User Manual

Allen-Bradley

EtherNet/IP and ControlNet to PROFIBUS PA Linking Devices

Catalog Numbers 1788-EN2PAR, 1788-CN2PAR

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.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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

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

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

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

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

	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**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).

Introduction

This user manual describes the installation and operation of the 1788-EN2PAR and 1788-CN2PAR linking devices.

About the Linking Devices

The 1788-EN2PAR linking device provides a fast and integrated solution for adding PROFIBUS PA (process automation) field devices to any Logix platform. This linking device provides a direct link between PROFIBUS PA and **EtherNet/IP** networks with no intermediate PROFIBUS DP (decentralized peripherals) layer required.

The 1788-CN2PAR linking device provides a fast and integrated solution for adding PROFIBUS PA field devices to any Logix platform. This linking device provides a direct link between PROFIBUS PA and **ControlNet** networks with no intermediate PROFIBUS DP layer required.

In this manual, both modules are referred to as the linking device.

Integration into the Studio 5000® Logix Designer™ environment is seamless when you use the Add-on Profiles (AOPs) of the linking device. The process variables of each field device appear in engineering units without any required user logic. The entire PROFIBUS PA configuration is done within the Studio 5000 Logix Designer application. Extra process variable (PV) statuses and diagnostic information is also available.

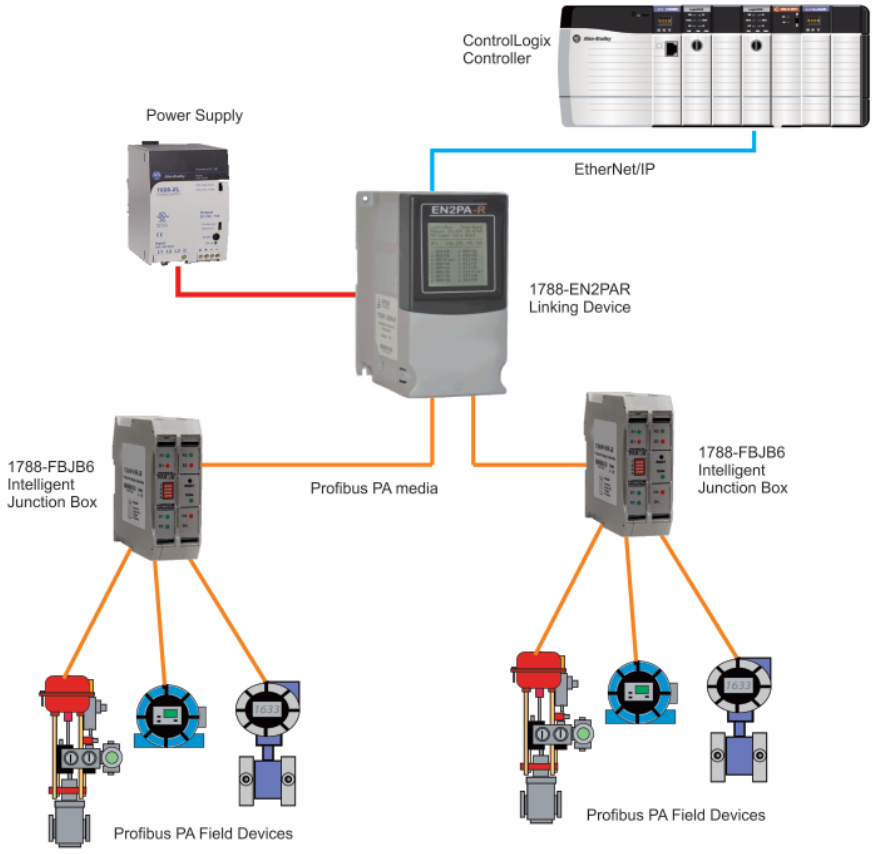
The linking device supports up to 24 field devices and supplies 500 mA per trunk.

You can view detailed diagnostics from each field device by using its device type manager (DTM) directly from the Studio 5000 environment with FDT ThinFrame. You can view a scope trace of the signal of each field device and provide extended statistics about packet count (sent, received, class 1, class 2, and so on).

Network Diagrams

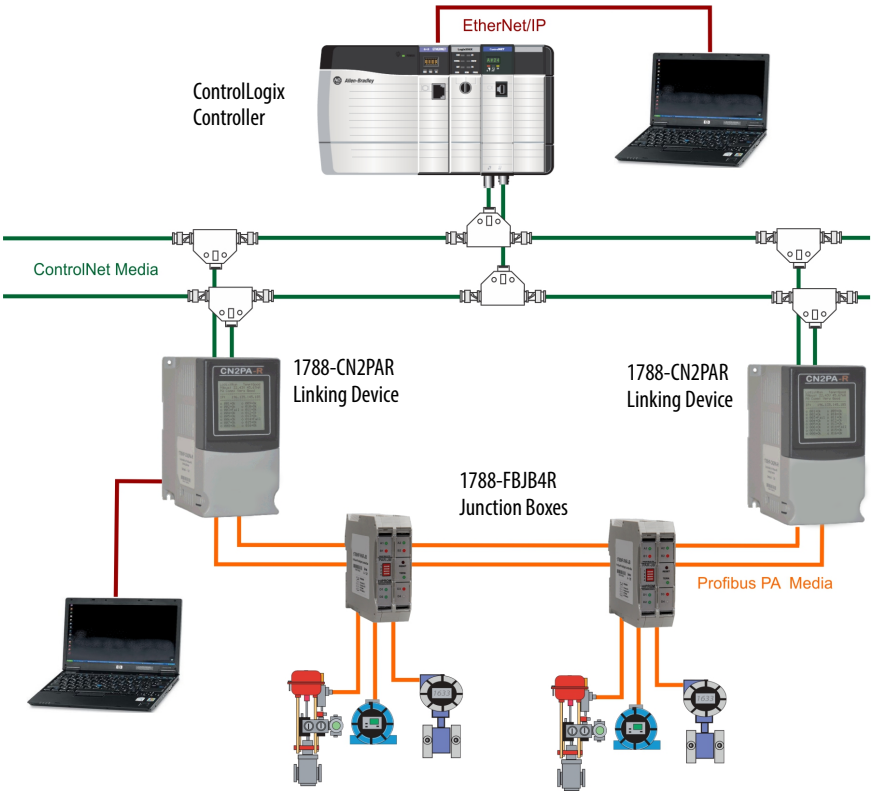
1788-EN2PAR Linking Device and EtherNet/IP Network

This diagram shows an example of how the 1788-EN2PAR linking device can be used with an EtherNet/IP network.



1788-CN2PAR Linking Device and ControlNet Network

The diagram shows an example of how a 1788-CN2PAR linking device can be used with a ControlNet network.



Features

The AOP provides an intuitive graphical interface to configure devices. A predefined data structure for each field device provides eight input process variables (PVs) and eight output PVs.

The linking device uses four controller connections. Data for the 24 field devices is distributed over the four common industrial protocol (CIP) connections. Connection A has the data for the linking device and four field devices. Connections B, C, and D have the data for four field devices each. The minimum requested packet interval (RPI) is 100 ms, and the maximum is 3,000 ms.

The HSProcessUtility is used to manage and register the general status description (GSD) files. The utility is launched from the AOP in the Studio 5000 Logix Designer application or directly in Microsoft Windows.

Field Device Tool/Device Type Manager (FDT/DTM) technology is supported; this technology allows access to field device configuration and diagnostics via FDT Frames such as FactoryTalk® AssetCentre. In addition, the Rockwell Automation® FDT ThinFrame (read only) can be launched from a FactoryTalk View or via the AOP providing access to each field devices status and extended diagnostics.

Built-in power conditioners and protection help to minimize installation space requirements. The PA segment is divided between two physical ports (A and B) with individual protection and a supply of 500 mA per port. See PA Network Connections on page 16.

Basic diagnostics of the linking device and field devices is found in the input assemblies. Advanced configuration is accomplished only through the AOP.

To help you troubleshoot the linking device, a 128 x 128 pixel display provides access to device status information. Status information includes network voltages and currents, internal temperature, and communication quality to each field device.

A built-in web server provides remote access to network and field device data.

General Precautions

Read and understand all precautions before using the linking device.

Prevent Electrostatic Discharge

ATTENTION: Prevent Electrostatic Discharge

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.

IMPORTANT Do not wire more than one conductor on any single terminal.

Environment and Enclosure

ATTENTION: Environment and Enclosure

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

ATTENTION: Do not place the module in direct sunlight. Prolonged exposure to direct sunlight could degrade the LCD.

European Hazardous Location Approval

The following applies when the product bears the marking.

This equipment is intended for use in potentially explosive atmospheres as defined by European Union Directive 94/9/EC 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, given in Annex II to this Directive.

Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 60079-15 and EN 60079-0.

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

WARNING: This equipment shall be mounted in an ATEX-certified enclosure with a minimum ingress protection rating of at least IP54 (as defined in IEC60529) and used in an environment of not more than Pollution Degree 2 (as defined in IEC 60664-1) when applied in Zone 2 environments. The enclosure must have a tool-removable cover or door.

WARNING: This equipment shall be used within its specified ratings defined by Rockwell Automation.

WARNING: Should the unit be installed in an environment where induced transients could exceed 44V, then external transient/surge arrestors should be installed.

WARNING: Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.

WARNING: Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.

WARNING: Devices shall be used in an environment of not more than Pollution Degree 2.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations.

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) may 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.
WARNING: 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	**AVERTISSEMENT: 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.

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

WARNING: Temperature rating of conductors must be higher than 82 °C (179.6 °F).

WARNING: If you connect or disconnect wiring while the field-side power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Additional Resources

These documents contain more information about related products from Rockwell Automation.

Resource	Description
FOUNDATION Fieldbus Linking Devices Technical Data, publication 1788-TD001	Provides technical data and specifications for the FOUNDATION Fieldbus linking devices.
FOUNDATION Fieldbus Junction Boxes Installation Instructions, publication 1788-IN006	Provides installation instructions and technical information about the FOUNDATION Fieldbus junction boxes (1788-FBJB4R, 1788-FBJB6)
ControlLogix® Enhanced Redundancy System User Manual, publication 1756-UM535	Provides information about enhanced redundancy systems including design and planning, installation, configuration, maintenance, and troubleshooting.
ControlLogix EtherNet/IP Module Installation Instructions, publication 1756-IN603	Provides hardware installation instructions for the ControlLogix EtherNet/IP module.
EtherNet/IP Network Configuration User Manual, publication ENET-UM001	Describes how you can use EtherNet/IP communication modules with your Logix5000 controller and communicate with various devices on the Ethernet network.
RSNetWorx™ for ControlNet Getting Results Guide, publication CNET-GR001	Provides information on how to install and navigate the RSNetWorx™ for ControlNet software. It explains how to use RSNetWorx for ControlNet software and how to access and navigate the online help.
RSNetWorx for EtherNet/IP Getting Results Guide, publication ENET-GR001	Provides information on how to install and navigate the RSNetWorx for EtherNet/IP software. It explains how to use RSNetWorx for EtherNet/IP software and how to access and navigate the online help.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

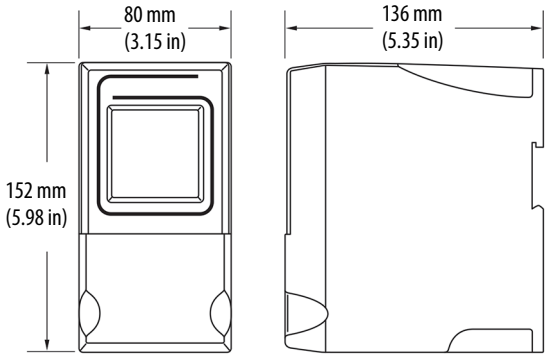
You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley® distributor or Rockwell Automation sales representative.

Installation

Hardware

ATTENTION: Do not wire multiple conductors on any single terminal.

Dimensions

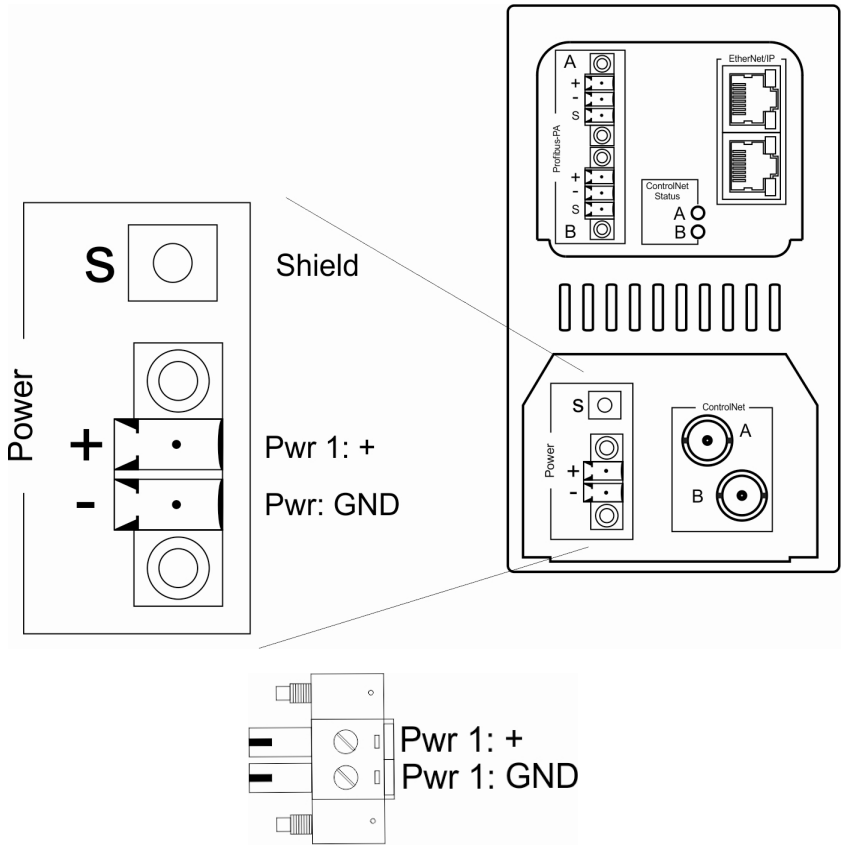


Power Connection

To comply with the CE Low Voltage Directive (LVD), this equipment must be powered from a source compliant with Safety Extra Low Voltage (SELV) or Protected Extra Low Voltage (PELV).

To comply with UL restrictions, this equipment must be powered from a source compliant with Class 2 or Limited Voltage/Current.

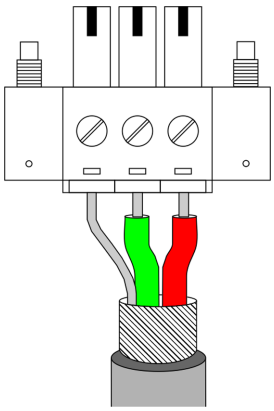
We recommend a 24…32V DC power supply for the linking device to operate correctly. No additional power supplies or power conditioners are required. The power supply connection is described here. Tighten DC Power connections to a torque of 0.22...0.25Nm (2...2.2 lb-in).



