Allen-Bradley

ControlLogix Digital I/O Modules

Input Modules

1756-IA16, -IA16I, -IA32, -IA8D, -IB16, -IB16D, -IB16I, -IB32/B, -IC16, -IG16, -IH16I, -IM16I, -IN16, -IV16, -IV32

Output Modules

1756-OA16, -OA16I, -OA8, -OA8D, -OA8E, -OB16D, -OB16E, -OB16I, -OB16IS, -OB32, -OB8, -OB8EI, -OC8, -OG16, -OH8I, -ON8, -OV16E, -OV32E, -OW16I, -OX8I

User Manual

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://www.ab.com/manuals/gi) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

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

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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

WARNING — Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

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

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

- identify a hazard
- avoid a hazard
- recognize the consequence

SHOCK HAZARD — Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.

BURN HAZARD — Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be dangerous temperatures.

Introduction

This release of this document contains updated information. Changes are designated by change bars in margin, as shown to the right.

New and Revised Information

Table Summary of Changes.1 lists the new and revised information included in this release of the ControlLogix digital I/O modules user manual.

Table Summary of Changes.1 New and Revised Information

Information About	Location	New or Revised
Event-Based Tasks	Chapter 2	New
1756-IA32 module	• Features description in Chapter 3 • Module-specific information (e.g. wiring diagram) on page 7-8	New
1756-IG16 module	• Features description in Chapter 3 • Module-specific information (e.g. wiring diagram) on page 7-29	New
1756-OB16IS module	• Features description in Chapter 3 • Module-specific information (e.g. wiring diagram) on page 7-71	New
1756-OG16 module	• Features description in Chapter 3 • Module-specific information (e.g. wiring diagram) on page 7-86	New
1756-OV32E module	• Features description in Chapter 3 • Module-specific information (e.g. wiring diagram) on page 7-98	New
Using the Motion Axis Output Cam (MAOC) Instructions with Time Scheduled Output Control	page 3-20	New
Scheduled output data per point communications format - 1756-OB16IS module only	page 6-7	New
Updated Environmental Condition Specifications	Chapter 7	Revised
Using 1492 Wiring Systems with Your Digital I/O Module	Appendix F	New
Glossary	After Appendix E	New and revised terms

Notes:

About This User Manual

What This Preface Contains

This preface describes how to use this manual.

Table Preface.1

For information about:	See page:
Who Should Use This Manual	Preface-1
Purpose of This Manual	Preface-1
What This Manual Contains	Preface-2
Related Products and Documentation	Preface-3

Who Should Use This Manual

You must be able to program and operate a Rockwell Automation ControlLogix™ controller to efficiently use your analog I/O modules.

We assume that you know how to do this in this manual. If you do not, refer to the Logix5000™ controller documentation before you attempt to use this module. Table Preface.3 on page Preface-3 lists related documentation.

Purpose of This Manual

This manual describes how to install, configure, and troubleshoot your ControlLogix digital I/O modules.

What This Manual Contains

Table Preface.2 lists describes the sections contained in this manual.

Table Preface.2

Section:	Title:	Description:
Chapter 1	What Are ControlLogix Digital I/O Modules?	A general overview of the ControlLogix digital I/O modules and how they are used
Chapter 2	Digital I/O Operation in the ControlLogix System	Description of how ControlLogix digital I/O modules work with in a ControlLogix system
Chapter 3	ControlLogix Standard Digital I/O Module Features	Listing of the features that are common to all standard ControlLogix digital I/O modules
Chapter 4	ControlLogix Diagnostic Digital I/O Module Features	Listing of the features that are common to all diagnostic ControlLogix digital I/O modules
Chapter 5	Installing the ControlLogix I/O Module	Step-by-step description of how to install ControlLogix digital I/O modules
Chapter 6	Configuring Your ControlLogix Digital I/O Modules	Description of how to configure ControlLogix digital I/O modules with RSLogix 5000™
Chapter 7	Module-Specific Information	A complete listing of module specific information for each ControlLogix digital I/O module catalog number, including: • wiring diagram • simplified schematic • status indicators • specifications
Chapter 8	Troubleshooting Your Module	Description of how to use status indicators and RSLogix 5000 to troubleshoot your application.
Appendix A	Tag Definitions	Listing and description of module-defined data types and tags available with ControlLogix digital I/O modules
Appendix B	Using Ladder Logic To Perform Run Time Services and Reconfiguration	Explanation of how to use ladder logic to perform run time services on your module
Appendix C	Power Supply Sizing Chart	Chart you can use to verify how much power is used in your ControlLogix chassis
Appendix D	Driving Motor Starters with ControlLogix Digital I/O Modules	Explanation of how to choose a ControlLogix digital I/O module to use with a Bulletin 500 Series motor starter
Appendix E	Hardware Response Times	Listing of nominal hardware response times for some ControlLogix dc I/O modules.
Appendix F	Using 1492 Wiring Systems with Your Digital I/O Module	Description of the bulletin 1492 interface modules (IFM) available for use with ControlLogix digital I/O modules.

Related Products and Documentation

The following table lists related ControlLogix products and documentation:

Table Preface.3 Related Documentation

Catalog number:	Document title:	Publication number:
1756-A4, -A7, -A10, -A13	ControlLogix Chassis Installation Instructions	1756-IN080
1756-PA72/B, -PB72/B	ControlLogix Power Supply Installation Instructions	1756-5.67
1756-PA75, -PB75	ControlLogix Power Supply Installation Instructions	1756-5.78
1756-Series	ControlLogix Module Installation Instructions (Each module has separate installation document.)	Multiple 1756-IN numbers
1756-Series	ControlLogix Analog I/O Modules User Manual	1756-UM058
1756-CNB, -CNBR	ControlNet Modules in Logix5000 Control Systems User Manual	CNET-UM001
1756-DNB	DeviceNet Modules in Logix5000 Control Systems User Manual	DNET-UM004
1756-DHRIO	ControlLogix Data Highway Plus Communication Interface Module User Manual	1756-UM514
1756-ENBT, -ENET	EtherNet/IP Modules in Logix5000 Control Systems User Manual	ENET-UM001
1756-Lx	ControlLogix Selection Guide	1756-SG001
1756-Lx	ControlLogix System User Manual	1756-UM001
1756-Lx, 1769-Lx, 1789-Lx, 1794-Lx, PowerFlex 700S	Logix5000 Controllers Quick Reference	1756-QR107
1756-Lx, 1769-Lx, 1789-Lx, 1794-Lx, PowerFlex 700S	Logix5000 Controllers Common Procedures Programming Manual	1756-PM001
1756-Lx, 1769-Lx, 1789-Lx, 1794-Lx, PowerFlex 700S	Logix5000 Controllers Motion Instruction Set Reference Manual	1756-RM007
1756-Lx, 1769-Lx, 1789-Lx, 1794-Lx, PowerFlex 700S	Logix5000 Controllers General Instructions Reference Manual	1756-RM003
Allen-Bradly I/O catalog numbers	I/O Products System Overview	CIG-SO001

For more information on these products, contact your local Rockwell Automation distributor or sales office.

The documentation listed in Table Preface.3 is available at the following locations:

- http://www.ab.com/manuals/cl
- http://www.theautomationbookstore.com

Chapter 1

What Are ControlLogix Digital I/O Modules?

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What Are ControlLogix Digital I/O Modules?

What This Chapter Contains

This chapter describes the ControlLogix digital modules and what you must know and do before you begin to use them.

Table 1.1

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What are ControlLogix Digital I/O Modules?

ControlLogix digital I/O modules are input/output modules that provide ON/OFF detection and actuation. Using the producer/consumer network model, they can produce information when needed while providing additional system functions.

Table 1.2 lists the features available on ControlLogix digital I/O modules that allow greater system applicability.

Table 1.2 ControlLogix Digital I/O Module Features

Feature:	Description:
Removal and Insertion Under Power (RIUP)	This system feature allows you to remove and insert modules and RTB while power is applied. For more information on RIUP, see page 1-6.
Producer/consumer communications	These communications are an intelligent data exchange between modules and other system devices in which each module produces data without having been polled.
System timestamp of data	A 64-bit system clock places a timestamp on the transfer of data between the module and its owner-controller within the local chassis.
Module level fault reporting and field side diagnostic detection	Fault and diagnostic detection capabilities that provide you the information necessary to most effectively and efficiently use your module and troubleshoot your application.
Class I Division 2, UL, CSA, FM and CE Agency Certification	Full agency certification for in any application that requires approval of the agencies listed.

Using an I/O Module in the ControlLogix System

ControlLogix modules mount in a ControlLogix chassis and use a Removable Terminal Block (RTB) or a Bulletin 1492 Interface Module[(1)] cable that connects to an IFM to connect all field-side wiring.

Before you install and use your module you should have already:

- installed and grounded a 1756 chassis and power supply[(2)]. To install these products, refer to the publications listed in Table Preface.3 on page Preface-3.
- ordered and received an RTB or IFM and its components for your application.

IMPORTANT RTBs and IFMs are not included with your module purchase.

Table 1.3 Types of ControlLogix Digital I/O Modules

Catalog Number:	Description:	Module Specific Information on:
1756-IA16	79-132V ac 16-point input module	page 7-2
1756-IA16I	79-132V ac 16-point isolated input module	page 7-5
1756-IA32	74-132V ac 32-point input module	page 7-8
1756-IA8D	79-132V ac 8-point diagnostic input module	page 7-11
1756-IB16	10-31V dc 16-point input module	page 7-14
1756-IB16D	10-30V dc diagnostic input module	page 7-17
1756-IB16I	10-30V dc 16-point isolated input module	page 7-20
1756-IB32/B	10-31V dc 32-point input module	page 7-23
1756-IC16	30-60V dc 16-point input module	page 7-26
1756-IG16	TTL input module	page 7-29
1756-IH16I	90-146V dc 16-point isolated input module	page 7-32
1756-IM16I	159-265V ac 16-point isolated input module	page 7-35
1756-IN16	10-30V ac 16-point input module	page 7-38
1756-IV16	10-31V dc 16-point sourcing current input module	page 7-41

(1) The Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of a ControlLogix digital I/O module.

(2) In additon to standard ControlLogix power supplies, ControlLogix Redundant Power Supplies are also available for your application. For more information on these supplies see the ControlLogix Selection Guide, publication 1756-SG001 or contact your local Rockwell Automation distributor or sales representative.

Table 1.3 Types of ControlLogix Digital I/O Modules

Catalog Number:	Description:	Module Specific Information on:
1756-IV32	10-31V dc 32-point sourcing current input module	page 7-44
1756-OA16	74-265V ac 16-point output module	page 7-47
1756-OA16I	74-265V ac 16-point isolated output module	page 7-50
1756-OA8	74-265V ac 16-point output module	page 7-53
1756-OA8D	74-132V ac 8-point diagnostic output module	page 7-56
1756-OA8E	74-132V ac 8-point e-fused output module	page 7-59
1756-OB16D	19-30V dc 16-point diagnostic output module	page 7-62
1756-OB16E	10-31V dc 16-point e-fused output module	page 7-65
1756-OB16I	10-30V dc 16-point isolated output module	page 7-68
1756-OB16IS	10-30V dc scheduled module	page 7-71
1756-OB32	10-31V dc 32-point output module	page 7-74
1756-OB8	10-30V dc 8-point output module	page 7-77
1756-OB8EI	10-30V dc 8-point e-fused isolated output module	page 7-80
1756-OC8	30-60V dc 8-point output module	page 7-83
1756-OG16	TTL output module	page 7-86
1756-OH8I	90-146V dc 8-point isolated output module	page 7-89
1756-ON8	10-30V ac 8-point output module	page 7-92
1756-OV16E	10-31V dc 16-point e-fused sinking current output module	page 7-95
1756-OV32E	10-31V dc 32-point electronically-fused sinking current output module	page 7-98
1756-OW16I	10-265V 16-point isolated relay output module	page 7-101
1756-OX8I	10-265V, 5-150V dc 8-point isolated relay normally open, normally closed output module	page 7-104

Physical Features of the ControlLogix Digital I/O Modules

Figure 1.1

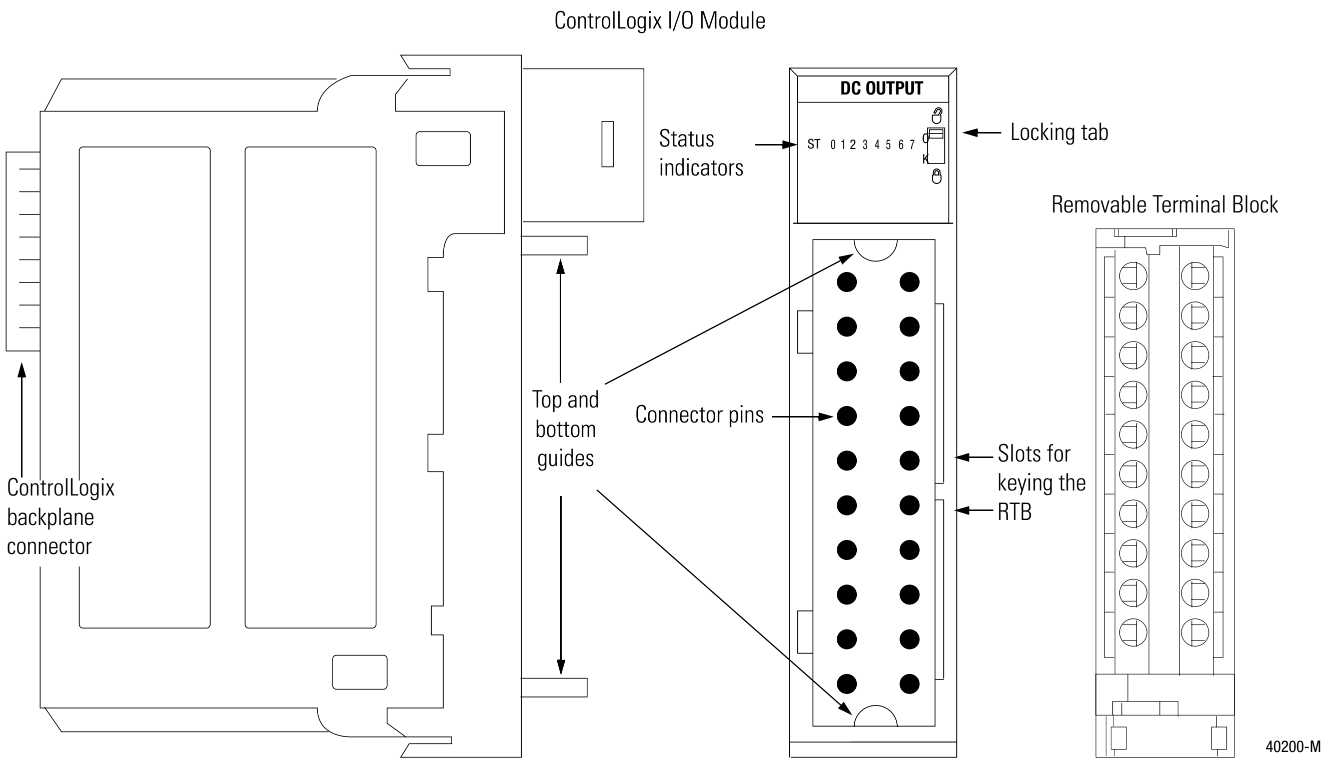

Table 1.4 Physical Features on the ControlLogix Digital I/O Modules

Physical Feature:	Description:
ControlLogix backplane connector	The backplane connector interface for the ControlLogix system connects the module to the ControlBus backplane.
Connector pins	Input/output, power and grounding connections are made to the module through these pins with the use of an RTB or IFM.
Locking tab	The locking tab anchors the RTB or IFM cable on the module, maintaining wiring connections.
Slots for keying	Mechanically keys the RTB to prevent inadvertently making the wrong wire connections to your module.
Status indicators	Indicators display the status of communication, module health and input/output devices. Use these indicators to help in troubleshooting.
Top and bottom guides	Guides provide assistance in seating the RTB or IFM cable onto the module.

Using Module Identification and Status Information

Each ControlLogix I/O module maintains specific identification information that separates it from all other modules. This information assists you in tracking all the components of your system.

For example, you can track module identification information to be aware of exactly what modules are located in any ControlLogix rack at any time. While retrieving module identity, you can also retrieve the module's status.

Each module maintains the following information:

Table 1.5 Module Identification and Status Information

Module Identification:	Description:
Product Type	Module's product type, such as Digital I/O or Analog I/O module
Product Code	Module's catalog number
Major Revision	Module's major revision number
Minor Revision	Module's minor revision number

Status	Module's status. Returns the following information:
	• Controller ownership (if any)
	• Whether module has been configured
	• Device Specific Status, such as:
	  • Self-Test
	  • Flash update in progress
	  • Communications fault
	  • Not owned (outputs in prog. mode)
	  • Internal fault (need flash update)
	  • Run mode
	  • Program mode (output mods only)
	• Minor recoverable fault
	• Minor unrecoverable fault
	• Major recoverable fault
	• Major unrecoverable fault

Vendor ID	Module manufacturer vendor, for example Allen-Bradley
Serial Number	Module serial number
Length of ASCII Text String	Number of characters in module's text string
ASCII Text String	Module's ASCII text string description

IMPORTANT You must perform a WHO service to retrieve this information. For more information on how to retrieve module identification information, see Appendix B.

Preventing Electrostatic Discharge

This module is sensitive to electrostatic discharge.

ATTENTION

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- If available, use a static-safe workstation.

When not in use, store the equipment in appropriate static-safe packaging.

Removal and Insertion Under Power

These modules are designed to be installed or removed while chassis power is applied.

WARNING

When you insert or remove the module while backplane power is on, 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.

Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

Environment and Enclosure

ATTENTION

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 meters without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as "open type" equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure. Also, see the appropriate sections in this publication, as well as the Allen-Bradley publication 1770-4.1 ("Industrial Automation Wiring and Grounding Guidelines"), for additional installation requirements pertaining to this equipment.

Chapter Summary and What's Next

In this chapter, you read about:

- what ControlLogix digital I/O modules are.
- types of ControlLogix digital I/O modules.

Chapter 2 explains Digital I/O Operation in the ControlLogix System.

Digital I/O Operation in the ControlLogix System

What This Chapter Contains

This chapter describes how digital I/O modules work in the ControlLogix system.

Table 2.1

For information about:	See page:
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Ownership

Every I/O module in the ControlLogix system must be owned by a Logix5000 controller. This owner-controller:

- stores configuration data for every module that it owns.
- can be local or remote in regard to the I/O module's position.
- sends the I/O module configuration data to define the module's behavior and begin operation with the control system.

Each ControlLogix I/O module must continuously maintain communication with its owner-controller to operate normally.

Typically, each module in the system will have only 1 owner. Input modules can have more than 1 owner. Output modules, however, are limited to a single owner.

For more information on the increased flexibility provided by multiple owners and the ramifications of using multiple owners, see page 2-19.

Using RSNetWorx and RSLogix 5000

The I/O configuration portion of RSLogix5000 generates the configuration data for each I/O module in the control system, whether the module is located in a local or remote chassis. A remote chassis, also known as networked, contains the I/O module but not the module's owner-controller. Remote chassis can be connected to the controller via a scheduled ControlNet or an EtherNet/IP network.

Configuration data is transferred to the controller during the program download and subsequently transferred to the appropriate I/O modules.

I/O modules in the local chassis, and modules in a remote chassis that is connected via the EtherNet/IP network, are ready to run as soon as the configuration data has been downloaded. However, you must run RSNetWorx for ControlNet to enable I/O modules in a scheduled ControlNet chassis.

Running RSNetWorx transfers configuration data to I/O modules on scheduled ControlNet and establishes a Network Update Time (NUT) for ControlNet that is compliant with the desired communications options specified for each module during configuration.

Anytime a controller references an I/O module in a scheduled ControlNet chassis, you must run RSNetWorx to configure ControlNet. Follow these general guidelines when configuring I/O modules:

1. Configure all I/O modules for a given controller using RSLogix 5000 and download that information to the controller.

2. If the I/O configuration data references a module in a remote chassis connected by scheduled ControlNet, run RSNetWorx.

3. After running RSNetWorx, perform an online save of the RSLogix 5000 project so the configuration infromation that RSNetWorx sends to the controller is saved.

IMPORTANT You **must** run RSNetWorx whenever a new module is added to a scheduled ControlNet chassis. When a module is permanently removed from a remote chassis, we recommend that RSNetWorx be run to optimize the allocation of network bandwidth.

Internal Module Operations

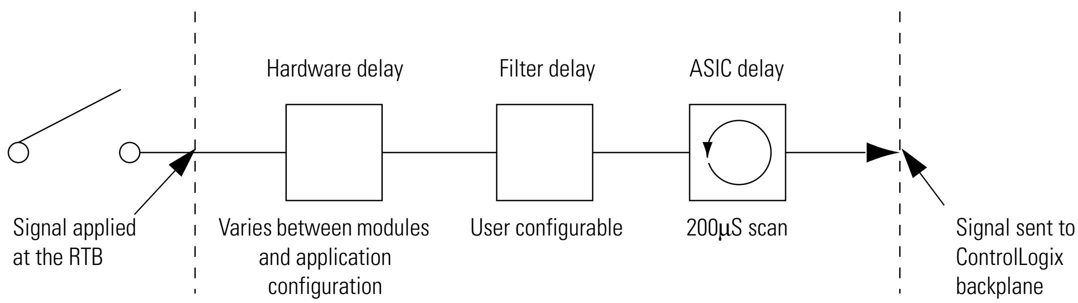
Signal propogation delays exist with ControlLogix I/O modules that must be accounted for when operating them. Some of these delays are user-selectable, and some are inherent to the module hardware. For example, there is a small delay (typically less than 1mS) between when a signal is applied at the RTB of a ControlLogix input module and when a signal is sent to the system over the ControlBus; this typical time reflects a filter time of 0mS for a DC input.

This section offers an explanation of the time limitations with ControlLogix I/O modules.

Input Modules

As shown below, ControlLogix input modules receive a signal at the RTB and process it internally (i.e., hardware delay, filter delay, ASIC delay) before sending a signal to the ControlBus via the Requested Packet Interval (RPI) or at a Change of State (COS) occurrence.

Figure 2.1



EXAMPLE

Many factors (e.g. module type, voltage, temperature, if the module is turning ON or OFF) affect the signal propogation delay on a module. But a typical delay time can be estimated.

For example, if you are **turning ON** a 1756-IB16 module at 24V dc in 25°C conditions, the signal propogation delay is affected by:

- hardware delay to energize the module (typically 290µS on this module)
- user-configurable filter time (0, 1, or 2mS)
- ASIC scan (200µS)

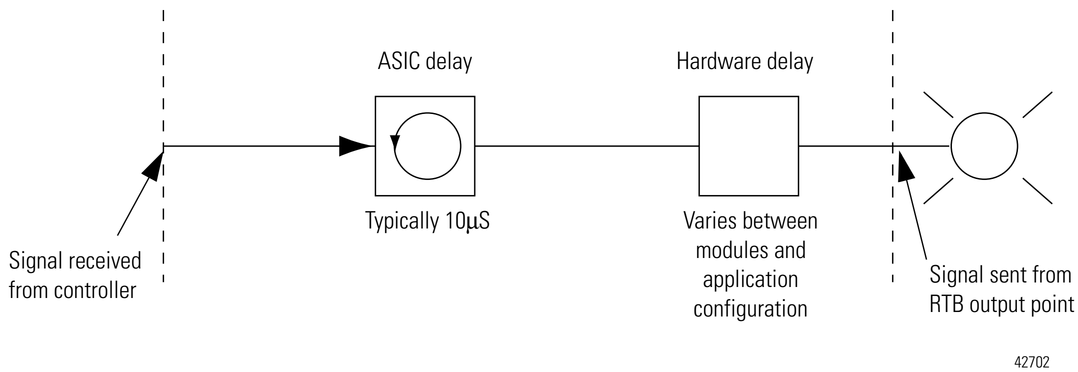
In the best case scenario (i.e., filter time of 0mS), the 1756-IB16 module has a 490µS signal propogation delay.

These times are not guaranteed. We list nominal and maximum delay times for each module in Chapter 7.

Output Modules

ControlLogix output modules receive a signal from the controller and process it internally (i.e., ASIC delay and hardware delay) before sending a signal to the output device via the RTB.

Figure 2.2



EXAMPLE

As previously stated, many factors (e.g. module type, voltage, temperature, if the module is turning ON or OFF) affect the signal propogation delay on a module. But a typical delay time can be estimated.

For example, if you are **turning ON** a 1756-OB16E module at 24V dc in 25°C conditions, the signal propogation delay is affected by:

- hardware delay to energize the module (typically 70µS on this module)
- ASIC scan (10µS)

In the best case scenario, the 1756-OB16E module has a 80µS signal propogation delay.

These times are not guaranteed. We list nominal and maximum delay times for each module in Chapter 7.

Connections

With respect to ControlLogix I/O modules, a connection is the data transfer link between a controller and an I/O module. There are two types of connections:

- Direct Connections
- Rack Connections

See Table 2.2 on page 2-9 for differences between connection types. The table also lists the advantages and disadvantages of each type.

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. When module configuration data is downloaded to an owner-controller, the controller attempts to establish a direct connection to each of the modules referenced by the data.

If a controller has configuration data referencing a slot in the control system, the controller periodically checks for the presence of a device there. When a device's presence is detected there, the controller automatically sends the configuration data.

If the data is appropriate to the module found in the slot, a connection is made and operation begins. If the configuration data is not appropriate, the data is rejected and an error message displays in the software. In this case, the configuration data can be inappropriate for any of a number of reasons. For example, a module's configuration data may be appropriate except for a mismatch in electronic keying that prevents normal operation.

The controller maintains and monitors its connection with a module. Any break in the connection, such as module faults or removal of the module from the chassis while under power, causes the controller to set fault status bits in the data area associated with the module. The RSLogix 5000 software monitors this data area to annunciate the modules' failures.

Rack Connections

When a digital I/O module is located in a remote chassis (with respect to its owner), you may select **rack optimization** or **listen-only rack optimization** in the Communications Format field during initial module configuration. This depends on the bridge module (1756-CNB) configuration. If the CNB is selected for Listen-Only rack option, then the I/O module only allows the Listen-Only rack option.

A rack connection economizes connection usage between the owner-controller and digital I/O in the remote chassis. Rather than having several direct connections with individual RPI values, the owner-controller has a single rack connection with a single RPI value. That RPI value accommodates all digital I/O modules in the rack connection.

IMPORTANT

Because rack connections are only applicable in applications that use a remote chassis, you must configure the Communications Format for both the remote I/O module and the remote 1756-CNB module.

Make sure you configure both modules for Rack Optimization. If you choose a different Communications Format for each, the controller makes two connections to the same chassis (one for each format) and the same data travels across ControlNet.

If you use Rack Optimization for both modules, you preserve bandwidth and configure your system to operate more efficiently.

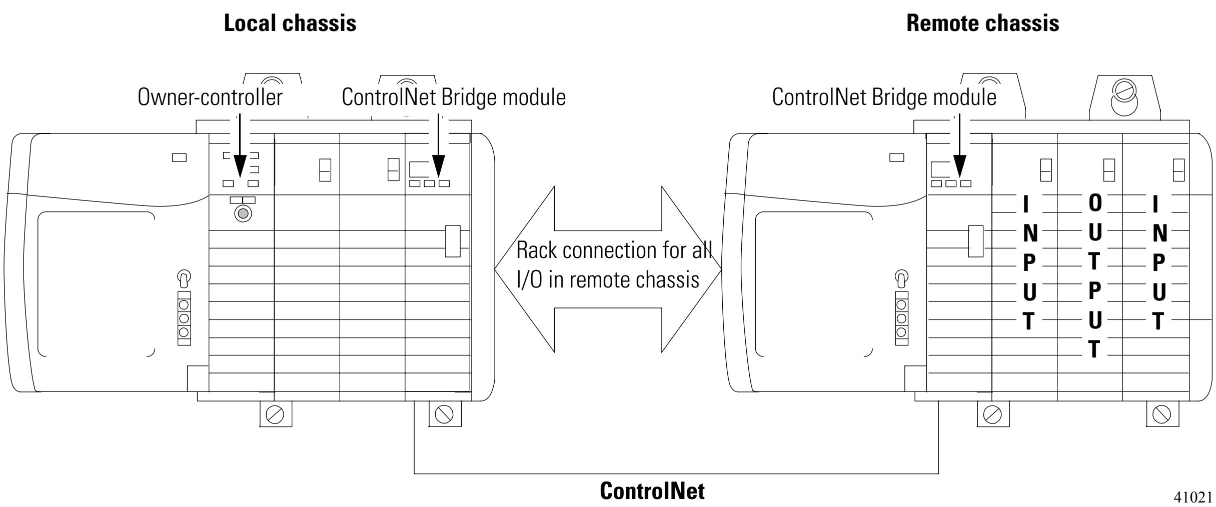
The input (or data echo) information is limited to general faults and data. No additional status (e.g. diagnostic) is available.

IMPORTANT

Each controller can only establish 250 connections, in any combination of direct or rack. In other words, you can use a rack connection between an owner-controller and multiple remote I/O modules while simultaneously using a direct connection between that same controller and any other I/O modules in the same remote chassis.

In Figure 2.3, the owner-controller is communicating with all I/O modules in the remote chassis but has used only one connection. The data from all three modules is sent together simultaneously at the RPI. This option eliminates the need for three separate connections.

Figure 2.3 Using a Rack Connection with I/O in a Remote Chassis



IMPORTANT	Rack connections are only available to digital I/O modules. Although analog modules can only use direct connections, the system can make both direct and rack connections to the same chassis.

Suggestions for Rack Connection Usage

We recommend that you use a rack connection for applications in which:

- standard digital I/O modules are used.
- non-fused digital output modules are used.
- your owner-controller is running low on connections.

IMPORTANT	Do not use a rack connection for diagnostic I/O modules or fused output modules. Diagnostic and fused output data will not be transferred over a rack connection. This defeats the purpose of using those modules.

Table 2.2 lists the differences between connection types and the advantages/disadvantages of each.

Table 2.2 Differences Between Direct and Rack Connections

Connection Type	Advantages	Disadvantages
Direct connections	All input and data echo information is transferred, including diagnostic information and fusing data.	With more data transferring over the network, your system does not operate as efficiently as with rack connections.
Rack connections	Connection usage is economized. The owner-controller has a single RPI value for each rack connection.	Input and data echo information is limited to general faults and data.

Input Module Operation

In traditional I/O systems, controllers poll input modules to obtain their input status. In the ControlLogix system, a controller does not poll digital input modules. Instead, the modules multicast their data either upon Change of State or periodically. The frequency depends on the options chosen during configuration and where in the control system that input module physically resides.

IMPORTANT This is called the Producer/Consumer model. The input module is the producer of input data and the controller is the consumer of the data.

All ControlLogix inputs are updated asynchronous to the controller's task execution. In other words, an input may be updaed in the controller at any time during the controller's execution of the tasks it is configured to run. The input device determines when the input is sent, based on its configuration.

An input module's behavior also varies depending upon whether it operates in the local chassis or in a remote chassis. The following sections detail the differences in data transfers between these set-ups.

Input Modules in a Local Chassis

When a module resides in the same chassis as the owner-controller, the following two configuration parameters will affect how and when an input module multicasts data:

- Requested Packet Interval (RPI)
- Change of State (COS)

Requested Packet Interval (RPI)

This interval specifies the rate at which a module multicasts its data. The time ranges from 100 microseconds to 750 milliseconds and is sent to the module with all other configuration parameters. When the specified time frame elapses, the module will multicast data. This is also called a cyclic update.

Change of State (COS)

This parameter instructs the module to transfer data whenever a specified input point transitions from ON to OFF or OFF to ON.

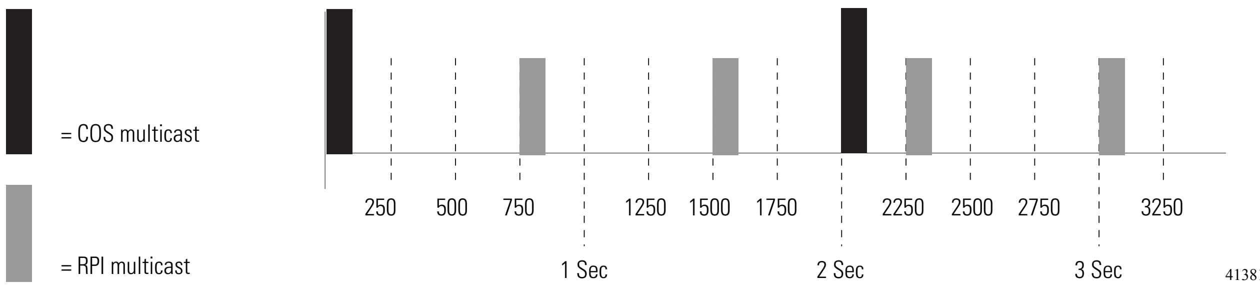
IMPORTANT The module COS feature defaults to Enabled for both ON to OFF and OFF to ON.

COS selection occurs on a per-point basis, but all module data is multicast when any point enabled for COS changes state. COS is more efficient than RPI because it multicasts data only when a change occurs.

IMPORTANT You must specify an RPI regardless of whether you enable COS. If a change does not occur within the RPI timeframe, the module will still multicast data at the rate specified by the RPI.

For example, if an input is changing state consistently every 2 seconds and the RPI is set at 750mS, the data transfer will look like Figure 2.4:

Figure 2.4



Because the RPI and COS functions are asynchronous to the program scan, it is possible for an input to change state during program scan execution. The point must be "buffered" to prevent this. Copy the input data from your input tags to another structure and use the data from there.

TIP To minimize traffic and conserve bandwidth, we recommend you use a larger RPI value if the COS option is used and the module is located in the same chassis as its owner.

Triggering Event Tasks

When configured to do so, ControlLogix digital input modules can trigger an event task. The event task offers ControlLogix controller users a task that executes a section of logic immediately when an event (i.e., receipt of new data) occurs.

Your ControlLogix digital I/O module can trigger event tasks whenever module input data state changes (e.g. when a COS occurs). When using a digital input module to trigger an event task, remember these considerations:

- Only one input module can trigger a specific event task.
- Input modules trigger the event task based on the module's COS configuration. The COS configuration defines which points prompt the module to produce data if they turn on or off. This production of data (due to COS) triggers the event task.
- Typically, enable COS for only one point on the module. If you enable COS for multiple points, a task overlap of the event task may occur.

For more information on using event tasks, see the Logix5000 Controllers Common Procedures Programming Manual, publication 1756-PM001.

Input Modules in a Remote Chassis

If an input module physically resides in a chassis other than where the owner-controller is (e.g. a remote chassis connected via ControlNet), the role of the RPI and the module's COS behavior changes slightly with respect to getting data to the owner.

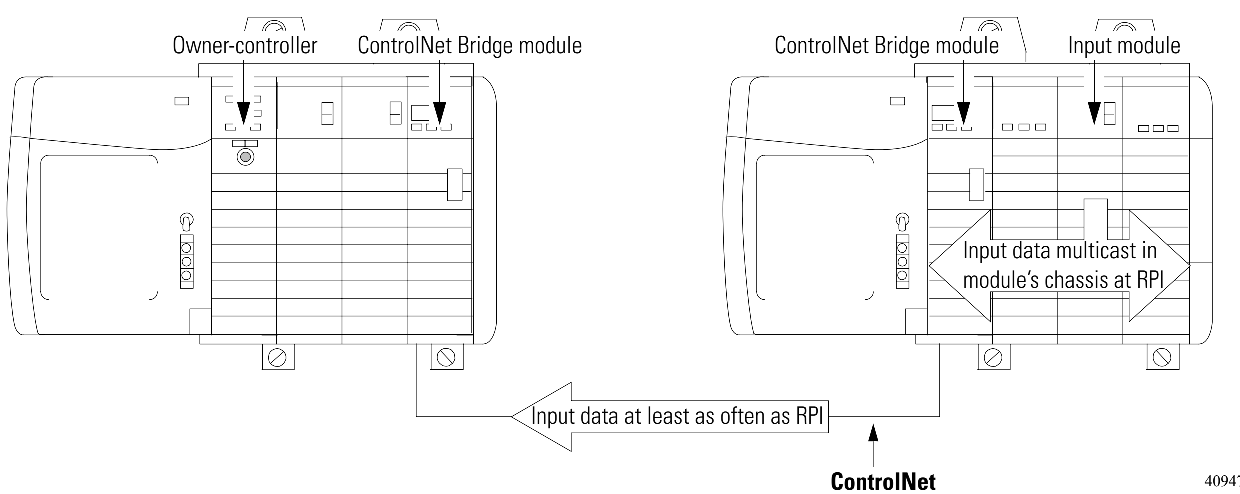
The RPI and COS behavior still define when the module will multicast data **within its own chassis** (as described in the previous section), but only the value of the RPI determines when the owner-controller will receive it over the network.

Remote Input Module Connected Via ControlNet

When an RPI value is specified for an input module in a remote chassis connected by a scheduled ControlNet network, in addition to instructing the module to multicast data within its own chassis, the RPI also "reserves" a spot in the stream of data flowing across the ControlNet network.

The timing of this "reserved" spot may or may not coincide with the exact value of the RPI, but the control system will guarantee that the owner-controller will receive data **at least as often** as the specified RPI.

Figure 2.5 Input Module in Remote Chassis with Data Coming At Least as Often as RPI



The "reserved" spot on the network and the module's RPI are asynchronous to each other. This means there are Best and Worst Case scenarios as to when the owner-controller will receive updated channel data from the module in a networked chassis.

Best Case RPI Multicast Scenario

In the Best Case scenario, the module performs an RPI multicast with updated channel data just before the "reserved" network slot is made available. In this case, the remotely-located owner-controller receives the data almost immediately.

Worst Case RPI Multicast Scenario

In the Worst Case scenario, the module performs an RPI multicast just after the "reserved" network slot has passed. In this case, the owner-controller will not receive data until the next available network slot.

IMPORTANT Enabling the COS feature on an input module in a remote chassis allows the module to multicast data at both the RPI rate and when the input changes state. This helps to **reduce the Worst Case time**.

Table 2.3 summarizes the Best Case and Worst Case scenarios, from the time an input changes state to the time the owner-controller will receive the data:

Table 2.3 Best and Worst Case Scenarios For Remote Input Data Transfer

	Best case scenario	Worst case scenario
COS disabled	Backplane/Network transfer times (<1mS)	Twice the RPI
COS enabled	Backplane/Network transfer times (<1mS)	Slightly less than the RPI

When selecting values for the remotely located module's RPI, system throughput is optimized when its RPI value is a power of 2 times the current NUT running on ControlNet.

For example, Table 2.4 shows recommended RPI values for a system using a NUT of 5mS:

Table 2.4 Recommended RPI Values for System Using NUT of 5mS

NUT=5mS	$x2^0$	$x2^1$	$x2^2$	$x2^3$	$x2^4$	$x2^5$	$x2^6$	$x2^7$
Optimal RPI Values (mS)	5mS	10mS	20mS	40mS	80mS	160mS	320mS	640mS

Remote Input Modules Connected Via EtherNet/IP

When remote digital input modules are connected to the owner-controller via an EtherNet/IP network, data is transferred to the owner-controller in the following way:

- At the RPI, the module multicasts data within its own chassis.
- The 1756-ENBT module in the remote chassis immediately sends the module's data over the network to the owner-controller as long as it has not sent data within a timeframe that is 1/4 the value of the digital input module's RPI.

  For example, if a digital input module uses an RPI = 100ms, the 1756-ENBT module only sends module data immediately on receiving it if another data packet was not sent within the last 25ms.

Output Module Operation

An owner-controller sends output data to an output module when either one of two things occur:

- at the end of every one of its tasks (local chassis only)

  and/or

- at the rate specified in the module's RPI

When an output module physically resides in a remote chassis (with respect to the owner-controller), the owner-controller sends data to the output module **only** at the RPI rate specified for the module. Updates are not performed at the end of the owner-controller's tasks.

Whenever the module receives data from the controller, it immediately multicasts the output commands it received to the rest of the system. The actual output data is echoed by the output module as input data and multicast back out onto the network. This is called **Output Data Echo**. The Output Data Echo also may contain fault and diagnostic information, depending on the module type.

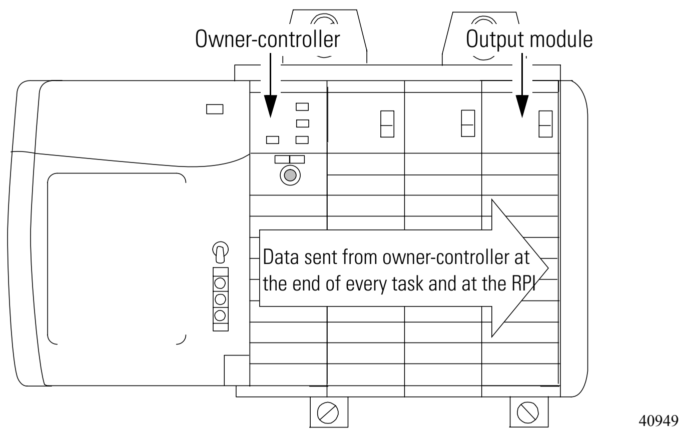
IMPORTANT	In this Producer/Consumer model, the output module is the Consumer of the controller's output data and the Producer of the data echo.

Output Modules in a Local Chassis

The owner-controller updates ControlLogix output modules in the local chassis at the end of every task and at the RPI.

When you specify an RPI value for a digital output module, you instruct the owner-controller when to broadcast the output data to the module. If the module resides in the same chassis as the owner-controller, the module receives the data almost immediately after the owner-controller sent it (backplane transfer times are small).

Figure 2.6



Depending on the value of the RPI, with respect to the length of the program scan, the output module can receive and “echo” data multiple times during one program scan.

Output Modules in a Remote Chassis

If an output module physically resides in a chassis other than that of the owner-controller (i.e., a remote chassis connected via ControlNet), the owner-controller sends data to the output module **only** at the RPI rate specified. Updates are **not** performed at the end of the controller’s tasks.

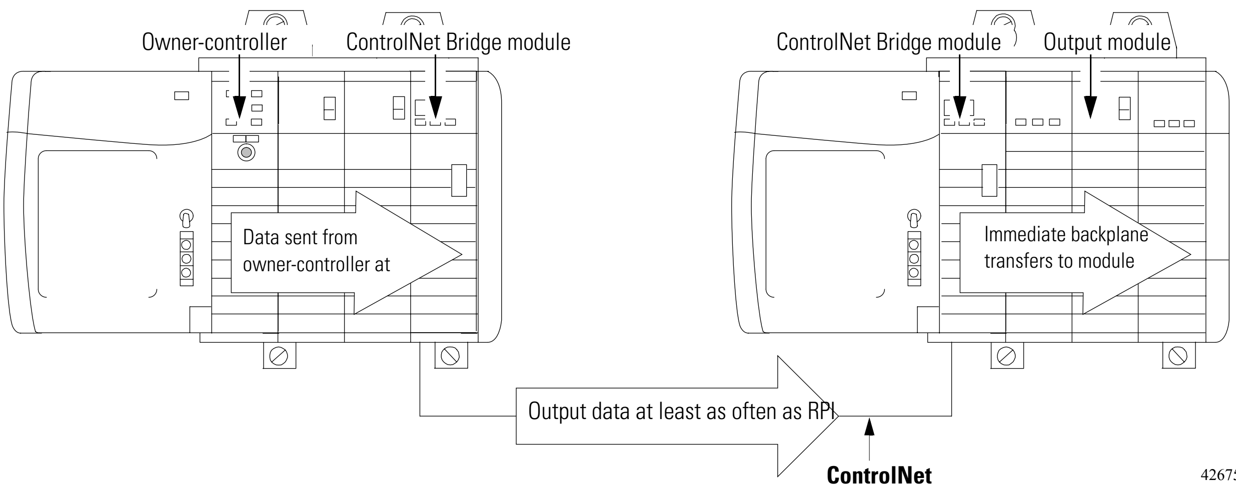
In addition, the role of the RPI for a remote output module changes slightly, with respect to getting data from the owner-controller.

Remote Output Modules Connected Via ControlNet

When an RPI value is specified for an output module in a remote chassis connected to the owner-controller by a scheduled ControlNet network, in addition to instructing the owner-controller to multicast the output data within its own chassis, the RPI also “reserves” a spot in the stream of data flowing across the ControlNet network.

The timing of this “reserved” spot may or may not coincide with the exact value of the RPI, but the control system will guarantee that the output module will receive data **at least as often** as the specified RPI.

Figure 2.7 Output Module in Remote Chassis with Data Coming At Least as Often as RPI



The “reserved” spot on the network and when the controller sends the output data are asynchronous to each other. This means there are Best and Worst Case scenarios as to when the owner-controller will receive updated channel data from the module in a networked chassis.

Best Case RPI Multicast Scenario

In the Best Case scenario, the owner-controller sends the output data just before the “reserved” network slot is made available. In this case, the remotely located output module receives the data almost immediately.

Worst Case RPI Multicast Scenario

In the Worst Case scenario, the owner-controller sends the output data just after the “reserved” network slot has passed. In this case, the output module does not receive data until the next available network slot.

Table 2.5 shows the Best Case and Worst Case times for output data sent from a controller to reach the output module:

Table 2.5 Best and Worst Case Times for Remote Output Data Transfer

Best case time	Worst case time
Backplane/Network transfer times (<1mS)	Twice the RPI rate

IMPORTANT

These Best and Worst Case scenarios indicate the time required for output data to transfer from the owner-controller to the module **once the owner-controller has produced it**. They do not take into account the user program time in the owner-controller.

The receipt of new data is a function of the length of the user program and its asynchronous relationship with the RPI.

Also, if your application uses:

- 1756-CNB or 1756-CNBR, series D
- RSLogix 5000, version 8 or greater

the owner-controller updates remotely-located digital output modules at the end of each task as well as at the RPI as described earlier in this section.

Remote Output Modules Connected Via EtherNet/IP

When remote digital output modules are connected to the owner-controller via an EtherNet/IP network, the controller multicasts data in the following way:

1. At the RPI, the owner-controller multicasts data within its own chassis.
2. The 1756-ENBT module in the local chassis immediately sends the data over the network to the digital output module as long as it has not sent data within a timeframe that is 1/4 the value of the digital module's RPI.

Listen-Only Mode

Any controller in the system can **listen** to the data from any I/O module (e.g. input data, "echoed" output data, or "echoed" diagnostic information) even if the controller does not own the module (i.e., it does not have to hold the module's configuration data to listen to the module).

During the I/O configuration process, you can specify one of several 'Listen' modes in the Communication Format field. For more information on Communications Format, see page 6-6.

Choosing a 'Listen' mode option allows the controller and module to establish communications without the controller sending any configuration data. In this instance, another controller owns the module being listened to.

IMPORTANT

In the Listen-Only mode, controllers will continue to receive data multicast from the I/O module as long as the connection between the owner-controller and I/O module is maintained.

If the connection between owner-controller and module is broken, the module stops multicasting data and connections to all 'Listening controllers' are also broken.

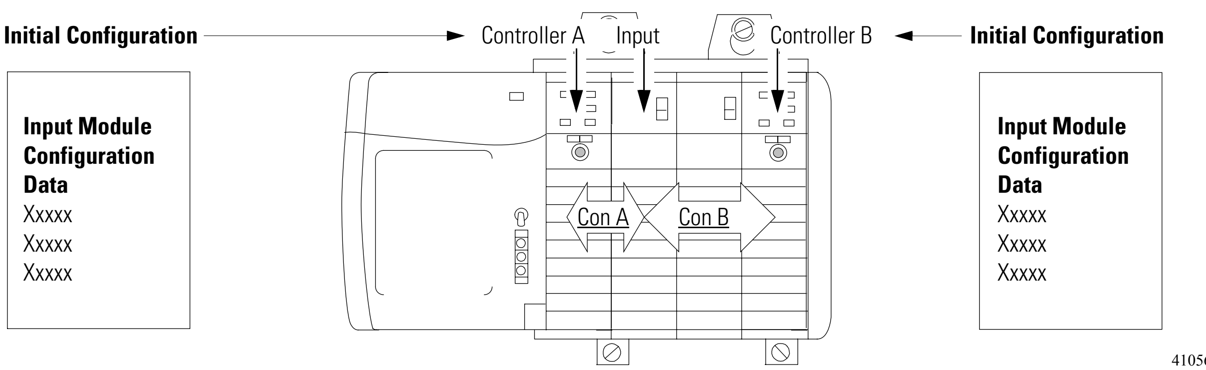
Multiple Owners of Input Modules

Because 'Listening controllers' lose their connections to modules when communications with the owner-controller stop, the ControlLogix system will allow you to define more than one owner-controller for input modules.

IMPORTANT	Only input modules can have multiple owners. If multiple owners are connected to the same input module, they **must maintain identical configuration** for that module.

In the example below, Controller A and Controller B have both been configured to be the owner-controller of the input module.

Figure 2.8 Multiple Owners with Identical Configuration Data



As soon as a controller receives its user program, it will try to establish a connection with the input module. Whichever controller's configuration data arrives first establishes a connection. When the second controller's data arrives, the module compares it to its current configuration data (the data received and accepted from the first controller).

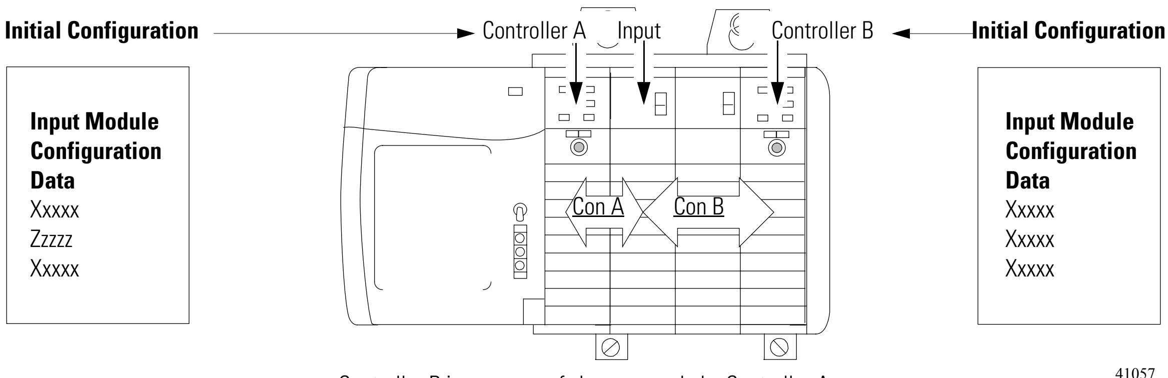
If the configuration data sent by the second controller matches the data sent by the first controller, that connection is also accepted. If any parameter of the second configuration data is different from the first, the module rejects the connection and the user is informed by an error in the software or programatically via a ladder logic program.

The advantage of multiple owners over a 'Listen mode' connection is that now either of the controllers can break the connection to the module and the module will continue to operate and multicast data to the system because of the connection maintained by the other controller.

Configuration Changes in an Input Module with Multiple Owners

You must be careful when changing an input module's configuration data in a multiple owner-controller scenario. When the configuration data is changed in one of the owners, for example, Controller A, and sent to the module, that configuration data is accepted as the new configuration for the module. Controller B will continue to listen, unaware that any changes have been made in the module's behavior

Figure 2.9 Multiple Owners with Changed Configuration Data in a Single Controller



Controller B is unaware of changes made by Controller A

IMPORTANT A pop-up screen in RSLogix 5000 alerts you to the possibility of a multiple owner-controller situation and allows you to inhibit the connection before changing the module's configuration. When changing configuration for a module with multiple owners, we recommend the connection be inhibited.

To prevent other owners from receiving potentially erroneous data, as described above, the following steps **must be followed** when changing a module's configuration in a multiple owner-controller scenario while online:

1. For each owner-controller, inhibit the controller's connection to the module, either in the software on the Connection tab or the pop-up screen warning of the multiple owner-controller condition.
2. Make the appropriate configuration data changes in the software. For detailed information on using RSLogix 5000 to change configuration, see Chapter 6.
3. Repeat steps 1 and 2 for all owner-controllers, making the **exact same changes** in all controllers.
4. Disable the Inhibit box in each owner's configuration.

Chapter Summary and What's Next

In this chapter, you read about:

- ownership and connections
- direct connections
- rack connections
- input module operation
- output module operation

Chapter 3 explains the ControlLogix Standard Digital I/O Module Features.

Notes:

ControlLogix Standard Digital I/O Module Features

What This Chapter Contains

This chapter describes devices compatible with ControlLogix I/O and features that are specific to various modules.

Table 3.1

For information about:	See page:
Determining Input Module Compatibility	3-1
Determining Output Module Compatibility	3-2
Features on ControlLogix Standard Digital I/O Modules	3-3
Using Features Common to ControlLogix Standard Digital I/O Modules	3-4
Using Features Specific to Standard Input Modules	3-11
Using Features Specific to Standard Output Modules	3-13
Fault and Status Reporting Between Input Modules and Controllers	3-21
Fault and Status Reporting Between Output Modules and Controller	3-22

Determining Input Module Compatibility

ControlLogix digital input modules interface to sensing devices and detect whether they are ON or OFF.

ControlLogix input modules convert ac or dc ON/OFF signals from user devices to appropriate logic level for use within the processor. Typical input devices include:

- proximity switches
- limit switches
- selector switches
- float switches
- pushbutton switches

When designing a system using ControlLogix input modules, you must consider:

- the voltage necessary for your application
- whether you need a solid state device
- current leakage
- if your application should use sinking or sourcing wiring.

For more information on compatibility of other Rockwell Automation products to ControlLogix input modules, see the I/O Systems Overview, publication CIG-SO001.

Determining Output Module Compatibility

ControlLogix output modules may be used to drive a variety of output devices. Typical output devices compatible with the ControlLogix outputs include:

- motor starters
- solenoids
- indicators

When designing a system:

- make sure that the ControlLogix outputs can supply the necessary surge and continuous current for proper operation.

- make sure that the surge and continuous current are not exceeded. Damage to the module could result.

When sizing output loads, check the documentation supplied with the output device for the surge and continuous current needed to operate the device.

The ControlLogix standard digital outputs are capable of directly driving the ControlLogix standard digital inputs. The exceptions are the ac and dc diagnostic input modules. When diagnostics are used a shunt resistor is required for leakage current.

For more information specifically on the compatibility of motor starters to ControlLogix output modules, see Appendix D.

For more information on compatibility of other Rockwell Automation products to ControlLogix output modules, see the I/O Systems Overview, publication CIG-SO001.

Features on ControlLogix Standard Digital I/O Modules

Table 3.2 lists features on ControlLogix standard digital I/O modules. The features are described later in this section.

IMPORTANT Not all the features described in this chapter are available on all ControlLogix standard digital I/O modules. Table 3.2 lists which modules support each feature.

Table 3.2

This feature	described on this page	is available on these modules:
Removal and Insertion Under Power (RIUP)	3-4	all standard digital input and output modules
Module Fault Reporting	3-4	
Fully Software Configurable	3-4	
Electronic Keying	3-5	
Using the System Clock to Timestamp Inputs and Schedule Outputs	3-8	
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Using Features Common to ControlLogix Standard Digital I/O Modules

The features described in this section are all available on all ControlLogix standard digital I/O modules.

Removal and Insertion Under Power (RIUP)

All ControlLogix I/O modules may be inserted and removed from the chassis while power is applied. This feature allows greater availability of the overall control system because, while the module is being removed or inserted, there is no additional disruption to the rest of the controlled process.

Module Fault Reporting

ControlLogix digital I/O modules provide both hardware and software indication when a module fault has occurred. Each module's LED fault indicator and RSLogix 5000 will graphically display this fault and include a fault message describing the nature of the fault.

This feature allows you to determine how your module has been affected and what action should be taken to resume normal operation.

Fully Software Configurable

The RSLogix 5000 software uses a custom, easily understood interface to write configuration. All module features are enabled or disabled through the I/O configuration portion of the software.

You can also use the software to interrogate any module in the system to retrieve:

- serial number
- revision information
- product code
- vendor identification
- error/fault information
- diagnostic counters.

By eliminating such tasks as setting hardware switches and jumpers, the software makes module configuration easier and more reliable.

Electronic Keying

Instead of plastic mechanical backplane keys, electronic keying allows the ControlLogix system to control what modules belong in the various slots of a configured system.

During module configuration, you must choose one of the following keying options for your I/O module:

- Exact Match
- Compatible Module
- Disable Keying

When the controller attempts to connect to and configure an I/O module (e.g. after program download), the module compares the following parameters before allowing the connection and configuration to be accepted:

- Vendor
- Product Type
- Product Code
- Major Revision - Change that affects the module's function or RSLogix 5000 interface
- Minor Revision - Change that does not affect the module's function or RSLogix 5000 interface (e.g. bug fixes)

The comparison is made between the keying information present in the I/O module and the keying information in the controller's program. This feature can prevent the inadvertent operation of a control system with the wrong module in the wrong slot. For example, if you select Exact Match and a module with revision 2.2 is placed in a location configured for a module with revision 2.4, the controller does not make a connection to the new module because of the mismatched revisions.

Table 3.3 describes the keying options available with your ControlLogix digital I/O module.

Table 3.3

Keying option:	Definiton:	
Exact Match	All of the parameters listed above must match or the inserted module will reject a connection to the controller.	
Compatible Module	The Compatible Match mode allows an I/O module to determine whether it can emulate the module defined in the configuration sent from the controller. With ControlLogix digital I/O modules, the module can emulate older revisions. The module will accept the configuration if the configuration's major.minor revision is less than or equal to the physical module's revision. For example, if the configuration contains a major.minor revision of 1.7, the module inserted into the slot must have a firmware revision of 1.7 or higher for a connection to be made. When a module is inserted with a major.minor revision that is less than the revision for which the slot is configured (i.e., the module has a revison of 1.6 and the slot is configured for a module with revision 1.8), no connection is made between the controller and the I/O module.	
	TIP	We recommend using Compatible Match whenever possible. Remember, though, with major revision changes, the module only works to the level of the configuration. For example, if a slot is configured for a module with major.minor revision of 1.7 and you insert a module with a major.minor revision of 2.3, the module works at the 1.7 level, with respect to module functions that are related to RSLogix 5000 such as interface changes. However, bug fixes that are affected by the module's firmware, would work at the 2.3 revision level. If possible, we suggest you make sure configuration is updated to match the revision levels of all I/O modules. Failure to do so may not prevent the application from working but may defeat the purpose of upgrading your modules' revision levels.
Disable Keying	The inserted module attempts to accept a connection to the controller regardless of its type.	
	ATTENTION	Be extremely cautious when using the disable keying option; if used incorrectly, this option can lead to personal injury or death, property damage or economic loss.
	If keying is disabled, a controller makes a connection with most modules of the same type as that used in the slot configuration. For example, if a slot is configured for a 1756-IA16I (standard input module), and a 1756-IB16 (standard input module) is inserted into the slot, the controller established a connection because keying is disabled. A controller will not establish a connection if any of the following conditions exist, even if keying is disabled: • The slot is configured for one module type (e.g. input module) and a module of another type (e.g. output module) is inserted in the slot. • The module inserted into the slot cannot accept some portion of the configuration. For example, if a standard input module is inserted into a slot configured for a diagnostic input module, the controller cannot make a connection because the module cannot accept/process the diagnostic configuration.	

Module Inhibiting

Module inhibiting allows you to indefinitely suspend a connection between an owner-controller and an digital I/O module. This process can occur in either of the following ways:

- You write configuration for an I/O module but inhibit the module to prevent it from communicating with the owner-controller. In this case, the owner does not establish a connection and configuration is not sent to the module until the connection is uninhibited.
- In your application, a controller already owns a module, has downloaded configuration to the module and is currently exchanging data over the connection between the devices. In this case, you can inhibit the module and the owner-controller behaves as if the connection to the module does not exist.

IMPORTANT	Whenever you inhibit an output module, it enters the program mode and all outputs change to the state configured for the program mode. For example, if an output module is configured so that the state of the outputs go to zero (0) during program mode, whenever that module is inhibited, the outputs will go to zero (0).

The following examples are instances where you may need to use module inhibiting:

- Multiple controllers own the same digital input module. A change is required in the module's configuration; however, the change must be made to the program in all controllers. In this case, you can:
  a. Inhibit the module.
  b. Change configuration in all controllers.
  c. Unihibit the module.

- You want to FLASH upgrade an digital I/O module. We recommend you:
  a. Inihibit the module.
  b. Perform the upgrade.
  c. Uninhibit the module.

- You are using a program that includes a module that you do not physically possess yet, but you do not want the controller to continually look for a module that does not exist yet. In this case, you can inhibit the module in your program until it physically resides in the proper slot.

