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.

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**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**

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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.

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

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- 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.

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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:

About This User Manual

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.

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:

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<thead>
<tr>
<th>Quantity</th>
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<th>Catalog Number</th>
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<td></td>
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<tr>
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<td>ControlLogix chassis</td>
<td>1756-A4, (or -A7, -A13, -A13, -A17)</td>
</tr>
<tr>
<td>2</td>
<td>ControlLogix power supply</td>
<td>1756-PA72, (or -PB72)</td>
</tr>
<tr>
<td>2</td>
<td>Ethernet Communications Interface Module</td>
<td>1756-ENET/B</td>
</tr>
<tr>
<td>2</td>
<td>Logix5550 controller</td>
<td>1756-L1</td>
</tr>
<tr>
<td>1</td>
<td>Analog Output Module</td>
<td>1756-0F8</td>
</tr>
<tr>
<td>1</td>
<td>Digital Input Module</td>
<td>1756-IB16I</td>
</tr>
<tr>
<td>1</td>
<td>Digital Output Module</td>
<td>1756-OB16I</td>
</tr>
<tr>
<td>1</td>
<td>Personal computer that supports RSLogix 5000 software</td>
<td>Any appropriate model running Windows NT 4.0, Service Pack 5 or higher</td>
</tr>
<tr>
<td>1</td>
<td>Ethernet switch</td>
<td>Refer to manufacturer's specifications</td>
</tr>
<tr>
<td></td>
<td>Associated media and connectors as needed</td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>RSLinx</td>
<td>9355-WAB, -WABOEM, -WABC</td>
</tr>
<tr>
<td>1</td>
<td>RSLogix 5000 programming software</td>
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**Where to Find More Information**

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

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<td>Ethernet/IP Cable Planning and Installation Guide</td>
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<td>RSLinx Lite User's Guide</td>
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Many of the above publications are available online from the Automation Bookstore:


For more information about Rockwell Software products, visit the Rockwell Software internet site:

## Terminology

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<td>bandwidth</td>
<td>The transmission capacity of the network, expressed in bits per second. Traditional Ethernet has a 10Mbit bandwidth. Fast Ethernet is 100Mbit.</td>
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<tr>
<td>BootP</td>
<td>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.</td>
</tr>
<tr>
<td>bridge</td>
<td>An internetwork node between two similar communication subnets where protocol translation is minimal.</td>
</tr>
<tr>
<td>CIP</td>
<td>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.</td>
</tr>
<tr>
<td>consumer</td>
<td>A destination device in the CIP networking model. See CIP.</td>
</tr>
<tr>
<td>CSMA/CD</td>
<td>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.</td>
</tr>
<tr>
<td>determinism</td>
<td>The ability to predict when information will be delivered. Important in time critical applications.</td>
</tr>
<tr>
<td>DHCP</td>
<td>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.</td>
</tr>
<tr>
<td>DNS</td>
<td>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.</td>
</tr>
<tr>
<td>Ethernet</td>
<td>A physical layer standard using Carrier Sense Multiple Access with Collision Detection (CSMA/CD) methods.</td>
</tr>
<tr>
<td><strong>This term</strong></td>
<td><strong>Means</strong></td>
</tr>
<tr>
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<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Ethernet network</td>
<td>A local area network designed for the high-speed exchange of information between computers and related devices.</td>
</tr>
<tr>
<td>Ethernet/IP</td>
<td>Ethernet Industrial Protocol. Ethernet/IP applies a common application layer (CIP) over Ethernet by encapsulating messages in TCP/UDP/IP.</td>
</tr>
<tr>
<td>explicit messaging</td>
<td>Non-time critical messaging used for device configuration and data collection, such as downloading programs or peer-to-peer messaging between two PLCs.</td>
</tr>
<tr>
<td>fast Ethernet</td>
<td>Ethernet operating at 100Mbps/second.</td>
</tr>
<tr>
<td>full duplex</td>
<td>A mode of communication that allows a device to send and receive information at the same time, effectively doubling the bandwidth.</td>
</tr>
<tr>
<td>fully qualified domain name</td>
<td>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.</td>
</tr>
<tr>
<td>gateway</td>
<td>A module or set of modules that allows communications between nodes on dissimilar networks.</td>
</tr>
<tr>
<td>host name</td>
<td>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 <a href="http://www.foobar.com">www.foobar.com</a>. 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, <a href="http://www.foobar.com">www.foobar.com</a>. 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, <a href="http://www.foobar.com">www.foobar.com</a>.</td>
</tr>
<tr>
<td>hub</td>
<td>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.</td>
</tr>
<tr>
<td>implicit messaging</td>
<td>Real time messaging of I/O data.</td>
</tr>
<tr>
<td>IP</td>
<td>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.</td>
</tr>
<tr>
<td><strong>This term</strong></td>
<td><strong>Means</strong></td>
</tr>
<tr>
<td>------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>IP address</td>
<td>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.</td>
</tr>
<tr>
<td>latency</td>
<td>The time between initiating a request for data and the beginning of the actual data transfer.</td>
</tr>
<tr>
<td>module address</td>
<td>A six-bit number used to uniquely identify any module on the local and extended ControlLogix backplane.</td>
</tr>
<tr>
<td>multicast</td>
<td>In the CIP producer/consumer model one producer multicasts (broadcasts) the data once to all the consumers.</td>
</tr>
<tr>
<td>producer</td>
<td>The source of information in the CIP networking model. See CIP.</td>
</tr>
<tr>
<td>rack</td>
<td>A physical and logical collection of application modules sharing a common power supply and backplane for module to module communication.</td>
</tr>
<tr>
<td>star configuration</td>
<td>A network configuration in which the devices are connected to a central hub or switch.</td>
</tr>
<tr>
<td>subnet mask</td>
<td>An extension of the IP address that allows a site to use a single net ID for multiple networks.</td>
</tr>
<tr>
<td>switch</td>
<td>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.</td>
</tr>
<tr>
<td>TCP</td>
<td>Transport Control Protocol. More reliable but slower transport protocol than UDP. Used for explicit (not time critical) messaging in Ethernet/IP.</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>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.</td>
</tr>
<tr>
<td>transaction</td>
<td>An exchange of request and data and response and data.</td>
</tr>
<tr>
<td>UDP</td>
<td>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.</td>
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Chapter 1

