



Redundant I/O System

Catalog Numbers 1715-AENTR, 1715-IB16D, 1715-IF16,
1715-OB8DE, 1715-OF8I



Allen-Bradley

by ROCKWELL AUTOMATION

User Manual

Original Instructions

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

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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.



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, and recognize the consequence.

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

These labels may also be on or inside the equipment to provide specific precautions.



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BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.



ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

The following icon may appear in the text of this document.



Identifies information that is useful and can help to make a process easier to do or easier to understand.

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About This Publication

This manual explains how to install and configure the 1715 Redundant I/O System. This redundant, modular system works with a ControlLogix® Enhanced Redundancy System. This system provides fault-tolerant I/O and redundancy for use in critical process applications.

Download Firmware, AOP, EDS, and Other Files

Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes from the Product Compatibility and Download Center at rok.auto/pcdc.

Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

Topic	Page
Changed screenshot across the manual.	Entire publication (marked with change bar)
Changed number of product version across the manual	Entire publication (marked with change bar)

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
1715 Redundant I/O System Technical Specifications, publication 1715-TD001	Provides technical specifications for components of the 1715 Redundant I/O System.
EtherNet/IP Network Configuration User Manual, publication ENET-UM001	Describes how you can use EtherNet/IP™ modules with your Logix 5000® controller and communicate with various devices on the Ethernet network.
ControlLogix Enhanced Redundancy System, publication 1756-UM535	Provides design and configuration information for a ControlLogix Redundancy System.
Using ControlLogix in SIL 2 Applications Safety Reference Manual, publication 1756-RM001	Describes the guidelines for using ControlLogix controllers in a SIL 2 safety application.
High Availability Systems Reference Manual, publication HIGHAV-RM002	Provides information to help design and plan high availability systems.
Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication SGI-1.1	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications .	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at rok.auto/literature.

Notes:

Redundancy System

The 1715 Redundant I/O system lets a ControlLogix® controller communicate to a remote, redundant I/O chassis by using EtherNet/IP™. The 1715 Redundant

I/O system provides fault tolerance and redundancy for critical processes by using a redundant adapter pair and multiple I/O modules that have diagnostics and are easily replaceable. The modular architecture lets you build and adapt a system to suit the specific needs of an installation.

The 1715 Redundant I/O system consists of a two-slot adapter base unit that houses a redundant adapter pair. The adapter base unit is connected to up to eight I/O base units, which can hold up to 24 I/O modules (three I/O modules per I/O base unit) when connected together. The I/O modules can be configured in any combination of simplex or duplex pairs, depending on the mode of operation needed. The I/O base units can be connected directly to the adapter base unit and other I/O base units, or through expansion cables.

The 1715 Redundant I/O system is a modular system in which the adapter and I/O base units snap together by using mating connectors and retaining clips to form the backplane. One module in a duplex pair can be removed and replaced without system interruption if the partner module is free of faults. The base units, via termination assemblies, provide the interconnections for power, adapter, and I/O data. Once connected, the base units form the single mechanical assembly or backplane.

Required Software

Before you begin using your 1715 Redundant I/O System, verify that you have the software that is required to install and configure your system:

- RSLogix 5000® programming software, version 20

Non-SIL 2 applications using revision 2.x of 1715 can use version 19.

- Studio 5000 environment, version 21 or later



ATTENTION: ControlLogix 5570 controllers are certified in RSLogix 5000 version 20 or later for SIL 2 operations. See the latest certifications for software and firmware at rok.auto/certifications. See the TÜV website at <https://www.tuv.com/world/en/functional-safety-services.html> for SIL 2 certification listings.

Redundant 1715 Adapters

The redundant, partnered adapters monitor inputs/outputs and diagnostics for the I/O in the remote chassis. If a fault occurs in one of the redundant adapters, an IP address switchover occurs and I/O monitoring and communication to the ControlLogix System continues without interruption. This switchover is transparent to the user. Status indicators and status information available to the ControlLogix application enables you to determine the status of each 1715-AENTR adapter. See [Appendix A](#).

1715 I/O Modules

Both digital and analog I/O modules are available for use in this system, depending on your needs. I/O modules can be used in the following modes:

- Simplex mode (one module, simplex termination assembly)
- Duplex mode (two modules, duplex termination assembly)

[Table 1](#) lists the 1715 modules that can be used in this system.

Table 1 - Modules Available for the 1715 Redundant I/O System

Cat. No.	Description
1715-AENTR x 2	A pair of Ethernet adapters
1715-IB16D	A 16-channel digital input module
1715-OB8DE	An 8-channel digital output module
1715-IF16	A 16-channel analog input module
1715-OF8I	An 8-channel analog output module

1715 I/O Modules in SIL 2 Applications

With the inclusion of diagnostics for the CIP™ messaging channel, the 1715 Redundant I/O system can be used for SIL 2 safety applications. For information about SIL 2 safety applications, see the Using ControlLogix in SIL 2 Applications Safety Reference Manual, publication [1756-RM001](#).

System Architecture

The 1715 Redundant I/O system operates with a pair of 1715-AENTR adapters.

When designing your control system by using the 1715 Redundant I/O system, you can use digital and analog I/O modules in one of these ways:

- One I/O module in Simplex mode
- A pair of I/O modules that work in Duplex mode

Before you build your system, decide the layout of your I/O. You can add more I/O modules at any time. The type of termination assembly installed, the number of modules, and the AOP configuration determine whether the I/O mode of operation is Simplex or Duplex.

The use of termination assemblies communicates the I/O mode of operation that you choose (Simplex or Duplex) to your system through the backplane (the adapter and I/O base units).

Termination Assemblies

The termination assembly (TA) matches your software configuration for simplex or duplex. Attached to an I/O base, the TA can start in any slot and can span multiple connected bases. When modules are used in Duplex mode, one module can be absent and the system still runs.

Base Unit Structure

The adapter base unit is always the leftmost base unit in the connection chain. The total length of the base unit connection chain, including all expansion cables, cannot exceed 10 m (32.81 ft).

An adapter always occupies slot 0 or 1.

One chassis can support up to 8 I/O base units (up to 24 I/O modules).

1715-AENTR Adapters

The leftmost adapter position, or slot, is 0. The rightmost adapter slot is 1. One redundant adapter pair always occupies slots 0 and 1 of the system. 'A' designates the primary adapter partner and 'B' designates the secondary adapter partner of the redundant adapter pair. This system is designed to run with two adapters. It can run with one adapter for a limited time while replacing a damaged module, but ideally, needs both adapters running simultaneously.

IMPORTANT There is no method to configure a system to use only one 1715-AENTR adapter. If you use only one 1715-AENTR adapter, the unused module generates errors.

You can install or remove a partner adapter for replacement while the 1715 Redundant I/O system is operational. The Network status indicator flashes green to identify the partner adapter. During replacement of the module, there is a one-time, maximum 500 ms delay until the module becomes a qualified partner.

I/O Modules

I/O module slots are numbered from 2...25, based on the distance from the adapter base unit. If duplex I/O module pairs are used, the two modules of the pair must be in adjacent slots. The left, lower slot number is considered the slot number and address for the pair. Any combination of simplex modules and duplex pairs can be used in one or more connected I/O base units.

IMPORTANT A partner I/O module can be installed or removed while the 1715 Redundant I/O system is operational without impact to the rest of the system.

Module Positioning in the 1715 Redundant I/O System

There are 26 total slot positions in the system that is numbered from 0...25. The first two positions always contain the redundant adapter pair, in slots 0 and 1. The remaining positions begin numbering at slot 2 and contain the I/O modules, ending at slot position number 25. Any combination of simplex or duplex I/O module pairs can be used in the I/O base units. See [Table 2](#) for a sample of what a system could look like.

Expansion cables can be used to connect base units, as shown in [Figure 1 on page 15](#).



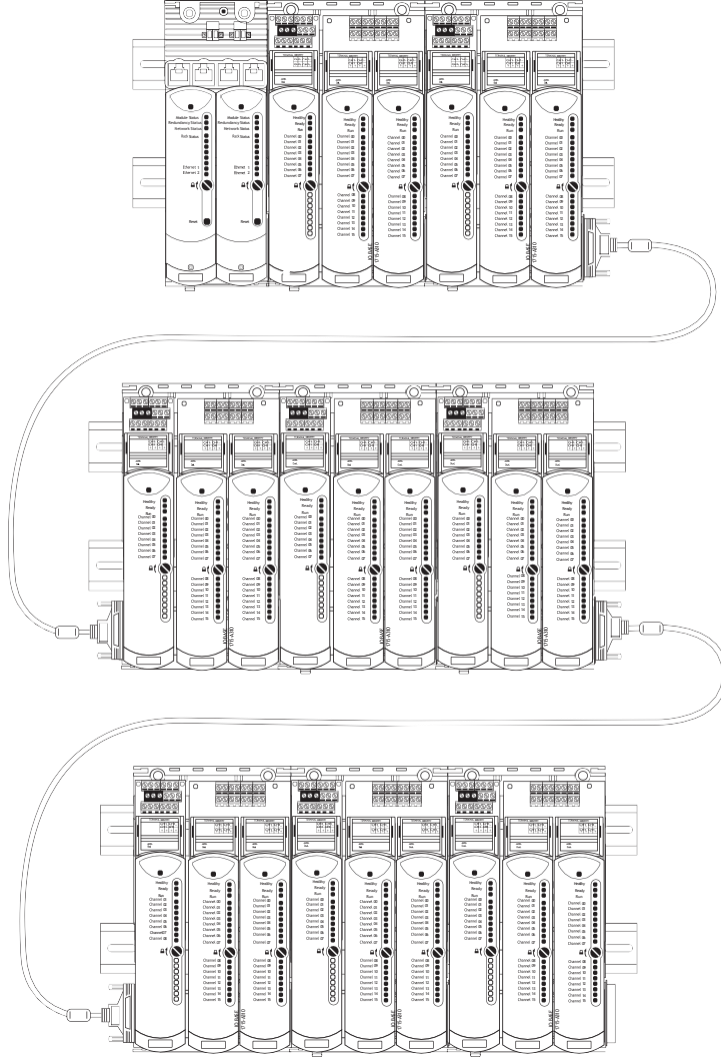
The sample system configuration in Example 1 does not match the system layout that is displayed in Example 2. Example 1 and Example 2 are different examples of possible configurations that you can have for your system.

Table 2 - Example 1 - A Sample System Configuration

System Slot Number	Base Unit Type	Module Position/Slot Number by Base Unit Type	Module Designation
0	Adapter	0	Adapter A
1	Adapter	1	Adapter B
2	I/O	01 First I/O base unit	Module A of first duplex pair
3	I/O	02	Module B of first duplex pair
4	I/O	03	Module A of second duplex pair
5	I/O	04 Second I/O base unit	Module B of second duplex pair
6	I/O	05	First simplex module
7	I/O	06	Module A of third duplex pair
8	I/O	07 Third I/O base unit	Module B of third duplex pair

Table 2 - Example 1 - A Sample System Configuration

System Slot Number	Base Unit Type	Module Position/Slot Number by Base Unit Type	Module Designation
9	I/O	08	Second simplex module
10	I/O	09	Third simplex module
11...25	I/O	10...24 Fourth...eighth I/O base unit	Any combination of simplex/duplex pair modules

Figure 1 - Example 2 - A Sample System Layout

Lay Out the Hardware

This section discusses how to lay out the hardware for the system by topology.

System Context

The redundant I/O subsystem must be connected to one ControlLogix redundancy system, or any Logix system that supports I/O via the EtherNet/IP network. The topologies that the 1756-EN2T or 1756-EN2TR modules support, Device Level Ring (DLR) and star, establish all connections via the EtherNet/IP network.

For more information about DLR topologies, see the EtherNet/IP Device Level Ring Application Technique, publication [ENET-AT007](#).

Figure 2 - 1715 Redundant I/O System DLR (Ring) Topology Attached to a 1756 ControlLogix Enhanced Redundancy System

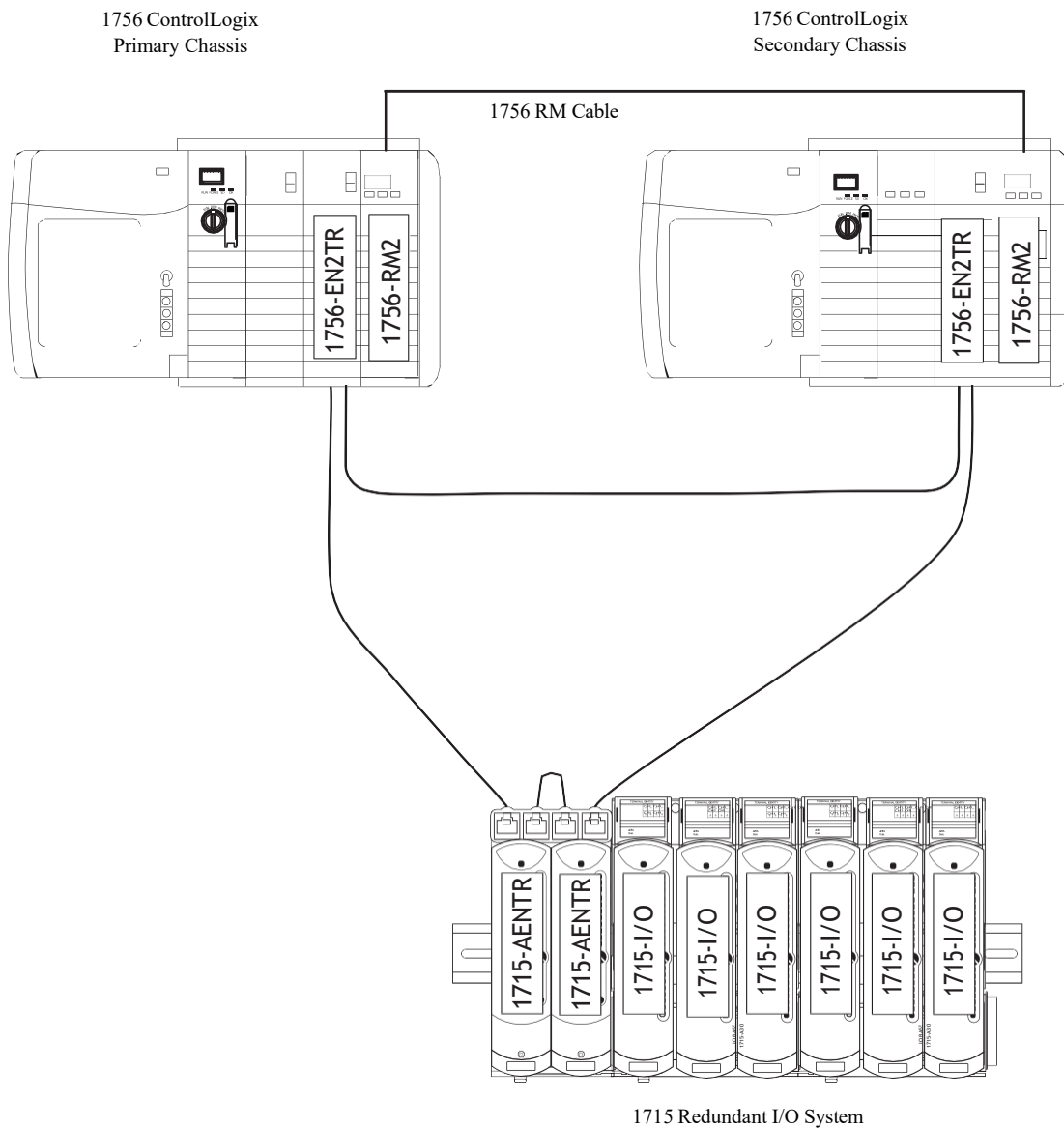
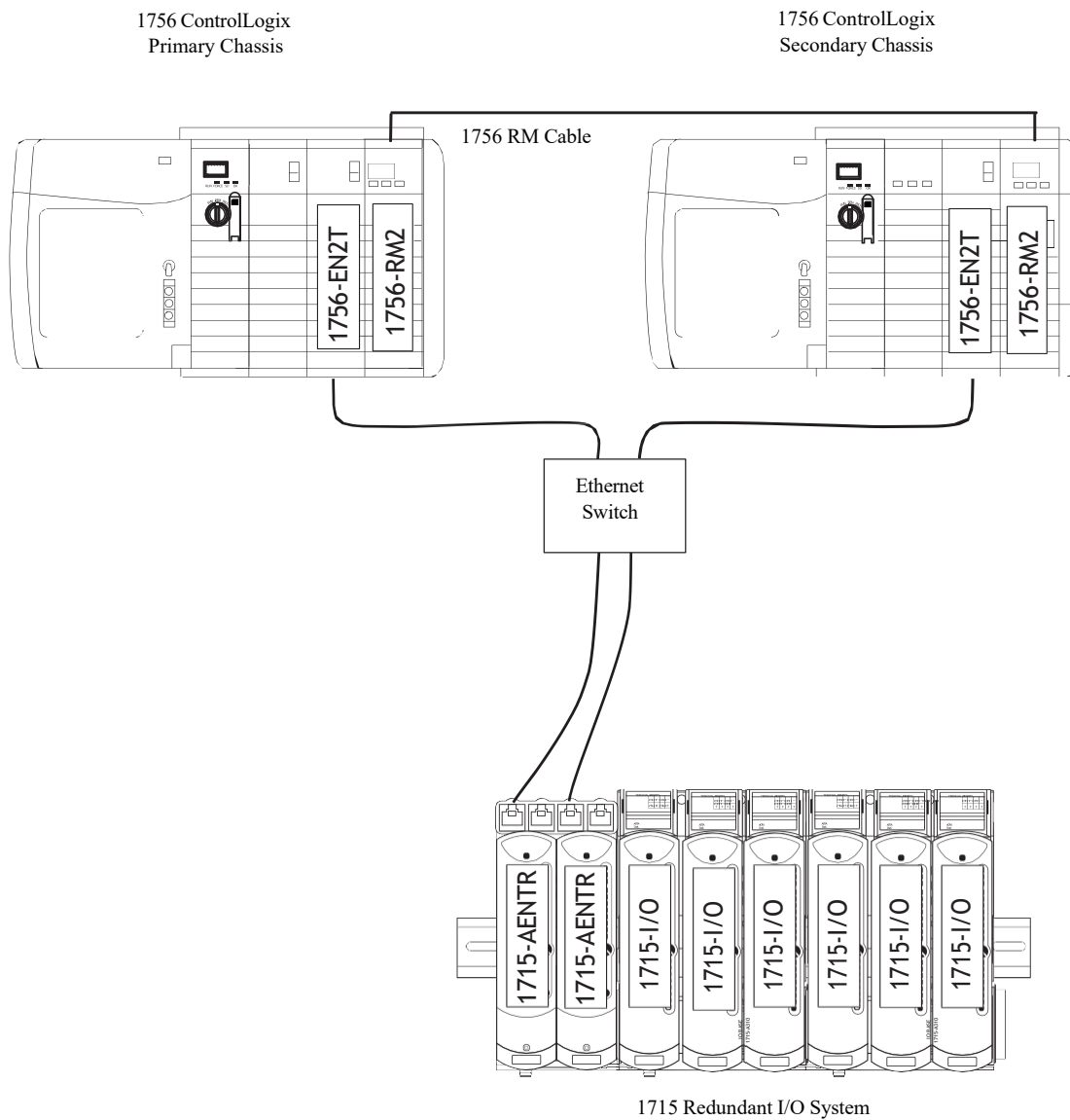
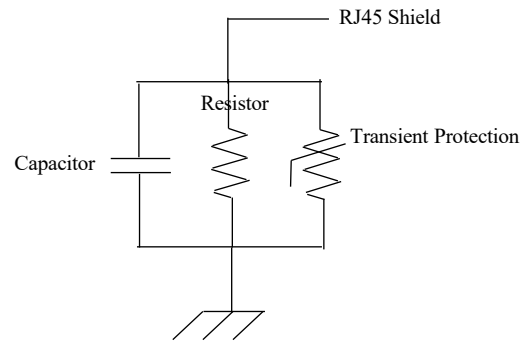


Figure 3 - 1715 Redundant I/O System Star Topology Attached to a 1756 ControlLogix Enhanced Redundancy System

To help prevent ground loops that are caused by shielded cables, RJ45 shields on the Ethernet ports on the 1715 adapter base unit are connected to earth through a parallel resistance /capacitance circuit arrangement as shown in [Figure 4](#).

Figure 4 - Shield Termination Arrangement to Help Prevent Ground Loops



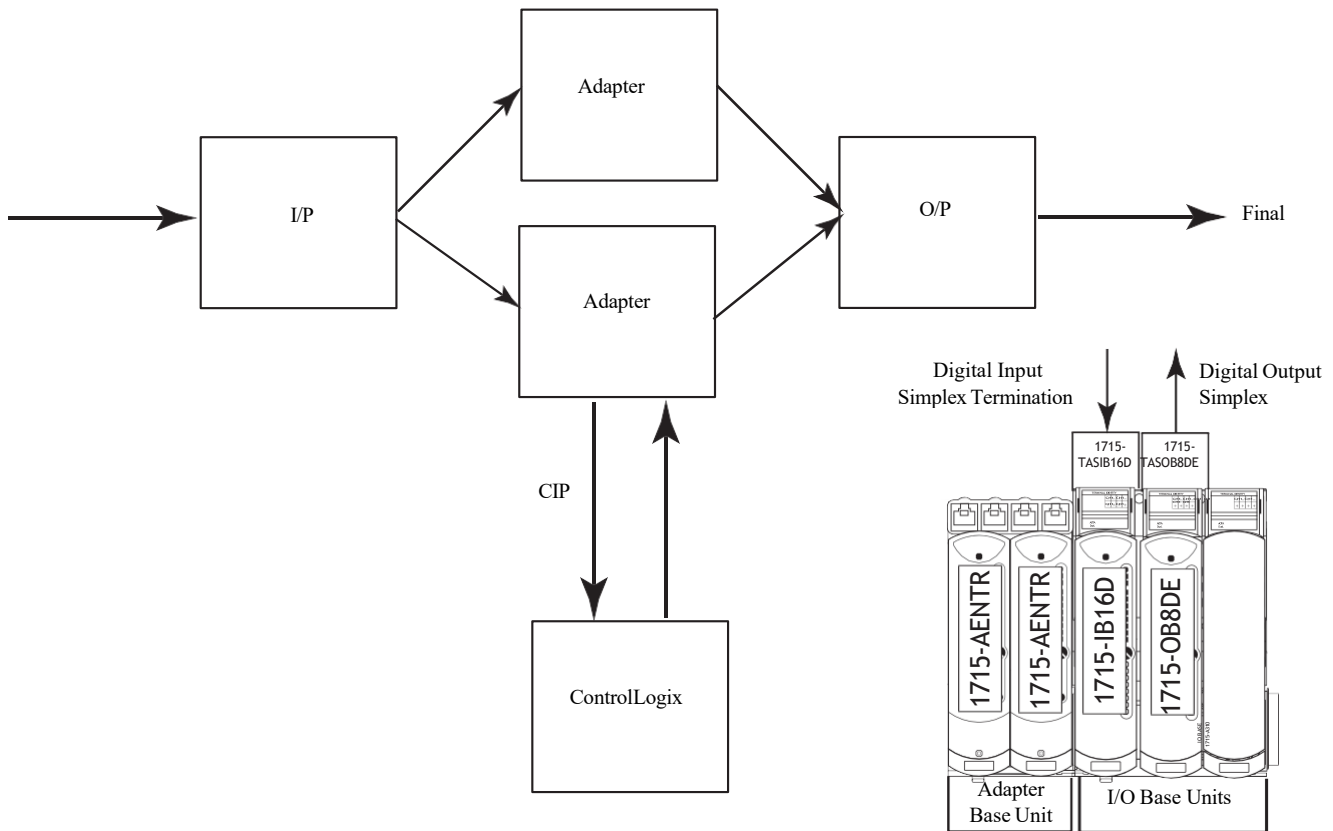
This complies with the shield grounding guidance that is given in The CIP Networks Library, Volume 2, Edition 1.21, section 8-9.4.3. ©ODVA, Inc. 2016.

For more information regarding ODVA, visit www.odva.org.

Simplex Architecture

Simplex I/O modules fail-safe on the first detected module fault.

Figure 5 - Simplex Architecture - Input and Output



Duplex Architecture

An example configuration of dual-input modules and adapters, and an output module is shown in [Figure 6](#). A redundant input or redundant output module provides fault tolerance for module and channel failures.

Figure 6 - Duplex Architecture Duplex Inputs, Simplex Output

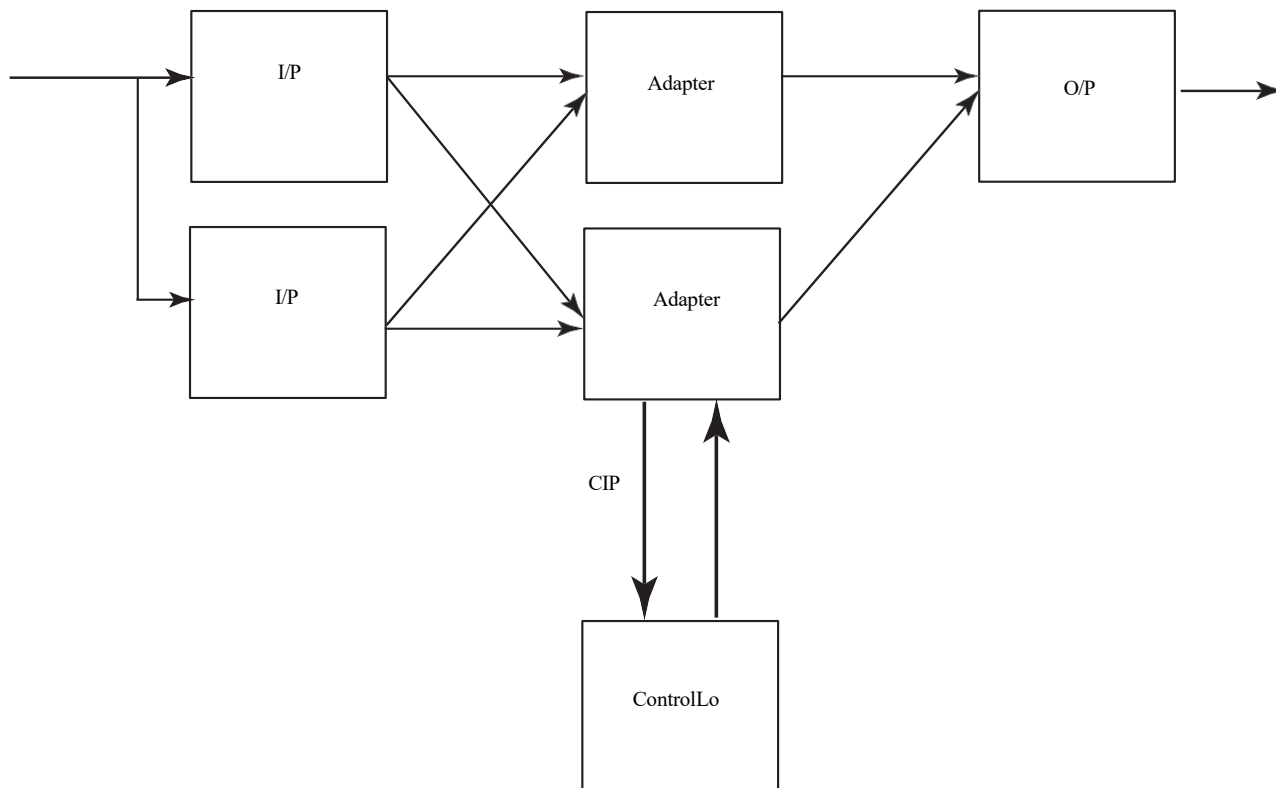
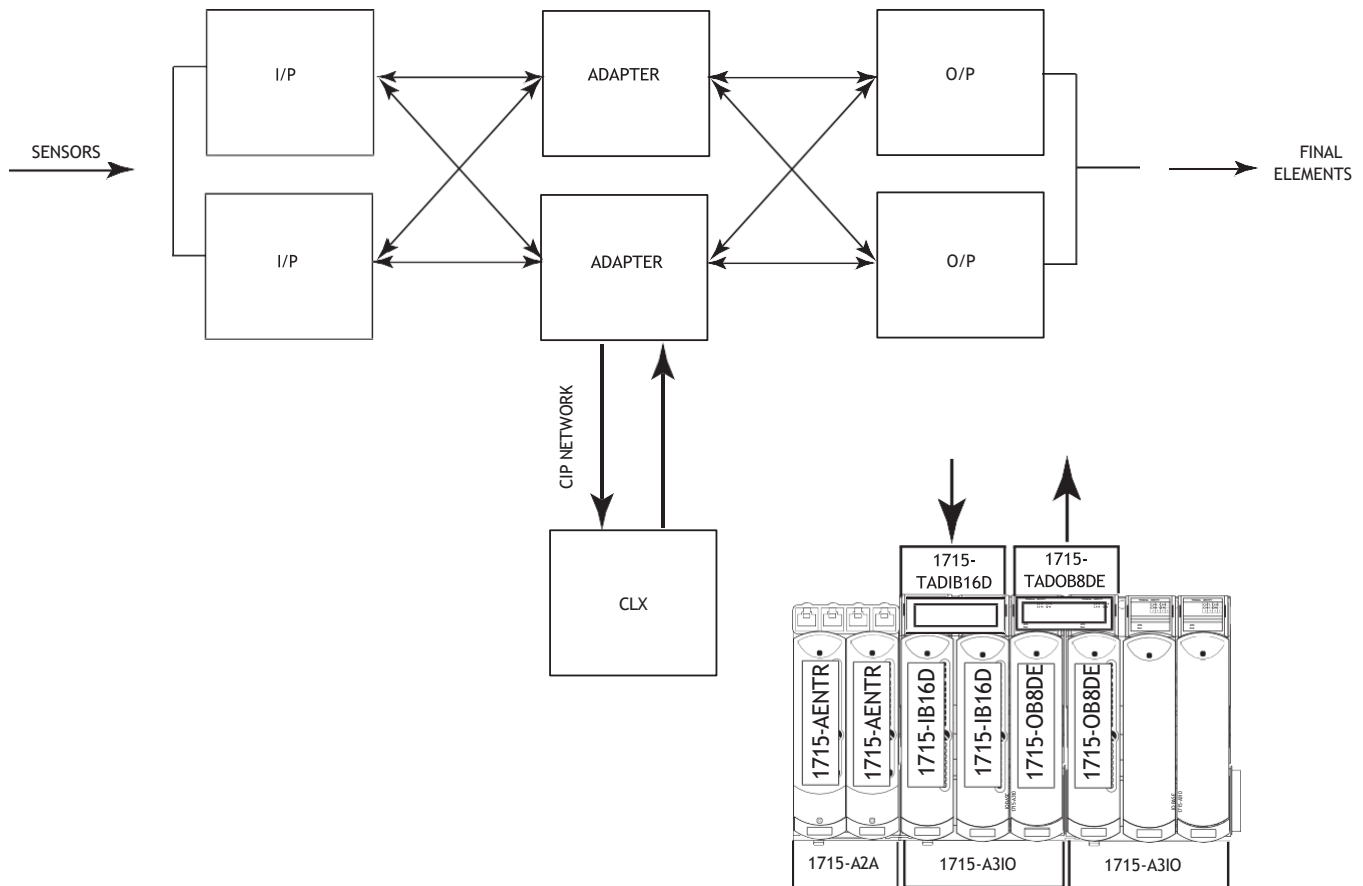


Figure 7 - Duplex Architecture Inputs and Outputs

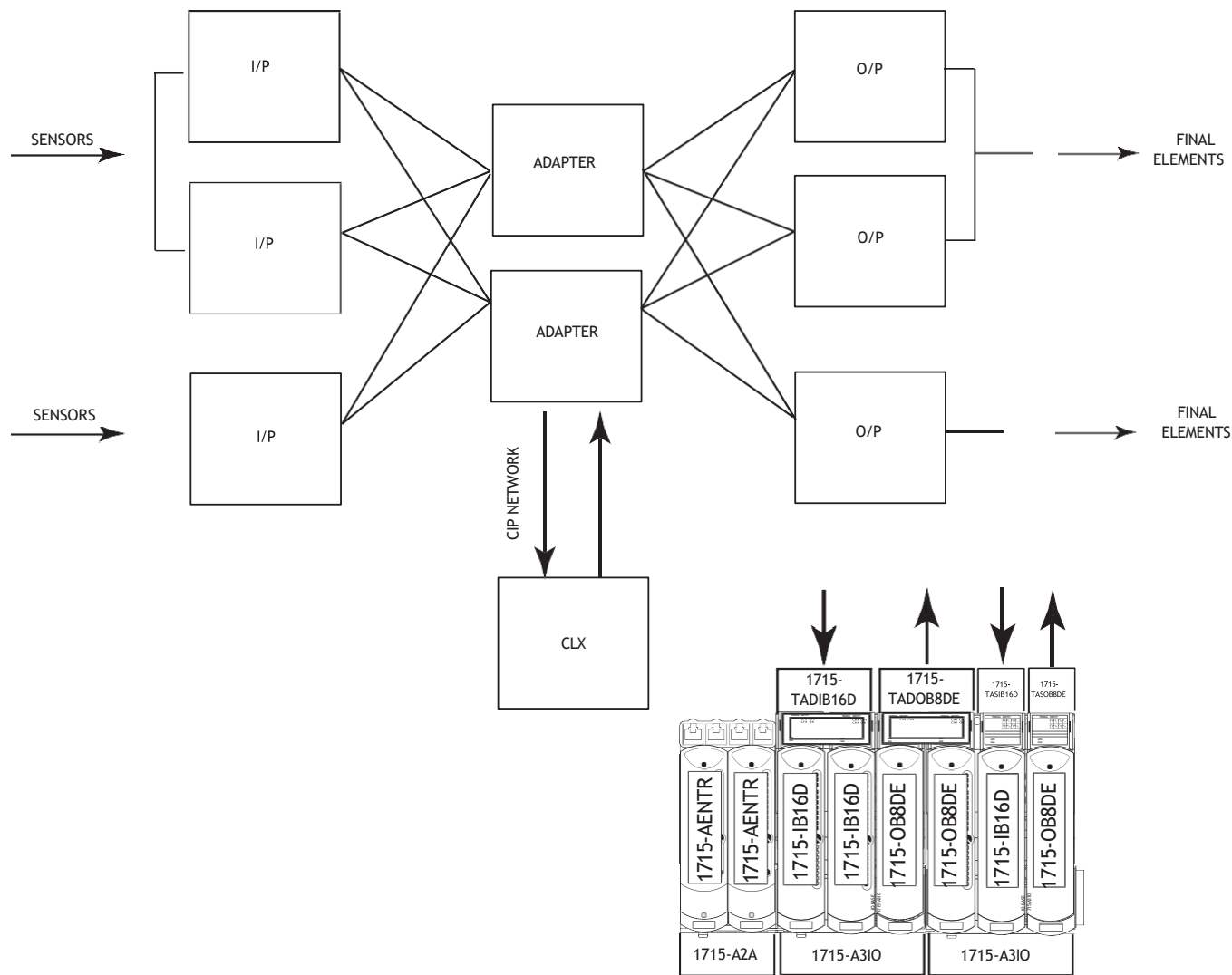


Termination assemblies can span across I/O base units.

Mixed Architecture

There can be a mixture of architectures within one system. [Figure 8](#) shows simplex and dual I/O configurations.

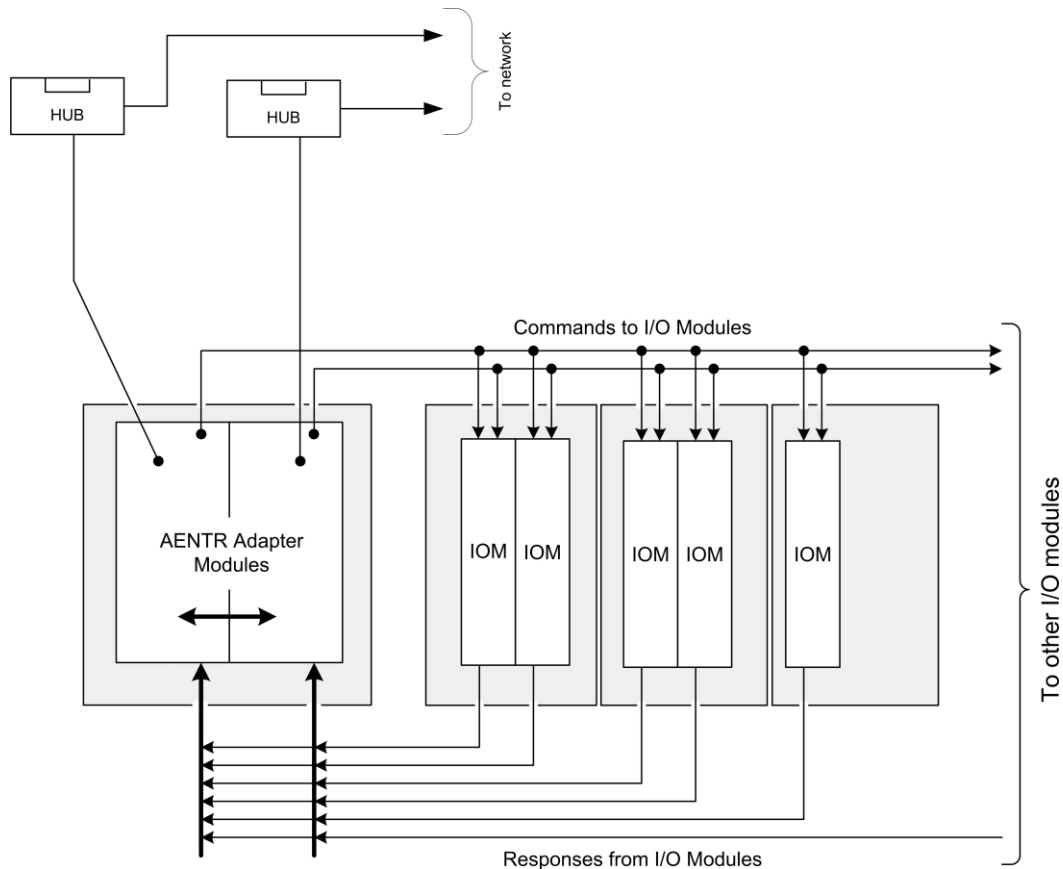
Figure 8 - Mixed Architecture



Bus Diagram

A detailed drawing of the backplane is shown [Figure 9](#).

Figure 9 - Bus Diagram of 1715 Redundant I/O System



Switchover Considerations

Each 1715 Redundant I/O system uses one IP address as the primary IP address for all communication on the EtherNet/IP network. The redundant adapter pair consists of two active modules, a primary adapter and its partner, a secondary module. For this document, the primary module is referred to as module 'A' and the secondary module is referred to as module 'B'.

On power-up, the adapter in the leftmost slot is considered the primary module (when two adapters are present) because it uses the primary IP address, and because it is the module responsible for receiving/transmitting to ControlLogix controller on the EtherNet/IP network.

The module in the rightmost slot is considered the secondary module partner and uses the primary IP address +1. For example, if the primary module in the leftmost slot has an IP address of 'N', then the secondary module in the rightmost slot, has an IP address of 'N+1'.

Both modules are always active and are responsible for monitoring all inputs and outputs, monitoring diagnostics in the system, and reading and writing data from/to I/O simultaneously. When the primary module receives a write, it notifies the secondary module of the data to write and which module to write it to. At a synchronized point in time, both adapters physically write to the I/O.

The adapters negotiate which module is primary, depending on the status of the system. If the primary module is unable to perform its role, for example, if a fault occurs in the primary module, then the secondary module becomes the new primary, assuming the IP address of the primary module, taking over the role of communication. The primary module is the only module of the pair that produces data on the EtherNet/IP network.

If there is a fault, the IP address swapping between the primary module and the secondary module takes no longer than 20 ms from the time of the initiating fault. The secondary module is the new primary and handles all communication. (Depending on the structure of your Ethernet configuration, this time can be impacted.)

This IP address swap is transparent to the user. You can detect which module the primary module is by examining the Network status indicator near the top of each adapter. On the primary adapter, the Network status indicator is steady green; on the secondary adapter, the Network status indicator flashes green.

Once a swap occurs, the new primary module remains the primary unless there is a good reason to swap over again.

Obtaining a New IP Address

The IP address of the primary module is stored in the adapter base unit. If a stored primary IP address is available, the adapter uses that address. If a stored primary IP address is not available, then the adapter uses BOOTP/DHCP to obtain an IP address.

The adapter transmits DHCP requests, but is able to process a BOOTP/DHCP response from either a DHCP or BOOTP server. If the BOOTP/DHCP request is unsuccessful, the secondary adapter (that is, Module B), attempts to obtain the IP address of the primary module through BOOTP/DHCP.

The adapters continue to attempt a BOOTP/DHCP configuration until an IP address is obtained, alternating between adapters A and B. Once an adapter has obtained the IP address, the secondary module can use that IP address + 1.

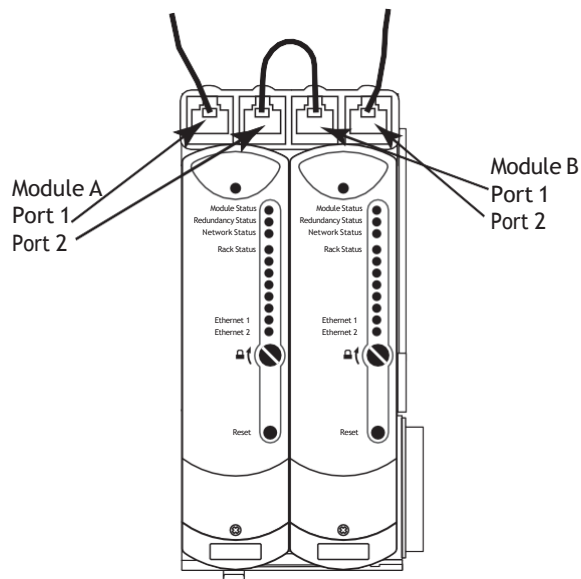
Once an adapter has a primary IP address, it confirms that it does not have a duplicate IP address. See EtherNet/IP Network Configuration User Manual, publication [ENET-UM001](#). The Network status indicator displays duplicated IP addresses by showing steady red. For additional information about assigning an IP address for the first time, see [Assign an IP Address on page 106](#).

Ethernet Topology

The 1715 Redundant I/O system supports Device Level Ring (DLR) and star topologies.

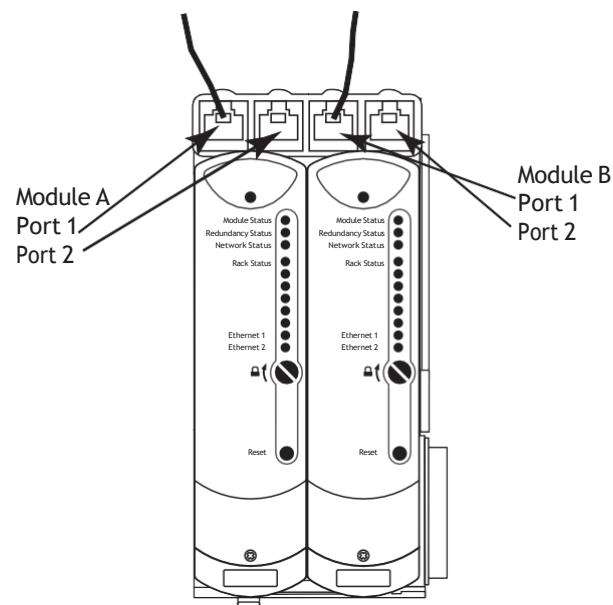
For DLR, the Ethernet ports of the adapters are configured with the outward-facing ports (Port 1 of Module A and Port 2 of Module B) operating as a 2-port switch. Port 2 of Module A and Port 1 of Module B must be connected together with an Ethernet patch cable.

Figure 10 - DLR Topology



For a star topology, the Ethernet ports of the adapters are configured with the leftmost ports (Port 1 of Module A and Port 1 of Module B) operating as a 2-port switch. The rightmost ports on each adapter are left unused.

Figure 11 - Star Topology



For Ethernet considerations, see EtherNet/IP Network Configuration User Manual, publication [ENET-UM001](#), and ControlLogix Redundancy User Manual, publication [1756-UM535](#).

Communication on the EtherNet/IP Network

Communication to a simplex module is addressed to the slot number for that module. CIP™ communication to modules in a duplex configuration, including the adapters, is addressed to the lowest slot number for the module pair.

The adapters respond with CIP errors for attempts to communicate to an I/O module of a type that is not the same as the physically installed module.

The termination assembly type (simplex/duplex) determines the CIP messages for corresponding CIP objects that the adapter processes for each I/O module.

Communication Port Security

Each TCP or UDP port exposed by the Product SHALL be documented along with the corresponding supported protocol.

See the TCP and UDP ports in this table:

Listening Port Number	Type	Protocol Name	Essential Port?	Active or Out of Box?	Can User Disable?
44818	TCP	EtherNet/IP	Yes	Yes	No
44818	UDP	EtherNet/IP	Yes	Yes	No
2222	UDP	EtherNet/IP I/O	Yes	Yes	No
55555	TCP	Diagnostic	Yes	Yes	No
80	TCP	Web server	No	No	Yes



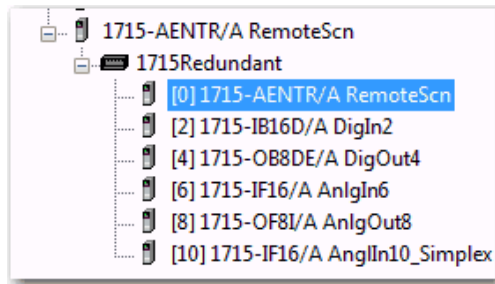
WARNING: The diagnostic port (55555) should only be used by Rockwell Automation Technical Support.

System Performance

This section describes connections and RPI settings for the system.

Connections

The adapter has one required connection and does not support a rack connection. Each I/O module has one required connection (simplex or duplex). For example, the system in [Figure 12](#) has five I/O modules. Four are duplex and one is simplex. They are all configured for data connection.

Figure 12 - Duplex and Simplex Connections

[Figure 12](#) shows six connections—one for each entry in the configuration.

Table 3 - RSLogix 5000 or Studio 5000 Logix Designer Configuration

Connection	Module	Duplex/ Simplex	Module Description
1	1715-AENTR	Duplex	Ethernet Adapter
1	1715-IB16D	Duplex	16-point Digital Input
1	1715-OB8DE	Duplex	8-point Diagnostic Digital Output
1	1715-IF16	Duplex	16-point Analog Input
1	1715-OF8I	Duplex	8-point Analog Digital Input
1	1715-IF16	Simplex	16-point Analog Input

The digital input module connections use change-of state-triggers, and the adapter and analog module connections use cyclic triggers.

RPI

The RPI you set specifies the maximum amount of time between data updates. The 1715 modules support an RPI range of 60...750 ms.

Cat. No.	Minimum RPI	Maximum RPI	Default RPI
1715-AENTR	60 ms	750 ms	180 ms
1715-IB16D			60 ms
1715-OB8DE			60 ms
1715-IF16			120 ms
1715-OF8I			120 ms

IMPORTANT Chassis that are near the maximum capacity can have connection timeouts during normal operation when the RPI is set to the minimum value. Test the system to validate the configuration.

Connection and Data Format

The adapter and I/O modules each support one data connection for input/output data. Listen Only connections are not supported.

Timestamping

A time stamp is the time that an event occurred. It is recorded by the 1715 system and passed to ControlLogix. Time stamp resolution is in μs , but 1715 is accurate to 10 ms typical.

Notes:

Installation Instructions

This chapter explains how to build the 1715 Redundant I/O system. These installation instructions include how to build the backplane by connecting the adapter and I/O base units and mounting them on DIN rails within a cabinet, how to install and wire the termination assemblies, how to mount the adapter and the I/O modules onto the system, and how to use expansion cables to allow for additional space requirements for the system within an enclosure.

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 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

This equipment is not intended for use in residential environments and may not provide adequate protection to radio communication services in such environments.

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 help prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to help prevent or minimize the spread of flame, complying with a flame spread rating of 5VA or be approved for the application if non-metallic. 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.

In addition to this publication, see the following:

- Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#), for additional installation requirements
- NEMA Standard 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by enclosures

Prevent 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.
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe packaging when not in use.



ATTENTION: Do not insert or remove a module, base unit, or termination assembly while power is applied. Interruption of the backplane can result in unintentional operation or machine motion.



ATTENTION: For UL approved installations, the 1715-OB8DE output power source must be isolating, wired with a minimum of 0.75 mm² (18 AWG) wire and fused with a rating of 32V DC min/5 A max.



ATTENTION: Do not wire more than 1 conductor on any single terminal.



ATTENTION: This equipment is not resistant to sunlight or other sources of UV radiation.

European and United Kingdom Hazardous Location Approval

The following applies when the product bears the Ex Marking.

This equipment is intended for use in potentially explosive atmospheres as defined by European Union Directive 2014/34/EU and UK Statutory Instrument (UKSI) 2016:1107 as amended by UKSI 2019:696, and has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of Category 3 equipment intended for use in Zone 2 potentially explosive atmospheres.

Compliance with the Essential Health and Safety Requirements has been assured by compliance with IEC/EN 60079-0, Explosive atmospheres – Part 0: Equipment – General requirements and IEC/EN 60079-7, Explosive atmospheres – Part 7: Equipment protection by increased safety “e”.

ATEX/UKCA certification: Ex ec IIC T4 Gc

ATEX certificate number: 11 ATEX 7928686X

UKCA certificate number: UL22UKEX2512X

IECEx certification:  II 3G Ex ec IIC T4 Gc

IECEx certificate number: IECEx UL 15.0032X

The ambient temperature range is -25...+60 °C (-13...+140 °F) for all models.

Special Conditions for Safe Use:

- All models: The ambient temperature range is -25 ...+60 °C (-13...+140 °F).
- Subject devices are to be installed in a tool-only accessible enclosure that provides a degree of protection not less than IP54 in accordance with IEC/EN 60079-0, Explosive atmospheres - Part 0: Equipment - General requirements and IEC/EN 60079-7, Explosive atmospheres - Part 7: Equipment protection by increased safety "e". Enclosure is to be marked with the following: "Warning - Do not open when energized". After installation of subject devices into the enclosure, access to termination compartments shall be dimensioned so that conductors can be readily connected. Grounding conductor should have a minimum cross-sectional area of 3.31 mm² (12 AWG).
- Subject devices are for use in an area of not more than pollution degree 2 in accordance with IEC 60664-1.
- Subject devices are to use conductors with a minimum conductor temperature rating of 85 °C (185 °F).
- Subject devices are to be installed in the vertical orientation only.

**WARNING:**

- This equipment shall be mounted in an enclosure with a minimum ingress protection rating of at least IP54 (as defined in IEC60529) in accordance with IEC/EN 60079-0, Explosive atmospheres – Part 0: Equipment – General requirements and IEC/EN 60079-7, Explosive atmospheres – Part 7: Equipment protection by increased safety “e”. The equipment shall be used in a Pollution Degree 2 environment (as defined in IEC 60664-1) when used in Zone 2 environments. The enclosure shall be the type that can only be opened, or the type with a cover that can only be removed by the use of a tool.
- This equipment shall be used within its specified ratings defined by Rockwell Automation.
- Provision shall be made to help prevent the rated voltage from being exceeded by transient disturbances of more than 140% of the rated voltage when applied in Zone 2 environments.
- This equipment must be used only with ATEX and UKCA-certified Rockwell Automation Termination Assemblies.
- Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
- Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.
- Enclosure must be marked with the following: ‘Warning - Do not open when energized.’ After installation of equipment into the enclosure, access to termination compartments shall be dimensioned so that conductors can be readily connected.

For ATEX, IECEx, and UKCA certificates, go to rok.auto/certifications.

Multi-point Network Communication Connections



WARNING: If you connect or disconnect the communication cable with power applied to this module or any device on the network, an electric 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.

Field-side Power



WARNING: If you connect or disconnect wiring while the field-wire power is on, an electric 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.

Removal and Insertion Under Power (RIUP) Fuses



WARNING: If you insert or remove a base unit or termination assembly while power is applied, an electric arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed before proceeding.



WARNING: Do not remove or replace fuses when energized. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations.	Informations sur l'utilisation de cet équipement en environnements dangereux.
Products marked 'CL I, DIV 2, GP A, B, C, D' are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest 'T' number) be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués 'CL I, DIV 2, GP A, B, C, D' ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.
EXPLOSION HAZARD • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous.	RISQUE D'EXPLOSION – • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

Before You Begin

This section lists important information that you must consider before starting to build your 1715 Redundant I/O system:

- Review the parts list and identify the system components.
- Review the power requirements for the system and for field devices.
- Review design considerations for heating and cooling.
- Specify an enclosure.
- Install the necessary software.

Make Sure that Warranty is Not Compromised



ATTENTION: Failing to install retaining clips and properly secure the Terminal Assembly (TA) can lead to connector / pin damage on the modules and the 1715-A3IO. Failure to comply with this Attention Notice will render the Warranty void and the equipment will not be covered.

Graphical Representation

IMPORTANT Throughout this manual, some graphics do not depict the actual hardware as required. These graphics are for representational purposes only and do not necessarily reflect the actual component layout of your system.

Parts List

These parts are available to build a 1715 Redundant I/O system. Their description and catalog part numbers are as follows.

Table 4 - Parts Table

Cat. No.	Description
1715-AENTR	Communication adapter
1715-IB16D	16-channel digital input module
1715-OB8DE	8-channel digital output module
1715-IF16	16-channel analog input module
1715-OF8I	8-channel analog output module
1715-A2A	2-slot communication adapter base unit
1715-A3IO	3-slot I/O base unit
1715-TASIB16D	Termination assembly - digital input simplex
1715-TADIB16D	Termination assembly - digital input duplex
1715-TASOB8DE	Termination assembly - digital output simplex
1715-TADOB8DE	Termination assembly - digital output duplex
1715-TASIF16	Termination assembly - analog input simplex
1715-TADIF16	Termination assembly - analog input duplex
1715-TASOF8	Termination assembly - analog output simplex
1715-TADOF8	Termination assembly - analog output duplex
1715-N2T	Tall slot filler cover
1715-N2S	Short slot filler cover
1715-C2	Expansion cable - 2 m

Required Tools

The installation and maintenance of the 1715 Redundant I/O system requires these tools:

- Screwdriver, 0.8 x 9.0 mm (1/25 x 3/8 in.), for module clamp screws and slot filler covers
- Torque screwdriver, 0.6 x 3.0 mm (1/40 x 1/8 in.), for DC power wiring terminals
- Torque screwdriver, 0.4 x 2.0 mm (1/64 x 5/64 in.), for field wiring terminals
- Two open-end wrenches, 10 mm (0.39 in.), for ground stud nuts
- A 2.5 mm (0.10 in.) Allen wrench

Spacing Requirements

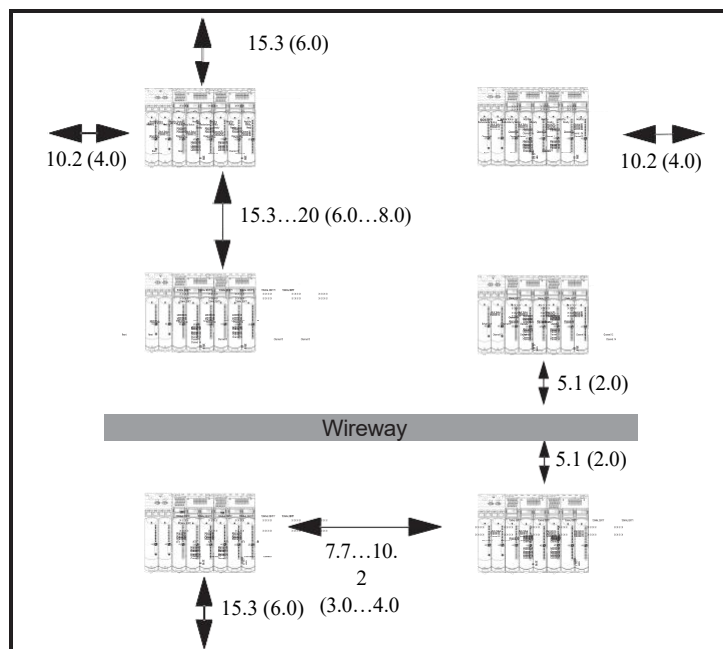
You must consider spacing requirements before mounting your system.

IMPORTANT Make sure that you meet the minimum spacing requirements shown.

Allow 15.3...20 cm (6.0...8.0 in.) between chassis and a heat source, and chassis and cabinet, and allow 5.1 cm (2.0 in.) between wireway and top or bottom of chassis.

Dimensions are in cm (in.).

Figure 13 - Cabinet



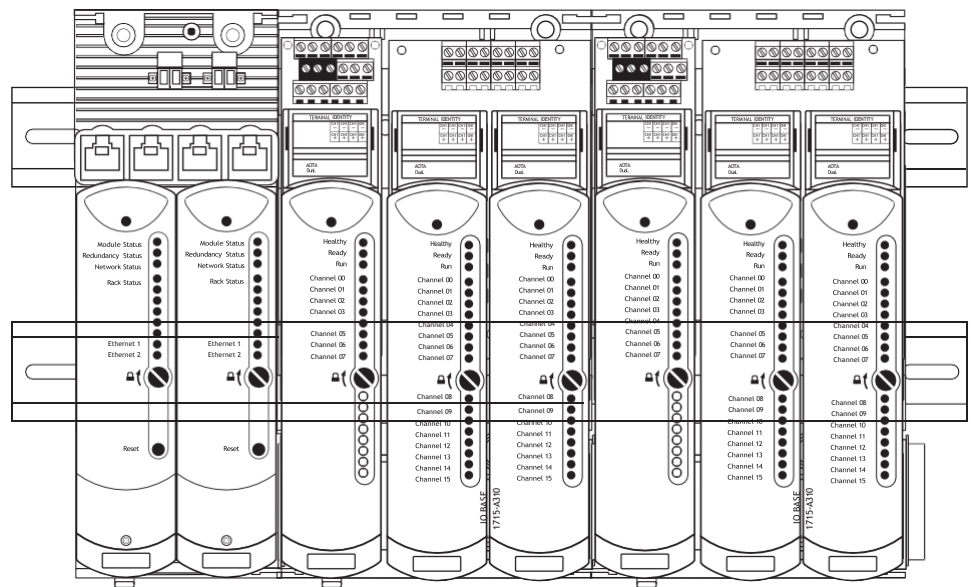
IMPORTANT When you install the modules into an I/O base unit, note that the bases are intended to be mounted only horizontally. Install the modules in the I/O base unit only in a vertical orientation.

System Hardware Components

The 1715 Redundant I/O System is a remote redundant I/O system that was developed to communicate with a Logix controller in a ControlLogix® enhanced redundant system by using the EtherNet/IP™ network and includes these components:

- A pair of 1715-AENTR adapters serves as a ‘proxy’ for all EtherNet/IP communication to and from redundant I/O modules.
- 1715 digital and analog I/O modules.
- A 1715-A2A dual redundant I/O adapter base unit connects to a 1715-A3IO I/O module base unit to form the backplane for the system.
- Termination assemblies are available in Simplex and Duplex configuration. They mount onto the 1715-A3IO I/O module base unit, and connect the I/O modules to the I/O wiring.
- Each 1715-A3IO I/O base unit holds up to three I/O modules. Up to 24 I/O modules can be added to the system.
- The system is built on DIN rails within a cabinet enclosure.
- 1715-C2 expansion cables can be used to allow for space restrictions of the system within the cabinet.

IMPORTANT Conformal coating is standard on all 1715 modules.

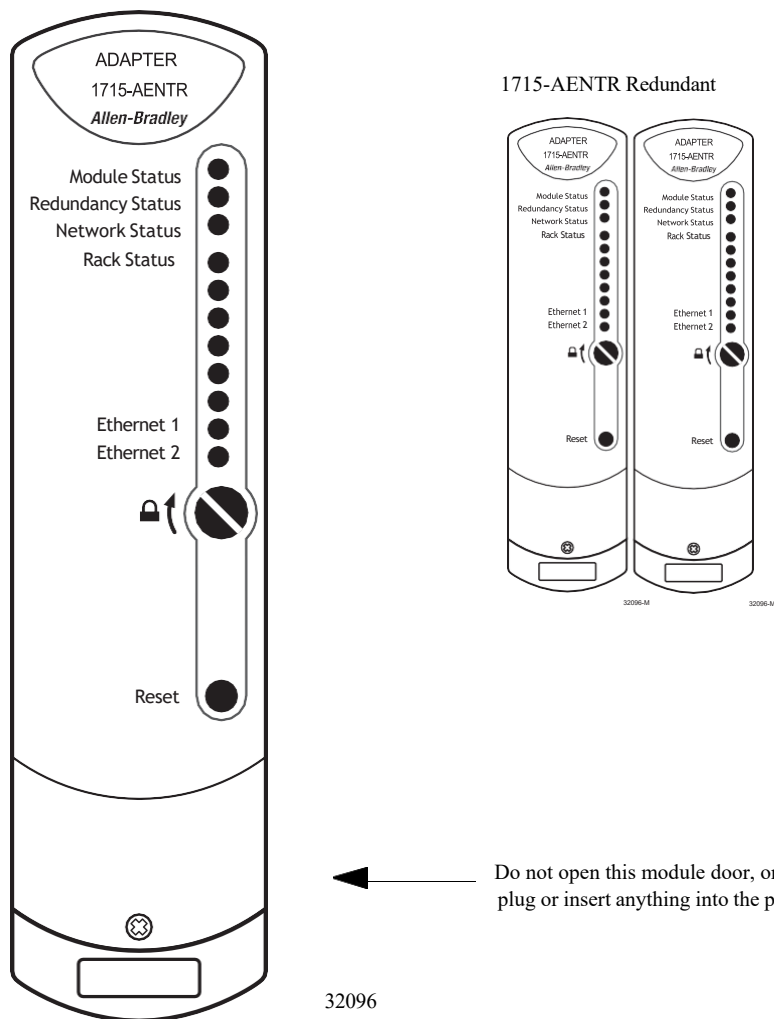


The general system layout for the 1715 Redundant I/O system consists of the following hardware components.

1715-AENTR Adapter Redundant Pair

The 1715 adapter communicates via the EtherNet/IP network to a 1756 ControlLogix controller, which conveys system I/O data.

Figure 14 - 1715-AENTR Adapter

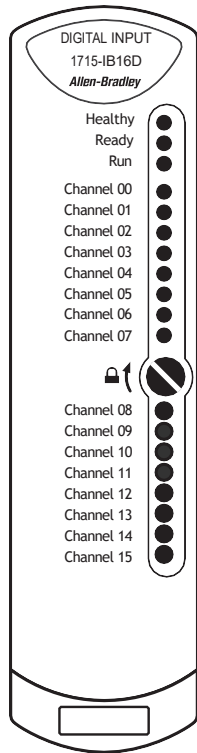
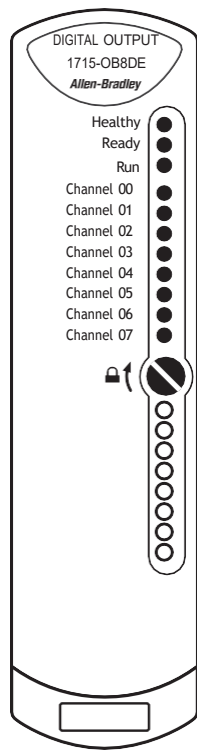
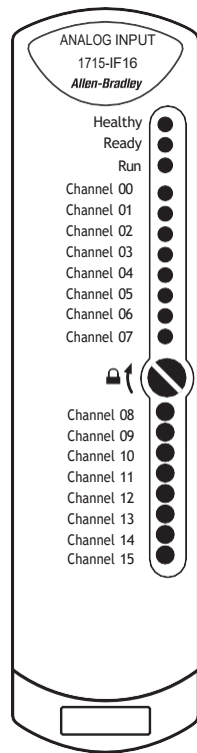
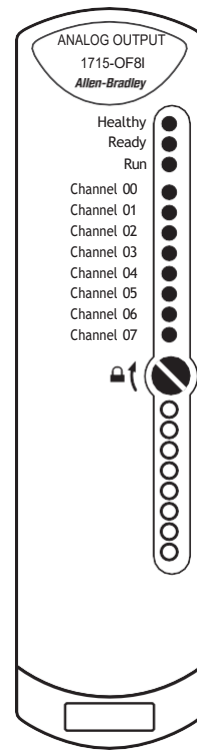


IMPORTANT Do not open this module door, or plug or insert anything into the port behind the module door unless instructed to do so by technical support.

1715 Digital and Analog I/O Modules

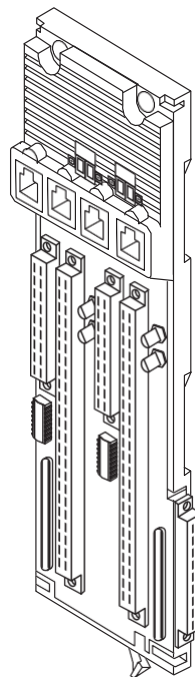
Your system can be configured with any combination of I/O modules, and in either Simplex or Duplex mode. These I/O modules can be included in your system:

- 1715-IB16D 16-channel digital input module
- 1715-OB8DE 8-channel digital output module
- 1715-IF16 16-channel analog input module
- 1715-OF8I 8-channel analog output module

Figure 15 - 1715 Digital and Analog I/O Modules**1715-IB16D 16-channel Digital
Input Module****1715-OB8DE 8-channel Digital
Output Module****1715-IF16 16-channel Analog
Input Module****1715-OF8I8 8-channel Analog
Output Module**

1715-A2A Adapter Base Unit

The adapter base unit holds a pair of adapters.



Adapter Base Unit Fuses

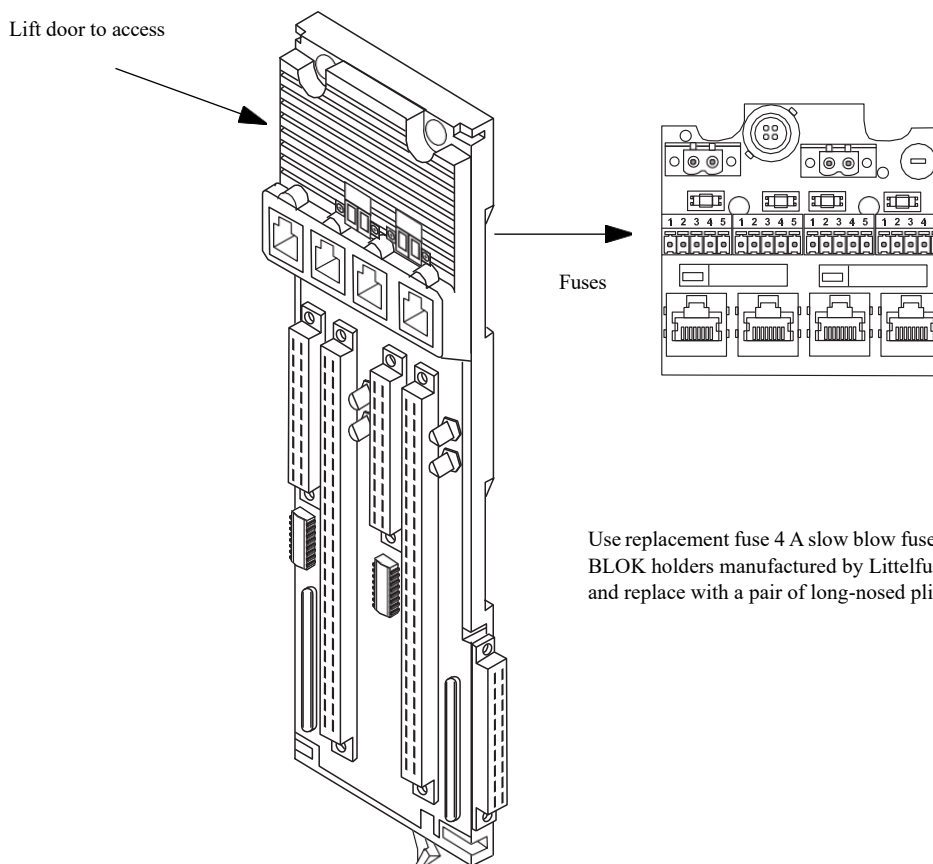
The 1715-A2A adapter base unit contains four fuses.

To replace the fuses, follow this procedure.

1. Lift the door to access the fuses.

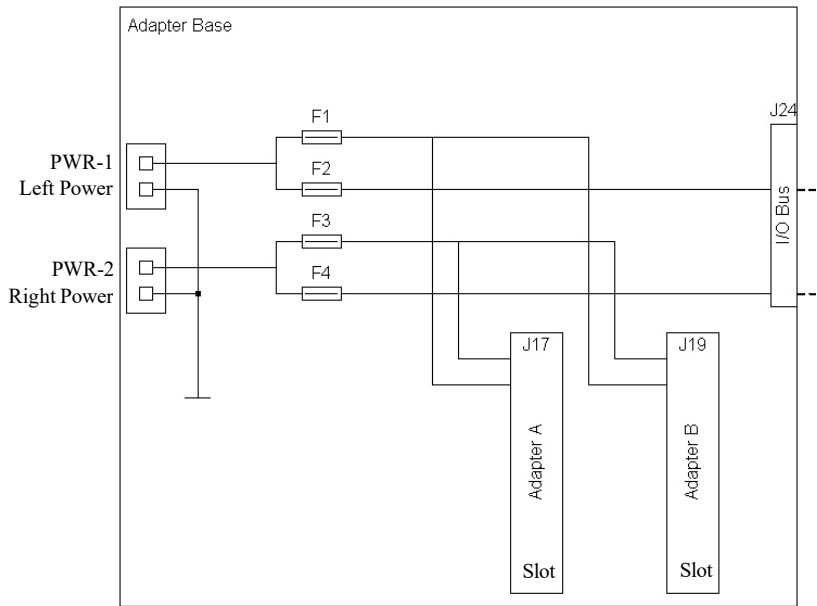
The fuses are labeled from F1...F4, from left to right. The replacement fuse part number is Littelfuse 0154004.DRT.

2. With a pair of small long-nosed pliers, remove and replace the blown fuse.



Use replacement fuse 4 A slow blow fuses in OMNI-BLOK holders manufactured by Littelfuse. Remove and replace with a pair of long-nosed pliers.

Figure 16 - Power Routing of Adapter Base Unit Fuses



Fuses F1 and F3 have independent tags under the 1715-AENTR module status flags. For example, in [Figure 17](#), F3 is blown or adapter power is missing to the PWR-2 connector.

Figure 17 - Fuse Tags

AENTR_1715:S	{...}
AENTR_1715:S.Fault	2#0000_0000_0000_0000_0000_0000_0000_0000
AENTR_1715:S.ModAFault	0
AENTR_1715:S.ModBFault	0
AENTR_1715:S.Power1Fault	0
AENTR_1715:S.Power2Fault	1

The F2 and F4 fusing faults of the 1715 I/O modules cannot be pinpointed. All healthy I/O module status indicators showing solid red indicates a blown F2 or F4 fuse.

