Chapter 1 High Availability Fieldbus Applications

This chapter provides information about fieldbus applications that require high availability. A high availability application includes a redundant Series 2 H1 card and redundant fieldbus power. In addition, a high availability application includes short circuit protection for the segment.

The first application shown in this chapter uses the Redundant Fieldbus Power System (FPS-Series) and Megablock with SpurGuards from Relcom, Inc. The second application uses the FieldConnex® Fieldbus Power Hub and FieldConnex® Segment Protector from Pepperl+Fuchs. The Relcom power supply is a redundant fieldbus power supply for a single segment with options for multi-segment use. The Pepperl+Fuchs power supply is a redundant fieldbus power supply for up to four segments with options for single-segment use.

Refer to the Relcom and Pepperl+Fuchs documentation and/or visit the DeltaV website (www.easydeltav.com) and follow the links to Relcom and Pepperl+Fuchs for additional information on their products.

Relcom Fieldbus Power System for Redundant Fieldbus Power

The FPS-I connects to one or two +24 VDC input power supplies and provides redundant fieldbus power to a single fieldbus segment. A single FPS-I consists of:

- A Redundant Coupler (RC)
- Two isolated fieldbus power modules (IPMs)

Table 1 shows the FPS-I specifications.

Table 1 Fieldbus Power System Specifications

FPS-I	Specification
Input voltage	24 VDC (18-30 VDC)
Fieldbus output current	350 mA @ 25-28 VDC
Maximum power dissipation	4.5 W max @ rated output
Dimensions	4.9 cm. x 10.1 cm. x 13.3 cm. (1.95 in. x 4 in. x 5.25 in.)
Operating temperature range	-40 to 60 º C
Alarm contact rating	1 A max @ 30 VDC max

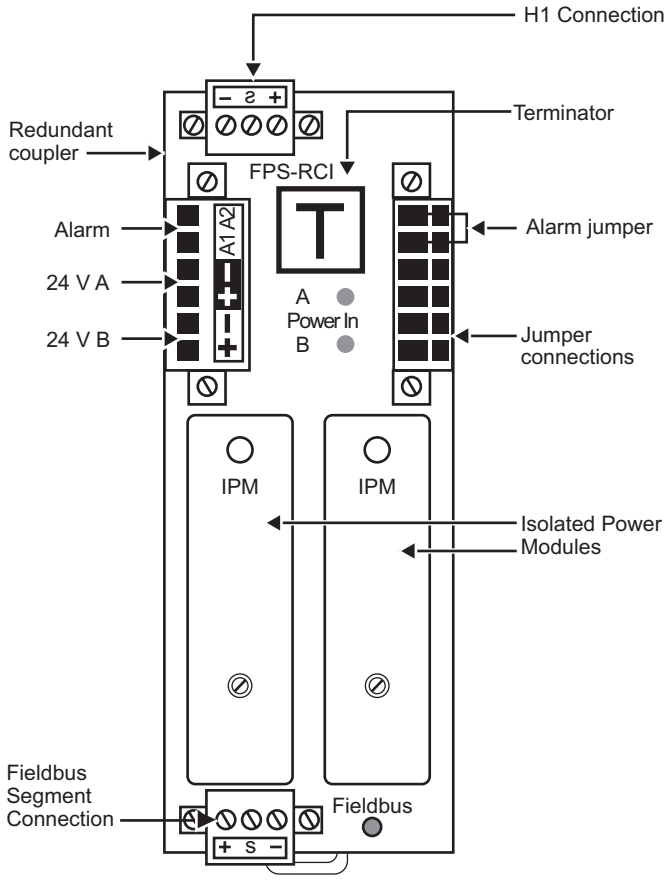

Figure 1 Fieldbus Power System

The FPS-I consists of two isolated power modules (IPM) that plug into each Redundant Coupler (RC). The IPMs are removable under power. The RCs are mounted on a DIN rail. One RC is used for each fieldbus segment. RCs can be connected together with pre-made jumpers to add additional fieldbus segments as shown in Figure 2 on page 1-4. One fieldbus terminator is built into each RC. Remember that each segment must have two terminators.

