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Installing Your DeltaV SIS™ Process Safety System Hardware

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See CE Statement in Chapter 2.

Contents

Welcome

Welcome to the Emerson Process Management DeltaV SIS™ Process Safety System. DeltaV SIS systems easily integrates with a DeltaV system to offer easy-to-install hardware and powerful, user-friendly software for your safety instrumented system.

About This Manual

This manual is designed to help you install your DeltaV SIS hardware and get it started up quickly. It is structured as follows:

- Chapter 1, *Overview*, provides general information on DeltaV SIS hardware.
- Chapter 2, *Installing the System*, provides detailed instructions and diagrams for system installation.
- Chapter 3, *Checking Out and Troubleshooting Your DeltaV SIS Hardware*, provides guidelines to ensure that your system is installed properly and to help you troubleshoot hardware problems.
- The Appendices include specifications, wiring diagrams, and other detailed information on the system devices.

This revision of *Installing Your DeltaV SIS™ Process Safety System Hardware* supports the hardware in DeltaV Version 11. Hardware components that are not available for sale concurrent with DeltaV Version 11 may not be included in this document.

The DeltaV Release Notes KBA may have important updates for system installation.

Assumptions

It is assumed that you have read the *Site Preparation Guide for DeltaV Automation Systems* and have followed the instructions for properly preparing your site for electrical power and grounding before installing DeltaV SIS hardware. The *Site Preparation Guide for DeltaV Automation Systems* is available from your Emerson Process Management representative or sales office or you can access it online in the DeltaV Books Online. It is also assumed that you have read the *Installing Your DeltaV Digital Automation System* manual and have followed the instructions for properly installing your DeltaV system hardware. The *Installing Your DeltaV Digital Automation System* manual is also available in Books Online.

Warning The *DeltaV SIS Safety Manual* contains user requirements for installing, operating, and maintaining a DeltaV Safety Instrumented System. Refer to the *DeltaV SIS Safety Manual* for all user requirements.

This manual shows factory tested and supported wiring connections. If your system requires a different configuration, contact your Emerson Process Management representative or sales office for help with design or review. It is assumed that all installation and maintenance procedures described in this document are performed by qualified personnel and that the equipment is used only for the purposes described.

Conventions

Warnings, cautions, notes and procedures are used in this manual to emphasize important information.

Warning A warning describes a critical procedure that must be followed to prevent a personal safety risk or equipment damage.

Caution A caution describes a procedure that must be followed to prevent equipment malfunction.

Note *A note is a procedure, condition, or statement that will help you understand and operate your system.*

➢ **Itemizes steps necessary to execute installation procedures.**

Chapter 1 Overview

This chapter provides general information on DeltaV SIS hardware. Refer to the *DeltaV S-series and CHARMs Hardware Reference* manual for complete information on DeltaV system equipment.

DeltaV SIS Equipment

A DeltaV automation system consists of carriers, one or more I/O subsystems, controllers, power supplies, workstations, and a control network.

DeltaV SIS systems consists of:

- Logic Solvers (SLS 1508) and termination blocks
- SISNet Repeaters
- SISNet Distance Extenders
- Carrier extender cables
- Local peer bus extender cables
- Right one-wide carrier with termination

Note *DeltaV SIS systems requires an MD Series 2 or later model controller.*

Logic Solvers (SLS) contain the logic solving capability and provide an interface to 16 I/O channels that can be configured as Discrete Input, Discrete Output, Analog Input (HART) and HART Two-state output channels. Logic Solvers and termination blocks install on the 8-wide carrier. DeltaV SIS systems support simplex and redundant Logic Solvers. Logic Solvers communicate with each other through the carriers over a two-channel, local peer bus and remote peer ring. Local Logic Solvers are hosted by the same DeltaV controller and remote Logic Solvers are hosted by a different DeltaV controller. Logic Solvers are powered by a 24VDC power supply that is separate from the power supply that drives the DeltaV controller and I/O. Logic Solvers install in odd numbered slots (1,3,5,7) on the 8-wide carrier. Simplex Logic Solvers use two slots and redundant Logic Solvers use four slots.

SISNet Repeaters extend communication beyond the local Logic Solvers connected to one DeltaV controller and broadcast global messages to remote Logic Solvers through a fiber-optic ring. Global messages refer to messages that are intended for all Logic Solvers. The SISNet Repeater installs on a 2-wide carrier. There is a primary and secondary SISNet Repeater on each carrier.

SISNet Distance Extenders convert multimode fiber-optic signals to single mode fiber-optic signals to allow SISNet Repeaters to communicate over greater distances.

Depending upon the installation, the remote peer ring can be extended by an additional 20 km when single mode fiber-optic cable is used.

Carrier extender cables extend LocalBus power and signals between 8-wide carriers. **Local peer bus extender cables** extend the local peer bus between Logic Solvers on different carriers. **One-wide carriers** with terminators terminate the local peer bus at the final carrier.

Figure 1-1 shows carrier extender cables and local peer bus extender cables connecting a DeltaV controller and 8-wide carrier with standard DeltaV I/O and DeltaV SIS components to a second 8-wide carrier (hosted by the same controller) installed with Logic Solvers, SISNet Repeaters, and a terminated one wide carrier. Logic Solver messages are communicated to a remote DeltaV SIS system (hosted by a separate controller) through multimode fiber-optic cables.

Note *SISNet Distance Extenders and single mode fiber-optic cable are not used in the example installation depicted in Figure 1-1. Refer to Figures 2-13 and 2-14 for examples of remote peer rings that are extended with SISNet Distance Extenders.*

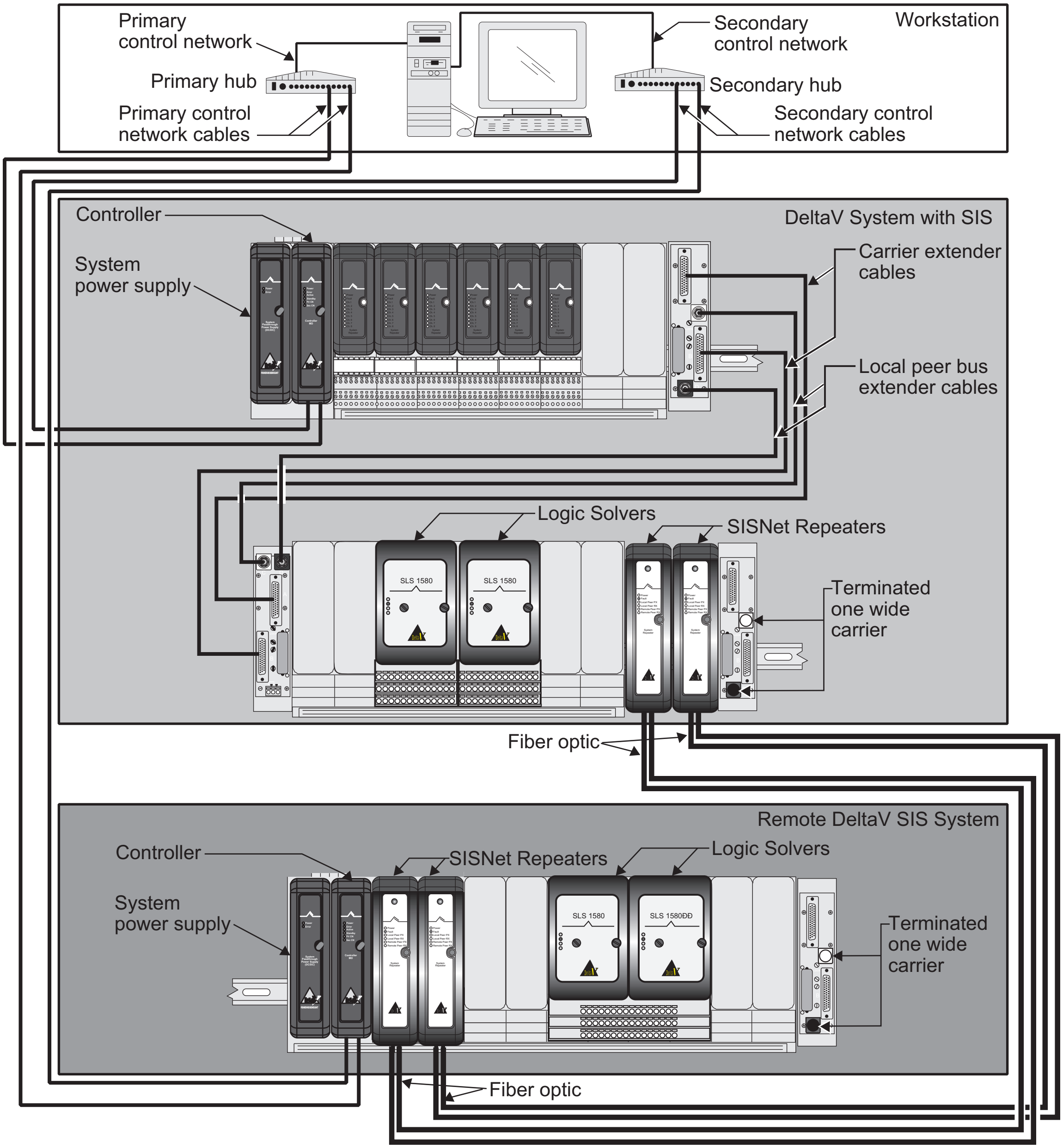

Figure 1-1 DeltaV SIS System Overview

Communication

Control Network

The DeltaV Control Network provides communication between the nodes in the DeltaV network. Refer to the *DeltaV S-series and CHARMs Hardware Reference* manual for complete information on the Control Network.

LocalBus

The LocalBus provides communication between DeltaV controllers and Logic Solvers and between DeltaV controllers and SISNet Repeaters.

Local Peer Bus

Logic Solvers communicate with other Logic Solvers and with local SISNet Repeaters through the carriers over a 2 channel local peer bus. The same message is broadcast over both channels. The local peer bus must be terminated at both ends. The local peer bus is terminated at the left end through the 2-wide power/controller carrier and at the right end through a terminated one wide carrier.

Remote Peer Ring

SISNet Repeaters hosted by one DeltaV controller communicate with SISNet Repeaters hosted by a different DeltaV controller over a fiber-optic remote peer ring. A local SISNet Repeater collects locally generated global messages into a single message and sends it to the next SISNet Repeater in the ring. Upon receipt of a message, the receiving SISNet Repeater broadcasts it to its local peer bus and forwards the message to the next SISNet Repeater in the ring. A global message is forwarded around the ring once. The primary SISNet Repeaters form one fiber-optic ring and the secondary form a separate, independent ring. SISNet Distance Extenders that convert multimode fiber-optic signals to single mode fiber-optic signals can be used to extend the remote peer ring.

Chapter 2 Installing the System

This chapter explains how to install the DeltaV SIS hardware only. It is assumed that the DeltaV system is properly installed. Refer to the *Installing Your DeltaV Digital Automation System* manual for complete information on:

- Torque limits
- Supplying system power
- Installing the DIN rails, carriers, and supplying bussed field power
- Installing the DeltaV controller, I/O interface, and workstations
- Installing in a Marine environment

For NAMUR NE 21 installations, refer to the document *DeltaV Digital Automation System Namur NE 21 Installation Instructions,* (12P2822) on the DeltaV installation disk #2 _Support\Supplemental Docs.

Notes *All electrical installations must conform to applicable local codes and regulations. All installation and maintenance procedures described in this document must be performed by qualified personnel and all equipment must be used only for the purposes described. If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.*

Agency Approvals

The DeltaV SIS hardware is certified to:

- European EMC compliance
- Low Voltage Directive IEC 61010-1
- NAMUR NE 21 EMC requirements
- Factory Mutual, Non-Arcing
- ATEX 3 G EEx IIC- nA T4 EN60079-15
- CSA 1010 or 61010

CE Statement

Note *This manual describes installation and maintenance procedures for products that have been tested to be in compliance with appropriate CE directives. To maintain compliance, these products must be installed and maintained according to the procedures described in this document. Failure to follow the procedures may compromise compliance.*

Tools Required for Installation

The following tools are needed to install DeltaV SIS hardware:

- Standard electrical tools (voltmeter, wire cutter, wire stripper, pliers, screwdrivers)
- Standard installation tools (screwdrivers, drill with standard bits)
- Ethernet cable tools (crimper, cable tester)

Wiring Guidelines

The power and grounding terminals and field termination points on the I/O subsystem are designed to accept 2.5 mm (14 AWG stranded or solid) wire. To select wire, calculate the maximum current limit expected for each wire. Local electrical codes define the wire size required for a specific current.

Shielded twisted pair wiring is recommended for low-level signal wiring to reduce susceptibility to noise.

Installing the Carriers

Note *DeltaV SIS hardware is supported on VerticalPLUS carriers only. It is not supported on legacy vertical carriers. Refer to the Installing Your DeltaV Digital Automation System manual for information on installing VerticalPLUS carriers.*

1. Install the 2-wide power/controller carriers and the 8-wide I/O interface carriers on the DIN rails. Install a DeltaV controller and power supply on the 2-wide power/controller carrier. Refer to the *Installing Your DeltaV Digital Automation System* manual for installation instructions. Read the following *Important* note and be sure that you are using the correct 2-wide power/controller carrier.

Important *Be sure that you are using the 2-wide power/controller carrier numbered KJ4001X1-BA3 or higher. DeltaV SIS hardware requires this version. As shown in Figure 2-1, a small white rectangle is printed on the front of this carrier to distinguish it from earlier versions.*

2. Install the 2-wide SISNet Repeater carriers on the DIN rails if remote communication is required. SISNet Repeater carriers can be installed anywhere between the 2-wide power/controller carrier and the terminated one-wide carrier. The 2-wide SISNet Repeater carrier installs exactly like a 2-wide power/controller carrier. Refer to the *DeltaV S-se*ries *and CHARMs Hardware Installation* manual for installation instructions. Refer to page 2-7 for information on installing SISNet Repeaters and to page 2-10 for information on the one-wide carrier.

3. Connect the carriers to any adjacent carriers by sliding together the 48 pin connectors on the sides of the carriers.

4. If you are installing carriers on separate DIN rails, you will need to connect two (left and right) one-wide carriers and then connect cables to extend the LocalBus and local peer bus. Refer to “Installing Extender Cables” on page 2-8.

5. To add carriers to an existing operational system, follow the instructions in Appendix D.

Installing the Terminal Blocks

Logic Solver (SLS) terminal blocks are yellow to distinguish them from other terminal blocks.

1. Locate an odd slot number on the I/O interface carrier. Simplex terminal blocks take two slots and redundant terminal blocks take four slots.

2. Insert the tabs on the back of the terminal block through the slots on the carrier and push the terminal block up to lock it into place. Figure 2-1 shows a redundant terminal block installed on an I/O interface carrier.

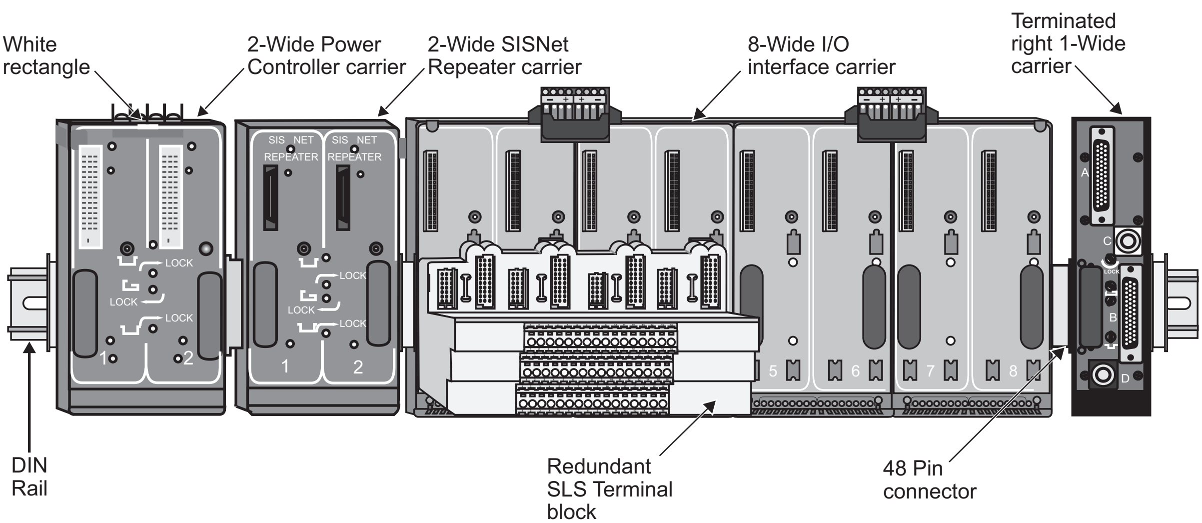

Figure 2-1 Redundant Terminal Block Installed on Carrier

3. Connect the field wiring. Refer to "Connecting the Field Wiring" on page 2-6 for information on channel configuration.

Note *The Logic Solver terminal blocks have tabs for quick release. Simplex Logic Solver terminal blocks have one tab as shown in Figure B-2 and redundant Logic Solver terminal blocks have two tabs as shown in Figure B-3.*

Installing the Logic Solver

Logic Solvers install on the terminal blocks in odd numbered slots (1,3,5,7) on the 8-wide carrier. Simplex Logic Solvers take two slots and redundant Logic Solvers take four slots.

1. Locate the Logic Solver terminal block on the I/O interface carrier.

2. Align the connectors on the back of the Logic Solver with the connectors on the front of the terminal block and push to attach.