IMPORTANT Do not use extra power supplies or power conditioners with the 1788-EN2PAR and 1788-CN2PAR linking devices.

PA Network Connections

The PA network must be connected via the PA terminal on the linking device. The PA network connection and pin-out is described here.

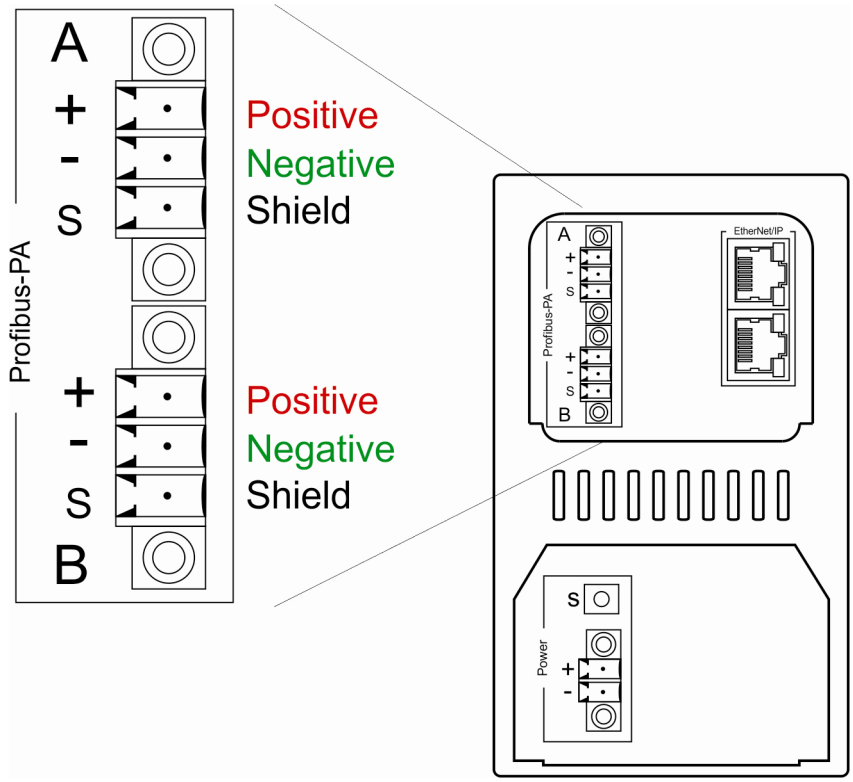


Pin	Description
Right/Top (red)	PA +
Middle (green)	PA -
Left/Bottom	Shield

Make PA network connections to a torque of 0.5...0.6 Nm (4.4...5.3 lb-in)

The PA segment is split between two physical ports, A and B.

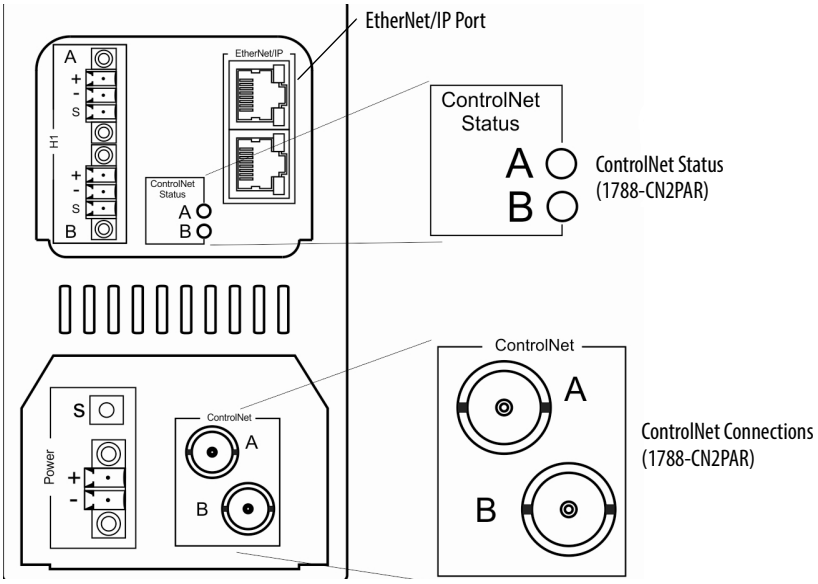
The PA network connections are described here.



ControlNet and EtherNet/IP Connections

Two BNC (Bayonet Neill-Concelman) connectors on the base of the 1788-CN2PAR linking device provide connections for single or dual ControlNet media. The dual port EtherNet/IP switch provides connections for multiple EtherNet/IP topologies, including device level ring (DLR). The EtherNet/IP port can also be used as a connection point in the field to access the Web server or asset management tools.

The ControlNet connections are described here.

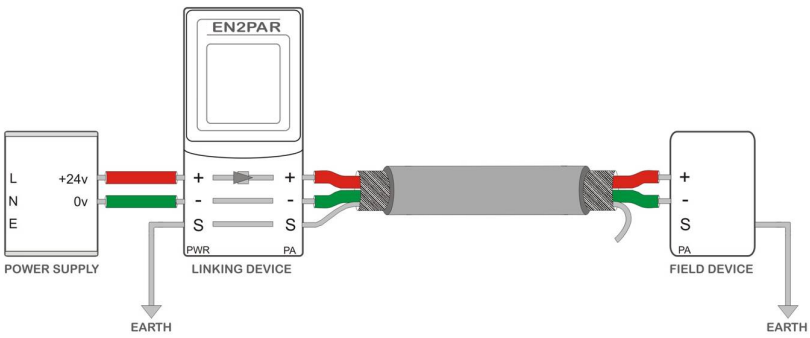


Shielding

Ground the linking device shield connection to a clean earth connection.

Connect the shield to the PA media so that connectivity runs through all junction boxes, but is not connected to the field device shield or grounded at the device.

Do not attach the PA media shield to the field device. Tape the media shield back to avoid accidental contact with other conductors or ground.



IMPORTANT If the shield is not correctly connected, noise from the environment on the PA bus can cause the PA data to be corrupted. Corrupted data can result in a low success rate and device connections being lost. Section 12.8.5 of IEC61158-2 (Physical Layer Specification), indicates that 90% of the full length of the cable must be shielded.

See Grounding/Earthing on page 19 for more details for shield connections.

PROFIBUS PA Physical Network Design Guidelines

This section provides more guidelines for the design of your PA network.

Power Supply

Verify that the power supply is not over-specified for the application; otherwise, the Switch mode generates noise when sufficient current is not being drawn. Table 1 shows an example of current consumption for a typical application.

Table 1 - Current Consumption Example

Linking device current consumption at 24V =	260 mA
PA bus current consumption for a specific application at 24V =	150 mA
Total =	410 mA

The minimum allowed input voltage is 24V DC, and the maximum is 32V DC.

IMPORTANT Do not use a 24V DC, 10 A power supply. We recommend using a 24V DC, 1 A power supply.

You must calculate the correct cable length and distance from the power supply for your installation. If the cable is too long, it can cause voltage drops in the supply rail when sufficient current is being drawn. See Cable Lengths on page 20 to help you determine the proper cable length for your installation.

Grounding/Earthing

Per section 12.8.7 of IEC61158-2 (Physical Layer Specification), PA signal wires (PA+ or PA-) must not be connected to ground/earth at any stage of the network. The shield must be grounded/earthed at only one place.

To ground the shield, connect it to the PROFIBUS PA connector as shown in Shielding on page 18, and connect ground/earth to the shield of the power connector as shown in Power Connection on page 15.

Cable Path

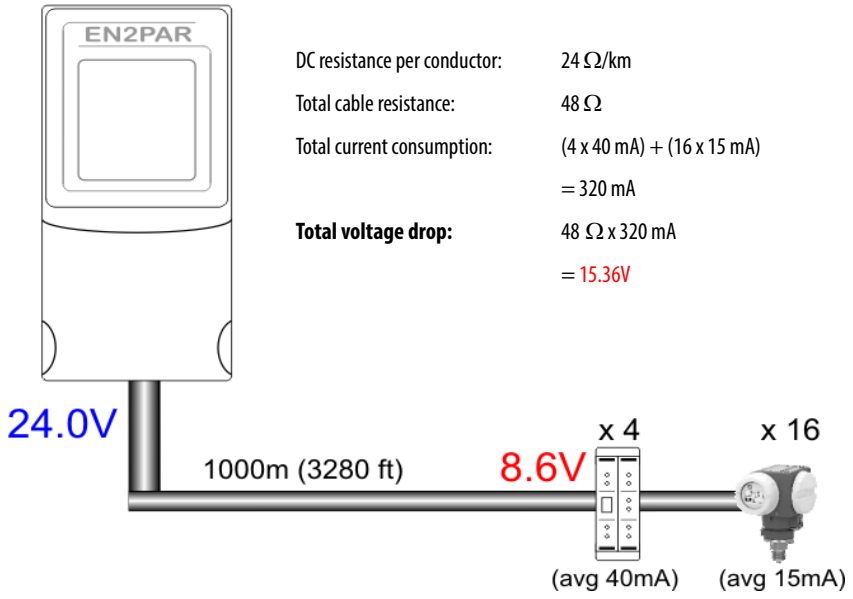
Do not route the PROFIBUS PA cable near any motors or high-voltage/high-current cables. Motors and high-voltage/high-current cables can generate noise that decreases communication signal quality on the PA cable, which can corrupt PA packets and cause field device timeouts.

Cable Lengths

Load and voltage drop determine maximum cable length. Consider these factors when planning the cable length for your installation:

- The more field devices and junction boxes that are connected, the bigger the load will be. The bigger the load, the more the signal attenuates, which can cause the signal to become unreadable.
- The bigger the load and the longer the cable, the bigger the voltage drop across the cable. The voltage at the end of a long cable can drop below the allowed PROFIBUS PA level. See Figure 1 for a cable length calculation example.

Figure 1 - Cable Length Calculation Example



Cable Type and Minimum Requirements

Per section 12.8.2 of IEC61158-2 (Physical Layer Specification), the PROFIBUS PA cable must meet the following minimum requirements:

- Impedance at 31.25 kHz of 100 Ω ± 20%
- Maximum attenuation of 3 dB/km
- Conductor cross-sectional area of 0.8mm^2 (18 AWG)
- Shield coverage of at least 90%
- Maximum DC resistance of 24 Ω/km per conductor
- Maximum capacitive unbalanced to the shield of 4nF/km

Cable Color Coding

Per section 12.8.8 of IEC61158-2 (Physical Layer Specification), the color code of the PROFIBUS PA cable must match the descriptions in the following table.

Cable Strand	Color
PA cable positive (+)	Red
PA cable negative (-)	Green
Non-IS PA cable	Black
IS PA cable	Blue or blue/black

Termination Guidelines

Terminate the PA bus cable at the beginning and end of the cable. You can set the linking device to be internally terminated. If the architecture allows it, terminators can be placed at different locations. See Appendix B for architectures and their correct termination locations.

Verify that junction boxes are not terminated internally. More than two terminators will cause the communication signal to become slewed and attenuated, which causes the signal to become unreadable.

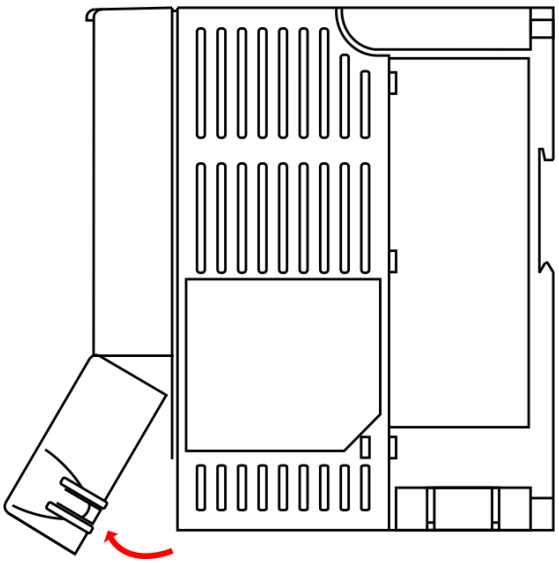
Per section 12.8.6 of IEC61158-2 (Physical Layer Specification), terminator impedance is equal to a 100 Ω resistor in series with a 1µF capacitor.

Set the Linking Device Network Address

This section describes the network address switches.

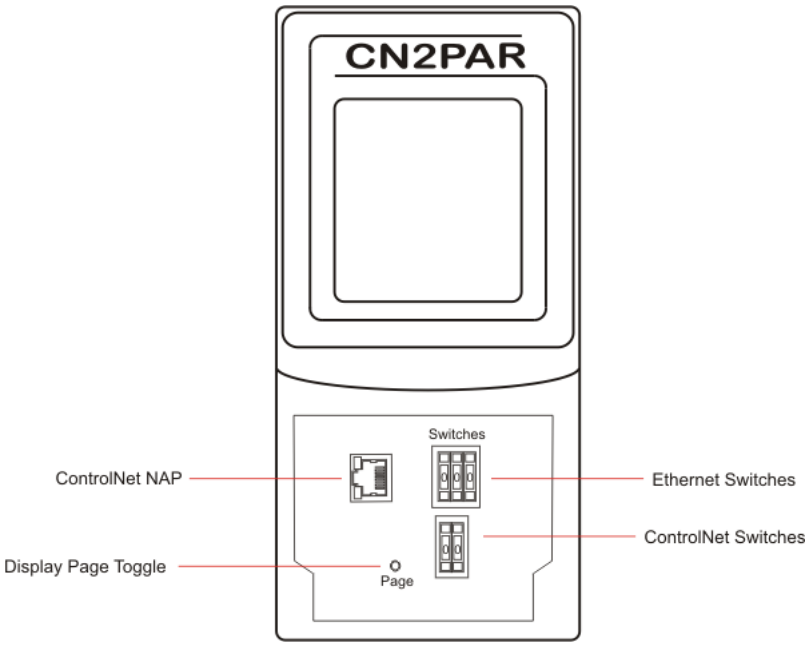
Hardware Switches Location

The hardware switches are located under the front cover of the linking device. Use the Page button to toggle between different diagnostics on the display.



