PROCESS AUTOMATION

Manual

FIELD BUS COMPONENTS

POWER REPEATERS / POWER SUPPLIES

FOR FIELD BUSSES IN ACCORDANCE WITH

IEC 61158-2

process automation

ISO9001

PEPPERL+FUCHS

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1 Declaration of conformity

Pepperl+Fuchs GmbH offers both power repeaters and power supplies for field bus systems with physical configuration corresponding to IEC 61158-2.This is used by the FOUNDATION field bus and PROFIBUS PA, for example. While the power repeaters switch the data signal and the power supply to the bus segment, the power supply switches only electrical power to the bus segment. Specific details of this manual apply to the following products of Pepperl+Fuchs GmbH:

Power repeater:

- KLD2-PR-Ex1.IEC.
- KLD2-PR2-Ex1.IEC.
- KLD2-PR-Ex1.IEC1.
- KLD2-PR2-Ex1.IEC1.
- KLD2-PR-1.IEC.
- KLD2-PR-NI1.IEC.

You will find a comparison of the individual power repeaters on Page 12

Power supplies:

- KLD2-STR-NI1.13.225.IEC.
- KLD2-STR-1.24.400.IEC.

All products have been developed and manufactured taking into account the applicable European standards and directives.

Note

A corresponding declaration of conformity may be requested from the manufacturer.

The manufacturer of the product, Pepperl+Fuchs GmbH in D-68301 Mannheim, has a certified quality assurance program in accordance with ISO 9001.

CE

ISO 9001

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2 Symbols used in this document

Warning

This symbol indicates a warning about a possible danger.
In the event the warning is ignored, the consequences may range from personal injury to death or from damage to equipment to destruction.

Attention

This symbol warns of a possible fault.
Failure to observe the instructions given in this warning may result in the device and any facilities or systems connected to it developing a fault or even failing completely.

Note

This symbol brings important information to your attention.

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3 Safety

3.1 Intended use

Warning

Protection of operating personnel and the system is only ensured if the sub-assembly is used in accordance with the usage for which it is properly intended.
The device can only be operated by trained professionals in accordance with the available instruction manual.

3.2 General Safety Instructions

Warning

Any other type of operation than what is described in this manual places the safety and functionality of the device and systems connected to it in question.
Only professionals trained in electronics are permitted to connect the device and to perform maintenance tasks with the power on.
If malfunctions cannot be corrected, the device must be taken out of operation and protected from being placed back in operation accidentally.
Repairs may only be performed directly at the manufacturer's facility.
No changes and operations made to the device are permitted and will render any warrantee claim void.

Note

Responsibility for adhering to local safety regulations and directives is held by the operator.

3.3 Safety instructions for power repeaters and power supplies

Power repeaters KLD2-PR-Ex1.IEC and KLD2-PR-Ex1.IEC1 are related apparatus as defined by EN 50020 and may only be installed outside the area subject to the risk of explosion.

Power repeaters KLD2-PR2-Ex1.IEC and KLD2-PR2-Ex1.IEC1 are approved for installation in Zone 2.

The KLD2-PR-NI1.IEC power repeater and KLD2-STR-NI1.13.225.IEC power supply are approved for installation in Class 1 Division 2.

Warning

*The K*LD2-PR-NI1.IEC and KLD2-STR-NI1.13.225.IEC are listed in the "Non incendive“ ignition protection class and may only be used where FM or CSA authorization is permitted. If this is the case, devices in Class 1 Division 2 can be used.

The intrinsically safe PROFIBUS PA or FOUNDATION Fieldbus cannot be taken into the area subject to the risk of explosion. The connection of the intrinsically safe bus is made exclusively with the blue removable connection terminals of power repeaters KLD2-PR-Ex1.IEC or KLD2-PR-Ex1.IEC1.

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Warning

For installation and operation of power repeaters with intrinsically safe interface, be certain to observe the Certificates of Conformity for the unit as well as applicable setup and installation requirements (DIN EN 50020, DIN VDE 0165) plus the FISCO Model (PTB Report W-53) or the Entity Model.

Note

The PROFIBUS PA Installation Guidelimitation must be observed for the installation of the PROFIBUS PA Segment (available from the PROFIBUS user organization).
Please note the FOUNDATION Fieldbus Application Guide 31.25 kbit/s Intrinsically Safe System (available from the Fieldbus Foundation) for installing the FOUNDATION Fieldbus.

A voltage complying with the requirements of VDE 0100 Part 410, low protective voltages (SELF) is assumed for the interfaces of all products that are treated in this manual.

3.4 Notes on the "Non Incendive“ ignition protection class

The KLD2-PR-NI1.IEC power repeater and KLD2-STR-NI1.13.225.IEC power supply are designed according to ignition protection class EEx n L IIC.

Warning

Do not fail to observe the warning on page 5

The devices are approved for installation in Class 1 Division 2. They have an electronic current limitationation on the field side. Field devices of the bus transmission line can therefore be connected or disconnected on the **field side** under voltage, for example.

A distinction must be made of 2 cases on the host side for the FOUNDATION Fieldbus:

1. There are **no** field devices on the transmission line connected between the host and power repeater
2. Field devices are connected to the transmission line between the host and the power repeater.

In the first case, no power is supplied through the transmission line. This causes the maximum electrical power that is available on the bus line to be so low that no special wiring technique needs to be used for usage in Class 1 Division 2.

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In the second case, power feed takes place that must be made available from a device other than the power repeater. If this power feed device is a device that also is equipped with an electrical current limitation in accordance with ignition protection type "Non incendive“ (for example KLD2-STR-NI1.13.225.IEC), no special wiring techniques are necessary. If the power feed device does not have any such current limitation (for example KLD2-STR-1.24.400.IEC), the wiring must be adequate to comply with the requirements of Class 1 Division 2 Installation. In this case, no work is permitted on the transmission line between the host and power repeater in Class 1 Division 2 under voltage.