Using the System Clock to Timestamp Inputs and Schedule Outputs

Controllers generate a 64-bit Coordinated System Time (CST) for their respective chassis. The CST is a chassis-specific time that is not synchronized with, or in any way connected to, the time generated over ControlNet to establish a NUT, as described in Chapter 2.

You can configure your digital input modules to access the CST and **timestamp input data** with a relative time reference (i.e., the value of the CST) of when that input data changes state.

IMPORTANT Because only one CST value is returned to the controller when any input point changes state, it is recommended that you use timestamping on only one input point per module.

Table 3.4 describes the ways you can use the system clock.

Table 3.4

Use of timestamping:	Definition:	
Timestamping for a Sequence of Events	The CST can be used to establish a sequence of events occurring at a particular input module point by timestamping the input data. To determine a sequence of events, you must: • Set the input module's communications format to: CST Timestamped Input Data • Enable Change of state for the input point where a sequence will occur (Disable COS for all other points on the module)	
	TIP	If you decide to configure multiple input points for COS, your module generates a unique CST each time any of those input points change state, as long as the changes do not occur within 500µS of each other. If multiple input points configured for COS change state within 500µs of each other, a single CST value is generated for all, making it appear that they changed at exactly the same time.
Timestamping in Conjunction with Scheduled Outputs	Timestamping can be used in conjunction with the **scheduled outputs** feature so that after input data changes state and a timestamp occurs, an output point will actuate at some configured time in the future. You can schedule outputs up to 16 seconds into the future. When you use timestamping of inputs and scheduled outputs, you must: • choose a Communications Format for each input and output module that allows timestamping. For more information on choosing a Communications Format, see Chapter 6. • have a controller in the same rack as both I/O modules • disable Change of State for all input points on the input module except the point being timestamped	
	TIP	For scheduled outputs to work most effectively, remember the following: • The time to schedule outputs to transition in the future must account for any controller, backplane and network delays. • The I/O modules must reside in the same rack as the timemaster. For a detailed example of how to write ladder logic to use these features, see page B-9.

Module Major Revision Considerations with Timestamping

When using timestamping for inputs or diagnostic timestamping of I/O modules, remember the following conditions that may occur depending on the module's Major Revision:

- If the module has a Major Revision = 1, it will always return a positive timestamping value.
- If the module has a Major Revision $\geq$ 2, it will return a negative timestamping value until the module is synchronized with the owner-controller and the first Change of State condition occurs.

Look at the Module Properties page of RSLogix 5000 to determine if the module has been synchronized with the owner-controller and whether the controller is synchronized with the CST.

For more information on synchronizing owner-controllers and modules with the CST, see the ControlLogix System User Manual, publication 1756-UM001.

Producer/Consumer Model

By using the Producer/Consumer model, ControlLogix I/O modules can produce data without having been polled by a controller first. The modules produce the data and any other owner-controller device can decide to consume it.

For example, an input module produces data and any number of processors can consume the data at the same time. This eliminates the need for one processor to send the data to another processor. For a more detailed explanation of this process, see page 2-19.

Status Indicator Information

Each ControlLogix digital I/O module has an LED status indicator on the front of the module that allows you to check the module health and operational status of a module. The LED displays vary for each module.

Table 3.5 describes what status each LED indicator represents:

Table 3.5

Status:	Description:
I/O status (*ST* LEDs)	This yellow display indicates the ON/OFF state of the field device. **IMPORTANT** For the 1756-OA8D and 1756-OA8E modules, the I/O status indicator does not illuminate without field power applied.
Module status (*OK* LED)	This green display indicates the module's communication status.
Fault status (*FLT* LEDs)	This display is only found on some modules and indicates the presence or absence of various faults.
Fuse status (*FUSE* LED)	This display is only found on electronically fused modules and indicates the state of the module's fuse.

For examples of LED status indicators on ControlLogix digital I/O modules, see Chapter 7.

Full Class I Division 2 Compliance

All ControlLogix digital I/O modules maintain CSA Class I Division 2 system certification. This allows the ControlLogix system to be placed in an environment other than only a 100% hazard free.

IMPORTANT Modules should not be pulled under power, nor should a powered RTB be removed, in a Class I Division 2 environment.

UL, CSA, FM, CE, C-Tick, EEx, TUV Agency Approvals

Any ControlLogix digital I/O modules that have obtained UL, CSA, FM, CE, C-Tick, EEx, TUV agency approval are marked as such. Ultimately, all digital modules will have these agency approvals and be marked accordingly.

Using Features Specific to Standard Input Modules

The features described in this section are available on all ControlLogix digital input modules.

Data Transfer on Either Change of State or Cyclic Time

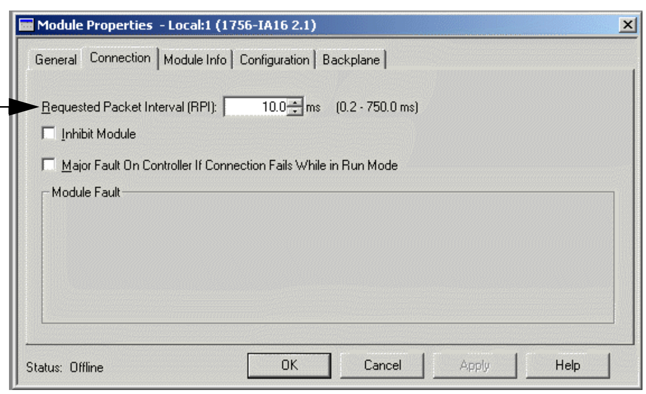
Your ControlLogix input module sends data in one of the ways described in Table 3.6:

Table 3.6

Method of Sending Data:	Description
Requested Packet Interval	A user defined rate at which the module updates the information sent to its owner-controller. This is also known as Cyclic Data Transfer.
Change of State	Configurable feature that, when enabled, instructs the module to update its owner-controller with new data whenever a specified input point transitions from ON to OFF or OFF to ON. The data will be sent at the RPI rate. By default, this setting is always enabled for input modules.

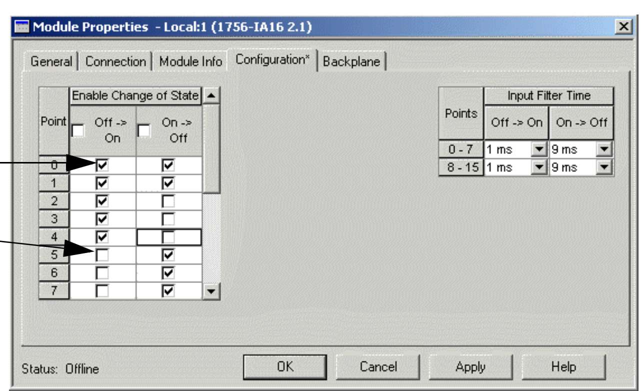
Digital input modules always send data at the RPI but only send data at a change of state if the COS feature is enabled. Set the RPI rate and enable COS for specific input points as shown below.

Change the RPI on the Connection tab.



Enable and disable COS on the Configuration tab.

- Check the box to enable COS for a point
- Clear the box to disable COS for a point



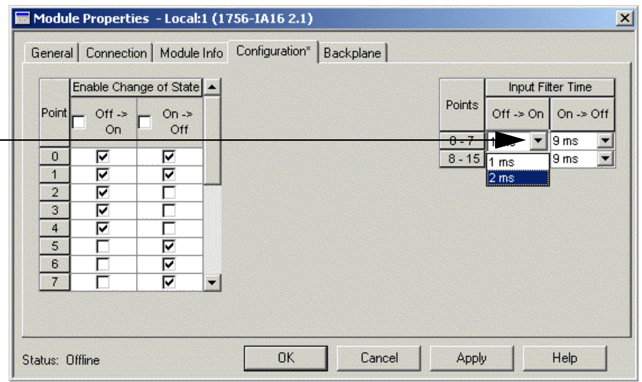
For a more detailed explanation of these features, see page 2-10.

Software Configurable Filter Times

ON to OFF and OFF to ON filter times can be adjusted through RSLogix 5000 software for all ControlLogix input modules. These filters improve noise immunity within a signal. A larger filter value affects the length of delay times for signals from these modules.

Set filter times as shown below.

Use the pulldown to set the input filter times on the Configuration tab.



Isolated and Non-Isolated Varieties of Modules

ControlLogix input modules provide isolated or non-isolated wiring options. Some applications require power for the I/O circuits to originate on separate, isolated, power sources. Because these conditions require separate commons for each channel, some input modules use individual isolation, or point-to-point isolation.

Other types of isolation available with ControlLogix input modules are channel-to-channel isolation and no isolation. Your application determines what type of isolation is necessary and which input module to use.

Multiple Input Point Densities

ControlLogix input modules use either 8, 16, or 32-point densities for greater flexibility in your application.

Using Features Specific to Standard Output Modules

The features described in this section are available on all ControlLogix digital output modules.

Configurable Point-Level Output Fault States

Individual outputs can be independently configured to unique fault states, either ON, OFF or Last State in case of a communications failure or program mode.

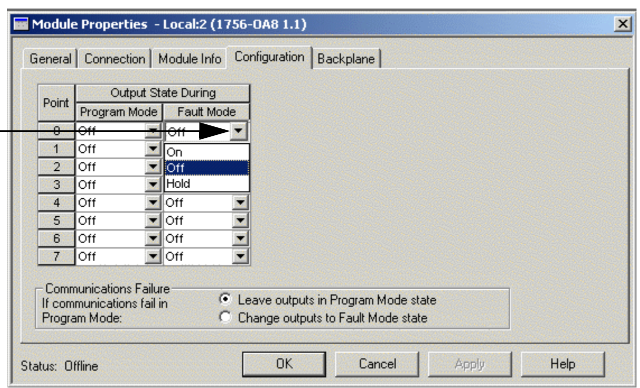
IMPORTANT

Whenever you inhibit an output module, it enters the program mode and all outputs change to the state configured for the program mode.

For example, if an output module is configured so that the state of the outputs turn off during program mode, whenever that module is inhibited, the outputs will turn off.

Set output fault state as shown below.

Use the pulldown to set the output fault state on the Configuration tab.



Output Data Echo

During normal operation, when a processor sends an output command out to the ControlLogix system, the output module that is targeted for that command will return the commanded state of the output to the system to verify the module received the command and will try to execute it.

Other devices can use this broadcast signal (via a listen-only connection) to determine the desired state of the output without having to interrogate the owner-controller.

Monitor Fault Bits

The Output Data Echo only matches the commanded state of the outputs if the module is operating under normal conditions. If there is a problem with the module, the commanded state and the Output Data Echo may not match.

You can monitor the fault bits for your output points for fault conditions. If a fault occurs, the fault bit is set and your program alerts you to the condition. In this case, the output data echo may not match the commanded state of the outputs.

If there is a mismatch between the commanded state of the outputs and the Output Data Echo, check your output module for the following conditions:

- Communications fault
- Connection is inhibited
- Blown fuse - Module will not turn ON output if overload/short circuit is detected.
- Loss of field power (1756-OA8D and 1756-OA8E only) - Module will not turn ON output if no AC power is detected.

Field Wiring Options

As with input modules, ControlLogix output modules provide isolated or non-isolated wiring options. I/O modules provide point-to-point, group-to-group, or channel-to-channel wiring isolation. Your specific application will determine what type of isolation is necessary and which output module to use.

IMPORTANT	Although some ControlLogix I/O modules provide non-isolated field side wiring options, each I/O module maintains internal electrical isolation between the system side and field side.

Multiple Output Point Densities

ControlLogix output modules use either 8, 16, or 32 point densities for greater flexibility in your application.

Fusing

Some digital outputs have internal electronic or mechanical fusing to prevent too much current from flowing through the module. This feature protects the module from electrical damage. Other modules require external fusing.

Reset an electronic fuse through RSLogix 5000 configuration software or through ladder logic running on a controller. For an example of how to reset an electronic fuse, see page 6-19.

IMPORTANT	Electronic fuses are also reset through a software reset or when the output module is power cycled.

The following modules use electronic fusing:

- 1756-OA8E
- 1756-OB16E
- 1756-OB8EI
- 1756-OG16
- 1756-OV16E
- 1756-OV32E

See Table 3.7 to determine what fuse to use in your application.

Table 3.7 Recommended Fuses

Circuit Type	Catalog Number	Fusing on the Module	Recommended Fuse	Fuse Supplier
AC	1756-OA8(1)	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)(8)	5x20mm 6.3A Medium lag	SAN-O Industry Corp. (SOC) p/n MT 4-6.3A
	1756-OA8E(2) (3)	Yes - Fused on a per point basis	Electronically fused	
	1756-OA16(1) (4) (5)	Yes - Fused on a per group basis	5x20mm 3.15A Slo-Blow 1500A Interruption current	Littlefuse p/n H2153.15
	1756-OA16I(1)	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)(8)	5x20mm 6.3A Medium lag	SOC p/n MT 4-6.3A
	1756-ON8	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)(8)		

Table 3.7 Recommended Fuses

Circuit Type	Catalog Number	Fusing on the Module	Recommended Fuse	Fuse Supplier
DC	1756-OB8[6]	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)[8]	5x20mm 4A Quick acting	SOC p/n MQ2-4A
	1756-OB8EI[2] [3] [6]	Yes - Fused on a per point basis	Electronically fused	
	1756-OB16E[2] [3] [6]	Yes - Fused on a per group basis		
	1756-OB16I[6] [7]	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)[8]	5x20mm 4A Quick acting	SOC p/n MQ2-4A
	1756-OB16IS[6] [7]	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)[8]		
	1756-OB32[6] [7]	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)[8]	5x20mm 800mA	Littelfuse p/n SP001.1003 or Schurter p/n 216.800
	1756-OC8[6]	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)[8]	5x20mm 4A Quick acting	SOC p/n MQ2-4A
	1756-OG16[6]	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)[8]		
	1756-OH8I[6] [7]	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)[8]		
	1756-OV16E[2] [3] [6]	Yes - Fused on a per group basis	Electronically fused	
	1756-OV32E[2] [3] [6]	Yes - Fused on a per group basis		
Relay	1756-OW16I[7]	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)[8]	5x20mm 6.3A Medium lag	SOC p/n MT 4-6.3A
	1756-OX8I[7]	None - Fused IFM can be used to protect outputs (See publication 1492-2.12)[8]		

(1) For voltages above 132V ac, the IFMs are not an acceptable means to provide external fusing. You must use a rated terminal block for the intended application.

(2) Electronic protection is not intended to replace fuses, circuit breakers, or other code required wiring protection devices.

(3) The electronic protection of this module has been designed to provide protection for the module from short circuit conditions. The protection is based on a thermal cut-out principle. In the event of a short circuit condition on an output channel, that channel will limit the current within milliseconds after its thermal cut-out temperature has been reached. All other channels with a NUT of that group will continue to operate as directed by the module master (CPU, Bridge, etc.)

(4) A fuse is provided on each common of this module for a total of 2 fuses. The fuses are designed to protect the module from short circuit conditions. The fuse does not provide overload protection. In the event of an overload on an output channel, it is likely that the fuse will not blow and the output device associated with that channel will be damaged. To provide overload protection for your application, user supplied fuses should be externally installed.

(5) If a short circuit condition occurs on any channel within this module's group, the entire group is turned off.

(6) The module does not provide protection against reverse polarity wiring or wiring to AC power sources.

(7) The recommended fuse for this module has been sized to provide short circuit protection for wiring only to external loads. In the event of a short circuit on an output channel, it is likely that the transistor or relay associated with that channel will be damaged and the module should be replaced or a spare output channel used for the load. The fuse does not provide overload protection. In the event of an overload on an output channel, it is likely that the fuse will not blow and the transistor or relay associated with that channel will be damaged. To provide overload protection for your application, user supplied fuse should be installed externally and properly sized to match the individual load characteristics.

(8) Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of this product.

Field Power Loss Detection

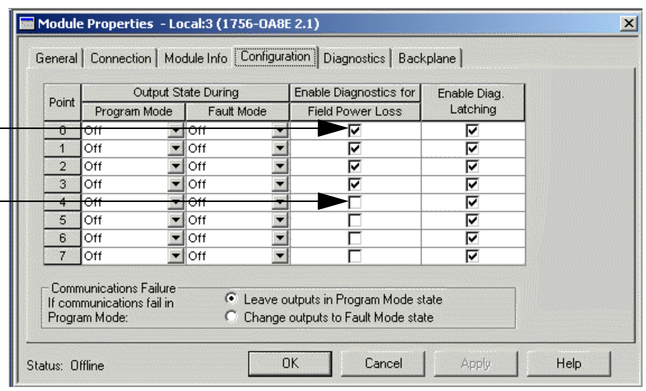
For the standard digital output modules, the Field Power Loss detection feature is found on the **1756-OA8E only**. When field power to the module is lost, or zero cross cannot be detected, a point level fault is sent to the controller to identify the exact point faulted.

IMPORTANT Only enable Field Power Loss detection for points that are in use. If this feature is enabled for points that are not in use, you will receive faults for those points during operation.

Enable Field Power Loss detection on the 1756-OA8E module as shown below.

Enable and disable field power loss detection on the Configuration tab.

- Check the box to enable field power loss detection
- Clear the box to disable field power loss detection



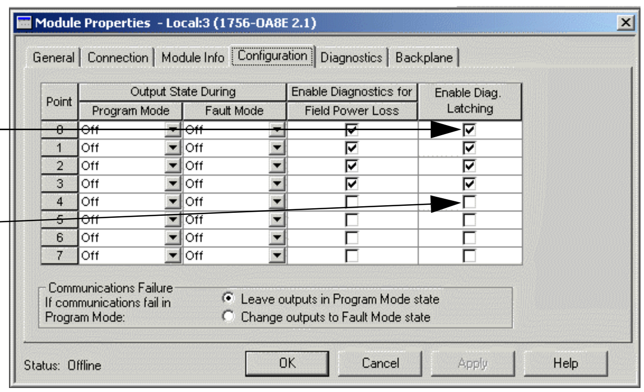
Diagnostic Latch of Information

For the standard digital I/O modules, the Diagnostic Latch of Information feature is found on the **1756-OA8E module only**. Diagnostic Latching allows this module to latch a fault in the set position once it has been triggered, even if the error condition causing the fault to occur disappears.

Latched diagnostic features can be cleared by the Reset Diagnostic Latch service. Enable Field Power Loss detection on the 1756-OA8E module as shown below.

Enable and disable diagnostic latch of information on the Configuration tab.

- Check the box to enable diagnostic latch of information
- Clear the box to disable diagnostic latch of information



IMPORTANT	Diagnostic latches are also reset through a software reset or when the I/O module's power is cycled.

Time Scheduled Output Control

Time scheduled output control is a feature available on the **first 8 outputs of the 1756-OB16IS module only**.

Using the time scheduled output control feature, the module can turn the outputs ON or OFF at a specific CST time. You can set the time setpoint (in 100µs increments) for the output to turn ON or OFF in the application program, and the 1756-OB16IS module manages the time locally such that the output is turned ON or OFF at the time specified.

Using the Motion Axis Output Cam (MAOC) Instructions with Time Scheduled Output Control

The MAOC instruction provides position-based control of outputs, using position and velocity information of any motion axis. When the 1756-OB16IS module is specified as the output source for the MAOC instruction, then the MAOC instruction automatically handles the time-based output scheduling and enables it on the first 8 outputs on the 1756-OB16IS module. The benefit of using output scheduling in this manner is that the resolution of the output control is improved from the motion coarse update rate (typically 1-32ms), to 100µs.

You can also use the second 8 outputs on the 1756-OB16IS module with the MAOC instruction. However, only the first 8 outputs have 100µs resolution. The second 8 outputs are updated at the motion coarse update rate.

Fault and Status Reporting Between Input Modules and Controllers

ControlLogix digital input modules multicast fault/status data to any owner/listening controllers.

All input modules maintain a Module Fault Word, the highest level of fault reporting. Some output modules also use additional words to indicate fault conditions, as shown on the next page.

Table 3.8 lists the tags that can be examined in ladder logic to indicate when a fault has occurred for a standard input module:

Table 3.8

Tag:	Description:
Module Fault Word	This word provides fault summary reporting. It's tag name is Fault. This word is available on all digital input modules.

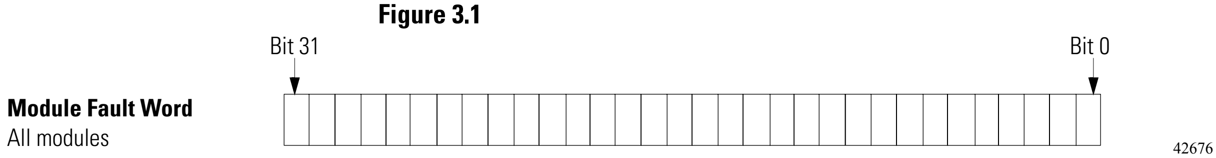
All words are 32-bit, although only the number of bits appropriate for each module's density are used. For example, the 1756-IA16I module has a Module Fault Word of 32 bits. But, because this is a 16 point module, only the first 16 bits (bits 0-15) are used in the Module Fault Word.

Table 3.9

This condition:	Set these bits:
Communications fault	All 32 bits are set to 1, regardless of the module's density.

Figure 3.1 offers an overview of the fault reporting process on ControlLogix digital input modules.

Figure 3.1



A communications fault sets **all bits** in the Module Fault Word.

Fault and Status Reporting Between Output Modules and Controller

ControlLogix digital output modules multicast fault/status data to any owner/listening controllers.

All output modules maintain a Module Fault Word, the highest level of fault reporting. Some modules also use additional words to indicate fault conditions, as shown on the next page.

Table 3.10 lists the tags that can be examined in ladder logic to indicate when a fault has occurred for a standard output module:

Table 3.10

Tag:	Description:
Module Fault Word	This word provides fault summary reporting. It's tag name is Fault. This word is available on all digital output modules.
Fuse Blown Word	This word indicates a point/group fuse blown on the module. It's tag name is FuseBlown. This word is only available on 1756-OA16, 1756-OA8E, 1756-OB16E, 1756-OB8EI and 1756-OV16E modules. For more information on fusing, see page 3-15.
Field Power Loss Word	This word indicates a loss of field power to a point on the module. It's tag name is FieldPwrLoss. This word is only available on 1756-OA8E module. For more information on field power loss, see page 3-18.

All words are 32 bit, although only the number of bits appropriate for each module's density are used. For example, the 1756-OB8 module has a Module Fault Word of 32 bits. But, because the module is an 8 point module, only the first 8 bits (bits 0-7) are used in the Module Fault Word.

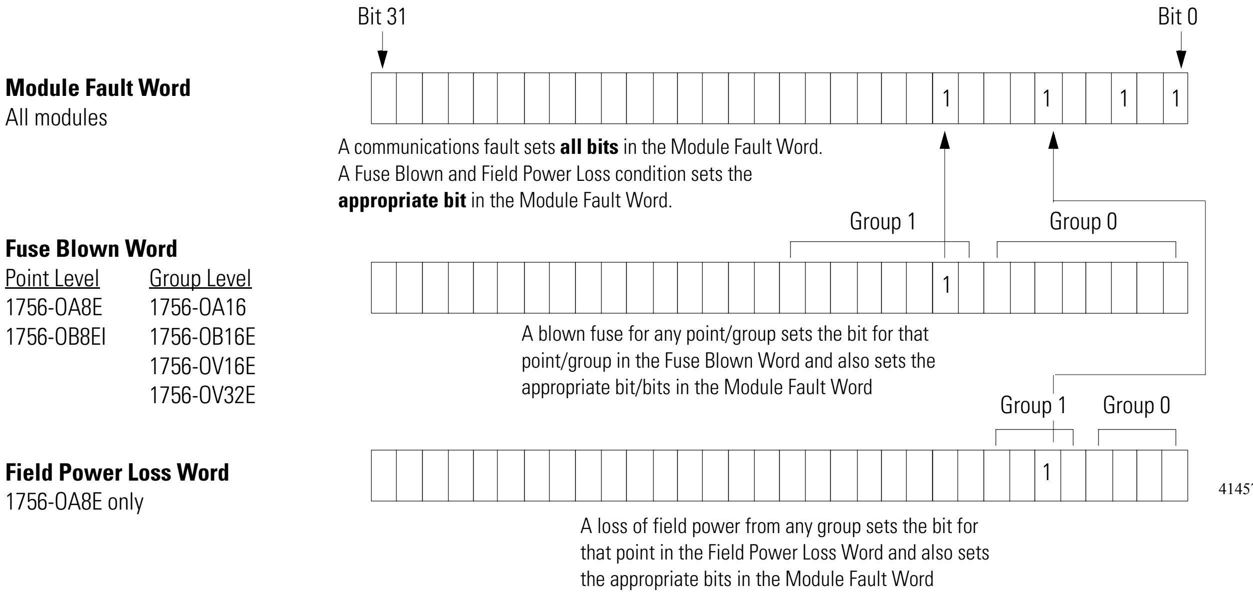
Fault bits in the Fuse Blown Word and Field Power Loss Word are logically ORed into the Module Fault Word. In other words, depending on the module type, a bit set in the Module Fault Word can mean multiple things, as indicated in Table 3.11:

Table 3.11

This condition:	Set these bits:
Communications fault	All 32 bits are set to 1, regardless of the module's density.
Fuse blown	Only the bit(s) affected is set to 1.
Field power loss	

Figure 3.2 offers an overview of the fault reporting process on ControlLogix digital output modules.

Figure 3.2



Chapter Summary and What's Next

In this chapter, you read about:

- determining input module compatibility
- determining output module compatibility
- using features common to ControlLogix standard digital I/O modules
- using features specific to ControlLogix standard digital input modules
- using features specific to ControlLogix standard digital output modules

Chapter 4 describes the ControlLogix Diagnostic Digital I/O Module Features.

Notes:

ControlLogix Diagnostic Digital I/O Module Features

What This Chapter Contains

This chapter describes devices compatible with ControlLogix I/O and features that are specific to various modules.

Table 4.1

For information about:	See page:
Determining Diagnostic Input Module Compatibility	4-1
Determining Diagnostic Output Module Compatibility	4-2
Using Features Common to ControlLogix Diagnostic Digital I/O Modules	4-4
Using Features Specific to Diagnostic Input Modules	4-15
Using Features Specific to Diagnostic Output Modules	4-20
Fault and Status Reporting Between Diagnostic Input Modules and Controllers	4-30
Fault and Status Reporting Between Output Modules and Controller	4-32

Determining Diagnostic Input Module Compatibility

ControlLogix digital input modules interface to sensing devices and detect whether they are ON or OFF.

ControlLogix input modules convert ac or dc ON/OFF signals from user devices to appropriate logic level for use within the processor. Typical input devices include:

- proximity switches
- limit switches
- selector switches
- float switches
- pushbutton switches

When designing a system using ControlLogix input modules, you must consider:

- the voltage necessary for your application
- whether you need a solid state device
- current leakage
- if your application should use sinking or sourcing wiring.

For more information on compatibility of other Allen-Bradley Company products to ControlLogix input modules, see the I/O Systems Overview, publication CIG-SO001.

Determining Diagnostic Output Module Compatibility

ControlLogix output modules may be used to drive a variety of output devices. Typical output devices compatible with the ControlLogix outputs include:

- motor starters
- solenoids
- indicators

When designing a system:

- make sure that the ControlLogix outputs can supply the necessary surge and continuous current for proper operation.

- make sure that the surge and continuous current are not exceeded. Damage to the module could result.

When sizing output loads, check the documentation supplied with the output device for the surge and continuous current needed to operate the device.

ControlLogix diagnostic digital outputs are capable of directly driving the ControlLogix diagnostic digital inputs. When diagnostics are used a shunt resistor is required for leakage current.

For more information on the compatibility of motor starters to ControlLogix output modules, see Appendix D.

For more information on compatibility of other Allen-Bradley Company products to ControlLogix output modules, see the I/O Systems Overview, publication CIG-SO001.

Features on ControlLogix Diagnostic Digital I/O Modules

Table 4.2 lists features on ControlLogix diagnostic digital I/O modules. The features are described later in this section.

IMPORTANT	Not all the features described in this chapter are available on all ControlLogix diagnostic digital I/O modules. Table 4.2 lists which modules support each feature.

Table 4.2

This feature	described on this page	is available on these modules:
Removal and Insertion Under Power (RIUP)	4-4	all diagnostic digital input and output modules
Module Fault Reporting	4-4	
Fully Software Configurable	4-4	
Electronic Keying	4-5	
Using the System Clock to Timestamp Inputs and Schedule Outputs	4-8	
Producer/Consumer Model	4-10	
Status Indicator Information	4-10	
Full Class I Division 2 Compliance	4-11	
UL, CSA, FM, CE, C-Tick, EEx, TUV Agency Approvals	4-11	
Diagnostic Latch of Information	4-11	
Diagnostic Timestamp	4-12	
8-Point AC/16-Point DC	4-12	
Point Level Fault Reporting	4-13	
Data Transfer on Either Change of State or Cyclic Time	4-15	diagnostic digital input modules
Software Configurable Filter Times	4-16	
Isolated and Non-Isolated Varieties of Modules	4-16	
Multiple Input Point Densities	4-16	
Open Wire Detection	4-17	
Diagnostic Change of State for Input Modules	4-18	
Field Power Loss Detection	4-19	1756-IA8D
Configurable Point-Level Output Fault States	4-20	diagnostic digital output modules
Output Data Echo	4-21	
Field Wiring Options	4-22	
Multiple Output Point Densities	4-22	
Fusing	4-23	
No Load Detection	4-24	
Field Side Output Verification	4-25	
Pulse Test	4-26	
Point Level Electronic Fusing	4-27	
Field Power Loss Detection	4-29	
Diagnostic Change of State for Output Modules	4-30	

Using Features Common to ControlLogix Diagnostic Digital I/O Modules

The features described in this section are all available on all ControlLogix diagnostic digital I/O modules.

Removal and Insertion Under Power (RIUP)

All ControlLogix I/O diagnostic modules may be inserted and removed from the chassis while power is applied. This feature allows greater availability of the overall control system because, while the module is being removed or inserted, there is no additional disruption to the rest of the controlled process.

Module Fault Reporting

ControlLogix diagnostic digital I/O modules provide both hardware and software indication when a module fault has occurred. Each module's LED fault indicator and RSLogix 5000 will graphically display this fault and include a fault message describing the nature of the fault.

This feature allows you to determine how your module has been affected and what action should be taken to resume normal operation.

Fully Software Configurable

The RSLogix 5000 software uses a custom, easily understood interface to write configuration. All module features are enabled or disabled through the I/O configuration portion of the software.

You can also use the software to interrogate any module in the system to retrieve

- serial number
- revision information
- product code
- vendor identification
- error/fault information
- diagnostic counters.

By eliminating such tasks as setting hardware switches and jumpers, the software makes module configuration easier and more reliable.

Electronic Keying

Instead of plastic mechanical backplane keys, electronic keying allows the ControlLogix system to control what modules belong in the various slots of a configured system.

During module configuration, you must choose one of the following keying options for your I/O module:

- Exact Match
- Compatible Module
- Disable Keying

When the controller attempts to connect to and configure an I/O module (e.g. after program download), the module compares the following parameters before allowing the connection and configuration to be accepted:

- Vendor
- Product Type
- Product Code
- Major Revision - Change that affects the module's function or RSLogix 5000 interface
- Minor Revision - Change that does not affects the module's function or RSLogix 5000 interface (e.g. bug fixes)

The comparison is made between the keying information present in the I/O module and the keying information in the controller's program. This feature can prevent the inadvertent operation of a control system with the wrong module in the wrong slot. For example, if you select Exact Match and a module with revision 2.2 is placed in a location configured for a module with revision 2.4, the controller does not make a connection to the new module because of the mismatched revisions.

Table 4.3 describes the keying options available with your ControlLogix digital I/O module.

Table 4.3

<table>
<tr><th>Keying option:</th><th colspan="2">Definiton:</th></tr>
<tr><td>Exact Match</td><td colspan="2">All of the parameters listed above must match or the inserted module will reject a connection to the controller.</td></tr>
<tr><td>Compatible Module</td><td colspan="2">The Compatible Match mode allows an I/O module to determine whether it can emulate the module defined in the configuration sent from the controller.

With ControlLogix digital I/O modules, the module can emulate older revisions. The module will accept the configuration if the configuration’s major.minor revision is less than or equal to the physical module’s revision.

For example, if the configuration contains a major.minor revision of 1.7, the module inserted into the slot must have a firmware revision of 1.7 or higher for a connection to be made. When a module is inserted with a major.minor revision that is less than the revision for which the slot is configured (i.e., the module has a revison of 1.6 and the slot is configured for a module with revision 1.8), no connection is made between the controller and the I/O module.</td></tr>
<tr><td></td><td>TIP</td><td>We recommend using Compatible Match whenever possible. Remember, though, with major revision changes, the module only works to the level of the configuration.

For example, if a slot is configured for a module with major.minor revision of 1.7 and you insert a module with a major.minor revision of 2.3, the module works at the 1.7 level, with respect to module functions that are related to RSLogix 5000 such as interface changes. However, bug fixes that are affected by the module’s firmware, would work at the 2.3 revision level.

If possible, we suggest you make sure configuration is updated to match the revision levels of all I/O modules. Failure to do so may not prevent the application from working but may defeat the purpose of upgrading your modules’ revision levels.</td></tr>
<tr><td>Disable Keying</td><td colspan="2">The inserted module attempts to accept a connection to the controller regardless of its type.</td></tr>
<tr><td></td><td>ATTENTION</td><td>Be extremely cautious when using the disable keying option; if used incorrectly, this option can lead to personal injury or death, property damage or economic loss.</td></tr>
<tr><td></td><td colspan="2">If keying is disabled, a controller makes a connection with most modules of the same type as that used in the slot configuration. For example, if a slot is configured for a 1756-IA16I (standard input module), and a 1756-IB16 (standard input module) is inserted into the slot, the controller established a connection because keying is disabled.

A controller will not establish a connection if any of the following conditions exist, even if keying is disabled:

• The slot is configured for one module type (e.g. input module) and a module of another type (e.g. output module) is inserted in the slot.

• The module inserted into the slot cannot accept some portion of the configuration. For example, if a standard input module is inserted into a slot configured for a diagnostic input module, the controller cannot make a connection because the module cannot accept/process the diagnostic configuration.</td></tr>
</table>

Module Inhibiting

Module inhibiting allows you to indefinitely suspend a connection between an owner-controller and an digital I/O module. This process can occur in either of the following ways:

- You write configuration for an I/O module but inhibit the module to prevent it from communicating with the owner-controller. In this case, the owner does not establish a connection and configuration is not sent to the module until the connection is uninhibited.
- In your application, a controller already owns a module, has downloaded configuration to the module and is currently exchanging data over the connection between the devices. In this case, you can inhibit the module and the owner-controller behaves as if the connection to the module does not exist.

IMPORTANT	Whenever you inhibit an output module, it enters the program mode and all outputs change to the state configured for the program mode. For example, if an output module is configured so that the state of the outputs go to zero (0) during program mode, whenever that module is inhibited, the outputs will go to zero (0).

The following examples are instances where you may need to use module inhibiting:

- Multiple controllers own the same digital input module. A change is required in the module's configuration; however, the change must be made to the program in all controllers. In this case, you can:
  a. Inhibit the module.
  b. Change configuration in all controllers.
  c. Unihibit the module.

- You want to FLASH upgrade an digital I/O module. We recommend you:
  a. Inihibit the module.
  b. Perform the upgrade.
  c. Uninhibit the module.

- You are using a program that includes a module that you do not physically possess yet, but you do not want the controller to continually look for a module that does not exist yet. In this case, you can inhibit the module in your program until it physically resides in the proper slot.

Using the System Clock to Timestamp Inputs and Schedule Outputs

Controllers generate a 64-bit Coordinated System Time (CST) for their respective chassis. The CST is a chassis-specific time that is not synchronized with, or in any way connected to, the time generated over ControlNet to establish a NUT, as described in Chapter 2.

You can configure your digital input modules to access the CST and **timestamp input data** with a relative time reference (i.e., the value of the CST) of when that input data changes state.

IMPORTANT Because only one CST value is returned to the controller when any input point changes state, it is recommended that you use timestamping on only one input point per module.

Table 4.4 describes the ways you can use the system clock.

Table 4.4

Use of timestamping:	Definition:
Timestamping for a Sequence of Events	The CST can be used to establish a sequence of events occurring at a particular input module point by timestamping the input data. To determine a sequence of events, you must: • Set the input module's communications format to: CST Timestamped Input Data • Enable Change of state for the input point where a sequence will occur (Disable COS for all other points on the module)
	TIP If you decide to configure multiple input points for COS, your module generates a unique CST each time any of those input points change state, as long as the changes do not occur within 500µS of each other. If multiple input points configured for COS change state within 500µs of each other, a single CST value is generated for all, making it appear that they changed at exactly the same time.

Table 4.4

<table>
<tr><th>Use of timestamping:</th><th colspan="2">Definition:</th></tr>
<tr><td rowspan="2">Timestamping in Conjunction with Scheduled Outputs</td><td colspan="2">Timestamping can be used in conjunction with the scheduled outputs feature so that after input data changes state and a timestamp occurs, an output point will actuate at some configured time in the future. You can schedule outputs up to 16 seconds into the future.

When you use timestamping of inputs and scheduled outputs, you must:
• choose a Communications Format for each input and output module that allows timestamping. For more information on choosing a Communications Format, see Chapter 6.
• have a controller in the same rack as both I/O modules
• disable Change of State for all input points on the input module except the point being timestamped</td></tr>
<tr><td>TIP</td><td>For scheduled outputs to work most effectively, remember the following:
• The time to schedule outputs to transition in the future must account for any controller, backplane and network delays.
• The I/O modules must reside in the same rack as the timemaster.
For a detailed example of how to write ladder logic to use these features, see Appendix B.</td></tr>
</table>

Module Major Revision Considerations with Timestamping

When using timestamping for inputs or diagnostic timestamping of I/O modules, remember the following conditions that may occur depending on the module's Major Revision:

- If the module has a Major Revision = 1, it will always return a positive timestamping value.

- If the module has a Major Revision $\geq$ 2, it will return a negative timestamping value until the module is synchronized with the owner-controller and the first Change of State condition occurs.

Look at the Module Properties page of RSLogix 5000 to determine if the module has been synchronized with the owner-controller and whether the controller is synchronized with the CST.

For more information on synchronizing owner-controllers and modules with the CST, see the ControlLogix System User Manual, publication 1756-UM001.

Producer/Consumer Model

By using the Producer/Consumer model, ControlLogix I/O modules can produce data without having been polled by a controller first. The modules produce the data and any other owner-controller device can decide to consume it.

For example, a diagnostic input module produces data and any number of processors can consume the data at the same time. This eliminates the need for one processor to send the data to another processor. For a more detailed explanation of this process, see Chapter 2.

Status Indicator Information

Each ControlLogix diagnostic digital I/O module has an LED indicator on the front of the module that allows you to check the module health and operational status of a module. The LED displays vary for each module.

Table 4.5 describes what status each LED indicators represents:

Table 4.5

Status:	Description:
I/O status (*ST* LEDs)	This yellow display indicates the ON/OFF state of the field device. **IMPORTANT**: For the 1756-OA8D and 1756-OA8E modules, the I/O status indicator does not illuminate without field power applied.
Module status (*OK* LED)	This green display indicates the module's communication status.
Fault status (*FLT* LEDs)	This display is only found on some modules and indicates the presence or absence of various faults.
Fuse status (*FUSE* LED)	This display is only found on electronically fused modules and indicates the state of the module's fuse.

For examples of status indicators on ControlLogix digital I/O modules, see Chapter 8.

Full Class I Division 2 Compliance

All ControlLogix digital I/O modules maintain CSA Class I Division 2 system certification. This allows the ControlLogix system to be placed in an environment other than only a 100% hazard free.

IMPORTANT	Modules should not be pulled under power, nor should a powered RTB be removed, in a Class I Division 2 environment.

UL, CSA, FM, CE, C-Tick, EEx, TUV Agency Approvals

Any ControlLogix digital I/O modules that have obtained UL, CSA, FM, CE, C-Tick, EEx, TUV agency approval are marked as such. Ultimately, all digital modules will have these agency approvals and be marked accordingly.

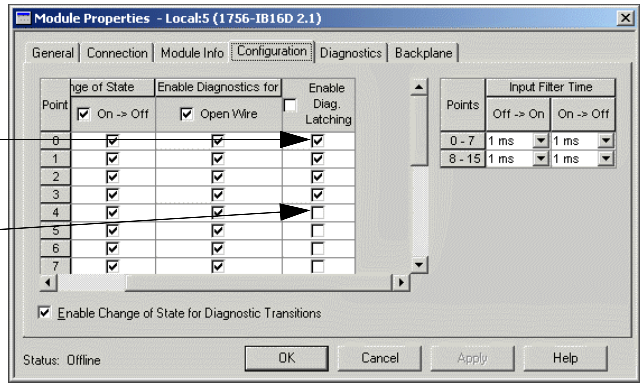
Diagnostic Latch of Information

Diagnostic Latching allows diagnostic I/O modules to latch a fault in the set position once it has been triggered, even if the error condition causing the fault to occur disappears.

Latched diagnostic features can be cleared by the Reset Diagnostic Latch service. Latched diagnostic features can be cleared by the Reset Diagnostic Latch service. Enable Field Power Loss detection on diagnostic digital I/O modules as shown below.

Enable and disable diagnostic latch of information on the Configuration tab.

- Check the box to enable diagnostic latch of information
- Clear the box to disable diagnostic latch of information



IMPORTANT	Diagnostic latches are also reset through a software reset or when the I/O module's power is cycled.

Diagnostic Timestamp

Diagnostic I/O modules can timestamp the time when a fault occurs or when it clears. This feature provides greater accuracy and flexibility in running applications. Modules use the ControlLogix system clock from a local controller to generate timestamps.

To use diagnostic timestamps, you must choose the appropriate Communications Format during initial configuration. For more information on choosing a Communications Format, see Chapter 6.

8-Point AC/16-Point DC

Diagnostic ControlLogix digital I/O modules provide various grouping of points on different modules. The 8 point AC modules and 16 point DC modules provide additional flexibility when designing module applications.

Point Level Fault Reporting

Diagnostic I/O modules set bits to indicate when a fault has occurred on a point-by-point basis. The following fault conditions generate their own unique fault bits:

Table 4.6 Unique Fault Bits for I/O Points

	Input Points	Output Points
Conditions Setting a Fault Bit	Open wire Field power loss – 1756-IA8D only	Fuse blown No load Output verify Field power loss – 1756-IA8D only

Using these bits in tandem with "data echo" and manually performing a pulse test can help to further isolate the fault. Table 4.7 lists possible diagnostic faults on the 1756-OA8D module.

Table 4.7 1756-OA8D Diagnostic Fault Table

Ladder Commands the Output to be ON:	Ladder Commands Output to be OFF:	Possible Cause of Fault:
1. Output Data Echo returns the state of the output as OFF. 2. Fuse Blown bit is set.	1. Output Data Echo returns the state of the output as OFF.(4) 2. Pulse Test fails.	Output is shorted to L2
1. Output Data Echo returns the state of the output as ON. 2. Pulse Test fails.(1)	1. Output Data Echo returns the state of the output as OFF. 2. No Load bit is set.	No Load or output is shorted to L1
1. Output Data Echo returns the state of the output as OFF. 2. No Load shows a Fault. 3. Field Power Loss shows a Fault. 4. Pulse Test fails.	1. Output Data Echo returns the state of the output as OFF. 2. No Load bit is set. 3. Field Power Loss bit is set. 4. Pulse Test fails.	L1 or L2 are disconnected or outside the 47-63Hz frequency range
1. Output Data Echo returns the state of the output as ON.(2) 2. Output Verify bit is set.(3)	1. Output Data Echo returns the state of the output as OFF. 2. Pulse Test fails.	Hardware point damage(5)

(1) When pulse test is executed, it is normal operation to see a momentary pulsation on the module display.

(2) The output cannot turn ON due to hardware point damage.

(3) Depending on the characteristics of an applied short circuit, an output verify fault could be set until the short circuit is detected by the module and the output is turned OFF.

(4) It is not possible to create a fuse blown fault in the OFF state. If a short circuit occurs, the output point is turned OFF and the fault appears in the OFF state until the point is reset.

(5) During normal operating conditions, hardware damage should not be possible. An output shorted to L2 may temporarily cause a hardware point fault. See output shorted to L2 as a possible cause.

Table 4.8 lists possible diagnostic faults on the 1756-OB16D module

Table 4.8 1756-OB16D Diagnostic Fault Table

Ladder Commands the Output to be ON:	Ladder Commands the Output to be OFF:	Possible Cause of Fault:
1. Output Data Echo returns the state of the output as OFF. 2. Fuse Blown bit is set.[1]	1. Output Data Echo returns the state of the output as OFF.[4] 2. Pulse Test fails.[5]	Output is shorted to GND
1. Output Data Echo returns the state of the output as ON. 2. Pulse Test fails.	1. Output Data Echo returns the state of the output as OFF. 2. No Load bit is set. 3. Pulse Test passes.	One of the following: 1. No Load 2. Output shorted to DC+ 3. No power at module
1. Output Data Echo returns the state of the output as ON.[2] 2. Output Verify sets a bit.[3]	1. Output Data Echo returns the state of the output as OFF. 2. Pulse Test fails.	Hardware point damage[6]

(1) The electronic protection of this module has been designed to provide protection for the module from short circuit conditions. The protection is based on a thermal cutout principal. In the event of a short circuit condition on an output channel, that channel will limit the current within milliseconds after its thermal cutout temperature has been reached. Other channels could produce a false error on the output verify fault signal due to the supply dropping below the minimum detect level of 19.2V dc. The output channels that are affected by this phenomena will continue to operate as directed by the module master (CPU, Bridge, etc.) What this means is that the output verify fault signals of the other channels should be checked and reset if a short circuit on one channel occurs.

(2) The output cannot turn ON due to hardware point damage.

(3) Depending on the characteristics of an applied short circuit, an output verify fault could be set until the short circuit is detected by the module and the output is turned OFF.

(4) It is not possible to create a fuse blown fault in the OFF state. If a short circuit occurs, the point is turned OFF and the fault appears in the OFF state until that point is reset.

(5) When pulse test is executed, it is normal operation to see a momentary pulsation on the module display.

(6) During normal operating conditions, hardware damage should not be possible. An output shorted to GND may temporarily cause a hardware point fault. See output shorted to GND as a possible cause.

Using Features Specific to Diagnostic Input Modules

The features described in this section are all available on all ControlLogix diagnostic digital input modules.

Data Transfer on Either Change of State or Cyclic Time

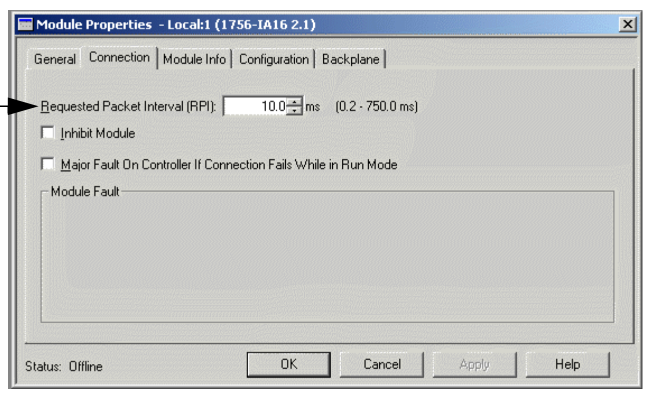
Your ControlLogix input module sends data in one of the ways described in Table 4.9:

Table 4.9

Method of Sending Data:	Description
Requested Packet Interval	A user defined rate at which the module updates the information sent to its owner-controller. This is also known as Cyclic Data Transfer.
Change of State	Configurable feature that, when enabled, instructs the module to update its owner-controller with new data whenever a specified input point transitions from ON to OFF or OFF to ON. The data will be sent at the RPI rate. By default, this setting is always enabled for input modules.

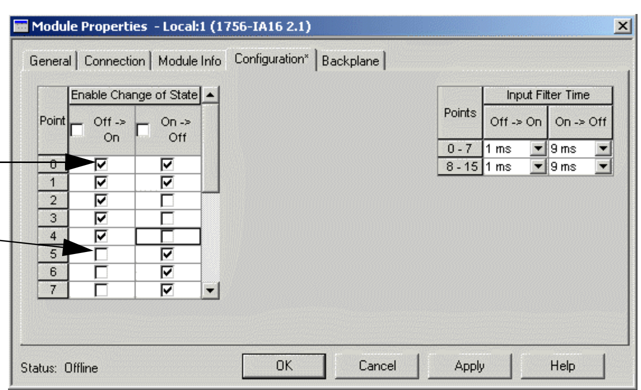
Digital input modules always send data at the RPI but only send data at a change of state if the COS feature is enabled. Set the RPI rate and enable COS for specific input points as shown below.

Change the RPI on the Connection tab.



Enable and disable COS on the Configuration tab.

- Check the box to enable COS for a point
- Clear the box to disable COS for a point



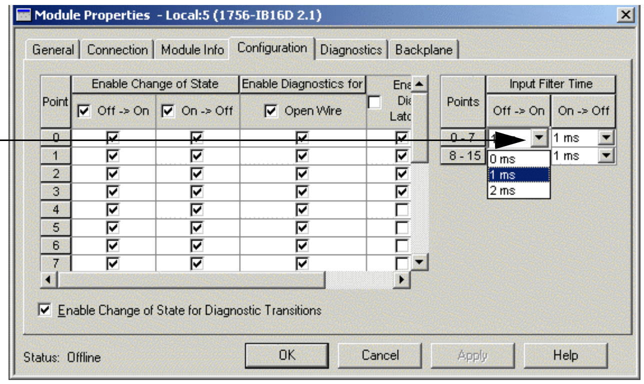
For a more detailed explanation of these features, see page 2-10.

Software Configurable Filter Times

ON to OFF and OFF to ON filter times can be adjusted through RSLogix 5000 software for all ControlLogix diagnostic input modules. These filters improve noise immunity within a signal. A larger filter value affects the length of delay times for signals from these modules.

Set filter times as shown below.

Use the pulldown to set the input filter times on the Configuration tab.



Isolated and Non-Isolated Varieties of Modules

ControlLogix diagnostic input modules provide isolated or non-isolated wiring options. Some applications require power for the I/O circuits to originate on separate, isolated, power sources. Because these conditions require separate commons for each channel, some input modules use individual isolation, or point-to-point isolation.

Other types of isolation available with ControlLogix diagnostic input modules are channel-to-channel isolation and no isolation. Your specific application will determine what type of isolation is necessary and which input module to use.

Multiple Input Point Densities

ControlLogix diagnostic input modules use either 8 or 16-point densities for greater flexibility in your application.

Open Wire Detection

Open Wire is used to make sure the field wiring is connected to the module. The field device must provide a minimum leakage current to function properly.

A leakage resistor must be placed across the contacts of an input device. (See each module's specifications, listed in Chapter 7, for more details.) The resulting current is then expected to exist when the input is open.

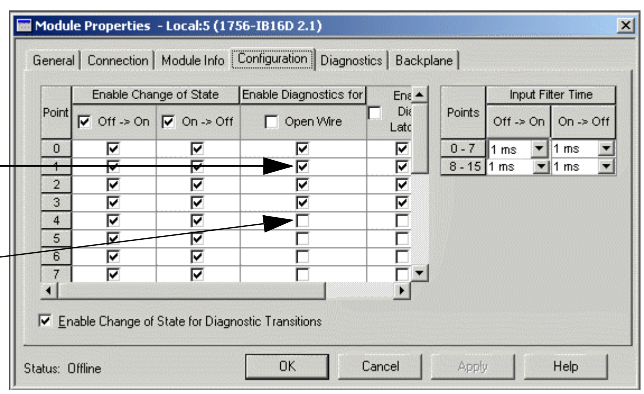
When an Open Wire condition is detected, a point-level fault is sent to the controller to identify the exact point fault. This feature has a corresponding tag that can be examined in the user program in the event of a fault. For more information on these tags, see Appendix A.

IMPORTANT	If this feature is enabled for points that are not in use, you will receive faults for those points during operation.

Set open wire detection as shown below.

Enable and disable open wire detection on the Configuration tab.

- Check the box to enable open wire detection.
- Clear the box to disable open wire detection.



Diagnostic Change of State for Input Modules

If the Diagnostic Change of State feature is enabled, a diagnostic input module sends new data to the owner-controller when one of the events described in Table 4.10 occurs:

Table 4.10

If this option is selected:	The input module sends data to the owner-controller:
Requested Packet Interval	at a user-defined rate.
Change of State	when a specified input point transitions from ON to OFF or OFF to ON. The transitioned input data is sent with the next RPI update.
Diagnostic Change of State	when any change in the diagnostics for an input module occurs.

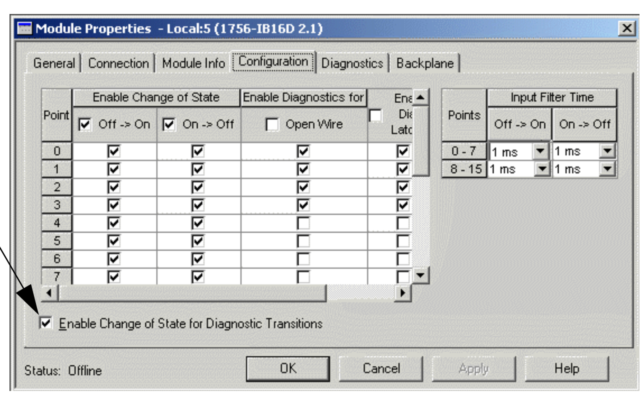
Although the RPI occurs continuously, the diagnostic COS feature allows you to decide whether changes in a module's diagnostic detection should cause the module to send real time data to the owner-controller.

- If this feature is **enabled**, the input module sends new data to the owner-controller at the RPI, on input COS if it is enabled, and if a diagnostic fault occurs.
- If this feature is **disabled**, real time data is **not** sent when a diagnostic fault occurs but is still sent at the specified RPI or on input COS if it is enabled.

Enable the diagnostic change of state as shown below.

Enable and disable diagnostic change of state on the Configuration tab.

- Check the box to enable diagnostic change of state.
- Clear the box to disable diagnostic change of state.



Field Power Loss Detection

For the diagnostic input modules, Field Power Loss detection is found on the **1756-IA8D module only**. When field power to the module is lost, a point level fault is sent to the controller to identify the exact point faulted. Only enable Field Power Loss detection for points that are in use.

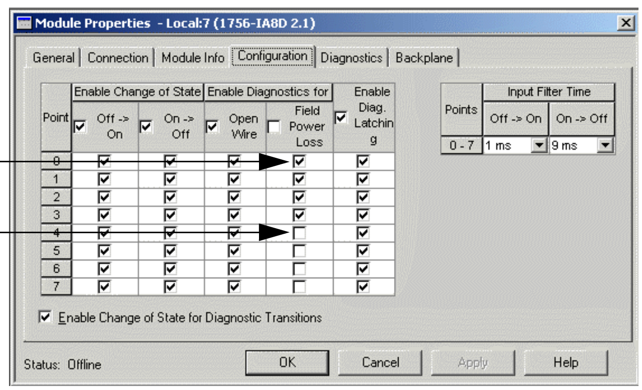
This feature has a corresponding tag that can be examined in the user program in the event of a fault. For more information on these tags, see Appendix A.

IMPORTANT	If this feature is enabled for points that are not in use, you will receive faults for those points during operation.

Enable field power loss detection as shown below.

Enable and disable field power loss detection on the Configuration tab.

- Check the box to enable field power loss detection.
- Clear the box to disable field power loss detection.



Using Features Specific to Diagnostic Output Modules

The features described in this section are all available on all ControlLogix diagnostic digital output modules.

Configurable Point-Level Output Fault States

Individual outputs can be independently configured to unique fault states, either ON, OFF or HOLD in case of a communications failure or program mode.

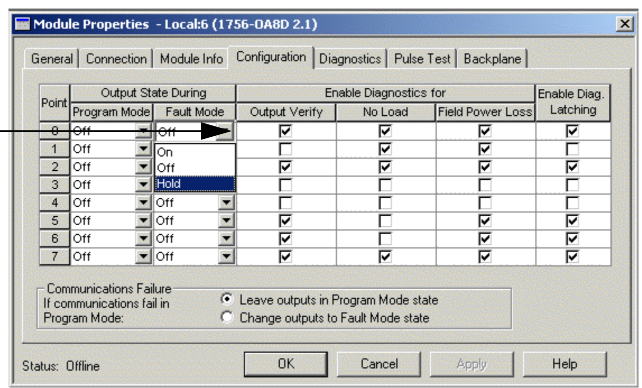
IMPORTANT

Whenever you inhibit a diagnostic output module, it enters the program mode and all outputs change to the state configured for the program mode.

For example, if an output module is configured so that the state of the outputs turn off during program mode, whenever that module is inhibited, the outputs will turn off.

Set output fault state as shown below.

Use the pulldown to set the output fault state on the Configuration tab.



Output Data Echo

During normal operation, when a processor sends an output command out to the ControlLogix system, the diagnostic output module that is targeted for that command will return the commanded state of the output to the system to verify the module received the command and will try to execute it.

Other devices can use this broadcast signal (via a listen-only connection) to determine the desired state of the output without having to interrogate the owner-controller.

This feature cannot relay to the system that the field-side device connected to the output module has executed the command. If your application requires a more detailed response than only acknowledging the receipt of a command, see the **Field Side Output Verification** feature, defined later in this chapter.

Monitor Fault Bits

The Output Data Echo only matches the commanded state of the outputs if the module is operating under normal conditions. If there is a problem with the module, the commanded state and the Output Data Echo may not match.

You can monitor the fault bits for your output points for fault conditions. If a fault occurs, the fault bit is set and your program alerts you to the condition. In this case, the output data echo may not match the commanded state of the outputs.

If there is a mismatch between the commanded state of the outputs and the Output Data Echo, check your diagnostic output module for the following conditions:

- Communications fault
- Connection inhibited
- Blown fuse - Module will not turn ON output if overload/short circuit is detected.
- Loss of field power (1756-OA8D and 1756-OA8E only) - Module will not turn ON output if no AC power is detected.

Field Wiring Options

As with diagnostic input modules, ControlLogix diagnostic output modules provide isolated or non-isolated wiring options. I/O modules provide point-to-point, group-to-group, or channel-to-channel wiring isolation.

Your specific application determines what type of isolation is necessary and which output module to use.

IMPORTANT	Although some ControlLogix diagnostic I/O modules provide non-isolated field side wiring options, each I/O module maintains internal electrical isolation between the system side and field side.

Multiple Output Point Densities

ControlLogix diagnostic output modules use either 8 or 16-point densities for greater flexibility in your application.

Fusing

Diagnostic digital outputs have internal electronics to prevent too much current from flowing through the module. This feature protects the module from electrical damage.

Reset an electronic fuse through RSLogix 5000 configuration software or through ladder logic running on a controller. For an example of how to reset an electronic fuse, see page 6-19.

IMPORTANT Electronic fuses are also reset through a software reset or when the diagnostic output module is power cycled.

Table 4.11 Recommended Fuses

Circuit Type	Catalog Number	Fusing on the Module	Recommended Fuse
AC	1756-OA8D(1) (2)	Yes - Fused on a per point basis	Electronically fused
DC	1756-OB16D(1) (2) (3)	Yes - Fused on a per point basis	Electronically fused

(1) Electronic protection is not intended to replace fuses, circuit breakers, or other code required wiring protection devices.

(2) The electronic protection of this module has been designed to provide protection for the module from short circuit conditions. The protection is based on a thermal cut-out principle. In the event of a short circuit condition on an output channel, that channel will limit the current within milliseconds after its thermal cut-out temperature has been reached. All other channels will continue to operate as directed by the module master (CPU, Bridge, etc.)

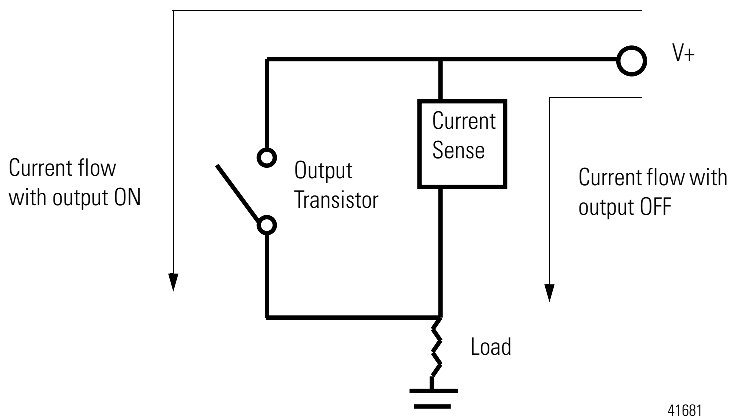
(3) The electronic protection of this module has been designed to provide protection for the module from short circuit conditions. The protections is based on a thermal cut-out principle. In the event of a short circuit condition on an output channel, that channel will limit the current within milliseconds after its thermal cut-out temperature has been reached. Other channels could produce a false error on the output verify fault signal due to the supply dropping below the minimum detect level of 19.2V dc. The output channels that are affected by this phenomena will continue to operate as directed by the module master (CPU, Bridge, etc.). What this means is that the output verify fault signals of the other channels should be checked and reset if a short circuit on one channel occurs.

