Allen-Bradley

ControlLogix Ethernet Communication Interface Module

1756-ENET/B

User Manual

Rockwell Automation

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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

WARNING

Identifies information about practices or circumstances that have the potential to create an explosion hazard.

ATTENTION

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

Warning and Attention statements help you to:

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

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

European Communities (EC) Directive Compliance

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

EMC Directive

This product is tested to meet the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying 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 Allen-Bradley publication Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

Open style devices must be provided with environmental and safety protection by proper mounting in enclosures designed for specific application conditions. See NEMA Standards publication 250 and IEC publication 529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

Rockwell Automation Support

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For presales support, call 1 440 646-3NET.

You can also obtain technical assistance online from the following Rockwell Automation WEB sites:

- www.ab.com/mem/technotes/kbhome.html (knowledge base)
- www.ab.com/networks/eds (electronic data sheets)

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.

About This User Manual

What this Preface Contains

This preface describes how to use this manual. The following table describes what this preface contains and where to find specific information.

For information about	See page
Who Should Use This Manual	P-1
Common Techniques Used in This Manual	P-2
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Who Should Use This Manual

This manual is intended for control engineers and technicians who are installing, programming, and maintaining a control system that communicates on an Ethernet network through a 1756-ENET/B module.

We assume you have a good understanding of Ethernet and the (TCP/IP) protocol. This user manual contains a brief description of Ethernet and TCP/IP in Chapter 3. For detailed information on TCP/IP protocol and networking in general, see the following publications:

- Comer, Douglas E. Internetworking with TCP-IP, Volume 1: Protocols and Architecture, 2nd ed. Englewood Cliffs, N.J.: Prentice-Hall, 1995. ISBN 0-13-216987-8.
- Tanenbaum, Andrew S. Computer Networks, 2nd ed. Englewood Cliffs, N.J.: Prentice-Hall, 1989. ISBN 0-13-162959-*X*.

Common Techniques Used in This Manual

The following conventions are used throughout this manual:

- Bulleted lists provide information, not procedural steps.

- Numbered lists provide sequential steps.

- Information in **bold** contained within text identifies menu windows, or screen options, screen names and areas of the screen, such as dialog boxes, status bars, radio buttons and parameters.

TIP

This symbol identifies helpful tips.

This is a definition box. When a word is bold within the text of a paragraph, a definition box will appear in the left margin to further define the text.

A **definition box** defines terms that may be unfamiliar to you.

Screen captures are pictures of the software's actual screens. The names of screen buttons and fields are often in bold in the text of a procedure. Pictures of keys represent the actual keys you press.

How To Use This Manual

This manual provides an overview of the 1756-ENET/B module, as well as general information about Ethernet. It describes how to install and configure the module, and provides three example applications showing how to use the module to communicate over Ethernet.

The example applications are intended as building blocks to help you get your own network up and running. We recommend that you set up and run the example applications and use them as a guide for setting up your own system.

About the Example Applications

The example applications presented in this manual are as follows:

- Rack Optimized I/O (chapter 5)

- Using Analog I/O with Direct Connection (chapter 6)

- Produced and Consumed tags (chapter 7)

Here's an example of the type of system you'll be creating for I/O applications:

System Components

We used the following components for the example applications:

Quantity	Product Name	Catalog Number
	Hardware	
2	ControlLogix chassis	1756-A4, (or -A7, -A13, -A13, -A17)
2	ControlLogix power supply	1756-PA72, (or -PB72)
2	Ethernet Communications Interface Module	1756-ENET/B
2	Logix5550 controller	1756-L1
1	Analog Output Module	1756-OF8
1	Digital Input Module	1756-IB16I
1	Digital Output Module	1756-0B16I
1	Personal computer that supports RSLogix 5000 software	Any appropriate model running Windows NT 4.0, Service Pack 5 or higher
1	Ethernet switch	Refer to manufacturer's specifications
	Associated media and connectors as needed	
	Software	
1	RSLinx	9355-WAB, -WAB0EM, -WABC
1	RSLogix 5000 programming software	9324-RLD300ENE

Where to Find More Information

Refer to the following Rockwell publications as needed for additional help when setting up and using your network.

For information about	See this publication	Publication number
Using Ethernet for Industrial Control	Ethernet/IP Performance and Application Guide	ENET-AP001A-EN-P
Ethernet Media	Ethernet/IP Cable Planning and Installation Guide	ENET-IN001A-EN-P
1756-ENET/B module	ControlLogix Ethernet Communication Module Installation Instructions	1756-IN015B-EN-P
ControlLogix Chassis	ControlLogix Chassis Installation instructions	1756-5.69 (Series A) 1756-5.80 (Series B)
ControlLogix power supplies	ControlLogix Power Supplies Installation Instructions	1756-5.67 (PA72/PB72) 1756-5.78 (PA75/PB75)
Logix5550 programmable controllers	Logix5550 Controller User Manual	1756-6.5.12
ControlLogix Analog I/O modules	ControlLogix Analog I/O Users Manual	1756-6.5.9
ControlLogix Digital I/O modules	ControlLogix Digital I/O Users Manual	1756-6.5.8
RSLogix 5000 programming software	Getting Results with RSLogix5000	9399-RLD300GR
RSLinx Lite software	RSLinx Lite User's Guide	9399-WAB32LUG

TIP	Many of the above publications are available online from the Automation Bookstore:
▶	http://www.theautomationbookstore.com.

TIP	For more information about Rockwell Software products, visit the Rockwell Software internet site:
▶	http://www.software.rockwell.com.

Terminology

This term	Means
bandwidth	The transmission capacity of the network, expressed in bits per second. Traditional Ethernet has a 10Mbit bandwidth. Fast Ethernet is 100Mbit.
BootP	BootP (Bootstrap Protocol) is a low-level protocol that provides configurations to other nodes on a TCP/IP network. BootP configuration files let you automatically assign IP addresses to an Ethernet module (you can also obtain subnet masks and gateway addresses from BootP). The Ethernet module factory default is BootP enabled. Upon powerup, the module sends a message containing its hardware address to the BootP server on the network. The server is a computer with BootP server software installed. The server compares that hardware address to those in its lookup table in the configuration file and sends a message back to the module with the appropriate IP address.
bridge	An internetwork node between two similar communication subnets where protocol translation is minimal.
CIP	Control and Information Protocol, the Ethernet/IP application layer. CIP uses the "producer/consumer" networking model. In this model one producer broadcasts (multicasts) the data once to all the consumers. All consumers see the data simultaneously, and may choose whether to consume (receive) the data or not. Delivery time is consistent, no matter how many consumers there are.
consumer	A destination device in the CIP networking model. See CIP.
CSMA/CD	Carrier Sense Multiple Access/Collision Detection. The access method used in Ethernet. When a device wants to gain access to the network, it checks to see if the network is quiet (senses the carrier). If it is not, it waits a random amount of time before retrying. If the network is quiet and two devices access the line at exactly the same time, their signals collide. When the collision is detected, they both back off and each waits a random amount of time before retrying.
determinism	The ability to predict when information will be delivered. Important in time critical applications.
DHCP	The Dynamic Host Configuration Protocol (DHCP) is an Internet protocol, similar to BootP, for automating the configuration of computers that use TCP/IP. DHCP can be used to automatically assign IP addresses, to deliver TCP/IP stack configuration parameters such as the subnet mask and default router, and to provide other configuration information such as the addresses for printer, time and news servers.
DNS	The Domain Name System (DNS) is a hierarchical, distributed method of organizing the name space of the Internet. The DNS administratively groups hosts into a hierarchy of authority that allows addressing and other information to be widely distributed and maintained. A big advantage to the DNS is that using it eliminates dependence on a centrally-maintained file that maps host names to addresses.
Ethernet	A physical layer standard using Carrier Sense Multiple Access with Collision Detection (CSMA/CD) methods.

This term	Means
Ethernet network	A local area network designed for the high-speed exchange of information between computers and related devices.
Ethernet/IP	Ethernet Industrial Protocol. Ethernet/IP applies a common application layer (CIP) over Ethernet by encapsulating messages in TCP/UDP/IP.
explicit messaging	Non-time critical messaging used for device configuration and data collection, such as downloading programs or peer-to-peer messaging between two PLCs.
fast Ethernet	Ethernet operating at 100Mbps/second.
full duplex	A mode of communication that allows a device to send and receive information at the same time, effectively doubling the bandwidth.
fully qualified domain name	A Fully Qualified Domain Name (FQDN) is a domain name that includes all higher level domains relevant to the entity named. If you think of the DNS as a tree-structure with each node having its own label, a Fully Qualified Domain Name for a specific node would be its label followed by the labels of all the other nodes between it and the root of the tree. For example, for a host, a FQDN would include the string that identifies the particular host, plus all domains of which the host is a part up to and including the top-level domain (the root domain is always null). For example, PARIS.NISC.SRI.COM is a Fully Qualified Domain Name for the host at 192.33.33.109.
gateway	A module or set of modules that allows communications between nodes on dissimilar networks.
host name	The Host Name is the unique name for a computer within its domain. It's always the first element of a full name, and, with its domain and top-level domain suffix, creates the unique name of that computer on the Internet. For example, let's say the foobar website is www.foobar.com. The Host Name is "www", which is not unique on the web, but is unique within the foobar domain.
	The Host Name can also refer to the Fully Qualified Domain Name, or in this example, www.foobar.com. Both naming methods seem to be used interchangeably in various documents. For the purposes of this document, the Host Name will refer to the FQDN, or as in this example, www.foobar.com.
hub	A central connecting device that joins devices together in a star configuration. Hubs are generally not suitable for use in I/O control systems, since they are time critical applications that cannot tolerate lost packets.
implicit messaging	Real time messaging of I/O data.
IP	Internet Protocol that provides the routing mechanism for messages. All messages contain not only the address of the destination station, but the address of a destination network, which allows messages to be sent to multiple networks within an organization or around the world.