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4 instrumentFOUNDATION FieldbusIntroduction to intrinsic safety for field bus systems

Pepperl+Fuchs GmbH offers power repeaters with an intrinsically safe interface. They are used if an intrinsically safe bus segment is in operation. The following illustration shows the topology of an intrinsically safe bus segment of this nature:

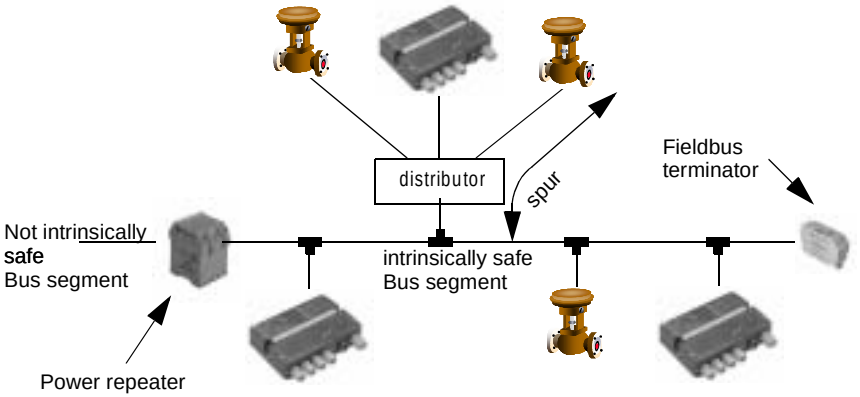

Figure 4.1: Topology of an intrinsically safe bus segment

Note

*The spur in the example above is determined for each station by the distance between the T piece and the field device or, in the case where a distributor is located in between in the circuit, by the distance between the T piece and the distributor **plus** the distance between the distributor and the field device*

A verification of intrinsic safety must be performed for the intrinsically safe bus segment.

To make this demonstration as simple as possible, two different models have been developed, the FISCO model and the Entity model of the field bus foundation. The two are distinguished in a number of ways, including the way the cable is considered.

While the FISCO model considers the transmission line as distributed inductance and capacitance, the basis of this consideration for the Entity model is concentrated inductance and capacitance. The result of this is that lower quantities of power can be transmitted with the Entity model into the Ex area, and that the number of field devicesinstrument that can be operated on a power repeater is therefore lower than with the FISCO model.

STOP

Warning

Note the national requirements for explosion protection by intrinsic safety. Which of the two ways to view the matter is determined here.

These two models will be briefly explained in the following section.

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4.1 The FISCO model

The German Federal Physical-Technical Institute (PTB) has developed the FISCO model which was published in Report PTB-W-53 "Examination on Intrinsic Safety for Field Bus Systems".

FISCO stands for **F**ieldbus **I**ntrinsically **S**afe **CO**ncept. This model is based on the following prerequisites:

1. To transmit power and data, the bus system uses the physical configuration defined by IEC 61158-2. This is the case for PROFIBUS PA and the H1 bus of the FOUNDATION FieldbusFOUNDATION Fieldbus.
2. Only one active source is permitted on a bus segment (here the power repeater). All other components work as passive current sinks.
3. The basic current consumption of a field device is at least 10 mA.
4. You must ensure for each instrument that
   $U_i \geq U_o$ of the power repeater
   $I_i \geq I_o$ of the power repeater
   $P_i \geq P_o$ of the power repeater.
5. Each instrument must fulfill the following requirement:
   $C_i \leq 5$ nF
   $L_i \leq 10$ µH
6. The permissible line length for EEx ia IIC applications is 1000 m.
7. The permissible spur length for Ex applications is 30 m per spur. The definition of spur on page 8 must be noted in this regard.
8. The transmission line that is used must conform to the following cable parameters:
   Resistor coating: 15 Ω/km < R' < 150 Ω/km
   Inductance coating: 0.4 mH/Km ≤ L' ≤ 1 mH/km
   Capacitance coating: 80 nF/km ≤ C' ≤ 200 nF/km (including the shield)
   Taking into account the shield, the capacitance coating is calculated as follows:
   $C' = C'_{conductor/conductor} + 0.5 * C'_{conductor/shield}$, if the bus lead is potential-free or
   $C' = C'_{conductor/conductor} + C'_{conductor/shield}$, if the shield is connected to one of the power repeater´s poles.
9. The bus segment must be terminated on both ends of the line with a terminal bus resistor. A terminal resistor is integrated into the power repeater so that an external bus terminator is only required on the other end. According to the FISCO model the fieldbus terminator must conform to the following limits:
   90 Ω ≤ R ≤ 100 Ω
   0 µF ≤ C ≤ 2.2 µF

Power repeater KLD2-PR-Ex1.IEC1 and KLD2-PR2-Ex1.IEC1 are approved according to the FISCO model. For the characteristic Ex values, please refer to the EC Declaration of Conformity PTB 99 ATEX 2142.

The KLD2-PR2-Ex1.IEC1 may be installed in Zone 2 of an area subject to the risk of explosion.

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Power repeaters with an intrinsically safe interface (KLD2-PR-Ex1.IEC1 and KLD2-PR2-Ex1.IEC1) provide a maximum basic current of 100 mA at a minimal output voltage of 12.8 V. Power can be supplied to as many as 10 field devices from these power repeaters.

Given the requirement that items 1 through 9 are all fulfilled, there is no need to consider inductance and capacitance.

Note

If the verification of Intrinsic Safety is made for the FISCO model, it is sufficient to demonstrate that the values U_i, I_i and P_i are greater than or equal to the values U_o, I_o and P_o of the power repeater for each instrument.

Warning

FOUNDATION Fieldbus field devices that are approved according toprofile 111 or112 , must not be connected to power repeaters KLD2-PR-Ex1.IEC1 and KLD2-PR2-Ex1.IEC1.

4.2 The Entity model

The Entity model is based on the observation that the cable represents concentrated inductance and capacitance. The result is that less electrical power can be transmitted into the area subject to the risk of explosion when compared with the FISCO model. The values for Power Repeaters KLD2-PR-Ex1.IEC and KLD2-PR2-Ex1.IEC are 10.6 V and 70 mA. The result of this is that only 6 stations can be operated on a bus segment.

For the Ex values of the power repeaters, please refer to the EC Declaration of Conformity PTB 00 ATEX 2036 or FM Approval Report J.I.3008872.

The points enumerated in Section 4.1 items 1 through 9 apply equally well to the Entity model, with the exception of Item 5. According to the Entity model the internal inductance of a field device must be less than 20 µH.

Note

Field bus instruments that are certified according to the FISCO model described in section 4.1, can be operated on the power repeaters that are certified for the Entity model.

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5 FOUNDATION FieldbusGeneral

5.1 Ranges of application of power repeaters

Power repeaters combine two identical H1 bus segments with each other on the physical level. Since the PROFIBUS PA and the H1 bus of the FOUNDATION Fieldbus use the same physical transmission configuration, the power repeaters can also be used for both systems. They are used to

- be able to increase the line length of the bus segment
- to be able to connect more instruments on a bus segment that a segment coupler/ a bridge can supply power to.
- to implement from a non-intrinsically safe bus segment to an intrinsically safe bus segment.