No Load Detection

For each output point, No Load detects the **absence of field wiring or a missing load** from each output point in the **off state only**.

The output circuit on a diagnostic output module has a Current Sense optoisolator used in parallel with the output transistor. Current flows through this sensing circuit only when the output is OFF, as shown in Figure 4.1.

Figure 4.1



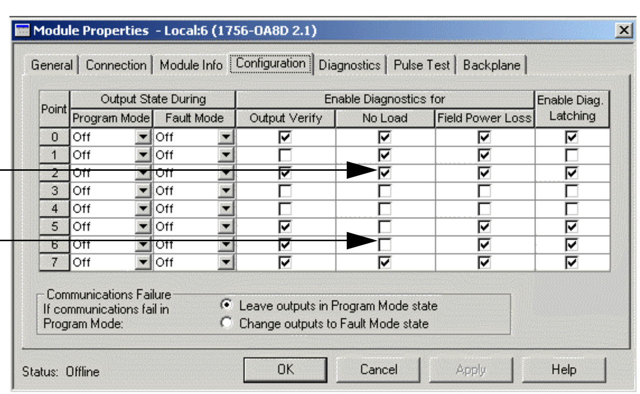
Diagnostic output modules list a minimum load current specification (1756-OA8D = 10mA & 1756-OB16D = 3mA). In the ON-state, the module must be connected to a load which will draw a minimum current equal to these values.

If a connected load is sized in accordance with the minimum load current specification, diagnostic output modules are capable of sensing current through the optoisolator and the load when the output point is OFF.

Enable No Load Detection as shown below.

Enable and disable no load detection on the Configuration tab.

- Check the box to enable no load detection.
- Clear the box to disable no load detection.



This feature has a corresponding tag that can be examined in the user program in the event of a fault. For more information on these tags, see Appendix A.

Field Side Output Verification

Field Side Output Verification informs the user that logic side instructions that the module consumes are accurately represented on the power side of a switching device. In other words, for each output point, this feature confirms that the output is ON when it is commanded to be ON.

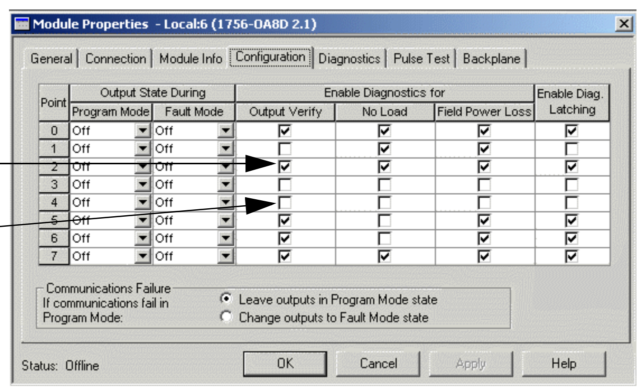
The diagnostic output module can tell a controller that it received a command and whether or not the field-side device connected to the module has executed the command. For example, in applications that need to verify that the module has accurately followed the processor's instructions, the module samples the field side state and compares it to the system side state.

This feature has a corresponding tag that can be examined in the user program in the event of a fault. For more information on these tags, see Appendix A.

If an output cannot be verified, a point level fault is sent to the controller. Enable Field Side Output Verification as shown below.

Enable and disable no load detection on the Configuration tab.

- Check the box to enable no load detection.
- Clear the box to disable no load detection.



Pulse Test

Pulse Test is a feature found on diagnostic output modules that can verify output-circuit functionality without actually changing the state of the output load device. A short pulse is sent to the targeted output circuit. The circuit should respond as it would if a real change-of-state command was issued, but the load device does not transition.

TIP Consider the following when using the Pulse Test:

- Only use the test when the output state does not transition for long periods of time. Normal diagnostics will catch faults if the outputs are transitioning regularly.
- When first performing the pulse test, it is recommended that you verify the load will not transition. You should be at the actual load while the test is performed.

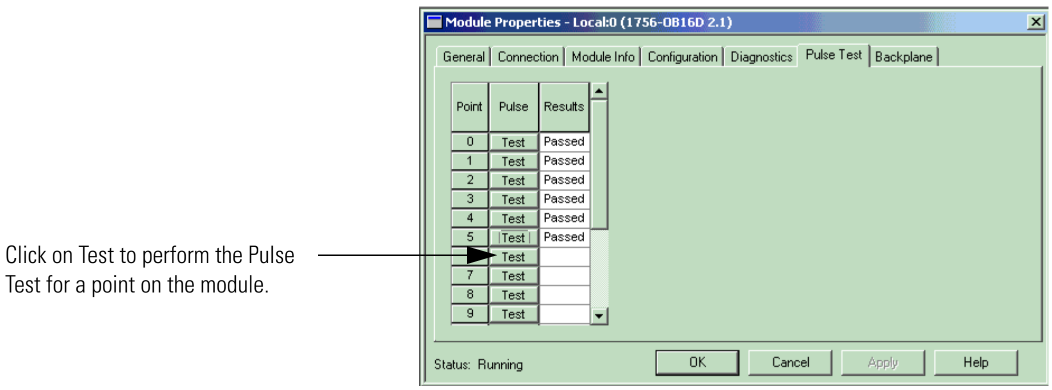
Table 4.12 lists how the Pulse Test can be used to perform a preemptive diagnosis of possible future module conditions.

Table 4.12

You can use the Pulse Test to:	Description:
detect a blown fuse before it happens	The Blown Fuse diagnostic (see page 4-23 for a complete explanation of fusing) can only be used when an output module is in the ON state. But it would useful to be made aware when operating conditions for a module may cause a blown fuse. If you perform a pulse test on the module while the output is in the OFF state, the output point is commanded to be ON briefly, as described above. Although no diagnostic bits are set in the output data echo, the pulse test will report a failure because conditions when the point is ON indicate a blown fuse condition may occur (see page 4-13). **IMPORTANT** The Pulse Test does not guarantee a fuse will blow when the output point turns ON. It merely indicates this condition is possible.
detect a No Load condition with an output ON	The No Load diagnostic (see page 4-24 for a complete explanation) can only detect a fault (i.e., set the No Load bit) when an output point is in the OFF state. But you may find it useful to be made aware when operating conditions for that point may reveal a potential No Load condition. If you perform a pulse test on an output point while it is in the ON state, the output point is commanded to be OFF briefly, as described on page 4-26. The pulse test will report a failure because conditions when the point is OFF indicate the possible absence of a field device; in this case, though, the No Load bit will not be set (see page 4-13)). **IMPORTANT** The Pulse Test does not guarantee the absence of a load. It merely indicates this condition is possible.

Pulse Test is a service that needs to be executed from an RSLogix 5000 program or the module properties page, using the pulse test tab and should be verified with your load to make sure that there are no false transitions.

Perform the Pulse Test in RSLogix 5000 as shown below. Your RSLogix 5000 project must be online for you to perform the pulse test.



For an example of how to perform a Pulse Test using ladder logic, see page B-12.

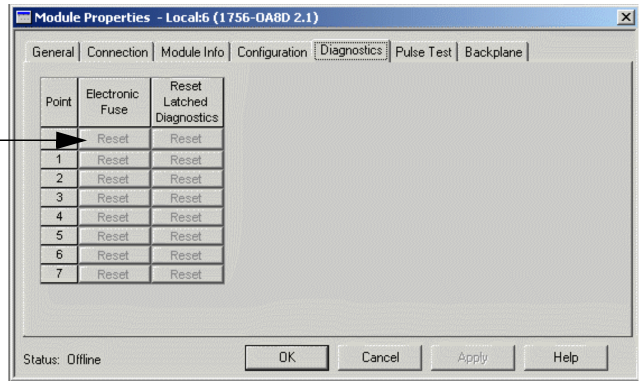
Point Level Electronic Fusing

Diagnostic output modules use electronic fusing to protect output points from the surge of too much current through that point on the module. If too much current begins to flow through a point, the fuse is tripped and a point level fault is sent to the controller.

Reset an electronic fuse through RSLogix 5000 configuration software or through ladder logic running on a controller. This feature has a corresponding tag that can be examined in the user program in the event of a fault. For more information on these tags, see Appendix A.

Reset the Electronic Fusing in RSLogix 5000 as shown below. Your RSLogix 5000 project must be online for you to reset a fuse.

Click on Reset to reset the fuse for a point on the module.



For an example of how to reset an electronic fuse in RSLogix 5000, see page 6-19. For an example of how to reset an electronic fuse using a ladder logic program, see page B-12.

IMPORTANT	Electronic fuses are also reset through a software reset or when the output module is power cycled.

Field Power Loss Detection

This feature is used when field power to the module is lost or zero cross cannot be detected. A point level fault is sent to the controller to identify the exact point faulted.

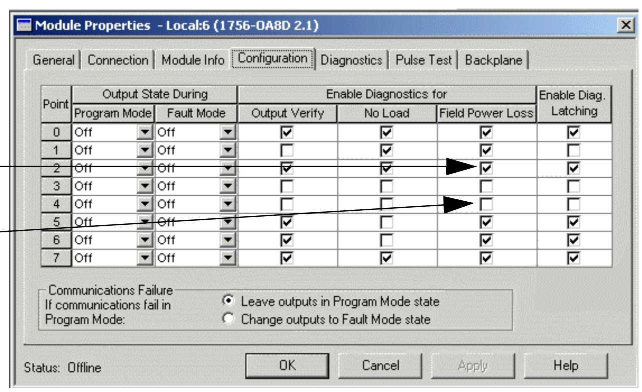
IMPORTANT	Only enable Field Power Loss detection for points that are in use. If this feature is enabled for points that are not in use, you will receive faults for those points during operation.

This feature has a corresponding tag that can be examined in the user program in the event of a fault. For more information on these tags, see Appendix A.

Enable Field Power Loss Detection as shown below.

Enable and disable field power loss detection on the Configuration tab.

- Check the box to enable field power loss detection.
- Clear the box to disable field power loss detection.



For an example of how to enable the Field Power Loss detection diagnostic, see page 6-12.

Diagnostic Change of State for Output Modules

If the Diagnostic Change of State feature is enabled, a diagnostic output module sends new data to the owner-controller when one of the events described in Table 4.13 occurs:

Table 4.13

If this option is selected:	The output module sends data to the owner-controller:
Receipt of Output Data	when the output module echoes data back to the owner-controller.
Diagnostic Change of State	when any change in the diagnostics for a particular output point occurs.

Unlike diagnostic input modules, this feature cannot be disabled for diagnostic output modules. If any of the three events described above occurs, the output module sends new data to the owner-controller.

Fault and Status Reporting Between Diagnostic Input Modules and Controllers

ControlLogix diagnostic digital input modules multicast fault/status data to any owner/ listening controllers.

All diagnostic input modules maintain a Module Fault Word, the highest level of fault reporting. Some modules also use additional words to indicate fault conditions, as shown on the next page.

Table 4.14 lists the tags that can be examined in ladder logic to indicate when a fault has occurred for a diagnostic input module:

Table 4.14

Tag:	Description:
Module Fault Word	This word provides fault summary reporting. It's tag name is Fault. This word is available on all digital input modules.
Field Power Loss Word	This word indicates loss of field power to a group on the module. It's tag name is FieldPwrLoss. This word is available on **1756-IA8D only**. For more information on field power loss, see page 4-19.
Open Wire Word	This word indicates the loss of a wire from a point on the module. It's tag name is OpenWire. For more information on open wire, see page 4-17.

All words are 32 bit, although only the number of bits appropriate for each module's density are used. For example, the 1756-IA16I module has a Module Fault Word of 32 bits. But, because this is a 16 point module, only the first 16 bits (bits 0-15) are used in the Module Fault Word.

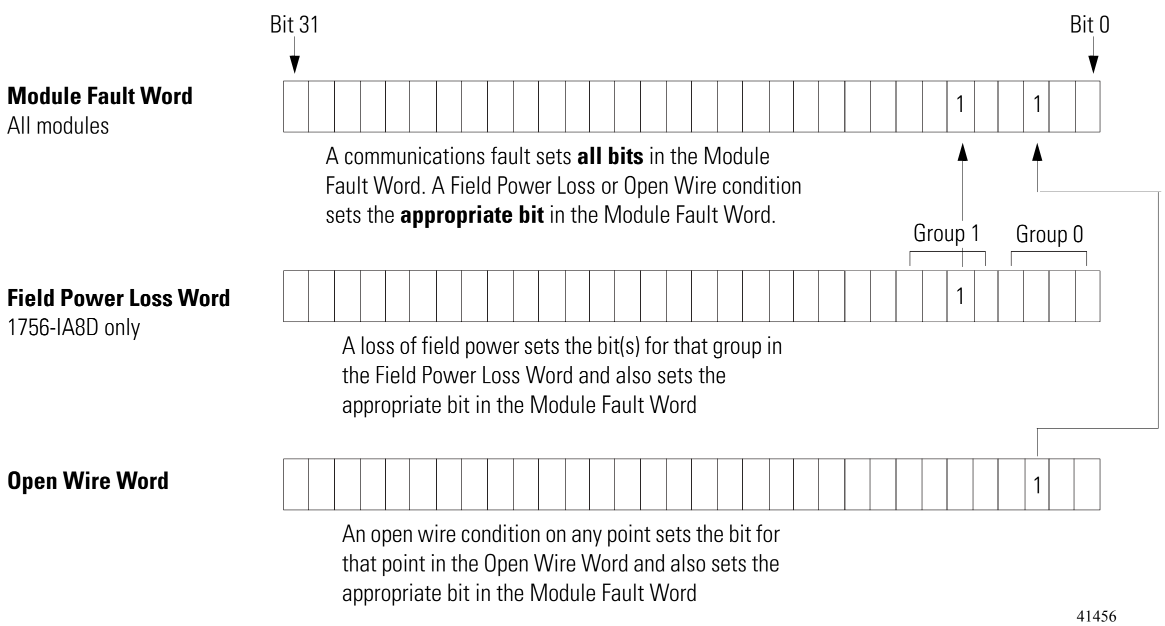
Fault bits in the Field Power Loss Word and Open Wire Word are logically ORed into the Module Fault Word. In other words, depending on the module type, a bit set in the Module Fault Word can mean multiple things, as indicated in Table 4.15:

Table 4.15

This condition:	Set these bits:
Communications fault	All 32 bits are set to 1, regardless of the module's density.
Field power loss	Only the bit(s) affected is set to 1.
Open wire	

The following graphic provides an overview of the fault reporting process on ControlLogix digital input modules.

Figure 4.2



Fault and Status Reporting Between Output Modules and Controller

ControlLogix diagnostic digital output modules multicast fault/status data to any owner/listening controllers.

All output modules maintain a Module Fault Word, the highest level of fault reporting. Some modules also use additional words to indicate fault conditions, as shown on the next page.

Table 4.16 lists the tags that can be examined in ladder logic to indicate when a fault has occurred for a diagnostic output module:

Table 4.16

Tag:	Description:
Module Fault Word	This word provides fault summary reporting. It's tag name is Fault. This word is available on all digital output modules.
Fuse Blown Word	This word indicates a point/group fuse blown on the module. It's tag name is FuseBlown. For more information on fusing, see page 4-23.
Field Power Loss Word	This word indicates a loss of field power to a point on the module. It's tag name is FieldPwrLoss. This word is available on **1756-OA8D only**. For more information on field power loss, see page 4-19.
No Load Word	This word indicates a loss of a load from a point on the module. It's tag name is NoLoad. For more information on no load conditions, see page 4-24.
Output Verify Word	This word indicates when an output is not performing as commanded by the owner-controller. It's tag name is OutputVerify. For more information on output verify, see page 4-25.

All words are 32 bit, although only the number of bits appropriate for each module's density are used. For example, the 1756-OB8 module has a Module Fault Word of 32 bits. But, because the module is an 8 point module, only the first 8 bits (bits 0-7) are used in the Module Fault Word.

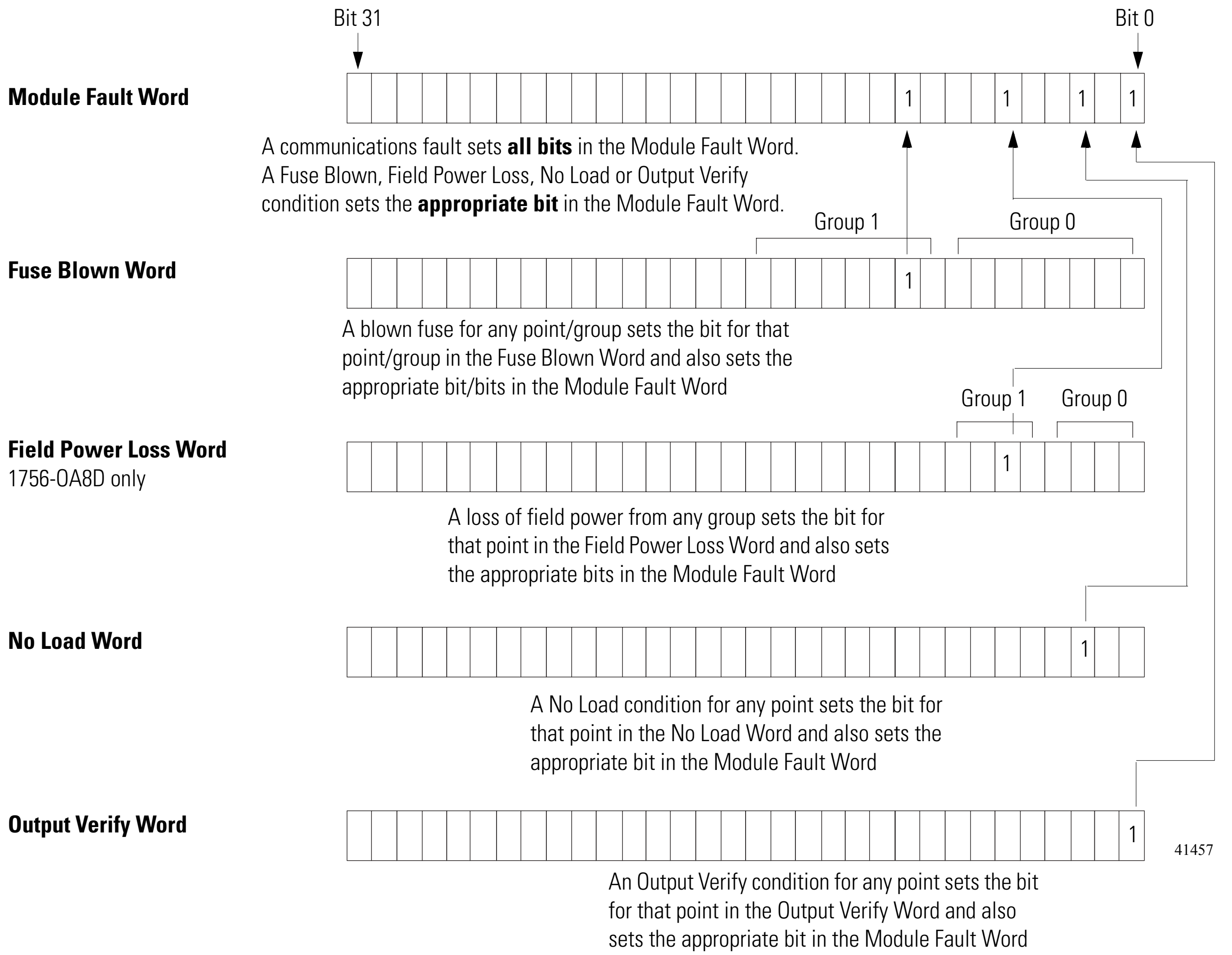
Fault bits in the Fuse Blown Word, Field Power Loss Word, No Load Word and Output Verify Word are logically ORed into the Module Fault Word. In other words, depending on the module type, a bit set in the Module Fault Word can mean multiple things, as indicated in Table 4.17:

Table 4.17

This condition:	Set these bits:
Communications fault	All 32 bits are set to 1, regardless of the module's density.
Fuse blown	Only the bit(s) affected is set to 1.
Field power loss	
No load	
Output verify	

Figure 4.3 provides an overview of the fault reporting process on ControlLogix digital output modules.

Figure 4.3



Chapter Summary and What's Next

In this chapter you learned about:

- determining input module compatibility
- determining output module compatibility
- using features common to ControlLogix diagnostic digital I/O modules
- using features specific to ControlLogix diagnostic digital input modules
- using features specific to ControlLogix diagnostic digital output modules

Chapter 5 explains Installing the ControlLogix I/O Module.

Installing the ControlLogix I/O Module

What This Chapter Contains

This chapter describes how to install ControlLogix modules.

For information about:	See page:
Installing the ControlLogix I/O Module	5-1
Keying the Removable Terminal Block	5-3
Connecting Wiring	5-4
Assembling The Removable Terminal Block and the Housing	5-8
Choosing the Extended-Depth Housing	5-9
Installing the Removable Terminal Block	5-11
Removing the Removable Terminal Block	5-13
Removing the Module from the Chassis	5-14

Installing the ControlLogix I/O Module

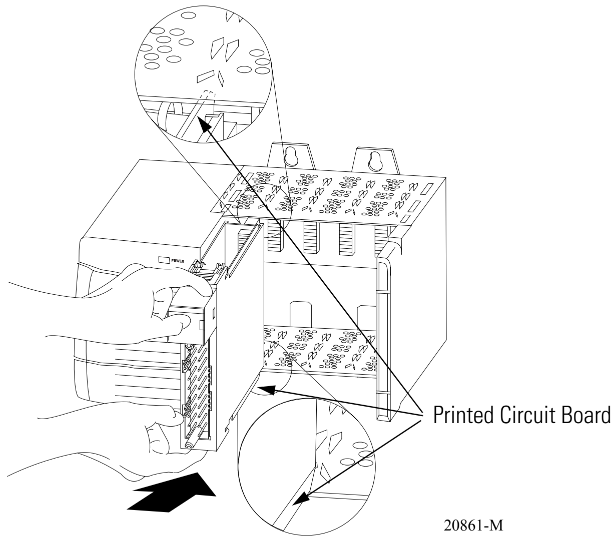
You can install or remove the module while chassis power is applied.

ATTENTION

The module is designed to support Removal and Insertion Under Power (RIUP). However, when you remove or insert an RTB with field-side power applied, **unintended machine motion or loss of process control can occur**. Exercise extreme caution when using this feature.

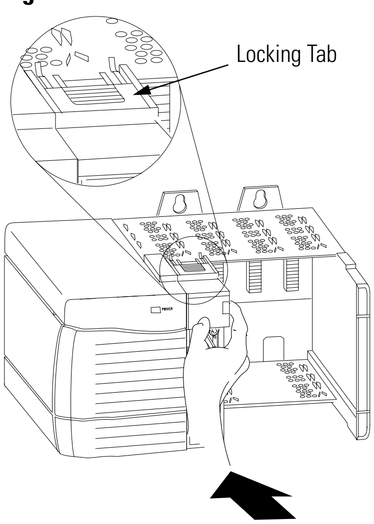
1. Align circuit board with top and bottom chassis guides.

Figure 5.1



2. Slide module into chassis until module tabs 'click'.

Figure 5.2



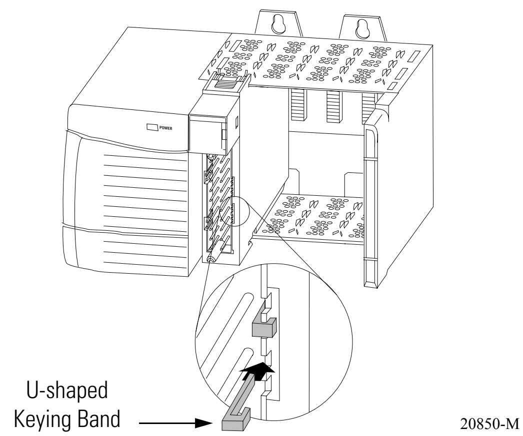
Keying the Removable Terminal Block

Key the RTB to prevent inadvertently connecting the incorrect RTB to your module. When the RTB mounts onto the module, keying positions will match up. For example, if you place a U-shaped keying band in position #4 on the module, you cannot place a wedge-shaped tab in #4 on the RTB or your RTB will not mount on the module.

We recommend that you use a unique keying pattern for each slot in the chassis.

1. Insert the U-shaped band with the longer side near the terminals. Push the band onto the module until it snaps in place.

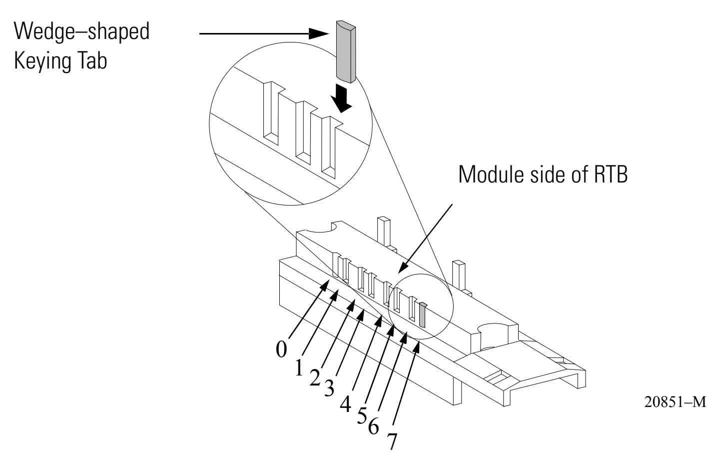
Figure 5.3 .



2. Key the RTB in positions that correspond to unkeyed module positions. Insert the wedge-shaped tab on the RTB with the rounded edge first. Push the tab onto the RTB until it stops.

IMPORTANT	When keying your RTB and module, you must begin with a wedge-shaped tab in position #6 or #7.

Figure 5.4



Connecting Wiring

You can use an RTB or a Bulletin 1492 prewired Interface Module (IFM)[1] to connect wiring to your module. If you are using an RTB, follow the directions below to connect wires to the RTB. An IFM has been prewired before you received it.

If you are using an IFM to connect wiring to the module, skip this section and go to page 5-8. To see a listing of the IFMs available for use with the ControlLogix analog I/O modules, see Appendix F, Using 1492 Wiring Systems with Your Digital I/O Module.

This chapter shows how the general guidelines for wiring your analog I/O modules, including grounding the cable and connecting wiring to each RTB type. For more specific information on wiring individual catalog numbers, refer to Table 5.1.

Table 5.1 Wiring Connections

Catalog number:	Wiring diagram on:
1756-IA16	page 7-2
1756-IA16I	page 7-5
1756-IA32	page 7-8
1756-IA8D	page 7-11
1756-IB16	page 7-14
1756-IB16D	page 7-17
1756-IB16I	page 7-20
1756-IB32/B	page 7-23
1756-IC16	page 7-26
1756-IG16	page 7-29
1756-IH16I	page 7-32
1756-IM16I	page 7-35
1756-IN16	page 7-38
1756-IV16	page 7-41
1756-IV32	page 7-44

(1) The Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of this product.

Table 5.1 Wiring Connections

Catalog number:	Wiring diagram on:
1756-OA16	page 7-47
1756-OA16I	page 7-50
1756-OA8	page 7-53
1756-OA8D	page 7-56
1756-OA8E	page 7-59
1756-OB16D	page 7-62
1756-OB16E	page 7-65
1756-OB16I	page 7-68
1756-OB16IS	page 7-71
1756-OB32	page 7-74
1756-OB8	page 7-77
1756-OB8EI	page 7-80
1756-OC8	page 7-83
1756-OG16	page 7-86
1756-OH8I	page 7-89
1756-ON8	page 7-92
1756-OV16E	page 7-95
1756-OV32E	page 7-98
1756-OW16I	page 7-101
1756-OX8I	page 7-104

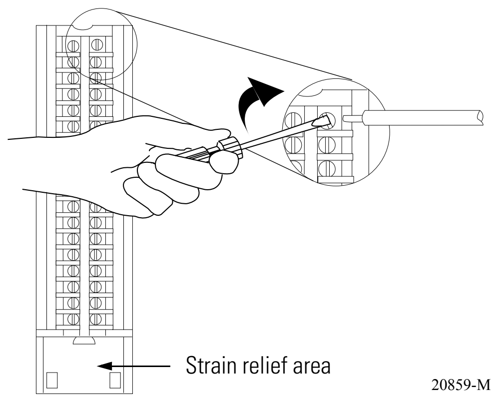
Three Types of RTBs (each RTB comes with housing)

- Cage Clamp - Catalog number 1756-TBCH
- NEMA Clamp - Catalog number 1756-TBNH
- Spring Clamp - Catalog number 1756-TBSH or TBS6H

Cage Clamp

1. Insert the wire into the terminal.
2. Turn the screw clockwise to close the terminal on the wire.

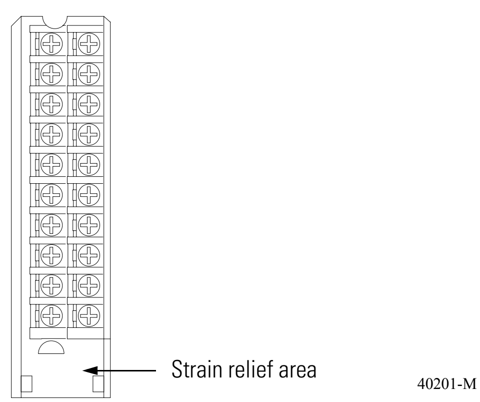
Figure 5.5



NEMA Clamp

1. Strip 5/16 inch (8mm) maximum length of wire.
2. Turn the terminal screw counterclockwise.
3. Insert stripped end of wire under plate on the terminal.
4. Turn the terminal screw clockwise until wire is secured.

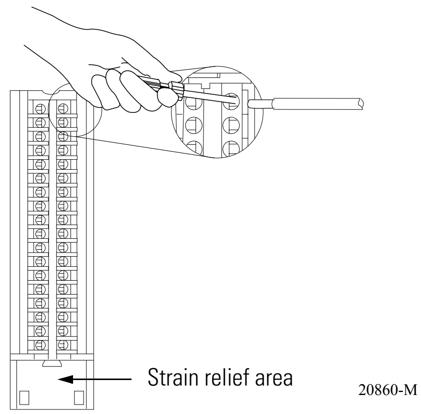
Figure 5.6



Spring Clamp

1. Insert the screwdriver into the outer hole of the RTB.
2. Insert the wire into the open terminal and remove the screwdriver.

Figure 5.7



Recommendations for Wiring Your RTB

Consider the following guidelines when wiring your RTB:

- Begin wiring the RTB at the bottom terminals and move up.
- Use a tie to secure the wires in the strain relief area of the RTB.
- The **jumper bar** part number is 97739201. Contact your local Rockwell Automation sales representative to order additional jumper bars, if necessary.

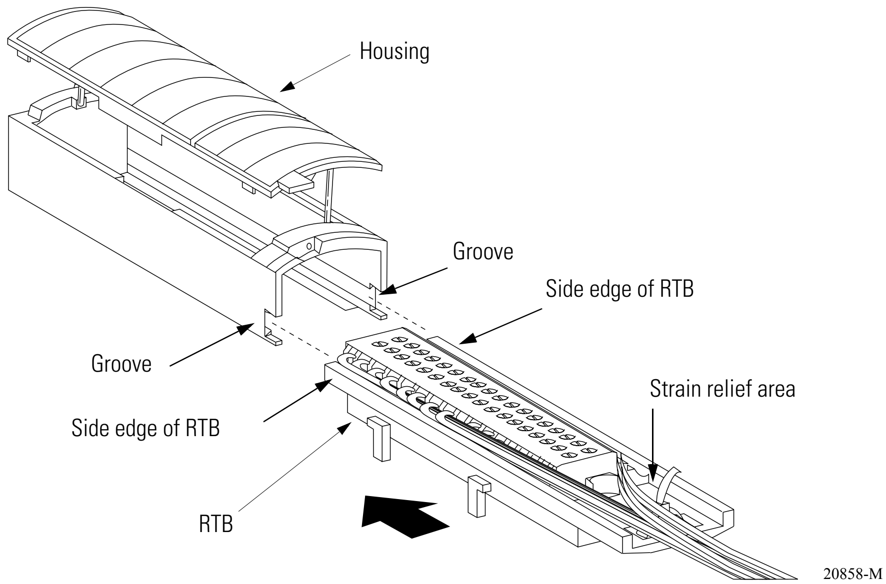
  For an example of when to use the jumper bar, see the 1756-IA16I wiring diagram in Figure 7.2 on page 7-5.
- Order and use an **extended-depth housing** (Cat. No.1756-TBE) for applications that require heavy gauge wiring. For more information, see page 5-9.

Assembling The Removable Terminal Block and the Housing

Removable housing covers the wired RTB to protect wiring connections when the RTB is seated on the module.

1. Align the grooves at the bottom of each side of the housing with the side edges of the RTB.

Figure 5.8



1756-TBCH RTB shown for reference

2. Slide the RTB into the housing until it snaps into place.

IMPORTANT	If additional wire routing space is required for your application, use extended-depth housing 1756-TBE.

Choosing the Extended-Depth Housing

There are two housing options you must consider when wiring your ControlLogix digital I/O module–standard-depth or extended-depth.

When you order an RTB for your I/O module, you receive a standard-depth housing with the RTB. If your application uses heavy gauge wiring, you can order an extended-depth housing. This housing does not come with an RTB.

You can use one of the housings listed in Table 5.2:

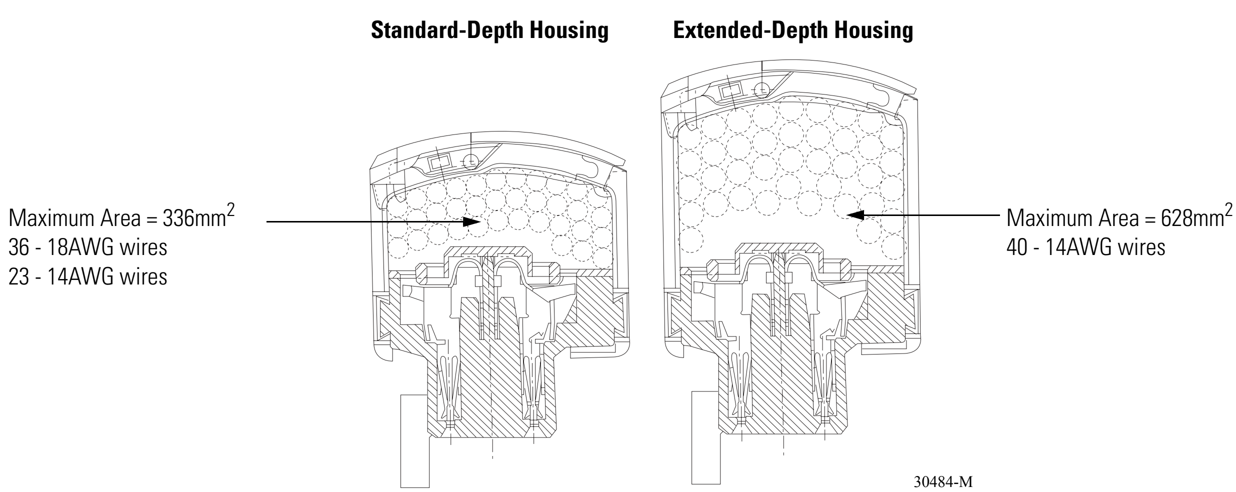
Table 5.2

This housing:	should be used with this RTB:	and allows up to this capacity of wires:
1756-TBNH	NEMA clamp	$336mm^2$
1756-TBSH	Spring clamp (20-position)	
1756-TBCH	Cage clamp	
1756-TBS6H	Spring clamp (36-position)	
1756-TBE	Any RTB that uses heavy gauge wiring	$628mm^2$

Figure 5.9 shows the difference, in terms of capacity, between the housing options.

IMPORTANT The housings shown are used with a spring clamp RTB, but the capacity for each remains the same regardless of RTB type.

Figure 5.9



Suggestions for Using the Extended-Depth Housing

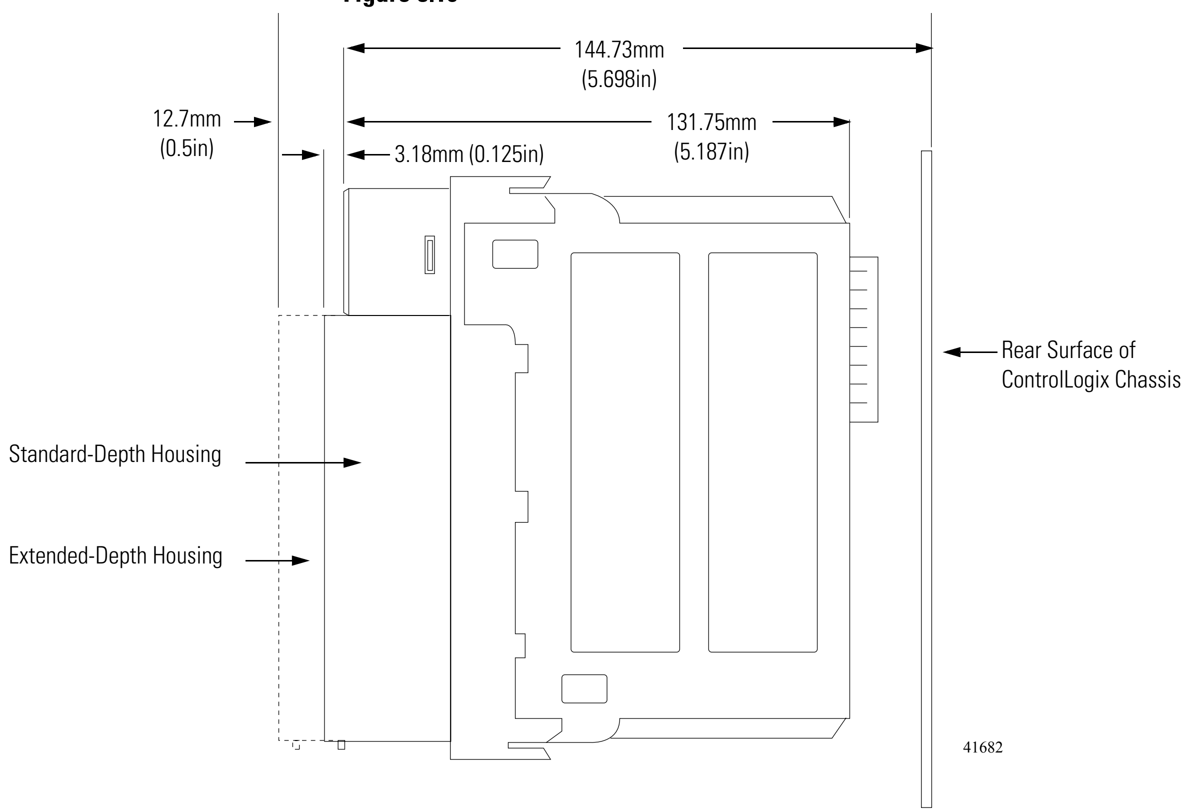
Consider the following recommendations when deciding to use an extended-depth housing on your I/O module. It is recommended you use the 1756-TBE when:

- using >36 18AWG wires
- using >23 14AWG wires

Cabinet Size Considerations With the Extended-Depth Housing

When you use an extended-depth housing (1756-TBE), the I/O module depth is increased. The diagram below shows the difference, in terms of depth, between an I/O module using a standard-depth housing and one using an extended-depth housing.

Figure 5.10



IMPORTANT The depth from front of the module to the back of the chassis is as follows:

– standard-depth housing = 147.91mm (5.823in)
– extended-depth housing = 157.43mm (6.198in)

Installing the Removable Terminal Block

Install the RTB onto the module to connect wiring.

ATTENTION

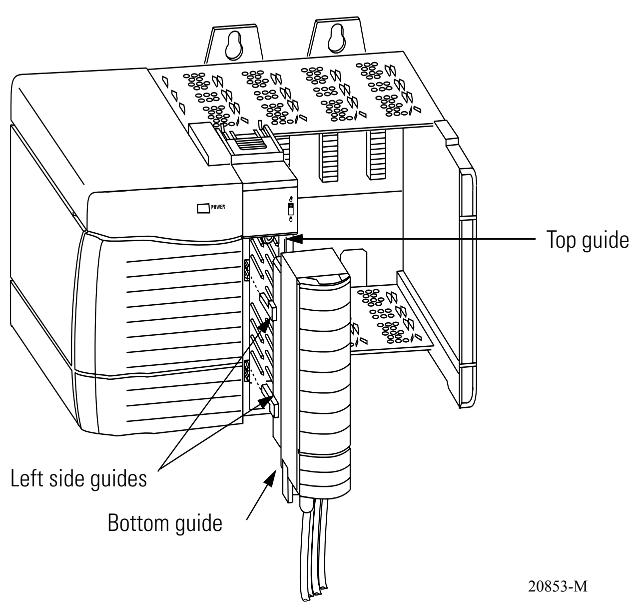
Shock hazard exists. If the RTB is installed onto the module while the field-side power is applied, the RTB will be electrically live. Do not touch the RTB's terminals. Failure to observe this caution may cause personal injury.

The RTB is designed to support Removal and Insertion Under Power (RIUP). However, when you remove or insert an RTB with field-side power applied, **unintended machine motion or loss of process control can occur**. Exercise extreme caution when using this feature. It is recommended that field-side power be removed before installing the RTB onto the module.

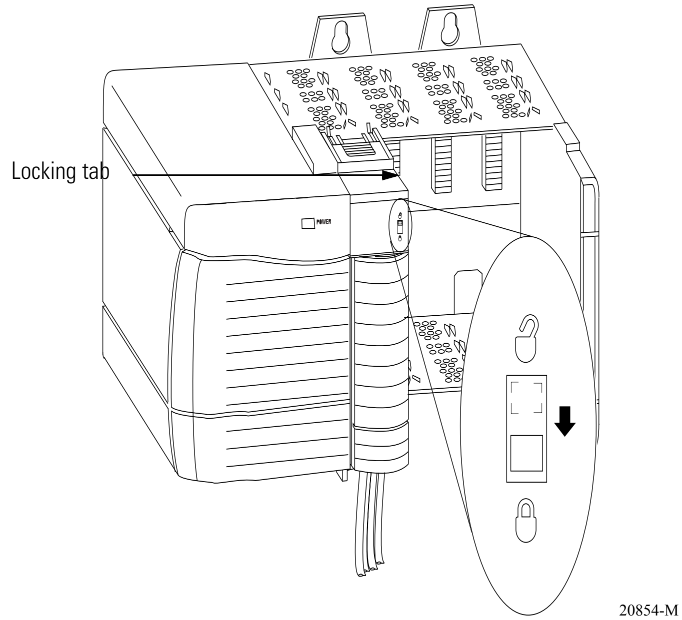
Before installing the RTB, make certain:

- field-side wiring of the RTB has been completed.
- the RTB housing is snapped into place on the RTB.
- the RTB housing door is closed.
- the locking tab at the top of the module is unlocked.

1. Align the top, bottom and left side guides of the RTB with the guides on the module.



2. Press quickly and evenly to seat the RTB on the module until the latches snap into place.



3. Slide the locking tab down to lock the RTB onto the module.

Removing the Removable Terminal Block

If you need to remove the module from the chassis, you must first remove the RTB from the module.

ATTENTION

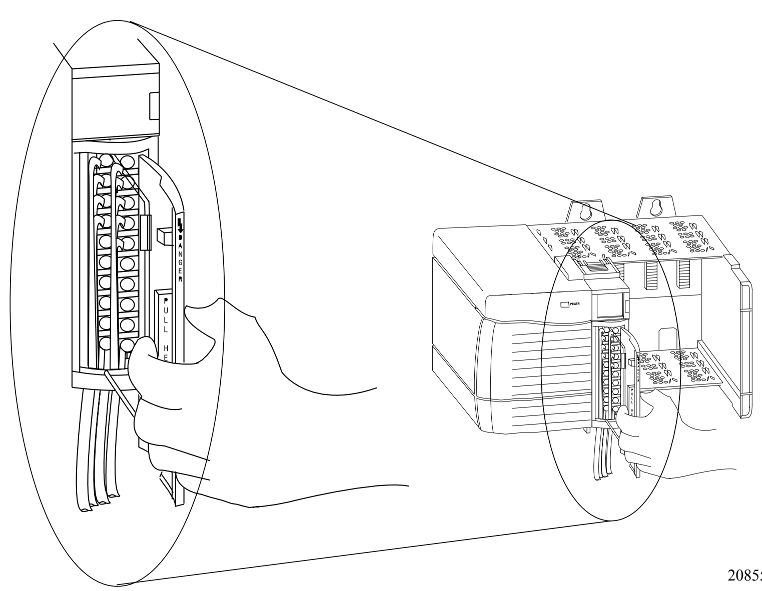
Shock hazard exists. If the RTB is removed from the module while the field-side power is applied, the module will be electrically live. Do not touch the RTB's terminals. Failure to observe this caution may cause personal injury.

The RTB is designed to support Removal and Insertion Under Power (RIUP). However, when you remove or insert an RTB with field-side power applied, **unintended machine motion or loss of process control can occur**. Exercise extreme caution when using this feature. It is recommended that field-side power be removed before removing the module.

1. Unlock the locking tab at the top of the module.
2. Open the RTB door using the bottom tab.
3. Hold the spot marked PULL HERE and pull the RTB off the module.

IMPORTANT

Do not wrap your fingers around the entire door. A shock hazard exists.



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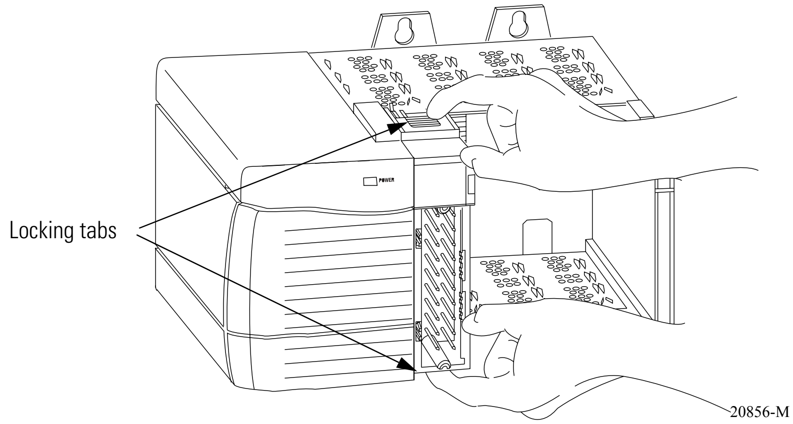
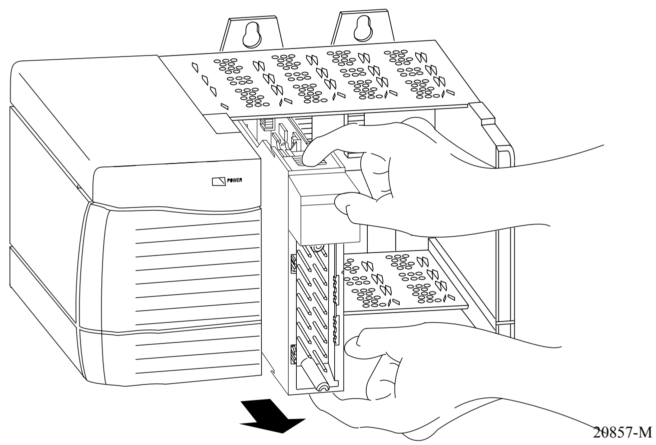
Removing the Module from the Chassis

1. Push in the top and bottom locking tabs.



2. Pull module out of the chassis.



Chapter Summary and What's Next

In this chapter, you read about:

- installing the module.
- keying the removable terminal block and the interface module.
- connecting wiring.
- assembling the removable terminal block and the housing.
- installing the removable terminal block or interface module onto the module.
- removing the removable terminal block from the module.
- removing the module from the chassis.

Chapter 6 explains Configuring Your ControlLogix Digital I/O Modules.

Configuring Your ControlLogix Digital I/O Modules

What This Chapter Contains

This chapter describes why you must configure your ControlLogix digital I/O modules and how to configure them for use in the ControlLogix system.

Table 6.1

For information about:	See page:
Configuring Your I/O Module	6-1
Overview of the Configuration Process	6-2
Creating a New Module	6-4
Using the Default Configuration	6-8
Altering the Default Configuration	6-9
Configuring a Standard Input Module	6-10
Configuring a Standard Output Module	6-11
Configuring a Diagnostic Input Module	6-12
Configuring a Diagnostic Output Module	6-13
Editing Configuration	6-14
Configuring I/O Modules in a Remote Chassis	6-16
Input Online Services	6-18
Output Online Services	6-19
Viewing and Changing Module Tags	6-20

Configuring Your I/O Module

You must configure your module upon installation. The module will not work until it has been configured.

IMPORTANT This chapter focuses on configuring I/O modules in a local chassis. To configure I/O modules in a remote chassis, you must follow all the detailed procedures with two additional steps. To see the additional steps, see page 6-16.

RSLogix 5000 Configuration Software

Use RSLogix 5000 software to set configuration for your ControlLogix digital I/O module. You have the option of accepting default configuration for your module or writing point level configuration specific to your application.

Both options are explained in detail, including views of software screens, in this chapter.

Overview of the Configuration Process

When you use the RSLogix 5000 software to configure a ControlLogix digital I/O module, you must perform the following steps:

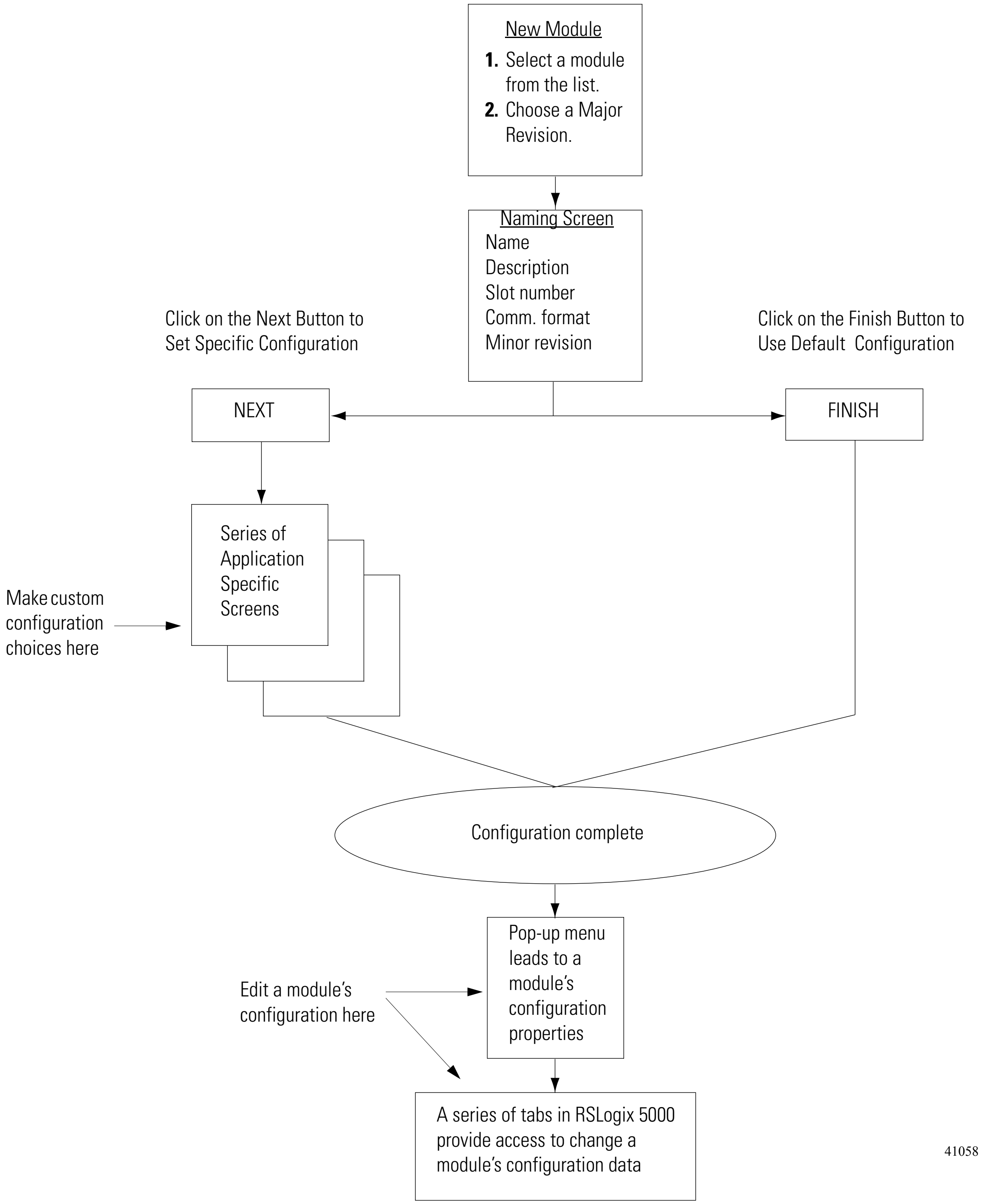
1. Create a new module.

2. Accept the default configuration or change it to specific configuration for the module.

3. Edit configuration for a module when changes are needed.

Figure 6.1 on page 6-3 shows an overview of the configuration process.

Figure 6.1


New Module
1. Select a module from the list.
2. Choose a Major Revision.
Naming Screen
Name
Description
Slot number
Comm. format
Minor revision
Click on the Next Button to Set Specific Configuration
Click on the Finish Button to Use Default Configuration
NEXT
FINISH
Series of Application Specific Screens
Make custom configuration choices here
Configuration complete
Pop-up menu leads to a module's configuration properties
Edit a module's configuration here
A series of tabs in RSLogix 5000 provide access to change a module's configuration data
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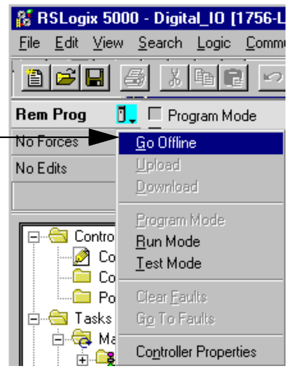
Creating a New Module

After you have started RSLogix 5000 and created a controller, you must create a new module. The wizard allows you to create a new module and write configuration. You can use default configuration or write specific configuration for your application.

IMPORTANT In RSLogix 5000, version 13 and earlier, you must be offline when you create a new module.

1. If necessary, go offline.

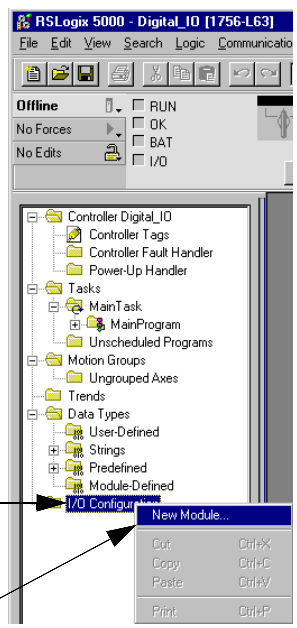
If you are not offline, use this pull-down menu to go offline



2. Add a new module to your RSLogix 5000 project.

A. Right-click on I/O Configuration.

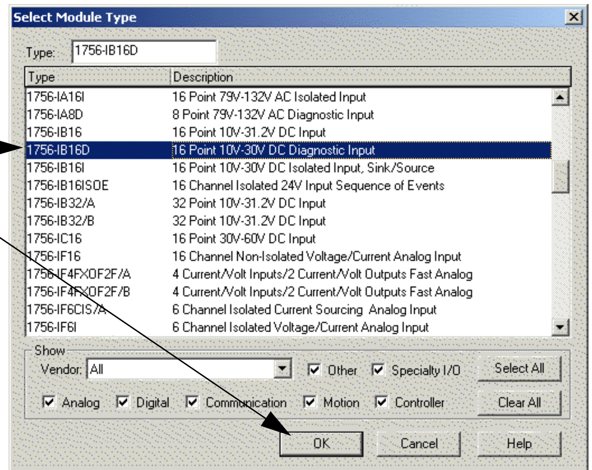
B. Click New Module



3. When the Select Module Type screen appears, select the new module for your project.

A. Select a module.

B. Click OK.



4. Configure the module. The first screen of the configuration wizard is shown below.

A. Name the module.

B. Select the module's slot number.

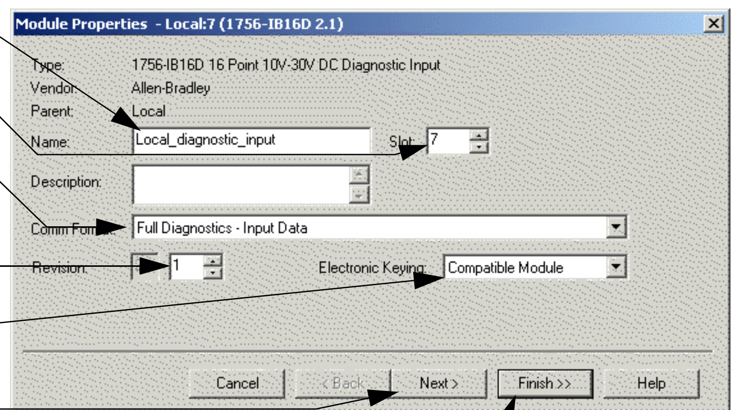
C. Choose a Communications Format. For more information, see page 6-6.

D. Make sure the Minor Revision number matches the label on the side of your module.

E. Choose an Electronic Keying method. For more information, see page 3-5.

F. If you are altering the default configuration, click here. Go to page 6-9.

G. If you are using default configuration, click here. Go to page 6-8.



Communications Format

The communications format determines what type of configuration options are made available, what type of data is transferred between the module and its owner-controller, and what tags are generated when configuration is complete. Once a module is created, you cannot change the communications format unless you delete and recreate the module.

The communications format also defines the connection between the controller writing the configuration and the module itself. The number and type of choices varies depending on what module you are using and whether it is in a local or remote chassis.

TIP

When you select a Listen-only Communications Format, only the General and Connection tabs appear when you view a module's properties in RSLogix 5000.

Controllers that want to listen to module but not own it use the listen-only communications formats.

Input Module Formats

Table 6.2 lists the communications formats used with input modules:

Table 6.2

If you want the input module to return this data	choose this communication format:	Modules that offer this format:
The module returns only general fault and input data.	Input data	1756-IA16, -IA16I, _IA32, -IM16I, -IB16I, -IB16, -IB32, -IC16, -IG16, -IH16I, -IN16, -IV16
The module returns input data with the value of the system clock (from its local chassis) when the input data changed.	CST timestamped input data	
The 1756-CNB module collects all digital input words in the remote chassis and sends them to the controller as a single rack image. This connection type limits the status and diagnostic information available.	Rack optimization	
These choices have the same definition as the similarly-named options above except that they are listen-only connections.	Listen only - input data	
	Listen only - CST timestamped input data	
	Listen only - rack optimization	
The module returns input data, the value of the system clock (from its local chassis) when the input data changed, and diagnostic data (diagnostic modules only).	Full diagnostic input data	1756-IA8D, -IB16D
This choice has the same definition as *Full diagnostic input data* except that it is a listen-only connections.	Listen only - full diagnostic input data	

Output Module Formats

As with input modules, the number and type of choices varies depending on which output module you are using and whether it is in a local or remote chassis.

Table 6.2 lists the communications formats used with input modules:

Table 6.3

If you want the output module to return this data	choose this communication format:	Modules that offer this format:
The owner-controller sends the module only output data.	Output data	1756-OA16I, -OA8, -OB16I, -OB16IS[1], -OB32, -OB8, -OC8, -OG16, -OH8I, -ON8, -OW16I, -OX8I
The owner-controller sends the module output data and a CST timestamp value.	Scheduled output data	
The owner-controller sends all digital output words to the remote chassis as a single rack image.	Rack optimization	
These choices have the same definition as those above except that they are listen-only connections.	Listen only - output data	
	Listen only - rack optimization	
The owner-controller sends the module only output data. The module returns fuse blown status with the value of the system clock (from its local chassis) when the fuse was either blown or reset.	CST timestamped fuse data - output data	1756-OA16, -OA8E, -OB16E, -OB8EI, -OV16E, -OV32E
The owner-controller sends the module output data and a CST timestamp value. The module returns fuse blown status with the value of the system clock (from its local chassis) when the fuse was either blown or reset.	CST timestamped fuse data - scheduled output data	
This choice has the same definition as *CST timestamped fuse data - output data* except that it is a listen-only connection.	Listen only - CST timestamped fuse data - output data	
The owner-controller sends the module only output data. The module returns diagnostic data and a timestamp of diagnostics.	Full diagnostic - output data	1756-OA8D, -OB16D
The owner-controller sends the module output data and a CST timestamp value. The module returns diagnostic data and a timestamp of diagnostics.	Full diagnostics - scheduled output data	
This choice has the same definition as *Full diagnostics - output data* except that it is a listen-only connection.	Listen only - full diagnostics - output data	
The owner-controller sends the module output data and a CST timestamp value.	Scheduled output data per point	1756-OB16IS only

(1) The 1756-OB16IS module does not support the Rack optimization, Listen only - rack optimization and Scheduled output data communication formats.