The adapter tags indicate each individual I/O module tag, ModAFault and ModBFault, as shown in [Figure 18](#).

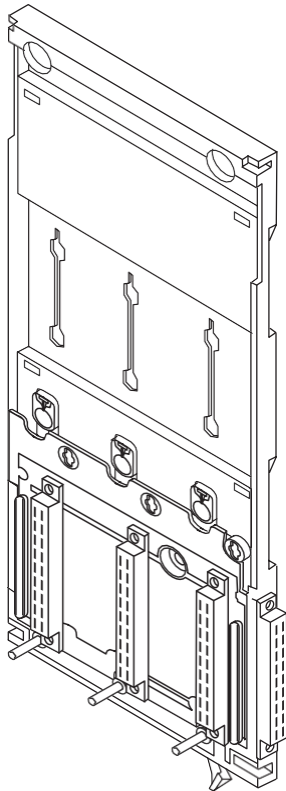
Figure 18 - Adapter Tags Indicate Faults

Name	Data Type	Value
AENTR_1715:2:I	AB:1715_A08_Duplex:I:0	{...}
+ AENTR_1715:2:I.Fault	DINT	2#0000_0000_0000_000...
+ AENTR_1715:2:I.Ch	AB:1715_A0_ChDuplex_Struct:I:0[8]	{...}
- AENTR_1715:2:I.ModAFault	BOOL	1
- AENTR_1715:2:I.ModBFault	BOOL	1
- AENTR_1715:2:I.GroupFault	BOOL	0
- AENTR_1715:2:I.ModAGroupFault	BOOL	0
- AENTR_1715:2:I.ModBGroupFault	BOOL	0
AENTR_1715:2:O	AB:1715_A08:O:0	{...}
+ AENTR_1715:2:O.Ch	AB:1715_A0_Simplex_Struct:O:0[8]	{...}
+ AENTR_1715:4:C	AB:1715_DI_Diag16:C:0	{...}
- AENTR_1715:4:I	AB:1715_DI16_Diag_Duplex:I:0	{...}
+ AENTR_1715:4:I.Fault	DINT	2#0000_0000_0000_000...
+ AENTR_1715:4:I.Data	INT	2#0000_0000_0000_0000
- AENTR_1715:4:I.ModAFault	BOOL	1
- AENTR_1715:4:I.ModBFault	BOOL	1
- AENTR_1715:4:I.GroupFault	BOOL	0

IMPORTANT After any fuse replacement or power-related issue on PWR-1/PWR-2, the Reset button on the 1715-AENTR must be pressed to clear the fault and reset the status indicator back to solid green.

1715-A3IO I/O Base Unit

The I/O base unit holds up to three I/O modules.



I/O Termination Assemblies

I/O termination assemblies are inserted into the I/O base units. There are eight types of termination assemblies (two for each module) depending on the architecture of your system and the I/O modules you are going to use.

Table 5 - I/O Termination Assembly Descriptions

I/O Module	Termination Assembly Cat. No.	Termination Assembly Description
1715-IB16D	1715-TASIB16D	Digital input simplex
	1715-TADIB16D	Digital input duplex
1715-OB8DE	1715-TAS0B8DE	Digital output simplex
	1715-TADOB8DE	Digital output duplex
1715-IF16	1715-TASIF16	Analog input simplex
	1715-TADIF16	Analog input duplex
1715-OF8I	1715-TASOF8	Analog output simplex
	1715-TADOF8	Analog output duplex

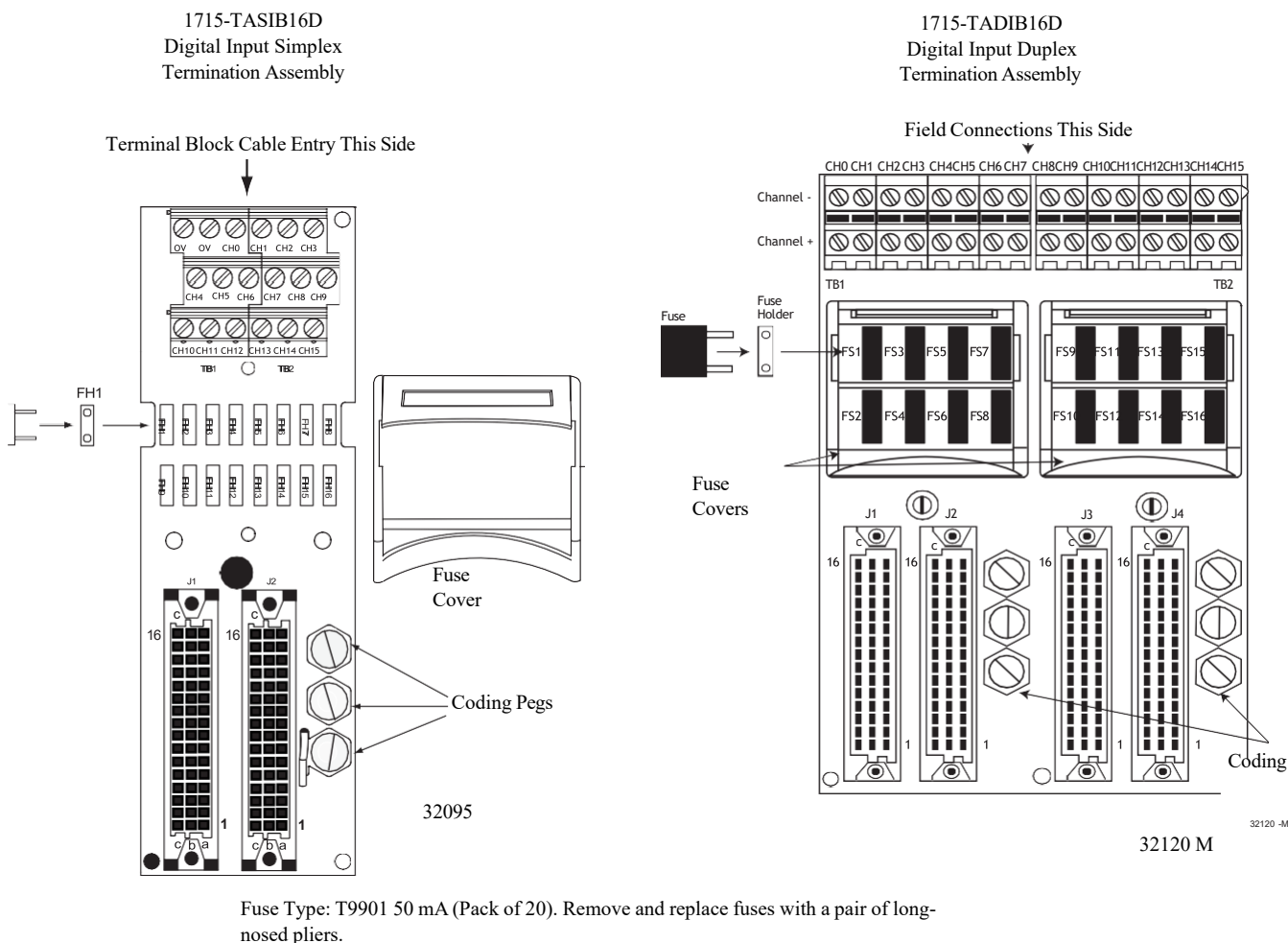
Digital Input Termination Assemblies

Digital input termination assemblies support these features:

- 16-channel simplex TA provides termination for 16 digital input channels
- Industry-standard field device connections at terminal blocks
- 24V DC digital input channels with a load of 5.11 k Ω per input channel
- Individually fused channels with over voltage input protection

There are two types of digital input termination assemblies:

- A 1715-TASIB16D, 16-channel simplex TA that provides termination for 16 digital input channels and mates with one 1715-IB16D digital input module
- A 1715-TADIB16D, 16-channel duplex TA that provides termination for 16 digital input channels and mates with up to two 1715-IB16D digital input modules

Figure 19 - 1715-TASIB16D and 1715-TADIB16D Digital Input Termination Assemblies

The simplex termination assembly routes the input signals to one input module. In duplex arrangements, the input signals are routed to two parallel modules.

See [page 79](#) for detailed wiring instructions.

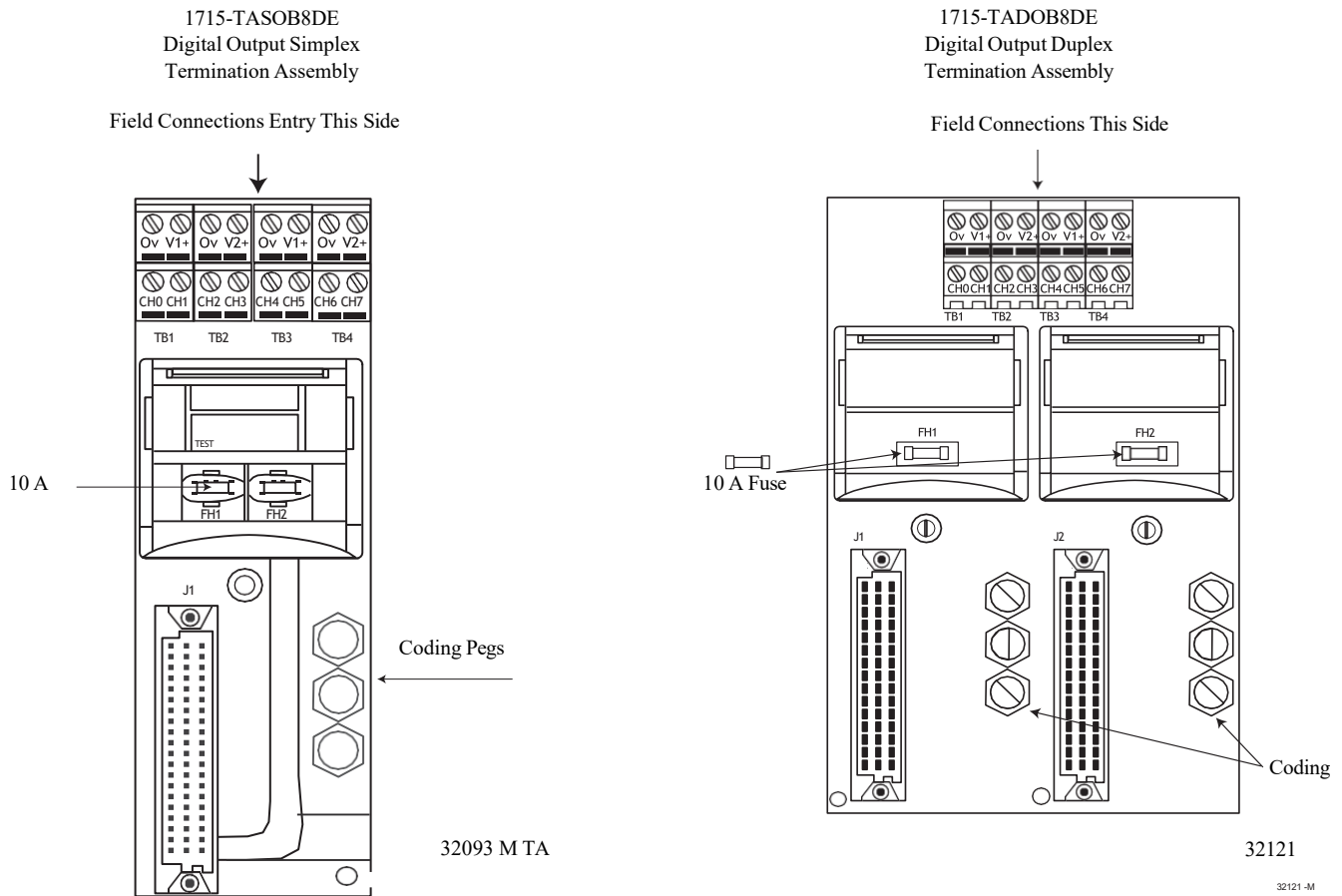
Digital Output Termination Assemblies

Digital output termination assemblies support these features:

- Provide connections for eight output channels
- Industry-standard field device connectors
- 24V DC operation
- Provide a fused field voltage supply to the module

There are two types of digital output termination assemblies:

- A 1715-TASOB8DE digital output, 24V DC, 8-channel, simplex TA that provides termination for 8 digital output channels and mates with one 1715-OB8DE digital output module
- A 1715-TADOB8DE digital output, 24V DC 8-channel duplex TA that provides fault tolerant operation for 8 digital output channels and mates with redundant 1715-OB8DE digital output modules

Figure 20 - 1715-TASOB8DE and 1715-TADOB8DE Digital Output Termination Assemblies

Fuse type: Littelfuse Type 451 Omni-Block 10 A, 125V fast acting fuse. Surface Mount Fuse Block 154 010 for Digital Output Termination Assemblies. Use a pair of long-nosed pliers for fuse removal and

See [page 84](#) for detailed wiring instructions.

Analog Input Termination Assemblies

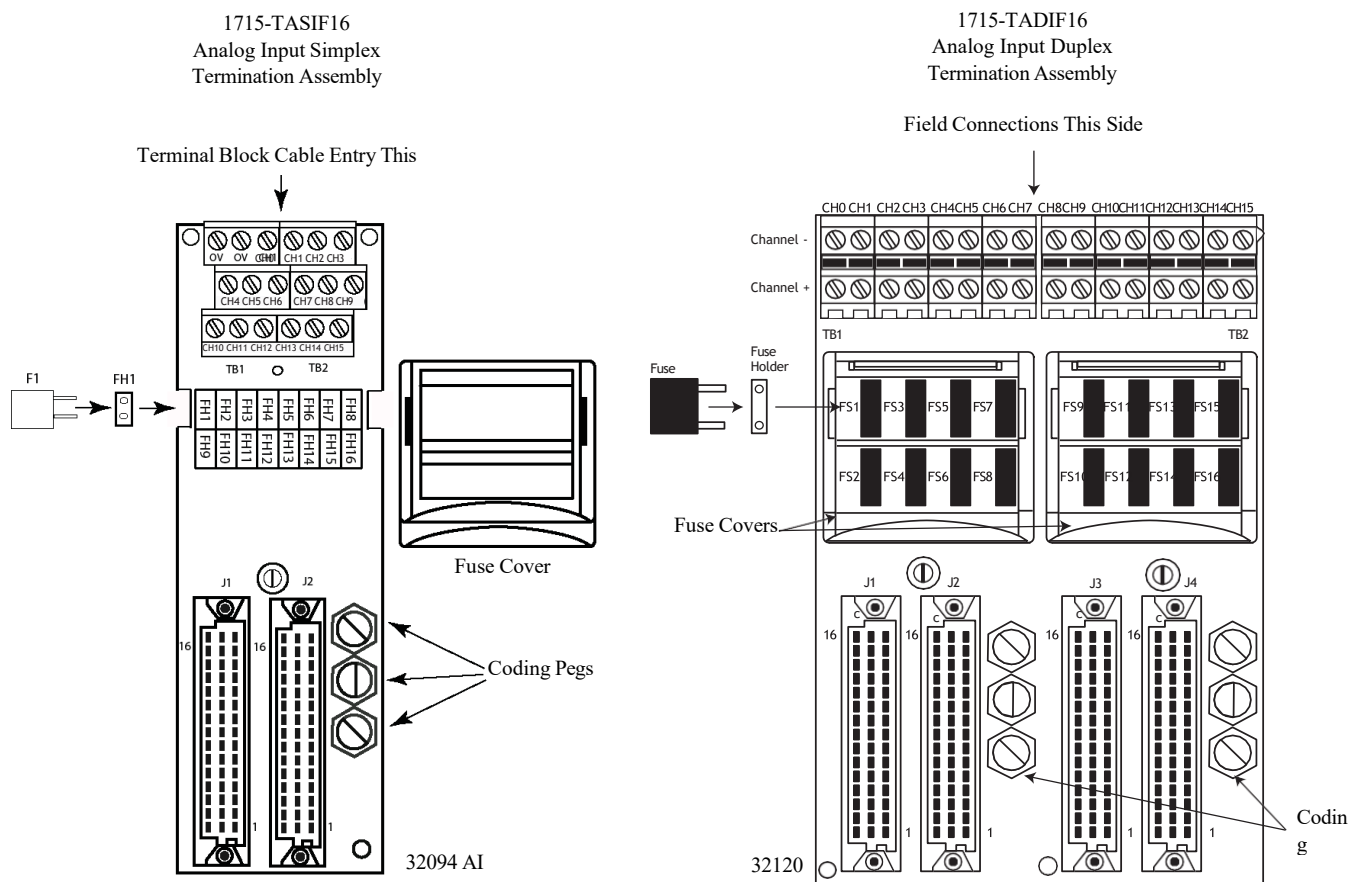
Analog input termination assemblies support these features:

- 16 input channels for a simplex/duplex configuration
- Industry-standard field device connections at the terminal blocks
- Analog input channels with a high reliability 120 Ω precision resistor termination per input channel
- Individually fused channels with over voltage input protection

There are two types of analog input termination assemblies:

- A 1715-TASIF16, 16-channel simplex TA that provides termination for 16 single-ended analog input channels and mates with one 1715-IF16 16-channel analog input module. There is no channel isolation.
- A 1715-TADIF16, 16-channel duplex TA that provides termination for 16 isolated analog input channels and mates with up to two 1715-IF16 16-channel analog input modules. The channels are isolated.

Figure 21 - 1715-TASIF16 and 1715-TADIF16 Analog Input Termination Assemblies



Fuse Type: Littelfuse No. 396/TE5 50 mA Timelag Fuse; UL 248-14, 125V, T
Leadfree for Analog Input Termination Assemblies. Use a pair of long-nosed pliers

See [page 93](#) for detailed wiring instructions.

Analog Output Termination Assemblies

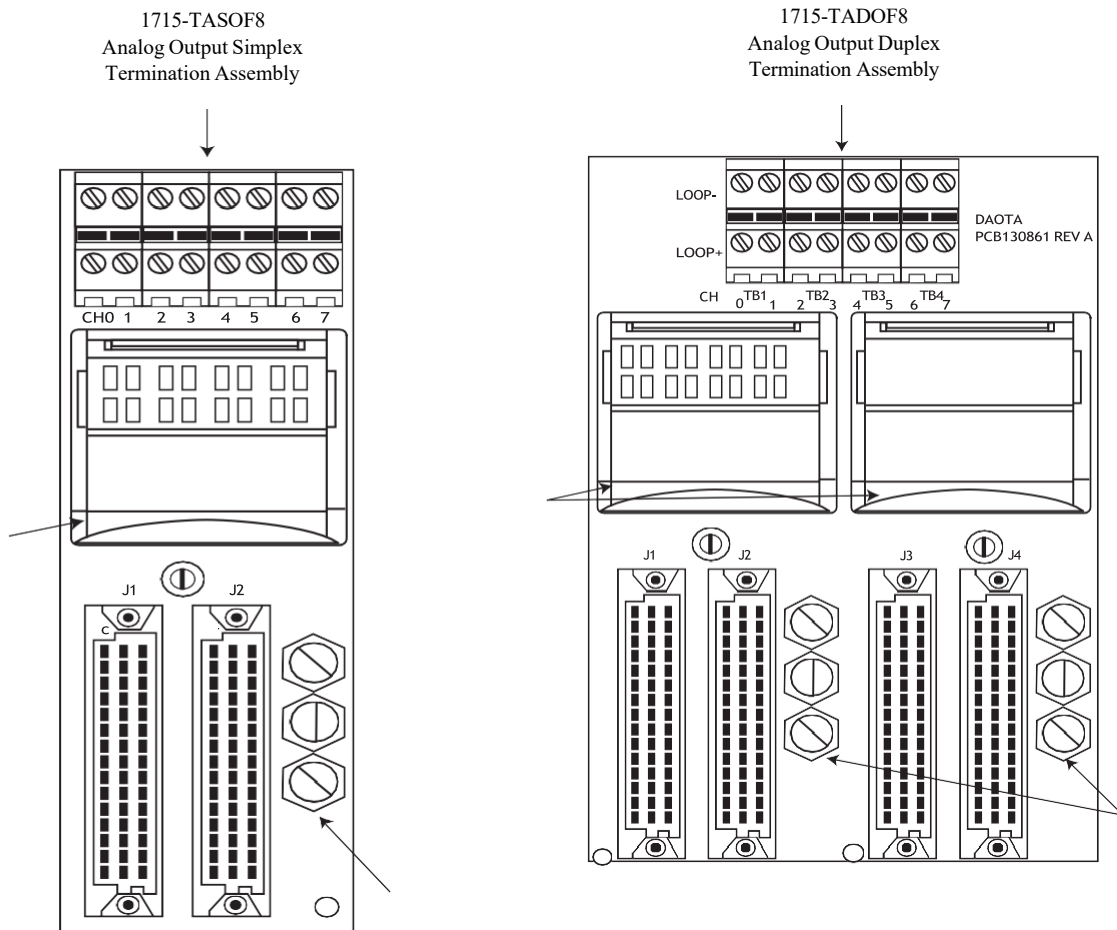
Analog output termination assemblies support these features:

- Eight output channels for a simplex/duplex configuration
- Industry-standard field device connections at the terminal blocks
- Analog output channels provide 4...20 mA DC for external field devices
- Duplex termination assembly provides increased fault tolerance for output channels

There are two types of analog output termination assemblies:

- A 1715-TASOF8, 8-channel simplex TA that provides termination for 8 single-ended analog output channels and mates with one 1715-OF8I 8-channel analog output module
- A 1715-TADOF8, 8-channel duplex termination assembly provides fault tolerant operation for 8 analog output channels through inter-module communication and by routing the output source current from two modules to the same field device

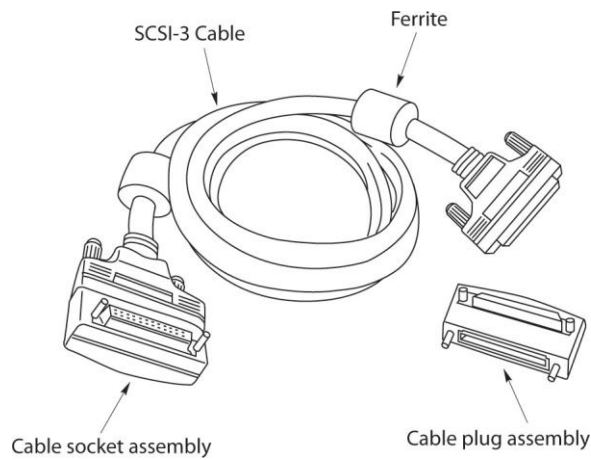
IMPORTANT	The dual termination assembly does this by supporting inter-module communication for current sync operation and by routing the channel outputs from two 8-channel analog output modules in parallel to 8 field devices. Therefore, each field device receives a current source from a channel on each of two modules. So if one module fails, or one or more channels fail on a module, the outputs from the second module continues to supply the field devices.
------------------	---

Figure 22 - 1715-TASOF8 and 1715-TAD0F8 Analog Output Termination Assemblies

1715-C2 Expansion Cable

A 2 m (6.56 ft) expansion cable is available to connect I/O modules to field devices, and to allow for space restrictions within the enclosure of the system.

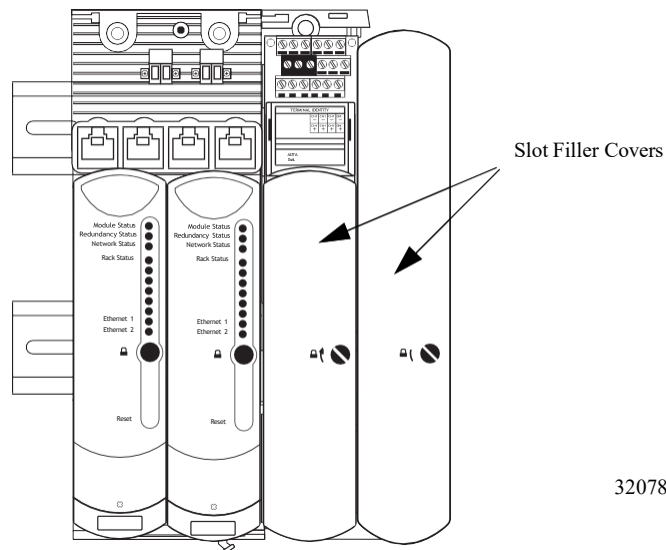
-
- IMPORTANT**
- 1715-C2 cables must be secured when installed; use the provided screws to secure the cable.
 - 1715-C2 cables are rated 30V/9.6 A.
-



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1715-N2T and 1715-N2S Slot Filler Covers

Slot filler covers are available in two sizes to cover empty slots in your system. Use the tall cover (catalog number 1715-N2T) when no termination assembly is present. Use the short cover (catalog number 1715-N2S) when a slot has a termination assembly, but no module.



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Power Requirements

A 24V DC power supplied is required. See [Install the Power Supply on page 60](#) for complete details.



ATTENTION: To comply with the CE and UKCA Low Voltage Directive (LVD), all connections to this equipment must be powered from a source compliant with the following: Safety Extra Low Voltage (SELV) or Protected Extra Low Voltage (PELV)



ATTENTION: In high demand energise to trip and continuous demand mode of operation additional protection will need to be in place to inherently limit each 1715-AENTR power supply to a maximum 32 V.

Cooling Requirements

The 1715-AENTR adapter is designed to operate in its specified environment without forced air cooling. Forced air cooling can be needed in individual circumstances, such as when the system shares its enclosure with other heat producing equipment.

Adequate ventilation must be provided for the system and the ambient temperature in the enclosure must not be higher than the maximum operating value of 60 °C (140 °F).

The adapter dissipates all power that it uses as heat. This is the power that is supplied to the terminals on the 1715-A2A adapter base unit. The I/O modules dissipate some of the power they take from the field power source as heat. The actual amount of heat depends on the number of channels in use.

IMPORTANT Cooling by Convection: For correct cooling of the equipment, fit the base units in the vertical plane and orientate so the modules are upright, with their ventilation slots at the top and bottom.

The 1715-AENTR adapter is open-type equipment that is rated IP20. This provides protection against solid objects over 12 mm (0.47 in.), but does not provide protection against liquids.

Heating Requirements

If enclosure is in colder environments, temperatures must be kept at -20 °C (-4 °F) or higher.

Specify an Enclosure

An enclosure for the 1715 Redundant I/O system must be designed for the specific environmental conditions that are present. It must support the weight of the system, provide mechanical protection, and remove the heat that the system creates. If the application of the adapter is not using existing power sources, the power supply units can be placed inside the enclosure.



ATTENTION: The modules contain static-sensitive devices that can be damaged by incorrect handling. Label the exterior surface of the enclosure to caution personnel to observe anti-static precautions when handling the modules.

System Software

The firmware on your 1715 Redundant I/O system can be updated with the following ControlFLASH™ files:

- Adapter ControlFLASH
- Adapter Recovery ControlFLASH
- I/O Module ControlFLASH

The files are available from the [Product Compatibility and Download Center website](#).

The Adapter module contains two sets of firmware. The normal firmware is the operational firmware and allows connections from a Logix Controller. The Recovery firmware is used to update the firmware in the I/O modules and help diagnose problems. The normal and Recovery firmware are updated with separate ControlFLASH files.

Before starting check that:

- RSLinx® Gateway has been installed and configured
- The BOOTP server has been configured with the MAC address and suitable IP address for the 1715-AENTR
- The correct ControlFLASH file for the 1715-AENTR module or I/O module has been installed
- When you update 1715 I/O module firmware, make sure that the 1715-AENTR Recovery mode firmware from 1715 revision 4.011 or later is installed and running (Recovery mode firmware revision 1.011 or later)

Dual 1715-AENTR modules are updated at the same time.

Each I/O module is updated separately, even if it is fitted to a dual termination assembly.

Update procedure:

- Run the ControlFLASH program
- Select the type of module from the list
- Browse to the 1715-AENTR and open it, open the Backplane, then select the module to be updated.
- Select the version of firmware to be sent to the module
- Update the module
- The firmware will be downloaded and stored on the module - this will take between 2 minutes and 25 minutes
- Control FLASH will report the success or failure of the update
- Repeat for other modules that need to be updated

See document [1756-UM105](#) ControlFLASH firmware Upgrade Kit User Manual in the Literature Library for detailed instructions for using ControlFLASH



When updating the firmware, it is recommended that RSWho is not actively browsing the 1715-AENTR or the associated I/O modules.

IMPORTANT The 1715-AENTR modules revision I6 contain base code. Both the normal and recovery mode firmware must be updated.

1715-AENTR modules newer than revision I6 and all I/O modules contain the latest firmware at manufacture time. It may be necessary to change the firmware to be compatible with your system, or to upgrade to the latest version.

IMPORTANT See the latest certifications for software and firmware at rok.auto/certifications. See the TÜV website at <http://www.tuvsi.com> for SIL 2 certification listings.

IMPORTANT When updating firmware the 1715 Redundant I/O system is off line. It must be in Recovery mode, or there must be no active connections.

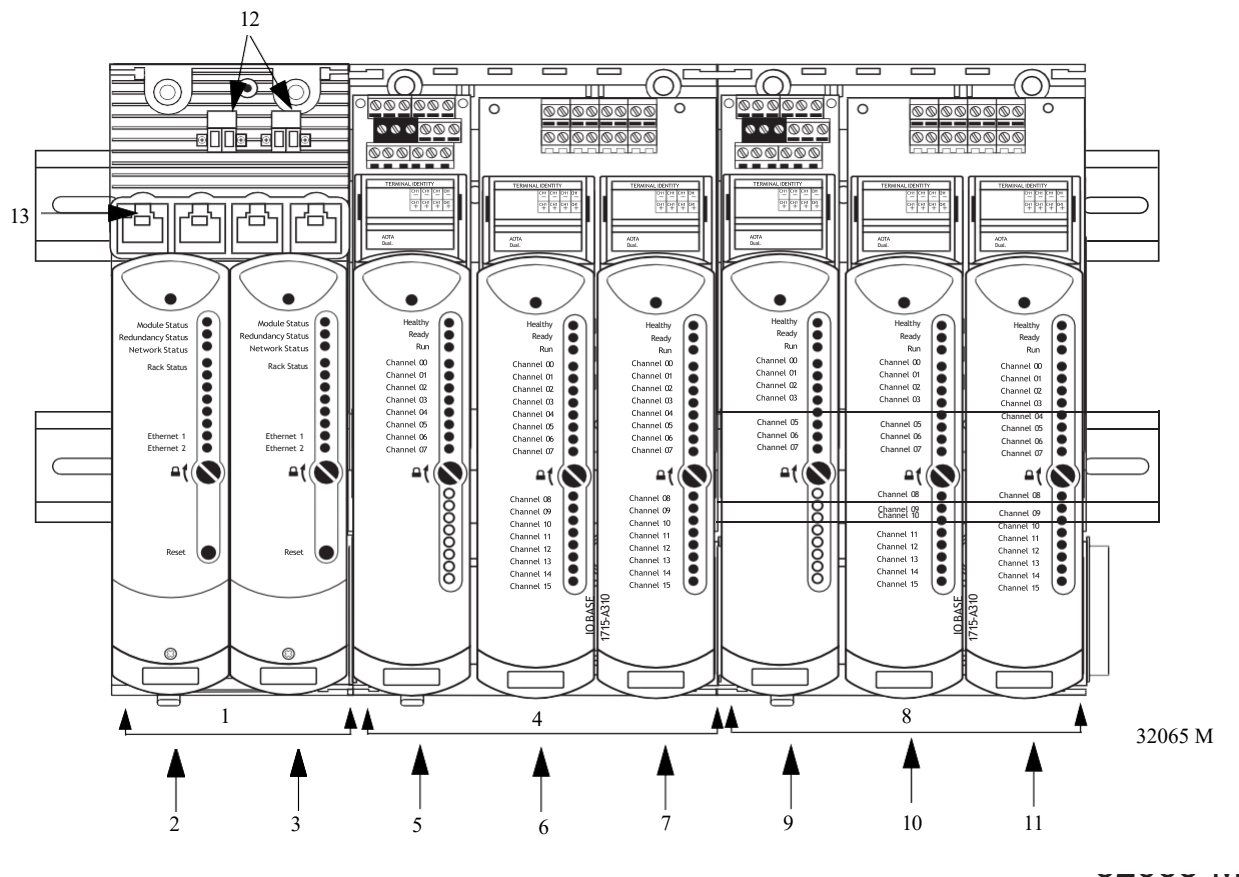
IMPORTANT ControlFLASH can be used to update the firmware in the adapter.

From 1715 revision 3.001 and later, when in Recovery mode, ControlFLASH can be used to update the firmware in the I/O modules. (This is available in the Adapter Recovery ControlFLASH version 1.011 and later.)

IMPORTANT After upgrading a revision 1.005 1715 chassis to revision 2.001 or later, power to the 1715 chassis must be cycled.

Module Placement

A general overview of a typical redundant I/O system layout is shown here.



 This illustration is only an example and is for illustrative purposes only.

Item	Description
1	Adapter base unit
2	Adapter A module
3	Adapter B module
4	I/O base unit
5	Simplex I/O module
6	Duplex I/O module - first in pair
7	Duplex I/O module - second in pair
8	I/O base unit
9	Simplex I/O module
10	Duplex I/O module - first in pair
11	Duplex I/O module - second in pair
12	Power connections
13	Ethernet connections

The adapter and base units are DIN rail mounted and connections are chained together from left to right.

Base Units

The adapter base unit is always the leftmost base unit in the connection chain. The total length of the base unit backplane length, including all expansion cables cannot exceed 10 m (32.81 ft).

A base slot (adapter or I/O) consumes an address whether it is full or empty. The first adapter in the pair occupies slot 0 and is on the left, the second adapter occupies slot 1 and is on the right. Only adapters can occupy the slots of the adapter base.

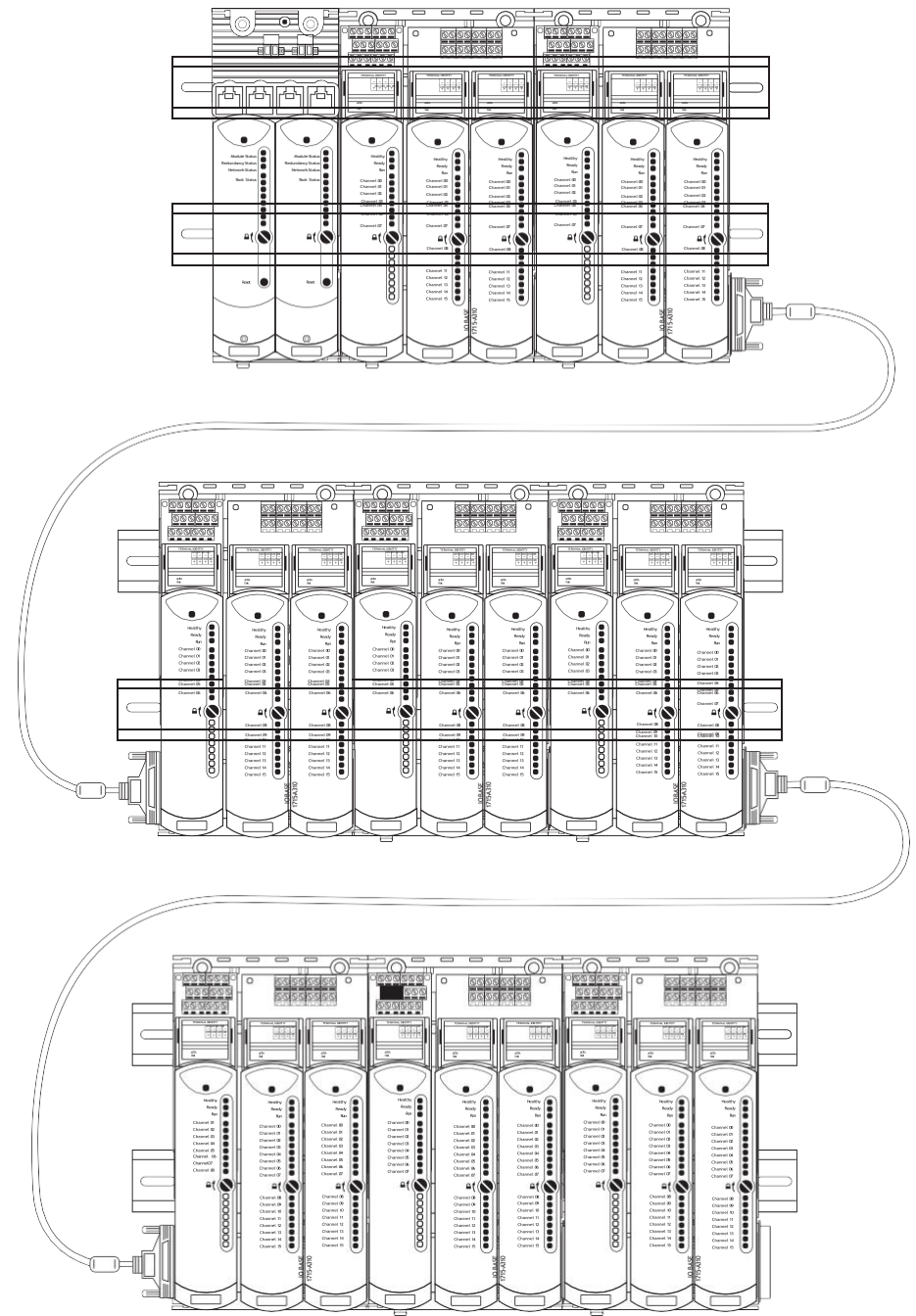
An adapter base unit can support up to 8 I/O base units (up to 24 I/O modules) on its right side.

Module positions within the I/O base units are numbered from 2...25, the leftmost position being slot 2.

The total number of slot positions in the system is 26; adapters occupy slots 0...1 and I/O modules occupy slots 2...25.

Expansion cables can be used to connect base units, as shown here.

Figure 23 - Example System Layout



Install Summary

The 1715 Redundant I/O system is a modular system. The adapter and I/O base units snap together by using mating connectors and retaining clips to form the backplane.

The base units provide the interconnections for power, adapter, and I/O data. Once connected, the base units form one mechanical assembly, or backplane.

IMPORTANT The insertion and removal of modules does not disturb the electrical connections with field devices.

Step 1: Enclosure DIN Rail Assembly

The 1715 Redundant I/O system is assembled on DIN rails within an enclosure.

After deciding on an enclosure, install the DIN rails before building your system.

Step 2: Build the System

After assembling the DIN rail enclosure, follow these steps in this order to build your redundant I/O system.

1. Mount a 24V, user-supplied, power supply.

See the instructions that came with the power supply.
2. Mount the adapter base unit onto the DIN rails.
3. Mount the I/O base units onto the DIN rails.
4. Insert retaining clips to connect adapter and I/O base units.
5. Install anchor end stops onto the DIN rails.
6. Mount termination assemblies to the base units.
7. Mount I/O expansion cable, if needed.
8. Wire the adapter base:
 - Connect to power.
 - Wire the ground.
 - Connect to field wiring.
9. Connect the adapter to the Ethernet network.
10. Module keying/verify coding peg positions.
11. Install the adapter redundant module pair.
12. Install the I/O modules.
13. Install slot filler covers over unused slots.

Product Dimensions

This section outlines the space requirements for your 1715 Redundant I/O System.

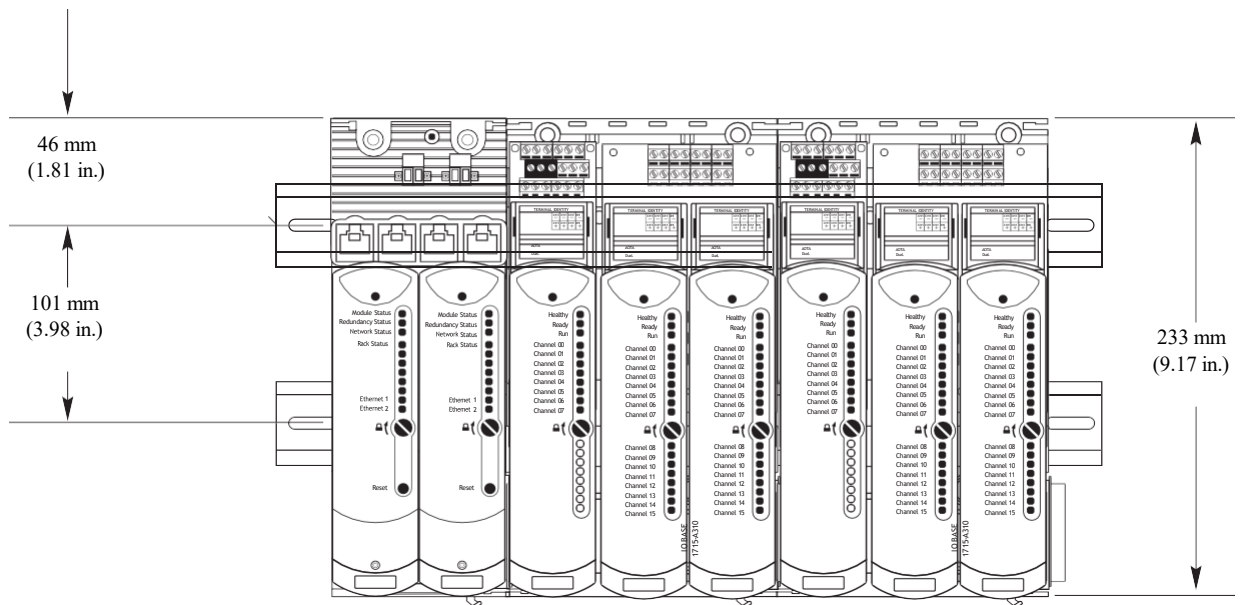
DIN Rail Mounting Dimensions

The system requires free space of at least 140 mm deep (5.51 in.) from front to back between the rear panel of an enclosure and the inside of an enclosure door.

- IMPORTANT** Allow sufficient free space around the base units. Every installation needs space on at least three sides, as follows:
- Space above, to manipulate and install field wiring
 - Space below, to enable modules to fit and to be able to grasp a module during removal
 - Space to the right, to maneuver an I/O base unit during assembly or in the event of installing a new base unit

IMPORTANT Minimum clearance between the product and the adjacent equipment must be 15.3...20 cm (6.0...8.0 in.) between chassis and a heat source, and allow 5.1 cm (2.0 in.) between wireway and top or bottom of chassis.

DIN rail mounting is shown in the following figure.



Each Base Unit (Two Shown) Occupies 126 mm

DIN Rail Assembly

The 1715 Redundant I/O system is mounted on DIN rails within an enclosure. Pay special attention to dimensions needed for base unit placement.

For each pair of DIN rails, mount the lower rail with its center line 101 mm (3.98 in.) below the center line of the upper rail.

Free space must also be provided on each end of the DIN rail for the end stops, if necessary.

Component Size and Weights

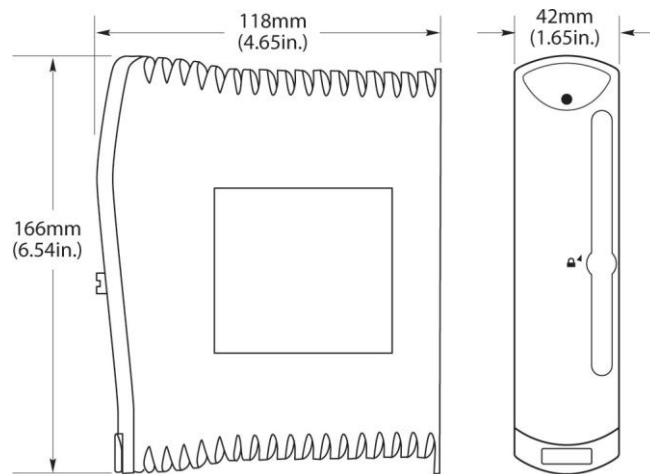
Table 6 - Component Sizes

Item	Size (H x W x D)
Adapter base unit	224 x 84 x 30 mm (8.82 x 3.31 x 1.18 in.)
I/O module base unit	233 x 126 x 18 mm (9.25 x 5 x 0.75 in.)
Module	166 x 42 x 118 mm (6.5 x 1.625 x 4.625 in.)

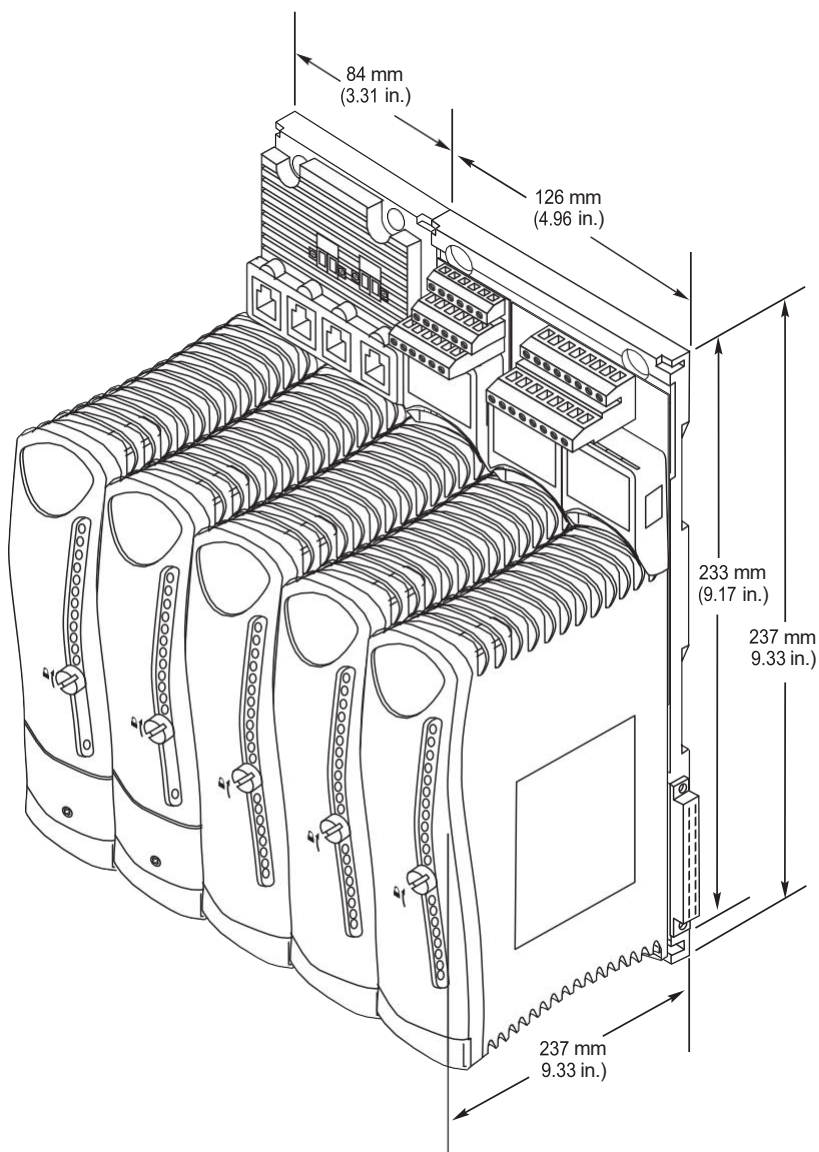
The total depth of a base unit and module is 136 mm (5.375 in.).

Figure 24 - Module Dimensions

All module dimensions are the same, whether they are adapters or I/O modules.



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Figure 25 - System Dimensions

Be sure that the mounting assembly can support the weight of the components by using this table.

Table 7 - Component Weights

Cat. No.	Component	Weight g (oz)
1715-A2A	Adapter base unit	283 (9.98) ⁽¹⁾
1715-A3IO	I/O base unit	220 (7.76)
1715-AENTR	Adapter	420 (14.82)
1715-IB16D	Digital input module	360 (12.70)
1715-IF16	Analog input module	360 (12.70)
1715-OB8DE	Digital output module	290 (10.23)
1715-OF8I	Analog output module	340 (11.99)
1715-TASIB16D	Digital input simplex termination assembly	133 (4.69)
1715-TADIB16D	Digital input duplex termination assembly	260 (9.17)
1715-TASIF16	Analog input simplex termination assembly	133 (4.69)

Table 7 - Component Weights (Continued)

Cat. No.	Component	Weight g (oz)
1715-TADIF16	Analog input duplex termination assembly	260 (9.17)
1715-TASOB8DE	Digital output simplex termination assembly	133 (4.69)
1715-TADOB8DE	Digital output duplex termination assembly	260 (9.17)
1715-TASOF8	Analog output simplex termination assembly	133 (4.69)
1715-TADOF8	Analog output duplex termination assembly	260 (9.17)
1715-N2S	Short blank slot filler	40 (1.41)
1715-N2T	Tall blank slot filler	50 (1.76)
Power supply	User-supplied	Varies

(1) All weights are approximate.

Install the Power Supply

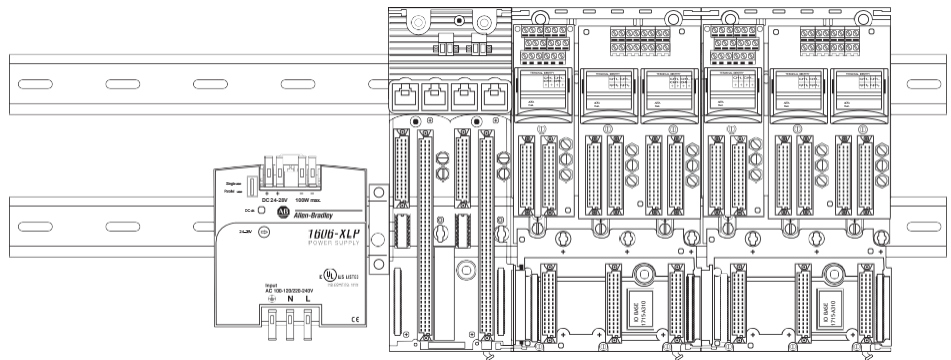
Power supplies must be installed to the left of the adapter base unit in a position where the 24V DC supply wiring can be kept reasonably short. [Figure 26](#) shows an example of a mounted power supply.



ATTENTION: To comply with the CE and UKCA Low Voltage Directive (LVD), all connections to this equipment must be powered from a source compliant with the following:
Safety extra low voltage (SELV) or protected extra low voltage (PELV)



ATTENTION: In high demand energize to trip and continuous demand mode of operation the power supply for the 1715-AENTR should include over voltage protection and supply a maximum of 32V.

Figure 26 - Power Supply

The 1715 Redundant I/O system requires 24V DC power with a tolerance between 18...32V DC. The system has been designed to operate with most commercially available industrial uninterruptible power supplies (UPS). To select a suitable power supply, calculate the overall system load that must be powered by using the following table, include any additional devices and add a contingency allowance between 25...50%.

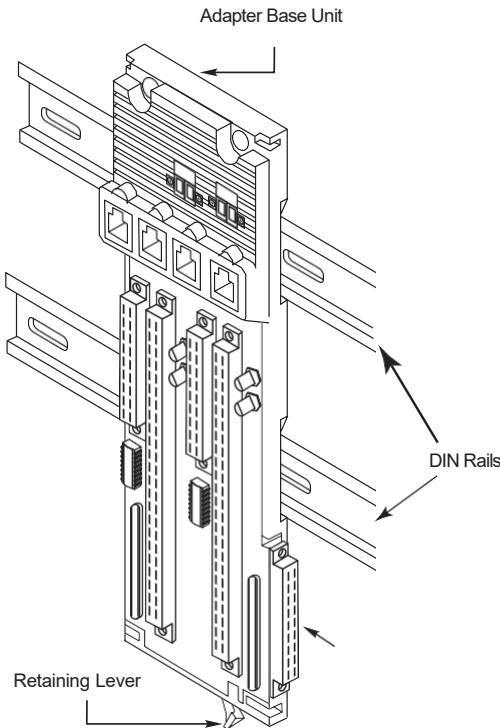
Component	Power Requirement
Adapter	8.0 W
Digital input module	4.0 W
Analog input module	4.0 W
Digital output module	3.0 W
Analog output module	3.6 W
Power supply	Varies

Install the Adapter Base Unit

The adapter base unit supports a pair of adapters. The adapter base unit has connections for two power feeds, four Ethernet ports, and two adapters on the front of the unit, and one I/O base connector on the right-hand side of the unit. The connections for the adapters are commonly referred to as adapter slots.

To mount the 1715-A2A adapter base unit, follow these steps.

1. Place the 1715-A2A adapter base unit onto the DIN rails and position them toward the left, leaving space for the I/O base units to the right.
2. Secure the adapter base unit onto the DIN rails by sliding the retaining lever (below the base unit) to the left, as far as it goes, until it latches in the locked position.

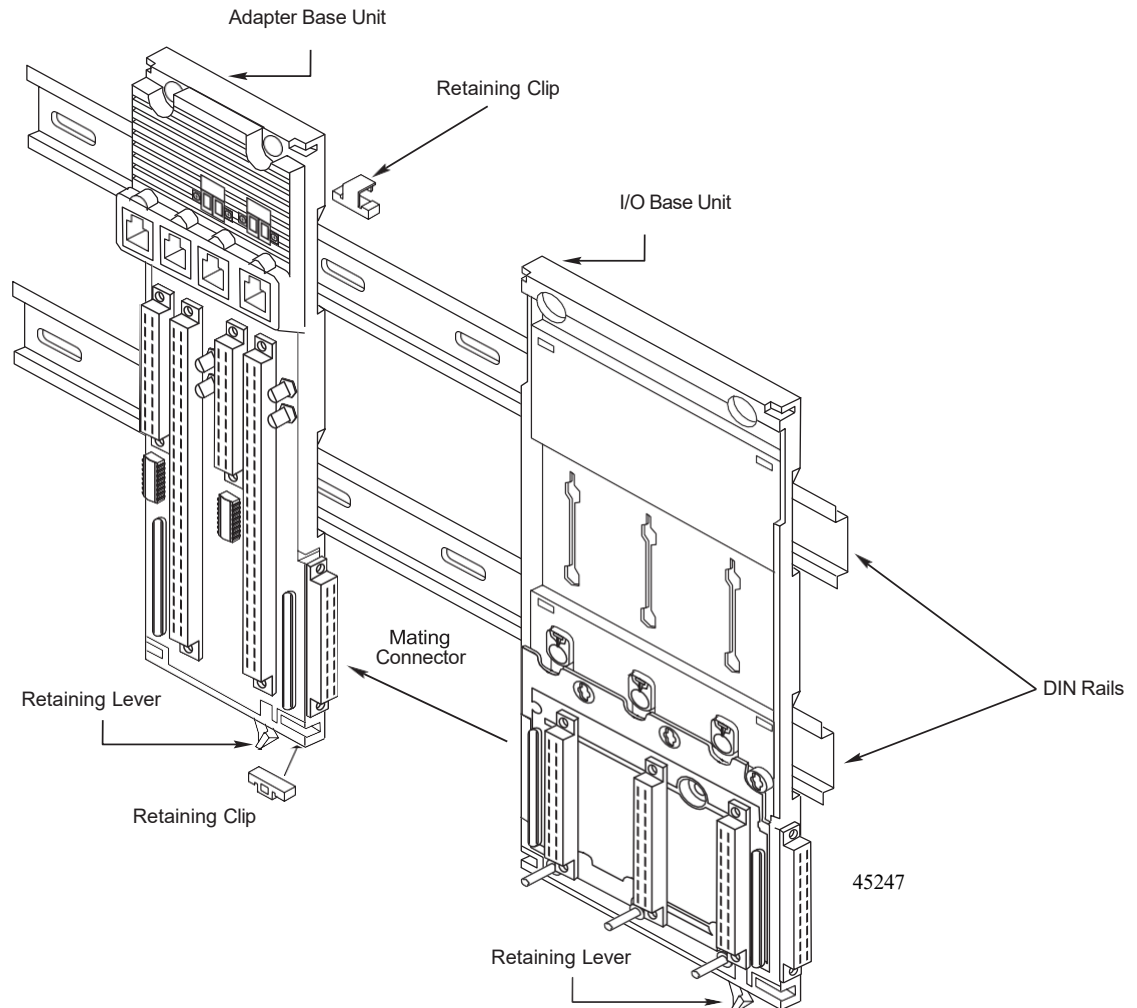


Install the I/O Base Unit

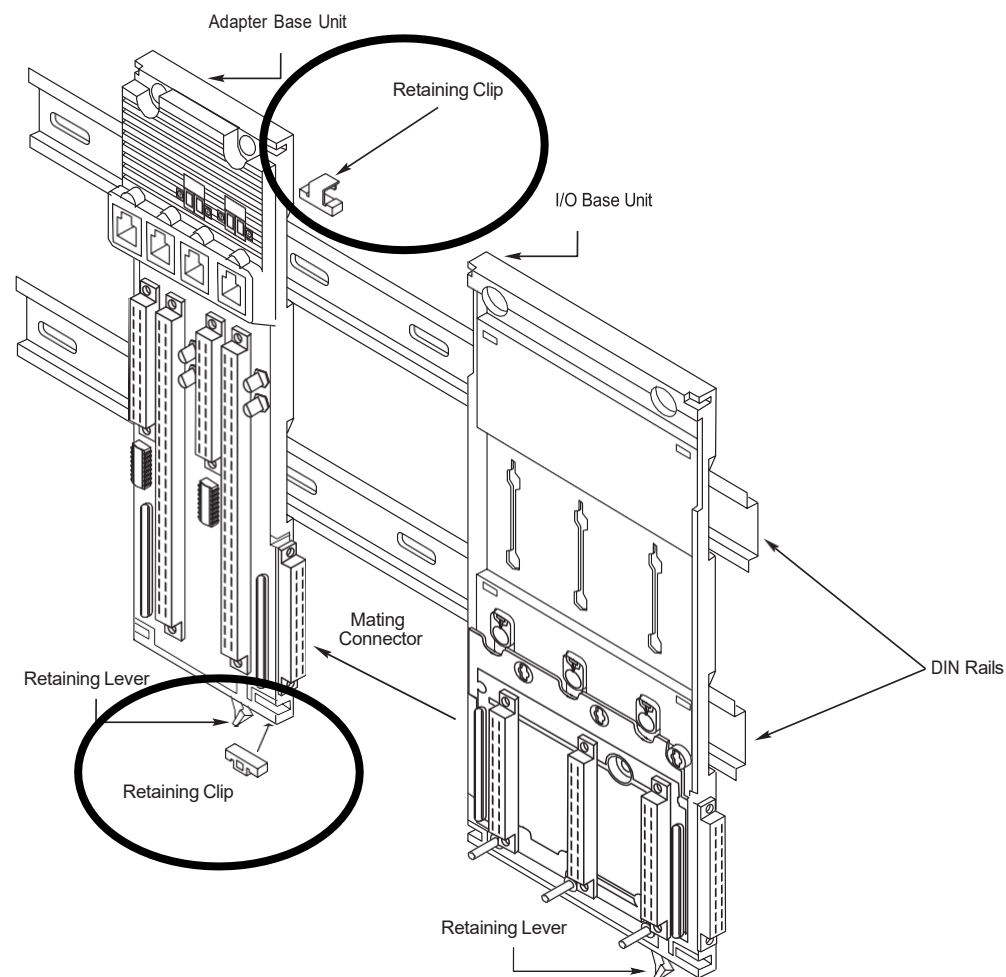
You can install up to three I/O modules on an I/O base unit. The I/O base unit has an incoming I/O base connector on the left-hand side of the unit, an outgoing I/O base connector on the right-hand side, and, on the front, connections for three I/O termination assemblies and three I/O modules. The locations for each I/O termination assembly and I/O module connectors are paired, and together represent an I/O module slot.

To mount the 1715-A3IO base unit, follow these steps.

1. Mount each 1715-A3IO base unit onto the DIN rails to the right of the 1715-A2A adapter base unit.
2. Slide the base unit to the left until the joining connectors are fully mated.

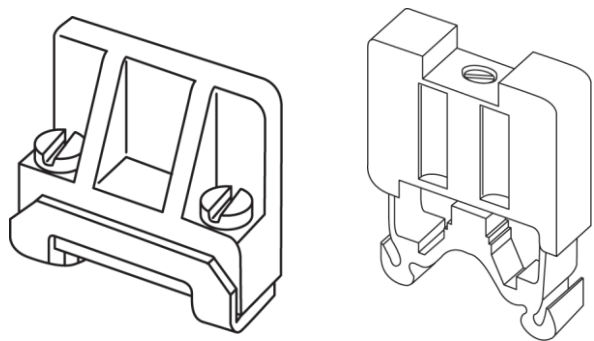


3. Secure the I/O base unit onto the DIN rails by sliding the bottom retaining lever (below the base unit) as far to the left as it goes until it latches in the locked position.
4. Insert the retaining clips into the top and the bottom slots to connect the adapter base unit to the I/O base unit.



5. Attach anchor end stops to the top of the DIN rails once all base units are mounted.

Typical Types of End



Install Termination Assembly to I/O Base Unit

I/O termination assemblies determine the type of I/O modules that can be installed in a particular slot. The I/O termination assemblies provide the mechanism to connect the field wiring specific to the I/O module type to the back of one or more installed I/O modules. I/O termination assemblies are available in single-width and double-width varieties. A single-width I/O termination assembly connects the field wiring to one I/O module slot for simplex operation, where a double-width I/O termination assembly connects the field wiring to two I/O module slots for duplex/redundant operation. I/O termination assemblies can span I/O base unit boundaries, though the I/O base units must be connected directly. I/O termination assemblies are keyed so that only I/O modules appropriate to the termination assembly type can be installed.

Each redundant I/O subsystem supports a maximum of 24 I/O module slots, which can be configured with 24 simplex I/O termination assemblies, 12 duplex I/O termination assemblies, or any combination in between.

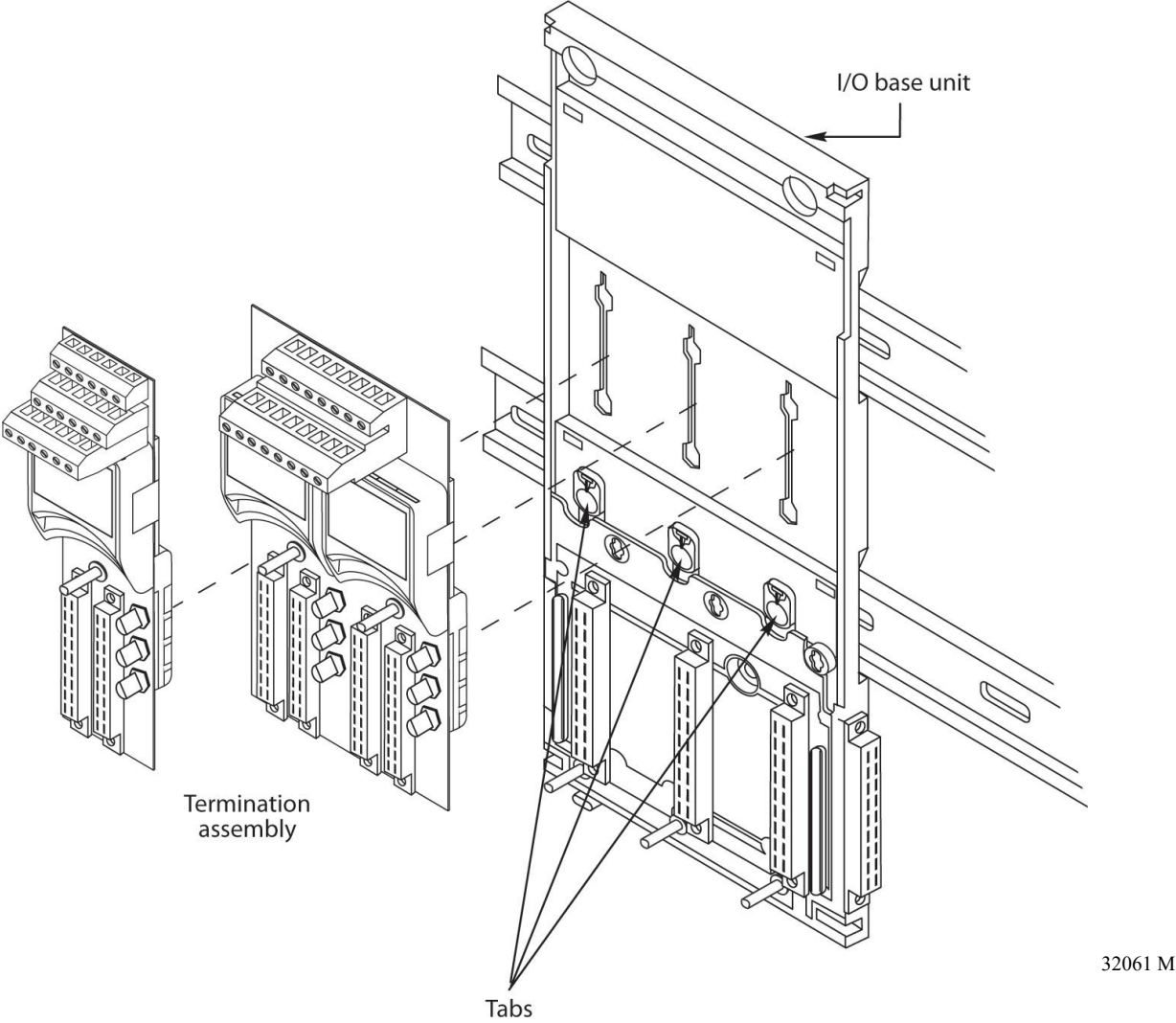
Once the base units and termination assemblies have been installed, the insertion and removal of modules does not disturb other electrical connections.

Mount Termination Assemblies

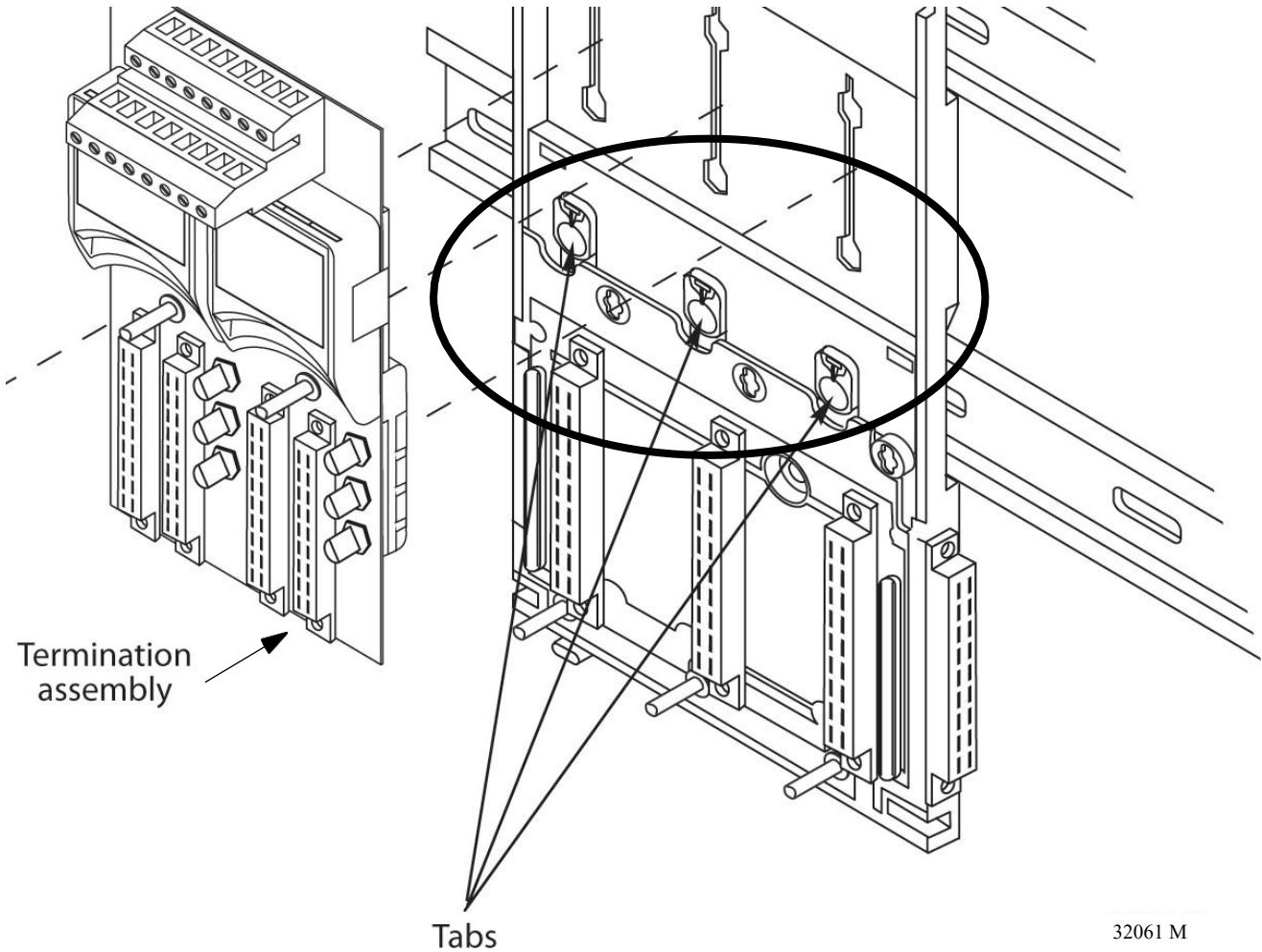
Termination assemblies connect to I/O base units. A combination of duplex and simplex Termination Assemblies may be mounted. A duplex Termination Assembly may be mounted across two I/O base units. The combination that is used depends on the specific configuration requirements of the system.

To connect termination assemblies to I/O base units, follow these steps.

1. Insert the termination assembly (TA) retaining clip on the back of the termination assembly into the slot on the I/O base unit.
2. Press in and slide the assembly upward as far as it goes until it locks in place.



3. Make sure the retaining tab clips over the circuit board to secure the TA in position.



Mount I/O Expansion Cable

The expansion cable assembly connects an I/O base unit to another I/O base unit or to the adapter base unit. You can add extra I/O at another location, such as on another DIN rail. The cable is 2 m long and provides connection for up to 24 I/O modules. The maximum length of an entire bus, or backplane, (the combination of I/O base units and expansion cables) is 10 m.

The assembly consists of a cable, terminated by multi-way plugs, and a pair of adapters.

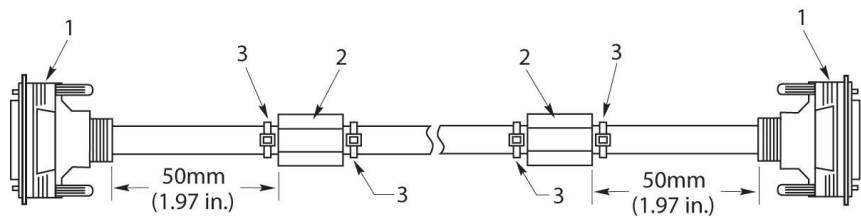
The expansion cable offers these features:

- Two-meter cable length
- Secure with retaining screws and screw cap screws
- Connects all command and response signals and system power
- Screened to reduce emissions

Cable Assembly

The cable assembly consists of an SCSI-3 cable and two ferrites. The ferrites are snap-on components that reduce resonance emissions.

Fit the ferrites 50 mm (1.97 in.) from each end and secure with cable ties either side of the ferrites.