The following illustration shows the possibilities for usage of power repeaters for both the PROFIBUS PA and the FOUNDATION Fieldbus:

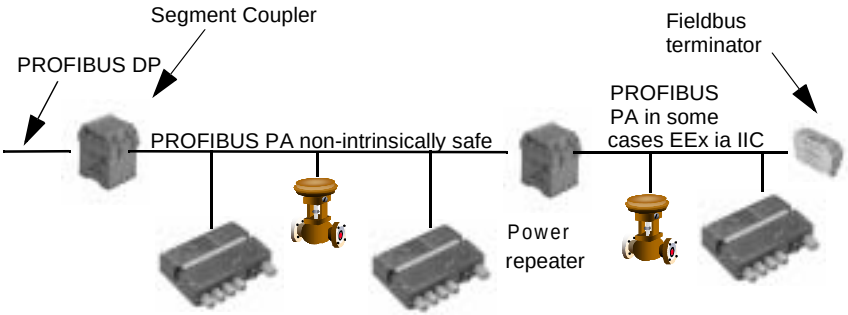

Figure 5.1: Power repeater on a PROFIBUS PA segment

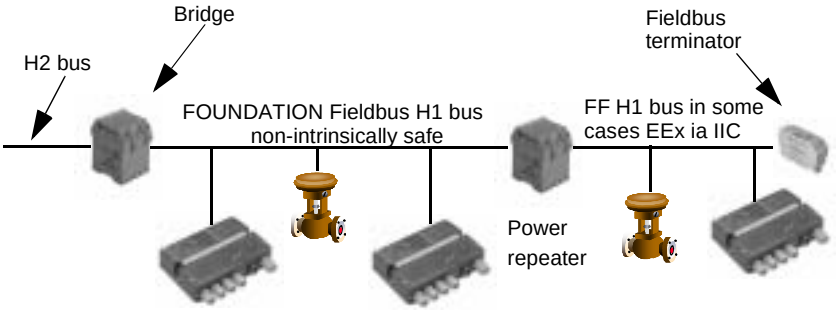

Figure 5.2: Power repeater on a FOUNDATION Fieldbus H1 segment

Note

Note the definition of stub line length on page 8

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The power repeaters fulfil the following tasks:

- Potential separation between bus segments
- Preparing the data signal bidirectionally.
- Power supply to the bus nodes through the bus line.
- Diagnostics via LEDs.

No configuration is required for power repeaters. From the point of view of the segment coupler/bridge, they are invisible.

Pepperl+Fuchs GmbH offers different power repeater that can be optimized for corresponding ranges of application.

1. KLD2-PR-Ex1.IEC, power repeater with 70 mA power supply current for connecting to field bus systems in accordance with the FISCO model or for connection to a field bus system in accordance with the Entity model (for description See section 4).
2. KLD2-PR2-Ex1.IEC, power repeater for installation in Zone 2 with 70 mA power supply current for connection to field bus systems in accordance with the FISCO model or for connection to the field bus system in accordance with the Entity model (for description See section 4).
3. KLD2-PR-Ex1.IEC1, power repeater with 100 mA power supply current for connecting to field bus systems in accordance with the FISCO model (for description See section 4).
4. KLD2-PR2-Ex1.IEC1, power repeater for installation in Zone 2 with 100 mA power supply current for connection to field bus systems in accordance with the FISCO model (for description See section 4).
5. KLD2-PR-1.IEC, Power repeater with 400 mA power supply for non-intrinsically safe field bus systems.
6. KLD2-PR-NI1.IEC, power repeater with 215 mA power supply current for applications in ignition protection class "Non Incendive“.

The following table shows an overview of the most important characteristic values:

	KLD2-PR(2)-Ex1.IEC	KLD2-PR(2)-Ex1.IEC1	KLD2-PR-NI1.IEC	KLD2-PR-1.IEC
Rated operational voltage on the host side	9 V ... 32 V	9 V ... 32 V	9 V ... 32 V	9 V ... 32 V
Rated operational voltage Field side	10.6 V ... 10.9 V	12.8 V ... 13.4 V	12.3 V ... 13.1 V	24 V ... 26 V
Rated operational current on the host side	2 mA	2 mA	2 mA	2 mA
Rated operational current Field side	70 mA	100 mA	215 mA	400 mA

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	KLD2-PR(2)-Ex1.IEC	KLD2-PR(2)-Ex1.IEC1	KLD2-PR-NI1.IEC	KLD2-PR-1.IEC
Modulation current on field side	±10 mA	±10 mA	±10 mA	±10 mA
max. number of field bus instruments[a]	6	10	21	32
max. line length[b]	1000 m	1000 m	1900 m	1900 m
min. line length[c]	519 m	860 m	348 m	852 m

a. The actual number of field devices on a bus segment depends on the actual current consumption of the slaves. The specified number of field devices is only reached if the current consumption for each station is 10 mA.

b. The actual line length depends among other things on the cable that is used and the number and distribution of slaves.

c. For max. output current and cable type A [0.8 mm² (18 AWG)]

If a Power Repeater with an intrinsically safe interface is used, the requirements of EN 50020 "Explosion Protection through Intrinsic Safety" and the PTB report PTB-W-53 (FISCO model) or the Entity model must be observed.

*Power repeater KLD2-PR-Ex1.IEC is certified according to Entity and FISCO modelThe KLD2-PR-Ex1.IEC1 power repeater is certified according to the FISCO model field devices that are certified for the Entity model must **not** be connected to the KLD2-PR-Ex1.IEC1.*

For more information on the topic of explosion protection through intrinsic safety, please refer to the Pepperl+Fuchs manual on explosion protection Part. No. 21417 or the video Explosion Protection of Electrical Systems:

5.1.1 Dimensioning of a field bus segment in accordance with IEC 61158-2

A power repeater opens a new PROFIBUS PA or H1 bus segment. The following section illustrates how a field bus segment of this type should be dimensioned.

The following section assumes that a cable with the following characteristic values is in use:

Cable structure	twisted wire pair, shielded
Conductor cross-section (nominal)	0.8 mm² (AWG 18)
Loop resistor (direct current)	44 Ω/km
Wave resistance at 31.25 kHz	100 Ω ± 20 %
Wave attenuation at 39 kHz	3 dB/km
Capacitive asymmetry	2 nF/km
Group runtime distortion (7.9 ... 39) kHz	1.7 µs
Covering level of the shield	90%

The cable parameters that are specified are cable type A of the PROFIBUS PA Com-

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missioning Manual.