Electronic Keying

Electronic keying allows the ControlLogix system to control what modules belong in the various slots of a configured system.

During module configuration, you must choose one of the following keying options for your I/O module:

- Exact Match
- Compatible Module
- Disable Keying

For more information on electronic keying, see page 3-5.

Using the Default Configuration

If you use the default configuration and click on Finish, you are done.

Altering the Default Configuration

If you want to alter or view the default configuration, click on Next. You will be taken through a series of wizard screens that enable you to alter or view the module.

Although each screen maintains importance during online monitoring, two of the screens that appear during this initial module configuration process are blank. They are shown here to maintain the graphical integrity of RSLogix 5000. To see these screens in use, see page 8-5.

After the naming page, multiple screens appear. Depending on the module you picked in step 3 on page 6-5, the number of screens and information on each screen may vary. The screens below show sample configuration screens for the 1756-IB16D module.

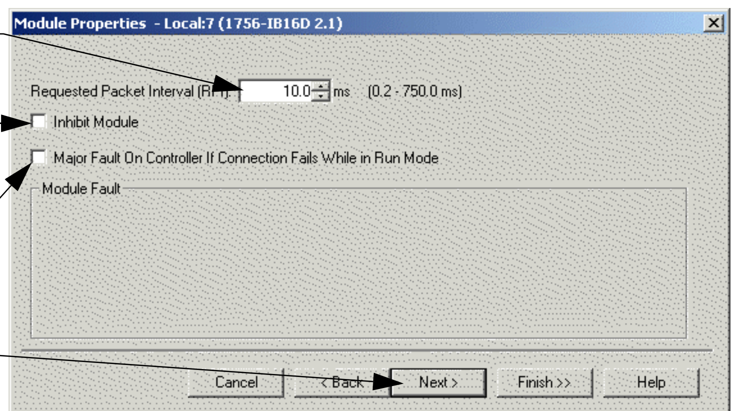
On this screen, you can:

A. Change the RPI. For more information on the RPI, see page 2-10.

B. Inhibit the module. For more information on inhibiting the module, see page 3-7.

C. Make sure a Major Fault occurs on the module's owner-controller if there is a connection failure between the module and the controller.

D. Click Next until you see additional configuration screens.



On this screen, you can:

A. Enable COS for individual points.

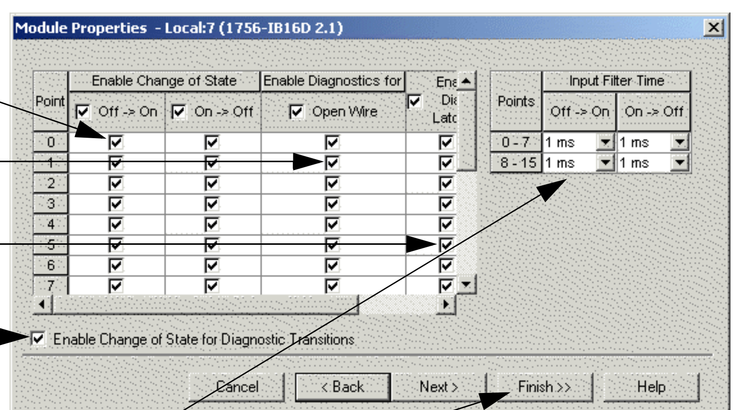
B. Enable Open Wire detection for individual points.

C. Enable Diagnostic Latching for individual points.

D. Enable COS for diagnostic transitions. This feature can only be set on a module-wide basis.

E. Change the Input Filter settings.

F. Click Finish when the module is configured.



Configuring a Standard Input Module

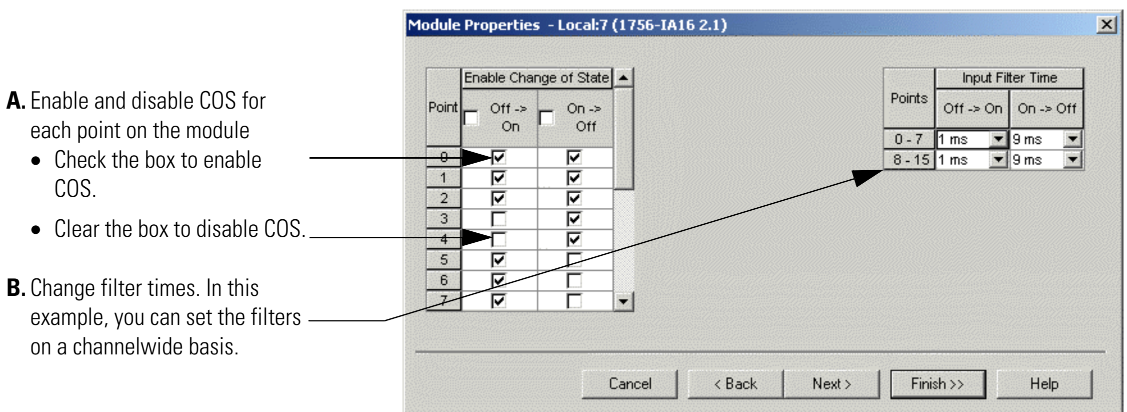
Table 6.4 lists the ControlLogix standard digital input modules and the configurable features they support:

Table 6.4

These input modules:	Offer these configurable features:	For a full description of the feature, see page:
1756-IA16 1756-IA16 1756-IA32I 1756-IB16 1756-IB16I 1756-IB32 1756-IC16 1756-IG16 1756-IH16I 1756-IM16I 1756-IN16 1756-IV16 1756-IV32	Change of State	3-11
	Input Filter Times	3-12

Create a new module in RSLogix 5000 as described on page 6-4. Figure 6.2 shows how to configure your standard input module.

Figure 6.2



Configuring a Standard Output Module

Table 6.5 lists the ControlLogix standard digital output modules and the configurable features they support:

Table 6.5

These output modules:	Offer these configurable features:	For a full description of the feature, see page:
1756-OA16 1756-OA16I 1756-OA8 1756-OA8E 1756-OB16E 1756-OB16I 1756-OB16IS 1756-OB32 1756-OB8 1756-OB8EI 1756-OC8 1756-OG16 1756-OH8I 1756-ON8 1756-OV32E 1756-OW16I 1756-OX8I	Output State in Program Mode Output State in Fault Mode	Choices shown in Figure 6.3 below
	Transition from Program State to Fault State	3-13
1756-OA8E only	Field Power Loss Detection	3-18
	Diagnostic Latching	3-19

Create a new module in RSLogix 5000 as described on page 6-4. Figure 6.3 shows how to configure your standard output module.

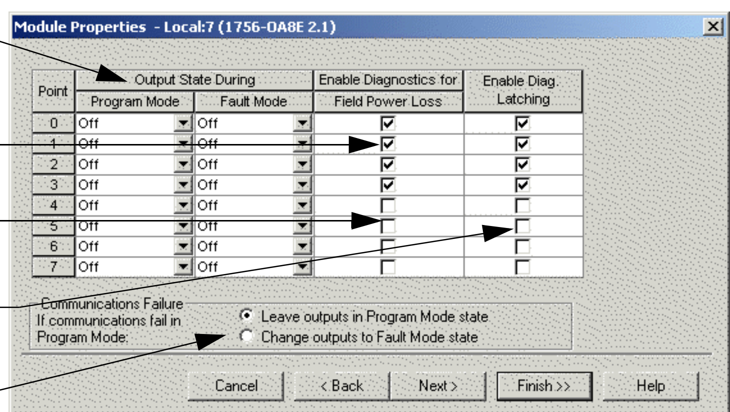
Figure 6.3

A. Set the state of each output during program mode and fault mode.

B. Enable Field Power Loss detection for each output.
- Check the box to enable field power loss detection
- Clear the box to disable field power loss detection

C. Enable Diagnostic Latching for each output.

D. Set the state of the outputs if communications fail in program mode.



Configuring a Diagnostic Input Module

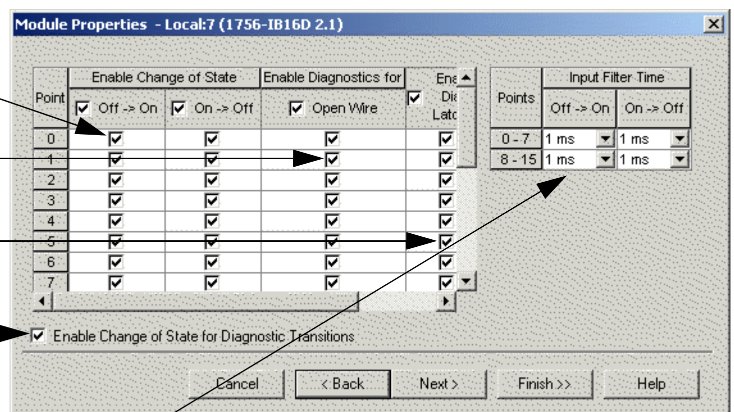
Table 6.6 lists the ControlLogix diagnostic digital input modules and the configurable features they support:

Table 6.6

These input modules:	Offer these configurable features:	For a full description of the feature, see page:
1756-IA8D 1756-IA16D	Change of State	4-15
	Input Filter Times	4-16
	Open Wire Detection	4-17
	Field Power Loss Detection	4-19
	Diagnostic Latching	4-11
	Diagnostic Change of State	4-18

Create a new module in RSLogix 5000 as described on page 6-4. Figure 6.4 shows how to configure your diagnostic input module.

Figure 6.4



A. Enable COS for individual points.

B. Enable Open Wire detection for individual points.

C. Enable Diagnostic Latching for individual points.

D. Enable COS for diagnostic transitions. This feature can only be set on a module-wide basis.

E. Change the Input Filter settings.

One diagnostic, Reset Latched Diagnostics, is not used when writing initial configuration but is typically accessed during online monitoring. For more information on how to reset Latched Diagnostics, see page 6-19.

Configuring a Diagnostic Output Module

Table 6.7 lists the ControlLogix standard digital output modules and the configurable features they support:

Table 6.7

These output modules:	Offer these configurable features:	For a full description of the feature, see page:
1756-OA8D 1756-OB16D	Output State in Program Mode	Choices shown in Figure 6.3 below
	Output State in Fault Mode	
	Transition from Program State to Fault State	4-20
	No Load Detection	4-24
	Diagnostic Latching	4-11
	Output Verify Detection	4-25
1756-OA8D only	Field Power Loss Detection	4-19

Create a new module in RSLogix 5000 as described on page 6-4. Figure 6.5 shows how to configure your diagnostic output module.

Figure 6.5

A. Set the state of each output during program mode and fault mode.

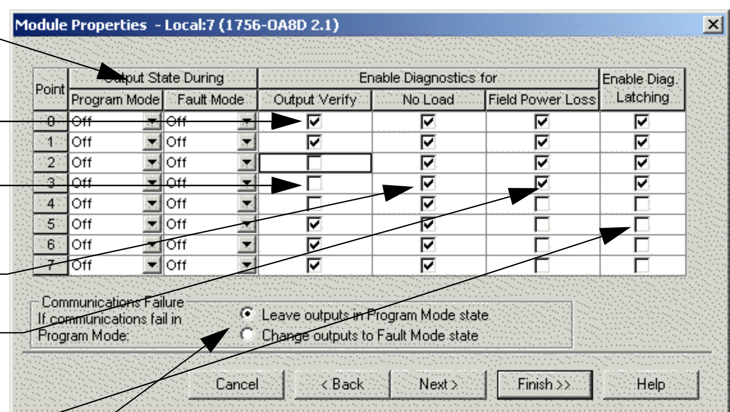
B. Enable Output Verify for each output..
- Check the box to enable output verify.
- Clear the box to disable output verify.

C. Enable No Load for each output.

D. Enable Field Power Loss for each output.

E. Enable Diagnostic Latching for each output.

F. Set the state of the outputs if communications fail in program mode.



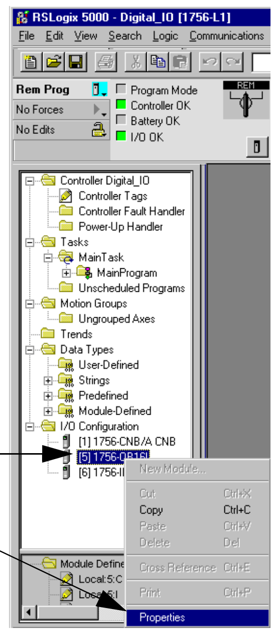
Editing Configuration

After you have set configuration for a module, you can review and change your choices. You can change configuration data and download it to the controller while online. This is called **dynamic reconfiguration**.

IMPORTANT	Although you can change configuration while online, you must go offline to add or delete modules from the project.

The editing process begins in the RSLogix 5000.

1. Access the module's configuration.



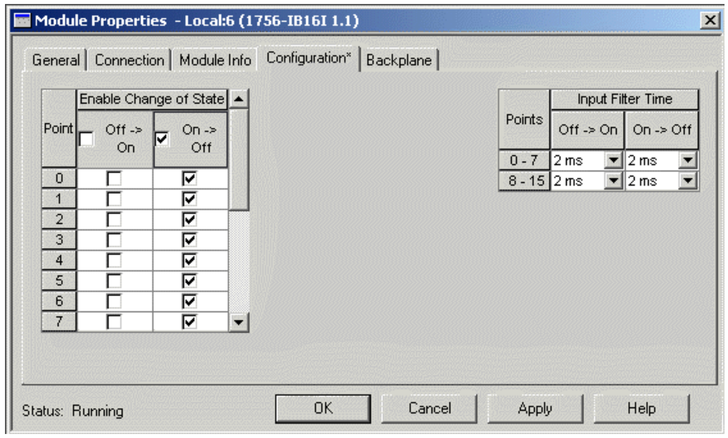
A. Right-click on I/O Configuration.

B. Click Properties.

The General tab of the configuration wizard appears.

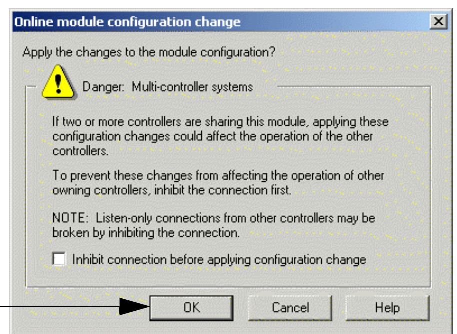
2. Click on the tab of the page that you want to view or reconfigure and make any appropriate changes.

3. Make any necessary changes. In the example below, COS was disabled for all inputs if they changed from OFF to ON. .



4. After you make the necessary changes, click OK. Before your project is updated online, RSLogix 5000 verifies your desired change.

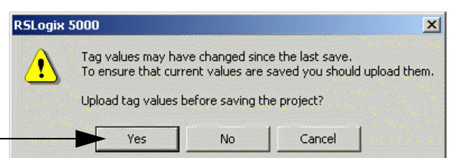
Click OK.



5. Save the project.

6. When prompted (as shown below), upload tag values.

Click Yes.

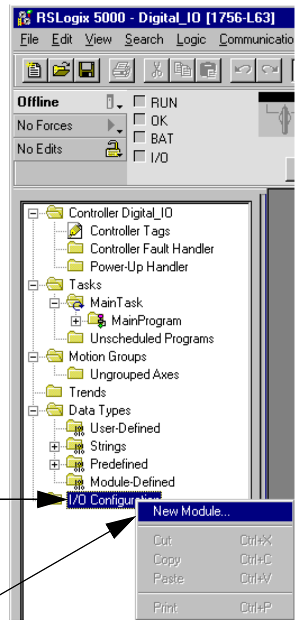


Configuring I/O Modules in a Remote Chassis

ControlLogix ControlNet Interface modules (1756-CNB or 1756-CNBR) or the EtherNet/IP Bridge module (1756-ENBT) are required to communicate with I/O modules in a remote chassis.

You must configure the communications module in the local chassis and the remote chassis before adding new I/O modules to the program.

1. Configure a communications module for the local chassis. This module handles communications between the controller chassis and the remote chassis.



A. Right-click on I/O Configuration.

B. Click New Module.

2. Choose a communications module (1756-CNB, 1756-CNBR or 1756-ENBT) for the local chassis.

3. Configure the communications module in the local chassis.

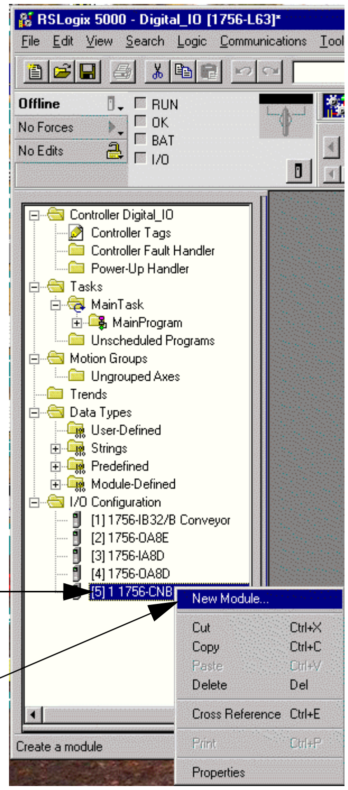
   For more information on the ControlLogix ControlNet Interface modules, see the ControlLogix ControlNet Interface user manual, publication 1756-6.5.3.

   For more information on the ControlLogix EtherNet/IP Bridge module, see the ControlLogix EtherNet/IP Bridge module user manual, publication 1756-UM050.

4. Configure a communications module for the remote chassis.

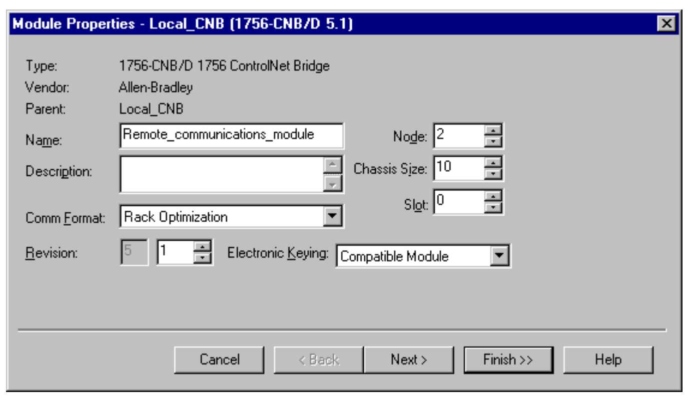
A. Right-click on the local communications module.

B. Click New Module



5. Select a communications module for the remote chassis.

6. Configure the communications module in the remote chassis..



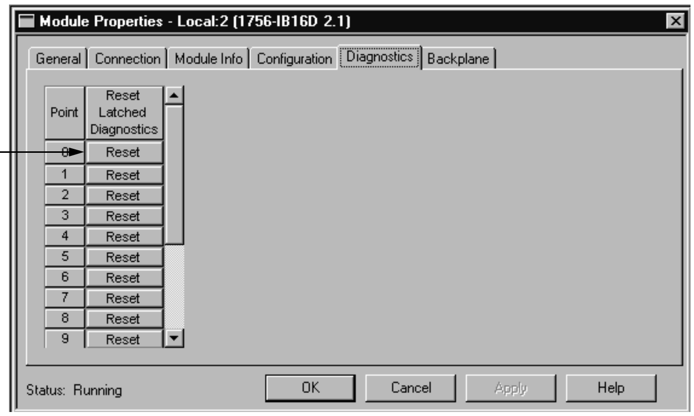
Now you can configure the remote I/O modules by adding them to the remote communications module. Follow the same procedures as you do for configuring local I/O modules as detailed earlier in this chapter.

Input Online Services

Diagnostic input modules have an additional pages of diagnostic services. **Reset Latched Diagnostics** is not used when writing configuration but are only accessed during online monitoring.

These screens are accessed through the module's properties.

Reset Latched Diagnostics here



Output Online Services

Diagnostic output modules have additional pages of diagnostic services. The following three diagnostics

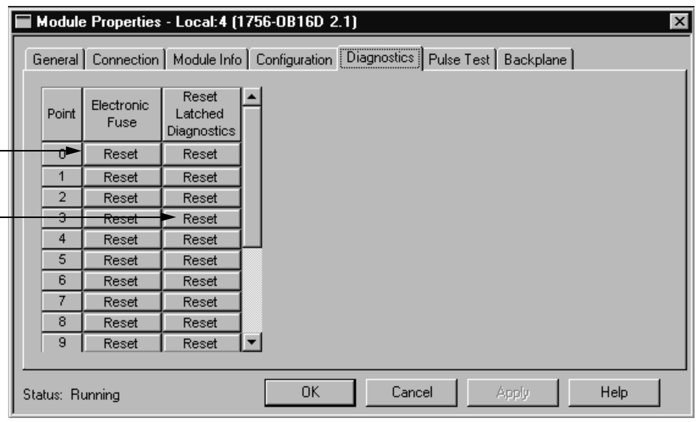
- Electronic Fuse reset
- Reset Latched Diagnostics
- Pulse Test

are not used when writing configuration but are only accessed during online monitoring.

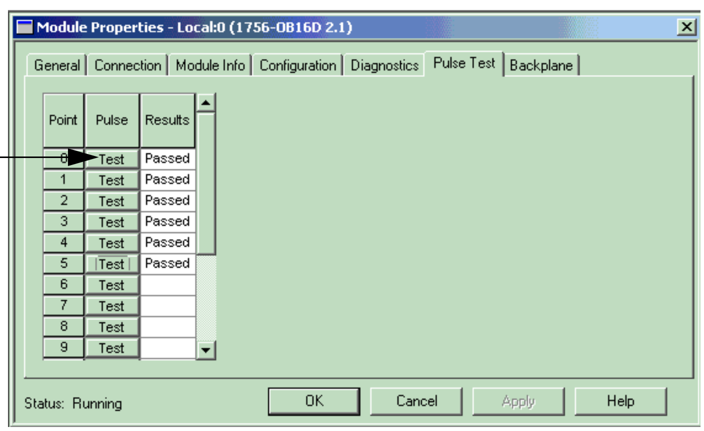
These screens are accessed through the module's properties.

Reset Electronic Fuses here

Reset Latched Diagnostics here



Click on Test to perform the Pulse Test for a point on the module.



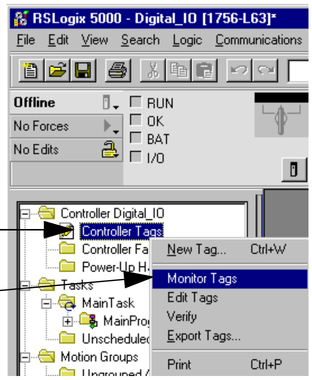
Viewing and Changing Module Tags

When you create a module, a set of tags are created by the ControlLogix system that can be viewed in the Tag Editor of RSLogix 5000. Each configurable feature on your module has a distinct tag that can be used in the processor's ladder logic.

You can access a module's tags through RSLogix 5000 as shown below.

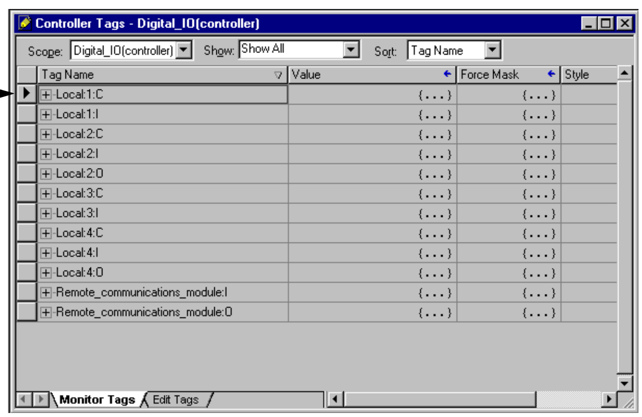
A. Richt-click Controller Tags.

B. Click Monitor Tags



You can view the tags from here.

Click on the slot number of the module you want to see



Because the process of viewing and changing a module's configuration tags is broader in scope than can be addressed in this chapter, you must turn to Appendix A for more information and sample tag collections.

Chapter Summary and What's Next

In this chapter you learned about:

- configuring ControlLogix digital I/O modules
- configuration tags
- editing module configuration

Chapter 7 lists Module-Specific Information.

Module-Specific Information

What This Chapter Contains

This chapter provides module specific information for all ControlLogix digital modules. The information is separated by module and includes a list of:

- configurable functions
- wiring diagrams
- LED indicators
- simplified schematics
- surge currents (when applicable)

The following tables list where module-specific information can be found:

Table 7.1

ControlLogix input modules	
For module:	**Refer to:**
1756-IA16	7-2
1756-IA16I	7-5
1756-IA32	7-8
1756-IA8D	7-11
1756-IB16	7-14
1756-IB16D	7-17
1756-IB16I	7-20
1756-IB32/B	7-23
1756-IC16	7-26
1756-IG16	7-29
1756-IH16I	7-32
1756-IM16I	7-35
1756-IN16	7-38
1756-IV16	7-41
1756-IV32	7-44

ControlLogix output modules	
For module:	**Refer to:**
1756-OA16	7-47
1756-OA16I	7-50
1756-OA8	7-53
1756-OA8D	7-56
1756-OA8E	7-59
1756-OB16D	7-62
1756-OB16E	7-65
1756-OB16I	7-68
1756-OB16IS	7-71
1756-OB32	7-74
1756-OB8	7-77
1756-OB8EI	7-80
1756-OC8	7-83
1756-OG16	7-86
1756-OH8I	7-89
1756-ON8	7-92
1756-OV16E	7-95
1756-OV32E	7-98
1756-OW16I	7-101
1756-OX8I	7-104

1756-IA16

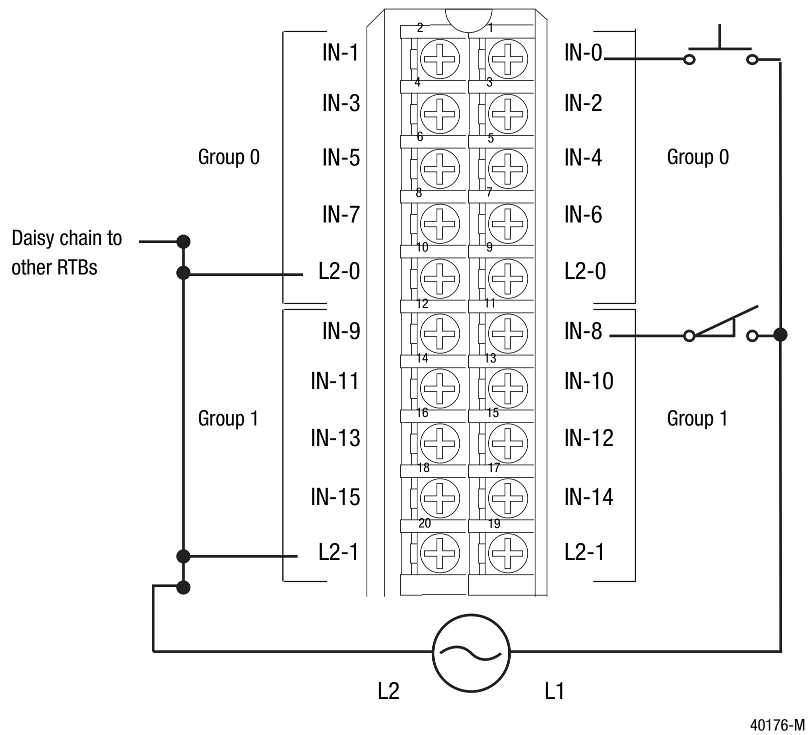
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

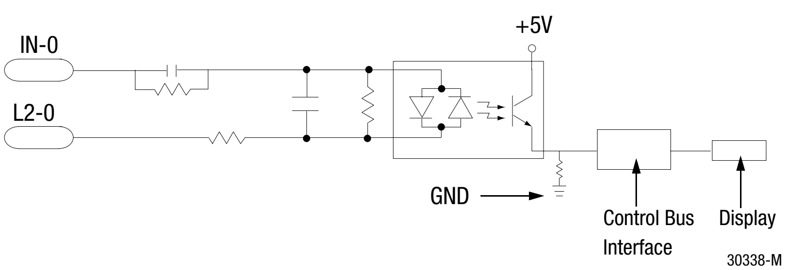
Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 9ms	3-12
Communications Format	Input data	6-6

Figure 7.1

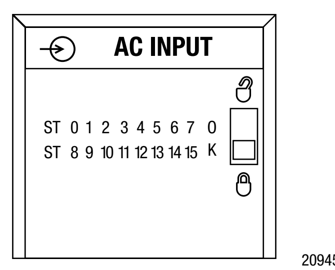
NOTES:
1. All terminals with the same name are connected together on the module. For example, L2 can be connected to any terminal marked L2-0.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-IA16 Specifications

Number of Inputs	16 (8 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	105mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 0.58W)
Maximum Power Dissipation (Module)	5.8W @ 60°C
Thermal Dissipation	18.41 BTU/hr
On-State Voltage Range	74-132V ac, 47-63Hz
Nominal Input Voltage	120V ac
On-State Current	5mA @ 74V ac minimum 13mA @ 132V ac maximum
Maximum Off-State Voltage	20V
Maximum Off-State Current	2.5mA
Maximum Input Impedance @ 132V ac	10.15kΩ @ 60Hz
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (10ms maximum) + Input Filter Time (User selectable time: 1ms or 2ms) Hardware Delay (8ms maximum) + Input Filter Time (User selectable time: 9ms or 18ms)
Diagnostic Functions Change of State Timestamp of Inputs	 Software configurable +/- 200µs
Short/Inrush Current	250mA peak (decaying to <37% in 22ms, without activation)
Change of State on Inputs	Software configurable (Within 200µs)
Cyclic Update Time	User selectable (100µs minimum/750ms maximum)
Isolation Voltage Group to group User to system	 250V maximum continuous 100% tested at 2546V dc for 1s 250V maximum continuous 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)

Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30g
Non-operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE(4) European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick(4) Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

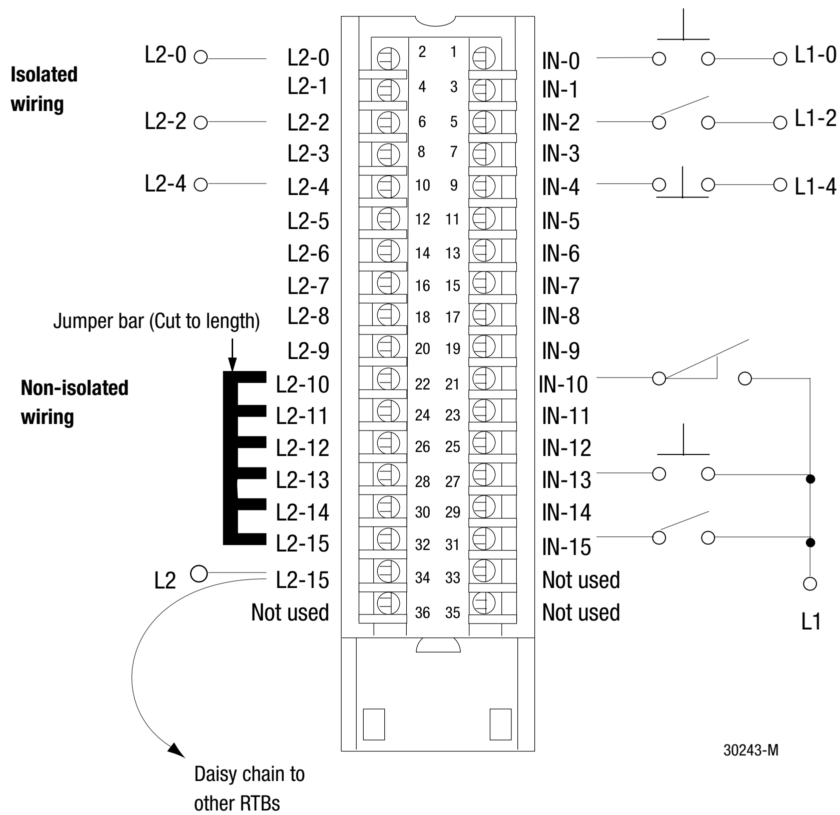
1756-IA16I

Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

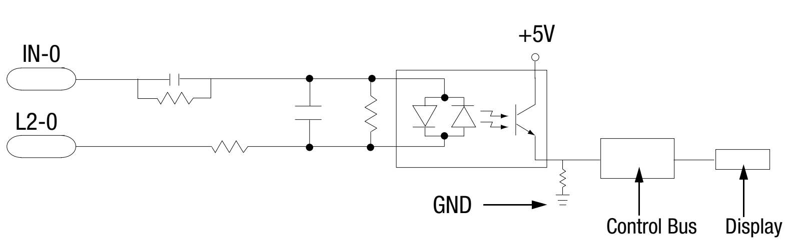
Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 9ms	3-12
Communications Format	Input data	6-6

Figure 7.2

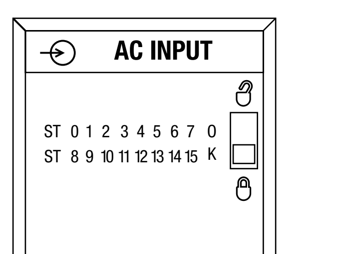


NOTES:
1. All terminals with the same name are connected together on the module. For example, L2 can be connected to any terminal marked L2-15.
2. Do not physically connect more than two wires to a single RTB terminal. When you use the second L2-15 terminal to daisy chain to other RTBs, always connect the daisy chain to the terminal directly connected to the supply wire as shown.
3. The **jumper bar** part number is 97739201. Contact your local Rockwell Automation sales representative to order additional jumper bars, if necessary.
4. If separate power sources are used, do not exceed the specified isolation voltage.

Simplified schematic



LED indicator



1756-IA16I Specifications

Number of Inputs	16 (individually isolated)
Module Location	1756 ControlLogix Chassis
Backplane Current	125mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.71W)
Maximum Power Dissipation (Module)	4.9W @ 60°C
Thermal Dissipation	16.71 BTU/hr
On-State Voltage Range	79-132V ac, 47-63Hz
Nominal Input Voltage	120V ac
On-State Current	5mA @ 79V ac, 47-63Hz minimum 15mA @ 132 V ac, 47-63Hz, maximum
Maximum Off-State Voltage	20V ac
Maximum Off-State Current	2.5mA
Maximum Input Impedance @ 132V ac	8.8kΩ @ 60Hz
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (10ms maximum) + Input Filter Time (User selectable time: 1ms or 2ms) Hardware Delay (8ms maximum) + Input Filter Time (User selectable time: 9ms or 18ms)
Diagnostic Functions Change of state Timestamp of inputs	 Software configurable +/- 200µs
Maximum Inrush Current	250mA
Cyclic Update Time	User selectable (100µs minimum/750ms maximum)
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
Environmental Conditions	
Operational Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85°C (-40 to 185°F)

Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30g
Non-operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Oscillatory Surge Withstand	IEEE C37.90.1: 4kV
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE(4) European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick(4) Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx(4)European Union 94/9/EC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" (Zone 2) when conformal coated

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IA32

Module features

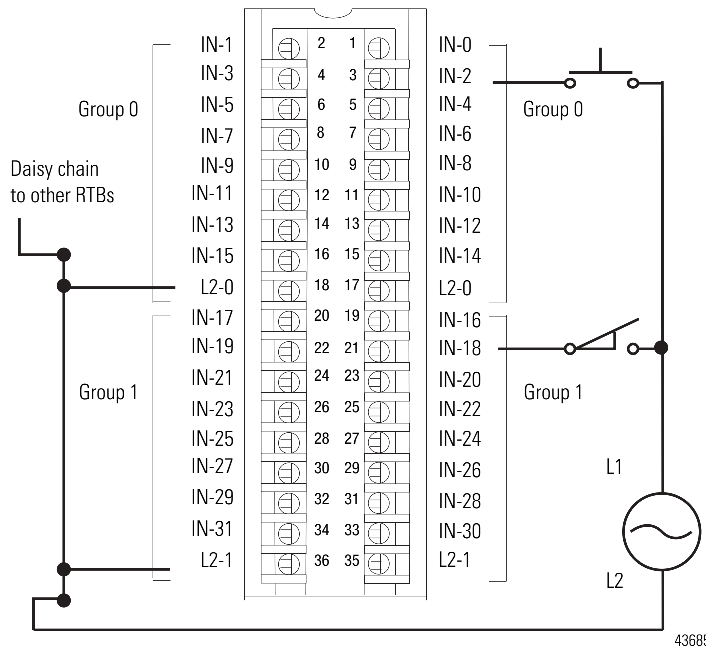
The following table lists the configurable features this module supports, the default value and the page of the feature's description:

Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 9ms	3-12
Communications Format	Input data	6-6

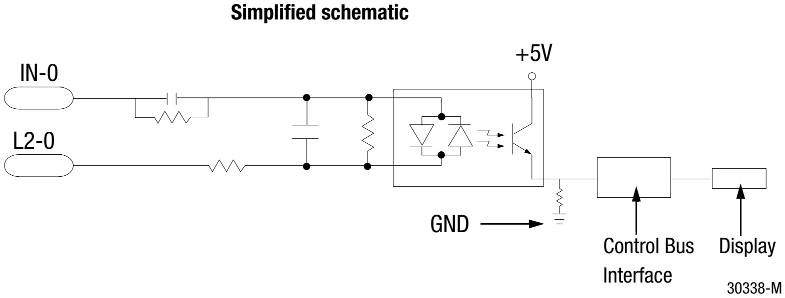
Figure 7.3

NOTES:

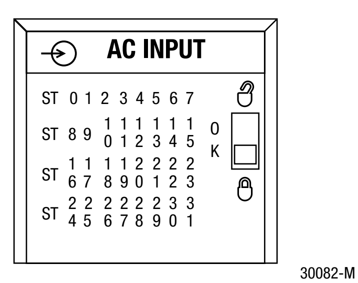
1. All terminals with the same name are connected together on the module. For example, L2 can be connected to any terminal marked L2-0.
2. When you daisy chain from a group to another RTB, always connect the daisy chain as shown above. Do not connect more than 2 wires to any single terminal.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-IA32 Specifications

Number of Inputs	32 (16 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	165mA @ 5.1V dc & 2.0mA @ 24V dc
Backplane Power	0.9W
Maximum Power Dissipation (Module)	6.1W @ 60°C
Thermal Dissipation	20.8 BTU/hr
On-State Voltage Range	74-132V ac, 47-63Hz
Nominal Input Voltage	120V ac
Off-State Voltage	20V ac maximum
On-State Current	5mA @ 74V ac minimum 15mA @ 132V ac maximum
Off-State Current	2.5mA ac maximum
Input Impedance	14.0kΩ @ 60Hz maximum
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (1.5ms nominal/10ms maximum) + Input Filter Time (User selectable time: 1ms or 2ms) Hardware Delay (1ms nominal/8ms maximum) + Input Filter Time (User selectable time: 9ms or 18ms)
Diagnostic Functions Change of State Timestamp of Inputs	 Software configurable +/- 200μs
Short/Inrush Current	390mA
Change of State on Inputs	Software configurable (Within 200μs)
Cyclic Update Time (RPI)	User selectable (200μs minimum/750ms maximum)
Isolation Voltage Group to group User to system	 250V continuous 250V continuous
Module Keying (Backplane)	Software configurable
RTB Screw Torque (NEMA)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User-defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
Conductors Wire Size Category Type	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded(1) 3/64 inch (1.2mm) insulation maximum 1(2) Copper
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)

Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 80MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz 10V/m with 200Hz 50% Pulse 100%AM at 1890Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations CE(3) European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick(3) Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this Conductor Category information for planning conductor routing. Refer to Publication 1770-4.1, "Industrial Automation Wiring and Grounding Guidelines".

(3) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IA8D

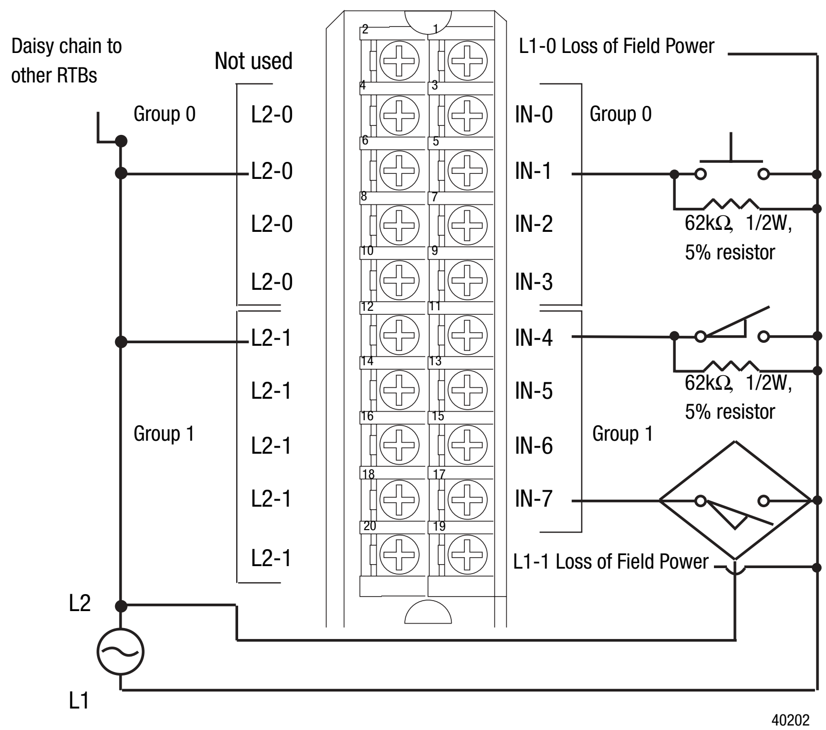
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 9ms	3-12
Diagnostic Latch of Information	Enabled	4-11
Open Wire Detection	Enabled	4-17
Field Power Loss Detection	Enabled	4-19
Diagnostic Change of State for Input Modules	Enabled	4-18
Communications Format	Input data	6-6

Figure 7.4

NOTES:
1. All terminals with the same name are connected together on the module. For example, L2 can be connected to any terminal marked L2-0.
2. This wiring example shows a single voltage source.
3. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to other RTBs, always connect the daisy chain as shown.
4. Resistors are not necessary if Wire Off diagnostic is not used.
5. If separate power sources are used, do not exceed the specified isolation voltage.

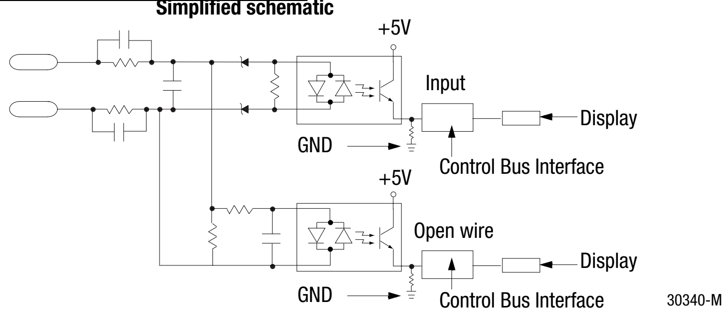


To Determine Leakage Resistor
(P/S = Field side power supply)
R_{LEAK}Maximum = (P/S Voltage-19V ac)/1.5mA
R_{LEAK}Minimum = (P/S Voltage-20V ac)/2.5mA

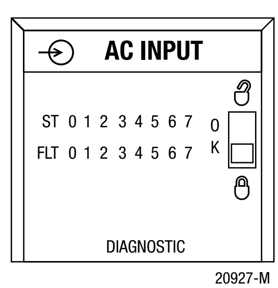
Recommended Values

Power Supply Voltage	R_{LEAK}, 1/2W, 5%
100V ac, +/-10%	43kΩ
110V ac, +/-10%	47kΩ
115V ac, +/-10%	47kΩ
120V ac, +/-10%	51kΩ

Simplified schematic



LED indicator



1756-IA8D Specifications

Number of Inputs	8 (4 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	100mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.58W)
Maximum Power Dissipation (Module)	4.5W @ 60°C
Thermal Dissipation	15.35 BTU/hr
On-State Voltage Range	79-132V ac, 47-63Hz
Nominal Input Voltage	120V ac
On-State Current	74V @ 5mA ac, 47-63Hz minimum 16mA @ 132V ac, 47-63Hz maximum
Maximum Off-State Voltage	20V
Maximum Off-State Current	2.5mA
Maximum Input Impedance @ 132V ac	8.25kΩ @ 60Hz
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (10ms maximum) + Input Filter Time (User selectable time: 1ms or 2ms) Hardware Delay (8ms maximum) + Input Filter Time (User selectable time: 9ms or 18ms)
Diagnostic Functions Open Wire Loss of Power Time Stamp of Diagnostics Change of State Time stamp of Inputs	 Off state leakage current 1.5mA minimum Transition range 46 to 85V ac +/- 1ms Software configurable +/- 200µs
Short/Inrush Current	250mA peak (decaying to <37% in 22ms, without activation)
Cyclic Update Time	User Selectable (200µs minimum/750ms maximum)
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac max. continuous voltage between groups) 100% tested at 2546V dc for 1s
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	20 Position RTB (1756-TBNH or TBSH)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[(1)] 3/64 inch (1.2mm) insulation maximum 1[(2)], [(3)]
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)

Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30g
Non-operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[4] European Union 94/9/EC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" (Zone 2) when conformal coated

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IB16

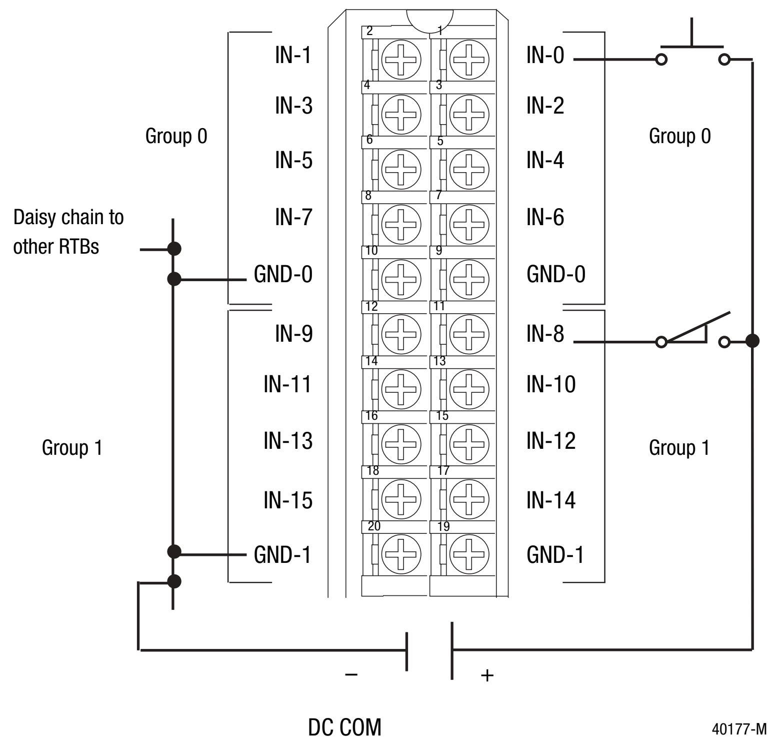
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

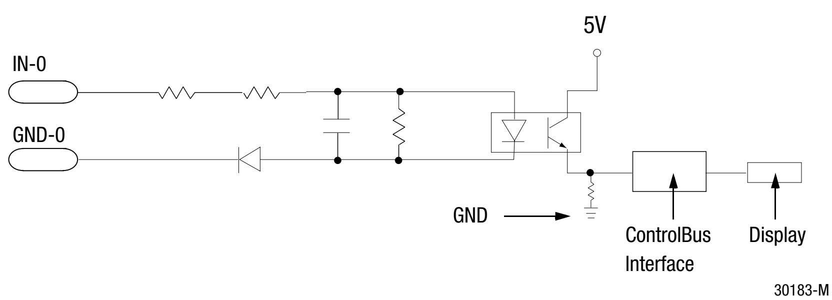
Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 1ms	3-12
Communications Format	Input data	6-6

Figure 7.5

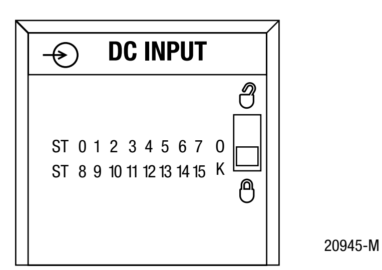
NOTES:
1. All terminals with the same name are connected together on the module. For example, DC COM can be connected to either terminal marked GND-0.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-IB16 Specifications

Number of Inputs	16 (8 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	100mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 0.56W)
Maximum Power Dissipation (Module)	5.1W @ 60°C
Thermal Dissipation	17.39 BTU/hr
On-State Voltage Range	10-31.2V dc
Nominal Input Voltage	24V dc
On-State Current	2.0mA @ 10V dc minimum 10mA @ 31.2V dc maximum
Maximum Off-State Voltage	5V
Maximum Off-State Current	1.5mA
Maximum Input Impedance @ 31.2V dc	3.12kΩ
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (290μs nominal/1ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms or 2ms) Hardware Delay (700μs/2ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms, 2ms, 9ms or 18ms)
Diagnostic Functions Change of State Time Stamp of Inputs	 Software configurable +/- 200μs
Short/Inrush Current	250mA peak (decaying to <37% in 22ms, without activation)
Cyclic Update Time	User selectable (100μs minimum/750ms maximum)
Reverse Polarity Protection	Yes
Isolation Voltage Group to group User to system	 250V maximum continuous 100% tested at 2546V dc for 1s 250V maximum continuous 100% tested at 2546V dc for 1s
RTB Screw Torque (NEMA clamp)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)

Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications: (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE(4) European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick(4) Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx(4) European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n"

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines.*

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IB16D

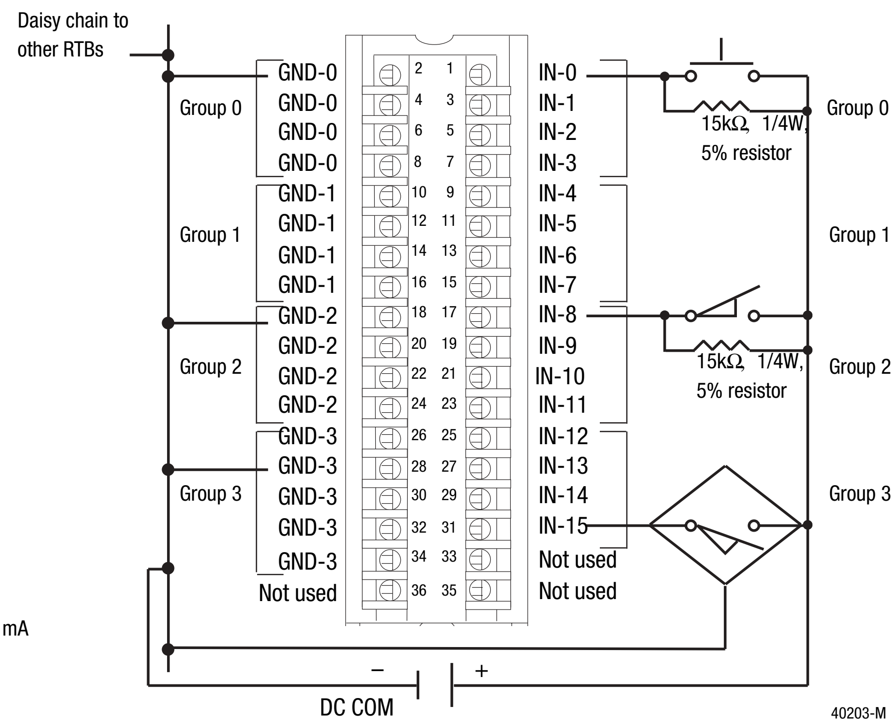
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 9ms	3-12
Diagnostic Latch of Information	Enabled	4-11
Open Wire Detection	Enabled	4-17
Diagnostic Change of State for Input Modules	Enabled	4-18
Communications Format	Full diagnostics - input data	6-6

Figure 7.6

NOTES:
1. All terminals with the same name are connected together on the module. For example, DC COM can be connected to any terminal marked GND-0.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to other RTBs, away connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. Resistors are not necessary if Wire Off diagnostic is not used.
5. If separate power sources are used, do not exceed the specified isolation voltage.

