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Allen-Bradley

PLC-5 Ethernet Interface Module

(Cat. No. 1785-ENET)

User Manual

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Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Controls*, publication SGI-1.1 describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will the Allen-Bradley Company be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, the Allen-Bradley Company cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Allen-Bradley Company with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual we use notes to make you aware of safety considerations.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Attentions help you:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is especially important for successful application and understanding of the product.

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Using This Manual

Read this preface to familiarize yourself with the rest of the manual. This preface covers the following topics:

- who should use this manual
- the purpose of this manual
- Allen-Bradley support

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Allen-Bradley programmable controllers or interface modules.

Who Should Use This Manual

You should have a basic understanding of PLC-5 programmable controller products and the following Ethernet-related topics:

- TCP/IP protocol
- Internet addressing

If you do not have an understanding of these areas, contact your local Allen-Bradley representative for information on available training courses before using this product.

Purpose of This Manual

This manual:

- tells you what equipment you must provide for installing the PLC-5 Ethernet Interface Module
- helps you install and configure the interface module
- helps you connect to an Ethernet link and communicate via the interface module

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Contents of This Manual

Chapter	Title	Contents
	Preface	Describes the purpose, background, and scope of this manual. Also specifies the audience for whom this manual is intended.
1	Quick Start	Provides brief installation and configuration procedures for the advanced user.
2	Installing the Interface Module	Explains and illustrates how to install and remove the interface module into and from the 1771 I/O chassis. Also specifies compliance with European Union Directives.
3	Configuring the Interface Module for Ethernet Communication	Provides instructions for: • configuring channel 3A • assigning an IP address to the module • using the BOOTP servers on the utility disk
4	Communicating via the Interface Module	Describes how to establish an Ethernet connection and monitor status data. Also specifies how to use the MSG instruction over the Ethernet link.
A	Specifications	Provides physical, electrical, and environmental specifications for the interface module.
B	Performance Data	Provides measured performance data for the interface module.
C	SNMP Management Information Base (MIB) II Data Groups	Describes the SNMP Management Information Base (MIB) II Data Groups.
D	Status LED Error Codes	Describes the status LED error codes.

Related Documentation

For additional information regarding Allen-Bradley programmable controllers and related products, see the *Enhanced and Ethernet PLC-5 Programmable Controllers User Manual*, publication 1785-6.5.12.

For Ethernet information, see these web sites:

- http://www.ab.com/networks/whatnew.html#ethernet
- http://standards.ieee.org/catalog/olis/lanman.html
- http://www.ietf.cnri.reston.va.us/

For additional information on TCP/IP protocol and networking in general, see these publications:

- Comer, Douglas E. *Internetworking with TCP-IP, Volume 1: Protocols and Architecture.* Englewood Cliffs, N.J.: Prentice-Hall, 1990. ISBN 0-13-468505-9.
- Tanenbaum, Andrew S. *Computer Networks*, 2nd ed. Englewood Cliffs, N.J.: Prentice-Hall, 1989. ISBN 0-13-162959-*X*.

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- sales and order support
- product technical training
- warranty support
- support service agreements

Technical Product Assistance

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Your Questions or Comments on This Manual

If you find a problem with this manual, please notify us of it on the enclosed Publication Problem Report.

If you have any suggestions for how this manual could be made more useful to you, please contact us at the address below:

Technical Communication
Allen-Bradley Comapny
1 Allen-Bradley Drive
Mayfield Heights, Ohio 44124

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Notes:

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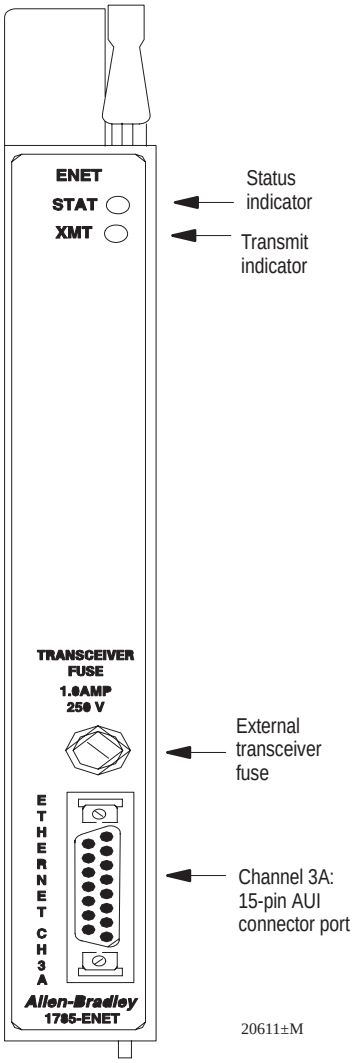
Performance Data — **Appendix B**

SNMP Management Information Base (MIB) II Data Groups — **Appendix C**

Status LED Error Codes — **Appendix D**

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Quick Start



This chapter can help you get started quickly using the PLC-5 Ethernet Interface Module. We base the procedures here on the assumption that you have an understanding of:

- PLC-5 products
- TCP/IP protocol
- Internet addressing

Because this is a quick start guide for experienced users, this chapter *does not contain detailed explanations about the procedures listed. It does, however, reference other chapters in this book where you can get more information.*

If you have any questions or are unfamiliar with the terms used or concepts presented in the procedural steps, *always read the referenced chapters and other recommended documentation before trying to apply the information.*

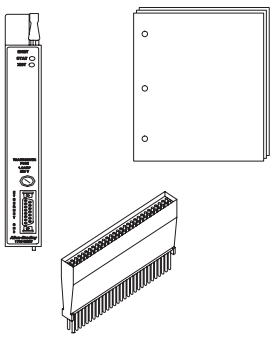
This chapter:

- tells you what equipment you must provide for installing the Ethernet interface module
- helps you install and configure the module
- helps you connect to an Ethernet link and communicate via the interface module

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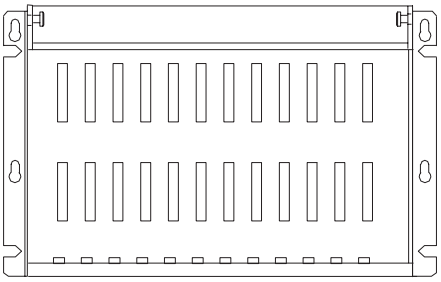
Installing and Configuring the Interface Module

Step 1 **Check the contents of your shipment.**

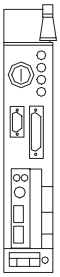


Quantity:	Description:
1	PLC-5 Ethernet Interface Module (1785-ENET)
1	Connector kit containing 1 PLC-5 58-pin connector header
1	*Industrial Automation Wiring and Grounding Guidelines*, publication 1770-4.1
1	*PLC-5 Ethernet Interface Module User Manual*, publication 1785-6.5.19

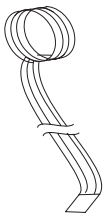
Step 2 **Locate and have ready all equipment and tools necessary for installation.**



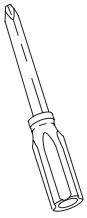
I/O Chassis
(1771-A1B/B, -A2B/B, -A3/B or -A4B/B)



