7 Safety Instrumented Systems

Topics covered in this chapter:

DeltaV SIS Process Safety Systems overview

DeltaV SIS hardware and software is used to install, configure, and operate a system to implement a safety instrumented system in conjunction with sensors and final elements to take a process to a configured safe state when hazardous conditions occur. There are two types of DeltaV safety instrumented systems:

- SLS 1508 Logic Solver systems
- CHARMs Smart Logic Solver (CSLS) systems

The two hardware types are different, and their physical installation and configuration in DeltaV Explorer is different, but both provide similar functionality to implement safety instrumented systems.

SLS 1508 Logic Solver Systems

A DeltaV SLS 1508 Logic Solver System consists of:

- Smart Logic Solvers (SLS) with I/O termination blocks
- SISNet Repeaters
- SISNet Repeater Carrier for use with VerticalPLUS I/O Interface Carriers
- SISNet Distance Extenders
- Local Peer bus extender cables
- Right one-wide carriers for use with Horizontal I/O Interface Carriers
- Terminators
- Optional Devices

SISNet Domains allow the creation of large DeltaV SIS networks containing multiple fiber optic rings. Each ring can contain multiple domains. For more information on SISNet Domains refer to *DeltaV Books Online*.

Figure 7-1 illustrates an example SLS 1508 System integrated with a DeltaV distributed control system. As shown in the figure, the safety instrumented system can include SLS 1508 equipment in remote locations.

The figure also shows DeltaV SLS 1508 equipment mounted on Horizontal I/O Interface Carriers. DeltaV SIS equipment can also be mounted on VerticalPLUS I/O Interface Carriers. See *Using vertical I/O carriers* in this chapter for information on using DeltaV SIS components on VerticalPLUS carriers.

Smart Logic Solvers

Smart Logic Solvers (SLS) contain the logic solving capability of the SLS 1508 system and provide an I/O interface for up to any 16-channel combination of Analog Input (HART), Discrete Input, and Discrete Output. SLSs and termination blocks mount on 8-wide horizontal I/O carriers or VerticalPLUS I/O carriers. SLSs mount in odd numbered slots (1,3,5,7). Simplex SLSs take two slots and redundant SLSs take four slots.

Analog Input (HART) and Discrete Input are standard DeltaV I/O specification. Discrete Output can be voltage (0 and 24 VDC) or current (4 and 20 mA) for full valve stroke. The current output may also be configured for 0 mA. The current output includes built-in HART capability for partial stroke testing. Hart is not used otherwise.

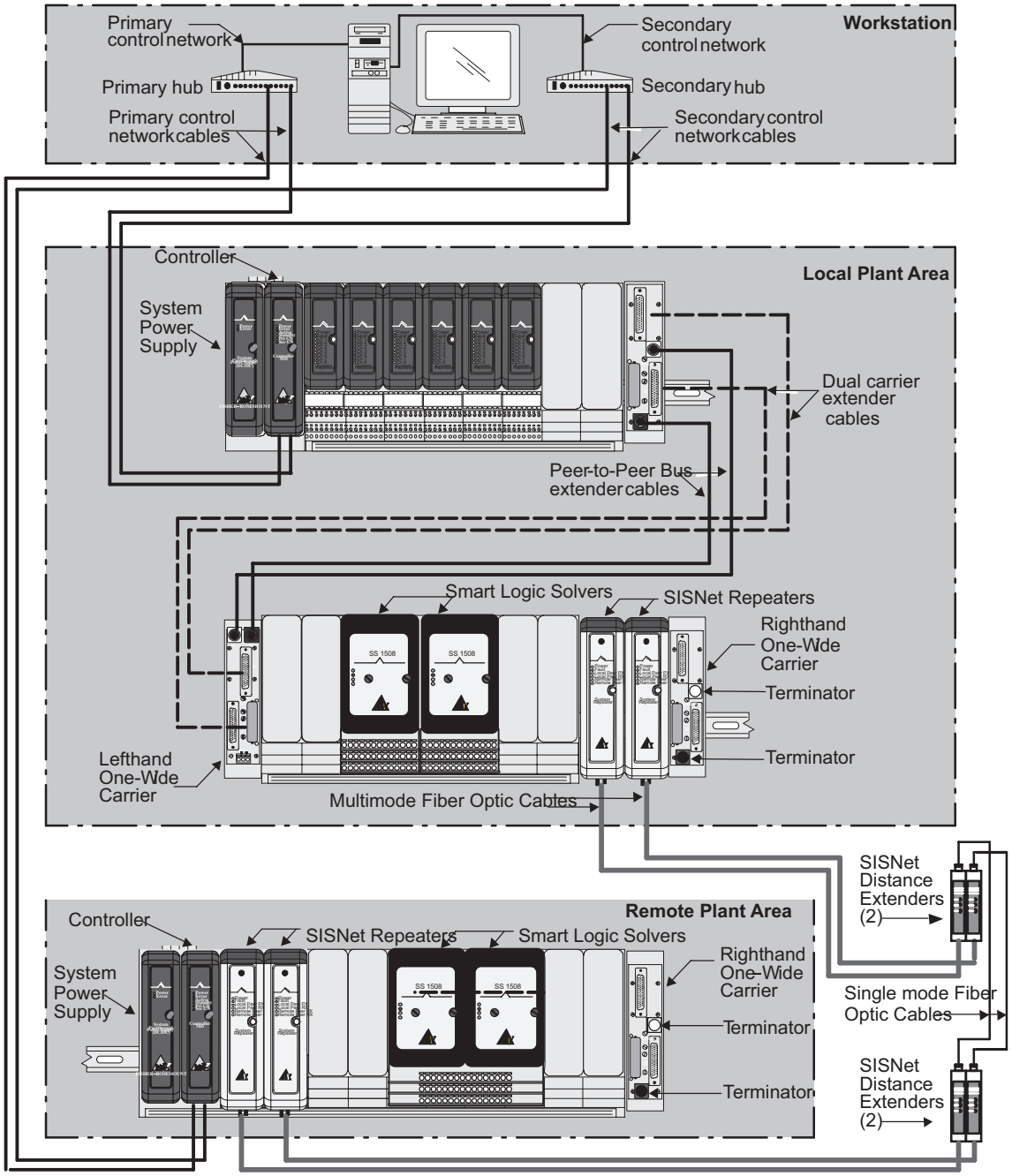
SLSs communicate with each other over a two-channel, peer-to-peer bus. The bus uses the railbus on the I/O carrier backplane and can be extended to SLSs on other carriers by peer-to-peer extender cables.