Current calculation

Power is fed to the field bus instrumentsfield bus instruments from the bus. They act as current sinks. The current consumption of each station from the bus line must be at least 10 mA for Ex applications. There are no restrictions for non-Ex applications. Power repeaters always have a current limit. The amount of the current value depends on whether the power repeater is a non Ex power repeater, a power repeater in accordance with the FISCO model or a power repeater according to theEntity model. You must ensure that the current consumption of all stations is less than the current the segment coupler is capable of providing. The following applies:

$$I_{out\_Power\_Repeater} \geq \Sigma\, I_{in\_field\ devices}$$

The current consumption of the field devices determines the maximum number of stations per field bus segment. For example, field devices with a current consumption of 22.8 mA are used, 4 field devices can be connected to one segment for Ex applications according to the FISCO model.
If the current consumption per field device falls to 10 mA, 10 field devices can be connected.

Dimensioning may be especially critical in the case of 10 field devices, since in the event of an error (a fault in one of the field bus instrumentsfield bus instruments) it may happen that this field device receives a higher current that the specified basic current from the bus line. Under worst case conditions, it may happen that the entire field bus segment is destroyed by a defective slave.

To avoid this, some field bus devices offer the Fault Disconnect Electronic (FDE). This is an electronic current limitation that limits additional current consumption of a defective slave in a failure case. This I_{FDE} can also vary between field bus instrumentsfield bus instruments. For details, see the relevant data sheet. If an error case is included in the current calculation, the situation described above changes as follows:

$$I_{out\_Power\_Repeater} \geq I_{FDE} + \Sigma\, I_{in\_field\ devices}$$

This means that when taking into account an error and a current consumption of 10 mA per slave, 9 stations can still be operated on a segment.

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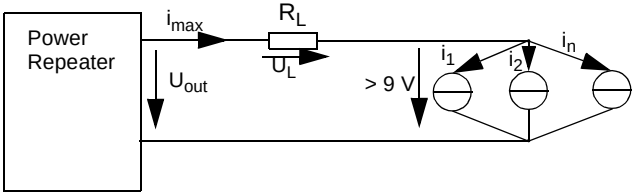
Voltage calculation and line length

The distribution of field devices on the field bus segment can have a negative effect on the maximum possible line length under certain circumstances. The following example is intended to clarify this point:



R_L = Lead resistor of lead segment x
I_x = current consumption of PA field device x

The case in question is an Ex application. The result of the current calculation is that a maximum direct current including I_{FDE} of 100 mA is flowing. Cable type A is used, with a resistor coating of 44 Ω/km.

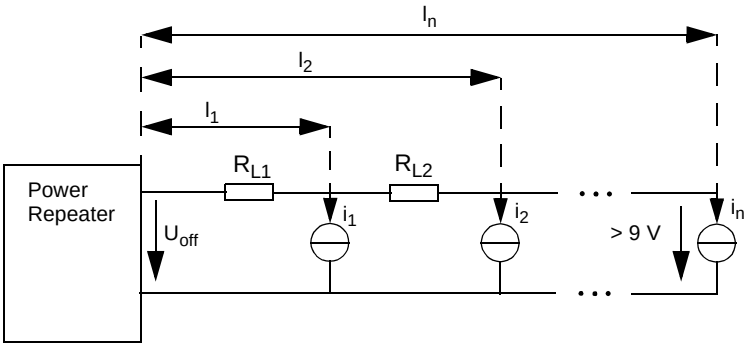
A requirement for problem-free functioning of a field device is that the input voltage on the bus line be at least 9 V. The following therefore applies to the maximum voltage drop over the lead:

$$U_{Lmax} = U_{out} - 9\ V$$

for example, U_{out} for the power repeater KLD2-PR-Ex1.IEC1 is at least 12.8 V (12.8 V to 13.4). For the worst case consideration, U_{out} must be set to 12.8 V. This results in U_{Lmax} of 3.8 V.

Since all field devices are connected to the end of the lead, the maximum line resistance is 38 Ω (U_L/i_{max}). This corresponds to a line length of 863 m for a resistor coating of 44 Ω/km.

Since in practice the field devices are not all connected compactly at the end of the transmission line, the resulting structure is as follows:



R_{Lx} = Lead resistor of lead segment x
I_x = current consumption of PA field device x

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Each field device causes a voltage drop on the length segment through which its power supply current flows. For the first station, this would be:

$U_{RL1} = i_1 * R_{L1}$ or $U_{RL1} = i_1 * l_1 * R'$; with R' = resistor coating of the lead

For the second station, this appears as follows:

$$U_{RL2} = i_2 * (R_{L1} + R_{L2}) \text{ or } U_{RL2} = i_2 * l_2 * R'$$

In general, the equation for Ex applications is then as follows:

$$U_{RL} = R' * \sum_{x=1}^{n} (i_x * l_x) \overset{!}{<} U_{out} - 9\ V$$

If the condition described above is not fulfilled,

a) the lead has be shortened or

b) a lead with reduced resistance coating has to be used.

Attention

When selecting the lead type, make certain that for Ex applications, the requirements in terms of insulation voltage and single wire insulation of EN 60079-14 Section 12 and characteristic values are observed according to the FISCO model or the Entity model.

Note

Please note that the length to be specified represents the length of the line between the terminals of the power repeater and the respective station.

If the opposite approach is selected, in other words if you would like to determine whether the input voltage U_{on} for a specified application is sufficiently high on the last station, the following equation must be used as the basis:

$$U_{in} = U_{out} - U_{RL} = U_{out} - R' * \sum_{x=1}^{n} (i_x * l_x) \overset{!}{>} 9\ V$$

5.2 Ranges of application of power supplies

The power supplies are provided to feed non-intrinsically safe H1 field bus segments or field bus segments with ignition protection type "Non-incendive“. The following illustration shows an example.

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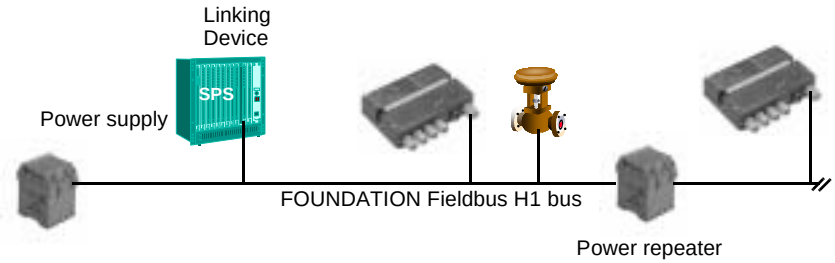

Figure 5.3: Use of power supplies on the FOUNDATION Fieldbus

Attention

The field bus power supplies have a field bus terminator that cannot be turned off. For this reason, the power supply must always be connected at the beginning or end of a transmission line.