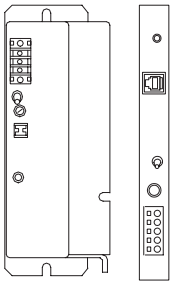
PLC-5 Processor



ESD
Grounding
Wrist Strap



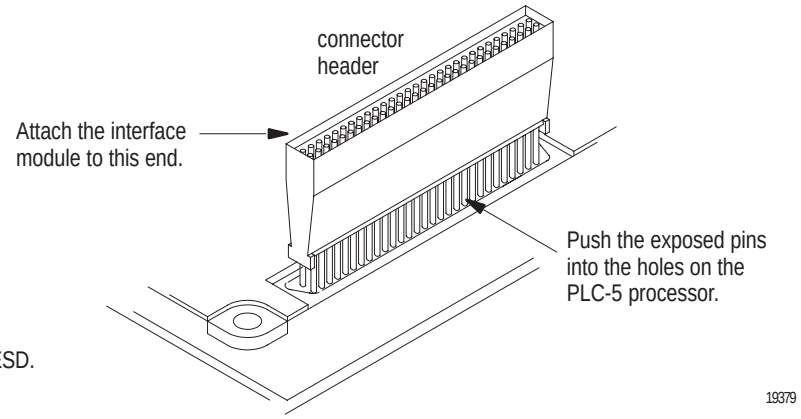
phillips
screwdriver



Any external or internal
Allen-Bradley power supply

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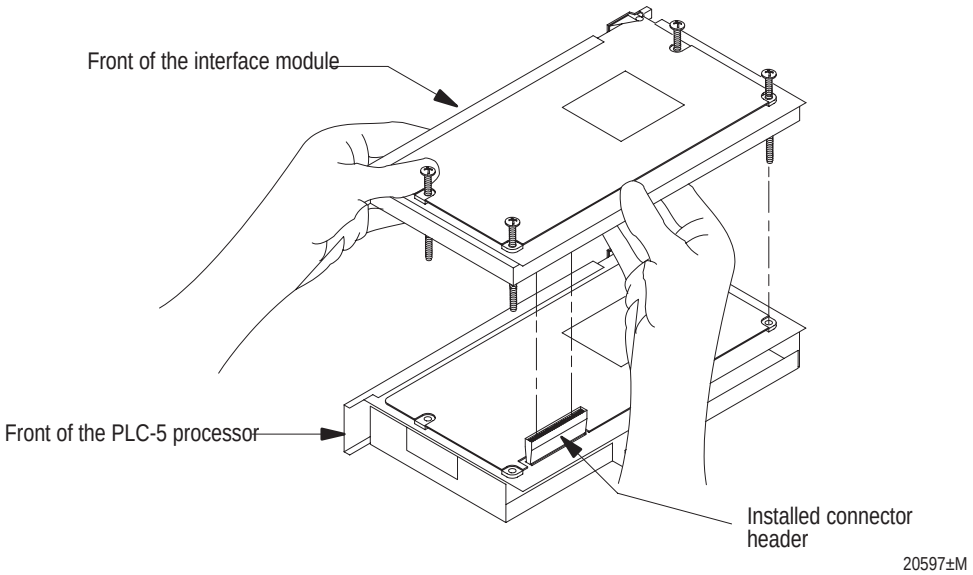
Step 3	Attach the connector header to the processor	See Chapter 2 *Installing the Interface Module*



Wear a grounding wrist strap to guard against ESD.

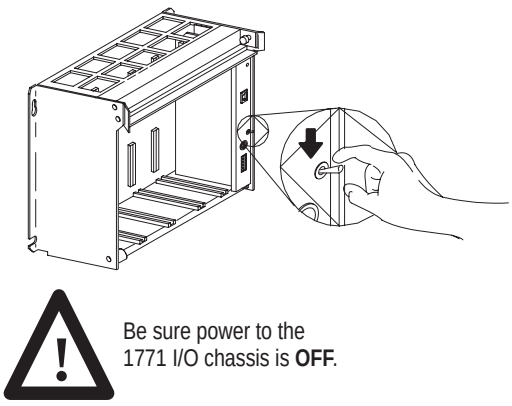
Important: Make sure you carefully align the pins and holes before you press the connector header into the processor. If you improperly align them, you will bend the connector header pins when you press them together. Do not use excessive force on the connector header when seating it into the processor. You do not need to key the connector.

Step 4	Use the captive screws to connect the interface module to the processor.	See Chapter 2 *Installing the Interface Module*

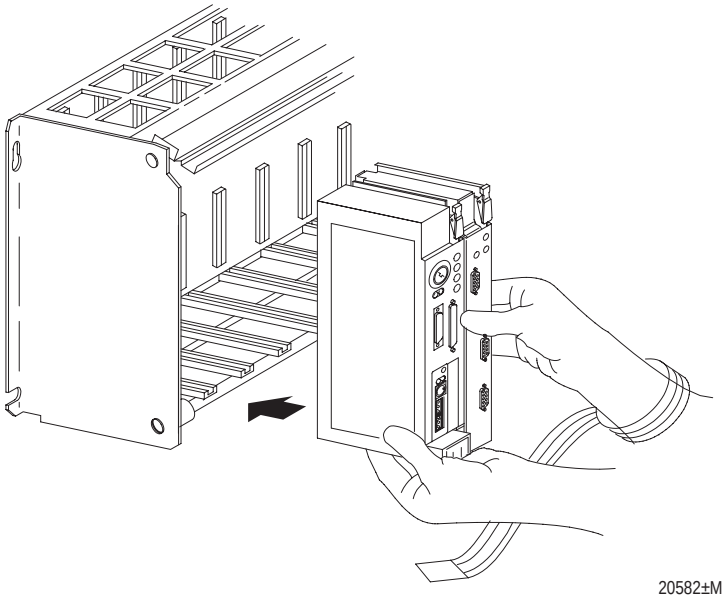


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Step 5	**Install the interface module/processor combination in the left-most slot of the 1771 I/O chassis.**	**See Chapter 2** *Installing the Interface Module*



Be sure power to the 1771 I/O chassis is **OFF**.



20582±M

Step 6	**Assign an IP address to the interface module.**	**See Chapter 3** *Configuring the Interface Module for Ethernet Communication*

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Step 7	Configure channel 3A for Ethernet communication.	See Chapter 3 *Configuring the Interface Module for Ethernet Communication*

A. Be sure channel 3A is designated as the channel supporting the 1785-ENET module.

- Your programming software must support configuration for channel 3A.
- The PLC-5 processor must contain the proper firmware revision. See chapter 2.
- If you are configuring **online** and the interface module is attached to the processor, channel 3A will automatically support the interface module.
- If you are configuring **offline**, follow the steps listed in your programming software documentation.

B. Specify Ethernet-specific configuration information (including the IP address) using any one of these methods:

- manually configure channel 3A using your programming software
- use a BOOTP server already on your network (see your Ethernet network administrator for assistance).

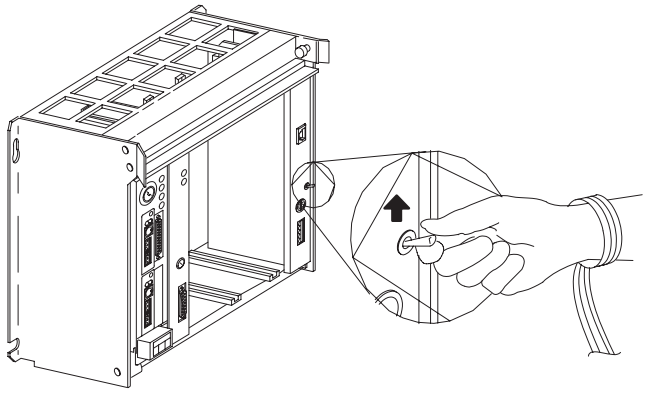
  Rockwell Automation offers a BOOTP tool on http://www.ab.com

Important: Assign a diagnostics file to store all status information for channel 3A. Use your programming software to select an unused integer file number (10-999). The software creates an integer file that is 44 words long.

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Step 8	Apply power to the I/O chassis and processor	See Chapter 4 *Communicating via the Interface Module*

Turn on the I/O chassis power supply.



20634±M

Step 9	Establish an Ethernet connection.	See Chapter 4 *Communicating via the Interface Module*

Step 10	Check that the module is operating correctly.	See Chapter 4 *Communicating via the Interface Module*

Be sure that you assigned a diagnostics file to store status information for channel 3A.

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What You Have Done

You have now successfully installed and configured the PLC-5 Ethernet interface module for operation with the attached processor on an Ethernet link. If your module is operating successfully, it is not necessary to continue reading this manual.

For more information about operation PLC-5 processors within your control system, see the *Enhanced and Ethernet PLC-5 Programmable Controller User Manual*, publication 1785-6.5.12.

What's Next

If necessary, see the remainder of this manual for more detailed information about installing and configuring the interface module.

For information about	See
installing the interface module	chapter 2
configuring the interface module for Ethernet communication	chapter 3
communicating over Ethernet via the interface module	chapter 4
interface module specifications	appendix A

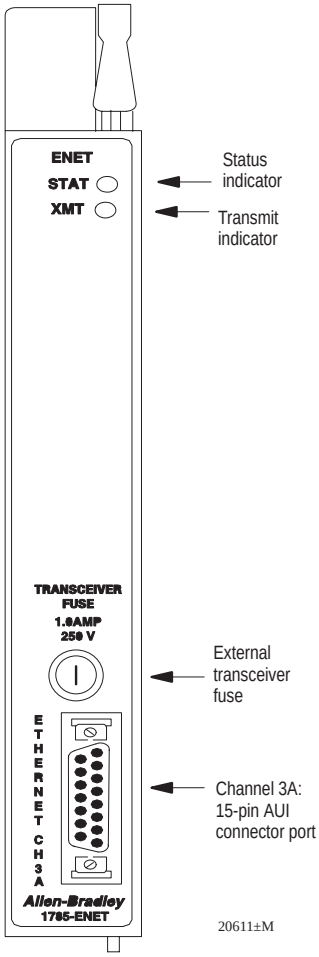
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Notes:

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Installing the Interface Module

Using This Chapter



Read this chapter to:

- connect your Ethernet interface module to a PLC-5 processor
- install the processor and interface module combination in a 1771 I/O chassis.

For information about:	See page:
Checking the 1785-ENET package before you begin	2-2
Equipment you must provide	2-3
Preventing electrostatic discharge (ESD) damage	2-4
Complying with the European Union Directive	2-4
Installing the Ethernet interface module	2-5
Removing the Ethernet interface module	2-8

The PLC-5 Ethernet Interface Module is a single-slot module that attaches to the side of any enhanced PLC-5 series B or later processor to provide Ethernet connectivity for the attached processor.