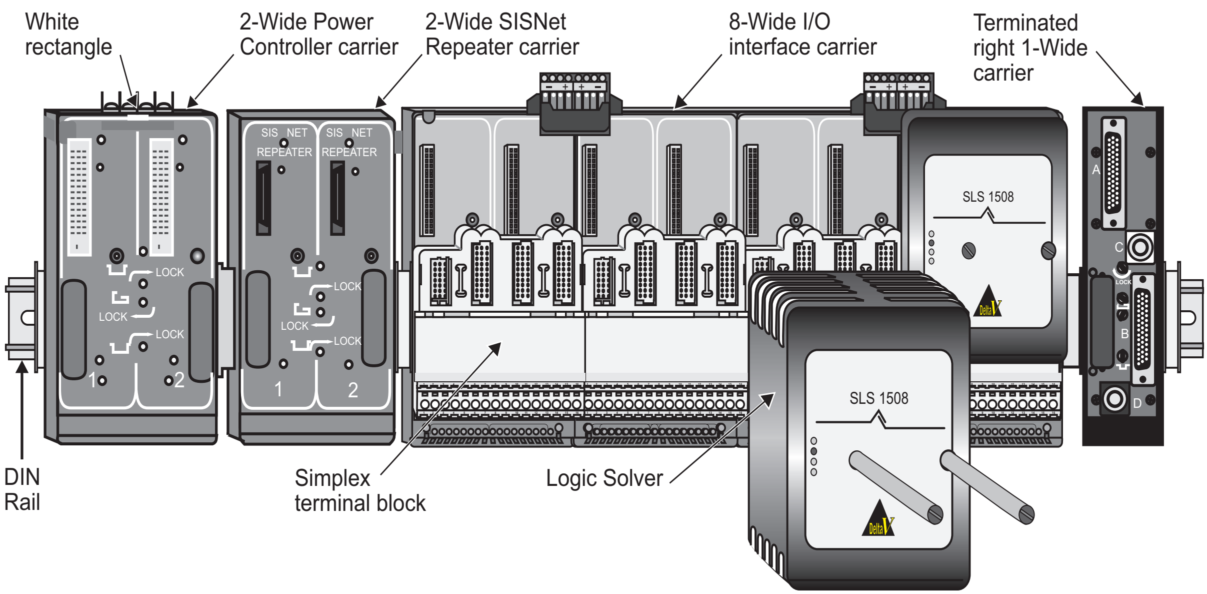

Figure 2-2 Logic Solver Installation

Connecting the Field Wiring

The terminal blocks provide 16 channels of I/O. Each channel can be configured as Discrete Input, Discrete Output, Analog Input (HART) and HART Two-state output. Refer to “Channel Specifications” on page B-5.

Installing the SISNet Repeater

The SISNet Repeater installs on the 2-wide SISNet Repeater carrier.

1. Align the connector on the back of the SISNet Repeater with the connector on the 2-wide SISNet Repeater carrier and push to attach.

2. Tighten the mounting screw.

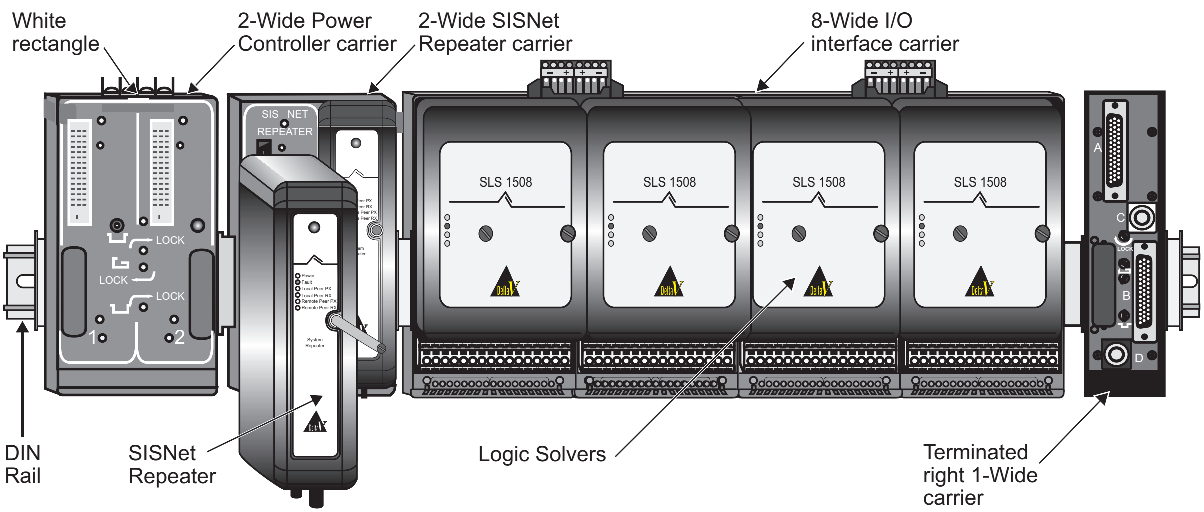

Figure 2-3 SISNet Repeater Installation

Refer to "Setting Up the Remote Peer Ring" on page 2-15 for information on connecting the fiber-optic cable. This section also includes information on installing and connecting SISNet Distance Extenders.

Installing Extender Cables

When carriers are installed on separate DIN rails, carrier extender cables and local peer bus extender cables are used to extend the LocalBus and local peer bus. Extender cables connect to one-wide carriers on the left and right sides of the 2-wide and 8-wide carriers. Remove the dust covers from the D-shell and BNC connectors on the one-wide carriers.

➢ **To install carrier extender cables**

A standard installation uses one carrier extender cable; however, dual carrier extender cables can also be used. The following procedure is for a standard installation that uses one carrier extender cable.

1. Install the right and left-side one-wide carriers by sliding together the 48 pin connectors on the sides of the carriers.

Refer to Figure 2-4.

2. Connect the 44 pin D-shell (male) connector on the carrier extender cable to the top D-shell connector labeled A on the right-side carrier and fasten the retainer screws.

3. Connect the 44 pin D-shell connector on the other end of the cable to the top D-shell connector labeled A on the left-side carrier and fasten the retainer screws.

➢ **To install local peer bus extender cables**

Refer to Figure 2-4.

1. Notice that the local peer bus extender cable has black and white boots. The cables connect black-to-black (D) and white-to-white (C). Place the cable end onto the BNC connector on the carrier and push and turn to lock the cable into place.

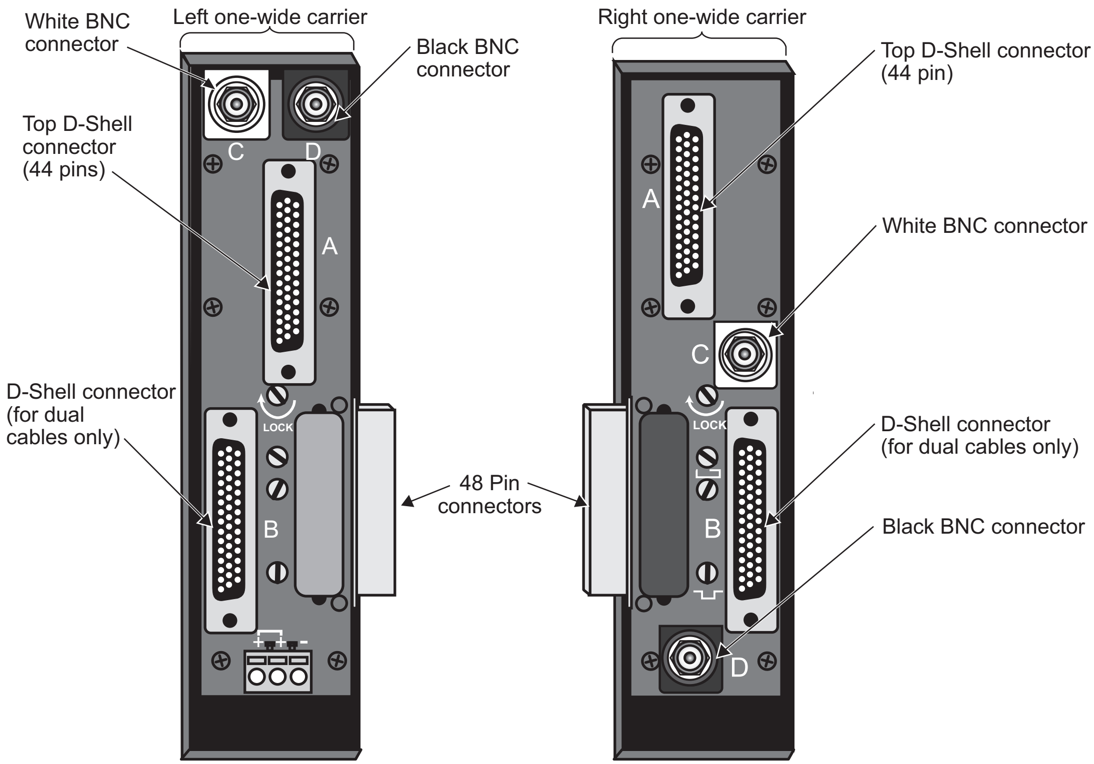

Figure 2-4 One-Wide Carriers

Terminating the Local Peer Bus

The local peer bus is terminated by 120 ohm BNC terminators on the right one-wide carrier connected to the last 8-wide carrier.

Important *Be sure to use BNC terminators numbered KJ4010X1-BN1.*

Refer to Figure 2-5.

1. Install a one-wide carrier onto the right side of the last carrier.
2. Place a 120 ohms BNC terminator onto each BNC connector on the carrier and push and turn to lock the terminator into place. Terminate both connectors.

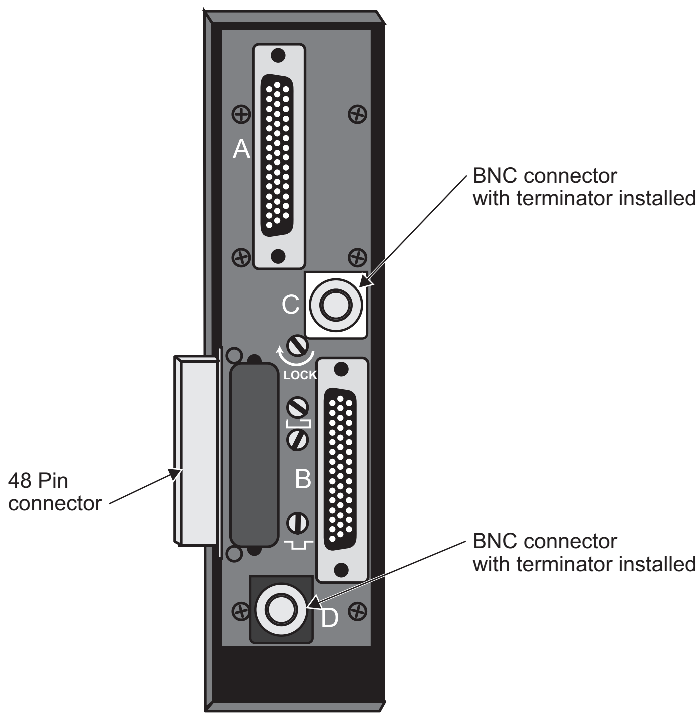

Figure 2-5 Local Peer Bus Terminations on the One-Wide Carrier

Providing Power

Logic Solvers, SISNet Repeaters, and SISNet Distance Extenders are powered separately from DeltaV controllers and I/O. This ensures that a loss of power to the DeltaV controller does not affect the operation of Logic Solvers, SISNet Repeaters, and SISNet Distance Extenders. In most installations, redundant 24 VDC power is used for both simplex and redundant SIS applications. When redundant 24 VDC power is used, both power supplies must be referenced to a common connection to ground. Refer to Figures 2-6, 2-7, and 2-9.

Caution Although the screw terminal connector on the Logic Solver, SISNet Repeater, and SISNet Distance Extender has two positive and two negative connectors, it is recommended that they not be used to daisy-chain power. Daisy-chaining could result in a loss of power to downstream Logic Solvers if power is removed or lost at an upstream Logic Solver.

➢ **To provide power to Logic Solvers**

Refer to Figure 2-6.

1. Locate the removable 24 VDC screw terminal connectors on the top of the Logic Solver.

2. Connect power supply positive (+) to the positive (+) connector on the Logic Solver and power supply negative (-) to the negative connector on the Logic Solver.

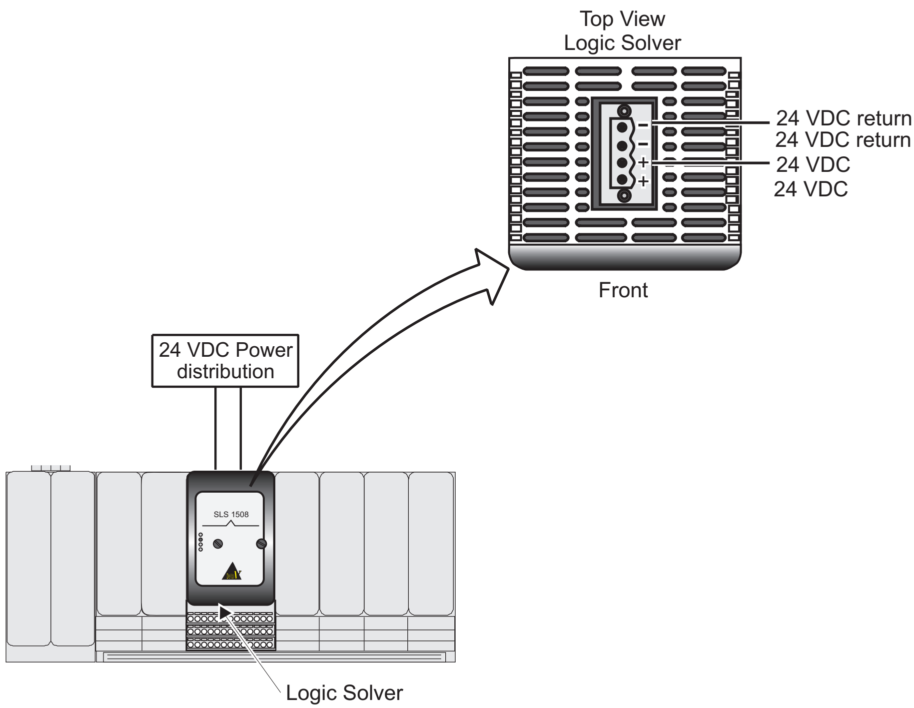

Figure 2-6 Providing Power to the Logic Solver

➢ To provide power to SISNet Repeaters

Refer to Figure 2-7.

1. Locate the removable 24 VDC screw terminal connectors on the top of the SISNet Repeater.

2. Connect power supply positive (+) to the positive (+) connector on the SISNet Repeater and power supply negative (-) to the negative (-) connector on the SISNet Repeater.

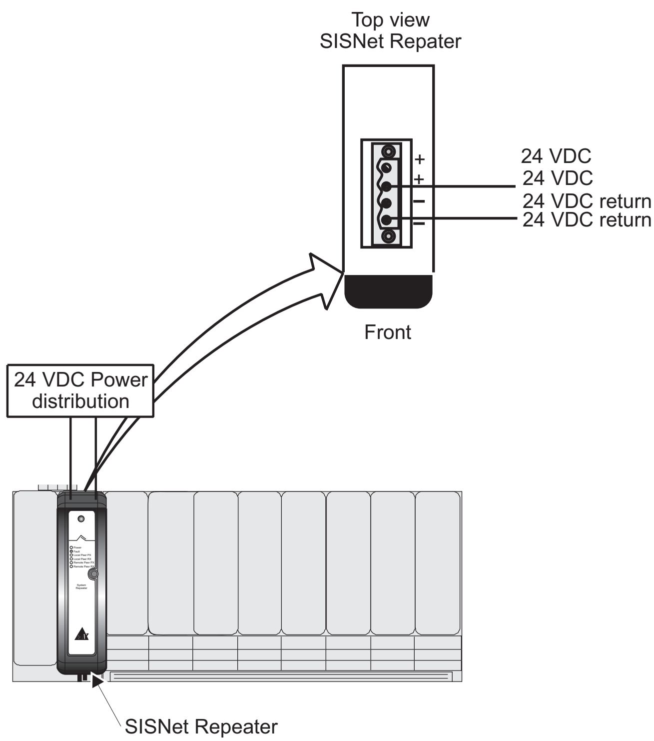

Figure 2-7 Providing Power to the SISNet Repeater

➢ **To provide power to SISNet Distance Extenders**

Refer to Figure 2-8.

1. Locate the removable 24 VDC screw terminal connectors on the top of the SISNet Distance Extender.

2. Connect power supply positive (+) to the positive (+) connector on the SISNet Distance Extender and power supply negative (-) to the negative (-) connector on the SISNet Distance Extender.

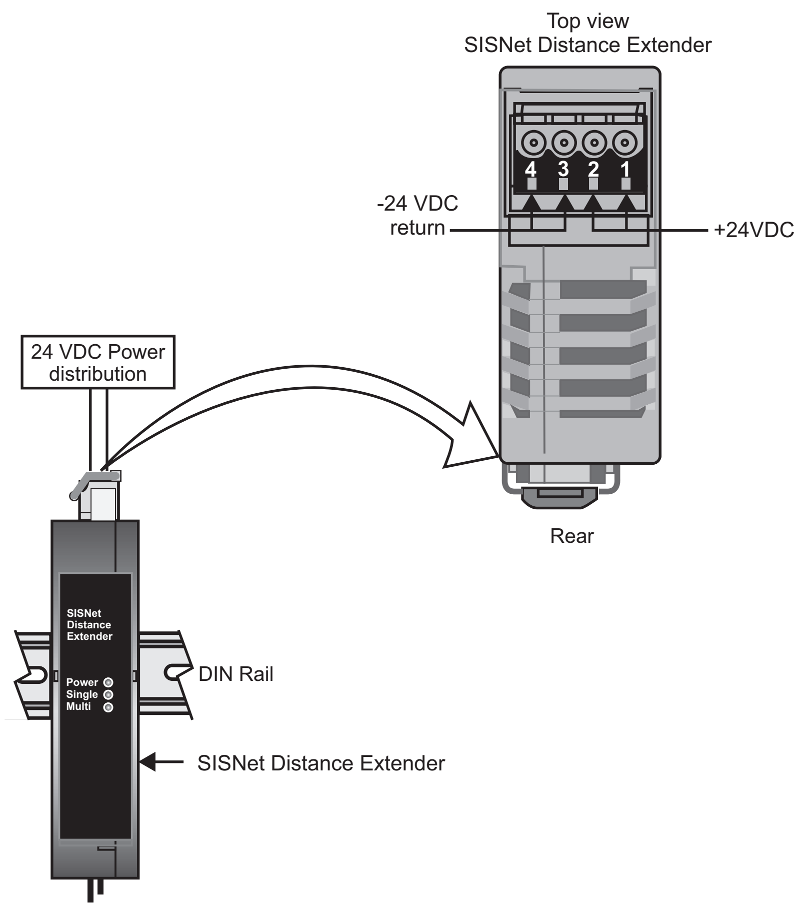

Figure 2-8 Providing Power to the SISNet Distance Extender

Setting Up the Remote Peer Ring

When link distances are a few kilometers (nominal) one way transmit to receive, SISNet Repeaters can be connected with multimode fiber-optic cables to form the remote peer ring. When link distances exceed a few kilometers one way, SISNet Distance Extenders can be used to convert multimode fiber-optic signals to single mode fiber-optic signals to extend the remote peer ring. Refer to "Extending the Remote Peer Ring with SISNet Distance Extenders" on page 2-18.