This term	Means
IP address	32-bit identification number for each node on an Internet Protocol network. These addresses are represented as four sets of 8-bit numbers (numbers from 0 to 255), with periods between them. Each node on the network must have a unique IP address.
latency	The time between initiating a request for data and the beginning of the actual data transfer.
module address	A six-bit number used to uniquely identify any module on the local and extended ControlLogix backplane.
multicast	In the CIP producer/consumer model one producer multicasts (broadcasts) the data once to all the consumers.
producer	The source of information in the CIP networking model. See CIP.
rack	A physical and logical collection of application modules sharing a common power supply and backplane for module to module communication.
star configuration	A network configuration in which the devices are connected to a central hub or switch.
subnet mask	An extension of the IP address that allows a site to use a single net ID for multiple networks.
switch	A network device that cross connects devices or network segments. A switch provides each sender/receiver the full network bandwidth (2x in full duplex mode), reduces collisions, and increases determinism.
TCP	Transport Control Protocol. More reliable but slower transport protocol than UDP. Used for explicit (not time critical) messaging in Ethernet/IP.
TCP/IP	Transmission Control Protocol/Internet Protocol (TCP/IP). A transport-layer protocol (TCP) and a network-layer protocol (IP) commonly used for communication within networks and across internetworks.
transaction	An exchange of request and data and response and data.
UDP	User Datagram Protocol. Transport protocol that provides a very simple, but fast capability to send datagrams between two devices. Used for I/O (implicit) messaging in Ethernet/IP.

Table of Contents

About the 1756-ENET/B Module

What This Chapter Contains

This chapter provides an overview of the ControlLogix 1756-ENET/B module, its primary features, what it does, and how to use it. You will need to understand the concepts discussed in this chapter in order to configure your Ethernet module and use it in a control system. The following table lists where to find specific information in this chapter.

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Module Features

The 1756-ENET/B module's features include:

- use Ethernet/IP messages encapsulated within standard TCP/UDP/IP protocol
- common application layer with ControlNet and DeviceNet
- interfacing via AUI and 10 Base-T media
- removal or insertion under power
- number of modules per chassis limited only by chassis size
- communication to and from other ControlLogix modules in the same chassis
- communication supported by RSLinx software
- configurable via RSLinx or standard BootP tools
- no network scheduling required
- no routing tables required

Hardware/Software Compatibility

The 1756-ENET/B module is compatible with the following firmware versions and software releases. Contact Rockwell Automation if you need software or firmware upgrades to use this equipment.:

Product	Firmware Version/ Software Release
1756-ENET/B module	2.01 or higher
Logix 5550 Controller	6.10 or higher
RSLogix 5000 software	7.0 or higher
RSLinx software	2.2 or higher

What the Module Does

The 1756-ENET/B module performs two primary tasks:

1. Control of real time I/O data (also known as "implicit messaging") in conjunction with a Logix 5550 controller. The Ethernet module may serve as an adaptor, interfacing the I/O modules to the network, or as a scanner, sending and receiving data between the controller and the network.

2. Support of messaging data for configuration and programming information, operator interfaces, etc. (also known as "explicit messaging.").

Support of Rack Optimized and Direct Connections

The 1756-ENET/B module supports both Rack Optimized and Direct Connections. A direct connection is a real-time data transfer link between the controller and the device that occupies the slot that the configuration data references. A rack optimized connection is a grouping of data from more than one I/O module into a single block of data sent over a single connection.

Rack optimized connections reduce the total number of connections needed to transfer data when using many I/O modules in a system. The following example illustrates the benefit of rack optimized connections.

Assume you have set up a system that contains 10 discrete I/O modules in a remote ControlLogix chassis. If you use direct connections to transfer data to each of the these I/O modules, you need 10 connections to transfer all of the data, one to each of the ten I/O modules. If you use a rack-optimized connection to transfer the data, you only need a single connection – the connection to the Ethernet module.

IMPORTANT	Although rack optimized connections offer an efficient way to use resources, there are a few limitations on their use:

- You can only use rack optimized connections to send data to and from discrete digital I/O modules. Analog I/O requires direct connections.

- Rack optimized connections can contain I/O data and status information only. Additional module information, such as diagnostics, is not available through a rack-optimized connection.

- All data is sent at the same time at the RPI rate of the Ethernet module, regardless of a COS on a particular module.

See the Ethernet Performance and Application Guide, publication number ENET-AP001A-EN-P, for more information on connections.

Mixing Rack Optimized and Direct Connections

You can mix communication formats for different I/O modules in the same chassis. I/O modules set up to use Rack Optimization will communicate at the rate of the RPI (requested packet interval) configured for the 1756-ENET/B module. I/O modules configured for direct communication will communicate at their set RPI and ignore the Ethernet module's RPI.

Use of the Control and Information Protocol (CIP)

The Ethernet module uses the Control and Information Protocol (CIP). CIP is the application layer protocol specified for Ethernet/IP, the Ethernet Industrial Protocol, as well as for ControlNet and DeviceNet. It is a message-based protocol that implements a relative path to send a message from the "producing" device in a system to the "consuming" devices. The producing device contains the path information that steers the message along the proper route to reach its consumers. Since the producing device holds this information, other devices along the path simply *pass* this information; they do not need to *store* it. This has two significant benefits:

- You do not need to configure routing tables in the bridging module, which greatly simplifies maintenance and module replacement.

- You maintain full control over the route taken by each message, which enables you to select alternative paths for the same end device.

Understanding the Producer/Consumer Model

CIP uses the "producer/consumer" networking model, replacing the old source/destination (master/slave) model. The producer/consumer model reduces network traffic and increases speed of transmission. In traditional I/O systems, controllers poll input modules to obtain their input status. In the CIP system digital input modules are not polled by a controller. Instead, they produce ("multicast") their data either upon a change of state (COS) or periodically. The frequency of update depends upon the options chosen during configuration and where on the network the input module resides. The input module, therefore, is a producer of input data and the controller is a consumer of the data.

The controller can also produce data for other controllers to consume. The produced and consumed data is accessible by multiple controllers over the ControlLogix backplane and over the Ethernet network. This data exchange conforms to the producer/consumer model.

You configure the producer and consumer by creating controller scoped tags using RSLogix 5000 software (see chapter 7).

Tag Type	Description	Specify Using RSLogix5000 Software
Produced[1]	Tags that the controller produced for other nodes to consume.	Enabled for producing Number of consumers allowed
Consumed[1]	Tags whose values are produced by another controller.	Name of controller that owns the tag the local controller wants to consume Tag name or instance that the local controller wants to consume Data type of the tag to consume Update interval of how often the local controller consumes the tag data

[1] Produced and consumed tags must be controller-scoped tags of DINT or REAL data type, or in an array or structure.

Specifying the Requested Packet Interval (RPI)

The RPI is the update rate specified for a particular piece of data on the network. The RPI can be specified for an entire rack (using a rack optimized connection) or for a particular module (using direct connection). When you add a module to the I/O configuration of a controller, you must enter the RPI as a parameter. 'This value specifies how often to produce the data for that module. For example, if you specify an RPI of 50ms, it means that every 50ms the I/O module should send its data to the controller or that the controller should send its data to the I/O module.

RPIs are only used for modules that produce data. For example a local 1756-ENET/B module (i.e., an ENET/B module in the same chassis as the controller) does not require an RPI because it is not a data-producing member of the system; it is used only as a bridge to remote racks.

What's Next?

The following chapter describes how to install the Ethernet module and connect it to the network.

Installing the Ethernet Module

What This Chapter Contains

This chapter describes how to install the module in the ControlLogix chassis and connect it to the network. The following table describes what this chapter contains and where to find specific information.

Identifying Module Features

Use the following illustration to identify the external features of the 1756-ENET/B module.

Backplane Connector   Product Label

Front Panel

AUI Ethernet Connector

MAC ID Label

10BT Ethernet Connector

RXD   TXD   OK

AUI

10 BASET

1756-ENET

Side View   Front View

Insertion and Removal Under Power

The Ethernet module is designed to be installed or removed while chassis power is applied. However, please observe the following precautions.

WARNING

When you insert or remove the module while backplane power is on, or you connect or disconnect the communications connectors, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Installing the Ethernet Module

Use the following procedure to install the Ethernet module.