When used with	The interface module provides
Enhanced PLC-5 processor	Ethernet connectivity without sacrificing DH+/RIO ports
ControlNet PLC-5 processor	Ethernet connectivity
Ethernet PLC-5 processor	the ability to operate dual Ethernet links

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Use the interface module with a programming software package that supports configuration for channel 3A and the following processors:

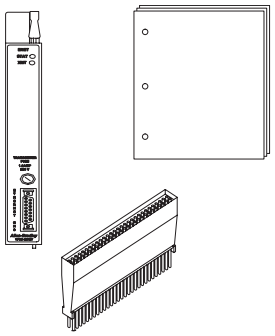
Series	Revision	Processor
E and later	any	all Enhanced, Ethernet, and ControlNet PLC-5 processors
D	B	PLC-5/11, -5/20, -5/26, -5/30, -5/40, -5/40L, -5/46, -5/60, -5/60L, -5/80, -5/86
		PLC-5/20E, -5/40E, -5/80E
		PLC-5/20C, -5/40C, -5/80C
C	K	PLC-5/11, -5/20, -5/26, -5/30, -5/40, -5/40L, -5/46, -5/60, -5/60L, -5/80, -5/86
		PLC-5/20E, -5/40E, -5/80E
		PLC-5/20C, -5/40C, -5/80C
B	L	PLC-5/40, -5/40L, -5/46, -5/60, -5/60L
A	L	PLC-5/30
A	K	PLC-5/11, -5/20, -5/26

All ControlNet 1.5 PLC-5 processors support the 1785-ENET sidecar module.

Before You Begin

Before installing your Ethernet interface module:

1. Check your Ethernet interface module package.
2. Make certain that you have the following:



Quantity:	Description:
1	PLC-5 Ethernet Interface Module (1785-ENET)
1	Connector kit containing 1 PLC-5 58-pin connector header
1	*Industrial Automation Wiring and Grounding Guidelines*, publication 1770-4.1
1	*PLC-5 Ethernet Interface Module User Manual*, publication 1785-6.5.19

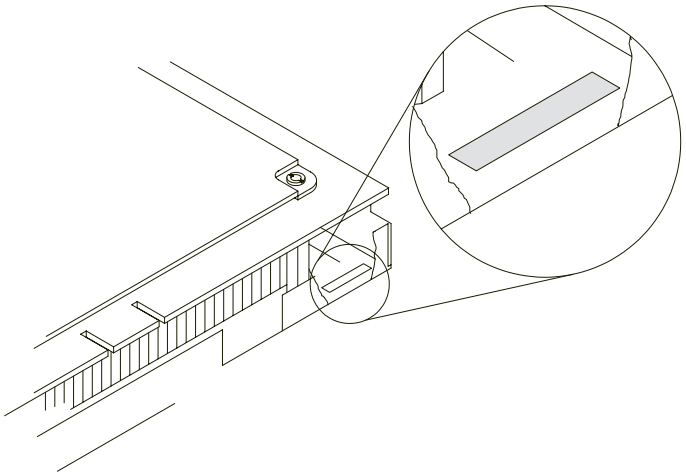
If any items are missing or incorrect, contact your local Allen-Bradley sales office or distributor.

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3. Locate and record the Ethernet hardware address.

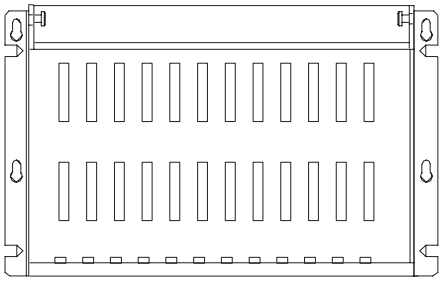
Allen-Bradley assigns each PLC-5 Ethernet interface module an Ethernet hardware address at the factory. Look for this address either:

- in the back, upper corner of your module
- in the channel 3A configuration screen of your PLC-5 programming software

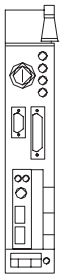


Necessary Equipment

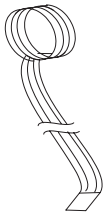
Locate and have ready all the tools and equipment necessary for installation:



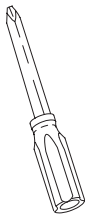
I/O Chassis
(1771-A1B/B, -A2B/B, -A3/B or -A4B/B)



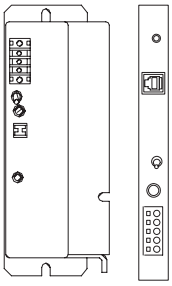
PLC-5 Processor
Supported processors and current firmware
(see page 2-1)



ESD
Grounding
Wrist Strap



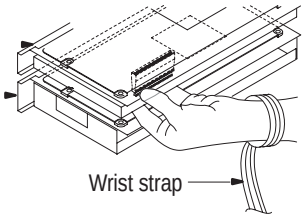
phillips
screwdriver



Any external or internal
Allen-Bradley power supply

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Preventing Electrostatic Discharge (ESD) Damage



The Ethernet interface module is shipped in a static-shielded container to guard against electrostatic discharge (ESD).

ESD can damage integrated circuits or semiconductors in the module if you touch the backplane connector pins. Avoid electrostatic damage by observing the following precautions:

- Remain in contact with an approved ground point while handling the module (by wearing a properly grounded wrist strap).
- Do not touch the backplane connector or connector pins.
- When not in use, keep the module in its static-shielded container.

Complying with European Union Directives

If this product has the CE mark it is approved for installation within the European Community or EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet Council Directive 89/336/EC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2
  EMC - Generic Emission Standard, Part 2 - Industrial Environment
- EN 50082-2
  EMC - Generic Immunity Standard, Part 2 - Industrial Environment

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests. For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the Industrial Automation Wiring and Grounding Guidelines for Noise Immunity, publication 1770-4.1.

This equipment is classified as open equipment and must be mounted in an enclosure during operation to provide safety protection.

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Installing the Interface Module

To install the PLC-5 Ethernet Interface Module, you must:

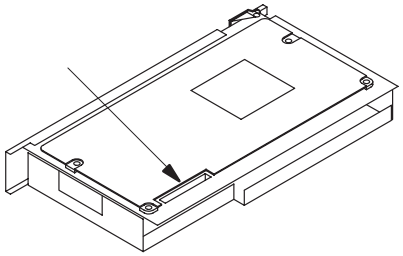
- attach the connector header to the processor
- attach adhesive washers to the processor
- connect the interface module to the processor
- install the combination into the chassis

ATTENTION: If your power supply is already installed in the chassis, be sure the chassis power supply is turned OFF before you begin the installation procedures. Do not attempt to install the interface module with chassis power ON. Installing the module with chassis power ON will damage the module.

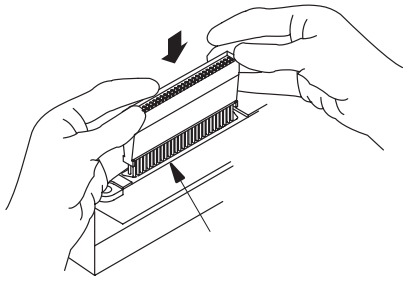
Attach the Connector Header to the Processor

If you have not already done so, attach a grounding wrist strap to your wrist. Then follow these steps to attach the connector header to the processor:

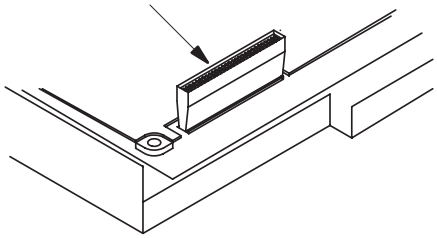
1. Locate the PLC-5 processor connector header port.



2. Push the exposed pins into the holes on the PLC-5 processor.



3. Attach the interface module to this end of the connector header.



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Important: Make sure you carefully align the pins and holes before you press the connector header into the processor. If you improperly align them, you will bend the connector header pins when you press them together.

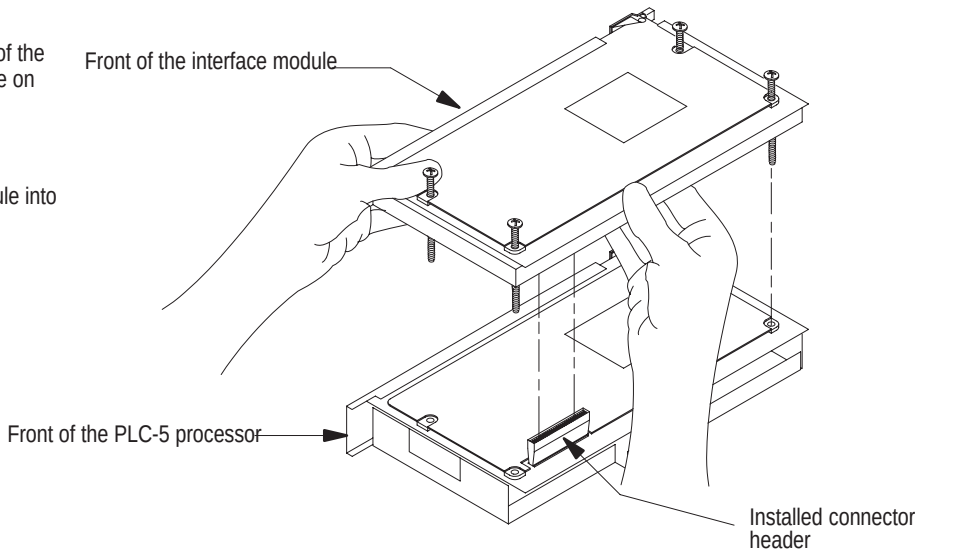
Do not use excessive force on the connector header when seating it into the processor.