- Item Description
- 1 SCSI-3 Cable
 - 2 Ferrite
 - 3 Cable-Tie

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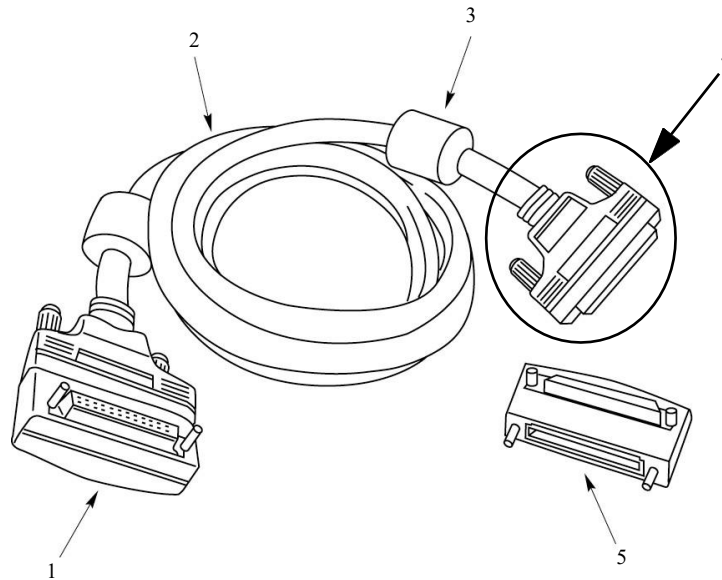
Table 8 - Cable Assembly

Item	Description
1	SCSI-3 cable
2	Ferrite
3	Cable-tie

Expansion Cable

The expansion cable has a left cable adapter and a right cable adapter. Connect one end to the right-hand bus connector of an I/O base (or adapter base) unit. The other end connects to the left-hand bus connector of an I/O base unit.

Figure 27 - I/O Expansion Cable Adapters



Item	Description
1	Cable socket assembly
2	SCS1-3 cable
3	Ferrite
4	Cable adapter
5	Cable plug assembly

Expansion cables are available in 2 m (78.74 in.) lengths.



Terminators are not required at the end of the bus (last base unit).

Install Expansion Cable

To install an expansion cable, follow these steps.

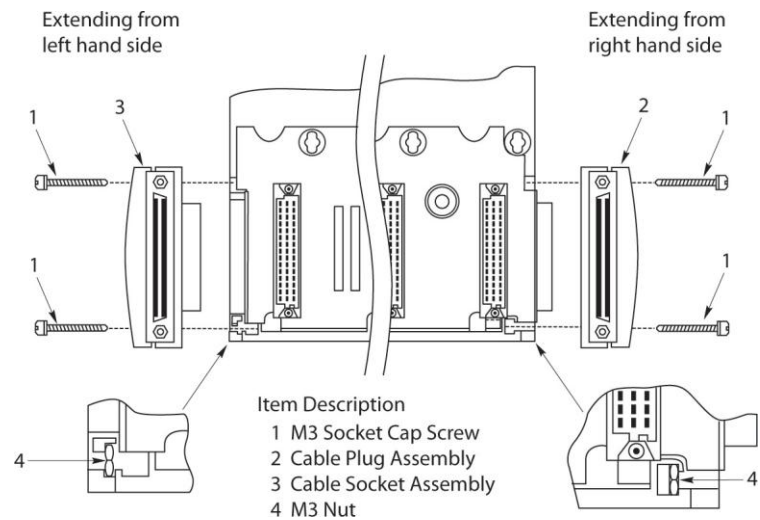


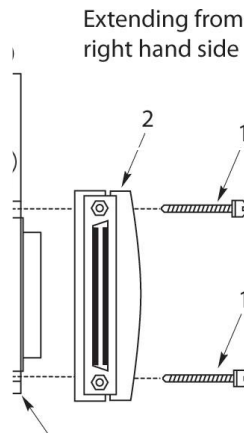
Table 9 - Expansion Cable Components

Item	Description
1	M3 socket cap screw
2	Cable plug assembly
3	Cable socket assembly
4	M3 nut

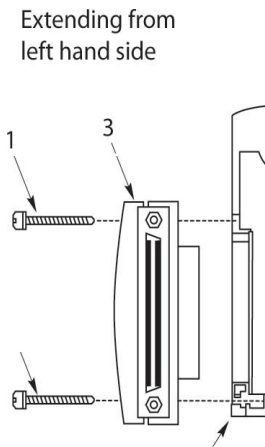
IMPORTANT Adapter base units can only be extended from the right side.

Connect to a 1715-A3IO 3-slot I/O Base Unit

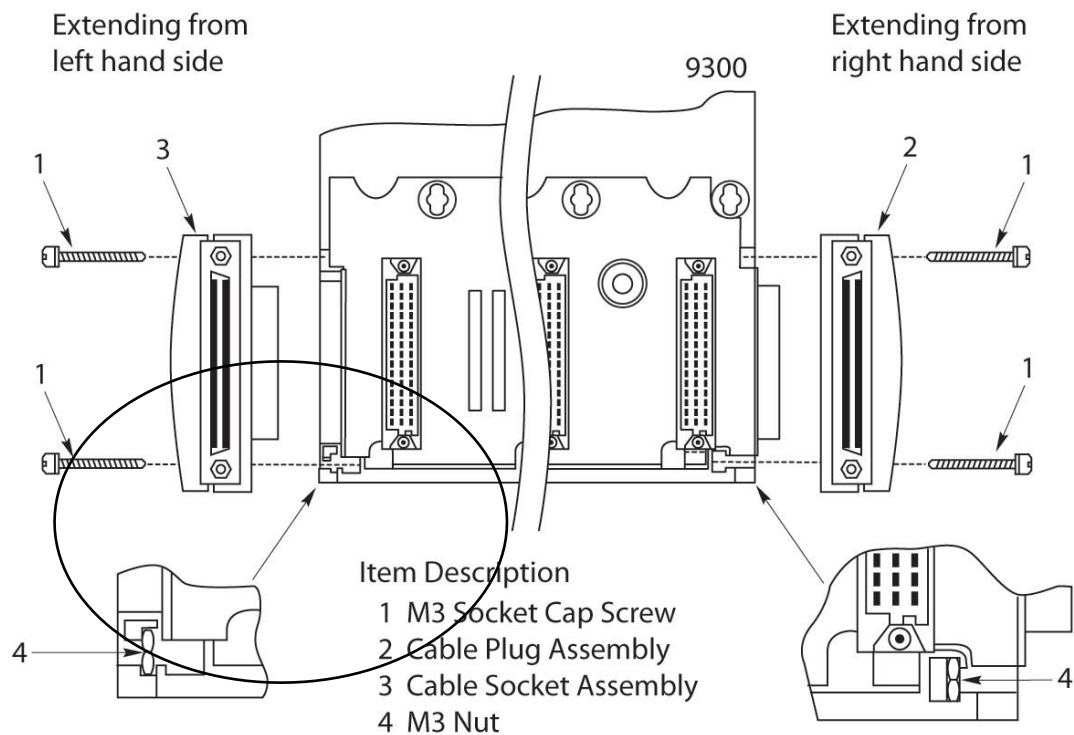
1. To extend from the right-hand side of an I/O base unit, insert a cable plug assembly into the I/O backplane connector.



2. When installing the cable on the left side of the base unit, insert a cable socket assembly into the I/O backplane connector.



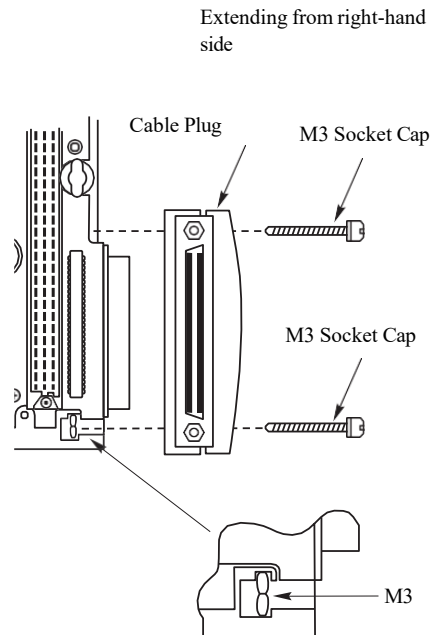
3. Insert an M3 nut into the base unit molding assembly as shown.



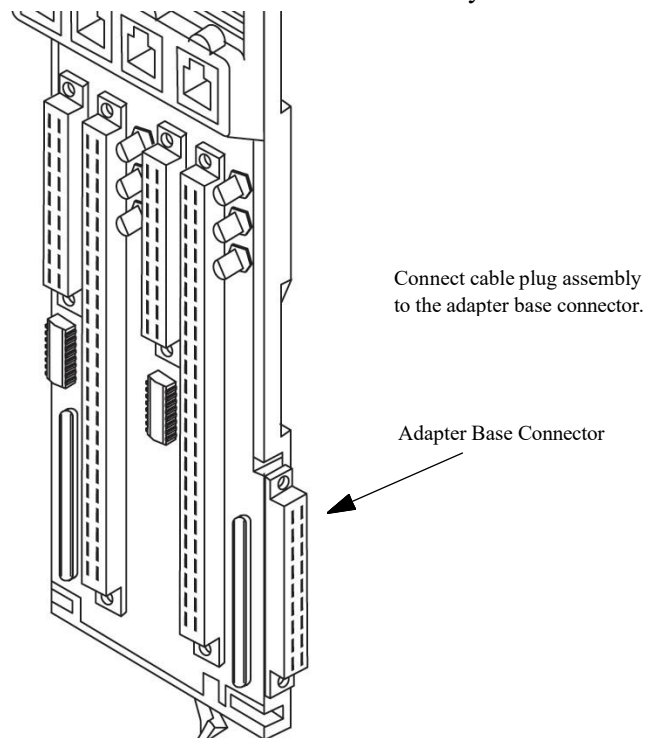
4. Secure the plug or socket assembly by inserting the two M3 socket cap screws.
5. Tighten the screws with a 2.5 mm hex key.
6. Install the cable end into the plug or socket assembly and tighten the retaining screws by hand.
7. Fit the cable plug or socket assembly to the other I/O base unit and secure as in steps [3](#) and [4](#).
8. Fit the other end of the cable into the cable plug or socket assembly.

Connect to a 1715-A2A 2-slot Adapter Base Unit

1. When installing the expansion cable from the right-hand side, insert a cable plug assembly into the 1715-A2A adapter base unit connector.



2. Follow steps [3](#), [4](#), and [5](#).
3. Insert the cable end into the cable plug assembly and tighten the retaining screws by hand.
4. Fit the cable socket assembly to the I/O base unit and secure as in steps [4](#) and [5](#).
5. Fit the other end of the cable into the cable socket assembly.



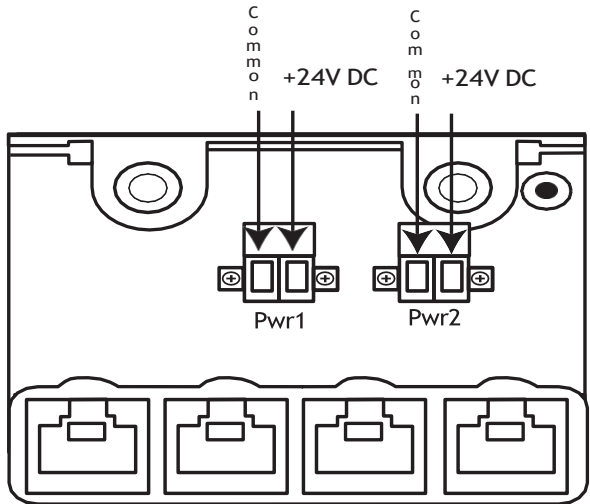
Wire the Adapter

The 1715 adapter base unit has a series of screw terminal blocks to terminate power connections to ease cable installation.

Connect the 24V DC System Power

The 1715 modules are designed to operate from two independent 24V DC sources with a common return. Power is connected to the two plugs, ‘PWR-1’ and ‘PWR-2’ on the adapter base plate. Power is distributed to the I/O modules through the base units.

Figure 28 - Connect System Power



ATTENTION: To comply with the CE and UKCA Low Voltage Directive (LVD), all connections to this equipment must be powered from a source compliant with safety extra low voltage (SELV) or protected extra low voltage (PELV).



ATTENTION: To comply with UL restrictions, all connections to this equipment must be powered from a UL Listed source compliant with Limited Voltage/Current per UL 508.

For each power supply connection, follow these steps.

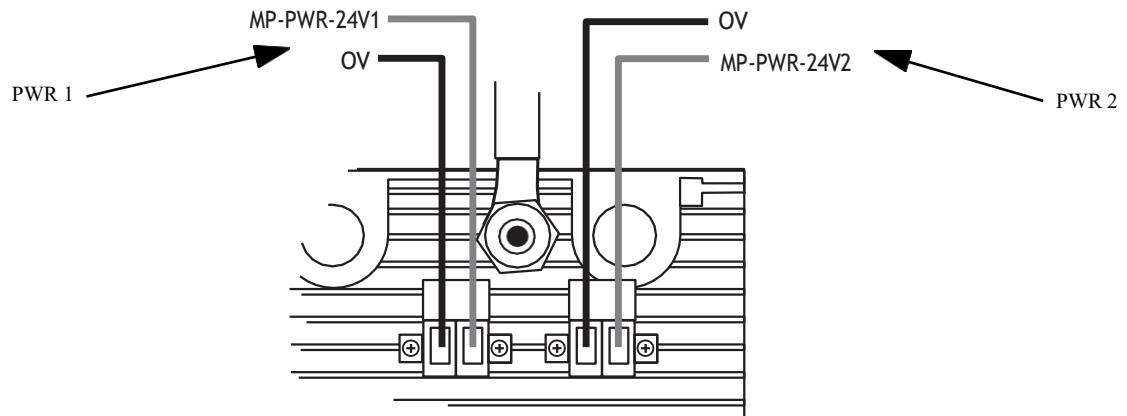
1. Connect the negative line from the power supply, typically labeled ‘OV’, to the left-hand terminal.
2. Connect the positive line from the power supply, typically labeled ‘+24V’, to the right-hand terminal.
3. Apply a minimum tightening torque of 0.5 N•m (0.37 lb•ft) to the terminal screws.

Table 10 - - Module Power Wiring Sizes

Wiring Attribute	Size
Conductor cross section, stranded maximum	2.5 mm ² (12 AWG)
Conductor cross section, solid maximum	2.5 mm ² (12 AWG)
Stripping length	7 mm (9/32 in.)

For maximum protection, be sure that the PWR-1 and PWR-2 plugs are supplied from independent 24V DC sources as in [Figure 29](#). Only having one power supply plug connection causes a Rack Status fault status indicator to illuminate on adapters.

Figure 29 - Independent Power Sources



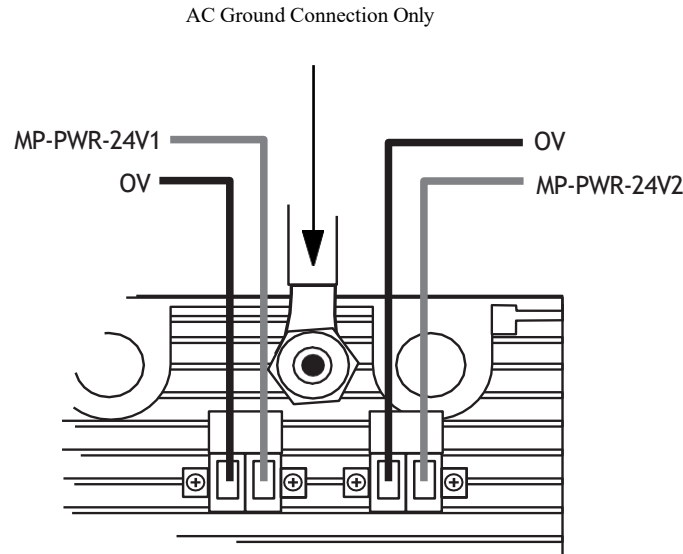
Wire the Ground Connection

The system can have up to three separate ground systems:

- An AC Safety Ground (sometimes called the ‘dirty ground’) to help protect you in the event of a fault. The ground stud on the adapter base unit must be connected to the AC safety ground, along with all exposed metalwork, such as DIN rails.
- An Instrument Ground (sometimes called the ‘clean ground’ or ‘OV DC ground’) to provide a good stable OV reference for the system. Every signal return must be referenced to the instrument ground, which is isolated from the AC Safety Ground.
- Some field wiring needs shielded (screened) cable. There can be a Shield Ground and the AC Safety and Instrument Grounds to provide a common point to terminate cable shields.

Connect the adapter base unit ground stud to the AC safety ground busbar of the system:

- Use an M6 lug on the end of the ground wire.
- Place the lug below the second nut on the ground stud between two washers and use two 10 mm (.039 in.) wrenches to tighten the nuts.
- Use a minimum conductor wire size of 4 mm² (10 AWG).

Figure 30 - Adapter Base Unit Ground Connection Detail

Connect Field Wiring

Connect the field wiring to the screw terminal blocks on the termination assemblies.

IMPORTANT The termination assemblies have integral fuses.

IMPORTANT You must use safety wiring principles if the applicable standards for the system require you take precautions to avoid external short circuits, because the internal diagnostics in the 1715 adapter do not detect external short circuits between channels. These standards include NFPA-72.



ATTENTION: To comply with the CE and UKCA Low Voltage Directive (LVD), all connections to this equipment must be powered from a source compliant with safety extra low voltage (SELV) or protected extra low voltage (PELV).



ATTENTION: To comply with UL restrictions, all connections to this equipment must be powered from a UL Listed source compliant with Limited Voltage/Current per UL 508.

Recommended Circuits for Digital Inputs

These circuits can be used for simplex and duplex configurations of digital input modules. Fit a fuse in each circuit to help protect the field wiring.

Figure 31 - Standard Input

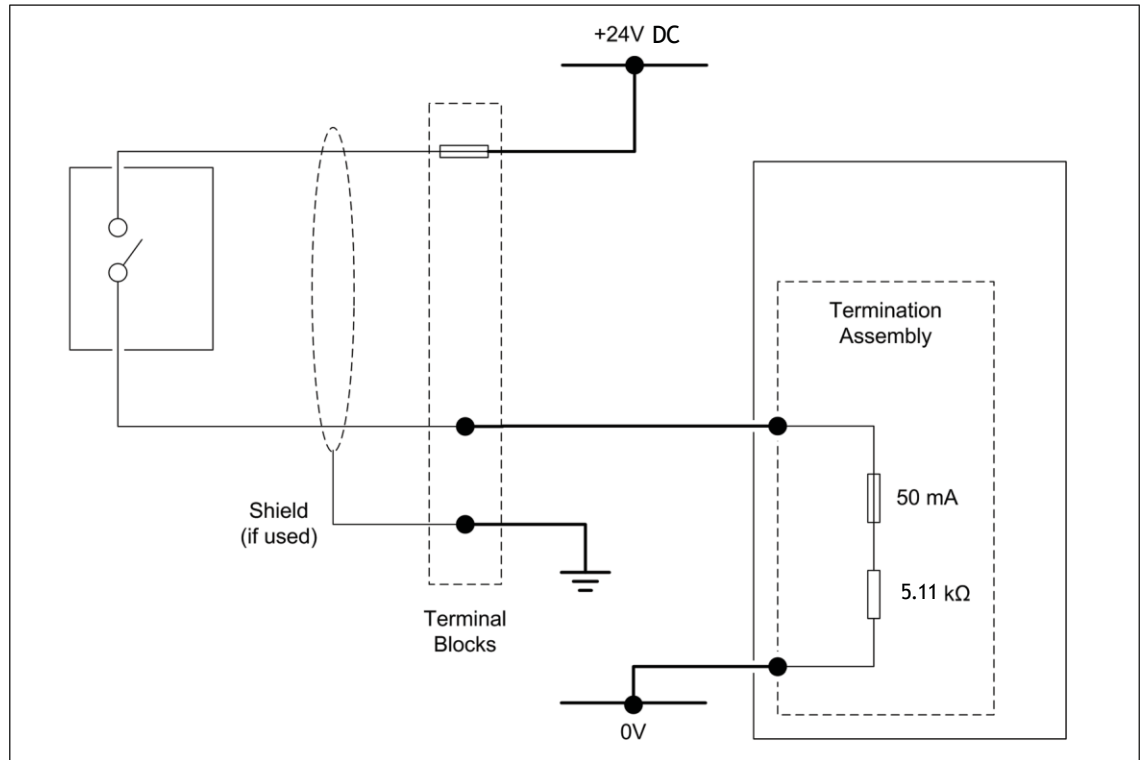
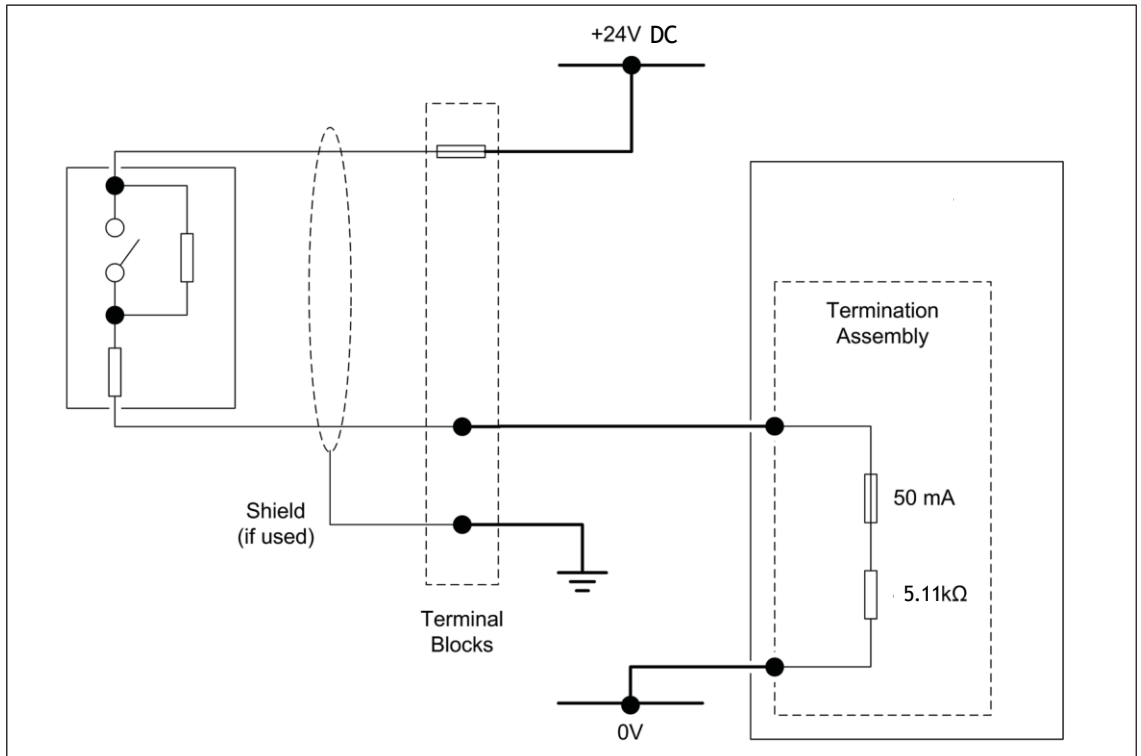


Figure 32 - Line Monitored Inputs



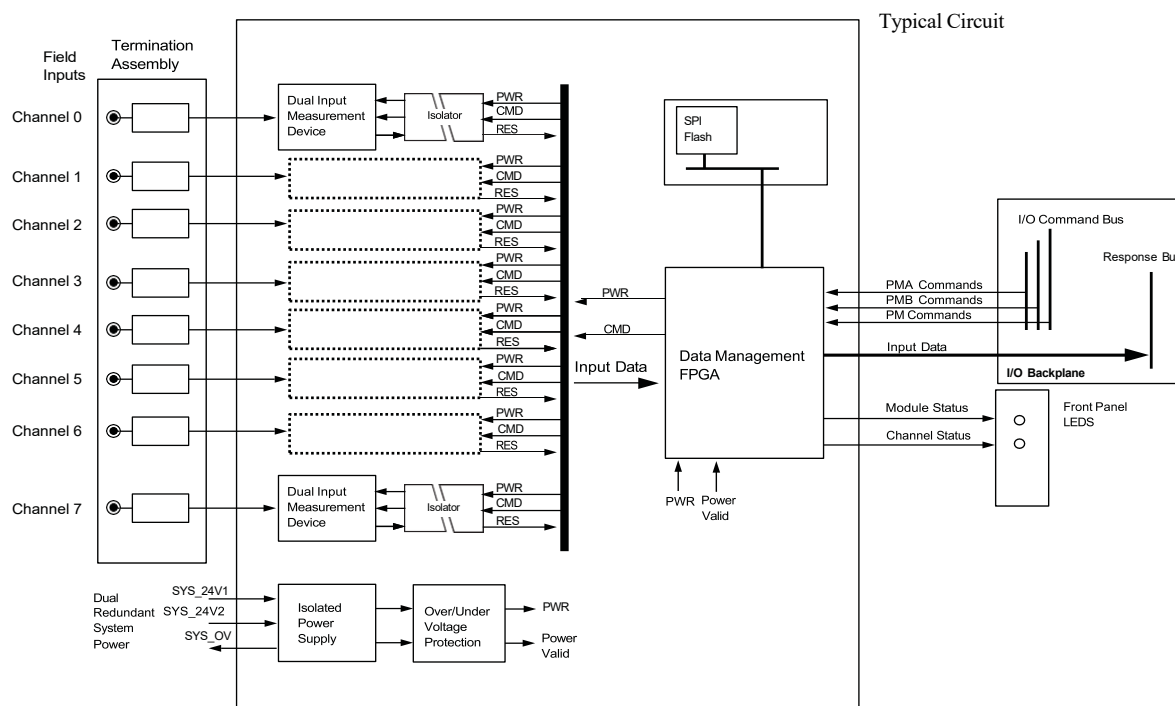
Threshold Settings for Line Monitored Field Devices

For information about setting threshold values, see [Threshold Values for Digital Inputs on page 225](#).

We recommend that you do a manual calibration drift check every two years. See [Calibration Drift Checks on page 235](#).

1715-IB16D Digital Input Module Functional Block Diagram

Figure 33 - 1715-IB16D 16-channel Module Functional Block Diagram



[Figure 33](#) provides a Function Block Diagram of the 1715 digital input module illustrating the input circuits, isolation circuits, internal power supplies, and the input data management by the FPGA. Each input signal is routed through a termination assembly to two input measurement devices. These devices determine the input status and channel condition and generate the input data for the ControlLogix controller.

The digital input module receives commands from the adapter and converts the channel input data into secure digital data packets. Signal power and isolation circuits separate out each input channel from the rest of the system and protect the system components from field faults.

The internal isolated power supply from the 24V DC dual redundant system power inputs produces module power. The isolated power supply provides power to the module and is protected by overvoltage and undervoltage detection circuits. Supply voltage monitoring initiates a warning signal and Power-off protective mode when a power failure is detected.

Internal diagnostics test the module every application cycle to see whether values are within the 1%-value fault band, and if appropriate, report a fault.

An independent watchdog arrangement also monitors the module operation and provides more fault containment by activating a shutdown mechanism if a fault is detected. For SIL 2 systems the time to active the shutdown mechanism can be configured in the CRTL on the SIL 2 Safety tab in them module profile in RSLogix/Logix Designer. For non-SIL 2 systems it is set at 10 seconds.

IMPORTANT If a fault occurs during normal operation in a duplex-configured system, an input module can be removed and replaced without disrupting the flow of input data.

The adapter also monitors the input data paths and can detect faults within each input channel. A visual indication of the module status and individual channel status is provided by an array of front panel indicators.

The range of termination assemblies can accept one or two input modules. Each assembly provides passive signal load termination and fuse overvoltage protection on each input channel. The system provides flexible and scalable input connectivity through mating termination assemblies with the relevant number of input modules.

Field Wiring of Digital Input Termination Assemblies

The termination assembly routes each digital input through a circuit. See [Figure 34](#). The input channel is protected with a 50 mA fuse. When an extreme overvoltage is applied to the input, the fuse blows. Each digital input signal is terminated by 5.11 k Ω high reliability load and is fed to the input circuit of the input module.

Figure 34 - 1715-TASIB16D Digital Input Termination Assembly Input Circuit

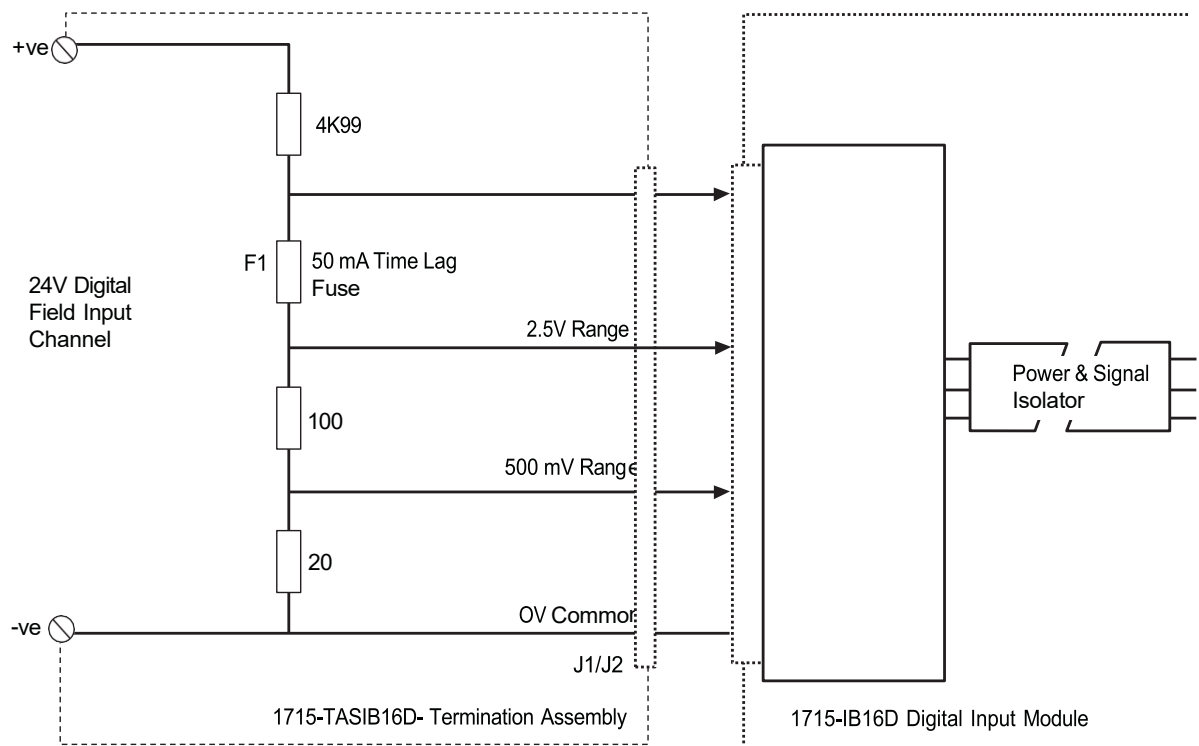


Figure 35 - 1715-TASIB16D and 1715-TADIB16D Digital Input Termination Assemblies

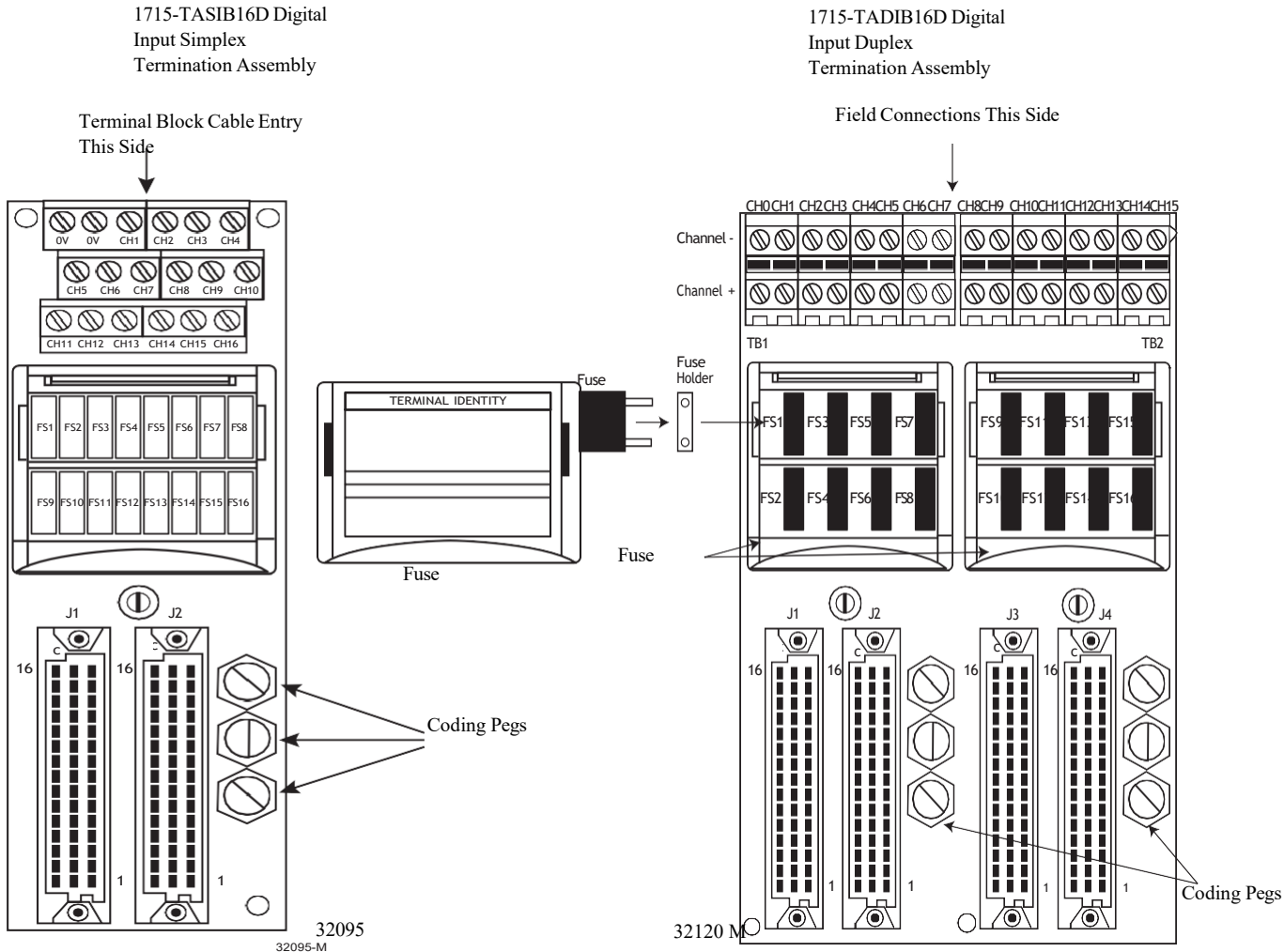
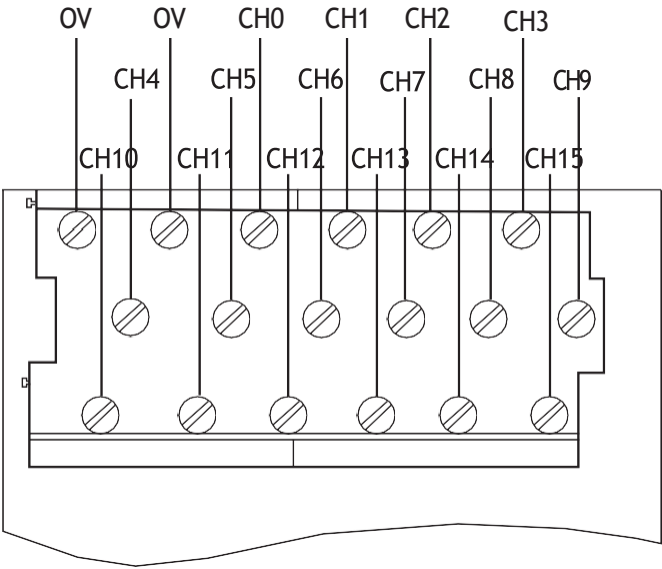
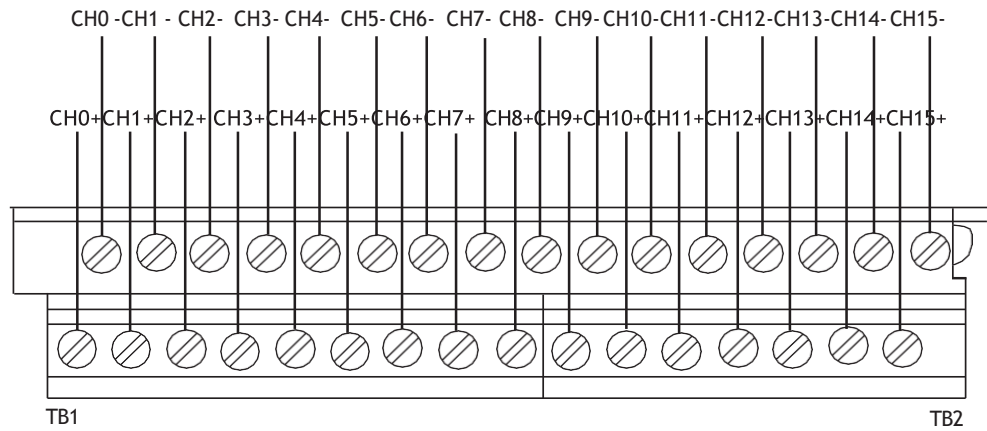


Figure 36 - Connections to 1715-TASIB16D Simplex Nonisolated Digital Input 16-channel Termination Assembly



Apply a minimum tightening torque of 0.5 N•m (0.37 lb•ft) to the terminal screws.

Figure 37 - Connections to 1715-TADIB16D Duplex Digital Input 16-channel Termination Assembly



Apply a minimum tightening torque of 0.5 N•m (0.37 lb•ft) to the terminal screws.

Digital Input Slew Tolerance

It is possible during sustained periods of abnormal input voltage slewing that channels can be declared faulted as a consequence of diagnostics that are otherwise designed to verify that the channels are operating within their designed safety accuracy.

To avoid spurious declaration of channel faults, it is necessary to make sure that the input signal condition satisfies the maximum slew rate criteria that are defined in the 1715 Redundant I/O System Specifications Technical Data, publication [1715-TD001](#). So it can be necessary to condition the input signal with low-pass filtering.

Field Loop Circuits for Digital Inputs

The recommended digital input field loop circuits for the 1715-IB16D digital input module are shown on [page 76](#).

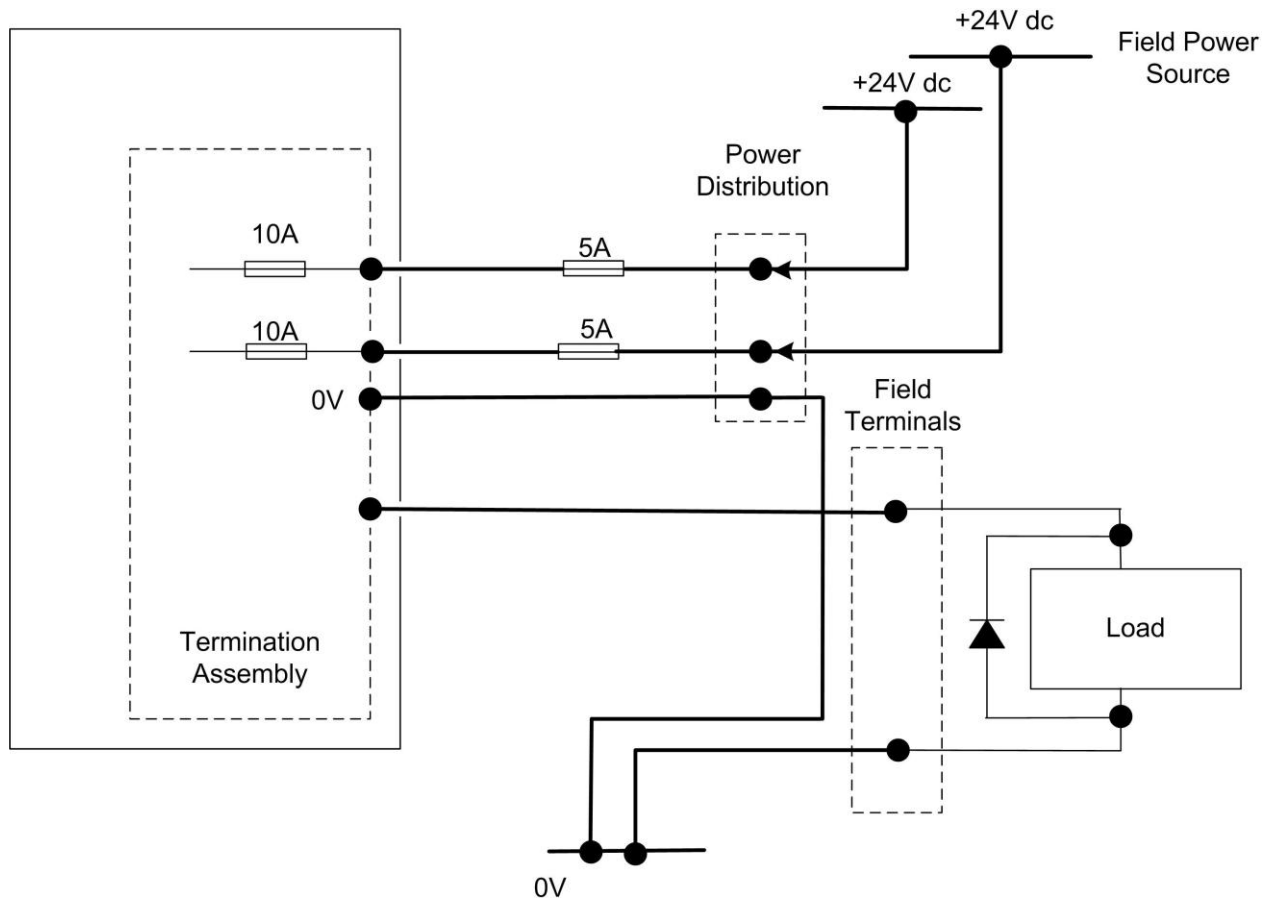
For line monitored digital input loop circuit wiring and recommended threshold values, see [Appendix B](#).

Recommended Circuits for Digital Outputs

This circuit is suitable for simplex and duplex configurations of digital output modules. The two 10 A fuses that are shown are supplied with the adapter in the output termination assembly. They help protect all output circuits that are associated with the particular termination assembly.

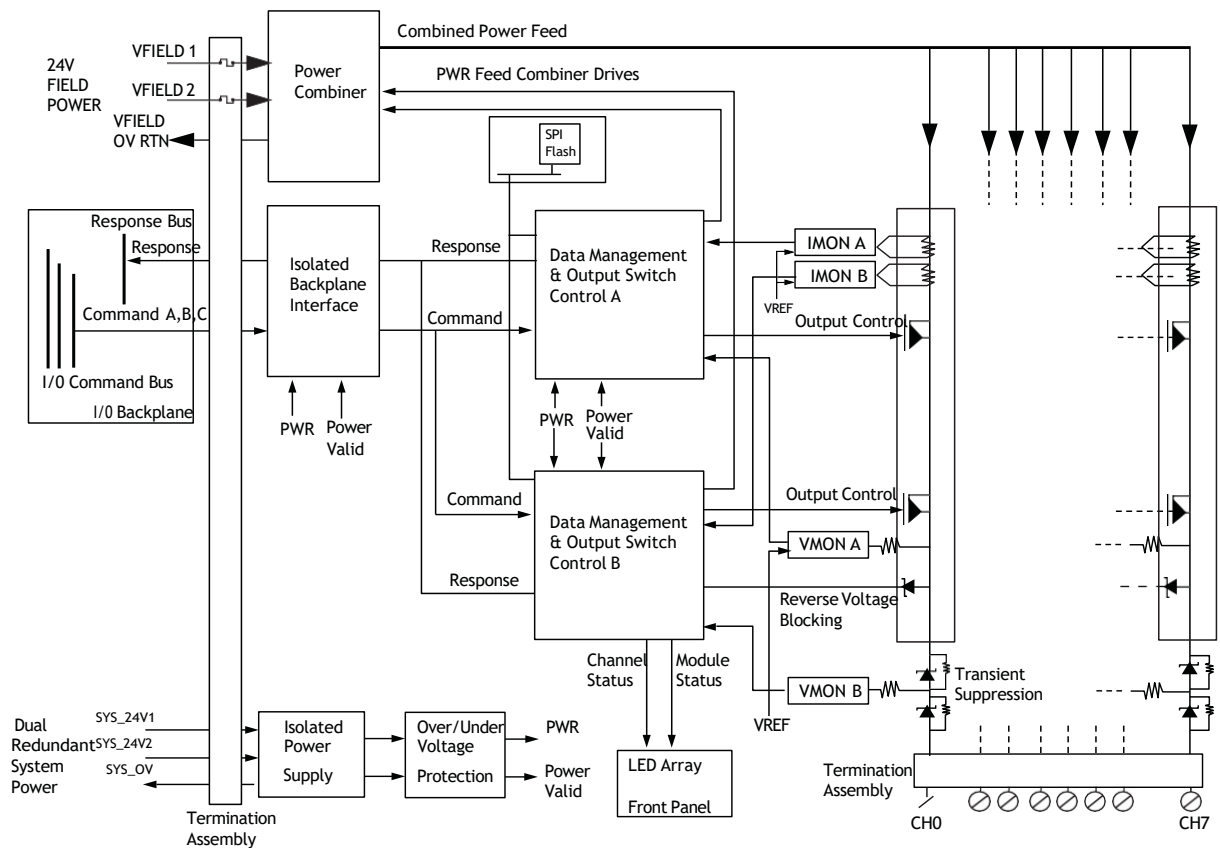


ATTENTION: For inductive loads, connect a diode at the actuator to protect the adapter against back EMF.



1715-OB8DE Digital Output Module FBD

Figure 38 - 1715-OB8DE Functional Block Diagram (FBD)



See [Figure 38](#). Two independent output switch control units control the field output channel. The field output circuitry is galvanically isolated from the processor input commands and response lines by an isolated interface circuit. This architecture helps protect the system processors from faults in the output control circuits of the module and possible field device faults.

The internal isolated power supply produces module power, which the dual redundant system power inputs supply. Over- and undervoltage protection is applied to the module internal power supply outputs.

Command packets are received from the processor module via the EtherNet/IP network. The output switch control units decode and vote the output data that is addressed to them and set the output FET switches accordingly. The output voltages are produced from the 24V DC field power input voltages by a power combiner circuit. Each output channel has a pair of FET switches arranged in a series that are independently controlled. Load current and voltage monitoring is provided for each switch. Output channel protection makes sure that the output circuit is switched off when the channel load current exceeds a safe limit.

A reverse voltage protection circuit makes sure that externally applied voltages to any output channel do not generate current flow backwards into the module outputs.

In Duplex redundant mode, the two fail-safe output switches per channel are combined in a parallel arrangement so that they automatically form a fault-tolerant output configuration. In this configuration, removal and of an output module is possible without any disruption to a live system.

The module has a range of self-checking functionality. Short circuit and open circuit line monitoring is provided on all outputs. In addition, each output channel is tested and checked for 'stuck-on' and 'stuck-off' conditions on the output switch pairs. The 'stuck-on'/'stuck-off' test is performed on one 1715-OB8DE module per minute.

Field Wiring of Digital Output Termination Assemblies

The 1715-TASOB8DE and 1715-TADOB8DE consist of a simple PCB, screw termination blocks (16 terminals), two 10 A fuses with a plastic fuse cover, coding pegs, field terminal connectors and connectors to connect the module to the command, and response buses.

Figure 39 - 1715-TASOB8DE and 1715-TADOB8DE Digital Output Termination Assemblies

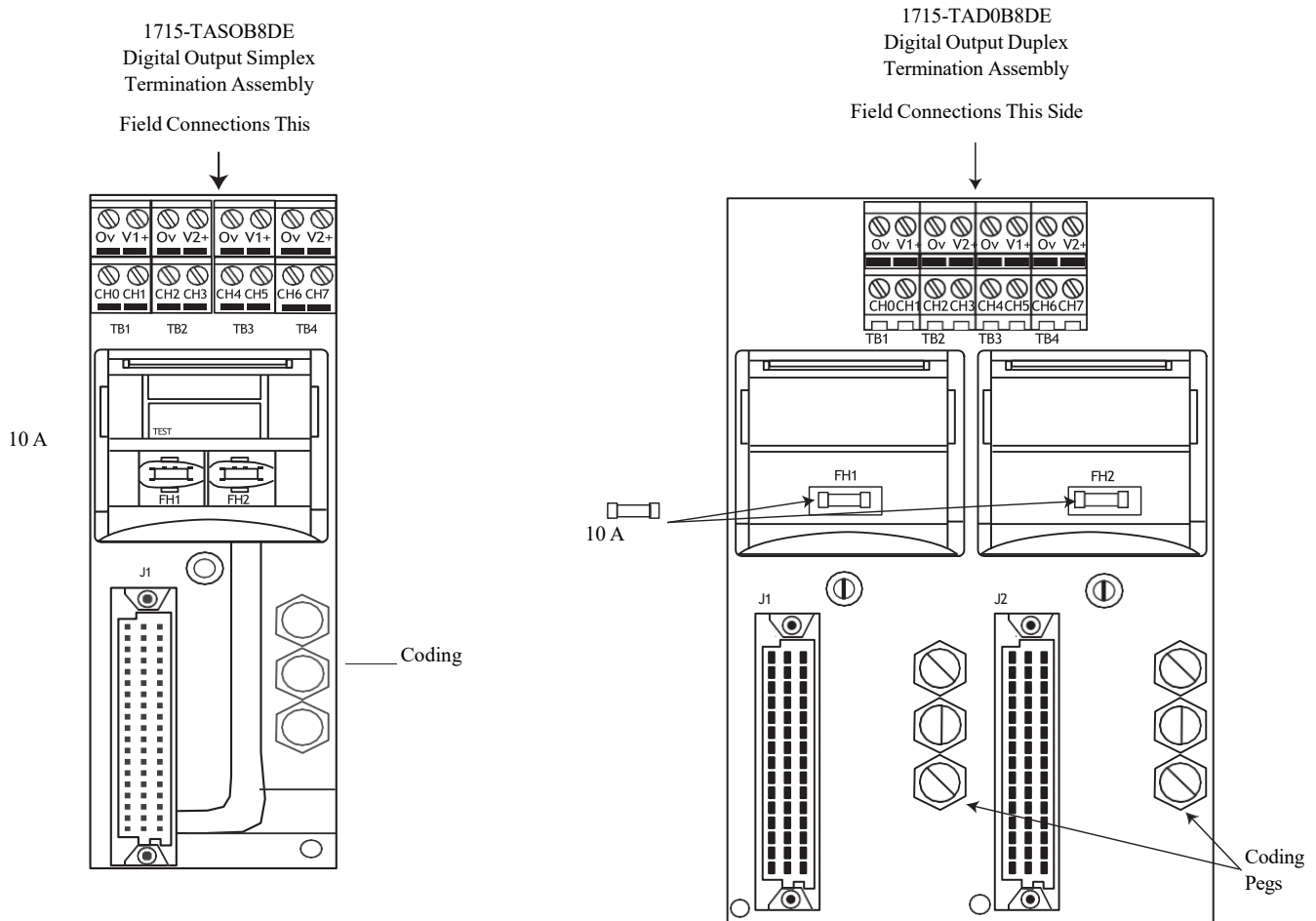
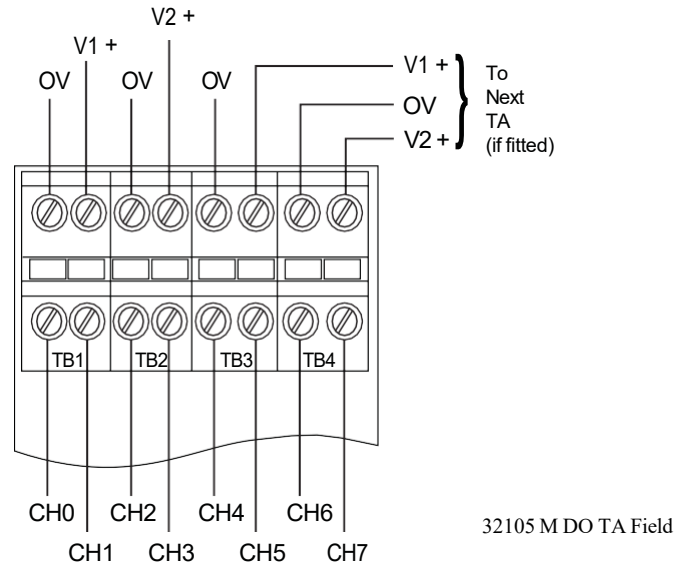


Figure 40 - Connections to 1715-TASOB8DE and 1715-TADOB8DE Digital Output Termination Assembly 8-channel Simplex/Duplex



Apply a minimum tightening torque of 0.5 N•m (0.37 lb•ft) to the terminal screws.

The 24V DC field voltages VFIELD 1 and VFIELD 2, used by the output module for the output field voltages, are connected at the terminal blocks and fed via two replaceable 10 A fuses, F1 and F2. These fuses give protection for the output module against field faults. Field OV (VFIELD RTN) is also routed from the output module connectors to the terminal block.

Figure 41 - 1715-TASOB8DE Digital Output Simplex Termination Assembly Connections

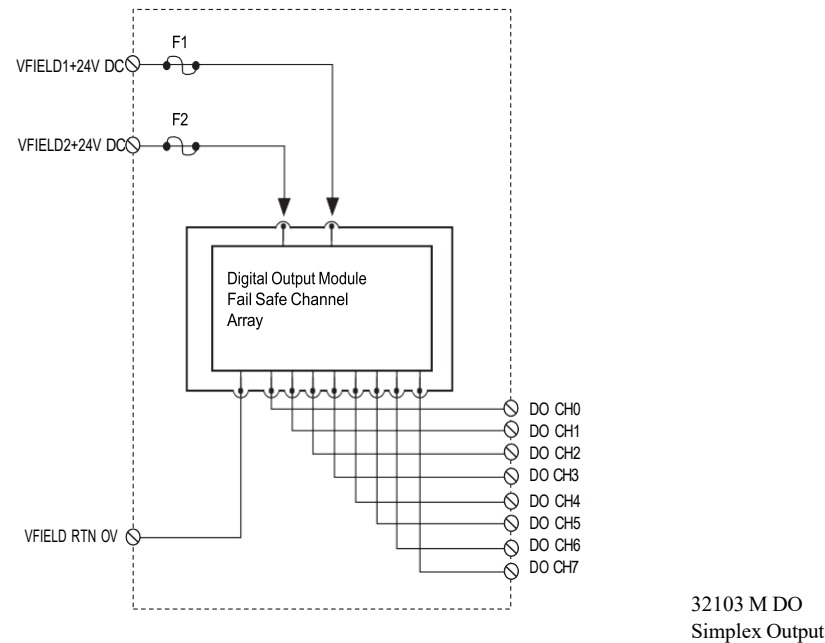


Figure 42 - 1715-TADOB8DE Digital Output Duplex Termination Assembly Connections

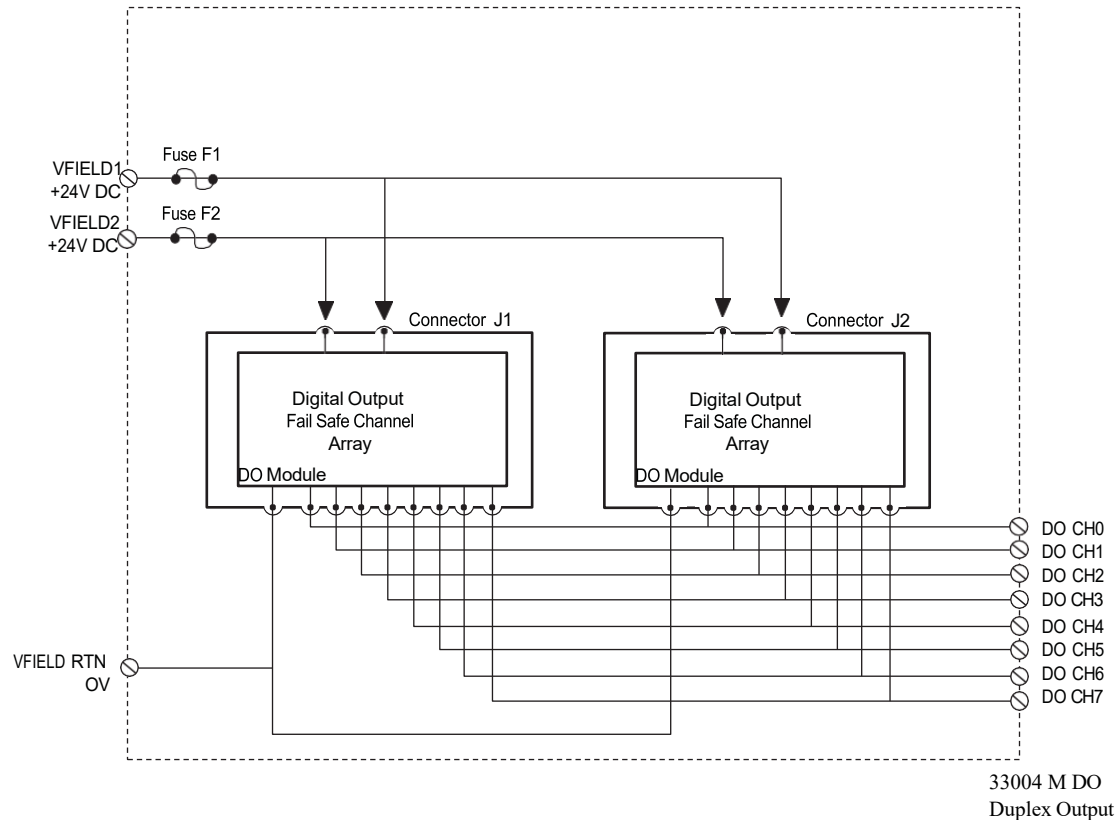
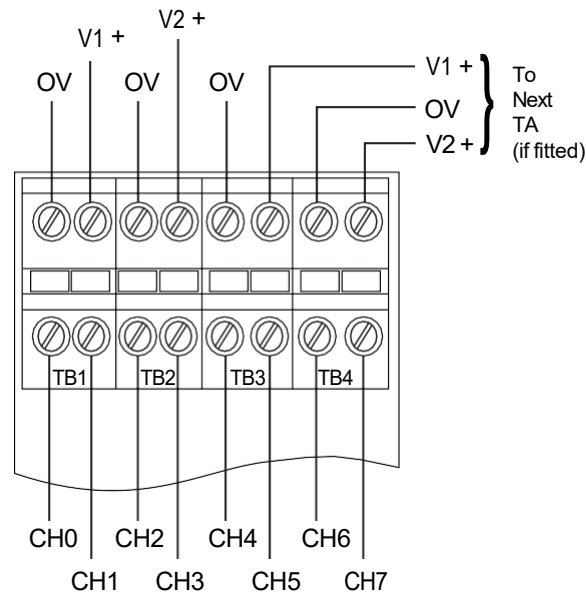


Figure 43 - Digital Output Termination Assembly Field Wiring

32105 M DO TA Field

Digital Output Slew Tolerance

It is possible during sustained periods of abnormal field supply or output signal condition slewing that channels can be declared faulted. The fault is a result of diagnostics that verify that the channels are operating within their designed safety accuracy.

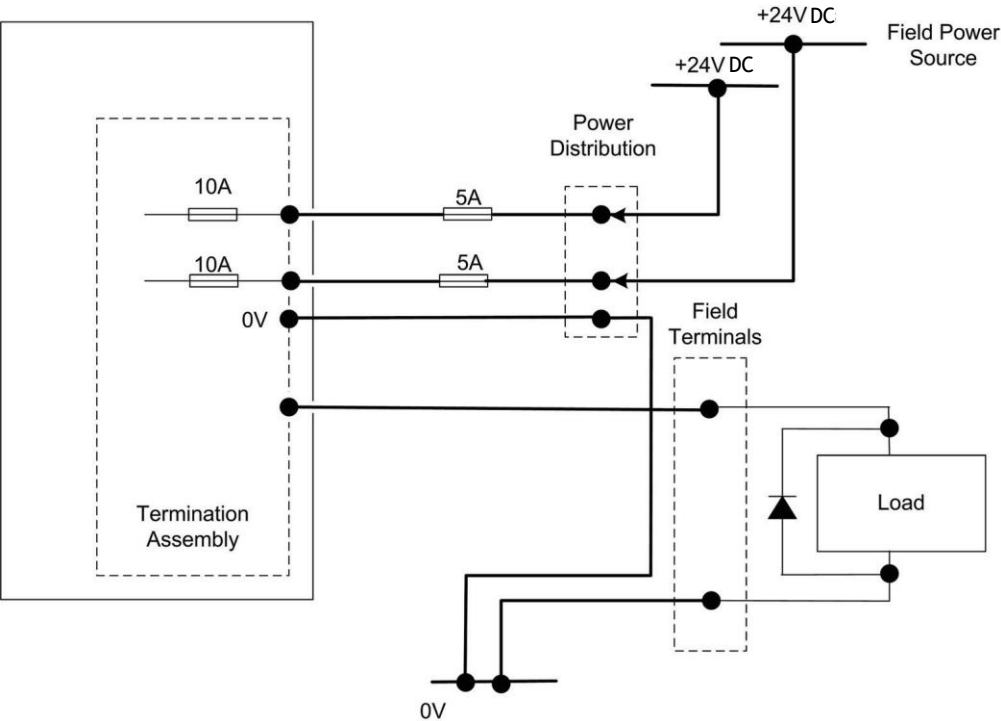
To avoid spurious declaration of channel faults, it is necessary to make sure that the field supply voltage and output signal condition satisfy the maximum slew rate criteria that are defined in the 1715 Redundant I/O System Specifications Technical Data, publication [1715-TD001](#).

Field Loop Circuits for Digital Outputs

The field loop circuit for a digital output is shown in [Figure 44](#).

IMPORTANT	The field power 5 A fuses comply with UL508 requirements. The 5 A fuses are No. 396/TE5 5 A time lag fuse; UL 248-14, 125V,T Leadfree; manufactured by Littelfuse. - You can use Class 2 power supplies for the +24V DC field voltage instead of the two 5 A fuses. The NEC defines Class 2 as providing less than 100 watts (at 24V). - When digital output modules are configured as a redundant pair, the minimum load current that is required for channels with line monitoring is 20 mA.
------------------	--

Figure 44 - Digital Output (Simplex or Duplex) Field Loop Circuit



IMPORTANT: For inductive loads, a back EMF protection diode is fitted at the load.

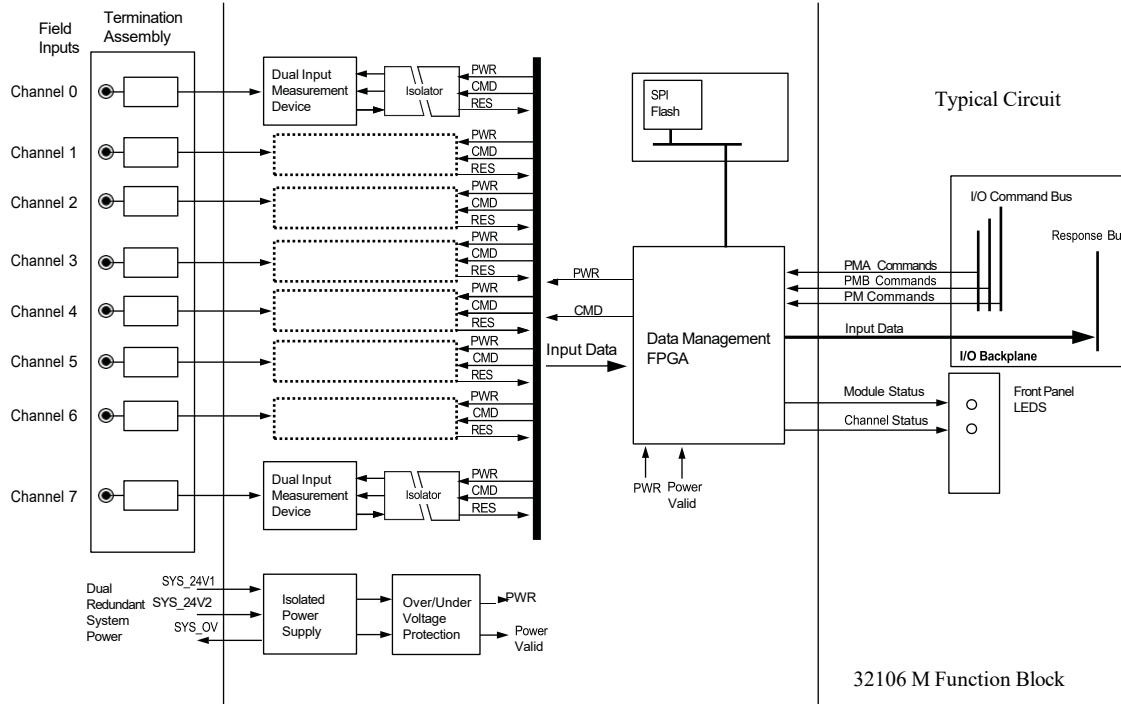
Recommended Circuits for Analog Inputs

This section describes the layout for analog inputs.

1715-TASIF16 Analog Input Termination Assembly Functional Block Diagram

[Figure 45](#) is the diagram for the analog input termination assembly.

Figure 45 - 1715-Analog Input Termination Assembly Functional Block



Each input signal is routed through the termination assembly to two input measurement devices. These devices determine the input status and channel condition and generate the input data for the controller.

Signal and power isolation circuits separate each input channel from the rest of the system, thus protecting the system components from field faults.

The internal isolated power supply from the 24V DC dual redundant system power inputs produces module power. The isolated power supply provides power to the module and is protected by overvoltage and undervoltage detection circuits. Supply voltage monitoring initiates a warning signal and Power-off protective mode when a power failure is detected.

Internal diagnostics, which the adapter controls, test the module at routine intervals of 50...100 ms. An independent watchdog arrangement also monitors the module operation and provides more fault containment by activating a shutdown mechanism when a fault is detected.

IMPORTANT If a fault occurs during normal operation in a duplex configured system, a faulted input module can be removed and replaced without disrupting the input signals to a live system.

Use extreme caution when removing and inserting I/O modules under power because bending or damaging the pins can fault the system.

The module also monitors the input data paths and can detect faults within each input channel. A visual indication of the module status and individual channel status is provided by an array of front panel indicators and can be connected to tags within the Studio 5000 Logix Designer® application.

The termination assemblies can accept one or two input modules. Each termination assembly provides passive signal load termination and overvoltage protection for each input channel. The system provides flexible input connectivity by mating specific termination assemblies with the relevant number of input modules.

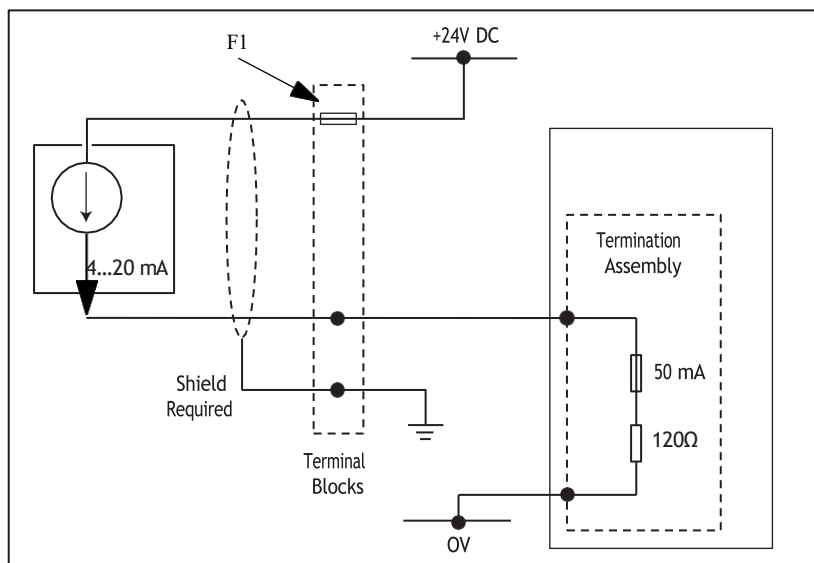
Field Loop Circuits for Analog Inputs

These circuits can be used for simplex and duplex configurations of analog input modules. Fit a suitably rated fuse, “F1” in each circuit to help protect the field wiring, terminal block, and 4...20mA current generator.

This field loop connection method is used for two-wire field devices.

Figure 46 - Two-wire Analog Input Field Loop Circuit

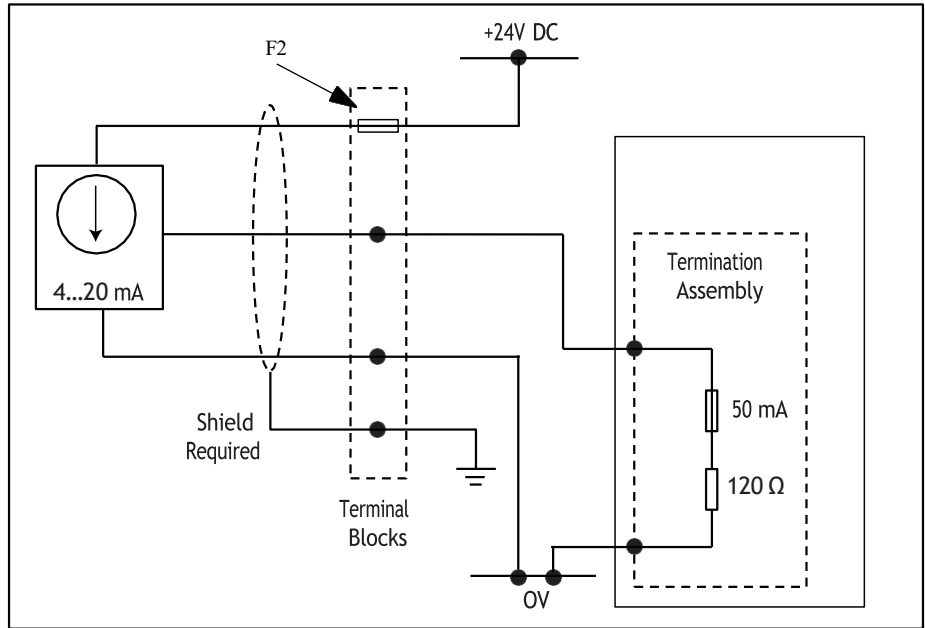
2-Wire Analog Input



This field loop connection is used for three-wire analog field devices. Fit a suitably rated fuse, “F2” in each circuit to help protect the field wiring, terminal block, and 4...20 mA current generator.