Preparing the Chassis for Module Installation

Before you install the Ethernet module, you must install and connect a ControlLogix chassis and power supply.

Power Supply

1756-A4 Chassis

20805-M

For information on installing these products, refer to the publications listed in the following table.

Chassis Type	Chassis Installation	Power Supply	Power Supply Installation
Series A: 1756-A4, -A7, -A10, -A13	1756-5.69	1756-PA72/B[1]	1756-5.67
		1756-PB72/B[1]	
Series B: 1756-A4, -A7, -A10, -A13	1756-5.80	1756-PA75/A[2]	1756-5.78
		1756-PB75/A[2]	

[1] Compatible with Series A chassis

[2] Compatible with Series B chassis

Determining Module Slot Location

You can install the module in any slot in the ControlLogix chassis. You can also install multiple ENET/B modules in the same chassis. The figure below shows chassis slot numbering in a 4-slot chassis. In a ControlLogix chassis slot 0 is the first slot and is always the leftmost slot in the rack (the first slot to the right of the power supply).

Inserting the Module in the Chassis

1

Align the circuit board with top and bottom guides in the chassis.

Circuit Board

2

Slide the module into the chassis. Make sure the module backplane connector properly connects to the chassis backplane.

3

The module is properly installed when it is flush with the power supply or other installed modules.

Removing or Replacing the Module (when applicable)

1

 Push on upper and lower module tabs to disengage them.

2

Slide module out of chassis.

| **IMPORTANT** | If you are replacing an existing module with an identical one, and you want to resume identical system operation, you must install the new module in the same slot. |

Wiring the Ethernet Connector

Note: If your application requires the module door to be closed, use one of the custom AUI connector cables, available in two lengths:

• 2 meters (cat. no. 1756- TC02)

• 15 meters (cat. no. 1756- TC15)

Use either an AUI or an RJ45 connector to connect to the Ethernet network. Wire the appropriate connector as shown below:

Protective Ground

9-Ctrl IN Ckt B
10-Data OUT Ckt B
11-Data OUT Ckt B
12-Data OUT Ckt B
13-Voltage Plus
14-Voltage Shield
15-Ctrl OUT Ckt B

1-Ctrl IN Ckt Shield
2-Ctrl IN Ckt A
3-Data OUT Ckt A
4-Data IN Ckt Shield
5-Data In Ckt A
6-Voltage Comm
7-Ctrl OUT Ckt A
8-Ctrl OUT Ckt Shield

1 ------ TD+
2 ------ TD-
3 ------ RD+
4 ------ NC
5 ------ NC
6 ------ RD-
7 ------ NC
8 ------ NC

AUI

RJ 45

Connecting the Module to the Ethernet Network

ATTENTION

If you connect or disconnect the Ethernet cable with power applied to the module or any device on the network, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceding.

Attach either the AUI or RJ45 connector to the matching Ethernet port.

IMPORTANT	Connecting the module to the network via an Ethernet switch instead of a hub reduces the number of collisions and lost packets and increases the bandwidth. See the Ethernet/IP Performance and Application Guide, publication ENET-AP001A-EN-P, for more information.

Applying Chassis Power

20921-M

Checking Power Supply and Module Status

Check the LED indicators to determine if the power supply and the Ethernet module are operating properly.

Power Supply indicator is GREEN.

RXD   TXD

OK indicator is RED, then FLASHING RED (or is GREEN if module is configured).

If the Power Supply and module OK indicators are not in the states described above refer to Appendix A for help in troubleshooting your module.

What's Next?

The following chapter describes some Ethernet basics you should know before configuring your module.

Chapter 3

Before You Configure Your Module

What This Chapter Contains

This chapter describes some of the basics you should know about Ethernet before you configure your Ethernet module. The following table describes where to find specific information in this chapter.

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Ethernet Protocols

On the most basic level, Ethernet is a wire or cable that connects computers and peripheral devices so that they can communicate. The actual wire used for the network is referred to as the network "medium." Beyond the physical medium, all Ethernet networks support protocols that provide sophisticated data transfer and network management functionality.

Transmission Control Protocol/Internet Protocol (TCP/IP)

Transmission Control Protocol/Internet Protocol (TCP/IP) is a transport-layer protocol (TCP) and a network-layer protocol (IP) commonly used in business environments for communication within networks and across internetworks. The 1756-ENET/B module uses TCP/IP for "explicit" messaging, that is, messages in which time is not a critical factor, such as uploading or downloading programs.

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User Datagram Protocol (UDP)

UDP is a much simpler transport protocol. It is connectionless and provides a very simple capability to send datagrams between two devices. UDP is used by applications that implement their own handshaking between devices and only want a minimal transport service. UDP is smaller, simpler, and faster than TCP and can operate in unicast, multicast, or broadcast mode. The 1756-ENET/B module employs UDP for real time I/O messaging.

Ethernet/IP

Ethernet/IP applies a common application layer over Ethernet by encapsulating messages in TCP/UDP/IP. This common application layer is the control and information protocol (CIP, see chapter 1), which provides interoperability and interchangeability of industrial automation and control devices on Ethernet. Ethernet/IP supports both real-time I/O ("implicit" messaging) and explicit messaging.

Refer to the Ethernet/IP Performance and Application Guide, publication number ENET-AP001A-EN-P, for more information on the Ethernet/IP protocol.

Simple Network Management Protocol (SNMP)

Simple Network Management Protocol (SNMP) is a standard for network management within TCP/IP environments. This lets client applications monitor and manage network information on host computers and gateways.

SNMP uses a distributed architecture consisting of management systems and agents. Data is passed from SNMP agents, which are hardware and/or software processes reporting activity in each network device (switch, router, bridge, etc.) to the workstation console used to oversee the network. The agents return information contained in a MIB (Management Information Base), which is a data structure that defines what is obtainable from the device and what can be controlled (turned off, on, etc.).

The ENET/B module is an agent, and its primary function is to process the operations requested by the management system. The Ethernet module supports the SNMP protocol at the MIB II level.

Configuration Requirements

Before you can use your Ethernet module, you must configure its IP address, gateway address, and subnet mask. The module ships with the Rockwell BootP utility, which you can use to perform the configuration. You can also use RSLinx software, generic BootP software, or, within some limitations, a DHCP server. These methods are described in chapter 4.

IP Address

The IP address identifies each node on the IP network (or system of connected networks). Each TCP/IP node on a network (including the Ethernet module) must have a unique IP address.

The IP address is 32 bits long and has a net ID part and a host ID part. Each network is a Class A, Class B, or Class C network. The class of a network determines how an IP address is formatted.

	0	1	8	16	24	31
Class A	0	net ID		host ID		

	0	1	8	16	24	31
Class B	1	0	net ID		host ID	

	0	1	8	16	24	31
Class C	1	1	0	net ID		host ID

Each node on the same physical network must have an IP address of the same class and must have the same net ID. Each node on the same network must have a different host ID thus giving it a unique IP address.

IP addresses are written as four decimal integers (0-255) separated by periods where each integer gives the value of one byte of the IP address.

EXAMPLE

For example, the 32-bit IP address:

10000010 00000000 00000000 00000001 is written as 130.0.0.1.

You can distinguish the class of an IP address from the first integer in its dotted-decimal IP address as follows:

Range of first integer	Class	Range of first integer	Class
0 -127	A	192 - 223	C
128 -191	B	224 - 255	other

> **TIP** ▶ Contact your network administrator or the Network Information Center for a unique fixed IP address to assign to your module.

For more information on Internet addressing, see Comer, Douglas E; Internetworking with TCP-IP, Volume 1: Protocols and Architecture; Englewood Cliffs, N.J.: Prentice-Hall, 1990.

Gateways

A gateway connects individual physical networks into a system of networks. When a node needs to communicate with a node on another network, a gateway transfers the data between the two networks. The following figure shows gateway G connecting Network 1 with Network 2.

```
        +---+
        | A |
        +---+
          | 128.1.0.1
 ---------+-----------------------------+----------
              Network 1            |      128.1.0.2
                                 +---+
                                 | G |
    +---+         +---+          +---+
    | B |         | C |            | 128.2.0.3
    +---+         +---+            |
      | 128.2.0.1   | 128.2.0.2    |
 -----+-------------+--------------+---------------
                 Network 2
```

When host B with IP address 128.2.0.1 communicates with host C, it knows from C's IP address that C is on the same network. In an Ethernet environment, B can then resolve C's IP address to a MAC address and communicate with C directly.

When host B communicates with host A, it knows from A's IP address that A is on another network (the net IDs are different). In order to send data to A, B must have the IP address of the gateway connecting the two networks. In this example, the gateway's IP address on Network 2 is 128.2.0.3.

The gateway has two IP addresses (128.1.0.2 and 128.2.0.3). The first must be used by hosts on Network 1 and the second must be used by hosts on Network 2. To be usable, a host's gateway must be addressed using a net ID matching its own.