You do not need to key the connector.

Connect the Interface Module to the Processor

Lay the processor on a flat surface and follow these steps to connect the interface module to the processor:

1. Align the pins and holes of the interface module to those on the connector header.
2. Press the interface module into the connector header.
3. Tighten the screws.



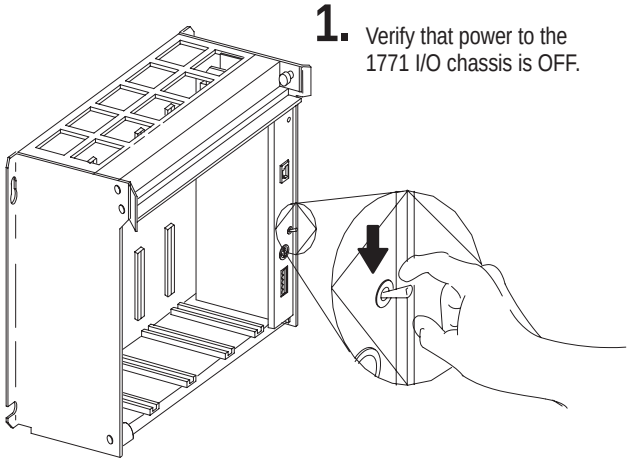
Important: Make sure you carefully align the pins and holes before you press the interface module into the connector header. If you improperly align them, you will bend the connector header pins.

Install the Processor/Interface Module into the Chassis

To install the attached modules into the 1771 I/O chassis, follow these steps:

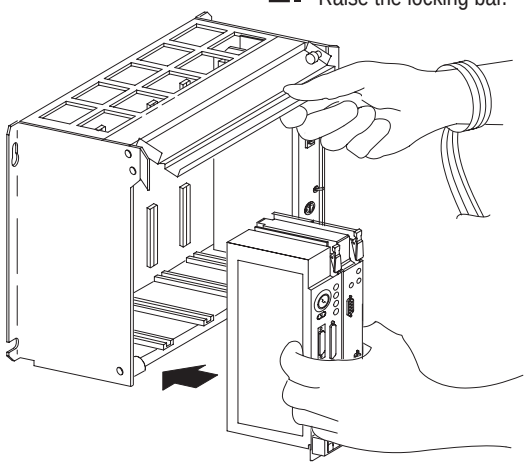
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1. Verify that power to the 1771 I/O chassis is OFF.

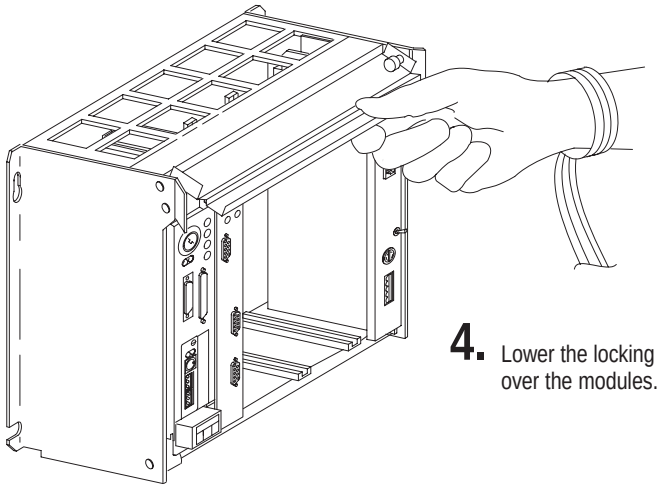


Remember to wear a grounding wrist strap to guard against ESD.

2. Raise the locking bar.



3. Insert the module combination into the 1771 I/O chassis in the left-most slots and slide along the the card guides.



4. Lower the locking bar into place over the modules.

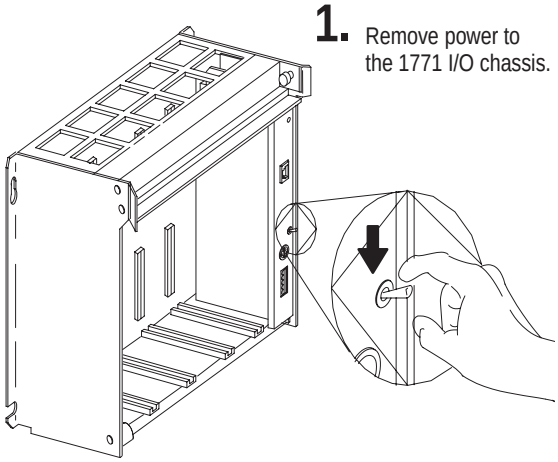
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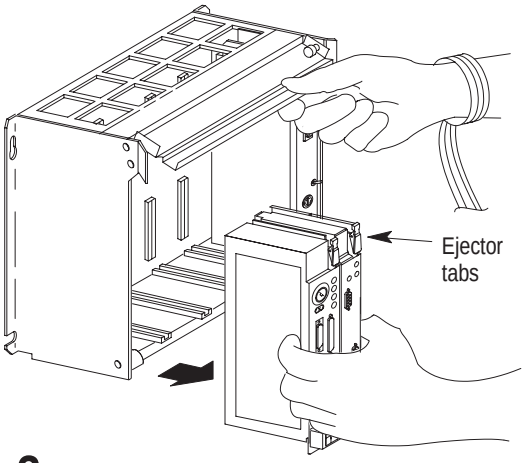
Removing the Interface Module

To remove the interface module from its installed position, follow the instructions below.

1. Remove power to the 1771 I/O chassis.



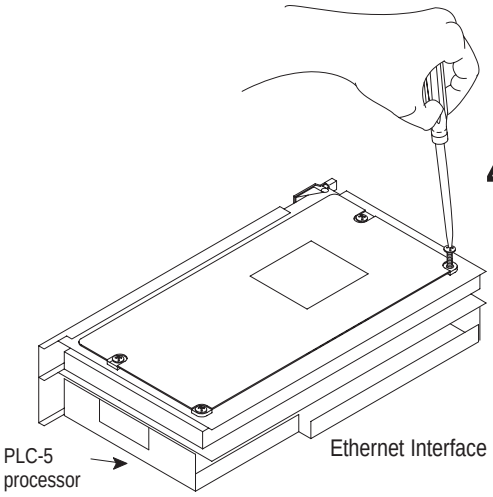
2. Lift the locking bar up and away from the processor and interface module.



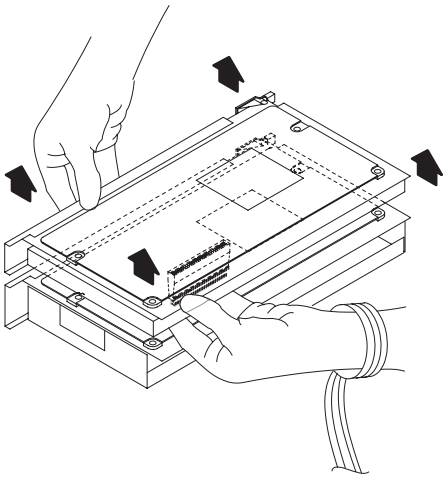
Remember to wear a grounding wrist strap to guard against ESD.

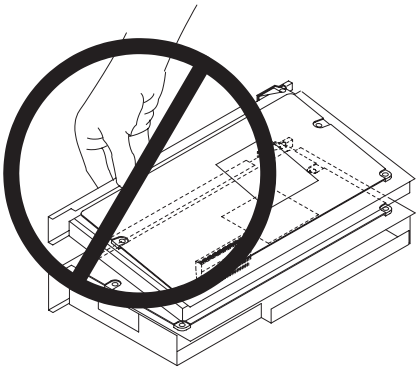
3. Lift the ejector tabs on the front of each module simultaneously and remove the connected modules.

4. Loosen the four screws on the side of the interface module.



5. Separate the interface module from the processor by placing your finger tips between the two modules. Pull directly and evenly upward.





Do not pry the interface module away from the processor by pulling on one corner or side. You will bend the connector header's pins.