The SISNet Repeaters connect transmit to receive, transmit to receive to form a fiber-optic ring. It is highly recommend that you connect SISNet Repeaters in a counter-rotation topology in which two signal paths, one in each direction, exist in the ring. This topology increases availability in the event of a failure in a single SISNet Repeater pair. Figure 2-10 shows a counter-rotation topology.

➢ **To connect a remote peer ring with multimode fiber only**

Refer to Figure 2-9.

1. Place one end of the fiber-optic cable connector on the input terminal and push and turn the cable connector into place.
2. Place the other end of the fiber-optic cable on the output terminal of the successor SISNet Repeater and push and turn the cable connector into place.
3. Connect together all SISNet Repeaters as shown in Figure 2-10.

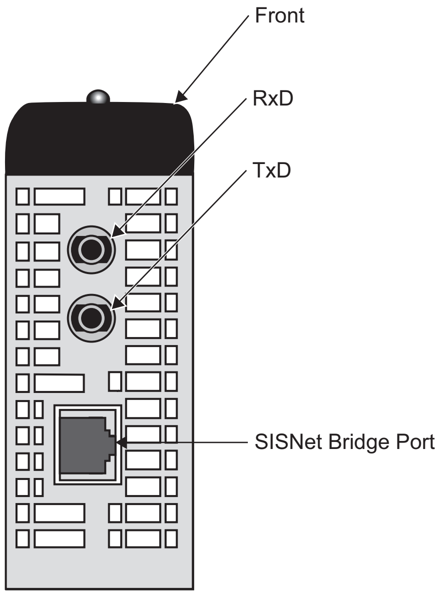

Figure 2-9 Connectors on the SISNet Repeater (Bottom View)

Figure 2-10 shows a multimode fiber-optic ring with a counter-rotation topology. The primary SISNet Repeaters are connected 1-2-3-1 and the secondary are connected 3-2-1-3. If any single pair in this ring fails, the remaining two pairs continue to communicate. No SISNet Distance Extenders are used in this remote peer ring.

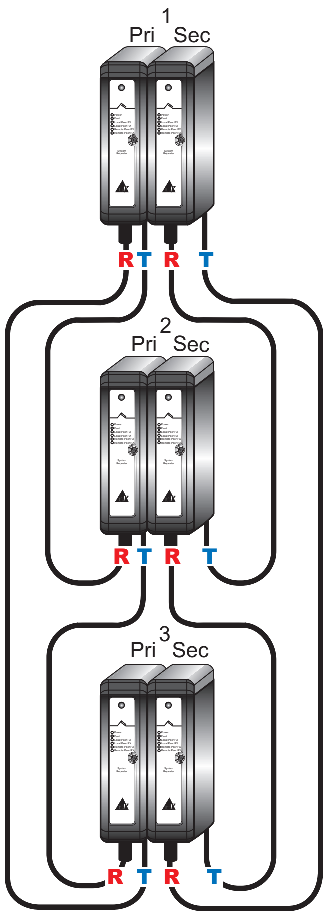

Figure 2-10 SISNet Repeaters Connected by Multimode Cable in a Counter-Rotation Fiber-Optic Ring Topology

Extending the Remote Peer Ring with SISNet Distance Extenders

Use SISNet Distance Extenders to enable SISNet Repeaters to communicate over distances greater than a few kilometers.

➢ **To extend a remote peer ring with SISNet Distance Extenders**

Note *The multimode fiber-optic cable on the SISNet Repeater connects to the SISNet Distance Extender through a conversion cable. The SISNet Repeater end of the conversion cable has an ST male and the SISNet Distance Extender end of the conversion cable has an SC male.*

Refer to Figures 2-11 and 2-12 for the location of the connectors on the SISNet Distance Extenders. Refer to Figures 2-13 and 2-14 for examples of remote peer rings that are extended with SISNet Distance Extenders.

1. Install the SISNet Distance Extender on the DIN rail.
2. Connect multimode fiber-optic cable TxD to RxD between the SISNet Repeaters and SISNet Distance Extenders.
3. Place a single mode fiber-optic cable end onto the SISNet Distance Extender's RxD terminal and push the cable into place.
4. Place the other end onto the TxD terminal of the predecessor SISNet Distance Extender and push the cable into place.
5. Place a single mode fiber-optic cable end onto the SISNet Distance Extender's TxD terminal and push the cable into place.
6. Place the other end onto the RxD terminal of the successor SISNet Distance extender and push the cable into place.
7. Connect together all SISNet Distance Extenders.

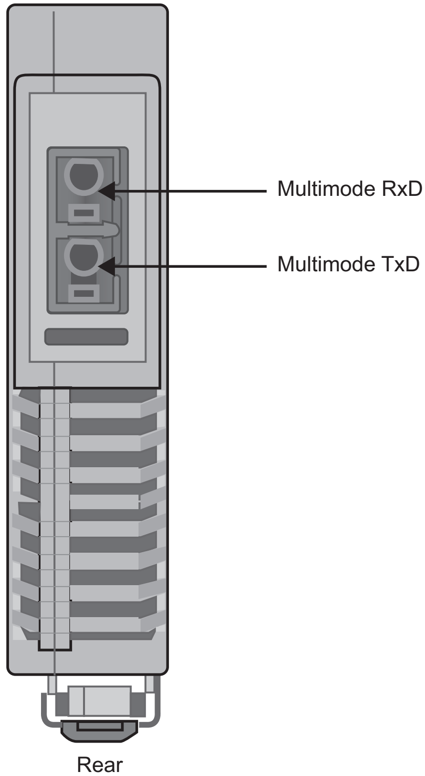

Figure 2-11 Multimode Fiber-Optic Connectors on the SISNet Distance Extender (Bottom View)

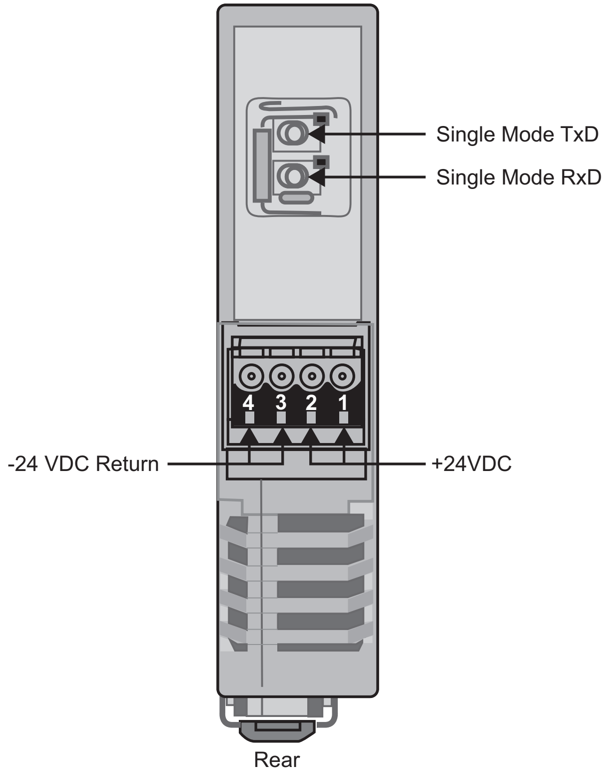

Figure 2-12 Single Mode Fiber-Optic Connectors on the SISNet Distance Extender (Top View)

Figure 2-13 shows a remote peer ring with two local nodes (Nodes 1 and 3) and one remote node (Node 2) where node refers to a SISNet Repeater pair and SISNet Distance Extender pair. Link distances for a local node are less than or equal to 2 km (nominal) one way. Link distances for a remote node are up to 20 km (nominal) one way. The remote peer ring shown in Figure 2-13 uses a counter-rotation topology in which the primary SISNet Repeaters are connected clockwise and the secondary counterclockwise. Secure parameters travel from Node 1 to Node 2 via Node 3 on the secondary ring. On the primary ring, parameters travel from Node 2 to Node 1 via Node 3.

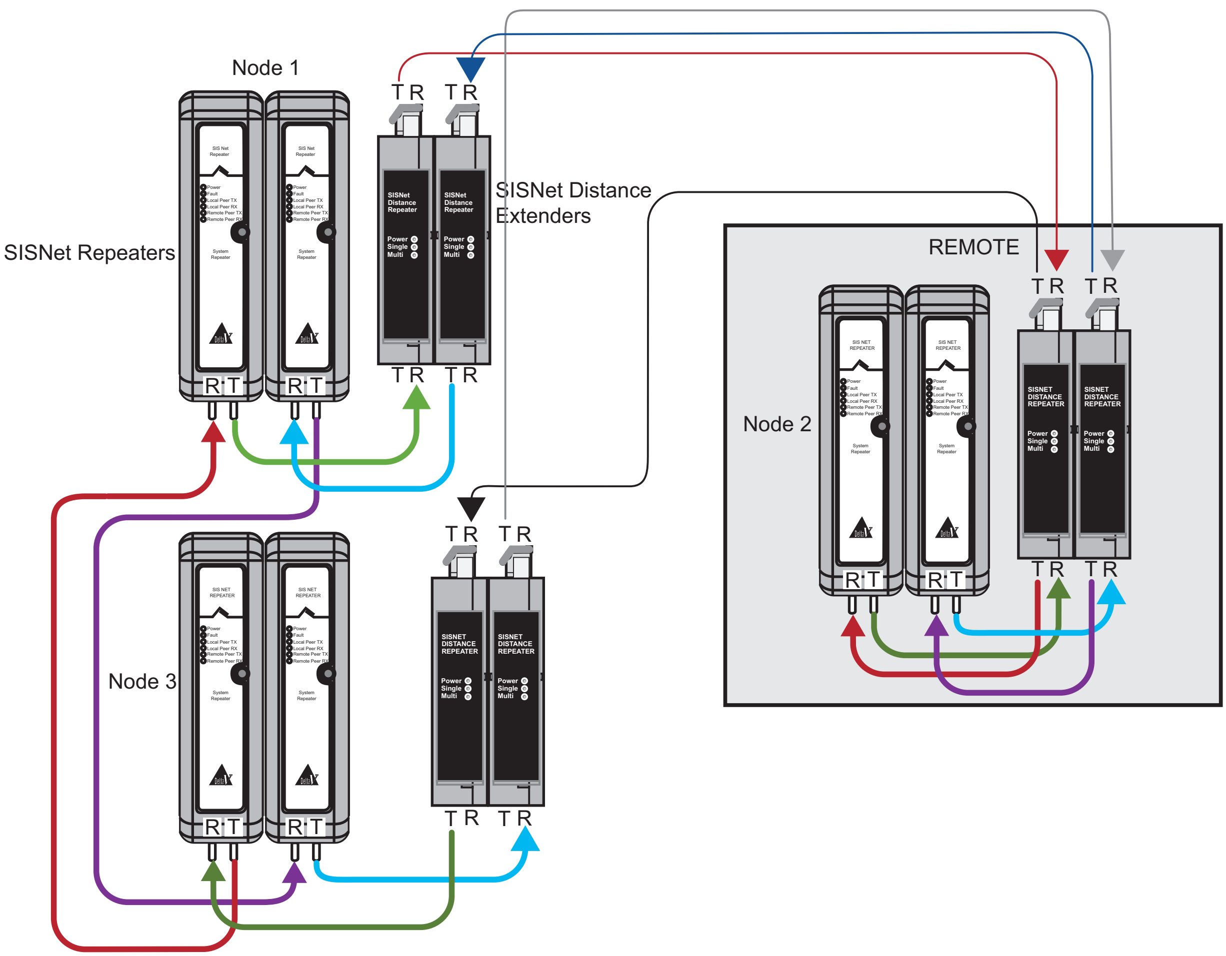

Figure 2-13 Remote Peer Ring with Local and Remote Nodes

Figure 2-14 shows a remote peer ring in which all nodes are remote. Again, node refers to a SISNet Repeater pair and SISNet Distance Extender pair. This remote peer ring uses a counter-rotation topology in which the primary SISNet Repeaters are connected clockwise and the secondary counterclockwise. Secure parameters travel from Node 1 to Node 2 via Node 3 on the primary ring. On the secondary ring, parameters travel from Node 2 to Node 1 via Node 3.

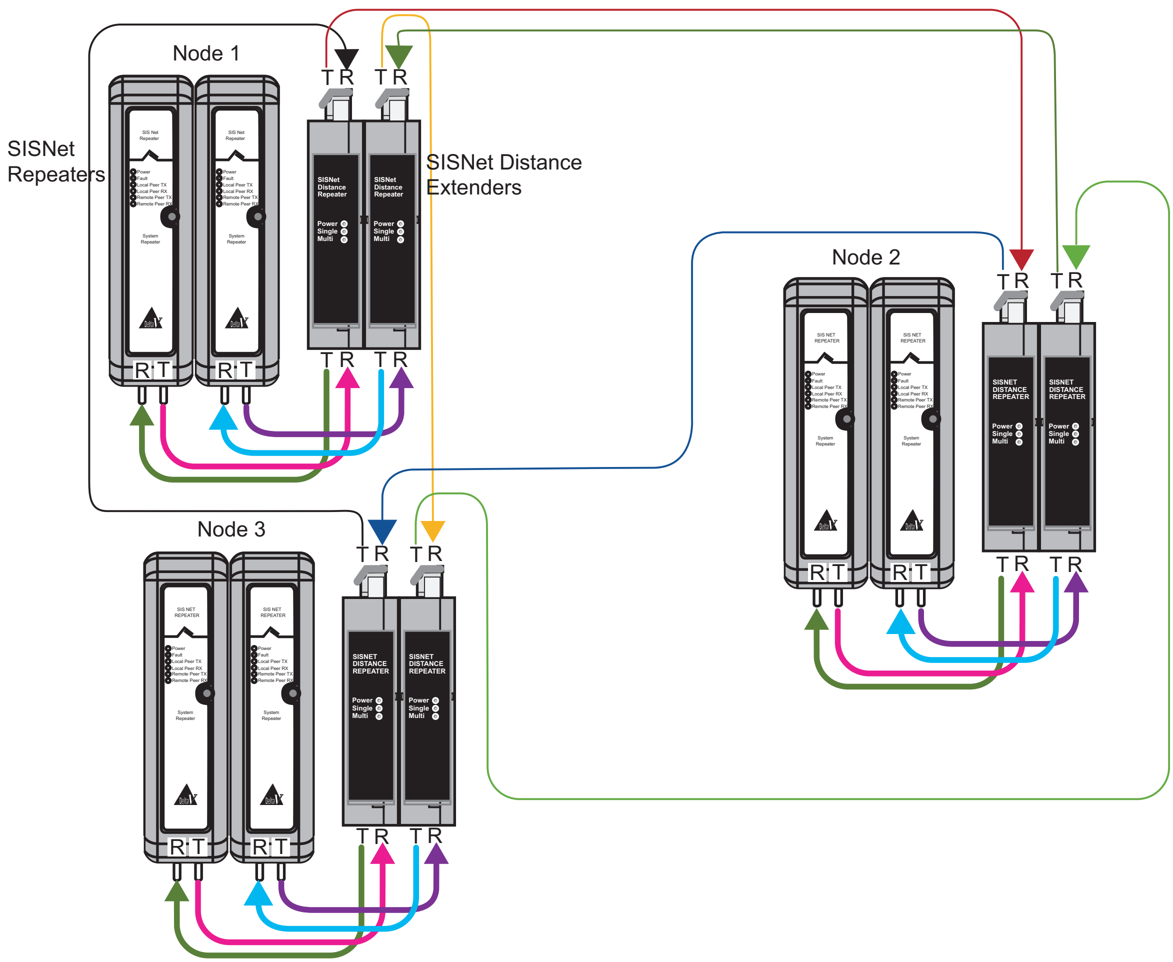

Figure 2-14 Remote Peer Ring with all Remote Nodes

Chapter 3 Checking Out and Troubleshooting Your DeltaV SIS Hardware

This chapter provides information on troubleshooting hardware problems. Refer to the *Installing Your DeltaV Digital Automation System* manual for complete troubleshooting information.

After installing, it is recommended that you check out the hardware for a smooth startup. Follow these steps to check out your system:

1. Verify all power and ground connections.
2. Verify all field connections.
3. Verify all LED indicators.

Checking the LED Indicators on Each Device

Table 3-1 describes the LED indicators on the Logic Solver.

Table 3-1 Logic Solver LED Indicators

LED	Pattern	State
All (Simplex, Active, Standby)	Off	No Power
Green - Power and Yellow Standby alternating with Red - Error and Yellow Active	On flashing On flashing	Power-up tests in progress.
Simplex Green - Power Red -Error Yellow-Active	 On solid On flashing On flashing	Not commissioned
Redundant pair (Active) Green - Power Red - Error Yellow - Active	 On solid On flashing On flashing	Not commissioned
Redundant pair (Standby) Green - Power Red - Error Yellow-Standby	 On solid On flashing On flashing	Not commissioned
Simplex Green - Power Yellow - Active	 On solid On flashing	Commissioned, not configured
Redundant pair (Active) Green - Power Yellow - Active	 On solid On flashing	Commissioned, not configured
Redundant pair (Standby) Green - Power Yellow - Standby	 On solid On flashing	Commissioned, not configured or configuration in progress
Simplex Green-Power and Yellow-Active	On solid	Configured
Redundant pair (Active) Green-Power and Yellow-Active	On solid	Configured
Redundant pair (Standby) Green-Power and Yellow-Standby	On solid	Configured

Table 3-1 Logic Solver LED Indicators

LED	Pattern	State
Green - Power[a] Red - Error Yellow - Active Yellow - Standby	On solid On solid On flashing On flashing	Card is not fully operational. Contact technical support.
Green - Power [a] Red - Error	On solid On solid	Error detected during power-up tests. Contact technical support.

a. Same for Simplex, Active, or Standby

Table 3-2 describes the LED indicators on the SISNet Repeaters.