Figure 47 - Three-wire Analog Input

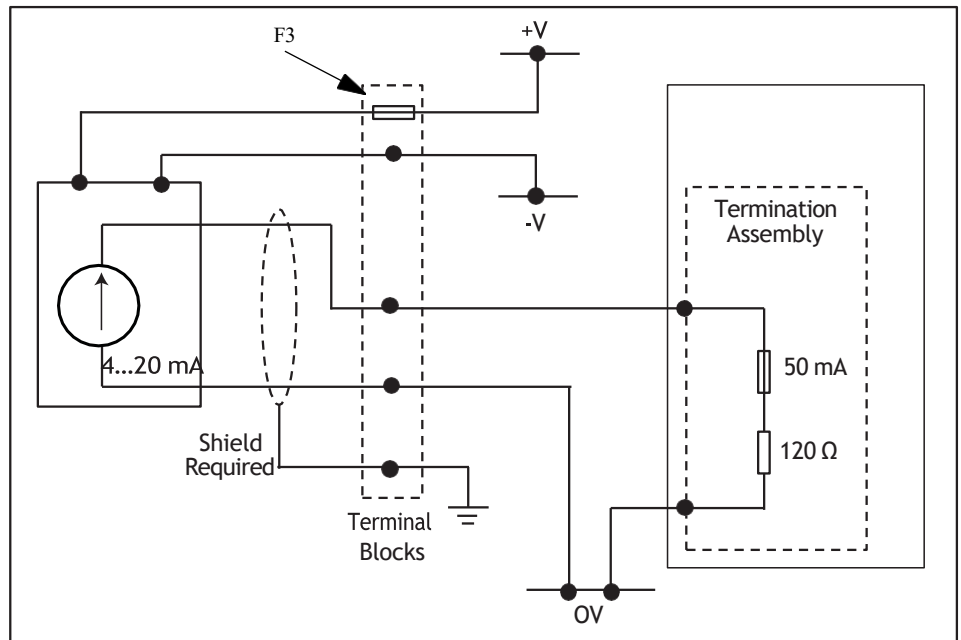
3-Wire Analog Input



This field loop connection method is used for four-wire analog field devices. Fit a suitably rated fuse, "F3" in each circuit to help protect the field wiring, terminal block, and 4 mA current generator.

Figure 48 - Four-wire Analog Input

4-Wire Analog Input



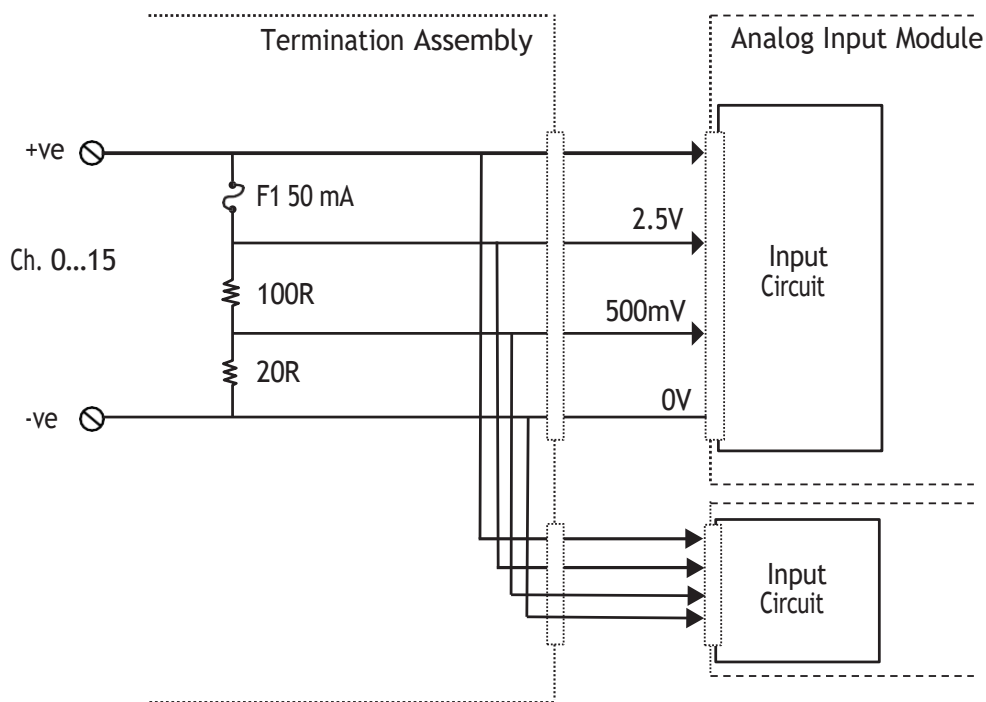
Field Wiring of Analog Input Termination Assemblies

The termination assembly routes each analog input through a circuit similar to that shown in [Figure 49](#). The input channel is protected with a 50 mA fuse. When an extreme over voltage is applied to the input, the fuse blows. Each analog input channel is terminated using a pair of high accuracy resistors presenting a combined termination resistance of 120 Ω . The input module monitors the channel current by measuring the voltage drop across each resistor. The fuses have a plastic fuse cover that must be kept in the closed position during normal operation. Standard field wiring connections are made at the terminal blocks on the termination assembly.

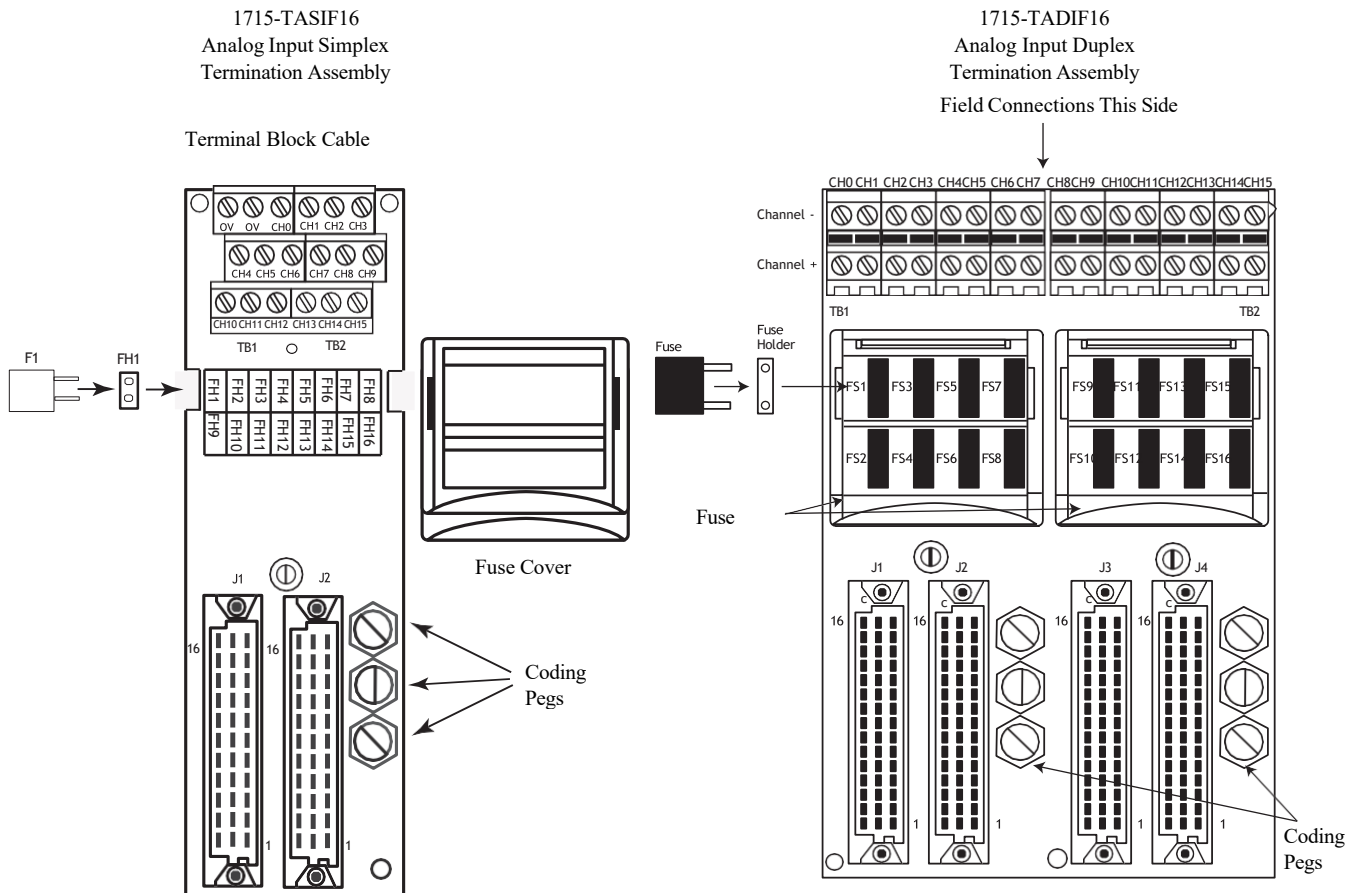
With a simplex termination assembly, the input signals are routed to one input module. In duplex configurations, they are routed in parallel to two modules.

IMPORTANT These resistors must be considered as part of the field loop circuit. Each channel has a 50 mA fuse to help prevent component damage in overcurrent situations.

Figure 49 - Analog Input Termination Assembly Input Circuit



When an analog input module is configured as dual, the analog field loop that is connected to channel 0 is automatically fed to both modules. The system automatically votes the data from the input modules so that you have only one value that is presented to the application. The application program is presented with channel 0 and channel 1 values in a fault tolerant manner so that if either input module is lost, both values are still available to the application program.

Figure 50 - 1715-TASIF16 and 1715-TADIF16 Analog Input Termination Assemblies

Analog Input Slew Tolerance

It is possible during sustained periods of abnormal input current slewing that channels can be declared faulted. The fault is a result of diagnostics that are designed to verify that the channels are operating within their designed safety accuracy.

To avoid spurious declaration of channel faults, it is necessary to make sure that the input signal condition satisfies the maximum slew rate criteria that are defined in the 1715 Redundant I/O System Specifications Technical Data, publication [1715-TD001](#). So it can be necessary to condition the input signal with low-pass filtering or sensor slew rate configuration.

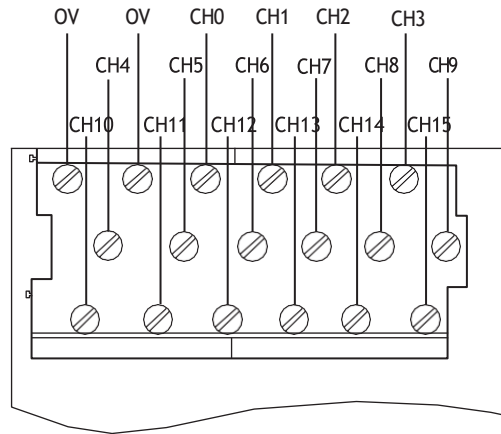
Analog Input Module Field Devices

If there are two field devices, you normally connect them to two channels of a fault tolerant pair of modules, for example to channel 0 and to channel 1.

The two input values (0 and 1) then must be voted by using logic or a function block in the application program. This is accomplished by taking either the lowest or highest value, depending on the application. The other option is to use the two values in two simplex input modules, for example, both using channel 0. In this case, the values must still be voted in the application program in the

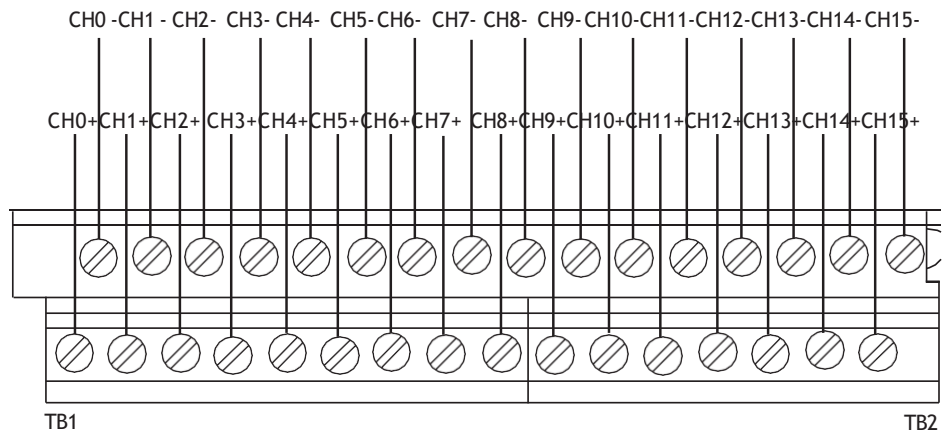
same way as previously stated, but the system has less fault tolerance, as the loss of one module removes one of the inputs.

Figure 51 - Connections to 1715-TASIF16 Simplex Nonisolated Analog Input Termination Assembly-16-channel



Apply a minimum tightening torque of 0.5 N•m (0.37 lb•ft) to the terminal screws.

Figure 52 - Connections to 1715-TADIF16 Duplex Isolated Analog Input Termination Assembly



Apply a minimum tightening torque of 0.5 N•m (0.37 lb•ft) to the terminal screws.

HART Secondary Master

The HART Secondary Master is a handheld monitor/controller that field engineers use to check and reconfigure the settings of field equipment. For Allen-Bradley modules to interface and operate with this equipment, an additional 120 Ω resistor assembly is required in the connecting circuit.

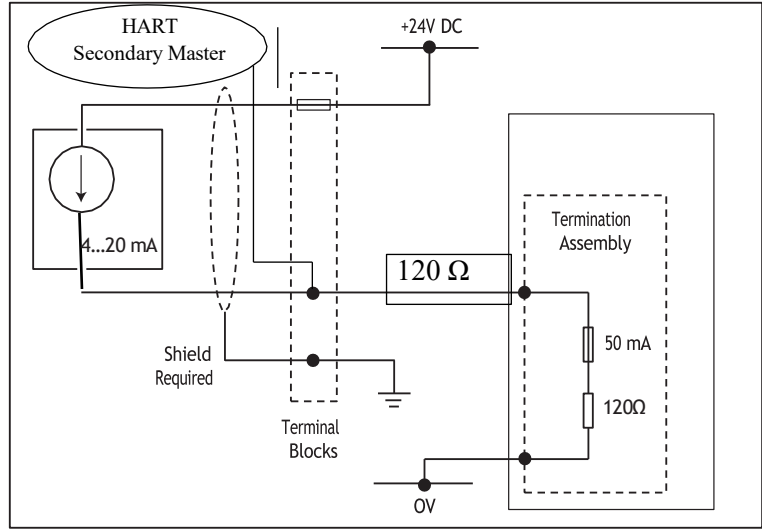
IMPORTANT It is the responsibility of the Installation Engineer to make sure that the HART secondary Master is correctly installed. information regarding HART equipment may be obtained from the HART website.

<http://en.hartcomm.org/>

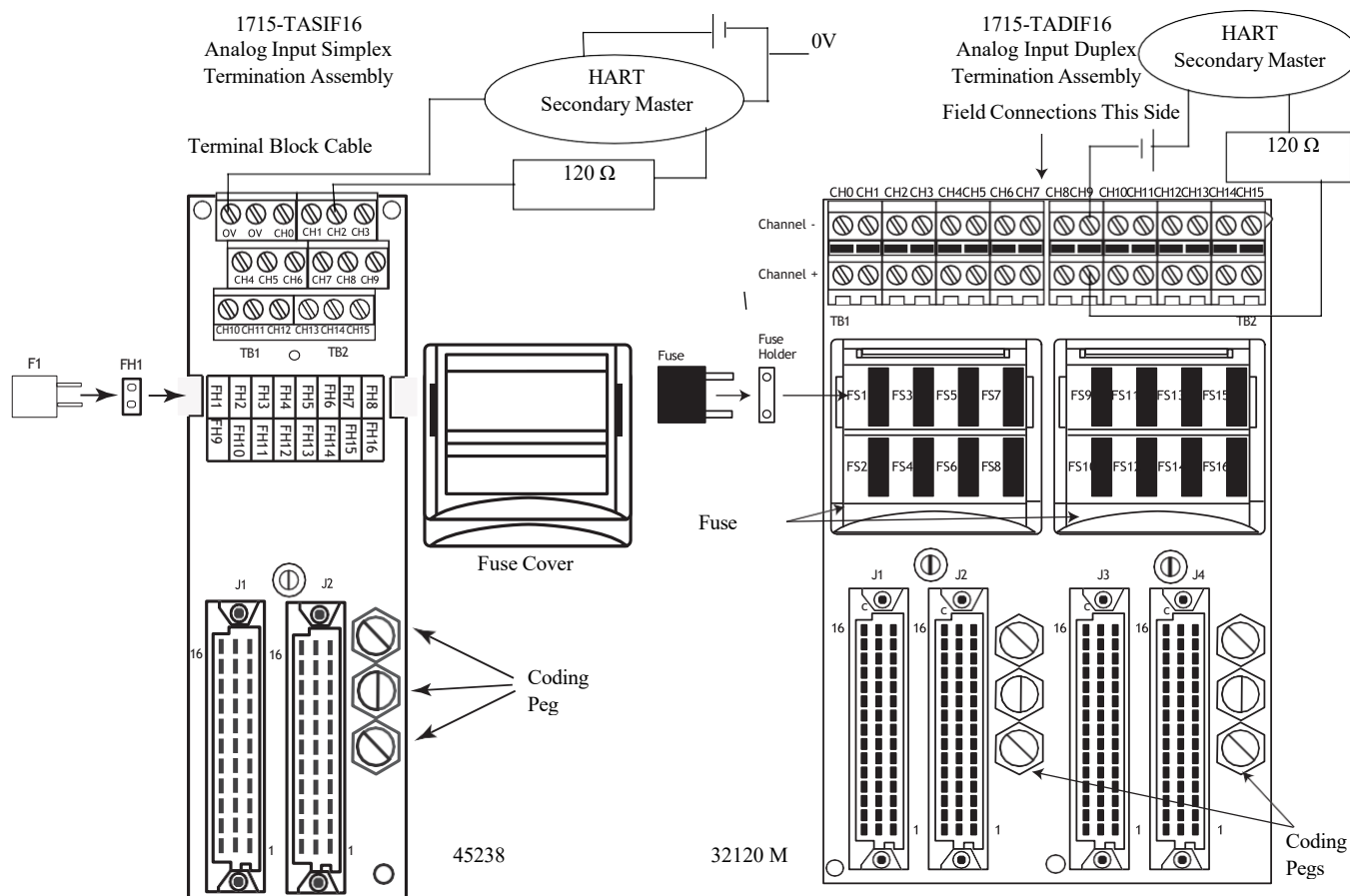
http://en.hartcomm.org/hcp/tech/aboutprotocol/aboutprotocol_how.html

Figure 53 - Connections for 120 Ω Resistor and Secondary Master

2-Wire Analog Input



[Figure 53](#) shows the addition of the 120 Ω resistor and HART Secondary Master to the Two-wire Analog Input Field Loop Circuit shown in [Figure 46](#). The circuit can be accomplished by connecting the secondary Master and 120 Ω resistor assembly to the 0 V terminal and required channel terminal on the terminal block as shown in [Figure 54](#) below.

Figure 54 - Connection of 120 Ω Assemblies and Secondary Masters to Terminal Blocks

The left circuit of [Figure 54](#) represents the secondary master that is connected to the Channel 2 terminal of a simplex termination assembly.

The right circuit of [Figure 54](#) represents the secondary master that is connected to the Channel 9 terminals of a duplex termination assembly.

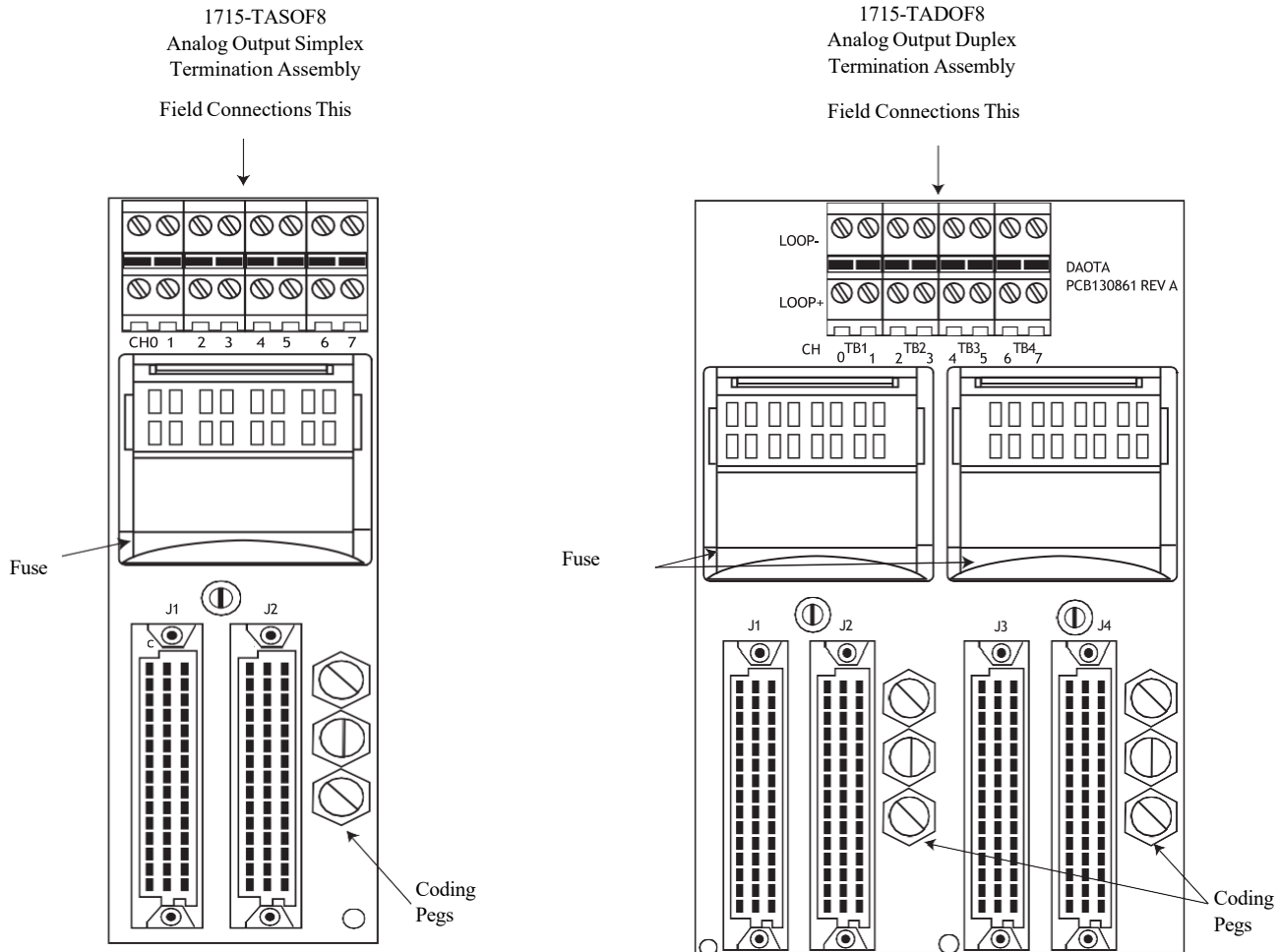
For both circuits, the secondary master is powered through a field power supply unit.

Recommended Wiring for Analog Output Modules

This section describes the wiring for analog outputs.

Field Wiring of Analog Output Termination Assemblies

Figure 55 - 1715-TASOF8 and 1715-TADOF8 Analog Output Termination Assemblies



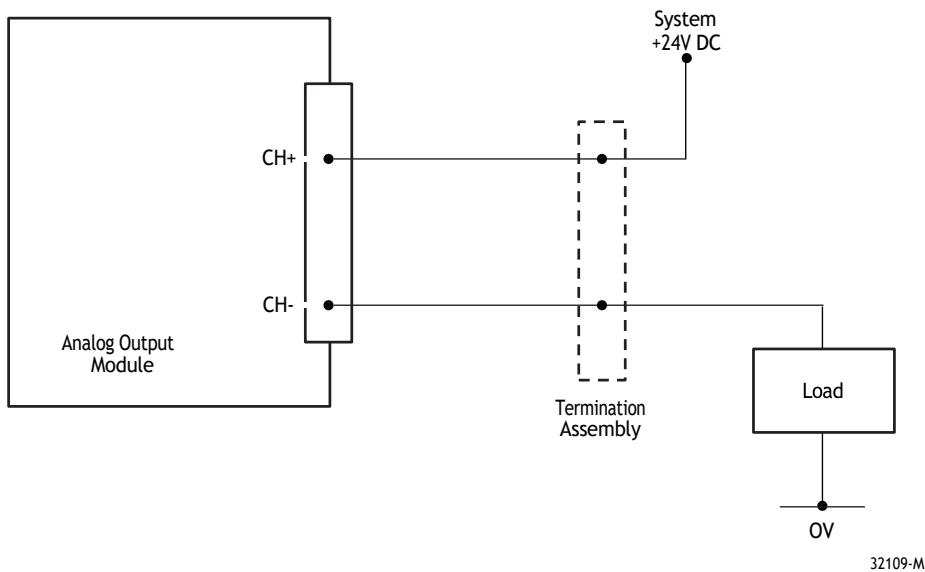
Analog Output Slew Tolerance

Analog output channel voltage slew is unconstrained with the limits set by the compliance operating voltage range of the module.

Field Loop Circuit for Analog Outputs

The field loop circuit for an analog output is shown in [Figure 56](#).

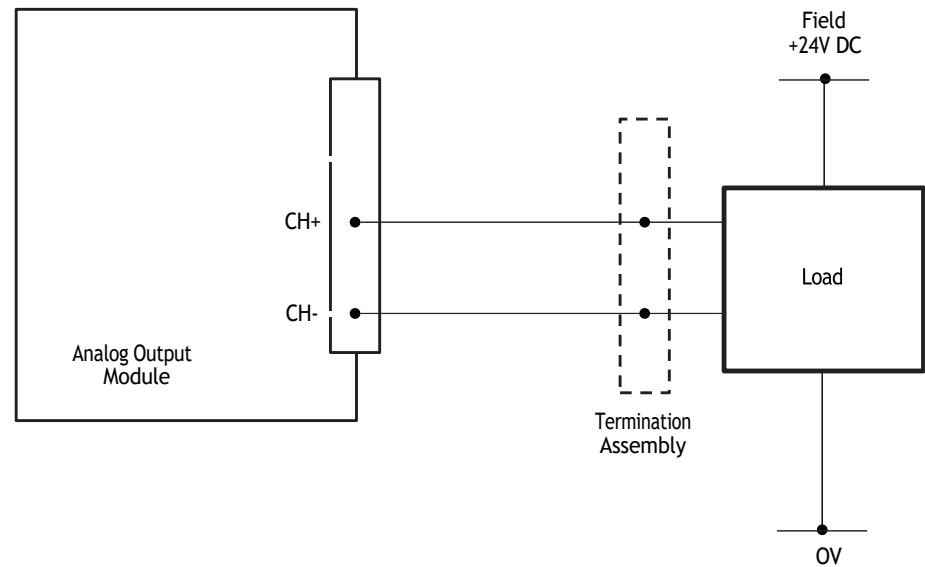
Figure 56 - 1715-OF8I Analog Output Module Recommended Field Loop Circuit



Field Power Circuit for Analog Outputs

An alternative method is shown in [Figure 57](#). The figure shows when the field power is used to supply the load.

Figure 57 - Field Power Circuit for Analog Outputs



Connect the Adapter to the Ethernet Network

The adapter supports Device Level Ring (DLR) and star topologies. For more details on topologies, see [System Architecture on page 13](#).

IMPORTANT For wiring details, see [Table 11](#).

The adapter has four autosensing 10/100BASE-TX Ethernet ports for connecting to a local area network through a minimum Cat5e shielded twisted-pair (STP) Ethernet cable. There are two ports for each adapter.

IMPORTANT The 1715 Redundant I/O system requires the use of a minimum Cat5e shielded twisted-pair (STP) Ethernet cable.

The adapter Ethernet ports are on the 1715-A2A adapter base unit and are identified in this table.

Table 11 - Allocation of 10/100BASE-TX Ports to Adapters

1715-AENTR Adapter	10/100BASE-TX Ports
Adapter A	A1, A2
Adapter B (where present)	B1, B2

IMPORTANT Most network connections use straight-through cables. Crossover cables are not needed due to the intelligence or functionality of the switch. If a direct connection is required from the adapter to the personal computer (for example, during setup), it can be necessary to use a crossover cable. This depends on the characteristics of the interface in the personal computer.

The fixed connectors on the adapter are female RJ45 modular jacks. Use a minimum Cat5e shielded twisted-pair (STP) cable with male RJ45 modular jacks for network cabling.

Connect the network cables to the sockets on the 1715-A2A adapter base unit.

To connect the adapter to the Ethernet network, follow these steps.

1. Insert the RJ45 modular jack on the cable into the appropriate socket for each network connection.
2. Make sure that the length of the cable does not exceed 100 m (328 ft).

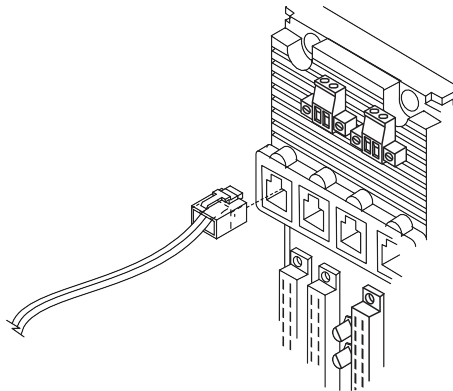
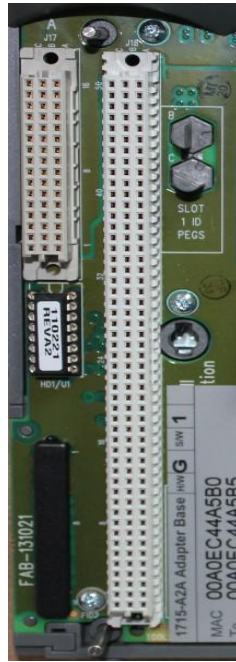
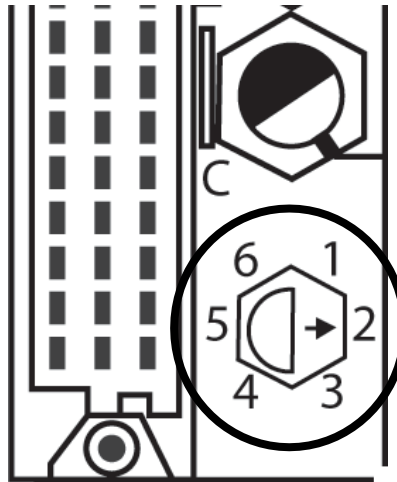


Figure 59 - Inserted Coding Pegs for Adapter Base Unit

Verify Coding Pegs

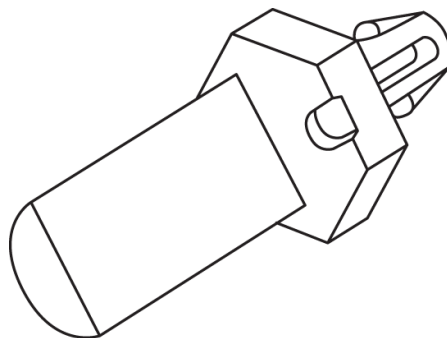
To verify that each coding peg, also known as a polarizing pin, is positioned correctly, follow these steps.

1. Review the diagram on the adapter base unit that shows the six possible positions for a coding peg.

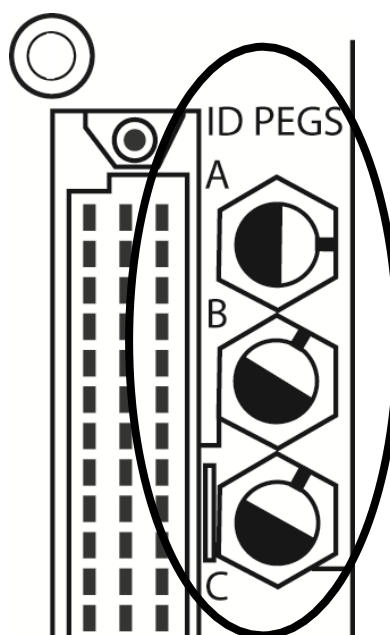


2. Examine a coding peg (fitted) and identify the index recess on the hexagonal flange.

Coding



3. See [Table 12](#) and verify that each coding peg is fitted so its index recess is next to the relevant numbered position.



Electronic Keying

Electronic Keying reduces the possibility that you use the wrong device in a control system. It compares the device that is defined in your project to the installed device. If keying fails, a fault occurs. These attributes are compared.

Attribute	Description
Vendor	The device manufacturer.
Device Type	The general type of the product, for example, digital I/O module.
Product Code	The specific type of the product. The Product Code maps to a catalog number.
Major Revision	A number that represents the functional capabilities of a device.
Minor Revision	A number that represents behavior changes in the device.

The following Electronic Keying options are available.

Keying Option	Description
Compatible Module	Lets the installed device accept the key of the device that is defined in the project when the installed device can emulate the defined device. With Compatible Module, you can typically replace a device with another device that has the following characteristics: • Same catalog number • Same or higher Major Revision • Minor Revision as follows: – If the Major Revision is the same, the Minor Revision must be the same or higher. – If the Major Revision is higher, the Minor Revision can be any number.
Disable Keying	Indicates that the keying attributes are not considered when attempting to communicate with a device. With Disable Keying, communication can occur with a device other than the type specified in the project. ATTENTION: Be cautious when using Disable Keying; if used incorrectly, this option can lead to personal injury or death, property damage, or economic loss. We strongly recommend that you do not use Disable Keying. If you use Disable Keying, you must take full responsibility for understanding whether the device being used can fulfill the functional requirements of the application.
Exact Match	Indicates that all keying attributes must match to establish communication. If any attribute does not match precisely, communication with the device does not occur.

Carefully consider the implications of each keying option when selecting one.

IMPORTANT Changing Electronic Keying parameters online interrupts connections to the device and any devices that are connected through the device. Connections from other controllers can also be broken.

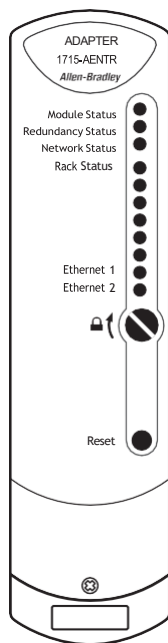
If an I/O connection to a device is interrupted, the result can be a loss of data.

More Information

For more detailed information on Electronic Keying, see Electronic Keying in Logix 5000 Control Systems Application Technique, publication [LOGIX-AT001](#).

Install the Adapters

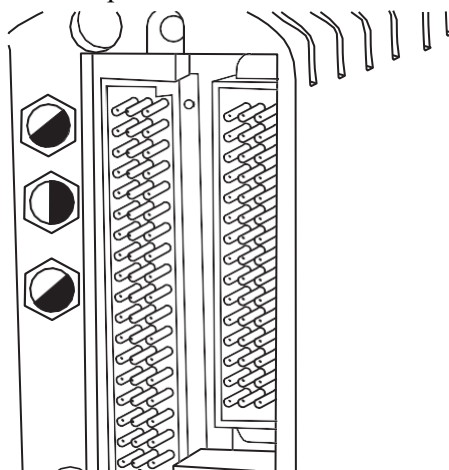
Install two 1715-AENTR adapters.



To install the 1715-AENTR adapters on to the 1715-A2A two-slot base unit, follow these steps.

IMPORTANT You must inspect the connector pins before you install the modules. If you install modules with bent or damaged connector pins, it can damage the backplane connectors. Also, inspect the socket contacts on the backplane, and for an I/O module, on the mating termination assembly. If a contact is damaged, do not attempt to install the module.

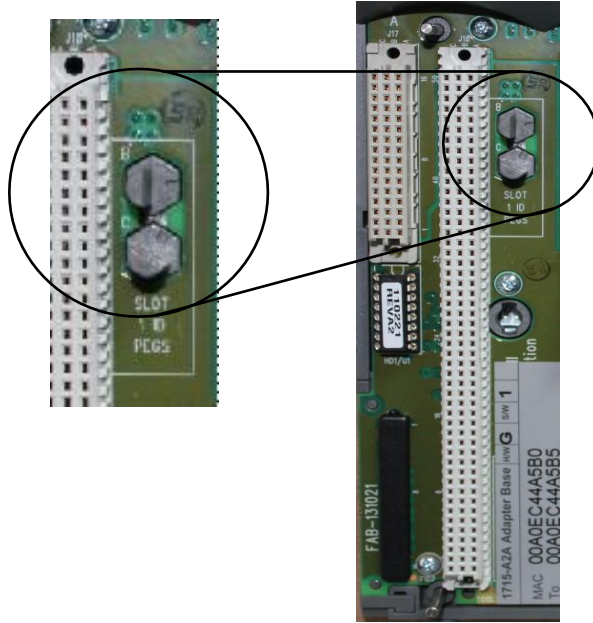
1. Inspect the connector pins.



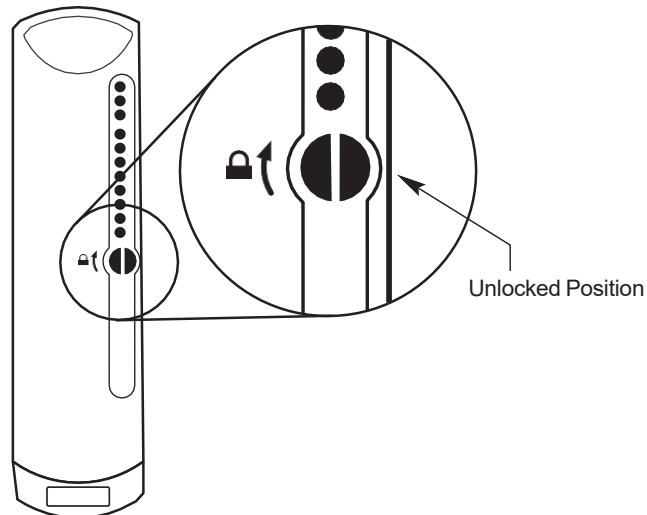
2. Inspect the identification labels on the sides of the adapters and record the location and the module information that is shown on the label.

This helps you when installing a new or replacement module in the future by allowing you to order the replacement parts without disturbing the system.

3. Check the coding pegs on the 1715-A2A adapter backplane and verify that they match the sockets on the back of the adapter.



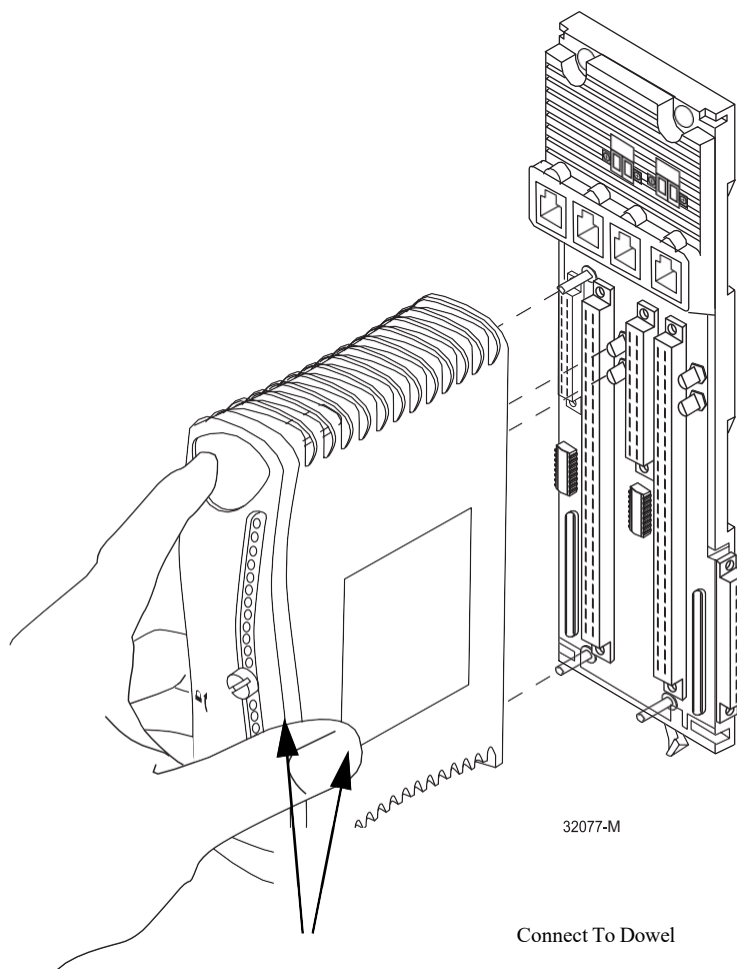
4. Verify that the slot on the head of the adapter clamp screw is vertical.



5. Record the MAC addresses.

The MAC addresses are between slot 0 and 1 of the adapter base. Every hardware component has its own unique MAC address. This hardware address is affixed to the hardware on a label.

6. Place the new module on to the dowel pin on the adapter base unit.



7. Push the adapter in until the dowel pin and connectors are fully mated.

The status indicators in [Table 13](#) illuminate. The table is a quick installation reference. For more detailed status indicator information, see [Appendix A](#).

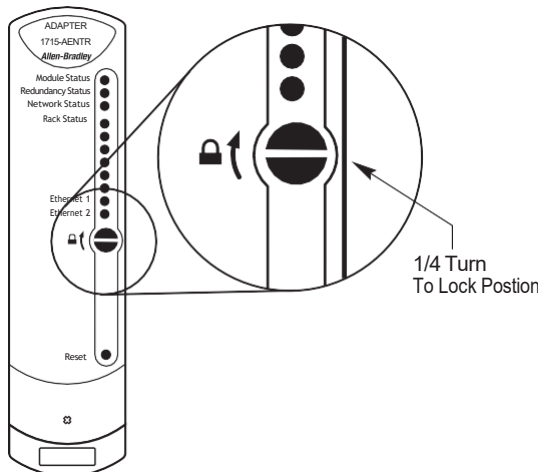
Table 13 - Startup Sequence

1715-AENTR Adapter	
Indicator	Status
Module Status	Steady green
Redundancy Status	Flashes, then steady green
Network Status	Off
Rack Status	Off, then steady green
Ethernet 1	Dependent on Ethernet connection status
Ethernet 2	Dependent on Ethernet connection status

8. Turn the locking screw on the front of the module a 1/4 turn clockwise to lock, by using a 9 mm screwdriver.

Each module has a locking screw that secures it to its base unit. The module has an interlock that detects when a module is locked or unlocked.

IMPORTANT Modules run only in the locked position.



For information about the functionality of the Reset button, see [Reset Button on page 216](#).

Assign an IP Address

Before you can use the hardware, you must assign an IP address to the primary adapter. This is done by associating an IP address to the MAC address of the primary hardware component, in this case, the adapter base unit.

Assign only one primary IP address to the MAC address.

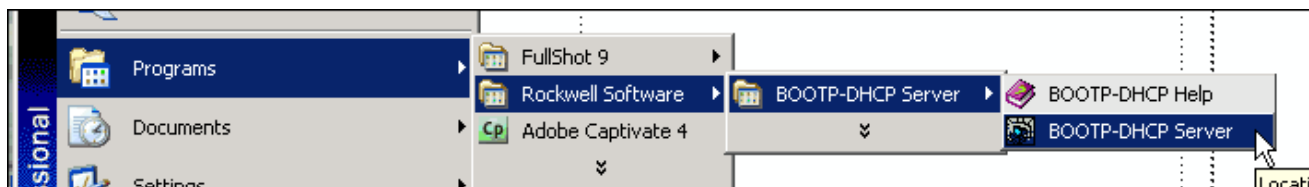
 You only assign one IP address to this hardware. The firmware automatically assigns the secondary IP address, which is the primary IP address + 1. The secondary module is not visible in the RSLinx® Classic RSWho tool. It responds to an Ethernet ping of its IP address.

Any BOOTP/DHCP server can be used to assign IP addresses.

Step 1: Assign an IP Address on the BOOTP/DHCP Server

To assign an address, follow this procedure to launch the BOOTP/DHCP server.

1. From the Start button, choose Programs>Rockwell Software®>BOOTP-DHCP Server>BOOTP-DHCP Server.

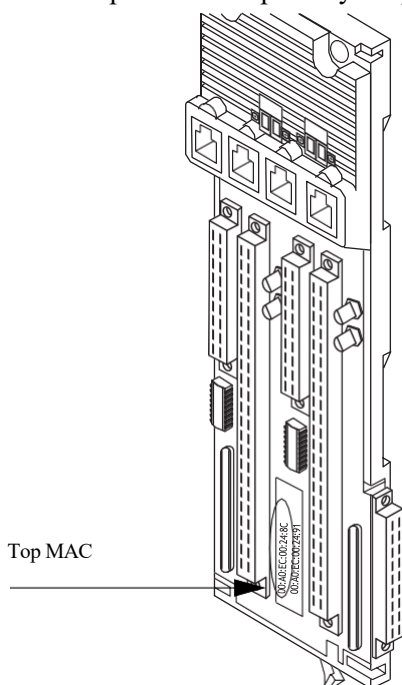


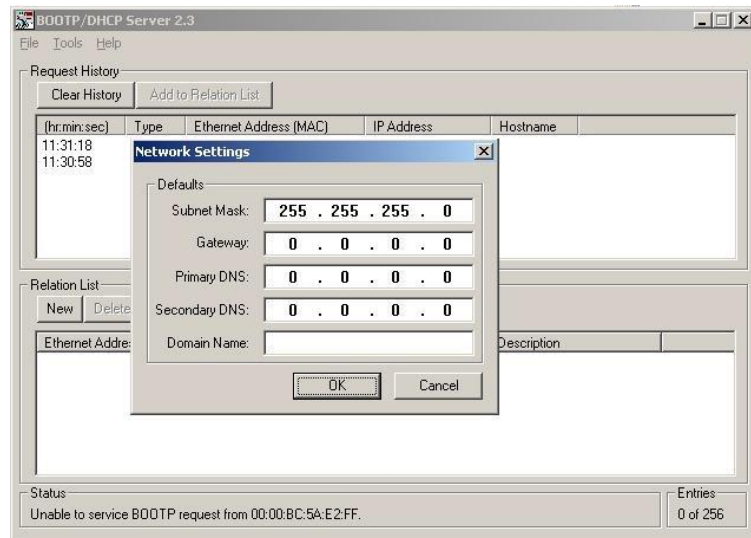
2. Verify BOOTP network settings. Choose Tools>Network Settings.

These settings are transmitted to the module along with your IP address, so verify that they are the correct settings.

IMPORTANT

- The adapter must be physically connected to the network running the BOOTP server.
- Multiple MAC address requests can be received. The lowest MAC addresses correspond to the leftmost adapter slot, or primary adapter. Do not assign an IP address to the higher MAC address requests, as these addresses correspond to the rightmost adapter slot, or secondary module.
- We recommend that you manually enter the MAC address. Sometimes the settings of your personal computer can help prevent you from obtaining MAC address requests from your BOOTP/DHCP server. Check the documentation for your BOOTP/DHCP server for more help. See Knowledgebase article [32648](https://rockwellautomation.custhelp.com/app/answers/detail/a_id/32648) for more details.
- The MAC address is found on the label on the front of the adapter backplane. The top MAC address corresponds to the primary adapter in the leftmost slot.

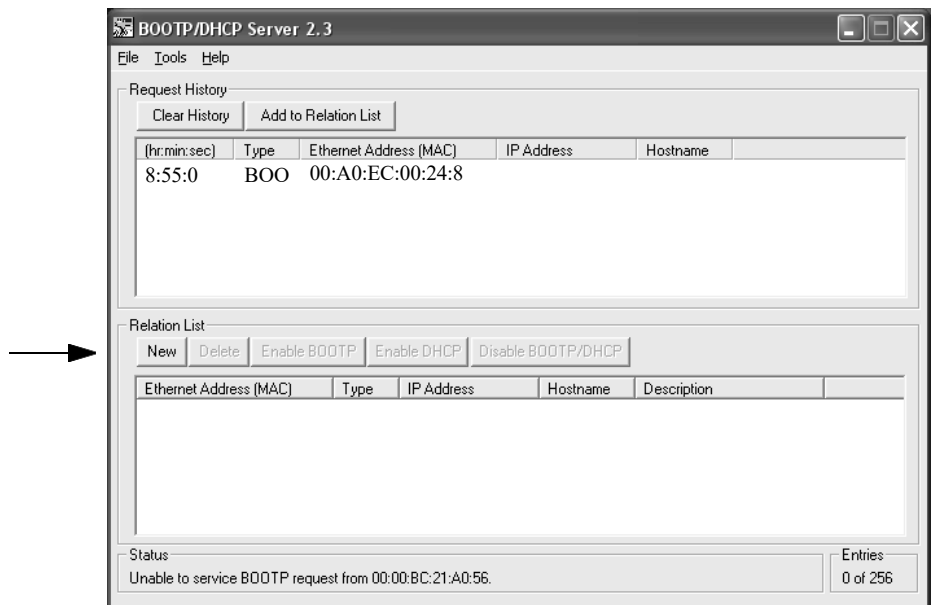




3. Click OK.

The Request History panel displays the hardware addresses of modules issuing BOOTP requests.

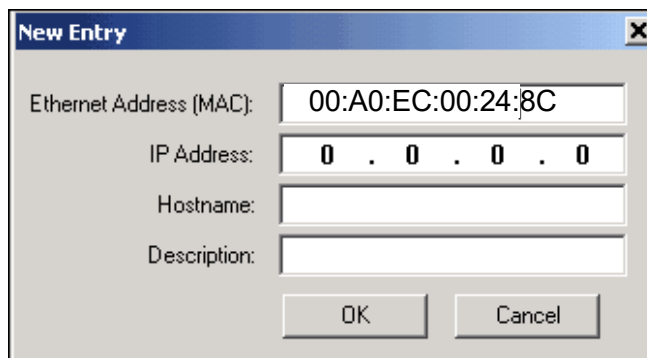
4. Click New to type in the MAC address.



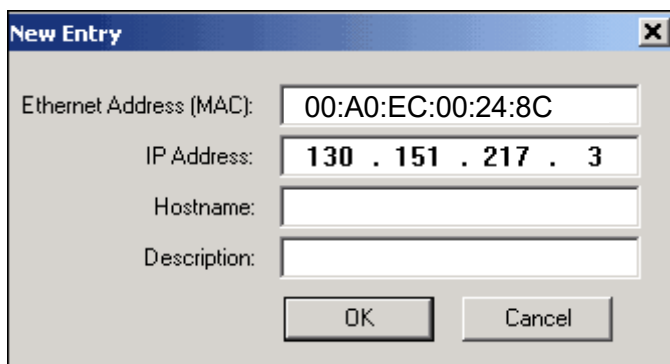
5. Enter the MAC address that you found at the top of the label on the adapter backplane.
6. Double-click the hardware (MAC) address of the module to be configured.

The New Entry window appears.

7. Enter the MAC address in the Ethernet Address (MAC): field.



8. Enter the IP address that you want to use in the IP address field.



9. Click OK.

IMPORTANT

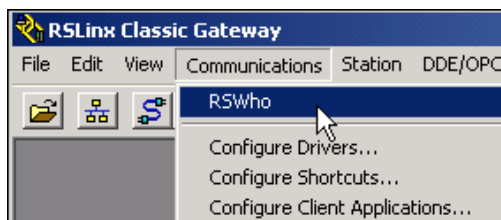
- IP addresses can be recovered, if needed, in the Module Properties tab.
- The second adapter (rightmost) has a MAC address that is the first adapter's (leftmost) MAC address + 2 in HEX.

10. Click Disable BootP/DHCP to set from dynamic to static.

Step 2: Configure the Module with RSLinx Classic Software

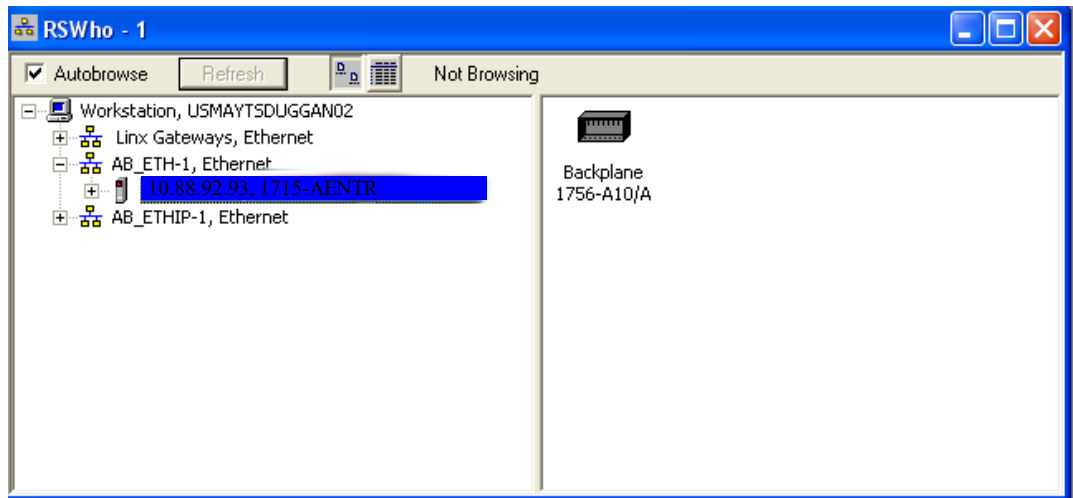
To use RSLinx Classic software to configure the adapter on the Ethernet network, follow these steps.

1. Launch RSLinx Classic software.
2. From the Communications menu, choose RSWho.



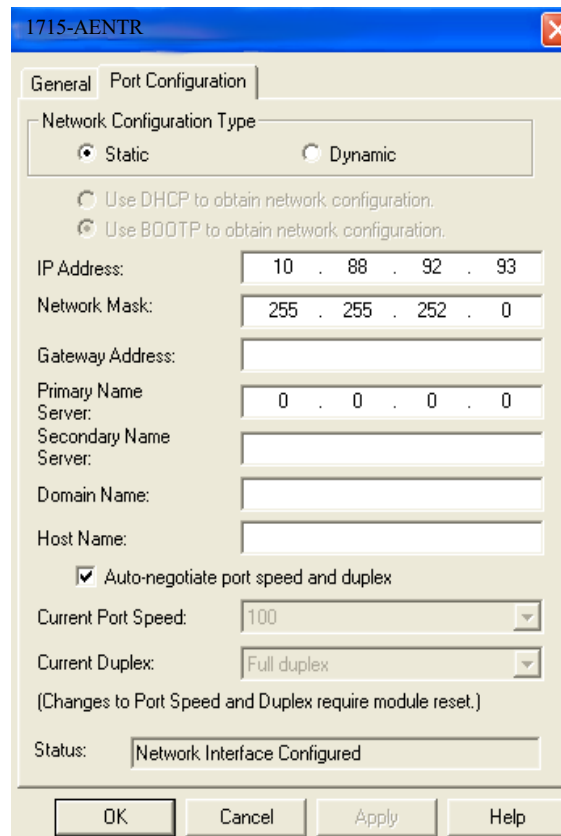
3. Navigate in RSWho to the Ethernet network.

4. If a 1715 device is not recognized, a question mark appears instead of the icon of the module or backplane. Right-click the device and select Upload EDS file from device.



5. Right-click the 1715 EtherNet/IP module and choose Module Configuration.
6. Click the Port Configuration tab.

The Module Configuration dialog box appears.



7. For Network Configuration Type, click **Static** to assign this configuration to the port.
 - a. In the IP Address field, verify the IP address.
 - b. In the Network Mask field, verify the network mask address.

The other fields are optional depending on your network and/or IT requirements. Verify or complete as needed.

8. Click OK.

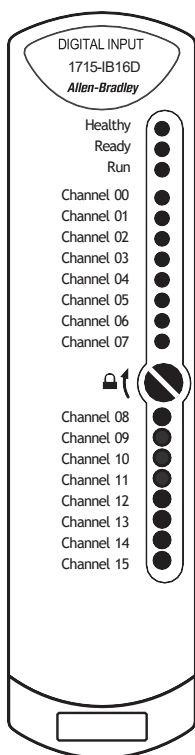
Install the I/O Modules

The I/O modules that are used for the 1715 Redundant I/O system are as follows:

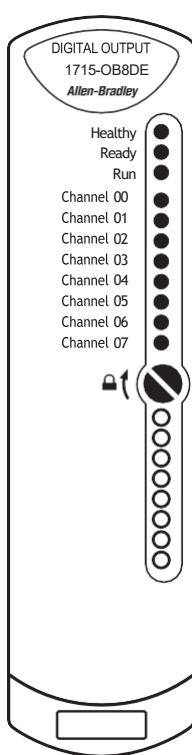
- 1715-IB16D 16-channel digital input module
- 1715-OB8DE 8-channel digital output module
- 1715-IF16 16-channel analog input module
- 1715-OF8I 8-channel analog output module

Figure 60 - I/O Modules

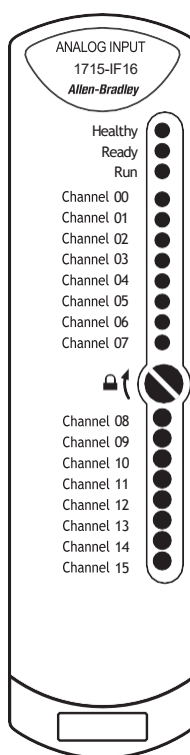
1715-IB16D 16-channel Digital Input Module



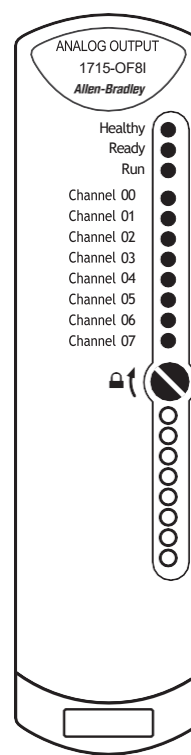
1715-OB8DE 8-channel Digital Output Module



1715-IF16 16-channel Analog Input Module



1715-OF8I 8-channel Analog Output Module

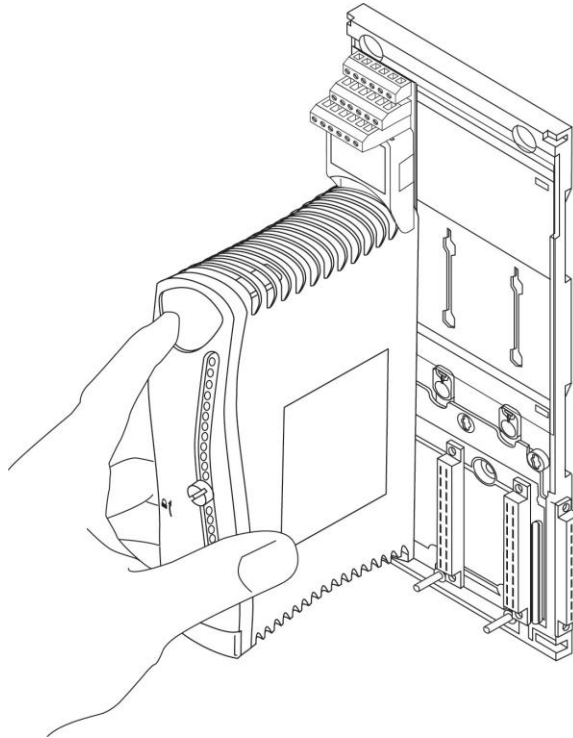


Modules are installed by pressing them onto the 1715-A3IO three-slot base unit. Follow these steps.

1. Inspect the connector pins, see [page 103](#).
2. Inspect the identification labels on the sides of the modules and record the location and the module information that is shown on the label.

This helps you when installing a new or replacement module in the future by allowing you to order the replacement parts without disturbing the system.

3. Check the coding pegs on the termination assembly and verify that they match the sockets on the back of the I/O module, see [page 104](#).
4. Verify that the slot on the head of the module clamp screw is vertical, see [page 104](#).
5. Place the new module on to the dowel pin on the I/O base unit, see [page 105](#).
6. Push the module in until the connectors are fully mated.



The status indicators in [Table 14](#) illuminate depending on which module you are installing. The table is a quick installation reference. For more detailed status indicator information, see [Appendix A](#).

Table 14 - Startup Sequence

1715-IB16D, 1715-OB8DE, 1715-IF16, and 1715-OF8I Modules	
Indicator	Status
Module Status	Green
Redundancy Status	Off
Network Status	Red
Channel 0...7, 8...15	Off

7. Turn the locking screw on the front of the module a 1/4 turn clockwise to lock, see [page 106](#).
 - The Redundancy Status indicator of the 1715-IB16D digital input module shows RED when the screw is locked.
 - The Redundancy Status indicator of the 1715-IF16 analog input module shows RED when the screw is locked.

The module enters its startup sequence. This takes approximately 3 seconds.

If the module is the first module in a TA group with a running adapter, it displays the following status indicators. See [Table 15](#).

Table 15 - First Module in TA Group

1715-IB16D, 1715-OB8DE, and 1715-IF16 Modules		1715-OF8I Module	
Indicator	Status	Indicator	Status
Module Status	Green	Module Status	Green
Redundancy Status	Green	Redundancy Status	Red to steady green
Network Status	Amber	Network Status	Amber
Channel 0...7, 8...15	Off	Channel 0...7	Off

8. If the module is installed next to other modules that are already online, the startup sequence completes.

When startup is complete, the status indicators light as follows.

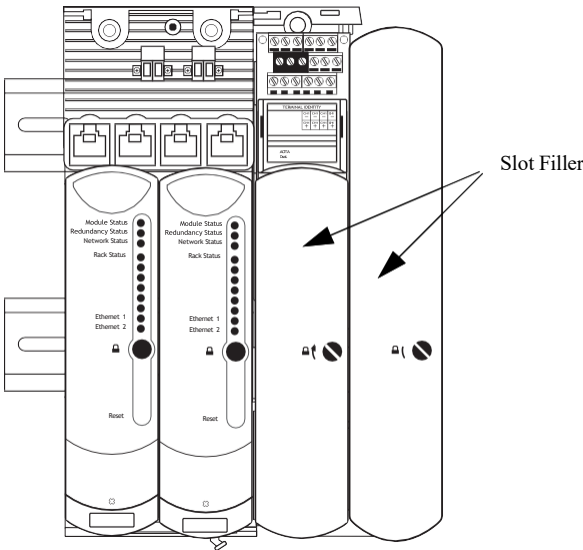
1715-IB16D, 1715-OB8DE, 1715-IF16 Modules		1715-OF8I Module	
Indicator	Status	Indicator	Status
Module Status	Green	Module Status	Green
Redundancy Status	Green	Redundancy Status	Red to steady green
Network Status	Green	Network Status	Amber
Channel 0...7, 8...15	Inputs show Green; Outputs show Amber	Channel 0...7	Inputs show Green; Outputs show Amber

If the module fails to go online, see the troubleshooting guide in [Chapter 7](#).

Install Slot Filler
Covers

To install the slot filler covers, follow these steps.

1. Place a slot filler cover on the empty slot.
2. Screw the clamp screw 90° to the lock position by using a 9 mm screwdriver.



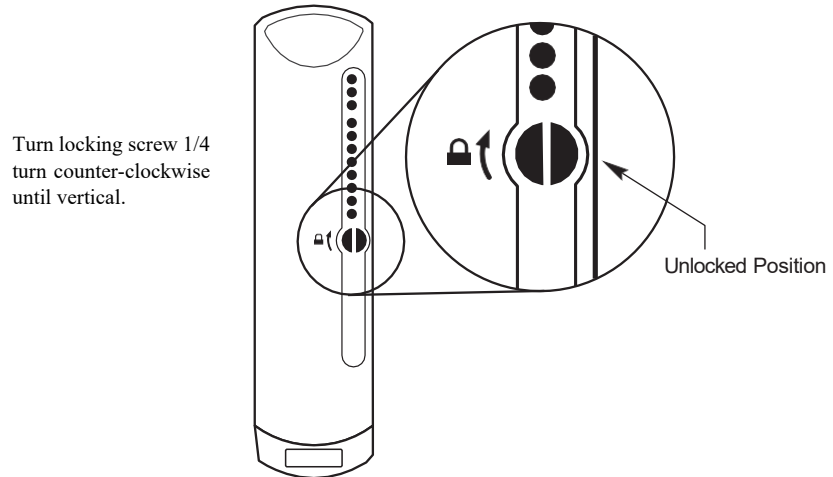
Remove Modules

Modules can be removed online without shutting down the system or upsetting the process in redundant configurations only. However, pulling out simplex module impacts the process.

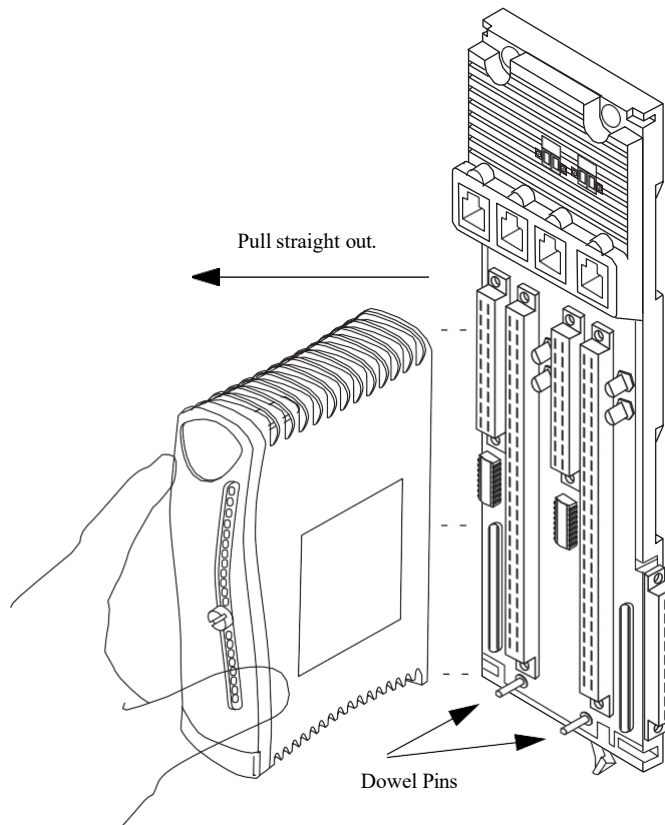
Remove modules by carefully pulling them out of the base unit by using this procedure.

1. Turn the locking screw on the front of the module 1/4 turn counter-clockwise.

The screw slot is vertical when the module is unlocked.



2. Carefully remove the module from the base unit.



IMPORTANT Make sure that you pull the module straight out when removing it from the base unit. Do not rock, or tilt the module while pulling it out, as it could damage the dowel pins.

Notes:

Security

Protected Mode

The adapter uses the implicit I/O strategy to enter and exit Protected mode. The use of an implicit I/O strategy means that no action is required to enter or leave Protected mode. Protected mode helps prevent the following actions:

- The reset of the 1715-AENTR module is prohibited if it is producing or consuming I/O or if it is bridging to an I/O module.
- The reset of an I/O module is prohibited if it is producing or consuming I/O.
- The use of ControlFLASH™ is prohibited for a 1715 AENTR module in Protected mode.

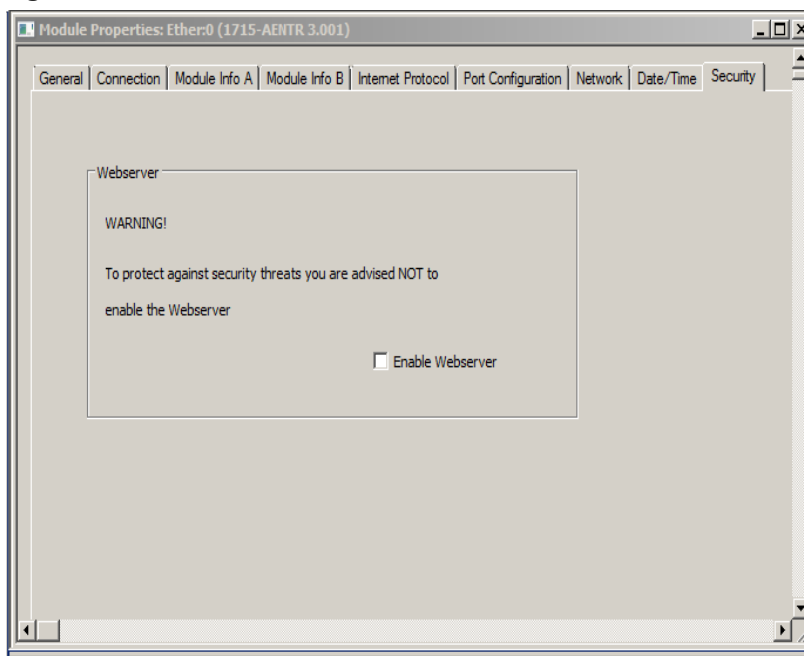
The 1715-AENTR recovery image does not support I/O and does not enter Protected mode, so ControlFLASH is available at any time.

Web Server Control

The 1715-AENTR contains a web server that can provide diagnostic information to a web browser. In revision 3..xxx and later, the web server is disabled by default and can be enabled or disabled via the Security tab of the 1715-AENTR module properties ([Figure 61](#)). In revision 2..xxx and earlier, the web server is always enabled.

To access the diagnostic information, direct your web browser to the IP address assigned to the 1715-AENTR.

Figure 61 - Enable Webserver Checkbox



Notes:

Digital I/O Operation

1715 Digital Module Overview

The 1715 digital I/O modules are I/O modules that provide On/Off detection and actuation. By using the producer/consumer network model, digital I/O modules can produce information when needed while providing more system functions.

The 1715 digital I/O modules mount in a 1715 Redundant I/O System and use an I/O termination assembly that is mounted in an I/O base unit to communicate via redundant 1715 adapters.

Before you install and use your module, you must do the following:

- Install and ground a user-supplied, 24V DC power supply.
- Determine if you are using your digital I/O module in Simplex or Duplex mode.
- Install the correct termination assembly that is based on your determination for either simplex or duplex operation.
- Configure the project in RSLogix 5000® software or the Logix Designer application to accept the number and type of modules for the project.

Each digital I/O module is an isolated module that plugs into one position of the I/O base unit and a termination assembly that is mounted to the base unit. Digital I/O modules can be configured in RSLogix™ programming software as simplex or duplex and then by selecting one of the two available termination assemblies and the required number of modules.

Termination assemblies provide termination for the field I/O channels and, by the use of coding pegs and sockets, are matched to a specific digital I/O module. Module keying can also be set in the project. Field connections are made at the terminal block connectors on the termination assembly.

The digital I/O modules and termination assemblies for the 1715 Redundant I/O system are as follows.

Table 16 - Types of ControlLogix Digital I/O Modules and Components

Cat. No.	Description
1715-IB16D	16-channel digital input module
1715-OB8DE	8-channel digital output module
1715-TASIB16D	16-channel digital input simplex termination assembly
1715-TADIB16D	16-channel digital input duplex termination assembly
1715-TASOB8DE	8-channel digital output simplex termination assembly
1715-TADOB8DE	8-channel digital output duplex termination assembly

1715-IB16D Digital Input Module

The digital input interface is a combination of digital input modules and termination assemblies. The 24V DC isolated digital input modules have a flexible and fail-safe design. The 1715-IB16D interfaces 16 digital input channels and can be configured in RSLogix programming software as simplex or duplex by selecting one of the two available termination assemblies and the required number of modules.