Subnet Mask

Subnet addressing is an extension of the IP address scheme that allows a site to use a single net ID for multiple physical networks. Routing outside of the site continues by dividing the IP address into a net ID and a host ID via the class. Inside a site, the subnet mask is used to redivide the IP address into a custom net ID portion and host ID portion.

Take Network 2 (a Class B network) in the previous example and add another physical network. Selecting the following subnet mask would add two additional net ID bits allowing for four physical networks:

EXAMPLE   11111111 11111111 11000000 00000000 = 255.255.192.0

Two bits of the Class B host ID have been used to extend the net ID. Each unique combination of bits in the part of the host ID where subnet mask bits are 1 specifies a different physical network.

The new configuration is:

```
        ┌───┐
        │ A │
        └───┘
          │
        128.1.0.1
─────────────────────────────────────────────────
        Network 1              128.1.0.2
                                  ┌───┐
                                  │ G │
        ┌───┐      ┌───┐          └───┘
        │ B │      │ C │        128.2.64.3
        └───┘      └───┘
      128.2.64.1   128.2.64.2
─────────────────────────────────────────────────
              Network 2.1
                                  ┌────┐
                                  │ G2 │
        ┌───┐      ┌───┐          └────┘
        │ D │      │ E │        128.2.128.3
        └───┘      └───┘
      128.2.128.1  128.2.128.2
─────────────────────────────────────────────────
              Network 2.2
```

A second network with Hosts D and E has been added. Gateway G2 connects Network 2.1 with Network 2.2. Hosts D and E will use Gateway G2 to communicate with hosts not on Network 2.2. Hosts B and C will use Gateway G to communicate with hosts not on Network 2.1. When B is communicating with D, G (the configured Gateway for B) will route the data from B to D through G2.

For More Information

For more information about Ethernet, refer to the following publications:

- Internetworking with TCP/IP   ISBN 0-13-216987-8
  Vol. 1, 2nd ed.
  by Douglas E. Comer

- The Ethernet Management Guide –   ISBN 0-07-046320-4
  Keeping The Link

- An Introduction to TCP/IP   ISBN 3-540-96651-X

- Computer Networks   ISBN 0-13-162959-X
  by Andrew S. Tanenbaum

What's Next?

The following chapter describes how to configure your Ethernet module.

Configuring the Ethernet Module

What This Chapter Contains

Before you can use your Ethernet module in a network you must configure it by providing an IP address, Gateway address, and Subnet mask. There are several way you can do this:

1. Using the Rockwell BootP utility that ships with RSLogix 5000 software

2. Using RSLinx

3. Using a standard BootP server

4. Having your network administrator configure the module via the network server

This chapter describes these procedures for configuring the 1756-ENET/B Ethernet module. The following table describes where to find specific information.

For information about	See page
Using the Rockwell BootP Utility	4-1
Using RSLinx Software	4-2
Using a BootP Server	4-5
Using DHCP Software to Configure Your Module	4-7

Using the Rockwell BootP Utility

BootP (Bootstrap Protocol) is a low-level protocol that provides configurations to the nodes on a TCP/IP network. The Rockwell BootP utility is a stand alone program that incorporates the functionality of standard BootP software with a user friendly graphical interface. It is located in the Utils directory on the RSLogix 5000 installation CD. Refer to the Readme file that accompanies the utility and to the utility's Help menu for directions on how to use this software. The Ethernet module must have BootP enabled (factory default) to use the utility.

Using RSLinx Software

You can use RSLinx software, version 2.2 or higher, to configure the Ethernet module via a ControlNet or Data Highway Plus network, or via the serial port on a Logix 5550 processor, if you insert the Ethernet module into a ControlLogix chassis containing:

- a 1756-CNB module connected to your workstation via ControlNet, or
- a 1756-DHRIO module connected to your workstation via DH+, or
- a Logix 5550 processor connected to your workstation via its serial port.

You must have an appropriate communication driver configured in RSLinx. After configuring the Ethernet module, you can move it to the chassis where you want to use it.

To configure the Ethernet module using RSLinx, perform the following steps:

1. Insert the ENET/B module in the ControlLogix chassis with the communications module you will be using.

2. Start RSLinx. The **RSWho** window will open.

3. Select the appropriate driver (e.g., AB_KT-1 for Data Highway Plus, AB_KTC-1 for ControlNet, or AB_DF1-1 for the Logix 5550's serial port).

The following example uses the Data Highway Plus driver. You can perform the same steps using one of the other drivers.

4. Expand the driver tree through the backplane of the chassis containing the 1756-ENET/B module.

5. Right click on the module. The following pop-up menu will appear.

6. Select **Module Configuration**.

The **1756-ENET Configuration** window will open.

7. Select the **Port Configuration** tab.

8. Uncheck the **Obtain IP Address from BootP Server** box.

9. Enter the desired **IP Address**, **Subnet Mask**, and **Gateway Address**. The values we used for one of the ENET/B modules in the example applications are shown above.

10. Click on **OK**.

You can now move the module to another chassis and access it over Ethernet using this configuration.

Using a BootP Server

The Ethernet module factory default is BootP enabled. The following is an example BootP tab file that can be used with a BootP server:

EXAMPLE

```
# Example /etc./bootptab: database for bootp server (/etc./bootpd).
#
# Format:
#       nodename:tag=value:tag=value: . . . .:tag=value
#
#       first field – – nodename (hostname) of terminal followed by colon
#       (should be full domain name)
#
# Blank lines and lines beginning with '#' are ignored.
# Make sure you include a colon and a backslash to continue a line.
# Don't put any spaces in the tag–value string.
# The ht tag MUST precede the ha tag.
#
# The options below are specified as tag=value and delimited by colons
# These are the options used by the 1756-ENET/B module:
#
#       gw – – gateway IP address
#       ha – – hardware address (link level address) (hex)
#       ht – – hardware type (either) (must precede the ha tag)
#       ip – – IP address
#       sm – – network subnet mask
#       tc – – template for common defaults (should be the first option listed)
#
#       vm – – vendor magic cookie selector (MUST be rfc1048 for
#       1756-ENET/B)
#
#————————————————————————————————————————————————
# default values for 1756-ENET/B
icp.defaults:\
        ht=ether:\
        vm=rfc1048:\
        sm=255.255.254.0:\
        gw=130.151.132.1
#————————————————————————————————————————————————

zappa0:\
        tc=icp.defaults:\
        ha=0000bc03404f:\
        ip=130.151.132.121

zappa1:\
        tc=icp.defaults:\
        ha=0000bc034073:\
        ip=130.151.132.122

zappa2:\
```

tc=icp.defaults:\
ha=0000bc034022:\
ip=130.151.132.123

To use a BootP server to configure the ENET/B module perform the following steps:

1. Access and open the BootP tab file using a text editor.

2. Enter the IP address of your module.

If you need more information on setting IP addresses, refer to pages 3-3 to 3-4.

3. Use the text editor to enter the Ethernet hardware address (MAC ID) of your module. You must enter all digits, including zeroes.

```
<•••> ETHERNET

[RXD] [TXD] [OK]
RXD TXD OK
```

Hardware
Address

AUI

10 BASET

1756-ENET

31153-M

IMPORTANT	When using the BootP protocol, you must enter the Ethernet hardware address of your module. Rockwell assigns each Ethernet module a unique 48-bit hardware address at the factory. The address is printed on a label on the front of your Ethernet module as shown in the figure on the left. It consists of six hexadecimal digits separated by dots. This address is fixed by the hardware, and cannot be changed.

If you change or replace this Ethernet module, you must enter the new Ethernet hardware address of the module when you configure the new module.

4. Enter the Gateway Address.

If you need more information on assigning gateway addresses, refer to pages 3-4 to 3-4.

5. Enter the Subnet Mask

If you need more information on selecting subnet masks, refer to pages 3-5 to 3-5.

6. After you have entered all the configuration data, save the file in a directory where the BootP server can access it.

Using DHCP Software to Configure Your Module

DHCP (Dynamic Host Configuration Protocol) software automatically assigns IP addresses to client stations logging onto a TCP/IP network. DHCP is based on BootP and maintains some backward compatibility. The main difference is that BootP was designed for manual configuration, while DHCP allows for dynamic allocation of network addresses and configurations to newly attached devices.

Be cautious about using DHCP software to configure your module. A BootP client, such as the 1756-ENET/B module, can boot from a DHCP server only if the DHCP server is specifically written to also handle BootP queries. This is specific to the DHCP software package you use. Check with your system administrator to see if your DHCP package supports BootP commands and manual IP allocation.

ATTENTION

The 1756-ENET/B module must be assigned a fixed network address. The IP address of this module must not be dynamically provided.

Failure to observe this precaution may result in unintended machine motion or loss of process control.

What's Next?

The following chapter describes an example application in which you configure remote digital I/O using a rack optimized connection.

Chapter **5**

Rack Optimized I/O

About the Example Application

This example uses rack optimized connections to read data from a remote digital input module and send data to a remote digital output module.

