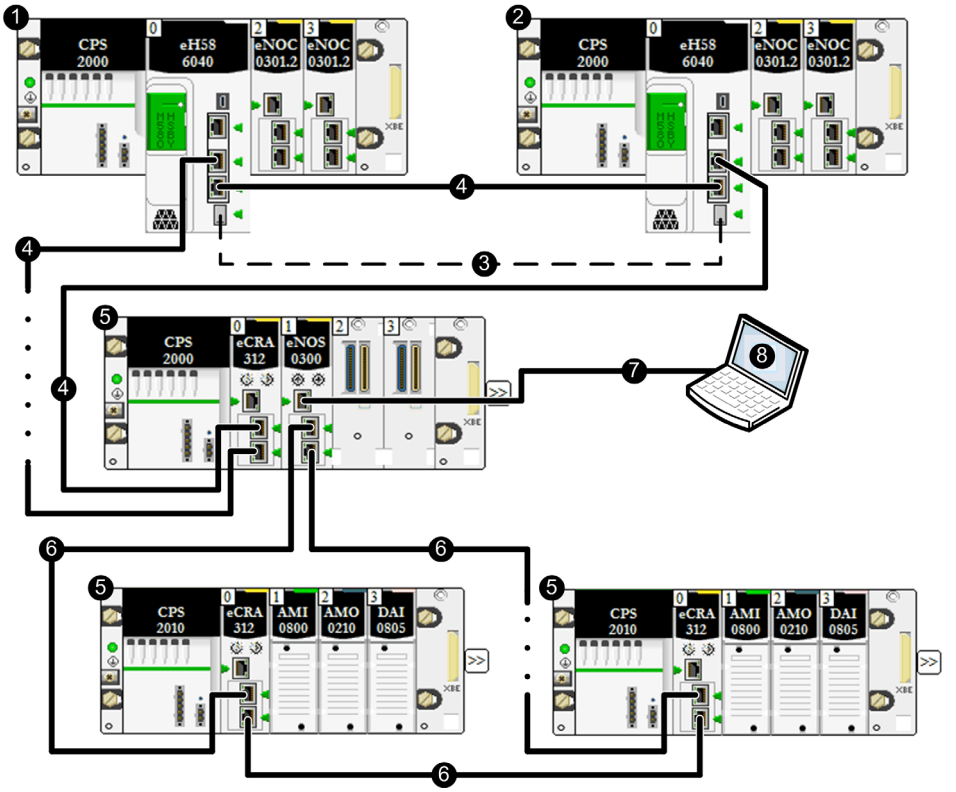
NOTE: Because RSTP is not enabled, there is no RSTP-based maximum device limit.

BMENOS0300 in RIO Drop of Hot Standby PACs in support of RIO Sub-Ring

RIO Main Ring with RIO Sub-Ring

In this Hot Standby topology, the BMENOS0300 network option switch resides in an RIO drop. It is used in place of an external dual ring switch (DRS) to reduce cost. Its ports are configured as follows:

- The two network ports are configured for an **RIO Ring**.
- The service port supports an engineering tool (for example, Control Expert) resident on a PC. **NOTE:** Instead of a PC, a DIO cloud could be connected to the service port.



1 Primary Hot Standby PAC
2 Standby Hot Standby PAC
3 Hot Standby communication link
4 Ethernet RIO main ring
5 (e)X80 RIO drop
6 Ethernet RIO sub-ring
7 Ethernet daisy chain
8 Engineering tool resident on PC

NOTE:
To achieve desired RSTP-based network response time targets, the maximum combined size of the RIO main ring plus a single RIO sub-ring is 32 switched devices, including:

- both Hot Standby CPUs
- the remote adapter (BMECRA312•0)
- the embedded switch in the Ethernet rack on which the BMENOS0300 is installed
- the BMENOS0300
- up to 27 additional switched devices