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Configuring the Interface Module for Ethernet Communication

Using This Chapter

For information about:	See page:
Before you begin	3-1
Configuring channel 3A	3-2
Specifying Ethernet-Specific information	3-2
Manually entering module configuration information	3-2
Using BOOTP to enter configuration information	3-4

Before You Begin

Before configuring channel 3A for Ethernet communication, be sure to:

- know the Ethernet hardware address (see page 2-2)
- assign an IP address to the module

Because the PLC-5 Ethernet interface module uses the TCP/IP protocol, each Ethernet hardware address on the network requires a unique IP address.

If the interface module is connected to	You must assign
an Ethernet PLC-5 processor	two (2) IP addresses: • one for the PLC-5 processor • one for the interface module
an Enhanced PLC-5 processor	one (1) IP address for the interface module
a ControlNet PLC-5 processor	one (1) IP address for the interface module

You must assign a unique IP address for each Ethernet hardware address.

The IP address is software-configurable using either the BOOTP protocol or your programming software package. See the “Manually Entering Module Configuration Information” section on page 3-2 or the “Using BOOTP to Enter Configuration Information” section on page 3-4.

Contact your network administrator or Network Solutions Inc. (the InterNIC) for a unique IP address to assign to your Ethernet interface module. You can reach the InterNIC by dialing (703) 742-4777 or by email at HOSTMASTER@INTERNIC.NET.

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Configuring Channel 3A

Once you know the unique IP address that you will assign to the PLC-5 Ethernet Interface Module, you must configure channel 3A so your network recognizes the module.

Use your programming software package to designate channel 3A as the channel that supports the PLC-5 Ethernet interface module if you are configuring **offline** (if you are configuring online, designation is automatic)

Important: To configure the 1785-ENET module online, it must be attached to the PLC-5 processor.

Specifying Ethernet-Specific Information

Specify Ethernet-specific information for the interface module by either:

- manually entering module configuration information using the screens within your programming software package
- supplying module configuration information using a BOOTP utility (use a BOOTP server on your network and edit the BOOTPTAB file)

Manually Entering Module Configuration Information

The default for the Ethernet interface module is BOOTP enabled. You must first disable BOOTP before you can use the programming software to enter module configuration information.

To disable BOOTP and to manually enter module configuration information for channel 3A, follow the steps specified in your programming software documentation.

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Enter configuration information in the appropriate fields.

This field:	Specifies:	Configure by doing the following:
Diagnostics file	The file containing the channel's status information	Cursor to the field, type an unused integer file number (10-999), and press **[Enter]**. The system creates an integer file 44 words long. **ATTENTION:** Do not assign a diagnostic file number that is the I/O status file you assigned to another communication channel or any other used file. Unpredictable machine action can result. **Important:** You must define a diagnostics file for a channel configured for anything but unused (even if you are not using the channel) if you want status information for that channel.
Ethernet address	The interface module's Ethernet hardware address Display only.	Assigned by Allen-Bradley and cannot be changed. Displayed as a set of 6 bytes (in hex), separated by colons.
IP address	The interface module's Internet address	Cursor to the field, and enter an address in this form: a.b.c.d Where: a, b, c, d are between 1–254 (decimal) You must specify the IP address to have the interface module connect to the TCP/IP network. Do not use 0 or 255 as a, b, c, or d in the IP address.
BOOTP enable	Whether BOOTP is enabled	Cursor to the field and specify No (for manual configuration). Before you disable BOOTP, make sure you have an IP address specified. With BOOTP set to No, the interface module uses the parameters that you specify locally. To enable BOOTP, see "Using BOOTP to Enter Configuration Information" on page 3-4.
MSG conn timeout	The number of milliseconds allowed for an MSG instruction to establish a connection with the destination node	Cursor to the field, and enter a timeout period in milliseconds. (The interface module rounds to the nearest 250 ms.) The valid range for a timeout period is 0–65,535 ms. The default is 15,000 ms.
MSG reply timeout	The number of milliseconds the Ethernet interface waits for a reply to a command it initiated (through an MSG instruction)	Cursor to the field, and enter a timeout period in milliseconds. (The interface module rounds to the nearest 250 ms.) The valid range for a timeout period is 0-65,535 ms. The default is 3,000 ms.
Inactivity timeout	The number of minutes of inactivity before the connection is closed	Cursor to the field, and enter a timeout period in minutes. The valid range for a timeout period is 0–65,535 minutes. The default is 30 minutes.
Broadcast address	The broadcast address to which the processor should respond	See the *Enhanced and Ethernet PLC-5 Programmable Controllers User Manual*, publication 1785-6.5.12 for information about how to configure these advanced Ethernet functions.
Subnet mask	The processor's subnet mask (used when network has subnets)	
Gateway address	The IP address of the gateway that provides a connection to another IP network	
Link ID	A DH+ link number Use the link ID number to identify the processor when configuring a ControlLogix system using the ControlLogix Gateway software.	Enter a link ID number. The valid range is 0-199. Only enter a Link ID number if you plan to configure multihop MSG instructions through a 1756-DHRIO module in a ControlLogix chassis. See chapter 4 for more information.

After entering the channel 3A configuration information, either accept edits or access status information about channel 3A.

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Using BOOTP to Enter Configuration Information

Be sure you have assigned a diagnostics file in which to store channel status information.

BOOTP is a protocol that supplies the interface module with configuration information at power-up. BOOTP lets you dynamically assign IP addresses to devices on the Ethernet link.

To use BOOTP, a BOOTP server must exist on the local Ethernet subnet. The server is a computer (either a personal computer, VAX, or UNIX system) that has BOOTP-server software installed and reads a text file containing network information for individual nodes on the network.

To enable BOOTP, follow the steps specified in your programming software documentation to specify Ethernet configuration information. See the table on page 3-3 for field descriptions.

When BOOTP is enabled, the following events occur at power-up:

- The processor broadcasts a BOOTP-request message containing its hardware address over the local network or subnet.
- The BOOTP server compares the hardware address with the addresses in its look-up table in the BOOTPTAB file.
- The BOOTP server sends a message back to the processor with the IP address and other network information that corresponds to the hardware address it received.

With all hardware and IP addresses in one location, you can easily change IP addresses in the BOOTP configuration file if your network needs change.

Edit the BOOTPTAB Configuration File

Important: Be sure you know the Ethernet hardware address of the module. You will enter it in this file.

You must edit the BOOTPTAB file, which is an ASCII text file, to include the name, IP address, and hardware address for each Ethernet interface module you want the server to boot. To edit this file:

See an example of a BOOTPTAB file on the page 3-6.

1. Open the BOOTPTAB file using a text editor.
   - The file contains lines that look like this:
     ```
     #Default string for each type of Ethernet client
     defaults5E: ht=1:vm=rfc1048
     ```
     These are the default parameters for Ethernet PLC-5 interface module and must always precede the client lines in the BOOTPTAB file.
   - The file also contains a line that looks like this:
     ```
     sidecar: tc=default5E:ip=aa.bb.cc.dd:ha=0000BC03xxyy
     ```

Important: Use this line as the configuration template for Ethernet devices.

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2. Make one copy of the Ethernet device template for every PLC-5 Ethernet Interface Module in your system (i.e. one line per module).

3. Edit each copy of the template as follows:

   A. Replace `sidecar` with the name you assigned the Ethernet interface module. Use only letters and numbers; do not use underscores.

   B. Replace `aa.bb.cc.dd` with the IP address to be assigned to the interface module.

   C. Replace `xxyy` with the last four digits of the Ethernet hardware address. Use only valid hexadecimal digits (0–9, A–F); do not use the hyphens or colons that separate the numbers. (You will find the hardware address on a label affixed to the printed circuit board of the Ethernet interface module.)

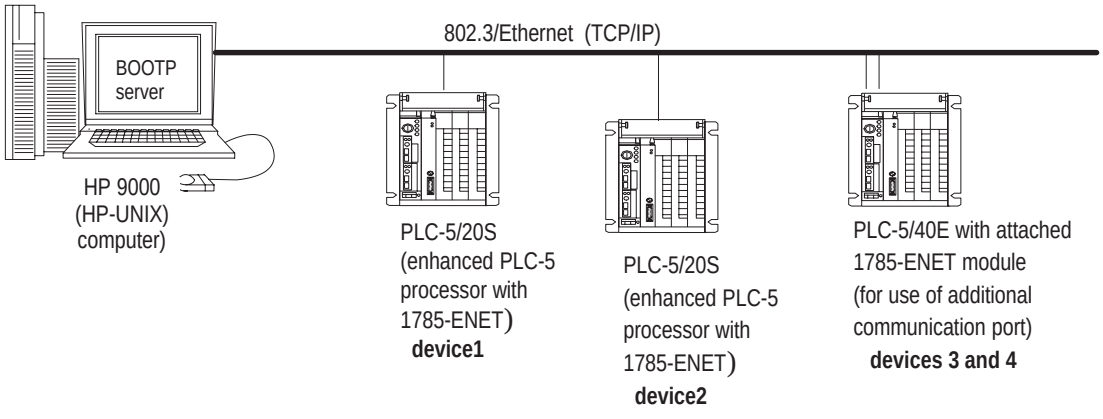
4. Save, close, and make a backup copy of this file.