IMPORTANT When the 1715-IB16D digital input module is used with the 1715-TASIB16D simplex termination assembly, it is nonisolated.

The 1715-IB16D digital input module has the following features:

- Flexible, modular construction for user-configured I/O applications
- 16-channel connection capability
- Suitable for simplex, duplex connections, and fault tolerant applications
- Independent, galvanically isolated input channels
- Built-in diagnostic testing and independent watchdog facility
- Module removal and replacement online and, when in Duplex mode, no interruption of the signal inputs
- Input voltage data is provided for line monitoring and field fault detection
- Time stamp value per channel, which records the time of any transition of state from ON->OFF or OFF->ON. Note that this value is overwritten with each change of state of the input.

1715-OB8DE Digital Output Module

The digital output module interface consists of a combination of digital output modules and digital output termination assemblies. Each module provides eight isolated output channels and plugs into one position of the I/O base unit and a corresponding termination assembly. Digital outputs can be configured as simplex or duplex.

The 1715-OB8DE digital output module has a flexible, fail-safe design, with eight field output channels. The module output can be up to 1 A continuous for each channel.

The 1715-OB8DE digital output module features are as follows:

- Eight isolated output channels per module
- Fail-safe design and operation
- Suitable for simplex and duplex connections for fault tolerant applications
- Duplex series output switches with overload protection for each channel
- Voltage and current monitoring on each channel with reverse current protection
- Short circuit and open circuit line fault detection
- Dual redundant field power feed capabilities without the need for external diodes
- When fitted in duplex configuration, modules can be replaced online without system interruption



ATTENTION: Maintenance must be performed only by qualified personnel, otherwise, personal injury or death, or damage to the system can result.

Common Features

The table lists several features available on 1715 digital I/O modules.

Feature	Description
Removal and Insertion Under Power (RIUP)	You can remove and insert modules while power is applied.
Module level fault reporting and field-side diagnostic detection	Fault and diagnostic detection capabilities that provide you the information necessary to use your module and troubleshoot your application most effectively and efficiently.

Input Module Compatibility

The 1715 digital input modules interface to sensing devices and detect whether they are ON or OFF. The 1715 digital input modules convert DC ON/OFF signals from user devices to appropriate logic level for use within the 1715 Redundant I/O System. Typical input devices include the following:

- Proximity switches
- Limit switches
- Selector switches
- Float switches
- Push button switches

When designing a system by using 1715 digital input modules, you must consider these items:

- The voltage necessary for your application
- Whether you need a solid-state device
- Current leakage
- If your application uses sinking or sourcing wiring

For more information on digital input modules, see the 1715 Technical Specifications, publication [1715-TD001](#).

Termination Assemblies

There are two types of termination assemblies for the digital input modules. The application of your system determines which termination assembly that you need:

- 1715-TASIB16D 16-channel, digital input simplex termination assembly
- 1715-TADIB16D 16-channel, digital input duplex termination assembly

Output Module Compatibility

1715 digital output modules can be used to drive various output devices. Typical output devices compatible with the 1715 digital outputs include the following:

- Motor starters
- Solenoids
- Indicators

When designing a system, do the following:

- Make sure that the 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 that is supplied with the output device for the surge and continuous current necessary to operate the device.

The 1715 digital outputs can directly drive the 1715 digital inputs. The exceptions are 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 output modules, see ControlLogix Digital I/O Modules, publication [1756-UM058](#).

Termination Assemblies

There are two types of termination assemblies for the digital output modules. The application of your system determines which termination assembly that you need:

- 1715-TASOB8DE 8-channel, digital output, simplex termination assembly
- 1715-TADOB8DE 8-channel, digital output duplex termination assembly

Features Common to 1715 Standard Digital I/O Modules

The following features are common to all 1715 digital I/O modules.

Removal and Insertion Under Power (RIUP)

All 1715 digital I/O modules can be inserted and removed from the I/O base unit while power is applied. This feature lets you have 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

1715 digital I/O modules provide hardware and software indication when a module fault has occurred. The status indicator of each module and the Logix Designer application graphically displays this fault and includes a fault message about the nature of the fault. This feature lets you determine how your module has been affected and what action must be taken to resume normal operation.

Fully Software Configurable

The Studio 5000 Logix Designer® application 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 the following:

- Vendor
- Product Type
- Product Code
- Revision
- Serial Number
- Product Name

The elimination of tasks, such as setting hardware switches and jumpers, improves the ease of module configuration.

Module Inhibiting

Module inhibiting lets you indefinitely suspend a connection between an owner-controller and a digital I/O module without having to remove the module from the configuration. This process lets you temporarily disable communication to a module to perform maintenance. You can inhibit a module in the following ways:

- You write the configuration for an I/O module but inhibit the module to help 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 the configuration to the module, and is 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 goes to zero during Program mode, whenever that module is inhibited, the outputs go to zero.
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These examples are instances where you can use module inhibiting:

- You want to upgrade / replace digital I/O modules. This procedure is only required when either changing / replacing a simplex module or when both duplex modules are removed before one is replaced. We recommend that you do the following.
 - a. Inhibit the module.
 - b. Perform the upgrade (module change).
 - c. Uninhibit the module.
- You are using a program that includes a module that is not physically installed, but you do not want the controller to 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.

Status Indicator Information

Each 1715 digital I/O module has a status indicator on the front of the module that lets you check the module health and operational status of a module. The status indicator displays vary for each module.

See Appendix A, [1715 Digital Input Module on page 286](#), for detailed status indicator information.

Features Specific to 1715-IB16D Digital Input Modules

The features that are described in this section are available on 1715 digital input modules.

Data Transfer on Either Cyclic Time or Change of State

Digital input modules always send data at the RPI, but they send data only at a change of state if the COS feature is enabled. COS is more efficient than RPI because it multicasts data only when a change occurs.

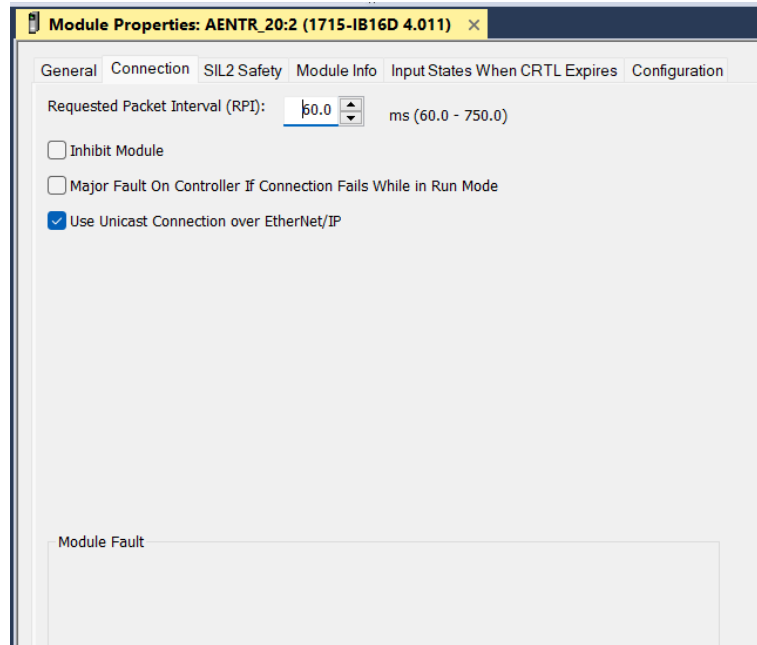
The table describes the two ways that a module sends data to the owner-controller.

Topic	Description
Requested packet interval	A user-defined rate at which the module updates the information that is sent to its owner-controller. 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 and Off to On. The data is sent at the RPI rate when there is no change of state. By default, this setting is always enabled for input modules.

Set RPI

The Connection tab on the Module Properties dialog box lets you enter a requested packet interval (RPI). The RPI sets the slowest rate at which data is multicast to the owner-controller.

The actual data transfer rate of the module can be faster than the RPI setting. But, the RPI provides a defined, maximum period when data is transferred to the owner-controller.



1. Choose from the options in the Connection tab.

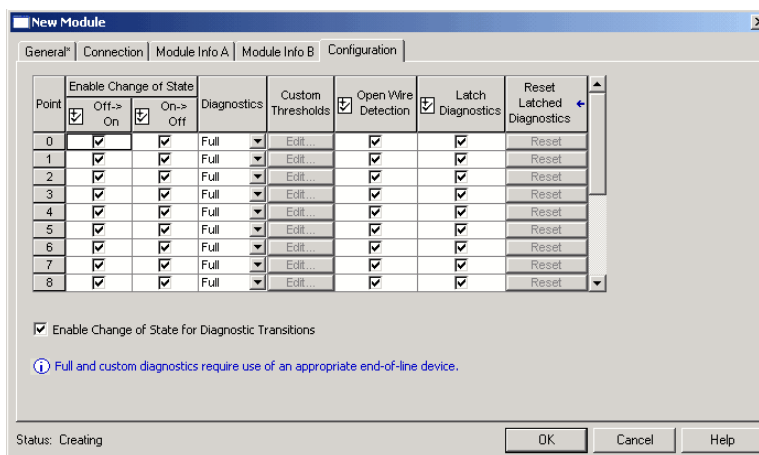
Parameter	Description
Requested Packet Interval (RPI)	Enter an RPI value or use the default.
Inhibit Module	Check the checkbox to help prevent communication between the owner-controller and the module. This option enables the module to be maintained without faults being reported to the controller.
Major Fault On Controller If Connection Fails While in Run Mode	Check the box to create a major fault if there is a connection failure with the module while in Run mode. For important information on this checkbox, see 'Configure a Major Fault to Occur' in the Logix 5000 Controllers Information and Status Programming Manual, publication 1756-PM015 .
Use Unicast Connection over EtherNet/IP	Choose between unicast and multicast for EtherNet/IP™ connections. This checkbox is enabled when the module supports unicast at the current revision and any part of the module path crosses EtherNet/IP. The checkbox is checked and dimmed when the module supports only unicast and any part of the module path crosses the EtherNet/IP network. The checkbox is not checked and dimmed if these conditions are true: • The current revision of the module does not support unicast. If a module is multicast only, no revision supports unicast. • The module is proxied (for example, 1734, 1738 and 1794 modules) and the current revision of the parent does not support Unicast. Unicast is not supported with ControlLogix® Redundancy, version 19.52. For more details, see Knowledgebase article Enhanced Redundancy will not Synchronize with Error Message: Unicast Connection Not Supported .

2. Click OK.

Enable Change of State

The Point column (on the left side of the Configuration tab) lets you determine whether a change of state occurs when a field device becomes Off to On or On to Off.

1. On the Module Properties dialog box, click the Configuration tab.



2. Do one of the following:
 - Check a checkbox to enable COS for a specific point for either Off to On or On to Off.
 - Clear the checkbox to disable the COS for a specific point.
3. Click OK.

See [Threshold Values for Digital Inputs on page 261](#) for setting custom threshold configurations.

Field-side Diagnostics

For 1715-IB16D thresholds, you are responsible for designing a circuit that provides unique voltage levels for Wire OFF, OFF, ON, and shorted to 24V DC. This design typically involves an inline and shunt resistor:

- A typical value for the inline resistor is 3.9 k Ω .
- A typical value for the shunt resistor is 15 k Ω . This generates an OFF voltage of 5V DC and an ON voltage of 14V DC if the supply voltage is 24V DC.

The digital input module can detect the voltage level, much like an analog input module. There are no circuit tests on field wiring. You define your diagnostic granularity by using custom thresholds that are built in to the channel configuration. For full diagnostics, you design a circuit for which the OFF state is, for example, 5V DC, and the ON state, which is, for example, 15V DC. Wire OFF creates 0V DC, which falls below the OFF threshold, and OpenWire fault status is set HI. A short to 24V DC is above the ON threshold, and Short Circuit fault status is sent HI.

Features Specific to 1715-OB8DE Digital Output Modules

The features that are described in this section are available on all 1715 digital output modules.

Field Power Status Integers

The field power status integers (all DINT) supply data to the application, about the field power supplies to a group of digital output modules.

Group Field Power Current

Values: 0 to 8,000 mA or greater (limited by capacity of DINT variable)

Description: Reports the total current that all the active digital output modules in a group draw from the field power supply. Accuracy is $\pm 10\%$.

Field Power Voltage 1

Values: 0 to 48,000 mV or larger (limited by capacity of DINT variable)

Description: Reports the voltage from the field power supply for the specified module and field power input. Accuracy is ± 500 mV.

Field Power Voltage 2

Values: 0 to 48,000 mV or larger (limited by capacity of DINT variable)

Description: Reports the voltage from the field power supply for the specified module and field power input. Accuracy is ± 500 mV.

Field Fault Detection

Detection criteria differs depending on whether the output is energized or de-energized.

Energized Open Circuit

Current per channel is < 10 mA regardless of whether the digital output module is on its own or in dual pair.

Energizing Short Circuit

When energizing, the output switch is set to flow a constant current of 2.5 A for up to 50 ms (5 A if dual module). If the voltage across the output switch fails to fall below 3V within this time, then the output load is deemed to be short circuited and the output is switched off

Energized Short Circuit

After the output is energized, another calculation is used. Any current in excess of 2.5 A (5 A if a dual module) is integrated and the duration time is multiplied by the current. The product is energy. The current and corresponding durations are measured and compared with the output switch ratings.

The following list shows the nominal times for which particular bands of current are tolerated before the switch declares short circuit and de-energizes:

- <5 A: 25.7 ms
- ≥ 5 A, <10 A: 3.2 ms
- ≥ 10 A, <15 A: 1.7 ms
- ≥ 15 A, <20 A: 1.0 ms
- ≥ 20 A: 0.9 ms

These times also account for delays that are associated with current filtering that is implemented to reduce the impact of electromagnetic interference (EMI).

Energized Field Fault

A field fault is declared when the channel voltage is ≥ 1 V above the field supply voltage (VF).

De-energized open circuit

The channel voltage is pulled up to $(VF/2)-0.75$ V, through an impedance of 26 k Ω in each module (so 13 k Ω for a dual pair) when open circuit and de-energized. In this state, it is declared as open circuit if the channel voltage is within the band of voltage around this point.

The load must draw the channel voltage down below $(VF/3)$ for it to be seen as present, so it must still flow a small current when de-energized. The current can be calculated as:

$$((VF/6)-0.75 \text{ V})/\text{impedance}$$

Where the impedance is 26 k Ω or 13 k Ω as above

De-energized short circuit

A short circuit cannot be detected when de-energized without a partial supply of current.

The output current increases until one of these conditions occurs:

- The current reaches 50 mA
- The output electro motive force (EMF) increases by 2 volts
- The calculated energy of the pulse reaches 5 mJ. A timeout condition also exists to catch module faults, but this does not impact short circuit detection.

Upon reaching a threshold, the actual change in voltage is divided by the actual change in current to yield a value representing the field load resistance. If this is

less than 10 Ω , then a short circuit is declared. The test currently occurs once per minute sequenced across all output modules.

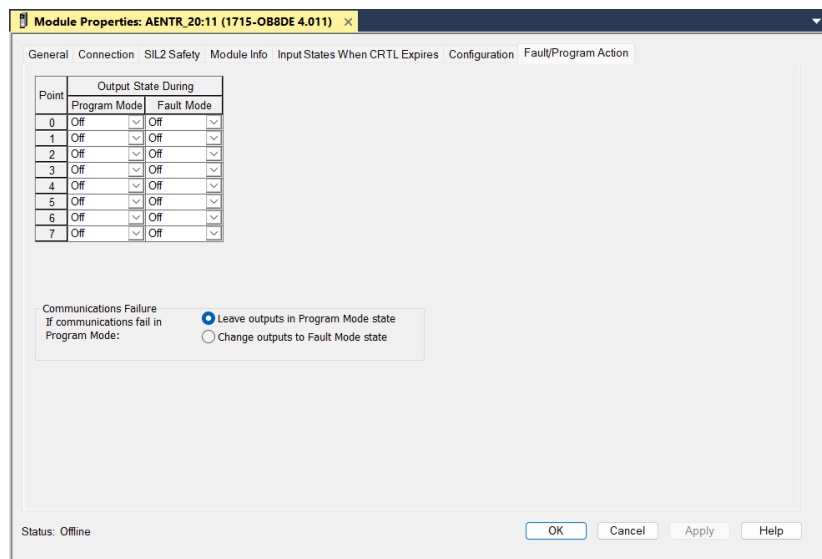
Configurable Point-level Output Fault States

Individual outputs can be independently configured to unique fault states, either On, Off, or Hold if there is a communication 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 turns off during Program mode, whenever that module is inhibited, the outputs turn off.

Follow these steps to enable a fault state.

1. On the Module Properties dialog box, click the Configuration tab.



2. Choose the Fault mode.
3. Click OK.

Output Data Echo

IMPORTANT

- Inhibiting a module is handled the same way as a communication failure.
- Setting the radio button to "Leave outputs in Program Mode state" causes the outputs to go to the Program Mode state when inhibited.
- Setting the radio button to "Change outputs to Fault Mode state" causes the outputs to go to the Fault Mode state when inhibited.

During normal operation, when a processor sends out an output command to the 1715 system, the output module that is targeted for that command returns the

commanded state of the output to the system. This process verifies that the module has received the command and tries to execute it.

Monitor Fault Bits

The Output Data Echo matches only the commanded state of the outputs if the module is operating under normal conditions. If there is an anomaly with the module, the commanded state and the Output Data Echo cannot 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 cannot 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 these conditions:

- Communication fault
- Connection is inhibited
- Blown fuse - Module does not turn on output if overload/short circuit is detected

Fusing

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

The 1715-OB8DE module uses electronic fusing.

You can reset an electronic fuse through the Logix Designer application or through ladder logic. This feature has a corresponding tag that can be examined in the user program if there is a fault.

See [Table 18](#) to determine what fuse to use in your application.

Table 17 - Recommended Fuses

Circuit Type	Cat. No.	Fusing on the module	Recommended Fuse
DC	1715-OB8DE ⁽¹⁾ (2) (3)	Yes - Fused on a per point basis	Electronically fused

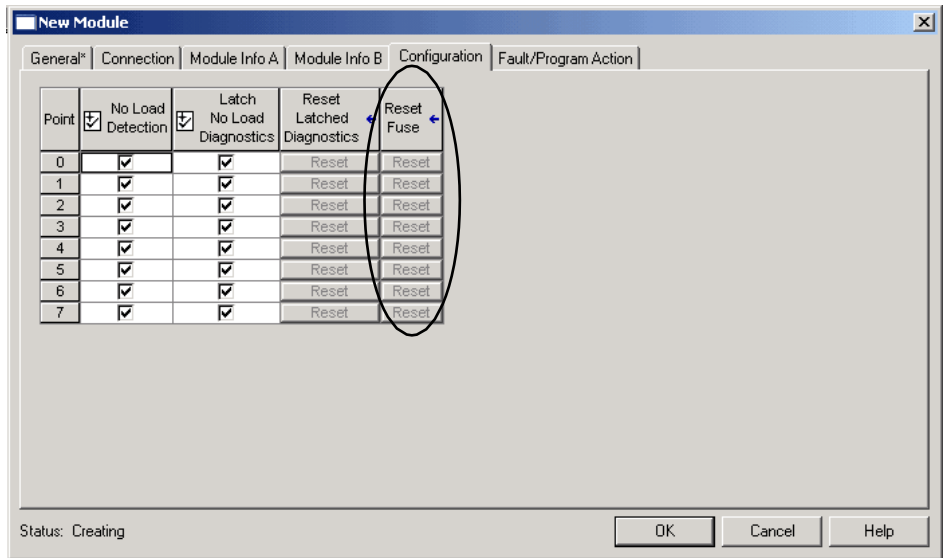
(1) Electronic protection is not intended to replace fuses, circuit breakers, or other code required wiring protection devices.

(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. If there is a short-circuit condition on an output channel, that channel limits the current within milliseconds after its thermal cut-out temperature has been reached.

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

Follow these steps to reset a fuse.

- 1. On the Module Properties dialog box, click the Configuration tab.



- 2. Click Reset for a particular point on the module to reset a fuse.
- 3. Click OK.

Diagnostic Latch Information

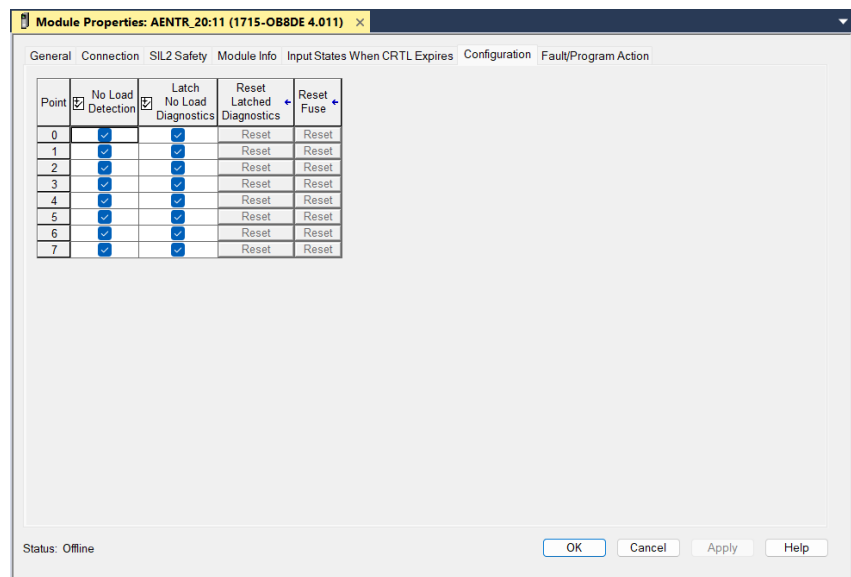
Diagnostic latching lets this module latch a fault in the set position once it has been triggered, even if the error condition causing the fault to occur disappears.

The Reset Diagnostic Latch service can clear latched diagnostic features.

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

Follow these steps to enable diagnostic latch of information.

1. On the Module Properties dialog box, click the Configuration tab.



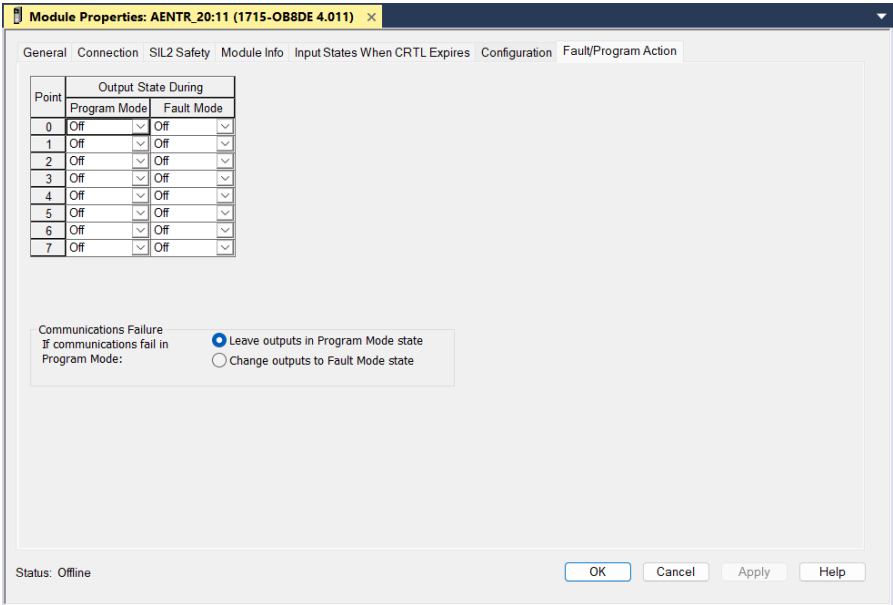
2. Do one of the following:
 - Check a checkbox to enable diagnostic latching for a specific point.
 - Clear the checkbox to disable diagnostic latching for a specific point.
3. Click OK.

Shutdown State

The output module shutdown state defines the behavior of the output module if communications to the module fail within the timeout period or if the processor is put into Program mode. This occurs on a channel-by-channel basis. These principles apply for the 1715 analog and digital output modules.

The shutdown state can be configured to these values:

- On-energize
- Off-de-energize
- Hold last state



During normal operation with an adapter present, the state of the outputs can be configured when no connections from a Logix controller are active.

Analog output modules can be configured to OFF, HOLD LAST VALUE, or GOTO SPECIFIED VALUE.

IMPORTANT In Shutdown mode, the analog output module will TURN OFF all channel status indicators irrespective of the value being output.

Energize-on-communication-failure

The 1715 Redundant I/O System can be a part of an energize-on communication failure system. This means that during a system fault, the output module can be set so that the output is energized. This is on a point-by-point basis. The following are examples of energize-to-trip uses:

- A fan that runs a ventilation system
- Emergency lights

De-energize-to-trip

During output, when a system fault occurs, the output module can be set so that the output is de-energized. This is on a point-by-point basis. The following are examples of de-energize-to-trip uses:

- Motor starters
- Safety contactors

Disable Line Test

The digital output module incorporates line test functionality that can report and indicate ‘no load’ field faults. This functionality can be enabled or disabled by checking or unchecking the box. This is on a point-by-point basis.

Fault and Status Reporting between Input Modules and Controllers

The 1715 digital input modules unicast fault and status data to any owner-controllers. All input modules maintain a module-fault word, the highest level of fault reporting. Additional fault information is provided in separate tags.

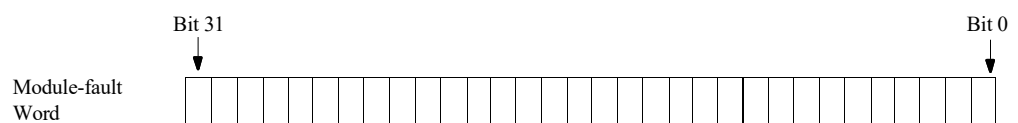
The table lists the tag that can be examined in ladder logic to indicate when a fault has occurred for a standard input module.

Tag	Description
Module-fault word	This word provides fault summary reporting. its tag name is Fault. This word is available on all digital input modules.
Fault	DINT Fault (Radix = Binary) - 0 at least one module present
	- FFFFFFFF No Logix connection, all additional tags are not valid
Simplex Digital Input Module Additional Tags Include	
GroupFault	BIT - 1 if any point on the module is faulted/failed
PtFault	INT (Radix = Binary) - 1 bit per point 0...15; 1 if point is faulted/failed
OpenWire	INT (Radix = Binary) - 1 bit per point 0...15; 1 indicates open wire
ShortCircuit	INT (Radix = Binary) - 1 bit per point 0...15; 1 indicates short circuit
Indeterminate	INT (Radix = Binary) - 1 bit per point 0...15; 1 indicates indeterminate
Duplex Digital Input Module Additional Tags Include	
ModAFault	BOOL - 0 Good, 1 fault or module not present
ModBFault	BOOL - 0 Good, 1 fault or module not present
GroupFault	BOOL - 1 if any point on either module is faulted/failed
ModAGroupFault	BOOL - 1 if any point on Module A is faulted/failed
ModBGroupFault	BOOL - 1 if any point on Module B is faulted/failed
PtFault	INT (Radix = Binary) - 1 bit per point 0...15; 1 if point is faulted/failed on both modules
ModAPtFault	INT (Radix = Binary) - 1 bit per Channel 0...15; 1 if channel has failed on module A
ModBPtFault	INT (Radix = Binary) - 1 bit per Channel 0...15; 1 if channel has failed on module B
OpenWire	INT (Radix = Binary) - 1 bit per point 0...15; 1 indicates open wire
ShortCircuit	INT (Radix = Binary) - 1 bit per point 0...15; 1 indicates short circuit
Indeterminate	INT (Radix = Binary) - 1 bit per point 0...15; 1 indicates indeterminate

All words are 32 bit, although only the number of bits appropriate for the density of each module are used.

Condition	Set Bits
Communication fault	All 32 bits are set to 1, regardless of the module's density.

This illustration offers an overview of the fault reporting process on 1715 standard digital input modules.



A communication fault sets all bits in the module-fault word.

Fault and Status Reporting between Output Modules and Controllers

The 1715 digital output modules unicast fault and status data to any owner-controllers. All output modules maintain a module-fault word, the highest level of fault reporting. Additional fault information is provided in separate tags.

The table lists the tags that can be examined in ladder logic to indicate when a fault has occurred for a standard output module.

Tag	Description
Simplex Digital Output Module Tags Include	
Fault	DINT Fault (Radix = Binary) - 0 at least one module present, data good
	- FFFFFFFF No Logix connection, data bad, all additional tags are not valid
ReadBack	SINT (Radix = Binary) - 1-bit readback per point 0...7
GroupFault	BOOL - 1 if any point on the module is faulted/failed
PtFault	SINT (Radix = Binary) - 1 bit per point 0...7; 1 if point is faulted/failed
NoLoad	SINT (Radix = Binary) - 1 bit per point 0...7; 1 indicates no load
ShortCircuit	SINT (Radix = Binary) - 1 bit per point 0...7; 1 indicates short circuit
Duplex Digital Output Module Tags Include	
Fault	DINT Fault (Radix = Binary) - 0 at least one module present
	- FFFFFFFF No Logix connection, all additional tags are not valid
ReadBack	SINT (Radix = Binary) - 1-bit readback per point 0...7
ModAFault	BOOL - 0 Good, 1 fault or module not present
ModBFault	BOOL - 0 Good, 1 fault or module not present
GroupFault	BOOL - 1 if any point on either module is faulted/failed
ModAGroupFault	BOOL - 1 if any point on Module A is faulted/failed
ModBGroupFault	BOOL - 1 if any point on Module B is faulted/failed
PtFault	INT (Radix = Binary) - 1 bit per point 0...15; 1 if point is faulted/failed on both modules
ModAPtFault	INT (Radix = Binary) - 1 bit per Channel 0...15; 1 if channel has failed on module A
ModBPtFault	INT (Radix = Binary) - 1 bit per Channel 0...15; 1 if channel has failed on module B
NoLoad	SINT (Radix = Binary) - 1 bit per point 0...7; 1 indicates no load
ShortCircuit	SINT (Radix = Binary) - 1 bit per point 0...7; 1 indicates short circuit

Notes:

Analog I/O Operation

1715 Analog Module Overview

The 1715 analog I/O modules mount in a 1715 Redundant I/O System and use an I/O termination assembly that is mounted in an I/O base unit to communicate via redundant 1715 adapters.

Before you install and use your module, you must do the following:

- Install and ground a user-supplied, 24V DC power supply.
- Determine whether you are using your analog I/O module in Simplex or Duplex mode.
- Install the correct termination assembly that is based on your determination for either simplex or duplex operation.

Each analog I/O module is an isolated module that plugs into one position of the I/O base unit and a termination assembly that is mounted to the base unit. Analog I/O modules can be configured in the Logix Designer application as simplex (not redundant) or duplex (redundant).

Termination assemblies provide termination for the field I/O channels and, by the use of coding pegs and sockets, are matched to a specific analog I/O module. Module keying can also be set in the RSLogix 5000® or Logix Designer application. Field connections are made at the terminal block connectors on the termination assembly.

The analog I/O modules and termination assemblies for the 1715 Redundant I/O system are as follows.

Table 18 - Types of ControlLogix® Analog I/O Modules and Components

Cat. No.	Description
1715-IF16	16-channel analog input module
1715-OF8I	8-channel analog output module
1715-TASIF16	16-channel analog input simplex termination assembly
1715-TADIF16	16-channel analog input duplex termination assembly
1715-TASOF8	8-channel analog output simplex termination assembly
1715-TADOF8	8-channel analog output duplex termination assembly

1715-IF16 Analog Input Module

The analog input interface is a combination of input modules and analog input termination assemblies. The 16-channel analog input module has a flexible and fail-safe design.

The 1715-IF16 analog input module features are as follows:

- Flexible, modular construction for user-configured I/O applications
- 16-channel connection capability
- Suitable for simplex, duplex connections, and fault tolerant applications
- Independent, galvanically isolated input channels
- Built-in diagnostic testing and independent watchdog facility
- Module removal and replacement online and, when in Duplex mode, no interruption of the signal inputs

The internal isolated power supply from the 24V DC dual redundant system power inputs produces module power. The isolated power supply provides power to the module and is protected by overvoltage and undervoltage detection circuits. Supply voltage monitoring initiates a warning signal and Power-off protective mode when a power failure is detected.

Internal diagnostics test the module at routine intervals. An independent watchdog arrangement also monitors the module operation and provides more fault containment by activating a shutdown mechanism when a fault is detected.

IMPORTANT

If a fault occurs during normal operation in a duplex configured system, an input module can be removed and replaced without disrupting the input signals to a live system.

The adapter also monitors the input data paths and can detect faults within each input channel. A visual indication of the module status and individual channel status is provided by an array of front panel indicators and can be connected to application variables and viewed in the Logix Designer application.

The termination assemblies can accept one or two input modules. Each termination assembly provides passive signal load termination and overvoltage protection for each input channel. The system provides flexible input connectivity by mating specific termination assemblies with the relevant number of input modules.

Table 19 - Performance Criteria for the Analog Input Module

Attribute	Value
Data Input value least significant bit	0.98 μ A
Channel Measurement Error at 25 $^{\circ}$ C (77 $^{\circ}$ F) $\pm$ 2 $^{\circ}$ C ($\pm$ 3.6 $^{\circ}$ F)	
After 1 year at 40 $^{\circ}$ C (104 $^{\circ}$ F)	0.21% + 10 μ A
After 2 years at 40 $^{\circ}$ C (104 $^{\circ}$ F)	0.22% + 10 μ A
After 5 years at 40 $^{\circ}$ C (104 $^{\circ}$ F)	0.23% +10 μ A
Temperature drift	(0.01% + 0.3 μ A) per $^{\circ}$ C

1715-OF8I Analog Output Module

The analog output interface consists of analog output modules and output termination assemblies. Each module provides eight isolated output channels and plugs into the I/O base unit and a corresponding termination assembly.

Termination assemblies provide termination for eight output channels and the coding pegs make sure they mate only with an analog output module. Field connections are connected to the terminal block connectors on the termination assembly.

The analog module provides 4...20 mA output current from each channel for field devices.

The 1715-OF8I analog output module features are as follows:

- Flexible module structure for a user configurable system
- Supports eight field devices
- Secure communication between modules for fault tolerant operation
- Operates as a simplex or duplex configuration
- Two-terminal current regulating device

Table 20 - Performance Criteria for the Analog Output Module

Attribute	Value
Data Input value least significant bit (control)	0.98 μ A
Data Output value least significant bit (monitor)	3.9 μ A
Channel Measurement Error at 25 °C (77 °F) $\pm$ 2 °C ($\pm$ 3.6 °F)	
After 1 year at 40 °C (104 °F)	0.30% + 10 μ A
After 2 years at 40 °C (104 °F)	0.35% + 10 μ A
After 5 years at 40 °C (104 °F)	0.44% + 10 μ A
Temperature drift	(0.01% + 0.1 μ A) per °C



ATTENTION: Maintenance must be performed only by qualified personnel, otherwise, personal injury or death, or damage to the system can result.

Features Common to All Analog I/O Modules

The following features that are described in this section are common to all 1715 ControlLogix® analog I/O modules:

- Removal and Insertion Under Power (RIUP)
- Module fault reporting
- Fully software configurable
- Status indicators

Removal and Insertion Under Power (RIUP)

All 1715 I/O modules can 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

The 1715 analog I/O modules provide hardware and software indication when a module fault has occurred. Each module has a status fault indicator and the Logix Designer application graphically displays this fault and include a fault message that describes the nature of the fault. This feature lets you determine how your module has been affected and what action must be taken to resume normal operation.

Fully Software Configurable

The Logix Designer application 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:

- Vendor
- Product Type
- Product Code
- Revision
- Serial Number
- Product Name

By eliminating such tasks, such as setting hardware switches and jumpers, the software eases module configuration.

The keying options available with your 1715 analog I/O are outlined in [Chapter 2](#).

Status Indicator Information

Each 1715 analog I/O module has status indicators on the front of the module that allow you to check the module health and operational status of a module.

Module Inhibiting

Module inhibiting lets you indefinitely suspend a connection between an owner-controller and an analog I/O module. This process can occur in either of these ways:

- You write the configuration of an I/O module but inhibit the module to help 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 the configuration to the module, and is 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 goes to zero during Program mode, whenever that module is inhibited, the outputs goes to zero.

These examples are instances where you can use module inhibiting:

- You want to upgrade an analog I/O module. We recommend that you do the following.
 - a. Inhibit the module.
 - b. Perform the upgrade.
 - c. Uninhibit the module.
- You are using a program that includes a module that is not physically installed, but you do not want the controller to 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.

Scaling

The limits field is a variable that lets you set the channel output current values based on a scaling factor. You set the minimum and maximum output values by using the scaling factor. The scaling factor requires you to set a percentage of the engineering values. This gives a linear transformation between the engineering values and the output scaled values across the defined range.

The default minimum and maximum values are 0% equals 4 mA and 100% equals 20 mA.

Regardless of the Limits field settings, the output current is clamped at 0...24 mA maximum.

The module can operate with values beyond the 4...20 mA range. If an input signal beyond the low and high signals is present at the module (for example, 3 mA), that data is represented in terms of the engineering units set during scaling. [Table 21](#) shows example values that can appear based on the example that is mentioned previously.

Table 21 - Current Values Represented in Engineering Units

Current	Engineering Units Value
4 mA	0%
12 mA	50%
20 mA	100%

Operating Modes

This section discusses operating modes for the analog input and output modules.

Online Mode

When fully online and operational, each channel provides a regulated current over a 1...24 mA range for the analog input module and a 0...24 mA range for the analog output module. The current values are set for each channel by the commanded values that are received from the running application. The module indicators are GREEN, and with all module indicators GREEN, none of the channels are in the failed state; however, the channel indicators depend on the individual channel status.

In the online mode, you can add a module to a group (in a duplex TA), or change a module in a pair, with no impact on the reported channel values or deviation between the regulated current. The unaffected module of a pair provides the full output values.

Offline Mode

The module is in the Offline mode when it is installed, but is not locked in position (locking screw that is not engaged). All channel outputs are off and the channel indicators are OFF. The Healthy indicator is GREEN and the Ready indicator goes OFF, while the Run indicator is RED. The module enters the Shutdown mode when locked in position.

When a critical power fault is detected, the module automatically enters the Shutdown mode and the Healthy indicator goes RED before it goes into Ready mode.

Shutdown Mode

In the Shutdown mode, all channels regulate their output to shutdown settings for each channel. The Ready and Run indicators are RED.

In a group arrangement, one module can be in shutdown while the other can continue to be online and in the Run mode and regulate the output according to the commanded values.

When the module is communicating with the processors in Shutdown mode, it transitions to the Ready mode. If there is an application running, it transitions to the Recover mode.

Ready Mode

All channels are off when in the Ready mode, the Ready indicator is GREEN and the Run indicator is RED while the channel indicators are OFF. When an application is started, the module transitions to the Run mode.

When a module loses communication with the processor, then it transitions back to the Shutdown mode.

Run Mode

In the Run mode, all channels regulate the output current to the commanded value for each individual channel. The Ready and Run indicators are GREEN. You must make sure that all user-required values have been set (by using RSLogix 5000® or Logix Designer application) before transitioning the module to Run mode.

If for any reason a module does not receive commanded values, then the module transitions to the Shutdown mode.

Shutdown States

You can configure the channel shutdown states to do one of the following:

- Turn-off/de-energize the channel
- Hold last state
- Regulate the output to a specified value

The shutdown state defaults to turn-off/de-energize.

IMPORTANT If no indicators are lit when the module is inserted, the base unit may not have an incoming power supply, or the module may be faulty.

HART

This section discusses The Highway Addressable Remote Transducer (HART®) communication protocol, which is an open standard that is owned by the more than 100 member companies in the HART Communication Foundation (HCF). Products use the HART protocol to provide both analog 4...20 mA and digital signals. Digital signals are combined with analog signals to provide control and status data for field devices.

HART is available in revision 3.x and later.

HART Features

The support for HART in the 1715 Redundant I/O System has the following features:

- HART support on every analog input and output channel
- Variables for each analog input and output channel to monitor HART device information

Configuration of HART Variables

The Controller tags created when an analog input module (1715-IF16), or analog output module (1715-OF8I), are added to an application, contain variables to monitor HART data.

Make sure that your HART field devices support HART command 0 ('read unique ID') and HART command 3 ('read current and four dynamic variables'), the 1715 redundant I/O system uses these commands to communicate with the HART devices.

The 1715 analog input and output modules use HART command #03 to collect data from the field device as defined by Revision 5 of the HART specification. The data available from HART enabled field devices is reported to the application in the AB:1715_ChHART_Struct substructure of the modules input tag.

The structures provide the following:

- Process measurements and measurement status.
- Errors on HART communication seen by the field device.
- Status of the field device.
- Time in milliseconds since the data was last updated.

You can monitor the status of the field device and use this to report diagnostic errors and manual configuration changes.

The HART data is also available to the user for monitoring purposes via the HART Device Info tab of the I/O module properties.

IMPORTANT	The update rate for HART data from field devices is slower than the update rate for the 4...20 mA analog signal itself. HART data can take up to 4 seconds to update a channel, depending on the device type and configuration. This is not affected by the number of channels that are enabled for HART, but is affected if HART Pass-Through is in use on the channel.
------------------	--

Precautions for HART in a Safety System

- IMPORTANT** If you use HART in a safety system, take these precautions:
- Do not use HART variables as the primary initiator for a Safety Instrumented Function. The HART protocol does not meet the applicable integrity levels for Safety Instrumented Functions.
 - Make sure that HART is disabled for field devices that do not have a locked configuration. This helps prevent the use of HART to change a device configuration.
 - Make sure that the custom data for the device (this is the data that is provided in response to HART command #03) is used in accordance with the device manufacturers published recommendations.

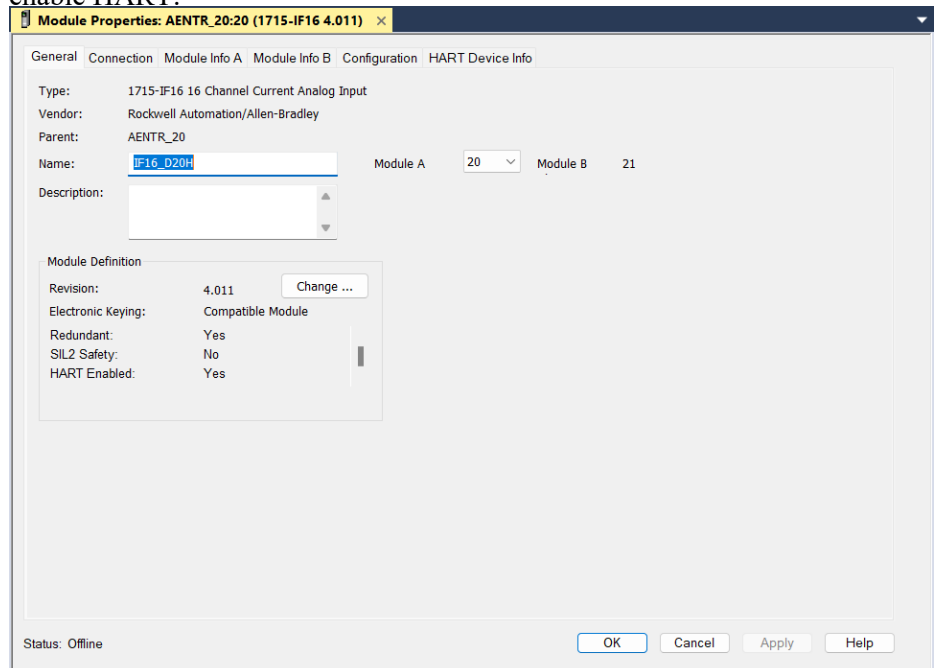
Configure HART for Field Device Monitoring

When an analog module is added to the RSLogix™ application, input, output, and configuration tags for the module are automatically created. The input tags contain AB:1715_ChHART_Struct substructures for HART data. The configuration tags contain a HartEn variable that is used to enable HART on individual channels.

To configure an analog channel to use HART to monitor a field device, HART must be enabled for the I/O module, and the channel the device is connected to.

To enable HART, do the following:

1. Double-click the I/O module in the Controller Organizer to display the I/O module properties. On the General tab, update the Module Definition to enable HART:



2. Enable HART on the channels to which the devices are connected.

To do this for a 1715-IF16, set the I/O module configuration variable <AENTR>:<slot>:C.HartEn. For example, enabling HART on all channels for a module in slot 2.

Name	Value	Force Mask	Style	Data Type
▲ AENTR_20:9:C	{...}		{...}	AB:1715_AI16_V4_SIL2:C:0
▸ AENTR_20:9:C.Ch	{...}		{...}	AB:1715_AI_Struc:C:0[16]
▸ AENTR_20:9:C.HartEn	-1		Decimal	INT
AENTR_20:9:C.HartEn0	1		Decimal	BOOL
AENTR_20:9:C.HartEn1	1		Decimal	BOOL
AENTR_20:9:C.HartEn2	1		Decimal	BOOL
AENTR_20:9:C.HartEn3	1		Decimal	BOOL
AENTR_20:9:C.HartEn4	1		Decimal	BOOL
AENTR_20:9:C.HartEn5	1		Decimal	BOOL
AENTR_20:9:C.HartEn6	1		Decimal	BOOL
AENTR_20:9:C.HartEn7	1		Decimal	BOOL
AENTR_20:9:C.HartEn8	1		Decimal	BOOL
AENTR_20:9:C.HartEn9	1		Decimal	BOOL
AENTR_20:9:C.HartEn10	1		Decimal	BOOL
AENTR_20:9:C.HartEn11	1		Decimal	BOOL
AENTR_20:9:C.HartEn12	1		Decimal	BOOL
AENTR_20:9:C.HartEn13	1		Decimal	BOOL
AENTR_20:9:C.HartEn14	1		Decimal	BOOL
AENTR_20:9:C.HartEn15	1		Decimal	BOOL
▸ AENTR_20:9:C.VariantID	3		Decimal	DINT
▸ AENTR_20:9:C.SourceIP	-1062731510		Decimal	DINT

For a 1715-OF8I, there is a BOOL variable for each channel to enable HART.

Name	Value	Force Mask	Style	Data Type
▲ AENTR_20:15:C	{...}		{...}	AB:1715_AO8_V4_SIL2:C:0
▲ AENTR_20:15:C.Ch	{...}		{...}	AB:1715_AO_V4_Struc:C:0[8]
▲ AENTR_20:15:C.Ch[0]	{...}		{...}	AB:1715_AO_V4_Struc:C:0
AENTR_20:15:C.Ch[0].LowSignal	4.0		Float	REAL
AENTR_20:15:C.Ch[0].HighSignal	20.0		Float	REAL
AENTR_20:15:C.Ch[0].LowEngineering	0.0		Float	REAL
AENTR_20:15:C.Ch[0].HighEngineering	100.0		Float	REAL
AENTR_20:15:C.Ch[0].HoldForInit	0		Decimal	BOOL
AENTR_20:15:C.Ch[0].FaultMode	1		Decimal	BOOL
AENTR_20:15:C.Ch[0].ProgMode	1		Decimal	BOOL
AENTR_20:15:C.Ch[0].RateAlarmLatch	0		Decimal	BOOL
AENTR_20:15:C.Ch[0].LimitAlarmLatch	0		Decimal	BOOL
AENTR_20:15:C.Ch[0].RampToRun	0		Decimal	BOOL
AENTR_20:15:C.Ch[0].RampToFault	0		Decimal	BOOL
AENTR_20:15:C.Ch[0].RampToProg	0		Decimal	BOOL
AENTR_20:15:C.Ch[0].AlarmDisable	0		Decimal	BOOL
AENTR_20:15:C.Ch[0].ProgToFaultEn	0		Decimal	BOOL
AENTR_20:15:C.Ch[0].HartEn	0		Decimal	BOOL
AENTR_20:15:C.Ch[0].FaultValue	0.0		Float	REAL
AENTR_20:15:C.Ch[0].ProgValue	0.0		Float	REAL
AENTR_20:15:C.Ch[0].MaxRampRate	0.0		Float	REAL
AENTR_20:15:C.Ch[0].LowLimit	0.0		Float	REAL

3. Repeat for all I/O modules and channels that you want to monitor.

AB:1715_ChCHART_Struc

The AB:1715_ChHART_Struc is the substructure within the analog modules input tag. It is used to contain the HART data from the device.

Identifier	Type	Description	Remarks
HARTPV	REAL	Variable	Primary loop current variable
HARTSV	REAL	Variable	Second loop current variable
HARTTV	REAL	Variable	Third loop current variable
HARTQV	REAL	Variable	Fourth loop current variable
PVStatus	SINT	Status	Primary variable status: 0x00: Variable is not connected. 0xc0 (decimal -64): Variable is connected.
SVStatus	SINT	Status	Second variable status. Values as for Primary.
TVStatus	SINT	Status	Third variable status. Values as for Primary.
QVStatus	SINT	Status	Forth variable status. Values as for Primary.
CommandStatus	SINT	Status	Command error summary. If bit 7 is 1, then the remaining bit indicate communications errors as follows. Bit 6: vertical parity error. Bit 5: overrun error. Bit 4: framing error. Bit 3: longitudinal parity error. Bit 2: reserved, set to 0. Bit 1: buffer overflow. Bit 0: not used. If bit 7 is 0, the remaining bits contain a command specific response code in the range 0 to 127. Some common response codes are: 0: Success – command completed successfully. 32: Busy – the device is performing a function that cannot be interrupted by this command. 64: Command not implemented – the device does not support the command.
FieldStatus	SINT	Status	Field Device status. Bit 7: field device malfunction. Bit 6: configuration changed. Bit 5: cold start. Bit 4: more status available. Bit 3: analog output current fixed Bit 2: analog output saturated Bit 1: non-primary variable out of limits Bit 0: primary variable out of limits
ExternalDevice Status	SINT	Status	Extended field device status. Bit 7: undefined. Bit 6: undefined. Bit 5: undefined. Bit 4: undefined. Bit 3: undefined. Bit 2: critical power failure. Bit 1: device variable alert. Bit 0: maintenance required.
DataAge	SINT	Time	Time, in seconds, that indicates the age of the HART data as follows: 0...127: Age in seconds of the current data values. -1: Values uninitialized. No successful read at all. This is the power-up condition. -2: Values are > 127 seconds old.

HART Pass-Through

The HART Pass-Through feature enables using an external asset management system to manage HART compatible field devices that are connected to a 1715 controller.

HART Pass-Through uses the device type manager (DTM) standard, which is defined by the HART Communication Foundation, to enable using any asset management system which using the generic 'Frame' standard. Examples of compatible tools are the FieldCare application by Endress+Hauser and the FactoryTalk® AssetCentre software by Rockwell Automation Automation.

Using HART Pass-Through

The Controller tags created when an analog input module (1715-IF16), or analog output module (1715-OF8I), are added to an application, contain variables to monitor HART data.

To use HART Pass-Through, you have to install the 1715-DTM software on the computer that is running the asset management system. You can then enable and disable the HART Pass-Through capability of the 1715 Adapter.

For an analog module, HART data is available to the application in the ChHart array element of the modules input tag when the module has HART enabled, for example:

HAIO:2:I.ChHart	{...}	{...}		AB:1715_ChHART_Struct:1:0[16]
HAIO:2:I.ChHart[0]	{...}	{...}		AB:1715_ChHART_Struct:1:0
HAIO:2:I.ChHart[0].HARTPV	0.11982727		Float	REAL
HAIO:2:I.ChHart[0].HARTSV	0.0		Float	REAL
HAIO:2:I.ChHart[0].HARTTV	0.0		Float	REAL
HAIO:2:I.ChHart[0].HARTQV	0.0		Float	REAL
HAIO:2:I.ChHart[0].PVStatus	-64		Decimal	SINT
HAIO:2:I.ChHart[0].SVStatus	-64		Decimal	SINT
HAIO:2:I.ChHart[0].TVStatus	-64		Decimal	SINT
HAIO:2:I.ChHart[0].QVStatus	-64		Decimal	SINT
HAIO:2:I.ChHart[0].CommandStatus	0		Decimal	SINT
HAIO:2:I.ChHart[0].FieldStatus	0		Decimal	SINT
HAIO:2:I.ChHart[0].ExternalDeviceStatus	0		Decimal	SINT
HAIO:2:I.ChHart[0].DataAge	0		Decimal	SINT

IMPORTANT HART Pass-Through must be enabled

Once HART Pass-Through has been enabled, HART device data can be viewed on the HART Device Info tab of a module's properties:

The screenshot shows the 'HART Device Info' tab of a module's properties. At the top, there are tabs for 'General', 'Connection', 'Module Info', 'Configuration', and 'HART Device Info'. Below the tabs is a 'Channel' selection area with a grid of buttons numbered 0 through 15. The '0' button is selected. Below the grid, the following information is displayed:

Tag:	PT101	Manufacturer ID:	Endress+Hauser
Message:		Device Type:	Cerabar M
Descriptor:		Device ID:	8068720
Date:	1/31/2001	Final Assembly Number:	0
Write Protect:	No	Status:	OK
		Diagnostic Code:	

Below this information, there are two sections:

PV

Upper Range Value:	40.00	bar
Lower Range Value:	0.00	bar
Damping:	0.00	s
Transfer Function:	Linear	

Revisions

Universal:	5
Device:	1
Software:	12
Hardware:	1

At the bottom right of the tab is a 'Refresh' button.

HART Pass-Through Features

The support for HART Pass-Through in the 1715 Adapter has these features:

- Pass-Through support for HART standards 5, 6 and 7.
- Support for CIP HART object services 0x4b, 0x5a, 0x5b, 0x5c, 0x5e, 0x5f, and 0x60.
- Supports the 1715-DTM provided by Rockwell Automation.

Precautions for HART Pass-Through in a Safety System

IMPORTANT If you use HART Pass-Through in a safety system, take these precautions:

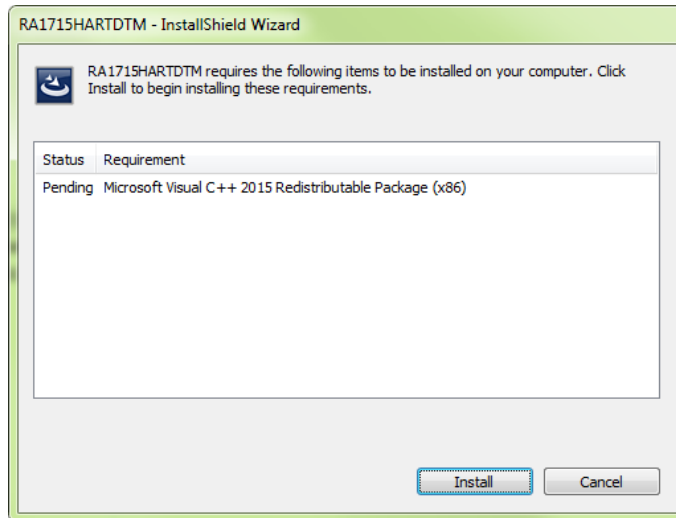
- Observe the precautions in Precautions for HART in a Safety System
- Make sure that HART Pass-Through is enabled only under the control of the application.
- Make sure that HART Pass-Through is enabled only when necessary.
- Configure the application to generate an alarm if Hart Pass-Through is enabled on any safety-critical channel of any module.

Installing the 1715-DTM

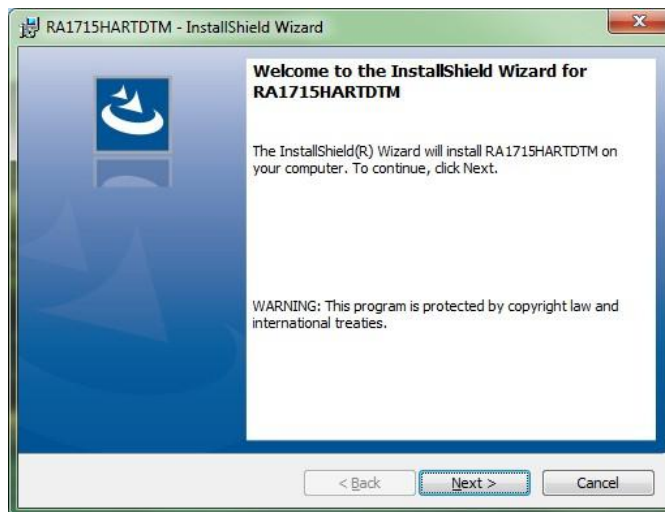
The 1715-DTM is the device type manager for the HART Pass-Through feature in a 1715 system. It must be installed on the Windows® computer that is running the asset management system. For the PC specification refer to the Preface chapter, Required Software.

To install the DTM, do the following:

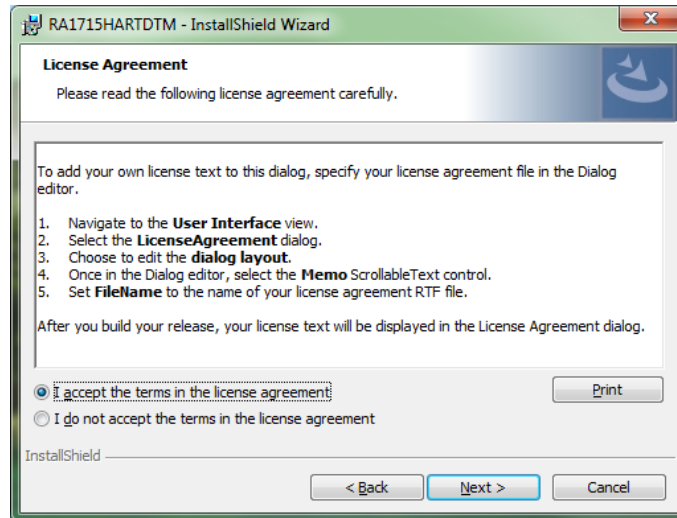
1. Locate setup.exe and run it.
2. If the computer onto which the DTM is being installed does not contain the Microsoft® packages that are required to support the DTM and the following screen appears, click Install.



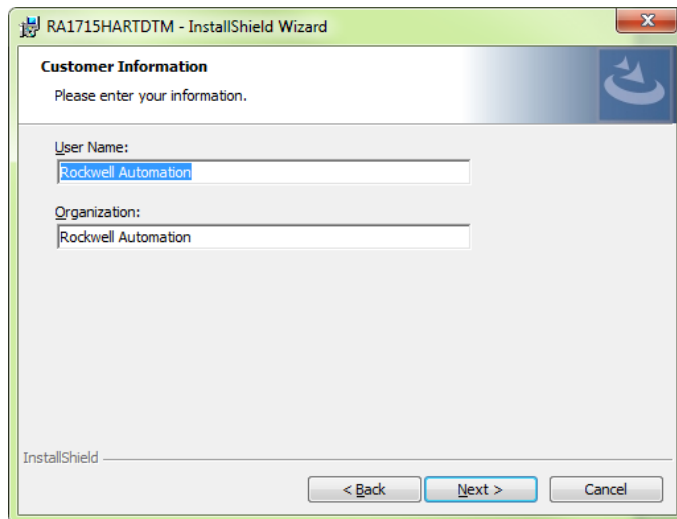
3. Click Next.



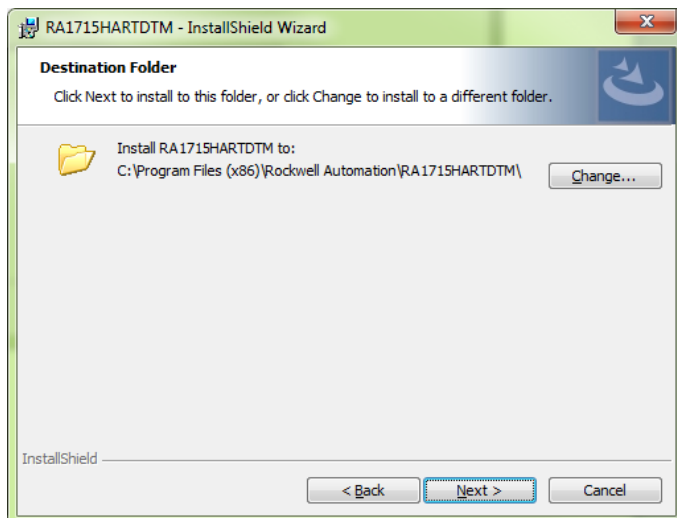
4. Accept the terms of the license agreement and click Next.



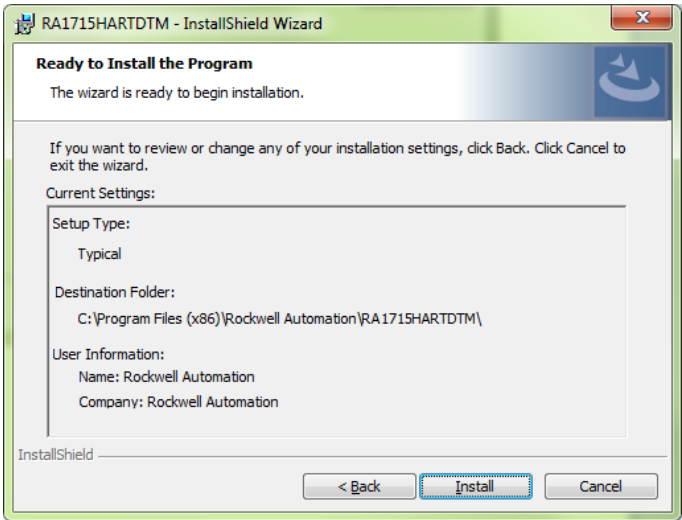
5. Fill out the customer information and click Next.



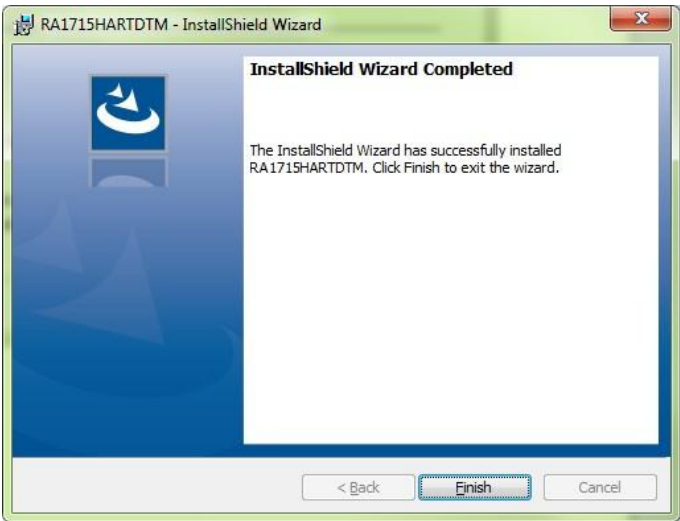
6. Change the destination folder if required and click Next.



7. Review the installation settings and click Install.

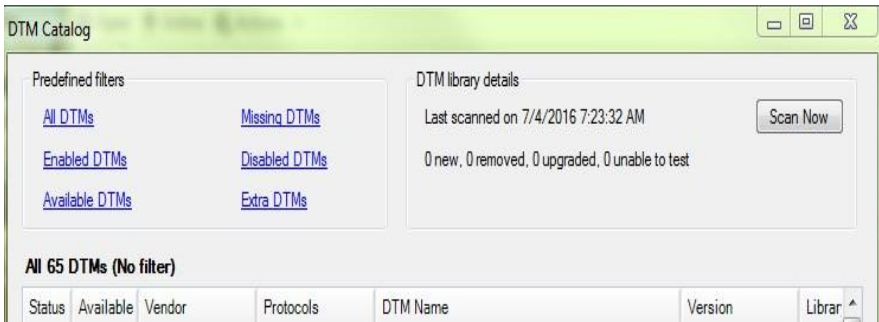


8. Once the DTM has installed, click Finish.



Updating the Asset Management System DTM Catalogue

Once the DTM is installed, the DTM catalog of the asset management system must be updated. For example, the FactoryTalk® AssetCentre DTM catalogue is updated by clicking the Scan Now button on the DTM Catalog dialogue:



The updated DTM catalog contains the following 3 1715 DTMs:

Rockwell Autom...	EtherNet/IP (CIP)	1715 EtherNet/IP Gateway DTM	3.1.3.0
Rockwell Autom...	EtherNet/IP (CIP), HART	1715-IF16	3.1
Rockwell Autom...	EtherNet/IP (CIP), HART	1715-OF8I	3.1

The purpose and usage of the DTMs is explained in the following sections.

Enable HART Pass-Through in the Controller

The 1715 DTM uses HART Pass-Through to communicate with HART devices. Before it can do this, HART Pass-Through must be enabled for the 1715, and HART enabled on the channels that HART devices are connected to.

To enable HART Pass-Through, do the following:

1. Open the RSLogix application that contains the 1715 adapter and its I/O modules.
2. Enable HART on the I/O modules and channels to which you wish to perform Pass-Through requests, see previous section on how to do this.
3. Enable HART Pass-Through for the 1715 by setting the output tag <AENTR>:O.HARTPassThrough:

HAIO.O	{...}	{...}	
HAIO.O.HARTPassThrough	2#0000_0000_0000_0000_0000_0000_0000_0001		Binary
HAIO.O.Enable	1		Decimal

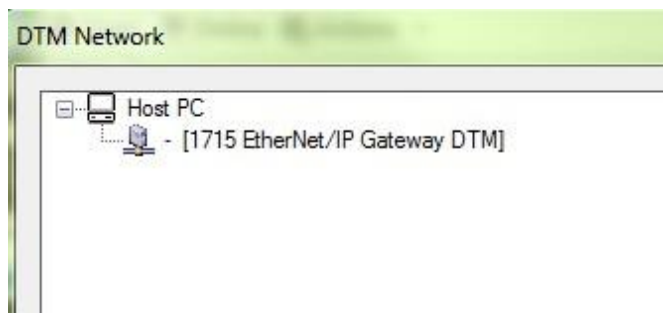
4. Compile and download the application.

Using FactoryTalk AssetCentre with Analog Modules

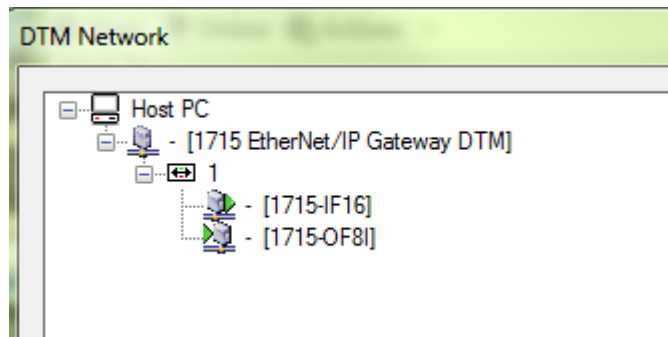
To use the DTMs, a DTM network must first be configured in the asset management system.

Use the FactoryTalk AssetCentre, for example, do the following:

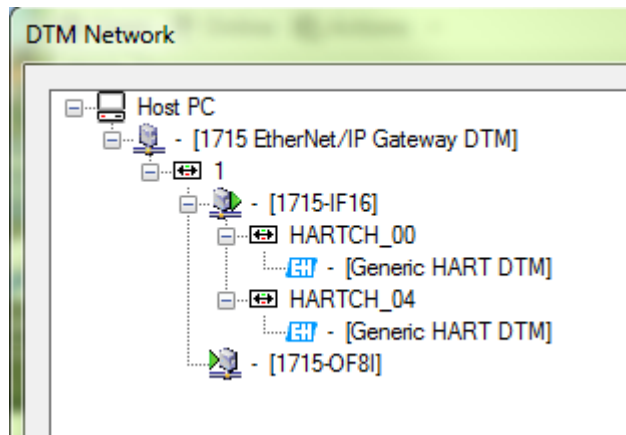
1. Make sure that the DTM catalog is up to date, see previous section on how to do this.
2. Right click the Host PC icon at the top of the tree and click Add DTM.
3. Select a 1715 EtherNet/IP™ Gateway DTM, click OK.



4. Right-click the 1715 EtherNet/IP Gateway DTM that has been added and click Add DTM.
5. Select a 1715-IF16 or 1715-OF8I, depending on the type of physical I/O module present.
6. Repeat for each I/O module.



7. Add the HART device DTMs.
 - a. Right-click an I/O module and select Add DTM.
 - a. Select the device DTM, and then select the I/O channel to which the device is connected. The first I/O channel number is 0.



8. Configure the 1715 I/O DTMs before or after adding the device DTMs.

IMPORTANT Device DTMs are provided by the device manufacturer, and require separate installation, not covered in this guide.

1715-DTM Configuration

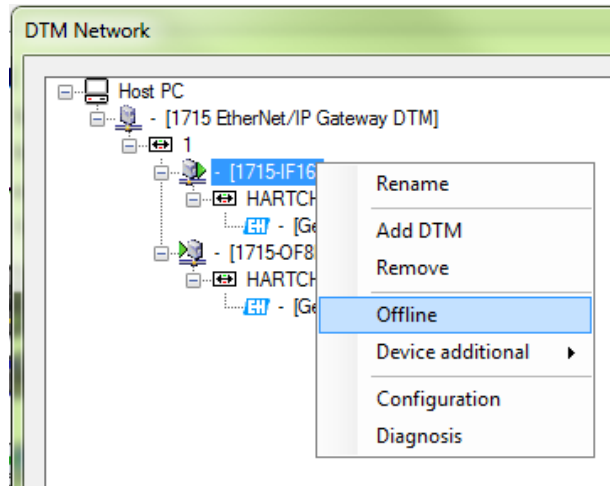
1715 EtherNet/IP Gateway DTM

This DTM does not require configuration.

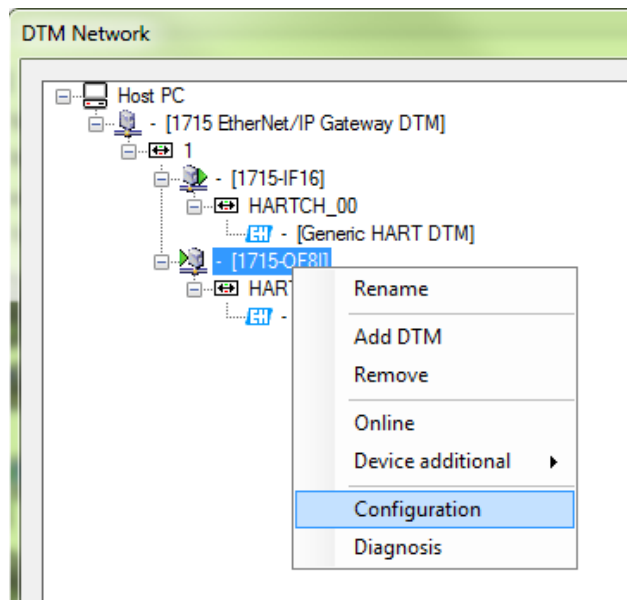
1715-IF16/OF8I

To configure the 1715-IF16 or 1715-OF8I DTM, follow these steps.