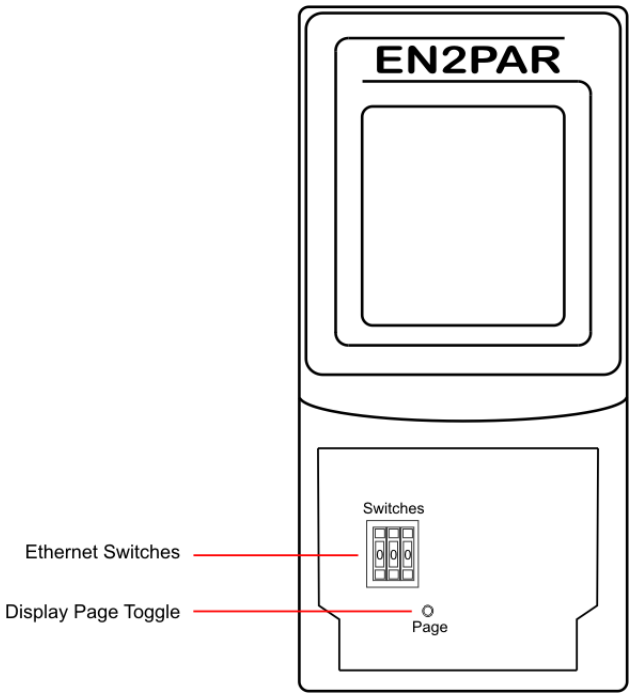
Set the ControlNet Node Address

To set the ControlNet node address of the 1788-CN2PAR linking device, use the hardware switches behind the front cover.



Set the EtherNet/IP Address

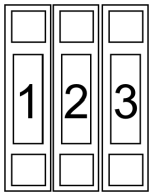
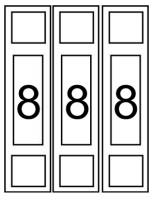
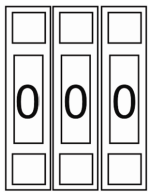
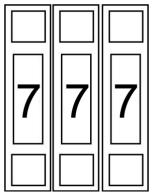
The linking device uses an RJ45 connector to connect to an Ethernet network. The linking device ships with BOOTP enabled. To set the IP address of the 1788-EN2PAR linking device, use a BOOTP server or use the hardware switches.



IMPORTANT Power down the linking device before changing the Ethernet switch settings. The IP address is set during powerup.

Ethernet Switch Settings

This table describes the Ethernet switch settings.

Ethernet Switch Setting	Description
	To set the IP address of the linking device to the 192.168.1.xxx sub net, set the switches to the required last three digits. In this example, the linking device will start up with IP address: 192.168.1.123.
	To set the IP address of the linking device via a BOOTP server, set the switches to 888 (factory default setting). Power up the linking device and set the IP address by using any BOOTP server. Once the new IP address has been set, power down the linking device, return the switches to 000, and power up the linking device.
	Normal setting after setting IP address with BOOTP. The 000 setting disables BOOTP and holds the IP address.
	The linking device can run the firmware that it was originally shipped with. If power was cycled while upgrading the firmware, the linking device could fail to start because the firmware was corrupted. Set the switches to 777 to set the linking device into Safe mode and upgrade the firmware again.

ControlNet Switch Settings

The linking device connects to a ControlNet network with a BNC connector. Set the ControlNet node address with the switches under the front cover.

This example shows a linking device set to the ControlNet address of 12.

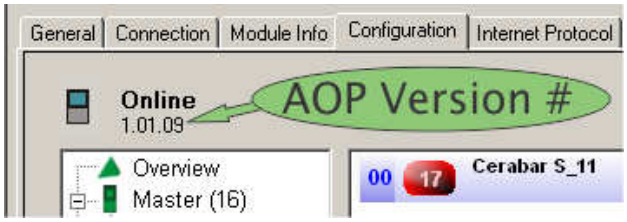
Software Installation

You need the AOP for the Studio 5000 Logix Designer application to configure and manage the linking device. The installation of the AOP includes the HSProcessUtility that is used to manage DTMs and GSD service libraries.

For the latest compatible software information and to download the AOP, see the Product Compatibility and Download Center at http://www.rockwellautomation.com/rockwellautomation/support/pcdc.page#/tab2.

AOP Version

The AOP version of the linking device is shown on the display during the start-up process.



TIP You can also click the upper-left corner of the profile window and click About Module Profile to view the AOP version.

Firmware Revision

The firmware revision is printed on the linking device and displayed on the screen during powerup. The Web server also provides the firmware revision.

Notes:

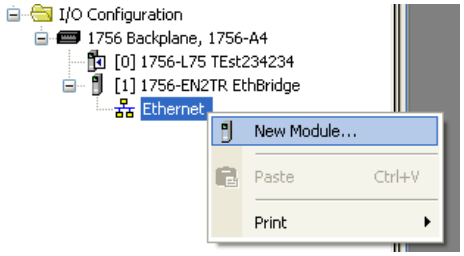
Set Up in the Studio 5000 Logix Designer Application

Add the 1788-EN2PAR Linking Device to the I/O Tree

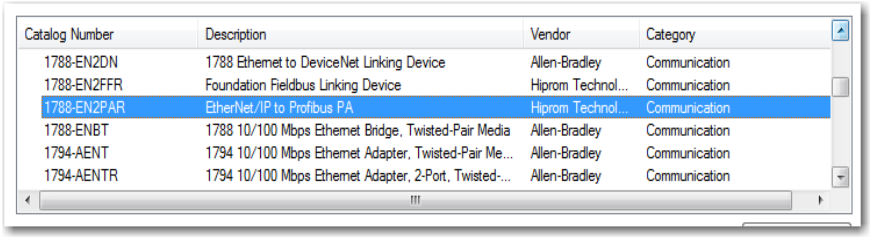
The 1788-EN2PAR linking device must be added to the I/O tree of the Logix controller. The linking device must be added to an Ethernet bridge module, such as an Allen-Bradley 1756-EN2T or 1756-EN2TR module.

Follow these steps to add the linking device to the I/O tree of the Logix controller. This example uses the 1756-EN2T module.

1. Right-click the Ethernet bridge and choose New Module.



2. Select the linking device that you want to add to the Ethernet bridge.



Catalog Number	Description	Vendor	Category
1788-EN2DN	1788 Ethernet to DeviceNet Linking Device	Allen-Bradley	Communication
1788-EN2FFR	Foundation Fieldbus Linking Device	Hiprom Technol...	Communication
1788-EN2PAR	EtherNet/IP to Profibus PA	Hiprom Technol...	Communication
1788-ENBT	1788 10/100 Mbps Ethernet Bridge, Twisted-Pair Media	Allen-Bradley	Communication
1794-AENT	1794 10/100 Mbps Ethernet Adapter, Twisted-Pair Me...	Allen-Bradley	Communication
1794-AENTR	1794 10/100 Mbps Ethernet Adapter, 2-Port, Twisted-...	Allen-Bradley	Communication

3. Click the General tab and set the name, description, and IP address.
4. Set the requested packet interval (RPI) for the linking device.

   The linking device RPI defaults to 300 ms. You can change the RPI if needed, depending on field device count and required update times.

IMPORTANT The RPI determines the amount of Class 1 data requests sent for the field devices that are configured on the PA bus. If many field devices are configured on the bus and RPI is set too low, class 1 data (PVs and status) do not update each cycle, and class 2 data responses are slowed.

See Class 2 MPPF on page 31 in the master configuration.

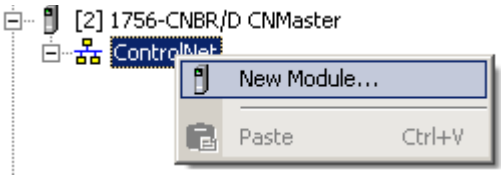
5. Click OK to add the linking device to the I/O tree.

Add the 1788-CN2PAR Linking Device to the I/O Tree

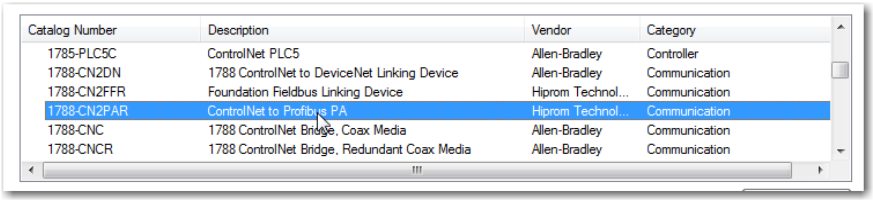
The 1788-CN2PAR linking device must be added to the I/O tree of the Logix controller. The linking device must be added to a ControlNet bridge module, such as an Allen-Bradley 1756-CNB or 1756-CNBR module.

Follow these steps to add the linking device to the I/O tree of the Logix controller. This example uses the 1756-CNBR module.

1. Right-click the ControlNet bridge and choose New Module.



2. Select the linking device to add to the ControlNet bridge.



3. Click the General tab and set the name, description, and ControlNet node address.
4. Set the RPI for the linking device.

   The linking device RPI defaults to 300 ms. You can change the RPI if needed, depending on field device count and required update times.

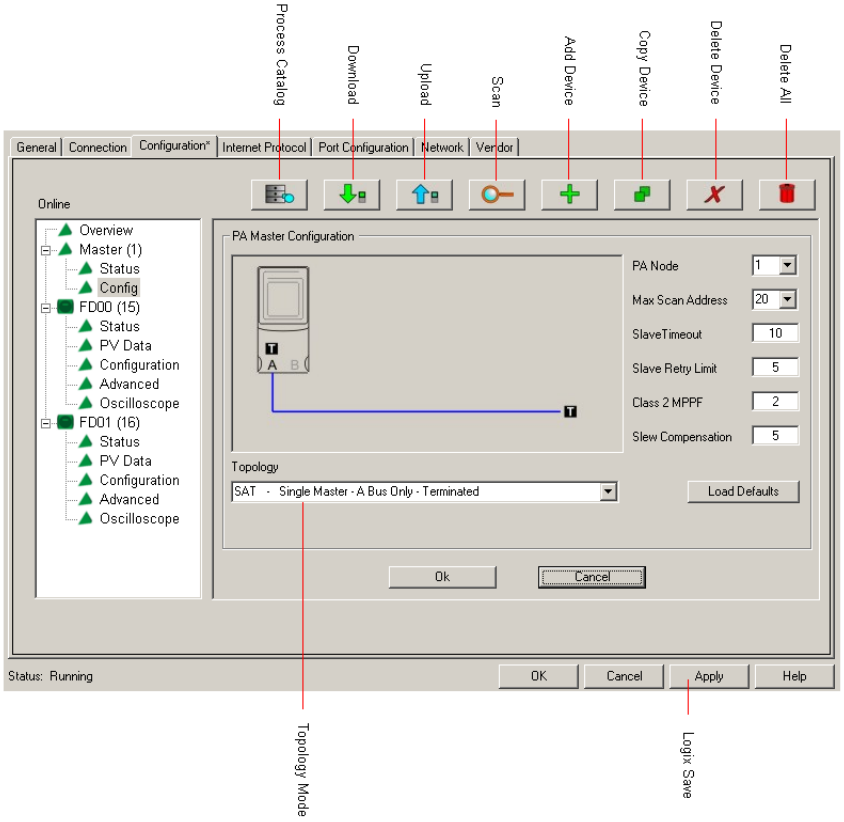
> **IMPORTANT** The RPI determines the number of Class 1 data requests sent for the field devices that are configured on the PA bus. If many field devices are configured on the bus and RPI is set too low, class 1 data (PVs and status) do not update each cycle, and class 2 data responses are slowed.
>
> See Class 2 MPPF on page 31 in the master configuration.

5. Click OK to add the linking device to the I/O tree.

Configure the Linking Device

After the linking device is added to the I/O tree, you can configure the device properties.

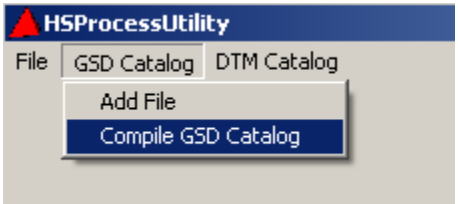
1. Right-click the linking device and choose Properties.
2. Click the Configuration tab to open the configuration page for the linking device.



Process Catalog

Launches the HSProcessUtility that manages the GSD files and DTMs. If you load new GSD files or DTMs, you launch the HSProcessUtility and update (compile) the libraries.

IMPORTANT You cannot configure a field device for cyclic communication unless the GSD file is in the process utility catalog and the catalog has been updated (compiled).



Download

Downloads the configuration to the linking device. The linking device saves the configuration in non-volatile memory.

IMPORTANT	After the configuration has been downloaded to the linking device, cycle power for the new configuration to take effect.

Upload

Uploads the configuration from the linking device to the Studio 5000 Logix Designer project.

IMPORTANT	Click the Apply button in the AOP to save the configuration to the Studio 5000 Logix Designer project.

Scan

Finds the field devices on the local PA bus and applies a default configuration to each device according to the GSD file of the manufacturer. The AOP scans up to the max scan address (see Max Scan Address on page 31).

Add Device

Manually adds a device that is not currently connected. The same default configuration is applied to the field device that is added.

Copy Device

Copies a field device configuration and applies it to all other locations.

TIP	If you want to replicate the configuration to many devices, the Copy Device button can speed up the process.

Delete Device

Deletes a device from the tree.

Delete All

Deletes all field devices from the configuration.

Configure the PA Master

Topology Mode

Choose the correct topology mode for the application. The graphical representation must match the actual topology. See Appendix B for available options. Use this setting to configure redundant linking devices, redundant PA media, and the internal PA segment terminators.

PA Node

The PA master (linking device) needs a node number to operate on the PA bus. The default is node number 1.

Max Scan Address

When the linking device is operating, a background scan probes each unused node number to see if any new field devices were connected. The background scan runs to the max scan address, then restarts at one.

TIP This process also determines the max scan address for the scan function (see Scan on page 30).

Slave Timeout

The time in milli-seconds (ms) that the PA master gives for a reply from a field device before retrying the request.

IMPORTANT If the timeout is set too low, some field devices will not be able to reply in time, and packets could be lost. If the timeout is set too high and a field device has gone offline, it might take a long time before the PA master will time out that field device.

Slave Retry

The slave retry limit sets the number of times the PA master re-requests data before dropping the connection. The default setting is 5.

IMPORTANT Do not modify the default setting. Communication slows down if the limit is above 5.

Class 2 MPPF

Used to determine the minimum amount of acyclic data requests allowed per cyclic scan.

Slew Compensation

IMPORTANT To help prevent communication problems, do not adjust this setting.

Configure the Field Devices

This section describes how to configure one PV and multiple PVs for a slot.

Configure PV with Single Format

Each field device can have multiple PVs, each with a different format. In most cases the default configuration correctly configures each PV, but if you add, remove, or change PVs, make sure to change the format if needed. Table 2 shows available PV format options.