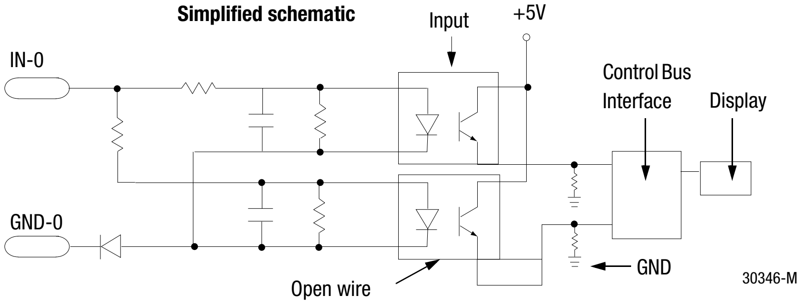


To Determine Leakage Resistor
(P/S = Field side power supply)
R_{LEAK}Maximum = (P/S Voltage - 4.6V dc)/1.21mA
R_{LEAK}Minimum = (P/S Voltage - 5V dc)/1.5mA

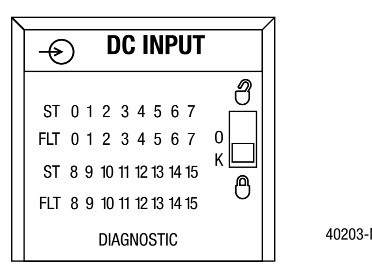
Recommended Values

Power Supply Voltage	R_{LEAK}, 1/2W, 5%
12V dc, +/-5%	5.23kΩ
24V dc, +/-10%	14.3kΩ

Simplified schematic



LED indicator



1756-IB16D Specifications

Number of Inputs	16 (4 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	150mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.84W)
Maximum Power Dissipation (Module)	5.8W @ 60°C
Thermal Dissipation	19.78 BTU/hr
On-State Voltage Range	10-30V dc
Nominal Input Voltage	24V dc
On-State Current	2mA @ 10V dc minimum 13mA @ 30V dc maximum
Maximum Off-State Voltage	5V dc
Minimum Off-State Current	1.5mA per point
Maximum Input Impedance @ 30V dc	2.31kΩ
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (335μs nominal/1ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms or 2ms) Hardware Delay (740μs/4ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms, 2ms, 9ms or 18ms)
Diagnostic Functions Open wire Time stamp of diagnostics Change of state Timestamp on inputs	 Off-state leakage current 1.2mA minimum +/- 1ms Software configurable +/- 200μs
Cyclic Update Time	User selectable (200μs minimum/750ms maximum)
Reverse Polarity Protection	Yes
Maximum Inrush Current	250mA
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
Environmental Conditions	
Operational Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)

Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85°C (-40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30g
Non-operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[4] European Union 94/9/EC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" (Zone 2)

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IB16I

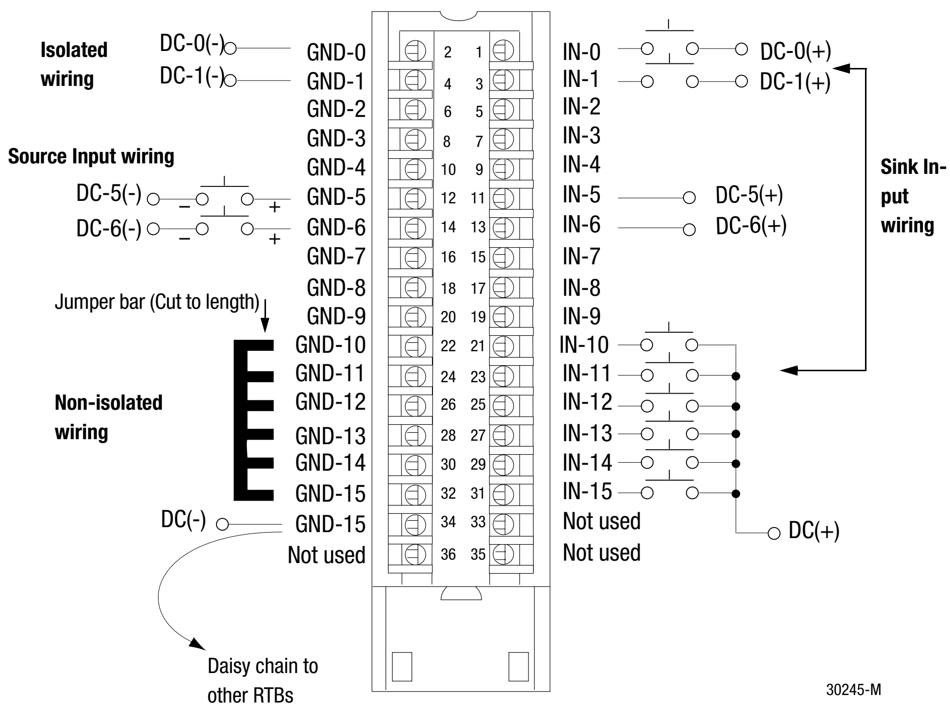
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

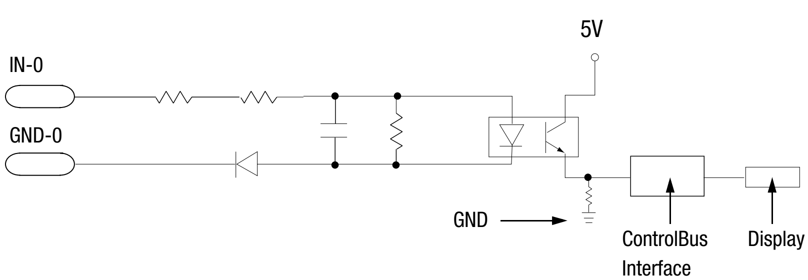
Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 1ms	3-12
Communications Format	Input data	6-6

Figure 7.7

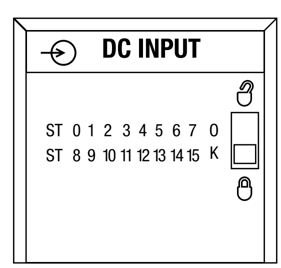
NOTES:
1. All terminals with the same name are connected together on the module. For example, DC(-) can be connected to either terminal marked GND-15.
2. Do not physically connect more than two wires to a single RTB terminal. When you use the second GND-15 terminal to daisy chain to other RTBs, always connect the daisy chain as shown.
3. Each input can be wired in a sink or source configuration as shown.
4. The **jumper bar** part number is 97739201. Contact your local Rockwell Automation sales representative to order additional jumper bars, if necessary.
5. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-IB16I Specifications

Number of Inputs	16 (individually isolated)
Module Location	1756 ControlLogix Chassis
Backplane Current	100mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.58W)
Maximum Power Dissipation (Module)	5W @ 60°C
Thermal Dissipation	17.05 BTU/hr
On-State Voltage Range	10-30V dc
Nominal Input Voltage	24V dc
On-State Current	2mA @ 10V dc minimum 10mA @ 30 V dc maximum
Maximum Off-State Voltage	5V dc
Maximum Off-State Current	1.5mA
Maximum Input Impedance @ 30V dc	3kΩ
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (1ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms or 2ms) Hardware Delay (4ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms, 2ms, 9ms or 18ms)
Diagnostic Functions Change of state Time stamp of inputs	 Software configurable +/- 200μs
Maximum Inrush Current	250mA
Cyclic Update Time	User selectable (100μs minimum/750ms maximum)
Reverse Polarity Protection	Yes
Isolation Voltage Channel to channel User side to system side	 100% tested at 2546V dc for 1 second (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1 second (250V ac maximum continuous voltage)
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
Environmental Conditions	
Operational Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)

Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85°C (-40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30g
Non-operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Oscillatory Surge Withstand	IEEE C37.90.1: 4kV
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE(4) European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick(4) Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx(4) European Union 94/9/EC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" (Zone 2)

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IB32/B

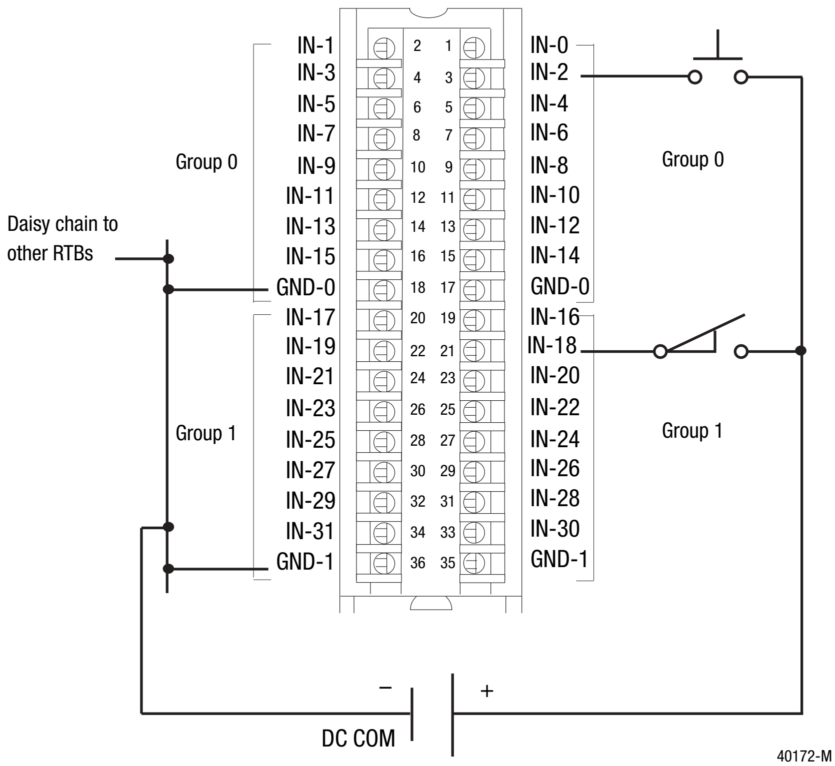
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

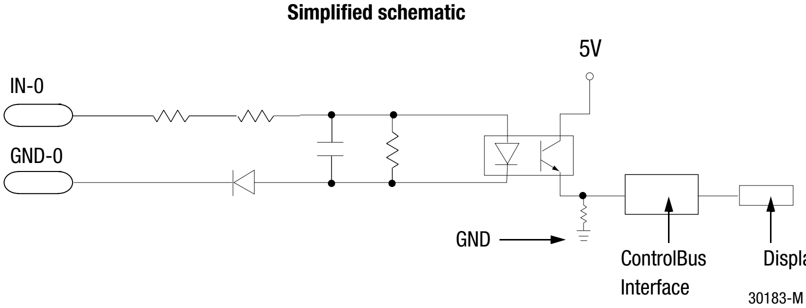
Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 1ms	3-12
Communications Format	Input data	6-6

Figure 7.8

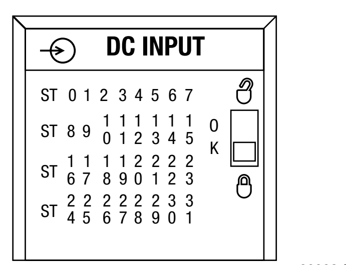
NOTES
1. All terminals with the same name are connected together on the module. For example, DC COM can be connected to either terminal marked GND-1.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain to other RTBs, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-IB32/B Specifications

Number of Inputs	32 (16 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	120mA @ 5.1V dc & 2mA @ 24V dc
Backplane Power	0.66W
Maximum Power Dissipation (Module)	6.2W @ 60°C
Thermal Dissipation	21.1 BTU/hr @ 60°C
On-State Voltage Range	10-31.2V dc
Nominal Input Voltage	24V dc
ON-State Current @ 10V dc @ 31.2V dc	 2.0mA 5.5mA
Maximum Off-State Voltage	5V dc
Maximum Off-State Current	1.5mA
Maximum Input Impedance @ 31.2V dc	5.67kΩ
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (480µs nominal/1ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms or 2ms) Hardware Delay (420µs/2ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms, 2ms, 9ms or 18ms)
Diagnostic Functions Change of state Time stamp on inputs	 Software configurable +/- 200µs
Short/Inrush Current	250mA peak (decaying to <37% in 22ms, without activation)
Cyclic Update Time	User selectable (100µs minimum/750ms maximum)
Reverse Polarity Protection	Yes
Isolation Voltage Group to group User to system	 250V maximum continuous 100% tested at 2546V dc for 1s 250V maximum continuous 100% tested at 2546V dc for 1s
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)

Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea Unpackaged shock): 30g
Non-Operating Shock	IEC60068-2-27 (Test Ea Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz 10V/m with 1kHz sine-wave 80%AM from 30MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 1890Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications: (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions EEx[4] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" (Zone 2)

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IC16

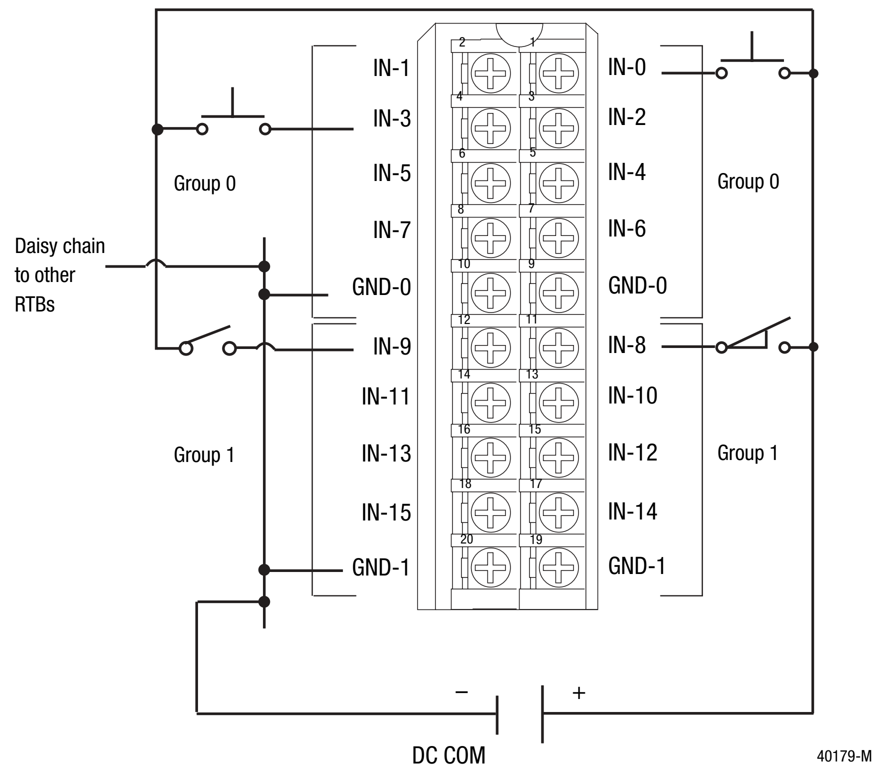
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

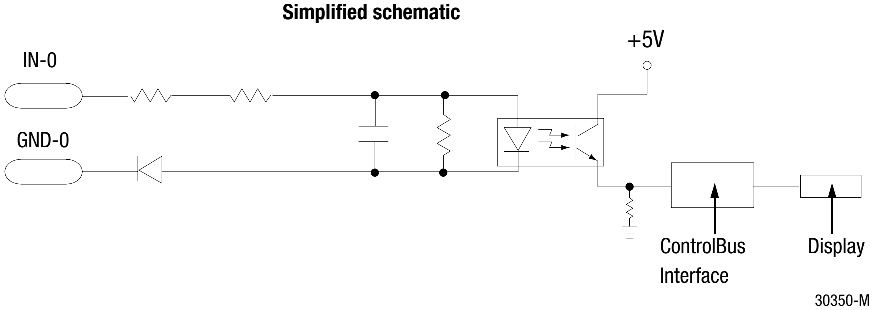
Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 1ms	3-12
Communications Format	Input data	6-6

Figure 7.9

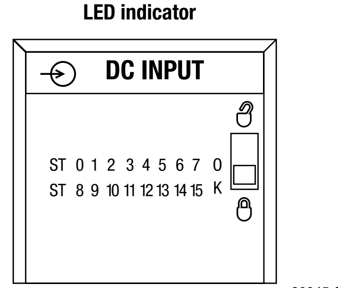
NOTES:
1. All terminals with the same name are connected together on the module. For example, DC COM can be connected to any terminal marked GND-1.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-IC16 Specifications

Number of Inputs	16 (8 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	100mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.58W)
Maximum Power Dissipation (Module)	5.2W @ 60°C
Thermal Dissipation	17.73 BTU/hr
On-State Voltage Range	30-55V dc @ 60°C all channels (Linear derating) 30-60V dc @ 55°C all channels (Linear derating)
Nominal Input Voltage	48V dc
On-State Current	2mA @ 30V dc minimum 7mA @ 60V dc maximum
Maximum Off-State Voltage	10V
Maximum Off-State Current	1.5mA
Maximum Input Impedance @ 60V dc	8.57kΩ
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (1ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms or 2ms) Hardware Delay (4ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms, 2ms, 9ms or 18ms)
Diagnostic Functions Change of state Time stamp of inputs	 Software configurable +/- 200µs
Cyclic Update Time	User selectable (200µs minimum/750ms maximum)
Reverse Polarity Protection	Yes
Maximum Inrush Current	250mA
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
Module Keying (Backplane)	Software configurable
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)(1)
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded(1) 3/64 inch (1.2mm) insulation maximum 1(2), (3)
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)

Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Oscillatory Surge Withstand	IEEE C37.90.1: 4kV
Enclosure Type Rating	None (open-style)
Certifications: (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE(4) European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick(4) Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx(4) European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n"

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines.*

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IG16

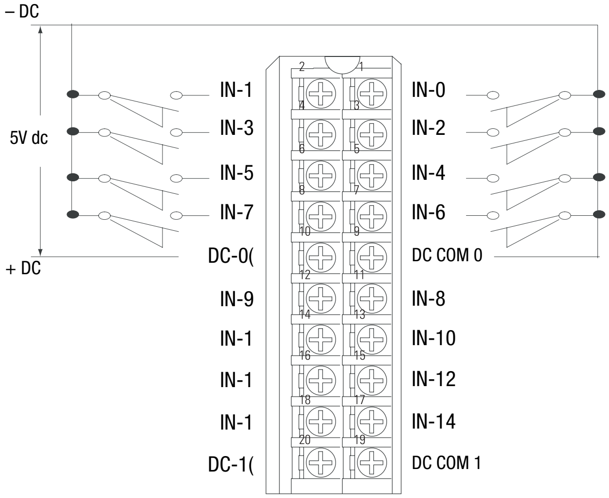
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 1ms	3-12
Communications Format	Input data	6-6

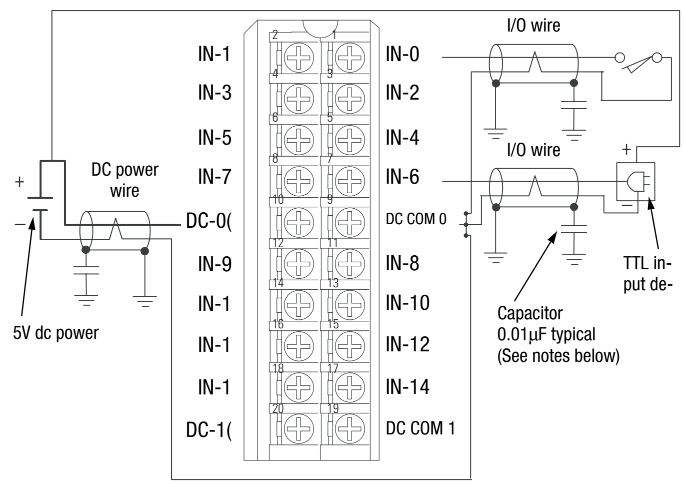
Figure 7.10

Wiring Diagram for Applications that Do Not Require CE Compliance



NOTES:
1. We recommend you use this diagram for applications that do not require CE compliance.
2. Do not connect more than two wires to any single terminal.
3. This example shows devices wired to only one of two groups on the module. You can make connections to the second group on terminals 11-20.

Wiring Diagram for CE-Compliant (and High Noise) Applicationsg

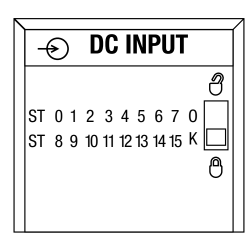


GENERAL NOTES:
1. We recommend you use Belden 8761 cable where shielded cables are shown.
2. Do not connect more than two wires to any single terminal.
3. This example shows devices wired to only one of two groups on the module. You can make connections to the second group on terminals 11-20.

CE REQUIREMENT NOTES:
1. DC power wire and I/O wire should not exceed 10m (30ft) in length.
2. The 0.01μF capacitors shown above must be rated for 2000V dc.

Simplified schematic

LED indicator



20945-M

1756-IG16 Specifications

Number of Inputs	16 (8 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	110mA @ 5.1V dc & 2mA @ 24V dc
Backplane Power	0.61W
Maximum Power Dissipation (Module)	1.4W @ 60°C
Thermal Dissipation	4.8 BTU/hr @ 60°C
Operating Voltage	4.5 to 5.5V dc source 50mV P-P ripple maximum
Voltage Category	5V dc TTL (Low = True)(1)
Off-State Voltage	2.0V dc maximum
Off-State Current	4.1mA maximum
Input Impedance	1.4KΩ minimum 1.5kΩ typical
Low-True Format	The module operates with the following definitions of ON and OFF states: -0.2V to 0.8V dc = Input guaranteed to be in ON state 0.8 to 2.0V dc = Input state not Guaranteed 2.0 to 5.5V dc = Input guaranteed to be in OFF state
Nominal Input Current	3.7mA @ 5V dc
Input Delay Time OFF to ON (5V to 0V dc transition) ON to OFF (0V to 5V dc transition)	 Hardware Delay (270µs nominal/450µs maximum) + Input Filter Time (User selectable time: 0ms, 1ms or 2ms) Hardware Delay (390µs nominal/700µs maximum) + Input Filter Time (User selectable time: 0ms, 1ms, 2ms, 9ms or 18ms)
Diagnostic Functions Change of State Timestamp of Inputs	 Software configurable +/- 200µs
Cyclic Update Time	User-selectable (100µs minimum to 750ms maximum)
Reverse Polarity Protection	None - damage to circuitry may result
Isolation Group	2 groups of 8
Isolation Voltage Group to group User to system	 250V maximum continuous 250V maximum continuous
RTB Screw Torque (NEMA clamp)	7 to 9 inch-pounds (0.8 to 1Nm) maximum
Module Keying (Backplane)	Software configurable
RTB Keying	User-defined mechanical keying
Field Wiring Arm and Housing	20-position RTB (1756-TBNH or 1756-TBSH)(2)
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded(1) 3/64 inch (1.2mm) insulation maximum 2(3)
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 4kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 80MHz to 1000MHz
EFT/B Immunity	IEC 61000-4-4: ±1kV at 5kHz on power ports ±1kV at 5kHz on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications: (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

(1) TTL inputs are inverted (-0.2 to +0.8 = low voltage = True = On.) Use a NOT instruction in your program to convert to traditional True - High logic.

(2) Maximum wire size will require extended housing - 1756-TBE.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IH16I

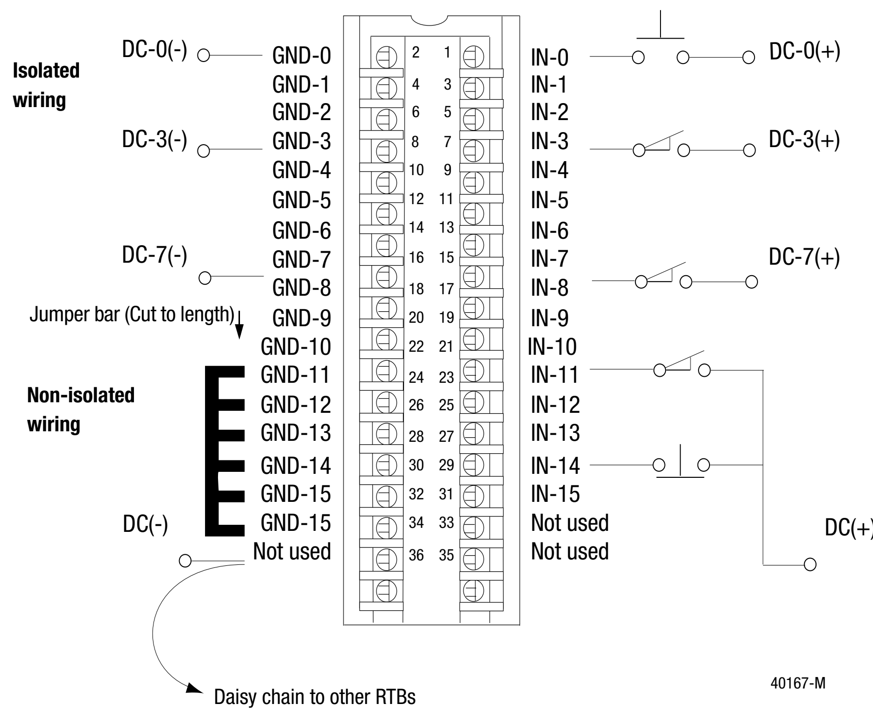
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

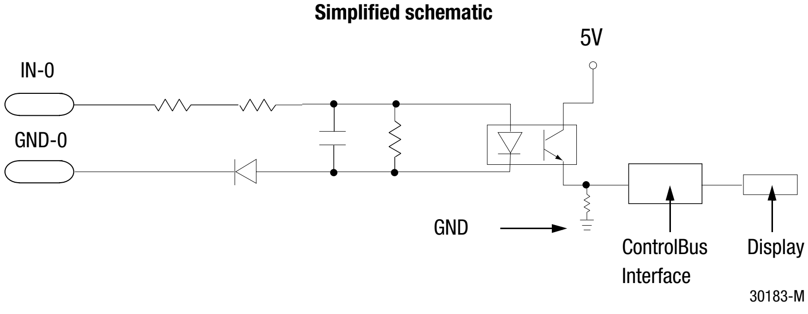
Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 1ms	3-12
Communications Format	Input data	6-6

Figure 7.11

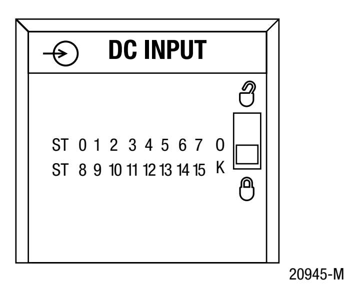
NOTES:
1. All terminals with the same name are connected together on the module. For example, DC(-) can be connected to either terminal marked GND-15.
2. Do not physically connect more than two wires to a single RTB terminal. When you use the second GND-15 terminal to daisy chain to other RTBs, always connect the daisy chain to the terminal directly connected to the supply wire as shown.
3. The **jumper bar** part number is 97739201. Contact your local Rockwell Automation sales representative to order additional jumper bars, if necessary.
4. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-IH16I Specifications

Number of Inputs	16 (Individually isolated)
Module Location	1756 ControlLogix Chassis
Backplane Current	125mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.71W)
Maximum Power Dissipation (Module)	5W @ 60°C
Thermal Dissipation	17.05 BTU/hr
On-State Voltage Range Derated as follows	90-146V dc 90-146V dc @ 50°C, 12 Channels ON @ same time 90-132V dc @ 55°C, 14 Channels ON @ same time 90-125V dc @ 60°C, 16 Channels ON @ same time 90-146V dc @ 30°C, 16 Channels ON @ same time
Nominal Input Voltage	125V dc
On-State Current	1mA @ 90V dc minimum 3mA @ 146V dc maximum
Maximum Off-State Voltage	20V dc
Maximum Off-State Current	0.8mA
Maximum Input Impedance @ 146V dc	48.67kΩ
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (2ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms or 2ms) Hardware Delay (6ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms, 2ms, 9ms or 18ms)
Diagnostic Functions Change of state Time stamp of inputs	 Software configurable +/- 200µs
Maximum Inrush Current	250mA
Cyclic Update Time	User selectable (200µs minimum/750ms maximum)
Reverse Polarity Protection	Yes
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)

Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea Unpackaged shock): 30g
Non-Operating Shock	IEC60068-2-27 (Test Ea Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz 10V/m with 1kHz sine-wave 80%AM from 30MHz to 2000MHz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Oscillatory Surge Withstand	IEEE C37.90.1: 4kV
Enclosure Type Rating	None (open-style)
Certifications: (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick[4]Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IM16I

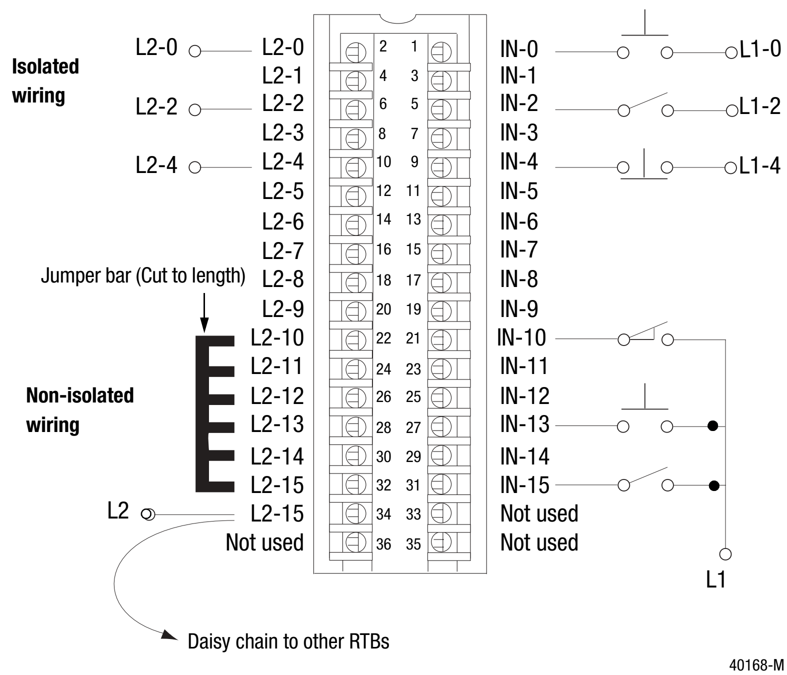
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

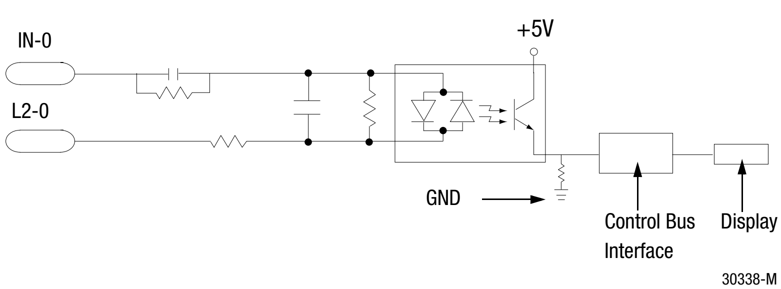
Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 1ms	3-12
Communications Format	Input data	6-6

Figure 7.12

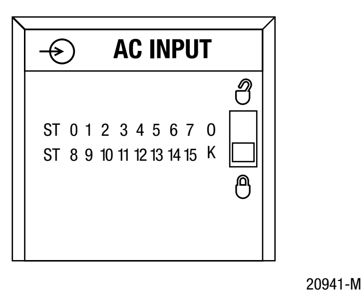
NOTES:
1. All terminals with the same name are connected together on the module. For example, L2 can be connected to any terminal marked L2-15.
2. Do not physically connect more than two wires to a single RTB terminal. When you use the second L2-15 terminal to daisy chain to other RTBs, always connect the daisy chain as shown.
3. The **jumper bar** part number is 97739201. Contact your local Rockwell Automation sales representative to order additional jumper bars, if necessary.
4. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-IM16I Specifications

Number of Inputs	16 (Individually isolated)
Module Location	1756 ControlLogix Chassis
Backplane Current	100mA @ 5.1V dc & 3mA @ 24V dc (Total backplane power 0.58W)
Maximum Power Dissipation (Module)	5.8W @ 60^{o}C
Thermal Dissipation	19.78 BTU/hr
On-State Voltage Range	159-265V ac, 47-63Hz @ 30°C All Channels ON 159-265V ac, 47-63Hz @ 40°C 8 Points ON 159-253V ac, 47-63Hz @ 45°C All Channels ON 159-242V ac, 47-63Hz @ 60°C All Channels ON
Nominal Input Voltage	240V ac
On-State Current	5mA @ 159V ac, 60Hz minimum 13mA @ 265V ac, 60Hz maximum
Maximum Off-State Voltage	40V ac
Maximum Off-State Current	2.5mA
Maximum Input Impedance @ 265V ac	20.38kΩ @ 60Hz
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (10ms maximum) + Input Filter Time (User selectable time: 1ms or 2ms) Hardware Delay (8ms maximum) + Input Filter Time (User selectable time: 9ms or 18ms)
Diagnostic Functions Change of state Time stamp of inputs	 Software configurable +/- 200µs
Maximum Inrush Current	250mA
Cyclic Update Time	User selectable (200µs minimum/750ms maximum)
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1s (265V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (265V ac maximum continuous voltage)
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea Unpackaged shock): 30g
Non-Operating Shock	IEC60068-2-27 (Test Ea Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications: (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IN16

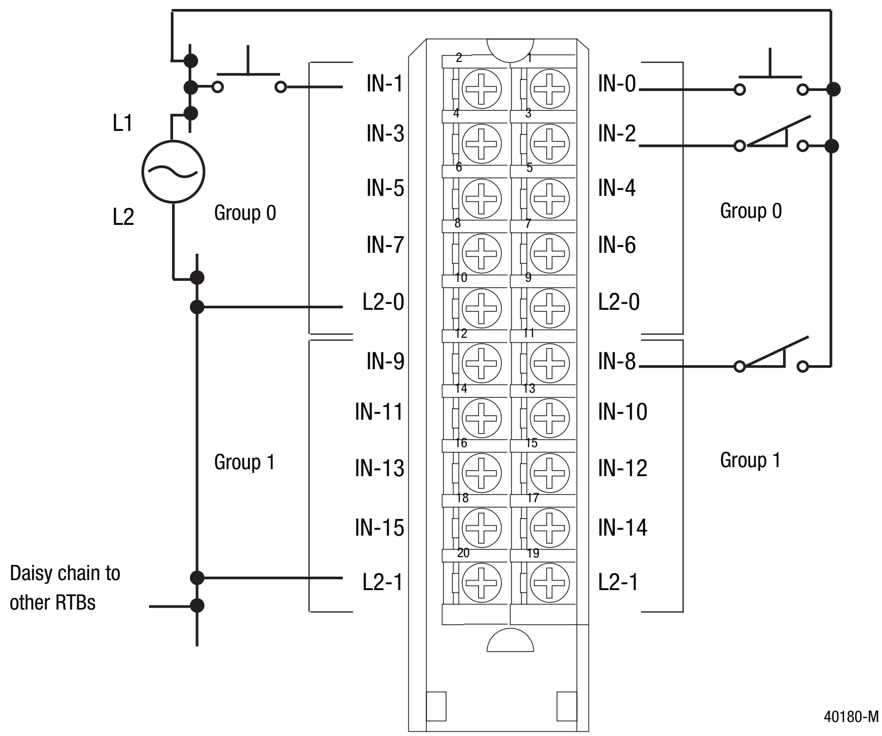
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

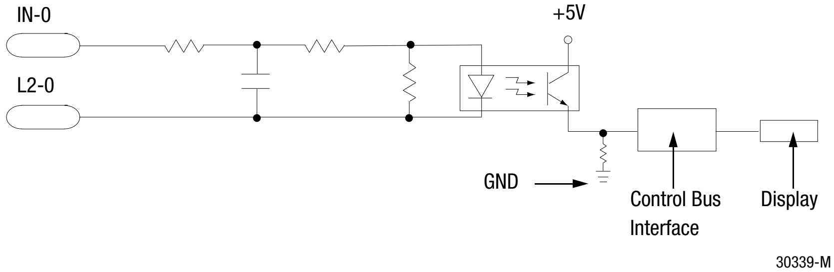
Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 1ms	3-12
Communications Format	Input data	6-6

Figure 7.13

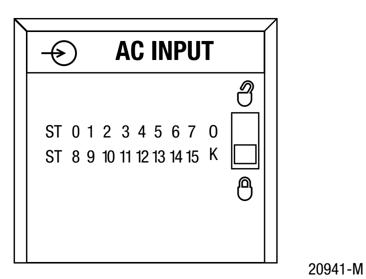
NOTES:
1. All terminals with the same name are connected together on the module. For example, L2 can be connected to any terminal marked L2-0.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-IN16 Specifications

Number of Inputs	16 (8 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	100mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 0.56W)
Maximum Power Dissipation (Module)	5.1W @ 60°C
Thermal Dissipation	17.39 BTU/hr
On-State Voltage Range	10-30V ac, 47-63Hz
Nominal Input Voltage	24V ac
On-State Current	5mA @ 10V ac, 60Hz minimum 25mA @ 30V ac, 60Hz maximum
Maximum Off-State Voltage	5V
Maximum Off-State Current	2.75mA
Maximum Input Impedance @ 30V ac	2.5kΩ @ 60Hz
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (10ms maximum) + Input Filter Time (User selectable time: 1ms or 2ms) Hardware Delay (10ms maximum) + Input Filter Time (User selectable time: 9ms or 18ms)
Diagnostic Functions Change of state Time stamp of inputs	 Software configurable +/- 200µs
Maximum Inrush Current	250mA
Cyclic Update Time	User Selectable (200µs minimum/750ms maximum)
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
Module Keying (Backplane)	Software configurable
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8–1Nm)
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	20-position RTB (1756-TBNH or 1756-TBSH)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications: (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions EEx[4] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n"

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-IV16

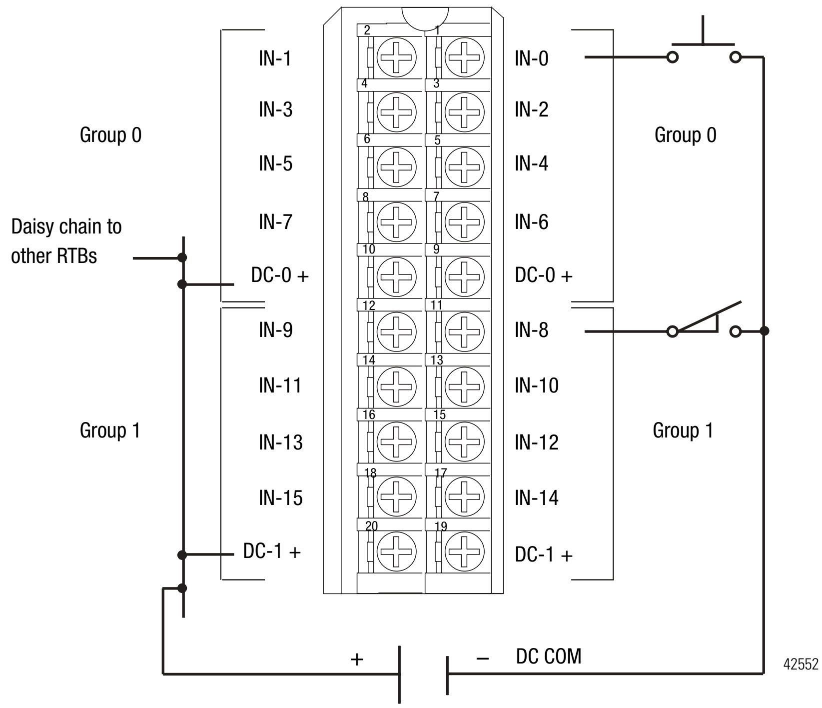
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

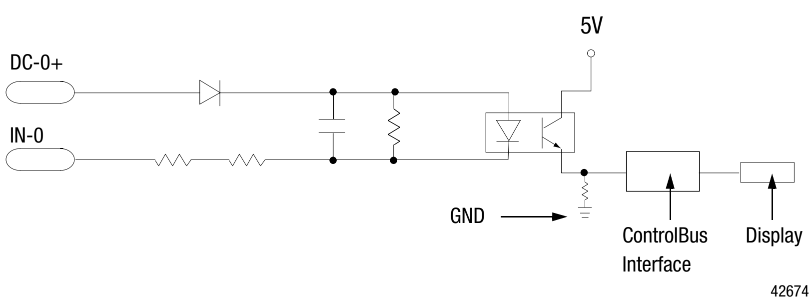
Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 1ms	3-12
Communications Format	Input data	6-6

Figure 7.14

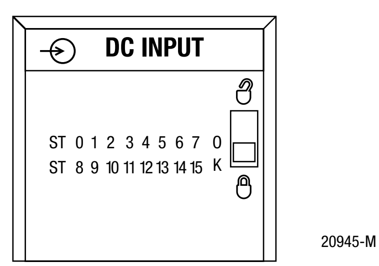
NOTES:
1. All terminals with the same name are connected together on the module. For example, DC (+) can be connected to either terminal marked DC-1+.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-IV16 Specifications

Number of Inputs	16 (8 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	110mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 0.61W)
Maximum Power Dissipation (Module)	5.41W @ 60°C
Thermal Dissipation	18.47 BTU/hr
On-State Voltage Range	10-30V dc
Nominal Input Voltage	24V dc
On-State Current	2.0mA @ 10V dc minimum 10mA @ 30V dc maximum
Maximum Off-State Voltage	5V
Maximum Off-State Current	1.5mA
Maximum Input Impedance @ 30V dc	3.2kΩ
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (280μs/1ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms or 2ms) Hardware Delay (540μs/2ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms, 2ms, 9ms or 18ms)
Diagnostic Functions Change of State Timestamp of Inputs	 Software configurable +/- 200μs
Maximum Inrush Current	250mA
Cyclic Update Time	User selectable (100μs minimum/750ms maximum)
Reverse Polarity Protection	Yes
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
RTB Screw Torque (NEMA clamp)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	20-position RTB (1756-TBNH or 1756-TBSH)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications: (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE(4) European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick(4) Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions EEx(4) European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection “n”

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

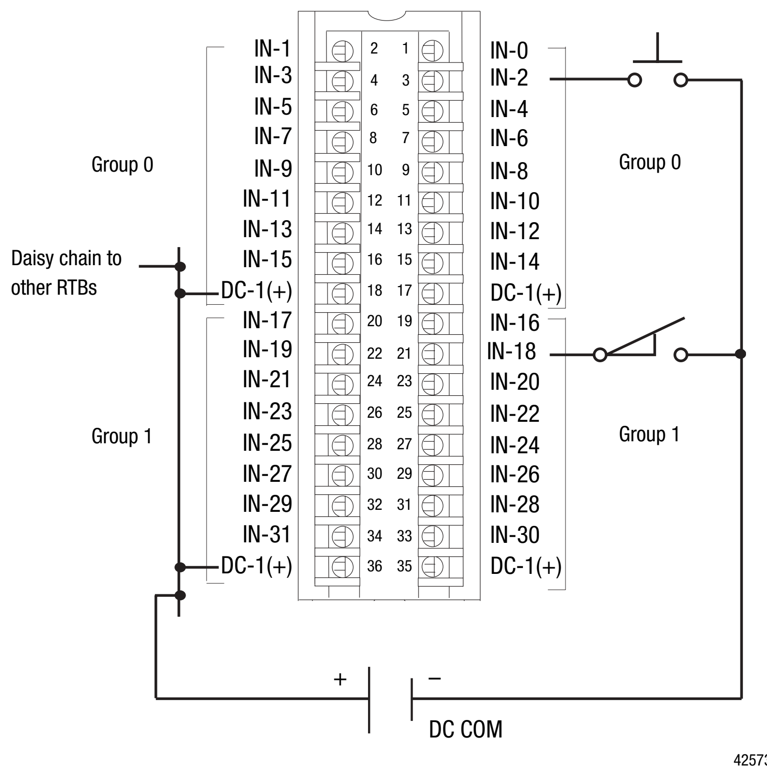
1756-IV32

Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

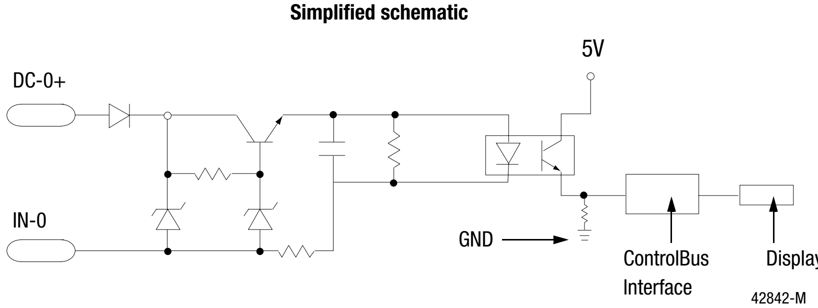
Feature	Default value	Page of description
Change of State (COS)	OFF-ON: Enabled ON-OFF: Enabled	2-10
Software Configurable Filter Times	OFF-ON: 1ms ON-OFF: 1ms	3-12
Communications Format	Input data	6-6

Figure 7.15

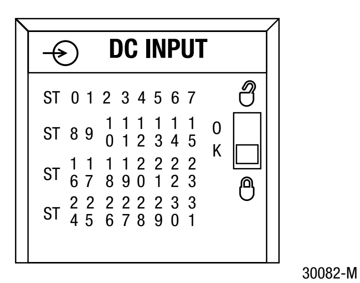


NOTES:
1. All terminals with the same name are connected together on the module. For example, DC COM can be connected to either terminal marked GND-1.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain to other RTBs, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.

Simplified schematic



LED indicator



1756-IV32 Specifications

Number of Inputs	32 (16 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	120mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 0.66W)
Maximum Power Dissipation (Module)	4.1W @ 60°C
Thermal Dissipation	14 BTU/hr @ 60°C
On-State Voltage Range	10-30V dc
Nominal Input Voltage	24V dc
ON-State Current @ 10V dc @ 30V dc	 2mA 3.5mA
Maximum Off-State Voltage	5V dc
Maximum Off-State Current	1.5mA
Maximum Input Impedance @ 30V dc	8.6kΩ
Input Delay Time OFF to ON ON to OFF	 Hardware Delay (350μs/1ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms or 2ms) Hardware Delay (590μs/2ms maximum) + Input Filter Time (User selectable time: 0ms, 1ms, 2ms, 9ms or 18ms)
Diagnostic Functions Change of state Timestamp on inputs	 Software configurable +/- 200μs
Short/Inrush Current	250mA peak (decaying to <37% in 22ms, without activation)
Cyclic Update Time	User selectable (100μs minimum/750ms maximum)
Reverse Polarity Protection	Yes
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage between groups) 100% tested at 2546V dc for 1s
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
Module Keying (Backplane)	Software configurable
RTB Keying	User-defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea Unpackaged shock): 30g
Non-Operating Shock	IEC60068-2-27 (Test Ea Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications: (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions EEx[4] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n"

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines.*

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OA16

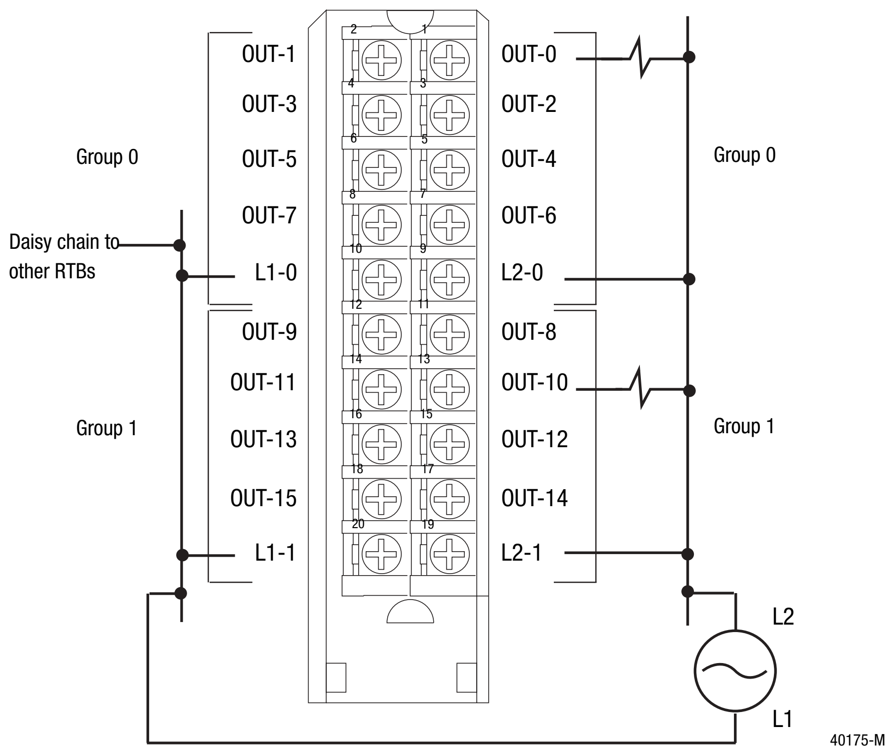
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

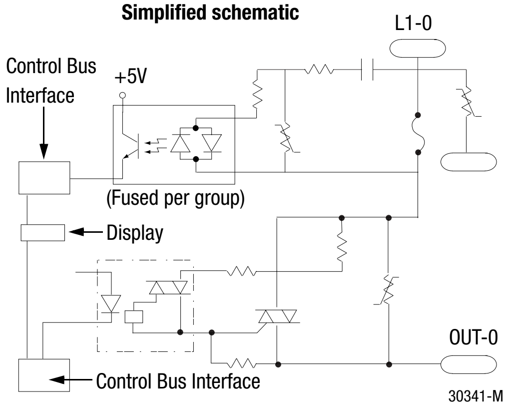
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.16

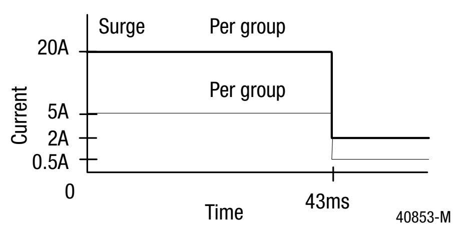
NOTES:
1. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to other RTBs, always connect the daisy chain as shown.
2. This wiring example shows a single voltage source.
3. If separate power sources are used, do not exceed the specified isolation voltage.



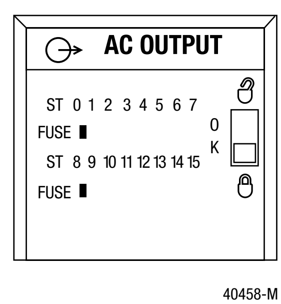
Simplified schematic



Surge Current Chart



LED indicator



1756-OA16 Specifications

Number of Outputs	16 (8 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	400mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 2.1W)
Max. Power Dissipation (Module)	6.5W @ 60^{o}C
Thermal Dissipation	22.17 BTU/hr
Output Voltage Range	74-265V ac, 47-63Hz
Output Current Rating Per Point Per Group Per Module	 0.5A maximum @ 60°C 2A maximum @ 60°C 4A maximum @ 60°C
Surge Current Per Point Per Group	 5A for 43’ms each, repeatable every 2s @ 60°C 15A for 43ms each, repeatable every 2s @ 60^{o}C
Minimum Load Current	10mA per point
Maximum On-State Voltage Drop	1.5V @ 0.5A 5.7V @ load current < 50mA
Maximum Off-State Leakage Current	3mA per point
Commutating Voltage	4V/µs for loads>50mA 0.2V/µs for loads<50mA[1]
Output Delay Time OFF to ON ON to OFF	 9.3ms @ 60Hz: 11ms @ 50Hz 9.3ms @ 60Hz; 11ms @ 50Hz
Diagnostic Functions Fuse Blown Time stamp of diagnostics	 1 Fuse and indicator/group +/- 1ms
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the Coordinated System Time
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Maximum Inhibit Voltage	Zero crossing 60V peak
Fusing	Mechanically fused/group 3.15A @ 250V ac slow blow 1500A interruption current Littelfuse p/n H2153.15
Isolation Voltage Group to group User to system	 250V maximum continuous 100% tested at 2546V dc for 1s 250V maximum continuous 100% tested at 2546V dc for 1s
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	20 Position RTB (1756-TBNH or TBSH)[2]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[3], [4]
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Enclosure Type Rating	None (open-style)
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[5] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick[5] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions

(1) The commutating dv/dt of the output voltage (OUTPUT to L2) should not exceed 0.2V/μs for loads under 50mA. The commutating dv/dt rating of the module for loads 50-500mA (OUTPUT TO L2) is 4V/μs maximum. If the commutating dv/dt rating of the TRIAC is exceeded, the TRIAC could latch on. If the commutating dv/dt rating is exceeded in the 10-50mA range, a resistor may be added across the output and L2. The purpose of this resistor is to increase the total output current to 50mA (I=V/R). At 50mA and above, the module has a higher commutating dv/dt rating. When adding a resistor for mthe output to L2, be sure it is rated for the power that it will dissipate (P=(V**2)/R). If the commutating dv/dt rating is exceeded in the 50-500mA range, the L1 AC waveform could be at fault. Be sure the waveform is a good sinusoid, void if any anomalies such as distorted or flattened sections.

(2) Maximum wire size requires extended housing - 1756-TBE.

(3) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(4) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(5) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OA16I

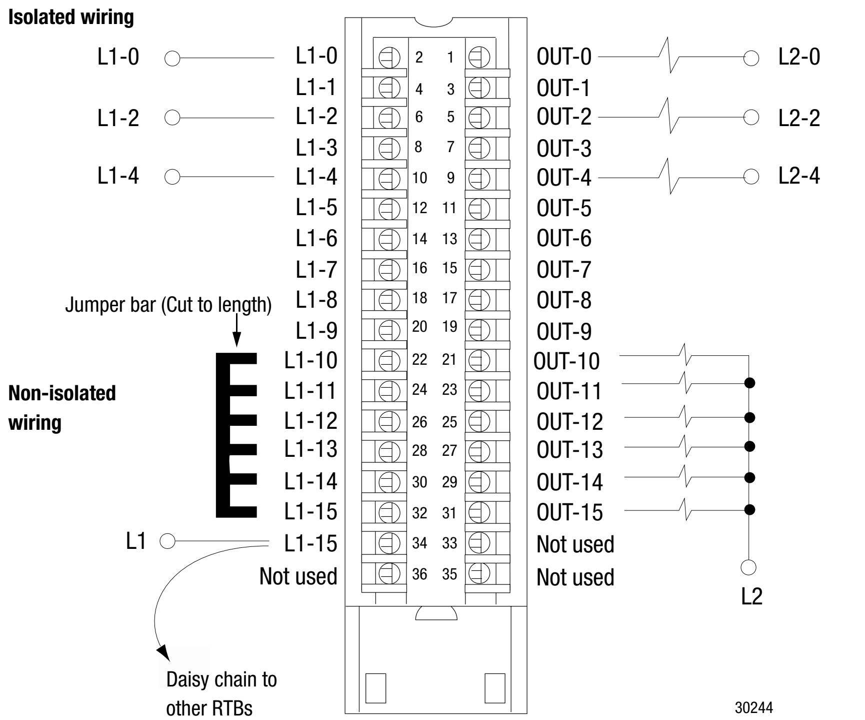
Module features

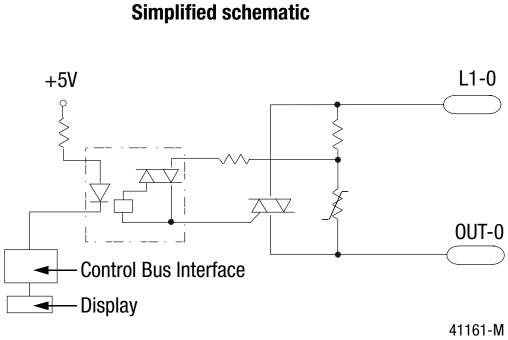
The following table lists the configurable features this module supports, the default value and the page of the feature's description:

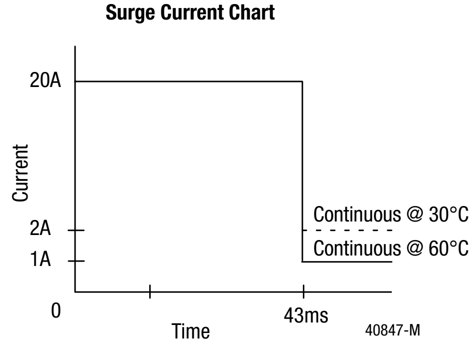
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

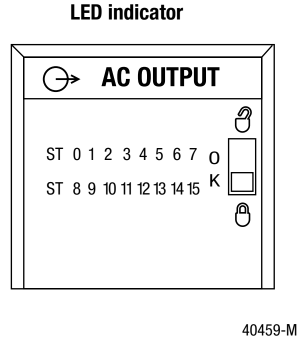
Figure 7.17

NOTES:
1. All terminals with the same name are connected together on the module. For example, L1 can be connected to either terminal marked L1-15.
2. Do not physically connect more than two wires to a single RTB terminal. When you use the second L1-15 terminal to daisy chain to other RTBs, always connect the daisy chain as shown.
3. The **jumper bar** part number is 97739201. Contact your local Rockwell Automation sales representative to order additional jumper bars, if necessary.
4. If separate power sources are used, do not exceed the specified isolation voltage.









1756-OA16I Specifications

Number of Outputs	16 (individually isolated)
Module Location	1756 ControlLogix Chassis
Backplane Current	300mA @ 5.1V dc & 2.5mA @ 24V dc (Total backplane power 1.60W)
Maximum Power Dissipation (Module)	5.5W @ 60°C
Thermal Dissipation	18.76 BTU/hr
Output Voltage Range	74-265V ac, 47-63Hz
Output Current Rating Per Point Per Module	 2A maximum @ 30°C & 1A maximum @ 60°C (Linear derating) 5A maximum @ 30°C & 4A maximum @ 60°C (Linear derating)
Surge Current per Point	20A for 43ms each, repeatable every 2s @ 60°C
Minimum Load Current	10mA per point
Maximum On-State Voltage Drop	1.5V peak @ 2A & 6V peak @ load current<50mA
Maximum Off-State Leakage Current	3mA per point
Commutating Voltage	4V/µs for loads>50mA 0.2V/µs for loads<50mA(1)
Output Delay Time OFF to ON ON to OFF	 9.3ms @ 60Hz; 11ms @ 50Hz 9.3ms @ 60Hz; 11ms @ 50Hz
Scheduled Outputs	Synchronization within 16.7 seconds maximum, reference to the CST
Configurable Fault States/ Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Maximum Inhibit Voltage	Zero crossing 60V peak
Fusing	Not protected - Fused IFM will protect outputs (See publication 1492-2.12). However, the Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of this product.
Isolation Voltage Channel to channel User side to system side	 100% tested at 2546V dc for 1 second (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1 second (250V ac maximum continuous voltage)
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)(2)
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded(1) 3/64 inch (1.2mm) insulation maximum 1(3), (4)
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)

Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Oscillatory Surge Withstand	IEEE C37.90.1: 4kV
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[5] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick[5] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[5] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" when conformal coated

(1) The commutating dv/dt of the output voltage (OUTPUT to L2) should not exceed 0.2V/µs for loads under 50mA. The commutating dv/dt rating of the module for loads 50-500mA (OUTPUT TO L2) is 4V/µs maximum. If the commutating dv/dt rating of the TRIAC is exceeded, the TRIAC could latch on. If the commutating dv/dt rating is exceeded in the 10-50mA range, a resistor may be added across the output and L2. The purpose of this resistor is to increase the total output current to 50mA (I=V/R). At 50mA and above, the module has a higher commutating dv/dt rating. When adding a resistor for mthe output to L2, be sure it is rated for the power that it will dissipate (P=(V**2)/R). If the commutating dv/dt rating is exceeded in the 50-500mA range, the L1 AC waveform could be at fault. Be sure the waveform is a good sinusoid, void if any anomalies such as distorted or flattened sections.

(2) Maximum wire size requires extended housing - 1756-TBE.

(3) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(4) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(5) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OA8

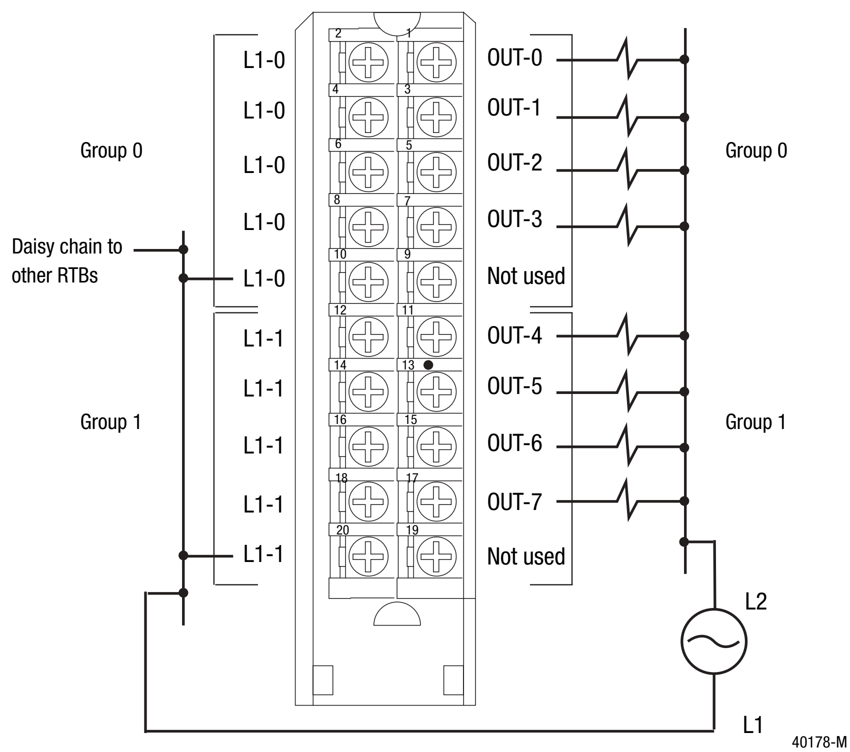
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

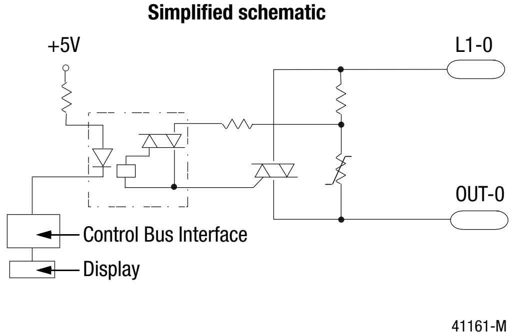
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.18

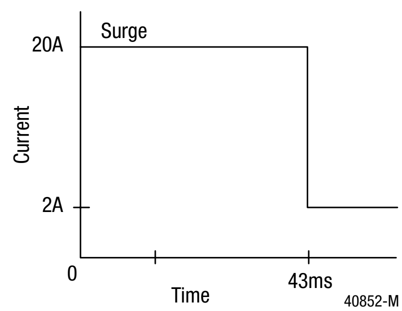
NOTES:
1. All terminals with the same name are connected together on the module. For example, L1 can be connected to any terminal marked L1-0.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



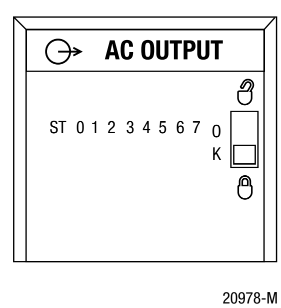
Simplified schematic



Surge Current Chart



LED indicator



1756-OA8 Specifications

Number of Outputs	8 (4 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	200mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 1.07W)
Maximum Power Dissipation	5.1W @ 60°C
Thermal Dissipation	17.39 BTU/hr
Output Voltage Range	74-265V ac, 47-63Hz
Output Current Rating Per Point Per Module	 2A maximum @ 60°C (Linear derating) 5A maximum @ 30°C & 4A maximum @ 60°C (Linear derating)
Surge Current per Point	20A for 43ms each, repeatable every 2s @ 60°C
Minimum Load Current	10mA per point
Maximum On-State Voltage Drop	1.5V peak @ 2A & 6V peak @ current<50mA
Maximum Off-State Leakage Current	3mA per point
Commutating Voltage	4V/µs for loads>50mA 0.2V/µs for loads<50mA[1]
Output Delay Time OFF to ON ON to OFF	 9.3ms @ 60Hz; 11ms @ 50Hz 9.3ms @ 60Hz; 11ms @ 50Hz
Scheduled Outputs	Synchronization within 16.7 seconds maximum, reference to the CST
Configurable Fault States/Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Maximum Inhibit Voltage	Zero crossing 60V peak
Fusing	Not protected - Fused IFM will protect outputs (See publication 1492-2.12). However, the Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of this product.
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (265V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (265V ac maximum continuous voltage)
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8–1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)[2]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[3], [4]
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±500V line-line(DM) and ±1kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[5] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick[5] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions

(1) The commutating dv/dt of the output voltage (OUTPUT to L2) should not exceed 0.2V/µs for loads under 50mA. The commutating dv/dt rating of the module for loads 50-500mA (OUTPUT TO L2) is 4V/µs maximum. If the commutating dv/dt rating of the TRIAC is exceeded, the TRIAC could latch on. If the commutating dv/dt rating is exceeded in the 10-50mA range, a resistor may be added across the output and L2. The purpose of this resistor is to increase the total output current to 50mA (I=V/R). At 50mA and above, the module has a higher commutating dv/dt rating. When adding a resistor for mthe output to L2, be sure it is rated for the power that it will dissipate (P=(V**2)/R). If the commutating dv/dt rating is exceeded in the 50-500mA range, the L1 AC waveform could be at fault. Be sure the waveform is a good.

(2) Maximum wire size will require extended housing - 1756-TBE.