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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</table>

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:

<table>
<thead>
<tr>
<th>Product</th>
<th>Firmware Version/Software Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>1756-ENET/B module</td>
<td>2.01 or higher</td>
</tr>
<tr>
<td>Logix 5550 Controller</td>
<td>6.10 or higher</td>
</tr>
<tr>
<td>RSLogix 5000 software</td>
<td>7.0 or higher</td>
</tr>
<tr>
<td>RSLinx software</td>
<td>2.2 or higher</td>
</tr>
</tbody>
</table>

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 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).

<table>
<thead>
<tr>
<th>Tag Type</th>
<th>Description</th>
<th>Specify Using RSLogix5000 Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Produced(1)</td>
<td>Tags that the controller produced for other nodes to consume.</td>
<td>Enabled for producing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of consumers allowed</td>
</tr>
<tr>
<td>Consumed(1)</td>
<td>Tags whose values are produced by another controller.</td>
<td>Name of controller that owns the tag the local controller wants to consume</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tag name or instance that the local controller wants to consume</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Data type of the tag to consume</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Update interval of how often the local controller consumes the tag data</td>
</tr>
</tbody>
</table>

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

Publication 1756-UM051B-EN-P - November 2000
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.
Chapter 2

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.

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<thead>
<tr>
<th>For information about</th>
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<td>2-2</td>
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<tr>
<td>Installing the Ethernet Module</td>
<td>2-2</td>
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<tr>
<td>Preparing the Chassis for Module Installation</td>
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<tr>
<td>Determining Module Slot Location</td>
<td>2-3</td>
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<tr>
<td>Inserting the Module in the Chassis</td>
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<tr>
<td>Removing or Replacing the Module (when applicable)</td>
<td>2-5</td>
</tr>
<tr>
<td>Wiring the Ethernet Connector</td>
<td>2-6</td>
</tr>
<tr>
<td>Connecting the Module to the Ethernet Network</td>
<td>2-6</td>
</tr>
<tr>
<td>Applying Chassis Power</td>
<td>2-7</td>
</tr>
<tr>
<td>Checking Power Supply and Module Status</td>
<td>2-8</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Chassis Type</th>
<th>Chassis Installation</th>
<th>Power Supply</th>
<th>Power Supply Installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series A: 1756-A4, -A7, -A10, -A13</td>
<td>1756-5.69</td>
<td>1756-PA72/B(1)</td>
<td>1756-5.67</td>
</tr>
<tr>
<td>Series B: 1756-A4, -A7, -A10, -A13</td>
<td>1756-5.80</td>
<td>1756-PA75/A(2)</td>
<td>1756-5.78</td>
</tr>
</tbody>
</table>

(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.