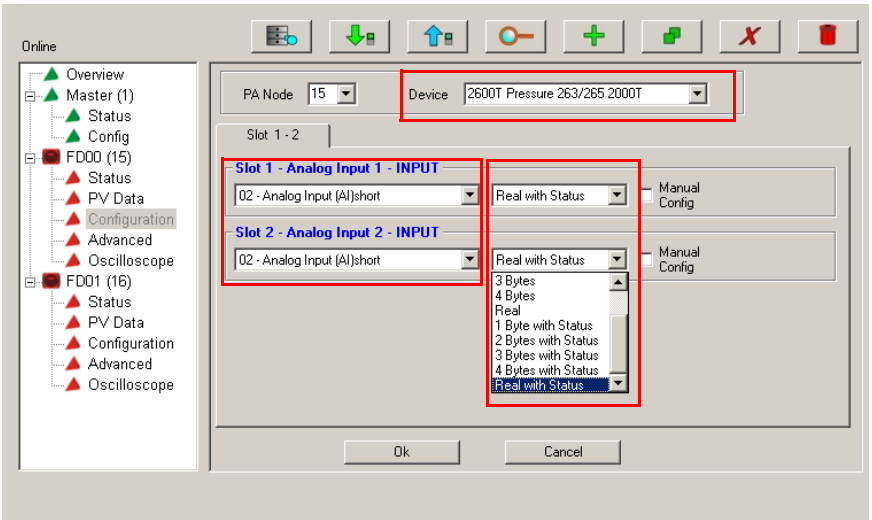
Table 2 - Process Variable (PV) Format Options

1 Byte	1 Byte with Status
2 Bytes	2 Bytes with Status
3 Byte	3 Byte with Status
4 Bytes	4 Bytes with Status
Real	Real with Status

IMPORTANT If you are not certain about the format of the PV, refer to the user manual of the field device being used.

To choose the PV format, follow these steps.

1. From the Device pull-down menu, choose the device that you want to configure.
2. From the Slot pull-down menu, choose the type of PV.
3. From the format options pull-down menu, choose the format for the PV.
4. Click Ok to save the PV formats.



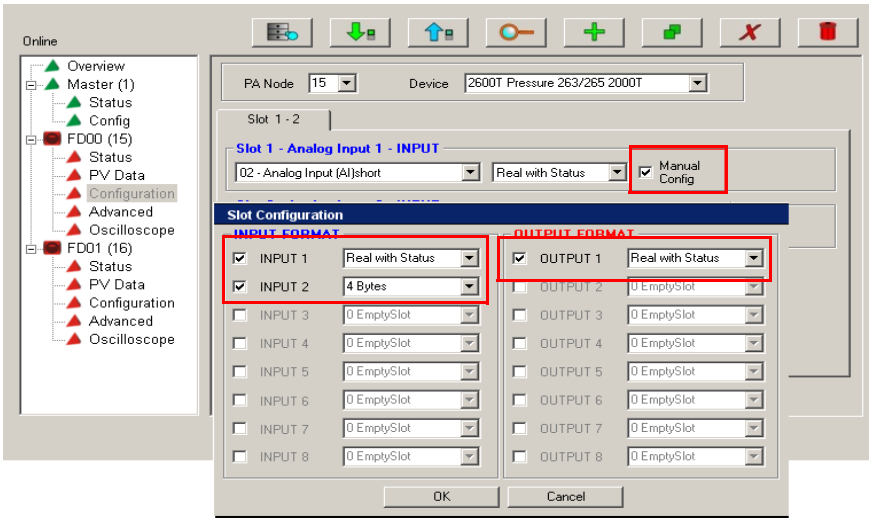
Configure PV with Multiple Formats

In some cases (for example, positioner field devices), there are multiple input and output PVs per slot. See Valve Positioner Configuration on page 34 for details.

IMPORTANT Select the number of inputs and outputs, and their respective PV formats, as shown in the user manual of the field device. In the input image of the field device, the PV is set per the manual slot configuration.

To configure multiple PV formats for the slot, follow these steps.

1. Select the Manual Config check box and click the Configure button to open the Slot Configuration dialog box.
2. Select the check boxes for the input and output PVs that you want to configure.
3. From the pull-down menu, choose the PV formats for the selected inputs and outputs.
4. Click Ok to save the PV formats.

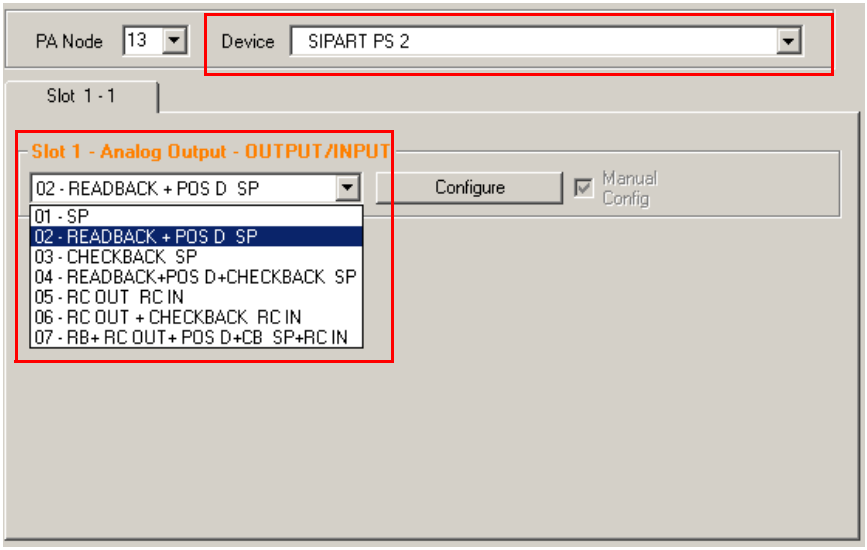


Valve Positioner Configuration

A valve positioner typically has only one slot that has multiple predefined inputs and outputs. Consult the user manual for the device to verify the definition for each option. One basic option is to configure the valve positioner to receive a setpoint from the ControlLogix controller via the linking device and to return the defined position.

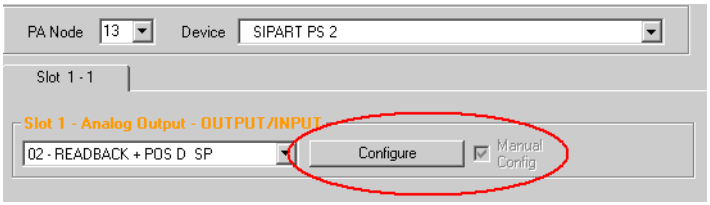
Follow these steps for setting the valve positioner.

1. From the Device pull-down menu, choose the device that you want to configure.
2. From the Slot pull-down menu, choose the output/input option for the valve positioner.



After you choose an output/input option, a Configure button replaces the data format option and the Manual Config option is checked.

3. Click the Configure button.

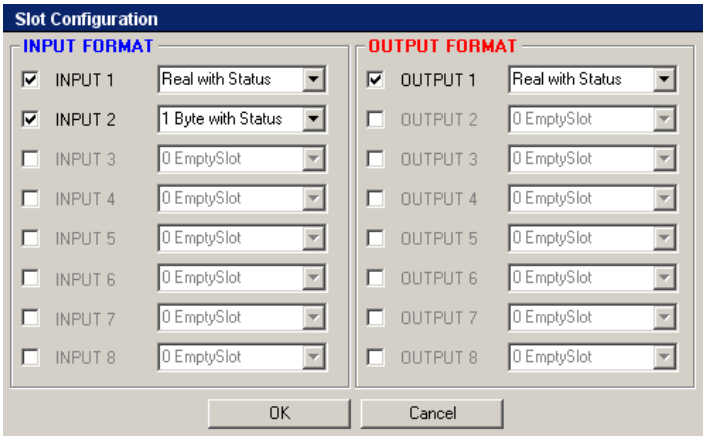


The Slot Configuration dialog box opens.

4. Configure the input and output formats for the slot configuration.

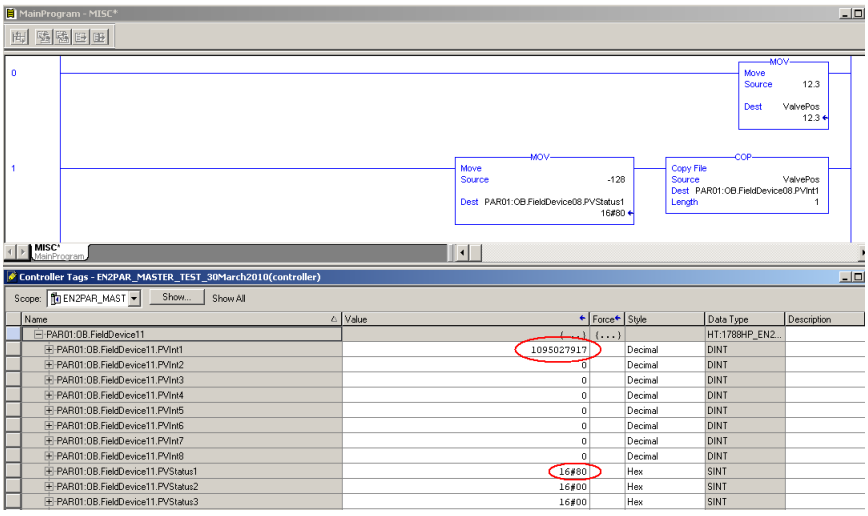
IMPORTANT See the documentation for the valve positioner to verify the correct data format for each option.

In this example, the setpoint sent to the valve positioner is a real value with a 1-byte status. The actual position that the valve positioner returns is also a real value with a 1-byte status, with an added 1 byte with status and discrete position.



5. Use the AOP to download the configuration to the linking device. A real value can now be written into the output PV tag for that field device in the Studio 5000 Logix Designer application (as shown in the following figure).

TIP See example code CN2PAR_FieldDevice_Outputs.ACD.



IMPORTANT Send a Good/Valid PV status to the field device output. See the field device user manual for the needed status values. Typically, if you send a PVStatus value of 0x80 (-128), the field device accepts the position that is given. If you do not send a Good/Valid PV status to the field device output, the valve postioner ignores the position that is supplied and returns to a Safe state.

PROFIBUS PA Redundancy Setup

The linking device provides PROFIBUS PA and Ethernet architectures. This section describes the PROFIBUS PA redundancy options that are available, and highlights the benefits and sets required to implement them.

Hardware

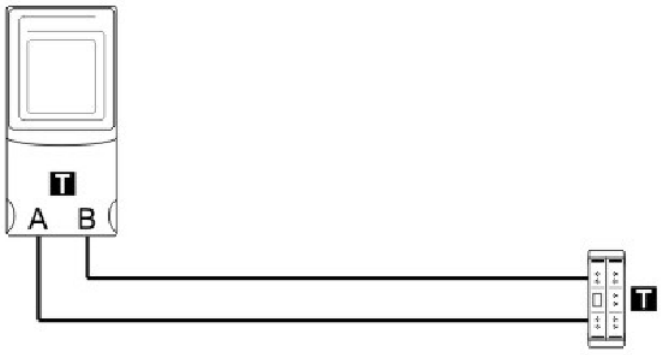
This section describes the hardware redundancy for media and master devices.

Media Redundancy

For media redundancy, you can select from dual trunk or ring redundant media architecture. When selecting the architecture, select the correct setup in the linking device AOP. See Software on page 39 for more details. Here are examples of dual trunk and ring architectures.

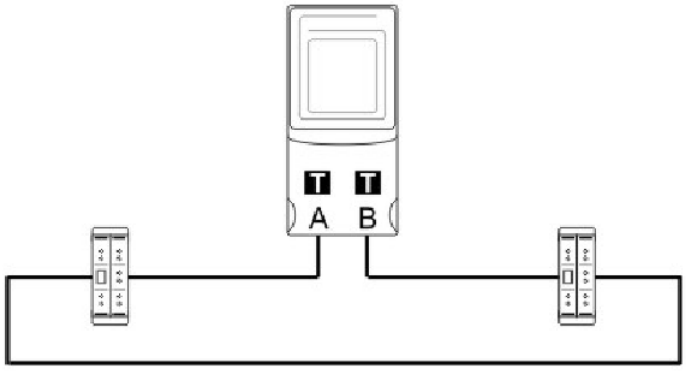
IMPORTANT To create the redundant media architecture, use the 1788-PARJB junction box.

Figure 2 - Dual Trunk Media Redundancy



IMPORTANT When using dual trunk redundancy, the total difference in cable length between trunk cable A and trunk cable B must not exceed 250 m (820 ft). This applies even when using multiple junction boxes.

Figure 3 - Ring Media Redundancy



IMPORTANT When using ring redundancy, enable the auto-terminate function on the 1788-PARJB junction box. See the1788-PARJB Quick Start Guide, publication 1788-QS005, for details. Failure to enable the auto-terminate function can cause network termination issues that can cause the network to become unstable.

Limitations

The linking device can support a maximum of 24 field devices and a maximum current supply of 500 mA per trunk.

Benefits

The network is protected against a segment open circuit and short circuit conditions, as long as a functional path exists to each instrument.

In a ring architecture, you can use bit 0 of the MasterStatus in the Logix input assembly to determine if the ring is healthy. A **1** indicates the ring is closed and operational, while a **0** indicates there is a break in the ring.

Master Redundancy

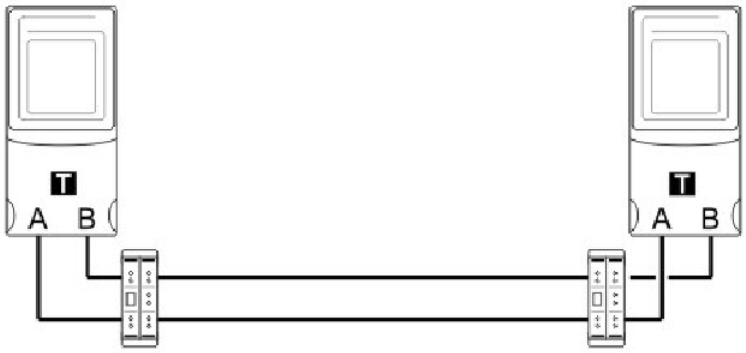
The linking device can support a maximum of two PA masters on one PROFIBUS PA network. Configure the PA master with one of the architectures in the software setup. Select the correct setup before downloading the configuration. Figure 4 is an example of a MulitMaster setup. When using only single trunk architecture, you can add any IEC61158 junction box.

Figure 4 - MultiMaster Redundancy

IMPORTANT When using certain MulitMaster architectures (such as ring redundancies), enable the auto-terminate function on the 1788-PARJB junction box. Refer to the 1788-PARJB Quick Start Guide, publication 1788-QS005, for details. Failure to enable the auto-terminate function might cause network termination issues that can cause the network to become unstable.

Master and media redundancy can run simultaneously as shown in Figure 5.

Figure 5 - MultiMaster and Media Redundancy



More junction boxes can be added to the dual trunk. See Appendix B for valid redundancy configurations.

IMPORTANT When using dual trunk architecture, use the 1788-PARJB junction box.

Limitations

A maximum of two linking devices can be added to one network.

Benefits

Master redundancy protects against loss of communication to a master device, and failure on a master device.

