Pepperl+Fuchs Fieldbus Power Hub for Redundant Fieldbus Power

The Fieldbus Power Hub connects to one or two +24 VDC input power supplies and provides redundant fieldbus power to up to four fieldbus segments. A Fieldbus Power Hub system includes:

- Fieldbus Motherboard - MB-FB-4R
- Galvanically Isolated Fieldbus Power Supply Modules - FBPS-1.500 (two per segment for four segments maximum)
- Fieldbus Diagnostic Module - DM-B

Table 1 shows specifications for the Fieldbus Power Hub with the FBPS-1.500 Isolated Power Supply module.

Table 1 Fieldbus Power Hub with FBPS-1.500 Isolated Power Supply Module Specifications

Fieldbus Power Hub with FBPS-1.500	Specification
Input voltage	24 VDC (19.2-35 VDC)
Fieldbus output current – FBPS-1.500	500 mA @ 28-30 VDC
Typical power dissipation	2.5 W per segment
Dimensions	22.1 cm. x 24.6 cm. x 16.2 cm. (8.7 in. x 9.7 in. x 6.4 in.)
Operating temperature range	-40 to 60 º C
Alarm contact rating - Diagnostic Module	1 A max @ 50 VDC max

Figure 1 shows a Fieldbus Power Hub installed with redundant power supplies for four segments and a Diagnostics module.

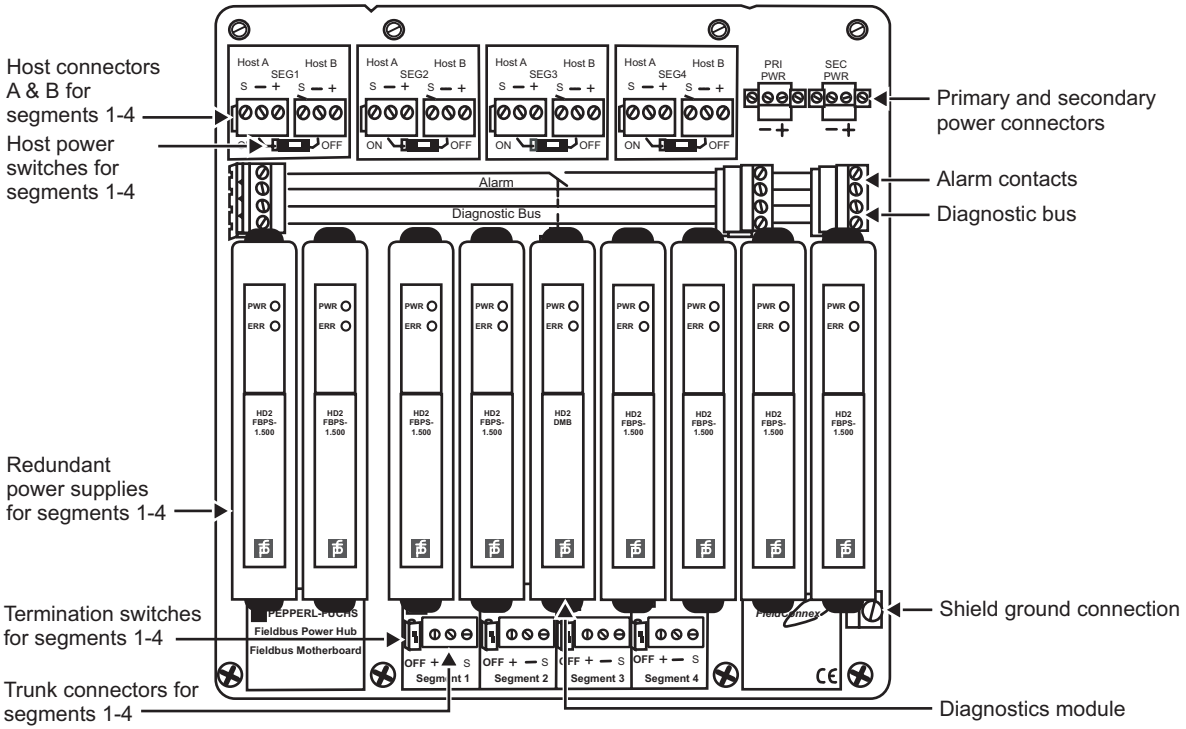

Figure 1 Fieldbus Power Hub with Four Redundant Segments and a Diagnostics Module

The Fieldbus Power Hub consists of a DIN rail-mounted Motherboard which supports plug-in modules that provide redundant power for up to four fieldbus segments plus one Diagnostic Module. Two FBPS-1.500 Isolated Power Supplies plug into the Motherboard to power each segment. The Diagnostic Module provides diagnostic monitoring and relay contacts for the segments. The plug-in modules are removable under power. A fieldbus terminator on the motherboard can be switched on for each segment. Each segment must have exactly two terminators.