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

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

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 proceeding.
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**
Checking Power Supply and Module Status

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

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.
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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<tr>
<td>Transmission Control Protocol/Internet Protocol (TCP/IP)</td>
<td>3-1</td>
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<tr>
<td>User Datagram Protocol (UDP)</td>
<td>3-2</td>
</tr>
<tr>
<td>Simple Network Management Protocol (SNMP)</td>
<td>3-2</td>
</tr>
<tr>
<td>Configuration Requirements</td>
<td>3-3</td>
</tr>
<tr>
<td>IP Address</td>
<td>3-3</td>
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<tr>
<td>Gateways</td>
<td>3-4</td>
</tr>
<tr>
<td>Subnet Mask</td>
<td>3-5</td>
</tr>
<tr>
<td>For More Information</td>
<td>3-6</td>
</tr>
</tbody>
</table>

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.
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.
Before you Configure Your Module

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.

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:

<table>
<thead>
<tr>
<th>Range of first integer</th>
<th>Class</th>
<th>Range of first integer</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 127</td>
<td>A</td>
<td>192 - 223</td>
<td>C</td>
</tr>
<tr>
<td>128 - 191</td>
<td>B</td>
<td>224 - 255</td>
<td>other</td>
</tr>
</tbody>
</table>

**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.

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.

---

**TIP**

Contact your network administrator or the Network Information Center for a unique fixed IP address to assign to your module.
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:

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 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.

EXAMPLE

```
128.1.0.1

128.2.64.1 128.2.64.2 128.2.64.3

128.1.0.2

128.2.128.1 128.2.128.2 128.2.128.3

Network 1

Network 2.1

Network 2.2

A

B C

G

D E

G2
```
For More Information

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

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

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

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

- Computer Networks
  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 ways 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.

<table>
<thead>
<tr>
<th>For information about</th>
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<tbody>
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<td>Using the Rockwell BootP Utility</td>
<td>4-1</td>
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<td>Using RSLinx Software</td>
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</tr>
<tr>
<td>Using a BootP Server</td>
<td>4-5</td>
</tr>
<tr>
<td>Using DHCP Software to Configure Your Module</td>
<td>4-7</td>
</tr>
</tbody>
</table>

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_DFI-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.

![1756-ENET Configuration Window](image)

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

![Port Configuration Tab](image)

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 /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
#
#-––––––––––––––––––––––––––––––––––––––––––––––––––––––––––––––––
zhappa0:
#    tc=icp.defaults:
#    ha=0000bc03404f:
#    ip=130.151.132.121
zhappa1:
#    tc=icp.defaults:
#    ha=0000bc034073:
#    ip=130.151.132.122
zhappa2:
```

EXAMPLE
Configuring the Ethernet Module

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.

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.

   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.

   tcn=icp.defaults: \n   ha=0000bc034022: \n   ip=130.151.132.123
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.
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.

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<td>Create the Example Application</td>
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</tr>
<tr>
<td>Add the Local Ethernet Module to the I/O Configuration</td>
<td>5-4</td>
</tr>
<tr>
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<td>Add the Remote Digital Input Module</td>
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<td>Test the Example Application</td>
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</tbody>
</table>
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.

   ![](image.png)

   The following pop-up window will open.

2. Click on **New Module**.
The **Select Module Type** window will open.

![Select Module Type Window](image)

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

The **Module Properties** window will open.

![Module Properties Window](image)

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Local_ENET</td>
</tr>
<tr>
<td>IP Address</td>
<td>130.130.130.2</td>
</tr>
<tr>
<td>Slot</td>
<td>1</td>
</tr>
<tr>
<td>Electronic Keying</td>
<td>Compatible Module</td>
</tr>
</tbody>
</table>

(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):

<table>
<thead>
<tr>
<th>Name</th>
<th>Remote_ENET</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP Address</td>
<td>130.130.130.3</td>
</tr>
<tr>
<td>Chassis Size</td>
<td>4</td>
</tr>
<tr>
<td>Slot</td>
<td>0</td>
</tr>
<tr>
<td>Comm Format</td>
<td>Rack Optimization</td>
</tr>
<tr>
<td>Electronic Keying(1)</td>
<td>Compatible Module</td>
</tr>
</tbody>
</table>

   *(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]

### 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 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

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.

![Select Module Type Window]

3. Select the **1756-IB16f** digital input module from the list and click on **OK**.

   The Module Properties window will open.

![Module Properties Window]

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

<table>
<thead>
<tr>
<th>Name</th>
<th>Remote_Digital_Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slot</td>
<td>1</td>
</tr>
<tr>
<td>Comm Format</td>
<td>Rack Optimization</td>
</tr>
<tr>
<td>Electronic Keying</td>
<td>Compatible Module</td>
</tr>
</tbody>
</table>

*See Appendix F for important information about Electronic Keying.*
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
```