Refer to Figure 1. Each RC has:

- Two, 3-position pluggable connectors. One connector is intended for the H1 host and the other for the fieldbus segment.
- Two 6-position pluggable connectors for two nominal 24 VDC input power sources and an alarm circuit. When the FPS-I is powered and functioning within its specifications, the alarm circuit provides a closed contact circuit. A failure in either input power supply, either IPM, or an over-current or short on any fieldbus output, opens the alarm circuit. The alarm circuit is galvanically isolated from the fieldbus segments and input power supplies. Connect the alarm pins together to complete the circuit. When using multiple Fieldbus Power Systems, connect together the last alarm pins in the group as shown in Figure 2.

Figure 2 shows multiple Fieldbus Power Systems connected together with pre-made jumpers. To add RCs without removing power to the other units when using multiple Fieldbus Power Systems, wire the two power sources to both ends of the group.

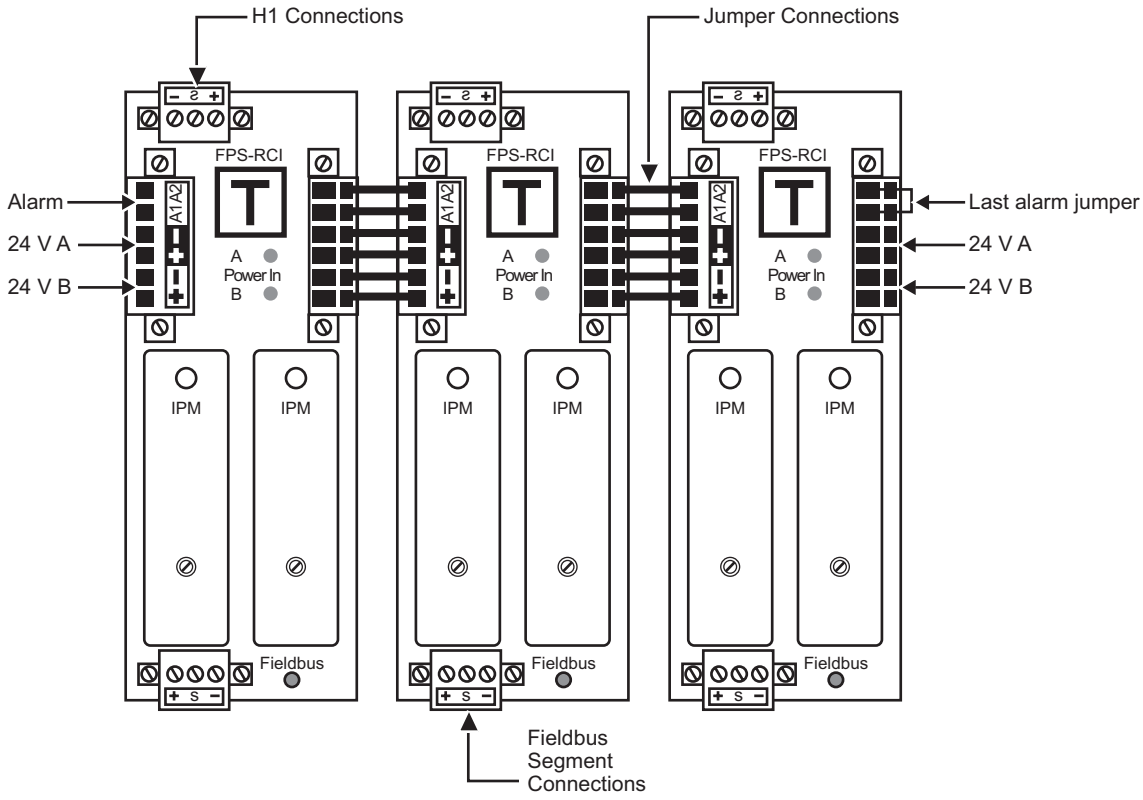

Figure 2 Multiple Fieldbus Power Systems

Refer to "Installing and Connecting the Fieldbus Power System" for installation information.