What you will do	See page
Set Up the Hardware	5-2
Create the Example Application	5-3
Add the Local Ethernet Module to the I/O Configuration	5-4
Add the Remote Ethernet Module to the I/O Configuration	5-6
Add the Remote I/O Modules to the I/O Configuration	5-8
Add the Remote Digital Input Module	5-8
Add the Remote Digital Output Module	5-10
Edit the Controller Tags	5-12
Create the Ladder Program	5-14
Download the Program to the Controller	5-15
Test the Example Application	5-16

Set Up the Hardware

For this example, the one ControlLogix chassis contains a Logix 5550 controller in slot 0 and a 1756-ENET/B module in slot 1. A second chassis contains a 1756-ENET/B module in slot 0 and the I/O modules in slots 1 and 2.

To work along with this example set up your system as shown above.

- Note that in the example application, the Logix5550 controller, I/O modules, and the 1756-ENET/B modules are in the slots shown above.

- Verify the IP addresses for your PC and 1756-ENET/B modules (see chapter 4).

- Verify that all wiring and cabling is properly connected.

- Make sure you have your communication driver (e.g., AB_ETH-1) configured in RSLinx as described in Appendix C.

Create the Example Application

Perform the following steps to create the example application:

1. Start **RSLogix5000**. The RSLogix 5000 Main Window will open.

2. From the **File** menu, select **New**.

The **New Controller** pop-up window will open.

3. Enter an appropriate name for the Controller, e.g., "Ethernet_IO_Controller."

4. Select the correct **Chassis Type** and **Slot** number of the Logix5550 controller, and the folder where you want to save the RSLogix 5000 file (**Create In**). The **Description** is optional.

5. Click on **OK**.

You now add the remote digital I/O modules to the controller's I/O configuration. To do this you first add the local 1756-ENET/B module to the I/O configuration. Next you add the 1756-ENET/B in the remote chassis with the digital I/O modules as a "child" of the local 1756-ENET/B module. Then you add the I/O modules as "children" of the remote 1756-ENET/B module.

Add the Local Ethernet Module to the I/O Configuration

1. Select the **IO Configuration** folder in the project window and click the right mouse button.

The following pop-up window will open.

2. Click on **New Module**.

The **Select Module Type** window will open.

3. Select the **1756-ENET/B** module and click on **OK**.

The **Module Properties** window will open.

4. Enter or select the following parameters: **Name**, **IP Address**, **Slot**, and **Electronic Keying**. We used the following values:

Name	Local_ENET
IP Address	130.130.130.2
Slot	1
Electronic Keying[1]	Compatible Module

[1] See Appendix F for important information about Electronic Keying.

5. Click on **Finish** to accept the configuration.

Add the Remote Ethernet Module to the I/O Configuration

Next, you must add the remote 1756-ENET/B module as a "child" of the local 1756-ENET/B module.

1. In the Project window, right click on the local 1756-ENET/B module under the I/O Configuration folder and select **New Module** from the pop-up window.

The **Select Module Type** window will open.

2. Select the **1756-ENET/B** module from the list and click on **OK**.

The **Module Properties** window will open.

3. Enter or select the following parameters (the values we used are listed in the table):

Name	Remote_ENET
IP Address	130.130.130.3
Chassis Size	4
Slot	0
Comm Format	Rack Optimization
Electronic Keying[1]	Compatible Module

[1]   See Appendix F for important information about Electronic Keying.

4. Click on **Next**.

The following page will open:

5. Make sure the **Requested Packet Interval** (RPI) is 5ms or greater for this example.

6. Click on the **Finish** button to accept the configuration. The remote
1756-ENET/B module will appear indented under the local
1756-ENET/B in the I/O Configuration folder.

```
□─🗀 I/O Configuration
  □─ 🗍 [1] 1756-ENET/B Local_ENET
      └─ 🗍 [0] 1756-ENET/B Remote_ENET
```

Add the Remote I/O Modules to the I/O Configuration

You must now add the remote I/O modules to the I/O Configuration
List under the remote 1756-ENET/B module.

In this example, you will add a a 1756-IB16I digital input module and
a 1756-OB16I digital output module with standard configurations. Use
these steps as a guide when you are configuring different I/O
modules for your actual system.

| **TIP** | This example application uses the I/O module default configurations. For information on altering the default configurations see the ControlLogix Digital I/O Module User Manual, publication 1756-6.5.8. |

Add the Remote Digital Input Module

```
□─🗀 I/O Configuration
  □─ 🗍 [1] 1756-ENET/B Local_ENET
      └─ 🗍 [0] 1756-ENET/B Remote_ENET   New Module...

                                          Cut
                                          Copy
                                          Paste
                                          Delete

                                          Cross Reference

                                          Print

                                          Properties
```

1. Right click on the remote **1756-ENET/B** module under the I/O
Configuration folder and select **New Module**.

2. The **Select Module Type** window will open.

3. Select the **1756-IB16I** digital input module from the list and click on **OK**.

The **Module Properties** window will open.

4. Enter the following parameters (the values we used are listed in the table):

Name	Remote_Digital_Input
Slot	1
Comm Format	Rack Optimization
Electronic Keying[1]	Compatible Module

[1] See Appendix F for important information about Electronic Keying.

> **TIP**
>
> ▶
>
> If you want to alter the default parameters, click on the **Next** button. Refer to the ControlLogix Digital I/O User Manual, publication 1756-6.5.8, for details.

5. Click on the **Finish** button to save the configuration.

The digital input module will appear in the I/O configuration indented under the remote 1756-ENET/B module.

```
└─ 🗁 I/O Configuration
   └─ 🗍 [1] 1756-ENET/B Local_ENET
      └─ 🗍 [0] 1756-ENET/B Remote_ENET
         └─ 🗍 [1] 1756-IB16I Remote_Digital_Input
```

Add the Remote Digital Output Module

```
└─ 🗁 I/O Configuration
   └─ 🗍 [1] 1756-ENET/B Local_ENET
      └─ 🗍 [0] 1756-ENET/B Remote_ENET          │ New Module...      │
         └─ 🗍 [1] 1756-IB16I Remote_Digital_Input │ Cut                │
                                                   │ Copy               │
                                                   │ Paste              │
                                                   │ Delete             │
                                                   │ Cross Reference    │
                                                   │ Print              │
                                                   │ Properties         │
```

6. Right click on the remote **1756-ENET/B** module and again select **New Module**.

The **Select Module Type** window will open.

7. Select the **1756-OB16I** digital output module from the list.

The **Module Properties** window will open.

8. Enter the following parameters (the values we used are listed in the table):

Name	Remote_Digital_Output
Slot	2
Comm Format	Rack Optimization
Electronic Keying[1]	Compatible Module

[1] See Appendix F for important information about Electronic Keying.

TIP	If you want to alter the default parameters, click on the **Next** button. Refer to the ControlLogix Digital I/O User Manual, publication 1756-6.5.8, for details.

▶

9. Click on the **Finish** button to accept the configuration.

The I/O Configuration in the Project window should look similar to the one shown below.

Edit the Controller Tags

When you add modules to the I/O configuration the system creates tags for those modules to use in the application program. For our example application we need to add another Controller Tag.

1. Double-click on the **Controller Tags** folder in the project window.

The Controller Tags window will open. You will see the tags created for the 1756-ENET/B and digital I/O modules.

Tags created by the system

Enter the new tag here →

	P	Tag Name	Alias For	Base Tag	Type	Style
▶		⊞ Remote_ENET:1:C			AB:1756_DI:C:0	
		⊞ Remote_ENET:1:I	Remote_ENET:I.Slot[1]	Remote_ENET:I.Slot[1]	AB:1756_ENET_SLOT:I:0	
		⊞ Remote_ENET:2:C			AB:1756_DO:C:0	
		⊞ Remote_ENET:2:I	Remote_ENET:I.Slot[2]	Remote_ENET:I.Slot[2]	AB:1756_ENET_SLOT:I:0	
		⊞ Remote_ENET:2:O	Remote_ENET:O.Slot[2]	Remote_ENET:O.Slot[2]	AB:1756_ENET_SLOT:O:0	
		⊞ Remote_ENET:I			AB:1756_ENET_4SLOT:I:0	
		⊞ Remote_ENET:O			AB:1756_ENET_4SLOT:O:0	
∗	☐					

2. Select the **Edit Tags** tab at the bottom of the Controller Tags window.

3. Create the following tag:

Tag	Type
Parts_Count	Counter

4. Close the **Controller Tags** window.

Create the Ladder Program

1. Double-click on **Main Routine** under the **Main Program** folder, and enter the following ladder program, using the tags previously created.

2. **Save** the program.

Download the Program to the Controller

1. Click on the **Communications** menu and select **Who Active**.

   The **Who Active** window will open (Your window will show the drivers and devices you have installed).

2. Select your Ethernet driver (e.g., AB_ETH-1) and expand the tree through the backplane of the local ControlLogix chassis.

3. Highlight the Logix 5550 controller and click on the **Download** button.

   You will see a message similar to the following:

4. Click on the **Download** button.

5. **Minimize** RSLogix5000.

Test the Example Application

You will test the example application by using a momentary switch to simulate a parts sensor.