The term "sidecar" in this template is a logical name used for identification in this file only. It is not associated with the stored processor name.

Example

In this example there are three PLC-5 processors (two enhanced processors and one Ethernet processor) with attached 1785–ENET interface modules and an HP 9000 workstation. The names and hardware addresses are device specific:

Device	Name	IP Address	Hardware Address
PLC-5/20S	device1	12.34.56.1	00:00:BC:03:12:34
PLC-5/20S	device2	12.34.56.2	00:00:BC:03:56:78
PLC-5/40E	device3	12.34.56.3	00:00:BC:1C:90:12
PLC-5/40S	device4	12.34.56.4	00:00:BC:03:88:27



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Based on this configuration, the BOOTPTAB file would look like this:

```
#      Legend:    gw -- gateways
#                 ha -- hardware address
#                 ht -- hardware type[1]
#                 ip -- host IP address
#                 sm -- subnet mask
#                 vm -- BOOTP vendor extensions format[2]
#                 tc -- template host

#Default string for each type of Ethernet client
defaults5E: ht=1:vm=rfc1048

#Entries for 1785-ENET modules:
device1: tc=defaults5E:ip=12.34.56.1:ha=0000BC031234
device2: tc=defaults5E:ip=12.34.56.2:ha=0000BC035678
device4: tc=defaults5E:ip=12.34.56.4:ha=0000BC038827

#Entries for Ethernet PLC-5 processors:
device3: tc=defaults5E:ip=12.34.56.3:ha=0000BC1C9012
```

1. 1 = 10MB Ethernet
2. use rfc1048

Run your BOOTP server utility and then cycle power on the chassis that contains the Ethernet interface module. This sends the configuration information to the Ethernet sidecar module.

If you do not have access to a BOOTP server, Rockwell Automation offers a BOOTP tool on http://www.ab.com/networks

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Communicating via the Interface Module

Using This Chapter

Once the PLC-5 Ethernet interface module is connected and configured, the interface module and the processor function as one unit.

For information about:	See page:
Applying power to the chassis	4-1
Monitoring the LEDs	4-1
Establishing an Ethernet connection	4-3
Monitoring Ethernet status data	4-4
Using the MSG instruction	4-5
Communicating with ControlLogix Devices	4-6
Interpreting error codes	4-7
Identifying the interface module within a network	4-9
Saving/restoring programs	4-9

Applying Power to the Chassis

After installing the interface module into the chassis and configuring channel 3A for Ethernet communication, apply power to the 1771 I/O chassis. Upon power-up, the PLC-5 Ethernet interface module performs the following functions:

- establishes communication with the PLC–5 processor
- broadcasts BOOTP requests (if BOOTP is enabled; see page 3-4)

Monitoring the LEDs

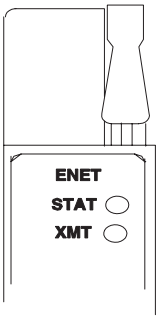
If your module is operating correctly, you see these LED indications:

- Status LED remains lit green
- Ethernet Transmit LED briefly lights green when transmitting packets

If the LEDs do not indicate the above normal operation, see the following table for an explanation of indicator lights.

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Monitor the series of blinks to determine the fault code. Count the first and last series of slow blinks, disregarding the series of fast blinks between the slow series.



Indicator	Color	Description	Probable Cause	Recommended Action
STAT	Solid red	Critical hardware fault	Interface module requires internal repair	Contact your local Allen-Bradley distributor
	Blinking red	Hardware or software fault (detected and reported via a code)	Fault-code dependent	See Appendix D
	Off	Ethernet interface is functioning properly but it is not attached to an active Ethernet network	Normal operation	Attach the processor and interface module to an active Ethernet network
	Green	Ethernet channel 3A is functioning properly and has detected that it is connected to an active Ethernet network	Normal operation	No action required
XMIT	Green	Lights (green) briefly when the Ethernet port is transmitting a packet. It does not indicate whether or not the Ethernet Port is receiving a packet.		

Important: The interface module will flash the indicator lights as shown in Appendix D. The processor may fault even though the interface module does not.

The table below lists all major processor fault codes pertinent to a sidecar module, such as the Ethernet interface module. For a complete list of fault codes for PLC-5 processors, see the *Enhanced and Ethernet PLC-5 Programmable Controllers User Manual*, publication 1785-6.5.12.

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Fault Code	Description
91	Sidecar module undefined message type.
92	Sidecar module requesting undefined pool.
93	Sidecar module illegal maximum pool size.
94	Sidecar module illegal ASCII message
95	Sidecar module reported fault, which may be the result of a bad program that corrupts memory or of a hardware failure.
96	Sidecar module not physically connected to the PLC-5 processor.
97	Sidecar module requested a pool size that is too small for PCC command (occurs at power-up)
98	Sidecar module first/last 16 bytes RAM test failed
99	Sidecar module-to-processor data transfer faulted
100	Processor-to-sidecar module transfer failed
101	Sidecar module end of scan transfer failed
102	The file number specified for raw data transfer through the sidecar module is an illegal value
103	The element number specified for raw data transfer through the sidecar module is an illegal value
104	The size of the transfer requested through the sidecar module is an illegal size
105	The offset into the raw transfer segment of the sidecar module is an illegal value
106	Sidecar module transfer protection violation; for PLC-5/26, -5/46, and -5/86 processors only.

Establishing an Ethernet Connection

The Ethernet interface module supports 64 simultaneous connections per module. A connection is a unique path to an end device, such as a ControlNet PLC-5 processor on a ControlNet link attached via a 1756-CNB module. Each unique path uses a different connection. There is an exception for a PLC-5 processor on a DH+ link attached via a 1756-DHRIO module. Each 1756-DHRIO module uses only one connection, regardless of how many devices are attached to it and how many paths you define to those devices.

Multiple MSG instructions can use the same path to a device, but only one connection is used because the path is the same.

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Monitoring Ethernet Status Data

Monitor the status of communication through the PLC-5 Ethernet interface module by accessing the Ethernet Channel 3A status screen.

Be sure you have assigned a diagnostics file before you try to monitor channel 3A. See page 3-4.

The diagnostic counter data displayed is stored in the diagnostics file you defined on the Ethernet Channel 3A configuration screen (see page 3-3).

Status field:		Bytes:	Displays the number of:
Commands	sent	0-3	Commands sent by the channel
	received	4-7	Commands received by the channel
Replies	sent	8-11	Replies sent by the channel
	received	12-15	Replies received by the channel
	sent with error	16-19	Replies containing errors sent by the channel
	received with error	20-23	Replies containing errors received by the channel
	timed out	24-27	Replies not received within the specified timeout period
Ethernet	in octets	28-31	Octets received on the channel
	out octets	32-35	Octets sent on the channel
	in packets	36-39	Packets received on the channel, including broadcast packets
	out packets	40-43	Packets sent on the channel, including broadcast packets
	alignment errors	44-47	Frames received on the channel that are not an integral number of octets in length
	FCS errors	48-51	Frames received on the channel that do not pass the FCS check
	carrier sense errors	52-55	Times that the carrier sense condition was lost or never asserted while trying to transmit a frame
	excessive collisions	56-59	Frames for which a transmission fails due to excessive collisions
	excessive deferrals	60-63	Frames for which a transmission is deferred for an excessive period of time
	MAC receive errors	64-67	Frames for which reception on an interface fails due to internal MAC sublayer receive error
	MAC transmit errors	68-71	Frames for which reception on an interface fails due to internal MAC sublayer transmission error
	single collisions	72-75	Successfully transmitted frames for which transmission was delayed because of collision
	multiple collisions	76-79	Successfully transmitted frames for which transmission was delayed more than once because of collision
	deferred transmissions	80-83	Frames for which the first transmission attempt is delayed because the medium is busy
	late collisions	84-87	Times that a collision is detected later than 512 bit-times into the transmission of a packet

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Using the MSG Instruction



The message (MSG) instruction transfers up to 1000 elements of data; the size of each element depends on the data table section that you specify and the type of message command that you use. One binary element contains one 16-bit word, for example, and one floating-point element contains two 16-bit words.

The MSG instruction transfers data in packets. Each packet can contain up to 709 words for Ethernet processors and interface modules. If your message transfer contains more words than fit in one packet, the transfer requires more than one packet of transfer data. The more packets of data to transfer, the longer the total transfer takes.

Entering Parameters

The control block is where all of the information relating to the message is stored. Ethernet message instructions use two consecutive control blocks:

This block	Contains
first	message information
second	destination address

Important: Because Ethernet messages need two consecutive control blocks, the message control block that you specify must start on an even number.

Use your programming software package to enter the control block address. After entering the control block, the programming terminal automatically displays a data entry screen, from which you enter instruction parameters that are stored at the control block address.