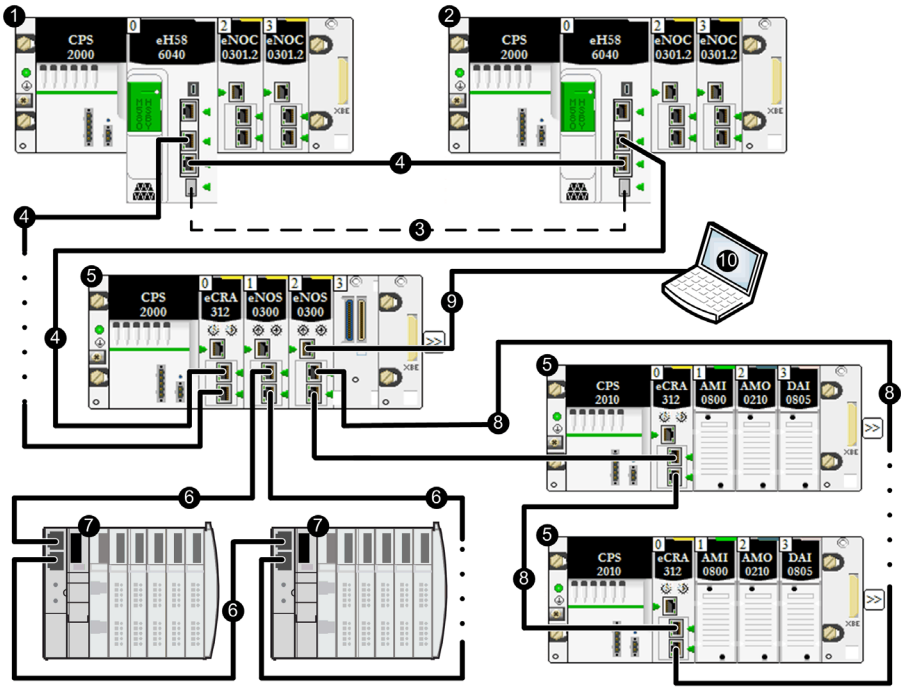
NOTE: When you set the BMENOS0300 network rotary switch to **RIO Ring**, configure RSTP bridge identifier priority settings for other devices in the RIO sub-ring to values greater than 0. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **RIO Ring**.

Two BMENOS0300 Modules in RIO Drop of Hot Standby PACs Supporting RIO Sub-Ring and DIO Ring

RIO Sub-Ring and DIO Ring

In this Hot Standby topology, two BMENOS0300 network option switch modules are used in place of external dual ring switches (DRSs) to reduce cost. These modules reside in an RIO drop. The ports of these modules are used as follows:

- Two network ports of one BMENOS0300 module are configured for an **RIO Ring**, and support an RIO sub-ring.
- The service port of the same module is configured as an **Access** port, and supports an engineering tool (for example, Control Expert) resident on a PC.
  NOTE: Instead of a PC, a DIO cloud could be connected to the service port.
- The two network ports of the other BMENOS0300 module are configured for a **DIO Ring**.



1 Primary Hot Standby PAC
2 Standby Hot Standby PAC
3 Hot Standby communication link
4 Ethernet main RIO ring
5 (e)X80 RIO drop
6 Ethernet DIO ring
7 Distributed equipment

8 Ethernet RIO sub-ring
9 Ethernet daisy chain
10 Engineering tool resident on PC

NOTE:

- To achieve desired RSTP-based network response time targets, the longest path that an Ethernet RIO packet would have to travel in the case of a cable break is 32 switched devices, including:
  - both Hot Standby CPUs
  - the remote adapter (BMECRA312•0)
  - the embedded switch in the Ethernet rack on which the BMENOS0300 modules are installed
  - the BMENOS0300 module
- When you set the BMENOS0300 network rotary switch to **RIO Ring**, configure the RSTP bridge identifier priority settings of other devices in the RIO sub-ring to values greater than 0. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **RIO Ring**.
- To achieve acceptable recovery times, limit the DIO design to a single DIO main ring without sub-rings.
- When you set the BMENOS0300 network rotary switch to **DIO Ring**, configure a distributed equipment Ethernet device to be the RSTP root bridge. Refer to the topic Device Rotary Switch Positions *(see page 31)* for information about the effects of selecting **DIO Ring**.
- RSTP limits the size of the DIO ring to a maximum of 40 switched devices, including the BMENOS0300 module.