1. If the DTM is online, take it offline by right-clicking the DTM and selecting Offline.



2. Right-click the I/O DTM and select Configuration.

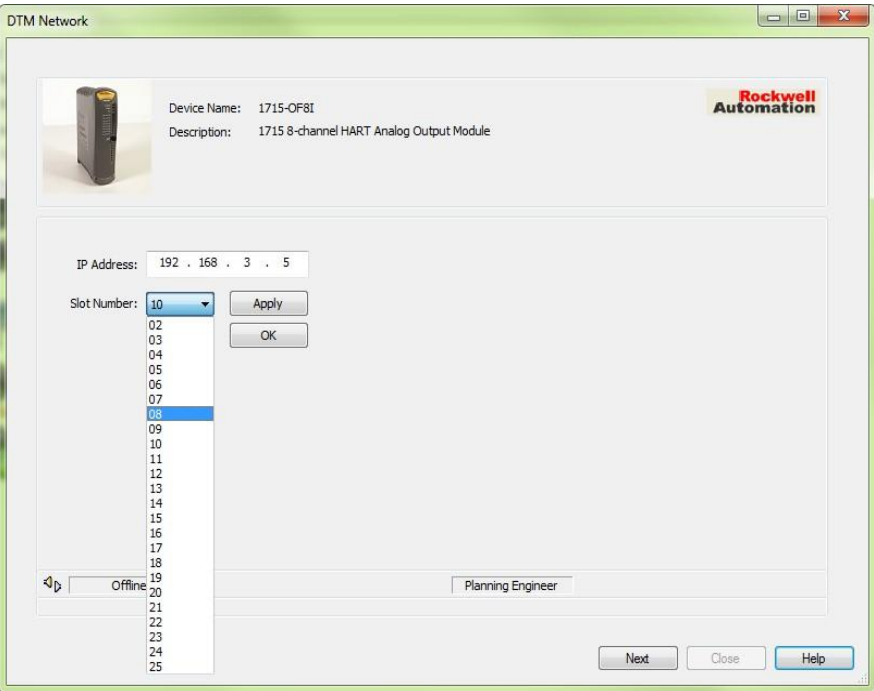


3. Enter the IP address of the 1715 adapter and select the I/O module slot position.

The first I/O slot number is 2.

4. Click OK.

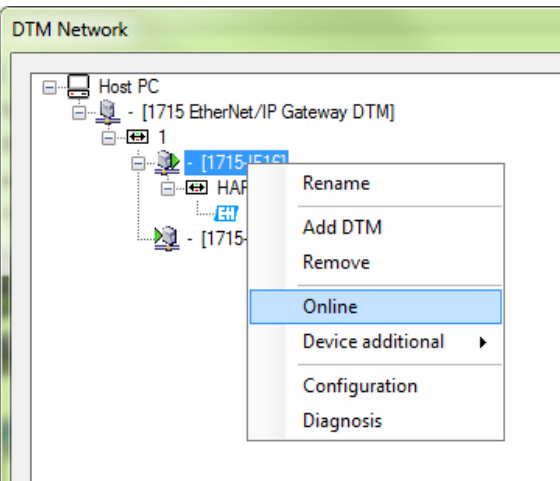
Either Apply or OK must be clicked for the changes to take effect. Changes are ignored if Next is clicked its own.



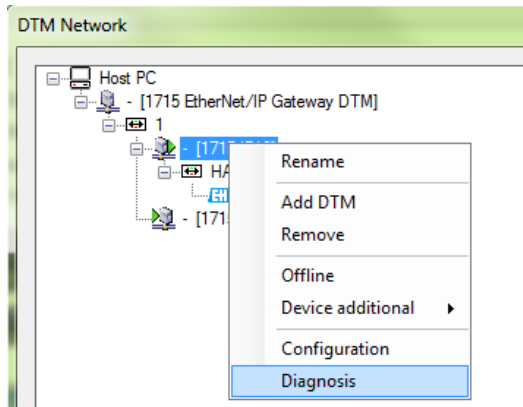
1715-DTM HART Diagnostics

The DTM provides a Diagnostics function that enables you to determine the state of any HART devices that are connected to a 1715 I/O module. To access the Diagnostics function using FactoryTalk AssetCentre, do the following:

- 1. Be sure that the I/O module DTM is online by right-clicking the I/O module and selecting Online.



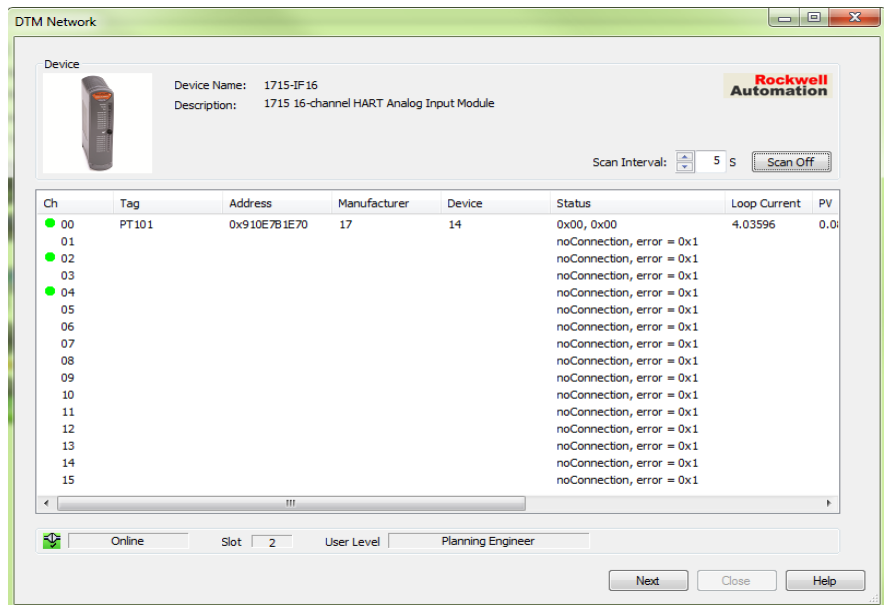
- Right-click the I/O module and select the Diagnosis function.



- On the Diagnostics dialog box, click Scan On.

The DTM queries each channel to determine whether a responding HART device is connected:

- For a channel with a connected device, the device information is displayed. The DTM refreshes this at intervals that are given by the Scan Interval.
- If a channel does not have a device that is attached, the DTM periodically queries the channel to detect a newly connected device.



- To exit, click Next.

IMPORTANT To use the Diagnostic function, the DTM must be online. Diagnostic controls are disabled if the DTM is offline when the Diagnostic dialogue is opened. The online status of the DTM appears at the bottom of the Diagnostics dialogue box.

IMPORTANT No device DTMs require configuration to use the Diagnostics function.

IMPORTANT The Scan Interval can be reduced, but doing so can help prevent other clients, for example RSLogix 5000, from communicating with the 1715 to retrieve HART information.

Notes:

Redundant I/O System Configuration

You can configure your 1715 Redundant I/O system by using the software applications from the Product Compatibility and Download Center at rok.auto/pcdc. See [System Software on page 51](#).

Before You Begin

Before you begin configuring the 1715-AENTR modules in the redundant chassis, verify that these tasks have been completed:

- Make sure that RSLogix 5000® programming software, version 20 or later, or Studio 5000® environment, version 21 or later, is installed.
- Make sure that the drivers are installed by using RSLinx® Classic software, version 2.57 or later.
- Make sure that the firmware is at the latest revision and the software is at the latest version.
- Make sure that both Add-on Profiles (AOPs) are installed on your system:
 - One for the 1715 adapter
 - One for the 1715 I/O modules

Install the Software

Install the following software:

- Studio 5000 environment, version 21 or later
- RSLinx® Classic software, version 2.57 or later

Install the AOPs

You must install two AOPs—one for the adapters, version 4.04.08 or later, and one for each of the I/O modules, version 5.04.13 or later. The four I/O module AOPs are contained in one file.

See the latest certifications for software and firmware at rok.auto/certifications. See the TÜV website at <https://www.tuv.com/landingpage/en/functional-safety-meets-cybersecurity/main-navigation/functional-safety/> for SIL 2 certification listings.

The AOPs can be found on the Product Compatibility and Download Center at rok.auto/pcdc.

Once the AOPs are installed on your computer, they can be accessed through the Logix Designer application.

With the AOPs, you are able to do the following:

- Add and configure the redundant adapter pair.
- Add and configure I/O modules in Simplex mode.
- Add and configure I/O modules in Duplex mode.
- Monitor diagnostics for I/O modules.

To install the AOPs, follow these steps.

IMPORTANT Make sure that any instances the Logix Designer application are shut down before beginning.

Product Installation

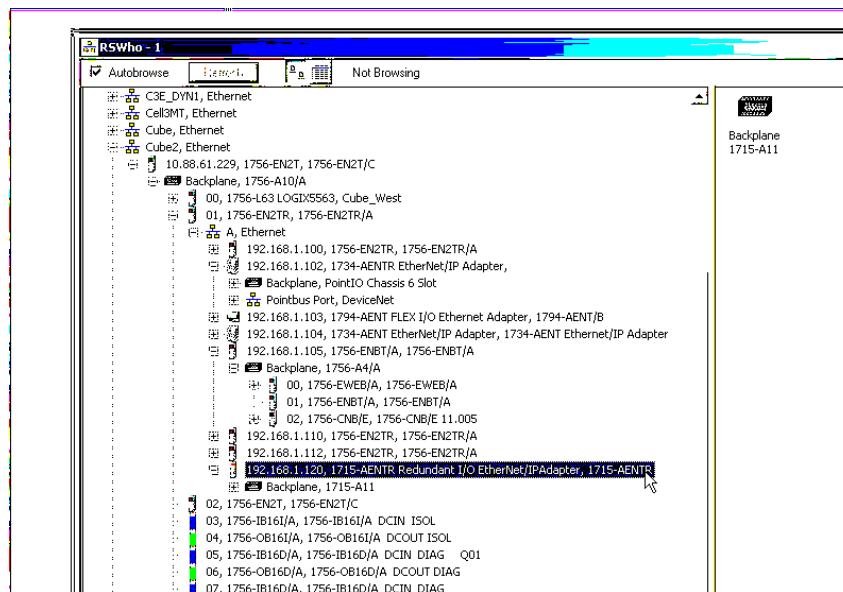
To download the AOPs for the 1715 adapter and I/O modules, go to the Product Compatibility and Download Center at rok.auto/pcdc.

EDS Files

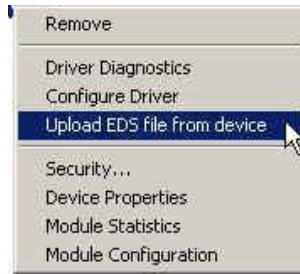
The 1715 modules contain the EDS files for installation into RSLinx® software. You can right-click the module in RSLinx Classic software and upload the EDS file into RSLinx Classic software without downloading EDS files.

Follow these steps to upload from RSLinx Classic software.

1. Open RSLinx Classic software.
2. In the RSWho tree, right-click the Ethernet adapter and choose Upload EDS file from device.



3. From the pull-down menu, choose Upload EDS file from device.



4. Follow the prompts in the Rockwell Automation EDS Wizard.



In the rare case that you must update an EDS file, you have to go to [Get Support Now](#) to obtain the correct files. Also note that when you download the EDS files, you see the Chassis EDS files that you do not see if you upload from the module. These files are necessary for chassis selection choices only in the Logix Designer application. Keep in mind that these are virtual chassis product numbers and not literal catalog numbers. See the example in [Figure 62](#).

Figure 62 - Virtual Chassis File Product Numbers

Brand	Details & Download	Device Type	Product	Catalog Number	Major Rev.	Minor Rev.
Allen-Bradley	Details Download	Analog I/O	1715-IF16	1715-IF16	1	5
Allen-Bradley	Details Download	Analog I/O	1715-OF8I	1715-OF8I	1	5
Allen-Bradley	Details Download	Chassis	1715-A11	1715-A11	1	1
Allen-Bradley	Details Download	Chassis	1715-A14	1715-A14	1	1
Allen-Bradley	Details Download	Chassis	1715-A17	1715-A17	1	1
Allen-Bradley	Details Download	Chassis	1715-A2	1715-A2	1	1
Allen-Bradley	Details Download	Chassis	1715-A23	1715-A23	1	1
Allen-Bradley	Details Download	Chassis	1715-A26	1715-A26	1	1
Allen-Bradley	Details Download	Chassis	1715-A5	1715-A5	1	1
Allen-Bradley	Details Download	Chassis	1715-A8	1715-A8	1	1
Allen-Bradley	Details Download	Digital I/O	1715-IB16D	1715-IB16D	1	5
Allen-Bradley	Details Download	Digital I/O	1715-OB8DE	1715-OB8DE	1	5

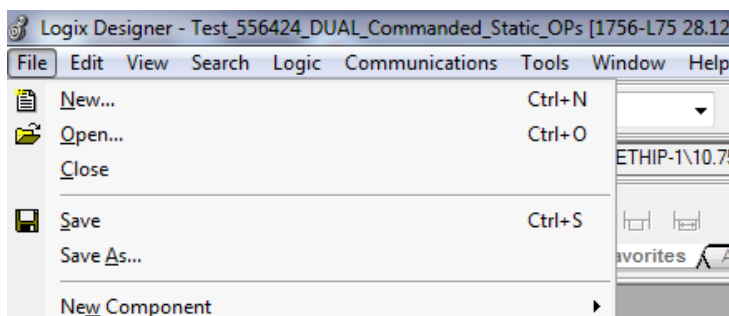
Create the Project in RSLogix 5000 or Studio 5000 Logix Designer

Once the AOP is installed, you are ready to create the Logix Designer project. In this section, you do the following:

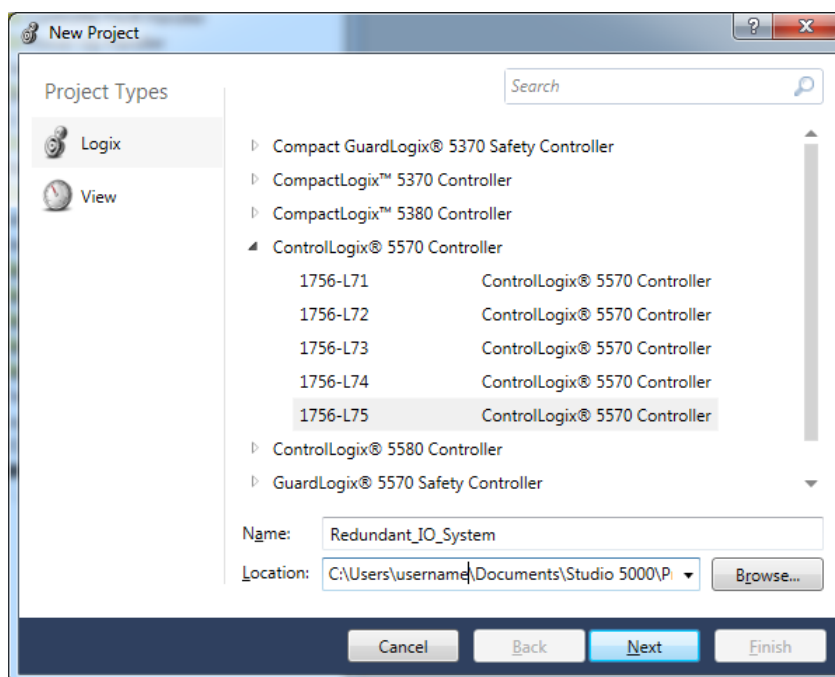
- Create a project.
- Configure the 1756 controller in the project.
- Add the 1756-EN2TR module to the project.

Step 1: Create the New Project

1. Launch the application and start a new project for the 1715 Redundant I/O system.
2. In the application, from the File menu, choose New to open the New Project dialog box.

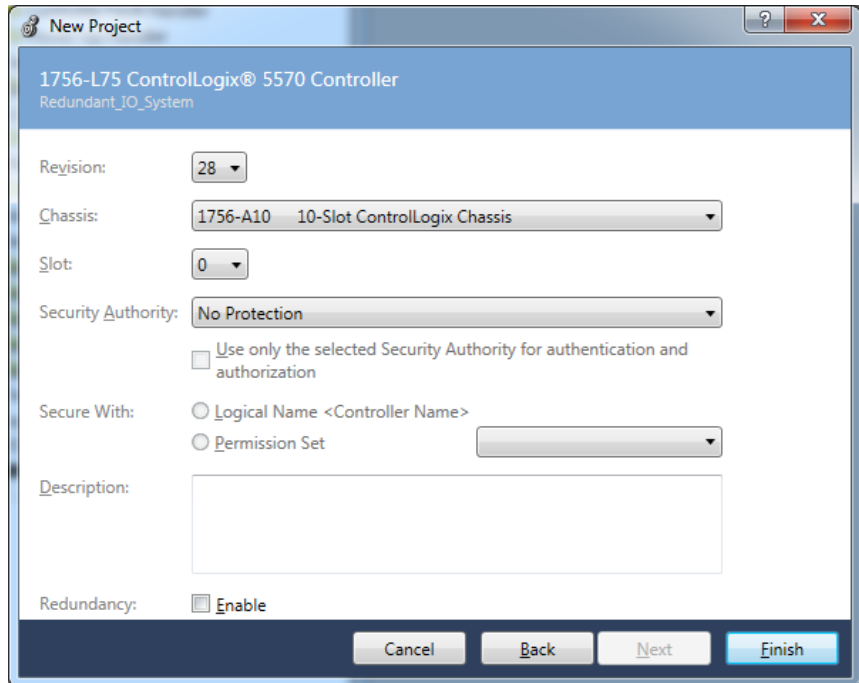


The New project dialog box appears.



3. In the New Project dialog box, from the Type pull-down menu, choose your ControlLogix® controller from the list.

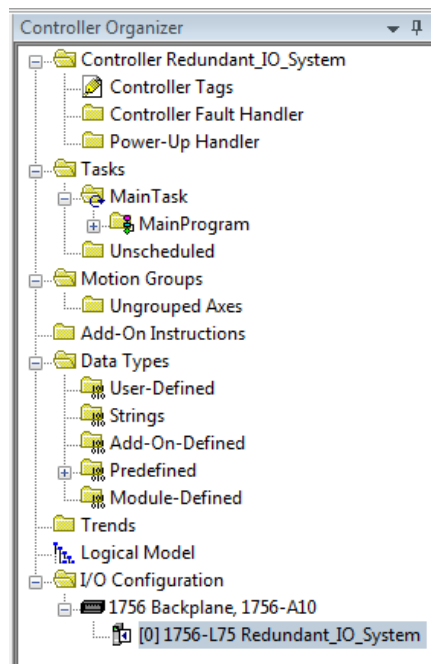
4. Enter the project filename, select a location to store the project file, and then click Next.



The previous example shows the 1756-L75 controller in slot 0.

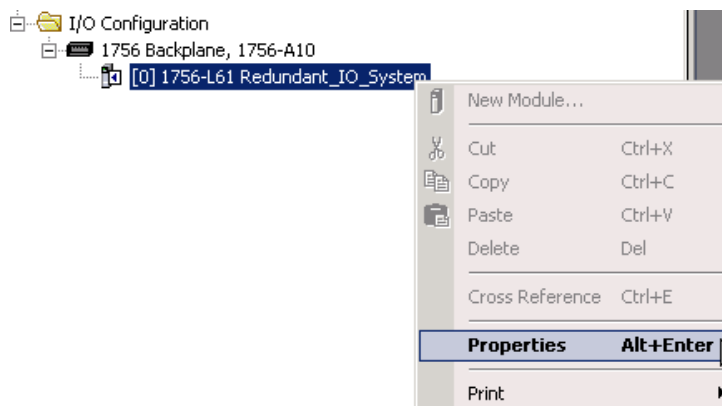
5. Choose the revision, chassis size, slot number, and security authority of your controller. Then click the Finish button.

You now see the new controller in the I/O Configuration tree of the Controller Organizer.

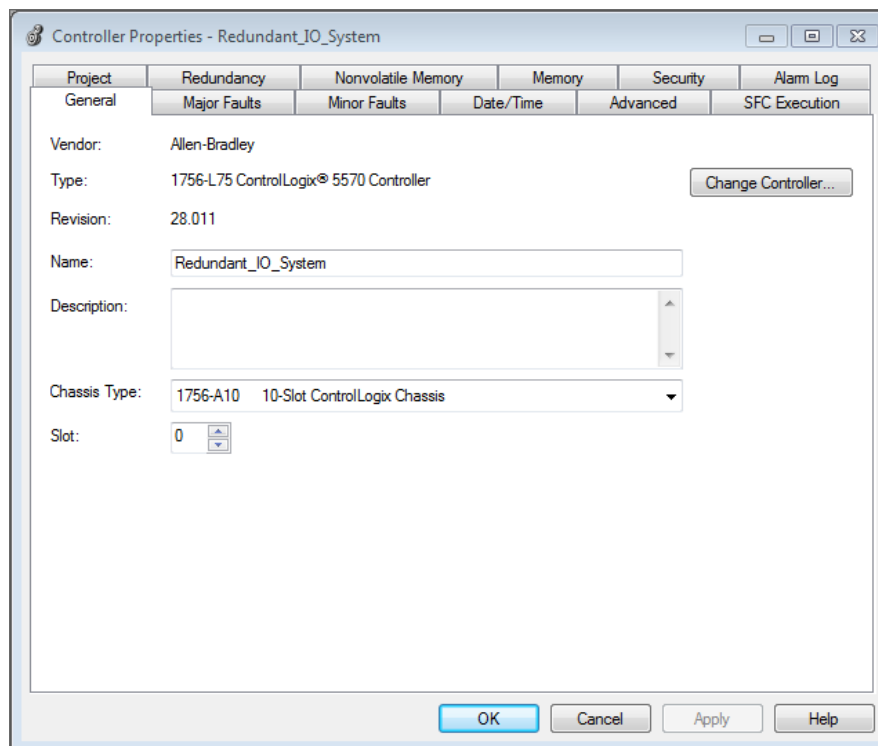


Step 2: Configure the Controller in the Project

1. To configure the controller, in the Controller Organizer, from the I/O Configuration folder, right-click the new controller that you created and choose Properties.



The Controller Properties dialog box appears.



2. In the Controller Properties dialog box, set controller configuration information for the open project, and when online—for the attached controller.

The tabs that appear are particular to the type of controller you have selected.

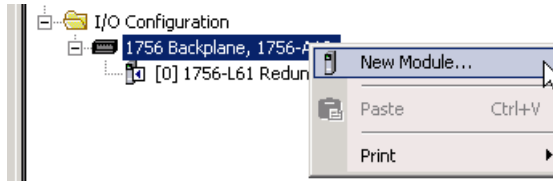
3. Click OK when you are done configuring each tab for your controller.

For a complete description of each tab and the appropriate configuration settings, refer to rok.auto/literature and type in the name of your controller under Keyword search.

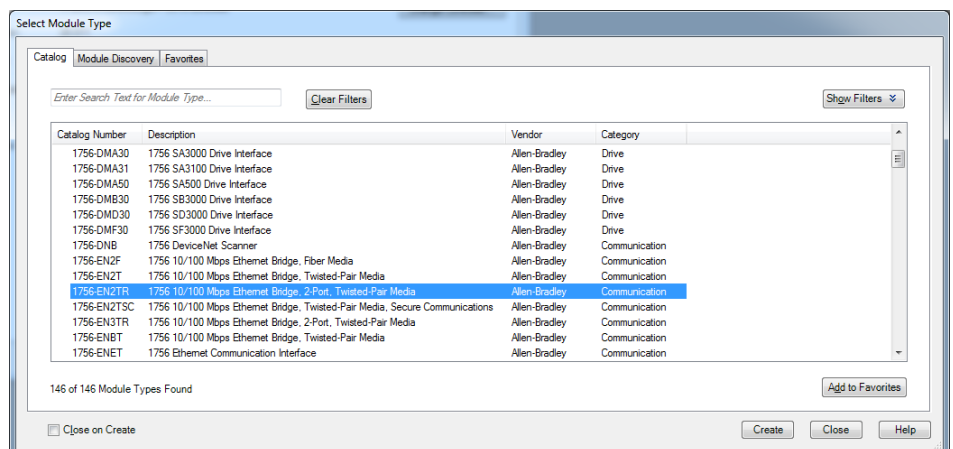
Next, add a communication module to the project to let the chassis communicate with the 1715 Redundant I/O system. The type of module you add depends on the needs of your system.

Step 3: Add a 1756-EN2TR Module to the Project

1. In the Logix Designer application project, right-click the 1756 backplane in the I/O Configuration folder, and choose New Module.

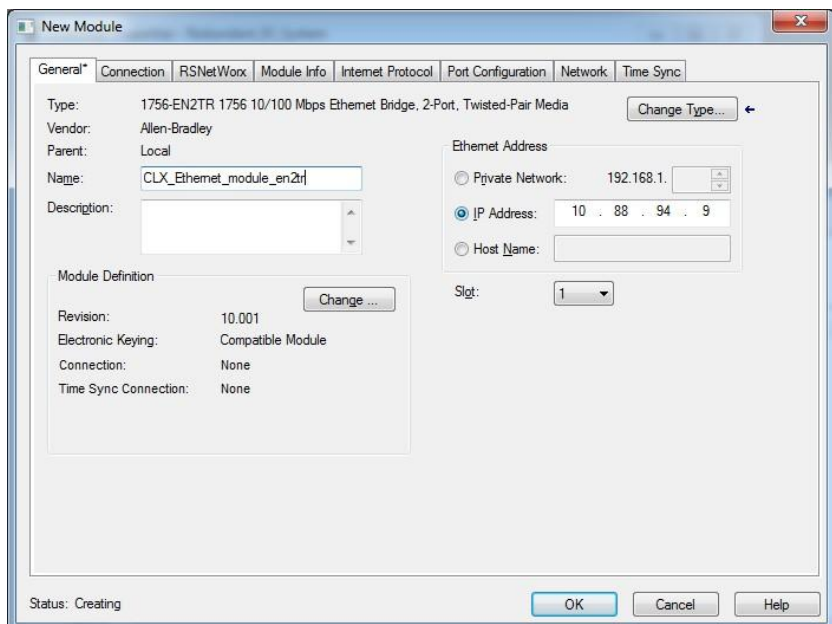


The Select Module dialog box appears.



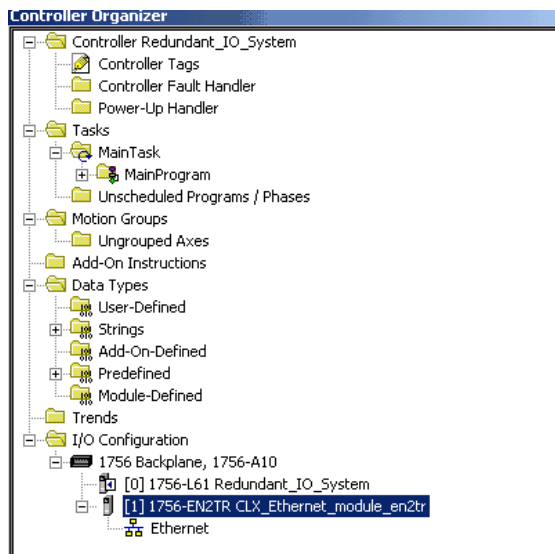
2. Expand the Communications list, select the 1756-EN2TR module, and click OK.

The Module Properties dialog box appears.



3. Name the module, enter the IP address, enter the Slot number (we chose 1 for this example).
4. Click Change.
5. Choose your Electronic Keying method, see [Electronic Keying on page 102](#).
6. Click OK.
7. To complete the configuration of the 1756 Ethernet module, refer to the EtherNet/IP Network Configuration User Manual, publication [ENET-UM001](#).

The I/O configuration folder of your project now looks similar to the following image.



IMPORTANT The previous Controller Organizer tree shows a 1756-EN2TR module. The 1756-EN2TR can be used in star (using only one port), Device Level Ring (DLR), or linear topologies. You can also use a 1756-EN2T module instead.

Add the 1715-AENTR Adapter to the I/O Configuration Tree

Once the project, controller and Ethernet module are configured, you are ready to add the 1715 adapter. In this section, you do the following:

- Add the 1715-AENTR adapter to the project.
- Configure the adapter for the EtherNet/IP™ network.

Step 1: Configure the Adapter for the EtherNet/IP Network

Plan IP addresses by doing the following:

- You must use two IP addresses.
- You must know the subnet mask for the Ethernet network the redundant modules are to operate on.

Options for Setting the IP Addresses of 1715-AENTR Modules

You can set the IP address of the redundant AENTR modules in the adapter base by using the following:

- A BOOTP/DHCP utility. A BOOTP/DHCP utility is provided with the Logix Designer application out of the box. See [Step 1: Assign an IP Address on the BOOTP/DHCP Server on page 107](#).
- Module Configuration properties that are specified in RSLinx Classic software, if the modules are already configured.
- Module Properties dialog box that is accessed by using RSLogix 5000 programming software or the Logix Designer application, if the modules are already configured.

If you are configuring your redundant EtherNet/IP modules by using any of the software options that are listed previously, see the EtherNet/IP Network Configuration User Manual, publication [ENET-UM001](#).

EtherNet/IP Network

We recommend that static IP addresses be assigned to EtherNet/IP modules in Logix 5000 control systems.

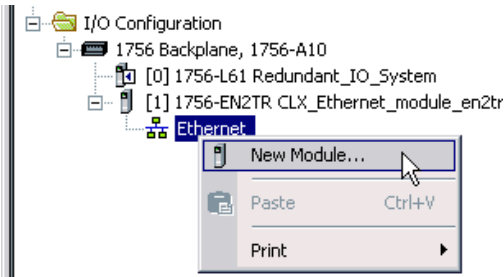
We recommend that you do not use dynamic IP addresses because if a power outage or other network failure occurs, modules with dynamic IP addresses can be assigned new addresses when the failure is resolved. If the IP addresses of modules change, you could experience a loss of control or other serious complications with your system.

However, if you must use the DHCP feature, you can use a Stratix® switch, which can be configured to provide the same IP address to any given port.

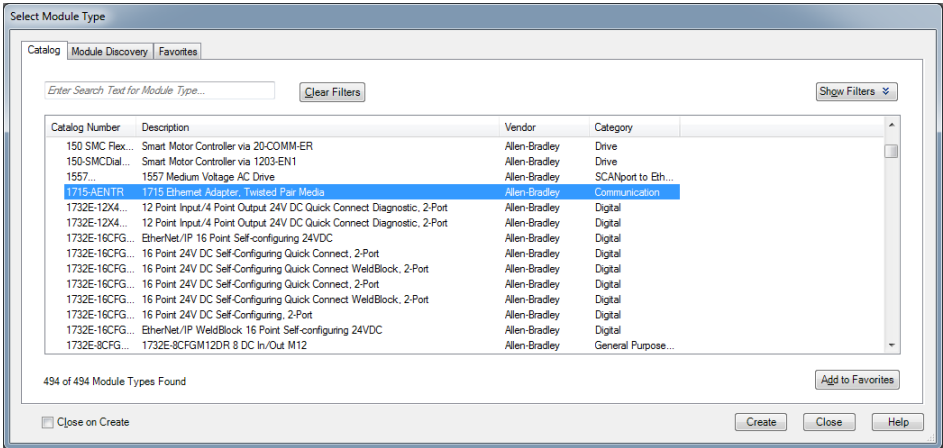
For more information, see the EtherNet/IP Network Devices User Manual, publication [ENET-UM006](#).

Step 2: Add the 1715-AENTR Adapter to the Project

- 1. In the Logix Designer project, right-click the Ethernet network icon in the I/O Configuration folder, and choose New Module.

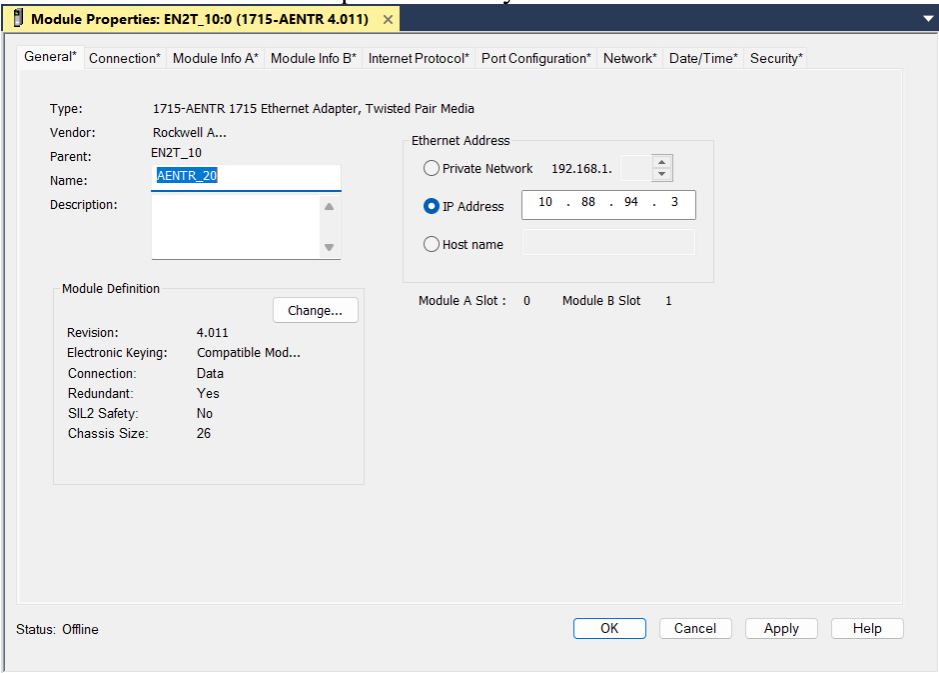


- 2. Expand the Communications list, select the 1715-AENTR module, and click OK.



- 3. Name the module and enter the IP address.

The Slot numbers for the adapters are always 0 and 1.

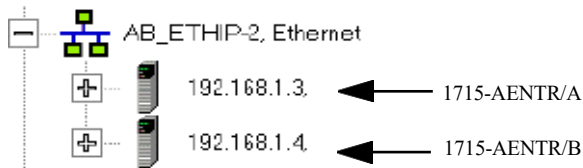


IMPORTANT When using IP address swapping, the same IP address, subnet mask, and gateway address is assigned to both the partnered EtherNet/IP adapters.

You cannot assign the backup module an IP address; it is automatically assigned the next highest IP address after the primary's. The backup module of the pair, is assigned the primary's, or active module's, IP address, plus one.

For example, if you assign the IP address of 192.168.1.3 to the primary (active) module, after synchronization, the secondary EtherNet/IP adapter automatically is assigned IP address 192.168.1.4.

Note: This graphic only is for illustrative purposes. In normal operation, the secondary adapter is not shown in the RSWho window.



4. Click Change and set module parameters.

The screenshot shows the 'Module Definition' dialog box. It contains the following fields and values:

- Series: A
- Revision: 4
- Electronic Keying: Compatible Module
- Connection: Data
- Redundant: Yes
- SIL2 Safety: No
- Chassis Size: 26

Buttons at the bottom include OK, Cancel, and Help.

Table 22 - Module Definition Parameters

Parameters	Description
Series	Module series letter.
Revision	Major: Choose the revision of the module. Minor: Set the minor revision of the module. This field is enabled while offline, and while in the Program, Remote Program, and Remote Run modes. It appears dimmed when in Run mode, or when electronic keying is set to Disable Keying. For SIL 2 applications, choose version 4.011 or later for 1715-AENTR modules.
Electronic Keying	Electronic Keying, see Electronic Keying on page 102 . Valid values are Compatible Module (default), Exact Match, or Disable Keying.
Connection	Leave as 'Data' - Listen Only is not supported.
Redundant	Always Yes.
SIL 2 Safety	Choose No if SIL 2 operation is not required. Choose Yes to enable SIL 2 operation. The safety pull-down menu appears only if using AOP version 2.01.007 or later. Two new tabs are available for SIL 2 configuration if you choose Yes.
Chassis Size	Choose the chassis size that you want to use: 5,8,11,14,17,20,23,26. The chassis size is a function of the number of bases that are installed in your system, which comes in either groups of three slots per base for I/O bases; and two slots per base for the redundant adapter base. All slots in the chassis do not have to be populated. To extend the size of a chassis, its size must be consistent with the number of base slots used. The minimum chassis size is 5 slots, which are built from one 2-slot adapter base and one 3-slot I/O base.

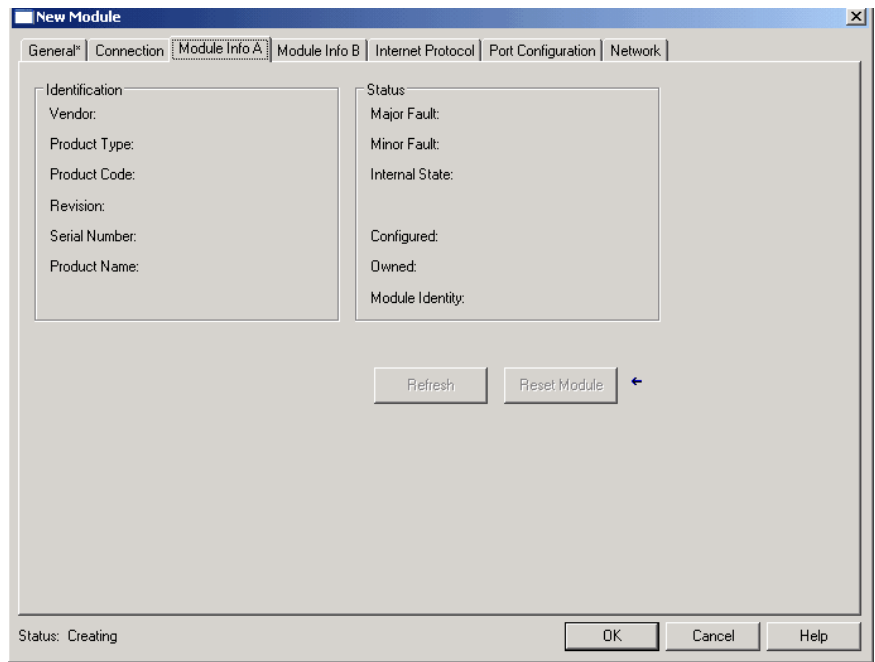
- 5. Click OK.
- 6. Click the Connection tab and set connection parameters.



Table 23 - Connection Tab Parameters

Parameters	Description
Requested Packet Interval	The Requested Packet Interval (RPI) specifies the rate at which the module and the controller exchange data to and from each other. The allowable range of the RPI is from 60...750 ms, with a default of 60 ms. When the specified time frame elapses, the module and the controller produce data for each other.
Inhibit Module	Check or clear this box to inhibit or uninhibit your connection to the module. Inhibiting the module causes the connection to the module to be closed. When you check this box and go online, the icon representing this module in the controller organizer displays the Inhibited icon.
Major Fault On Controller If Connection Fails While in Run Mode	Check this box to configure the controller so that failure of the connection to this module causes a major fault on the controller if the connection for the module fails.
Use Unicast Connection over EtherNet/IP	Choose between Unicast and Multicast for EtherNet/IP connections. Use only Multicast in redundancy applications or else the connection drops upon switchover. Make sure that the box is unchecked.

7. Click the Module Info A Tab.



The Module A Info Tab displays module and status information about the primary adapter, in slot 0 or 1. (During initial setup, the primary adapter is installed in slot 0. If an IP address swap occurs, the primary adapter is now in slot 1.)

This tab also lets you reset a module to its power-up state. The information on this tab is not displayed if you are one of the following:

- Offline
- Currently creating a module

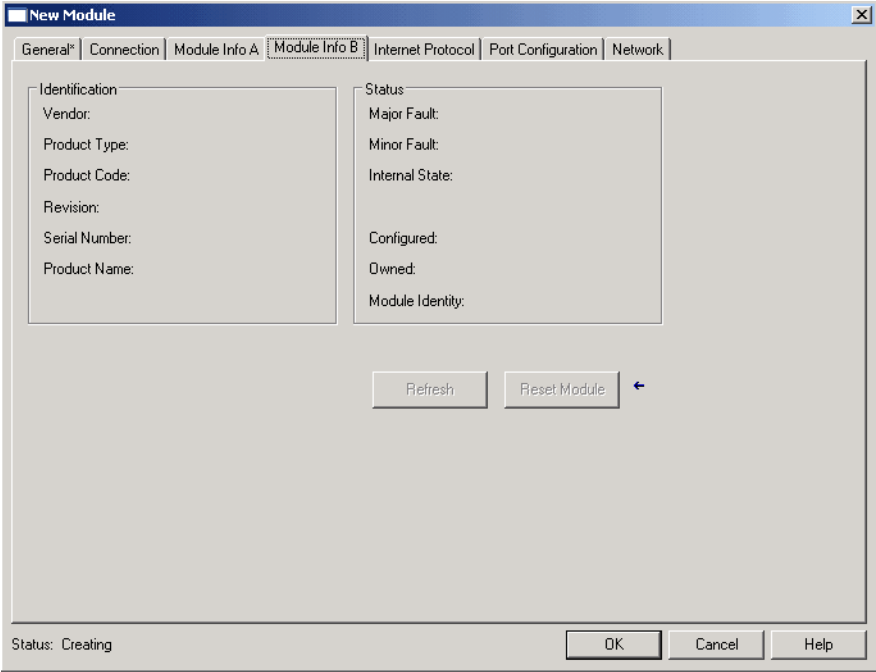
Table 24 - Module Info A Parameters

Parameters	Description	
Identification	Displays the following module information: • Vendor • Product Type • Product Code • Revision • Serial Number • Product Name	
Status	Major Fault	Minor Fault
Major/Minor Fault	Displays the fault type	Displays the fault type
Internal State	Displays the module's current operational state	
Configured	Displays a yes or no value, which indicates whether the module has been configured by an owner controller who is connected to it - Once a module has been configured, it stays configured until the module is reset or power is cycled, even if the owner drops connection to the module. This information only applies to I/O modules and does not apply to adapters, scanners, bridges, or other communication modules.	
Owned	Displays a yes or no value indicating whether an owner controller is connected to the module.	

Table 24 - Module Info A Parameters (Continued)

Parameters	Description	
Module Identity	Displays	If the physical mode is
	Match	Agrees with what is specified on the General Tab. For the Match condition to exist, these must agree: • Vendor • Module Type (the combination of Product Type and Product Code for a particular Vendor) • Major Revision
	Mis-match	Does not agree with what is specified on the General Tab.
Reset	Click Reset to return a module to its power-up state by emulating the cycling of power.	
Refresh Module	Click Refresh Module to refresh the tab with new data from the module.	

8. Click the Module Info B tab.



The Module B Info Tab displays module and status information about the secondary adapter, in slot 0 or 1. (During initial setup, the secondary adapter is installed in slot 1. If an IP address swap occurs, the secondary adapter is now in slot 0.)

This tab also lets you reset a module to its power-up state. The information on this tab is not displayed if you are one of the following:

- Offline
- Currently creating a module

See [Table 24 on page 175](#).

9. Click the Internet Protocol tab and set IP parameters.

You must be online to configure the Internet Protocol settings.

Module Properties: EN2_11:0 (1715-AENTR 4.011)

General | Connection | Module Info A | Module Info B | **Internet Protocol** | Port Configuration | Network | Date/Time | Security

☒ Manually configure IP settings
☐ Obtain IP settings automatically using BOOTP
☐ Obtain IP settings automatically using DHCP
☐ IP settings set by switches on the module

Physical Module IP Address: 192 . 168 . 42 . 70 Subnet Mask: 255 . 255 . 255 . 0
Gateway Address: 192 . 168 . 42 . 1

Domain Name: Primary DNS Server Address: 0 . 0 . 0 . 0
Host Name: my1715 Secondary DNS Server Address: 0 . 0 . 0 . 0

[Refresh communication](#) **Set**

Status: Running **OK** Cancel Apply Help

Table 25 - Internet Protocol Parameters

Parameters	Description
Internet Protocol (IP) Settings	Displays the IP settings Configuration mode of the module. Click the appropriate button to configure the IP settings: - Manually configure the IP settings - Obtain IP settings automatically by using BOOTP - Obtain IP settings automatically by using DHCP Internet Protocol (IP) Settings controls appear dimmed when: - Offline - Online and a module mismatch or communication error occurs - BOOTP or DHCP is not supported
IP Settings Configuration	
Physical Module IP Address	Displays the physical IP address of the module or, if you chose to configure the IP settings manually, enter a valid physical module IP address.
Subnet Mask	Displays the subnet mask of the module or, if you chose to configure the IP settings manually, enter a valid subnet mask.
Gateway Address	Displays the gateway IP address of the module or, if you chose to configure the IP settings manually, enter a valid gateway address.
Domain Name	Displays the domain name of the module or to configure the IP settings manually, enter a valid domain name.
Host Name	Displays the host name of the module or enter a valid host name.
Primary DNS Server Address	Displays the primary DNS server IP address of the module or if you chose to configure the IP settings manually, enter a valid primary DNS server address.
Secondary DNS Server Address	Displays the secondary DNS server IP address of the module or if you chose to configure the IP settings manually, enter a valid secondary DNS server address.
Refresh communication	This link appears when communication with the module has failed. Click Refresh communication to attempt to restart communication with the module.
Set	Click this button to commit your modifications to the module.

10. Click the Port Configuration tab and set port parameters.

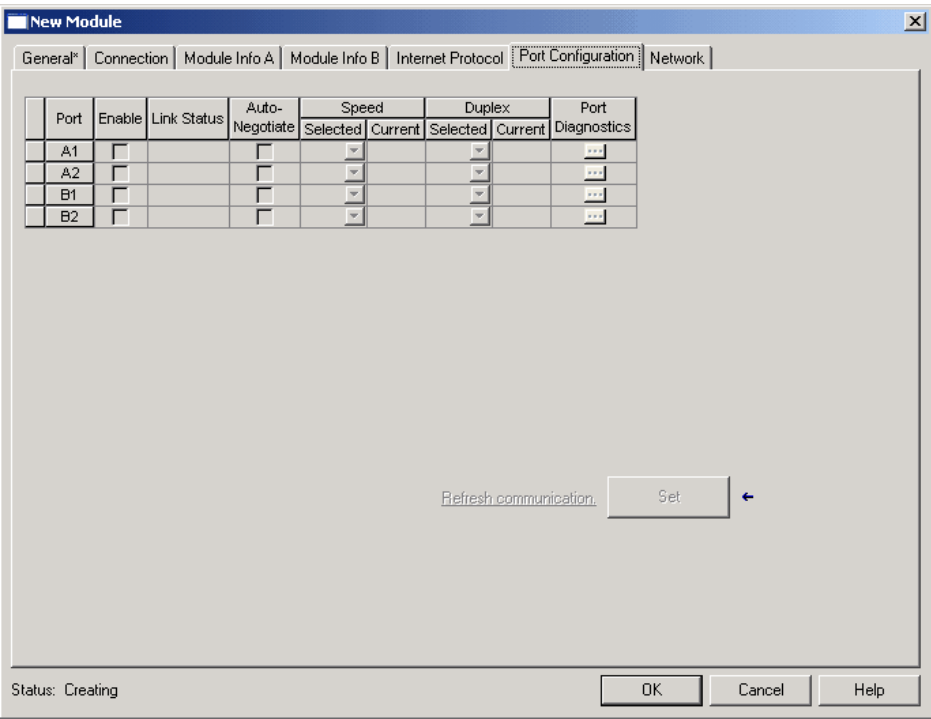


Table 26 - Port Configuration Parameters

Parameters	Description
Port	Displays the name of the port.
Enable	Displays the enabled state of the port or check to enable the port.
Link Status	Displays the link status of the port as Inactive (port is inactive) or Active (port is active).
Auto-Negotiate	Displays the port's auto-negotiate status. • Check Auto-Negotiate to enable the module to negotiate the speed and duplex of the port automatically. • Uncheck Auto-Negotiate to set the speed and duplex of the port manually. • Auto-Negotiate appears dimmed and checked when the port and duplex of the module cannot be specified manually. • Auto-Negotiate appears dimmed and unchecked when the module specifies the speed and duplex of the port.
Speed	Selected: Displays the selected speed of the port if Auto-Negotiate is unchecked. Valid speeds are: • 10 Mbps • 100 Mbps Current: Displays the current speed of the port.
Duplex	Selected: Displays the selected duplex of the port if Auto-Negotiate is unchecked. Valid duplexes are: • Half • Full Current: Displays the current duplex of the port.
Port Diagnostics	Use the Port Diagnostics tab to view diagnostic information for the port. Various communications diagnostic information is available. For each physical Ethernet port, this includes link status, duplex setting, speed and auto-negotiation status, and CIP™ diagnostic information.
Refresh communication	This link appears when communication with the module has failed. Click Refresh communication to attempt to restart communication with the module.
Set	After you modify the Auto-Negotiate state of the port, Selected Speed, or Selected Duplex configuration values, a reset module message displays if the module must be reset before the modifications take effect. Clicking reset module initiates a reset operation on the module, which returns the module to its power-up state by emulating the cycling of power. The Reset Operation also causes the changes that are made to Auto-Negotiate, Selected Speed, and Selected Duplex to become the current settings of the port.

11. Click the Network tab and set network parameters.

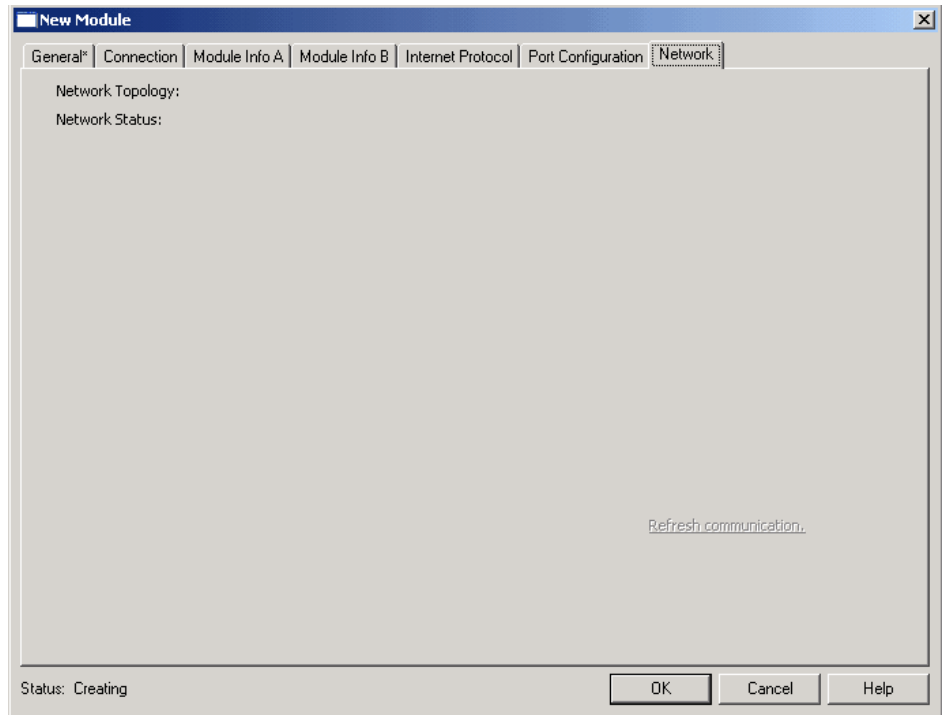
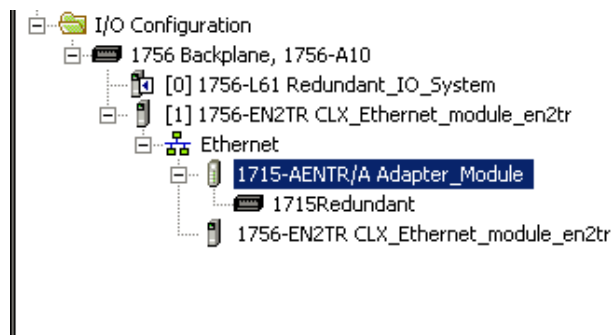


Table 27 - Network Parameters

Parameters	Description
Network Topology	Displays the current network topology as either: • Linear/Star, or • Ring
Network Status	Displays the current network status as: • Normal • Ring Fault, or • Unexpected Loop Detected
Refresh communication	This link appears when communication with the module has failed. Click Refresh communication to attempt to restart communication with the module.

12. Click OK.

The I/O Configuration folder of your project now looks similar to this.



Obtaining System Status

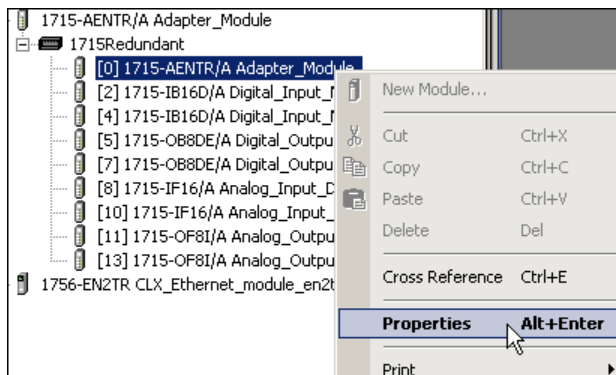
There are two ways to access the status of the primary and secondary adapters:

- Via the module properties while online with the application
- Via the tags in the owner controller

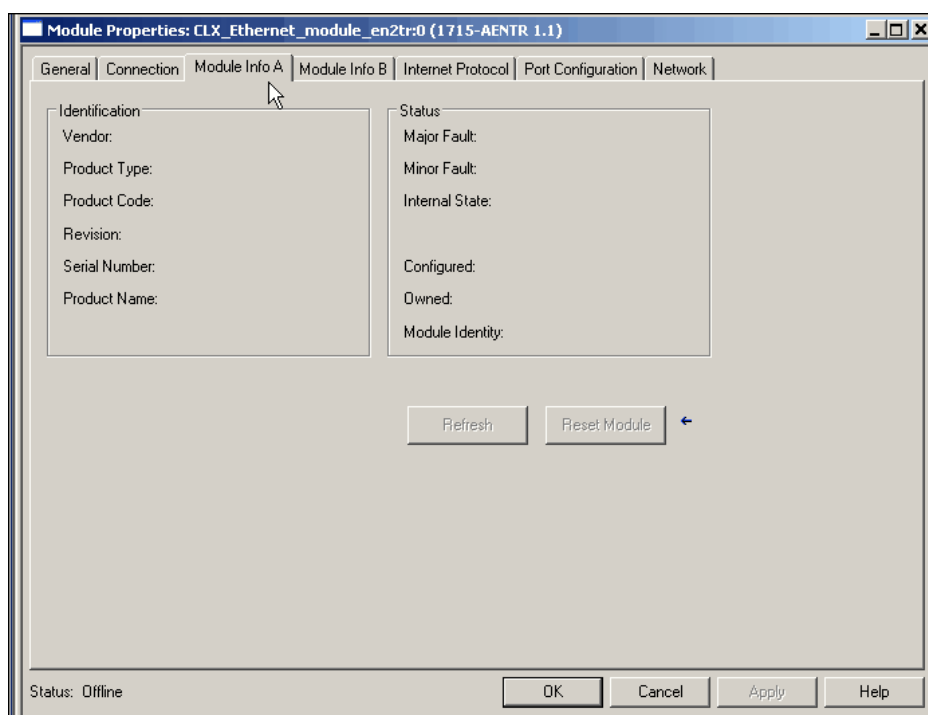
Check Adapter Status While Online

To check the status of the primary and secondary adapters while online, follow these steps.

1. In the application, from the I/O Configuration tree, right-click the 1715 adapter and choose Properties.



The Module Properties dialog box appears.

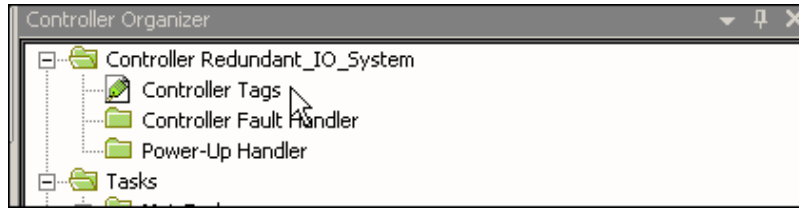


2. Click the Module Info A or Module Info B tabs to display adapter status information.

Check Adapter Status via the Owner Controller Tags

To check the status of the primary and secondary adapters through the owner controller tags, follow these steps.

1. Go online with the controller.
2. Double-click the Controller Tags folder in the Controller Organizer.



The Controller Tags window appears.

Adapter Status tag →

[-] Adapter_Module:S	{...}	{...}		AB:1715_AENTR:S:0
[+] Adapter_Module:S.Fault	2#0000_000...		Binary	DINT
[-] Adapter_Module:S.ModA4Fault	0		Decimal	BOOL
[-] Adapter_Module:S.ModB4Fault	0		Decimal	BOOL
[-] Adapter_Module:S.Power1Fault	0		Decimal	BOOL
[-] Adapter_Module:S.Power2Fault	0		Decimal	BOOL
[-] Adapter_Module:S.PortA1Connected	0		Decimal	BOOL
[-] Adapter_Module:S.PortA2Connected	0		Decimal	BOOL
[-] Adapter_Module:S.PortB1Connected	0		Decimal	BOOL
[-] Adapter_Module:S.PortB2Connected	0		Decimal	BOOL
[-] Adapter_Module:S.PortA1FullDuplex	0		Decimal	BOOL
[-] Adapter_Module:S.PortA2FullDuplex	0		Decimal	BOOL
[-] Adapter_Module:S.PortB1FullDuplex	0		Decimal	BOOL
[-] Adapter_Module:S.PortB2FullDuplex	0		Decimal	BOOL
[+] Adapter_Module:S.PortA1Autonegotia...	2#0000_0000		Binary	SINT
[+] Adapter_Module:S.PortA2Autonegotia...	2#0000_0000		Binary	SINT
[+] Adapter_Module:S.PortB1Autonegotia...	2#0000_0000		Binary	SINT
[+] Adapter_Module:S.PortB2Autonegotia...	2#0000_0000		Binary	SINT
[+] Adapter_Module:S.PortA1Speed	0		Decimal	DINT
[+] Adapter_Module:S.PortA2Speed	0		Decimal	DINT
[+] Adapter_Module:S.PortB1Speed	0		Decimal	DINT
[+] Adapter_Module:S.PortB2Speed	0		Decimal	DINT
[+] Adapter_Module:S.CIPTimeouts	2#0000_000...		Binary	DINT
[+] Adapter_Module:S.CIPConnections	2#0000_000...		Binary	DINT
[+] Adapter_Module:S.CIPLostPackets	2#0000_000...		Binary	DINT
[+] Adapter_Module:S.TCPCConnections	2#0000_000...		Binary	DINT

3. Locate the adapter status tag.

The adapter status tag name is followed by ‘:S.’

4. Expand the twisty for the adapter status tag to view the status information for the primary and secondary adapters.

1715-IB16D Digital Input Module

Add the Digital Input Module to the Project

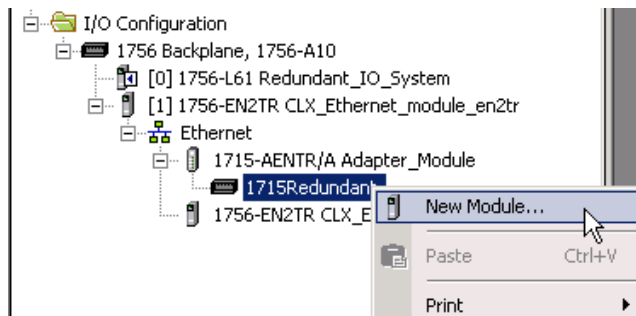
Once the 1715-AENTR adapter is configured in the project, you are ready to add I/O modules to the project. In this section, you do the following:

- Add a 1715-IB16D digital input module in Duplex mode to the project.
- Add a 1715-IB16D digital input module in Simplex mode to the project.

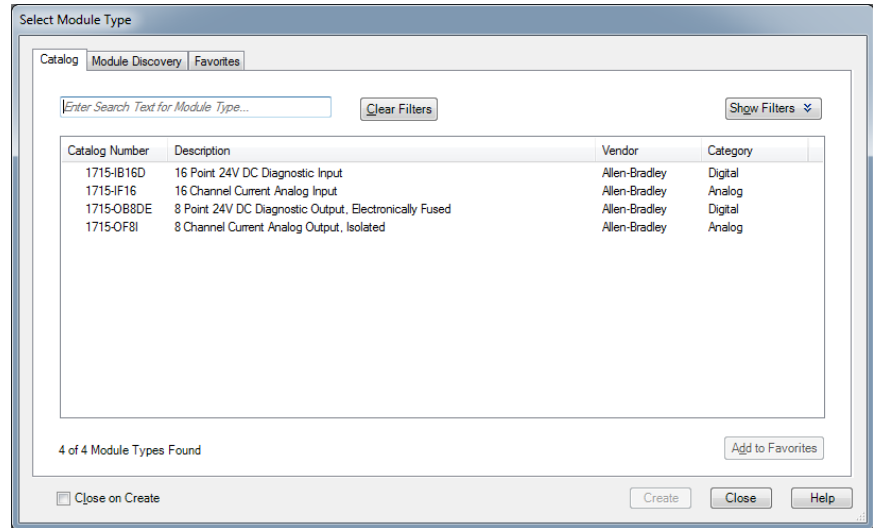
Depending on which configuration you choose, you can skip the steps that do not apply.

Step 1: Add the Digital Input Module in Duplex Mode

1. To add a 1715-IB16D Digital Input module in Duplex mode to the project, right-click the 1715-AENTR adapter and choose New Module.



The Select Module dialog box appears.



2. Expand the Digital module list, select the 1715-IB16D module, and click OK.

3. On the General tab, complete the general parameters.

New Module

General* Connection Module Info A Module Info B Configuration

Type: 1715-IB16D 16 Point 24V DC Diagnostic Input
 Vendor: Rockwell Automation/Allen-Bradley
 Parent: AENTR_20
 Name: IB16D_D22 Module A 22 Module B 23
 Description:

Module Definition

Revision: 4.011 Change ...
 Electronic Keying: Compatible Module
 Connection: Data
 Redundant: Yes
 SIL2 Safety: No

Status: Creating OK Cancel Help

Table 28 - General Parameters for the Digital Input Module in Duplex Mode

Parameters	Description
Type	Displays the type and description of the module being created (read-only).
Vendor	Displays the vendor of the module being created (read-only).
Parent	Displays the name of the parent module (read-only).
Name	Enter the name of the module.
Description	Enter a description for the module here, up to 128 characters. You can use any printable character in this field. If you exceed the maximum length, the software ignores any extra characters.
Slot A	Choose the slot number in which the module resides.
Slot B	When your module is configured for duplex, the slot number in which the redundant module resides is displayed. When configured for duplex, the Slot B field is shown for reference only.
Change	Click Change to access the Module Definition dialog box. From the Module Definition dialog box, you can change the values that define the module definition, Electronic Keying, and Minor Revision.

- Click Change.
- On the Module Definition dialog box, complete the module parameters.

Module Definition

Series:

A

Revision:

4

011

Electronic Keying:

Compatible Module

Connection:

Data

Redundant:

Yes

SIL2 Safety:

No

OK

Cancel

Help

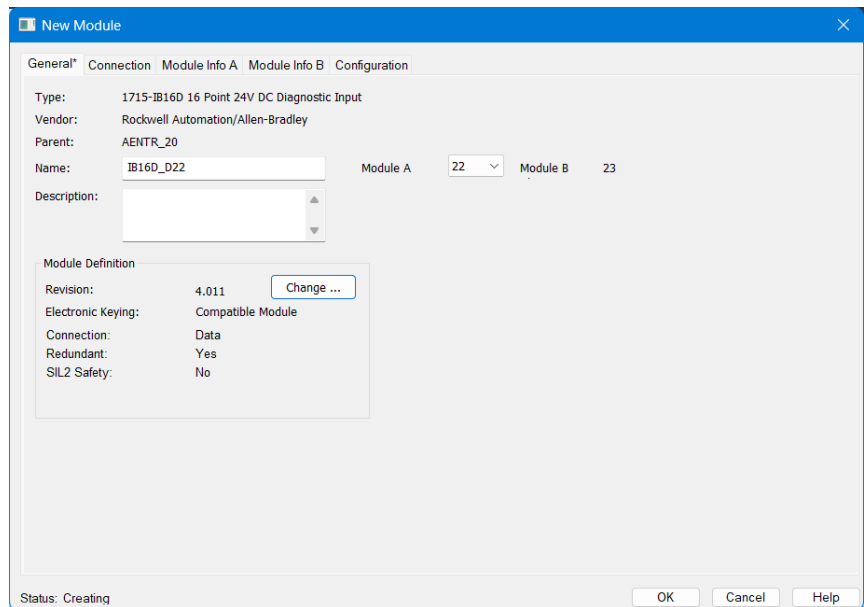
Table 29 - Module Definition Parameters for Digital Input Module Duplex Mode

Parameters	Description
Series	Choose the Series of the module. Only the series that the module supports are displayed.
Revision	Major: Choose the Revision of the module. Minor: Sets the minor revision of the module. The valid range is 1...255. This field is enabled while offline, and while in the Program, Remote Program, and Remote Run modes. For SIL 2 applications, choose version 4.011 or later for 1715 I/O modules.
Electronic Keying	Choose the Electronic Keying that you wish to use for the selected module. Valid values are Compatible Module (default), Exact Match, or Disable Keying. See Electronic Keying on page 102 .
Connection	Leave as 'Data' - Listen Only is not supported.
Redundant	Yes for Duplex mode. No for Simplex mode.
SIL 2 Safety	Choose No if SIL 2 operation is not required. Choose Yes to enable SIL 2 operation. The safety pull-down menu appears only if using AOP version 2.01.007 or later. Two new tabs are available for a SIL 2 configuration if you choose Yes. For information on SIL 2 configuration, see the Using ControlLogix in SIL 2 Applications Safety Reference Manual, publication 1756-RM001 .

6. Click OK.
7. On the Module Properties dialog box, verify Redundant is Yes for Duplex mode.

Note the additional module slot on the Module Properties dialog box.

 See Online Help in the application for more information on how to set Module Definition parameters.

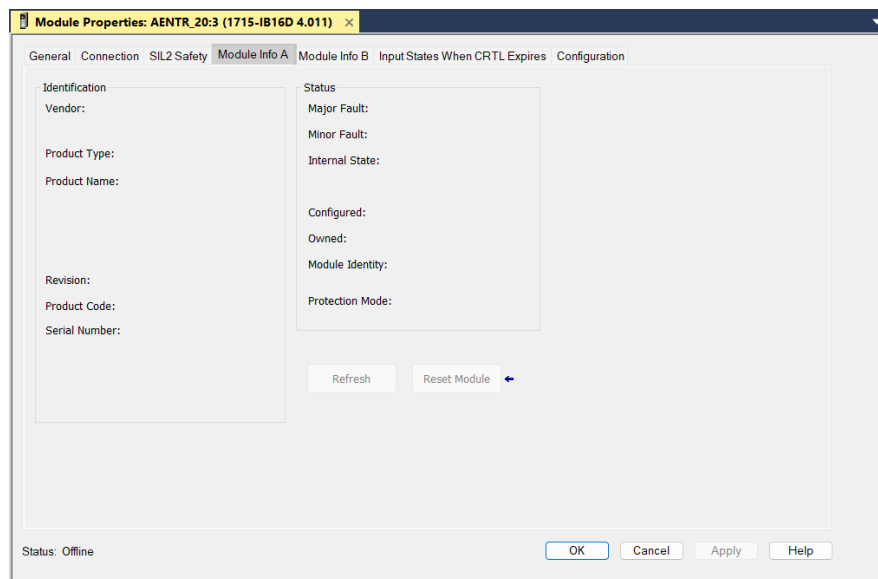


8. Click OK.
9. Click the Connection tab.

See [page 174](#).

10. Click the Module Info A tab.

The Module Info A tab appears.



See [page 175](#) for a definition of parameters on the Module Info A tab.

11. Click the Module Info B tab.

The Module Info B tab appears. You set the parameters for Module B the same way as Module A. See [page 176](#).

12. Click the Configuration tab.

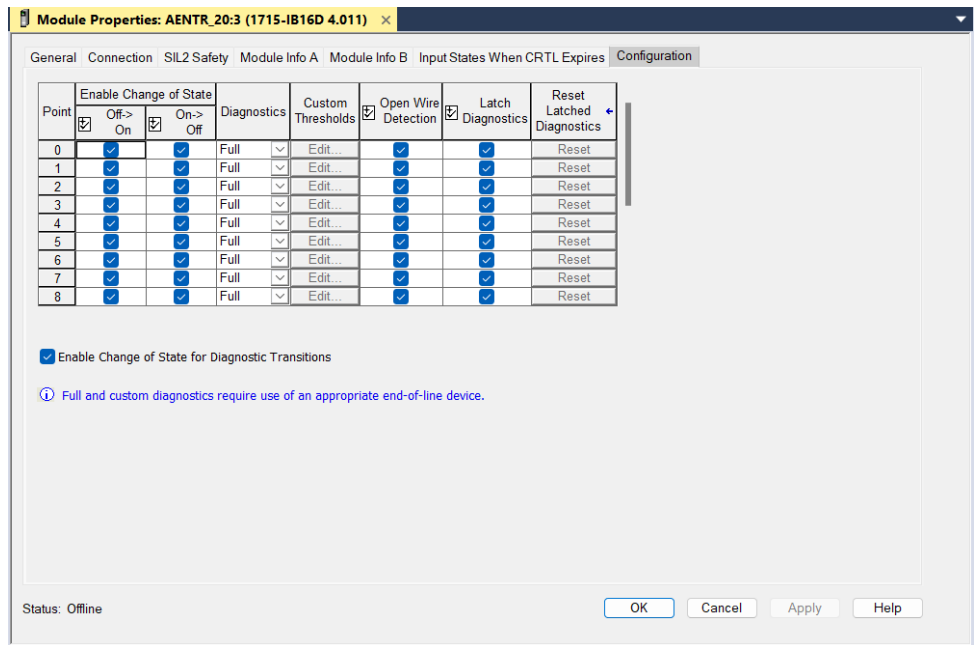


Table 30 - Configuration Parameters for Duplex Mode

Parameters	Description
Point	Click the point number to configure parameters for the specified point (0...15).
Enable Change of State	Check which points trigger production of data on Change of State. If the box is checked, Change of State is enabled for a particular state transition that by the column header indicates. If the box is unchecked, Change of State is disabled. Enable Change of State appears dimmed only when in Hard Run mode (0...15).
Diagnostics	Choose from the following three pre-selected threshold types for each point: - Full – Thresholds are used that work with the Rockwell Automation preferred end-of-line devices to support open-wire and short circuit protection and diagnostics. - None – Thresholds are used that are appropriate for use with no end-of-line device. This option does not support open-wire and short circuit protection and diagnostics. - Custom – You provide the thresholds. The default matches the Full thresholds.
Custom Thresholds	Click Edit to display the Edit Custom Thresholds dialog box and edit thresholds for the selected point. When offline or online (including Hard Run mode), the Edit button is enabled when the Custom diagnostics type is selected for a point and dimmed when the Full or None diagnostic types are selected. When the Custom diagnostic type is selected, the default matches the Full thresholds.
Open Wire Detection	Select if the thresholds allow for open wire detection (for example, if the threshold 2 value is not 0). By default, the header checkbox is selected and all points (0...15) are selected. If the header checkbox is cleared, all points (0...15) are cleared. To select open wire detection for a specific point, check the checkbox in the appropriate row for that point. To clear open wire detection for a specific point, clear the checkbox in the appropriate row for that point.
Latch Diagnostics	Select if line fault alarms are latched until reset (including Open Wire Detection and Short Circuit detection). By default, the header checkbox is selected and all points (0...15) are selected. If the header checkbox is cleared, all points (0...15) are cleared.