**Add the Remote Digital Output 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
```

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):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Remote_Digital_Output</td>
</tr>
<tr>
<td>Slot</td>
<td>2</td>
</tr>
<tr>
<td>Comm Format</td>
<td>Rack Optimization</td>
</tr>
<tr>
<td>Electronic Keying</td>
<td>Compatible Module</td>
</tr>
</tbody>
</table>

(1) See Appendix F for important information about Electronic Keying.
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.

![I/O Configuration Diagram]

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

3. Create the following tag:

<table>
<thead>
<tr>
<th>Tag</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parts_Count</td>
<td>Counter</td>
</tr>
</tbody>
</table>

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).

   ![](image1)

   - The **Autoconnect** checkbox is checked.
   - The **Domain**, **Network**, and **Device** fields are empty.
   - The **Current Path** field shows the path to the directory.
   - The **Apply Current Path to Project** checkbox is checked.
   - The **Path in Project** field shows the path to the directory.

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:

   ![](image2)

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.
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.

**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.
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.

<table>
<thead>
<tr>
<th>What you will do</th>
<th>See page</th>
</tr>
</thead>
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</tr>
<tr>
<td>Create the Example Application</td>
<td>6-3</td>
</tr>
<tr>
<td>Add the Remote Analog I/O Module to the I/O Configuration</td>
<td>6-4</td>
</tr>
<tr>
<td>Edit the Controller Tags</td>
<td>6-8</td>
</tr>
<tr>
<td>Modify the Ladder Program</td>
<td>6-10</td>
</tr>
<tr>
<td>Download the Program</td>
<td>6-11</td>
</tr>
<tr>
<td>Test the Example Application</td>
<td>6-12</td>
</tr>
</tbody>
</table>
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.
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.

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

The **Module Properties** window will open.

![Module Properties Window](image)

3. Enter the following parameters:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Remote_Analog_Output</td>
</tr>
<tr>
<td>Slot</td>
<td>3</td>
</tr>
<tr>
<td>Comm Format</td>
<td>Float Data(1)</td>
</tr>
<tr>
<td>Electronic Keying(2)</td>
<td>Compatible Module</td>
</tr>
</tbody>
</table>

(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:

![Next Page](image)
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.

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

<table>
<thead>
<tr>
<th></th>
<th>High Signal</th>
<th>High Engineering</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Signal</td>
<td>10.0 V</td>
<td>8000</td>
</tr>
<tr>
<td>Low Signal</td>
<td>0.0 V</td>
<td>0</td>
</tr>
</tbody>
</table>

(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.

10. Enter the following Limits:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>High Clamp</td>
<td>8000</td>
</tr>
<tr>
<td>Low Clamp</td>
<td>0</td>
</tr>
</tbody>
</table>

11. Click on Finish to save the configuration.

The I/O Configuration tree should now 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. We now need to add another Controller Tag to modify the application program.

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.

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:

<table>
<thead>
<tr>
<th>Tag Name</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog_Output</td>
<td>Timer</td>
</tr>
</tbody>
</table>
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.

![Ladder Diagram]

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 Diagram](image)

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.
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.

<table>
<thead>
<tr>
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<th>See page</th>
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<tbody>
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<td>7-3</td>
</tr>
<tr>
<td>Create the Producer Tags</td>
<td>7-4</td>
</tr>
<tr>
<td>Create the Producer Ladder Program</td>
<td>7-6</td>
</tr>
<tr>
<td>Download the Producer Application</td>
<td>7-7</td>
</tr>
<tr>
<td>Create the Consumer Application</td>
<td>7-8</td>
</tr>
<tr>
<td>Create the Consumer Controller</td>
<td>7-8</td>
</tr>
<tr>
<td>Add the Producer to the Consumer’s I/O Configuration</td>
<td>7-9</td>
</tr>
<tr>
<td>Add the Local ENET/B Module to the I/O Configuration</td>
<td>7-9</td>
</tr>
<tr>
<td>Add the Remote ENET/B Module to the I/O Configuration</td>
<td>7-11</td>
</tr>
<tr>
<td>Add the Remote (Producer) Controller to the I/O Config</td>
<td>7-13</td>
</tr>
<tr>
<td>Create the Consumer Tags</td>
<td>7-15</td>
</tr>
<tr>
<td>Download the Configuration to the Consumer</td>
<td>7-18</td>
</tr>
<tr>
<td>Test the Messaging</td>
<td>7-19</td>
</tr>
</tbody>
</table>
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.

   ![RSLogix5000 Main Window](image)

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

   The **New Controller** window will open.

   ![New Controller Window](image)

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.

   ![Controller Tags Window]

   The Controller Tags window will open.

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

<table>
<thead>
<tr>
<th>Tag Name</th>
<th>Type</th>
<th>Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>produced_data</td>
<td>DINT</td>
<td>Decimal</td>
</tr>
<tr>
<td>T1</td>
<td>TIMER</td>
<td></td>
</tr>
</tbody>
</table>
3. Produce the tag that is being sent. Either:

   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:

   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.

![Select Module Type Window]

2. Select New Module.

The Select Module Type window will open.

![Select Module Type Window]

3. Select the 1756-ENET/B module and click on OK.
The **Module Properties** window will open.

4. Enter the following parameters:

<table>
<thead>
<tr>
<th>Name</th>
<th>Local_ENET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slot</td>
<td>1</td>
</tr>
</tbody>
</table>

   **Electronic Keying**
   
   (1) See Appendix F for important information about Electronic Keying.

   **Compatible Module**

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:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Remote_ENET</td>
</tr>
<tr>
<td>IP Address</td>
<td>130.130.130.2</td>
</tr>
<tr>
<td>Chassis Size</td>
<td>4</td>
</tr>
<tr>
<td>Slot</td>
<td>1</td>
</tr>
<tr>
<td>Comm Format</td>
<td>Rack Optimization</td>
</tr>
<tr>
<td>Electronic Keying</td>
<td>Compatible Module</td>
</tr>
</tbody>
</table>

(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.

![Module Properties window](image)

3. Enter the following parameters:

<table>
<thead>
<tr>
<th>Name</th>
<th>Producer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slot</td>
<td>0</td>
</tr>
</tbody>
</table>

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

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