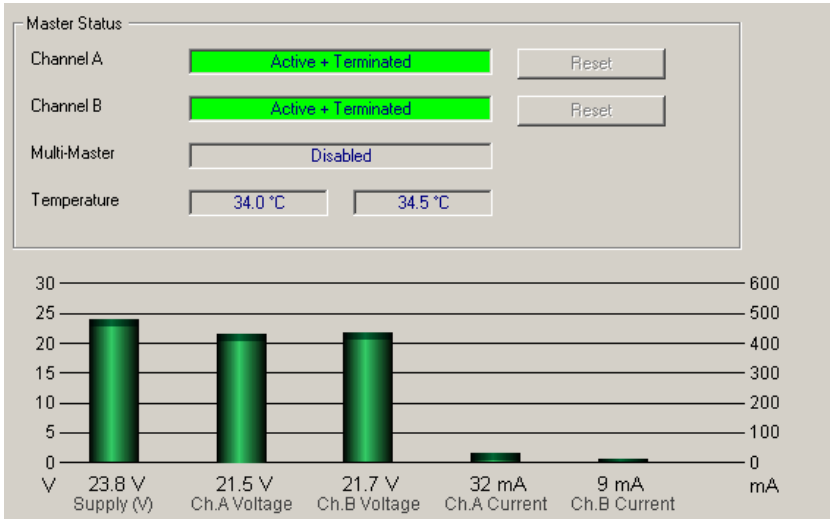
Software

IMPORTANT Choose the architecture that is used in the field before downloading the configuration. If the incorrect architecture is chosen, the network will not function correctly.

Media Redundancy

If the dual trunk redundancy is selected, you can view the PA Bus, and Channel A and Channel B diagnostics (voltage, current, and so on) as shown in Figure 6.

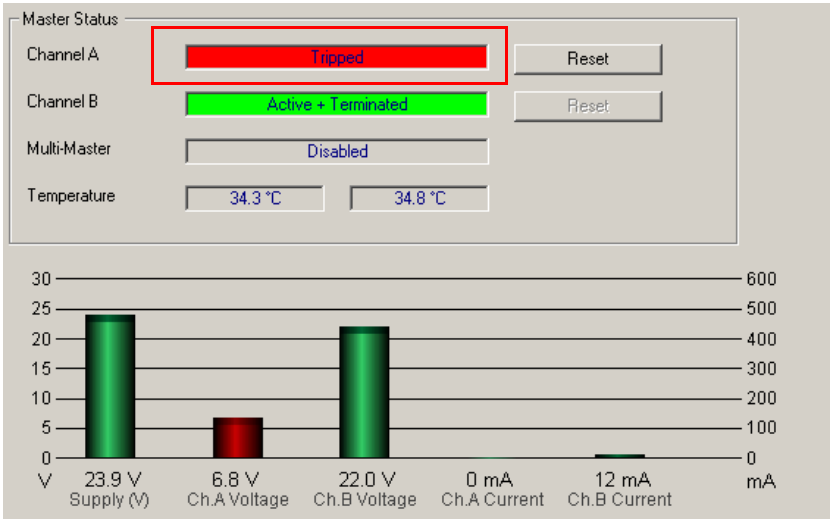
Figure 6 - PA Bus and Channel A/B Diagnostics



PAR01:IA.Master	{...}
PAR01:IA.Master.PABusVoltageA	21.53363
PAR01:IA.Master.PABusCurrentA	32.4
PAR01:IA.Master.PABusVoltageB	21.639708
PAR01:IA.Master.PABusCurrentB	10.08
PAR01:IA.Master.ExternalVoltage	23.84844
PAR01:IA.Master.Temperature	34.25
PAR01:IA.Master.BusAEnabled	1
PAR01:IA.Master.BusBEnabled	1
PAR01:IA.Master.BusATripped	0
PAR01:IA.Master.BusBTripped	0
PAR01:IA.Master.BusATerminated	1
PAR01:IA.Master.BusBTerminated	1
PAR01:IA.Master.NewFieldDevice	0
PAR01:IA.Master.MultiMasterActive	0
PAR01:IA.Master.MasterMode	4
PAR01:IA.Master.ModuleStatus	0
PAR01:IA.Master.ConnectionStatus	2#0000_0000_0000_0000_0000_0000_0100_0000

A short on either bus is indicated in the Studio 5000 Logix Designer application, or in the AOP as shown in Figure 7.

Figure 7 - Bus Short/Open Circuit



PAR01:IA.Master	{...}
PAR01:IA.Master.PABusVoltageA	6.834
PAR01:IA.Master.PABusCurrentA	0.0
PAR01:IA.Master.PABusVoltageB	22.039708
PAR01:IA.Master.PABusCurrentB	12.08
PAR01:IA.Master.ExternalVoltage	23.84844
PAR01:IA.Master.Temperature	34.25
PAR01:IA.Master.BusAEnabled	1
PAR01:IA.Master.BusBEnabled	1
PAR01:IA.Master.BusATripped	1
PAR01:IA.Master.BusBTripped	0
PAR01:IA.Master.BusATerminated	1
PAR01:IA.Master.BusBTerminated	1
PAR01:IA.Master.NewFieldDevice	0
PAR01:IA.Master.MultiMasterActive	0
PAR01:IA.Master.MasterMode	4
PAR01:IA.Master.ModuleStatus	0
PAR01:IA.Master.ConnectionStatus	2#0000_0000_0000_0000_0000_0000_0100_0000

IMPORTANT The linking device can only detect a short/open circuit on either of the trunks that are connected directly to the linking device. If there is a fault between two junction boxes, you will only see the fault by examining the junction boxes in the field. The junction boxes will indicate a fault on either a trunk or a drop.

The PA network will keep operating, but we recommend that you remove the short on the trunk, and use the AOP to reset the bus.

Reset the trunk on the 1788-PARJB junction box, since it will also be tripped.

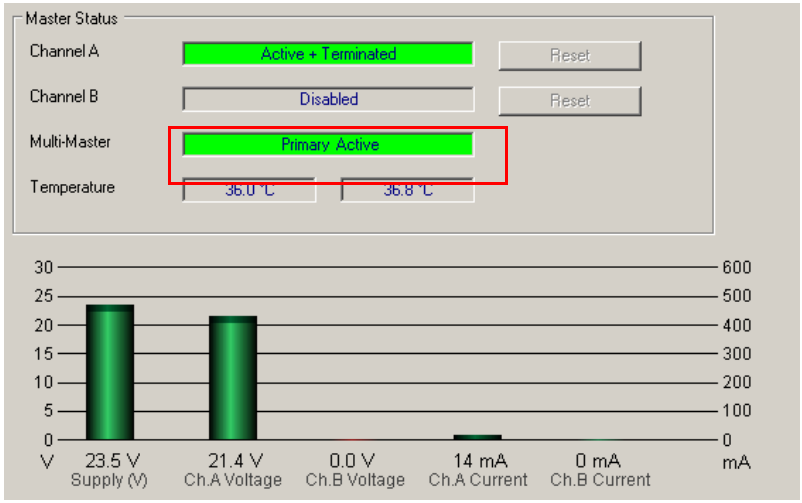
MultiMaster Mode

When running in redundant master mode (MultiMaster mode), the PA master can be in one of three different states:

- Primary Active
- Secondary Active
- Master Config Mismatch
- Master Node Mismatch

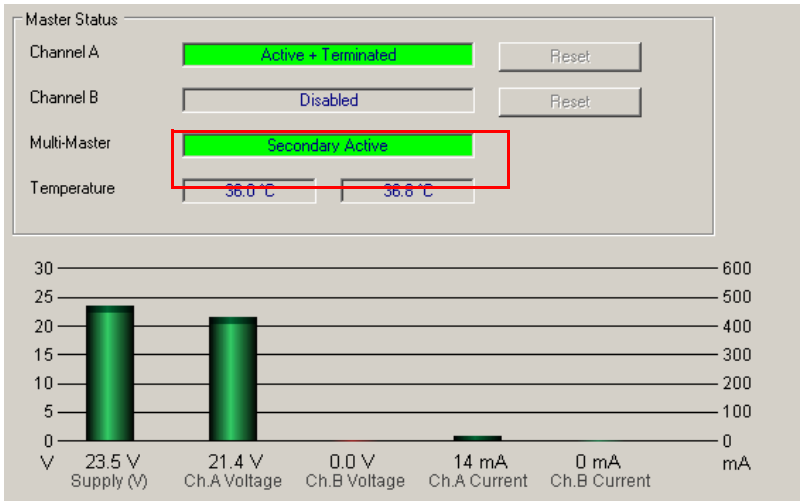
Primary Active

The Primary Active linking device is the primary master that is currently providing communication.



Secondary Active

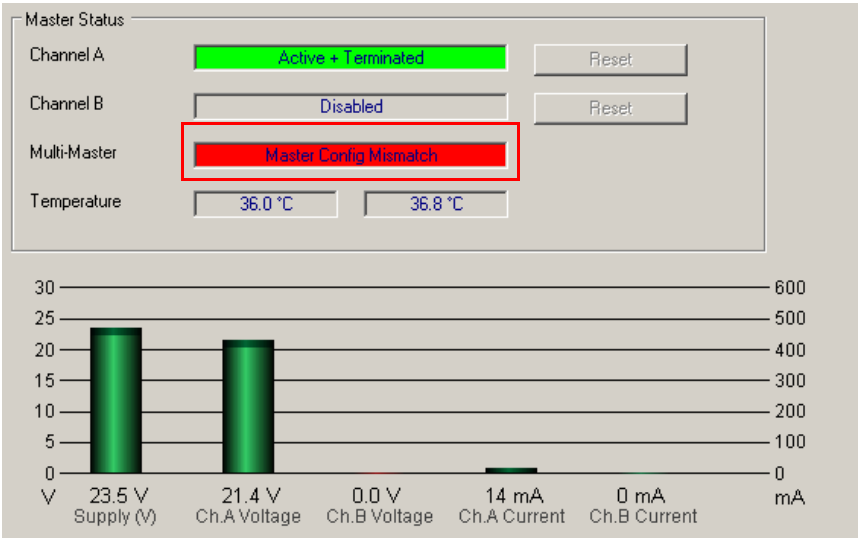
The Secondary Active linking device is the secondary master (hot backup). The secondary master does not provide communication until the primary master has not communicated for a certain amount of time.



Master Config Mismatch

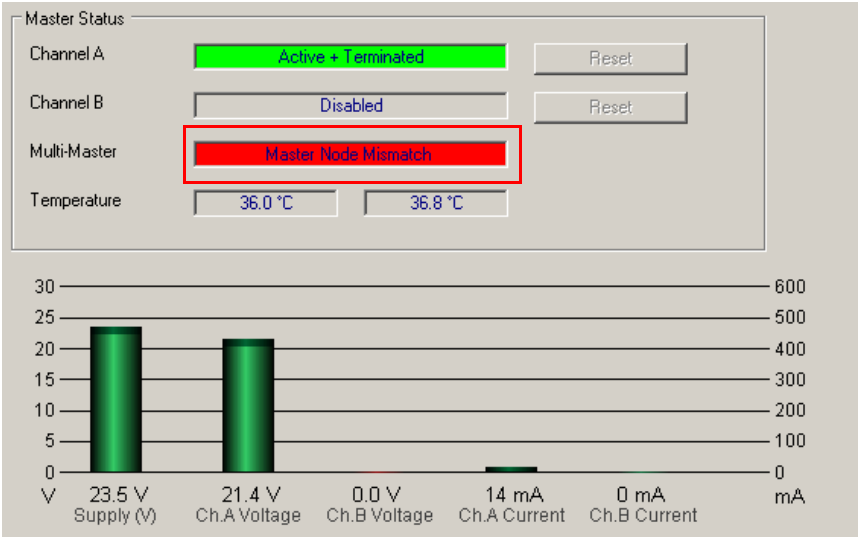
The Master Config Mismatch state occurs when the PA master configuration does not match the other PA master on the PA network.

IMPORTANT Both masters must have the same master and field device configurations.



Master Node Mismatch

The Master Node Mismatch state occurs when the primary and secondary masters do not have the same node address.

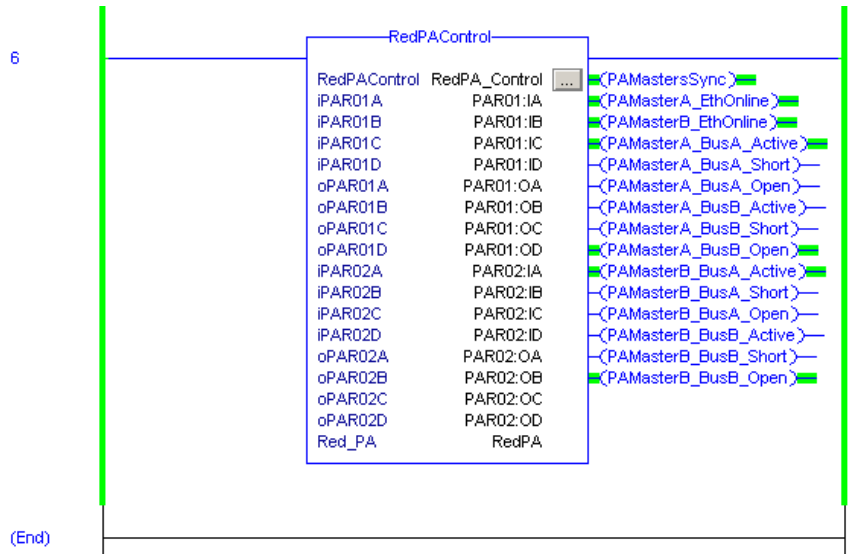


Redundant PA Code Example

When running in MulitMaster mode, the data appears twice in the Logix controller (once for each PA master). A combination of PA master status, MulitMaster active, and field device connection statuses are used as criteria.

The example code in Figure 8 provides an AOI to control the redundant PA.

Figure 8 - Example of Redundant PA Code



Notes:

Logix Assemblies

PA Master Input Image

Each linking device uses a total of four connections from the Logix controller, regardless of the field device count. Therefore, the input and output image of each linking device is divided into four sections, A through D. Connection A has the data for the linking device and four field devices. Connections B, C, and D have the data of four field devices each. Figure 9 shows the input image of the PA master.