Table 30 - Configuration Parameters for Duplex Mode

Parameters	Description
Reset Latch Diagnostics	Click Reset to reset the diagnostic latch serviced.
Enable Change of State for Diagnostic Transitions	Select whether Change of State is enabled when any diagnostic event occurs.
Full And Custom Diagnostics Require Use Of An Appropriate End-of-line Device	Specifies that a custom end device must be used when using full or custom diagnostics.

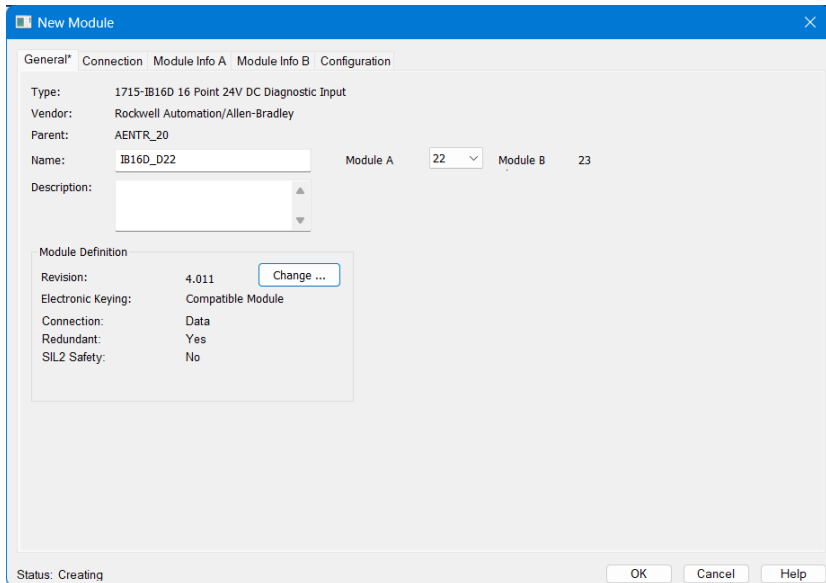
13. Click OK.

Step 2: Add the Digital Input Module in Simplex Mode

To add a 1715-IB16D Digital Input module in Simplex mode to the project, follow these steps.

1. Add the new module, see [page 182](#).
2. Select the 1715-IB16D Digital Input module, see [page 182](#), and click OK.

The General tab appears.



3. Enter the module name.

Notice that there are still two slot numbers that are displayed, indicating that the module is in the default Duplex mode.

4. Click Change.

The Module Definition dialog box appears.

Module Definition

Series:

A

Revision:

4

011

Electronic Keying:

Compatible Module

Connection:

Data

Redundant:

Yes

SIL2 Safety:

No

OK

Cancel

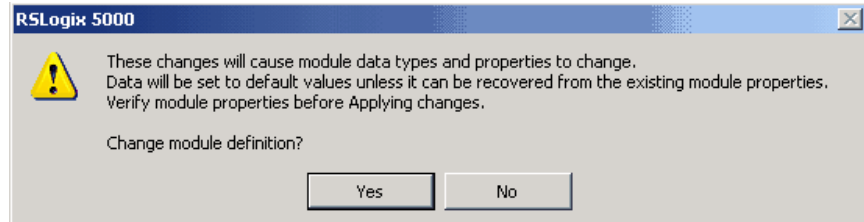
Help

5. Change the module default from Redundant= Yes to Redundant=No to run the module in Simplex mode.

See [page 183](#) for more setup information.

6. Click OK.

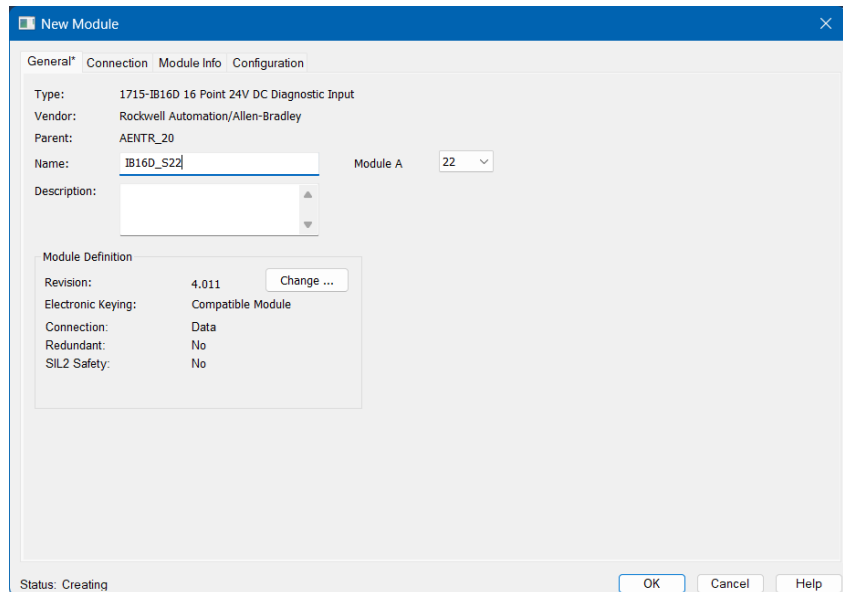
A Verify Module Properties dialog box appears



7. Click Yes.

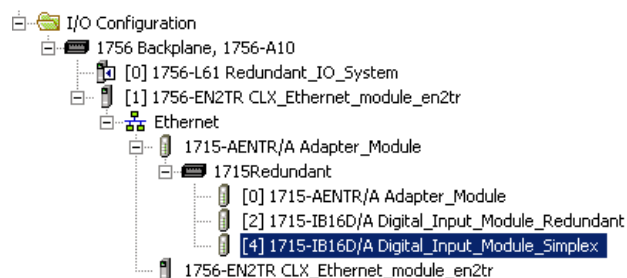
A new General tab appears in Simplex mode.

Notice there is now only one slot number that is displayed and Redundant now is 'No'.



8. Click the Connection tab, see [page 174](#).
9. Click the Module Info tab, see [page 175](#).
10. Click the Configuration tab, see [page 185](#).
11. Click OK.

The I/O Configuration folder of your project now looks similar to this.



1715-OB8DE Digital Output Module

Add the Digital Output Module to the Project

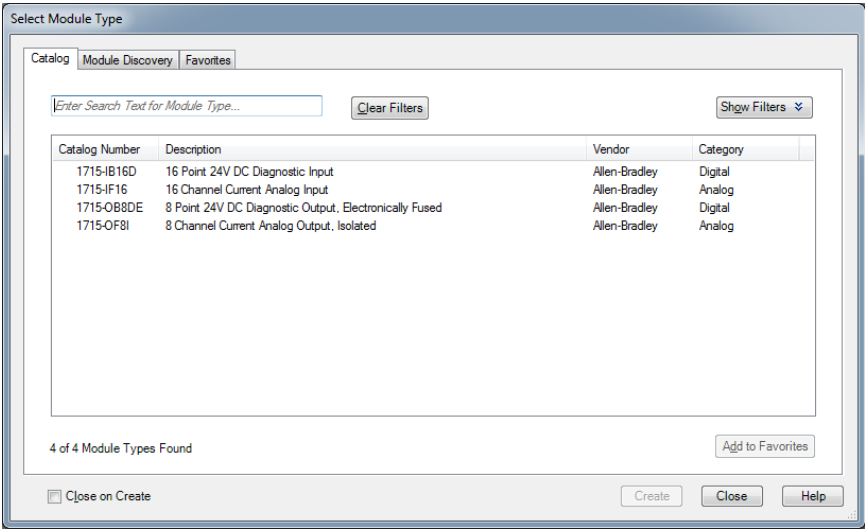
In this section, you do the following:

- Add a 1715-OB8DE digital output module in Duplex mode to the project.
- Add a 1715-OB8DE digital output module in Simplex mode to the project.

Step 1: Add the Digital Output Module in Duplex Mode

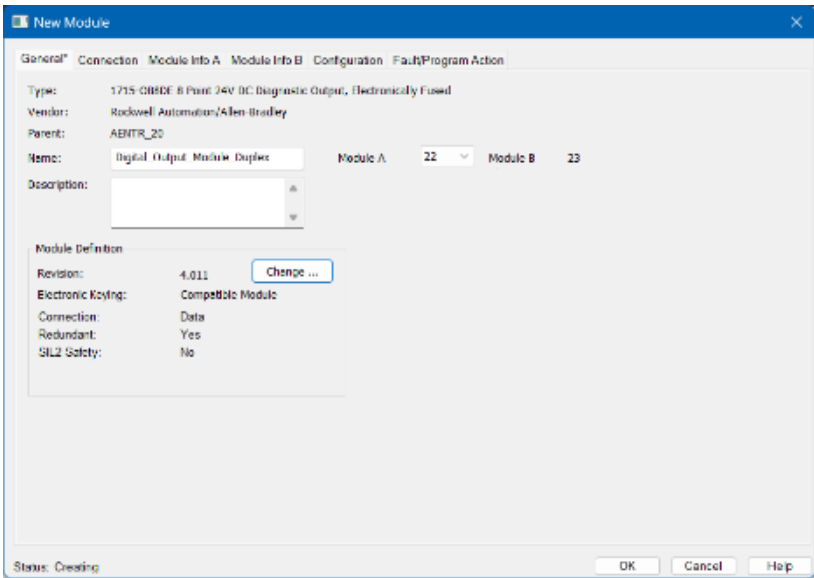
1. To add a new 1715-OB8DE digital output module in Duplex mode to the project, right-click the 1715-AENTR adapter and choose New Module.

The Select Module dialog box appears.



2. Expand the Digital module list and select the 1715-OB8DE module, and click OK.

The General tab appears.



3. Enter the parameters.

They are similar to the settings on [page 182](#).

4. Click Change.
5. Enter the parameters, see [page 183](#).
6. Click OK.
7. Click the Connection tab, see [page 174](#).
8. Click the Module Info A tab, see [page 175](#).
9. Click the Module Info B tab, see [page 175](#).
10. Click the Configuration tab.

The Configuration tab appears.

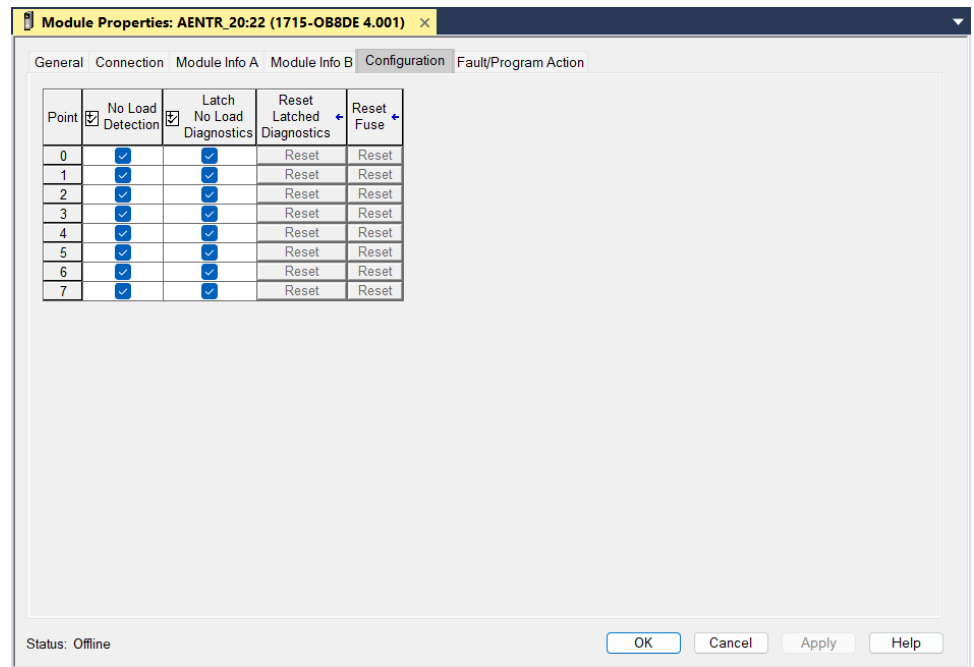


Table 31 - Configuration Parameters for Digital Output Module in Duplex Mode

Parameters	Description
Point	Click the point number to configure parameters for the specified point (0...7).
No Load Detection	By default, the header checkbox is selected and all points (0...7) are selected. If the header checkbox is cleared, all points (0...7) are cleared. To specify no load detection for a specific point, check the checkbox in the appropriate row for that point. To clear no load detection for a specific point, clear the checkbox in the appropriate row for that point.
Latch No Load Diagnostics	Choose if load fault alarms are latched until reset (including Open Wire Detection and Short Circuit detection). By default, the header checkbox is selected and all points (0...7) are selected. If the header checkbox is cleared, all points (0...7) are cleared. To select load fault alarms are latched until reset for a specific point, check the checkbox in the appropriate row for that point. To clear load fault alarms are latched until reset for a specific point, clear the checkbox in the appropriate row for that point.
Reset Latched Diagnostics	Click Reset to reset the diagnostic latch service. When online and in Program mode, Remote Program mode, Run mode, the Reset button is enabled for a point. When offline, the Reset button is dimmed for a point.
Reset Fuse	Click Reset to reset the fuse reset short/overload service. When online and in Program mode, Remote Program mode, Run mode, the Reset button is enabled for a point. When offline, the Reset button is dimmed for all points.

11. Click the Fault/Program Action tab.

The Fault/Program Action tab appears.

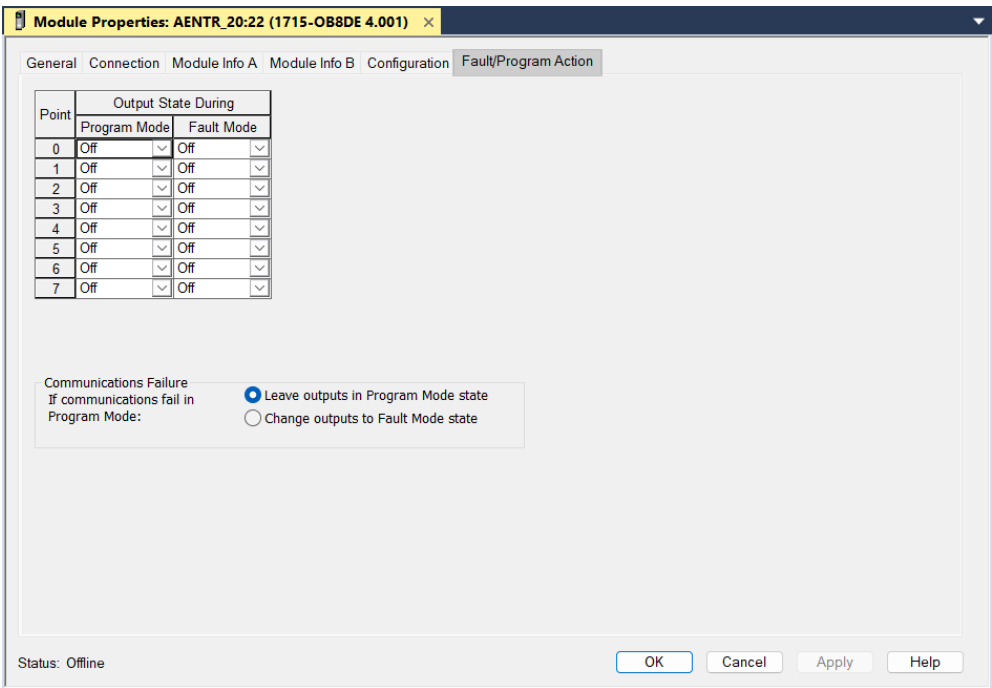


Table 32 - Fault/Program Action Parameters

Parameters	Description		
Point	Click the point number to configure parameters for the specified point (0...7).		
Output State During		This value	Indicates the following controller tag settings
	Program mode	• On	ProgMode = 0 ProgValue = 1
		• Off	ProgMode = 0 ProgValue = 0
		• Hold	ProgMode = 1 ProgValue = The value previously set.
	Fault mode	• On	FaultMode = 0 FaultValue = 1
		• Off	FaultMode = 0 FaultValue = 0
• Hold		FaultMode = 1 FaultValue = The value previously set.	
Communication Failure If Communication Fail in Program Mode	Specify the action to take when communication fail in Program mode. Choose one of the following: • Leave outputs in Program mode state – When selected, lets you maintain outputs in the Program mode state (default). When cleared, changes outputs to the Fault mode state. Leave outputs in Program mode state appears dimmed only when in Hard Run mode. • Change outputs to Fault mode state – When selected, lets you change outputs to the Fault mode state. When cleared, changes outputs to the Program mode state. Change outputs to Fault mode state appears dimmed only when in Hard Run mode.		

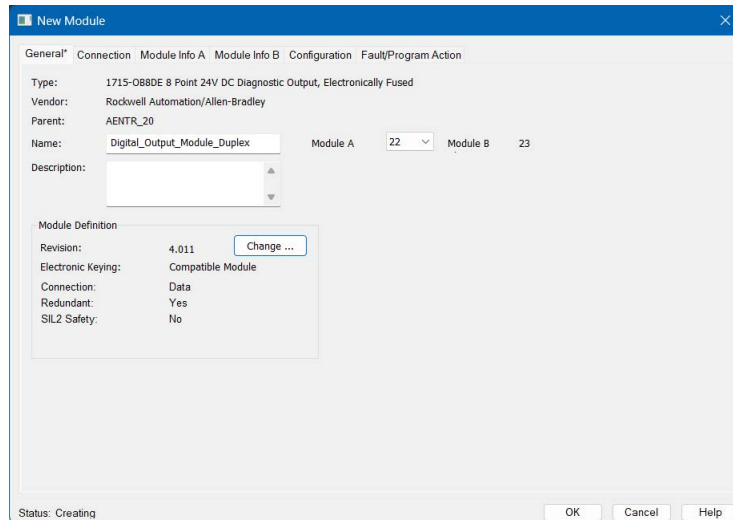
12. Click OK.

Step 2: Add the Digital Output Module in Simplex Mode

Add a 1715-IB16D Digital Input module in Simplex mode to the project.

1. Add the new module, see [page 182](#).
2. Select the 1715-OB8DE Digital Output module, see [page 182](#), and click OK.

The General tab appears.

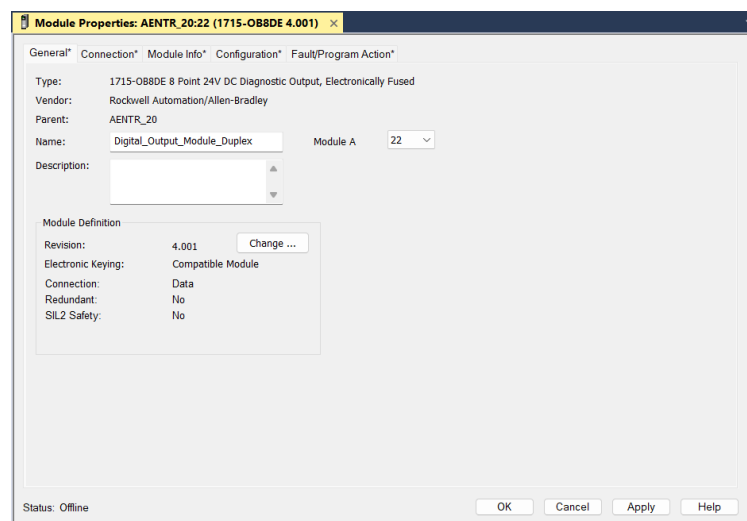


3. Enter the module name.

Notice that there are still two slot numbers that are displayed, indicating that the module is in the default Duplex mode.

4. Click Change, see [step 6 and step 7 on page 189](#), and [step 8 on page 189](#).

A new General tab appears in Simplex mode.

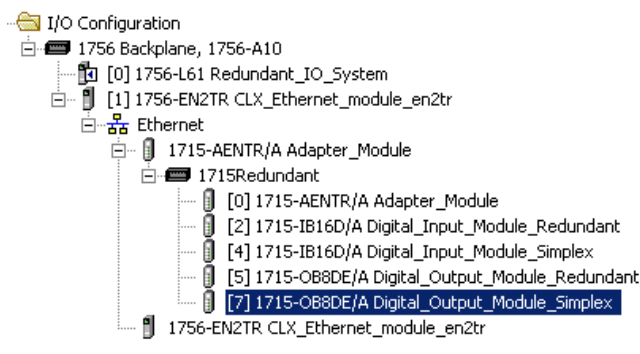


Notice there is now only one slot number available and Redundant is 'No', indicating that the module is now in Simplex mode.

5. Click the Connection tab, see [page 174](#).

6. Click the Module Info tab, see [page 175](#).
7. Click the Configuration tab, see [page 191](#).
8. Click the Fault/Program Action tab, see [page 192](#).
9. Click OK.

The I/O configuration folder of your project now looks similar to this.



1715-IF16 Analog Input Module

Add the Analog Input Module to the Project

In this section, you do the following:

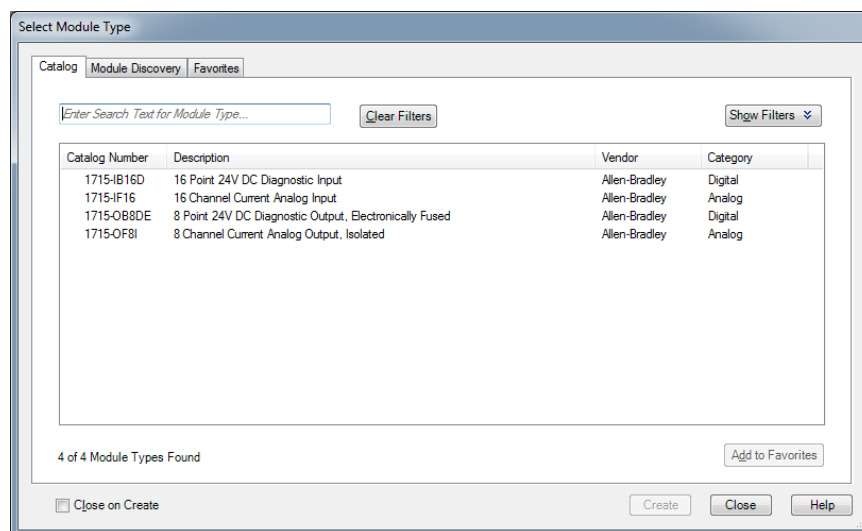
- Add a 1715-IF16 analog input module in Duplex mode to the project.
- Add a 1715-IF16 analog input module in Simplex mode to the project.

Step 1: Add the Analog Input Module in Duplex Mode

Add a 1715-IF16 Analog Input module in Duplex mode to the project.

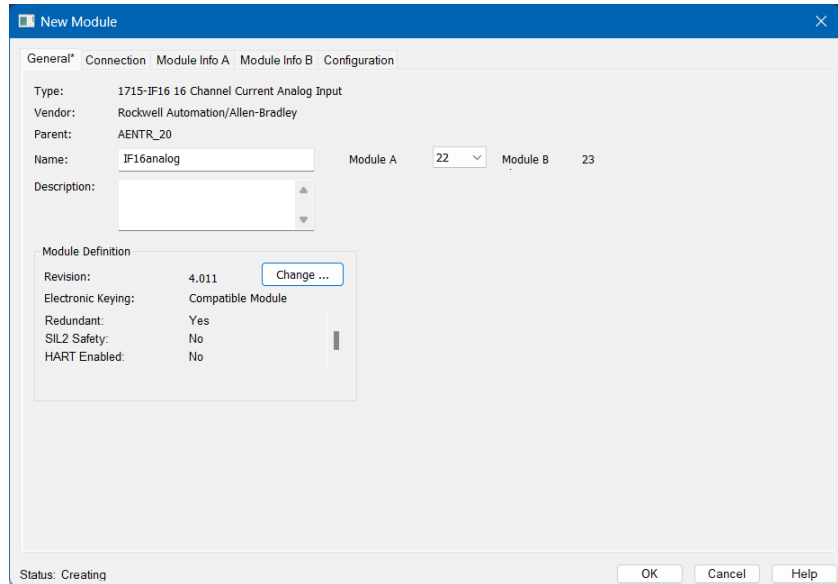
1. Add the new module, see [page 182](#).

The Select Module dialog box appears.



- Expand the Analog module list, select the 1715-IF16 module, and click OK.

The General tab appears.



See figure on [page 182](#) for detailed parameter information for the General tab.

- Click Change.

The Module Definition dialog box appears.

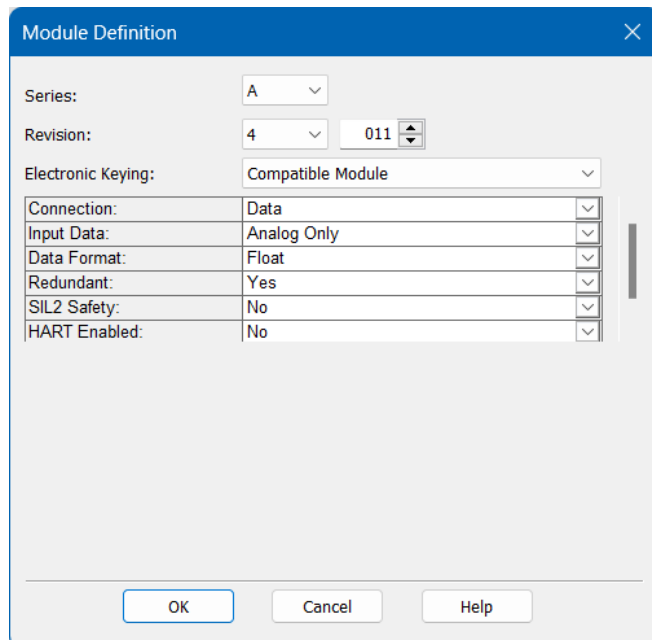


Table 33 - Module Definition Parameters for Analog Input Module

Parameters	Description
Series	Choose the Series of the module.
Revision	Choose the Revision of the module. For SIL 2 applications, choose version 4.011 or later for 1715 I/O modules.
Electronic Keying	Choose the Electronic Keying that you wish to use for the selected module. See Electronic Keying on page 102.
Connection	Leave as 'Data' - Listen Only is not supported.
Input Data	Display Only.
Data Format	Display Only.
Redundant	Yes indicates Duplex mode.
SIL 2 Safety	Choose No if SIL 2 operation is not required. Choose Yes to enable SIL 2 operation. The safety pull-down menu appears only if using AOP version 2.01.007 or later. Two new tabs are available for SIL 2 configuration if you choose Yes. For information on SIL 2 configuration, see the Using ControlLogix in SIL 2 Applications Safety Reference Manual, publication 1756-RM001 .

4. Click OK.
5. Click the Connection tab, see [page 174](#).
6. Click the Module Info A tab, see [page 175](#).
7. Click the Module Info B tab, see [page 176](#).
8. Click the Configuration tab.

The Configuration tab appears.

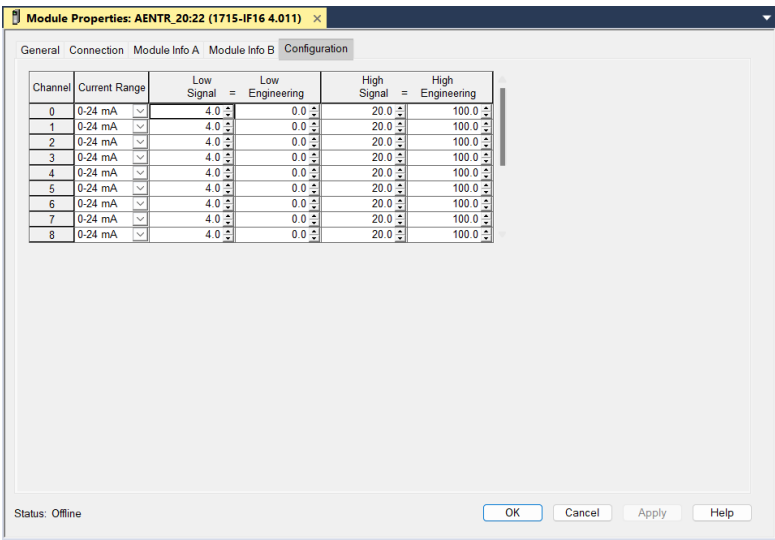


Table 34 - Configuration Parameters for the Analog Input Duplex Module

Parameters	Description
Channel	Displays the channel number.
Current Range	Displays the current range (0...20 mA) for the channel. This field is read-only.
Low Signal	Enter the Low Signal value for the channel (between 0.0...20.0 mA). The default is 4.0 mA. This value must be less than the High Signal value. Low Signal and Low Engineering values are shown in pairs.

Table 34 - Configuration Parameters for the Analog Input Duplex Module

Parameters	Description
Low Engineering	Enter the Low Engineering value for the channel (between -9999999...+99999999). The default is 0.0. Low Signal and Low Engineering values are shown in pairs.
High Signal	Enter the High Signal value for the channel (between 0.0...20.0 mA). The default is 20.0 mA. This value must be greater than the Low Signal value. High Signal and High Engineering values are shown in pairs.
High Engineering	Enter the High Engineering value for the channel (between -9999999...+99999999). The default is 100.0. High Signal and High Engineering values are shown in pairs.

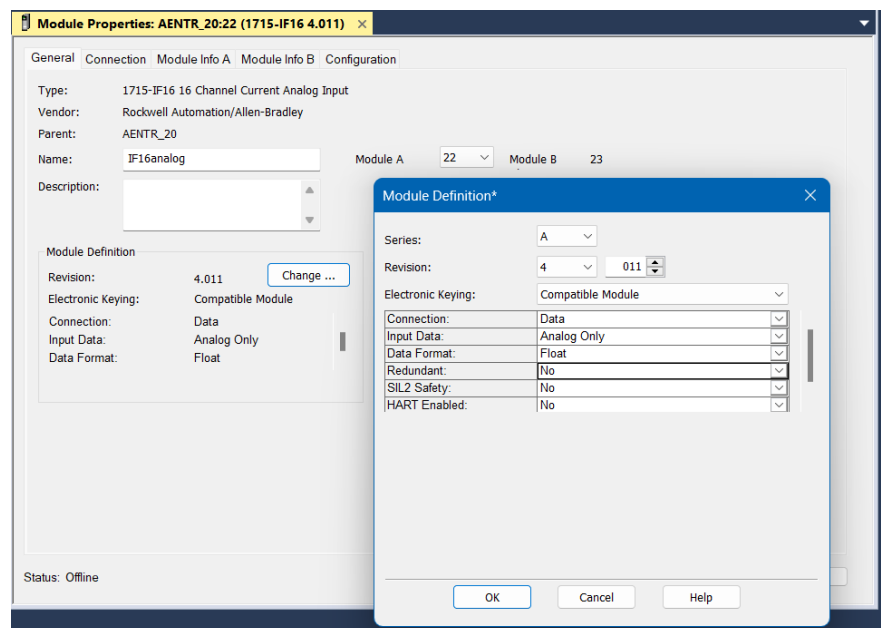
9. Click OK.

Step 2: Add the Analog Input Module in Simplex Mode

Add a 1715-IF16 Analog Input module in Simplex mode to the project.

1. Add the new module, see [page 182](#).
2. Select the 1715-IF16 module, see [step 2](#) on [page 195](#).

The General tab appears.



See [Figure on page 183](#) for General parameter settings.

3. Click Change.

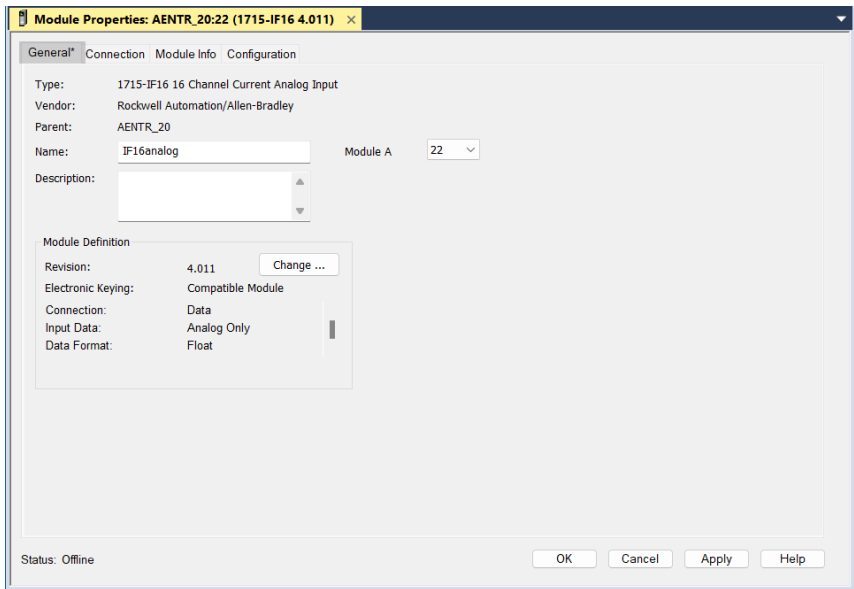
See [Figure on page 195](#) for Module Definition parameter settings.

4. Change Redundant to No to place the module in Simplex mode.
5. Click OK.

The Verify Module Properties dialog box appears. See [page 189](#).

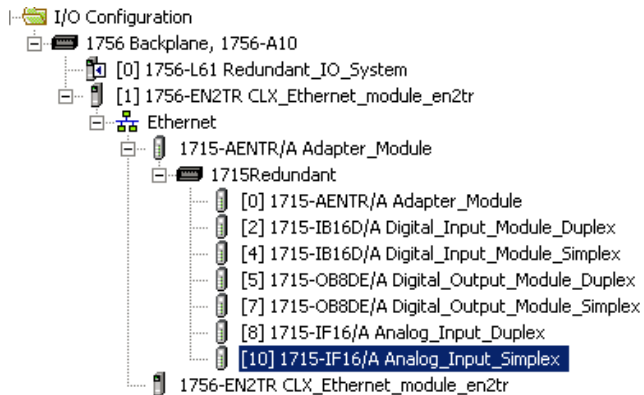
6. Click Yes.

A new General tab appears showing only one slot as available. The module is now in Simplex mode.



7. Click the Connection tab, see [page 174](#).
8. Click the Module Info A tab, see [page 175](#).
9. Click the Configuration tab, see [page 196](#).
10. Click OK.

The I/O configuration folder of your project now looks similar to the following image.



1715-OF8I Analog Output Module

Add the Analog Output Module to the project

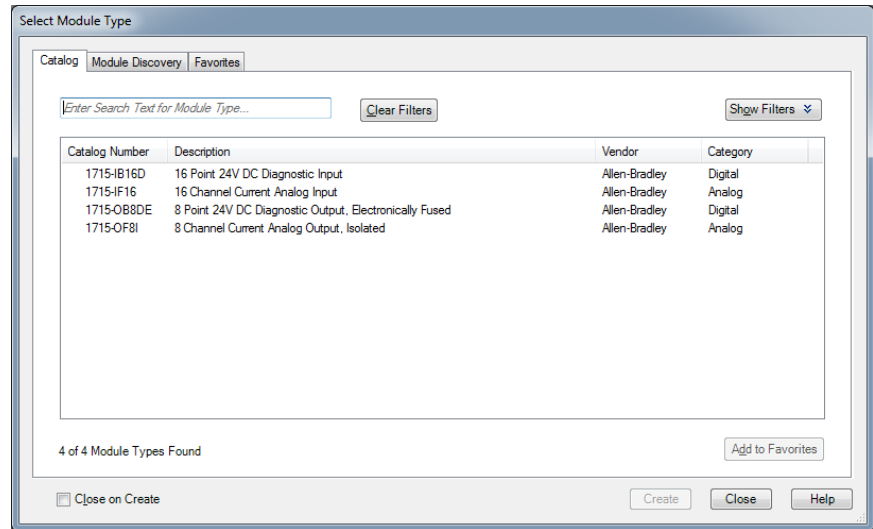
In this section, you do the following:

- Add a 1715-OF8I analog output module in Duplex mode to the project.
- Add a 1715-OF8I analog output module in Simplex mode to the project

Step 1: Add the Analog Output Module in Duplex Mode

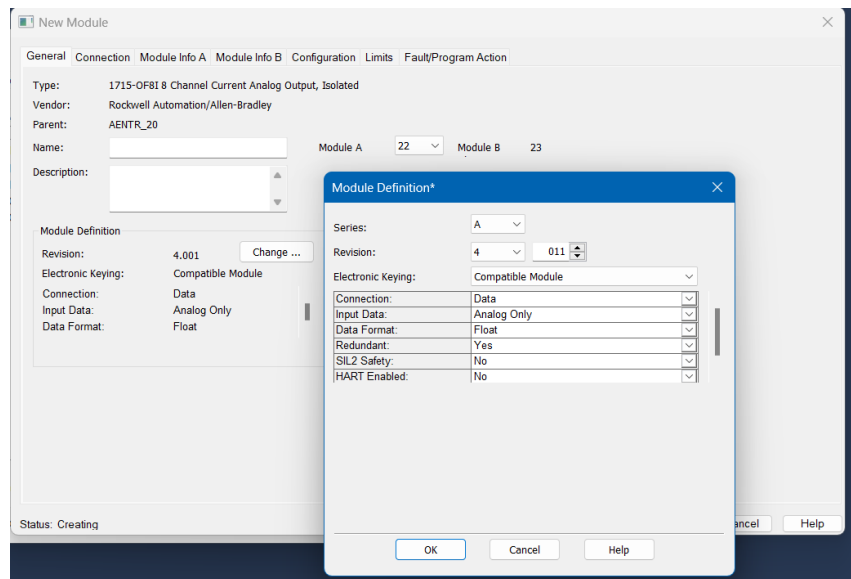
1. Add the new module, see [page 182](#).

The Select New Module dialog box appears.



2. Expand the Analog module list, select the 1715-OF8I module, and click OK.

The General tab appears.



See [page 182](#).

- 3. Click Change.
- 4. Verify that Redundant is Yes.

See [page 195](#).

- 5. Click OK.
- 6. Click the Connection tab, see [page 174](#).
- 7. Click the Module Info A tab, see [page 175](#).
- 8. Click the Module Info B tab, see [page 176](#).
- 9. Click the Configuration tab.

The Configuration tab appears.

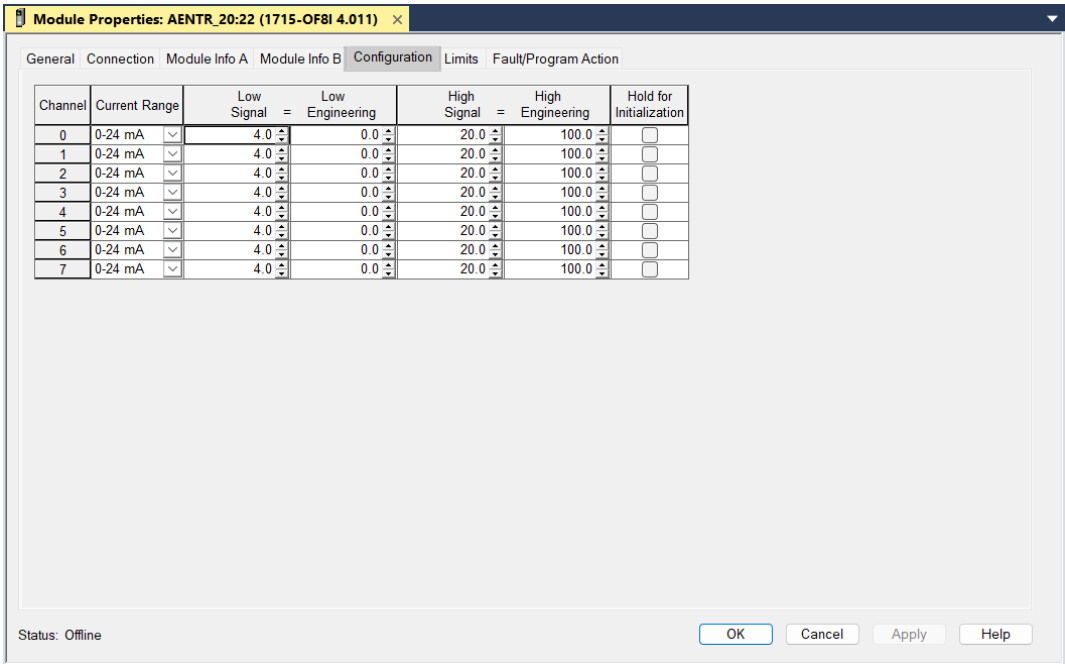


Table 35 - Analog Output Configuration Parameters Duplex Mode

Parameters	Description
Channel	Displays the channel number.
Current Range	Displays the current range (0...20 mA) for the channel. This field is read-only.
Low Signal	Check the Low Signal value for the channel (between 0.0...20.0 mA). The default is 4.0 mA. This value must be less than the High Signal value. Low Signal and Low Engineering values are shown in pairs.
Low Engineering	Check the Low Engineering value for the channel (between -9999999...+99999999). The default is 0.0. Low Signal and Low Engineering values are shown in pairs.
High Signal	Check the High Signal value for the channel (between 0.0...20.0 mA). The default is 20.0 mA. This value must be greater than the Low Signal value. High Signal and High Engineering values are shown in pairs.
High Engineering	Check the High Engineering value for the channel (between -9999999...+99999999). The default is 100.0. High Signal and High Engineering values are shown in pairs.
Hold for Initialization	Set the channel to hold, or not change, until initialized with a value within 0.1% of full scale of its current value when one of these conditions occurs: • Module initial connection (power-up) • Module transition from Program mode back to Run mode • Module re-establishes communication after fault.

10. Click the Limits tab.

The Limits Configuration tab appears.

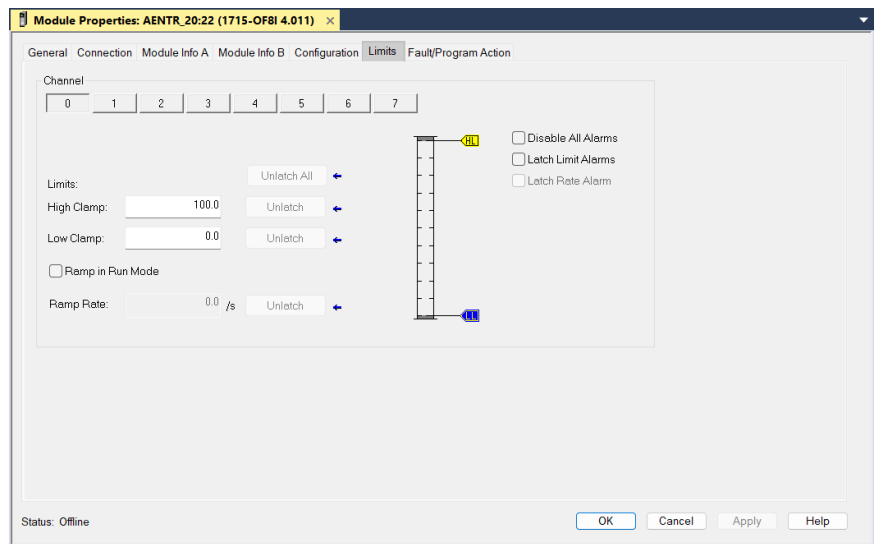


Table 36 - Limits Parameters for Analog Output Duplex Module

Parameters	Description
Channel	Displays the channel number.
High Clamp Limit	Enter a High Clamp Limit (between -9999999...+99999999). The default is 100.0000. The High Clamp Limit must be greater than the Low Clamp Limit. Any out of range value causes a profile validation error. HI appears dimmed only when in Hard Run mode.
Unlatch High Clamp Limit	Click Unlatch High Clamp Limit to send a message to the module to unlatch a High Limit Alarm (online only). Unlatch (High Clamp) is enabled when online (including Hard Run mode) and when Latch Limit Alarms is selected. Unlatch (High Clamp) is dimmed when offline and online (including Hard Run mode) when Latch Limit Alarms is cleared.
Low Clamp Limit	Enter a Low Clamp Limit (between -9999999...+99999999). The default is 0.0000. The Low Clamp Limit must be less than the High Clamp Limit. Any out of range value causes a profile validation error. LO appears dimmed only when in Hard Run mode.
Unlatch Low Clamp Limit	Click Unlatch Low Clamp Limit to send a message to the module to unlatch a Low Limit Alarm (online only). Unlatch (Low Clamp) is enabled when online (including Hard Run mode) and when Latch Limit Alarms is selected. Unlatch (Low Clamp) is dimmed when offline and online (including Hard Run mode) when Latch Limit Alarms is cleared.
Unlatch All	Click Unlatch All to send a message to the module to unlatch all latched alarms (High Limit, Low Limit, and Ramp Alarm).
Ramp in Run Mode	Check this checkbox to establish whether to limit the rate of change of the output. If selected, then changes due to command values, fault actions, and program actions are limited to the specified ramp rate.
Ramp Rate	Enter the maximum ramp rate for changes in the output value (in seconds). The default is blank, which results in an auditing error. This default forces you to enter an appropriate value.
Unlatch Ramp Rate	Click Unlatch Ramp Rate to send a message to the module to unlatch based on Ramp Rate. Unlatch (Ramp Rate) is enabled when online (including Hard Run mode) and when Latch Rate Alarm is selected. Unlatch (Low Clamp) is dimmed when offline and online (including Hard Run mode) when Latch Rate Alarm is cleared.
Disable All Alarms	Check the checkbox if you do not want to report Latch Limit and Latch Rate Alarms in the input tag. By default, Disable All Alarms is enabled and cleared.
Latch Limit Alarms	Check the checkbox if you want the High Clamp and Low Clamp Limit Alarms to be latched until a message resets them or by the use of a latch reset member of the output tag. By default, Latch Limit Alarms is enabled and cleared.
Latch Rate Alarm	Check the checkbox if you want the Rate Alarm to be latched until it is reset either by a message or by use of a latch reset member of the output tag. By default, Latch Rate Alarm is dimmed and cleared.

IMPORTANT Changing engineering scale values does not automatically adjust the Alarms/Limits. It is your responsibility to verify/re-adjust the alarm and limit values.

11. Click the Fault/Program Action tab.

The Fault/Program Action tab appears.

Module Properties: AENTR_20:22 (1715-OF8I 4.011)

General Connection Module Info A Module Info B Configuration Limits **Fault/Program Action**

Channel	Fault Mode	Fault Value	Ramp to Fault Value	Program Mode	Program Value	Ramp to Program Value	Program Mode Communication Failure Output State	Ramp Rate
0	Hold last state	0.0	☐	Hold last state	0.0	☐	Program Mode	0.0
1	Hold last state	0.0	☐	Hold last state	0.0	☐	Program Mode	0.0
2	Hold last state	0.0	☐	Hold last state	0.0	☐	Program Mode	0.0
3	Hold last state	0.0	☐	Hold last state	0.0	☐	Program Mode	0.0
4	Hold last state	0.0	☐	Hold last state	0.0	☐	Program Mode	0.0
5	Hold last state	0.0	☐	Hold last state	0.0	☐	Program Mode	0.0
6	Hold last state	0.0	☐	Hold last state	0.0	☐	Program Mode	0.0
7	Hold last state	0.0	☐	Hold last state	0.0	☐	Program Mode	0.0

Status: Offline

OK Cancel Apply Help

Table 37 - Fault/Program Action Parameters for Analog Output Duplex Module

Parameters	Description
Channel	Displays the channel number.
Fault Mode	For a channel, choose the behavior of the output channel when a communication fault occurs. Choose between Hold Last State and Use Fault Value. The default is Hold Last State.
Fault Value	Enter a fault value (between -9999999 and 99999999). The default is 0.0. Fault Value is enabled (excluding Hard Run mode) when the Fault mode is set to Use Fault Value. Fault Value is dimmed (including Hard Run mode) when the Fault mode is set to Hold Last State.
Ramp to Fault Value	Check the Ramp to Fault Value checkbox to transition the channel from the current value to the fault value (when in Fault mode and limited by Ramp Rate). The default is cleared. Ramp to Fault Value is enabled (excluding Hard Run mode) when the Fault mode is set to Use Fault Value. Ramp to Fault Value is dimmed (including Hard Run mode) when the Fault mode is set to Hold Last State.
Program Mode	For a channel, choose the behavior of the output channel when there is a transition to Program mode. Choose between Hold Last State and Use Program Value. The default is Hold Last State.
Program Value	Enter a program value (between -9999999...+99999999). The default is 0.0. Program Value is enabled (excluding Hard Run mode) when the Program mode is set to Use Program Value. Program Value is dimmed (including Hard Run mode) when the Program mode is set to Hold Last State.
Ramp to Program Value	Check the Ramp to Program Value checkbox to transition the channel from the current value to the program value (when in Program mode and limited by Ramp Rate). The default is cleared. Ramp to Program Value is enabled (excluding Hard Run mode) when the Program mode is set to Use Program Value. Ramp to Program Value is dimmed (including Hard Run mode) when the Program mode is set to Hold Last State.
Program Mode Communication Failure Output State	Choose the output state when there is communication failure in Program mode (Program mode or Fault mode). The default is Program mode.
Ramp Rate	Displays the Ramp Rate for the channel as it is displayed on the Module Properties dialog box - Limits tab (1715-OF8I). To change this value, enter a Ramp Rate value on the Module Properties dialog box - Limits tab (1715-OF8I). Ramp Rate is enabled when online in the following: • Program mode • Remote Program mode • Remote Run mode

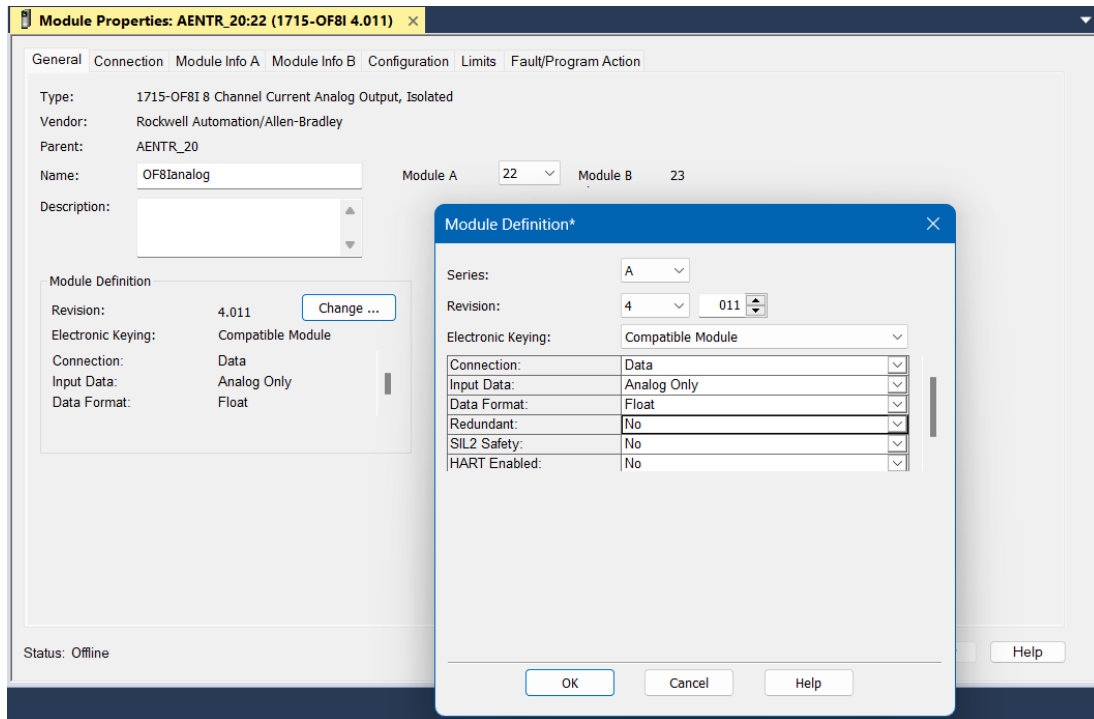
12. Click OK.

Step 2: Add the Analog Output Module in Simplex Mode

1. Add the new module, see [page 182](#).
2. Select the 1715-OF8I Analog Output Module and click OK.

See [step 2](#) on [page 199](#).

The General tab appears.



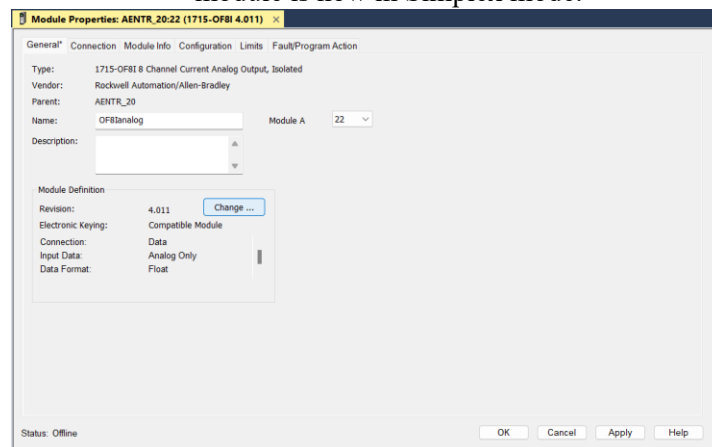
See figure on [page 182](#) for General parameter settings.

3. Click Change, referring to [Figure on page 195](#) for Module Definition parameter settings.
4. Change Redundant to No to place the module in Simplex mode.
5. Click OK.

The Verify Module Properties dialog box appears. See [page 189](#).

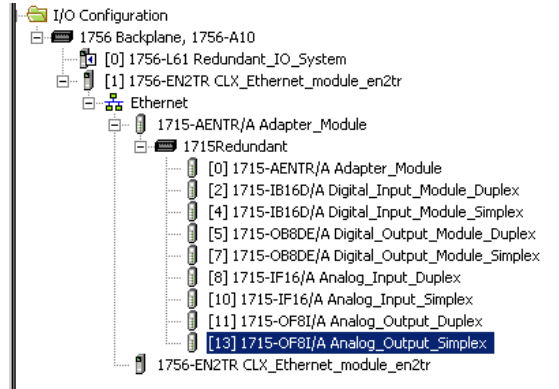
6. Click Yes.

A new General tab appears showing only one slot as available. The module is now in Simplex mode.



7. Click the Connection tab, see [page 174](#).
8. Click the Module Info tab, see [page 200](#).
9. Click the Configuration tab, see [page 200](#).
10. Click the Limits tab, see [page 201](#).
11. Click the Fault/Program Action tab, see [page 203](#).
12. Click OK.

The I/O configuration folder of your project now looks similar to the following image.



Notes:

Redundant I/O System Diagnostics

Diagnostic Features

Many of the diagnostic functions that are associated with an analog module are provided by proxy by the adapter. These tables summarize the functions for each module type.

Table 38 - 1715-AENTR Adapter Diagnostic Features

Feature	Description
Redundancy level	Duplex only.
Redundancy status	The status of each module of a duplex pair is available in the input tag.
Communication diagnostics	Various communication diagnostic information is available through the input tag. For each physical Ethernet port, diagnostics include link status, duplex setting, speed, and auto-negotiation status. For the module, diagnostics include CIP™ on EtherNet/IP™ timeout count, CIP on EtherNet/IP connection count, CIP on EtherNet/IP network lost packets count, TCP connection count, and CPU utilization.

Table 39 - 1715-IB16D Module Diagnostic Features

Feature	Description
Redundancy level	Simplex or duplex.
Redundancy status	The status of each module of a duplex pair is available in the input tag.
Change of state transport	The connection trigger for the discrete modules is change of state.
Points that trigger production	The trigger for change of state production is selectable on a point basis for values and on a module basis for diagnostics.
Open wire detection	With an appropriate end-of-line device installed and the open wire detection diagnostic enabled, a fault is indicated when an open wire condition is detected. The fault indication is reset when the open wire condition no longer exists. Open wire detection can be disabled to help prevent unused points from indicating faults.
Short circuit detection	With an appropriate end-of-line device installed and the short circuit detection diagnostic enabled, a fault is indicated when a short circuit is detected. The fault indication is reset when the short is removed.
Overload protection	User-serviceable fuses are included in the termination assembly.
Diagnostic latch	When latching is enabled, diagnostic alarms are latched until they are reset. This aids in detecting intermittent issues. For input modules, latch reset occurs only through messaging.
Configurable thresholds	To allow flexibility in the use and choice of end-of-line devices, you can select the thresholds for detection of inputs, short circuits, and open wires.

Table 40 - 1715-OB8DE Module Diagnostic Features

Feature	Description
Redundancy level	Simplex or duplex.
Redundancy status	The status of each module of a duplex pair is available in the input tag.
Change of state transport	The connection trigger for the discrete output is change of state. Data is produced when output data is consumed, or when diagnostic data changes state, or at the Requested Packet Interval. Unlike the discrete input module, change of state production cannot be disabled for the discrete output module.
No load detection	A fault is indicated when no load is detected while the output point is in the off state. No load detection can be disabled to help prevent alarms from appearing for unused points.
Short circuit detection	A fault is indicated when a short circuit/over current condition is detected. The fault indication is reset when the following occurs. 1. Point is commanded off. 2. A short reset service is sent to the module. 3. A reset is done through a bit in the output tag.

Table 40 - 1715-OB8DE Module Diagnostic Features (Continued)

Feature	Description
Diagnostic latch	When latching is enabled, diagnostic alarms are latched until they are reset. This aids in detecting intermittent issues. For output modules, latch reset can occur either through messaging or through a member of the output tag.
Fault mode	When a connection from a controller exists, and the connection is interrupted, the module outputs take on a user-selected state. This Fault mode is either Off, On or Hold Last State.
Program mode	When a connection from a controller exists, and the controller is not in Run mode, the module outputs take on a user-selected state. This Program (a.k.a. 'Idle') mode is either Off, On or Hold Last State.
Program to fault enable	When enabled, the outputs assume the fault value when a communication fault occurs while in Program mode.
Readback	The state of each output point is reflected in the input tag.

Table 41 - 1715-IF16 Module Diagnostic Features

Feature	Description
Redundancy level	Simplex or duplex.
Redundancy status	The status of each module is available in the input tag.
Input range	Fixed as 0...20 mA.
Wiring	Single-ended only.
Data format	Read-only.
Scaling	Support choice of signal and engineering range.
Underrange overrange	Diagnostic alarms are provided when the signal goes above or below what the module can detect. (Zero or less is considered underrange.)
Rolling time stamp	1 ms resolution.
Real-time sample rate	Fixed RTS.

Table 42 - 1715-OF8I Module Diagnostic Features

Feature	Description
Redundancy level	Simplex or duplex.
Redundancy status	The status of each module is available in the input tag.
Input range	Fixed as 0...20 mA.
Scaling	Support choice of signal and engineering range.
Readback	The state of each output point is reflected in the input tag.
Hold for initialization and enable	Hold for initialization causes outputs to hold present state until the value that is commanded by the controller matches the value at the output screw terminal within 0.1% of full scale, providing a bumpless transfer. A bit in the configuration tag selects whether Hold For Initialization is used. A bit in the input tag indicates when a channel is holding.
Fault mode/Fault value	When a connection from a controller exists, and the connection is interrupted, the module outputs take on a user-selected state. This Fault mode is either a user-defined value or Hold Last State.
Program module/Program value	When a connection from a controller exists, and the controller is not in Run mode, the module outputs take on a user-selected state. This Program (a.k.a. 'Idle') mode is either a user-defined value or Hold Last State.
Ramp to run	Enables ramping of the output value during Run mode between the current output level and a newly requested output. Ramping defines the maximum rate that the output is allowed to transition at, based on the configured rate by the Maximum Ramp Rate.
Ramp to program	Enables ramping to the output value to a user-defined program value. Ramping defines the maximum rate that the output is allowed to transition based on the configured Maximum Ramp Rate.
Ramp to fault	Enables ramping of the output value to a user-defined fault value. Ramping defines the maximum rate that the output is allowed to transition at based on the configured Maximum Ramp Rate.
Maximum Ramp Rate	A limit on the rate of change of the output, in engineering units (per scaling) per second. The Maximum Ramp Rate applies when any of the Ramp to Run, Ramp to Program, or Ramp to Fault features are enabled.
Ramp rate alarm	A diagnostic that is triggered when the rate of change of the output is limited by the Maximum Ramp Rate.
Ramp alarm latch	When latching is enabled, the Ramp Rate Alarm is latched and the unit is explicitly reset.
Ramp alarm unlatch	When a Ramp Rate Alarm is latched, a bit in the output image can be used to unlatch the alarm. The unlatch is triggered on a rising edge. If the change in the channel value is still limited by the Maximum Ramp Rate when the latch is attempted, the alarm remains. (A direct-to-module message can also be used to unlatch an alarm.)

Table 42 - 1715-OF8I Module Diagnostic Features

Feature	Description
Clamp limits/Clamp limit alarms	Changing limits the output from the analog module to remain within a range that the controller configures, even when the controller commands an output outside that range. When a command value exceeds a clamp limit (either above the High clamp or below the Low clamp), the output is commanded to the clamp value and an alarm is indicated in the input tag.
Clamp alarm latch	When latching is enabled, Clamp Limit Alarms are latched until they are reset. This aids in detecting intermittent issues.
Clamp alarm unlatch	When a clamp alarm is latched, a bit in the output image can be used to unlatch the alarm. The unlatch is triggered on a rising edge. If the point is still clamped when the unlatch is attempted, the clamp and alarm remains. (A direct-to-module message can also be used to unlatch an alarm.)
Not a number	A bit in the input tag indicates when the controller has commanded an output value that is not a number.

Status Indicators

The front panel module status indicators report general status and fault status. Faults can also be reported via the user application, sourced from system variables or I/O connection points. Faults are classified as listed here:

- System faults
- Module faults
- Channel faults
- Field faults

Faults

Faults are described here.

System Faults

If redundant adapters are fitted, then the Rack status indicator on both adapters simultaneously turns RED.

A system fault is indicated when a fault is detected on any module (including the adapter) or any channel. When this type of fault occurs in the system, the Rack status indicator on the adapters turns red.

Module Faults

A module fault is indicated when a detected fault is isolated to the hardware of a specific module. The module status indicator turns RED on the faulty module and then the Rack status indicator on the adapter turns RED.

It is possible during sustained periods of abnormal field voltage and/or current slewing for channels to be declared faulted as a consequence of diagnostics that are otherwise designed to verify that the channels are operating within their designed safety accuracy. For details of slew rate limitations, refer to the 1715 Redundant I/O System Specifications Technical Data, publication [1715-TD001](#).

Channel Faults

A channel fault is indicated when a detected, faulty channel is isolated to a hardware fault on a specific channel of an I/O module. All channel faults are also reported as a module fault. This means that the CHANNEL indicator turns RED, the module status indicator turns RED, and the Rack status indicator on the adapter also turns RED.

A channel fault on an input module indicates that the channel with the fault no longer contributes to the reported values. In a dual configuration, as long as one channel is not faulted, valid data continues to be reported.

If a channel fault on an output module occurs, the channel continues to drive the output to the best of its ability, in most cases. Otherwise, a fail-safe state occurs.

In dual configuration, the output values continue as determined by the adapter as the second module outputs the full current.

It is possible during sustained periods of abnormal field voltage and/or current slewing for channels to be declared faulted as a consequence of diagnostics that are otherwise designed to verify that the channels are operating within their designed safety accuracy. For details of slew rate limitations, refer to the 1715 Redundant I/O System Specifications Technical Data, publication [1715-TD001](#).

Field Faults

A field fault is indicated when a detected fault condition is isolated to a field condition or field device and the cause is not the hardware that is associated with the channel or output module. Examples are an open circuit field connection, no field power, or an out-of-range signal. A CHANNEL indicator flashing yellow indicates these faults. Steady yellow indicates that the channel is ON or in range.

User Application Fault Indications and Logging

The information available includes the following:

- Module presence (that is, shutdown or Run modes)
- Module health and status (that is, Module Status or Fault)
- Channel health and status (that is, individual channel Module Status/fault or field fault)
- An echo of the front panel indicators for each module

Troubleshooting Faults

Follow this troubleshooting procedure to diagnose field faults.

1. Note the affected channel as a field fault can indicate that there is a blown fuse on an input channel.
2. To find the source of the over voltage that caused the fuse to blow, check the input field connections to the faulty channel.
3. After you have removed the source of the over voltage, replace the blown fuse by following these steps.

The fuse can be changed with the termination assembly still installed. You do not have to remove it.

- a. Lift the plastic cover that covers the fuses.
- b. Use a fuse removal tool to lever the fuse out of the fuse holder and replace the fuse.

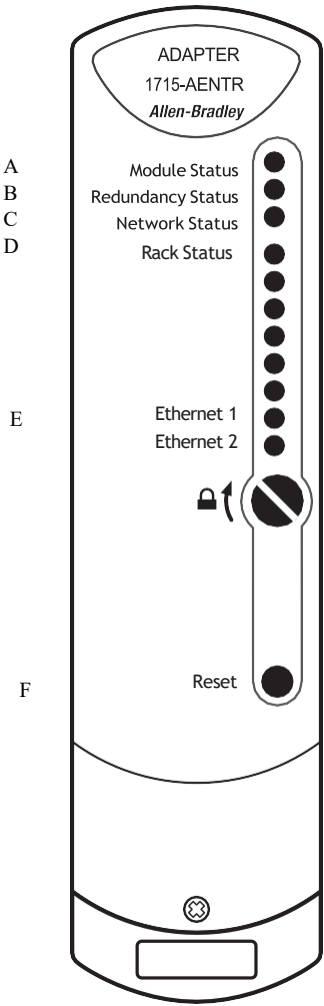
You can use these types of replacement fuses.

Component	Fuse Type
Analog Input Termination Assembly	Littelfuse No. 396/TE5 50 mA time lag fuse; UL 248-14, 125V, T Leadfree
Digital Input Termination Assembly	Littelfuse No. 396/TE5 50 mA time lag fuse; UL 248-14, 125V, T Leadfree
Digital Output Termination Assembly	Littelfuse Type 451 Omni-Blok 10 A, 125V fast acting fuse. Surface mount fuse block 154 010.

- c. Close the plastic cover.

1715 Adapter

The adapter has these status indicators.



Indicator	Description
A	Module Status
B	Redundancy Status
C	Network Status
D	Rack Status
E	Ethernet 1 & 2
F	Reset

Status indicators for the 1715-AENTR adapter are shown in this table.

Table 43 - Adapter Status Indicators

Indicator	State	Description
Module Status	Steady off	No power - There is no power to the module.
	Steady green	Module operational - The module has been configured without any faults.
	Flashing green	Standby - The module has not been configured.
	Flashing red (with steady red for network status)	An address conflict has been detected.
	Flashing red (with flashing green for network status)	Module firmware is being updated with ControlFLASH™
	Flashing red (with NOT steady red and NOT flashing green for network status)	Recoverable fault detected.
	Steady red	Major fault - The module has detected a nonrecoverable fault.
	Flashing green/red	Self-test - The module is performing its power on self tests.
	Flashing yellow	Unlocked - The adapter is unlocked from a previously locked state.
Redundancy Status	Steady off	No power, unlocked, or no partner - The module is not locked (via the locking screw), or no partner module is present.
	Steady green	Synchronized - The module is synchronized with the partner module (redundant operation).
	Flashing green	Partner detected, synchronizing - The partner module has been detected and is synchronizing with its partner module in preparation for redundant operation.
	Steady red	Synchronization fault - The partner module is present, but unable to synchronize (no redundant operation).
	Flashing green/red	Self-test - The module is performing its power on self tests.
	Flashing yellow	Unlocked - The adapter is unlocked from a previously locked state.
Network Status	Steady off	No power, unlocked, no IP address - The module has no power, or the module is not locked (via the locking screw), or no IP address has been assigned or obtained.
	Steady green	Connected - The module has at least one established connection (either to itself or to an I/O module).
	Flashing green	No connections - The module has an IP address, but there are no established connections (either to itself or an I/O module).
	Flashing red	Connection timeout - One or more of the connections (either to itself or to an I/O module) has timed out.
	Steady red	Duplicate IP - The module has detected that its IP address is already in use.
	Steady red (with flashing red for module status)	An address conflict has been detected.
	Flashing green/red	Self-test - The module is performing its power on self tests.
	Flashing yellow	Unlocked - The adapter is unlocked from a previously locked state.
Rack Status	Steady off	No power, unlocked - The module has no power or it is not locked (via the locking screw).
	Steady green	Rack operational - All modules in the rack are operating without fault.
	Steady red	Fault - At least one module in the rack has detected a fault. Examine the other modules in the rack for their status indicator condition.
	Flashing green/red	Self-test - The module is performing its power on self tests.
	Flashing yellow	Unlocked - The adapter is unlocked from a previously locked state.
Unlabeled Status 1 Located directly below Rack Status-used in Recovery mode	Steady off	No power - The module has no power or is not in recovery mode.
	Steady yellow	Recovery mode - The module is in Recovery mode.
	Flashing yellow	Unlocked - The adapter is unlocked from a previously locked state.
Unlabeled Status 2 Located directly below Unlabeled Status 1-used in Recovery mode	Steady off	No power - The module has no power or is not in recovery mode.
	Steady yellow	Recovery mode - The module is in Recovery mode.
	Flashing yellow	Unlocked - The adapter is unlocked from a previously locked state.
Ethernet 1 and 2	Steady off	No power, no link - There is no power or an Ethernet link is not established.
	Steady green	Link present - A valid Ethernet link has been established.
	Amber	Activity - Tx and/or Rx activity is present.

Reset Button

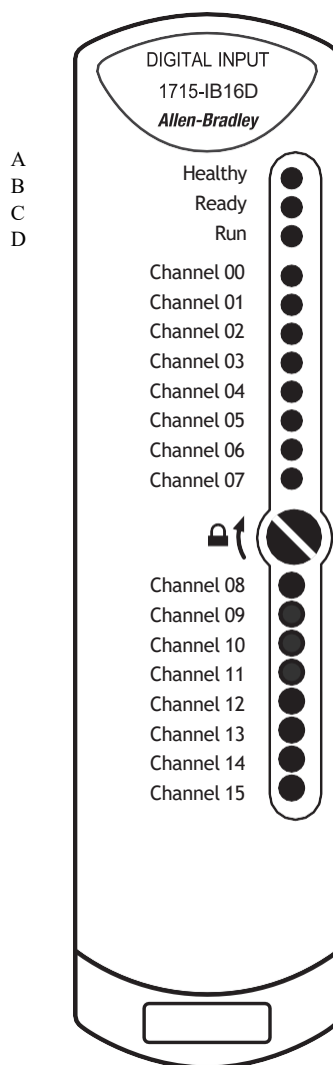
The reset button does the following three functions:

- **Firmware recovery:** Press the Reset button while cycling power if communication during a firmware update is interrupted and the module becomes inoperable. Cycle power to the module while pressing the button. This places the adapter in Safe mode so that you can update it.
- **Recover a lost IP address:** Press and hold the Reset button while cycling power. This places the module in Safe mode. Cycle power again without holding the Reset button. This re-enables BOOTP mode. The adapter requests a new IP address.
- **Fault reset:** Certain faults on an I/O module require a hard reset. Pressing the Reset button during operation resets the fault.