DC Power Considerations for High Availability Applications Using the Fieldbus Power System

The available power to a field device depends on the length and resistance characteristics of the fieldbus cable. The formula for the calculations in Table 2 on page 1-6, which shows the maximum distance for a given load on the Fieldbus Power System, are based on the following assumptions:

- Power Supply Voltage = 25.0 VDC @ 350 mA
- Minimum Device Voltage = 9 VDC (calculations use 9.5 VDC)
- Maximum Voltage drop from cable = 15.5 VDC
- Each device has an average load of 20 mA
- Fieldbus Type A 18 AWG cable @ 22 ohms/km (44 ohms/km loop resistance) at 22°C
- Devices are connected on one end of the cable and the Fieldbus Power System is connected on the other end of the cable
- Maximum Distance (km) = (Allowed Loop V drop / Loop current) / Loop resistance per km

There will be different restrictions and limitations on your segment if these assumptions do not hold for your segment layout. If your devices average more than 20 mA per device, reduce the maximum cable length indicated in the table for that number of devices or reduce the number of devices on the segment. Refer to the device documentation for information on current requirements for the device.

When referring to Table 2, remember that the H1 card requires 12 mA of fieldbus power in simplex mode and an additional 12 mA of fieldbus power (24 mA total) in redundant mode. Table 2 includes the maximum distance, in meters, for applications with and without Megablocks with SpurGuards. The distance is reduced to allow for an application design that uses a Megablock with SpurGuards to prevent a short on the spur from disrupting the trunk.

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Table 2 Distance per Load on the Fieldbus Power System with and without Megablocks with SpurGuards

Number of Devices / Load (mA)	Power Supply Load (mA)		Maximum Distance without Megablock with SpurGuards (meters)	Maximum Distance with Megablock with SpurGuards (meters)
	Series 2 H1 Simplex	Series 2 H1 Redundant		
1 / 20	32	44	1900	1900
2 / 40	52	64	1900	1900
3 / 60	72	84	1900	1900
4 / 80	92	104	1900	1900
5 / 100	112	124	1900	1850
6 / 120	132	144	1900	1670
7 / 140	152	164	1900	1520
8 / 160	172	184	1855	1395
9 / 180	192	204	1725	1290
10 / 200	212	224	1570	1200
11 / 220	232	244	1440	1120
12 / 240	252	264	1330	1050
13 / 260	272	284	1240	990
14 / 280	292	304	1155	N/A
15 / 300	312	324	1085	N/A
16 / 320	332	344	1020	N/A

Short Circuit Protection with Megablocks

The Relcom Megablocks with SpurGuards (SG) connect field devices to the fieldbus segment cable and provide short circuit protection to the segment. Figure 3 shows an FCS-MB8- SG for eight devices. The Megablock mounts on a DIN rail and requires a connection to a terminator (+, -, and S) from one of the trunk connectors. To connect multiple Megablocks together, use a short jumper cable between the trunk connectors on the Megablocks.

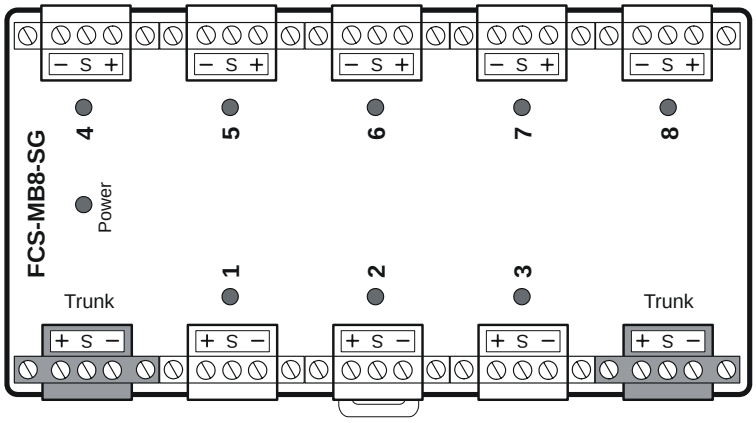

Figure 3 Megablock Spur Guard for 8 Devices

Designing an Application for Short Circuit Protection Using Megablocks

When designing an application that uses a Megablock for short circuit protection, allow an additional 60 mA in the design to give the power supply the additional current capability to support a short circuit in one device (should it occur) and continue to power the segment without interruption. Normally a 0.5 voltage drop (assuming a 20 mA device) occurs across the Megablock to the device. An additional voltage drop occurs during a short circuit condition. To prevent devices from dropping off the segment because of reduced voltage, be sure that the application design allows for the voltage drop in both the normal and short circuit condition. Use the following calculation to calculate the short circuit voltage drop to the farthest device:

.060A X (44 ohms/km) X distance in km

The following example calculates the voltage drops on 0.5 km segment to the farthest device:

Normal voltage drop = 0.5 Volts

Short circuit voltage drop =.060A X (44 ohms/km) X.5 km = 1.32 Volts

Total voltage drop = normal voltage drop + short circuit voltage drop = 1.82 volts.