Figure 9 - PA Master Input Image

PAR01:IA.Master	{...}	{..		HT:1788HP_EN2...
PAR01:IA.Master.PABusVoltageA	21.392195		Float	REAL
PAR01:IA.Master.PABusCurrentA	0.0		Float	REAL
PAR01:IA.Master.PABusVoltageB	21.2154		Float	REAL
PAR01:IA.Master.PABusCurrentB	37.44		Float	REAL
PAR01:IA.Master.ExternalVoltage	23.55474		Float	REAL
PAR01:IA.Master.Temperature	37.25		Float	REAL
PAR01:IA.Master.BusAEnabled	1		Decimal	BOOL
PAR01:IA.Master.BusBEnabled	1		Decimal	BOOL
PAR01:IA.Master.BusATripped	0		Decimal	BOOL
PAR01:IA.Master.BusBTripped	0		Decimal	BOOL
PAR01:IA.Master.BusATerminated	1		Decimal	BOOL
PAR01:IA.Master.BusBTerminated	1		Decimal	BOOL
PAR01:IA.Master.NewFieldDevice	0		Decimal	BOOL
PAR01:IA.Master.MultiMasterActive	1		Decimal	BOOL
PAR01:IA.Master.MasterMode	15		Decimal	SINT
PAR01:IA.Master.ModuleStatus	0		Decimal	INT
PAR01:IA.Master.ConnectionStatus	2#0000_0000_0000_0000_0000_0000_0000_0011		Binary	DINT

Bus A/B Tripped

If too much current is drawn (> 500 mA) on Bus A or Bus B, a trip occurs and the bus is no longer functional. The trip is indicated in the input image.

NewFieldDevice

This bit is set when a new field device is found that is not in the configuration of the PA master.

MultiMasterActive

This bit is set after the two PA master modules have synchronized, and they have the same node number and the same configuration.

IMPORTANT Both PA Masters must have the same configuration (master and field devices) for the masters to be able to synchronize.

MasterMode

This value indicates the currently implemented topology (see Appendix B).

ModuleStatus

This word is currently reserved.

Connection Status

If a field device is online and running (exchanging cyclic data), then the field device index bit in the connection status is set. If the device goes offline, the bit is cleared.

Field Device Input Image

Each field device displays its PA diagnostics and all available PVs and their status as shown in Figure 10.

Figure 10 - Field Device Input Image

PAR01:IA.FieldDevice00	{...}	{..		HT:1788HP_EN2...
PAR01:IA.FieldDevice00.PANode	15		Decimal	SINT
PAR01:IA.FieldDevice00.OnlineRunning	1		Decimal	BOOL
PAR01:IA.FieldDevice00.ConfigFault	0		Decimal	BOOL
PAR01:IA.FieldDevice00.ExtDiagAvail	0		Decimal	BOOL
PAR01:IA.FieldDevice00.ParameterFault	0		Decimal	BOOL
PAR01:IA.FieldDevice00.ParamaterReq	0		Decimal	BOOL
PAR01:IA.FieldDevice00.FreezeMode	0		Decimal	BOOL
PAR01:IA.FieldDevice00.SyncMode	0		Decimal	BOOL
PAR01:IA.FieldDevice00.WatchDog	0		Decimal	BOOL
PAR01:IA.FieldDevice00.PAIdent	16#04c2		Hex	INT
PAR01:IA.FieldDevice00.Data	{...}	{..		HT:1788HP_EN2...
PAR01:IA.FieldDevice00.Data.PVReal1	-1.191981		Float	REAL
PAR01:IA.FieldDevice00.Data.PVReal2	852.3965		Float	REAL
PAR01:IA.FieldDevice00.Data.PVReal3	0.0		Float	REAL
PAR01:IA.FieldDevice00.Data.PVReal4	0.0		Float	REAL
PAR01:IA.FieldDevice00.Data.PVReal5	0.0		Float	REAL
PAR01:IA.FieldDevice00.Data.PVReal6	0.0		Float	REAL
PAR01:IA.FieldDevice00.Data.PVReal7	0.0		Float	REAL
PAR01:IA.FieldDevice00.Data.PVReal8	0.0		Float	REAL
PAR01:IA.FieldDevice00.Data.PVStatus1	16#8d		Hex	SINT
PAR01:IA.FieldDevice00.Data.PVStatus2	16#80		Hex	SINT
PAR01:IA.FieldDevice00.Data.PVStatus3	16#00		Hex	SINT
PAR01:IA.FieldDevice00.Data.PVStatus4	16#00		Hex	SINT
PAR01:IA.FieldDevice00.Data.PVStatus5	16#00		Hex	SINT
PAR01:IA.FieldDevice00.Data.PVStatus6	16#00		Hex	SINT
PAR01:IA.FieldDevice00.Data.PVStatus7	16#00		Hex	SINT
PAR01:IA.FieldDevice00.Data.PVStatus8	16#00		Hex	SINT
PAR01:IA.FieldDevice00.Data.PVInt1	-1080519979		Decimal	DINT
PAR01:IA.FieldDevice00.Data.PVInt2	1146427744		Decimal	DINT
PAR01:IA.FieldDevice00.Data.PVInt3	0		Decimal	DINT

PANode

The node number of the field device on the PA bus.

OnlineRunning

This bit is set when the device is online and exchanging cyclic data.

ConfigFault

This bit is set if there is a fault in the configuration of the field device.

ExtDiagAvail

This bit is set when the field device has extra extended diagnostics available. This bit can be dynamic.

ParameterFault

This bit is set if there is a fault in the parameterization of the field device.

ParameterReq

This bit is set if the device has not received its parameterization.

FreezeMode

This bit is set if you enable Freeze mode in the parameterization of the field device and a global control is sent to freeze the device PVs.

SyncMode

This bit is set if you enable Sync mode in the parameterization of the field device and a global control is sent to synchronize the device PVs.

WatchDog

This bit is set if the watchdog is enabled in the parameterization of the field device.

PAIdent

This is the identity number of the specific field device.

PVReal1…PVReal8

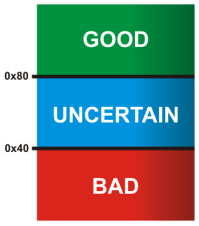
If you set a process variable to be a Real format, the data is displayed in this section.

PVStatus1…PVStatus8

If you set a process variable to have a Status, the status value for the each PV is displayed in this section.

See the user manual of the field device for the definition of the PV status. In general, the status definitions are as follows:

- Good = a value ≥ 0x80
- Uncertain = a value from 0x40…0x7F
- Bad = a value < 0x40 (for example, 0…0x3F)



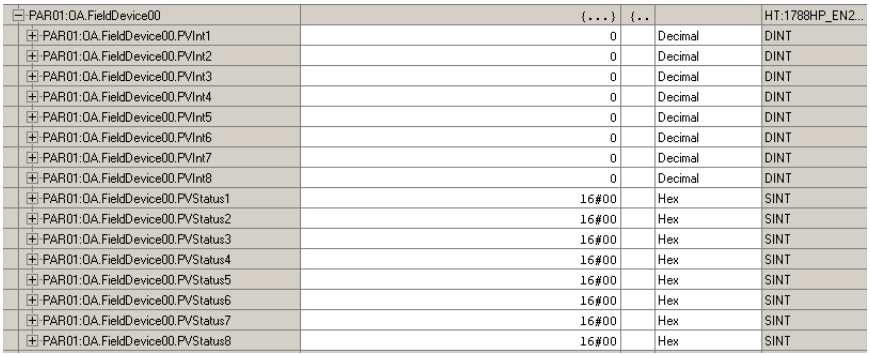
PVInt1…PVInt8

If you set a process variable to be a 1-byte to 4-byte format, the data is displayed in this image.

Field Device Output Image

Each field device displays its PA diagnostics and all available PVs and their status as shown in Figure 11.

Figure 11 - Field Device Output Image



PAR01:0A.FieldDevice00	{...}	{..		HT:1788HP_EN2...
PAR01:0A.FieldDevice00.PVInt1	0		Decimal	DINT
PAR01:0A.FieldDevice00.PVInt2	0		Decimal	DINT
PAR01:0A.FieldDevice00.PVInt3	0		Decimal	DINT
PAR01:0A.FieldDevice00.PVInt4	0		Decimal	DINT
PAR01:0A.FieldDevice00.PVInt5	0		Decimal	DINT
PAR01:0A.FieldDevice00.PVInt6	0		Decimal	DINT
PAR01:0A.FieldDevice00.PVInt7	0		Decimal	DINT
PAR01:0A.FieldDevice00.PVInt8	0		Decimal	DINT
PAR01:0A.FieldDevice00.PVStatus1	16#00		Hex	SINT
PAR01:0A.FieldDevice00.PVStatus2	16#00		Hex	SINT
PAR01:0A.FieldDevice00.PVStatus3	16#00		Hex	SINT
PAR01:0A.FieldDevice00.PVStatus4	16#00		Hex	SINT
PAR01:0A.FieldDevice00.PVStatus5	16#00		Hex	SINT
PAR01:0A.FieldDevice00.PVStatus6	16#00		Hex	SINT
PAR01:0A.FieldDevice00.PVStatus7	16#00		Hex	SINT
PAR01:0A.FieldDevice00.PVStatus8	16#00		Hex	SINT

PVInt1…PVInt8

If you are using a field device that requires an output, the data must be updated in the output image of that field device. If a real value must be sent, use the copy function to update the PVInt.

IMPORTANT See the Redundant PA Code Example on page 43 for a detailed example of how to update data for output modules.

PVStatus1…PVStatus8

If you set a process variable to be a 1-byte to 4-byte format, the data is displayed in this image.

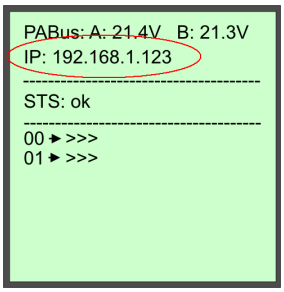
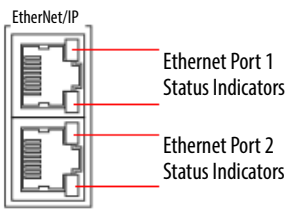
IMPORTANT Some field devices (such as valve positioners) operate correctly only after a valid status (for example, $\geq 80_h$) is sent with the process variable. See Valve Positioner Configuration on page 34 for more details.

Diagnostics

Linking Device is Offline

Use these diagnostic checks to help you identify and fix the problem when the linking device goes offline.

Table 3 - Linking Device is Offline Diagnostic Checks

Symptom	Checks
The I/O tree in the Studio 5000 Logix Designer application shows an orange triangle next to the linking device, and the module cannot be seen from the Add-On Profile (AOP).	Does the linking device have power, and did it powered up? Verify that the LCD backlight is on and information is displayed on the LCD screen.
	Can you ping the linking device? Verify that the linking device is on the same local Ethernet network when a ping is sent, and the computer network address is the same subnet. Example: • Linking device IP address: 172.30.187.120 • Linking device subnet mask: 255.255.255.0 • Computer IP address: 172.30.187.1…172.30.187.254
	Does the linking device have an IP address? Examine the linking device LCD and verify that there is an IP address, or that BOOTP is active. 
	Verify that the IP address of the linking device is in the same subnet range as that of the Allen-Bradley Ethernet module. • Linking device IP address: 172.30.187.1…172.30.187.254 • Linking device subnet mask: 255.255.255.0 • Ethernet module IP address: 172.30.187.1…172.30.187.254 • Ethernet module subnet mask: 255.255.255.0
	Verify that no duplicate IP address exists on network. Examine the LCD on the linking device to see if it indicates an IP conflict.
	Verify that the Ethernet cable is plugged into the linking device.
	Verify that the Ethernet status indicators are on, or flashing. Note: the status indicators flash when there is data exchange. • Yellow status indicator = 10 Mbit/s • Green status indicators = 100 Mbit/s 
	Verify that the Ethernet cable length from the linking device to the switch is less than 330 ft (100 m).

Field Device is Not Detected

Use these diagnostic checks to help you identify and fix the problem when a field device is not detected.

Table 4 - Field Device is Not Detected Diagnostic Checks

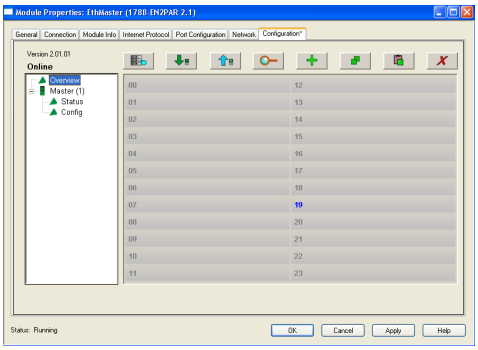
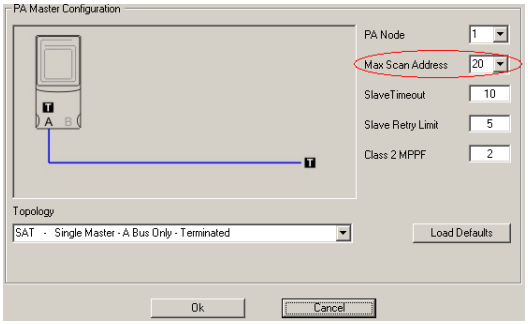
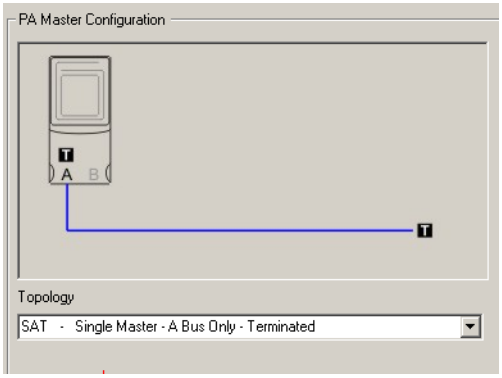
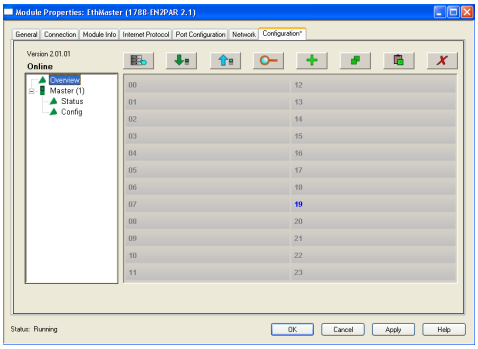
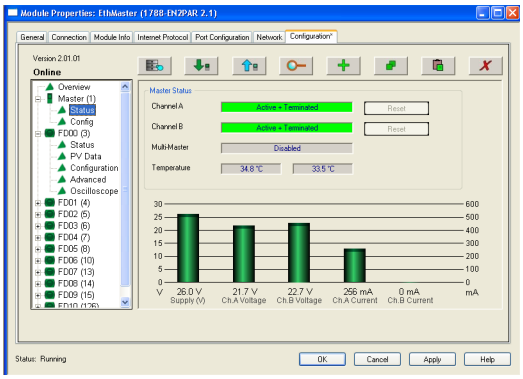
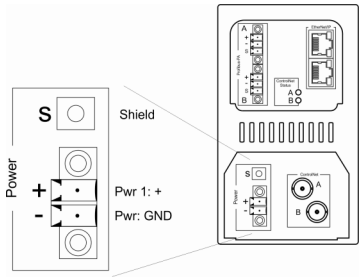
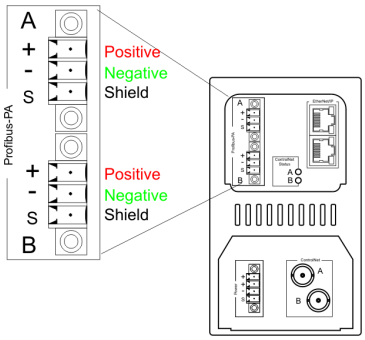
Symptom	Checks
The linking device AOP scan reports NO DEVICES FOUND when linking devices are connected. 	Are the PA node addresses set on the field devices? If you are using the soft address setting, add only one field device at a time and set the node address before adding the next field device. If you do not set the node address before adding the next field device, the field devices default to a node address of 126.
	Verify that the PA node address does not conflict with existing field devices on the network.
	Verify that the PA node address is less than or equal to the max scan address in the linking device AOP. 
	Verify that the field device has power. If a display is present, verify that the display is illuminated. If no display is present, use a voltmeter to check the voltage across the PA terminal in the field device (verify correct polarity). See the field device manual to see minimum input voltage. The longer the cable and the bigger the load (number of field devices and junction boxes), the bigger the voltage drop across the cable. See Cable Lengths on page 20 and Table 1 on page 19 for a description of cable length guidelines.
	Verify that the PROFIBUS PA network cable is not in a noisy environment. Keep away from power cables, drives, and other sources of noise.
	Verify that the cable shield is connected at the linking device and at the junction box, and not at the field device. Verify that the shield is not touching the instrument casing or gland. Tape off the cable end.
	Verify that the network is sufficiently terminated (not over or under terminated). Typically, a terminator is placed at the start and end of the PROFIBUS PA network. In some network architectures, the linking device can terminate the start of the PROFIBUS PA network. See Termination Guidelines on page 21 and Appendix B for termination guidelines and network architectures.
	Verify that the network topology setting in AOP matches the physical network topology. See Configure the PA Master on page 31 and Appendix B for configuring the topology in AOP and network architectures. 