Chapter 7
Ethernet Services

Ethernet Services

Introduction

The BMENOS0300 network option switch provides the following Ethernet services:

- HTTP web page server
- SNMP network management agent
- QoS message priority tagging
- DHCP client for IP address assignment
- FTP server, for firmware upgrade

As implemented in the BMENOS0300 network switch module, all services are pre-configured, and do not require custom configuration.

HTTP Web Page Server

The BMENOS0300 network switch module includes a Hypertext Transfer Protocol (HTTP) server. Use the server to access the module's web pages *(see page 70)* for the purpose of monitoring and diagnosing the module. All web pages are read-only. The server provides easy access to the module from standard internet browsers.

The HTTP web pages are accessed using the IP address *(see page 32)* of the module.

SNMP Network Management Agent

The BMENOS0300 network switch module includes an SNMP v1 agent. An SNMP agent is a software component running on the module that allows access to the module's diagnostic and management information via the SNMP service. SNMP browsers, network management software, and other tools typically use SNMP to access this data. The SNMP agent is read-only.

The SNMP agent is accessed using the IP address *(see page 32)* of the module.

QoS Message Priority Tagging

The BMENOS0300 network switch module supports the OSI layer 3 Quality of Service (QoS) standard defined in RFC-2475, by accepting and re-transmitting Ethernet packets that contain a differentiated services code point (DSCP). The QoS tags are added to Ethernet packets by other devices that support QoS configuration.

DHCP Client

The BMENOS0300 network option switch includes a DHCP client. The purpose of the DHCP client is to receive, from a DHCP server, an IP address for Ethernet network communications. When powered up, the module sends a request, based on the module's device name, to the DHCP server resident in the CPU. The DHCP server delivers an IP address to the module, if the DHCP server has been configured to do so. If not, the module assigns itself an IP address based on its MAC Address.

FTP Server

The BMENOS0300 network option switch includes an FTP server. The FTP server is continuously enabled.

The FTP server is accessed using the IP address *(see page 32)* of the module.

Chapter 8
Cyber Security

Cyber Security

Introduction

The BMENOS0300 module is an inexpensive, easy-to-use network switch that is configured exclusively by means of the two rotary switches. In addition, it receives its IP address from a DHCP server, based on the auto-generated device name *(see page 34)*. As a simple device, the BMENOS0300 has very limited functionality. Its core functionality, switching, is configured using rotary switches. Diagnostics are provided by IP based Ethernet services.

This topic shows you how to provide CPU-based Ethernet services and switching functionality to the BMENOS0300 module.

Access Control

Because the BMENOS0300 is a switching module, there is no need for it to provide ACL protection to IP based services. All Ethernet packets are pass through. Hence protection can be provided for the connected end devices (such as the CPU and the Ethernet I/O adapter module).

The BMENOS0300 module accepts Ethernet packets sent to its Ethernet ports from connected Ethernet devices. If you wish to limit the inflow of Ethernet packets into your application, you can enable **Access Control** in the **Security** tab of the M580 CPU module DTM. Access Control restricts device access to the CPU in its role as a server. You can add the IP addresses of the devices that you want to communicate with the CPU to the list of Authorized Addresses:

- By default, the IP address of the CPU's embedded Ethernet I/O scanner service with subnet set to Yes allows any device in the subnet to communicate with the CPU through EtherNet/IP or Modbus TCP.
- Add the IP address of any client device that may send a request to the CPU's Ethernet I/O scanner service, which, in this case, acts as a Modbus TCP or EtherNet/IP server.
- Add the IP address of your maintenance PC to communicate with the PAC through the CPU Ethernet I/O scanner service via Control Expert to configure and diagnose your application.