The power supply must always be connected on the physical end of a transmission line. The maximum distance to the next node depends on the number of field devices connected in this bus segment. The following table shows an overview of permissible stub lines.

Number of field devices	max. permissible spur length
1 - 12	120 m
13 - 14	90 m
15 - 18	60 m
19 -24	30 m
25 - 32	1 m

Attention

The line lengths specified above apply exclusively to non-Ex applications

Note

Note the definition of spur length on page 8

Table 2 applies with the prerequisite that exactly one field device is connected to a spur. If more field devices are connected on a spur, the line lengths must be reduced.

You should also take into consideration that the total length of the field bus system is calculated as follows:

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Total line length = length of the trunk line + total of spurs

The total maximum line length for non-Ex applications is 1900 m.

Pepperl+Fuchs GmbH offers two different power supplies:

1. KLD2-STR-1.24.400.IEC, field bus power supply current with 400 mA current for non-Ex applications
2. KLD2-STR-NI1.13.225.IEC, field bus power supply with 225 mA supply current in "Non Incendive“ ignition protection class.

The following table shows an overview of the most important characteristic values:

	KLD2-STR-1.24.400.IEC	KLD2-STR-NI1.13.225.IEC
Rated operational voltage Field side	24 V ... 26 V	12.2 V ... 13 V
Rated operational-field bus instru-ments current Field side	400 mA	225 mA
max. number of field bus instru-ments[a]	32	22
max. line length[b]	1900 m	1900 m
min. line length[c]	852 m	323 m

a.The actual number of field devices on a bus segment depends on the actual current consumption of the slaves. The specified numbe r of field devices is only reached if the current consumption for each field device is 10 mA.

b.The actual line length depends among other things on the cable that is used and the number and distribution of slaves.

c.For max. output current and cable type A [0.8 mm² (18 AWG)]

To determine the exact maximum line length, please refer to the section "Voltage calculation and line length“ on page 15 of this manual. of this manual.

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6 FOUNDATION FieldbusMechanics of power repeaters

6.1 Mechanical dimensions and connections

Power repeaters and power supplies are designed according to the tried and proven KF system of Pepperl+Fuchs.

In principle, there are three housing types for power repeaters and power supplies. For the dimensions of this housing, please refer to the following illustrations:

The following illustration applies in regard to the mechanical dimensions for products

- KLD2-STR-1.24.400.IEC
- KLD2-STR-NI1.13.225

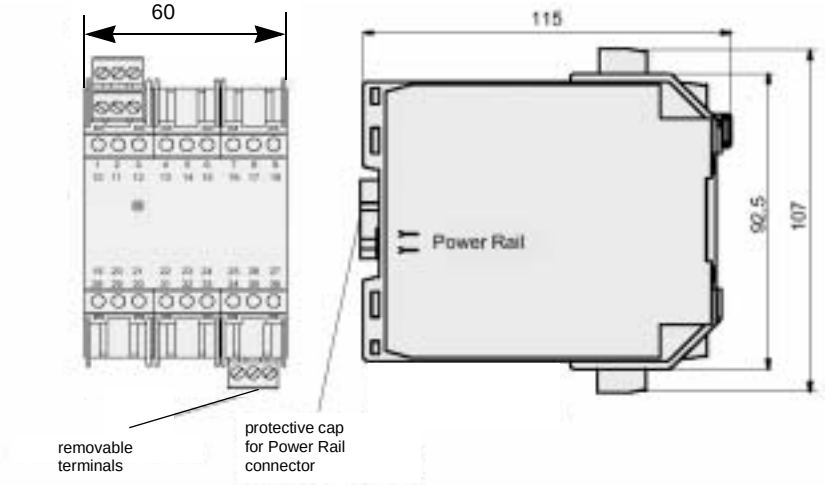

Figure 6.1: Mechanical dimensions of power supplies

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The following illustration applies in regard to the mechanical dimensions for products

- KLD2-PR-1.IEC
- KLD2-PR-NI1.IEC

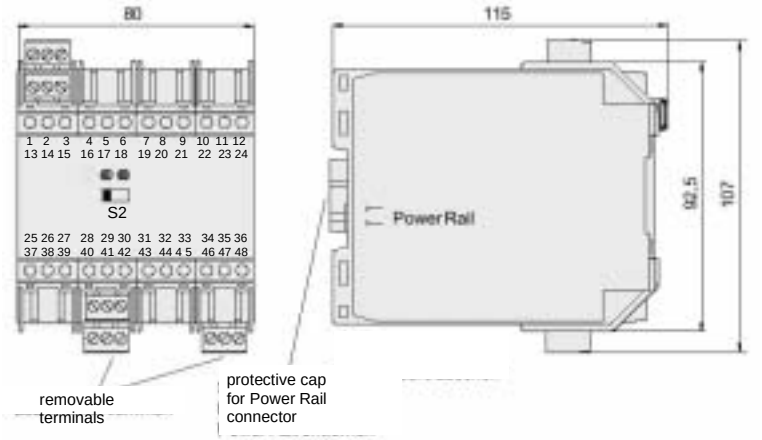

Figure 6.2: Mechanical dimensions of power repeaters without Ex i interface

The following illustration applies in regard to the mechanical dimensions for products

- KLD2-PR-Ex1.IEC
- KLD2-PR2-Ex1.IEC
- KLD2-PR-Ex1.IEC1
- KLD2-PR2-Ex1.IEC1

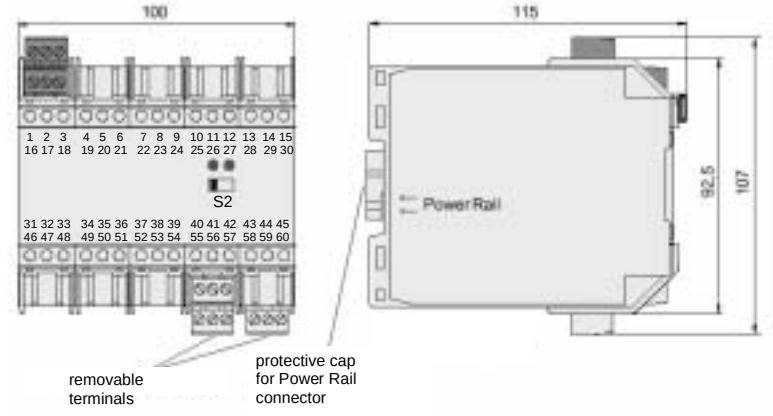

Figure 6.3: Mechanical dimensions of power repeater with Ex i interface

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7 FOUNDATION FieldbusPower supply, connections and operating components

The power repeaters and field bus power supplies are products in the KF housing of Pepperl+Fuchs.