This calculation is based on a design that allows for one short circuit in a running segment. For example, a situation in which an inadvertent shorting of a device occurs during routine replacement on an operating system. The calculation does not allow for multiple short circuit conditions in a new installation that has not been verified with the segment checkout procedure. Table 2 includes maximum distances when the application uses a Megablock with SpurGuards.

Installing and Connecting the Fieldbus Power System

➢ **To install the Redundant Coupler and connectors**

1. Attach the top latch of the Redundant Coupler onto the DIN rail and push the unit into place.
2. Plug the IPMs, H1 connector, fieldbus segment connector, and the input power/ alarm circuit connector into the Redundant Coupler.

➢ **To connect the Fieldbus Power System (FPS-I)**

Refer to Figure 1 on page 1-2.

1. Connect the primary 24 VDC input positive (+) to the 24 V A + terminal and the primary 24 VDC input negative (-) to the 24 V A - terminal.
2. Connect the secondary 24 VDC input positive (+) to the 24 V B + terminal and the secondary 24 VDC input negative (-) to the 24 V B - terminal.
3. For a single unit, connect the alarm wires and short the alarm pins on the opposite side of the fieldbus power system.
4. Connect the segment positive (+) wire to the fieldbus segment + and the segment negative (-) wire to the fieldbus segment -.
5. Connect the segment shield wire (S) to the fieldbus segment S.
6. Connect the H1 card positive wire (+) to the H1 + and the H1 card negative wire (-) to the H1 -.
7. Connect the H1 card shield wire (S) to the H1 S.

Note *Ground the shield at only one point — usually at the H1 card on the shield ground bar.*

➢ **To connect additional Fieldbus Power Systems**

Refer to Figure 2 on page 1-4.

1. Install the second Redundant Coupler (RC 2) onto the DIN Rail next to RC 1 and plug in the IPMs, H1 connector, and fieldbus segment connector.
2. Insert one end of the pre-made jumper into the right-hand side power and alarm wiring connector on RC1 and the other end into the left-hand side power and alarm wiring connector on RC 2.
3. Connect the segment wiring and H1 cards.
4. Follow steps 1-3 for each additional RC.
5. Connect the last alarm pins in the group together to complete the circuit.

A maximum of eight Fieldbus Power Systems can be connected together in a group.

Installing and Connecting Megablocks

Refer to Figure 3 on page 1-7.

➢ **To install and connect a Megablock**

Notice that the Trunk connectors are black and the spur connectors for the devices are gray.

1. Attach the top latch of the Megablock onto the DIN rail and push the unit into place.
2. For the Trunk connector (black): connect the positive (+) segment wire to the positive, connect the negative (-) segment wire to the negative, and connect the segment shield (S) to the S.
3. For each device connector (gray): connect the positive (+) spur wire to the positive, connect the negative (-) spur wire to the negative, and connect the shield wire (S) to the S.
4. If this Megablock is the end of the segment, connect a terminator (Relcom FCS-MBT) at the end of the Trunk and at a ground connection. Use a properly sized ground wire to reduce the risk of a surge affecting the segment.

5. If the segment continues and connects to another Megablock, continue the Trunk by connecting it to the next Megablock and make the connections described in steps 2 and 3.

6. At each device, ensure that the shield is isolated and not connected to the device.

7. If this Megablock is the end of the segment, connect a terminator (Relcom FCS-MBT) at the end of the Trunk and at a ground connection. Use a properly sized ground wire to reduce the risk of a surge affecting the segment.

Verifying the Installation

Use the segment checkout procedure on page 63 to measure resistance, capacitance, DC voltage, and the AC waveform (steps 1, 2, 4, and 5) with only one of the IPMs installed. Then, measure DC voltage and the AC waveform (steps 4 and 5) again with both IPMs installed. Verify that the measured DC voltage allows for the additional voltage drop if a short circuit should occur.