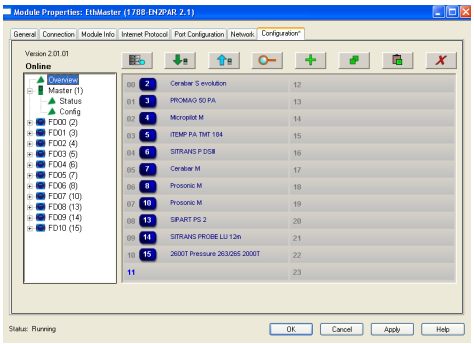
Table 4 - Field Device is Not Detected Diagnostic Checks (Continued)

Symptom	Checks
The linking device AOP scan reports NO DEVICES FOUND when linking devices are connected. 	Check the PA bus voltage in the AOP. Check if the PA bus has tripped. 
	Verify that the cable used in the PA network is in compliance with section 12.8.2 of IEC61158-2 (Physical Layer Specification). The PROFIBUS PA cable must meet the minimum requirements that are described in Cable Type and Minimum Requirements on page 21.
	Verify that the shield on the power connector of the linking device is connected to a clean, high-quality ground. 
	Verify that the shield of the PROFIBUS PA connector is connected to the shield of the cable. Do not connect the shield at the field devices. 
	Verify that a low-noise power supply is feeding the linking device.

Field Device is Not Configured

Use these diagnostic checks to help you identify and fix the problem when the field device is not configured.

Table 5 - Field Device is Not Configured Diagnostic Checks

Symptoms	Checks
The field device is attached but is not producing process variables in the controller. Devices are blue or switch blue/red. This condition usually indicates the configuration is incorrect. 	Verify that the field device configuration is correct. Certain field devices require an output process variable (for example, a set-point for valve positioner) to stay connected. If the configuration is incorrect, the field device switches between green and blue. The field device indicates green after it is configured, but changes to blue (not-configured) when it does not receive any process variables. See the manual for the field device for more information regarding PROFIBUS PA configuration.
	See all checks in Field Device is Not Detected on page 50.

Field Device Faults

Use these diagnostic checks to help you identify and fix the problem when the field device indicates faults.

Table 6 - Field Device Faults Diagnostic Checks

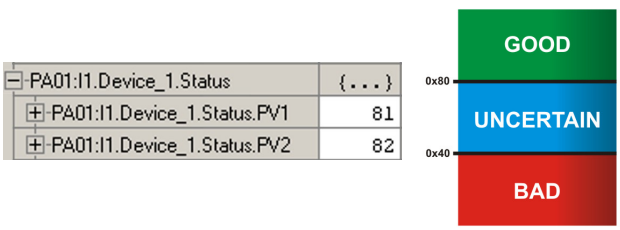
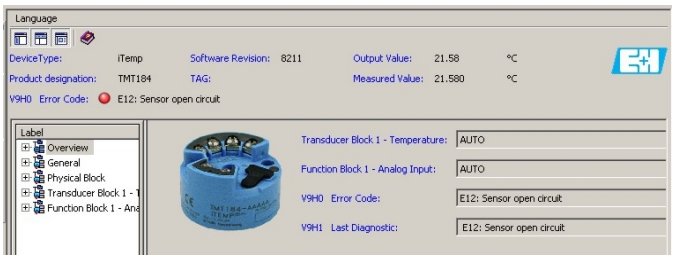
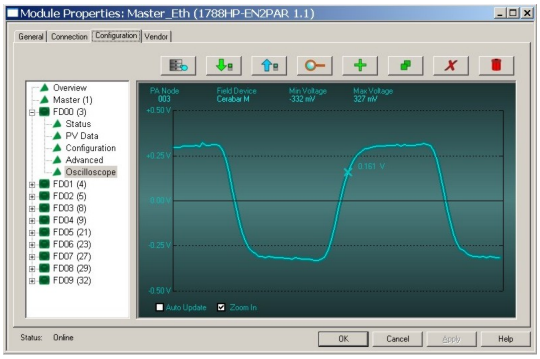
Symptoms	Checks
The field device indicates red in the AOP. The field device indicates Err on LCD of module. No process variable is found in the process variable tag of the field device.	Verify that the field device has power. If a display is present, verify that the display is illuminated. If no display is present, use a voltmeter to check the voltage across the PA terminal in the field device (verify correct polarity). See the field device manual to see minimum input voltage. The longer the cable and the bigger the load (number of field devices and junction boxes), the bigger the voltage drop across the cable. See Cable Lengths on page 20 and Table 1 on page 19 for a description of cable length guidelines.
	Verify that the cable is not damaged or is not near a source of noise. Replace a damaged cable, and route the cable away from any source of noise.
	Read the status indicators on the junction box (if short-circuit protection is provided and indicated).
	Verify that the linking device can see the field device when doing a scan in the AOP? If the linking device cannot see the field device, see all checks in Field Device is Not Detected on page 50.
	Check the field device PV status in the Studio 5000 Logix Designer application. If the field device has an error that affects the PV, the PV status changes from GOOD to UNCERTAIN or BAD. 

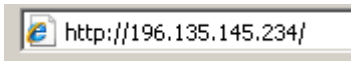
Table 6 - Field Device Faults Diagnostic Checks (Continued)

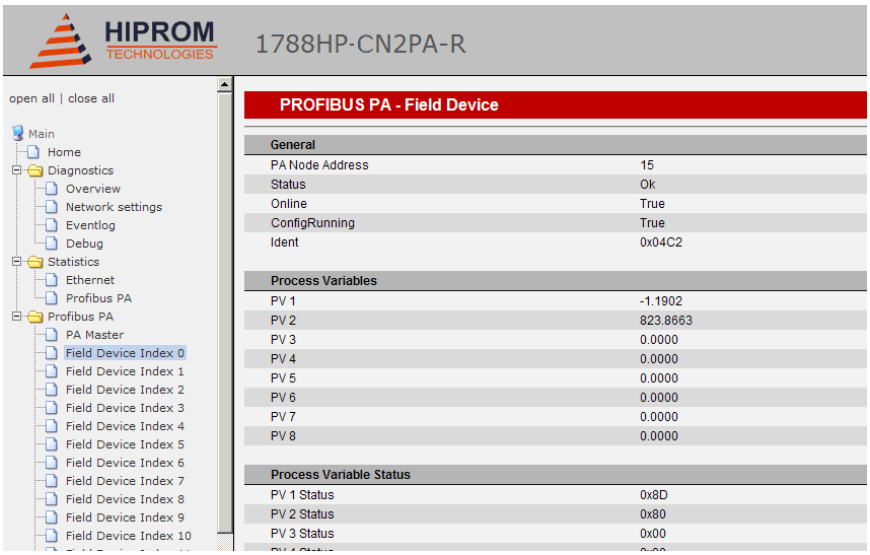
Symptoms	Checks
The field device indicates red in the AOP. The field device indicates Err on LCD of module. No process variable is found in the process variable tag of the field device.	Launch the DTM and see if the device has any errors. 
	Check the scope trace in the AOP: • Is there any noise on the bus? • Is the slew rate ok? The wave must not be triangular. • Is the signal amplitude modulated? This condition typically indicates noise on the shield. • Is the voltage level ok? 
	Has the environment changed? Is there a new source of noise, such as drives, motors, HT cables, or other noise sources?
	Has the PA configuration been changed?
	Have any new field devices been added to the bus?

Web Interface

To view device status and diagnostic information that is stored in the web server, enter the device IP address into a web browser and press Enter.

For example, linking device IP address 196.135.145.234





IMPORTANT If data is not being updated, turn off page caching or try another Web browser.

Device Type Manager

You can use the DTM in the profile with the HSThinFrame, or with an FDT Frame (for example, FactoryTalk AssetCentre).

IMPORTANT The HSThinFrame can only view diagnostics of the field device. You need an FDT Frame to configure and parameterize the field device.

IMPORTANT The **1788-CN2PAR** linking device can process Class 2 data (DTMs) on either the ControlNet or Ethernet interface, which can help preserve the unscheduled bandwidth of the ControlNet network.

The **1788-EN2PAR** linking device can only process Class 2 data (DTMs) on the Ethernet interface.

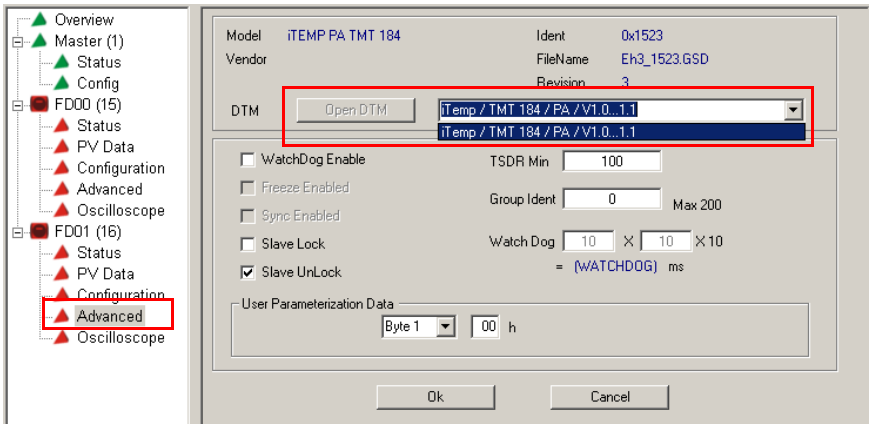
IMPORTANT The correct DTM must be installed and the HSProcessUtility DTM catalog must be updated for the correct DTM to display in the pull-down list.

Follow these steps to open the DTM.

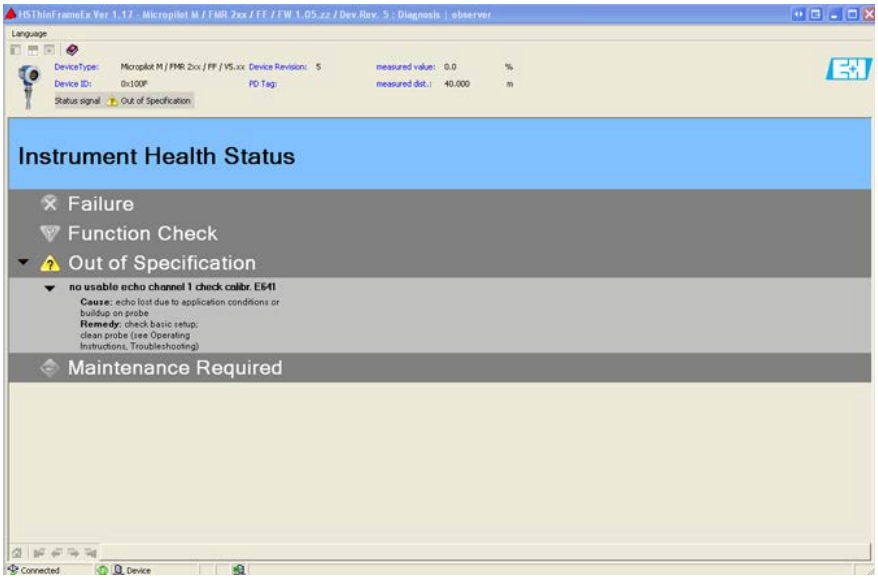
1. Click Advanced in the config tree.
2. Choose the DTM revision from the pull-down menu.

IMPORTANT If you are presented with multiple DTMs of the same device but with different revisions, select the correct DTM and revision for the specific field device.

3. Click Open DTM.



4. Choose the device information that you want to view.
5. View the selected device information.



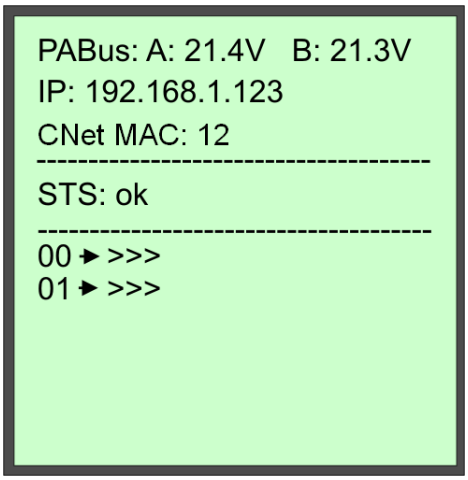
Notes:

Linking Device Display Status

The display of the linking device provides status and diagnostic data in one of three page formats: main page, PA master page, or field device page. Use the Page button behind the front cover to scroll through the pages (see Hardware Switches Location on page 22 for location of the Page button).

Main Page

The main page is the default display. The linking device returns to this page after 10 seconds.



PA Bus A/B: Displays the bus voltages on each port.

IP: Displays the current IP address or BOOTP if enabled.

CNet MAC: Displays the current ControlNet node address (1788-CN2PAR linking device only).

STS: Displays the status (see Table 7).

Table 7 - STS Status Descriptions

Status Message	Description
ok	No events.
new device found	A new field device is on the bus.
redundancy ok	Masters are synchronized.
redundancy err	The master linking devices are out of sync.
bus A tripped	PA bus A has tripped because of over current.
bus B tripped	PA bus B has tripped because of over current.
SAFE MODE	The linking device has been set into safe mode.
not owned	No connection to a Logix controller.