NOTE: The subnet in the IP Address column can be the subnet itself or any IP address inside the subnet. If you select **Yes** for a subnet that does not have a subnet mask, a pop-up window states that the screen cannot be validated because of a detected error.

Disabling Ethernet Services

Ethernet access to the BMENOS0300 module is not enabled until it is served an IP address from a DHCP server.

If you wish to disable Ethernet services for the module, do not assign it an IP address. In this configuration, the module continues to operate as an Ethernet switch, but does not initiate its Ethernet services.

When the BMENOS0300 receives an IP address, the information that can be accessed via its DDDT *(see page 79)* is read-only diagnostic data, which necessarily presents only a limited security concern. If the BMENOS0300 stops functioning properly as the result of a cyber attack, the module enters a reduced functionality operating mode, in which its switching function is disabled. This response limits the likelihood of the attack affecting other devices in the Ethernet network.

Disabling Switch Ports

You can disable the service port by setting the **SERVICE** rotary switch to the **DISABLED** position. You cannot disable the two network ports or the backplane port. However, as noted above, you can configure access control *(see page 65)* for the M580 CPU in your application.

Chapter 9
Diagnostics

Overview

This chapter presents diagnostic tools for the BMENOS0300 network switch module.

What Is in This Chapter?

This chapter contains the following sections:

Section 9.1
BMENOS0300 Diagnostic LEDs

LED Diagnostics for the BMENOS0300 Module

Overview

The BMENOS0300 module includes diagnostic LEDs:

- In a panel at the top of the module front face.
- Next to each RJ45 Ethernet connector.

LED Panel Display

A 4-LED display is located on the front panel of the module:

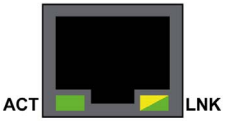
The BMENOS0300 panel LEDs indicate the following states:

LED	Color	State	Description
RUN	Green	On	The module is operating normally.
		Off	The module is powered off or is not configured.
		Flashing	The module is in STOP mode, self-test mode, duplicate IP mode, or there is no Ethernet link.
ERR	Red	Off	The module is operating normally; no error is detected.
		Flashing	The module is not configured, a configuration is in progress, or a backplane communication error is detected.
		On	An error is detected.

LED	Color	State	Description
MS	Green	On	The module is operating normally.
		Flashing	The module has not been configured.
	Green / Red	Off	Power is not supplied to the module.
	Red	On	A non-recoverable fault is detected.
		Flashing	A recoverable fault is detected.
NS	Green	On	The module has established at least one CIP connection.
		Flashing	An IP address has been assigned, but the no CIP connections are established.
	Green / Red	Off	No IP address has been assigned to the module.
	Red	On	A duplicate IP address is detected.
		Flashing	One or more CIP connections, for which the module is a target, have timed out.

Ethernet Port Connector LEDs

Each Ethernet RJ45 connector presents a pair of LED indicators:



The Ethernet connector LEDs indicate the following states:

LED	Color	State	Description
ACT	Green	Flashing	Data is being transmitted over the link.
		Off	No transmission activity is occurring.
LNK	Green	On	Link speed = 100 Mbit/s.
	Yellow	On	Link speed = 10 Mbit/s.
	Green / Yellow	Off	No link is established.

Section 9.2
BMENOS0300 Module Embedded Web Pages

Introduction

The BMENOS0300 network switch module includes an HTTP server. The server transmits web pages for the purpose of monitoring and diagnosing the module. The server provides easy access to the module from standard internet browsers.

Use the module IP address *(see page 32)* to access the web pages.

