# Chapter 3 Intrinsically Safe Fieldbus Applications

This chapter provides information about fieldbus applications that provide Intrinsically Safe (IS) power to fieldbus devices located in hazardous areas. The Pepperl+Fuchs FieldConnex® Fieldbus Power Hub and FieldConnex® FieldBarrier provide Intrinsically Safe power for both Intrinsically Safe – entity applications and FISCO (Fieldbus Intrinsically Safe COncept)applications. Refer to the Pepperl+Fuchs (P+F) documentation and/or visit the DeltaV website (www.easydeltav.com) and follow the links for additional information on these products.

Ensure that the fieldbus devices and all components used in the application are rated and certified for IS applications.

**Warning** In any hazardous area installation it is important to read and follow the device manufacturer's design and installation documents. Failure to follow the documentation could result in an unapproved and unsafe application. Additionally, in hazardous locations follow your plant's procedures for making the area safe during installation and maintenance operations.

## DC Power Considerations for Intrinsically Safe Applications

The basic IS application uses the Fieldbus Power Hub with the FBPS-1.500 Isolated Power Supply Module to provide power to field devices connected through one or more IS Field Barriers.

The available power to a field device depends on the length and resistance characteristics of the fieldbus cable to each Field Barrier and the output characteristics of the Field Barrier to the field device. The P+F segment calculator tool was used to make the example calculations in Table 6 on page 53. The calculations show the maximum distance for a given load on the Fieldbus Power Hub for applications using

2, 3, and 4 Field Barriers to connect up to 16 field devices. The calculations are based on the following assumptions:

- Power Supply Voltage = 28.0 VDC @ 500 mA
- Minimum Voltage at last Barrier = 16 VDC
- Minimum Device Voltage = 9 VDC
- Maximum Voltage drop from cable to last barrier = 12 VDC
- Redundant H1 connected at a load of 24 mA
- Each device has an average load of 20 mA
- Ensure that any device load on a spur output from the field barrier is 30 mA or less
- Each Barrier spur has a maximum of one device connected.
- Barriers and Devices are connected on one end of the cable and the Fieldbus Power Hub is connected on the other end of the cable
- Each device is connected on a 10 meter maximum spur cable.
- Barriers are inter-connected on a 10 meter maximum trunk cable.
- Fieldbus Type A 18 AWG cable @ 22 ohms/km (44 ohms/km loop resistance) at 22°C
- 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 6, remember the Redundant Series 2 H1 card requires 24 mA of fieldbus power.

The loads listed are the normal loads required by the barriers and devices. However, the numbers take into account the additional current required if the smallest load on one barrier is accidentally shorted (during a maintenance operation) to protect the segment from being affected.

If these assumptions do **not** properly represent your specific application, it is recommended that a calculation be completed to verify that the segment design adequately meets your process requirements.

*Table 6 Distance per Load on the Fieldbus Power Hub with Field Barriers*

| Number of Devices / Load (mA) | Distance (meters) and Power Supply Load (mA) | | | | | |
|---|---|---|---|---|---|---|
| | Max Distance with 2 Barriers | Power Supply Load with 2 Barriers | Max Distance with 3 Barriers | Power Supply Load with 3 Barriers | Max Distance with 4 Barriers | Power Supply Load with 4 Barriers |
| 1 / 20 | 1875 | 75 | 1850 | 103 | 1575 | 131 |
| 2 / 40 | 1850 | 94 | 1625 | 123 | 1400 | 151 |
| 3 / 60 | 1675 | 112 | 1425 | 143 | 1250 | 171 |
| 4 / 80 | 1500 | 130 | 1275 | 161 | 1125 | 192 |
| 5 / 100 | 1325 | 149 | 1150 | 180 | 1025 | 211 |
| 6 / 120 | 1200 | 163 | 1050 | 198 | 950 | 231 |
| 7 / 140 | 1000 | 184 | 975 | 218 | 875 | 250 |
| 8 / 160 | 1000 | 208 | 900 | 237 | 800 | 267 |
| 9 / 180 | N/A | N/A | 825 | 256 | 750 | 288 |
| 10 / 200 | N/A | N/A | 775 | 274 | 700 | 307 |
| 11 / 220 | N/A | N/A | 725 | 290 | 650 | 325 |
| 12 / 240 | N/A | N/A | 725 | 316 | 625 | 346 |
| 13 / 260 | N/A | N/A | N/A | N/A | 600 | 366 |
| 14 / 280 | N/A | N/A | N/A | N/A | 550 | 378 |
| 15 / 300 | N/A | N/A | N/A | N/A | 525 | 395 |
| 16 / 320 | N/A | N/A | N/A | N/A | 525 | 422 |
| 16 / 340 | N/A | N/A | N/A | N/A | 475 | 429 |
| 16 / 360 | N/A | N/A | N/A | N/A | 425 | 433 |

## Fieldbus Power Hub

Refer to “Pepperl+Fuchs Fieldbus Power Hub for Redundant Fieldbus Power” on page 39 for information on the Fieldbus Power Hub system.

