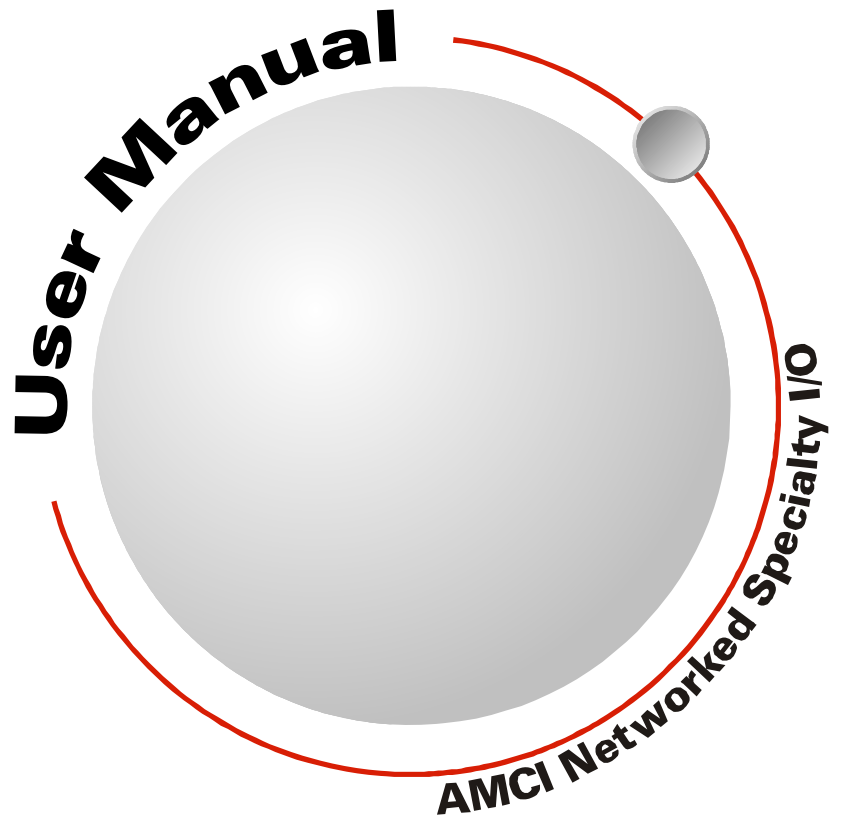


RBE2-8

Networked Relay Board

**with Integral 2-Port Ethernet Switch
Device Level Ring functionality for EtherNet/IP
Media Redundancy Protocol for PROFINET**



EtherNet/IP™



GENERAL INFORMATION

Important User Information

The products and application data described in this manual are useful in a wide variety of different applications. Therefore, the user and others responsible for applying these products described herein are responsible for determining the acceptability for each application. While efforts have been made to provide accurate information within this manual, AMCI assumes no responsibility for the application or the completeness of the information contained herein.

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24 Hour Technical Support Number

24 Hour technical support is available on this product. If you have internet access, start at www.amci.com. Product documentation and FAQ's are available on the site that answer most common questions.

If you require additional technical support, call (860) 583-1254. Your call will be answered by the factory during regular business hours, Monday through Friday, 8AM - 5PM Eastern. During non-business hours an automated system will ask you to enter the telephone number you can be reached at. Please remember to include your area code. The system will page an engineer on call. Please have your product model number and a description of the problem ready before you call.

Waste Electrical and Electronic Equipment (WEEE)



At the end of life, this equipment should be collected separately from any unsorted municipal waste.

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ABOUT THIS MANUAL

Read this chapter to learn how to navigate through this manual and familiarize yourself with the conventions used in it. The last section of this chapter highlights the manual's remaining chapters and their target audiences.

Audience

This manual explains the set-up, installation, and operation of AMCI's RBE2-8 Networked Relay Board. It is written for the engineer responsible for incorporating these units into a design, as well as the engineer or technician responsible for their actual installation.

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Revision Record

This manual, 940-0R011, is the second release of this manual. It was released May 10th, 2022. It adds additional relays to the compatible relay list.

Revision History

940-0R010 February 28th, 2022. Initial Release.

Navigating this Manual

This manual is designed to be used in both printed and on-line formats. Its on-line form is a PDF document, which requires Adobe Acrobat Reader version 7.0+ to open it. The manual is laid out with an even number of pages in each chapter. This makes it easier to print a chapter to a duplex (double sided) printer.

The PDF file is password protected to prevent changes to the document. You are allowed to select and copy sections for use in other documents and, if you own Adobe Acrobat version 7.0 or later, you are allowed to add notes and annotations.

Manual Conventions

Three icons are used to highlight important information in the manual:



NOTES highlight important concepts, decisions you must make, or the implications of those decisions.



CAUTIONS tell you when equipment may be damaged if the procedure is not followed properly.



WARNINGS tell you when people may be hurt or equipment may be damaged if the procedure is not followed properly.

Manual Conventions (continued)

The following table shows the text formatting conventions:

Format	Description
Normal Font	Font used throughout this manual.
<i>Emphasis Font</i>	Font used the first time a new term is introduced.
<i>Cross Reference</i>	When viewing the PDF version of the manual, clicking on the cross reference text jumps you to referenced section.
<i>HTML Link</i>	When viewing the PDF version of the manual, clicking on the link will connect you with the www.amci.com website.

Where To Go From Here

You will most likely read this manual for one of two reasons:

- ▶ If you are curious about the RBE2-8 Networked Relay Board from AMCI, this manual contains the information you need to determine if these product is the right one for your application. The first chapter, *RBE2-8 Introduction* contains all of the information you will need to fully specify the right product for your application.
- ▶ If you need to install and use the RBE2-8 Networked Relay Board, then the rest of the manual is written for you. To simplify installation and configuration, the rest of the manual is broken down into *references* and *tasks*. Using this product requires you to complete multiple tasks, and the manual is broken down into sections that explain how to complete each one.

Chapter Title	Page	Intended Audience
<i>RBE2-8 Introduction</i>	7	Anyone new to the RBE2-8. This chapter gives a basic overview of the features available on the unit and specifications.
<i>Data Formats</i>	15	Anyone that needs detailed information on the data formats used by the RBE2-8 to communicate with its host controller.
<i>Configuring Network Interfaces</i>	17	Basic information on configuring a PC or laptop to successfully communicate with an RBE2-8 to set its IP address.
<i>Installing the RBE2-8</i>	19	Anyone that must install an RBE2-8 on a machine. Includes information on mounting, grounding, and wiring specific to the units.
<i>Set the IP Address and Protocol</i>	25	Anyone that needs to change the IP address or communications protocol used by the RBE2-8.
<i>Implicit Communications with an EDS</i>	31	Anyone that needs information on installing an EDS file for use on EtherNet/IP systems. An Allen-Bradley controller is used as an example.
<i>Implicit Communications Without an EDS</i>	36	Anyone that needs information on configuring Implicit Messaging on an EtherNet/IP system that does not use EDS files. An Allen-Bradley controller is used as an example.
<i>EtherNet/IP Explicit Messaging</i>	40	Anyone that needs information on configuring Explicit Messaging on an EtherNet/IP system. An Allen-Bradley controller is used as an example.
<i>Modbus TCP Configuration</i>	45	Anyone using Modbus TCP to communicate with the RBE2-8.
<i>PROFINET Network Configuration</i>	49	Anyone using PROFINET to communicate with the RBE2-8. A Siemens SIMATIC controller is used as an example.

RBE2-8 INTRODUCTION

This reference section contains the information you need to decide if the RBE2-8 Networked Relay Board is the right product for your application.

The RBE2-8

The RBE2-8 is a member of the growing line of products from AMCI that incorporate our *E2 Technology*. E2 Technology by AMCI is an innovative new multi-protocol approach to Ethernet distributed I/O.

E2 Technology products are simple and intuitive, allowing easy transition between Ethernet/IP, PROFINET, or Modbus/TCP protocols without the need to physically switch parts. An advanced web server integrated into all AMCI E2 Technology devices facilitates simple network configuration and troubleshooting via a web-browser. Furthermore, an impressive array of advanced features for each supported protocol has been incorporated into the devices to meet many unique application requirements.

The RBE2-8 is an eight output relay board that accepts AC and DC solid state relays. The RBE2-8 can drive high power loads while allowing you to lower wiring cost by placing the RBE2-8 close to those loads and running a single network cable back to the host controller. The RBE2-8 also future-proofs your high power output design. The host controller can be updated to any future platform that supports EtherNet/IP, PROFINET, or Modbus TCP and the RBE2-8 will operate with the new system.

Features of the RBE2-8 include:

- Compatible with a variety of AC and DC solid state relays
- 24 Vdc operation
- A push button on the relay board that disables / enables the outputs
- A DIP switch on the relay board sets the state of outputs if there is a network communications loss
- A Reset Module push button to reboot the relay board without the need to cycle power
- All relay control lines are monitored for open, short to ground, and short to power supply

Each unit has two Ethernet ports which are internally connected through an onboard, two port, 10/100 Mbps ethernet switch. These ports allow you to wire your network in a “daisy-chain” fashion, which may lower network wiring costs and complexities.

The two ports also allow the units to function as members of a redundant Device Level Ring (DLR) network when using the EtherNet/IP protocol or as clients in a Media Redundancy Protocol (MRP) network when using PROFINET.

In DLR environments, the units act as Beacon-Based Ring Nodes. All units can process beacon packets at the default rate of every 400 microseconds. Beacon-based nodes can respond faster to network changes than nodes that only process Announce packets.

Unit Description

Figure R1.1 shows the layout of the RBE2-8 Networked Relay Board.

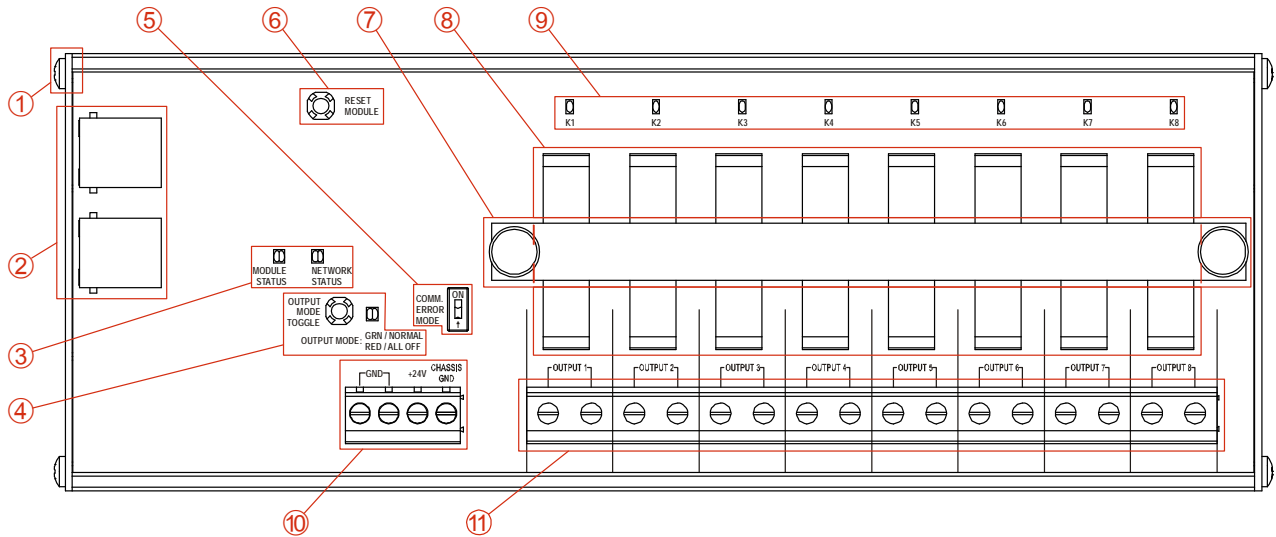


Figure R1.1 RBE2-8 Layout

- 1) The RBE2-8 can be mounted on a DIN rail or directly on a panel. The four outer screws on the unit, and the included two brackets, allow you to change how the unit is mounted. Instructions, and dimensional drawings of the two configurations, can be found in the *Installing the RBE2-8* section of the manual, starting on page 19.
- 2) Two RJ45 Ethernet jacks. The two ports are connected through an embedded two port switch. Both ports feature auto-switch and auto-MDIX functionality. They will automatically adjust to the speed of your network, and crossover cables are never needed. In non-redundant networks, either port can be used to connect to your host controller and the other port can be used to extend the network if this would reduce wiring costs. In redundant networks, both ports are used. There is a Link Activity LED on each connector. See the *Status LEDs* section starting on page 9 for a description of these LED's.
- 3) Status LED's. The Module Status and Network Status LED's indicate the state of the unit and the network connection. The state of the LED's is determined by the protocol the RBE2-8 is configured for. See the *Status LEDs* section starting on page 9 for a complete description.
- 4) Output Mode momentary pushbutton and LED. Allows you to disable the outputs from the relay board regardless of the state of the network data. Press the button to toggle between its Active and Disabled states. The LED is red when the outputs are disabled by the switch and green when the outputs are controlled by the network data.
- 5) Communication Error Mode switch. This slide switch is used to specify what state the output take if the network connection is lost. When the switch is off, the outputs retain their last state. When the switch is on, all of the outputs turn off if the network connection is lost. The state of this switch is only read when power is applied to the relay board or when the relay board is reset with the "Reset Module" button.
- 6) Reset Module momentary pushbutton. This pushbutton can be used to force the RBE2-8 to re-read the state of the Communication Error Mode switch and/or disconnect and reconnect to the network. If you disconnect the RBE2-8 from your host controller and attach it to your PC to troubleshoot or reconfigure the relay board, press the Reset Module switch to force the RBE2 to drop all connections to the host controller and create new ones with your PC.
- 7) Relay hold down bar and thumb screws. This bar and thumb screws are used to keep the relays in place in applications that are subject to shock and vibration.
- 8) Eight Output Relays. The relays are field replaceable. A variety of AC and DC relays are compatible with the RBE2-8. See *Compatible Relays*, starting on page 11, for information on compatible relays. Please note that relays are not included with the RBE2-8.

Unit Description (continued)

- 9) Channel Status LED's. These eight LED's show the on/off status of the control signals to the relays. (One LED for each relay.) Note that this is the *control* side of the relay. The RBE2-8 cannot monitor the state of the relay output due to the required isolation.
- 10) Power Connector. The RBE2-8 requires 24 Vdc to operate. The maximum current draw is 300 mA. An earth ground pin is also available on this connector.
- 11) Relay Output Connector. Each relay output has a two pin connector. These connectors offer a high voltage and current connection to your load device.

Status LEDs

Output Mode LED

The Output Mode LED is a bi-color red/green LED. For its location on the relay board, see item ④ in figure R1.1 on page 8.

LED State	Description
Red	The relays are disabled. Press the Output Mode push button once to enable the relays.
Green	The state of the relays is controlled by the host controller. Press the Output Mode push button once to disable the relays.

Table R1.1 Output Mode LED

Channel Status LEDs

Each output channel has a yellow status LED that shows the state of the relay control signal. For their locations on the relay board, see item ⑨ in figure R1.1 on page 8.

LED State	Description
Off	The relay is off and should not be conducting current.
On	The relay is on and should be conducting current.

Table R1.2 Channel Status LEDs

Link Activity LEDs

There is a Link Activity LED on each of the two RJ45 connectors. For their locations on the relay board, see item ② in figure R1.1 on page 8. They are amber LEDs.