1. Wire the 1756-IB16I digital input module as shown in the following figure:

2. Restore the **RSLogix5000** software and place the controller in **Run** mode.

3. Repeatedly press and release the momentary switch at IN-0 (Count) on the 1756-IB16I digital input module. Each time you press the switch you should see the Parts_Count accumulated value increment on the screen and the LED display of the OB16I output module increment in binary.

4. Press and release the momentary switch at IN-1 (Reset) on the 1756-IB16 digital input module. You should see the accumulated value of the Parts_Count reset to zero and all of the LEDs on the 1756-OB16I output module turn off.

TIP

Refer to the ControlLogix Digital I/O Modules User Manual, publication 1756-6.5.8, for assistance in wiring and debugging the I/O modules.

This completes the Rack Optimized I/O example.

What's Next?

The following chapter describes an example application in which you add an analog output module to the I/O configuration using a direct connection.

Analog I/O with Direct Connection

About the Example Application

In this example you add an analog output module to the remote chassis containing the 1756-ENET/B module and the two digital I/O modules configured in the previous chapter. Analog modules default to direct connection. Note that you will open a direct connection to the analog module while still using a single rack optimized connection for the two digital I/O modules.

To test the connection the RSLogix 5000 project of the previous chapter is modified to produce a varying signal at one of the analog output channels.

Set Up the Hardware

Change the system configuration of the previous chapter to that shown below, adding an analog output module to the remote chassis in slot 3. For this example, we used a 1756-OF8 analog output module.

- Note that in the example application, the Logix5550 controller, I/O modules, and the 1756-ENET/B modules are in the slots shown above.

- Verify that the IP addresses for the 1756-ENET/B modules and personal computer are correct.

- Verify that all wiring and cabling is properly connected.

- Make sure you have your communication driver (e.g., TCP-1) configured in RSLinx as described in Appendix C.

Create the Example Application

Perform the following steps to create the example application:

1. Start **RSLogix5000**. The RSLogix 5000 Main Window will open.

2. Open the project file from the previous chapter (i.e., "Ethernet_IO_Controller").

3. Save the file using a different name (e.g., "Ethernet_IO_Controller_2").

Add the Remote Analog I/O Module to the I/O Configuration

You must now add the new remote analog I/O module to the I/O Configuration. In this example, you add the 1756-OF8 analog output module and configure one of its channels for a 0V to 10V output range. Use these steps as a guide when you are configuring different I/O modules for your system.

> **TIP**
>
> For additional information on configuring a ControlLogix analog I/O module see the ControlLogix Analog I/O Module User Manual, publication 1756-6.5.9.

```
☐ I/O Configuration
   ☐ [1] 1756-ENET/B Local_ENET
      ☐ [0] 1756-ENET/B Remote_ENET
         [1] 1756-IB16I Remote_Digital_Input
         [2] 1756-OB16I Remote_Digital_Output
```

| New Module... |
| Cut |
| Copy |
| Paste |
| Delete |
| Cross Reference |
| Print |
| Properties |

1. Right click on the **Remote_ENET** module under the I/O Configuration folder and select **New Module** from the pop-up window.

The **Select Module Type** window will open.

Select Module Type

Type: 1756-OF8   Major Revision: 1

Type	Description
1756-OB16I	16 Point 10V-30V DC Isolated Output, Sink/Source
1756-OB32	32 Point 10V-31.2V DC Output
1756-OB8	8 Point 10V-30V DC Output
1756-OB8EI	8 Point 10V-30V DC Electronically Fused Isolated Output
1756-OC8	8 Point 30V-60V DC Output
1756-OF4	4 Channel Non-Isolated Voltage/Current Analog Output
1756-OF6CI	6 Channel Isolated Current Analog Output
1756-OF6VI	6 Channel Isolated Voltage Analog Output
1756-OF8	8 Channel Non-Isolated Voltage/Current Analog Output
1756-OH8I	8 Point 90V-146V DC Isolated Output
1756-ON8	8 Point 10V-30V AC Output
1756-OW16I	16 Point 10V-265V AC, 5V-150V DC Isolated Relay

Show — Vendor: All   ☑ Other ☑ Specialty I/O   Select All
☑ Analog ☑ Digital ☑ Communication ☑ Motion ☑ Processor   Clear All

OK   Cancel   Help

2. Select the **1756-OF8** analog output module from the list and click on **OK**.

The **Module Properties** window will open.

3. Enter the following parameters:

Name	Remote_Analog_Output
Slot	3
Comm Format	Float Data[1]
Electronic Keying[2]	Compatible Module

[1] All analog Comm Formats use direct connection. The default is floating decimal point data.

[2] See Appendix F for important information about Electronic Keying.

You must now configure the channel settings of the Analog I/O module. You do this using a series of pages that appear in the Module Properties window.

4. Click on the **Next** button. The following page will open:

5. This window allows you to adjust the **Requested Packet Interval (RPI)** to meet your system's requirements (for this example you can leave it at the default 10 ms rate).

6. Click on **Next** to open the next page.

This page is used during online monitoring but not during initial configuration.

Module Properties - Remote_ENET:3 (1756-OF8 1.1)

Identification
Vendor:
Product Type:
Product Code:
Revision:
Serial Number:
Product Name:

Status
Major Fault:
Minor Fault:
Internal State:

Configured:
Owned:
Module Identity:

Coordinated System Time (CST)
Timer Hardware:
Timer Sync'ed:

Refresh   Reset Module

Cancel   < Back   Next >   Finish >>   Help

7. Click on **Next** to move to the first Channel Configuration page.

The choices available on the **Channel Configuration** pages vary according to the module being configured. The page below opens for the 1756-OF8 module.

Module Properties - Remote_ENET:3 (1756-OF8 1.1)

Channel
0* 1 2 3 4 5 6 7

Output Range: -10 V to 10 V
Calibration Bias: 0.0

Scaling
High Signal: 10.0 V = High Engineering: 8000.0
Low Signal: 0.0 V = Low Engineering: 0.0

☐ Hold for Initialization

Cancel   < Back   Next >   Finish >>   Help

8. Click on **Channel 0** and enter the following **Scaling** parameters:

High Signal	High Engineering
10.0 V	8000[1]
Low Signal	**Low Engineering**
0.0 V	0

[1] This scaling is selected to use the 13-bit voltage
resolution of the 1756-OF8. See specifications in
publication 1756-6.5.9 for more information.

9. Click on **Next** twice to access the **Limits** page.

Module Properties - Remote_ENET:3 (1756-OF8 1.1)

Channel

| 0ˣ | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

☐ Disable All Alarms
☐ Latch Limit Alarms
☐ Latch Rate Alarm

Limits: Unlatch All
High Clamp: 8000   Unlatch
Low Clamp: 0   Unlatch
☐ Ramp in Run Mode
                per Sec
Ramp Rate: Unlatch

HL
LL

Cancel   < Back   Next >   Finish >>   Help

10. Enter the following **Limits**:

High Clamp	8000
Low Clamp	0

11. Click on **Finish** to save the configuration.

The I/O Configuration tree should now look similar to the one
shown below.

```
I/O Configuration
    [1] 1756-ENET/B Local_ENET
        [0] 1756-ENET/B Remote_ENET
            [1] 1756-IB16I Remote_Digital_Input
            [2] 1756-OB16I Remote_Digital_Output
            [3] 1756-OF8 Remote_Analog_Output
```

Edit the Controller Tags

When you add modules to the I/O configuration the system creates
tags for those modules. We now need to add another Controller Tag to
modify the application program.

```
Controller Ethernet_IO_Controller
   Controller Tags
   Controller Fault Handler
   Power-Up Handler
```

1. Double-click on the **Controller Tags** folder in the project window.

2. Note that new tags have been added for the remote analog output
module.

Tags for new remote
analog output module
created by the system.

Tag Name	Value	Force Mask	Style	Type
+Part_Count	{...}	{...}		COUNT
+Remote_ENET:1:C	{...}	{...}		AB:175
+Remote_ENET:1:I	{...}	{...}		AB:175
+Remote_ENET:2:C	{...}	{...}		AB:175
+Remote_ENET:2:I	{...}	{...}		AB:175
+Remote_ENET:2:O	{...}	{...}		AB:175
+Remote_ENET:3:C	{...}	{...}		AB:175
+Remote_ENET:3:I	{...}	{...}		AB:175
+Remote_ENET:3:O	{...}	{...}		AB:175
+Remote_ENET:I	{...}	{...}		AB:175
+Remote_ENET:O	{...}	{...}		AB:175

Controller Tags - Ethernet_IO_Controller(controller)
Scope: Ethernet_IO_Control Show: Show All Sort: Tag Name
Monitor Tags / Edit Tags

3. Select the **Edit Tags** tab at the bottom of the Controller Tags
window.

The tag editor will become active.

4. Create the following tag:

Tag Name	Type
Analog_Output	Timer

Modify the Ladder Program

1. Double-click on **Main Routine** under the **Main Program** folder, and add rungs 3 and 4 to the ladder program of the previous chapter.

2. **Save** the program.