A special feature of the KF system is the removable terminals. Screw-in self-opening apparatus terminals suitable for a conductor cross-section of up to 2.5 mm² are integrated.

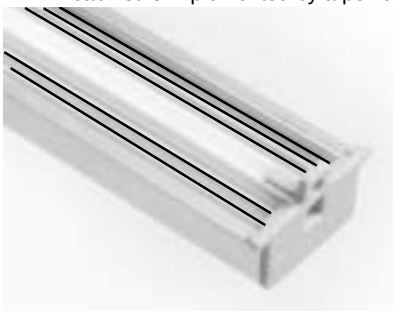
Figure 7.1:Terminals of KF system

Devices of the KF system are normally installed on a 35-mm top hat section rail in accordance with DIN EN 50022 with an inserted power rail. The devices can simply be snapped vertically onto the top hat section rail. In no case should the module be mounted from the side so that it is slanted or tipped.

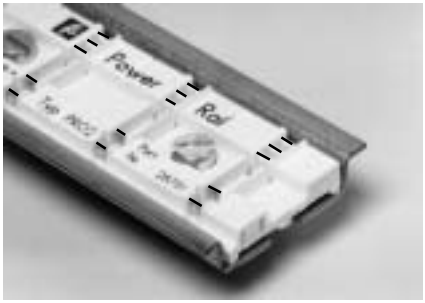
The advantage of the power rail is that power can be supplied to the modules through it. Power can also optionally be fed in through the terminals of the power repeater/power supply.

Figure 7.2: Mounting

The illustration below shows the power rail versions that are used. The connection between the current-conducting leads of the power rail and the power pack of the switch cabinet is implemented by a power feed module.



Power Rail UPR-05



Power Rail PR-05

Figure 7.3: Power rail variants

The UPR-05 Power Rail does not have a grid and is delivered together with a carrier rail 2 meters in length. The UPR-05 can be shortened at any spot. The PR-05 has a 20-mm grid and is an insert component to be fitted onto a DIN rail in accordance with EN 50022. It is supplied with a length of 50 cm and can be reduced in size at any of the marks spaced at intervals of 4o mm.

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Pepperl+Fuchs offers power feed components with differing functionality or connections. The KFD2-EB2 and KFD2-EB2.B power supply modules are designed for a maximum design isolation current of 4 A. The total current drawn from a power feed module must not exceed 4 A.

If too great a current is drawn, a fuse integrated into the power supply components will be tripped and will interrupt the power supply of the entire power rail segment. A fuse being tripped is indicated through a relay output on terminals 7 and 10 of the power feed module.

7.1 Redundant power supply

The KFD2-EB.D2A.B and KFD2-EB-R2A.B power feed modules allow for redundant power supply. The difference between the power feed modules described above and these ones is that no decoupling diodes are integrated in this case that prevent the flow of power from the power rail through the power feed module to the power pack. Power feed module KFD2-EB.D2A.B is designed for connecting 2 independent power packs, while power feed module KFD2-EB.R2A.B can only be used with one power pack. The connection options with redundant power supply are shown in the illustration below.

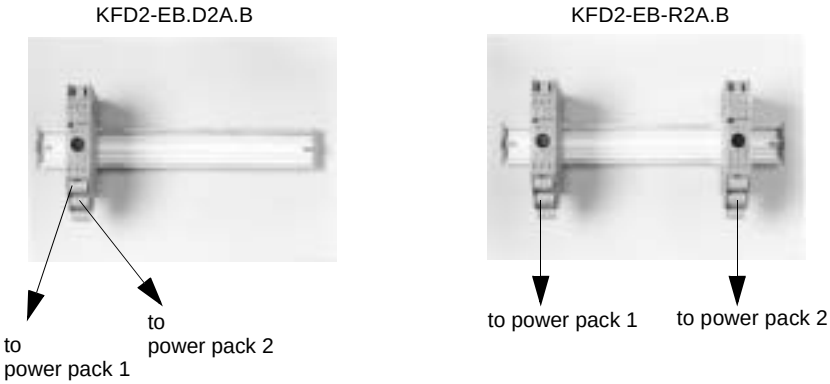

Figure 7.4: Possibilities of redundant power supplies

The KFD2-EB.D2A.B and KFD2-EB.R2A.B power supply modules are designed for a maximum power supply current of 2 A. If the current consumption of the application is greater than 2 A, segmentation must be performed.

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7.2 Connection of power repeaters to the power rail

The following illustration shows the interconnection of power repeaters/power supplies with a power feed module through the power rail:

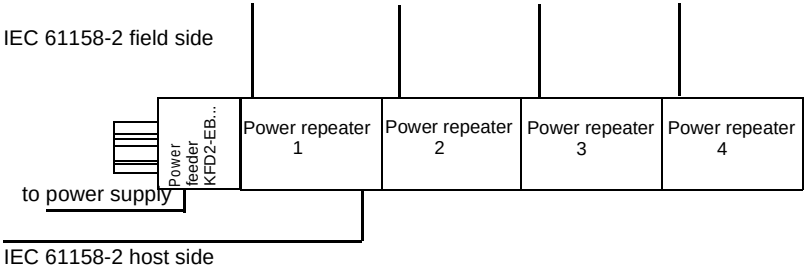

Figure 7.5: Bus signal via power rail

In this example, the power feed module supplies power to 4 power repeaters. The power feed module is connected as the only device with a power supply.

In addition, only power repeater 1 is connected with the field bus on the host side. This applies the signal to the power rail. Power repeaters 2 to 4 receive the data signal from there. For the terminal assignment for the different versions, please refer to Section 7.4 on page 24.

The bus signal can also be optionally attached to power feed module terminals 13+ and 15-.

7.3 Segmentation

If segmentation is required because of too much current consumption from the power rail, the interconnection of the individual segments may appear as follows.