LED State	Description
Off	A valid Ethernet hardware connection does not exist between the RBE2-8 and the network equipment it is connected to.
On	The RBE2-8 has a valid hardware connection to the network equipment it is attached to.
Blinking	The RBE2-8 is transmitting data across the Ethernet link.

Table R1.3 Link Activity LEDs

Status LED's (continued)

Module Status (MS) LED

The Module Status LED is a bi-color red/green LED. For its location on the relay board, see item ③ in figure R1.1 on page 8. The unit will blink the Module Status LED green during initialization. After initialization, the state of the LED depends on the state of the network adapter and the configured protocol.

LED State	EtherNet/IP Definition	Modbus TCP Definition	PROFINET Definition
Off	No Power	No Power	No power
Alternating Red/Green	Initializing: Power up Self-Test		
	Communications failure. There is a communications error between the main processor and the ethernet co-processor within the unit. You must cycle power to the RBE2-8 to attempt to clear this fault, or press the "Reset Module" push button to reset the relay board.		
Flashing Green	Initializing: Waiting for valid physical connection to the network.		
Steady Green	Module and Network are operational.		Device Name or IP Address are set.
Flashing Red	Initializing: IP Address conflict		Initializing: Device Name or IP Address are not set.
	If the Network Status LED is also flashing, the IP Address or Network Protocol has been changed. Cycle power to the unit or press the "Reset Module" push button to continue.		

Table R1.4 Module Status LED States

Network Status (NS) LED

The Network Status LED is a bi-color red/green LED. For its location on the relay board, see item ③ in figure R1.1 on page 8. The state of the LED depends on the state of the network adapter on the protocol the RBE2-8 is configured to for.

LED State	EtherNet/IP Definition	Modbus TCP Definition	PROFINET Definition
Off	No Power	No power or no TCP connections	No power, duplicate IP address on the network, mismatch in Device Name, or no connection to IO Controller.
Alternating Red/Green	Power up Self-Test	Power up Self-Test	Power up Self-Test
Blinking Green	Ethernet connection, but no CIP connections	Indicates number of connections with 2 second delay between group. The RBE2-8 supports up to four concurrent connections.	On-line, Stop state. A connection with the IO Controller is established and it is in its STOP state.
Steady Green	Valid Ethernet network and CIP connections	Not Implemented	On-line, Run state. A connection with the IO Controller is established and it is in its RUN state.
Blinking Red	If the MS LED is steady green: Network Connection Timeout	Not Implemented	Not Implemented
	If the MS LED is blinking green: IP Address or Network Protocol changed: Cycle power		
Steady Red	Duplicate IP address on network.		Not Implemented.

Table R1.5 Network Status LED States

Compatible Relays

The RBE2-8 was designed for compatibility with the following AC and DC Relays:

- Sensata-Crydom MCXE240D5, MP120D3, MP240D3, and MP240D4 AC relays
- Opto22 MP120D4, and MP240D4 AC relays
- Sensata-Crydom MPDCD3 and MPDCD3-B DC Relays
- Opto22 DC60MP and DC200MP DC Relays

Relays from other manufacturers that have identical physical dimensions and use 24Vdc as the control voltage, should also be compatible with the RBE2-8. Contact AMCI for assistance if required.

AC Relay Specifications

	Crydom	Crydom	Crydom	Crydom
	MP120D3	MP240D3	MP240D4	MCXE240D5
Control Voltage (Vdc)	3 - 32	3 - 32	3 - 32	15 - 32
Typical Control Current (mA)	23	23	23	15
Load Voltage (Vrms) 47-63 Hz	12 - 140	24 - 280	24 - 280	12 - 280
Transient Overvoltage (Vpk)	400	600	600	600
Maximum Off-State Leakage Current (mA)	5	5	5	0.1
Minimum Off-State dv/dt (v/μs)	200	200	200	500
Maximum Load Current (Arms)	3	3	4	5
Minimum Load Current (Arms)	0.02	0.02	0.02	0.06
Maximum Surge Current (Apk for 16.67 mS)	90	90	130	250
Maximum On-State Voltage Drop	1.6	1.6	1.6	1.4
Minimum Power Factor @ Max. Load	0.5	0.5	0.5	0.5

	Opto22	Opto22
	MP120D4	MP240D4
Control Voltage (Vdc)	3 - 24	3 - 24
Typical Control Current (mA)	24	24
Load Voltage (Vrms) 47-63 Hz	12 - 140	24 - 280
Transient Overvoltage (Vpk)	600	600
Maximum Off-State Leakage Current (mA)	5	5
Maximum Load Current (Arms)	4	4
Minimum Load Current (Arms)		
Maximum Surge Current (Apk for 16.67 mS)	47	47
Maximum On-State Voltage Drop	1.6	1.6

Table R1.6 AC Relay Specifications

DC Relay Specifications

	Crydom	Opto22	Opto22
	MPDCD3(-B)	DC60MP	DC200MP
Control Voltage (Vdc)	3 - 32	3 - 24	3 - 24
Typical Control Current (mA)	23	24	24
Load Voltage (Vdc)	3 - 60	3 - 60	12 - 250
Maximum Load Current (Adc)	3	3	1
Minimum Load Current (Adc)	0.02		
Maximum Surge Current (Adc for 1 Second)	5	5	2
Maximum On-State Voltage Drop (Vdc)	1.5	1.5	1.5
Maximum Off-State Leakage Current (mA)	1.0	1.0	1.0

Table R1.7 DC Relay Specifications

Compatible Relays (continued)

Relay Dimensions

The following figure are the dimensions of the listed compatible relays. Other relays must be of the same dimensions to be compatible.

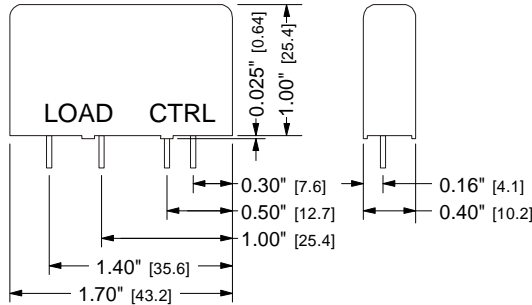


Figure R1.2 Dimensions of Compatible Relays

Relay Environmental Curves

The following figure show the maximum allowable load current per relay vs. the ambient temperature. Note that the RBE2-8 itself is rated to 50°C.

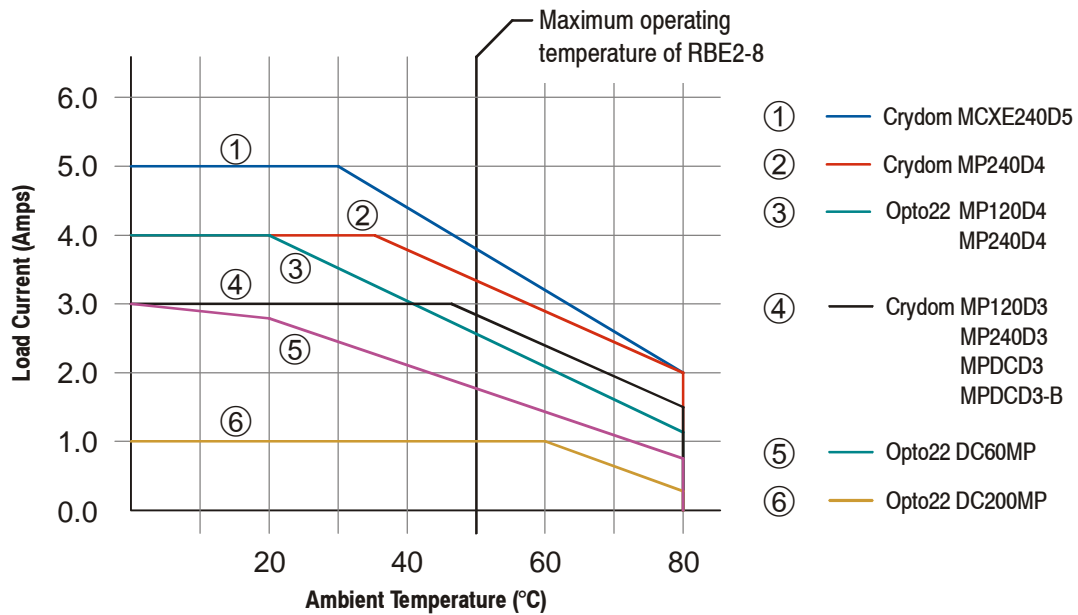


Figure R1.3 Relay Maximum Allowable Current

Specifications

Network Interface

10/100baseT. Two switched ports.
Supports EtherNet/IP, PROFINET, and Modbus TCP. EtherNet/IP-DLR and PROFINET-MRP extensions also supported.

Number of I/O Words (16 bits each)

Two input words and two output words.

Mounting

DIN rail or panel mount. The RBE2-8 ships in its DIN rail mount configuration. Mounting style can be changed in the field. DIN channel can be EN 05 022 or EN 05 035.

Physical Dimensions

See page 21 for the DIN rail mount configuration
See page 22 for the panel mount configuration

Weight

1.50 lb (0.68 kg) maximum

Input Power

24 Vdc \pm 10%. Requires a maximum of 7.3 watts when all relays are on. (0.3A @ 24Vdc)

Maximum Relay Output Voltage

300 Vac. The RBE2-8 is designed for operation with 240Vac relays. 380Vac and 480Vac relays are not compatible.

Compatible Relays

Sensata-Crydom MCXE240D5, MP120D3, MP240D3, and MP240D4 AC relays.

Opto22 MP120D4 and MP240D4 AC relays.

Sensata-Crydom MPDCD3 and MPDCD3-B DC Relays

Opto22 DC60MP and DC200MP AC relays.

Relays from other manufacturers that have an identical height and pin configuration, and use 24Vdc as the control voltage, should also be compatible with the RBE2-8. Contact AMCI for assistance if required.

Status LEDs

See *Status LEDs* starting on page 9.

Environmental Specifications

Ambient Operating Temperature[†]
..... -4° to 122°F (-20° to 50°C)

Storage Temperature
..... -40° to 185°F (-40° to 85°C)

Humidity 0 to 95%, non-condensing

[†] This specification is for the RBE2-8 Networked Relay Board itself. The actual operating temperature may be limited by the relays.

The following Opto22 relays are available from AMCI using the given AMCI part numbers.

AC Relays	AMCI Part #	DC Relays	AMCI Part #
MP120D4	KA-1	DC60MP	KD-1
MP240D4	KA-2	DC200MP	KD-2

Notes

REFERENCE 2

DATA FORMATS

This reference chapter details the input and output data formats used to communicate with the RBE2-8.

Data Addressing

When using the PROFINET protocol or the EtherNet/IP protocol with an EDS file, the input and output registers are named in the GSDML or EDS file. When using the EtherNet/IP protocol without an EDS file, both the input and output registers start with address 0.

Addresses for the Modbus TCP protocol are given in *zero based* addressing in this manual. In this scheme, the first register is given an address of zero. This is the actual addressing scheme used in the Modbus packets. Input registers start at address 0. Output registers start at address 1024.

Output Data Format

Figure R2.1 below shows the format of the output data. The bottom eight bits of the first output word are used to control the state of the eight relay outputs. A “0” in the bit location turns the output off. A “1” in the bit locations turns the output on. Note that the state of these bits is ignored and the outputs are forced off if the Output Mode momentary pushbutton is toggled to its Disabled state.

See bullet ④ of figure R1.1 on page 8 for location of the Output Mode momentary pushbutton and its LED. Note that the Output Mode state is reported in the network input data.

EtherNet/IP PROFINET Word	Modbus TCP Register	Bit Number																
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	1024	0	0	0	0	0	0	0	0	0	Output_K8	Output_K7	Output_K6	Output_K5	Output_K4	Output_K3	Output_K2	Output_K1
1	1025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

IGNORED: Bit should equal zero for compatibility with future versions.

Figure R2.1 Output Data Format

Input Data Format

Figure R2.2 below shows the format of the network input data.

EtherNet/IP PROFINET Word	Modbus TCP Register	Bit Number																
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	0	0	0	Fault_8	Fault_7	Fault_6	Fault_5	Fault_4	Fault_3	Fault_2	Fault_1
1	1	0	Heartbeat	OutputMode	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure R2.2 Input Data Format

Word 1 Input Bits

Bit 14: Heartbeat Bit – This bit will change state approximately every 500 milliseconds. Monitor this bit to verify that the unit and network connection are operating correctly.

Bit 13: Output Mode State Bit – This bit reports the present state of the Output Mode toggle. If this bit equals “1”, the outputs are forced off, regardless of the state of their control bits in Output Word 0. If this bit equals “0”, then the outputs are controlled by the state of their control bits in Output Word 0.

The state of this bit is controlled by the Output Mode momentary pushbutton. See bullet ④ of figure R1.1 on page 8 for location of this pushbutton and its LED. Note that this bit is reset on power up or when the RBE2-8 board is reset by the Reset Module momentary pushbutton.

Word 0 Input Bits

Bits 07-00:Relay Fault Bits – The low power input circuit of each relay is monitored for fault conditions. Each relay has a fault bit associated with it. The associated bit equals “0” when the corresponding relay is functioning normally. The associated bit equals “1” when the corresponding relay has a fault. Table R2.1 below lists the fault states based on the state of the Output_‘K’n’ bit and the Fault_‘n’ bit. (‘n’ = 1 to 8.) This table assumes that the Output Mode State bit (Input Word 1, bit 13) equals “0”.

Fault_‘n’ State	Output_‘K’n’ State	Description
0	0	No fault detected, the relay is off.
0	1	No fault detected, the relay is on.
1	0	A fault is detected. The fault is an open circuit, or a short to ground. Replace the relay to try to fix the problem.
1	1	A fault is detected. The fault is an open circuit, or a short to the 24Vdc supply. Replace the relay to try to fix the problem.

Table R2.1 Multi-Word Format Examples

NOTE

- 1) The monitoring circuit only monitors the state of the circuit that drives the low power input circuit of the relay. Due to the required opto-isolation of the relay, the high power drive circuit of the relay cannot be monitored.
- 2) Open circuit faults are always detected. Shorts to ground or the 24Vdc supply can only be detected when the relay is driven low or high with the Output_‘K’n’ control bit. In the case of a short to ground, the fault bit will be off when you command the relay to turn on. The fault bit will turn on when you command the relay to turn off.

CONFIGURING NETWORK INTERFACES

This section lists suggestions for configuring the network interfaces on your computer or laptop before attaching to the RBE2-8.

Firewall Settings

Firewalls are hardware devices or software that prevent unwanted network connections from occurring. Firewall software has been present on Windows based computers since XP, and it may prevent your computer from communicating with the RBE2-8. The internal webserver uses port 80, which is the default http port, and should work without changing any firewall settings. Configuring your firewall to allow communication with the RBE2-8 is beyond the scope of this manual.


Disable All Unused Network Interfaces

Routing and default gateway setting on your computer might prevent connection to the RBE2-8. When using the Net Configurator utility, broadcast packets that are used to find the RBE2-8 often go out the wrong port. The easiest way to avoid this problem is to temporarily disable all network interfaces that are not attached to the RBE2-8.

This includes all wireless interfaces as well as all Bluetooth interfaces.

Configure Your Network Interface

Before you can communicate with the RBE2-8, your network interface must be on the same subnet as the relay board.

NOTE  The rest of this procedure assumes you are using the 192.168.0.xxx subnet. If you are not, you will have to adjust the given network addresses accordingly.