Refer to Figure 1 on page 1-2. The Fieldbus Power Hub has:

- Two, 2-position pluggable connectors for Primary and Secondary 24 VDC input Power.
- Three, 4-position pluggable connectors for the alarm contacts and the Diagnostic Bus.
- Four, 3-position pluggable connectors for connection to the H1 host (Host A); one for each of the four segments.
- Four, 3-position pluggable connectors for connection to a second host (Host B, not used); one for each of the four segments.
- Four redundant host power switches for connecting host power to each of the four segments. All switches must be in the On position.
- Four, 3-position pluggable connectors for connection to the fieldbus segment, one for each of the four segments.
- Four termination switches for connecting an integrated fieldbus terminator to each of the four segments.
- One connection for connecting the cable shields to ground.

When the Fieldbus Power Hub is powered and functioning within its specifications the alarm circuit provides a closed-contact circuit. A failure in either input power supply, any fieldbus power supply module, 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. The alarm pins at the last unit must be connected together to complete the circuit.

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

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 1-5, which shows the maximum distance for a given load on the Fieldbus Power System, are based on the following assumptions:

- Power Supply Voltage = 28.0 VDC @ 500 mA
- Minimum Device Voltage = 9 VDC (Calculations use 9.5 VDC)
- Maximum Voltage drop from cable = 18.5VDC
- 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 Hub 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 the Series 2 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. There are distance columns for applications both with and without segment protectors. The distance associated with the segment protector is reduced due to the possible condition of a short on a spur which would increase the current on the trunk and also reduce the voltage to the other devices.

Table 2 Distance per Load on the Fieldbus Power Hub with and without Segment Protectors

Number of Devices / Load (mA)	Power Supply Load (mA)		Maximum Distance without Segment Protector (meters)	Maximum Distance with Segment Protector (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	1900
6 / 120	132	144	1900	1900
7 / 140	152	164	1900	1855
8 / 160	172	184	1900	1695
9 / 180	192	204	1900	1565
10 / 200	212	224	1875	1450
11 / 220	232	244	1720	1350
12 / 240	252	264	1590	1265
13 / 260	272	284	1480	1190
14 / 280	292	304	1380	1120
15 / 300	312	324	1295	1060
16 / 320	332	344	1220	1005
16 / 340	352	364	1155	960
16 / 360	372	384	1090	915

Short Circuit Protection with Segment Protectors

The Pepperl+Fuchs Segment Protector connects field devices to the fieldbus segment cable and provides short circuit protection to the segment. Figure 2 shows a Segment Protector for eight devices.