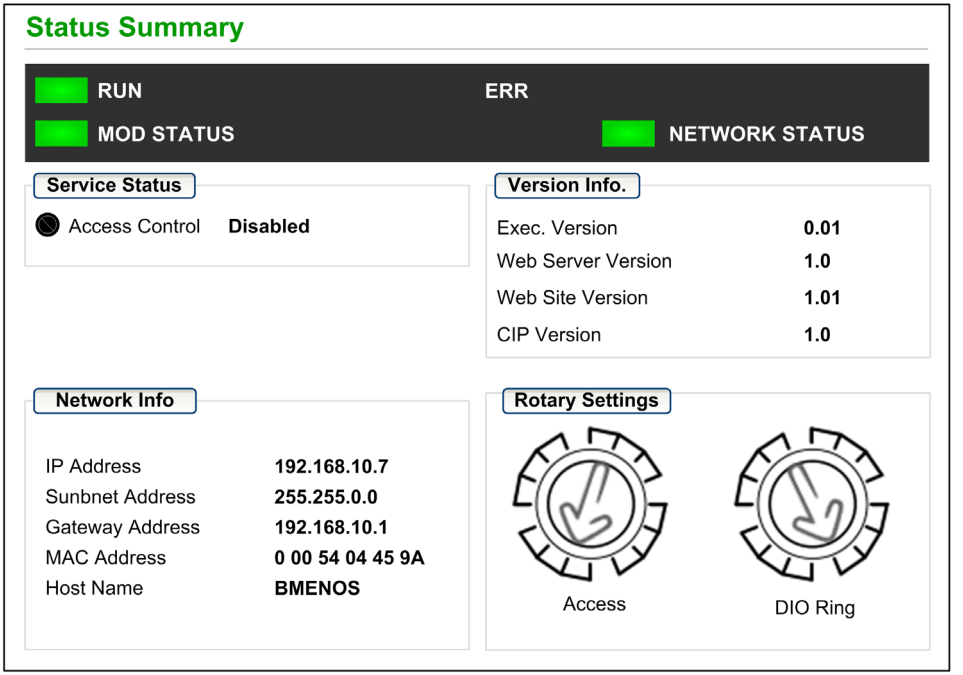
What Is in This Section?

This section contains the following topics:

Status Summary

Open the Page

Access the **Status Summary** page from the **Diagnostics** tab (**Menu → Module → Summary**):



NOTE: This page is updated every 5 seconds.

Diagnostic Information

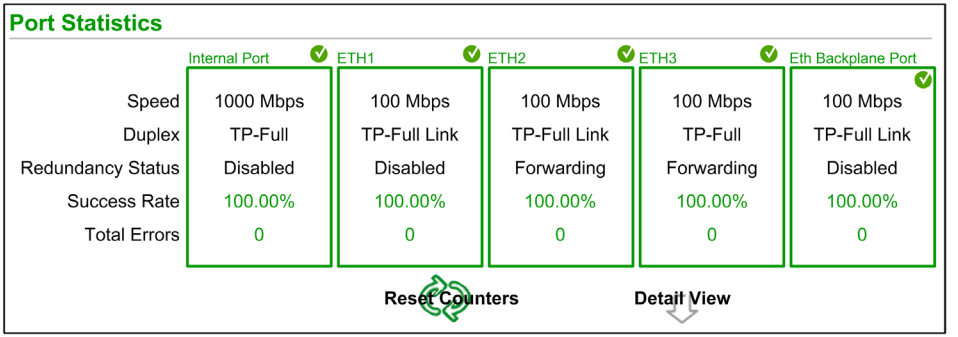
The objects on this page provide status information:

Parameters	Description	
LEDs	The LED panel includes the following LED indicators: • RUN • ERR • MOD STATUS • NETWORK STATUS **NOTE:** The LEDs are described in the description of the LED panel. *(see page 68)*	
Service Status	green	The available service is operational and running.
	red	An error is detected in an available service.
	black	The available service is not present or not configured.
Version Info.	This field describes the software versions that are running on the module.	
Network Info.	This field contains network and hardware address information and connectivity that corresponds to the module.	
Rotary Settings	This field describes the position of the two rotary switches *(see page 30)* on the front of the module: • The left switch setting describes the configuration of the service port. • The right switch setting describes the configuration of the two network ports.	