```plaintext
├── I/O Configuration
│   ├── 1756-L1 ENE/8 Local ENE
│   │   ├── 1756-L1 ENE/8 Remote ENE
│   │   │   └── 1756-L1 Producer
```
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.
2. Select the **Edit Tags** tab and create the following tag:

<table>
<thead>
<tr>
<th>Tag Name</th>
<th>Type</th>
<th>Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>consumed_data</td>
<td>DINT</td>
<td>Decimal</td>
</tr>
</tbody>
</table>

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

4. Select **Edit Tag Properties**.
The **Tag Properties** window will open.

![Tag Properties screenshot]

5. Enter or select the following parameters:

<table>
<thead>
<tr>
<th>Name</th>
<th>consumed_data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tag Type</strong></td>
<td>Consumed</td>
</tr>
<tr>
<td><strong>Controller</strong></td>
<td>Producer</td>
</tr>
<tr>
<td><strong>Remote Tag</strong></td>
<td>produced_data(1)</td>
</tr>
<tr>
<td><strong>Data Type</strong></td>
<td>DINT(1)</td>
</tr>
<tr>
<td><strong>Style</strong></td>
<td>Decimal(1)</td>
</tr>
<tr>
<td><strong>RPI</strong></td>
<td>10ms(1)</td>
</tr>
</tbody>
</table>

(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.

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.
   
   ![Controller Tags](image)
   
   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.
Appendix A

LED 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:

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

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

<table>
<thead>
<tr>
<th>If this indicator:</th>
<th>is:</th>
<th>the module is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>TXD</td>
<td>Green</td>
<td>Transmitting data</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>Not active</td>
</tr>
<tr>
<td>RXD</td>
<td>Green</td>
<td>Receiving data</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>Not active</td>
</tr>
</tbody>
</table>

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

![ENET/IP (CIP) Statistics Window](image)

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.
Appendix C

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:

<table>
<thead>
<tr>
<th>For information about</th>
<th>See page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installing the RSLinx Software</td>
<td>C-1</td>
</tr>
<tr>
<td>Configuring the AB_ETH Driver</td>
<td>C-2</td>
</tr>
</tbody>
</table>

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 RSlnx.

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.

![Add New RSLinx Driver](image)

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.

![Configure driver](image)

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.
Appendix E

Example Network Configurations

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.

<table>
<thead>
<tr>
<th>For information about</th>
<th>See page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small System Example</td>
<td>E-2</td>
</tr>
<tr>
<td>Expanded System with FLEX I/O</td>
<td>E-3</td>
</tr>
<tr>
<td>Larger Control Networks</td>
<td>E-4</td>
</tr>
</tbody>
</table>
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.