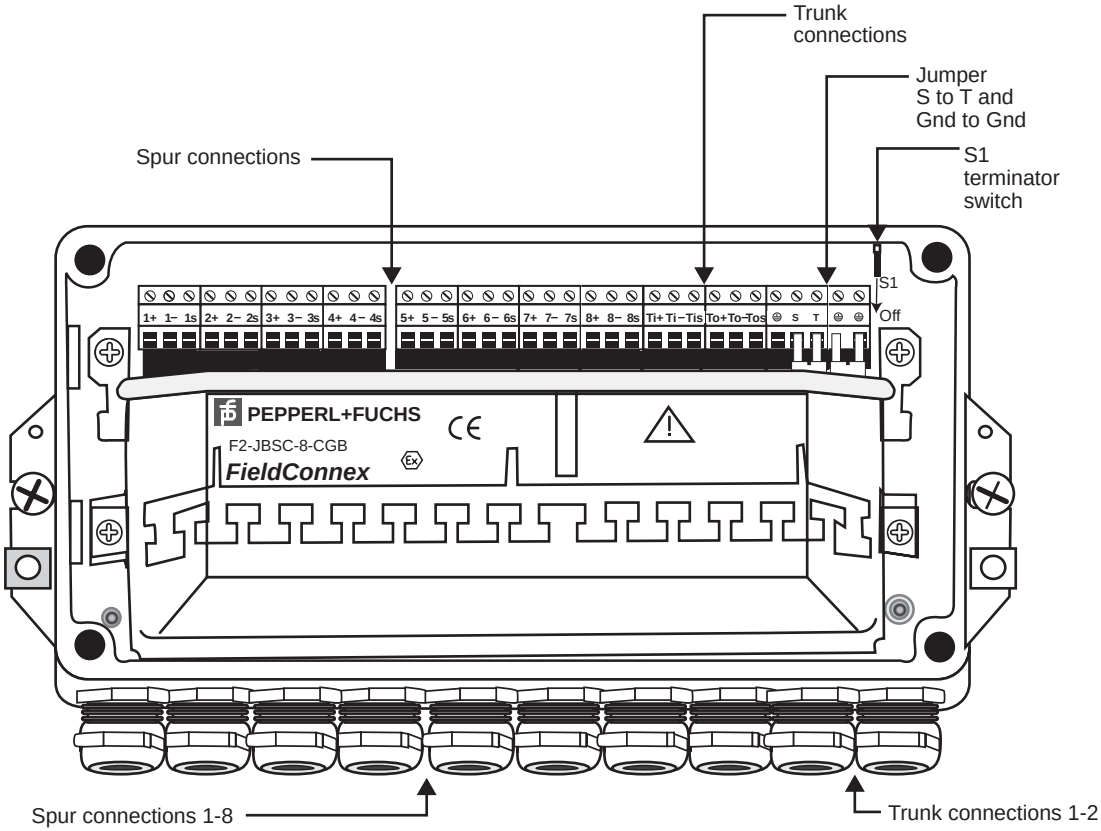

Figure 2 Segment Protector for Eight Devices

Designing an Application for Short Circuit Protection Using a Segment Protector

When designing an application that uses a Segment Protector for short circuit protection, allow an additional 50 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 1.0 voltage drop (assuming a 20 mA device) occurs across the Segment Protector 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:

.050A 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 = 1.0 Volt

Short circuit voltage drop =.050A X (44 ohms/km) X.5 km = 1.1 Volts

Total voltage drop = normal voltage drop + short circuit voltage drop = 2.1 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 in 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 on page 1-5 provides the maximum distance when the application includes the Segment Protector.

Installing and Connecting the Fieldbus Power Hub

➢ **To install the Fieldbus Motherboard, Power Supply Modules, and Diagnostic Module**

1. Attach the top latch of the Fieldbus Motherboard onto the DIN rail and push it into place. Tighten the two DIN rail latching screws until the Motherboard is held securely onto the rail.
2. Plug the Fieldbus Power Supply Modules (FBPS-1.500) and the Diagnostic Module on to the Motherboard. Secure the modules to the Motherboard by depressing the two latching levers on each module.

➢ **To connect the Fieldbus Power Hub**

Refer to Figure 1 on page 1-2.

1. Connect the primary 24 VDC input to the PRI PWR connector.
2. Connect the secondary 24 VDC input to the SEC PWR connector.
3. Connect the alarm wires and short the alarm pins on the opposite side of the Fieldbus Motherboard. If multiple Motherboards share the same alarm circuitry, short the alarm pins on the last one in the chain.
4. Connect the H1 segment wire to the Host A connector for each segment that is used.
5. Ensure that Host B is not connected.
6. Ensure that the redundant host power switch is On for each segment.
7. Connect each field segment wire to the appropriate terminal on the Motherboard for each segment that is used.
8. If the Fieldbus Power Hub is on the end of each segment, switch the terminator for each segment On.
9. Connect the shield ground connection on the Motherboard with an adequately sized grounding wire to an appropriate grounding location. Ensure that all segment shields are connected to ground at this one location only. **Do not** connect the shields to ground at the 8-wide carrier shield bar or at any device in the field.

Installing and Connecting the Fieldbus Segment Protector

Refer to Figure 1 on page 1-2.

➢ **To install and connect a Fieldbus Segment Protector**

1. Securely attach the Fieldbus Segment Protector at the desired location. Choose a location that minimizes the length of the spur cables.
2. For the Trunk segment connection: 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 connection: 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. The two shorting jumpers must be repositioned so that the Trunk (T) and Spur (S) shields are connected together and **not** connected to case. Jumper T to S and Gnd to Gnd.
5. If this Segment Protector is at the end of the segment, the terminator switch S1 should be in the On position. If it is not at the end of the segment, ensure that terminator switch S1 is in the Off position.
6. If the segment continues and connects to another Segment Protector, continue the Trunk segment by connecting the Trunk Out connections to the next Segment Protector and proceed with the connections described in steps 2, 3, and 4.
7. For all Segment Protectors, ensure that the two shorting jumpers are repositioned so that the Trunk (T) and Spur (S) shields are connected together and **not** connected to case. Jumper T to S and Gnd to Gnd.
8. At each device ensure that the shield is isolated and not connected to the device.
9. If this Segment Protector is at the end of the segment, ensure that the terminator switch S1 is in the On position.