This Parameter:	Specifies:
Command Type	Whether the MSG instruction performs a read or write operation. The software toggles between: PLC-5 Typed Read, PLC-5 Typed Write, PLC-5 Typed Write to SLC, PLC-5 Typed Read from SLC, SLC Typed Logical Read, SLC Typed Logical Write, PLC-2 Unprotected Read, PLC-2 Unprotected Write, PLC-3 Word Range Read, and PLC-3 Word Range Write.
PLC-5 Data Table Address	The data file address of the processor containing the message instruction. If the MSG operation is write, this address is the starting word of the source file. If the MSG operation is read, this address is the starting word of the destination file.
Size in Elements	The number of elements (1 – 1000) to be transferred.
Destination Address	The starting address of the source or destination file in the target processor.
Port Number	The channel for message communications. Communications through the Ethernet interface module use channel 3A.

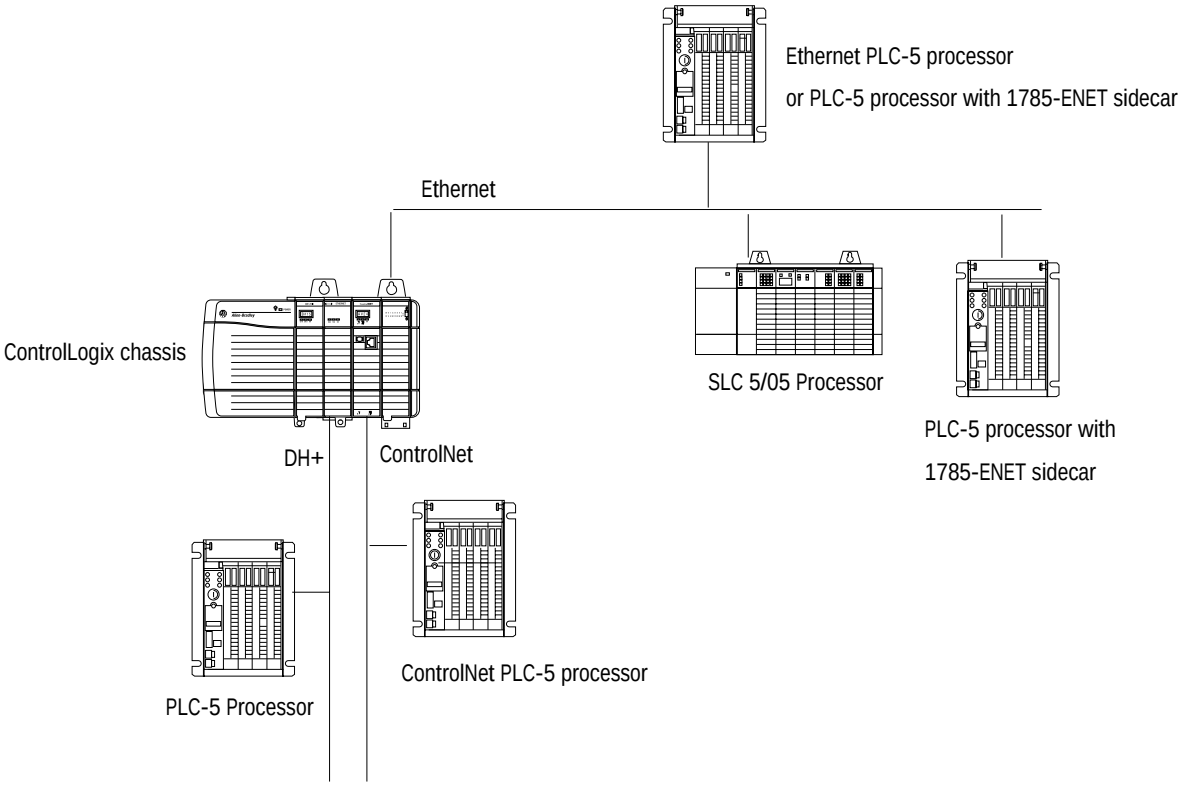
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When you enter 3A as the port number, an Ethernet instruction entry screen appears. In addition to the information you entered previously this screen includes a field for entering the Host/Internet (IP) address. Enter the IP address of the destination processor here.

This Parameter:	Specifies:
IP Address	The MSG instruction's destination node. • If the destination is a PLC-5/20E, -5/40E, -5/80E, or another 1785-ENET-equipped PLC-5 processor, the destination must be a full IP address • If the destination is an INTERCHANGE client program, type "CLIENT" in the Destination Node field. **Important:** You must set the port number to 3A in order to access this function.

Communicating with ControlLogix Devices

The Ethernet interface module, series A, revision E and later, with a PLC-5 processor can communicate over Ethernet with ControlLogix devices or through a ControlLogix Ethernet (1756-ENET) module to other PLC-5 processors. The following diagram shows an Ethernet PLC-5 processor (or PLC-5 processor with a 1785-ENET sidecar module) and the other PLC and SLC processors it can communicate with using a multihop MSG instruction.



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To communicate through a ControlLogix 1756-ENET module, you configure the multihop feature of a MSG instruction from the Ethernet PLC-5 processor (or PLC-5 processor with 1785-ENET sidecar module) to the target device. You need RSLogix 5 programing software. For more information, see the MSG instruction in the *PLC-5 Programmable Controller Instruction Set Reference Manual*, publication 1785-6.1.

If you want to go through the ControlLogix 1756-ENET module and out the 1756-DHRIO module to the target device, you:

- use Gateway configuration software to configure the 1756-DHRIO module routing table in the ControlLogix system.
- specify a Link ID number on channel properties for channel 2/3A of the Ethernet PLC-5 processor (or PLC-5 processor with a 1785-ENET sidecar module).

For information on specifying the path of the MSG instruction, see the documentation for your programming software.

Interpreting Error Codes

When the processor/interface module detects an error during the transfer of message data, the processor sets the .ER bit and enters an error code that you can monitor from your programming software.

Code (Hexadecimal - Word 1 of the control block)	**Description** (Displayed on the data monitor screen)
0010	No IP address configured for the network
0011	Already at maximum number of connections
0012	Invalid internet address or host name
0013	No such host
0014	Cannot communicate with the name server
0015	Connection not completed before user-specified timeout
0016	Connection timed out by the network
0017	Connection refused by destination host
0018	Connection was broken
0019	Reply not received before user-specified timeout
001A	No network buffer space available
0037	Message timed out in local processor
0083	Processor is disconnected
0089	Processor's message buffer is full
0092	No response (regardless of station type)
00D3	Control block formatted incorrectly

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Code (Hexadecimal - Word 1 of the control block)	**Description** (Displayed on the data monitor screen)
00D5	Incorrect address for the local data table
0500	Message timed out waiting for a response from a client
1000	Illegal command specified in MSG instruction.
2000	Error communicating with a client
3000	Client session has disconnected
4000	Processor connected but faulted (hardware)
5000	Client generated an error converting data.
6000	Requested function is not available. Client's unsolicited handler returned an error.
7000	Processor is in program mode
8000	Processor's compatibility file does not exist
9000	Client's backlog has been exceeded
B000	Processor is downloading so it is inaccessible
F001	Processor incorrectly converted the address
F002	Incomplete address
F003	Incorrect address
F006	Addressed file does not exist in target processor
F007	Destination file is too small for number of words requested
F00A	Target processor cannot put requested information in packets
F00B	Privilege error, access denied
F00C	Requested function is not available
F00D	Request is redundant
F011	Data type requested does not match data available
F012	Incorrect command parameters

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Identifying the Interface Module within a Network

The PLC-5 Ethernet Interface Module supports the Simple Network Management Protocol (SNMP).

The module responds automatically to SNMP requests and maintains a Management Information Base (MIB) file (Level II). Information kept in this file could include for example:

- number of datagrams received
- number of fragmented packets received
- maximum number of TCP connections allowed

See Appendix C for more details.

Saving and Restoring Programs

You can physically and logically save and restore all programs, provided you are using:

- any release of RSLogix 5 programming software
- AI Programming Software, release 7.21 or later, for all logical saves/restores
- 6200 Series Programming Software, release 5.2 or later, for all logical saves/restores
- an enhanced PLC-5 processor, series B or later

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Module Specifications

PLC-5 Ethernet Interface Module (1785-ENET)

Backplane Current	2.2A	
Heat Dissipation	37.54 BTU/hr	
Environmental Conditions	Operating Temperature	0 to 60° C (32–140° F)
	Storage Temperature	–40 to 85° C (–40 to 185° F)
	Relative Humidity	5 to 95% (without condensation)
Shock	Operating	30 g peak acceleration for 11±1 ms duration
	Non-operating	50 g peak acceleration for 11±1 ms duration
Vibration (operating and non-operating)	2 g @ 10 to 500 Hz 0.012 inches peak-to-peak displacement	
Hardware Addressing	Module communicates through processor channel 3A. It does not communicate across the 1771 I/O backplane	
Communication	Ethernet (TCP/IP protocol, 15-pin AUI transceiver port)	
Connections	64 simultaneous connections per module 512 unsolicited definitions per module (used by RSLinx and INTERCHANGE software packages)	
Location	1771-A1B, -A2B, -A3B, -A3B1, -A4B chassis, second left-most slot, attached to the processor.	
Keying	none	
Weight	0.95 kg (2.1 lbs)	
Agency Certification (when product or packaging is marked)	• CSA Class I, Division 2, Groups A, B, C, D • UL listed • CE marked for all applicable directives	

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Performance Data

PLC-5 Ethernet Interface Module (1785-ENET)

The following tables show measured performance data for the 1785-ENET module.