Port Statistics

Open the Page

Access the **Port Statistics** page from the **Diagnostics** tab (**Menu → Module → Port Statistics**):



NOTE: This page is updated every 5 seconds. Click **Reset Counters** to reset all dynamic counters to 0.

Diagnostic Information

This page shows the statistics for each port on the module. This information is associated with the configuration of the Service port (ETH 1) and the Device network ports (ETH 2 and ETH 3) *(see page 30)*.

The frame color indicates the port activity:

- *green*: active
- *gray*: inactive
- *yellow*: recoverable error detected
- *red*: non-recoverable error detected

Expanded View

Click **Detail View** to see more statistics:

Statistic	Description
Frames Transmitted	Number of frames successfully transmitted.
Frames Received	Number of frames received.
Excessive Collisions	Number of excessive Ethernet collisions.
Late Collisions	Number of late Ethernet collisions.
CRC Errors	Number of detected cyclic redundancy check (CRC) errors.
Bytes Received	Number of bytes received.
Inbound Packet Errors	Number of detected inbound packet errors.

Statistic	Description
Inbound Packets Discarded	Number of inbound packets discarded.
Bytes Transmitted	Number of bytes transmitted.
Outbound Packet Errors	Number of detected outbound packet errors.
Outbound Packets Discarded	Number of outbound packets discarded.
Carrier Sense Errors	Number of detected carrier sense errors. A carrier sense error is detected when a port tries to transmit a frame, but cannot do so because no carrier is detected.
FCS Errors	Number of detected frame check sequence (FCS) errors. An FCS error is detected when a frame is corrupted during transmission as indicated by its checksum value.
Alignment Errors	The number of byte alignment errors that have been detected. A byte alignment occurs when the number of bits in a frame is not divisible by 8. An alignment error also triggers an FCS error.
Internal MAC Trans. Errors	The number of detected transmit errors that are not late collisions, excessive collisions, or CRC errors.
Internal MAC Rec. Errors	The number of detected receive errors that are not late collisions, excessive collisions, or CRC errors.
SQE Test Errors	The number of detected signal quality error (SQE) instances. Some Ethernet transceivers use an SQE heartbeat to indicate it is connected to a host interface. This detected error indicates that a transceiver has no heartbeat. Note that not all transceivers produce a heartbeat.

QoS

Open the Page

Access the **QoS** (quality of service) page from the **Diagnostics** tab (**Menu → Services → QoS**):

NOTE:

- QoS values are automatically set when you select positions for the rotary switches *(see page 30)*.
- Click **Detail View** to expand the list of parameters.
- This page is updated every 5 seconds.

Service Status

This table shows the possible states for the **Service Status**:

Status	Description
Running	The service is correctly configured and running.
Disabled	The service is disabled.
Uknown	The status of the service is not known.

Diagnostic Information

QoS causes the module to add a differentiated services code point (DSCP) tag to each Ethernet packet it transmits, thereby indicating the priority of that packet:

Field	Parameter	Description
Precision Time Protocol	DSCP PTP Event Priority	Point-to-point time synchronization.
	DSCP PTP General	Point-to-point general.
EtherNet/IP Traffic	DSCP Value for I/O Data Scheduled Priority Messages	Configure the priority levels to prioritize the management of data packets.
	DSCP Value for Explicit Messages	
Modbus/TCP Traffic	DSCP Value for I/O Messages	**NOTE:** We recommend that you use a larger timeout value for explicit messaging connections and a smaller timeout value for implicit messaging connections. The specific values that you employ depend on your application requirements.
	DSCP Value for Explicit Messages	
Network Time Protocol Traffic	DSCP Value for Network Time	—