SISNet Repeaters

When one controller (or set of redundant controllers) is used for the local and remote SLSs, SISNet Repeaters and fiber-optic cable provide ring-type, global-broadcast communication between local SLSs and SLSs scattered across two or more I/O subsystems. There is one SISNet Repeater pair for each I/O subsystem carrier. Up to 32 simplex SLSs or 16 redundant SLSs can be connected on the fiber-optic ring.

SISNet Repeaters mount in pairs (for redundancy) on 2-wide repeater carriers [9.5 cm (3.8 in) wide]. Although this carrier is the same width as a power/controller carrier, it is *not* interchangeable with the power/controller carrier. For further information, including allowable fiber-optic cable length, see the manual *Installing Your DeltaV SIS Process Safety System Hardware*.

Figure 7-1: Safety Instrumented System integrated into a DeltaV system



Workstation communication

An certain hardware revisions of the MD controller, an MD Plus controller, or an MX controller provides the communications link to the workstation via a DeltaV control network. Local SLSs are connected to the local controller and remote SLSs are connected to remote controllers, as shown in the figure. It is highly recommended that fiber-optic cable be used in the control network between the remote controller and the workstation.

SISNet distance extenders

SISNet Distance Extenders allow fiber optic extensions between SISNet Repeaters of up to 20 km (nominal) beyond the limitations of multimode fiber optic cable. The extenders mount directly on DIN-rail wherever it can be conveniently located (within environmental specifications) and are powered from field 24 VDC.

Single mode fiber optic cable connects local and remote extenders. Two extenders are used for each cable; one at each end. Redundant extensions use four extenders as shown in *Figure 7-1*.

Using horizontal I/O carriers

Left-hand and right-hand one-wide cable carriers provide connectors for the redundant peer-to-peer bus extender cables. The cables require proper electrical impedance termination which is accomplished with two terminators at the right-hand one-wide carrier on the farthest I/O horizontal carrier. Horizontal cable carriers are each 42 mm (1.6 in) wide.

Dual carrier extender cables connect railbus power and signals between carriers. The cables connect to the same left-hand and right-hand one-wide cable carriers as the peer-to-peer bus extender cables. SLSs are powered by a 24VDC power supply that is separate from the DeltaV controller and I/O power supply.

Using vertical I/O carriers

SLS 1508 equipment can be mounted on VerticalPLUS I/O carriers; not Legacy Vertical carriers. With VerticalPLUS I/O carriers, you can connect DeltaV SIS systems, such as local and remote, by SISNet Repeaters mounted on 4-Wide VerticalPLUS SISNet Repeater Carriers as shown in *Figure 7-2*. SISNet repeaters are not needed unless you need to connect to another DeltaV SIS system.

In the figure, note the extender cable connections. In SLS 1508 systems, carrier extender cables and SISNet Repeater extender cables are required between the left and right carriers. You may use only one carrier extender cable, but you must use both SISNet Repeater extender cables for redundancy. The repeater carrier is always mounted above the cable extender card (left-hand card) used with a right-hand vertical carrier. SISNet extender cables are one meter long.