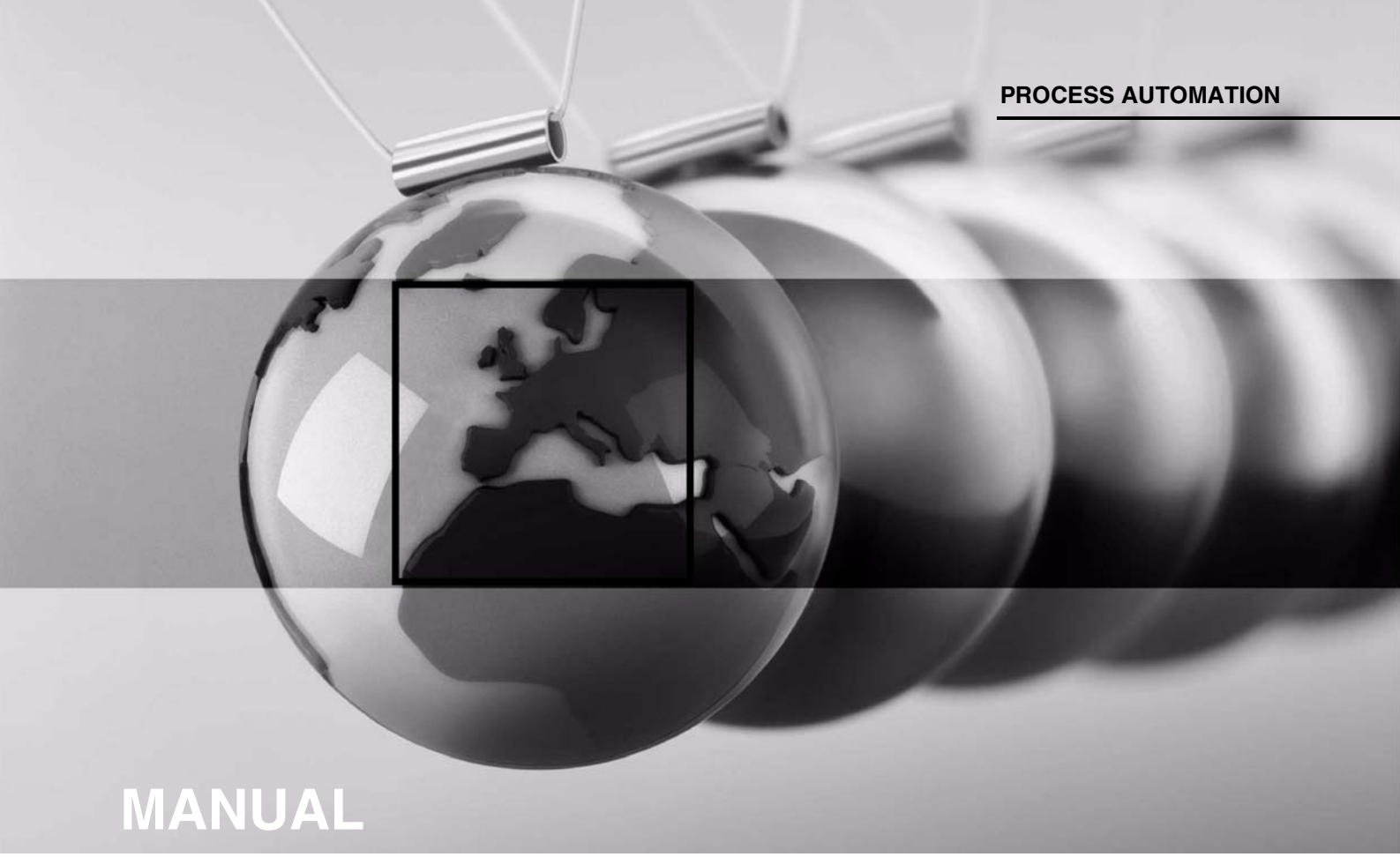
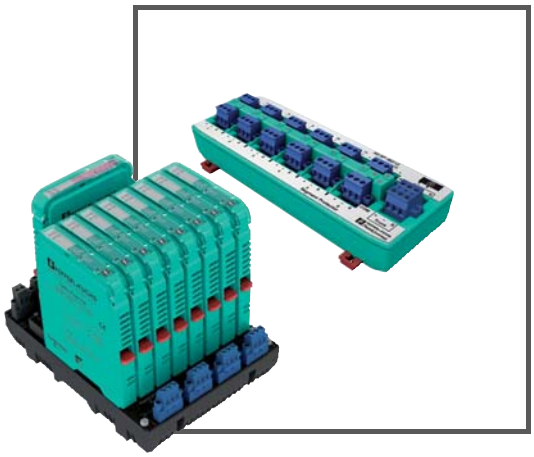


MANUAL

DART FIELDBUS POWER HUB GENERIC INTERFACE



FieldConnex®

DART FIELDBUS

FOUNDATION™

PEPPERL+FUCHS

PROTECTING YOUR PROCESS

With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

1 Safety

1.1 Validity

The chapter “Safety” is valid as instruction manual.

Specific processes and instructions in this document require special precautions to guarantee the safety of the operating personnel.

1.2 Symbols used

This document contains information that you must read for your own personal safety and to avoid property damage. Depending on the hazard category, the warning signs are displayed in descending order as follows:

Safety-relevant symbols

Danger!
This symbol indicates a warning about an immediate possible danger.

In case of ignoring the consequences may range from personal injury to death.

Warning!
This symbol indicates a warning about a possible fault or danger.

In case of ignoring the consequences may cause personal injury or heaviest property damage.

Caution!
This symbol indicates a warning about a possible fault.