(3) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(4) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(5) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OA8D

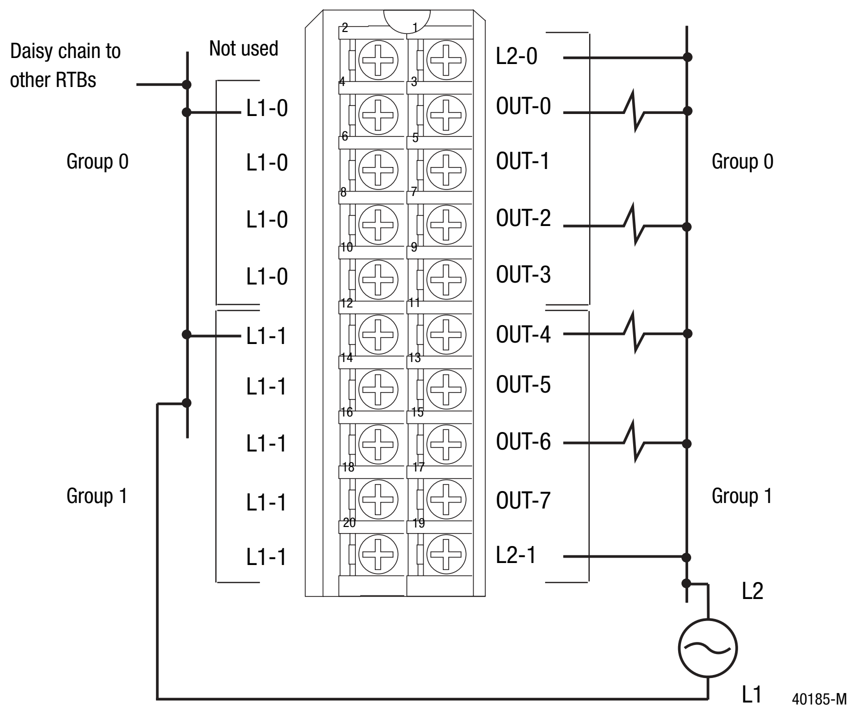
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

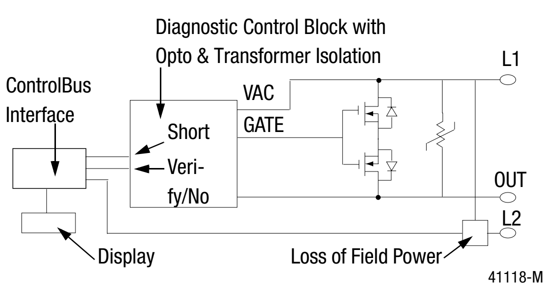
Feature	Default value	Page of description
Diagnostic Latch of Information	Enabled	4-11
No Load Detection	Enabled	4-24
Field Side Output Verification	Enabled	4-25
Pulse Test	Performed at user's request	4-26
Field Power Loss Detection	Enabled	4-29
Communications Format	CST timestamped fuse data - output data	6-6
Output State in Program Mode	Off	6-13
Output State in Fault Mode	Disabled	6-13
Transition from Program State to Fault State	Off	6-13

Figure 7.19

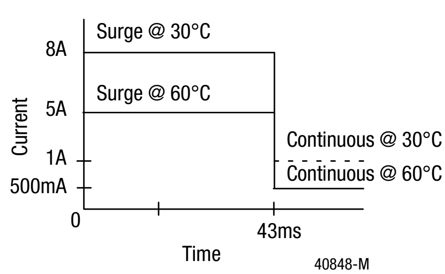
NOTES:
1. All terminals with the same name are connected together on the module. For example, L1 can be connected to any terminal marked L1-0.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



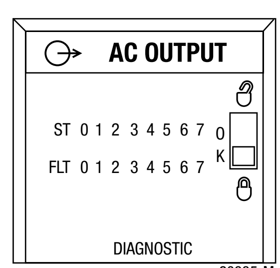
Simplified schematic



Surge Current Chart



LED indicator



1756-OA8D Specifications

Number of Outputs	8 (4 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	175mA @ 5.1V dc & 250mA @ 24V dc (Total backplane power 6.89W)
Maximum Power Dissipation (Module)	5.3W @ 60°C
Thermal Dissipation	18 BTU/hr
Output Voltage Range	74-132V ac, 47-63Hz
Output Current Rating Per Point Per Module	 1A max @ 30°C & 0.5A maximum @ 60°C (Linear derating) 8A max @ 30°C & 4A maximum @ 60°C (Linear derating)
Surge Current per Point	8A for 43ms each, repeatable every 2s @ 30°C 5A for 43ms each, repeatable every 1s @ 60°C
Minimum Load Current	10mA per point
Maximum On-State Voltage Drop	2.5V peak @ 0.5A & 3V peak @ 1A
Maximum Off-State Leakage Current	3mA per point
Output Delay Time OFF to ON ON to OFF	 9.3ms @ 60Hz: 11ms @ 50Hz 9.3ms @ 60Hz; 11ms @ 50Hz
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Configurable Fault States/Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Diagnostic Functions Short Trip NoLload Output Verification Pulse Test Field Power Loss (Zero Cross) Timestamp of diagnostics	 12A for 500µs minimum Off state detection only On state detection only User selectable maximum width & user selectable maximum time delay from zero cross Detects at 25V peak minimum (Firmware phase locked loop) +/- 1ms
Maximum Inhibit Voltage	Zero crossing 25V peak
Fusing	Electronically fused per point
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
Module Keying (Backplane)	Software configurable
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)(1)
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded(1) 3/64 inch (1.2mm) insulation maximum 1(2), (3)
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[4] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" when conformal coated

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OA8E

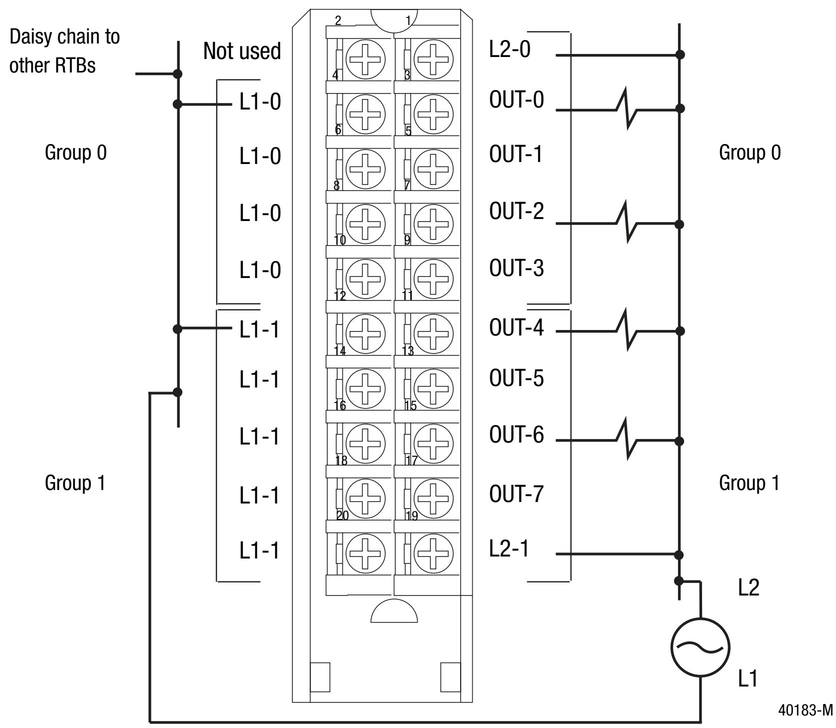
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

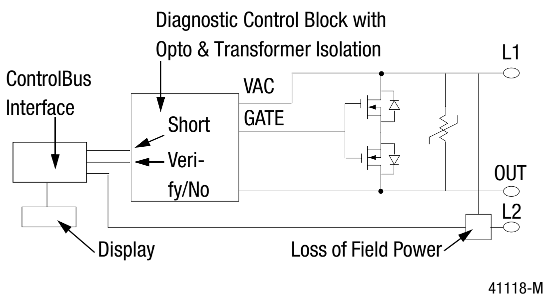
Feature	Default value	Page of description
Field Power Loss Detection	Enabled	3-18
Diagnostic Latch of Information	Enabled	3-19
Communications Format	CST timestamped fuse data - output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.20

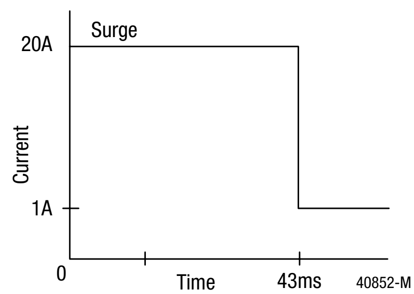
NOTES:
1. All terminals with the same name are connected together on the module. For example, L1 can be connected to any terminal marked L1-0.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



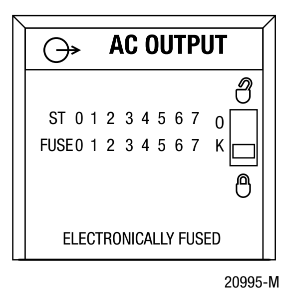
Simplified schematic



Surge Current Chart



LED indicator



1756-OA8E Specifications

Number of Outputs	8 (4 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	200mA @ 5.1V dc & 250mA @ 24V dc (Total backplane power 7.02W)
Maximum Power Dissipation (Module)	5.5W @ 60°C
Thermal Dissipation	18.76 BTU/hr
Output Voltage Range	74-132V ac, 47-63Hz
Output Current Rating Per Point Per Group Per Module	 2A maximum @ 60°C 4A maximum @ 30°C & 2A max @ 60°C (Linear derating) 8A maximum @ 30°C & 4A max @ 60°C (Linear derating)
Surge Current per Point	20A for 43ms each, repeatable every 2s @ 60°C
Minimum Load Current	10mA per point
Maximum On-State Voltage Drop	4V peak @ 2A
Maximum Off-State Leakage Current	3mA per point
Output Delay Time OFF to ON ON to OFF	 9.3ms @ 60Hz; 11ms @ 50Hz 9.3ms @ 60Hz; 11ms @ 50Hz
Diagnostic Functions Short Trip Field Power Loss (Zero Cross) Time stamp of Diagnostics	 >20A for 100ms minimum Detects at 25V peak minimum (Firmware phase locked loop) +/- 1ms
Configurable Fault States/Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode/Point	Hold Last State, ON or OFF (OFF is the default)
Scheduled Outputs	Synchronization within 16.7s maximum, reference to CST
Maximum Inhibit Voltage	Zero crossing 25V peak
Fusing	Electronically fused per point
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)(1)
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded(1) 3/64 inch (1.2mm) insulation maximum 1(2), (3)
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OB16D

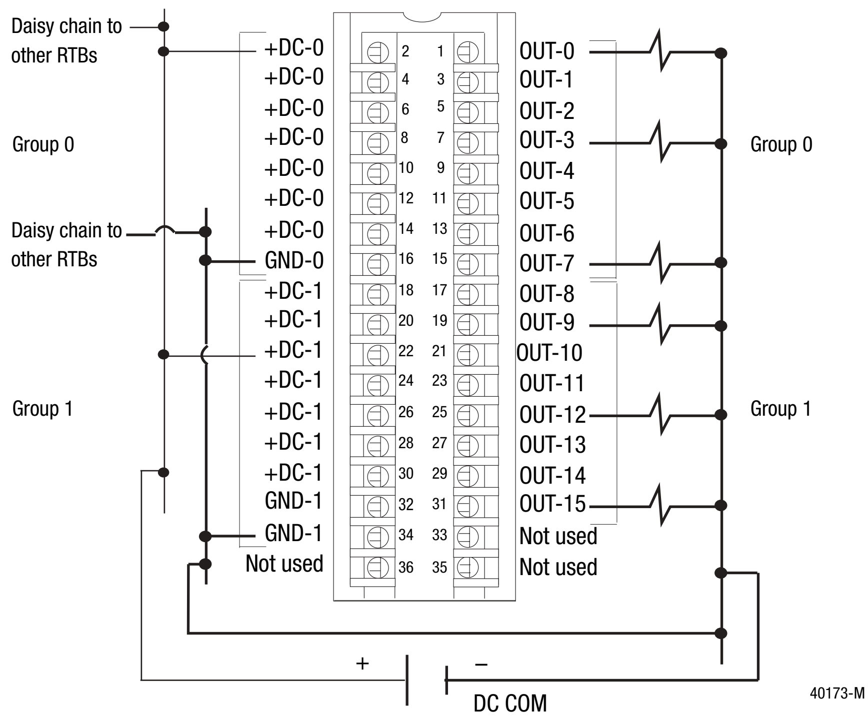
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

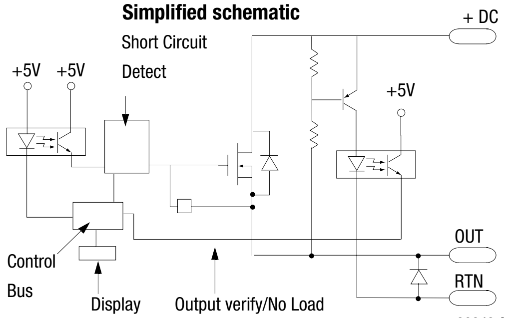
Feature	Default value	Page of description
Diagnostic Latch of Information	Enabled	4-11
No Load Detection	Enabled	4-24
Field Side Output Verification	Enabled	4-25
Pulse Test	Performed at user's request	4-26
Communications Format	CST timestamped fuse data - output data	6-6
Output State in Program Mode	Off	6-13
Output State in Fault Mode	Disabled	6-13
Transition from Program State to Fault State	Off	6-13

Figure 7.21

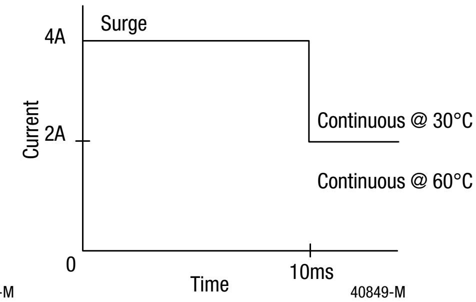
NOTES:
1. All terminals with the same name are connected together on the module. For example, DC COM can be connected to either terminal marked GND-1.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



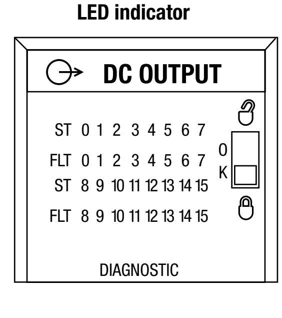
Simplified schematic



Surge Current Chart



LED indicator



1756-OB16D Specifications

Number of Outputs	16 (8 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	250mA @ 5.1V dc & 140mA @ 24V dc (Total backplane power 4.64W)
Maximum Power Dissipation (Module)	3.3W @ 60°C
Thermal Dissipation	11.25 BTU/hr
Output Voltage Range	19.2-30V dc
Output Current Rating Per Point Per Module	 2A maximum @ 30°C & 1A maximum @ 60°C (Linear derating) 8A maximum @ 30°C & 4A maximum @ 60°C (Linear derating)
Surge Current per Point	4A for 10ms each, repeatable every 1s
Minimum Load Current	3mA per point
Maximum On-State Voltage Drop	1.2V dc @ 2A
Maximum Off-State Leakage Current	1mA per point
Output Delay Time OFF to ON ON to OFF	 55µs nominal/1ms maximum 630µs nominal/5ms maximum
Diagnostic Functions: Short trip No load Output verification Pulse test Timestamp of diagnostics	 8A for 180ms minimum 10A for 120ms minimum OFF STATE detection only ON STATE detection only User selectable maximum pulse width +/- 1ms
Configurable Fault States/Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode/Point	Hold Last State, ON or OFF (OFF is the default)
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Fusing	Electronically fused per point
Reverse Polarity Protection	None - If module is wired incorrectly, outputs may be damaged.
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OB16E

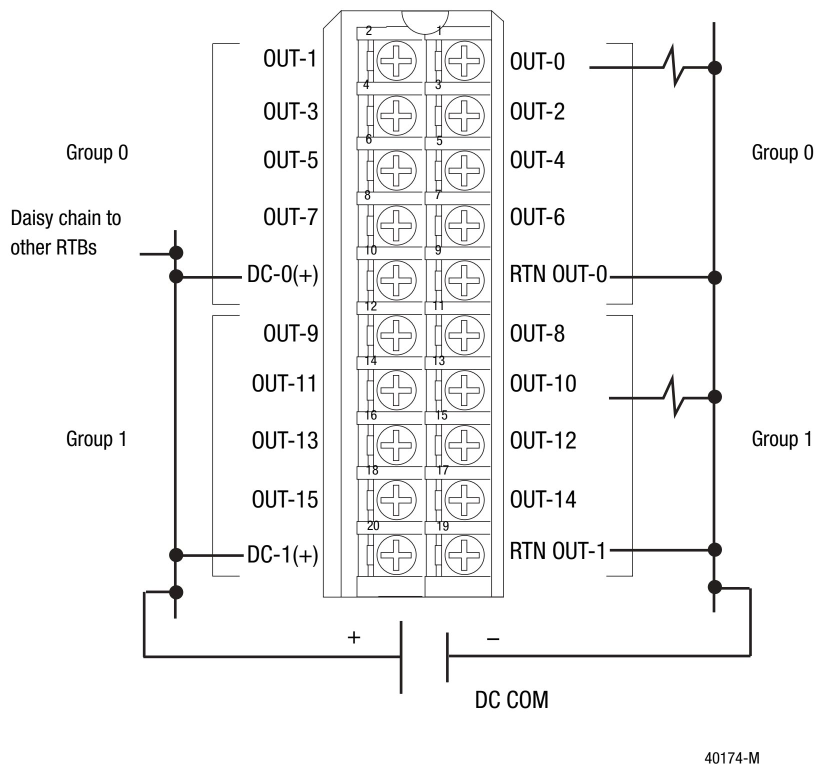
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

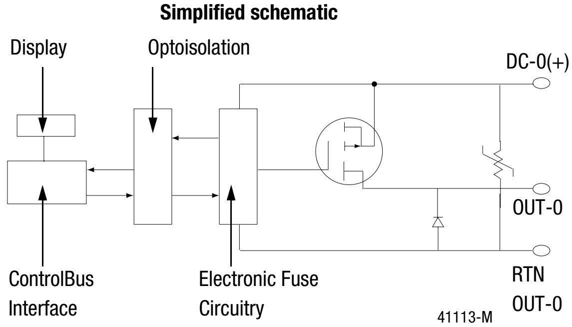
Feature	Default value	Page of description
Communications Format	CST timestamped fuse data - output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.22

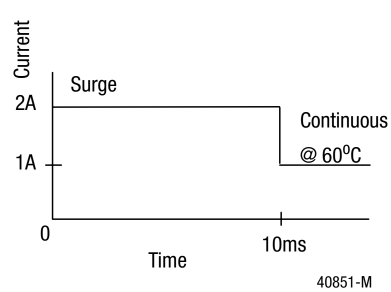
NOTES:
1. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
2. This wiring example shows a single voltage source.
3. If separate power sources are used, do not exceed the specified isolation voltage.



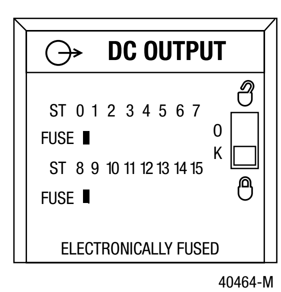
Simplified schematic



Surge Current Chart



LED indicator



1756-OB16E Specifications

Number of Outputs	16 (8 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	250mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 1.32W)
Maximum Power Dissipation (Module)	4.1W @ 60°C
Thermal Dissipation	13.98 BTU/hr
Output Voltage Range	10-31.2V dc
Output Current Rating Per Point Per Module	 1A maximum @ 60°C 8A maximum @ 60°C
Surge Current per Point	2A for 10ms each, repeatable every 2s @ 60°C
Minimum Load Current	3mA per output
Maximum On-State Voltage Drop	400mV dc @ 1A
Maximum Off-State Leakage Current	1mA per point
Output Delay Time OFF to ON ON to OFF	 70μs nominal/1ms maximum 360μs nominal/1ms maximum
Diagnostic Functions: Short Trip Time stamp of diagnostics	 1.8A @ 24V dc (Output ON, then short) 4.1A @ 24V dc for 18ms (Output ON into short) +/- 1ms
Scheduled Outputs	Synchronization within 16.7 seconds maximum, reference to the Coordinated System Time
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Electronically fused per group
Reverse Polarity Protection	None - If module is wired incorrectly, outputs may be damaged.
Isolation Voltage Group to group User to system	 30V maximum continuous 100% tested at 2546V dc for 1s 30V maximum continuous 100% tested at 2546V dc for 1s
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[4] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection “n”

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OB16I

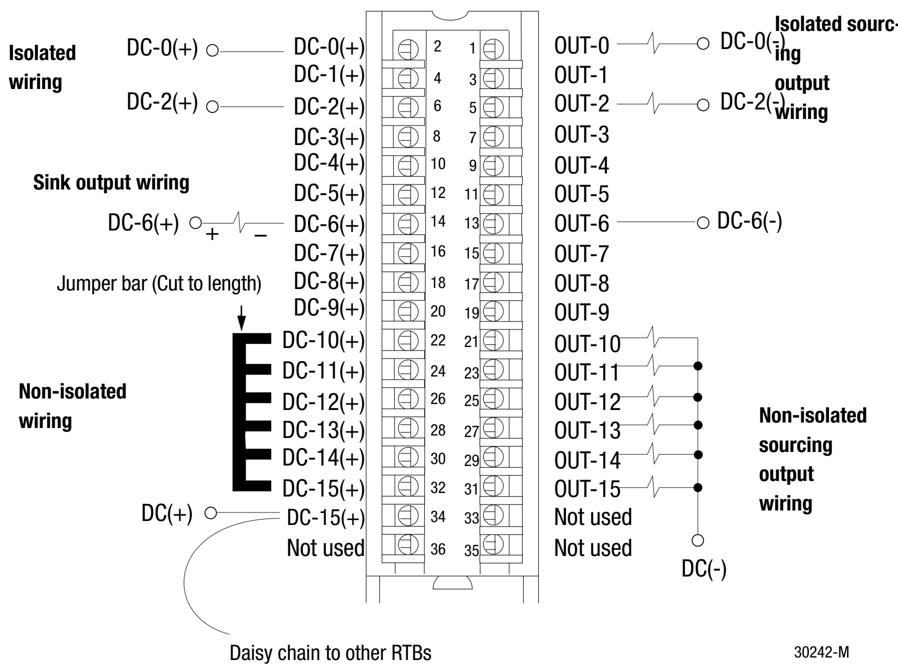
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

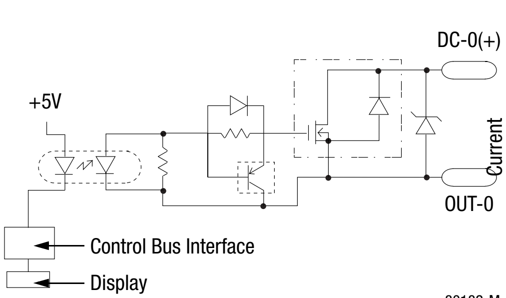
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.23

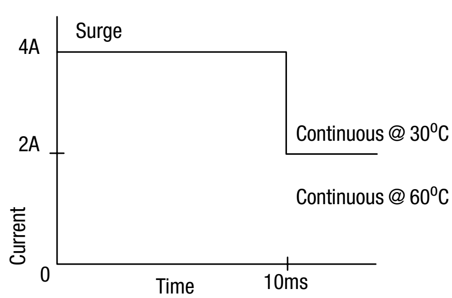
NOTES:
1. All terminals with the same name are connected together on the module. For example, DC(+) can be connected to either terminal marked DC-15.
2. Do not physically connect more than two wires to a single RTB terminal. When you use the second DC-15(+) terminal to daisy chain to other RTBs, always connect the daisy chain as shown.
3. Outputs can be wired in a sink or source configuration as shown above.
4. The **jumper bar** part number is 97739201. Contact your local Rockwell Automation sales representative to order additional jumper bars, if necessary.
5. If separate power sources are used, do not exceed the specified isolation voltage.



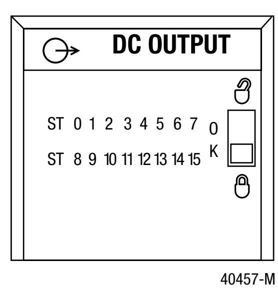
Simplified schematic



Surge Current Chart



LED indicator



1756-OB16I Specifications

Number of Outputs	16 (individually isolated)
Module Location	1756 ControlLogix Chassis
Backplane Current	350mA @ 5.1V dc & 2.5mA @ 24V dc (1.8W Total backplane power)
Maximum Power Dissipation (Module)	3.6W @ 60^{o}C
Thermal Dissipation	12.28 BTU/hr
Output Voltage Range	10-30V dc
Output Current Rating Per Point Per Module	 2A maximum @ 30°C & 1A maximum @ 60°C (Linear derating) 8A maximum @ 30°C & 4A maximum @ 60°C (Linear derating)
Surge Current/Point	4A for 10ms each, repeatable every 2s
Minimum Load Current	1mA per point
Maximum On-State Voltage Drop	1.2V dc @ 2A
Maximum Off-State Leakage Current	0.5mA per point
Output Delay Time OFF to ON ON to OFF	 1ms maximum 2ms maximum
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Configurable Fault States/ Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode/Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Not protected - Fused IFM will protect outputs (See publication 1492-2.12). However, the Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of this product.
Reverse Polarity Protection	None (If module is wired incorrectly, outputs may be damaged.)
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE(4) European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick(4) Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx(4) European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n"

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OB16IS

Module features

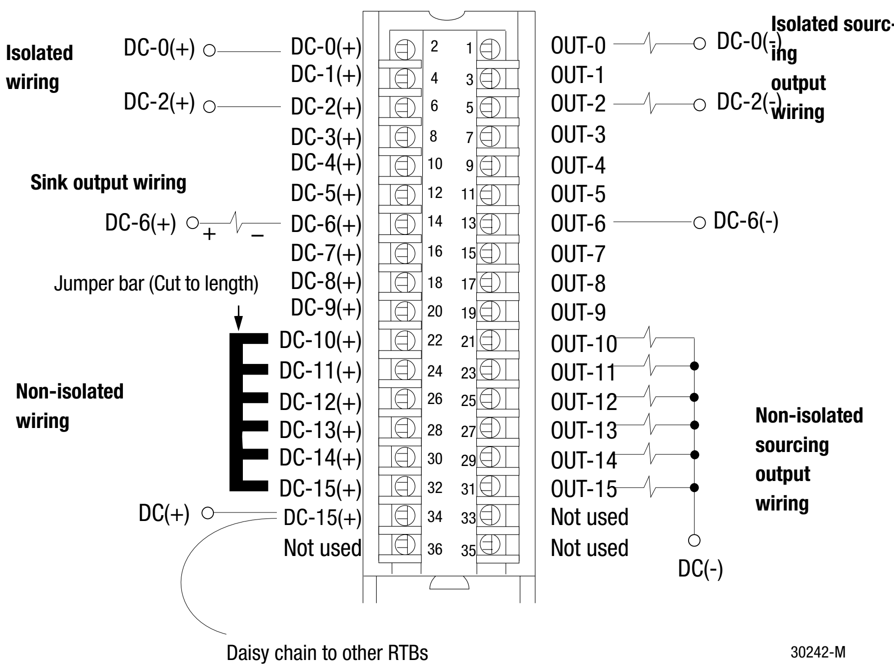
The following table lists the configurable features this module supports, the default value and the page of the feature's description:

Feature	Default value	Page of description
Communications Format	Scheduled Output Data per Point	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

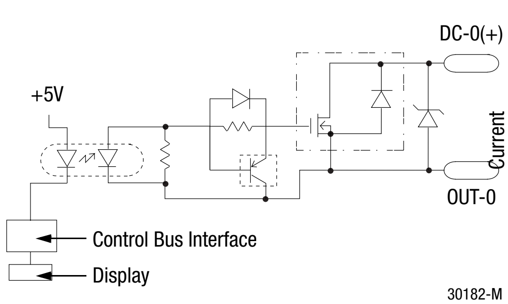
Figure 7.24

NOTES:

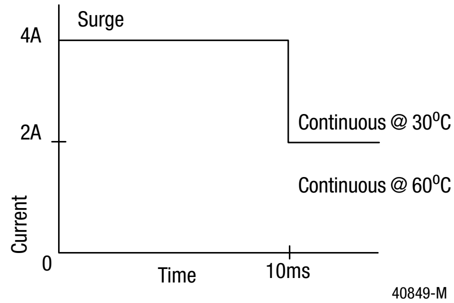
1. All terminals with the same name are connected together on the module. For example, DC(+) can be connected to either terminal marked DC-15.
2. Do not physically connect more than two wires to a single RTB terminal. When you use the second DC-15(+) terminal to daisy chain to other RTBs, always connect the daisy chain as shown.
3. Outputs can be wired in a sink or source configuration as shown above.
4. The **jumper bar** part number is 97739201. Contact your local Rockwell Automation sales representative to order additional jumper bars, if necessary.
5. If separate power sources are used, do not exceed the specified isolation voltage.



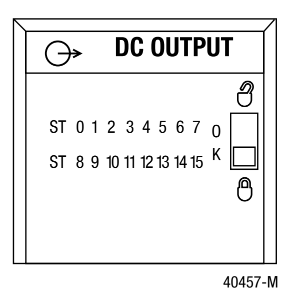
Simplified schematic



Surge Current Chart



LED indicator



1756-OB16IS Specifications

Number of Outputs	16 (individually isolated)
Module Location	1756 ControlLogix Chassis
Backplane Current	350mA @ 5.1V dc & 2.5mA @ 24V dc (1.8W Total backplane power)
Maximum Power Dissipation (Module)	3.6W @ 60^{o}C
Thermal Dissipation	12.28 BTU/hr
Output Voltage Range	10-30V dc
Output Current Rating Per Point Per Module	 2A maximum @ 30°C 1A maximum @ 60°C (Linear derating) 8A maximum @ 30°C 4A maximum @ 60°C (Linear derating)
Surge Current/Point	4A for 10ms each, repeatable every 2s
Minimum Load Current	1mA per point
Maximum On-State Voltage Drop	1.2V dc @ 2A
Maximum Off-State Leakage Current	0.5mA per point
Output Delay Time OFF to ON ON to OFF	 1ms maximum 2ms maximum
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the Coordinated System Time
Configurable Fault States/ Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode/Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Not protected - Fused IFM will protect outputs (See publication 1492-2.12). However, the Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of this product.
Reverse Polarity Protection	None (If module is wired incorrectly, outputs may be damaged.)
Isolation Voltage Channel to channel User to system	 250V maximum continuous 100% tested at 2546V dc for 1s 250V maximum continuous 100% tested at 2546V dc for 1s
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[(1)] 3/64 inch (1.2mm) insulation maximum 1[(2), (3)]

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	10V/m with 1kHz sine-wave 80%AM from 80MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	±4kV at 2.5kHz on signal ports
Surge Transient Immunity	±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations CE(4) European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick(4) Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OB32

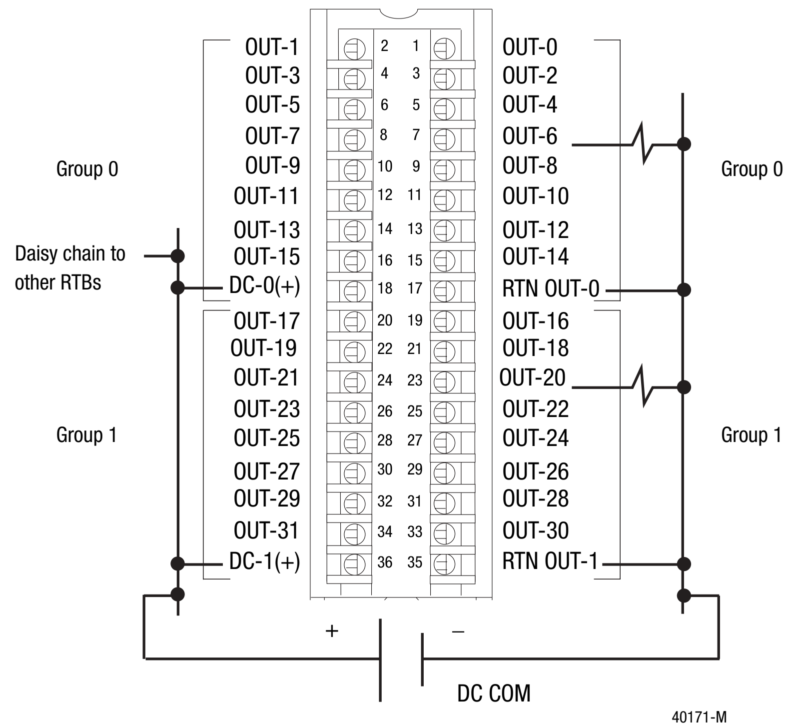
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

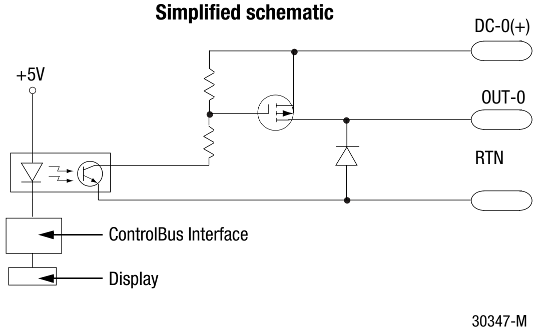
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.25

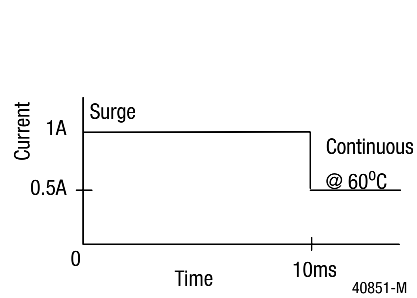
NOTES:
1. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
2. This wiring example uses a single voltage source.
3. If separate power sources are used, do not exceed the specified isolation voltage.



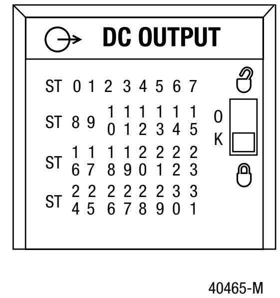
Simplified schematic



Surge Current Chart



LED indicator



1756-OB32 Specifications

Number of Outputs	32 (16 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	300mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 1.58W)
Maximum Power Dissipation	4.8W @ 60°C
Thermal Dissipation	16.37 BTU/hr
Output Voltage Range	10-31.2V dc @ 50°C (Linear derating) 10-28V dc @ 60°C
Output Current Rating Per Point Per Module	 0.5A maximum @ 50°C (Linear derating) 0.35A maximum @ 60°C 16A maximum @ 50°C (Linear derating) 10A maximum @ 60°C
Surge Current per Point	1A for 10ms each, repeatable every 2s @ 60°C
Minimum Load Current	3mA per point
Maximum On-State Voltage Drop	200mV dc @ 0.5A
Maximum Off-State Leakage Current	0.5mA per point
Output Delay Time OFF to ON ON to OFF	 55μs nominal/1ms maximum 200μs nominal/1ms maximum
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the Coordinated System Time
Configurable Fault States/Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Not protected - Fused IFM can be used to protect outputs (See publication 1492-2.12). However, the Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of this product.
Reverse Polarity Protection	None - If module is wired incorrectly, outputs may be damaged.
Isolation Voltage Group to group User to system	 30V maximum continuous 100% tested at 2546V dc for 1s 30V maximum continuous 100% tested at 2546V dc for 1s
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE(4) European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick(4) Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx(4) European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n"

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OB8

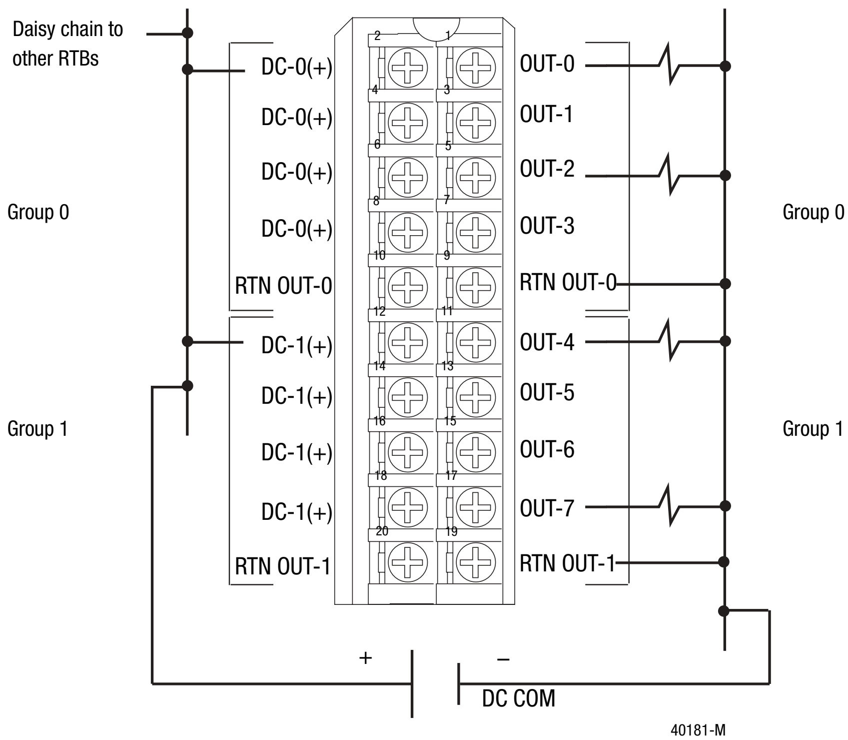
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

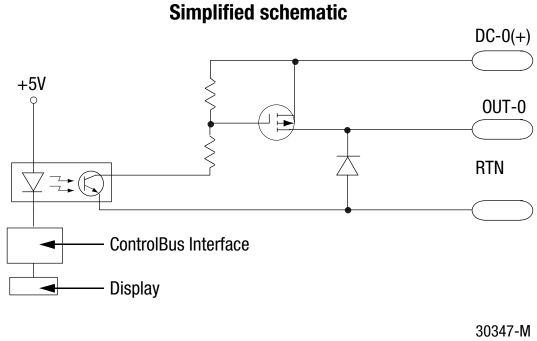
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.26

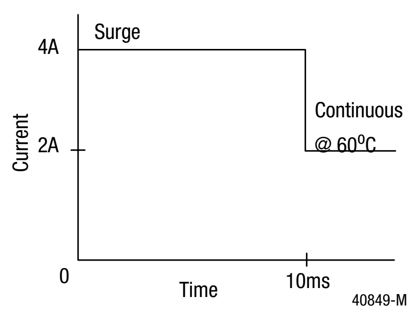
NOTES:
1. All terminals with the same name are connected on the module. For example, DC COM can be connected to either terminal marked RTN OUT-1.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



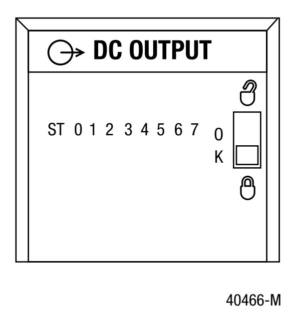
Simplified schematic



Surge Current Chart



LED indicator



1756-OB8 Specifications

Number of Outputs	8 (4 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	165mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 0.89W)
Maximum Power Dissipation (Module)	2.5W @ 60°C
Thermal Dissipation	8.53 BTU/hr
Output Voltage Range	10-30V dc
Output Current Rating Per Point Per Module	 2A maximum @ 60°C 8A maximum @ 60°C
Surge Current per Point	4A for 10ms each, repeatable every 1s @ 60°C
Minimum Load Current	2mA per point
Maximum On-State Voltage Drop	2V dc @ 2A
Maximum Off-State Leakage Current	1mA per point
Output Delay Time OFF to ON ON to OFF	 1ms maximum 2ms maximum
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Configurable Fault States/Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode/Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Not protected - Fused IFM will protect outputs (See publication 1492-2.12). However, the Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of this product.
Reverse Polarity Protection	None - If module is wired incorrectly, outputs may be damaged.
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[4] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n"

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

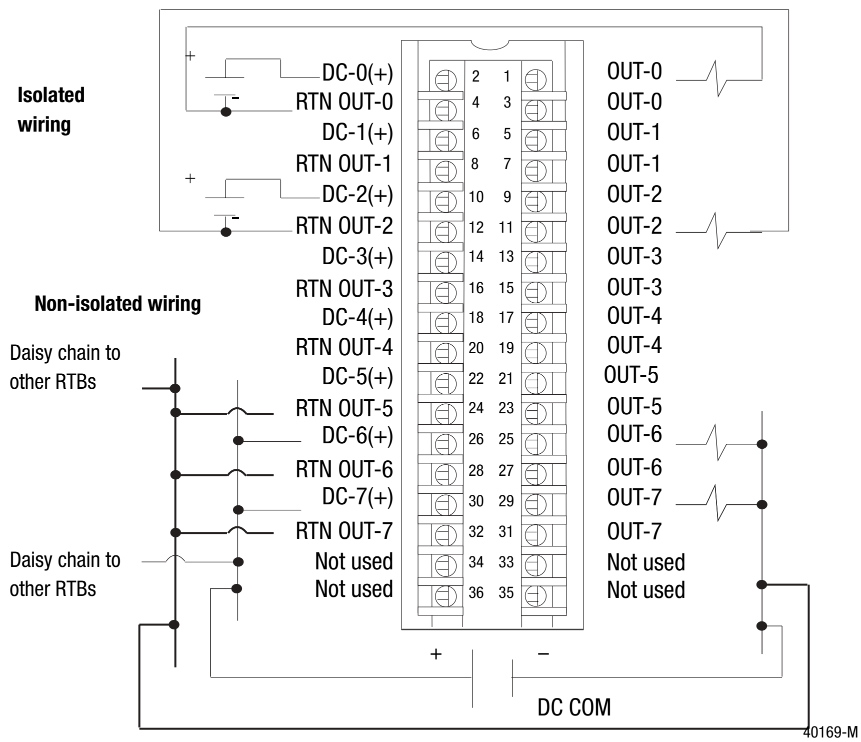
1756-OB8EI

Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

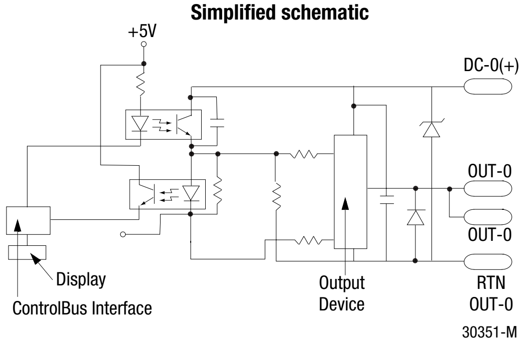
Feature	Default value	Page of description
Communications Format	CST timestamped fuse data - Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.27

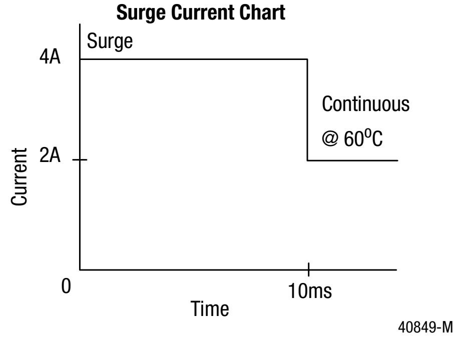


NOTES:
1. All terminals with the same name are connected together on the module. For example, the load can be connected to either terminal marked OUT-0.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain to other RTBs, always connect the daisy chain as shown.
3. If separate power sources are used, do not exceed the specified isolation voltage.

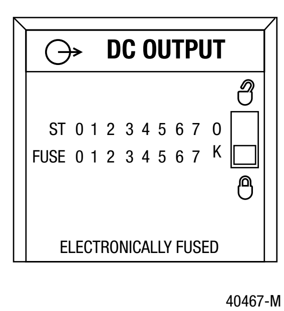
Simplified schematic



Surge Current Chart



LED indicator



1756-OB8EI Specifications

Number of Outputs	8 (individually isolated)
Module Location	1756 ControlLogix Chassis
Backplane Current	250mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 1.30W)
Maximum Power Dissipation (Module)	4.7W @ 60^{o}C
Thermal Dissipation	16.03 BTU/hr
Output Voltage Range	10-30V dc
Output Current Rating Per Point Per Module	 2A maximum @ 60°C 10A maximum @ 60°C & 16A maximum @ 55°C (Linear derating)
Surge Current per Point	4A for 10ms each, repeatable every 2s
Minimum Load Current	3mA per point
Maximum On-State Voltage Drop	1.2V dc @ 2A
Maximum Off-State Leakage Current	1mA per point
Output Delay Time OFF to ON ON to OFF	 1ms maximum 5ms maximum
Diagnostic Functions: Short trip Time stamp of diagnostics	 >4.5A for 500µs maximum (Output ON, then short) >4.5A for 1.5ms maximum (Output ON into short) +/- 1ms
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Fusing	Electronically fused per point
Configurable Fault States/Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode/Point	Hold Last State, ON or OFF (OFF is the default)
Reverse Polarity Protection	None - If module is wired incorrectly, outputs may be damaged.
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)[(1)]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[(1)] 3/64 inch (1.2mm) insulation maximum 1[(2), (3)]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[4] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n"

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OC8

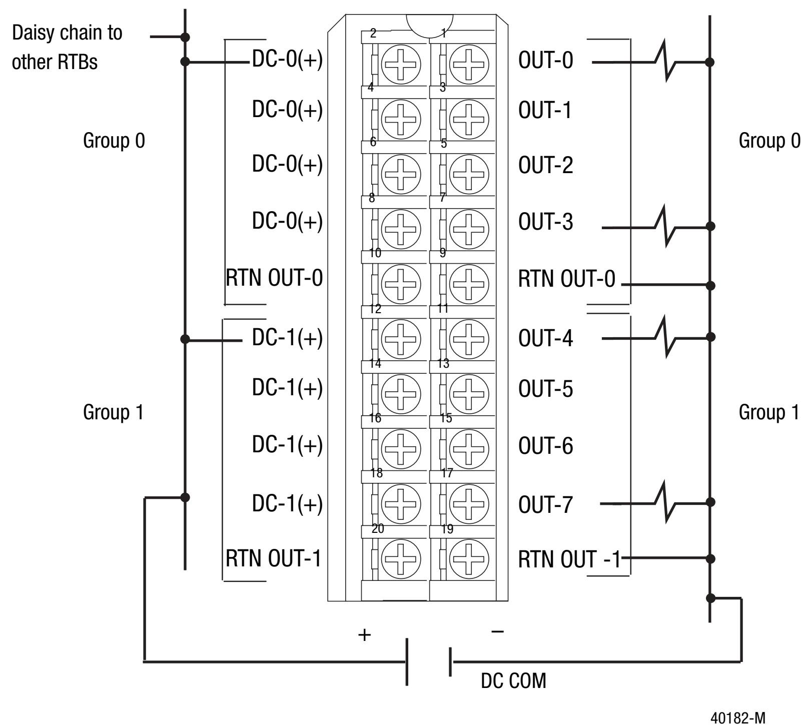
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

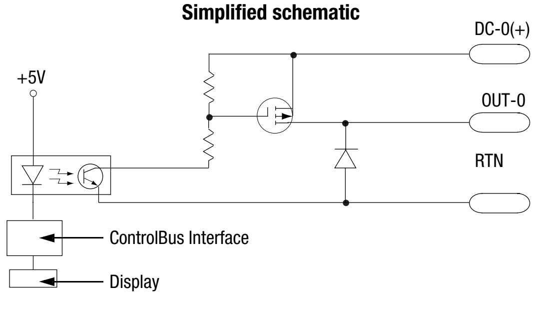
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.28

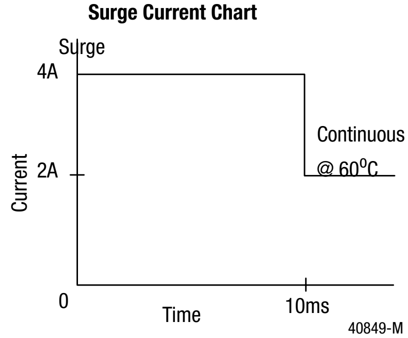
NOTES:
1. All terminals with the same name are connected together on the module. For example, DC COM can be connected to either terminal marked RTN OUT-1.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



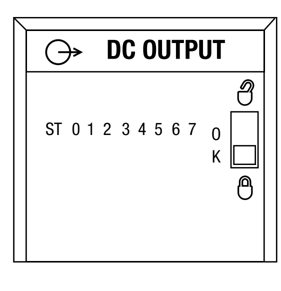
Simplified schematic



Surge Current Chart



LED indicator



1756-OC8 Specifications

Number of Outputs	8 (4 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	165mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 0.89W)
Maximum Power Dissipation (Module)	4.9W @ 60°C
Thermal Dissipation	16.71 BTU/hr
On State Voltage Range	30-60V dc
Output Current Rating Per Point Per Module	 2A maximum @ 60°C 8A maximum @ 60°C
Surge Current per Point	4A for 10ms each, repeatable every 1s @ 60°C
Minimum Load Current	2mA per point
Maximum On-State Voltage Drop	2V dc @ 2A
Maximum Off-State Leakage Current	1mA per point
Output Delay Time OFF to ON ON to OFF	 1ms maximum 2ms maximum
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Not protected - Fused IFM will protect outputs (See publication 1492-2.12). However, the Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of this product.
Reverse Polarity Protection	None - If the module is wired incorrectly, outputs may be damaged.
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)(1)
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded(1) 3/64 inch (1.2mm) insulation maximum 1(2), (3)
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[4] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n"

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OG16

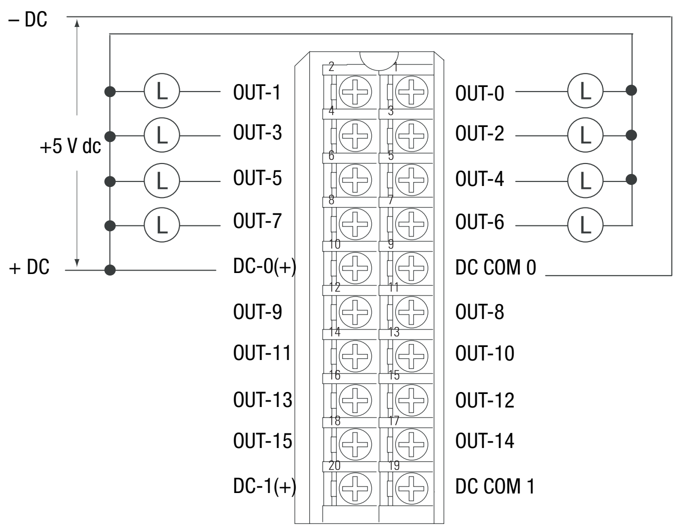
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

Feature	Default value	Page of description
Communications Format	CST timestamped fuse data - Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

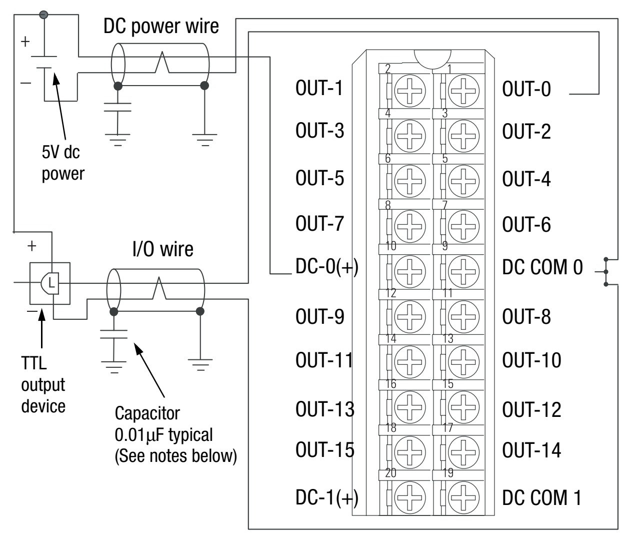
Figure 7.29

Wiring Diagram for Applications that Do Not Require CE Compliance



NOTES:
1. We recommend you use this diagram for applications that do not require CE compliance.
2. Do not connect more than two wires to any single terminal.
3. This example shows devices wired to only one of two groups on the module. You can make connections to the second group on terminals 11-20.

Wiring Diagram for CE-Compliant (and High Noise) Applicationsg



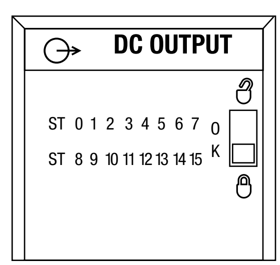
GENERAL NOTES:
1. We recommend you use Belden M 8761 cable where shielded cables are showr
2. Do not connect more than two wires to any single terminal.
3. This example shows devices wired to only one of two groups on the module. Yo can make connections to the second group on terminals 11-20.

CE REQUIREMENT NOTES:
1. DC power wire and I/O wire should not exceed 10m (30ft) in length.
2. The 0.01µF capacitors shown must be rated for 2000V dc.

Simplified schematic

Surge Current Chart

LED indicator



1756-OG16 Specifications

Number of Outputs	16 (8 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	210mA @ 5.1V dc & 2mA @ 24V dc
Backplane Power	1.12W
Maximum Power Dissipation (Module)	1.5W @ 60°C
Thermal Dissipation	5.2 BTU/hr @ 60°C
Operating Voltage	4.5 to 5.5V dc source 50mV P-P ripple maximum
Voltage Category	5V dc TTL (Low = True)(1)
Low-True Format	The module operates with the following definitions of ON and OFF states: 0V to 0.4V dc = Output guaranteed to be in ON state 0.4 to 4.5V dc = Output state not Guaranteed 4.5 to 5.5V dc = Output guaranteed to be in OFF state
Off-State Leakage Current	0.1mA maximum
Continuous Current	24mA maximum
Load Current Per Point Per Module	0.15mA minimum 24mA maximum 384mA maximum
On-State Voltage Drop	0.4V dc maximum
Output Delay Time (resistive load) OFF to ON (5V to 0V dc transition) ON to OFF (0V to 5V dc transition)	45μs nominal 450μs maximum 145μs nominal 700μs maximum
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the Coordinated System Time
Configurable Fault4 States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable Fault States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	None
Reverse Polarity Protection	None Damage to circuitry could result
Isolation Group	2 groups of 8
Isolation Voltage Group to group User to system	250V maximum continuous 250V maximum continuous
Field Wiring Arm and Housing	20-position RTB (1756-TBNH or 1756-TBSH)(2)
RTB Screw Torque (NEMA clamp)	7 to 9 inch-pounds (0.8 to 1Nm) maximum
Module Keying (Backplane)	Software configurable
RTB Keying	User-defined mechanical keying
Conductors Wire Size Category	#22 to #14 AWG (0.324 to 2.08 sq. mm) stranded(1) 3/64 inch (1.2mm) insulation maximum 2(3)

Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 4kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 80MHz to 1000MHz
EFT/B Immunity	IEC 61000-4-4: ±1kV at 5kHz on power ports ±1kV at 5kHz on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications: (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

(1) TTL outputs are inverted (0 to +0.4V dc = low voltage = True = On.) Use a NOT instruction in your program to convert to traditional True - High logic.

(2) Maximum wire size will require extended housing - 1756-TBE.

(3) Use this Conductor Category information for planning conductor routing. Refer to Publication 1770-4.1, 'Industrial Automation Wiring and Grounding Guidelines'.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OH8I

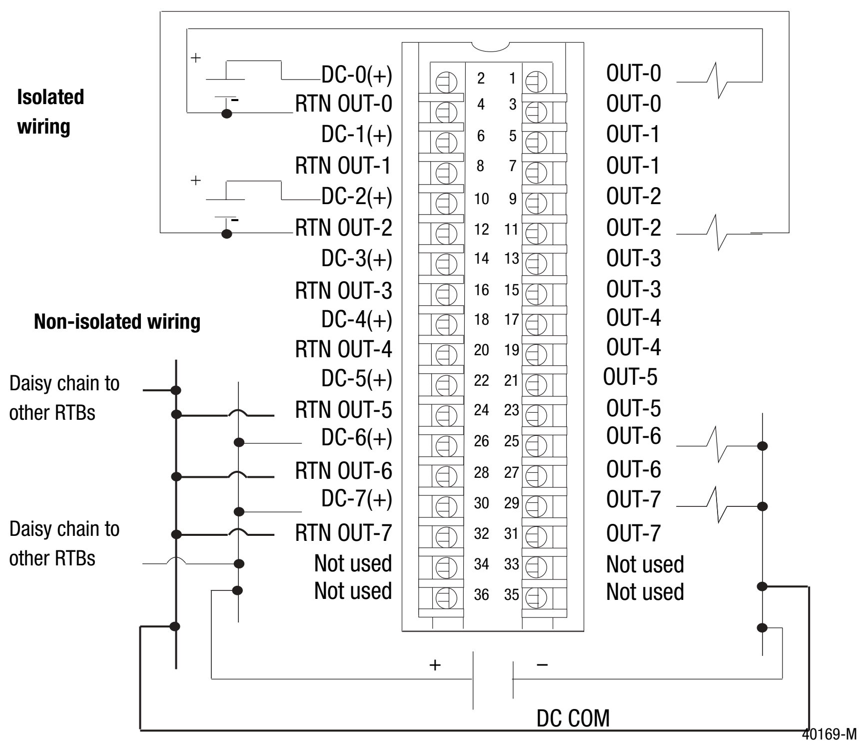
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

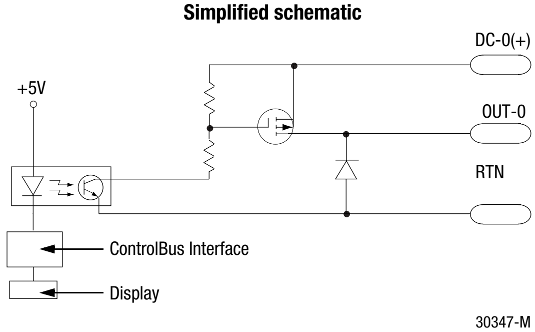
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.30

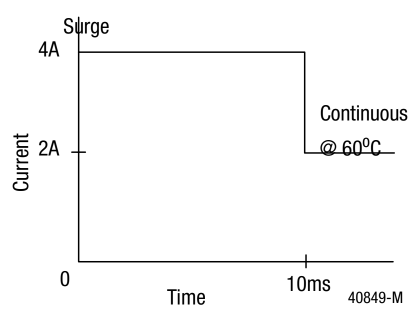
NOTES:
1. All terminals with the same name are connected together on the module. For example, the load can be connected to either terminal marked OUT-0.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain to other RTBs, always connect the daisy chain as shown.
3. If separate power sources are used, do not exceed the specified isolation voltage.



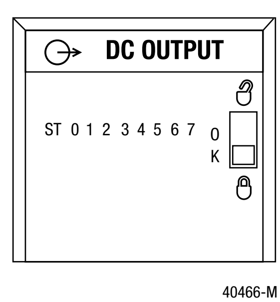
Simplified schematic



Surge Current Chart



LED indicator



1756-OH8I Specifications

Number of Outputs	8 (individually isolated)
Module Location	1756 ControlLogix Chassis
Backplane Current	210mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 1.11W)
Maximum Power Dissipation (Module)	3.3W @ 60°C
Thermal Dissipation	11.25 BTU/hr
On State Voltage Range	90-146V dc
Output Current Rating Per Point Per Module	 2A maximum @ 60°C 8A maximum @ 60°C
Surge Current per Point	4A for 10ms each, repeatable every 1s @ 60°C
Minimum Load Current	2mA per point
Maximum On-State Voltage Drop	2V dc @ 2A
Maximum Off-State Leakage Current	1mA per point
Output Delay Time OFF to ON ON to OFF	 2ms maximum 2ms maximum
Scheduled Outputs	Synchronization within 16.7 seconds maximum, reference to the CST
Configurable Fault States/Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Not protected - Fused IFM will protect outputs (See publication 1492-2.12). However, the Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of this product.
Reverse Polarity Protection	None - If module is wired incorrectly, outputs may be damaged.
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1 second (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1 second (250V ac maximum continuous voltage)
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE(4) European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick(4) Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-ON8

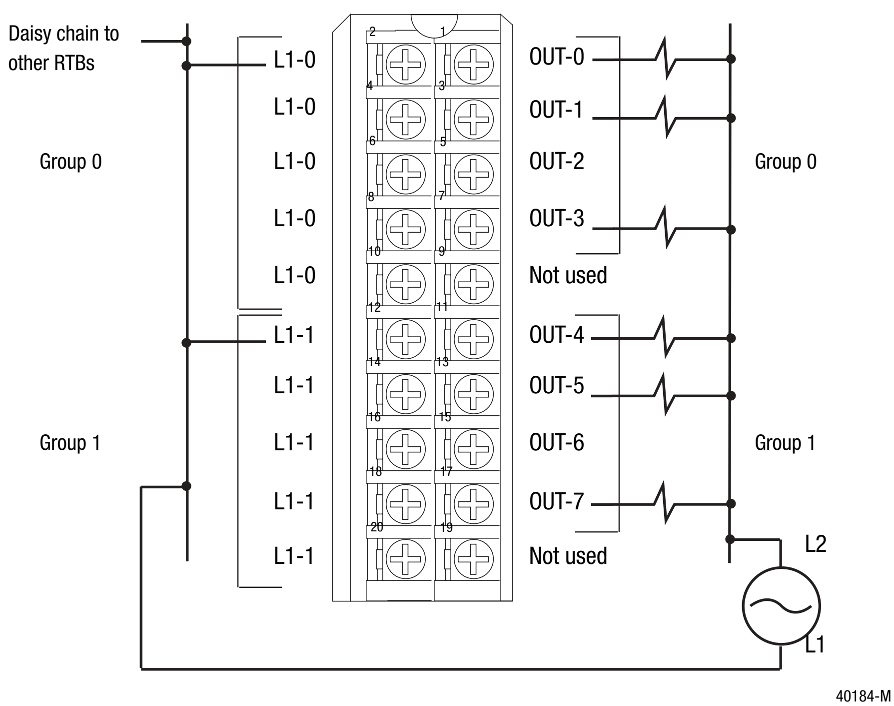
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

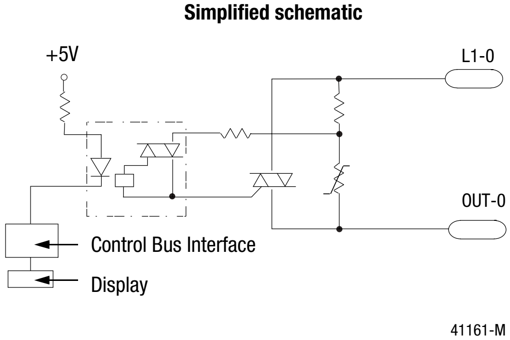
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.31

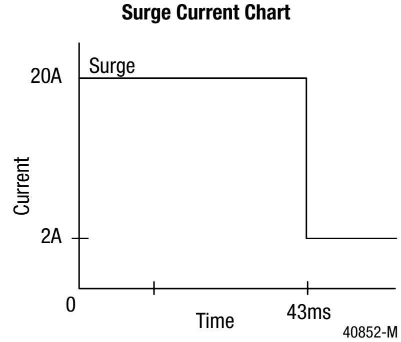
NOTES:
1. All terminals with the same name are connected together on the module. For example, L1 can be connected to any terminal marked L1-1.
2. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
3. This wiring example shows a single voltage source.
4. If separate power sources are used, do not exceed the specified isolation voltage.