PLC-to-PLC (1 active MSG instruction)

Operation:	Words:	MSG per second:	ms per MSG:	Words per second:
read	1	20.2	49.5	20
read	20	19.8	50.5	396
read	100	18.8	53.2	1,880
read	1000	10.6	94.3	10,600
write	1	21.4	46.7	21
write	20	21.3	46.9	426
write	100	20.4	49.0	2,040
write	1000	11.4	87.7	11,400

Workstation-to-PLC (Solicited Asynchronous)

Operation:	Words:	MSG per second:	ms per MSG:	Words per second:
read	1	99.3	10.1	99
read	20	96.8	10.3	1,936
read	100	90.7	11.0	9,070
read	1000	54.7	18.2	54,700
write	1	102.6	9.7	102
write	20	100.4	10.0	2,008
write	100	94.0	10.6	9,400
write	1000	49.8	20.1	49,800

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Workstation-to-PLC (Solicited Synchronous)

Operation:	Words:	MSG per second:	ms per MSG:	Words per second:
read	1	45.8	21.8	45
read	20	43.6	22.9	872
read	100	41.8	23.9	4,180
read	1000	23.3	42.9	23,300
write	1	45.4	22.0	45
write	20	44.3	22.6	886
write	100	41.7	24.0	4,170
write	1000	21.9	45.7	21,900

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SNMP Management Information Base (MIB) II Data Groups

Simple Network Management Protocol (SNMP) specifies the diagnostic data that a host computer must maintain for a network management software to access. Hosts typically keep statistics on the status of their network interfaces, incoming and outgoing traffic, dropped datagrams, and error messages generated. Network management protocols let network management software access these statistics.

MIB II is the SNMP standard for the management of network data. The following tables list the MIB II data items and their definitions.

Group:	MIB:	Description:
System	sysDescr	description of device
	sysObjectID	identity of agent software
	sysUpTime	how long ago the agent started
	sysName	device name
	sysServices	services offered by the device
Interfaces	ifIndex	interface number
	ifDescr	description of the interface
	ifType	type of interface
	ifMTU	MTU size
	ifSpeed	transmission rate in bits/second
	ifPhysAddress	media specific address
	ifAdminStatus	desired interace state
	ifOperStatus	current interface state
	ifLastChange	how long ago interface changes state
	ifInOctets	total octets received from the data
	ifUcasPackets	broadcast/multicast packets delivered above
	ifInDiscards	packets discarded due to resource limitations
	ifInErrors	packets discarded due to format
	ifUnknownProtos	packets destined for unknown protocols

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Group:	MIB:	Description:
Interfaces (continued)	ifOutOctets	total octets sent on the media
	ifOutOcastPkts	unicast packets from above
	ifOutNUcastPkts	broadcast/multicast packets from above
	ifOutDiscards	packets discarded due to resource limitations
	ifOutErrors	packets discarded due to errors
	ifOutQlen	packet size of output queue
	ifSpecific	MIB-specific pointer
UDP	udpIndataGrams	datagrams delivered above
	udpNoPorts	datagrams destined for unknown ports
	udpInErrors	datagrams discarded due to format errors
	udpOutDatagrams	datagrams sent from above
	udpLocalAddress	local IP address
	udpLocalPort	local UDP port
IP	ipForwarding	acting as a gateway or host
	ipDefaultTTL	default TTL for IP packets
	ipInReceives	total datagrams from below
	ipInHdrErrors	datagrams discarded due to format errors
	ipInAddrErrors	datagrams discarded due to misdelivery
	ipForwDatagrams	datagrams forwarded
	ipUnknownProtos	datagrams destined for unknown protocols
	ipInDiscards	datagrams discarded due to resource limitations
	ipInDelivers	datagrams delivered above
	ipOutRequests	datagrams from above
	ipOutNoRoutes	datagrams discarded due to no route
	ipReasmTimeout	timeout value for reassmebly queue
	ipRouteDest	destination IP address
	ipRouteflIndex	interface number
	ipRouteMetric1	routing metric number 1
	ipRouteMetric2	routing metric number 2
	ipRouteMetric3	routing metric number 3
	ipRouteMetric4	routing metric number 4
	ipRoutenextHop	next hop (gateway IP address for indirect routing)
	ipRouteType	type (direct, remote, valid, invalid)

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Group:	MIB:	Description:
IP (continued)	ipRouteProto	mechanism used to determine route
	ipRouteAge	age of route in seconds
	ipRouteMask	subnet mask for route
	ipNetToMediaflIndex	interface number
	ipNetToMediaPhysAddress	media address of mapping
	ipNetToMediaNetAddress	IP address of mapping
	ipNetToMediaType	how mapping was detemined
	ipReasmReqds	fragments received needing reassembly
	ipReasmOKs	datagrams successfully reassembled
	ipReasmFails	reassembly failure
	ipFragOKs	datagrams successfully fragmented
	ipFragCreates	fragments created
	ipAdEntAddr	the IP address of this entry
	ipAdEntflIndex	interface number
	ipAdEntNetMask	subnet mask for IP address
	ipAdEntBcastAddr	LSB of IP broadcast address
	ipAdEntReasMaxSize	the largest IP datagram able to be reassembled
ICMP	26 counters	two counters for each ICMP message type
TCP	tcpRtoAlgorithm	identifies retransmission algorithm
	tcpRtoMin	minimum retransmission timeout in milliseconds
	tcpRtoMax	maximum retransmission timeout in milliseconds
	tcpmaxConn	maximum of simultaneous TCP connections allowed
	tcpActiveOpens	number of active opens
	tcpPassiveOpens	number of passive opens
	tcpAttemptFails	number of failed connection attempts
	tcpEstabResets	number of connections reset
	tcpCurrEstab	number of current connections

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Group:	MIB:	Description:
TCP (continued)	tcpInSegs	number of segments received
	tcpOutSegs	number of segments sent
	tcpRetransSegs	number of segments retransmitted
	tcpInErrors	number of segments discarded due to format errors
	tcpOutRsts	number of resets generated
	tcpConnState	state of connection
	tcpConnLocalAddress	local IP address
	tcpConnLocalPort	local TCP port
	tcpConnRemAddress	remote IP address
	tcpConnRemPort	remote TCP port

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Status LED Error Codes

Interpreting LED Error Codes

When the status LED blinks red, it signals that a hardware or software fault has been detected and it reports that error via a code. This code is a two-digit fault code signalled by a flash sequence. First, the LED begins the sequence with ten rapid flashes. Then the LED signals the first digit of the code by a number of slow flashes. Approximately two seconds after the LED displays the first digit, the LED displays the second digit. This sequence repeats itself until the module is either reset or replaced.

Code	Description
01	General 68000 test failure
02	Bus error
03	Address error
04	Illegal instruction
05	Divide by zero
06	CHK instruction
07	TRAPV instruction
08	Privileged instruction
09	Trace trap
10	Line 1010 instruction
11	Line 1111 instruction
12	Hardware breakpoint
13	Coprocessor violation
14	Uninitialized interrupt
15	Format error
16	Autovector interrupts
24	Spurious interrupt
25	TRAP in instruction
26	Unassigned user
27	Unassigned reserved
31	OS area checksum not valid
32	Static RAM self-test failed
33	Jump table wrong

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Code	Description
34	SONIC chip test failed
35	FLASH BOOT area checksum incorrect
36	PLC-5 dualport initialization failure
37	PLC-5 not compatible with 1785-ENET
41	Could not read FLASH id
42	Could not erase FLASH bank
43	Could not program FLASH bank
51	Software initialization failure
52	ENET firmware hardware fault
53	ENET software failure
54	Network system failure
61	Lump system call failed
62	Lump internal inconsistency
63	PCCC system call failed
64	PCCC internal inconsistency
65	Dual port system call failed
66	Dual port internal inconsistency
67	ISR system call failed
68	ISR internal inconsistency
71	AC power fail
72	Reset asserted
73	Fault asserted
74	Watchdog timeout
75	Unknown NMI

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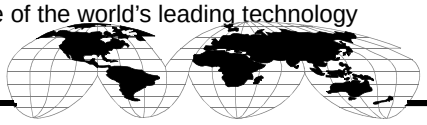
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