Repeat the above steps to install the redundant adapter.

1715 Digital Input Module

The digital input module has these status indicators.



Indicator	Description
A	Healthy - general status display
B	Ready - redundancy status indicator
C	Run - network status indicator
D	Channel 0...7, 8...15 - channel status indicators

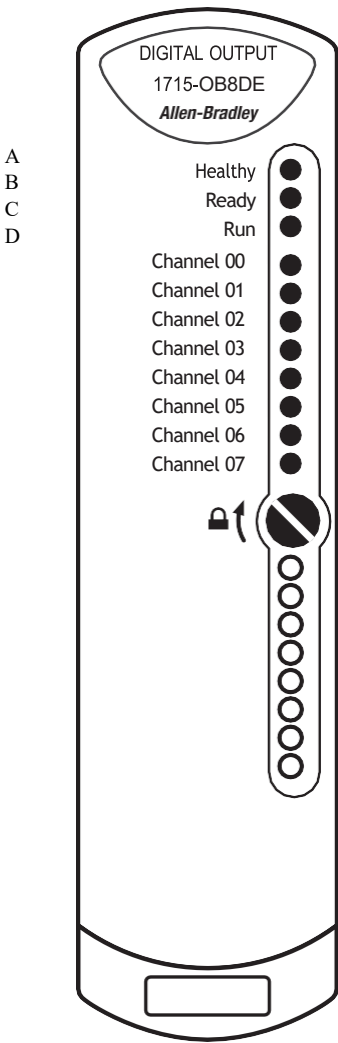
Status indicators for the 1715-IB16D digital input module are shown in this table.

Table 44 - Digital Input Module Status Indicators

Indicator	State	Description
Healthy	Steady off	No power.
	Steady green	Module operational - The module has been configured and is operating without any faults.
	Flashing green	Standby - The module has not been configured.
	Steady red	Fault - A fault has been detected on the module.
Ready	Steady off	No power or no partner module present.
	Steady green	Synchronized - Synchronized with partner module; redundant operation.
Run	Steady off	No power; no backplane communication - No power or the module is not communicating over the backplane.
	Steady green	Connected - The module has at least one established connection.
	Flashing green	No connections - The module is communicating over the backplane, but there are no established connections.
Channel 0...7, 8...15	Steady off	Off/de-energized, no backplane communication - The channel is off/de-energized or the module is not communicating over the I/O backplane.
	Steady yellow	On/energized - The channel is on/energized.
	Flashing yellow	Field fault - A field fault has been detected on this channel.
	Steady red	Fault - A fault has been detected on this channel.

1715 Digital Output Module

The digital output module has these status indicators.



Indicator	Description
A	Healthy - general status display
B	Ready - redundancy status indicator
C	Run- network status indicator
D	Channel 0...7 - channel status indicators

Status indicators for the 1715-OB8DE digital output module are shown in this table.

Table 45 - Digital Output Module Status Indicators

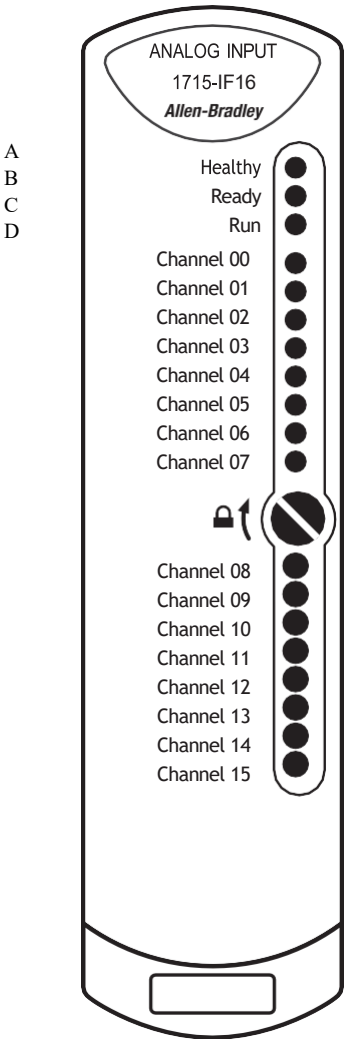
Indicator	State	Description
Healthy	Steady off	No power.
	Steady green	Module operational - The module has been configured and is operating without any faults.
	Flashing green	Standby - The module has not been configured.
	Steady red	Fault - A fault has been detected on this module.
Ready	Steady off	No power or no partner module present.
	Steady green	Synchronized - Synchronized with partner module; redundant operation.

Table 45 - Digital Output Module Status Indicators

Indicator	State	Description
Run	Steady off	No power; no backplane communication - No power or the module is not communicating over the backplane.
	Steady green	Connected - The module has at least one established connection.
	Flashing green	No connections - The module is communicating over the backplane, but there are no established connections.
Channel 0...7	Steady off	Off/de-energized - The channel is off/de-energized.
	Steady yellow	On/energized - The channel is on/energized.
	Flashing yellow	Field fault - A field fault has been detected on this channel.
	Steady red	Fault - A fault has been detected on this channel.

1715 Analog Input Module

The digital output module has these status indicators.



Indicator	Description
A	Healthy - general status display
B	Ready-redundancy status indicator
C	Run- network status indicator
D	Channel 0...7, 8...15 - channel status indicators

Status indicators for the 1715-IF16 analog input module are shown in this table.

Table 46 - Analog Input Module Status Indicators

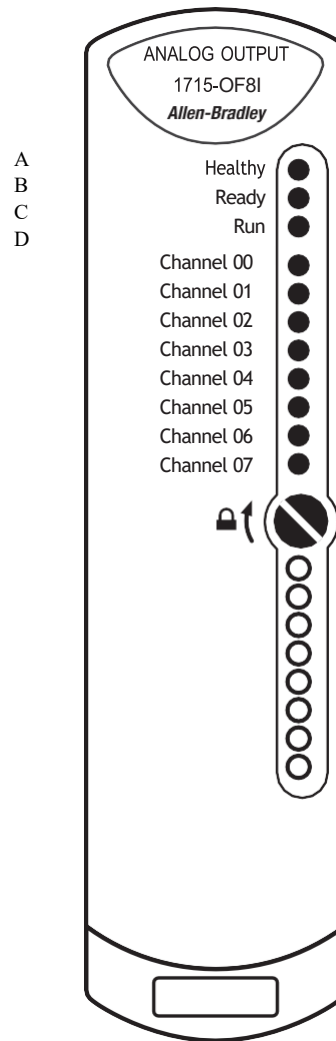
Indicator	State	Description
Healthy	Steady off	No power.
	Steady green	Module operational - The module has been configured and is operating without any faults.
	Flashing green	Standby - The module has not been configured.
	Steady red	Fault - A fault has been detected on the module.
Ready	Steady off	No power or no partner module present.
	Steady green	Synchronized - Synchronized with partner module; redundant operation.

Table 46 - Analog Input Module Status Indicators (Continued)

Indicator	State	Description
Run	Steady off	No power; no backplane communication - No power or the module is not communicating over the backplane.
	Steady green	Connected - The module has at least one established connection.
	Flashing green	No connections - The module is communicating over the backplane, but there are no established connections.
Channel 0...7, 8...15	Steady off	No signal, no backplane communication - There is no signal on the channel or the module is not communicating over the I/O backplane.
	Steady yellow	Signal present - A valid signal has been detected (that is, measured signal ≥ 0.4 mA).
	Flashing yellow	Field fault - A field fault has been detected on this channel.
	Steady red	Fault - A fault has been detected on this channel.

1715 Analog Output Module

The analog output module has these status indicators.



Indicator	Description
A	Healthy - general status display
B	Ready - redundancy status indicator
C	Run - network status indicator
D	Channel 0...7 - channel status indicators

Status indicators for the 1715-OF8I analog output module are shown in this table.

Table 47 - Analog Output Module Status Indicators

Indicator	State	Description
Healthy	Steady off	No power.
	Steady green	Module operational - The module has been configured and is operating without any faults.
	Flashing green	Standby - The module has not been configured.
	Steady red	Fault - A fault has been detected on the module.
Ready	Steady off	No power or no partner module present.
	Steady green	Synchronized - Synchronized with partner module; redundant operation.
Run	Steady off	No power; no backplane communication - No power or the module is not communicating over the backplane.
	Steady green	Connected - The module has at least one established connection.
	Flashing green	No connections - The module is communicating over the backplane, but there are no established connections.
Channel 0...7	Steady off	Off/de-energized - The channel is not being driven (output current < 0.4 mA).
	Steady yellow	On/energized - The channel is being driven (output current is ≥ 0.4 mA).
	Flashing yellow	Field fault - A field fault has been detected on this channel.
	Steady red	Fault - A fault has been detected on this channel.

Notes:

1715-IB16D Digital Input Module Diagnostics

Threshold Values for Digital Inputs

This section describes how to calculate and set threshold values for digital inputs.

The module determines the channel state and the line fault status by comparing the channel input voltage with defined threshold values. Line faults, such as short circuit and wire off, can be determined by using different input voltage values.

With this module, you can define custom threshold values or use a set of preset default values. The types of threshold values you choose initially for the module become inherent in each channel; you can define different thresholds for individual channels later.

The threshold values determine which end-of-line (EOL) resistor value that you choose, and vice versa, depending on whether you choose the threshold values first, or the EOL resistor values first.

By considering these two components—EOL resistor values and the threshold values, we can arrive at the diagnostic settings for the module.

Figure 63 - Common EOL Device Scenario

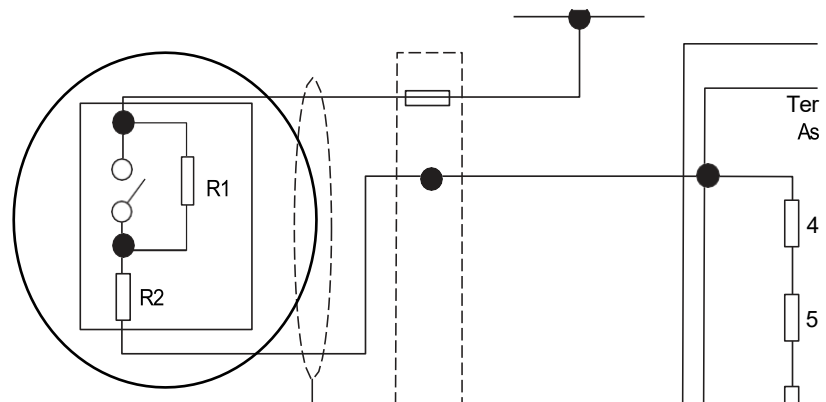
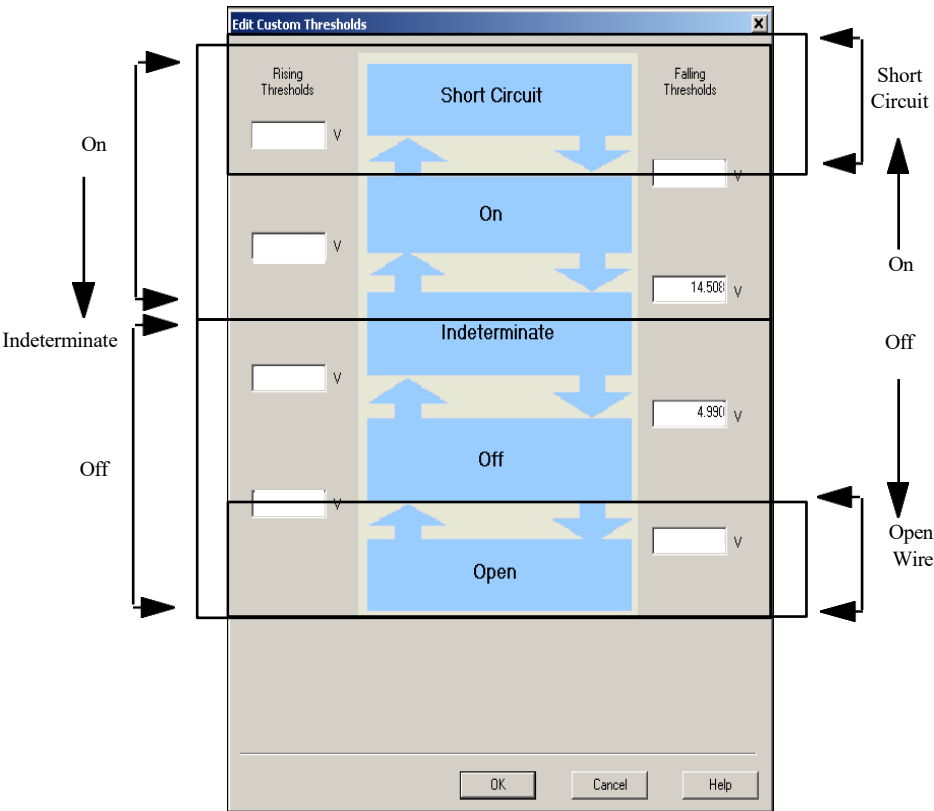


Figure 64 - Threshold Settings



Threshold Diagnostics Settings

There are three types of threshold diagnostics settings to choose from in the Logix Designer application:

- [Full Diagnostics Configuration](#)
- [None Diagnostics Configuration](#)
- [Custom Diagnostics Configuration](#)

Module Properties: Adapter_Module:2 (1715-IB16D 1.1)

General Connection Module Info A Module Info B Configuration*									
Point	Enable Change of State		Diagnostics	Custom Thresholds	Open Wire Detection	Latch Diagnostics	R	L	Diag
	Off-> On	On-> Off							
0	☒	☒	Full	Edit...	☒	☒			
1	☒	☒	Full	Edit...	☐	☐			
2	☒	☒	None	Edit...	☒	☒			
3	☒	☒	Custom	Edit...	☒	☒			
4	☒	☒	Full	Edit...	☒	☒			

Full Diagnostics Configuration

To load a set of threshold default values into the threshold settings, select Full from the Diagnostics pull-down menu. **If an EOL is used, you must select Full.**

Figure 65 - Full Diagnostics Threshold Default Values

RemoteScn:2:C.PtThreshold[0]		{...}
+	RemoteScn:2:C.PtThreshold[0].IndeterminateOffFalling	6000
+	RemoteScn:2:C.PtThreshold[0].IndeterminateOffRising	6500
+	RemoteScn:2:C.PtThreshold[0].OffOpenFalling	3000
+	RemoteScn:2:C.PtThreshold[0].OffOpenRising	3500
+	RemoteScn:2:C.PtThreshold[0].OnIndeterminateFalling	10500
+	RemoteScn:2:C.PtThreshold[0].OnIndeterminateRising	11000
+	RemoteScn:2:C.PtThreshold[0].ShortOnFalling	18500
+	RemoteScn:2:C.PtThreshold[0].ShortOnRising	19000
+	RemoteScn:2:C.PtThreshold[0].ShortOffFalling	18500

For a full-diagnostics setting configuration, use these resistor values.

IMPORTANT These are the most common commercially available EOL devices.

Table 48 - Full Diagnostics Resistor Values

Item	Value
R1	15 k Ω (1%) - power 0.5 W (max power dissipated 0.128 W)
R2	3.9 k Ω (1%) - power 0.5 W (max power dissipated 0.128 W)
Loop supply voltage	24V DC ($\pm 10\%$)

None Diagnostics Configuration

To load another set of default values into the threshold settings, select None from the Diagnostics pull-down menu. **Select None when no EOL devices are used.**

Figure 66 - None Diagnostics Threshold Default Values

RemoteScn:2:C.PtThreshold[0]		{...}
+	RemoteScn:2:C.PtThreshold[0].IndeterminateOffFalling	4990
+	RemoteScn:2:C.PtThreshold[0].IndeterminateOffRising	5509
+	RemoteScn:2:C.PtThreshold[0].OffOpenFalling	-259
+	RemoteScn:2:C.PtThreshold[0].OffOpenRising	0
+	RemoteScn:2:C.PtThreshold[0].OnIndeterminateFalling	14508
+	RemoteScn:2:C.PtThreshold[0].OnIndeterminateRising	14991
+	RemoteScn:2:C.PtThreshold[0].ShortOnFalling	32000
+	RemoteScn:2:C.PtThreshold[0].ShortOnRising	32000

Below 5.5V
Causes An
'Off'
Condition

Indicates
An 'On'
Condition

Based on these settings, if the switch is closed, the input reports an 'on' condition anytime the voltage is above ~14.5V, but does not report a short circuit, because there is no way to get the voltage to rise to 32V.

The same is true with an 'off' condition. The module reports an 'off' condition anytime the voltage is below ~5.5V, but does not report a wire off, because it has to go below 0V to do so.

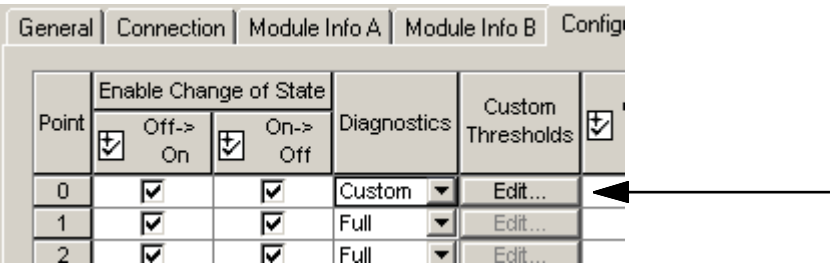
Custom Diagnostics Configuration

For custom diagnostics, you calculate and enter the threshold values.

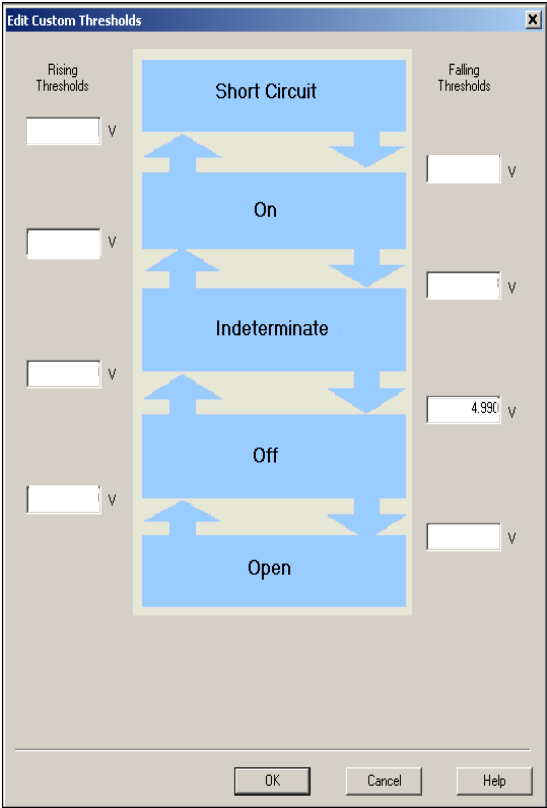
To calculate the desired values, see [Calculate Threshold and Resistor Values on page 229](#).

Once calculated, follow these steps to enter the settings.

- 1. From the Diagnostics pull-down menu, choose Custom.
- 2. Click Edit from the Custom Thresholds column.



- 3. Enter the desired value ranges into the Threshold dialog boxes.

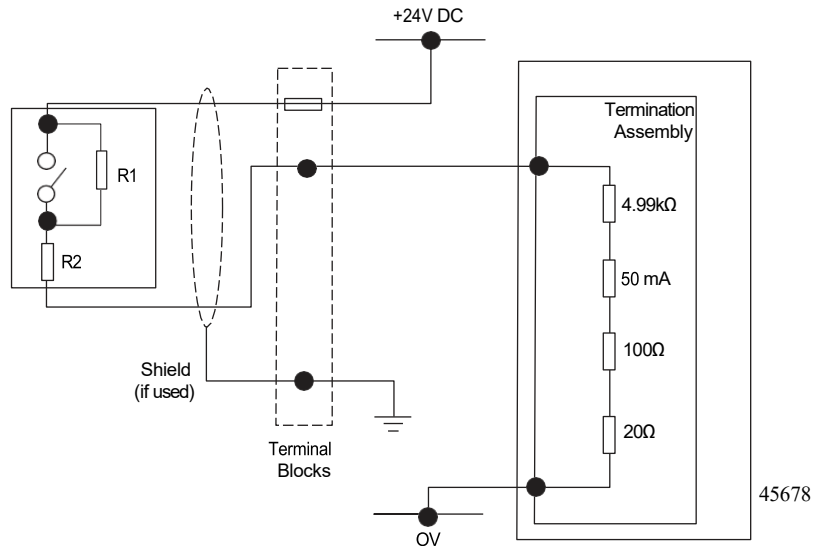


Calculate Threshold and Resistor Values

To arrive at the correct diagnostic settings, you must know one of the two values—either the threshold values or the resistor values, and then calculate the other set of values from the known values.

The following example shows a typical EOL arrangement for an Emergency Shutdown Device.

Figure 67 - Field Loop Circuit for Line Monitored Digital Input for Emergency Shutdown Systems (ESD)



You must realize that by virtue of R1 and R2, in combination with the internal impedance and field switch position of the module, various voltage levels are produced at the input terminal that the threshold values can characterize.

Knowing the resistor values allows you to calculate the voltage levels to arrive at the threshold settings.

Use [Figure 68](#) and [Figure 69](#), and the resistor values you choose, to determine how the system responds to various field wiring conditions, so that the threshold values can be set. For our example, we used the resistor values in [Table 48 on page 227](#).

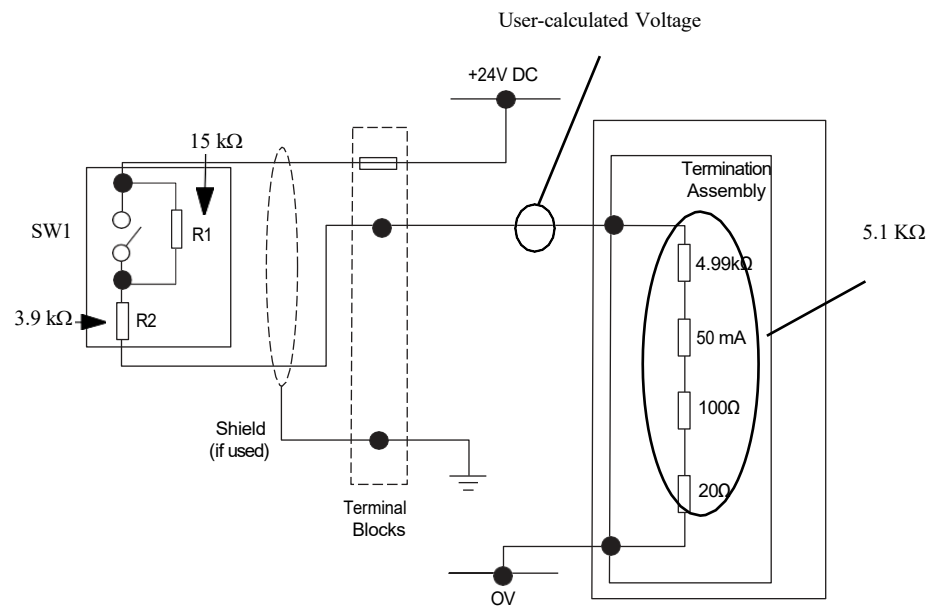
Calculate the Voltage for Off/On Conditions for Threshold Values

The following examples calculate the voltage for an Off condition with the switch opened and closed.

Open Switch/Off Condition

With SW1 open, current flows through R1 and R2 ($15 + 3.9 \text{ k}\Omega = 18.9 \text{ k}\Omega$). We can calculate the voltage that is present at the input of the input module and by using a voltage divider circuit, we can calculate the voltage for an Off condition.

Figure 68 - Open Switch/Off Condition



I

$$E_n = E_{total} \frac{R_n}{R_{total}}$$

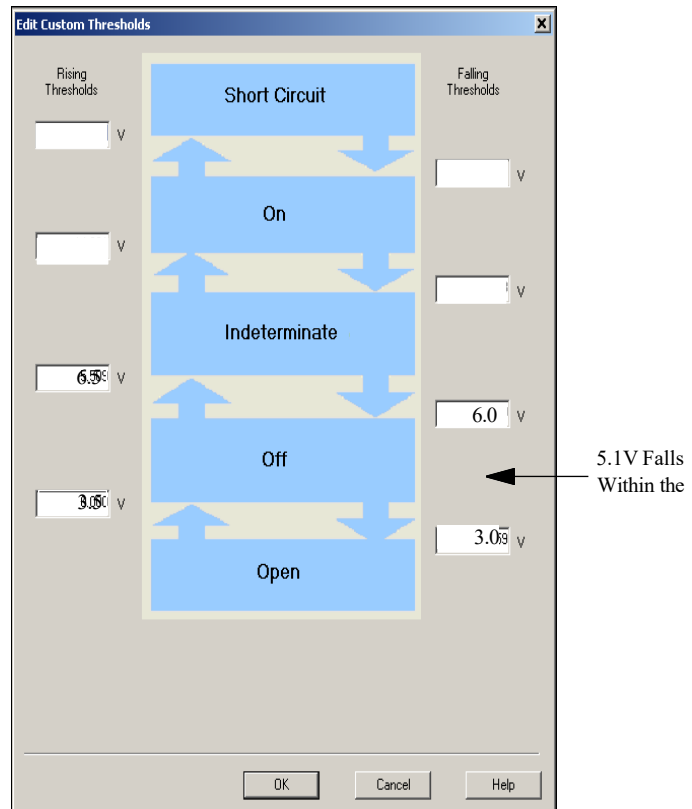
$$E_n = 24 \frac{18.9K}{24K}$$

$$E_n = 18.9$$

$$V_{in} = 24 - 18.9 \qquad 45680$$

$$V_{in} = 5.1$$

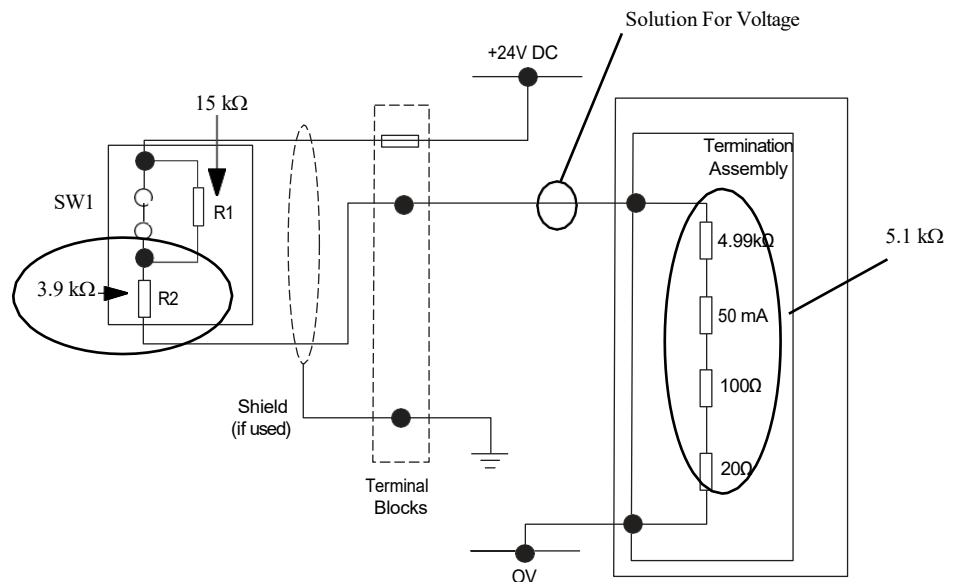
If 5.1V is present, you know that the switch is in the Off position. You can enter a range into the threshold that lets 5.1V be an Off condition. This example uses 3.0...6.5V as the range. If the voltage drops below 3.0V, it is considered a wire-off. If it goes above 6.5V, it is considered indeterminate.



Closed Switch/On Condition

If SW1 is closed, then current only flows through R2. To calculate the voltage present at the input module, use the R2 value of 3.9 k Ω /Rtotal.

Figure 69 - Closed Switch/On Condition



$$E_n = E_{total} \frac{R_n}{R_{total}}$$

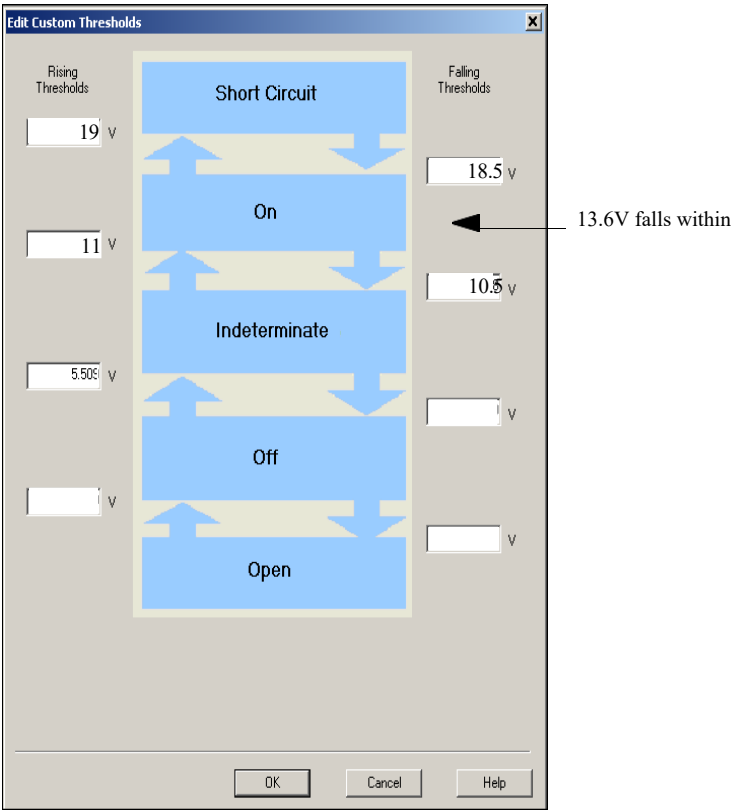
$$E_n = 24 \frac{3.9 \text{ K}}{9 \text{ K}}$$

$$E_n = 10.4$$

$$V_{in} = 24 - 10.4$$

V_{in} = 13.6 Solution For Voltage

If 13.6V is present, the switch is in the On position. A range can be entered into the threshold value that lets 13.6V be an On condition. This example uses 19...10.5V as the range. If the voltage drops below 10.5V, it is indeterminate and if it goes above 19V, it is a short circuit.



Calculate On/Off Condition for Resistor Values

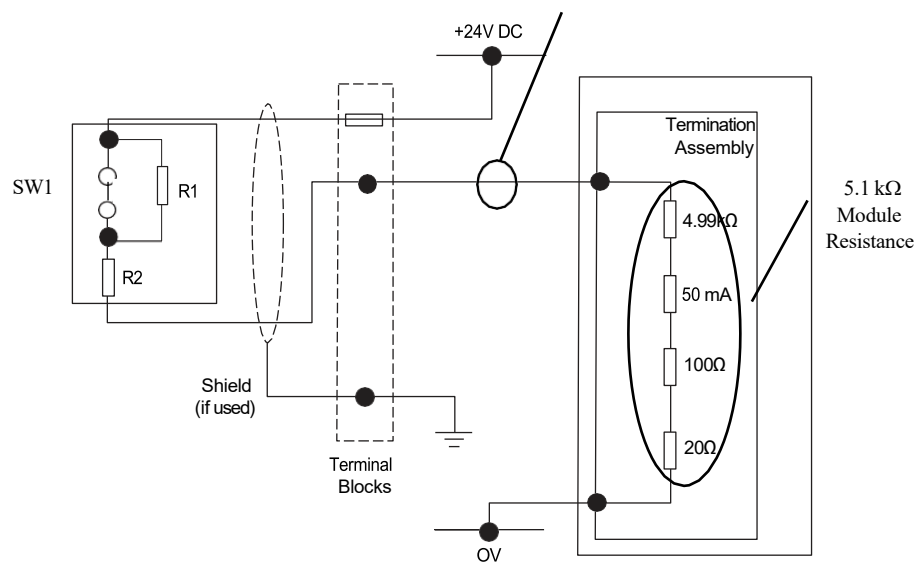
If a threshold value is set and you want to figure out which resistors to use, follow these examples.

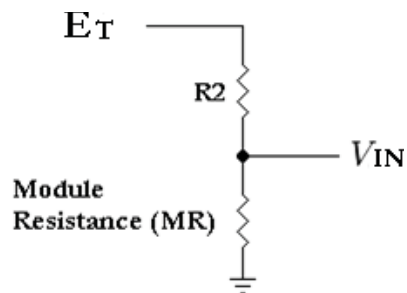
On Condition

For an On condition, use the following formulas.

In this case, the module load is 5.1 k Ω and the supply voltage is assumed to be 24V DC. For this example, use [Figure 70](#) and choose 13V DC because it is a value within the range in the threshold tables.

Figure 70 - On Condition





$$R2 = \frac{MR \cdot E_T}{V_{IN}} - MR$$

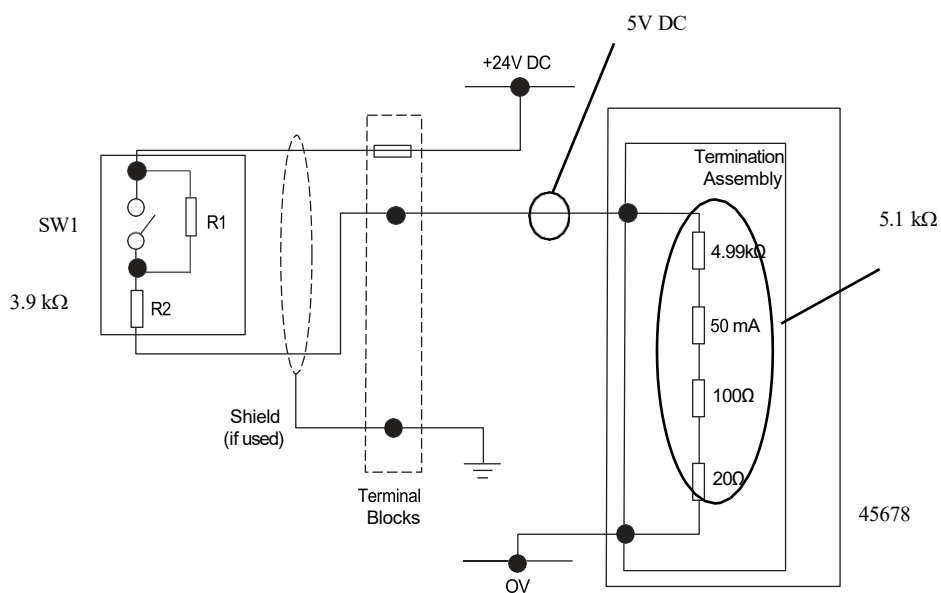
$$R2 = \frac{5100 \cdot 24}{13} - 5100$$

$$R2 = 4.3K$$

4.3 kΩ is a close standard value, so this example uses 3.9 kΩ, which changes the voltage slightly but not enough to cause the range to change.

Off Condition

For an Off condition, you must add a resistor to the formula. The R2 is 3.9 kΩ, so you can use that, too.



$$R1 = \left(\frac{MR \cdot E_T}{V_{IN}} - MR \right) \cdot R2$$

$$R1 = \left(\frac{5100 \cdot 24}{5} - 5100 \right) \cdot 3.9K$$

$$R1 = 15.4K$$

In this example, 15.4 kΩ is a close standard value, so use 15 kΩ, which changes the voltage slightly, but not enough to make us change our range.

Calibration Drift Checks

The 1715 I/O analog modules are calibrated at the factory with a default calibration. As time passes, the electrical specifications of various electronic components of your analog module drift.

To make sure the best possible accuracy in measurements that your analog input module makes and signals that your analog output module generates are maintained, it is recommended to perform a calibration drift check every 2 years for most applications.

Although the purpose of checking the calibration of analog modules is the same for input and output modules, to verify that the accuracy and repeatability of the module is maintained, the procedures that are involved differ per module.

When you check the calibration of input modules, you use current, voltage, or ohms calibrators to send a signal to the module and check that the correct values are reported.

When you calibrate output modules, you use a digital multimeter (DMM) to measure the signal that the module is sending out.

IMPORTANT Before you check calibration, do the following:

- Stop the process that your output module is controlling or your input module is tracking.
 - Disconnect input signals and connect test signals. Any control that depends on the normal input signals does not have them during the calibration check process.
 - Disconnect output signals and connect a suitable measuring instrument. Any control that depends on the outputs from this module does not have them during the calibration check process.
 - Make sure the equipment, a Multimeter, is calibrated.
-

The calibration drift process can impair control.

When you begin the calibration check process, if a real-time connection is open, the module points you are calibrating can fault. We recommend that you change your controller to Program mode before you begin calibration.

IMPORTANT The 1715-IF16 and 1715-OF8 modules can be operated with multiple ranges. Verify that the appropriate Output Range or Input Range is selected before continuing with the calibration check procedure.

The two general functions in the calibration check process are as follows:

- Attaching/generating a Low Reference Signal
- Attaching/generating a High Reference Signal

Verify that the physical values correspond to the module read/produced values within desired tolerances. If not, consider replacement of the affected module.

Reconfigure a Module Online

Use Ladder Logic to Reconfigure an I/O Module

If an I/O module supports reconfiguration, you can reconfigure the module via one of the following:

- Studio 5000 Logix Designer® application
- An MSG instruction in program logic

IMPORTANT Consider these guidelines in SIL 2 applications:

- We recommend configuring SIL 2 safety applications offline. Even if the Logix controller and RSLogix 5000® software permit online SIL 2 configuration (that is, module interface option changes, import of the Add-On Instructions, and so forth.) a **download** to the processor is **required**.
 - Enabling SIL 2 on spare modules while **online** is **not supported**.
 - Where a module is used without SIL 2 enabled and SIL 2 is then enabled for that module, a power cycle of the rack is required to force the new configuration to the module. The same is true where a module is used with SIL 2 enabled, and SIL 2 is then disabled for that module.
 - A programming terminal is not normally connected.
-

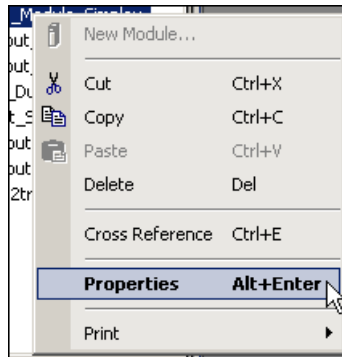


ATTENTION: Use care when changing the configuration of an I/O module. You could inadvertently cause the I/O module to operate incorrectly.

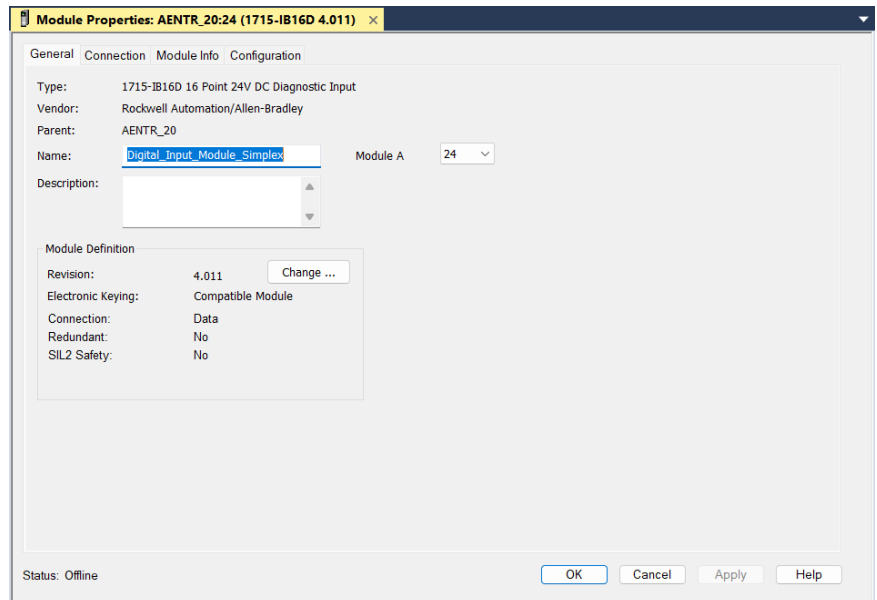
Reconfigure a Module via Studio 5000 Logix Designer Application

To reconfigure a module, perform this procedure.

1. In the Logix Designer application, right-click a module in the I/O Configuration tree and choose Properties.



The Module Properties dialog box appears.



2. Reconfigure the I/O module.
3. Click OK.

Reconfigure a Module Via Ladder Logic

It is sometimes advantageous to change the functional operation of a module in the ControlLogix® system automatically via the user program instead of by using the Logix Designer application to reconfigure it. This way, changes in the process can dictate when the reconfiguration takes place rather than you performing that function manually.

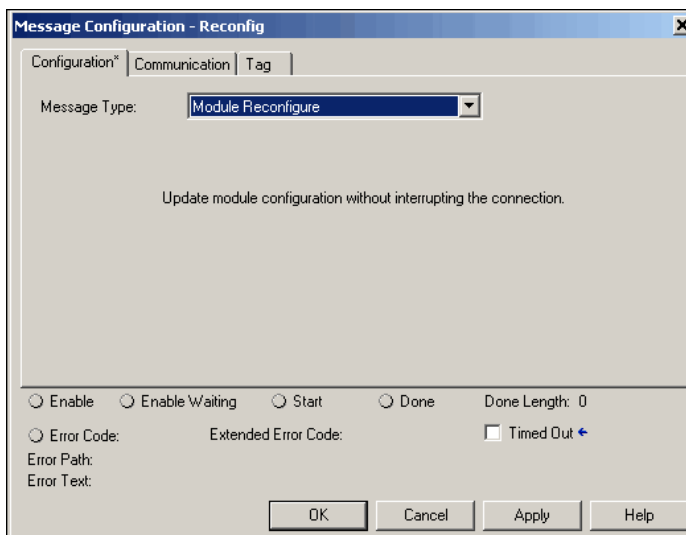
The 1715 modules support sending an MSG instruction of type Module Reconfigure. This MSG instruction can be sent to a module to reconfigure it without stopping the module.

Use an MSG instruction of type Module Reconfigure to send new configuration information to an I/O module. During the reconfiguration, the following occurs:

- Input modules continue to send input data to the controller.
- Output modules continue to control their output devices.

The following steps are used in this example when reconfiguring a module via ladder logic.

1. Move new configuration parameters to the Configuration portion of the tag structure that is associated with the module.
2. Use a message instruction to send a Reconfigure Module service to the same module.



Before the new configuration parameters are sent to the module, you must make sure that their relationship to each other is in a format the module accepts and that the values are within the range the module accepts, otherwise the module can fault, or the reconfiguration attempt can fail.

IMPORTANT Reconfiguring analog modules via ladder logic can be limited to functions that involve only the changing of values. We do not recommend that you enable or disable features via ladder logic. Use the Logix Designer application to enable or disable these features.

Notes:

I/O Tag Definitions

1715-AENTR Adapter

This section describes the tags that are associated with the 1715-AENTR adapter.

Table 49 - Input

Tag Name	Data Type	Definition						
Fault	DINT, Binary	Adapter fault bit: 0 when at least one adapter is present and reporting valid data, 0xFFFF_FFFF when no adapters are present, no Logix connection exists, or reported data is invalid.						
Status	DINT, bit field	Adapter redundancy and power status: Bit 0: ModAFault 0 = good 1 = fault or module not present Bit 1: ModBFault 0 = good 1 = fault or module not present Bit 8: Power1Fault 0 = good 1 = fault or module not present Bit 9: Power2Fault 0 = good 1 = fault or module not present						
LinkStatus	DINT, bit-field	Adapter Ethernet port status: Bit 0: PortA1Connected 0= Inactive 1 = Active Bit 2: PortA2Connected 0= Inactive 1 = Active Bit 3: PortB1Connected 0= Inactive 1 = Active Bit 4: PortB2Connected 0= Inactive 1 = Active						
FullDuplex	DINT, bit-field	Adapter Ethernet port half/full duplex status: Bit 0: PortA1FullDuplex 0= Inactive 1 = Active Bit 2: PortA2Duplex 0= Inactive 1 = Active Bit 3: PortB1Duplex 0= Inactive 1 = Active Bit 4: PortB2Duplex 0= Inactive 1 = Active						
PortA1ANStatus	SINT, enumerated	Enumerated adapter Ethernet port auto-negotiation status: <table><tr><th>Value</th><th>Description</th></tr><tr><td>0</td><td>Auto-negotiation in progress</td></tr><tr><td>1</td><td>Auto-negotiation of duplex and speed detection failed; by using a default value for speed and duplex</td></tr></table>	Value	Description	0	Auto-negotiation in progress	1	Auto-negotiation of duplex and speed detection failed; by using a default value for speed and duplex
Value	Description							
0	Auto-negotiation in progress							
1	Auto-negotiation of duplex and speed detection failed; by using a default value for speed and duplex							

Table 49 - Input (Continued)

Tag Name	Data Type	Definition	
		Value	Description
		2	Auto-negotiation of duplex but detected speed; by using a default value for duplex
		3	Successfully negotiated duplex and speed
		4	Auto-negotiation not attempted, by using forced speed and duplex values
		5-255	Undefined
PortA2ANStatus	SINT, enumerated	Enumerated adapter Ethernet port auto-negotiation status:	
		Value	Description
		0	Auto-negotiation in progress
		1	Auto-negotiation of duplex and speed detection failed; by using a default value for speed and duplex
		2	Auto-negotiation of duplex but detected speed; by using a default value for duplex
		3	Successfully negotiated duplex and speed
		4	Auto-negotiation not attempted, by using forced speed and duplex values
		5-255	Undefined
PortB1ANStatus	SINT, enumerated	Enumerated adapter Ethernet port auto-negotiation status:	
		Value	Description
		0	Auto-negotiation in progress
		1	Auto-negotiation of duplex and speed detection failed; by using a default value for speed and duplex
		2	Auto-negotiation of duplex but detected speed; by using a default value for duplex
		3	Successfully negotiated duplex and speed
		4	Auto-negotiation not attempted, by using forced speed and duplex values
		5-255	Undefined
PortB2ANStatus	SINT, enumerated	Enumerated adapter Ethernet port auto-negotiation status:	
		Value	Description
		0	Auto-negotiation in progress
		1	Auto-negotiation of duplex and speed detection failed; by using a default value for speed and duplex
		2	Auto-negotiation of duplex but detected speed; by using a default value for duplex
		3	Successfully negotiated duplex and speed
		4	Auto-negotiation not attempted, by using forced speed and duplex values
		5-255	Undefined
PortA1Speed	DINT	Interface speed in Mbps that is in use, for example, 10 Mbps or 100 Mbps, or 0 when the port is active	
PortA2Speed	DINT	Interface speed in Mbps that is in use, for example, 10 Mbps or 100 Mbps, or 0 when the port is active	
PortB1Speed	DINT	Interface speed in Mbps that is in use, for example, 10 Mbps or 100 Mbps, or 0 when the port is active	
PortB2Speed	DINT	Interface speed in Mbps that is in use, for example, 10 Mbps or 100 Mbps, or 0 when the port is active	
CIPTimeouts	DINT	Total of all Connection Manager object Connection Timeout values	
CIPConnections	DINT	Total number of active CIP™ connections	
CIPLostPackets	DINT	Total of all CIP packets	
TCP Connections	DINT	Total of all TCP connections	
CUPUtilization	DINT	Echo of Connection Manager object CPU_Utilization attribute	

1715-IB16D

This section describes the tags that are associated with the 1715-IB16D module.

Table 50 - 16-channel Digital Input, Simplex

Tag Name	Data Type	Definition					
Fault	DINT, Binary	Module fault bit:	0 when a module is present and reporting valid data, 0xFFFF_FFFF when no module is present, no Logix connection exists, or reported data is valid				
Data	INT	Input state, 1 bit per channel for channels 0...15: 0 = Off/de-energized 1 = On, energized					
Status	DINT, bit-field	Redundancy and power status:					
		<table><tr><th>Bit Name</th><th>Description</th></tr><tr><td>8 GroupFault</td><td>0 = Good 1 = Any channel or module faulted/failed</td></tr></table>	Bit Name	Description	8 GroupFault	0 = Good 1 = Any channel or module faulted/failed	
Bit Name	Description						
8 GroupFault	0 = Good 1 = Any channel or module faulted/failed						
PtFault	INT	Channel fault status; 1 bit per channel for channels 0...15: 0 = Normal 1 = Channel is faulted/failed					
Open Wire	INT	Open wire diagnostic status; 1 bit per channel for channels 0...15: 0 = Normal 1 = Indicates open wire detected					
ShortCircuit	INT	Short circuit diagnostic status; 1 bit per channel for channels 0 ...15: 0 = Normal 1 = Indicates short circuit detected					
Indeterminate	INT	Indeterminate diagnostic status; one channel per channel for channels 0...15: 0 = Normal 1 = Indicates indeterminate input voltage detected					
Timestamps	AB:1715:TIMESTAM P[16]	TIMESTAMP array	One element per channel. NB each timestamp is equivalent DINT[2] representing a 64-bit value (number of microseconds since 1 st January 1970). An Add-On Instruction ‘SystemTime_64bit_ Interpreted’ is available to convert such time stamps to a more manageable format with individual values for Day, month, year and so on.				

Table 51 - 16-channel Digital Input, Duplex

Tag Name	Data Type	Definition																		
Fault	DINT, Binary	Module fault bit: 0 when one module is present and reporting valid data, 0xFFFF_FFFF when no modules are present, no Logix connection exists, or reported data is invalid.																		
Data	INT	Input state, 1 bit per channel for channels 0...15: 0 = Off/de-energized 1 = On, energized																		
Status	DINT, bit-field	Redundancy and power status: <table border="1"> <thead> <tr> <th>Bit</th><th>Name</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>ModAFault</td><td>0 = Good 1 = Fault or module not present</td></tr> <tr> <td>1</td><td>ModBFault</td><td>0 = Good 1 = Fault or module not present</td></tr> <tr> <td>8</td><td>GroupFault</td><td>0 = Good 1 = Any channel or module faulted/failed</td></tr> <tr> <td>9</td><td>ModAGroupFault</td><td>0 = Good</td></tr> <tr> <td>10</td><td>ModBGroupFault</td><td>1 = Any channel or module A faulted/failed 0 = Good 1 = Any channel or Module B faulted/failed</td></tr> </tbody> </table>	Bit	Name	Description	0	ModAFault	0 = Good 1 = Fault or module not present	1	ModBFault	0 = Good 1 = Fault or module not present	8	GroupFault	0 = Good 1 = Any channel or module faulted/failed	9	ModAGroupFault	0 = Good	10	ModBGroupFault	1 = Any channel or module A faulted/failed 0 = Good 1 = Any channel or Module B faulted/failed
Bit	Name	Description																		
0	ModAFault	0 = Good 1 = Fault or module not present																		
1	ModBFault	0 = Good 1 = Fault or module not present																		
8	GroupFault	0 = Good 1 = Any channel or module faulted/failed																		
9	ModAGroupFault	0 = Good																		
10	ModBGroupFault	1 = Any channel or module A faulted/failed 0 = Good 1 = Any channel or Module B faulted/failed																		

Table 51 - 16-channel Digital Input, Duplex (Continued)

Tag Name	Data Type	Definition
PtFault	INT	Channel fault status; 1 bit per channel for channels 0...15: 0 = Normal 1 = Channel is faulted/failed
Open Wire	INT	Open wire diagnostic status; 1 bit per channel for channels 0...15: 0 = Normal 1 = Indicates open wire detected
ShortCircuit	INT	Short circuit diagnostic status; 1 bit per channel for channels 0...15: 0 = Normal 1 = Indicates short circuit detected
Indeterminate	INT	Indeterminate diagnostic status; one channel per channel for channels 0...15: 0 = Normal 1 = Indicates indeterminate input voltage detected
Timestamps	AB:1715:TIMESTAMP[16]	TIMESTAMP array One element per channel. NB each time stamp is equivalent DINT[2] representing a 64-bit value (number of microseconds since 1 st January 1970). An Add-On Instruction 'SystemTime_64bit Interpreted' is available to convert such time stamps to a more manageable format with individual values for Day, month, year and so on.

1715-OB8DE

This section describes the tags that are associated with the 1715-OB8DE module.

Table 52 - 8-channel Digital Output, Simplex, Output

Tag Name	Data Type	Definition
Data	SINT	Output channel commanded data; 1 bit per channel for channels 0...7: 0 = Off/de-energize 1 = On/energize
AlarmUnlatch	SINT	Unlatch alarm; 1 bit per channel for channels 0...7; rising edge transition (that is, 0>1)
ResetBlownFuse	SINT	Reset blown electronic fuse, 1 bit per channel for channels 0...7; rising edge transition (that is, 0>1) resets

Table 53 - 8-channel Digital Output, Simplex, Input

Tag Name	Data Type	Definition						
Fault	DINT, Binary	Module fault bit: 0 when a module is present and reporting valid data, OxFFF_FFFF when no module is present, no Logix connection exists, or reported data is invalid.						
Readback	SINT	Output channel readback state, 1 bit per channel for channels 0...7: 0 = Off/de-energized 1 = On/energized						
Status	DINT, bit-field	Redundancy and power status: <table border="1"> <thead> <tr> <th>Bit</th><th>Name</th><th>Description</th></tr> </thead> <tbody> <tr> <td>8</td><td>GroupFault</td><td>0 = Good 1 = Any channel or module faulted/failed</td></tr> </tbody> </table>	Bit	Name	Description	8	GroupFault	0 = Good 1 = Any channel or module faulted/failed
Bit	Name	Description						
8	GroupFault	0 = Good 1 = Any channel or module faulted/failed						
PtFault	SINT	Channel fault status; 1 bit per channel for channels 0...7: 0 = Normal 1 = Pint is faulted/failed						
NoLoad	SINT	No Load diagnostic status, 1 bit per channel for channels 0...7: 0 = Normal 1 = Indicates no load detected						
ShortCircuit	SINT	Short Circuit diagnostic status, 1 bit per channel for 0...7 channels: 0 = Normal						

Table 53 - 8-channel Digital Output, Simplex, Input (Continued)

Tag Name	Data Type	Definition		
		1 = Indicates short circuit detected		
GroupFieldPowerCurrent	DINT	Reports the total current that all active digital output modules in a group are drawing from the field power supply. Accuracy is $\pm 10\%$.		
FieldPowerVoltage1	DINT	Reports the voltage from the field power supply for the specified module and field power input. Accuracy is ± 500 mV		
FieldPowerVoltage2	DINT	Reports the voltage from the field power supply for the specified module and field power input. Accuracy is ± 500 mV		
Ch	AB_1715_ChStatusStruct: I:0[8]	Current / Voltage Status Array	Each element of the array comprises	Current: REAL Reports the current for the channel in milliamps and with an accuracy of ± 2 mA and $\pm 10\%$ of measurement Voltage: REAL Reports the channel voltage at the output terminals in units of millivolts and with an accuracy of ± 500 mV (The voltage element cannot report values below 0 mV)

Table 54 - 8-channel Digital Output, Duplex, Input

Tag Name	Data Type	Definition		
Fault	DINT, Binary	Module fault bit:	0 when one module is present and reporting valid data, 0xFFFF_FFFF when no modules are present, no Logix connection exists, or reported data is invalid.	
Readback	SINT	Output channel readback state, 1 bit per channel for channels 0...7: 0 = Off/de-energized 1 = On/energized		
Status	DINT, bit-field	Redundancy and power status:		
		Bit	Name	Description
		0	ModAFault	0 = Good 1 = Fault or module not present
		1	ModBFault	0 = Good 1 = Fault or module not present
		8	GroupFault	0 = Good 1 = Any channel or module faulted/failed
		9	ModAGroupFault	0 = Good 1 = Any channel or module A faulted/failed
		10	ModBGroupFault	0 = Good 1 = Any channel or Module B faulted/failed
PtFault	SINT	Channel fault status; 1 bit per channel for channels 0 ...7: 0 = Normal 1 = Pint is faulted/failed		
NoLoad	SINT	No Load diagnostic status, 1 bit per channel for channels 0...7: 0 = Normal 1 = Indicates no load detected		
ShortCircuit	SINT	Short Circuit diagnostic status, 1 bit per channel for 0...7 channels: 0 = Normal 1 = Indicates short circuit detected		
GroupFieldPowerCurrent	DINT	Reports the total current that all active digital output modules in a group are drawing from the field power supply. Accuracy is ± 10%.		
ModAFieldPowerVoltage1	DINT	Reports the voltage from the field power supply for the specified module and field power input. Accuracy is ± 500 mV		

Table 54 - 8-channel Digital Output, Duplex, Input (Continued)

Tag Name	Data Type	Definition
ModAFieldPowerVoltage2	DINT	Reports the voltage from the field power supply for the specified module and field power input. Accuracy is ± 500 mV
ModBFieldPowerVoltage1	DINT	Reports the voltage from the field power supply for the specified module and field power input. Accuracy is ± 500 mV
ModBFieldPowerVoltage2	DINT	Reports the voltage from the field power supply for the specified module and field power input. Accuracy is ± 500 mV
Ch	AB_1715_ChStatusStruct: I:0[8]	Current: REAL Reports the current for the channel in milliamps and with an accuracy of ± 2 mA and $\pm 10\%$ of measurement Current / Voltage Status Array Each element of the array comprises Voltage: REAL Reports the channel voltage at the output terminals in units of millivolts and with an accuracy of ± 500 mV (The voltage element cannot report values below 0 mV)

1715-IF16

This section describes the tags that are associated with the 1715-IF16 module.

Table 55 - 16-channel Analog Input, Simplex, Input

Tag Name	Data Type	Definition												
Fault	DINT, Binary	Module fault bit: 0 when one module is present and reporting valid data, 0xFFFF_FFFF when no modules are present, no Logix connection exists, or reported data is invalid.												
ChSimplex[0...15]	Array of structure	Array of 16 structures that represent the data and fault status for channels 0...15:												
Data	REAL	Input data status												
Faults	DINT, bit-field	Channel fault status: <table> <tr> <th>Bit</th><th>Name</th><th>Description</th></tr> <tr> <td>0</td><td>Fault</td><td>0 = Good 1 = Circuit fault for this channel</td></tr> <tr> <td>3</td><td>Underrange</td><td>0 = Good 1 = Underrange detected</td></tr> <tr> <td>4</td><td>Overrange</td><td>0 = Good 1 = Overrange detected</td></tr> </table>	Bit	Name	Description	0	Fault	0 = Good 1 = Circuit fault for this channel	3	Underrange	0 = Good 1 = Underrange detected	4	Overrange	0 = Good 1 = Overrange detected
Bit	Name	Description												
0	Fault	0 = Good 1 = Circuit fault for this channel												
3	Underrange	0 = Good 1 = Underrange detected												
4	Overrange	0 = Good 1 = Overrange detected												
RollingTimestamp	INT	Time stamp data												
Status	DINT, bit-field	<table> <tr> <th>Bit</th><th>Name</th><th>Description</th></tr> <tr> <td>8</td><td>GroupFault</td><td>0 = Good 1 = Any channel on the module is faulted/failed</td></tr> </table>	Bit	Name	Description	8	GroupFault	0 = Good 1 = Any channel on the module is faulted/failed						
Bit	Name	Description												
8	GroupFault	0 = Good 1 = Any channel on the module is faulted/failed												

Table 56 - 16-channel Analog Input, Duplex, Input

Tag Name	Data Type	Definition			
Fault	DINT, Binary	Module fault bit: 0 when one module is present and reporting valid data, 0xFFFF_FFFF when no modules are present, no Logix connection exists, or reported data is invalid.			
ChSimplex[0...15]	Array of structure	Array of 16 structures that represent the data and fault status for channels 0...15: 0 = Data 1 = Faults			
Data	REAL	Input data			
Faults	DINT, bit-field	Channel fault status: <table> <tr> <th>Bit</th><th>Name</th><th>Description</th></tr> </table>	Bit	Name	Description
Bit	Name	Description			

Table 56 - 16-channel Analog Input, Duplex, Input

Tag Name	Data Type	Definition		
		0	Fault	0 = Good 1 = Circuit fault for this channel
		1	ModAFault	0 = Good 1 = This channel on Module A is faulted/failed
		2	ModBFault	0 = Good 1 = This channel on Module B is faulted/failed
		3	Underrange	0 = Good 1 = Underrange detected
		4	Overrange	0 = Good 1 = Overrange detected
RollingTimestamp	INT	Time stamp data		
Status	DINT, bit-field	Bit	Name	Description
		0	ModAFault	0 = Good 1 = Fault or module not present
		1	ModBFault	0 = Good 1 = Fault or module not present
		8	GroupFault	0 = Good 1 = Any channel on module is faulted/failed
		9	ModAGroupFault	0 = Good 1 = Any channel on Module A is faulted/failed
		10	ModBGroupFault	0 = Good 1 = Any channel on ModuleB is faulted/failed

1715-OF8I

This section describes the tags that are associated with the 1715-OF8I module.

Table 57 - 8-channel Analog Output, Output

Tag Name	Data Type	Definition		
AOCh[0...7]	Array of structure	Array of 8 structures for the output data: 0 = Data 1 = Faults		
Data	REAL	Commanded output value		
Control	DINT, bit-field	Alarm control:		
		Bit	Name	Description
		0	HAlarmUnlatch	Rising edge transition (that is, 0 > 1) unlatches alarm
		1	LAlarmUnlatch	Rising edge transition (that is, 0 > 1) unlatches alarm
		2	RateAlarmUnlatch	Rising edge transition (that is, 0 > 1) unlatches alarm

Table 58 - 8-channel Analog Output, Simplex, Input

Tag Name	Data Type	Definition	
Fault	DINT, Binary	Module fault bit:	0 when a module is present and reporting valid data, 0xFFFF_FFFF when no module is present, no Logix connection exists, or reported data is invalid.
ChDuplex[0...7]	Array of structure	Array of 8 structures that represent the data and fault status for channels 0...7: 0 = Data	

Table 58 - 8-channel Analog Output, Simplex, Input (Continued)

Tag Name	Data Type	Definition 1 = Faults		
Readback	REAL	Input data		
Faults	DINT, bit-field	Channel fault status:		
		Bit	Name	Description
		0	Fault	0 = Good 1 = Circuit fault for this channel
		4	InHold	
		5	NotANumber	
		6	LAlarm	
		7	HAlarm	
		8	RateAlarm	
		9	LineFault	
Status	DINT, bit-field	Bit	Name	Description
		8	GroupFault	0 = Good 1 = Any channel on module is faulted/failed

Table 59 - 8-channel Analog Output, Duplex, Input

Tag Name	Data Type	Definition		
Fault	DINT, Binary	Module fault bit:	0 when a module is present and reporting valid data, 0xFFFF_FFFF when no module is present, no Logix connection exists, or reported data is invalid.	
ChDuplex[0...7]	Array of structure	Array of 8 structures that represent the data and fault status for channels 0...7: 0 = Data 1 = Faults		
Readback	REAL	Input data		
Faults	DINT, bit-field	Channel fault status:		
		Bit	Name	Description
		0	Fault	0 = Good 1 = Circuit fault for this channel
		1	ModAFault	0 = Good 1 = Fault or Module A not present
		2	ModBFault	0 = Good 1 = Fault or Module B not present
		4	InHold	
		5	NotANumber	
		6	LAlarm	
		7	HAlarm	
		8	RateAlarm	
		9	LineFault	

Table 59 - 8-channel Analog Output, Duplex, Input

Tag Name	Data Type	Definition		
Status	DINT, bit-field	Redundancy and power status:		
		Bit	Name	Description
		0	ModAFault	0 = Good 1 = Fault or module not present
		1	ModBFault	0 = Good 1 = Fault or module not present
		8	GroupFault	0 = Good 1 = Any channel on module is faulted/failed
		9	ModAGroupFault	0 = Good 1 = Any channel on Module A is faulted/failed
		10	ModuleBGroupFault	0 = Good 1 = Any channel on Module B is faulted/failed

History of Changes

This appendix contains the new or updated information for each revision of this publication. These lists include substantive updates only and are not intended to reflect all changes. Translated versions are not always available for each revision.

Table 60 - 1715-UM001N-EN-P, October 2025

Change
Changed screenshots and information about product version across the manual.

Table 61 - 1715-UM001M-EN-P, January 2025

Change
Added a paragraph “Communication Port Security” to Chapter 1 of this manual.

Table 62 - 1715-UM001L-EN-P, September 2022

Change
Moved content related to SIL 2 safety applications to the ControlLogix in SIL 2 Applications Safety Reference Manual, publication 1756-RM001

Table 63 - 1715-UM001K-EN-P, March 2022

Change
Updated for UKCA
Updated Appendix D - PFD and PFH Calculations for a SIL 2 System

Table 64 - 1715-UM001J-EN-P, December 2020

Change
Updated 1715-AENTR firmware revision in PFD Calculations with 24-hour MTTR to 3.003
Applied latest publication template

Table 65 - 1715-UM001I-EN-P, March 2020

Change
Updated IEC 61508 edition.
Updated calculations for 1715 I/O modules.
Changed the section PFD Calculations with 10-hour MTTR to PFD Calculations with 24-hour MTTR.
Added Communications Data section.

Table 66 - 1715-UM001H-EN-P, December 2018

Change
Changed ambient temperature range.
Added references to ATEX and IECEx UL certificates in the Literature Library.

Table 67 - 1715-UM001G-EN-P, October 2018

Change
Format changes.
Added Important table to 1715-C2 Expansion Cable section.

Table 68 - 1715-UM001F-EN-P, July 2017

Change
Increment ControlFLASH™ tool version..
Correction to Typographical errors.
Cross-reference and hypertext links.
Change heading to accommodate table of contents.
Reformat Cell height and margins in table.
Reformat instruction numbers.
Version update to RSLogix 5000® programming software.
Remove reference to installation from disk and reword section.
Insertion of screen capture for updated version of software.
Modification of status indicator behavior.
Move December 2016 New and Updated Information into Revision History.

Table 69 - 1715-UM001E-EN-P, December 2016

Change
Addition of Studio 5000 environment to required software.
Studio 5000™ Logix Designer application is the rebranding of RSLogix 5000 software
Added sentence “One module in a duplex pair can be removed and replaced without system interruption.” to the Redundancy System Overview section.
Added detail of the flashing green Network status indicator to identify ‘partner’ adapter during module replacement to a 1715 Redundant I/O operational system. Detail included in an Important statement.
Inclusion of Figure 4- “Shield Termination Arrangement to Help Prevent Ground loops” and supporting text
Added “Timestamping” section
Added “Attention” statement to detailing how warranty effected by failure to install retaining clips correctly.
Added drawing detail for removal of adapter coding peg (Reducing number of coding pegs from 3 to 2.
Added “Attention” statement to “Power Requirements” subsection
Added ControlFLASH detail to the new “System Software” section.
Added “Attention” statement to “Install the Power Supply” section
Added sub-sub-section detailing the addition of a 120 Ω resistor assembly to facilitate use of HART Secondary Master.
Added Chapter 3, Security
Added more detailed explanation to examples of how to upgrade / replace digital I/O modules
Added sub section Field Power Status Integers
Added subsection Field Fault Detection
Added New Section “HART”
Modified Firmware Revision Column in Table 39- 1715 Devices in a SIL 2 System
Modified Table 40 - SIL 2 Add-On Instructions
Modified Table 46 - Maximum Scan Rates Measured. Added detail - The L75 Controller was used for taking measurements.
Added Table 47 - Maximum Scan Rates Measured - The L75 Controller was used for taking measurements
Added detail to subsection Module Faults
Added detail to subsection Channel Faults

Table 70 - 1715-UM001D-EN-P, September 2015

Change
Updated European Hazardous Location Approval information and embedded certificates
Added slew tolerance information
Added Electronic Keying approved text
Clarification of SIL 2 module reconfiguration

Table 71 - 1715-UM001C-EN-P, March 2014

Change
Updates to include SIL 2 operations with L7 ControlLogix® controllers
Studio 5000 Logix Designer® application added throughout document and new information about who can use this system
Using ControlLogix in SIL 2 Applications Safety Reference Manual added to Additional Resources section
Added redundant 1715 adapter and status indicator information
Added information to use a 1715 system in a SIL 2 application
Corrected drawing; added 1756-L7 controller and 1756-RM2 module; added reference for DLR topologies
Corrected drawing; added 1756-L7 controller and 1756-RM2 module
Network status indicator information
CIP™ messages
Required connections for duplex and simplex operation
Listen Only connections
Conformal coating is available on all 1715 modules
1715-A2A adapter base unit fuse graphic and removal and replacement information
Digital input termination assembly removal and replacement of fuses
Digital output termination assembly removal and replacement of fuses
Analog input termination assembly removal and replacement of fuses
Power requirements
1715 chassis firmware update; power recycle needed
ControlFLASH revision number
Power requirements for PELV/SELV
Correction to system power graphic
Digital Input diagram correction-standard inputs
Short circuit information
Digital Input diagram correction-line monitored inputs. Added reference for calibration drift checks
Corrected digital input termination assembly graphics
Added Attention table for inductive loads
Added missing arrow on 1715-OB8DE function block diagram, to go from the Control B box to the Output Control
Diagram correction-digital outputs
Damage to pins when inserting/removing I/O modules under power can fault the system
Corrected analog inputs graphic by removing footnote numbers on voltage
Added information about analog field loops, input modules and analog input field devices
Find and record MAC addresses
Added status indicator labels to the adapter graphic of the locking mechanism
Changes throughout the Assign an IP Address on the BOOTP/DHCP Server section
Verify BOOTP network settings Important table added
Added last step to disable BootP/DHCP
Module inhibiting when using multiple controllers
Corrected ohms symbol and added DC on voltage numbers
Shutdown states

Table 72 - 1715-UM001C-EN-P, March 2014

Change
Removed references to the 1756-IA16 module
Digital input module tags
Digital output module tags
Correction of table header to ControlLogix Analog I/O Modules and Components
Added performance criteria for the analog input module
Added performance criteria for the analog output module
Module inhibiting when using multiple controllers
Changed Get Support Now website to the Product and Compatibility Download Center website, added AOP versions for the adapter and I/O modules. Added reference to the release list of approved versions on https://www.tuvasi.com/
Updated screen capture throughout to reflect Logix Designer application version 21 interface and to include SIL 2 operation options
Connections for Listen Only
Module definition parameters for 1715-IB16D digital input module in Duplex mode for SIL 2 applications
Added Important table on how to change Alarms/Limits values
Added a chapter about SIL 2 safety operation with 1715 redundant I/O
Added a chapter about SIL 2 Add-On Instructions with 1715 redundant I/O
Corrected text from 3.9 to 4.3
Corrected text from 15 to 15.4. Added Calibration Drift Checks section
SIL 2 safety application online configuration restrictions
Added appendix for PFD and PFH calculations for a SIL 2 system
Added appendix for SIL 2 Applications Checklist
Added appendix for Tag Definitions

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Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, Knowledgebase, and product notification updates.	rok.auto/support
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
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