The easiest way to check the current settings for your NIC is with the 'ipconfig' command.

- For Windows 7, click on the [Start] button, and type "cmd" in the "Search programs and files" text box. Press [Enter] on the keyboard.
- For Windows 8 and 10, press the [Win+X] keys and select "Command Prompt" from the resulting popup. There is no need to run the command prompt as the administrator, so do not select "Command Prompt (Admin)".

Configure Your Network Interface (continued)

A DOS like terminal will open. Type in ‘ipconfig’, press [Enter] on the keyboard and the computer will return the present Address, Subnet Mask, and Default Gateway for all of your network interfaces. If your present address is 192.168.0.xxx, where ‘xxx’ does not equal 50, and your subnet mask is 255.255.255.0, then you are ready to configure your RBE2-8 board. Figure R3.1 shows the output of an ipconfig command that shows the “Local Area Connection 2” interface on the 192.168.0.xxx subnet.

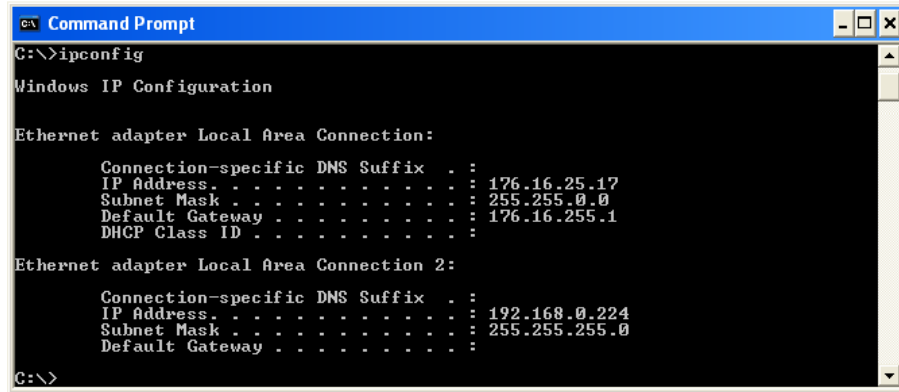


Figure R3.1 ipconfig Command

If your present address is not in the 192.168.0.xxx range, type in ‘ncpa.cpl’ at the command prompt and hit [Enter] on the keyboard.

- For Windows 7 through 10, this open the *Network Connections* window. Double click on the appropriate interface. In the window that opens, select “Internet Protocol Version 4 (TCP/IP v4)” from the list and then click on the [Properties] button.

Set the address and subnet mask to appropriate values. (192.168.0.1 and 255.255.255.0 will work for an RBE2-8 that has factory default settings.) The default gateway and DNS server settings can be ignored.

Test Your Network Interface

Going back to the terminal you opened in the last step, type in ‘ping aaa.bbb.ccc.ddd’ where ‘aaa.bbb.ccc.ddd’ in the IP address of the RBE2-8. The computer will ping the unit and the message “Reply from aaa.bbb.ccc.ddd: bytes=32 time<10ms TTL=128” should appear four times.

If the message “Request timed out.” or “Destination host unreachable” appears, then one of four things has occurred:

- You set a new IP address, but have not yet cycled power to the RBE2-8
- You did not enter the correct address in the ping command.
- The IP address of the RBE2-8 is not set correctly.
- The RBE2-8 and the computer are not on the same subnet.

TASK 1

INSTALLING THE RBE2-8

This chapter covers the physical installation of the RBE2-8.

1.1 Safe Handling Guidelines

1.1.1 Prevent Electrostatic Damage



CAUTION

Electrostatic discharge can damage the RBE2-8. Follow these guidelines when handling the relay board.

- 1) Touch a grounded object to discharge static potential before handling the unit.
- 2) Work in a static-safe environment whenever possible.
- 3) Wear an approved wrist-strap grounding device.
- 4) Do not touch the pins of the Ethernet connectors.
- 5) Do not disassemble the relay board except to change the mounting style as described in this chapter.
- 6) Store the module in its anti-static bag and shipping box when it is not in use.

1.1.2 Prevent Debris From Entering the Unit



WARNING

While mounting a unit, make sure that all debris (metal chips, wire strands, tapping liquids, etc.) is prevented from falling into the board. Debris may cause damage to the unit or unintended machine operation with possible personal injury. When using DIN rail to mount the unit, the rail should be securely installed and grounded before the unit is mounted on it.

1.1.3 Remove Power Before Servicing



WARNING

Remove power before removing or installing the RBE2-8 module.

1.2 General Wiring Guidelines

When wiring any control system, these guidelines must be followed to help prevent electromagnetic interference and ground loops:

1.2.1 Wiring

Networking signals are generally low voltage, low power signals. If you are using A-B guidelines for cabling installation, treat the transducer cable as a Category 2 cable. Ethernet cables can be installed in conduit along with other low power communication cables and low power ac/dc I/O lines. It cannot be installed in conduit with ac power lines or high power ac/dc I/O lines including cabling from the relay outputs of the RBE2-8.

- If the Ethernet cables must cross power feed lines, they should do so at right angles.
- Route at least five feet from high voltage enclosures, or sources of “rf” radiation.

1.2 General Wiring Guidelines (continued)

1.2.2 Grounding

- All ground connections must be permanent and continuous to provide a low-impedance path to earth ground for induced noise currents.
- The chassis of the RBE2-8 must be connected to chassis ground through a grounding wire connected to the ground connection of the power supply connector.
- The power supply that is attached to the RBE2-8 must be connected to the same chassis ground as the unit to avoid ground loops.
- All isolation transformer secondary windings must be grounded to the same earth ground as the machine ground.

1.2.3 Surge Suppression

- Surge suppression devices should be placed across the coil of an inductive device to reduce the effects of high voltage transients (i.e., varistors, diodes, etc.). This includes any inductive load that is powered by the same supply used to power the RBE2-8 and any of the loads attached to its relay outputs.

1.2.4 Mounting

If mounting an RBE2-8 on an enclosure door, do not rely on the hinge to make an electrical connection between the door and the enclosure. A bonding wire from the door to the rest of the enclosure must be installed.

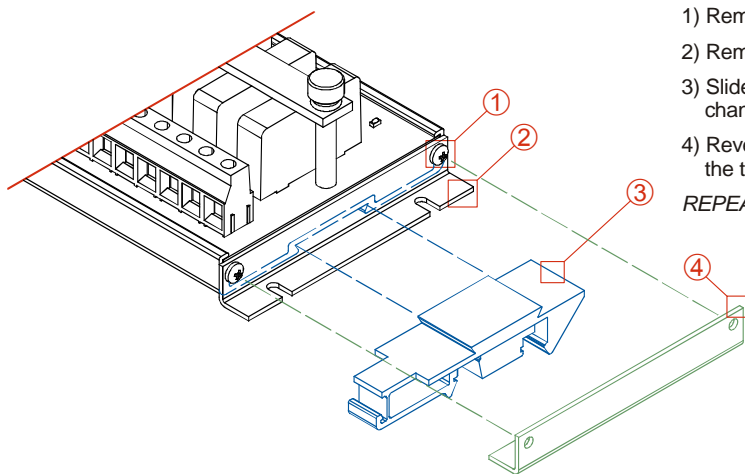
When mounting an RBE2-8 on DIN Rail, the included plastic DIN rail brackets will electrically isolate the unit. A grounding wire must be run from the grounding pin on the power connector to an earth ground point.

1.3a DIN Rail Mounting

Follow these instructions when mounting an RBE2-8 on a DIN rail.

1.3a.1 Reattach the DIN Brackets (if needed)

The RBE2-8 ships with the DIN brackets installed. Figure T1.1 shows how to install the DIN brackets if converting an RBE2-8 from its panel mount configuration.



- 1) Remove the two screws that hold the bracket in place.
 - 2) Remove the bracket.
 - 3) Slide the plastic DIN adapter into the channel to install it.
 - 4) Reverse the bracket and reattach it to the relay board with the two screws.
- REPEAT THESE STEPS TO CONVERT THE OTHER SIDE.*

Figure T1.1 Attaching DIN Brackets

1.3a DIN Rail Mounting (continued)

1.3a.2 DIN Rail Installation

RBE2-8 Networked Relay Boards can be mounted on EN 05 022 or EN 05 035 DIN Rail. The DIN Rail must be securely mounted to a panel and solidly grounded before the unit is installed. Grounding is usually accomplished through the mounting hardware, by first removing any paint or other material from all surfaces that may interfere with proper grounding. Another option is to install a heavy gauge wire from the DIN rail to the system's ground bus.

1.3a.3 Dimensions

Figure T1.2 shows the dimensions of the RBE2-8 Networked Relay Board when mounting on a DIN rail. The RBE2-8 does not require any additional spacing when mounting the unit.

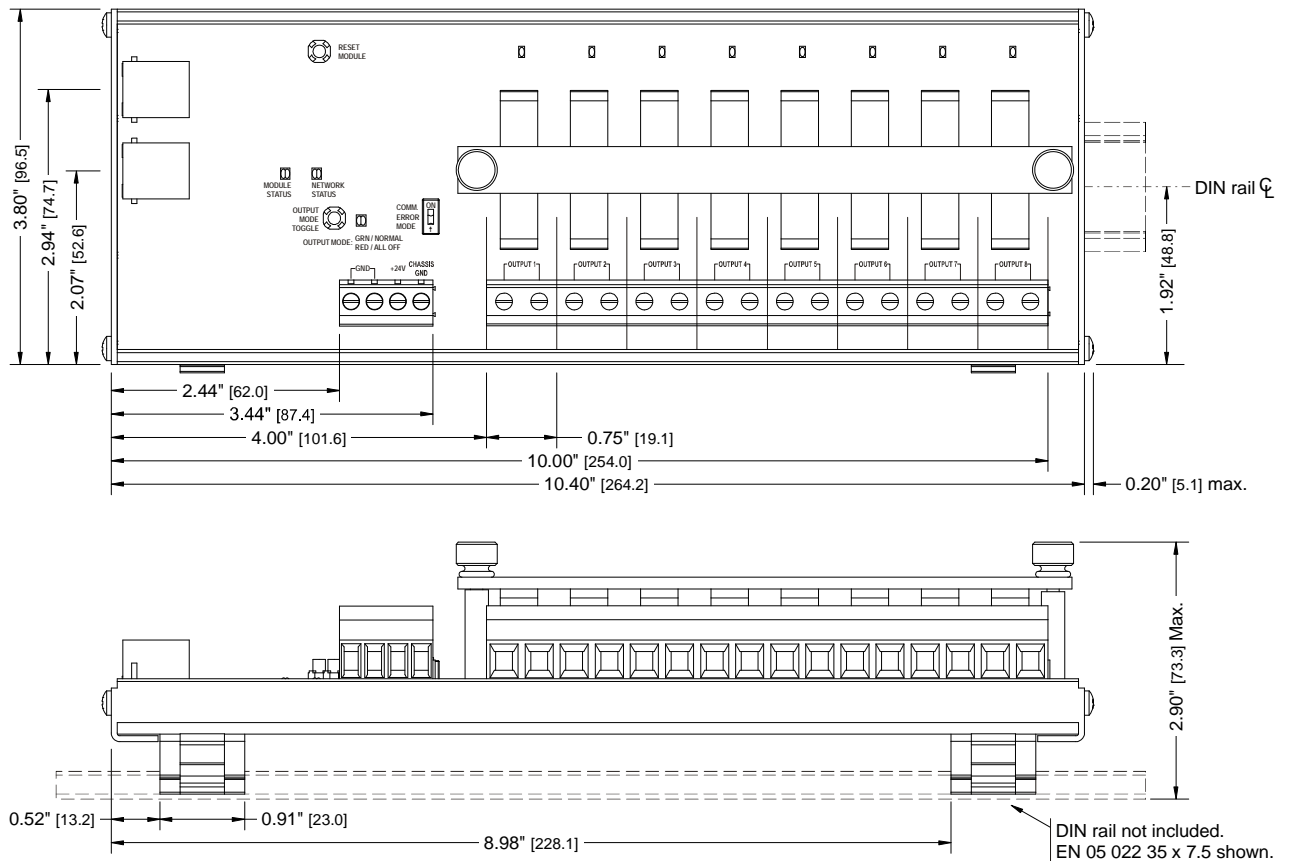


Figure T1.2 RBE2-8 DIN Rail Mount Outline

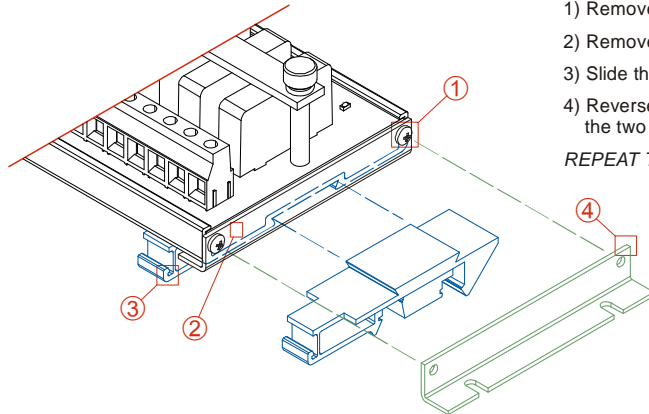
NOTE The plastic DIN rail brackets electrically isolate the RBE2-8 from the rest of the system. A grounding wire from the grounding connection on the power connector to the system ground bus must be installed. Refer to 1.4, *Power Wiring* on page 23 for additional information.

1.3b Panel Mounting

Follow these instructions when mounting an RBE2-8 on a panel.

1.3b.1 Attach the Panel Mount Brackets

Figure T1.3 shows how to remove the DIN rail mounts so the RBE2-8 can be mounted to a panel.



- 1) Remove the two screws that hold the bracket in place.
 - 2) Remove the bracket.
 - 3) Slide the plastic DIN adapter off of the channel to remove it.
 - 4) Reverse the bracket and reattach it to the relay board with the two screws.
- REPEAT THESE STEPS TO CONVERT THE OTHER SIDE.

Figure T1.3 Panel Mount Bracket Conversion

1.3b.2 Dimensions

Figure T1.4 shows the dimensions of the RBE2-8 Networked Relay Board when panel mounting.