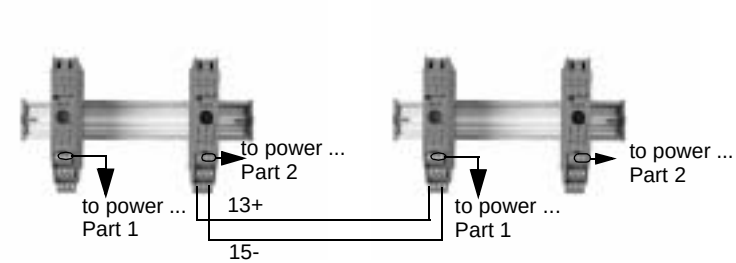

Figure 7.6: Segmentation of power rail segments with redundant power supply

If segmentation is performed in the manner described above, power feed components with the extension .B (for example KFD2-EB-D2A**.B**) should be used. Only these cables have the necessary bus pick-up.

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7.4 Connections of power repeaters and power supplies

In principle, both power repeaters and power supplies can be supplied with power through the power rail. If you do not want power to be supplied to the segment couplers through the power rail, the following terminals are available for this purpose:

Table 1: Connections for the power supply

	KLD2-STR-1.24.400.IEC KLD2-STR-1.13.225.IEC	KLD2-PR-1.IEC KLD2-PR-NI1.IEC	KLD2-PR(2)-Ex1.IEC KLD2-PR(2)-Ex1.IEC1
+	Terminal 35	Terminal 47	Terminal 59
-	Terminal 36	Terminal 48	Terminal 60
FE	Terminal 34	Terminal 46	Terminal 58

The following tables show the pin assignment for power repeaters and power supplies:

Table 2: Bus connections of the power repeaters

	Function	KLD2-PR-1.IEC KLD2-PR-NI1.IEC	KLD2-PR(2)-Ex1.IEC KLD2-PR(2)-Ex1.IEC1
IEC 61158-2 **Host side**	+	Terminal 28 or 40	Terminal 40 or 55
	-	Terminal 29 or 41	Terminal 41 or 56
IEC 61158-2 **Field side**	+	Terminal 3 or 15	Terminal 3 or 18
	-	Terminal 2 or 14	Terminal 2 or 17
	Shield		Terminal 1 or 16

Table 3: Bus connections of the power supplies

	Function	KLD2-STR-1.24.400.IEC KLD2-STR-NI1.13.225.IEC
IEC 61158-2 **Field side**	+	Terminal 3 or 12
	-	Terminal 2 or 1

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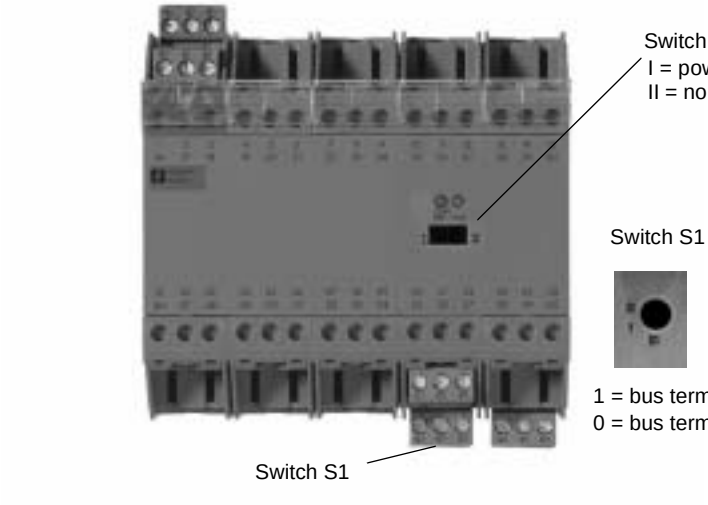
7.5 Operating components

7.5.1 Operating components for power repeater

The following illustration shows that connection components and operating components of power repeaters with an intrinsically safe interface:



The field bus terminator must be turned on the host side (Position 1) if the power repeater is the last instrument on the non-intrinsically safe segment of the field bus.

Switch S2 below the LEDs should be placed in Position I if the host has the function of supplying power. This setting corresponds to the state of the product as supplied.

If the host does not make any power feed available for field devices, the switch must be set in Position II. The power repeater then works as the power feed source and supplies power to field bus devices connected to this H1 bus segment.

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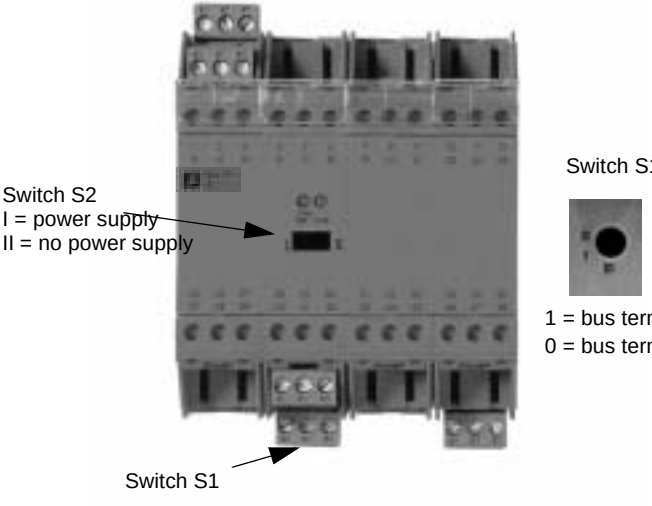
The following illustration shows the operating components of power repeaters without an intrinsically safe interface



Here also the rule applies that the field bus terminator must be turned on the host side if the power repeater represents the last instrument in the bus segment.

Note

The power repeater has a permanently integrated field bus terminator on the field side that cannot be turned off.

The position of Switch S2 must be observed in the case of these power repeaters as well (see page 25)

7.5.2 Operating components for field bus power supply

The field bus power supplies do not have any operating components.

The KLD2-STR-1.24.400.IEC and KLD2-STR-NI1.13.225.IEC power supplies have an integrated field bus terminator that cannot be turned off on the field side.

Note

If a power supply is used on a bus segment, it must always be connected at the end of a bus segment.