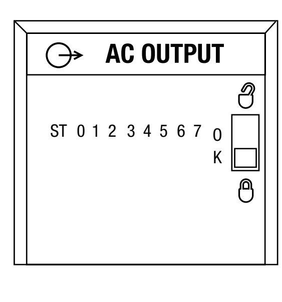
Simplified schematic



Surge Current Chart



LED indicator



1756-ON8 Specifications

Number of Outputs	8 (4 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	200mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 1.07)
Maximum Power Dissipation (Module)	5.1W @ 60°C
Thermal Dissipation	17.39 BTU/hr
Output Voltage Range	10-30V ac, current>50ma 47-63Hz 16-30V ac, current<50ma 47-63Hz
Output Current Rating Per Point Per Module	 2A maximum @ 60°C 5A maximum @ 30°C; 4A maximum @ 60°C (Linear derating)
Surge Current per Point	20A for 43ms each, repeatable every 2s @ 60°C
Min. Load Current	10mA per point
Maximum On-State Voltage Drop	1.5V peak @ 2A & 6V peak @ load current<50mA
Maximum Off-State Leakage Current	3mA per point
Commutating Voltage	4V/μs for loads>50mA 0.2V/μs for loads<50mA(1)
Output Delay Time OFF to ON ON to OFF	 9.3ms @ 60Hz: 11ms @ 50Hz 9.3ms @ 60Hz: 11ms @ 50Hz
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Not protected - Fused IFM is recommended to protect outputs (See publication 1492-2.12)
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)(2)
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded(2) 3/64 inch (1.2mm) insulation maximum 1(3), (4)
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[5] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[5] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[5] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection “n”

(1) The commutating dv/dt of the output voltage (OUTPUT to L2) should not exceed 0.2V/µs for loads under 50mA. The commutating dv/dt rating of the module for loads 50-500mA (OUTPUT TO L2) is 4V/µs maximum. If the commutating dv/dt rating of the TRIAC is exceeded, the TRIAC could latch on. If the commutating dv/dt rating is exceeded in the 10-50mA range, a resistor may be added across the output and L2. The purpose of this resistor is to increase the total output current to 50mA (I=V/R). At 50mA and above, the module has a higher commutating dv/dt rating. When adding a resistor for mthe output to L2, be sure it is rated for the power that it will dissipate (P=(V**2)/R). If the commutating dv/dt rating is exceeded in the 50-500mA range, the L1 AC waveform could be at fault. Be sure the waveform is a good sinusoid, void if any anomalies such as distorted or flattened sections.

(2) Maximum wire size will require extended housing - 1756-TBE.

(3) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(4) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(5) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OV16E

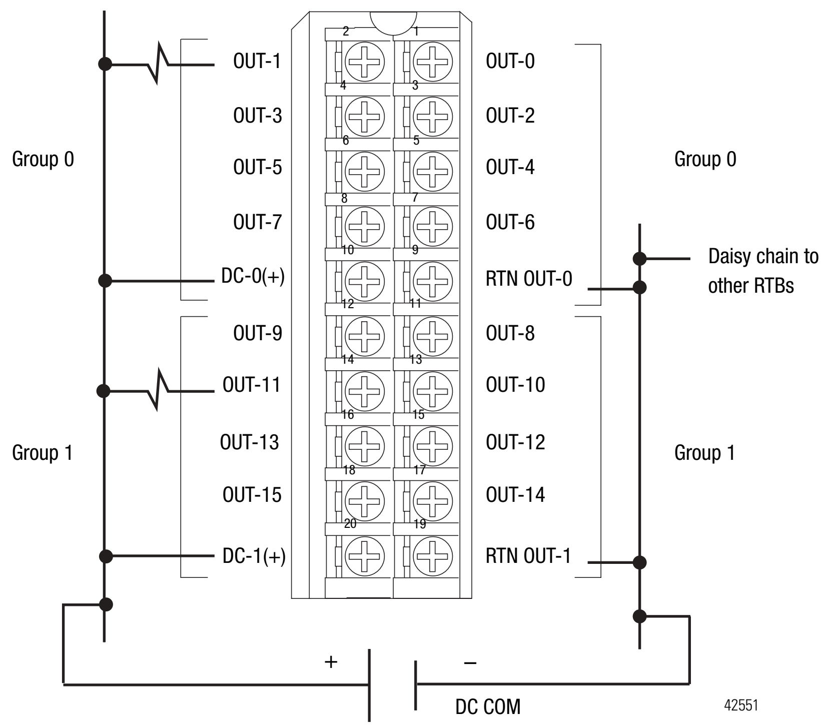
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

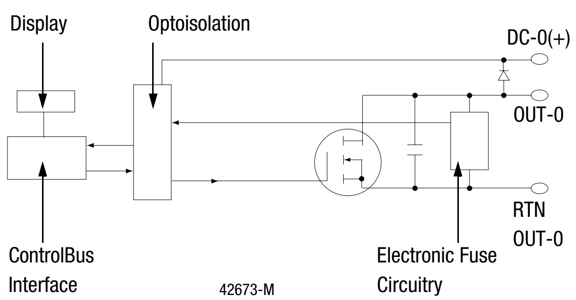
Feature	Default value	Page of description
Communications Format	CST timestamped fuse data - Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.32

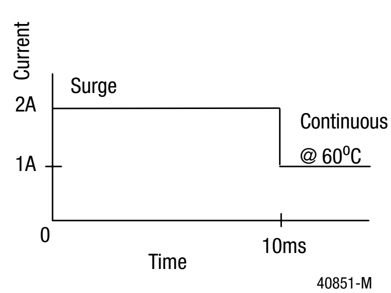
NOTES:
1. Do not physically connect more than two wires to a single RTB terminal. When you daisy chain from a group to another RTB, always connect the daisy chain as shown.
2. This wiring example shows a single voltage source.
3. If separate power sources are used, do not exceed the specified isolation voltage.
4. If separate power sources are used, do not exceed the specified isolation voltage.



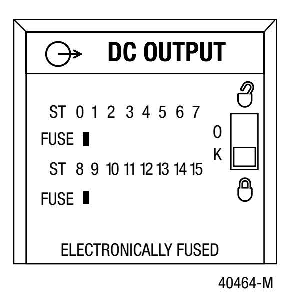
Simplified schematic



Surge Current Chart



LED indicator



1756-OV16E Specifications

Number of Outputs	16 (8 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	210mA @ 5.1V dc & 2mA @ 24V dc (Total backplane power 1.12W)
Maximum Power Dissipation (Module)	6.72W @ 60°C
Thermal Dissipation	22.94 BTU/hr
Output Voltage Range	10-30.0V dc
Output Current Rating Per Point Per Module	 1A maximum @ 60°C 8A maximum @ 60°C
Surge Current per Point	2A for 10ms each, repeatable every 2s @ 60°C
Minimum Load Current	2mA per output
Maximum On-State Voltage Drop	700mV dc @ 1A
Maximum Off-State Leakage Current	1mA per point
Output Delay Time OFF to ON ON to OFF	 75µs nominal/1ms maximum 360µs nominal/1ms maximum
Diagnostic Functions: Short Trip Timestamp of diagnostics	 5A for 20mS @ 24V dc (Output ON, then shorted) 5A for 20mS @ 24V dc (Output turned ON into short) +/- 1ms
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the CST
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Electronically fused per group
Reverse Polarity Protection	None - If module is wired incorrectly, outputs may be damaged.
Isolation Voltage Group to group User to system	 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage) 100% tested at 2546V dc for 1s (250V ac maximum continuous voltage)
RTB Screw Torque (NEMA clamp)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
RTB and Housing	20 Position RTB (1756-TBNH or TBSH)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[2] 3/64 inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	5/16 inch (8mm) maximum

Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[5] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[5] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n"

(1) Maximum wire size will require extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OV32E

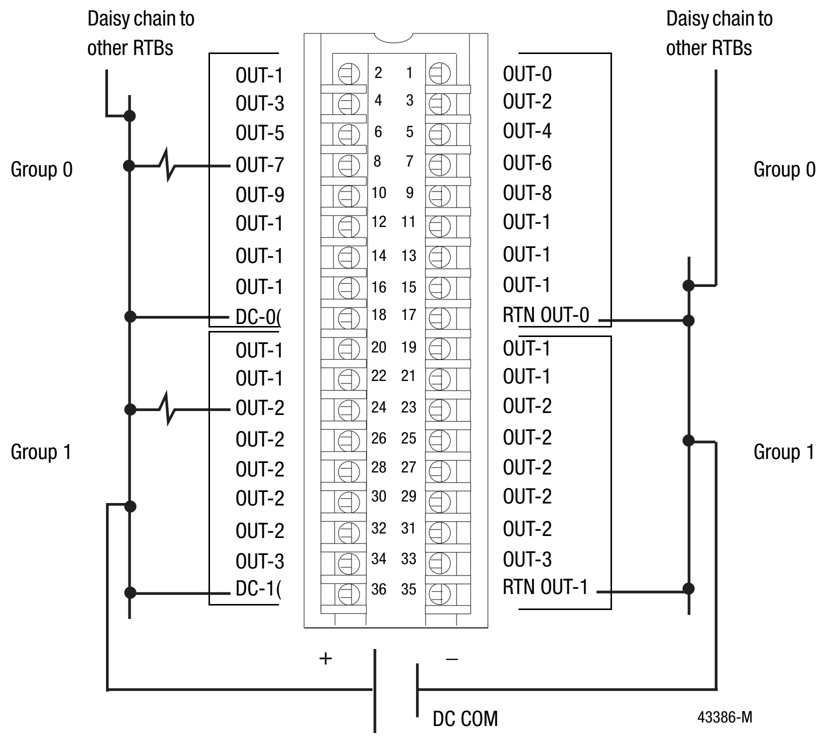
Configurable Features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

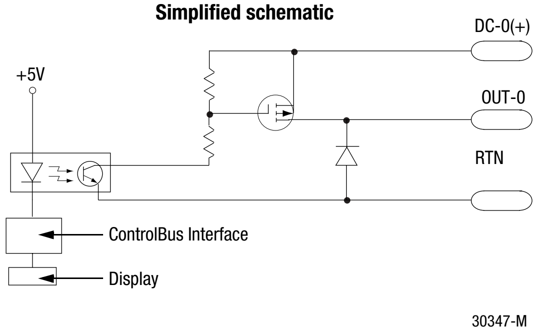
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.33

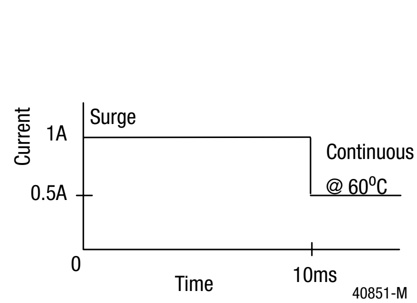
NOTES:
1. When you daisy chain from a group to another RTB, always connect the daisy chain to the terminal directly connected to the supply wire, as shown above.
2. This wiring example uses a single voltage source.
3. If separate power sources are used, do not exceed the specified isolation voltage.
4. Do not physically connect more than two wires to a single RTB terminal.



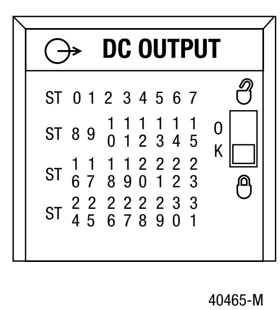
Simplified schematic



Surge Current Chart



LED indicator



1756-OV32E Specifications

Number of Outputs	32 (16 points/common)
Module Location	ControlLogix Chassis
Backplane Current	390mA @ 5.1V dc & 2.0mA @ 24V dc
Backplane Power	2.04W
Maximum Power Dissipation	5.88W @ 60° C
Thermal Dissipation	20.1 BTU/hr
Output Voltage Range	10-30.0 V dc
Nominal Input Voltage	24V dc
Output Current Rating Per Point Per Group Per Module	Derated linearly 0.35 A maximum @ 60°C & 0.5 A maximum @ 50°C 5.0 A maximum @ 60°C & 8.0 A maximum @ 50°C 10.0 A maximum @ 60°C & 16.0 A maximum @ 50°C
Surge Current per Point	2.0 A for 10ms each repeatable every2s @ 60°C
Minimum Load Current	2.0mA per output
Maximum On-State Voltage Drop	350mV dc @ 0.5A
Maximum Off-State Leakage Current	1.0mA per point
Output Delay Time OFF to ON (24V to 0V dc transition) ON to OFF (24V to 0V dc transition)	 75µs nominal; 300µs maximum 230µs nominal; 1ms maximum
Diagnostic Functions Short Trip Timestamp of Diagnostics	 5A for 20ms @ 24Vdc (Output on then shorted) 5A for 20ms @ 24V dc (Output turned on into short) ± 1.0ms
Scheduled Outputs	Synchronization within 16.7s maximum, reference to the Coordinated System Time
Configurable Fault States per Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Electronically fused per group
Reverse Polarity Protection	Yes for 60 seconds maximum @ 60 C° without circuit damage (conditional). Each output group’s power supply input requires external current limiting protection less than 15A. Time to current limit should be less than 60 seconds to afford maximum protection to the module’s circuits.
Isolation Voltage Group to Group User to System	 100% tested at 2546V dc for 1s 250V maximum continuous voltage between groups 100% tested at 2546V dc for 1s 250V maximum continuous voltage between groups
RTB Screw Torque (NEMA clamp)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
Field Wiring Arm	36 Position RTB (1756-TBCH or TBS6H)(1)

Conductors Wire Size Category	 22-14 AWG (2mm) stranded[2] 3/64-inch (1.2mm) insulation maximum 1[2], [3]
Screwdriver Blade Width for RTB	5/16-inch (8mm) maximum
Environmental Conditions	
Operational Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85°C (-40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30g
Non-operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 20V/m with 1kHz sine-wave 80%AM from 80MHz to 1000MHz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications: (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OW16I

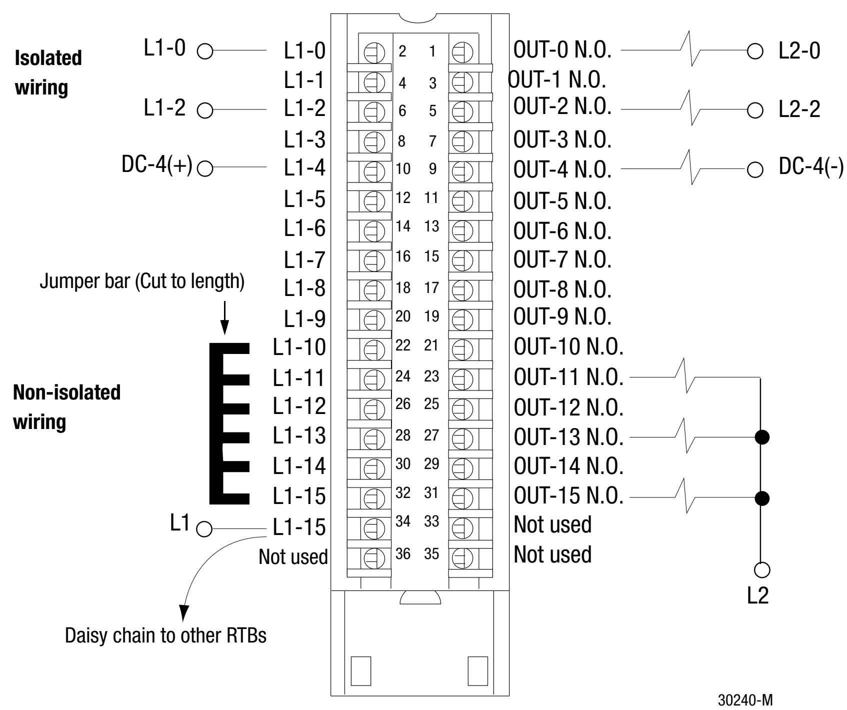
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

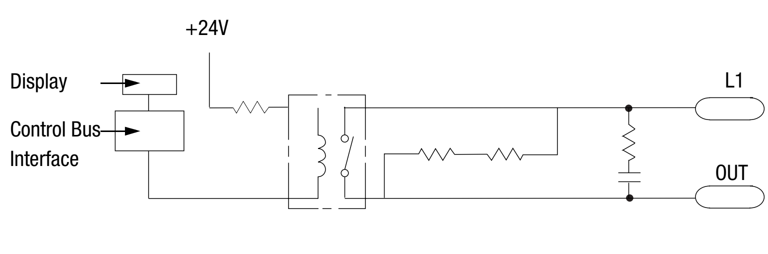
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.34

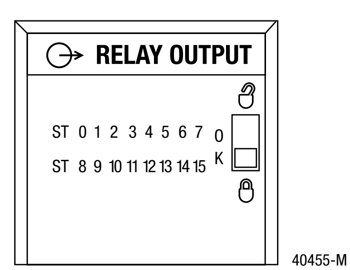
NOTES:
1. All terminals with the same name are connected together on the module. For example, L1 can be connected to either terminal marked L1-15.
2. Do not connect more than two wires to a single RTB terminal. When you use the second L1-15 terminal to daisy chain to other RTBs, always connect the daisy chain as shown.
3. When using the **jumper bar** to daisy chain terminals together as shown, the **maximum current** you may apply to the module through a **single contact point is 8A**.
4. The **jumper bar** part number is 97739201. Contact your local Rockwell Automation sales representative to order additional jumper bars, if necessary.
5. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-OW16I Specifications

Number of Outputs	16 N.O. (Contacts individually isolated)
Module Location	1756 ControlLogix Chassis
Backplane Current	150mA @ 5.1V dc & 150mA @ 24V dc (4.4W Total backplane power)
Maximum Power Dissipation (Module)	4.5W @ 60°C
Thermal Dissipation	15.35 BTU/hr
Output Voltage Range	10-265V 47-63Hz/5-150V dc
Output Voltage Range (load dependent)	5-30V dc @ 2.0A resistive 48V dc @ 0.5A resistive 125V dc @ 0.25A resistive 125V ac @ 2.0A resistive 240V ac @ 2.0A resistive
UL Ratings	C300, R150 Pilot Duty
Minimum Load Current	10mA per point
Initial Contact Resistance	30mΩ
Switching Frequency	1 operation/3s (0.3Hz at rated load) maximum
Bounce Time	1.2ms (mean)
Expected Contact Life	300k cycles resistive/100k cycles inductive
Maximum Off-State Leakage Current	1.5mA per point
Output Delay Time OFF to ON ON to OFF	 10ms maximum 10ms maximum
Scheduled Outputs	Synchronization within 16.7 seconds maximum, reference to the Coordinated System Time
Output Current Rating (at rated power)	Resistive / Inductive 2A @ 5-30V dc / 2.0A steady state @ 5-30V dc 0.5A @ 48V dc / 0.5A steady state @ 48V dc 0.25A @ 125V dc / 0.25A steady state @ 125V dc 2A @ 125V ac / 2.0A steady state, 15A make @ 125V ac 2A @ 240V ac / 2.0A steady state, 15A make @ 240V ac
Power Rating (steady state)	250W maximum for 125V ac resistive output 480W maximum for 240V ac resistive output 60W maximum for 30V dc resistive output 24W maximum for 48V dc resistive output 31W maximum for 125V dc resistive output 250VA maximum for 125V ac inductive output 480VA maximum for 240V ac inductive output 60VA maximum for 30V dc inductive output 24VA maximum for 48V dc inductive output 31VA maximum for 125V dc inductive output
Configurable Fault States/Point	Hold Last State, ON or OFF (OFF is the default)
Configurable States in Program Mode per Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Not protected - Fused IFM can be used to protect outputs (See publication 1492-2.12). The Bulletin 1492 IFM may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of this product.
Isolation Voltage User to system	 250V maximum continuous 100% tested at 2546V dc for 1s
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]

Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[4] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" when conformal coated

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

1756-OX8I

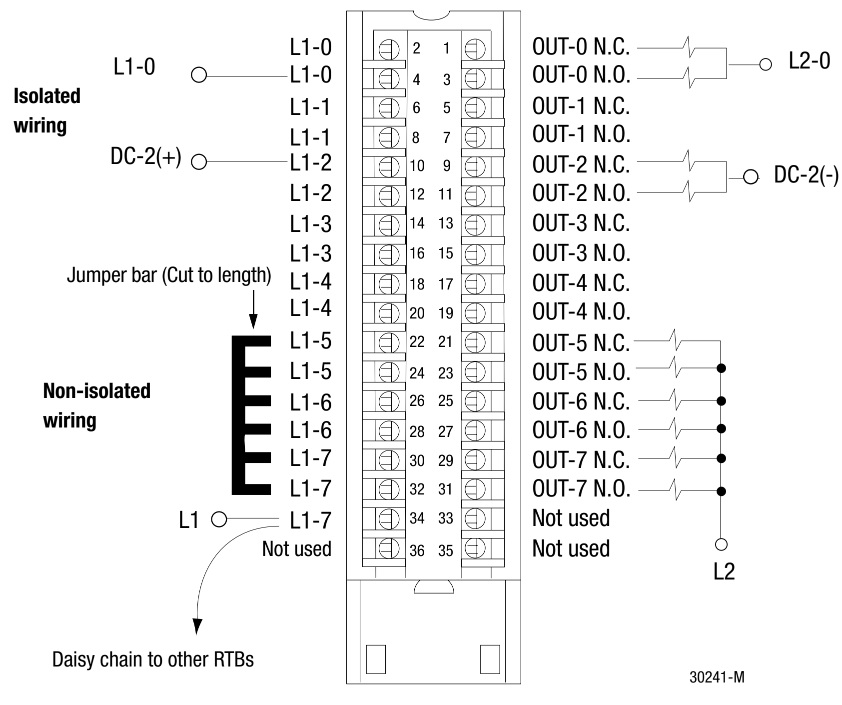
Module features

The following table lists the configurable features this module supports, the default value and the page of the feature's description:

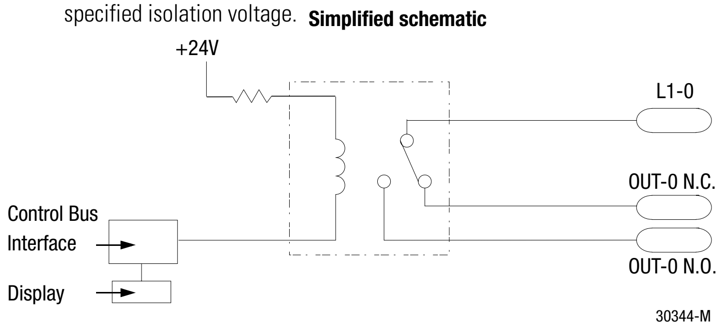
Feature	Default value	Page of description
Communications Format	Output data	6-6
Output State in Program Mode	Off	6-11
Output State in Fault Mode	Disabled	6-11
Transition from Program State to Fault State	Off	6-11

Figure 7.35

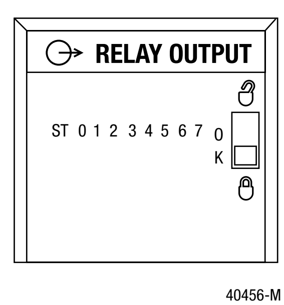
NOTES:
1. All terminals with the same name are connected together on the module. For example, L1-0 can be connected to either terminal marked L1-0.
2. Do not physically connect more than two wires to a single RTB terminal. When you use the third L1-7 terminal to daisy chain to other RTBs, always connect the daisy chain to the terminal directly connected to the supply wire, as shown.
3. When using the **jumper bar** to daisy chain terminals together as shown, the **maximum current** you may apply to the module through a **single contact point is 8A**.
4. The **jumper bar** part number is 97739201. Contact your local Rockwell Automation sales representative to order additional jumper bars, if necessary.
5. If separate power sources are used, do not exceed the specified isolation voltage.



Simplified schematic



LED indicator



1756-OX8I Specifications

Number of Outputs	8 N.O. & 8 N.C. (2 points/common)
Module Location	1756 ControlLogix Chassis
Backplane Current	100mA @ 5.1V dc & 100mA @ 24V dc
Backplane Power	2.9W
Maximum Power Dissipation (Module)	3.1W @ 60°C
Thermal Dissipation	10.57 BTU/hr
Output Voltage Range	10-265V 47-63Hz/5-150V dc
Output Voltage Range (load dependent)	5-30V dc @ 2.0A resistive 48V dc @ 0.5A resistive 125V dc @ 0.25A resistive 125V ac @ 2.0A resistive 240V ac @ 2.0A resistive
Output Current Rating (at rated power)	Resistive / Inductive 2A @ 5-30V dc / 2.0A steady state @ 5-30V dc 0.5A @ 48V dc / 0.5A steady state @ 48V dc 0.25A @ 125V dc / 0.25A steady state @ 125V dc 2A @ 125V ac / 2.0A steady state, 15A make @ 125V ac 2A @ 240V ac / 2.0A steady state, 15A make @ 240V ac
Power Rating (steady state)	250W maximum for 125V ac resistive output 480W maximum for 240V ac resistive output 60W maximum for 30V dc resistive output 24W maximum for 48V dc resistive output 31W maximum for 125V dc resistive output 250VA maximum for 125V ac inductive output 480VA maximum for 240V ac inductive output 60VA maximum for 30V dc inductive output 24VA maximum for 48V dc inductive output 31VA maximum for 125V dc inductive output
UL Ratings	C300, R150 Pilot Duty
Minimum Load Current	10mA/point
Initial Contact Resistance	30mΩ
Switching Frequency	1 operation/3s (0.3Hz at rated load) maximum
Bounce Time	1.2ms (mean)
Expected Contact Life	300k cycles resistive/100k cycles inductive
Maximum Off-State Leakage Current	0mA
Output Delay Time OFF to ON ON to OFF	 13ms maximum 13ms maximum
Scheduled Outputs	Synchronization within 16.7 seconds maximum, reference to the Coordinated System Time
Configurable Fault States/Point	Hold Last State, ON or OFF (OFF is the default)
Config. States in Program Mode/Point	Hold Last State, ON or OFF (OFF is the default)
Fusing	Not protected - Fused IFM is recommended to protect outputs (See publication 1492-2.12)
Isolation Voltage Channel to channel User to system	 100% tested at 2546V dc for 1s (265V ac maximum continuous voltage between channels) 100% tested at 2546V dc for 1s
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm) maximum
Module Keying (Backplane)	Software configurable
RTB Keying	User defined mechanical keying
Field Wiring Arm and Housing	36 Position RTB (1756-TBCH or TBS6H)[1]
Conductors Wire Size Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[1] 3/64 inch (1.2mm) insulation maximum 1[2], [3]

Screwdriver Blade Width for RTB	1/8 inch (3.2mm) maximum
Environmental Conditions	
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): –40 to 85°C (–40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Oscillatory Surge Withstand	IEEE C37.90.1: 3kV
Enclosure Type Rating	None (open-style)
Certifications (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations CE[4] European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick[4] Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions EEx[4] European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection “n” when conformal coated

(1) Maximum wire size requires extended housing - 1756-TBE.

(2) Use this conductor category information for planning conductor routing as described in the system level installation manual.

(3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.

(4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

Chapter Summary and What's Next

In this chapter you learned about module specific information. Move on to Chapter 8, Troubleshooting Your Module.

Notes:

Troubleshooting Your Module

What This Chapter Contains

This chapter describes the status indicators on the ControlLogix digital modules and how to use them to troubleshoot the module.

Table 8.1

For information about:	See page:
Using Indicators to Troubleshoot Your Module	8-1
Using RSLogix 5000 to Troubleshoot Your Module	8-5

Using Indicators to Troubleshoot Your Module

Each ControlLogix I/O module has indicators which show individual I/O state (yellow), fault, or fuse status (red). A bi-colored LED indicates module status with an "OK" (red/green). Status indicators are located on the front of the module.

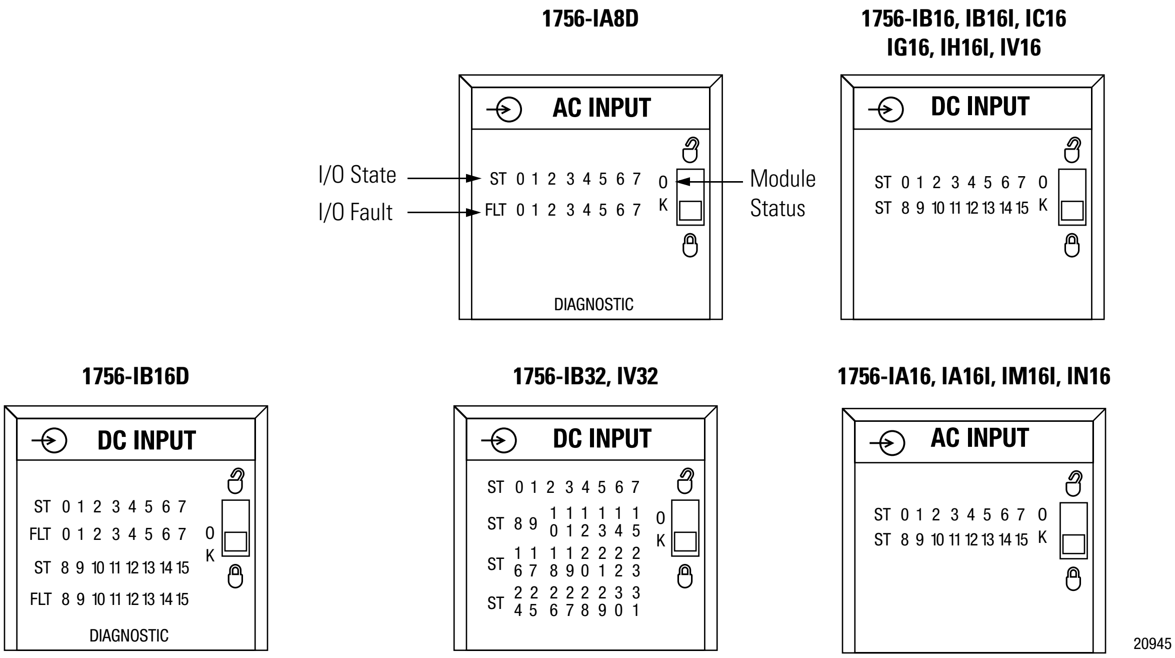
Status Indicators for Input Modules

Table 8.2 Status Indicators for Input Modules

Status indicators:	This display:	Means:	Take this action:
OK	Green light	The inputs are being multicast and in normal operating state.	None
OK	Flashing green light	The module has passed internal diagnostics but is not multicasting inputs or it is inhibited.	None
OK	Flashing red light	Previously established communication has timed out.	Check controller and chassis communication.
OK	Red light	The module must be replaced.	Replace the module.
I/O State	Yellow	The input is active.	None
I/O Fault	Red	A fault has occurred for this point.	Check this point at the controller.

The status indicators shown in Figure 8.1 are used on input modules:

Figure 8.1



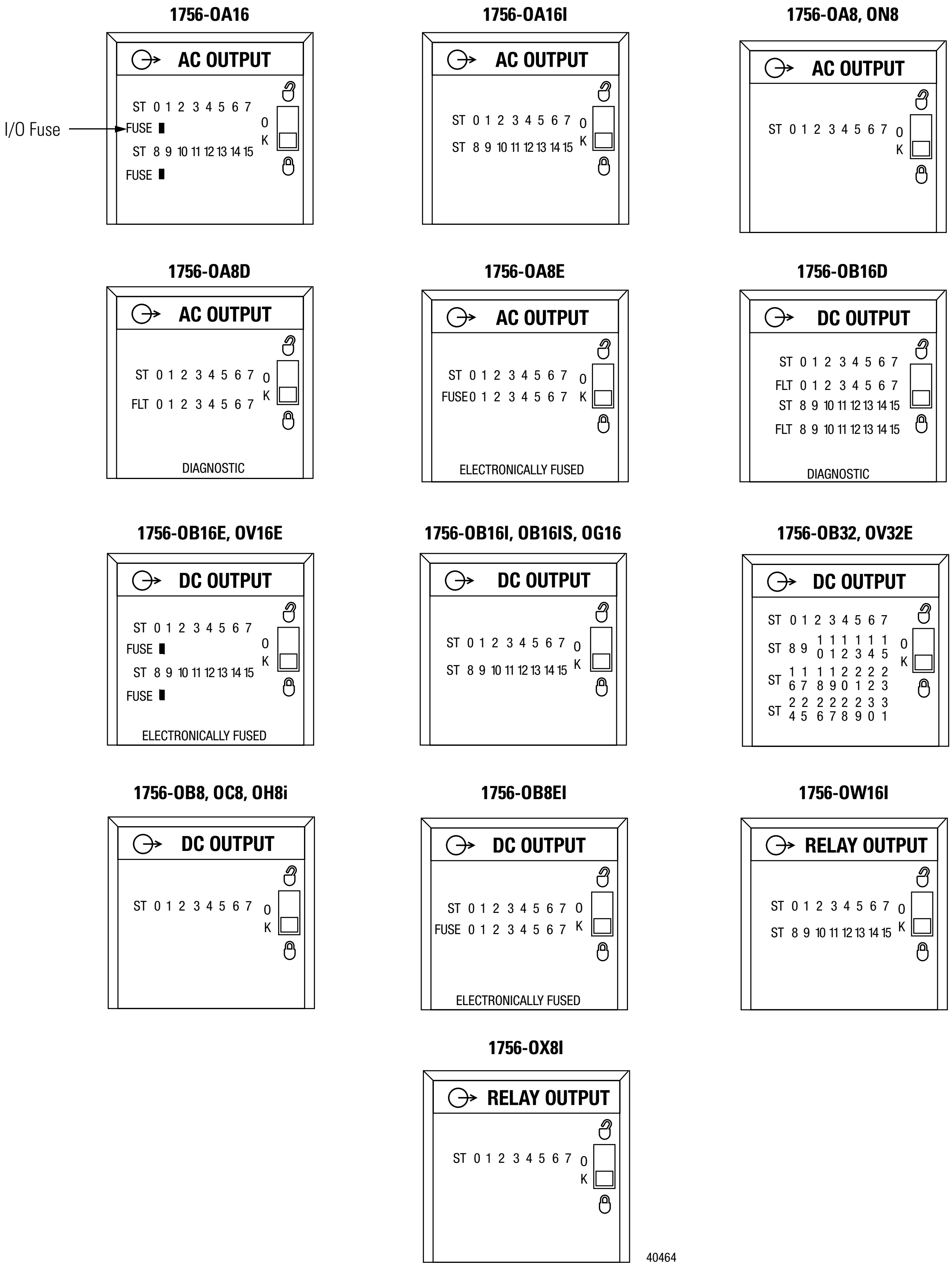
Status Indicators for Output Modules

Table 8.3 Status Indicators for Output Modules

LED indicators	This display:	Means:	Take this action:
OK	Steady green light	The outputs are actively being controlled by a system processor.	None
OK	Flashing green light	The module has passed internal diagnostics but is not actively controlled or it is inhibited.	None
OK	Flashing red light	Previously established communication has timed out.	Check controller and chassis communication.
OK	Steady red light	The module must be replaced.	Replace the module.
I/O State	Yellow	The output is active.	None
I/O Fuse	Red	A short overload fault has occurred for a point in this group.	Check wiring for short overload. Check the module properties in RSLogix 5000 and reset the fuse.
I/O Fault	Red	A fault has occurred for this point.	Check this point at the controller.

The status indicators shown in Figure 8.2 are used on output modules.

Figure 8.2


1756-OA16
AC OUTPUT
ST 0 1 2 3 4 5 6 7
FUSE
ST 8 9 10 11 12 13 14 15
FUSE
OK
I/O Fuse
1756-OA16I
AC OUTPUT
ST 0 1 2 3 4 5 6 7
ST 8 9 10 11 12 13 14 15
OK
1756-OA8, ON8
AC OUTPUT
ST 0 1 2 3 4 5 6 7
OK
1756-OA8D
AC OUTPUT
ST 0 1 2 3 4 5 6 7
FLT 0 1 2 3 4 5 6 7
OK
DIAGNOSTIC
1756-OA8E
AC OUTPUT
ST 0 1 2 3 4 5 6 7
FUSE 0 1 2 3 4 5 6 7
OK
ELECTRONICALLY FUSED
1756-OB16D
DC OUTPUT
ST 0 1 2 3 4 5 6 7
FLT 0 1 2 3 4 5 6 7
ST 8 9 10 11 12 13 14 15
FLT 8 9 10 11 12 13 14 15
DIAGNOSTIC
1756-OB16E, OV16E
DC OUTPUT
ST 0 1 2 3 4 5 6 7
FUSE
ST 8 9 10 11 12 13 14 15
FUSE
OK
ELECTRONICALLY FUSED
1756-OB16I, OB16IS, OG16
DC OUTPUT
ST 0 1 2 3 4 5 6 7
ST 8 9 10 11 12 13 14 15
OK
1756-OB32, OV32E
DC OUTPUT
ST 0 1 2 3 4 5 6 7
ST 8 9 10 11 12 13 14 15
ST 16 17 18 19 20 21 22 23
ST 24 25 26 27 28 29 30 31
OK
1756-OB8, OC8, OH8i
DC OUTPUT
ST 0 1 2 3 4 5 6 7
OK
1756-OB8EI
DC OUTPUT
ST 0 1 2 3 4 5 6 7
FUSE 0 1 2 3 4 5 6 7
OK
ELECTRONICALLY FUSED
1756-OW16I
RELAY OUTPUT
ST 0 1 2 3 4 5 6 7
ST 8 9 10 11 12 13 14 15
OK
1756-OX8I
RELAY OUTPUT
ST 0 1 2 3 4 5 6 7
OK
40464

Using RSLogix 5000 to Troubleshoot Your Module

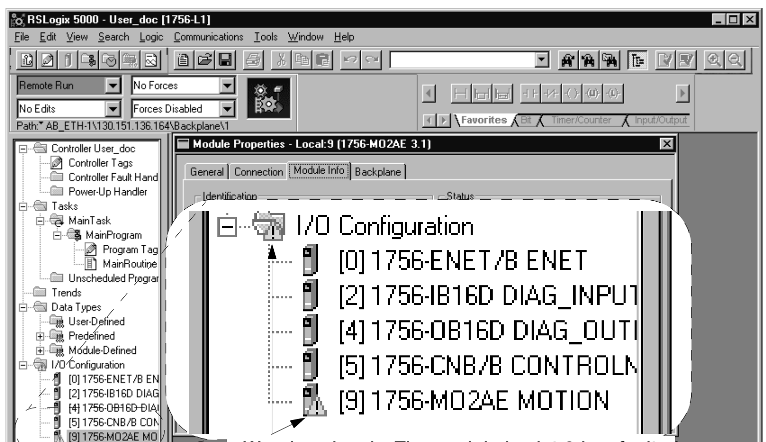
In addition to the LED display on the module, RSLogix 5000 will alert you to fault and other conditions. You will be alerted in one of three ways:

- Warning signal on the main screen next to the module-This occurs when the connection to the module is broken
- Message in a screen's status line
- Notification in the Tag Editor - General module faults are also reported in the Tag Editor. Diagnostic faults are **only** reported in the Tag Editor
- Status on the Module Info page

The screens below display fault notification in RSLogix 5000.

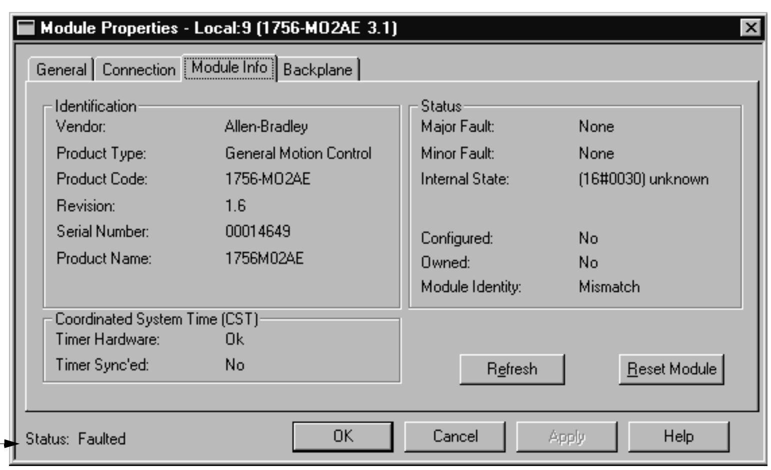
Warning signal on main screen

Warning icon when a communications fault occurs or if the module is inhibited



Warning signal - The module in slot 9 has faulted

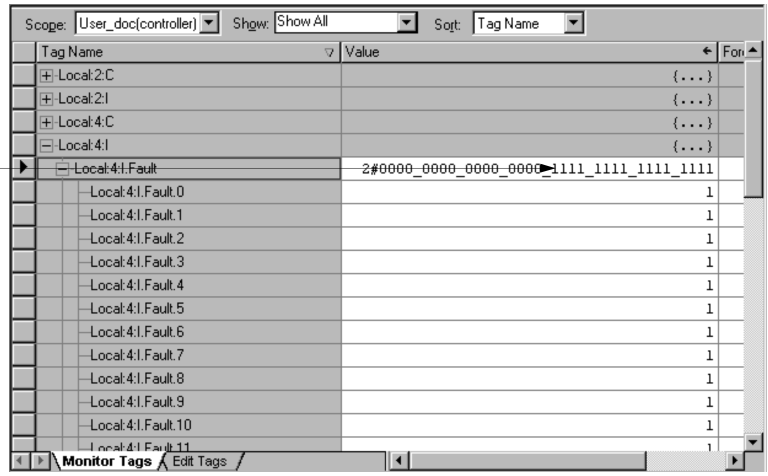
Fault message in status line



Status line provides information on the module's fault and on the connection to the module

Notification in Tag Editor

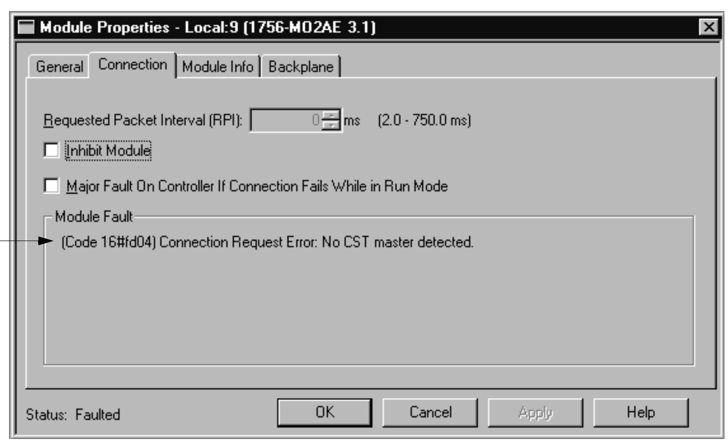
A fault has occurred for any point that lists the number 1 in the Fault line



Determining Fault Type

When you are monitoring a module's configuration properties in RSLogix 5000 and receive a Communications fault message, the Connection page lists the type of fault.

The fault type is listed here



For a detailed listing of the possible faults, their causes and suggested solutions, see Module Faults in the online help.

Chapter Summary and What's Next

In this chapter you learned about troubleshooting the module.

Appendix A explains Tag Definitions.

Notes:

Tag Definitions

Module Tag Names and Definitions

The set of tags associated with any module depends on the type of module and the Communications Format chosen during configuration.

Standard Input Module Tags

Tables A.1 and A.2 list and define all tags that may be used for ControlLogix standard digital input modules. Input modules have two types of tags:

- configuration
- input data.

IMPORTANT The table below lists all possible standard input module tags. In each application, though, the series of tags varies, depending on how the module is configured.

Configuration Tags

Table A.1 Standard Input Module Configuration Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
COSOnOffEn (1bit per point)	Configuration	**Change of State ON to OFF** – Triggers an event in the controller for ON to OFF transition of input point and causes the input module to update the data table as soon as possible. The CST timestamp is also updated. 0 = disable 1 = enable
COS OffOnEn (1 bit per point)	Configuration	**Change of State OFF to ON** – Triggers an event in the controller for OFF to ON transition of input point and causes the input module to update the data table as soon as possible. The CST timestamp is also updated. 0 = disable 1 = enable
FilterOnOff_0_7 etc. (1 byte per group)	Configuration	Filter Times ON to OFF – Filter time for digital filter in digital input modules for ON to OFF transition. Operates on groups of 8 points. Valid DC filter times=0, 1, 2, 9, 18ms Valid AC filter times=1, 2ms

Table A.1 Standard Input Module Configuration Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
FilterOffOn_0_7 etc. (1 byte per group)	Configuration	**Filter Times OFF to ON** – Filter time for digital filter in digital input modules for OFF to ON transition. Operates on groups of 8 points. Valid DC filter times=0, 1, 2ms Valid AC filter times=1, 2ms

Input Data Tags

Table A.2
Standard Input Module Input Data Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
CSTTimestamp (8 bytes)	Input data	**Coordinated System Time Timestamp** – Timestamp can be configured to indicate the time that data changed (see COSOffOnEn, COSOnOffEn, COSStatus, DiagCOSDisable) and/or the time that a diagnostic fault occurred (see OpenWireEn, FieldPwrLossEn).
Data (1 bit per point)	Input data	Off/On status for the input point. 0 = Off 1 = On
Fault (1 bit per point)	Input data	This is an ordered status of faults which indicates that a point is faulted and input data for that point may be incorrect. Check other diagnostic faults, if they are available, for further diagnosis of the root cause. If communication to the input module is lost, then all points for the module will be faulted. 0 = no fault 1 = fault (OpenWire or FieldPwrLoss or Comm Fault)

Standard Output Module Tags

Tables A.3 to A.5 list and define all tags that may be used for ControlLogix standard digital output modules. Output modules have three types of tags

- configuration
- input data
- output data.

IMPORTANT The table below lists all possible standard output module tags. In each application, though, the series of tags varies, depending on how the module is configured.

Configuration Tags

Table A.3 Standard Output Module Configuration Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
FaultMode (1 bit per point)	Configuration	**Fault Mode** – Used in conjunction with FaultValue to configure the state of outputs when a communications fault occurs. See FaultValue. 0 = Use FaultValue (OFF or ON) 1 = Hold Last State
FaultValue (1 bit per point)	Configuration	**Fault Value** – Used in conjunction with FaultMode to configure the state of outputs when a communications fault occurs. See FaultMode. 0 = OFF 1 = ON
ProgMode (1 bit per point)	Configuration	**Program Mode** – Used in conjunction with ProgValue to configure the state of outputs when the controller is in Program Mode. See ProgValue. 0 = Use ProgValue (OFF or ON) 1 = Hold Last State
ProgValue (1 bit per point)	Configuration	**Program Value** – Used in conjunction with ProgMode to configure the state of outputs when the controller is in Program Mode. See ProgMode. 0 = Off 1 = On
ProgToFaultEn (1 byte per module)	Configuration	**Program to Fault Transition** – Diagnostic enables the transitioning of outputs to FaultMode if a communications failure occurs in Program Mode. Otherwise outputs will remain in ProgramMode. See ProgMode, ProgValue, FaultMode, FaultValue. 0 = outputs stay in ProgramMode if comm failure 1 = outputs got to FaultMode if comm failure

Input Data Tags

Table A.4 Standard Output Module Input Data Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
CSTTimestamp (8 bytes)	Input data	**Coordinated System Time Timestamp** – Timestamp of diagnostic input data including fusing (see BlownFuse, NoLoad, OutputVerifyFault, FieldPwrLoss), which is updated whenever a diagnostic fault occurs or goes away.
Data (1 bit per point)	Input data	**Data** – Off/On status for the output point ECHOED back from the output module. This is used to verify proper communication only No field side verification is done. For field side verification, see OutputVerifyFault. 0 = Off 1 = On
Fault (1 bit per point)	Input data	This is an ordered status of faults which indicates that a point is faulted and I/O data for that point may be incorrect. Check other diagnostic faults, if they are available, for further diagnosis of the root cause. If communication to the input module is lost, then all points for the module will be faulted. 0 = no fault 1 = fault (FuseBlown, NoLoad, OutputVerifyFault, FieldPwrLoss, or CommFault)
FuseBlown. (1 bit per point)	Input Data	Fuse is Blown – An electronic or mechanical fuse has detected a short or overload condition for an output point. All FuseBlown conditions are latched and must be reset by the User. 0 = no fault 1 = fault

Output Data Tags

Table A.5 Standard Output Module Output Data Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
CSTTimestamp (8 bytes)	Output data	**Coordinated System Time Timestamp** – Timestamp to be used with Scheduled Outputs and Coordinated System Time (CST). Used to synchronize outputs across the system by indicating the time (CST Timestamp) at which the output module is to apply its outputs.
Data (1 bit per point)	Output data	Off/On status for the output point. originating from the controller 0 = Off 1 = On

Diagnostic Input Module Tags

Tables A.6 and A.7 list and define all tags that may be used for ControlLogix diagnostic digital input modules. Input modules have two types of tags

- configuration
- input data.

IMPORTANT The table below lists all possible diagnostic input module tags. In each application, though, the series of tags varies, depending on how the module is configured.

Configuration Tags

Table A.6
Diagnostic Input Module Configuration Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
COSOnOffEn (1bit per point)	Configuration	**Change of State ON to OFF** – Triggers an event in the controller for ON to OFF transition of input point and causes the input module to update the data table as soon as possible. The CST timestamp is also updated. 0 = disable 1 = enable
COS OffOnEn (1 bit per point)	Configuration	**Change of State OFF to ON** – Triggers an event in the controller for OFF to ON transition of input point and causes the input module to update the data table as soon as possible. The CST timestamp is also updated. 0 = disable 1 = enable
DiagCOSDisable (per module)	Configuration	**Diagnostic Change of State** – Triggers the module to transmit diagnostic status data with an updated timestamp as soon as the diagnostic data changes state

Table A.6
Diagnostic Input Module Configuration Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
FaultLatchEn (1 bit per point)	Configuration	**Fault is Latched** – If enabled for a point, any OpenWire or FieldPwrLoss will stay latched in the faulted state even if the fault no longer exists until the User clears the fault. 0 = disable 1 = enable latching
FieldPwrLossEn (1 bit per point)	Configuration	**Field Power Loss** – Enables Field Power Loss diagnostic. 0 = disable 1 = enable
FilterOnOff_0_7 etc. (1 byte per group)	Configuration	Filter Times ON to OFF – Filter time for digital filter in digital input modules for ON to OFF transition. Operates on groups of 8 points. Valid DC filter times=0, 1, 2, 9, 18ms Valid AC filter times=1, 2ms
FilterOffOn_0_7 etc. (1 byte per group)	Configuration	**Filter Times OFF to ON** – Filter time for digital filter in digital input modules for OFF to ON transition. Operates on groups of 8 points. Valid DC filter times=0, 1, 2ms Valid AC filter times=1, 2ms
OpenWireEn (1 bit per point)	Configuration	**Open Wire** – Enables Open Wire diagnostic. 0 = disable 1 = enable

Input Data Tags

Table A.7
Diagnostic Input Module Input Data Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
CSTTimestamp (8 bytes)	Input data	**Coordinated System Time Timestamp** – Timestamp can be configured to indicate the time that data changed (see COSOffOnEn, COSOnOffEn, COSStatus, DiagCOSDisable) and/or the time that a diagnostic fault occurred (see OpenWireEn, FieldPwrLossEn).
Data (1 bit per point)	Input data	Off/On status for the input point. 0 = Off 1 = On
Fault (1 bit per point)	Input data	This is an ordered status of faults which indicates that a point is faulted and input data for that point may be incorrect. Check other diagnostic faults, if they are available, for further diagnosis of the root cause. If communication to the input module is lost or inhibited, then all points for the module will be faulted by the processor. 0 = no fault 1 = fault (OpenWire or FieldPwrLoss or Comm Fault)
FieldPwrLoss (1 bit per point)	Input Data	**Field Power Loss** – AC input diagnostic detects that field power has failed or is disconnected from the module. Open Wire will also be detected. 0 = no fault 1 = fault
OpenWire (1 bit per point)	Input data	**Open Wire** – Diagnostic which detects that a wire has been disconnected from the input point. If a group of points all show this fault, then possibly the return (L1 or GND) is missing from the module. Also see FieldPwrLoss. 0 = no fault 1 = fault

Diagnostic Output Module Tags

Tables A.8 to A.10 list and define all tags that may be used for ControlLogix diagnostic digital output modules. Output modules have three types of tags

- configuration
- input data
- output data.

IMPORTANT The table below lists all possible diagnostic output module tags. In each application, though, the series of tags varies, depending on how the module is configured.

Configuration Tags

Table A.8 Diagnostic Output Module Configuration Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
FaultLatchEn (1 bit per point)	Configuration	**Fault is Latched** – If enabled for a point, any NoLoad, OutputVerifyFault or FieldPwrLoss will stay latched in the faulted state even if the fault no longer exists until the User clears the fault. This does not affect FuseBlown; it is always latched. 0 = disable 1 = enable latching
FaultMode (1 bit per point)	Configuration	**Fault Mode** – Used in conjunction with FaultValue to configure the state of outputs when a communications fault occurs. See FaultValue. 0 = Use FaultValue (OFF or ON) 1 = Hold Last State
FaultValue (1 bit per point)	Configuration	**Fault Value** – Used in conjunction with FaultMode to configure the state of outputs when a communications fault occurs. See FaultMode. 0 = OFF 1 = ON
FieldPwrLossEn (1 bit per point)	Configuration	**Field Power Loss** – Enables Field Power Loss diagnostic. 0 = disable 1 = enable
NoLoadEn (1 bit per point)	Configuration	**No Load** – Enables No Load diagnostic. 0 = disable 1 = enable
OutputVerifyEn (1 bit per point)	Configuration	**Output Verify** – Enables Output Verify diagnostic. 0 = disable 1 = enable

Table A.8 Diagnostic Output Module Configuration Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
ProgMode (1 bit per point)	Configuration	**Program Mode** – Used in conjunction with ProgValue to configure the state of outputs when the controller is in Program Mode. See ProgValue. 0 = Use ProgValue (OFF or ON) 1 = Hold Last State
ProgValue (1 bit per point)	Configuration	**Program Value** – Used in conjunction with ProgMode to configure the state of outputs when the controller is in Program Mode. See ProgMode. 0 = Off 1 = On
ProgToFaultEn (1 byte per module)	Configuration	**Program to Fault Transition** – Diagnostic enables the transitioning of outputs to FaultMode if a communications failure occurs in Program Mode. Otherwise outputs will remain in ProgramMode. See ProgMode, ProgValue, FaultMode, FaultValue. 0 = outputs stay in ProgramMode if comm failure 1 = outputs got to FaultMode if comm failure

Input Data Tags

Table A.9 Diagnostic Output Module Input Data Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
CSTTimestamp (8 bytes)	Input data	**Coordinated System Time Timestamp** – Timestamp of diagnostic input data including fusing (see BlownFuse, NoLoad, OutputVerifyFault, FieldPwrLoss), which is updated whenever a diagnostic fault occurs or goes away.
Data (1 bit per point)	Input data	**Data** – Off/On status for the output point ECHOED back from the output module. This is used to verify proper communication only No field side verification is done. For field side verification, see OutputVerifyFault. 0 = Off 1 = On
Fault (1 bit per point)	Input data	This is an ordered status of faults which indicates that a point is faulted and I/O data for that point may be incorrect. Check other diagnostic faults, if they are available, for further diagnosis of the root cause. If communication to the input module is lost or inhibited, then all points for the module will be faulted by the processor. 0 = no fault 1 = fault (FuseBlown, NoLoad, OutputVerifyFault, FieldPwrLoss, or CommFault)
FieldPwrLoss (1 bit per point)	Input Data	**Field Power Loss** – AC output diagnostic detects that field power has failed or is disconnected from the module. No Load will also be detected. 0 = no fault 1 = fault

Table A.9 Diagnostic Output Module Input Data Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
FuseBlown. (1 bit per point)	Input Data	**Fuse is Blown** – An electronic or mechanical fuse has detected a short circuit condition for an output point. All FuseBlown conditions are latched and must be reset by the User. 0 = no fault 1 = fault
NoLoad (1 bit per group)	Input data	**No Load** – Diagnostic which indicates the absence of a load (e.g. the wire is disconnected from the module). This diagnostic only operates in the OFF state. 0 = no fault 1 = fault
OutputVerifyFault (1 bit per point)	Input data	**Output Verify** – Diagnostic which indicates that the output has been commanded to the ON state but the output has not been verified to be ON. 0 = no fault 1 = fault (output is not ON)

Output Data Tag

Table A.10
Diagnostic Output Module Output Data Tags

Name (as listed in the Tag Editor):	Configuration or I/O Data:	Definition:
CSTTimestamp (8 bytes)	Output data	**Coordinated System Time Timestamp** – Timestamp to be used with Scheduled Outputs and Coordinated System Time (CST). Used to synchronize outputs across the system by indicating the time (CST Timestamp) at which the output module is to apply its outputs.
Data (1 bit per point)	Output data	Off/On status for the output point. originating from the controller 0 = Off 1 = On

Using Ladder Logic To Perform Run Time Services and Reconfiguration

You can use ladder logic to perform run time services on your module. For example, page 6-19 shows how to reset an electronic fuse on the 1756-OA8D module using RSLogix 5000. This appendix provides an example of how to reset the same fuse **without using RSLogix 5000.**

In addition to performing run time services, you can use ladder logic to change configuration. Chapter 6 explained how to use the RSLogix 5000 software to set configuration parameters in your ControlLogix analog I/O module. Some of those parameters may also be changed through ladder logic.

Using Message Instructions

In ladder logic, you can use Message instructions to send occasional services to any ControlLogix I/O module. Message instructions send an explicit service to the module, causing specific behavior to occur, for example, unlatching a high alarm.

Message instructions maintain the following characteristics:

- messages use unscheduled portions of system communications bandwidth
- one service is performed per instruction
- performing module services does not impede module functionality, such as sampling inputs or applying new outputs

Processing Real-Time Control and Module Services

Services sent via message instructions are not as time critical as the module behavior defined during configuration and maintained by a real-time connection. Therefore, the module processes messaging services only after the needs of the I/O connection have been met.

For example, you may want to unlatch all process alarms on the module, but real-time control of your process is still occurring using the input value from that same channel. Because the input value is critical to your application, the module prioritizes the sampling of inputs ahead of the unlatch service request.

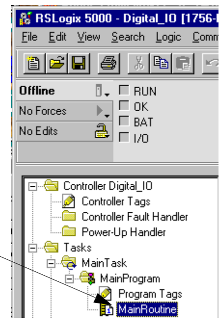
This prioritization allows input channels to be sampled at the same frequency and the process alarms to be unlatched in the time between sampling and producing the real-time input data.

One Service Performed Per Instruction

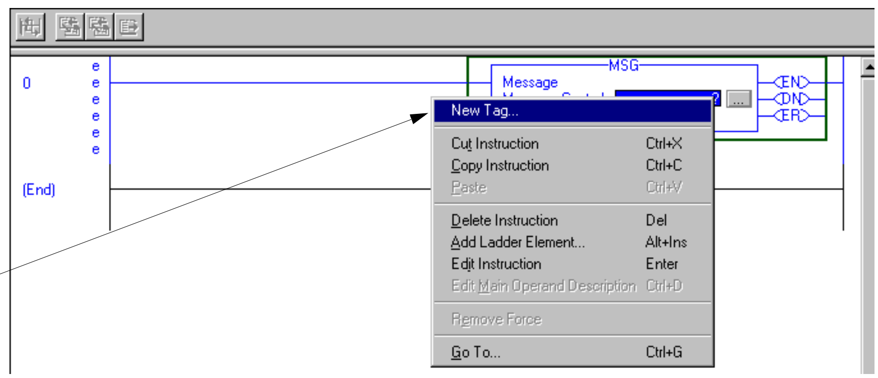
Message instructions will only cause a module service to be performed once per execution. For example, if a message instruction sends a service to the module to unlatch the high high alarm on a particular channel, that channel's high high alarm will unlatch, but may be set on a subsequent channel sample. The message instruction must then be reexecuted to unlatch the alarm a second time.

Creating a New Tag

This ladder logic is written in the Main Routine section of RSLogix 5000.



Double-click here to enter the Main Routine

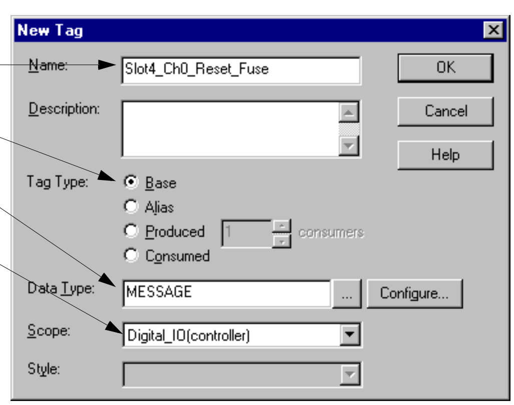


After adding a message instruction to a rung, you must create a tag for the message instruction

1. Right-click on the question mark (?) to see this pull-down menu.
2. Click here to Create a Tag.

Fill in the following information when the New Tag pop-up screen appears:

IMPORTANT We suggest you name the tag to indicate what module service the message instruction is sending. For example, the message instruction below is used to reset an electronic fuse, and the tag is named to reflect this.