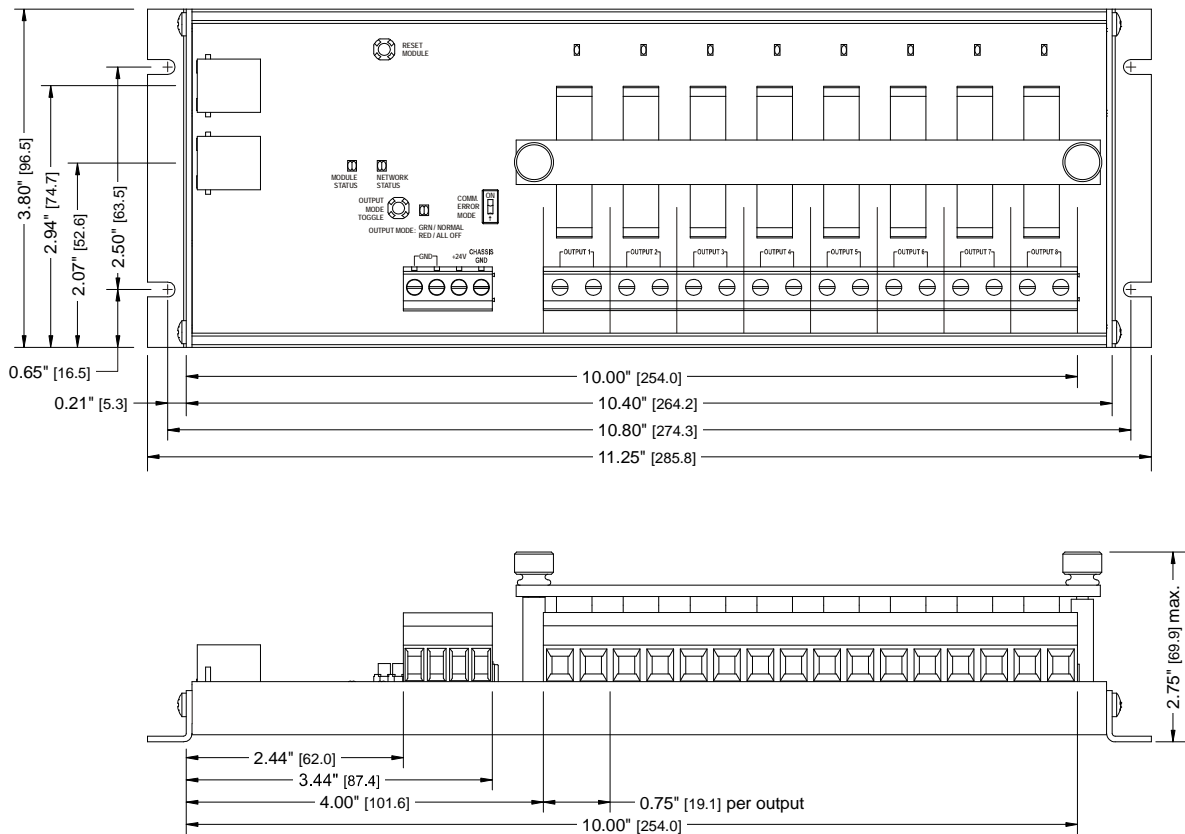


Figure T1.4 RBE2-8 Panel Mount Outline



When panel mounted, the RBE2-8 is typically grounded through its mounting hardware. If needed, a wire from the grounding connection on the power connector to the system ground bus can be installed. Refer to 1.4, *Power Wiring* on page 23 for additional information.

1.4 Power Wiring

The RBE2-8 accepts 24 Vdc $\pm 10\%$ as its input power. Minimum current draw occurs when all of the outputs are off. The minimum current draw is 0.125 A @ 24 Vdc, which is 3 watts. The maximum current draw occurs when all of the relays are on. If you installation uses one of the suggested relays shown on page 11, then the maximum current draw is 0.30 A @ 24Vdc, which is 7.3 watts.

The connector accepts 30 to 10 AWG wire. Choose your wire size based on current draw and local safety codes.

The power connector is located on the left side of the unit. Power connections should be tight, as loose connections may lead to arcing which will heat the connector. Phoenix Contact specifies a tightening torque of 4.4 to 5.4 lb-in (0.5 to 0.6 Nm).

The power supply is connected to the pins marked “+24V” and “GND”. The “CHASSIS GND” pin is used to attach the aluminum frame of the RBE2-8 to earth ground. The use of a 12 AWG, stranded wire for the earth ground connection is strongly recommended.



A strip length of up to 0.4 inches (10 mm) is acceptable for the power connector. Neat wiring is important to prevent the wires from shorting against each other or the grounded aluminum frame of the RBE2-8.

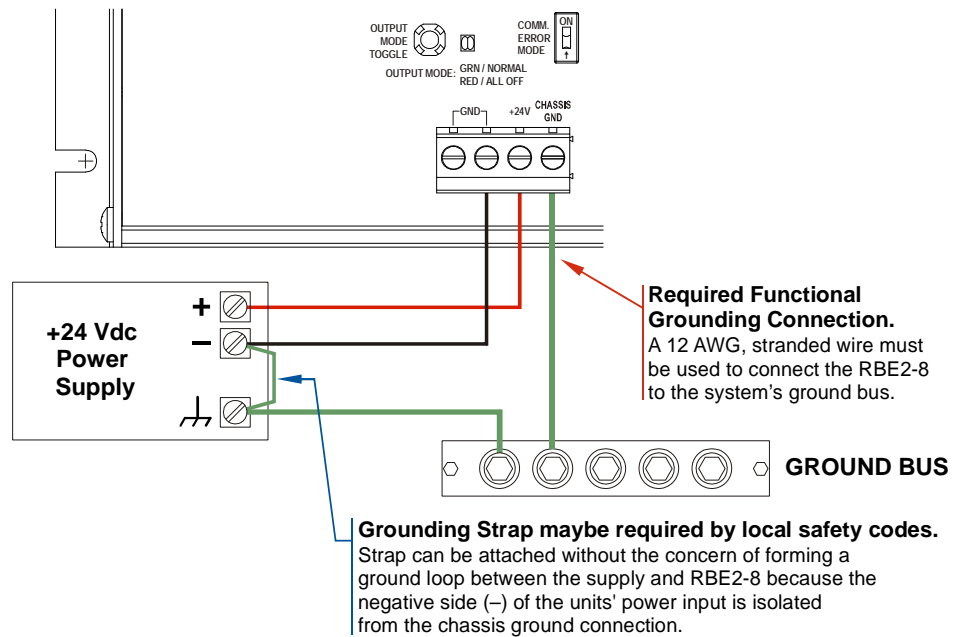


Figure T1.5 Power Supply and Grounding Connections

1.5 Network Connections

Figure R1.1 on page 8 shows the location of the two Ethernet ports on the RBE2-8. An internal two port Ethernet switch connects the two ports. In non-redundant applications, either port can be used to attach the board to the network. The remaining port can be used to extend the network to another device if this would reduce wiring costs.

1.5.1 EtherNet/IP DLR Applications

In Device Level Ring applications, the RBE2-8 functions as a Beacon-Based Ring Node. In these applications, both ports are used when wiring the ring, daisy chaining from one unit in the ring to the next.

1.5.2 PROFINET MRP Applications

In Media Redundancy Protocol applications, the RBE2-8 functions as a Media Redundancy Client (MRC). In these applications, both ports are used when wiring the ring, daisy chaining from one unit in the ring to the next.

1.6 Installing Relays

- 1) Remove the two thumb screws and remove the aluminum anti-vibration bar.
- 2) Install your choice of compatible relays. If using an equivalent to the crydom relays, verify that the relays are one inch (25.4 mm) in height. The relays will only install in one direction.
- 3) Install the aluminum anti-vibration bar and the two thumb screws to complete the installation.

1.7 Relay Output Wiring

A simple wiring diagram is shown below. For AC relays, the polarity of the connections is not important. For example, the Neutral connection of a 120V circuit can be connected to either pin. For DC relays, the high side of the power supply voltage must be attached to the right pin of the connector. (A “+” symbol is on the silk-screen to denote the high side connection.) For both AC and DC relays, the load can be wired to either side of the relay.

NOTE 

Inductive DC loads, such as mechanical relays solenoids, and DC motors, must have surge suppression placed across their coils. This limits the electrical noise spikes when the load is switched off. As shown in the figure below, the surge suppressor should be installed on the terminals of the load, not the terminals of the RBE2-8.

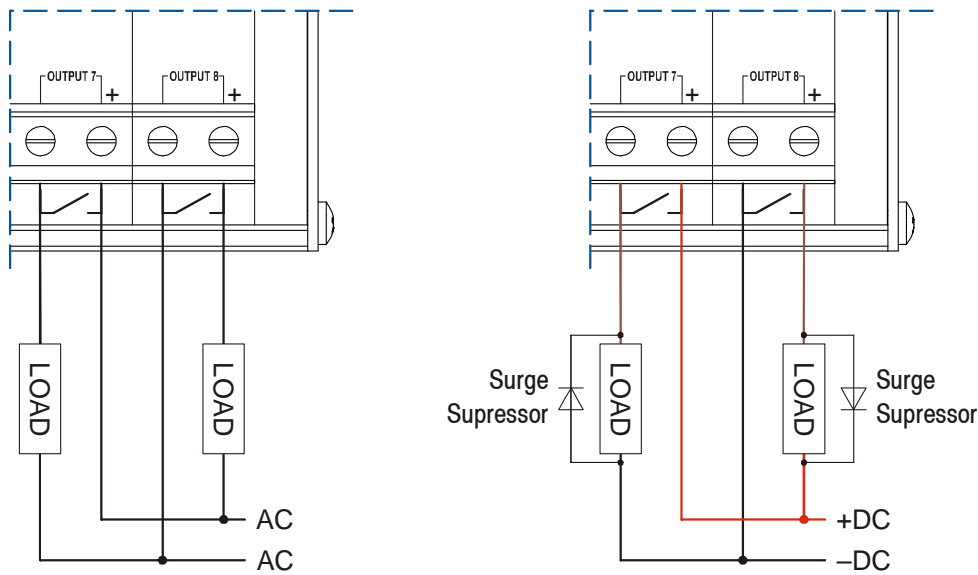


Figure T1.6 Output Wiring

TASK 2

SET THE IP ADDRESS AND PROTOCOL

This section is intended for the engineer or technician responsible for setting the IP address of an AMCI RBE2-8. The factory default IP address is 192.168.0.50. This address is stored in flash memory and can be changed as described below.

2.1 Determine the Best Method for Setting the IP Address

There are two methods for setting the IP address on an RBE2-8. Table T2.1 below outlines the available methods and when you can use them.

Method	Restrictions	Section
<i>Use Factory Default Settings</i>	1) The machine must use 192.168.0.xxx subnet. 2) The 192.168.0.50 address must be available.	2.2a
<i>Use the Embedded Web Server</i>	No restrictions on use. This is the preferred method. The internal webserver can be used to set the RBE2-8 to any IPv4 address. The IP address and protocol will be stored in nonvolatile memory and used on subsequent power-ups.	2.2b

Table T2.1 Methods for Setting the IP Address

NOTE

There is a MAC address label on each RBE2-8. It is located on the side of the painted aluminum frame near the RJ-45 connectors. There is an additional label next to the MAC address label that has a writable surface. There is room on the label for writing the programmed IP address of the unit. It is a best practice to use this label to document the IP address of the unit in case it is ever repurposed.

NOTE

The AMCI NET Configurator utility can also be used to configure the IP Address of the RBE2-8. However, it is a more complicated method, that requires a software download and installation. If you are already familiar and comfortable with the NET Configurator software, feel free to use it.

NOTE

In order to conform to the ODVA specification for EtherNet/IP, the RBE2-8 also supports the DHCP protocol. You can use an EtherNet/IP DHCP server, such as the one available from Rockwell Automation, to save the IP address to flash memory. It is supported, but AMCI encourages you to use the embedded web server.

2.2a Use Factory Default Settings

The factory default address for the RBE2-8 is 192.168.0.50 with a subnet mask of 255.255.255.0. The easiest way to verify this address is with the ping command as described in *Configuring Network Interfaces* which starts on page 17.

If the unit does not respond to this address then it may take some effort to determine the correct address. There is a label on the driver that lists the MAC address of the device. There is space on the label for noting the IP address of the device if it is changed. If the address was not documented, a program called Wireshark (<https://www.wireshark.org/>) can be used to determine the address of the unit.

Task Complete

2.2b Use the Embedded Web Server

PREREQUISITE: You must know the present IP address of the RBE2-8. The factory default address is 192.168.0.50.

PREREQUISITE: Task 1.4: *Power Wiring*, found on page 23. You must be able to power the RBE2-8.

PREREQUISITE: Task 1.5 *Network Connections*, found on page 24. You must attach your RBE2-8 to your computer.

PREREQUISITE: The network interfaces on your computer must be on the same subnet before you can communicate with an RBE2-8. Refer to *Configuring Network Interfaces*, which starts on page 17 if needed.

2.2b.1 Disconnect the RBE2-8 from the host controller and cycle power to the RBE2-8.

This ensures that the unit does not have any open connections to the host controller.

2.2b.2 Start your web browser and connect to the RBE2-8

The internal HTML pages should work with any browser. Once your web browser is running, enter the present IP address of the RBE2-8 into the address bar. The default address is 192.168.0.50. The unit will respond with the following page. Note that the Firmware Version number may be different.

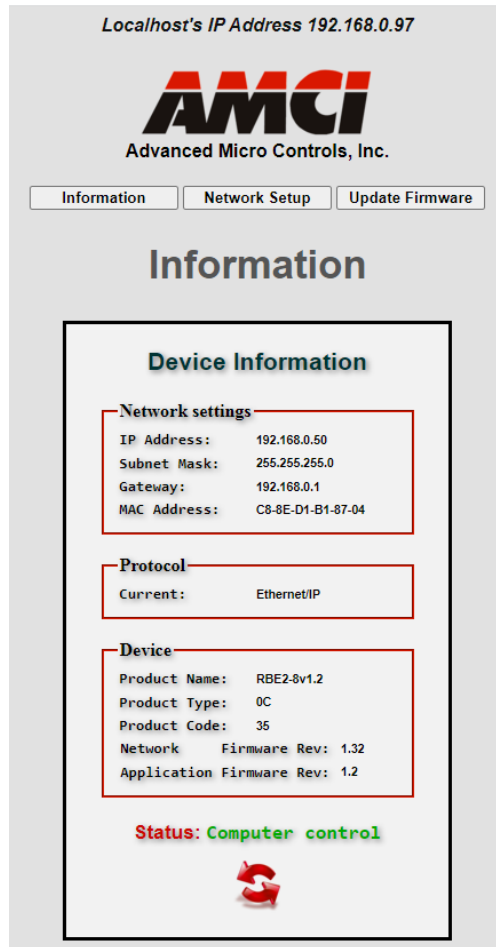


Figure T2.1 RBE2-8 Information Webpage

2.2b Use the Embedded Web Server (continued)

2.2b.3 Network Setup Page

- 1) Click on the [Network Setup] button to switch to the Network Setup page shown below. This page shows the current IP address settings, as well as the configured protocol.

Localhost's IP Address 192.168.0.97

AMCI
Advanced Micro Controls, Inc.

Information Network Setup Update Firmware

Network Setup

Device Configuration

Network settings

IP Address:

Subnet Mask:

Gateway:

Protocol


Ethernet/IP

Modbus-TCP

PROFINET (Protocol default address of 0.0.0.0 is set)

Figure T2.2 RBE2-8 Network Setup Web Page

- 2) Enter your desired values into the IP Address, Subnet Mask, and Default Gateway fields.

NOTE  The Default Gateway setting is not optional! It must be set to a valid address on the chosen subnet. Because the Default Gateway is often not used in device level networks, if you do not have a required value for it, AMCI suggests setting the Default Gateway to the IP address of your host controller.

- 3) If needed, click on the proper radio button to select the required protocol.
- 4) Click on the [Write Configuration] button to write the new configuration to the unit. If there are any errors with the data, the unit will display a warning message instead of accepting the new values.

2.2b Use the Embedded Web Server (continued)

2.2b.3 Network Setup Page (continued)

5) If the values are accepted, the following pages will be displayed while the data is being written to the unit.

NOTE ⚠ Wait for the pop up window to appear before cycling power to the RBE2-8. Cycling power before this window appears may corrupt the non-volatile memory of the RBE2-8. The RBE2-8 will also flash the Network Status LED red to indicate that power must be cycled.