High Availability Application Example for the Fieldbus Power System

Figure 4 shows an application that uses a redundant pair of Series 2 H1 cards with redundant fieldbus power for both segments and short circuit protection for devices on a long (0.5 km) trunk cable. If a failure occurs on an H1 card, a 24 V power supply, or a fieldbus power supply, the segments continue to operate as expected. A status indication on connected alarms alerts the operator that an error has occurred. It is assumed that the application design follows the criteria specified in "Designing an Application for Short Circuit Protection Using Megablocks". Therefore, if a short occurs when a device is installed or removed from the segment, only that device is affected; the rest of the segment is unchanged.

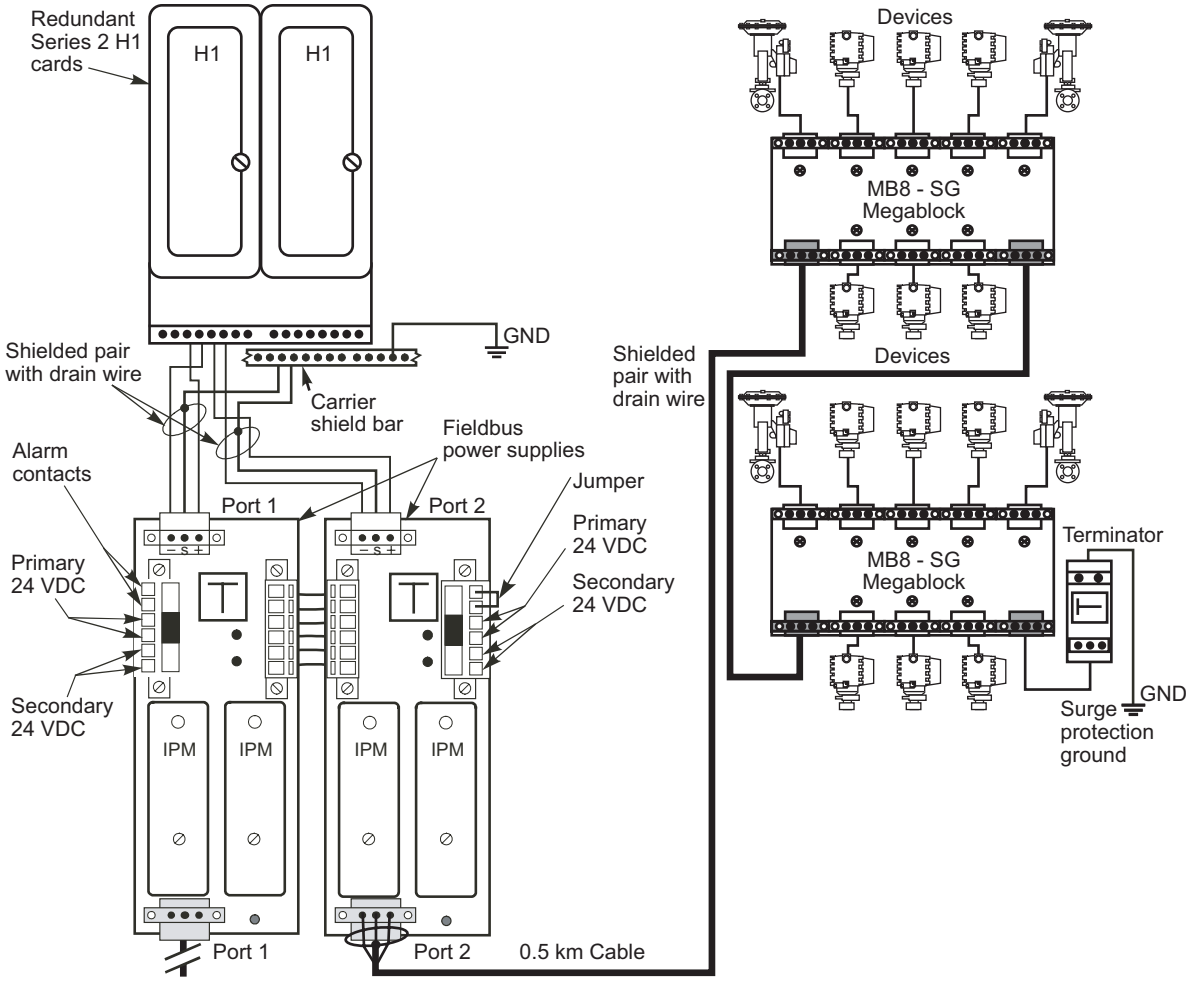

Figure 4 High Availability Application Example