Considerations

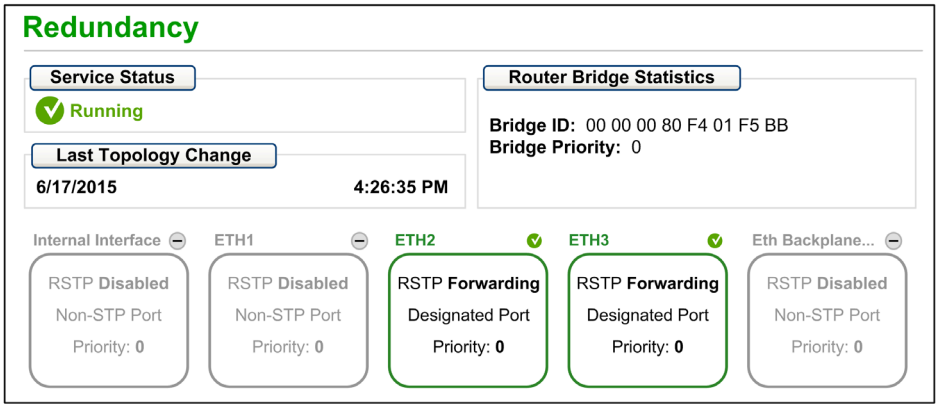
Take measures to effectively implement QoS settings in your Ethernet network:

- Use only network switches that support QoS.
- Apply the same DSCP values to all network devices and switches.
- Use switches that apply a consistent set of rules for handling the different DSCP values when transmitting and receiving Ethernet packets.

Redundancy

Open the Page

Access the **Redundancy** page on the **Diagnostic** tab (**Menu → Services → Redundancy**):



NOTE:

- When redundancy is enabled in the configuration, both port ETH2 and port ETH3 are designated as RSTP ports. No other module port can be configured to support the RSTP protocol.
- This page is updated every 5 seconds.

Diagnostic Information

This page displays RSTP-related data:

Field	Description	
Service Status	**Running**	The RSTP bridge on the corresponding CPU is properly configured and running.
	Disabled	The RSTP bridge on the corresponding CPU is disabled.
	Unknown	The status of the RSTP bridge on the corresponding CPU is not known.
Last Topology Change	These values represent the date and time that the last topology change was received for the corresponding **Bridge ID**.	
Redundancy Status	green	The designated Ethernet port is learning or formatting information.
	yellow	The designated Ethernet port is discarding information.
	gray	RSTP is disabled for the designated Ethernet port.
Router Bridge Statistics	**Bridge ID**	This unique bridge identifier is the concatenation of the bridge RSTP priority and the MAC address.
	Bridge Priority	The RSTP priority of the port.

Section 9.3
BMENOS0300 DDDT

BMENOS0300 DDDT

Introduction

BMENOS0300 network option switch includes the following 16-Byte DDDT, which you can interrogate to diagnose the status of the module.

Byte	Bit Offset	Parameter	Description
0	ETH_STATUS		
	0.0	PORT1_LINK[1]	0: Link down / 1: Link up
	0.1	PORT2_LINK[1]	0: Link down / 1: Link up
	0.2	PORT3_LINK[1]	0: Link down / 1: Link up
	0.3	PORT4_LINK[1]	0: Link down / 1: Link up
	0.4	<Reserved>	–
	0.5	REDUNDANCY_STATUS	0: Ring broken or status unknown / 1: Ring intact
	0.6	<Reserved>	–
	0.7	GLOBAL_STATUS	0: Non-normal operation / 1: Normal operation
1	SERVICE_STATUS		
	1.0	RSTP_SERVICE	0: Non-normal operation / 1: Normal operation
	1.1	PORT502_SERVICE	0: Non-normal operation / 1: Normal operation
	1.2	SNMP_SERVICE	0: Non-normal operation / 1: Normal operation
	1.3	WEB_SERVER	0: Non-normal operation / 1: Normal operation
	1.4	ETH_BKP_FAILURE	0: Detected error / 1: OK
	1.5	ETH_BKP_ERROR	0: Detected error / 1: OK
	1.6	FIRMWARE_UPGRADE	0: Non-normal operation / 1: Normal operation
	1.7	EIP_ADAPTER	0: Non-normal operation / 1: Normal operation
2	ETH_PORT_1_2_STATUS		
	2.0...2.1	PORT1_FUNCTION	0:Disabled / 1: Access / 2: Mirror / 3: Network
	2.2...2.3	PORT1_RSTP_ROLE	0:Alternate / 1: Backup / 2: Designated / 3: Root
	2.4...2.5	PORT2_FUNCTION	0:Disabled / 1: Access / 2: Mirror / 3: Network
	2.6...2.7	PORT2_RSTP_ROLE	0:Alternate / 1: Backup / 2: Designated / 3: Root
1. Port number references are: Port 1: ETH1 / Port 2: ETH2 / Port 3: ETH 3 / Port 4: Backplane port			