Download the Program

1. Click on the **Communications** menu and select **Who Active**.

2. The **Who Active** window will open (Your window will display the drivers and devices you have configured on your system).

3. Select your Ethernet driver (e.g., AB_ETH-1) and expand the tree through the backplane of the local ControlLogix chassis.

4. Highlight the controller and click on the **Download** button to download the program to the Logix5550 controller.

You will see a message similar to the following:

5. Click on the **Download** button.

6. Minimize RSLogix5000.

Test the Example Application

Use the following procedure to test the operation of the remote analog output:

1. Connect a voltmeter across the channel 0 output of the 1756-OF8 analog output module as shown in the following figure:

1756-OF8

2. Restore **RSLogix5000** and place the controller in **Run** mode.

3. Measure the output voltage of channel 0. You should see it slowly rise to approximately 10V, reset to zero, start rising again, etc.

| **TIP** | Refer to the ControlLogix Analog I/O Module User Manual, publication 1756-6.5.9, for assistance in wiring and debugging the I/O modules. |

This completes the Direct Connect I/O example.

What's Next?

The following chapter describes an example application in which one controller sends a message to another controller using produced and consumed tags.

Produced and Consumed Tags

About the Example Application

In this example one Logix5550 controller (the producer) sends data to another Logix5550 controller (the consumer) over the Ethernet network. A Timer provides the test data for the message.

Set Up the Hardware

In both chassis the controller is in slot 0 and the 1756-ENET/B module is in slot 1.

To work along with this example set up your system as shown above.

- Note that in the example application, the Logix5550 controllers and the 1756-ENET/B modules are in slots 0 and 1 in each ControlLogix chassis, as shown.

- Verify the IP addresses for the 1756-ENET/B modules.

- Verify that all wiring and cabling is properly connected.

- Make sure you have your communication drivers (e.g., TCP-1 and TCP-2) configured in RSLinx as described in Appendix C.

Create the Producer Application

Perform the following steps to create the producer application.

1. Start **RSLogix5000**. The RSLogix 5000 Main Window will open.

2. From the **File** menu, select **New**.

The **New Controller** window will open.

3. Enter an appropriate name for the Controller, e.g., "Producer."

4. Select the correct **Chassis Type** and **Slot Number** for the Logix5550 controller, and the folder where you want to save the file (**Create In**).

5. Click on **OK** to save the project file.

Create the Producer Tags

1. Double-click on the **Controller Tags** folder in the project window.

The **Controller Tags** window will open.

Enter the new tags starting here.

2. Select the **Edit Tags** tab and create the following tags:

Tag Name	Type	Style
produced_data	DINT	Decimal
T1	TIMER	

3. Produce the tag that is being sent. Either:

Check the "P" box in the tag database to make this a produced tag.

a. Check the "P" box in the tag database:-OR-

b. Right-click on the tag and select **Edit Tag Properties**. The **Tag Properties** window will open:

Make sure this box is checked.

c. Check the **Produce this tag for up to** box and select the number of **consumers** (1 to 256). The default is 2.

d. Click on **OK**.

Create the Producer Ladder Program

1. Double-click on **Main Routine** under the **Main Program** folder, and create the following ladder program, using the tags you previously created.

Download the Producer Application

1. Click on the **Communications** menu and select **Who Active**.

The **Who Active** window will open (Your window will display the drivers and devices you have installed).

2. Select your Ethernet driver (e.g., AB_ETH-1) and expand the tree through the backplane of the local ControlLogix chassis.

3. Highlight the Logix 5550 controller and click on the **Download** button.

4. You will see a message similar to the following:

5. Click on the **Download** button.

6. Put the controller in **Run** mode.

7. **Minimize** this session of RSLogix 5000.

Create the Consumer Application

In order to test the messaging application you have to create a consumer application, add the producer to the I/O configuration of the consumer, and create a consumed tag to receive the data.

Create the Consumer Controller

Perform the following steps to create the consumer controller:

1. Open a second session of **RSLogix5000** (leave the current session running).

2. From the **File** menu, select **New**.

   The **New Controller** window will open.

3. Enter an appropriate **Name** for the Controller, e.g., "Consumer."

4. Select the correct **Chassis Type** and **Slot Number** of the controller, and the folder where you want to save the project file (**Create In**).

5. Click on **OK** to save the project file.

Add the Producer to the Consumer's I/O Configuration

Adding the producer to the I/O configuration of the consumer involves several steps. First, you must add the consumer's local 1756-ENET/B module to the I/O configuration. Then you add the remote 1756-ENET/B as a "child" of the local 1756-ENET/B module. Finally, you add the producer as a child of the remote 1756-ENET/B module.

Add the Local ENET/B Module to the I/O Configuration

1. Select the **I/O Configuration** folder in the project window and click the right mouse button. The following pop up window will open.

2. Select **New Module**.

The **Select Module Type** window will open.

3. Select the **1756-ENET/B** module and click on **OK**.

The **Module Properties** window will open.

4. Enter the following parameters:

Name	Local_ENET
Slot	1
Electronic Keying[1]	Compatible Module

[1] See Appendix F for important information about Electronic Keying.

5. Click on **Finish** to accept the configuration.

The 1756-ENET/B module will be added to the I/O configuration.

Add the Remote ENET/B Module to the I/O Configuration

Next, you must add the remote 1756-ENET/B as a "child" of the local 1756-ENET/B.

1. In the Project window, right click on the local 1756-ENET/B module under the I/O Configuration folder and select **New Module** from the pop-up window.

The **Select Module Type** window will open

2. Select the **1756-ENET/B** module and click on **OK**.

The **Module Properties** window will open.

3. Enter the following parameters:

Name	Remote_ENET
IP Address	130.130.130.2
Chassis Size	4
Slot	1
Comm Format	Rack Optimization
Electronic Keying[1]	Compatible Module

[1]   See Appendix F for important information about Electronic Keying.

4. Click on **Finish** to accept the configuration. The remote 1756-ENET/B module will appear indented under the local 1756-ENET/B in the I/O Configuration folder.

Add the Remote (Producer) Controller to the I/O Configuration

You must now add the remote Controller (the Producer) to the I/O Configuration under the remote 1756-ENET/B module.

1. Right click on the remote **1756-ENET/B** module under the I/O Configuration folder and select **New Module**.

The **Select Module Type** window will open.

2. Select the **1756-L1 ControlLogix5550 processor** and click on **OK**.

The **Module Properties** window will open.

3. Enter the following parameters:

Name	Producer
Slot	0

4. Click on the **Finish** button to accept the configuration.

The I/O Configuration tree should look similar to the one shown below.

Create the Consumer Tags

The consumer tags are created via the Project window.

1. Double-click on the **Controller Tags** icon in the project window.

The **Controller Tags** window will open.

Enter the new tag here ⟶

2. Select the **Edit Tags** tab and create the following tag:

Tag Name	Type	Style
consumed_data	DINT	Decimal

```
Controller Tags - Consumer(controller)                              _ □ ×
Scope: Consumer(controller) ▼   Show: Show All     ▼   Sort: Tag Name  ▼
    P │ Tag Name        ▽ │ Alias For │ Base Tag │ Type                    │ Style        ▲
      │ ⊞ Remote_ENET:I   │           │          │ AB:1756_ENET_7SLOT:I:0  │
      │ ⊞ Remote_ENET:O   │           │          │ AB:1756_ENET_7SLOT:O:0  │
  ✎ □ │   consumed_data   │           │          │ DINT               ⋯   │ Decimal
  ✳ □ │                   │           │          │                         │
```

3. Right-click on the new tag. The following pop-up menu will open:

```
Monitor Tag - consumed_data
Edit Tag Properties                          Alt+Enter
Edit Data Type
Create Tag which aliases - consumed_data

Go to Cross Reference                        Ctrl+E
Go to Axis Wizard
Go to Axis Properties
Go to Motion Group Wizard
Go to Motion Group Properties
Go to PID Properties
Go to Message Properties
Go to Cam/Cam Profile Editor
Go To...                                     Ctrl+G

Options...
Find...

Cut                                          Ctrl+X
Copy                                         Ctrl+C
Paste                                        Ctrl+V
Delete                                       Del
```

4. Select **Edit Tag Properties**.

The **Tag Properties** window will open.

5. Enter or select the following parameters:

Name	consumed_data
Tag Type	Consumed
Controller	Producer
Remote Tag	produced_data[1]
Data Type	DINT[1]
Style	Decimal[1]
RPI	10ms[1]

[1] These parameters must match those in the Producer.

6. Click on **OK** to save the tag properties.

Download the Configuration to the Consumer

You must now load the configuration parameters to the Consumer controller. Note that no ladder logic is required for routing in the Consumer. The logic can consist of a single "End" rung.

(End)

1. Click on the **Communications** menu and select **Who Active**.

   The **Who Active** window will open (Your window will display the drivers and devices you have installed).

2. Select your Ethernet driver (e.g., AB_ETH-1) and expand the tree through the backplane of the local ControlLogix chassis.