# Field Barrier for Intrinsically Safe Applications in Hazardous Locations

The Field Barrier connects up to four field devices located in hazardous locations to the fieldbus segment and provides short circuit protection to each device. Ensure that any device load on a spur output from the field barrier is 30 mA or less. Figure 11 shows a Field Barrier for four devices.

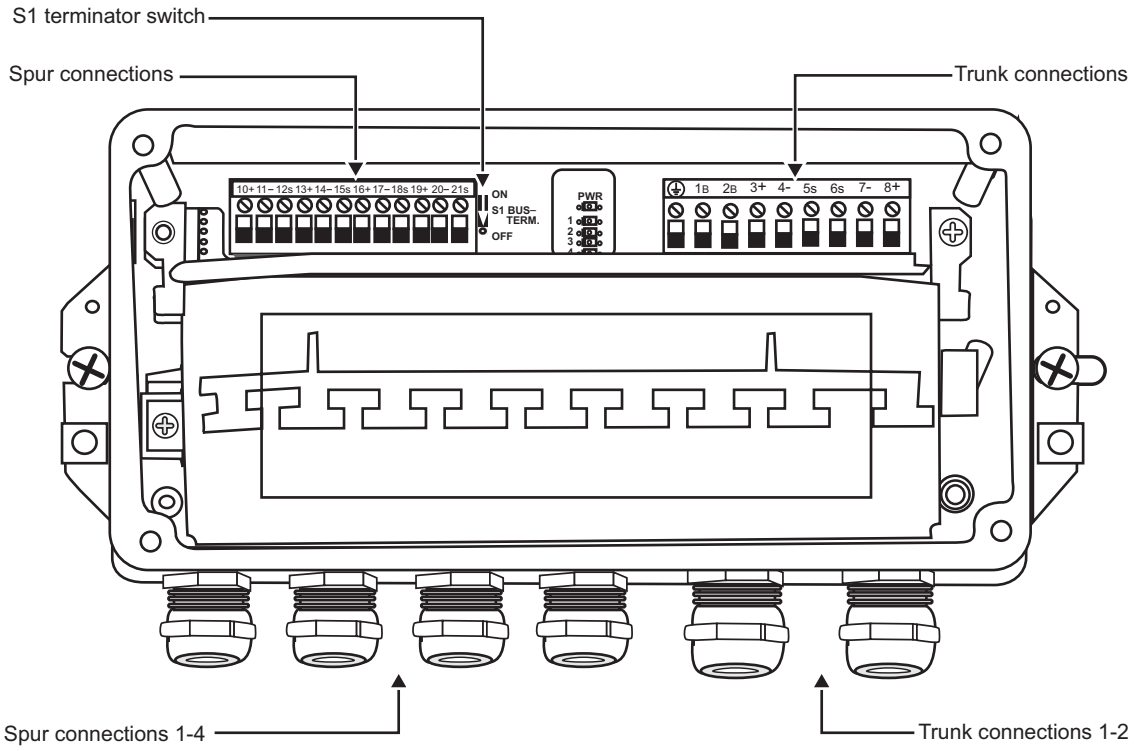


Figure 11 Field Barrier for Four Devices

# Installing and Connecting the Fieldbus Power Hub

Refer to "Installing and Connecting the Fieldbus Power Hub" on page 46 for information on installing the Motherboard, Power Supply Modules, and Diagnostics Modules and connecting the Fieldbus Power Hub.

## Installing and Connecting the Field Barrier

Refer to Figure 11 on page 54.

➢ **To install and connect a Field Barrier**

1. Securely attach the Field Barrier at the desired location.
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. Remove the shorting jumpers (1B, 2B) so that the Trunk (S) shields are **isolated from, not connected** to the Field Barrier case.
4. 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.
5. The Spur (S) shields must be connected to the Field Barrier case and isolated at the device in the field. The best way to ground the output shields at the barrier is with a mechanical connection through a metal gland or bar at the barrier.
6. If this Field Barrier is at the end of the segment, the terminator switch S1 should be in the On position. If this is not the end of the segment, ensure that the terminator switch S1 is in the Off position.
7. If the segment continues and connects to another Field Barrier, continue the Trunk segment by connecting the Trunk Out connections to the next Field Barrier and proceed with steps 3, 4, and 5.
8. Ensure that the shorting jumpers (1B, 2B) are removed on all Field Barriers, so that the Trunk (S) shields are **isolated from not connected** to the Field Barrier case.
9. If this Barrier is the end of the segment, ensure that the terminator switch S1 is in the On position.