Verifying the Installation

After the segment is installed with all devices connected, use the segment checkout procedure on page 63. First measure resistance, capacitance, DC voltage, and the AC waveform (steps 1, 2, 4, and 5) with only one of the power supply modules installed. Then, measure DC voltage and the AC waveform (steps 4 and 5) again with both power supply modules installed. Verify that the measured DC voltage allows for the additional voltage drop if a short circuit occurs on one spur.

High Availability Application Examples for the Fieldbus Power Hub

Figure 3 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 a Segment Protector". 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.

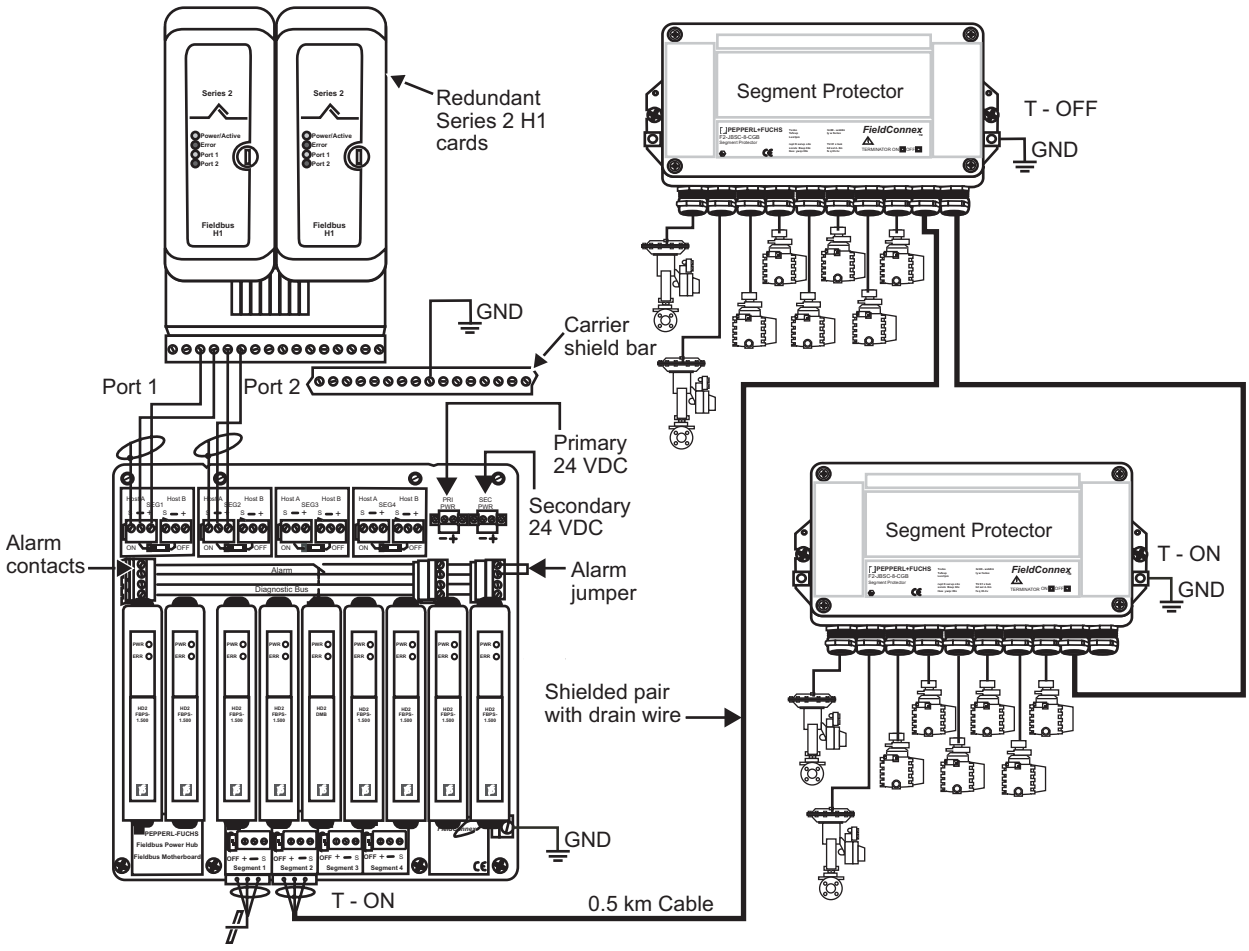

Figure 3 High Availability Application with 16 Devices Using the Fieldbus Power Hub and Segment Protectors