A. Name the tag.

B. Choose the Base tag type.

C. Choose the Message data type.

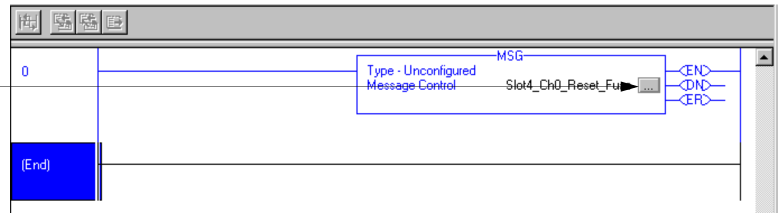
D. Choose the Controller scope.

IMPORTANT: Message tags can only be created with the Controller Scope.

Enter Message Configuration

After creating a new tag, you must enter message configuration.

Click here to see the message configuration pop-up screens



Enter message configuration on the following screens:

- Configuration Pop-Up Screen
- Communications Pop-Up Screen

A description of the purpose and set-up of each screen follows.

IMPORTANT

In RSLogix 5000, version 10 and greater, the message configuration screens changed significantly to make it easier for you to configure you messages.

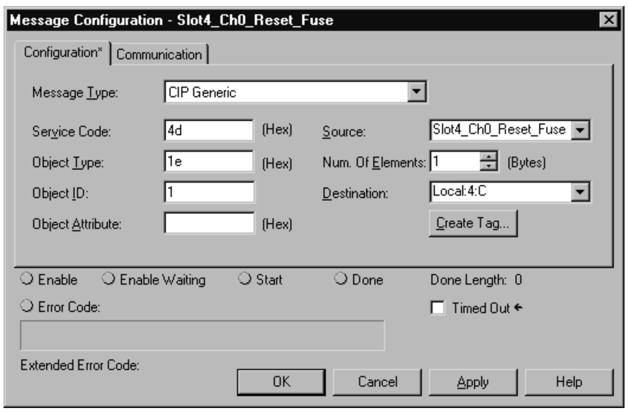
- For example, **in version 9 and earlier**, depending on the Message Type, you are required to configure some combination of the following:
  - Service Code
  - Object Type
  - Object ID
  - Object Attribute
  - Source
  - Number of Elements
  - Destination
- In **version 10 and greater**, however, after you choose a Service Type, RSLogix 5000 fills in most of the fields listed above. The fields you must fill in are dependent on what Service Type you choose. For example, with the Reset Electronic Fuse service, you must only know the Source Element and the Destination.

The following sections show how to configure messages with RSLogix 5000, versions 9 and earlier and RSLogix 5000, versions 10 and greater.

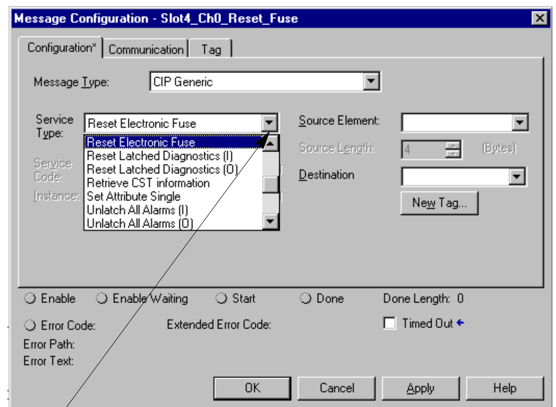
Configuration Pop-Up Screen

This pop-up screen provides information on what module service to perform and where to perform it. For example, you must use this screen to reset an electronic fuse (module service) on channel 0 of a 1756-OA8D module (where to perform service).

RSLogix 5000, version 9 and earlier



RSLogix 5000, version 10 and greater



In versions 10 or greater of RSLogix 5000, you can use a pull-down menu to choose the Service Type.

Table B.2 contains information that must be entered on the configuration pop-up screen to perform I/O module services. This information is **only necessary** if you are configuring the message with RSLogix 5000, **version 9 or earlier**:

Table B.1 Module Services and Configuration Pop-Up Screen Information – Required for RSLogix 5000, Versions 9 and Earlier

	Retrieve CST information	**Retrieve Device Information (WHO)**	**Reset the Module**	**Reset Latched Diagnostics**	**Reset Electronic Fuse**	**Pulse Test**
Service Code	1	1	5	4b	4d	4c
Object Type	77	1	1	1d = input modules 1e = output modules	1e	1e
Object ID	1	1	1	1	1	1
Object Attribute	NA	NA	NA	NA	NA	NA
Source	NA	NA	NA	Enable_32_Points DINT	Enable_32_Points DINT	Pulse_Test_Param eters SINT[10]
Number of Elements (bytes)	0	0	0	4	4	10
Destination	CST_Information SINT [20]	WHO_Information SINT [48]	NA	NA	Results_32_Points DINT	NA
Modules	All	All	All	1756-OA8D, OB16D, OA8E, IA8D, IB16D only	1756-OA8D, OB16D	1756-OA8D, OB16D

When you are using RSLogix 5000, versions 9 or earlier, some services require multiple parameters/tags in the source and destination fields (e.g. Pulse Test).

These services use copy instructions to move the multiple tags to/from the message instruction source/destination tags. Table B.2 lists the copy instruction parameters need for these services.

Table B.2 Copy Instruction Parameters for Module Services – Required for RSLogix 5000, Versions 9 and Earlier

Source/Destination Tag in MSG Instruction:	Description:	Copy Instruction (COP) - This instruction moves data to/from generic source/destination buffers		
		Source	**Destination**	**Length (bytes)**
Pulse_Test_Parameters SINT[10]	Determines which point to perform the pulse test on. Each bit corresponds to a point. Only test one point at a time.	Enable_32_points DINT	Pulse_Test_Parameters [0]	4
	Determines maximum pulse width of the pulse test in ms. Pulse test inverts state of the output up to the maximum specified time. Units are in 100µs increments. Default tag value = 2ms (i.e., 20).	Pulse_Width INT	Pulse_Test_Parameters[4]	2
	For AC modules only, this specifies how long to delay after the zero cross before performing the pulse test. Optimum time to perform pulse test is at its peak AC voltage. Units are in 100µs increments. Default tag value = 4ms (i.e., 40).	Zero_Cross_Delay INT	Pulse_Test_Parameters[6]	2
	Specifies how long to wait after the pulse is completed before declaring a fault. Output verify delay parameter is needed to account for the hardware propagation delay. Units are in 100µs increments. Default tag value = 2ms (i.e., 20).	Output_Verify_Delay INT	Pulse_Test_Parameters[8]	2
CST_Information SINT[20]	Current CST Time from Module	CST_Information[0]	Current_Time DINT[2]	8
	Status of CST in Module Bit0: 0=timer OK, 1=timer fault Bit1: 0=no ramping, 1=ramping (ramping indicates that once time is synchronized, it will correct errors by slowly ramping to the master's time) Bit2: 0=not time master, 1=time master (e.g. controller) Bit3: 0=time not synced, 1=time synced with master	CST_Information[8]	CST_Status INT	2
	Size of timer in bits	CST_Information[10]	CST_Timer_Size INT	2
	Unused	CST_Information[12]	CST_reserved	8

Table B.2 Copy Instruction Parameters for Module Services – Required for RSLogix 5000, Versions 9 and Earlier

<table>
<tr><th rowspan="2">Source/Destination Tag in MSG Instruction:</th><th rowspan="2">Description:</th><th colspan="3">Copy Instruction (COP) - This instruction moves data to/from generic source/destination buffers</th></tr>
<tr><th>Source</th><th>Destination</th><th>Length (bytes)</th></tr>
<tr><td>WHO_Information
SINT[47]</td><td>Device manufacturer's vendor ID (e.g. 1=AB)</td><td>WHO_Information[0]</td><td>WHO_vendor
INT</td><td>2</td></tr>
<tr><td></td><td>Device's product type (e.g. 7=Digital I/O)</td><td>WHO_Information[2]</td><td>WHO_product_type
INT</td><td>2</td></tr>
<tr><td></td><td>Device's catalog code which maps to its catalog number</td><td>WHO_Information[4]</td><td>WHO_catalog_code
INT</td><td>2</td></tr>
<tr><td></td><td>Device's major revision</td><td>WHO_Information[6]</td><td>WHO_major_revision
SINT</td><td>1</td></tr>
<tr><td></td><td>Device's minor revision</td><td>WHO_Information[7]</td><td>WHO_minor_revision
SINT</td><td>1</td></tr>
<tr><td></td><td>Device's internal status
Bit 0: 0=unowned, 1=owned
Bit 2: 0=unconfigured, 1=configured
Bits 7-4: forms a 4-bit number indicating Device Specific Status
For Digital I/O:
0 = Self-Test
1 = Flash update in progress
2 = Communications fault
3 = Not owned
4 = Unused
5 = Internal fault (module needs to be flash updated)
6 = Run Mode
7 = Program Mode (N/A for input modules)
Bit 8: 0=no fault, 1=Minor recoverable fault (e.g. backplane error detected)
Bit 9: 0=no fault, 1=Minor non-recoverable fault
Bit 10: 0=no fault, 1=Major recoverable fault
Bit 11: 0=no fault, 1=Major non-recoverable fault (e.g. module needs to be reflashed)
Bits 15-12: unused</td><td>WHO_Information[8]</td><td>WHO_status
INT</td><td>2</td></tr>
<tr><td></td><td>Device's serial number</td><td>WHO_Information[10]</td><td>WHO_serial_number
DINT</td><td>4</td></tr>
<tr><td></td><td>Number of characters in the text string.</td><td>WHO_Information[14]</td><td>WHO_string_length
SINT</td><td>1</td></tr>
<tr><td></td><td>Device's ASCII text string describing the module.</td><td>WHO_Information[15]</td><td>WHO_ascii_string</td><td>32</td></tr>
</table>

Table B.3 lists tags used in the Source and Destination fields of the message instructions described in Table B.2.

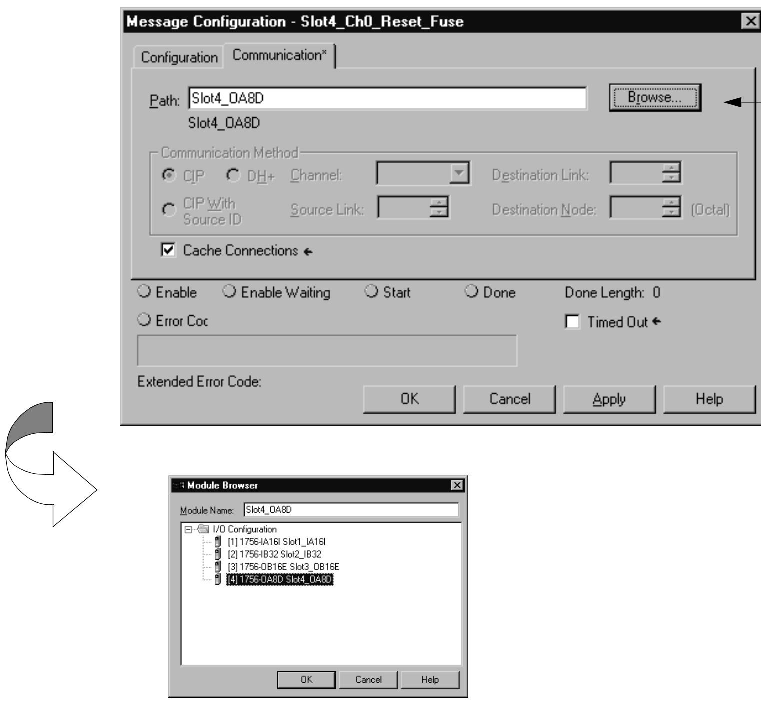
Table B.3 Source and Destination Field Tags

Source Tag:	Description:
Enable_32_Points DINT	Parameter used to determine which points are enabled for the service e.g. If bit 0 = 1 for Reset Fuse, then point 0 has its electronic fuse reset.
Results_32_Points DINT	Pass (0)/ Fail (1) result for the service i.e., If bit 0 = 1 for the results of the Reset Fuse, then the Reset Fuse failed for point 0.

Communications Pop-Up Screen

This pop-up screen provides information on the path of the message instruction. For example, the slot number of a 1756-OA8D module distinguishes exactly which module a message is designated for.

IMPORTANT	Use the Browse button to see a list of the I/O modules in the system. You choose a path when you choose a module from the list. You must name an I/O module during initial module configuration to choose a path for your message instruction.



Use this Browse button to see a list such as the one displayed below.

Using Timestamped Inputs and Scheduled Outputs

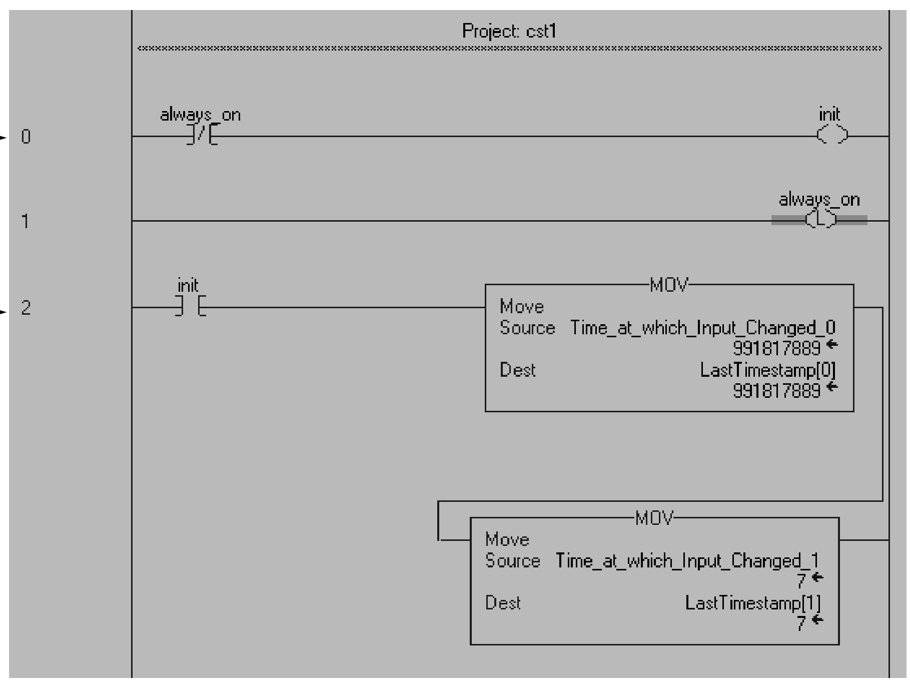
This example demonstrates the use of timestamped inputs and scheduled outputs for digital I/O. The CST can be utilized to synchronize the output turning OFF to ON based upon the time that the input transitioned OFF to ON. The program can be extended to include synchronizing multiple output modules by sending the same timestamp to all output modules.

For this example, the output will follow the state of the input 0, but it will be delayed by exactly 10ms. The advantage of using CST (over timers) is that the synchronization is being performed at the I/O module which eliminates any jitter due to controller or communication delays.

Your control becomes much more deterministic even under changing loads. For this synchronization to work properly, the 10ms delay must be long enough to account for any controller, backplane, and network delays. The input and output modules must reside in the same rack as a Time Master (i.e., Controller) Timestamp units are µsecs.

Rungs 0 and 1 are used to detect the transition from PROGRAM to RUN mode. This is used to turn ON "init" which causes the program to initialize its tags

Rung 2 only executes once and initializes the LastTimestamp. LastTimestamp is used to detect a Change of State on the input point by checking to see if the timestamp of the input data has changed



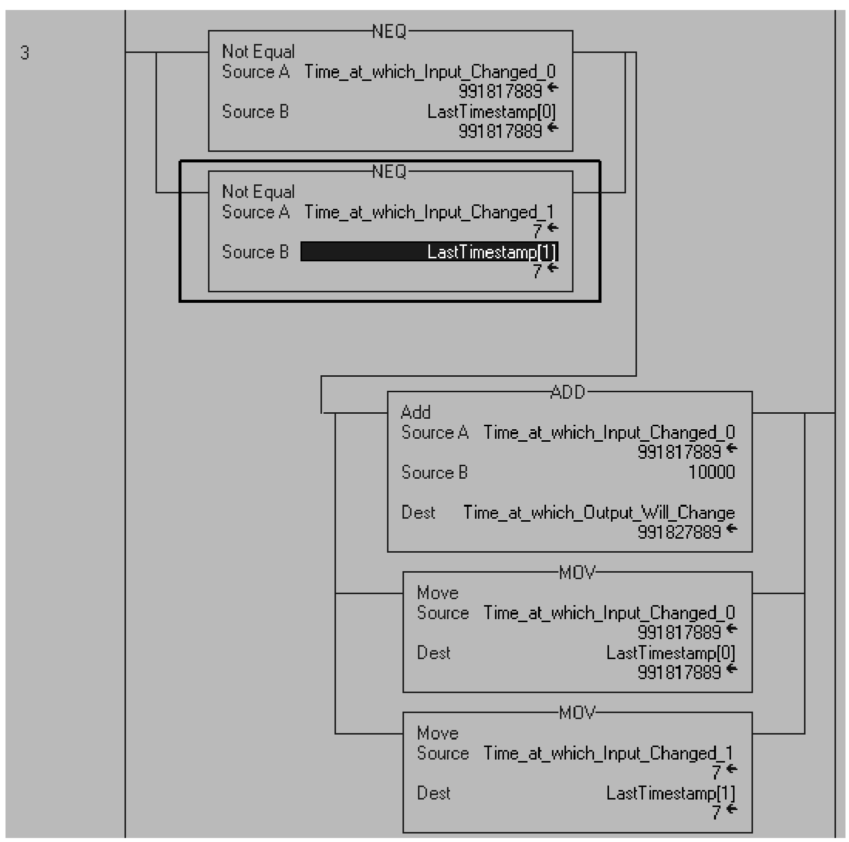
Rung 3 is the main rung which checks for Change of State on the input point by comparing the current input timestamp (i.e., Time_at_which_Input_Changed) with the last timestamp (i.e., LastTimestamp).

The input point (i.e., point 0) must have Change of State enabled or the timestamp will not update when the point transitions (e.g. OFF-ON). Once Change of State has been detected,10ms is ADDed to the input timestamp and sent to the output module's timestamp.

This will cause the output module to apply its output exactly 10ms (i.e., 10,000µs) after the input changed state.

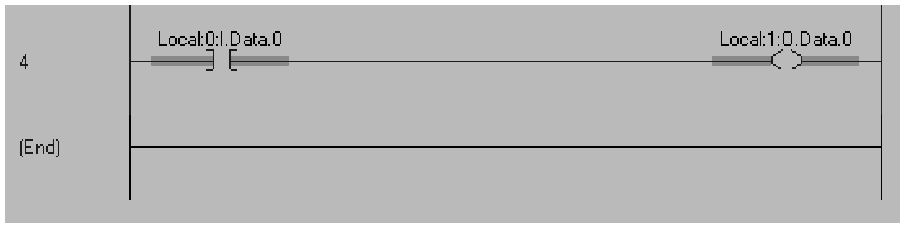
The MOVe instructions update "LastTimestamp[]" in preparation for the next change of state.

IMPORTANT Timestamps are 8 bytes in size, two DINTs, but only the lower 4 bytes of the output timestamp (i.e., Time_at_which_Output_Will_Change) are used to schedule the outputs into the future (to a max of 16.7s or 16,700,000µs

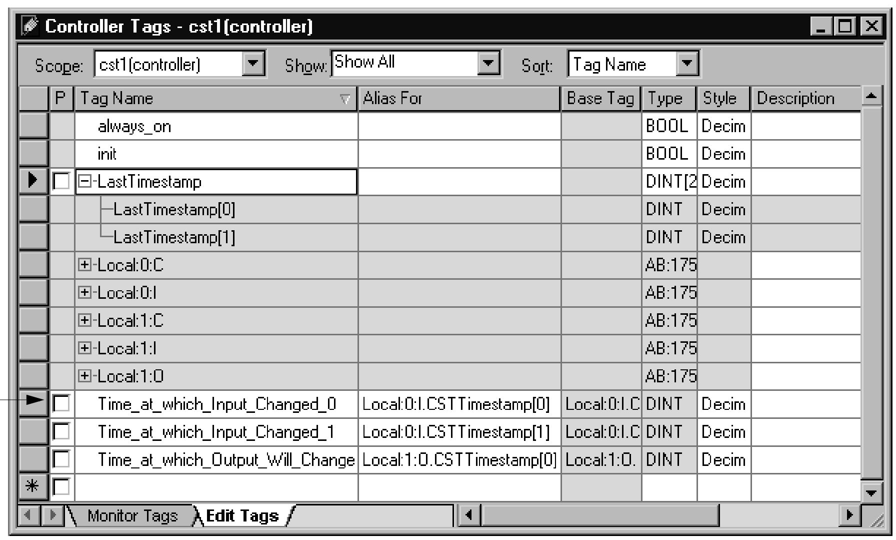


Rung 4 is the standard XIC-OTE rung which controls the output point based upon the input point.

The only difference is that the output module is configured for Scheduled Outputs. The outputs will not get applied until the scheduled time has occurred.



The following screen shows examples of the tags used in the ladder logic as they appear in the tag editor.



These tags were created for this ladder logic.

Resetting a Fuse, Performing the Pulse Test and Resetting Latched Diagnostics

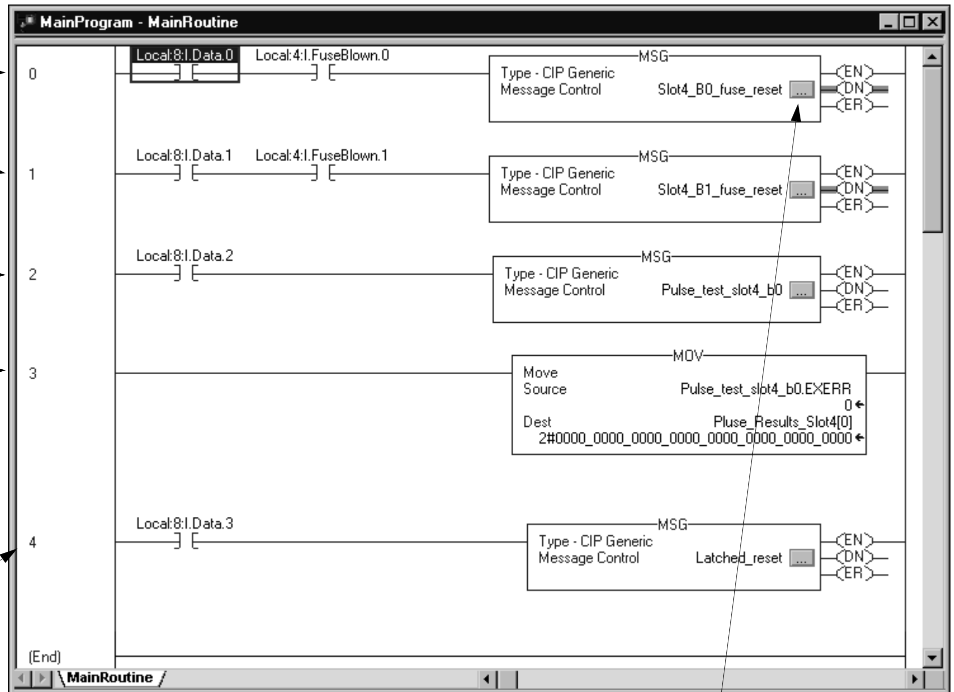
The following ladder logic program shows how to use ladder logic to reset the electronic fuse of a faulted point and perform a pulse test.

Rungs 0 and 1 are used to perform a reset fuse service on Bits 0 and 1, respectively, of a 1756-OA8D module in slot 4.

Rung 2 performs a pulse test service to slot 4.

Rung 3 moves the results of the pulse test to a data storage location. (The actual results appear in the message instruction tags under the tag name EXERR)

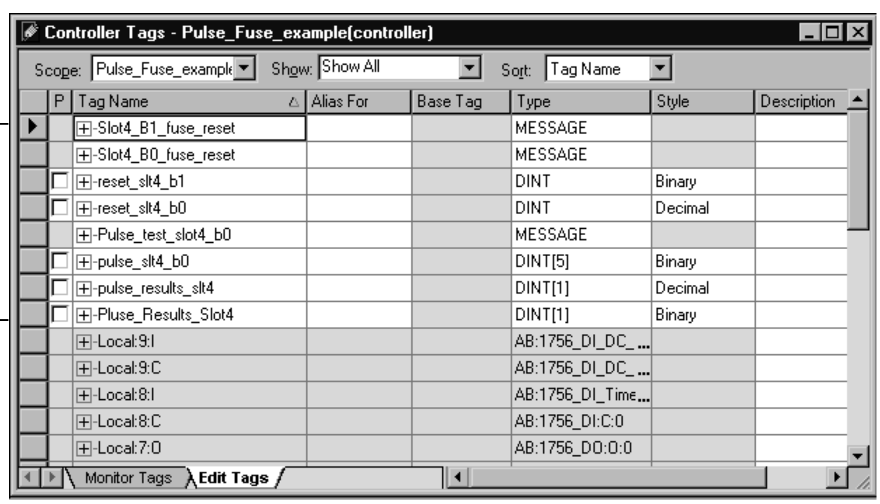
Rung 4 performs a reset latched diagnostics service to slot 4. This example shows an output module.



Click on the box in each rung to see the configuration and communication information pop-up associated with it.

The following screen shows examples of the tags used in the ladder logic as they appear in the tag editor.

These tags were created for this ladder logic.



Performing a WHO to Retrieve Module Identification and Status

This ladder logic example shows how to retrieve module identification and status through a WHO service. In this application, a message instruction retrieves the following module identification information:

- Product type
- Product code
- Major revision
- Minor revision
- Status
- Vendor
- Serial number
- String length
- Ascii string

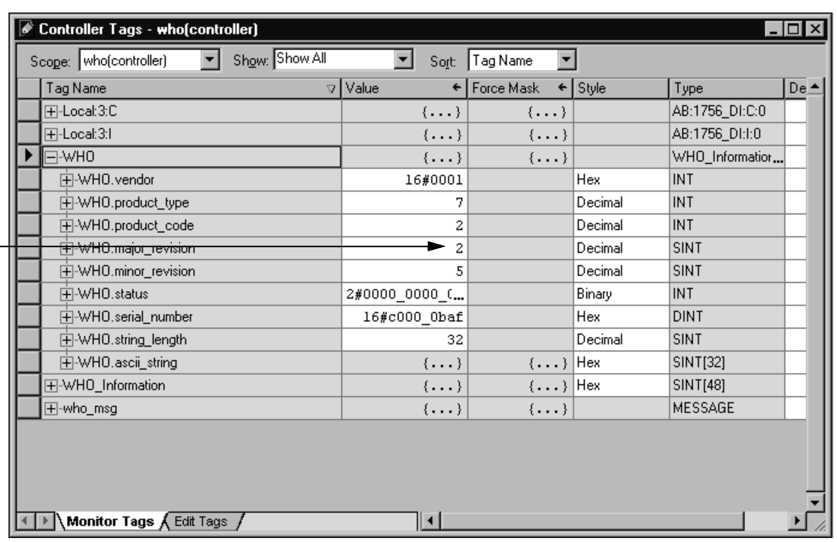
A full explanation of each module identification category above is provided after the ladder logic application.

IMPORTANT	This example uses a user-defined WHO data structure and a series of Copy instructions (following the Message instruction in the screen capture below) to make the module identification information more easily understood.

The user-defined data structure appears below.

The user-defined WHO data structure displays module identification information in an easily understood format.

For example, major revision displays that the module's major revision is 2.



You do not have to create the user-defined data structure. If you choose not to create this structure, you can use the Ascii string and String length to retrieve and understand module identification through some interface excluding RSLogix 5000 software.

The screen below shows the example WHO ladder logic application.

Rung 0 constantly polls the module for WHO status. To conserve bandwidth, only poll for status when necessary.

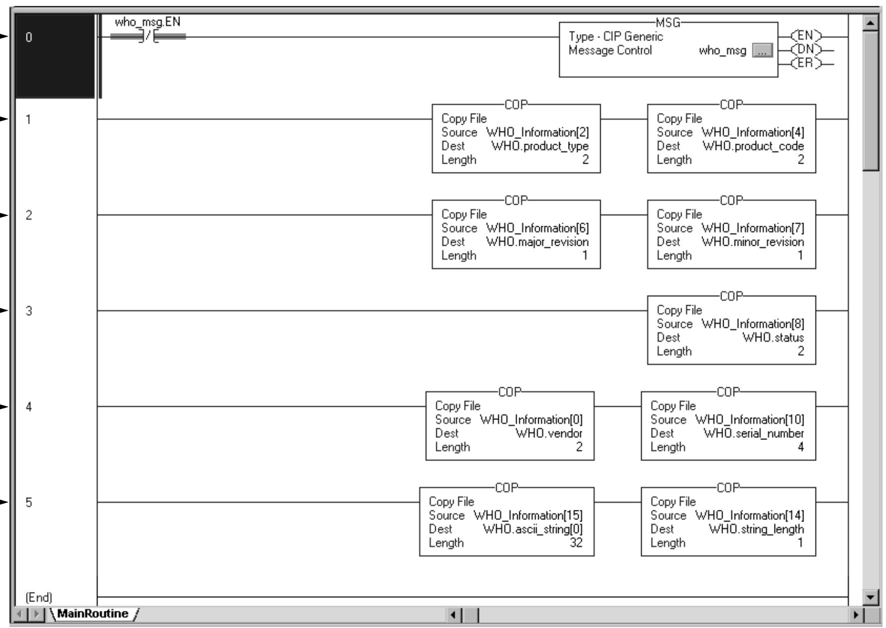
Rung 1 extracts the product type and catalog code.

Rung 2 extracts the module's major and minor revisions.

Rung 3 extracts the module's status information.

Rung 4 extracts the vendor ID and serial number.

Rung 5 extracts the module's ASCII text string and the length of the text string in bytes.



Use Table B.4 to understand the values returned for each rung.

Table B.4 Rung Values for Example WHO Ladder Logic Application

Rung:	Destination (Module Identification Retrieved):	Description:
Rung 1	Product Type Catalog Code	Module's product type, 7 = Digital I/O, 10 = Analog I/O Module's catalog number.
Rung 2	Major Revision Minor Revision	Module's major revision Module's minor revision

Table B.4 Rung Values for Example WHO Ladder Logic Application

Rung:	Destination (Module Identification Retrieved):	Description:
Rung 3	Status	Module's status. Multiple bits listed. Bit 0: 0 = Unowned, 1 = Owned Bit 1: Reserved Bit 2: 0 = Unconfigured, 1 = Configured Bit 3: Reserved Bits 7-4: Forms a 4-bit number indicating Device Specific Status. 0 = Self-Test 1 = Flash update in progress 2 = Communications fault 3 = Not owned (outputs in prog. mode) 4 = unused 5 = Internal fault (need flash update) 6 = Run mode 7 = Program mode (output mods only) Bit 8: 0 = No fault, 1 = Minor recoverable fault Bit 9: 0 = No fault, 1 = Minor unrecoverable fault Bit 10: 0 = No fault, 1 = Major recoverable fault Bit 11: 0 = No fault, 1 = Major unrecoverable fault Bits 15-12: Unused
Rung 4	Vendor ID Serial Number	Module manufacturer vendor, 1 = Allen-Bradley Module serial number
Rung 5	Length of ASCII Text String ASCII Text String	Number of characters in module's text string Module's ASCII text string description

Using Tags in Ladder Logic

When using tags in ControlLogix digital I/O ladder logic applications, you must remember the following:

- Ladder logic tags represent the module on a **point per bit basis**. For example, point 0 = bit 0 on the module
- If you are **performing a service** through the tags, a value of 0 prevents the action from occurring, and a value of 1 causes the action to occur. For example, if you want to reset the electronic fuse on a particular bit, enter 1 in the tags.
- If you are checking the **response of a service** through the tags, a value of 0 means the bit passed the service, and a value of 1 means the bit failed the service. For example, if you perform a pulse test and the response displays a 0 for a particular bit, the bit passed the test.

Power Supply Sizing Chart

Use Table C.1 to check the power your ControlLogix chassis is using.

Table C.1 Power Supply Sizing Chart

Slot Number	Module Catalog Number	Current @ 5.1V DC (mA)		Power @ 5.1V DC (Watts)	Current @ 24 VDC (mA)		Power @ 24 VDC (Watts)	Current @ 3.3V DC (mA)		Power @ 3.3V DC (Watts)
0			x 5.1V =			x 24V =			x 3.3V =	
1			x 5.1V =			x 24V =			x 3.3V =	
2			x 5.1V =			x 24V =			x 3.3V =	
3			x 5.1V =			x 24V =			x 3.3V =	
4			x 5.1V =			x 24V =			x 3.3V =	
5			x 5.1V =			x 24V =			x 3.3V =	
6			x 5.1V =			x 24V =			x 3.3V =	
7			x 5.1V =			x 24V =			x 3.3V =	
8			x 5.1V =			x 24V =			x 3.3V =	
9			x 5.1V =			x 24V =			x 3.3V =	
10			x 5.1V =			x 24V =			x 3.3V =	
11			x 5.1V =			x 24V =			x 3.3V =	
12			x 5.1V =			x 24V =			x 3.3V =	
13			x 5.1V =			x 24V =			x 3.3V =	
14			x 5.1V =			x 24V =			x 3.3V =	
15			x 5.1V =			x 24V =			x 3.3V =	
16			x 5.1V =			x 24V =			x 3.3V =	
	TOTALS	mA		W (1)	mA		W (2)	mA		W (3)
		This number cannot exceed: 10000mA for 1756-PA72/PB72 13000mA for 1756-PA75/PB75			This number cannot exceed 2800mA			This number cannot exceed 4000mA		
				These three wattage values (1, 2, 3), added together, cannot exceed: • 70W @ 40°C - For 1756-PA72/PB72, Series A 55W @ 60°C - For 1756-PA72/PB72, Series A • 75W @ 40°/60°C - For 1756-PA72/PB72, Series B and 1756-PA75/PB75, Series A						

We recommend that you copy this worksheet for use in checking the power supply of each ControlLogix chassis used.

Notes:

Driving Motor Starters with ControlLogix Digital I/O Modules

Use this appendix to choose a ControlLogix digital I/O module to drive Bulletin 500 Series motor starters in your application. The tables below list the number of motor starters (5 sizes are listed for each module) that a particular digital I/O module can drive.

IMPORTANT When using the tables, remember that the supply voltage for each module must not drop below the minimum state motor starter supply voltage.

Table D.1 Maximum Allowed 2-3 Pole Motor Starters (120V ac/60Hz)

Catalog Number	Size 0-1 Motor Starter	Size 2 Motor Starter	Size 3 Motor Starter	Size 4 Motor Starter	Size 5 Motor Starter
1756-OA16I	16	15 @ 30°C 12 @ 60°C	13 @ 30°C 10 @ 60°C	8 @ 30°C 6 @ 60°C	5 @ 30°C 4 @ 60°C
1756-OA16	16	14 (Only 7 per group)	4 (Only 2 per group)	None	None
1756-OA8	8	8	8	8 @ 30°C 6 @ 60°C	5 @ 30°C 4 @ 60°C
1756-OA8D	8	8	8	None	None
1756-OA8E	8	8	8	6 (Only 3 per group)	6 @ 30°C (Only 3 per group) 4 @ 60°C (Only 2 per group)

Table D.2 Maximum Allowed 2-3 Pole Motor Starters (230V ac/60Hz)

Catalog Number	Size 0-1 Motor Starter	Size 2 Motor Starter	Size 3 Motor Starter	Size 4 Motor Starter	Size 5 Motor Starter
1756-OA16I	16	16	16	16 @ 30° C 13 @ 60° C	11 @ 30° C 9 @ 60° C
1756-OA16	16	16	16	4 (Only 2 per group)	2 (Only 1 per group)
1756-OA8	8	8	8	8	8

Table D.3 Maximum Allowed 2-3 Pole Motor Starter (24V ac/60Hz)

Catalog Number	Size 0-1 Motor Starter	Size 2 Motor Starter	Size 3 Motor Starter	Size 4 Motor Starter	Size 5 Motor Starter
1756-ON8	4 @ 30° C 3 @ 60° C	4 @ 30° C 3 @ 60° C	None	None	None

Determining the Maximum Number of Motor Starters

To determine the maximum number of motor starters that can be used by any 1756 digital I/O module, refer to the example in Table D.4:

Table D.4

Step:	Value Used in this Example:
1. Choose your motor starter:	Allen-Bradley Bulletin 500 Size 3 120V ac/60Hz/ 2-3 Poles, Inrush 1225VA, Sealed=45VA
2. Determine the number of Motor starters required for your application:	12 size 3 motor starters
3. Choose a ControlLogix digital output module:	1756-OA16I • Output voltage = 74 – 265V ac • Output steady state current per point = 2A maximum @ 30°C • & 1A maximum @ 60°C (Linear derating) • Output steady state current per module = 5A maximum @ 30°C & 4A maximum @ 60×C (Linear derating) • Output surge current per point = 20A maximum for 43mS repeatable every 2S @ 60°C
4. Determine the maximum environmental operating temperature:	50°C
5. Confirm the voltage Range is within the Motor starter range:	Motor Starter uses 120V ac 1756-OA16I operates in a 74 to 120V ac voltage range
6. Confirm the inrush current per point:	Inrush of motor starter – Line voltage = Inrush current = 1225VA/120V ac = 10.2Amps Inrush The 1756-OA16I allows 20A Inrush current from above specification at @ 60°C
7. Confirm the steady state point current of the module can drive the motor starter:	Sealed/Line voltage = Steady state current = 45VA/120V ac = 0.375A @ 50°C Output point current can drive: 2A - (.033ma X 10°C) = 2A - 0.33A = 1.67A @ 50°C Above 30°C, output point derates to .033mA/°C (point derating) The 1756-OA16I output point current (1.67A) can drive the motor starter (0.375A @ 50°C.
8. Confirm the 1756-OA16I/A total module current can drive 12 size 3 motor starters @ 50°C	Motor starter steady state current X 11 motor starters = .375 X 12 = 4.5A @ 50°C The output total module current can drive: 5A - (.033ma X 10×C) = 5A - 0.33A = 4.67A @ 50°C Above 30°C total output current derates to .033mA/×C (Module derating) The 1756-OA16I total output current (4.67A) can drive the 12 motor starters (4.5A) @ 50°C

Notes:

Hardware Response Times

Table E.1 lists the nominal hardware response times for some ControlLogix dc I/O modules. Times are listed for these modules because they are most likely to be used in applications that use tasks, such as Events tasks, where estimating module throughput time is critical.

Table E.1

Catalog number:	Nominal response time in microseconds (µs):			
	25°C		60°C	
	OFF to ON	ON to OFF	OFF to ON	ON to OFF
1756-IB16	290	640	290	700
1756-IB16D	335	675	335	740
1756-IB32/B	365	400	380	420
1756-IG16	270	365	270	390
1756-IV16	280	480	280	540
1756-IV32	420	525	350	590
1756-OB16D	55	570	55	630
1756-OB16E	70	320	70	360
1756-OB32	45	175	55	200
1756-OG16	45	120	45	145
1756-OV16E	75	285	75	360
1756-OV32E	75	190	75	230

Notes:

Using 1492 Wiring Systems with Your Digital I/O Module

As an alternative to buying RTBs and connecting the wires yourself, you can buy a wiring system of:

- **interface modules (IFMs)** that mount on DIN rails provide the output terminal blocks for the I/O module. Use the IFMs with the pre-wired cables that match the I/O module to the interface module.

  For a complete list of the IFMs available for use with ControlLogix digital I/O modules, see Table F.1 on page F-2.

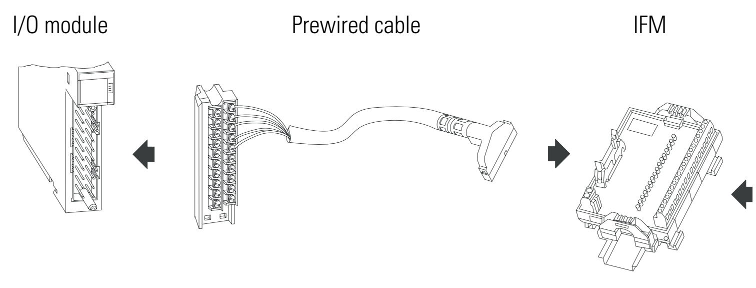
and

- **I/O-module-ready prewired cables**. One end of the cable assembly is an RTB that plugs into the front of the I/O module. The other end has individually color-coded conductors that connect to a standard terminal block.

  For a complete list of the prewired cables available for use with ControlLogix digital I/O modules, see Table F.2 on page F-10.

Figure F.1 shows the IFM and prewired cables.

Figure F.1



IMPORTANT	The 1492 IFMs may not be used in any application that requires agency certification of the ControlLogix system. Use of the IFM violates the UL, CSA and FM certifications of these products.

Table F.1 lists the IFMs and prewired cables that can be used with ControlLogix digital I/O modules.

Table F.1

For this catalog number	Use one of these IFMs:			With this prewired cable:
	Catalog number:	IFM Type	Description	
1756-IA16	1492-IFM20F	Feed through	Standard	1492-CABLExX (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-IFM20F-3		3-wire sensor type input devices	
	1492-IFM20D120	LED-indicating	Standard with 120V ac LEDs	
	1492-IFM20D120N		Narrow standard with 120V ac LEDs	
	1492-IFM20D120A-2		120V ac with extra terminals for inputs	
	1492-IFM20F-F120A-2	Fusible	Extra terminals with 120V ac blown fuse indicators for inputs	
1756-IA16I	1492-IFM40DS120-4	LED-indicating	Isolated with 120V ac LEDs and 4 terminals per input	1492-CABLExY (x = cable length)
	1492-IFM40F-FS120A-4	Fusible	Isolated with 120V ac blown fuse indicators and 4 terminals per input	
1756-IA32				
1756-IA8D	1492-IFM20F	Feed-through	Standard	1492-CABLExU (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-IFM20D120	LED-indicating	Standard with 120V ac LEDs	
	1492-IFM20D120N		Narrow standard with 120V ac LEDs	
	1492-IFM20D120A-2		120V ac with extra terminals for inputs	
	1492-IFM20F-F120A-4	Fusible	Isolated with 4 terminals with 120V ac blown fuse indicators for inputs	
1756-IB16	1492-IFM20F	Feed through	Standard	1492-CABLExX (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-IFM20F-3		3-wire sensor type input devices	
	1492-IFM20D24	LED-indicating	Standard with 24V ac/dc LEDs	
	1492-IFM20D24N		Narrow standard with 24V ac/dc LEDs	
	1492-IFM20D24A-2		24V ac/dc LEDs and extraterminals for inputs	
	1492-IFM20D24-3		3-wire sensor with 24V ac/dc LEDs	
	1492-IFM20F-F24-2	Fusible	Extra terminals with 24V ac/dc blown fuse indicators for inputs	

Table F.1

For this catalog number	Use one of these IFMs: Catalog number:	IFM Type	Description	With this prewired cable:
1756-IB16D	1492-IFM40F	Feed through	Standard	1492-CABLExY (x = cable length)
	1492-IFM40F-2		Extra terminals	
	1492-IFM40DS24A-4	LED-indicating	Isolated with 24/48V ac/dc LEDs and 4 terminals per input	
	1492-IFM40F-FS24A-4	Fusible	Isolated with 24V ac/dc blown fuse indicators and 4 terminals per input	
1756-IB16I	1492-IFM40F	Feed through	Standard	1492-CABLExY (x = cable length)
	1492-IFM40DS24A-4	LED-indicating	Isolated with 24/48V ac/dc LEDs and 4 terminals per input	
	1492-IFM40F-FS24A-4	Fusible	Isolated 24V ac/dc blown fuse indicators and 4 terminals per input	
1756-IB32/B	1492-IFM40F	Feed through	Standard	1492-CABLExZ (x = cable length)
	1492-IFM40F-2		Extra terminals	
	1492-IFM40F-3		3-wire sensor type input devices	
	1492-IFM40D24	LED-indicating	Standard with 24V ac/dc LEDs	
	1492-IFM40D24A-2		24V ac/dc LEDs and extra terminals for inputs	
	1492-IFM40D24-3		3-wire sensor with 24V ac/dc LEDs for inputs	
1756-IC16	1492-IFM20F	Feed through	Standard	1492-CABLExX (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-IFM20F-3		3-wire sensor type input devices	
1756-IG16				
1756-IH16I	1492-IFM40F	Feed through	Standard	1492-CABLExY (x = cable length)
	1492-IFM40F-FS120A-4	Fusible	Isolated with 120V ac blown fuse indicators and 4 terminals per input	
1756-IM16I	1492-IFM40DS240A-4	Led-indicating	Isolated with 240V ac LEDs and 4 terminals per output	1492-CABLExY (x = cable length)
1756-IN16	1492-IFM20F	Feed through	Standard	1492-CABLExX (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-IFM20F-3		3-wire sensor type input devices	
	1492-IFM20D24	LED-indicating	Standard with 24V ac/dc LEDs	
	1492-IFM20D24N		Narrow standard with 24V ac/dc LEDs	
	1492-IFM20D24A-2		24V ac/dc LEDs and extraterminals for inputs	
	1492-IFM20D24-3		3-wire sensor with 24V ac/dc LEDs	
	1492-IFM20F-F24-2	Fusible	Extra terminals with 24V ac/dc blown fuse indicators for inputs	

Table F.1

For this catalog number	Use one of these IFMs:			With this prewired cable:
	Catalog number:	**IFM Type**	**Description**	
1756-IV16				
1756-IV32				
1756-OA16	1492-IFM20F	Feed through	Standard	1756-CABLExX (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-XIMF-2		Expander with eight feed through channels[1]	
	1492-IFM20D120N	LED-indicating	Narrow standard with 120V ac LEDs	
	1492-IFM20D120-2		120V ac/dc LEDs and extra terminals for outputs	
	1492-IFM20F-F-2	Fusible	Extra terminals for outputs	
	1492-IFM20F-F120-2		Extra terminals with 120V ac blown fuse indicators for outputs	
	1492-IFM20F-F240-2		Extra terminals with 240V ac blown fuse indicators for otuputs	
	1492-XIMF-F120-2		Expander with eight 120V ac channels with blown fuse indicators[1]	
	1492-XIM120-8R	Relay	Expander with eight 120V ac relays[1]	
1756-OA16I	1492-IFM40F	Feed through	Standard	1492-CABLExY (x = cable length)
	1492-IFM40DS120-4	LED-indicating	Isolated with 120V ac LEDs and 4 terminals per output	
	1492-IFM40F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM40F-FS120-2		Isolated with extra terminals and 120V ac blown fuse indicators for outputs	
	1492-IFM40F-FS120-4		Isolated with 120V ac blown fuse indicators and 4 terminals per output	
	1492-IFM40F-FS240-4		Isolated with 240V ac blown fuse indicators and 4 terminals per output	

Table F.1

For this catalog number	Use one of these IFMs:			With this prewired cable:
	Catalog number:	**IFM Type**	**Description**	
1756-OA8	1492-IFM20F	Feed-through	Standard	1492-CABLExU (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-IFM20DS120-4	LED-indicating	Isolated with 120V ac LEDs and 4 terminals for outputs	1492-CABLExW (x = cable length)
	1492-IFM20F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM20F-FS120-2		Isolated with extra terminals with 120V ac blown fuse indicators for outputs	
	1492-IFM20F-FS120-4		Isolated with 4 terminals with 120V ac blown fuse indicators for outputs	
	1492-IFM20F-FS240-4		Isolated with 4 terminals with 240V ac blown fuse indicators for outputs	
1756-OA8D	1492-IFM20F	Feed-through	Standard	1492-CABLExU (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-IFM20DS120-4	LED-indicating	Isolated with 120V ac LEDs and 4 terminals for outputs	1492-CABLExV (x = cable length)
	1492-IFM20F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM20F-FS120-2		Isolated with extra terminals with 120V ac blown fuse indicators for outputs	
	1492-IFM20F-FS120-4		Isolated with 4 terminals with 120V ac blown fuse indicators for outputs	
1756-OA8E	1492-IFM20F	Feed-through	Standard	1492-CABLExU (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-IFM20DS120-4	LED-indicating	Isolated with 120V ac LEDs and 4 terminals for outputs	1492-CABLExV (x = cable length)
	1492-IFM20F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM20F-FS120-2		Isolated with extra terminals with 120V ac blown fuse indicators for outputs	
	1492-IFM20F-FS120-4		Isolated with 4 terminals with 120V ac blown fuse indicators for outputs	

Table F.1

For this catalog number	Use one of these IFMs:			With this prewired cable:
	Catalog number:	**IFM Type**	**Description**	
1756-OB16D	1492-IFM40F	Feed through	Standard	1492-CABLExY (x = cable length)
	1492-IFM40F-2		Extra terminals	
	1492-IFM40DS24-4	LED-indicating	Isolated with 24/48V ac/dc LEDs and 4 terminals per output	
	1492-IFM40F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM40F-FS24-2		Isolated with extra terminals and 24V ac/dc blown fuse indicators for outputs	
	1492-IFM40F-FS24-4		Isolated with extra terminals and 24V ac/dc blown fuse indicators and 4 terminals per output	
1756-OB16E	1492-IFM20F	Feed through	Standard	1492-CABLExX (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-XIMF-2		Expander with eight feed through channels	
	1492-IFM20D24	LED-indicating	Standard with 24V ac/dc LEDs	
	1492-IFM20D24N		Narrow standard with 24V ac/dc LEDs	
	1492-IFM20D24-2		24V ac/dc LEDs and extra terminals for outputs	
	1492-IFM20F-F-2	Fusible	Extra terminals for outputs	
	1492-IFM20F-F24-2		Extra terminals with 24V ac/dc blown fuse indicators for outputs	
	1492-XIMF-F24-2		Expander with eight 24V dc channels with blown fuse indicators(1)	
	1492-XIM2024-8R	Relay	20-pin master with eight 24V dc relays	
	1492-XIM24-8R		Expander with eight 24V dc relays(1)	
1756-OB16I	1492-IFM40F	Feed through	Standard	1492-CABLExY (x = cable length)
	1492-IFM40DS24-4	LED-indicating	Isolated with 24/48V ac/dc LEDs and 4 terminals per output	
	1492-IFM40F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM40F-FS24-2		Isolated with extra terminals and 24V ac/dc blown fuse indicators for outputs	
	1492-IFM40F-FS24-4		Isolated with extra terminals and 24V ac/dc blown fuse indicators and 4 terminals per output	
1756-OB16IS				

Table F.1

For this catalog number	Use one of these IFMs:			With this prewired cable:
	Catalog number:	IFM Type	Description	
1756-OB32	1492-IFM40F	Feed through	Standard	1492-CABLExZ (x = cable length)
	1492-IFM40F-2		Extra terminals	
	1492-XIMF-2[1]		Expander with eight feed	1492-CABLExX (x = cable length)
	1492-IFM20D24	LED-indicating	Standard with 24V ac/dc LEDs	1492-CABLExZ (x = cable length)
	1492-IFM40D24-2		24V ac/dc LEDs and extra terminals for outputs	
	1492-IFM40F-F-2	Fusible	Extra terminals for outputs	
	1492-IFM40F-F24-2		Extra terminals with 24V ac/dc blown fuse indicators for outputs	
	1492-XIMF-F120-2		Fusible expander with eight 24V dc channels with blown fuse indicators[1]	1492-CABLExX (x = cable length)
	1492-XIM4024-8R	Relay	40-pin master with eight 24V dc relays	1492-CABLExZ (x = cable length)
	1492-IXM40120-16R		40-pin master with sixteen 24V dc relays	
1756-OB8	1492-IFM20F	Feed-through	Standard	1492-CABLExU (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-IFM20DS24-4	LED-indicating	Isolated with 24/48V ac/dc LEDs and 4 terminals for outputs	1492-CABLExW (x = cable length)
	1492-IFM20F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM2OF-FS24-2		Isolated with extra terminals and 24V ac/dc blown fuse indicators for outputs	
1756-OB8EI	1492-IFM40F	Feed through	Standard	1492-CABLExY (x = cable length)
	1492-IFM40DS24-4	LED-indicating	Isolated with 24/48V ac/dc LEDs and 4 terminals per output	
	1492-IFM40F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM40F-FS24-2		Isolated with extra terminals and 24V ac/dc blown fuse indicators for outputs	
	1492-IFM40F-FS24-4		Isolated with extra terminals and 24V ac/dc blown fuse indicators and 4 terminals per output	

Table F.1

For this catalog number	Use one of these IFMs:			With this prewired cable:
	Catalog number:	**IFM Type**	**Description**	
1756-OC8	1492-IFM20F	Feed-through	Standard	1492-CABLExU (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-IFM20DS24-4	LED-indicating	Isolated with 24/48V ac/dc LEDs and 4 terminals for outputs	1492-CABLExW (x = cable length)
	1492-IFM20F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM2OF-FS24-2		Isolated with extra terminals and 24V ac/dc blown fuse indicators for outputs	
1756-OG16				
1756-OH8I	1492-IFM40F	Feed through	Standard	1492-CABLExY (x = cable length)
	1492-IFM40F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM40F-FS120-2		Isolated with extra terminals and 120V ac blown fuse indicators for outputs	
1756-ON8	1492-IFM20F	Feed-through	Standard	1492-CABLExU (x = cable length)
	1492-IFM20FN		Narrow standard	
	1492-IFM20F-2		Extra terminals	
	1492-IFM20DS24-4	LED-indicating	Isolated with 24/48V ac/dc LEDs and 4 terminals for outputs	1492-CABLExW (x = cable length)
	1492-IFM20F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM2OF-FS24-2		Isolated with extra terminals and 24V ac/dc blown fuse indicators for outputs	
1756-OV16E				
1756-OV32E				

Table F.1

For this catalog number	Use one of these IFMs:			With this prewired cable:
	Catalog number:	IFM Type	Description	
1756-OW16I	1492-IFM40F	Feed through	Standard	1492-CABLExY (x = cable length)
	1492-IFM40DS24-4	LED-indicating	Isolated with 24/48V ac/dc LEDs and 4 terminals per output	
	1492-IFM40DS120-4		Isolated with 120V ac LEDs and 4 terminals per output	
	1492-IFM40F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM40F-FS24-2		Isolated with extra terminals and 24V ac/dc blown fuse indicators for outputs	
	1492-IFM40F-FS24-4		Isolated with extra terminals and 24V ac/dc blown fuse indicators and 4 terminals per output	
	1492-IFM40F-FS120-2		Isolated with extra terminals and 120V ac blown fuse indicators for outputs	
	1492-IFM40F-FS120-4		Isolated with 120V ac blown fuse indicators and 4 terminals per output	
	1492-IFM40F-FS240-4		Isolated with 240V ac blown fuse indicators and 4 terminals per output	
1756-OX8I	1492-IFM40F	Feed through	Standard	1492-CABLExY (x = cable length)
	1492-IFM40DS24-4	LED-indicating	Isolated with 24/48V ac/dc LEDs and 4 terminals per output	
	1492-IFM40DS120-4		Isolated with 120V ac LEDs and 4 terminals per output	
	1492-IFM40F-FS-2	Fusible	Isolated with extra terminals for outputs	
	1492-IFM40F-FS24-2		Isolated with extra terminals and 24V ac/dc blown fuse indicators for outputs	
	1492-IFM40F-FS24-4		Isolated with extra terminals and 24V ac/dc blown fuse indicators and 4 terminals per output	
	1492-IFM40F-FS120-2		Isolated with extra terminals and 120V ac blown fuse indicators for outputs	
	1492-IFM40F-FS120-4		Isolated with 120V ac blown fuse indicators and 4 terminals per output	
	1492-IFM40F-FS240-4		Isolated with 240V ac blown fuse indicators and 4 terminals per output	

(1) One expander module is connected to a master to provide a total of 16 outputs. An extender cable is included with each expander to connect it to the master.

Table F.2 describes the I/O module-ready prewired cables available for use with your ControlLogix digital I/O modules.

Table F.2

Catalog Number:[1]	Number of Conductors:	Conductor Size:	Nominal Outer Diameter:	RTB at the I/O Module End:
1492-CABLExU	20	22 AWG	9.0 mm (0.36 in)	1756-TBNH
1492-CABLExV				
1492-CABLExW				
1492-CABLExX				
1492-CABLExY	40		11.7 mm (0.46 in)	1756-TBCH
1492-CABLExZ				

(1) Cables are available in lengths of 0.5m, 1.0m, 2.5m, and 5.0m. To order, insert the code for the desired cable length into the catalog number in place of the x: 005=0.5m, 010=1.0m, 25=2.5m, 050=5m. Build-to-order cable lengths are also available.

Table F.2 describes the I/O module-ready prewired cables available for use with your ControlLogix digital I/O modules.

Table F.3

Catalog Number:[1]	Number of Conductors:	Conductor Size:	Nominal Outer Diameter:	RTB at the I/O Module End:
1492-CABLExTBNH	20	18 AWG	11.4 mm (0.45 in)	1756-TBNH
1492-CABLExTBCH	40[2]		14.1 mm (0.55 in)	1756-TBCH

(1) Cables are available in lengths of 0.5m, 1.0m, 2.5m, and 5.0m. To order, insert the code for the desired cable length into the catalog number in place of the x: 005=0.5m, 010=1.0m, 25=2.5m, 050=5m. Build-to-order cable lengths are also available.

(2) Four conductors are not connected to the RTB.

Broadcast

Data transmissions to all address or functions

Bumpless reconfiguration

A reconfiguration in which the real time data connection to the module is not closed and reopened. Communications are never interrupted and configuration data is applied to the module immediately. This works best in a single owner-controller system.

Change of state (COS)

Any change in the ON or OFF state of a point on an I/O module

Communications format

Format that defines the type of information transferred between an I/O module and its owner-controller. This format also defines the tags created for each I/O module.

Compatible match

An electronic keying protection mode that requires that the physical module and the module configured in the software to match according to vendor and catalog number. In this case, the minor revision of the module must greater than or equal to that of the configured slot.

Connection

The communication mechanism from the controller to another module in the control system.

ControlBus

The backplane used by the 1756 chassis.

Coordinated system time (CST)

Timer value which is kept synchronized for all modules within a single ControlBus chassis

Direct connection

An I/O connection where the controller establishes an individual connection with I/O modules

Disable keying

An electronic keying protection mode that requires no attributes of the physical module and the module configured in the software to match

Download

The process of transferring the contents of a project on the workstation into the controller

Electronic keying

A feature where modules can be requested to perform an electronic check to make sure that the physical module is consistent with what was configured by the software

Exact match

An electronic keying protection mode that requires the physical module and the module configured in the software to match according to vendor, catalog number, major revision and minor revision

Field side

Interface between user field wiring and I/O module

Inhibit

A ControlLogix process that allows you to configure an I/O module but prevent it from communicating with the owner-controller. In this case, the controller behaves as if the I/O module does not exist at all

Interface module (IFM)

A module that uses prewired cable to connect wiring to an I/O module

Listen-only connection

An I/O connection where another controller owns/provides the configuration and data for the module

Major revision

A module revision that is updated any time there is a functional change to the module

Minor revision

A module revision that is updated any time there is a change to the module that does not affect its function or interface

Multicast

Data transmissions which reach a specific group of one or more destinations

Multiple owners

A configuration set-up where multiple owner-controllers use exactly the same configuration information to simultaneously own an input module

Network update time (NUT)

The smallest repetitive time interval in which the data can be sent on a ControlNet network. The NUT ranges from 2ms to 100ms

Owner-controller

The controller that creates and stores the primary configuration and communication connection to a module

Program Mode

In this mode the following events occur:

- Controller program is not executing.
- Inputs are still actively producing data.
- Outputs are not actively controlled and go to their configured program mode

Rack connection

An I/O connection where the 1756-CNB module collects digital I/O words into a rack image to conserve ControlNet connections and bandwidth

Rack optimization

A communications format in which the 1756-CNB module collects all digital I/O words in the remote chassis and sends them to controller as a single rack image

Remote connection

An I/O connection where the controller establishes an individual connection with I/O modules in a remote chassis

Removal and insertion under power (RIUP)

ControlLogix feature that allows a user to install or remove a module or RTB while power is applied

Removable Terminal Block (RTB)

Field wiring connector for I/O modules

Requested packet interval (RPI)

The maximum amount of time between broadcasts of I/O data

Run mode

In this mode, the following events occur:

- Controller program is executing
- Inputs are actively producing data.
- Outputs are actively controlled

Service

A system feature that is performed on user demand, such as fuse reset or diagnostic latch reset

System side

Backplane side of the interface to the I/O module

Tag

A named area of the controller's memory where data is stored

Timestamping

ControlLogix process that stamps a change in input data with a relative time reference of when that change occurred

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Cat. No. 1756 Series Pub. No. 1756-UM058D-EN-P Pub. Date October 2004 Part No. 957726-67

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Preliminary Publication 1756-UM058D-EN-P - October 2004
PN 957726-67
Supersedes Publication 1756-UM058C-EN-P - March 2001