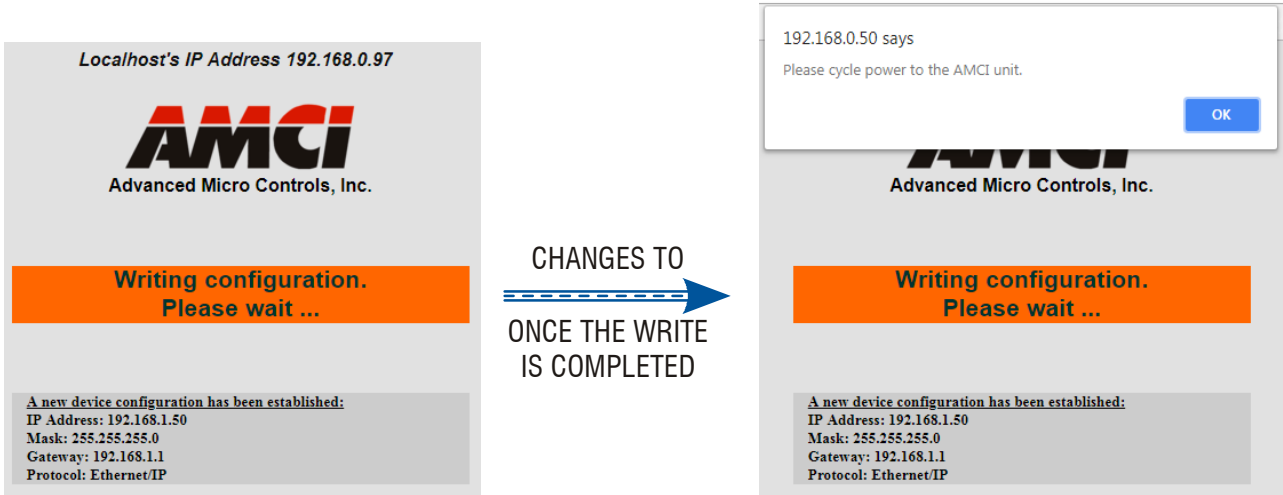


Figure T2.3 Write Configuration to Flash Memory Pages

6) Once instructed to, cycle power to the unit. You can now enter the new IP address into the address bar of your web browser to reconnect with the RBE2-8.

Task Complete

PROTOCOL SPECIFIC INFORMATION

Manual Sections

The remainder of this manual is divided into three sections, one for each supported protocol. Each section has the protocol name in the page header.

Starting Pages

EtherNet/IP protocol: Page 31

Modbus TCP protocol: Page 45

PROFINET protocol: Page 49

Notes

TASK 3 (EtherNet/IP Option)

IMPLICIT COMMUNICATIONS WITH AN EDS

Many EtherNet/IP platforms support the use of EDS files to simplify the addition and configuration of devices. This chapter covers the installation and use of the EDS file for systems that are programmed with Rockwell Automation Studio 5000 version 20 and above. Other systems will follow a similar pattern. Consult your controller's documentation if you need additional information.

Note: Use of an EDS file is completely optional. The RBE2-8 can always be added to a system as a generic module. If you are using RSLogix 5000 version 19 and below, or RSLogix 500, adding the unit as a generic module is the only option available.

Using the EDS file simplifies configuration and adds named tags for all input and output data.

3.1 Obtain the EDS file

All AMCI EDS files are located on our website at the following address:

➤ <http://www.amci.com/industrial-automation-support/configuration-files/>

Simply download the ZIP file and extract it to its own directory. The ZIP file contains the EDS text file and a custom icon file for the device.

3.2 Install the EDS file

3.2.1 Start the EDS Hardware Installation Tool

1) Once Studio 5000 is running, in the menu bar select Tools → EDS Hardware Installation Tool. This will open the EDS Wizard.

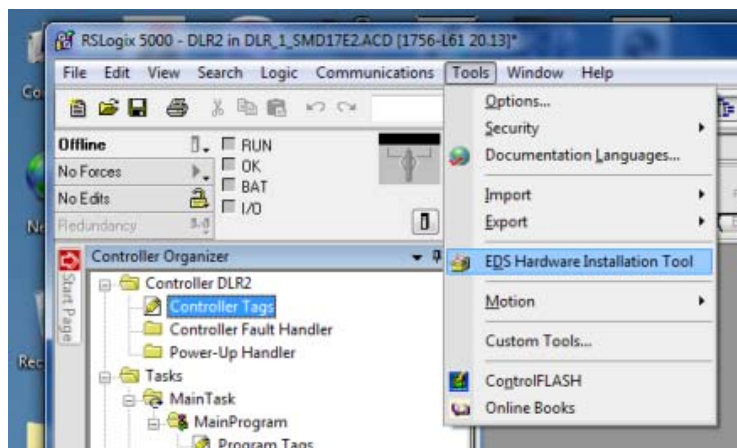


Figure T3.1 Opening the EDS Wizard

2) Click on [Next >] to advance to the Options screen.

3.2 Install the EDS file (continued)

3.2.2 Install the EDS File

1) On the Options screen, select the Register an EDS file(s) radio button and press [Next >].

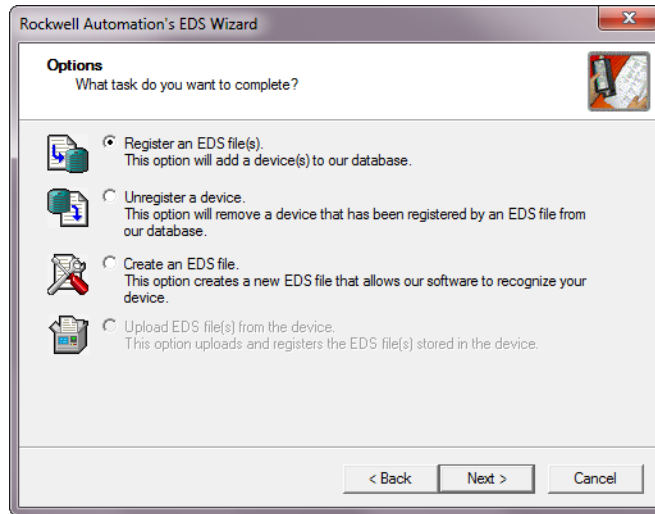


Figure T3.2 EDS Options Screen

2) The registration screen will open. Select the Register a single file radio button.

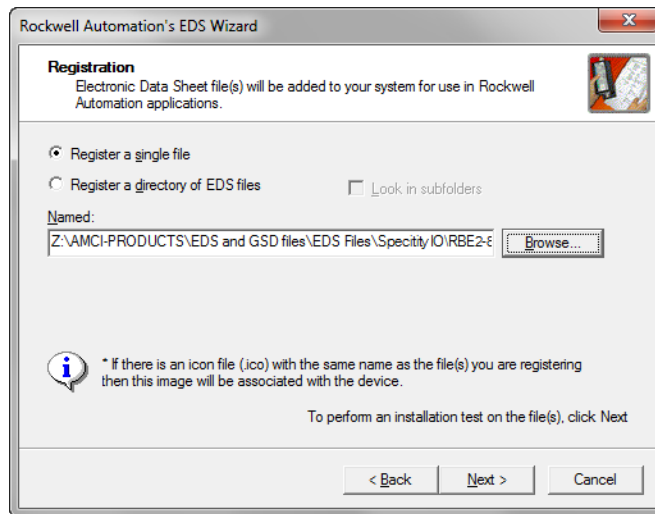


Figure T3.3 EDS Registration Screen

3) Click on the [Browse...] button and browse to the folder that contains the extracted EDS file you downloaded from the AMCI website. Select the EDS file and click on the [Open] button to return to the registration screen. Click on the [Next >] button to advance to the EDS file test screen.

3.2 Install the EDS file (continued)

3.2.2 Install the EDS File (continued)

- 4) Once at the EDS File Installation Test Results screen, expand the tree as needed to view the results of the installation test for the EDS file. You should see a green check mark next to the file name indicating that the EDS file is correct.

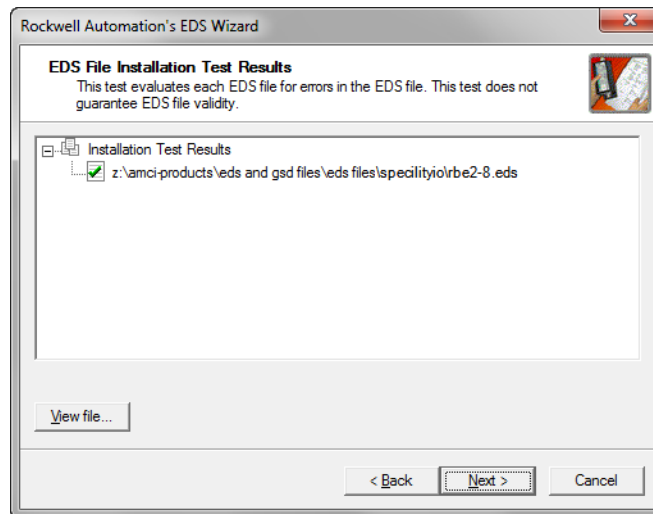


Figure T3.4 EDS Test Screen

- 5) Press on the [Next >] button to advance to the Change Graphic Image screen. This screen gives you the ability to change the icon associated with the device.

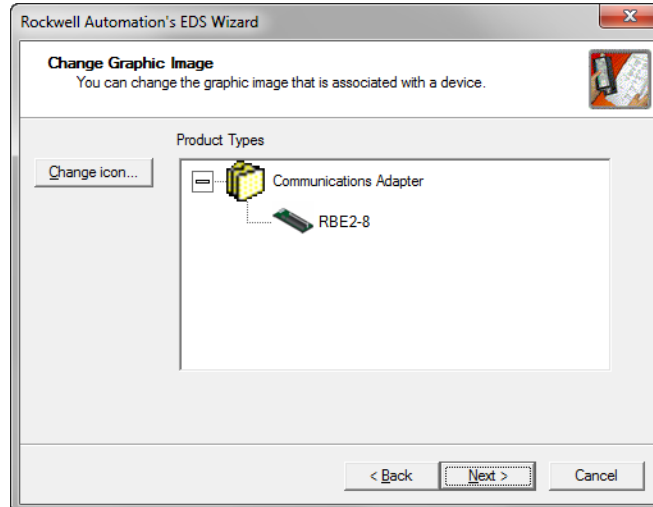


Figure T3.5 Change ECS Icon Screen

- 6) Click on the [Change icon...] button. In the window that opens, click on [Browse...] and browse to the folder that contains the extracted EDS and icon files you downloaded from the AMCI website.
- 7) Select the icon file (*.ico) associated with the device. Click on the [Open] button and then on [OK] to return to the Change Graphic Image screen.
- 8) Click on the [Next...] button to advance to the completion screen. The Completion screen tells you that you have successfully completed the wizard.
- 9) Click on the [Finish] button to exit the EDS wizard.

3.3 Host System Configuration

Studio 5000 is used to configure both the ControlLogix and CompactLogix platforms. When using these platforms, you have the option of using a separate Ethernet Bridge module or an Ethernet port built into the processor.

If the Ethernet port is built into processor, the only step you have to take before adding an AMCI RBE2-8 is to create a new project with the correct processor or modify an existing project. Once this is done, the Ethernet port will automatically appear in the Project Tree. If you are using an Ethernet bridge module, you will have to add it to the I/O Configuration tree before adding the unit to your project.

Refer to your Rockwell Automation documentation if you need instructions for configuring the ethernet port.

3.4 Add the RBE2-8 to Your Project

You can add an RBE2-8 to the project once the Ethernet port (built-in or bridge module) is configured. As shown in figure T3.6 below, the Ethernet port will be listed under the I/O Configuration tree.

- 1) Right click on the Ethernet port and then click on “New Module...” in the pop-up menu.

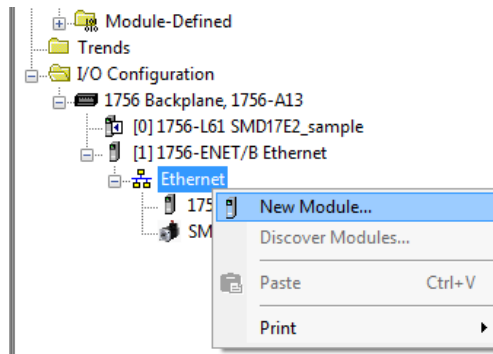


Figure T3.6 Adding an AMCI Ethernet Driver

- 2) In the resulting Select Module Type screen, select “Advanced Micro Controls Inc. (AMCI)” in the Vendor Filters. This will limit the results to catalog numbers from AMCI.
- 3) Select “RBE2-8” in the resulting list.
- 4) Click on the [Create] button to create the module.
- 5) Click on [Close] if necessary to close the Select Module Type screen.

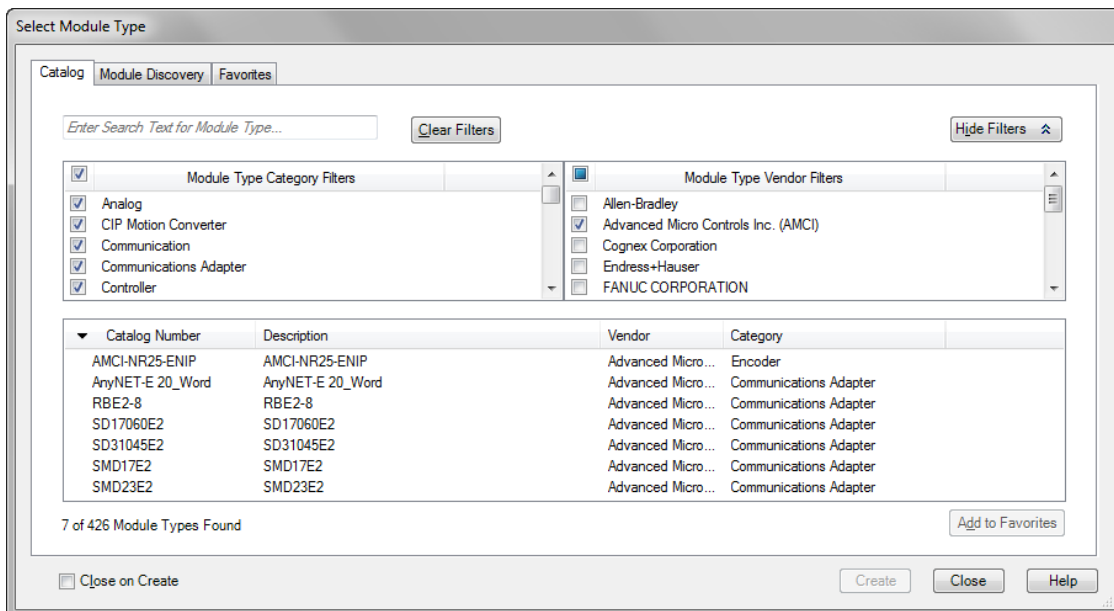



Figure T3.7 Selecting the Networked Driver

3.5 Configure the RBE2-8

If you are continuing from step 3.4, the resulting New Module screen is used to configure the network connection between the RBE2-8 and your controller. If you need to open the screen to perform this task at a later time, right click on the unit in the project tree and then select “Properties” from the drop-down menu

NOTE  Tabs that are not listed in the steps below are filled with reasonable defaults by the EDS file.

3.5.1 General Tab

The Name, Description, and IP address of the device must be specified here. The [Change...] button allows you to change the Module Definition if needed.

3.5.2 Connection Tab

The default RPI time is eight milliseconds. This value can be changed in this tab. The minimum acceptable value is one millisecond. The maximum value is 3200 milliseconds.