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7.6 Meaning of the LED

7.6.1 LEDs of the power repeaters

Power repeaters make the following LEDs available:

Table 4: LEDs of the power repeaters

LED	Color	Status/function
PWR	Green	On, power supply voltage present
COM/ERR	Red	Off: Communication OK On, flashing at 2 Hz: Communication error, no activity on the field side (timeout 3 s) On continuously: Hardware error

7.6.2 LEDs of the power supplies

The field bus power supplies offer the following LEDs:

Table 5: LEDs of the field bus power supplies

LED	Color	Status/function
PWR	Green	On, power supply voltage present

7.7 Grounding

Shielded cables are normally used for the field bus transmission leads. For reasons of electromagnetic compatibility (EMC), the shield of this transmission line must be grounded. There are 3 ways this can be done:

1. Hard grounding on both ends of the field bus transmission line and on each field bus instrument. This requires laying a potential equalization line.
2. Hard grounding on all field devices, capacitive grounding on the power repeater/on the current supply, separated potential equalization lines for the field and host side (only if required). Different companies offer terminals with an integrated capacitor (for example Phoenix Contact, Wago, ...).
3. Hard grounding on the power repeater/on the power supply, capacitive grounding on all field devices.

The best EMC protection will be achieved with Version 1, the worst with Version 3.

The following illustrations are examples of grounding on a power repeater with intrinsically safe interface.

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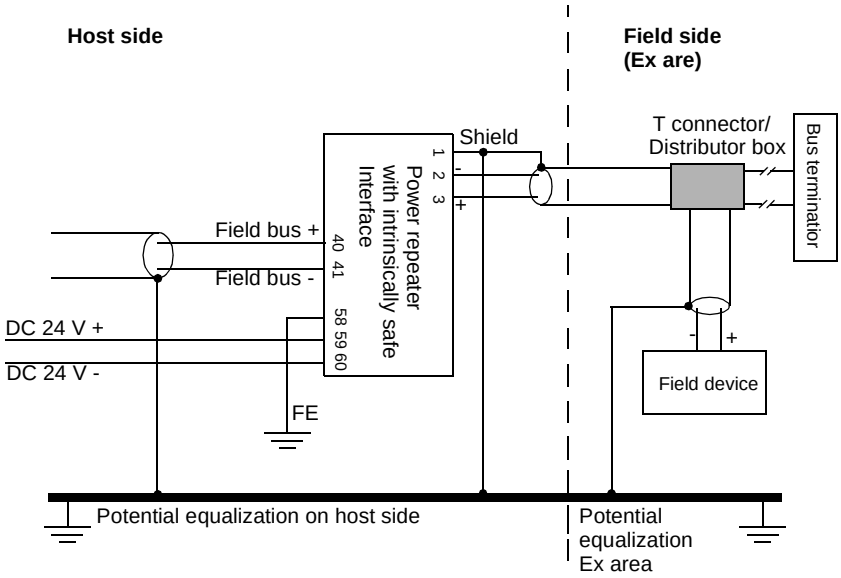

Figure 7.7: Example: hard grounding on all field bus instruments

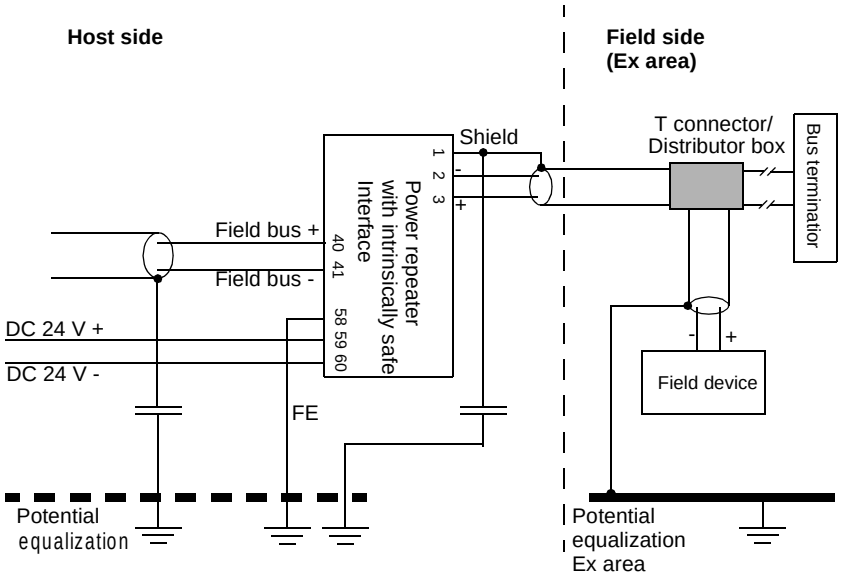

Figure 7.8: Example: capacitive grounding on the power repeater/on the power supply

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Warning

Pepperl+Fuchs recommends that you always use shielded leads for the field bus.
For hard grounding with intrinsically safe applications, a potential equalization must be laid between the Ex and non-Ex area.
This is not required with a capacitive ground. In the case of capacitive grounding, note the conditions listed below for the capacitor to be used.

Note

In the case of capacitive grounding, potential equalization is only required in a non-Ex area if it is to be expected that different ground potentials will occur in the application. In this case, an equalization current through the shield must be avoided.

For Ex applications with capacitive grounding, the capacitor must fulfil the following requirements:

1. The capacitor must have a fixed dielectric.
2. The capacitance C of the capacitor must be less than or equal to 10 nF.
3. The capacitor must be designed for a design isolation voltage greater than or equal to 1500 V.

For Ex applications a potential equalization is always required within the Ex area according to EN 60079-14 Section 6.3 .

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Note

For additional information on grounding problems associated with the PROFIBUS PA, please refer to the "PROFIBUS Commissioning Manual“ (Part No. 2.091, available from the PROFIBUS user organisation)

Note

For additional information on grounding problems associated with the FOUNDATION Fieldbus, please refer to the "31.25 kbit/s Intrinsically Safe Systems Application Guide for FOUNDATION Fieldbus“ of the Fieldbus Foundation.

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One Company, Two Divisions.

Factory Automation Division

Product Range

- Digital and analogue sensors
- in different technologies
  - Inductive and capacitive sensors
  - Magnetic sensors
  - Ultrasonic sensors
  - Photoelectric sensors
- Incremental and absolute rotary encoders
- Counters and control equipment
- Identification Systems
- AS-Interface

Areas of Application

- Machine engineering
- Conveyor or transport
- Packaging and bottling
- Automotive industry

Process Automation Division

Product Range

- Signal conditioners
- Intrinsically safe interface modules
- Remote Process Interface (RPI)
- Intrinsically safe field bus solutions
- Level control sensors
- Process measuring and control systems engineering at the interface level
- Intrinsic safety training

Areas of Application

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- Industrial and community sewage
- Oil, gas and petrochemical industry
- PLC and process control systems
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