## Verifying the Installation

Refer to “Verifying the Installation” on page 48.

# Intrinsically Safe Application Example

Figure 12 shows an application that uses a redundant pair of Series 2 H1 cards with redundant fieldbus power and intrinsic safety barrier protection for 16 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 "DC Power Considerations for Intrinsically Safe Applications" on page 51. 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.

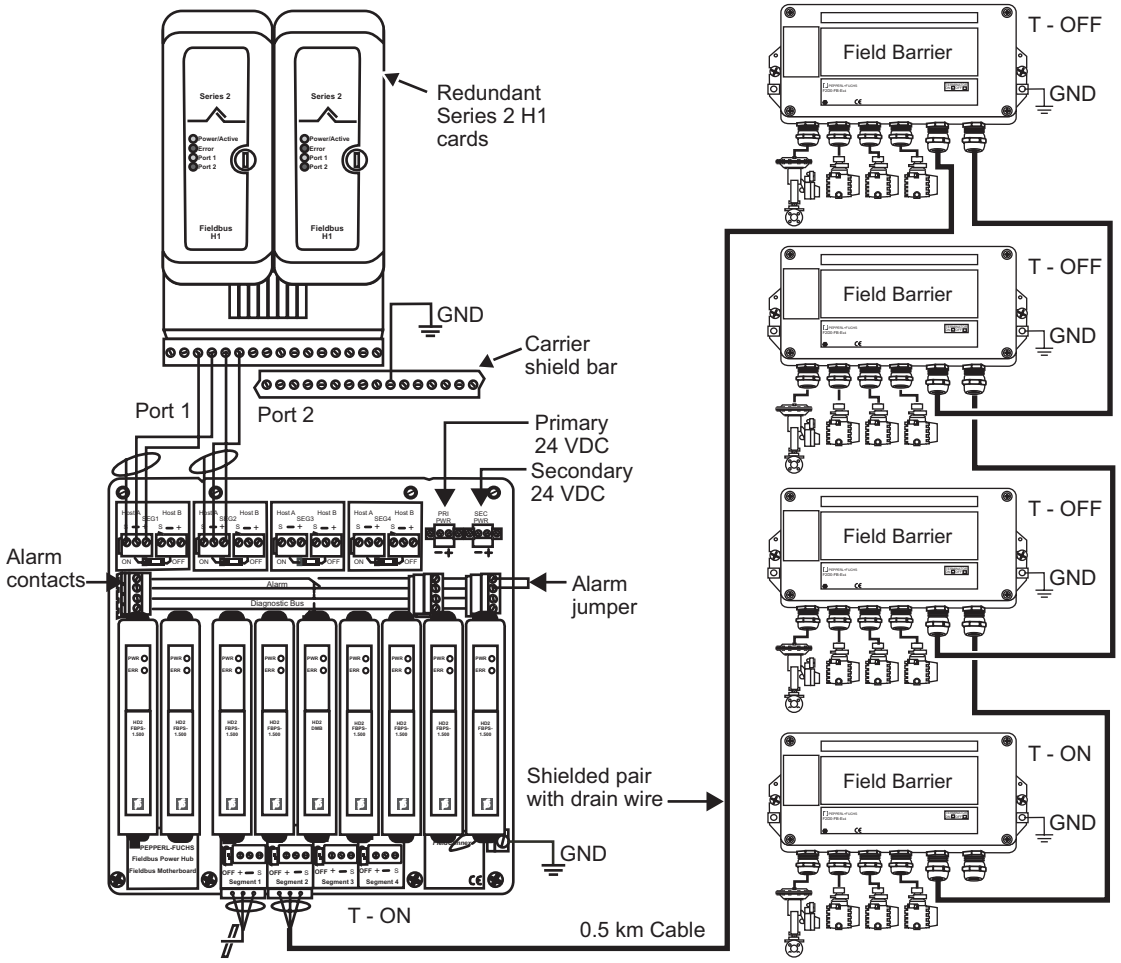


Figure 12 IS Application with 16 Devices Using the Fieldbus Power Hub and Field Barrier