3.6 Buffering the I/O Data

Input and output data is transferred asynchronously to the program scan. The input data tags should be buffered with Synchronous Copy File instructions to guarantee stable data during the program scan.

The data from the RBE2-8 is updated is asynchronously to the program scan. The following rung ensures that the data from the driver does not change in the middle of the ladder logic program by copying it to the internal tag array buffered_RBE2-8_data[0] through buffered_RBE2-8_data[1].

It is these buffered registers that your ladder logic program should use when referencing the RBE2-8's input data.

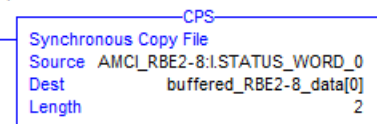


Figure T3.8 Buffer I/O Data

TASK 4 (EtherNet/IP Option)

IMPLICIT COMMUNICATIONS WITHOUT AN EDS

An AMCI RBE2-8 requires a host controller to issue output updates to it. This chapter tells you how to configure implicit connections in EtherNet/IP systems that do not use EDS files. If you instead wish to use explicit messaging, refer to the next chapter for information on using message instructions.

Rockwell Automation's RSLogix 5000 version 20 software is used for the example installation in this chapter.

4.1 Host System Configuration

RSLogix 5000 is used to configure both the ControlLogix and CompactLogix platforms. When using these platforms, you have the option of using a separate Ethernet Bridge module or an Ethernet port built into the processor.

If the Ethernet port is built into processor, the only step you have to take before adding the RBE2-8 is to create a new project with the correct processor or modify an existing project. Once this is done, the Ethernet port will automatically appear in the Project Tree. If you are using an Ethernet bridge module, you will have to add it to the I/O Configuration tree before adding the driver to your project.

Refer to your Rockwell Automation documentation if you need instructions for configuring the ethernet port.

4.2 Add the RBE2-8

You can add the RBE2-8 to the project once the Ethernet port (built-in or bridge module) is configured.

1) Right click on the Ethernet port and then click on "New Module..." in the pop-up menu.

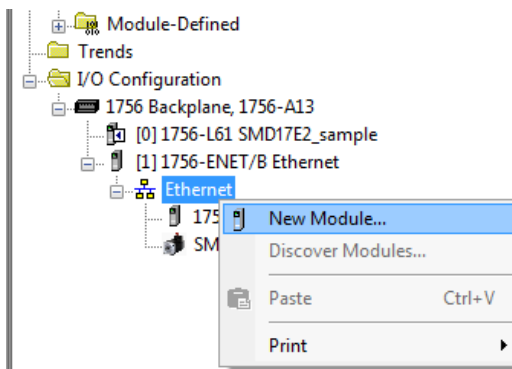


Figure T4.1 Adding an AMCI RBE2-8

4.2 Add the RBE2-8 (continued)

- 2) In the resulting Select Module Type screen, type “generic” into the filter as shown in figure T4.2. This will limit the results in the Catalog Number list.
- 3) Select the Catalog Number “ETHERNET-MODULE” in the list.
- 4) Click on the [Create] button to create the module.
- 5) Click on [Close] if necessary to close the Select Module Type screen.

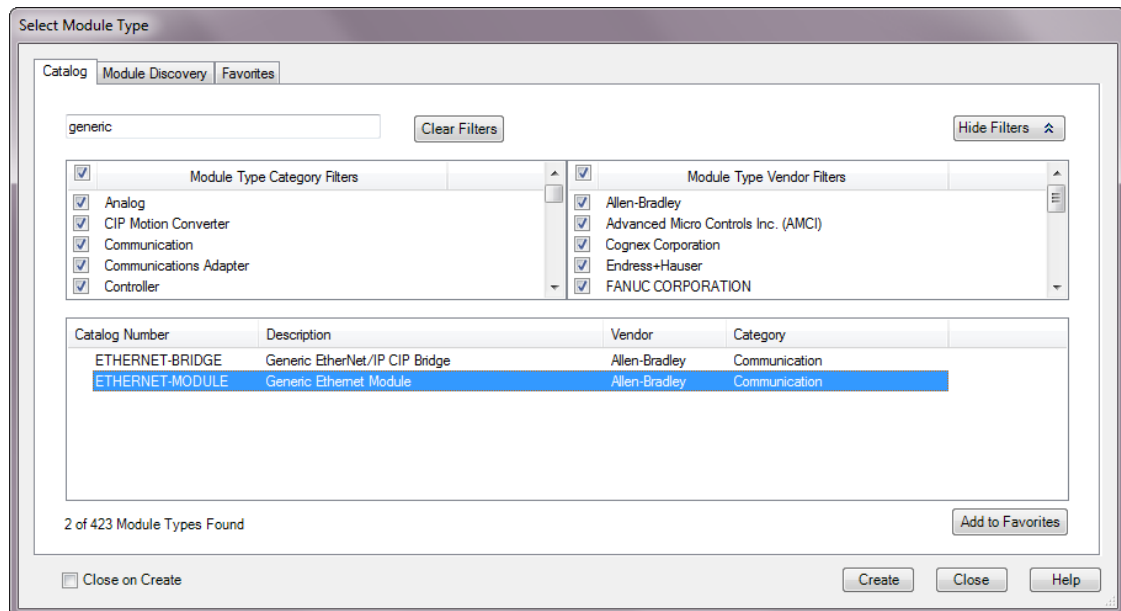


Figure T4.2 Selecting a Generic Device

4.2 Add the RBE2-8 (continued)

6) Set the following parameters in the Module Properties window. All parameters not listed here are optional. Figure T4.3 shows a completed screen.

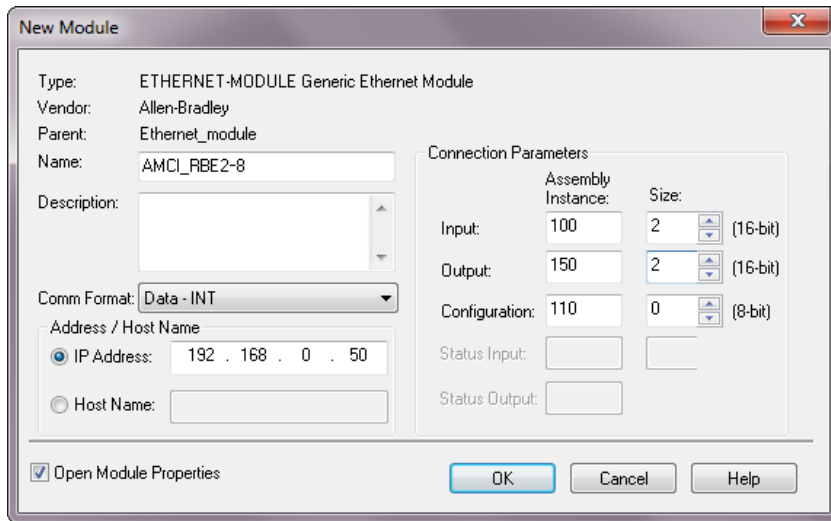


Figure T4.3 Configuration Screen - Generic Device

- **Name:** A descriptive name for the RBE2-8
- **Comm Format:** Data - INT



The Comm Format defaults to Data - DINT. The RBE2-8 will not be able to communicate with the host controller if this format is not changed when the device is added to the system. Once added, the Comm Format cannot be changed. The device must be deleted and again added to the project if the Comm Format is incorrect.

- **IP Address:** Must be the address you set for the RBE2-8. Refer to the [Set the IP Address and Protocol](#) task chapter starting on page 25 for information on setting the IP Address of the unit.
- **Input:** Assembly Instance = 100, Size = 2 words.
- **Output:** Assembly Instance = 150, Size = 2 words.
- **Configuration:** Assembly Instance = 110, Size = 0

7) Verify that the “Open Module Properties” check box is selected and click on [OK]. The Module Properties window will open. You can set the RPI time as required for your system in this window. The minimum RPI time for an RBE2-8 is one millisecond. When done, click on [OK] to complete the setup.

Error Code 16#0109

The PLC will generate an Error Code 16#0109 when the Comm Format parameter is not changed from its default of “Data-DINT” to “Data-INT”. This is the most common cause of communication failures with the RBE2-8.

4.3 Buffer I/O Data

Data to and from the RBE2-8 should be buffered once per scan using Synchronous Copy instructions. This is to insure stable input data during the program scan and guarantee that complete command data is delivered to the device. Ten word integer arrays can be used for this purpose.

These data tags should be buffered with Synchronous Copy File instructions to guarantee stable input data during the program scan and guarantee that complete command data is delivered to the device.

The data from the RBE2-8 is updated asynchronously to the program scan. The following rung ensures that the data from the driver does not change in the middle of the ladder logic program by copying it to the internal tag array buffered_RBE2-8_data[0] through buffered_RBE2-8_data[1].

It is these buffered registers that your ladder logic program should use when referencing the RBE2-8's input data.

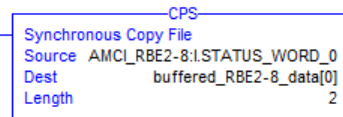


Figure T4.4 Buffer I/O Data

TASK 5 (EtherNet/IP Option)

ETHERNET/IP EXPLICIT MESSAGING

All controllers that support EtherNet/IP support explicit messaging. When using explicit messaging, Message Instructions must be added to your program to communicate with the RBE2-8. Explicit messaging can be used on platforms that also support implicit messaging.

Rockwell Automation controllers which are programmed with the RSLogix 500 software only support explicit messaging. A MicroLogix 1100 will be used as an example in this chapter.

5.1 Required Message Instructions

Only two instructions are required to transfer data between the PLC and the RBE2-8. One instruction reads data from the unit and the other writes data to it. The sample programs available from AMCI use this style of programming. The two instructions are alternately triggered using the instruction's ENABLE bits. The remainder of the program controls when data in the source tags of the write instruction changes. The following table gives the required attributes for the instructions.

	Read Instruction	Write Instruction
Service Type	Read Assembly	Write Assembly
Service Code	E (hex)	10 (hex)
Class	4 (hex)	4 (hex)
Instance	100 (decimal)	150 (decimal)
Attribute	3 (hex)	3 (hex)
Length	4 bytes	4 bytes

Table T5.1 Message Instruction Attributes



Only RSLogix 500 version 8.0 or above can be used to configure Message Instructions to communicate with an EtherNet/IP device. Message Instructions do not work correctly in version 10 of RSLogix 500.

5.2 Create Four New Data Files.

- An Integer file to contain the data read from the RBE2-8. This file must be at least 2 words in length.
- An Integer file to contain the data written to the RBE2-8. This file must be at least 2 words in length.
- A Message (MG) data file. This file must have at least two elements, one to control the Read Operation and one to control the Write Operation.
- An Extended Routing Information (RIX) data file. This file is used to store information used by the Message Instructions. This file must have at least two elements, one for the Read Operation and one for the Write Operation.

5.3 Add the Message Instructions to your Ladder Logic

The following rungs show how you can alternately read data from and write data to the unit.



Figure T5.1 Message Instruction Example

- 1) Double click on *Setup Screen* text inside the Message Instruction. The following window will open. Note that this is the default window and its appearance will change considerably as you progress through these steps.

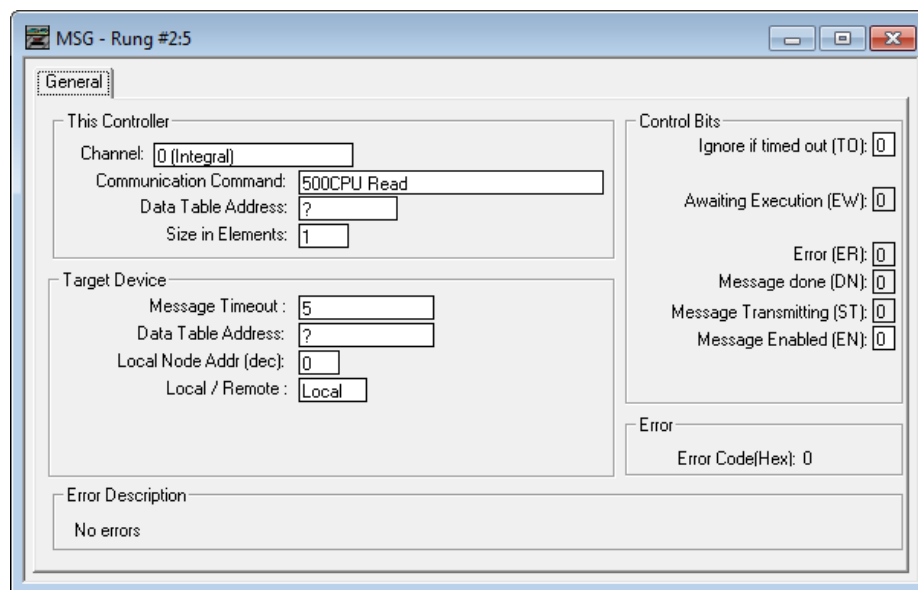


Figure T5.2 Message Instruction Setup Screen

- 2) Double click in the *Channel* field, click on the ▼, select “1 (Integral)”, and press Enter.
- 3) Double click in the *Communication Command* field, click on the ▼, select “CIP Generic” and press Enter.
- 4) If the Message Instruction is being used to read data from the RBE2-8, enter the integer file where the data will be placed in the *Data Table Address (Received)* field and press enter.
- 5) If the Message Instruction is being used to write data to the RBE2-8, enter the integer file where the source data will be located in the *Data Table Address (Send)* field and press Enter.
- 6) Enter “4” as the number of bytes needed in either the *Size In Bytes (Receive)* or *Size In Bytes (Send)* fields. The RBE2-8 requires 4 bytes for both Receive and Send.
- 7) Enter a RIX address in the *Extended Routing Info* field. Please note that each Message Instruction must have its own RIX address.

5.3 Add the Message Instructions to your Ladder Logic (continued)

- 8) Double click in the *Service* field and select “Read Assembly” for a Message Instruction that is being used to read data from the RBE2-8, or “Write Assemble” for a Message Instruction that is being used to send data to the RBE2-8, and press Enter.
- 9) For *Read* operations, the *Service Code* field will change to “E” (hex). For *Write* operations, the *Service Code* field will change to “10” (hex). For both read and write operations, the *Class* field will change to “4” (hex), and the *Attribute* field will change to “3” (hex).
- 10) For Read operations, enter a value of 100 decimal (64 hex) in the *Instance* field.
For Write operations, enter a value of 150 decimal (96 hex) in the *Instance* field.

The figure below show a typical configuration for Message Instructions being used to read data from the RBE2-8. Please note that the Data Table Address (Receive) field may be different in your application.

The screenshot shows the 'MSG - Rung #2:5' configuration window with the following settings:

- General Tab:**
 - This Controller:** Channel: 1 (Integral), Communication Command: CIP Generic, Data Table Address (Receive): N9:0, Size in Bytes (Receive): 4.
 - Target Device:** Message Timeout: 5, Local / Remote: Local, MultiHop: Yes, Extended Routing Info File(RIX): RIX10:0.
 - Service:** Read Assembly, Service Code (hex): E, Class (hex): 4 (dec): 4, Instance (hex): 64 (dec): 100, Attribute (hex): 3 (dec): 3.
 - Error Description:** No errors.
- Control Bits:** Ignore if timed out (TO): 0, Break Connection (BK): 0, Awaiting Execution (EW): 0, Error (ER): 0, Message done (DN): 0, Message Transmitting (ST): 0, Message Enabled (EN): 0.
- Error:** Error Code(Hex): 0.