Table 3-2 SISNet Repeaters LED Indicators

LED	Correct Operating Condition	Fault Indications	Probable Cause	Corrective Action
Power (green)	On	Off	Power is not supplied to unit.	Check power supply and connections.
Fault (red)	Off	On	Internal fault	Contact technical support.
		Flashing	Maintenance required.	Contact technical support.
Local Peer Tx (yellow)	On - normal operations. The SISNet Repeater is receiving global data from other SISNet Repeaters and transmitting it to the local peer bus. Off - normal operations. There is no Logic Solver for the SISNet Repeater to synchronize with on the local peer bus. **Note:** This normally occurs during early configuration when Logic Solvers are planned, but not yet installed.	Flashing (local Peer Tx only)	The SISNet Repeater is not receiving its own transmissions while still receiving the transmissions of local Logic Solvers.	Contact technical support.
		Flashing (both local Peer Tx and Rx)	Local peer bus extender cables are disconnected, bus is not terminated or is terminated with wrong resistance.	Check local peer bus cables and termination.
		Off	The SISNet Repeater Local Peer bus transmitter hardware has detected a problem.	Contact technical support.
Local Peer Rx (yellow)	On - normal operations. The SISNet Repeater is receiving transmissions from local Logic Solvers. Off - normal operations. There is no Logic Solver for the SISNet Repeater to synchronize with on the local peer bus. **Note:** This normally occurs during early configuration when Logic Solvers are planned, but not yet installed.	Flashing (both local Peer Rx and Tx)	1.Local peer bus extender cables are disconnected, bus is not terminated or is terminated with wrong resistance.	1. Check local peer bus cables and termination.
			2. More than 5% of received messages have errors.	2. Check local peer bus termination. Contact technical support.
		Off	The SISNet Repeater Local Peer bus receiver hardware has detected an error.	Contact technical support.

Table 3-2 SISNet Repeaters LED Indicators (Continued)

LED	Correct Operating Condition	Fault Indications	Probable Cause	Corrective Action
Remote Peer Tx (yellow)	On - normal operations. The SISNet Repeater is transmitting local and remote global messages on the fiber-optic ring.	Flashing	Break in fiber-optic ring.	Check that this SISNet Repeater is receiving remote global data and its own global data is making it around the ring
		Off	Hardware error.	Contact technical support.
Remote Peer Rx (yellow)	On - normal operation. This SISNet Repeater is receiving global data.	Flashing	1. Fiber-optic cable is disconnected, broken, or crossed.	1. Check fiber-optic cable connections. Connects Primary to Primary, Secondary to Secondary.
			2. More than 5% of received messages have errors.	2. Check remote peer predecessor for transmit error. Contact technical support.
		Off	Hardware error.	Contact technical support.

Note *If a single SISNet Repeater is used (for example for diagnostic testing), loop the SISNet Repeater to itself input to output.*

Table 3-3 describes the LED indicators on the SISNet Distance Extenders.

Table 3-3 SISNet Distance Extenders LED Indicators

LED	Correct Operating Condition	Fault Indicators	Probable Cause	Corrective Action
PWR	On	Off	Power is not supplied to unit.	Provide power to unit.
SM	On	Off	No single mode carrier detected.	Restore connection to predecessor SISNet Distance Extender's single mode TxD.
MM	On	Off	No multimode carrier detected.	Restore connection to predecessor SISNet Repeater's multimode TxD.

Appendix A Environmental Specifications

The environmental specifications for normal operation of DeltaV SIS devices are:

- **Operating temperature**: -40°C to 70°C (-40°F to 158°F)[1]
- **Storage temperature**: -40°C to 85°C (-40°F to 185°F)
- **Relative humidity**: 5% to 95% non-condensing
- **Shock**: 10 g ½-sine wave for 11 ms
- **Vibration**: 1 mm peak-to-peak from 5 to 16 Hz; 0.5g from 16 to 150 Hz
- **Airborne contaminants**: Severity level G3
- **IP 20 rating**
- **Electromagnetic compatibility**: Per EN61326-1, Criteria A and Namur NE21

1.Forced air is required for Logic Solvers installed on VerticalPLUS carriers operating in a temperature range of 60°C to 70°C (140°F to 158°F).

Appendix B Logic Solver and Channel Specifications

This appendix provides specifications for the Logic Solver and for the Analog Input (HART), HART Two-state output, Discrete Input, and Discrete Output channels.

Logic Solver Specifications

Table B-1 provides specifications for the Logic Solver.

Table B-1 Logic Solver Specifications

Item	Specification
Input power	24 VDC ± 20%, 1.0 A plus field power (5.0 A total) **Note** It is recommended that the Logic Solver and DeltaV controller and I/O use separate power supplies.
Field Power	4 A maximum (actual value depends upon channel type and field device type)
Isolation	Each channel is optically isolated from the system and factory tested to 1500 VDC. No channel-to-channel isolation.
LocalBus current	None
Mounting	On Logic Solver (yellow) terminal blocks in odd numbered slots (1, 3, 5, 7) on the 8-wide carrier. Simplex Logic Solvers take 2 slots and redundant Logic Solvers take 4 slots.

Figure B-1 shows Logic Solver dimensions.

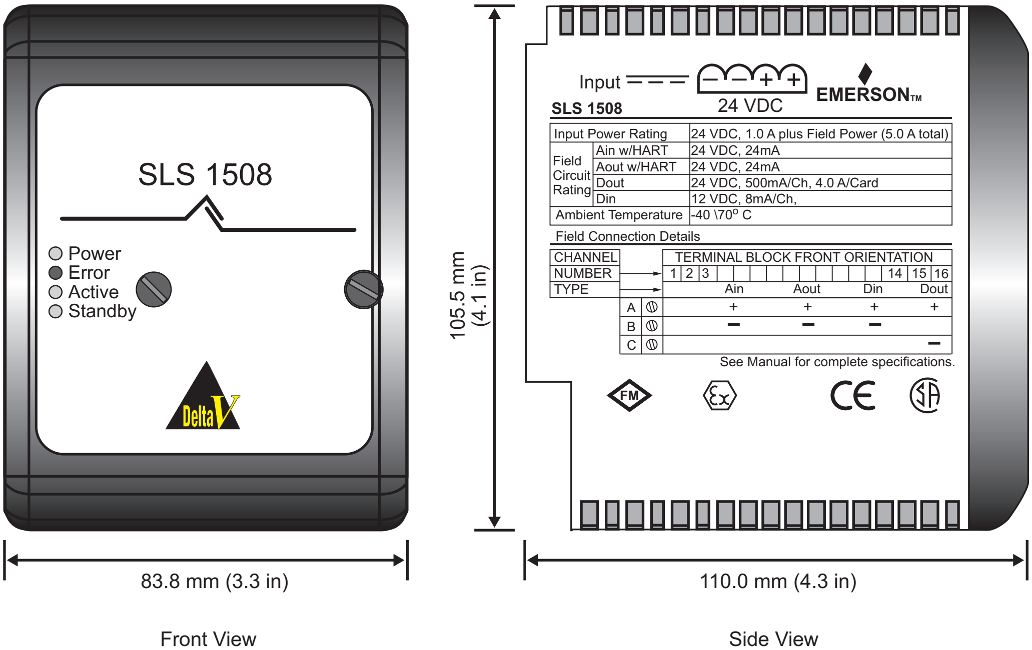

Figure B-1 Logic Solver Dimensions

Logic Solvers install on termination blocks that provide 16 channels of I/O. Figure B-2 shows a simplex termination block and Figure B-3 shows a redundant termination block.

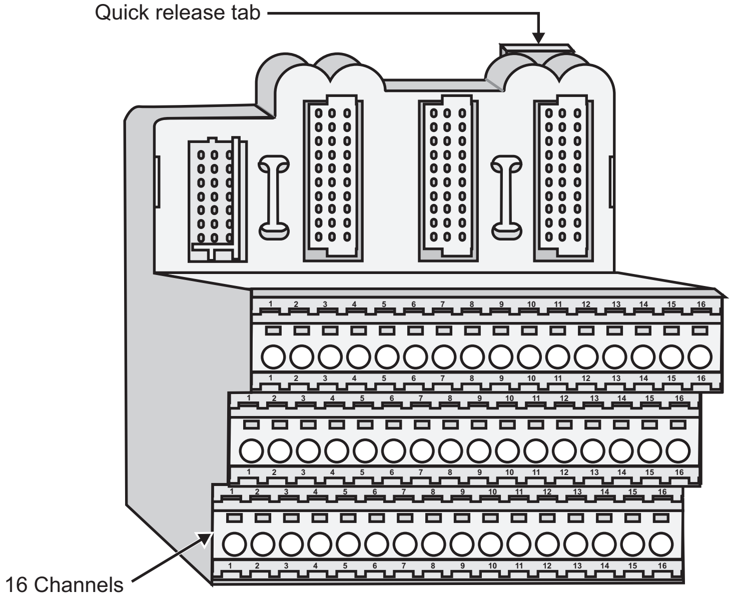

Figure B-2 Simplex Termination Block

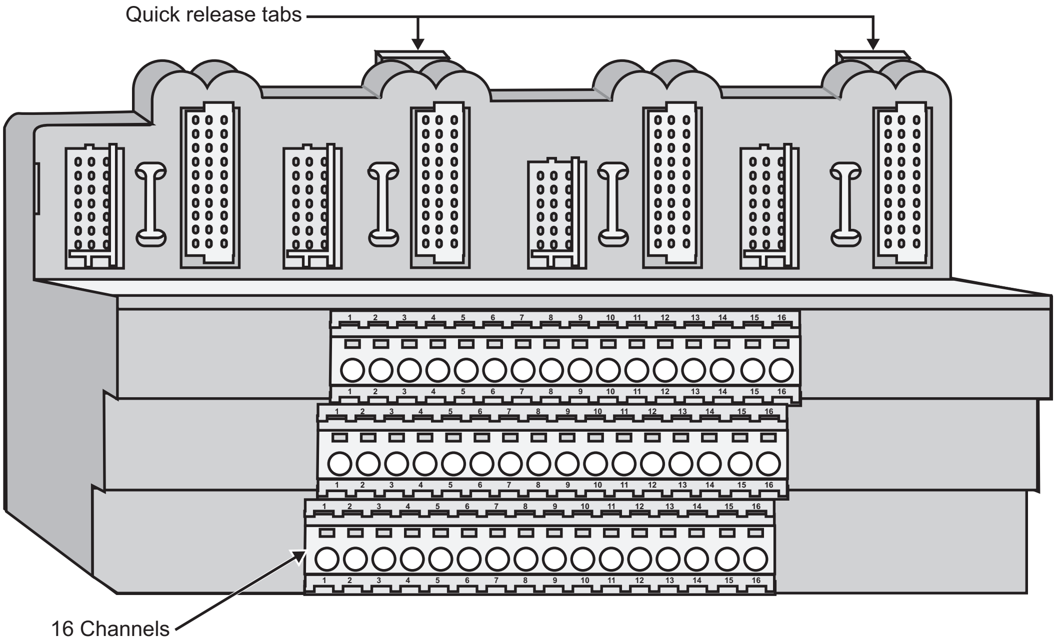

Figure B-3 Redundant Termination Block

Channel Specifications

The Logic Solver provides 16 channels of flexible I/O, meaning that each channel can be configured as an Analog Input (HART), HART Two-State Output, Discrete Input, or Discrete Output channel. Refer to Figures B-4 through B-8 for wiring diagrams and terminations for each of the channel types.

Analog Input Channel Specifications

Table B-2 provides specifications for the Analog Input channels.

Table B-2 Analog Input Channel Specifications (Includes HART)

Item	Specification
Number of channels	16
Isolation	Each channel is optically isolated from the system and factory tested to 1500 VDC. No channel-to-channel isolation.
Nominal signal range (span)	4 to 20 mA
Full signal range	1 to 24mA
Field circuit power per channel	24 mA
2-wire transmitter power	15.0 V minimum terminal to terminal @ 20 mA; current limited to 24 mA max.
input measurement accuracy	0.1% of span
Safety/diagnostic accuracy	2.0% of span
Resolution	16 bits
Filtering	2-pole filter, corner frequency 5.68 Hz -3 db at 5.68 Hz -20.0 db at 40 Hz (half the sample rate)

Figure B-4 shows a wiring diagram and terminations for the HART Analog Input channels.

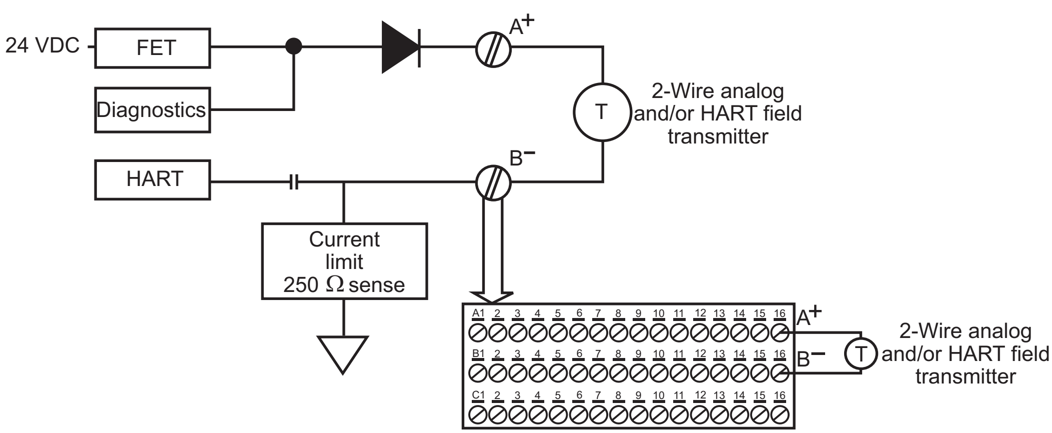

Figure B-4 Wiring Diagram and Terminations for Hart Analog Input Channels

HART Two-State Output Channel Specifications

Table B-3 provides specifications for the HART Two-State Output channels.

Table B-3 HART Two-State Output Specifications

Item	Specification
Number of channels	16
Isolation	Each channel is optically isolated from the system and factory tested to 1500 VDC. No channel-to-channel isolation.
Nominal signal range (span)	On state - 20 mA Off state - 0 or 4 mA (configurable)
Full signal range	0 to 24 mA
Safety/diagnostic accuracy	5% of span
Resolution	12 bits
Compliance voltage	20 mA into 600 Ω load
Open-loop detection	< 1.0 mA - when the output drifts 15% out of the configured value

Figure B-5 shows a wiring diagram and terminations for the HART Two-state output channels.

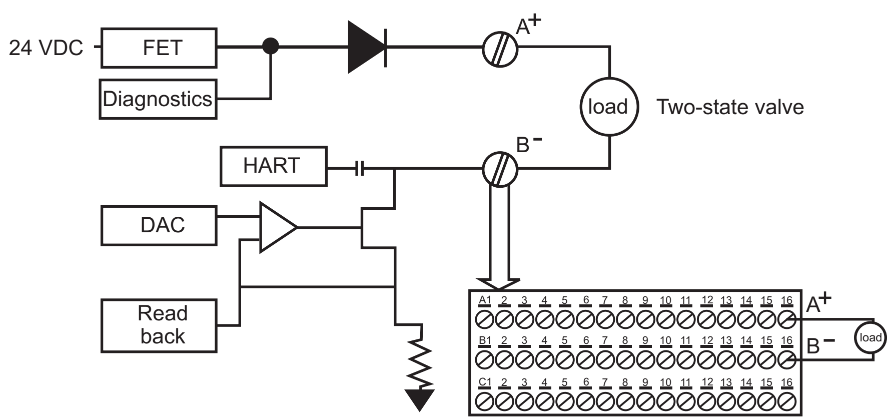

Figure B-5 Wiring Diagram and Terminations for 2- Wire HART Two-state Output Channels

Discrete Input Channel Specifications

Table B-4 provides specifications for the Discrete Input channels.

Table B-4 Discrete Input Channel Specifications

Item	Specification
Number of channels	16
Isolation	Each channel is optically isolated from the system and factory tested to 1500 VDC. No channel-to-channel isolation.
Detection level for ON	≥ 2 mA
Detection level for OFF	< 1.65 mA
Input impedance	~ 1790 Ω
Input compatibility	Inputs compatible with: NAMUR sensors (12 V) Dry contact Dry contact with end of line resistance
Line fault detection - short circuit (optional)	<100 Ω for guaranteed short circuit detection > 6 mA (simplex) >11 mA (redundant)
Line fault detection - open circuit (optional)	> 40 kΩ for guaranteed open loop detection < 0.35 mA

- **Line Fault Detection** — The Discrete Input channels have line fault detection for detecting open or short circuits in field wiring. To use this capability you must:
  - Enable line fault detection in your configuration. Enable line fault detection on a channel-by-channel basis when you configure the channels.
  - Connect the dry contact to external resistors. Connect the dry contact to a 12 KΩ resistor in parallel (allows the open circuit detection) and a 2.4 KΩ resistor in series (allows short circuit detection).
    Emerson's End of Line Resistance Module (KJ2231X1-EC1) provides this function. This module connects to the Discrete Input channel and to a field contact.
- **Line Fault Detection in NAMUR Sensors** — Line fault detection is built into NAMUR sensors. Do not use external resistors with NAMUR sensors; however, you must enable line fault detection in your configuration when using NAMUR sensors.

Figure B-6 shows a wiring diagram and terminations for the Discrete Input channels with the line fault detection options.