3. Highlight the Logix 5550 controller and click on the **Download** button. You will see a message similar to the following:

4. Click on the **Download** button.

Test the Messaging

1. Open the session of RSLogix 5000 for the Producer and verify that the timer is running.

2. In the RSLogix 5000 session for the Consumer controller:

   a. Double-click on the **Controller Tags** folder and select the **Monitor Tags** tab.

You should see this value changing.

   b. Examine the **consumed_data** field. You should see the value changing in step with the accumulated value of the timer in the Producer.

This completes the example of Logix5550 controller to Logix5550 messaging using produced/consumed tags.

What's Next?

This concludes the example applications. The appendices that follow provide information to help you troubleshoot the module, describe how to configure the Ethernet driver in RSLinx, and show the use of the Ethernet module in a ControlLogix Gateway system and in larger control systems.

LED Status Indicators

Interpreting the Status Indicators

The faceplate of the 1756-ENET/B module is provided with LED indicators that display the module status and transmit/receive status. The following table describes module health indicator displays, module status, and recommended action:

TXD Indicator

RXD Indicator

OK Indicator

<···> ETHERNET

RXD TXD OK

AUI

10 BASET

1756-ENET

Front View   31153-M

If the OK indicator is:	then module status is:	take this action:
Off	Not operating.	Apply chassis power. Verify module is completely inserted into chassis and backplane.
Red, then flashing red or flashing green	Performing powerup diagnostics.	None, normal operation.
Green	Operating.	None.
Red flashing	Not configured.	Configure the module.
Red	Unrecoverable fault.	Repair or replace module.

The following table describes the displays of the transmit (TX) and receive (RX) indicators:

If this indicator:	is:	the module is:
TXD	Green	Transmitting data
	Off	Not active
RXD	Green	Receiving data
	Off	Not active

Detailed network diagnostics are provided by the module's Web pages, which can be accessed through Netscape or Microsoft Internet Explorer. See Appendix B.

1756-ENET/B Module Web Pages

Web Page Diagnostics

The Ethernet module's Web pages offer extensive internal and network diagnostics. To view the Web pages, enter the module's IP address into Netscape or Microsoft Internet Explorer. You will see the following Web page:

The module's Web pages provide the following information:

- Module Information
- TCP/IP Configuration
- Diagnostic Information
- Chassis Who

These pages are shown in the following figures.

Module Information

The **Module Information** page provides specific information about your ENET/B module, such as its serial number and firmware version.

TCP/IP Configuration

The **TCP/IP Configuration** page provides the Ethernet configuration of your module, including IP Address, Gateway Address, Subnet Mask, etc.

Diagnostic Information

The 1756-ENET/B module provides advanced diagnostic information via this page. This information may be useful to systems administrators and other experienced information technology personnel. As an example, selecting **ENET/IP Statistics** under the ***Miscellaneous*** heading opens the following window.

ENET/IP Statistics

This page provides access to detailed ENET/IP diagnostics. For example, selecting **CIP (ENET/IP) Statistics** opens the following window.

ENET/IP (CIP) STATISTICS

The CIP (ENET/IP) Statistics page provides the connection and traffic information shown above.

Chassis Who

The **Chassis Who** window shows the current configuration of the chassis in which the 1756-ENET/B module resides. It identifies all of the modules in the chassis and their slot locations.

Configuring the RSLinx Ethernet Communication Driver

What This Appendix Contains

In order to communicate with your 1756-ENET/B modules over your network you must configure the RSLinx Ethernet communication driver (AB_ETH). You can configure the AB_ETH driver with the IP addresses of all the Ethernet modules on your system. You will need this driver to download the example application programs in this manual.

The following table lists the contents of this appendix and where to find specific information:

For information about	See page
Installing the RSLinx Software	C-1
Configuring the AB_ETH Driver	C-2

Installing the RSLinx Software

Use the following procedure to install RSLinx software on your computer.

1. Insert the CD in the CD-ROM drive.

Note: The CD-ROM supports Windows Autorun. Once inserted into the CD-ROM drive, if you have Autorun configured, the installation will automatically start at the first setup screen.

If Autorun is not configured for your CD-ROM drive, go to step 2.

2. From the **Start** menu, choose **Run**.

You will see the Run pop-up window.

3. Type **d:/setup** (if it doesn't appear automatically), where **d:** is your CD-ROM driver letter.

4. Click on **OK**.

You will see the progress bar, followed by the welcome screen.

Configuring the AB_ETH Driver

To configure the AB-ETH Ethernet communication driver perform the following steps:

1. Start **RSLinx**.

2. From the **Communications** menu, select **Configure Drivers**. The following window will open.

3. Click on the arrow to the right of the **Available Driver Types** box.

   The **Available Driver Types** list will appear.

4. Select **Ethernet Devices** and click on **Add/New**. You will be prompted to name the driver.

5. Select the default driver name (e.g., AB_ETH-1) or type in your own name and click on **OK**.

The **Configure driver** window will appear with the **Station Mapping** page open.

6. Click on **Add New** and enter the IP address of your 1756-ENET/B module (e.g., 130.130.130.2).

7. Repeat step 6 for each additional Ethernet module you need to access.

8. When you are done entering the IP addresses, click on **Apply**.

9. Click on **OK** to close the **Configure driver** window.

The new driver will appear in the list of configured drivers. (Your list will display the drivers you have configured on your workstation.)

10. Close RSLinx

1756-ENET/B Support of ControlLogix Gateway Communication

Using the 1756-ENET/B Module in a ControlLogix Gateway

The 1756-ENET/B Ethernet module supports ControlLogix Gateway communication of control and information data between Ethernet and other networks, including ControlNet, DeviceNet, and Data Highway Plus.

The following figure shows an example of a typical ControlLogix gateway system. This system uses one ControlLogix Gateway linking existing Data Highway Plus, Ethernet, and ControlNet networks.

Please refer to the ControlLogix Gateway System User Manual, publication number 1756-6.5.13, for more information.

Example Network Configurations

What This Appendix Contains

This appendix shows examples of Ethernet control networks, along with the RSLogix 5000 I/O configurations for those networks. You configure these networks using the procedures described in this manual, adding each remote 1756-ENET/B module and its I/O modules to the local ENET/B module in turn as you build your system.

Small System Example

An example small system is shown below, consisting of a local chassis with a Logix 5550 controller and a 1756-ENET/B module serving as a network scanner, and two remote chassis with 1756-ENET/B modules serving as adaptors for the I/O modules in those chassis.

The RSLogix 5000 I/O Configuration for this network is shown in the following figure.

Expanded System with FLEX I/O

The following figure shows the previous network with FLEX I/O added to the system.

Slot 0 1

Local Chassis

Slot 1 2 3

Remote Chassis #1

Logix5550 Controller

1756-ENET/B

1756-ENET/B

1756-OB16I Digital Output

1756-IB16 Digital Input

Slot 0 1

Remote Chassis #2

Ethernet Switch

PC Workstation

1756-OF6VI Analog Output

1756-ENET/B

Flex I/O

The RSLogix 5000 I/O Configuration for this network is shown below.

```
I/O Configuration
  [1] 1756-ENET/B Local_ENET
    [0] 1756-ENET/B Remote_ENET_1
      [1] 1756-IB16I Remote_Digital_Input_1
      [2] 1756-OB16I Remote_Digital_Output_1
    [0] 1756-ENET/B Remote_ENET_2
      [1] 1756-IF8 Remote_Analog_Input_2
      [2] 1756-OF8 Remote_Analog_Output_2
    1794-AENT/A Remote_FLEX_IO_Adaptor
      [0] 1794-IB16/A Remote_DC_Input
      [1] 1794-OB16/A Remote_DC_Output
```

Larger Control Networks

Larger control networks may use additional local ENET/B modules communicating with remote chassis. A partial system is shown below.

The partial RSLogix 5000 I/O Configuration for this network is shown in the following figure.

Appendix **F**

Electronic Keying

| ATTENTION | Be extremely cautious if you disable electronic keying. If used incorrectly, this option can lead to personal injury or death, property damage, or economic loss. |

Specifying Electronic Keying

You specify electronic keying to ensure that a module being inserted or configured is of the proper type and firmware revision.

	Keying	Description
"least"	disable keying	No attributes of the software or hardware are required to match.
"moderate"	compatible module	The module must be compatible with the software configuration. These characteristics must match: • module type • catalog number • major revision The minor revision must be equal to or greater than the one specified in the software.
"most"	exact match	The module must match the software configuration exactly. These characteristics must match: • module type • catalog number • major revision • minor revision

Allen-Bradley
Publication Problem Report

Pub. Name ControlLogix Ethernet Communication Interface Module User Manual

Cat. No. 1756-ENET/B   Pub. No. 1756-UM051B-EN-P   Pub. Date November 2000   Part No. 957400-29

Check Problem(s) Type:	Describe Problem(s)			Internal Use Only
Technical Accuracy	text		illustration	
Completeness	procedure/step	illustration	definition	info in manual
What information is missing?	example	guideline	feature	(accessibility)
	explanation	other		info not in
Clarity				
What is unclear?				
Sequence				
What is not in the right order?				
Other Comments				
Use back for more comments.				

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Other Comments

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