Figure T5.3 Read Message Instruction Setup Screen

5.3 Add the Message Instructions to your Ladder Logic (continued)

The figure below show a typical configuration for Message Instructions being used to write data to the RBE2-8. Please note that the Data Table Address (Send) field may be different in your application.

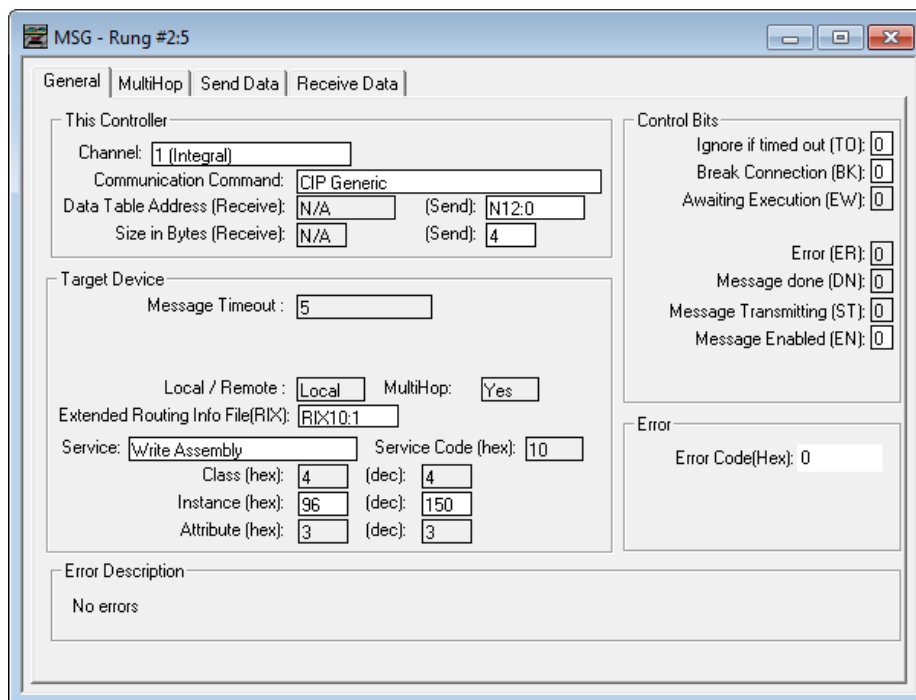


Figure T5.4 Write Message Instruction Setup Screen

Click on the MultiHop tab on the top of the window. As shown in figure T5.5, enter the IP address of the RBE2-8 and press Enter.

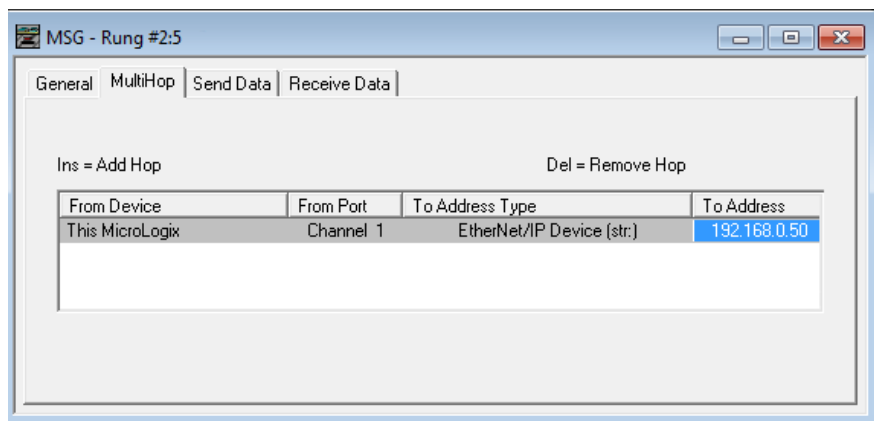


Figure T5.5 Message Instruction MultiHop Settings

After you are finished adding both the read and write message instructions to your program, save and download the program to the PLC.

5.4 Troubleshooting

If you are unable to communicate with the RBE2-8, the problem may be that the Ethernet port of your MicroLogix 1100 has not been configured. To check this:

- 1) Double click on Channel Configuration in the Project Tree and then select the Channel 1 tab. The following window will open.

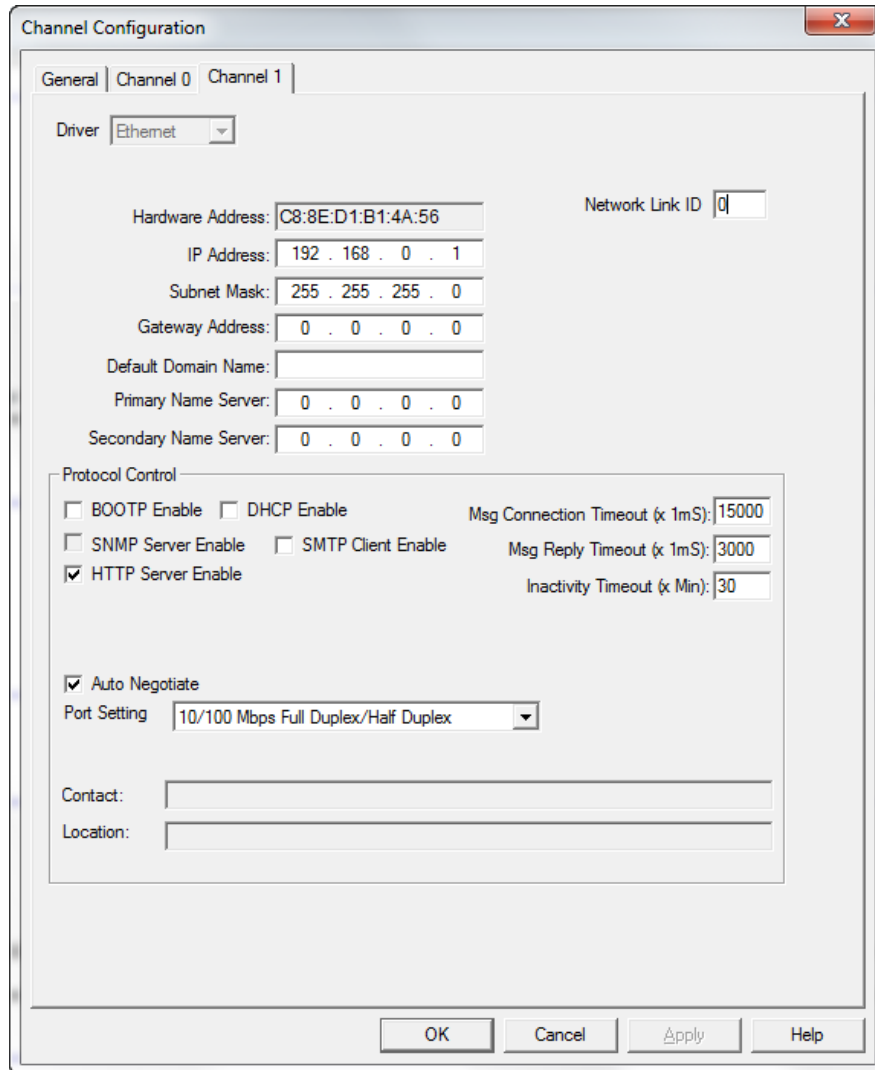


Figure T5.6 MicroLogix Ethernet Configuration Screen

- 2) Enter the IP address and Subnet Mask of your MicroLogix 1100, (not the address of the RBE2-8) and click on [Apply]. The Ethernet Port should now be working.

NOTE 

AMCI is aware of an issue with the RIX data type in version 10 of RSLogix 500. If you are experiencing communications errors and are running version 10, please contact Rockwell Automation for support.

TASK 6 (Modbus TCP Option)

MODBUS TCP CONFIGURATION

This chapter tell you how the I/O words used by an AMCI RBE2-8 are mapped to the Modbus I/O registers.

Enable Modbus TCP Protocol

The internal web page utility can be used to change the communications protocol used by the RBE2-8. This is typically done while setting the IP address. Specifically, follow the steps in section 2.2b, *Use the Embedded Web Server* which starts on page 26.

Modbus Addressing

The register addresses used in this manual are the *Modbus logical reference numbers*[†], which are unsigned integers starting at zero. This is often called *zero based* addressing. In this scheme, the first register is given an address of zero. This is the actual addressing scheme used in the Modbus packets.

Another common addressing scheme is *one based* or *data model* addressing. In this scheme, the register's number is used as its address, so the first register, Register 1 in the data model, has an address of 1.

Modbus Table Mapping

The Discrete Input and Input Register tables in the Modbus data model map to the same physical memory locations in the RBE2-8 units.

- These registers hold data that is reported from the RBE2-8 to the host controller.
- Addresses for these registers and inputs start at 0 in zero based addressing.

As examples:

- Discrete Input 0 is the same memory location as bit 0 of the first Input Register.
- Register address 1, the second register, contains Discrete Inputs 16 through 31.

The Coil and Holding Register tables in the Modbus data model map to the same physical memory locations in the RBE2-8 relay boards.

- These registers hold data that is from the host controller to the unit.
- Addresses for these registers start at 1024 in zero based addressing. Coil addresses start at 16,384 in zero based addressing (1024*16).

As examples:

- Coil 16384 is the same memory location as bit 0 of the first Holding Register.
- Register address 1025, the address of the second Holding Register, contains Discrete Outputs 16,400 through 16,415 in zero based addressing.

Host Addressing

Your host controller may not use these basic addressing schemes for communicating over a Modbus connection. For example, Modicon controllers use addresses starting at 30000 for Input Registers and addresses starting at 40000 for Holding Registers. GE hosts internally use their %R memory for Holding Registers and %AI memory for Input Registers.

If this is the case, you will define a mapping between your host controller's addressing scheme and the zero based Modbus TCP addresses when you add the RBE2-8 to your host controller. Refer to your host controller's documentation for information on how to accomplish this.

[†] MODBUS Application Protocol Specification V1.1b3, section 4.3: MODBUS Data model. www.modbus.org

AMCI Modbus TCP Memory Layout

The RBE2-8 has a starting Input Register address of 0 and a starting Output Register address of 1024. Input Registers hold the data from the RBE2-8 while Output Registers hold the data to be written to the unit. Figure T6.1 shows how an RBE2-8 is mapped to the Modbus data reference. The complete specification for the Modbus protocol can be downloaded at <http://www.modbus.org/specs.php>.

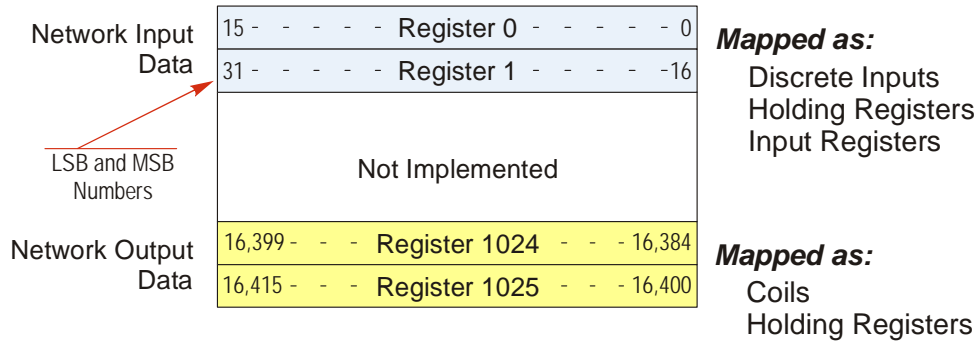


Figure T6.1 Modbus Data Reference Map

Supported Number of Connections

All RBE2-8 units support four concurrent connections. When connections exist, the Network Status (NS) LED on the unit will flash green. The number of blinks indicate the number of active connections. There is a two second break between groups of flashes.

Supported Modbus Functions

Function Code	Function Name	RBE2-8 Register	Addressing method
1	Read Coils	OUTPUT	Bit: Addresses starting at 16,384
2	Read Discrete Inputs	INPUT	Bit: Addresses starting at 0
3	Read Holding Registers	OUTPUT & INPUT	Word: Out Regs.Starting at 1024 In Regs.Starting at 0
4	Read Input Registers	INPUT	Word: Addresses starting at 0.
5	Write Single Coil	OUTPUT	Bit: Addresses starting at 16,384
6	Write Single Register	OUTPUT	Word: Addresses starting at 1024
15	Write Multiple Coils	OUTPUT	Bit: Addresses starting at 16,384
16	Write Multiple Registers	OUTPUT	Word: Addresses starting at 1024
22	Mask Write Register	OUTPUT	Word: Addresses starting at 1024
23	Read/Write Registers	INPUT/OUTPUT	Word: Out Regs.Starting at 1024 In Regs.Starting at 0

Table T6.1 Supported Modbus Functions

Table T6.1 above lists all of the Modbus functions supported by an RBE2-8. AMCI supports all of these functions so that you can control the unit as you see fit. However, if you are looking for the easiest way to interface with your unit, then you only need to use the *Read/Write Registers* function, which is function code 23.

NOTE Each RBE2-8 buffers the data that is sent to it over the network. If you use the *Read/Write Registers* function to write data to the unit, the data read with that command will not contain the response to the new write data. The response to the new data will be sent with the next data read.

Supported Modbus Exceptions

Code	Name	Description
01	Illegal function	The RBE2-8 does not support the function code in the query.
02	Illegal data address	The data address received in the query is outside the initialized memory area.
03	Illegal data value	The data in the request is illegal.

Table T6.2 Supported Modbus Exceptions

Notes

TASK 7 (PROFINET Option)

PROFINET NETWORK CONFIGURATION

This chapter outlines the steps commonly needed to get an RBE2-8 to communicate with a PROFINET master. A Siemens SIMATIC S7-1212C controller is used as an example.

Basic Steps

Configuring a PROFINET host requires a few basic steps.

- 1) Download the ZIP archive that contains the GSDML files for the RBE2-8 from the www.amci.com website.
- 2) Install the GSDML file into the configuration software for your host controller.
- 3) Add the RBE2-8 to the PROFINET Network.
- 4) Set the I/O word addresses used to communicate with the unit.

7.1 Download the GSDML files

The GSDML files are available on the AMCI website on the <http://www.amci.com/industrial-automation-support/configuration-files/> web page. The file is a ZIP archive that has to be extracted to a folder on your computer. Extracting the ZIP file will leave you with multiple files. One is the GSDML file and the others are icon files for the various devices.

7.2 GSDML File Installation

- 1) Open or create a new project that will include the RBE2-8 and open the Project View of the project.
- 2) In the menu, select *Options -> Manage general station description files (GSD)*.
- 3) In the window that opens, click on the [...] button and navigate to the folder that contains the extracted GSDML file you downloaded from the AMCI website. Once at the folder, click on the [OK] button.
- 4) Click on the check box next to the name of the GSD file and click on the [Install] button. The system will install the GSD file.
- 5) Click the [Close] button and wait for the software to finish installing the file and updating the Hardware Catalog.