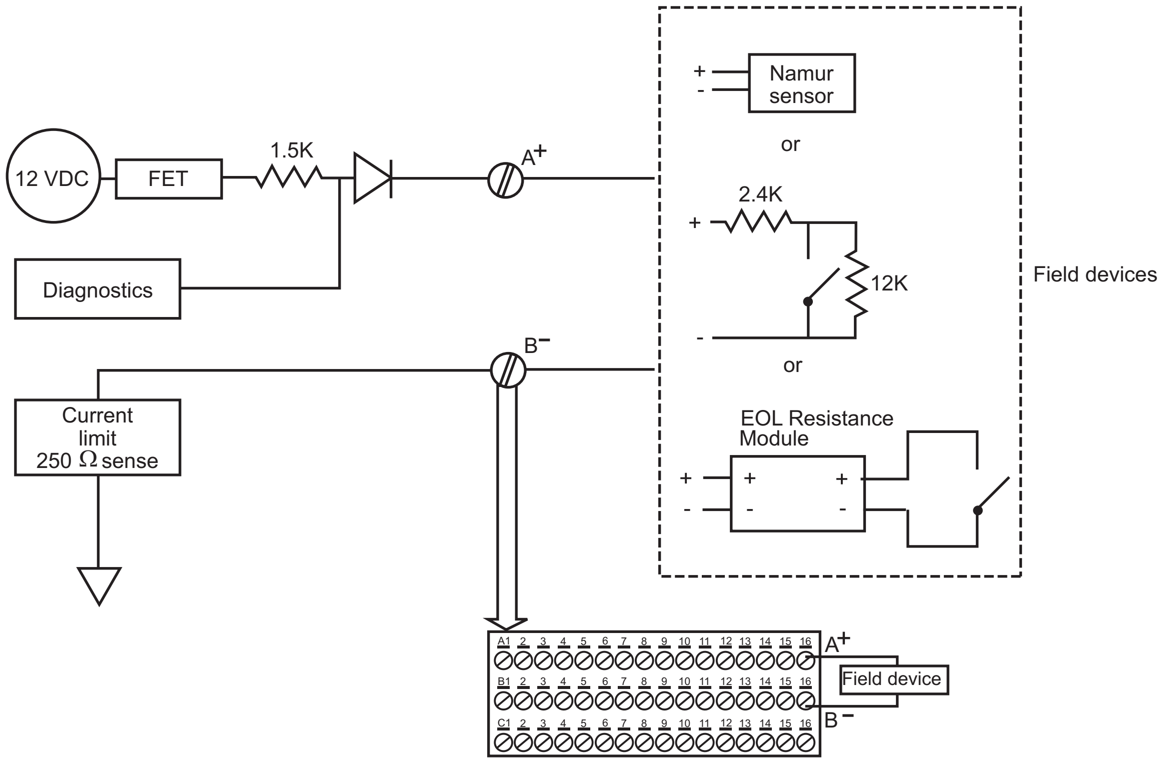

Figure B-6 Wiring Diagram and Terminations for Discrete Input Channels Showing the Line Fault Detection Options

It is assumed and recommended that applications use line fault detection; however, line fault detection can be omitted. Figure B-7 shows a wiring diagram and terminations for the Discrete Input channels without the line fault detection options.

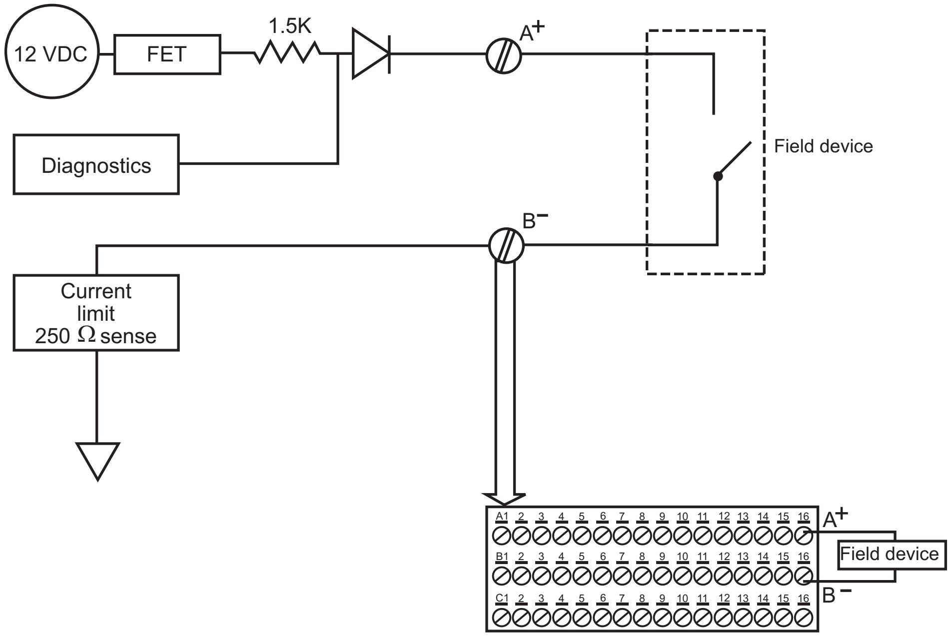

Figure B-7 Wiring Diagram and Terminations for the Discrete Input Channels with no LIne Fault Detection Options

Discrete Output Channel Specifications

Installation Notes

When driving inductive loads greater than or equal to 0.8 Henry in simplex or 0.3 Henry in redundant, an RC compensator may be required. Size the RC compensator at 3.3 kΩ and 0.47 µf for simplex and 2.7 kΩ and 0.22 µf for redundant as shown in Figure B-8. Emerson's R-C Compensator module (KJ2231X1-ED1) provides this function. This module can be used for simplex and redundant applications.

Pulse testing is recommended; however, it can be disabled for field devices such as solid state relays or active electronics that cannot support it. With redundant Logic Solvers, pulse testing requires partner synchronization and stops if the redundant partner becomes unavailable.

Table B-5 provides specifications for the Discrete Output channels.

Table B-5 Discrete Output Channel Specifications

Item	Specification
Number of channels	16
Isolation	Each channel is optically isolated from the system and factory tested to 1500 VDC. No channel-to-channel isolation.
Output voltage	Field power minus 2 V
Field power	0.5 A continuous per channel; 4.0 A max. per card
Output loading	56 to 3500 Ω
Off-state leakage	Open loop test off: 4.5 µA typical; 10 µA max. **Note** Optional pulse test will apply 24 VDC pulse on line for 1.0 mS every 50 mS. Refer to the Installation Notes for more information on pulse testing.
Short circuit protection	Outputs current limited to 2.0 A typical
Line fault detection - short circuit	< 5 Ω for > 1 second with +24 VDC field power. Refer to the Installation Notes for information on pulse testing.
Line fault detection - open circuit (with +24 VDC field power)	>25 kΩ for guaranteed open loop detection < 3.5 kΩ for guaranteed no open loop detection Refer to the Installation Notes for information on pulse testing.

Figure B-8 shows a wiring diagram and terminations for the Discrete Output channels.

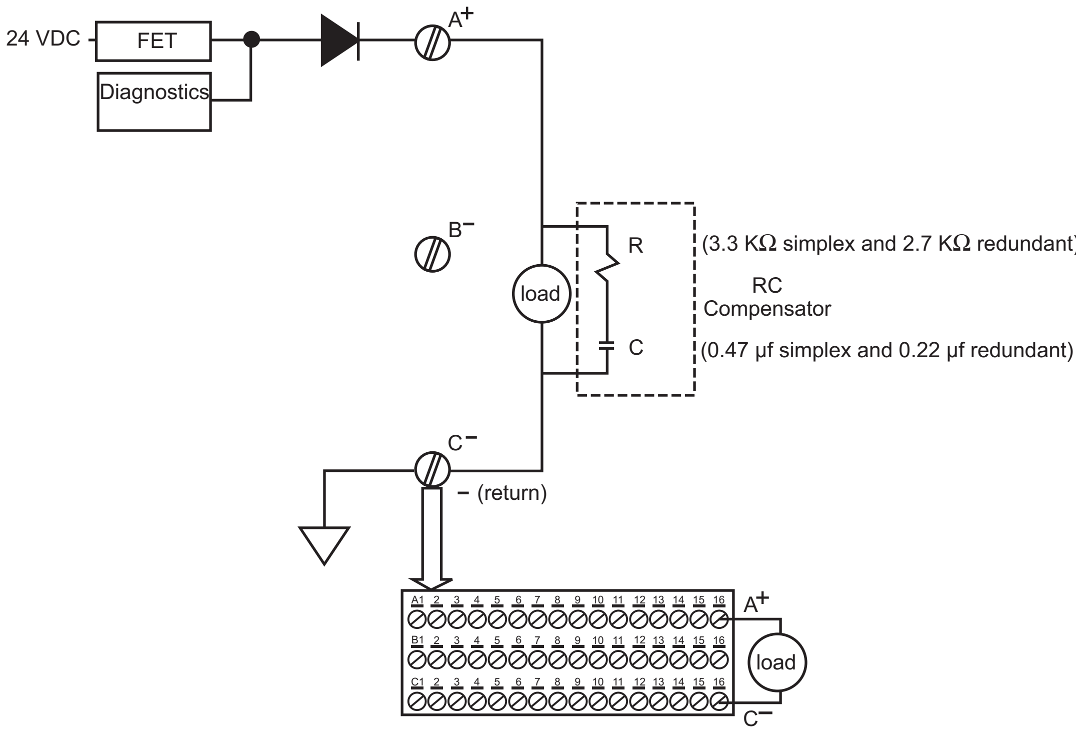

Figure B-8 Wiring Diagram and Terminations for Discrete Output Channels

Appendix C SISNet Repeater and SISNet Distance Extender Specifications

This appendix provides specifications for the SISNet Repeater and SISNet Distance Extender. Table C-1 shows general specifications for the SISNet Repeater.

Table C-1 SISNet Repeater Specifications

Item	Specification
Port type	ST female
Cable type	Multimode 62.5 /125 µm ST type or Multimode 50 /125 µm ST type
Output power	< -12dBm
Link budget	Multimode 62.5 /125 µm - max attenuation 11 dB Multimode 50 /125 µm - max attenuation 8 dB Wavelength 1300 nm
Link distance (nominal)	2 km one way TxD to RxD; actual length depends upon the quality of the fiber-optic cable Refer to "Example Fiber-Optic Link Loss Calculation" on page C-2 for additional information.
Topology	Physical ring: RxD connects to TxD of predecessor and TxD connects to RxD of successor.
SISNet Bridge Port	Used to make an Ethernet connection between two SISNet Repeaters in different SISNet rings.
Mounting	2-wide SISNet Repeater carrier left carrier position is primary SISNet Repeater; right carrier position is secondary SISNet Repeater.

Table C-2 shows power specifications for the SISNet Repeater.

Table C-2 SISNet Repeater Power Specifications

Item	Specification
Input power	24 VDC 300 mA (max)
Connector type	4-position screw terminal
Wire type	Solid or Stranded
Wire gauge	12 AWG maximum

Example Fiber-Optic Link Loss Calculation

The fiber-optic link budget must account for all losses at fiber-optic cable splices and connector insertion points. Refer to Table C-3 for the link budgets for single mode and multimode fiber at various core diameters. Keep an accurate account of losses at all connectors and splices in the system. The manufacturer of the components can provide the loss specifications. Many types of cables and connectors with different loss (attenuation) specifications are available.

Multimode Fiber

The following example shows typical link losses in a multimode, point-to-point fiber-optic link.

- Link budget 11 dB
- Fiber-optic cable (example 2 dB/km) x 2 km max = 4 dB
- TxD connector =.5 dB
- RxD connector =.5 dB
- Patch panel splices 2 x .5 dB = 1 dB
- Fiber-optic cable loss due to aging over time = 3 dB
- Total link losses = 4 + .5 + .5 + 1 + 3 = 9 dB

Margin = 11 dB -9 dB = 2 dB (the margin is greater than zero and falls within the link budget).

Single mode Fiber

The following example shows typical link losses in a single mode, point-to-point fiber-optic link with a core diameter of 9/125 μm. Refer to Table C-3 for the link budgets for other fiber-optic core diameters.

- Link budget 30 dB
- Fiber-optic cable (example 0.38 dB/km) x 60 km max = 22.8 dB
- TxD connector = 0.6 dB
- RxD connector = 0.6 dB
- Patch panel splices 2 x 0.1 dB = 0.2 dB
- Cable splices 10 x 0.1 dB = 1 dB
- Fiber-optic cable loss due to aging over time = 3 dB
- Total link losses = 22.8 + 0.6 + 0.6 + 0.2 + 1.0 + 3.0 = 28.2 dB

Margin = 30 dB - 28.2 dB = 1.8 dB (the margin is greater than zero and falls within the link budget).

Dimensions

Figure C-1 shows the dimensions for the SISNet Repeater.

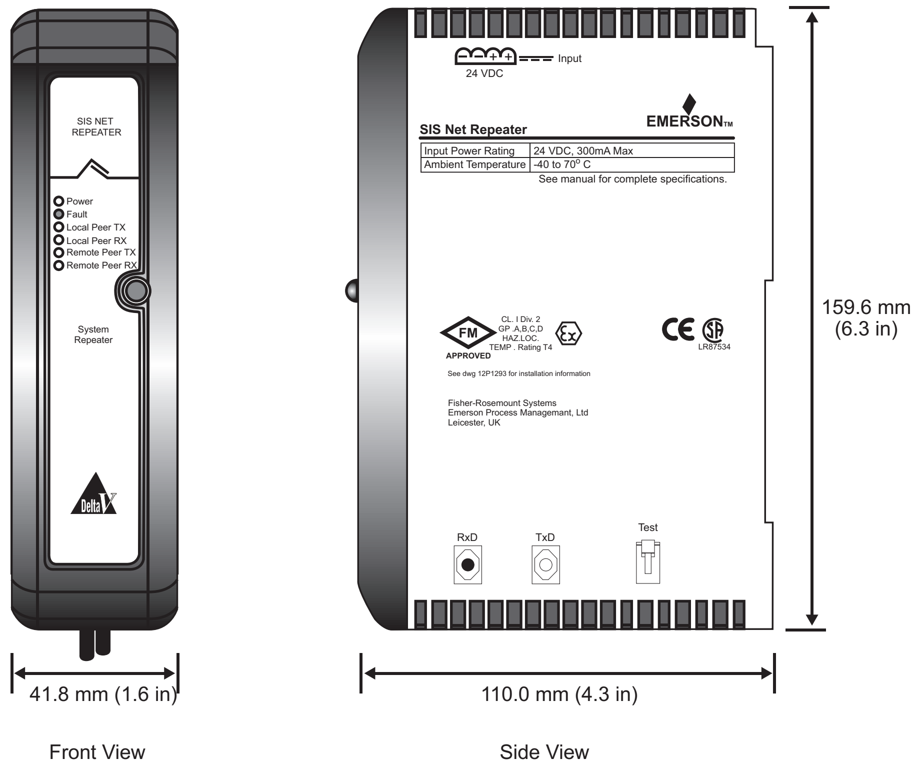

Figure C-1 SISNet Repeater Dimensions

Table C-3 shows general specifications for the SISNet Distance Extender.

Table C-3 Specifications for the SISNet Distance Extender

Item	Specification
Port types Multimode fiber port Single mode fiber port'	 Duplex SC Duplex LC
Cable types Multimode Single mode	 62.5 /125 µm ST type or 50/125 µm ST type 9/125 µm, 8.8/125 µm, 8.5/125 µm, 8.2/125 µm See note on page 2-18 about the conversion cable ends.
Output power Multimode Single mode	 14 dBm 0 dBm
Link budget Multimode Single mode	 62.5 /125 µm - max attenuation 11 dB 50/125 µm - max attenuation 8 dB Wavelength 1300 nm 9/125 µm - max attenuation 30 dB 8.8/125 µm - max attenuation 29.0 dB 8.5/125 µm - max attenuation 28.5 dB 8.2/125 µm - max attenuation 28.0 dB Wavelength 1310 nm
Link distance (nominal) Multimode Single mode	 2 km one way TxD to RxD 60 km one way TxD to RxD **Note** Actual lengths depend upon the quality of the fiber-optic cable and the connections.
Topology	Multimode (between SISNet Repeaters and SISNet Distance Extenders): SISNet Repeater RxD to SISNet Distance Extender TxD and SISNet Repeater TxD to SISNet Distance Extender RxD. Single mode (between SISNet Distance Extenders): RxD of successor SISNet Distance Extender to TxD of predecessor SISNet Distance Extender.
Mounting	DIN rail

Table C-4 shows power specifications for the SISNet Distance Extender.

Table C-4 SISNet Distance Extender Power Specifications

Item	Specification
Input power	19.2 VDC to 28.8 VDC @ 250 mA max
Connector type	4-position screw terminal
Wire type	Solid or Stranded
Wire gauge	12 AWG maximum

Dimensions

Figure C-2 shows the dimensions for the SISNet Distance Extender.

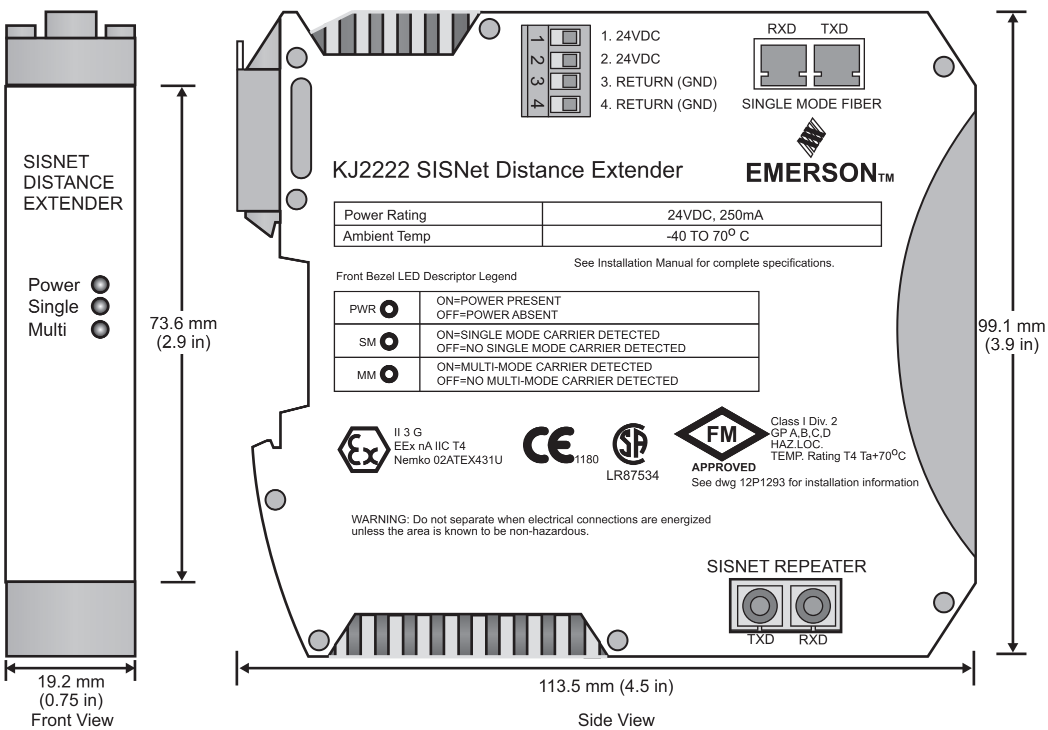

Figure C-2   SISNet Distance Extender Dimensions

Appendix D Extending an Operational System

This appendix explains how to add carriers to an operational system, add SISNet Repeaters to an operational system, and use Intrinsically Safe DeltaV cards with DeltaV SIS hardware.