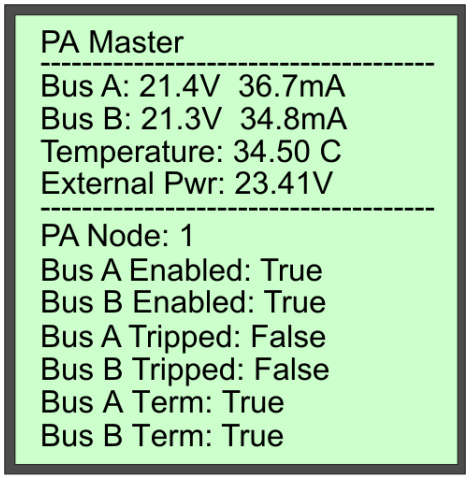
The lower portion of the main page shows the communication quality to each field device represented as a percentage of data packets sent compared to data packets received for each field device index (see Table 8).

Table 8 - Field Device Communication Quality

Display	Communication Quality
>>>	95+
>>	80+
>	70+
X	60+
XX	50+
XXX	Below 50
???	Unknown

PA Master Page

The next page that is accessed by the Page button is the PA Master page.



Bus A/B: Displays the bus voltages and currents.

Temperature: Displays the internal temperature of the linking device.

External Pwr: Displays the power supply voltage.

PA Node: Displays the node address of the linking device.

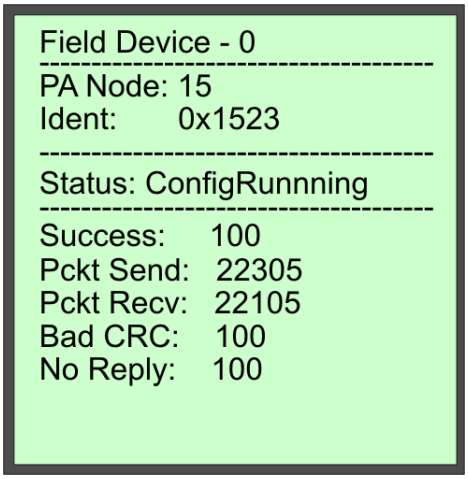
Bus A/B Enabled: PA Bus A and/or PA Bus B is enabled for communication.

Bus A/B Tripped: PA Bus A and/or PA Bus B has tripped indicating that there was an over-current on either port.

Bus A/B Term: The linking device is configured to terminate PA Bus A and/or PA Bus B.

Field Device Page

The next 23 Field Device pages display the status of each of the field device indices.



PANode: Displays the PA node address.

Ident: Displays the ident (identity) number of the specific field device.

Status: Displays the field device status (see Table 9).

Table 9 - Field Device Status Descriptions

Status Message	Description
Not Connected	The device cannot be seen.
Online	The device is online but not configured.
ConfigRunning	The device is configured and exchanging data.
N/A	The device has not been added to the configuration.

Success: Displays the data packets that are received as a percentage of packets that are sent for the previous 100 packets.

Pckt Send: Displays the total number of data packets that are sent from the field device.

Pckt Recv: Displays the total number of data packets that are received from the field device.

Bad CRC: Displays the total number of bad CRC packets received.

No Reply: Displays the total number of data requests to which the field device did not respond.

Notes:

PA Topology

Master Mode 0

Single Master

A Bus Only

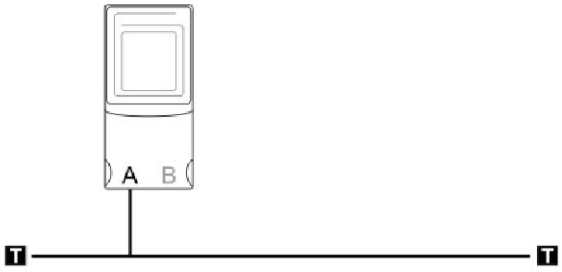
Terminated at the linking device.

Master Mode 1

Single Master

A Bus Only

Not terminated at the linking device.



Master Mode 2

Single Master

B Bus Only

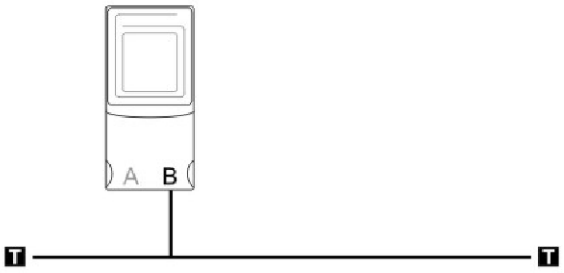
Terminated at the linking device.

Master Mode 3

Single Master

B Bus Only

Not terminated at the linking device.



Master Mode 4

Single Master

Dual Bus

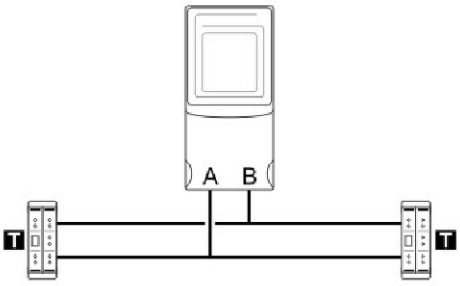
Terminated at the linking device.

Master Mode 5

Single Master

Dual Bus

Not terminated at the linking device.

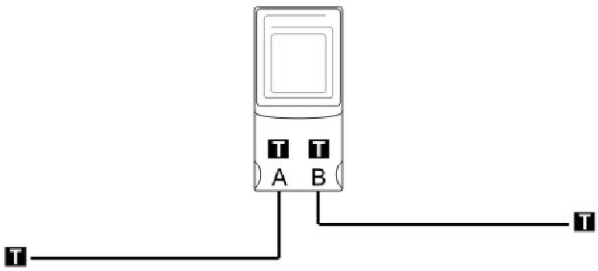


Master Mode 6

Single Master

Split Bus

Terminated at the linking device.

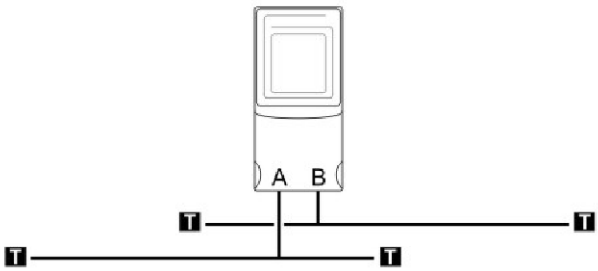


Master Mode 7

Single Master

Split Bus

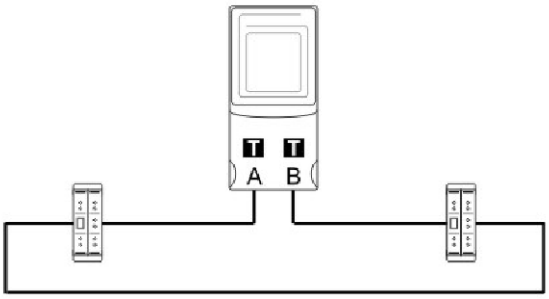
Not terminated at the linking device.



Master Mode 8

Single Master

Ring Bus



Master Mode 9

MultiMaster

A Bus Only

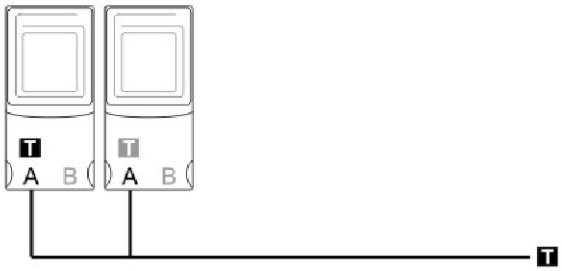
Terminated at the linking devices.

Master Mode 10

MultiMaster

A Bus Only

Shared termination at the linking devices.

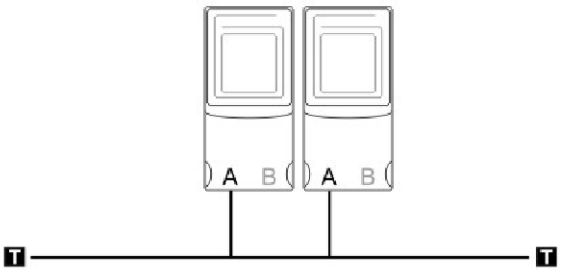


Master Mode 11

MultiMaster

A Bus Only

Not terminated at the linking devices.



Master Mode 12

MultiMaster

B Bus Only

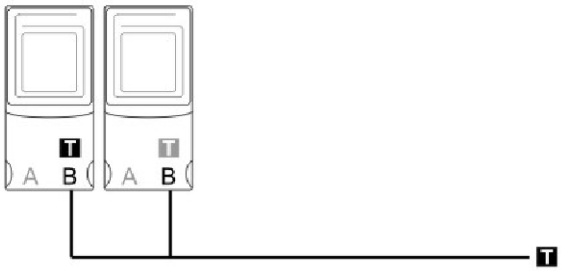
Terminated at the linking devices.

Master Mode 13

MultiMaster

B Bus Only

Shared termination at the linking devices.

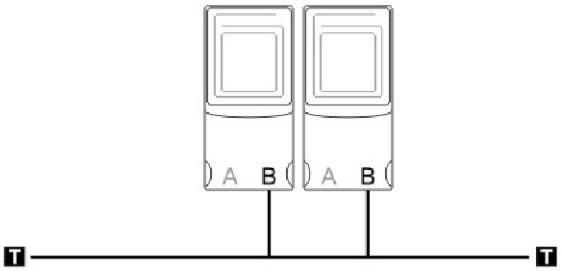


Master Mode 14

MultiMaster

B Bus Only

Not terminated at the linking devices.



Master Mode 15

MultiMaster

Dual Bus

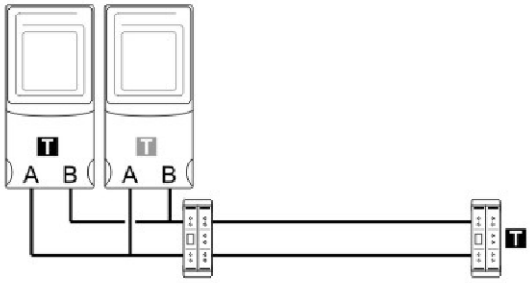
Terminated at the linking devices.

Master Mode 16

MultiMaster

Dual Bus

Shared termination at the linking devices.



Notes:

The following terms and abbreviations are used throughout this manual. For definitions of terms not listed here, refer to the Allen-Bradley Industrial Automation Glossary, publication AG-7.1.

1788-CN2PAR linking device Provides a gateway between ControlNet and a PROFIBUS PA network.

1788-EN2PAR linking device Provides a gateway between EtherNet/IP and a PROFIBUS PA network.

1788-PARJB junction box Provides fault-tolerant connections for a PA network.

AO Abbreviation for an analog output; signal is generated by the host system and transmitted to a field device.

AOP Abbreviation for Add-on Profile; provides an intuitive graphical interface for configuring devices.

BOOTP A protocol to boot a diskless workstation and receive the boot information from a server.

bridge An interface in a Profibus network that interconnects two or more PA networks.

bus A Profibus cable between a Host and field devices connected to multiple segments, sometimes through the use of repeaters.

channel A path for a signal.

CIP Acronym for Common Industrial Protocol; a communication protocol, or language, between industrial devices. CIP provides seamless communication for devices on DeviceNet, ControlNet, and EtherNet/IP networks.

configurable Capability to select and connect standard hardware modules to create a system; or the capability to change functionality or sizing of software functions by changing parameters without having to modify or regenerate software.

configuration Physical installation of hardware modules to satisfy system requirements; or the selection of software options to satisfy system requirements.

connector Coupling device used to connect the wire medium to a fieldbus device or to another segment of wire.

ControlNet network An open control network that uses the producer/consumer model to combine the functionality of an I/O network and peer-to-peer network, while providing high-speed performance for both functions.

cycle Scanning of inputs, execution of algorithms and transmission of output values to devices.

device The term in this manual refers to the instruments that make up the fieldbus system.

DO Abbreviation for discrete output; signal is generated by the host system and transmitted to a field device.

DTM Acronym for Device Type Manager; used to connect to the field device and configure the parameters.

Ethernet Physical and data link layer defined by IEEE 802 standards used by EtherNet/IP.

EtherNet/IP An open, industrial networking standard that supports both real-time I/O messaging and message exchange.

GSD Acronym for General Status Description; used to define the class 1 capabilities of the field device.

link A logical link is a connection between function blocks; a physical link is a connection between fieldbus devices.

linking device As a bridge, enables peer-to-peer communication between PA devices without the need for host system intervention. As a gateway, connects the PA network to other plant control and information networks, such as EtherNet/IP and ControlNet.

network A network as applied in this document is the termination of one or more fieldbus segments into an interface card of the Host system.

node The connection point at which media access is provided.

node address A node address is a unique address identifier for a device assigned to a Profibus network. A PROFIBUS network can have as many as 126 devices connected on it, where each device on the network must have a unique node address between 0 and 126.

offline Perform tasks while the Host system is not communicating with the field devices.

online Perform tasks, such as configuration, while the Host system is communicating with the field devices.

Profibus Network A Profibus network uses RS485 to connect devices (for example, controllers, drives, motor starters and other equipment in automation systems). A Profibus network can support a maximum of 126 devices. Each device is assigned a unique node address and transmits data on the network at the same data rate. A cable is used to connect devices on the network. It contains the bus signal. Devices can be connected to the network in a daisy chain connection.

PV Acronym for Process Variable, which is the primary value.

redundancy The duplication of devices for the purpose of enhancing the reliability or continuity of operations in the event of a failure without loss of a system function.

ring bus A network where signals are transmitted from one station and replayed through each subsequent station in the network. Signal can travel in either direction of the ring so it creates network redundancy; if the ring breaks in one place the nodes can still communicate.

Studio 5000 Logix Designer Software that provides a programming environment for sequential, process, drive, and motion control programming. The Studio 5000 Logix Designer application provides an IEC 61131-3 compliant interface for controls programming.

signal The event or electrical quantity that conveys information from one point to another.

terminator Impedance-matching module used at or near each end of a transmission line that has the same characteristic impedance of the line. Terminators are used to minimize signal distortion, which can cause data errors. PA terminators convert the current signal transmitted by one device to a voltage signal that can be received by all devices on the network.

topology The shape and design of the PROFIBUS PA network.

trunk The main communication highway between devices on a PROFIBUS PA network. The trunk acts as a source of main supply to spurs on the network.

Notes:

Numerics

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Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support you can find technical and application notes, sample code, and links to software service packs. You can also visit our Support Center at https://rockwellautomation.custhelp.com/ for software updates, support chats and forums, technical information, FAQs, and to sign up for product notification updates.

In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/services/online-phone.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page, or contact your local Rockwell Automation representative.

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