```
I/O Configuration
- [1] 1756-ENET/B Local_ENET
- [0] 1756-ENET/B Remote_ENET_1
  - [1] 1756-IB16 Remote_Digital_Input_1
  - [2] 1756-OB16 Remote_Digital_Output_1
- [0] 1756-ENET/B Remote_ENET_2
  - [1] 1756-IF16 Remote_Analog_Input_2
  - [2] 1756-OF6VI Remote_Analog_Output_2
```
Expanded System with FLEX I/O

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

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

```
<table>
<thead>
<tr>
<th>I/O Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 1756-ENET/B Local_ENET</td>
</tr>
<tr>
<td>2. 1756-ENET/B Remote_ENET</td>
</tr>
<tr>
<td>3. 1756-ENET/B Remote_Digital_Input1</td>
</tr>
<tr>
<td>4. 1756-ENET/B Remote_Digital_Input2</td>
</tr>
<tr>
<td>5. 1756-ENET/B Remote_Digital_Output1</td>
</tr>
<tr>
<td>6. 1756-ENET/B Remote_Digital_Output2</td>
</tr>
</tbody>
</table>

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### 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.

<table>
<thead>
<tr>
<th>Keying</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;least&quot;</td>
<td>disable keying</td>
</tr>
<tr>
<td></td>
<td>No attributes of the software or hardware are required to match.</td>
</tr>
<tr>
<td>&quot;moderate&quot;</td>
<td>compatible module</td>
</tr>
<tr>
<td></td>
<td>The module must be compatible with the software configuration. These</td>
</tr>
<tr>
<td></td>
<td>characteristics must match:</td>
</tr>
<tr>
<td></td>
<td>- module type</td>
</tr>
<tr>
<td></td>
<td>- catalog number</td>
</tr>
<tr>
<td></td>
<td>- major revision</td>
</tr>
<tr>
<td></td>
<td>The minor revision must be equal to or greater than the one specified in</td>
</tr>
<tr>
<td></td>
<td>the software.</td>
</tr>
<tr>
<td>&quot;most&quot;</td>
<td>exact match</td>
</tr>
<tr>
<td></td>
<td>The module must match the software configuration exactly. These</td>
</tr>
<tr>
<td></td>
<td>characteristics must match:</td>
</tr>
<tr>
<td></td>
<td>- module type</td>
</tr>
<tr>
<td></td>
<td>- catalog number</td>
</tr>
<tr>
<td></td>
<td>- major revision</td>
</tr>
<tr>
<td></td>
<td>- minor revision</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Check Problem(s) Type:</th>
<th>Describe Problem(s)</th>
<th>Internal Use Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Accuracy</td>
<td>text</td>
<td>illustration</td>
</tr>
</tbody>
</table>

| Completeness          | procedure/step      | illustration     |
|                       | example             | guideline        |
|                       | explanation         | other            |

<table>
<thead>
<tr>
<th>What information is missing?</th>
<th>definition</th>
<th>info in manual (accessibility)</th>
</tr>
</thead>
<tbody>
<tr>
<td>example</td>
<td>feature</td>
<td>info not in</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clarity</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>What is unclear?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sequence</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>What is not in the right order?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Comments</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Use back for more comments.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Your Name

Location/Phone

Return to: Marketing Communications, Allen-Bradley., 1 Allen-Bradley Drive, Mayfield Hts., OH 44124-6118 Phone: (440) 646-3176 FAX: (440) 646-4320