Warning Be sure to follow the manufacturer's installation procedure and all applicable plant procedures when performing installation maintenance on an operational system. Failure to follow the appropriate procedures could result in unexpected and undesired system operation.

Adding Carriers to an Operational System

Additional carriers and components can be added to an operational DeltaV SIS system to extend the system. However, care must be taken to add the carriers without disrupting communication on the local peer bus. Follow these steps to add one or more 8-wide carriers to an operational system.

1. Install a left and right one-wide carrier to the 8-wide carrier that you intend to add to the existing system.
2. Connect the 44 pin D-Shell carrier extender cables between the existing carrier and the new carrier. Refer to "Installing Extender Cables" on page 2-8 for information.
3. Remove the 120 ohms BNC terminator from the secondary black connector on the existing right one-wide carrier and install it on the black connector on the new right one-wide carrier. Refer to "Terminating the Local Peer Bus" on page 2-10 for information.
4. Connect the local peer bus cable from the open, secondary black BNC connector on the existing carrier to the secondary black BNC connector on the new left one-wide carrier.
5. Open DeltaV Diagnostics and verify that there are no MaintAlerts or AdviseAlerts involving SISNet Error or SISNet High Error Rate for any Logic Solver. Also if using SISNet Repeaters, verify that Repeater02 OInteg is Good.

Warning Do not proceed until all alerts and statuses are Good in DeltaV Diagnostics.

6. Remove the 120 ohms BNC terminator from the primary white connector on the existing one-wide carrier and install it on the white connector on the new right one-wide carrier.
7. Connect the local peer bus cable from the primary white BNC connector on the existing right one-wide to the primary white BNC connector on the new left one- wide carrier.
8. In DeltaV Diagnostics verify that there are no MaintAlerts or AdviseAlerts involving SISNet Error or SISNet High Error Rate for any Logic Solver. If using SISNet Repeaters, verify that Repeater01 OInteg is Good.

Adding SISNet Repeaters to an Operational System

Additional SISNet Repeaters can be added to an operational DeltaV SIS system to extend the system. However, care must be taken to add the SISNet Repeaters without disrupting communication on the remote peer ring.

Note *Refer to "Setting Up the Remote Peer Ring" on page 2-15 and to the specifications in Appendix C before adding SISNet Repeaters and SISNet Distance Extenders to an operational system.*

The following example shows how to add a third SISNet Repeater pair to an operational system. Read the Note on page D-4 if the remote peer ring includes SISNet Distance Extenders.

1. Install the carriers, Logic Solvers, cards, terminators, the new SISNet Repeater pair. Refer to "Installing the System" on page 2-1 for installation instructions. In this example, the new SISNet Repeater pair is referred to as Pri. (Primary) and Sec. (Secondary) SISNet Repeater 3.

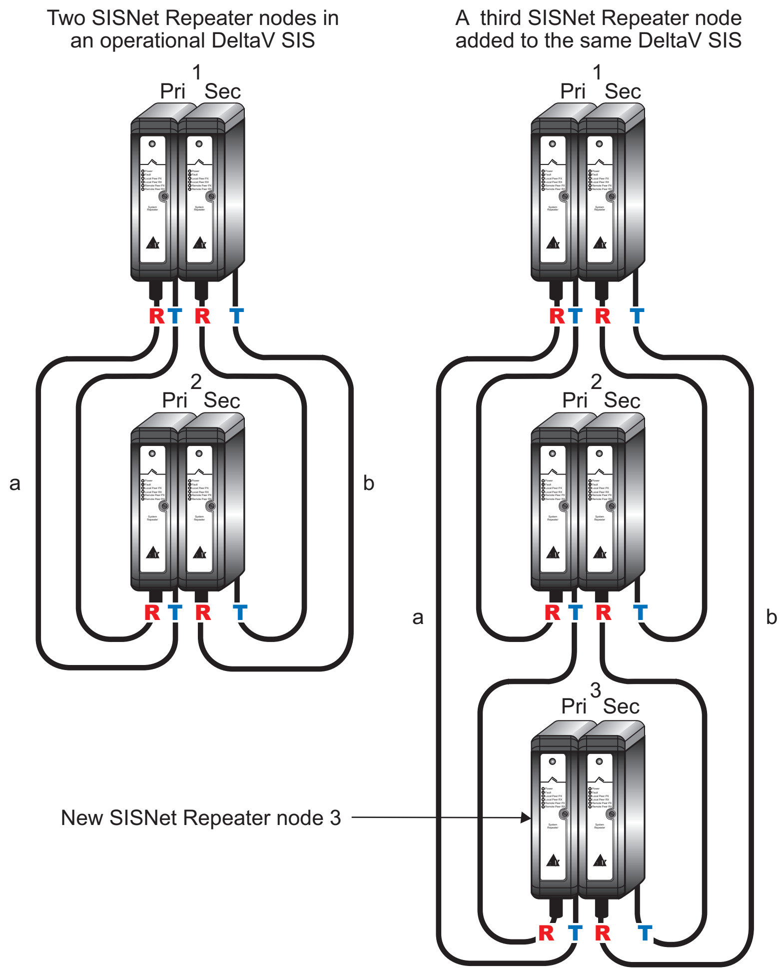

Figure D-1 A Third SISNet Repeater Added to an Operational System

Refer to Figure D-1.

2. Remove cable “a” from the existing two Pri. SISNet Repeater nodes shown in Figure D-1 and replace it with a new fiber-optic cable that connects R (RxD) on Pri. SISNet Repeater 1 to T (TxD) on the new Pri. SISNet Repeater 3.

3. Install a fiber-optic cable that connects R (RxD) on the new Pri. SISNet Repeater 3 to T (TxD) on Pri. SISNet Repeater 2.

4. Open DeltaV Diagnostics and be sure that OInteg is GOOD for each primary SISNet Repeater (REPEATER01). (The path to SISNet Repeaters is SISNetwork | Repeaters | Controller | SISNet Repeaters | REPEATERO1/02.)

5. Remove cable “b” from the existing two Sec. SISNet Repeater nodes shown in Figure D-1 and replace it with a new fiber-optic cable that connects T (TxD) on Sec. SISNet Repeater 1 to R (RxD) on the new Sec. SISNet Repeater 3.

6. Install a fiber-optic cable that connects T (TxD) on the new Sec. SISNet Repeater 3 to R (RxD) on Sec. SISNet Repeater 2.

7. In DeltaV Diagnostics, be sure that OInteg is GOOD for each secondary SISNet Repeater (REPEATER02). (The path to SISNet Repeaters is SISNetwork | Repeaters | Controller | SISNet Repeaters | REPEATERO1/02.)

Note *SISNet Distance Extenders are considered to be part of a SISNet Repeater node (primary or secondary). Add SISNet Distance Extenders along with SISNet Repeaters one node at a time to ensure that communication on the remote peer ring is not disrupted.*

Using DeltaV Intrinsically Safe Cards with DeltaV SIS Hardware

A single DeltaV controller can host both DeltaV SIS hardware and DeltaV Intrinsically Safe (I.S.) cards making it possible to use DeltaV I.S. cards in a DeltaV Safety Instrumented System. One-wide carriers and extender cable, with the right one-wide carrier terminated, are used to connect a DeltaV SIS system to a second 8-wide carrier installed with DeltaV I.S. cards. A LocalBus Isolator and I.S. Power Supply must be installed on the second carrier. The LocalBus Isolator separates DeltaV I.S. cards from standard I/O cards to protect the I.S. cards from damaging voltages.

➢ **To use DeltaV I.S. Cards with a DeltaV SIS system**

Refer to Figure D-2.

1. Install a right one-wide carrier onto the 8-wide carrier installed with DeltaV SIS components by sliding together the 48 pin connectors on the carriers.

2. Install a left one-wide carrier onto the 8-wide carrier to be installed with DeltaV I.S. cards by sliding together the 48 pin connectors on the carriers.

3. Terminate the right one-wide carrier. Refer to "Terminating the Local Peer Bus" on page 2-10 for information.

4. Connect the 44 pin D-shell (male) connector on the one-wide carrier extender cable to the top D-shell (female) connector on the terminated, right one-wide carrier and fasten the retainer screws.

5. Connect the 44 pin D-shell connector on the other end of the cable to the top D-shell connector on the left one-wide carrier and fasten the retainer screws.

6. Install a LocalBus Isolator and I.S. Power Supply on the 8-wide carrier holding the DeltaV I.S. cards to separate standard DeltaV cards from DeltaV I.S. cards. Refer to the *Installing Your DeltaV Digital Automation System* manual for information on installing DeltaV I.S. components.

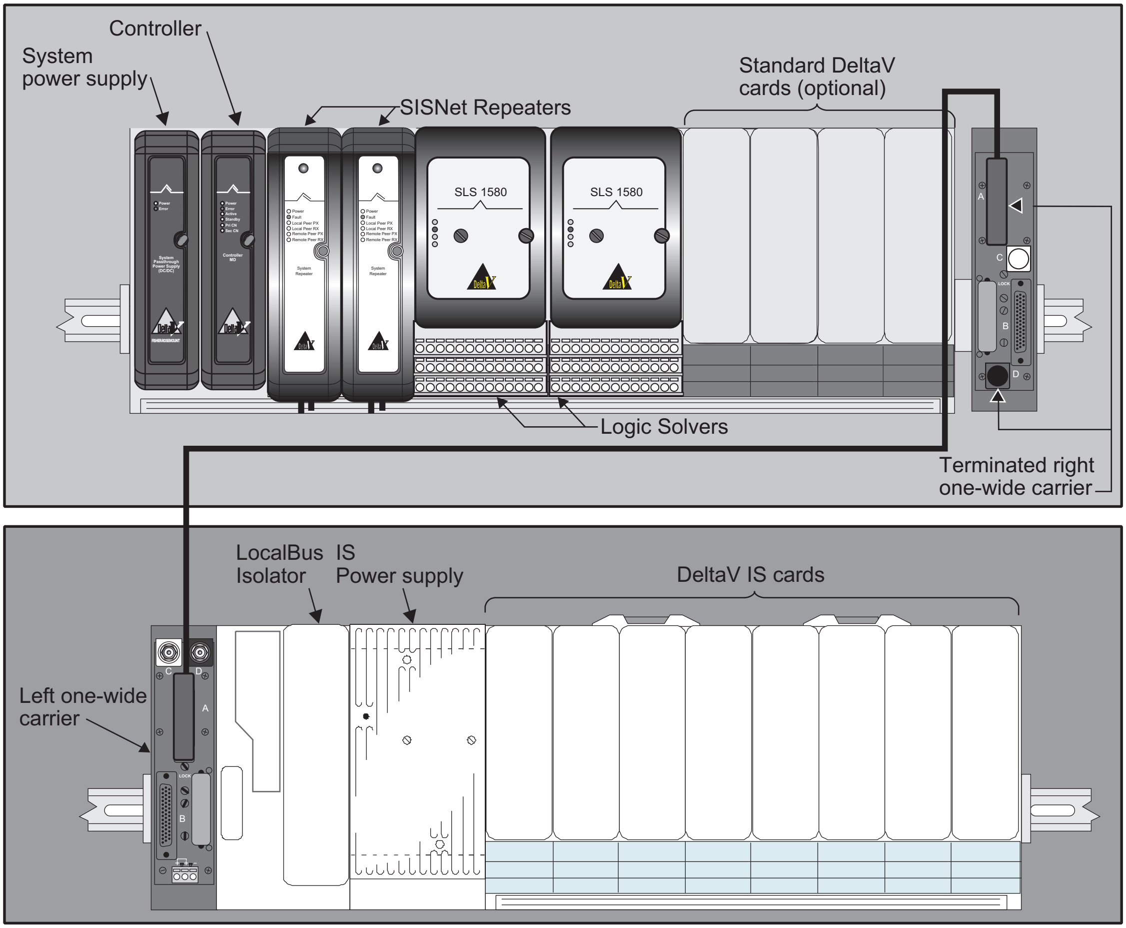

Figure D-2 DeltaV I.S. Cards Used with DeltaV SIS Hardware

Appendix E Using Auxiliary Equipment with DeltaV SIS Hardware

This appendix provides information on using auxiliary equipment with DeltaV SIS hardware.

Relay Module for Fire and Gas Applications

DeltaV SIS hardware can be used with auxiliary equipment to support energize to actuate applications such as fire and gas applications.

Two modules are available for fire and gas and other energize to actuate applications:

- Auxiliary Relay De-Energize to Actuate (DTA-Inverting) module
- Auxiliary Relay Diode module

The Auxiliary Relay DTA-Inverting module has a connection to a redundant Logic Solver's discrete input and discrete output channels and connections to redundant 24 VDC power supplies. Field terminals are used to connect to the Relay Diode module that is located next to the field actuator as shown in Figure E-1.

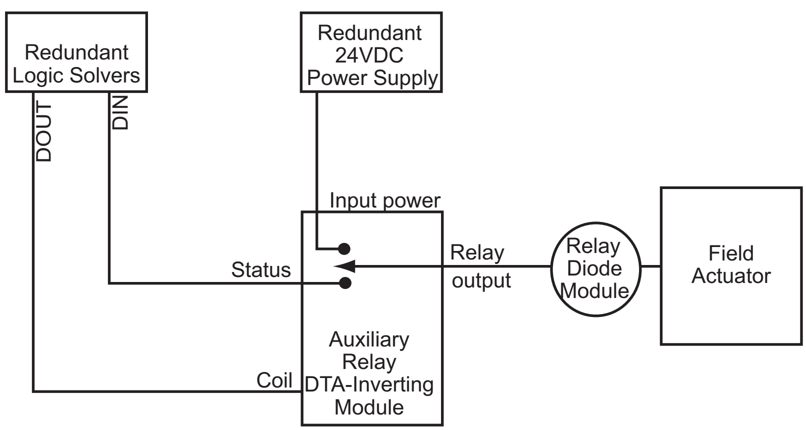

Figure E-1 Block Diagram for Fire and Gas Application

The Auxiliary Relay DTA-Inverting module energizes the field when Discrete Out is turned Off.

The Auxiliary Relay DTA-Inverting module is paired with the Auxiliary Relay Diode module to perform the required function such as monitoring field wiring when not actuated. A switch on the Auxiliary Relay Diode module is used to change between Energize to Actuate and De-Energize to Actuate. Refer to "Auxiliary Relay Diode Module" on page E-6. The Auxiliary Relay DTA-Inverting module's LED shows if power is correctly installed and the state of the relay coil.

Refer to Figure E-2. The Auxiliary Relay DTA-Inverting module has the following connections:

- Two pin connections for primary power
- Two pin connections for secondary power
- Two pin connections for field output to the Auxiliary Relay Diode module
- Two pin connections for coil input
- Two pin connections for status output
- Two pin connections for auxiliary output contact closure (not used in the application depicted in Figure E-1)

Table E-1 shows the specifications for the Auxiliary Relay DTA-Inverting module.

Table E-1 Auxiliary Relay DTA-Inverting Module Specifications

Item	Specification
Input field power	24 VDC ± 20% 5A maximum (actual current depends upon actuator used) Contains integrated OR-ing diodes for redundant 24 V inputs.
Relay current rating	5 A @ 24 VDC nominal
Isolation	None Power input and Logic Solvers must be connected to a common ground.
Coil input voltage Coil input impedance	17-28.8 VDC to energize 430 Ω
Mounting	horizontal DIN rail

Table E-2 summarizes the Auxiliary Relay DTA-Inverting module functionality.

Table E-2 Auxiliary Relay DTA-Inverting Module Functions

Process State	DO Channel	Relay State	Relay LED	Relay Output	DI Channel (Relay Status)	Line Fault Detection[a]		
						DO	**DI**	**Relay Output**
Normal (Alarm Off)	On (1)	On	On	Off	On (1)	Open/Short	Open/Short	Open/Short
Tripped (Alarm On)	Off (0)	Off	Off	On	Off (0)	Open/Short	Open/Short	N/A

a. Only applies when Line Fault Detection is enabled. When Line Fault Detection is not enabled, the On states detect opens only and the Off states detect shorts only.

Figure E-2 shows the connections on the top of the Auxiliary Relay DTA-Inverting module and the module's dimensions.

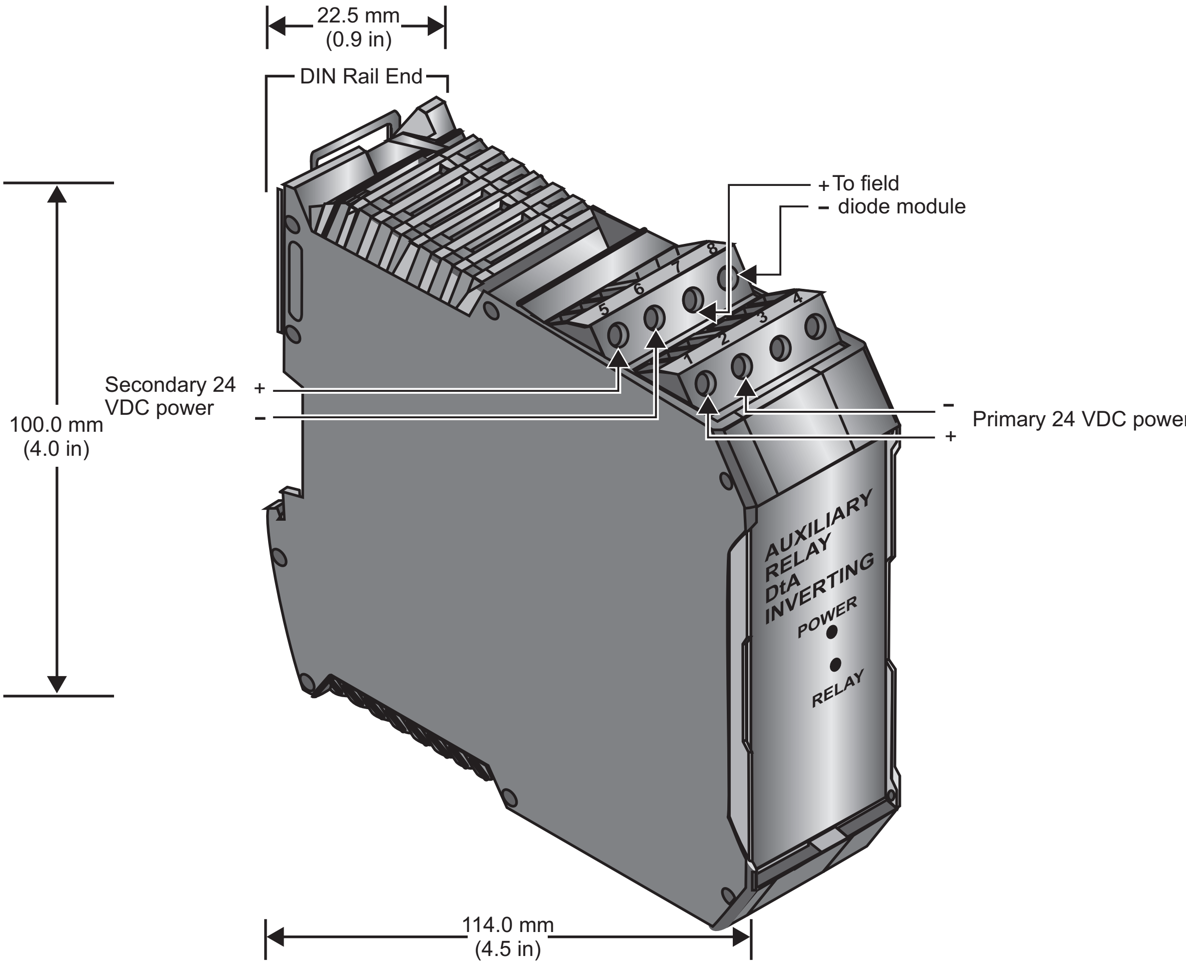

Figure E-2   Auxiliary Relay DTA-Inverting Module Top View and Dimensions

Figure E-3 shows the connections on the bottom of the Auxiliary Relay DTA-Inverting module.