Byte	Bit Offset	Parameter	Description
3	ETH_PORT_3_BKP_STATUS		
	3.0...3.1	PORT3_FUNCTION	0:Disabled / 1: Access / 2: Mirror / 3: Network
	3.2...3.3	PORT3_RSTP_ROLE	0:Alternate / 1: Backup / 2: Designated / 3: Root
	3.4...3.5	PORT4_FUNCTION	0:Disabled / 1: Access / 2: Mirror / 3: Network
	3.6...3.7	PORT4_RSTP_ROLE	0:Alternate / 1: Backup / 2: Designated / 3: Root
4...5	MODULE_PORT_FUNCTIONS		
	4.0...5.3	<Reserved>	–
	5.4...5.5	SERVICE_PORT_FUNCTION	0:Disabled / 1: Access / 2: Mirror / 3: Unused
	5.6...5.7	NETWORK_PORT_FUNCTION	0: RIO Ring / 1: DIO Ring / 2: DIO Ports / 3: DIO Root
6...7	MODULE_STATUS_FLAGS		
	6.0...7.6	<Reserved>	–
	7.7	POTENTIAL_STORM_DETECT	0: Normal / 1: Potential storm
8...11	POTENTIAL_STORM_COUNTER		Potential storm counter (integer)
12...15	<Reserved>		–
1. Port number references are: Port 1: ETH1 / Port 2: ETH2 / Port 3: ETH 3 / Port 4: Backplane port			

Establishing a Connection to the DDDT via EtherNet/IP

You can establish a read-only connection to the BMENOS0300 DDDT using either of the following EtherNet/IP connection types:

- Transport class 1: Implicit scheduled data transfer (I/O) connection (UDP/IP)
- Transport class 3: Explicit unscheduled messaging via the CIP Assembly Object (TCP/IP)

Establishing an Implicit Messaging Connection

You can establish an implicit messaging connection to the module using the following connection configuration information:

- Connection transport class: 01 (decimal)
- Connection type: O->T Exclusive Owner
- Instance ID: 101 (decimal)
- Data size: 16 bytes (decimal)

Sending an Explicit Message

You can use the CIP Assembly object of the BMENOS0300 module to send a one-time read-only explicit message to the module.

NOTE: 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.

The Assembly object includes the following attributes and services:

- Connection transport class: 04 (decimal)
- Instance ID: 101 (decimal)
- Attribute ID: 03 (decimal)
- Service ID: 14 (decimal) / 0E (hex): Get_Attribute_Single

Reading the Response

The response of either an implicit or an explicit message consists of 16 hexadecimal byte values, with the least significant byte (0) on the left, and the most significant byte (15) on the right.

Glossary

C

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.

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

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.

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*.

DSCP

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

E

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.

F

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.

H

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

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.

M

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.

P

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.

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

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.

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

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.

sub-ring

An Ethernet-based network with a loop attached to the main ring, via a dual-ring switch (DRS) or BMENOS0300 network option switch module on the main ring. This network contains RIO or distributed equipment.

T

TCP/IP

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

U

UDP

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

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