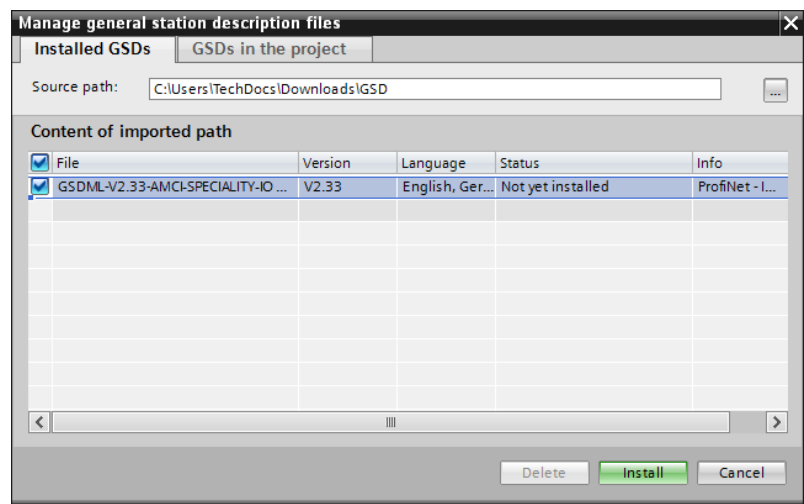


Figure T7.1 GSD File Installation

7.3 Configure the PROFINET Network

A CPU must be added to the project and the PROFINET network must be configured before a Networked Relay Board can be added to the system.

Refer to Siemens documentation for information on configuring the PROFINET network to suit your application.

7.4 Add the RBE2-8 to the PROFINET Network

- 1) With the project open in Project View, double click on “Device & Networks” in the project tree.
- 2) If need be, click on the “Hardware Catalog” vertical tab to open the Hardware Catalog.
- 3) You can search for “RBE”, or browse to the RBE2-8 icon by clicking through *Other field devices* +> *PROFINET IO* +> *IO* +> *Advanced Micro Controls Inc.* +> *AMCI_Products* +> *AMCI_Speciality IO*. Drag and drop the appropriate icon onto the PROFINET network.
- 4) Drag the green square on the RBE2-8 icon onto the PROFINET network line to connect the device to the network.

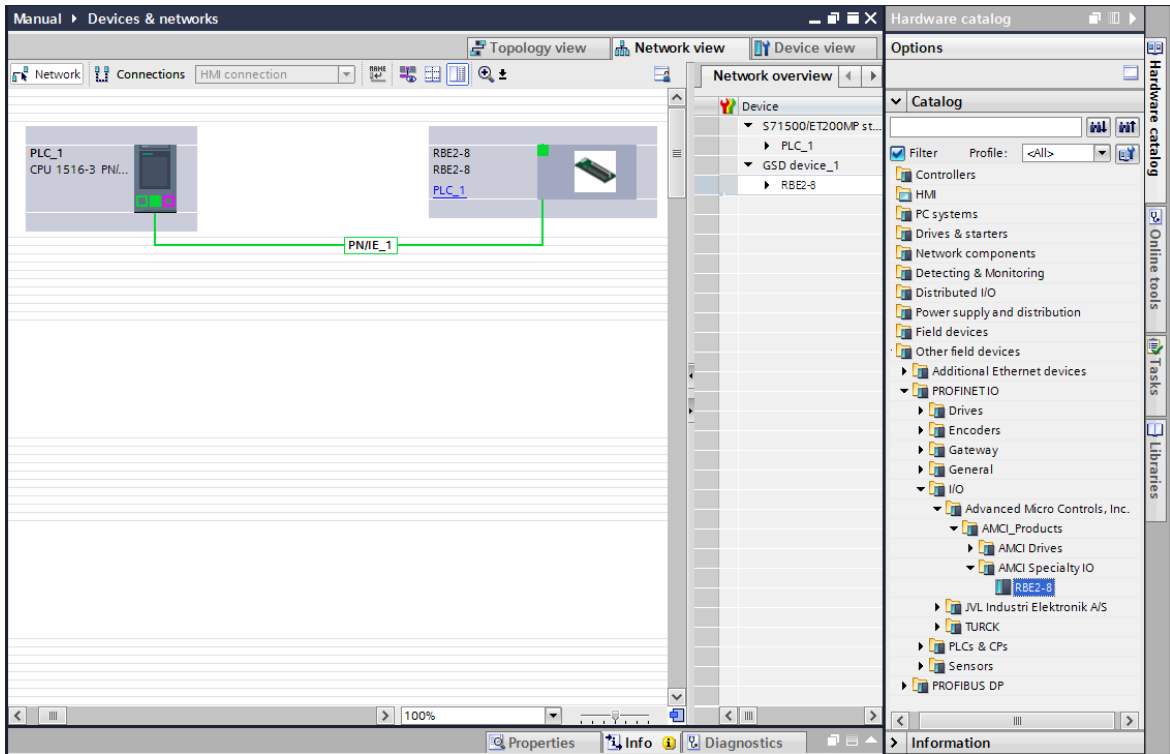


Figure T7.2 RBE2-8 Added to PROFINET Network

7.4 Add the Networked Driver to the PROFINET Network (continued)

- 5) Right click on the RBE2-8 icon and select “Properties” from the pop up menu. The Inspector window will open at the bottom of the screen. Under the “General” tab, select the “►General” heading. You can rename the RBE2-8 by changing the Name: field.
- 6) Under the “►PROFINET interface [x1]” heading, select “Ethernet addresses”. Under the IP protocol section, set the desired IP address and subnet mask for the RBE2-8.

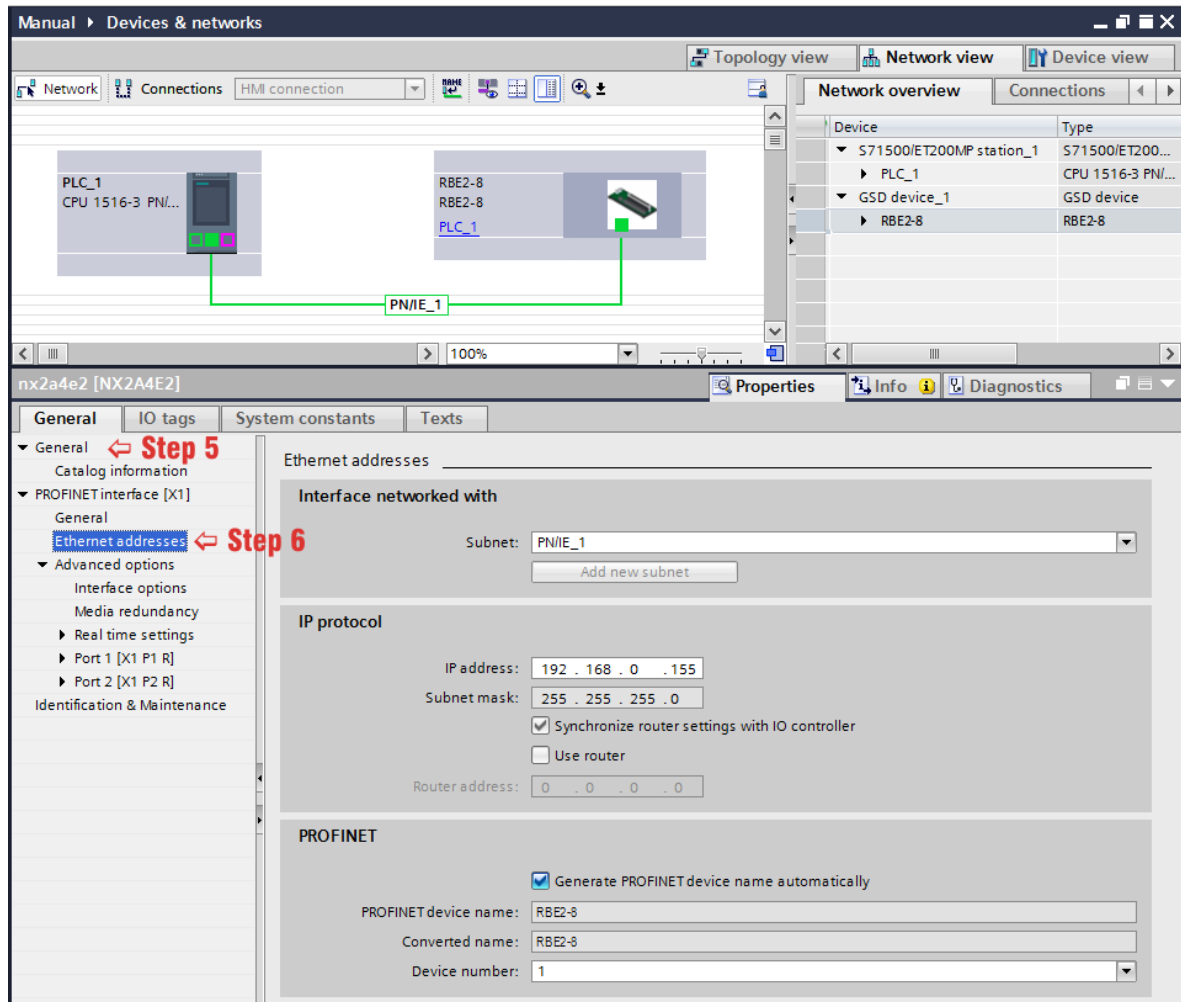


Figure T7.3 RBE2-8 IP Addressing

7.5 Set the I/O Configuration

The RBE2-8 units require 2 Input Words (4 Input Bytes) and 2 Output Words (4 Output Bytes). All required Input and Output Bytes are defined by the GSDML file and divided into suitable modules. These settings are shown in the Table T7.1.

Input / Output Bytes of an RBE2-8	Input / Output Modules of an RBE2-8
4 Input Bytes	Input Module - Slot 1: 4 bytes
4 Output Bytes	Output Module - Slot 2: 4 bytes

Table T7.1 PROFINET I/O Configuration

- 1) With the RBx2-8 icon selected on the PROFINET bus, click on the “Device view” tab. The view in the Hardware Catalog will change. Expand the Module tree to show both the Input and Output modules.
- 2) To map the I/O bytes to the CPU, double click on the “4 bytes IN” and “4 bytes OUT” icons in the Hardware Catalog. The system will automatically assign the next I and Q addresses to the data table.

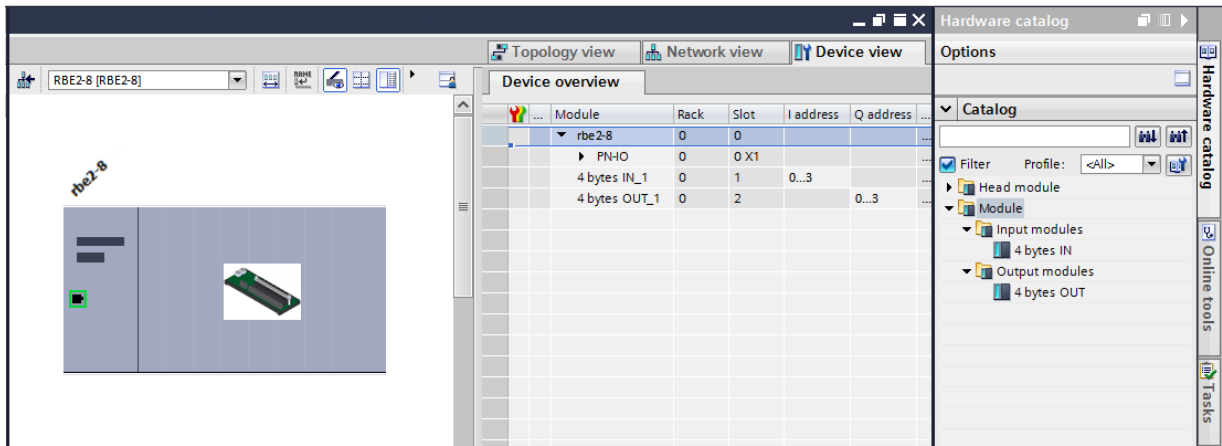


Figure T7.4 I/O Byte Mapping

7.6 Verify and Download the New Configuration

- 1) Continue by adding any remaining devices to your PROFINET network.
- 2) Compile and download the project to the CPU.

MRP Installations

At this point, the RBE2-8 is configured and ready to use. If you are using the unit in a redundant, ring based, network that uses the Media Redundancy Protocol (MRP), continue with the following instructions.

Media Redundancy Protocol (MRP) installations require that the RBE2-8 be installed in a ring topology. In these applications, both Ethernet ports are used when wiring the ring, daisy chaining from one unit in the ring to the next. The steps below covers typical software configuration that must also be completed.

7.7 Configure the RBE2-8 as an MRC

The RBE2-8 functions as a Media Redundancy Client (MRC) in an MRP network.

- 1) Switch to Topology view and drag the additional connections between the appropriate ports.
- 2) Click on the RBx2-8 icon to select it. In the Inspector window, select *Advanced options* +> *Media redundancy*. Use the “MRP domain:” drop down menu to select the appropriate domain. Use the “Media redundancy role:” drop down menu to select “Client”.
- 3) Continuing in the Inspector window, select *Advanced options* +> *Port 1* +> *Port interconnection*. Under “Partner port:”, the partner port you assigned to the port when you drew the topology is shown. If you do not know which port will be the partner port in the actual installation, you can use the drop down menu to select “Any partner”.
- 4) If need be, repeat step 3 for Port 2 of the RBE2-8.

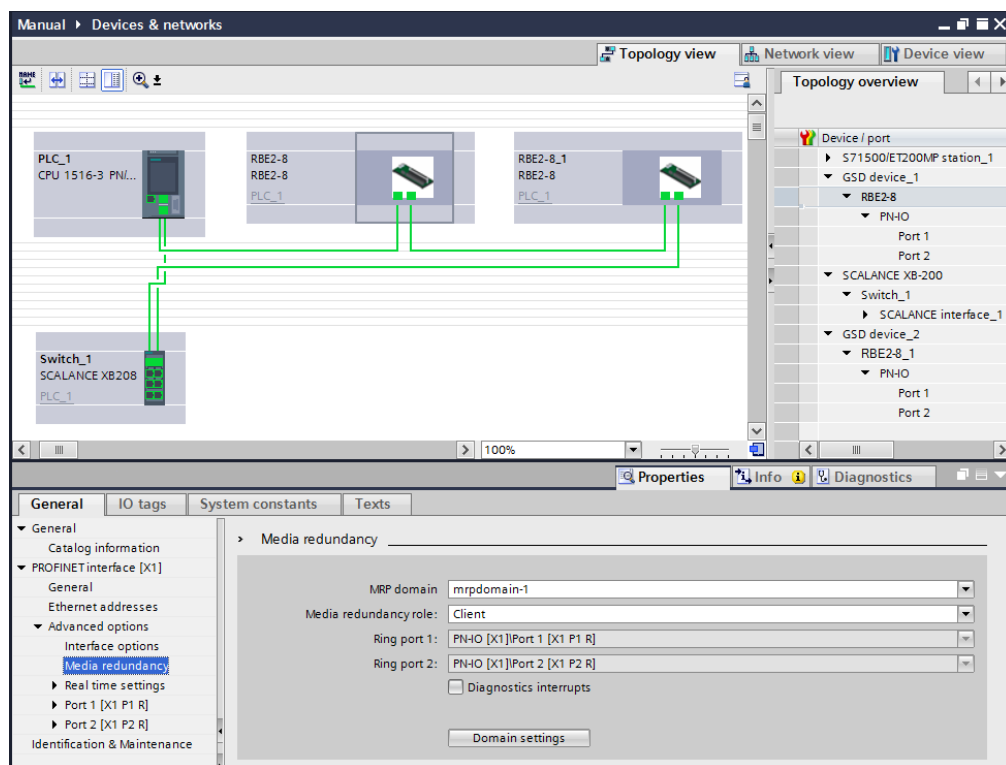


Figure T7.5 MRP Topology and Client settings

- 5) Continue configuring the rest of the devices on the network before compiling the project and downloading it to the CPU.



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