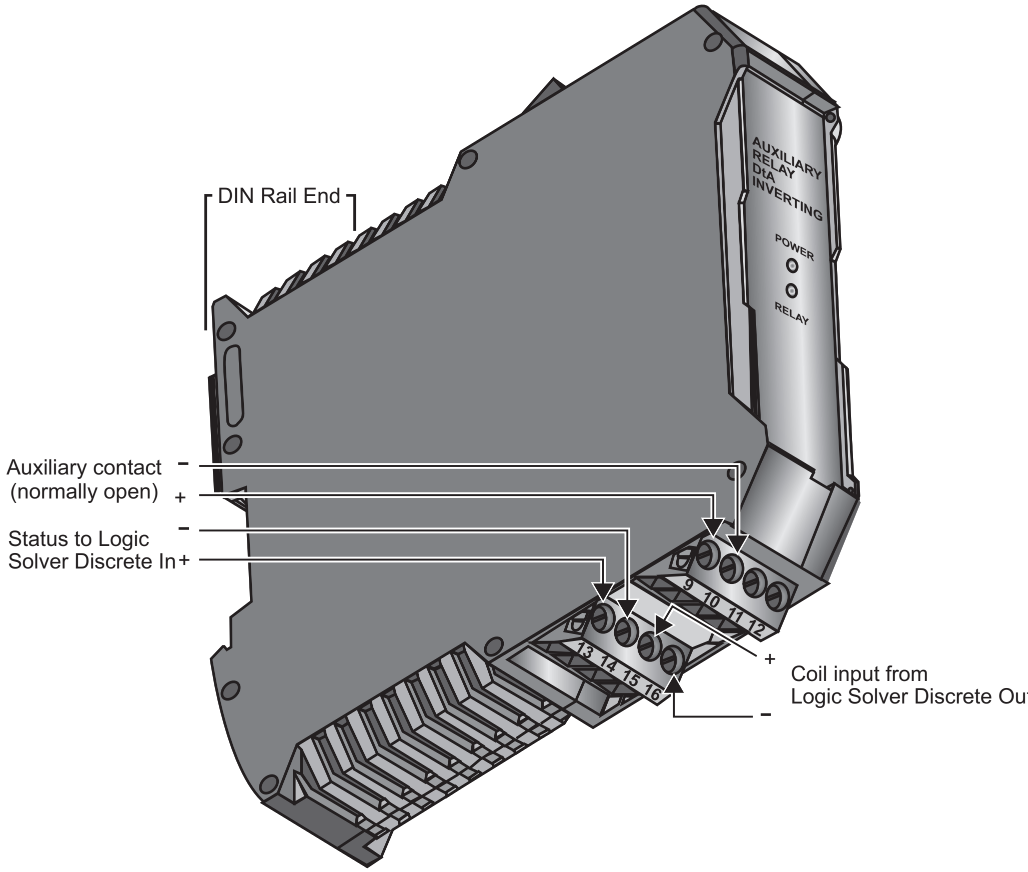

Figure E-3   Bottom View of the Auxiliary Relay DTA-Inverting Module

Auxiliary Relay Diode Module

Table E-3 shows the specifications for the Auxiliary Relay Diode module.

Table E-3 Auxiliary Relay Diode Module Specifications

Item	Specification
Mode selection	Switch selectable between ETA and DTA operation. Incorrect switch position will cause bad status on SLS Discrete Input.
Diode rating	24 VDC ± 20% 5 A maximum (actual current depends upon actuator used)
Mounting	Per DIN 43729

Figure E-4 shows the connections and switch positions on the Auxiliary Relay Diode module as well as the module's dimensions.

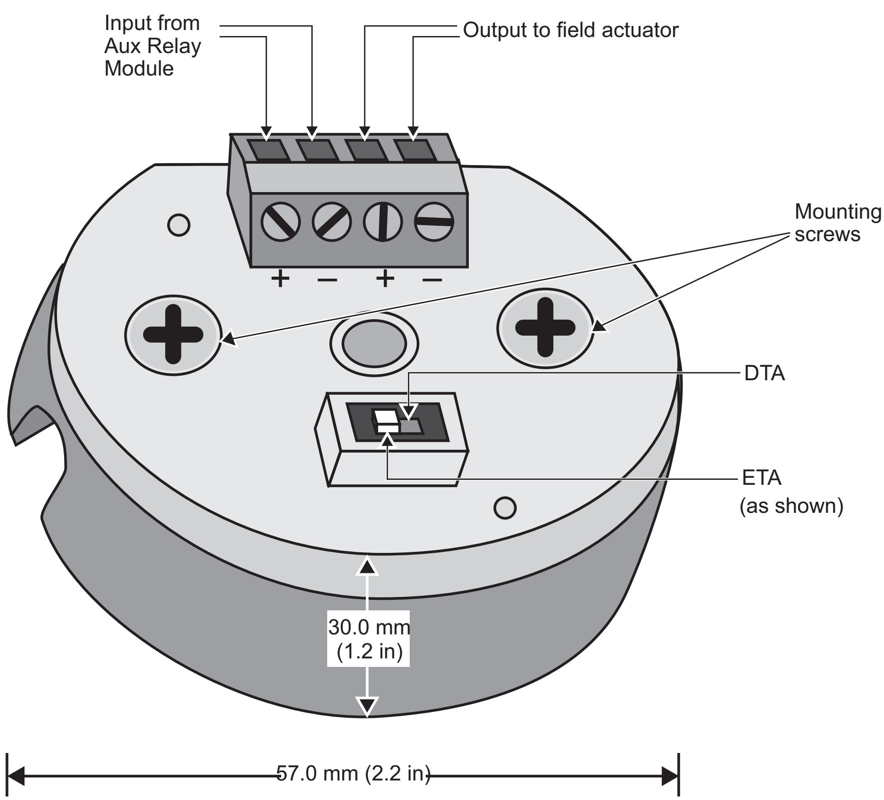

Figure E-4 Auxiliary Relay Diode Module Connections, Switch Positions, and Dimensions

Relay Module for Other Applications

DeltaV SIS hardware can be used with auxiliary equipment to support other applications. Two modules are available for other applications:

- Auxiliary Relay Energize to Actuate (ETA-Direct) module
- Auxiliary Relay Diode module

The Auxiliary Relay ETA-Direct module energizes the field when Discrete Out is turned On.

The Auxiliary Relay ETA-Direct module has a connection to a Logic Solver's discrete input and discrete output channels and a connection to a dual 24 VDC power supply. Two field terminals are used to connect to the Auxiliary Relay Diode module that is located next to the field actuator as shown in Figure E-1.

The Auxiliary Relay ETA-Direct module energizes the field when Discrete Out is turned On. This module is not intended for SIL-certified applications but may be useful in lock-out or deluge applications where an unintended trip caused by a Logic Solver fault or operator error could be hazardous to personnel and equipment.

The Auxiliary Relay ETA-Direct module is paired with the Auxiliary Relay Diode module to perform the required function. A switch on the Auxiliary Relay Diode module is used to change between Energize to Actuate and De-Energize to Actuate. Refer to "Auxiliary Relay Diode Module" on page E-6. The Auxiliary Relay ETA-Direct module's LED shows if power is correctly installed and the state of the relay coil.

Table E-4 shows the specifications for the Auxiliary Relay ETA-Direct module.

Table E-4 Auxiliary Relay ETA-Direct Module Specifications

Item	Specification
Input field power	24 VDC ± 20% 5A maximum I (actual current depends upon actuator used) Contains integrated OR-ing diodes for redundant 24 V inputs.
Relay current rating	5 A @ 24 VDC nominal
Isolation	None Power input and Logic Solvers must be connected to a common ground.
Coil input voltage Coil input impedance	17-28.8 VDC to energize 430 Ω
Mounting	horizontal DIN rail

The connections on the Auxiliary Relay ETA-Direct module are the same as those on the Auxiliary Relay DTA-Inverting module. Refer to Figures E-2 and E-3.

Table E-5 summarizes the Auxiliary Relay ETA-Direct module functionality.

Table E-5 Auxiliary Relay ETA-Direct Module Functions

Process State	**DO Channel**	**Relay State**	**Relay LED**	**Relay Output**	**DI Channel (Relay Status)**	**Line Fault Detection[a]**		
						DO	**DI**	**Relay Output**
Normal (Alarm Off)	Off (0)	Off	Off	Off	On (1)	Open/Short	Open/Short	Open/Short
Tripped (Alarm On)	On (1)	On	On	On	Off (0)	Open/Short	Open/Short	N/A

a. Only applies when Line Fault Detection is enabled. When Line Fault Detection is not enabled, the On states detect opens only and the Off states detect shorts only.

SIS Relay Module

The SIS Relay module can be used with DeltaV SIS hardware to switch up to 2.5A at 250 VAC for safety applications. It opens contacts for field power when de-energized.

The SIS Relay module contains three relays from different manufacturers. A relay coil is energized for all three relays in normal operation. If a demand occurs, the SLS removes the power from the coil for all three relays at the same time. Each relay can be proof tested in the field. Refer to “Proof Testing the SIS Relay Module” on page E-12.

AC Field Wiring

Refer to Figure E-5 for AC field wiring connections.

- Two pin connections for input from an SLS Discrete Output channel
- Two pin connections for input from an AC power source
- Two pin connections for output to an AC field device

DC Field Wiring

Refer to Figure E-6 for DC field wiring connections.

- Two pin connections for input from an SLS Discrete Output channel
- Four pin connections for input from two DC power sources
- Four pin connections for output to two DC field devices

The SIS Relay module’s LED shows if power is correctly installed and the state of the relay coil.

Table E-6 shows the specifications for the SIS Relay module.

Table E-6 SIS Relay Module Specifications

Item	Specification
Input power rating	70 mA @24 VDC ± 20%
Relay current rating	2.5 A @ 250 VAC 2.5 A @ 30 VDC
Mounting	Horizontal DIN rail

The dimensions for the SIS Relay are the same as the Voltage Monitor (see Figure E-7). Figure E-5 shows the SIS Relay module’s connections for AC wiring.

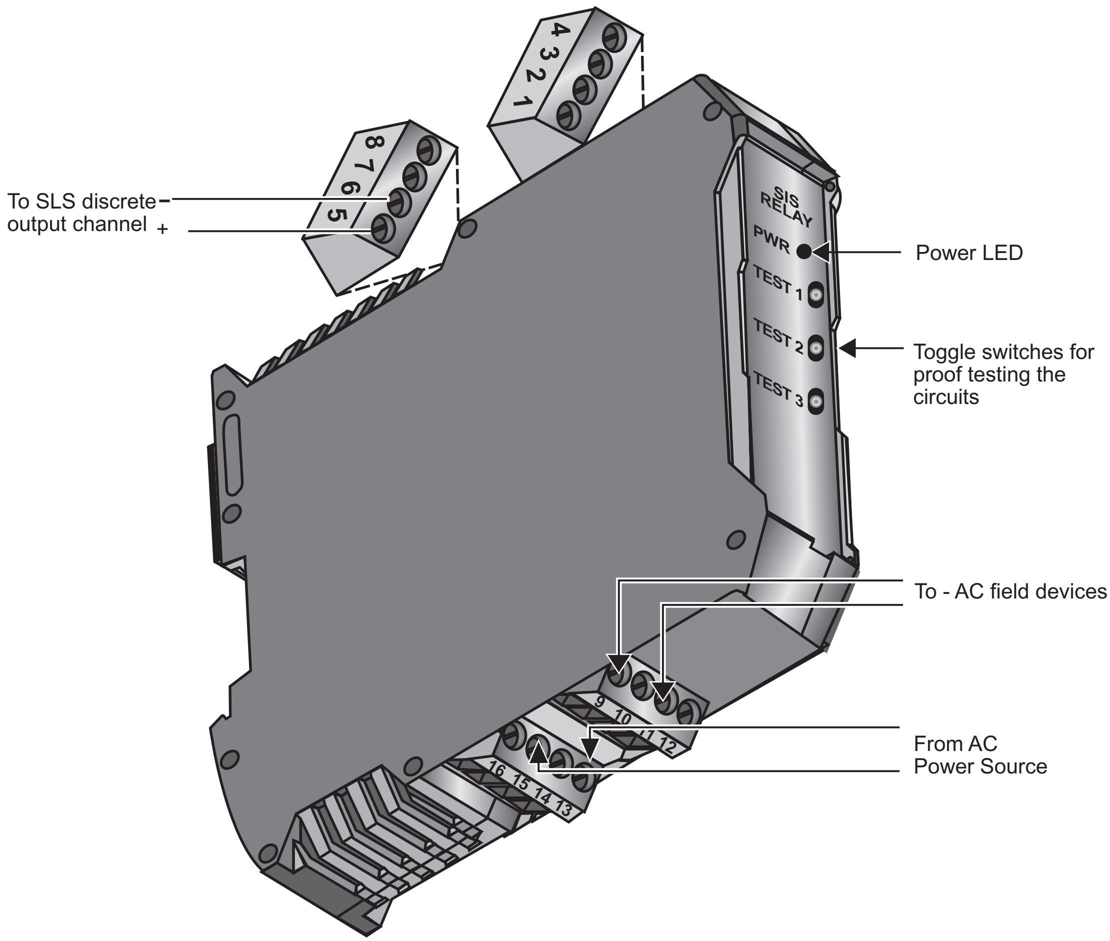

Figure E-5 SIS Relay Module for AC Field Wiring

Figure E-6 shows the SIS Relay module's connections for DC field wiring.

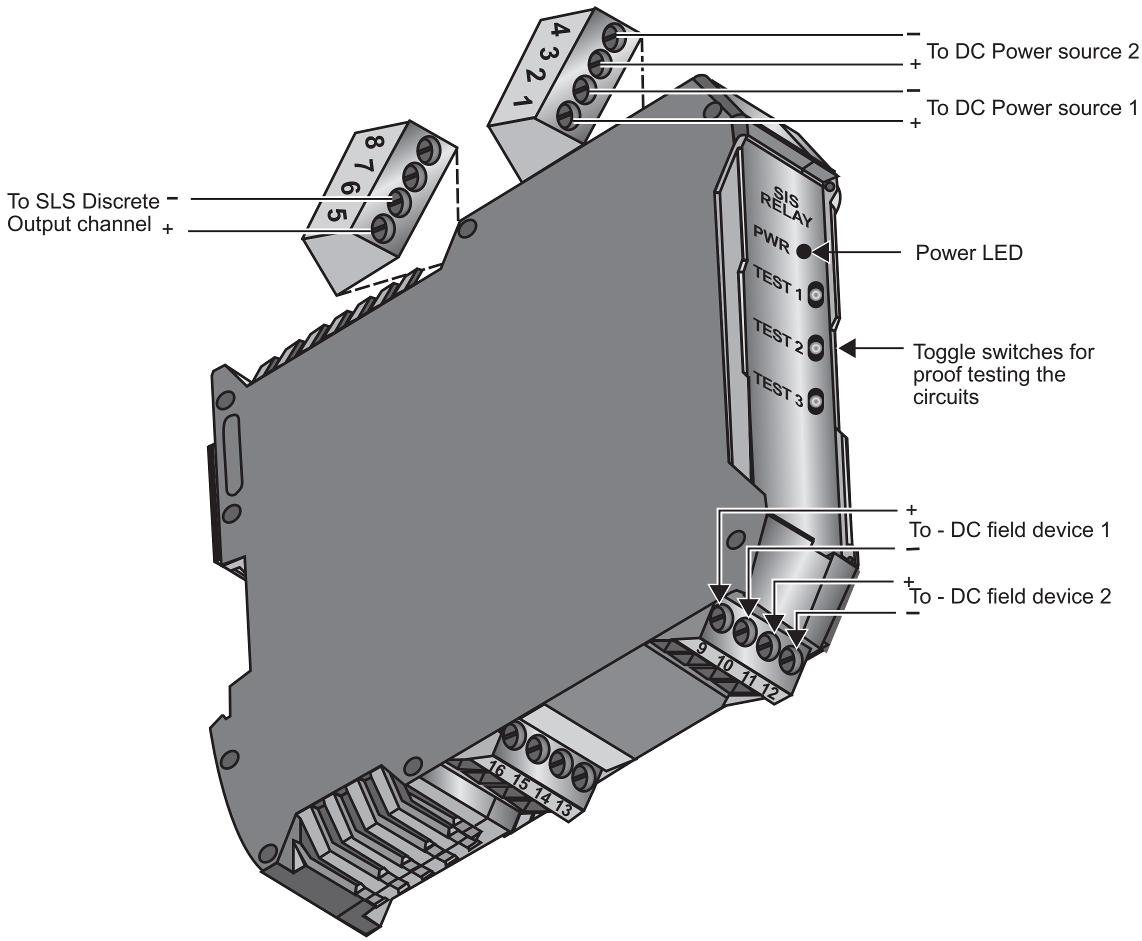

Figure E-6 SIS Relay Module for DC Field Wiring

Proof Testing the SIS Relay Module

It is important that you proof test all three relays individually. A circuit that does not open when the switch is toggled indicates a stuck contact. If this occurs, replace the module.

It is the user's responsibility to by-pass the field circuit during proof testing if required.

Follow these steps to proof test the SIS Relay module for AC wiring:

1. Measure the voltage at the AC field device's + and - connections (screw terminals 9 and 11). The voltage at these points should match the input voltage.

2. Slide the switch labeled Test 1 down to toggle it and then measure the voltage at the AC field device's + and - connections (screw terminals 9 and 11). The voltage at these points should be 0 when toggled. Release the toggle and re-measure the voltage.

3. Slide the switch labeled Test 2 down to toggle it and then measure the voltage at the AC field device's + and - connections (screw terminals 9 and 11). The voltage at these points should be 0 when toggled. Release the toggle and re-measure the voltage.

4. Slide the switch labeled Test 3 down to toggle it and then measure the voltage at the AC field device's + and - connections (screw terminals 9 and 11). The voltage at these points should be 0 when toggled. Release the toggle and re-measure the voltage.

Follow these steps to proof test the SIS Relay module for DC wiring:

1. Measure the voltage at the first DC field device's + and - connections (screw terminals 9 and 10). The voltage at these points should match the input voltage.

2. Slide the switch labeled Test 1 down to toggle it and then measure the voltage at the DC field device's + and - connections (screw terminals 9 and 10). The voltage at these points should be 0 when toggled. Release the toggle and re-measure the voltage.

3. Slide the switch labeled Test 2 down to toggle it and then measure the voltage at the DC field device's + and - connections (screw terminals 9 and 10). The voltage at these points should be 0 when toggled. Release the toggle and re-measure the voltage.

4. Slide the switch labeled Test 3 down to toggle it and then measure the voltage at the DC field device's + and - connections (screw terminals 9 and 10). The voltage at these points should be 0 when toggled. Release the toggle and re-measure the voltage.

If you have a second DC field device, perform steps 1-4 by measuring the voltage at pins 11 and 12.

Voltage Monitor

The Voltage Monitor can be used with DeltaV SIS hardware to drive a Logic Solver's Discrete Input channel or a Series 2 DI Dry Contact channel based on the output of the SIS Relay module. Refer to Figures E-7 and E-8. The Voltage Monitor has the following connections:

- Four pin connections for connecting input to DC or AC power sources
- Four pin connections for connecting outputs to two SLS DI channels
- Four pin connections for connecting outputs to two DI, Dry Contact channels

Table E-7 shows the specifications for the Voltage Monitor.

Table E-7 Voltage Monitor Specifications

Item	Specification
Input power rating per channel	6 mA @ 24 VDC ± 20% 15 mA @ 120/230 VAC
Mounting	horizontal DIN rail

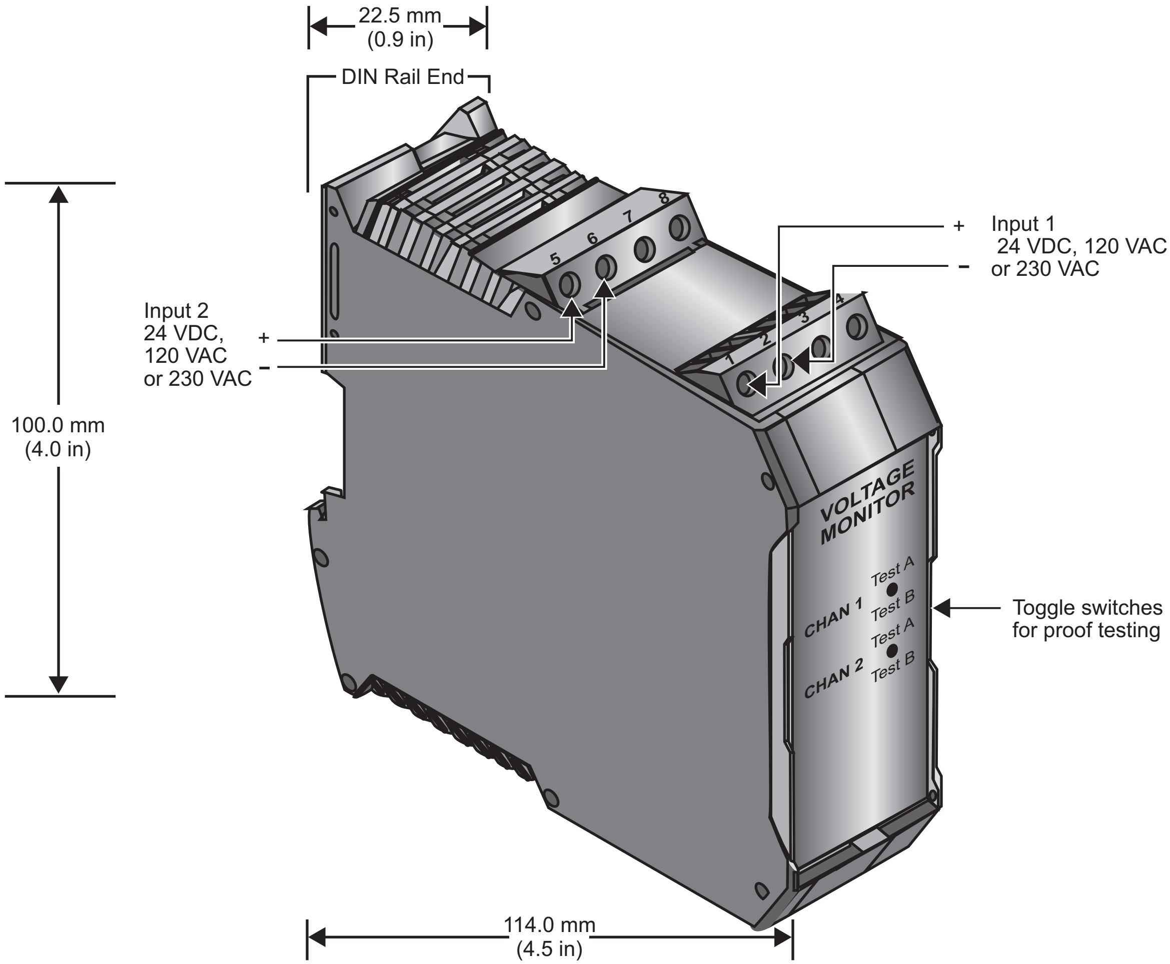

Figure E-7 Voltage Monitor Top View and Dimensions

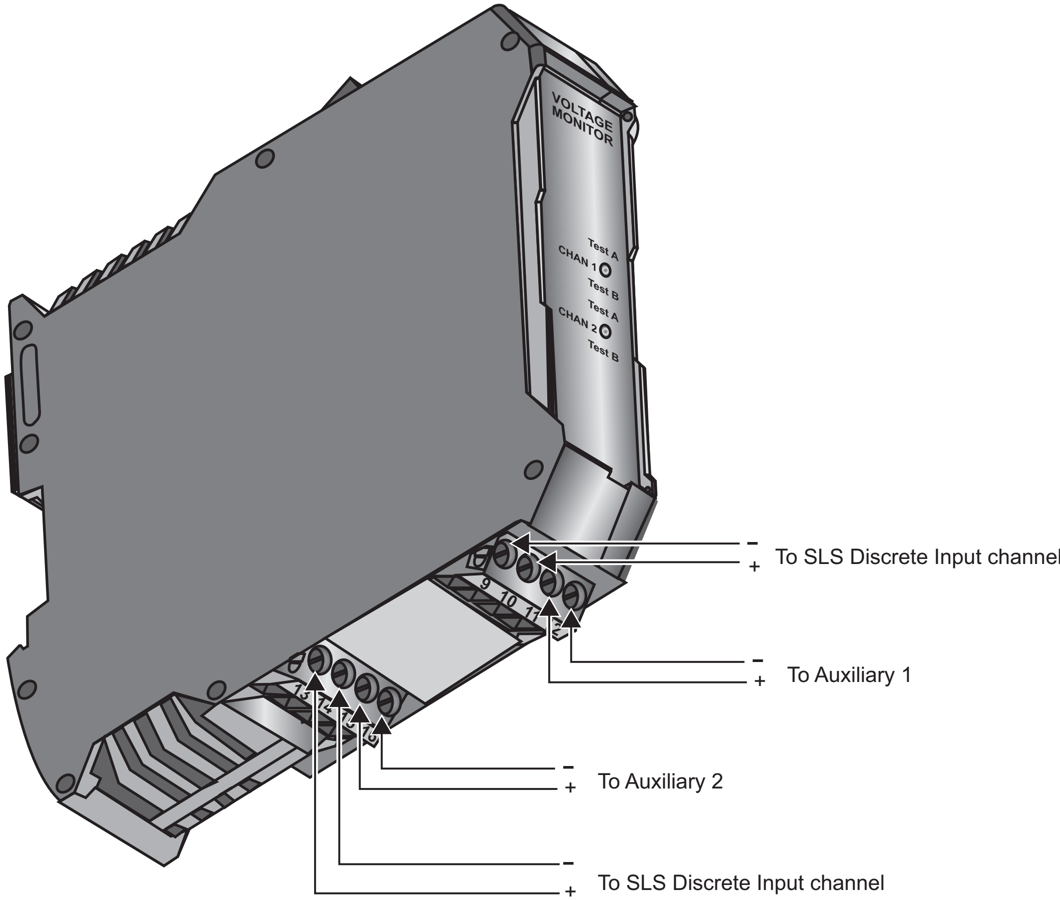

Figure E-8 Voltage Monitor Bottom View

Proof Testing the Voltage Monitor

The output to the SLS Discrete Input channels can be proof tested. A circuit that does not open when the switch is toggled indicates a stuck contact. If this occurs, replace the Voltage Monitor.

1. Measure the voltage at SLS Discrete Input channel one (screw terminals 9 and 10). The voltage should be about 7 VDC.
2. Slide the switch labeled CHAN 1 to the Test A position and then measure the voltage at SLS Discrete Input channel one (screw terminals 9 and 10). The voltage should increase to about 11 VDC.
3. Release the switch to its original position.
4. Slide the switch labeled CHAN 1 to the Test B position and then measure the voltage at SLS Discrete Input channel one (screw terminals 9 and 10). The voltage should increase to about 11 VDC.
5. Measure the voltage at SLS Discrete Input channel two (screw terminals 13 and 14). The voltage should be about 7 VDC.
6. Slide the switch labeled CHAN 2 to the Test A position and then measure the voltage at SLS Discrete Input channel one (screw terminals 13 and 14). The voltage should increase to about 11 VDC.
7. Release the switch to its original position.
8. Slide the switch labeled CHAN 2 to the Test B position and then measure the voltage at SLS Discrete Input channel one (screw terminals 13 and 14). The voltage should increase to about 11 VDC.

SIS Current Limiter

The SIS Current Limiter limits the current from the SLS Discrete Output channels to levels below the ignition curves for Class 1 Div 2 and Zone 2 installations. Field wiring from the Current Limiter output to the field can be removed and reconnected under power. Table E-8 shows specifications for the Current Limiter.

Table E-8 SIS Current Limiter Specifications

Item	Specification
Input power (from SLS DO channels)	17 to 29 VDC; 22 VDC nominal
Output power	28.8 VDC (max)
Output current range	0-100 mA (max)
Output current limit threshold	100 mA (min); 120 mA (max)
Mounting	Horizontal DIN rail

Refer to figures E-9 and E-10. The SIS Current Limiter has the following connections:

- Four pin connections for input from the SLS DO channels
- Four pin connections for output to energy-limited loads

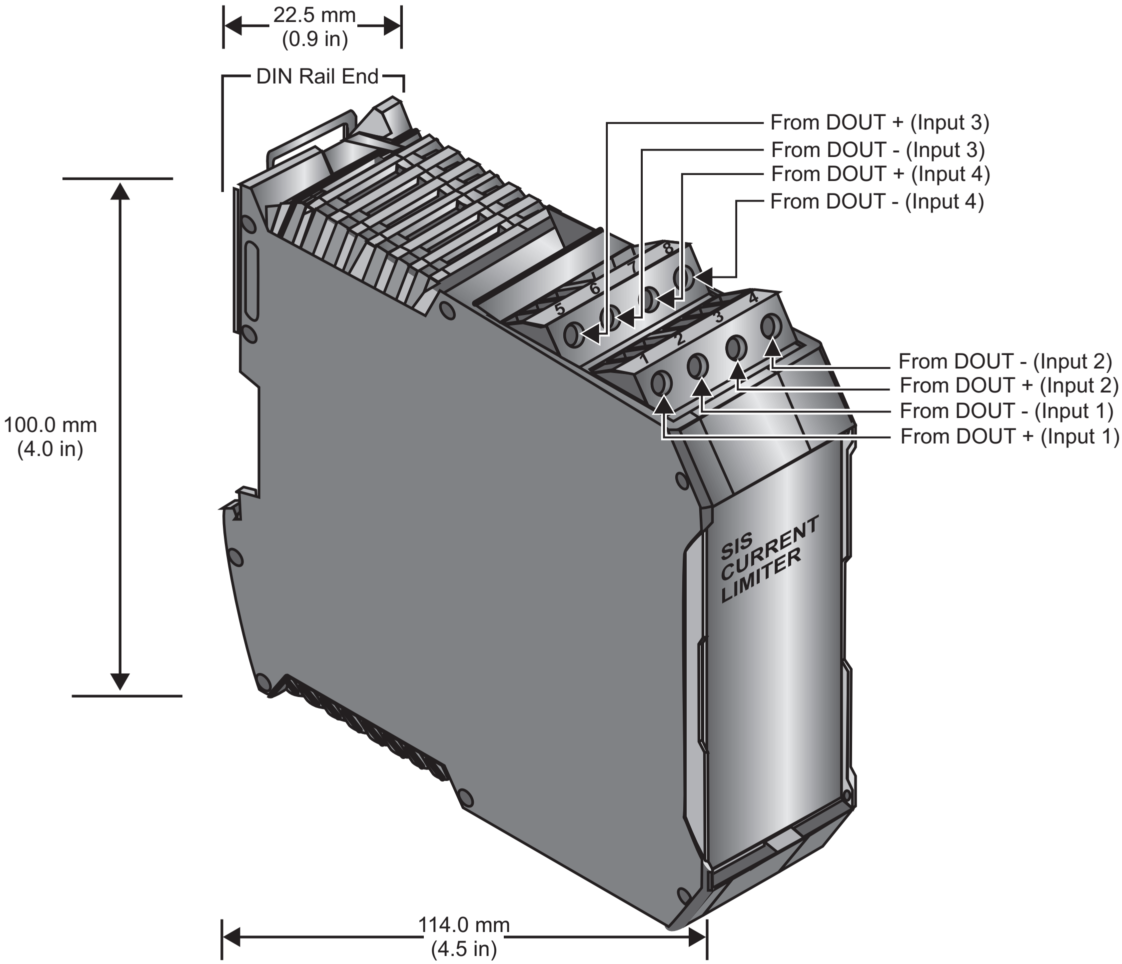

Figure E-9 SIS Current Limiter Top View and Dimensions

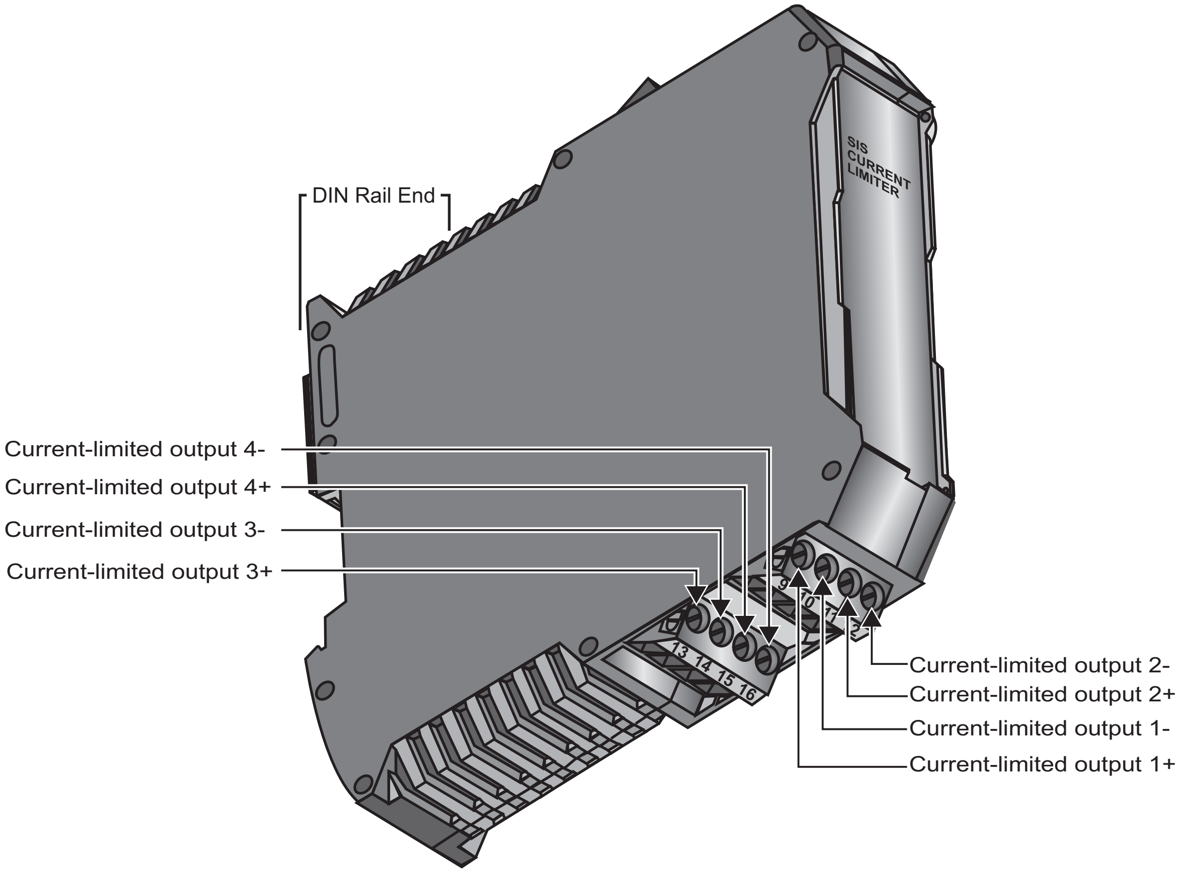

Figure E-10 Bottom View of the SIS Current Limiter

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