In case of ignoring the devices and any connected facilities or systems may be interrupted or fail completely.

Informative symbols

Note!

This symbol brings important information to your attention.

Action

This symbol indicates a paragraph with instructions.

1.3 System Operator and Personnel

The plant owner is responsible for its planning, installation, commissioning, operation, maintenance and disassembly.

Mounting, installation, commissioning, operation, maintenance and disassembly of any devices may only be carried out by trained, qualified personnel. The instruction manual must be read and understood.

1.4 Pertinent Laws, Standards, Directives, and further Documentation

Laws, standards, or directives applicable to the intended use must be observed. In relation to hazardous areas, Directive 1999/92/EC must be observed.

The corresponding data sheets, declarations of conformity, EC Type-examination certificates, certificates and Control Drawings if applicable (see data sheet) are an integral part of this document. You can find this information under www.pepperl-fuchs.com.

Due to constant revisions, documentation is subject to permanent change. Please refer only to the most up-to-date version, which can be found under www.pepperl-fuchs.com.

1.5 Delivery, Transport and Storage

Check the packaging and contents for damage.

Check if you have received every item and if the items received are the ones you ordered.

Keep the original packaging. Always store and transport the device in the original packaging.

Always store the device in a clean and dry environment. The permitted storage temperature (see data sheet) must be considered.

1.6 Marking

DART Motherboards

MBHD-FB-D-4R.*
Pepperl+Fuchs GmbH
Fieldbus Power Hub
EC-type-examination certificate:
PTB 11 ATEX 2010 X
II 2 G Ex ib IIC T4
II (2) D [Ex ib] IIIC
Statement of conformity
II 3(2) G Ex nAc [ib] IIC T4

DART Power Supply

HD2-FBPS-IBD-1.24.360

Pepperl+Fuchs GmbH
Fieldbus Power Supply Module
EC-type examination certificate:
PTB 10 ATEX 2020 X
II 2 G Ex ib IIC T4
II (2) D [Ex ib] IIIC
Statement of conformity
II 3(2) G Ex nAc [ib] IIC T4

Diagnostic Modules

HD2-DM-A

Pepperl+Fuchs GmbH
Fieldbus Power Hub
TÜV 04 ATEX 2500 X
II 3 G Ex nA II T4

HD2-DM-A.RO

Pepperl+Fuchs GmbH
Fieldbus Power Hub
TÜV 04 ATEX 2500 X
II 3 G Ex nA II T4

HD2-DM-B

Pepperl+Fuchs GmbH
Fieldbus Power Hub
TÜV 04 ATEX 2500 X
II 3 G Ex nA C IIC T4

DART Segment Protector

R3-SP-IBD12

Pepperl+Fuchs GmbH
Fieldbus Power Supply Module
EC-type examination certificate:
PTB 10 ATEX 2018 X
II 2 G Ex ib IIC T4
II (2) G [Ex ib] IIIC

DART Surge Protector

-LBF-I1.36

Pepperl+Fuchs GmbH
Fieldbus Power Supply Module
EC-type examination certificate:
KEMA 09 ATEX 0191 X
II 2(1)G Ex ia IIC T4/T5/T6
Declaration of conformity:
KEMA 09 ATEX 0190 X
II 3G Ex ic IIC T4/T5/T6 ,
II 3G Ex nA II T4/T5/T6

1.7 Intended Use

The Fieldbus DART System is intended to power four FOUNDATION Fieldbus H1 or PROFIBUS PA intrinsically safe, Ex ib IIC segments in redundant mode according to IEC 61158-2.

The Fieldbus DART Power Hub product range may be installed in Zone 2 hazardous areas. Types of protection are Ex nA (non-arcing) for Zone 2 Gas Groups IIC, IIB, IIA.

Dedicated Pepperl+Fuchs DART Segment Protectors will allow to connect fieldbus devices certified according to Entity model with safety values of $U_i \geq 24$ V, $I_i \geq 47$ mA, $P_i \geq 1.08$ W, $C_i \leq 5$ nF, Li ≤ 20 µH. Thus live maintenance at field device level in Zone 1 is permitted at any time.

For further information about hazardous area installation refer to referenced documents .

The devices are only approved for appropriate and intended use. Ignoring these instructions will void any warranty and absolve the manufacturer from any liability.

1.8 Mounting and Installation

Prior to mounting, installation, and commissioning of the device you should make yourself familiar with the device and carefully read the instruction manual.

1.8.1 Mounting Instructions for Power Hub

The devices must be installed at least in an environment according pollution degree 2.

Instructions for Zone 2

The devices may only be installed and operated in zone 2 if they have been mounted in an enclosure with degree of protection IP 54 according to IEC/EN 60529. The enclosure must have a declaration of conformity according to 94/9/EC for at least category 3G.

Connection or disconnection of energized non-intrinsically-safe circuits is only permitted in the absence of a hazardous atmosphere.

Instructions for Zone 22

The devices may only be installed and operated in zone 22 if mounted in an enclosure for which an EC-type-examination certificate acc. 94/9/EG for at least category 3D exists.

1.8.2 Mounting Instructions for HD2* Modules

The modules are intended for mounting on an appropriate Fieldbus Power Hub motherboard.

There is a special connection slot for the diagnostic modules HD2-DM-* on the Power Hub motherboard, which is labeled "Diagnostic Module only". Do not try to plug other modules into this connection slot. Other modules may be damaged.

Instruction for redundant systems

Each segment on a redundant motherboard must only be fitted with two power modules of the same type.

1.8.3 Ambient Conditions

Power Hub

The devices must be installed at least in an environment according pollution degree 2.

Power Hub Motherboard: Pay attention to avoid electrostatic discharges while operating the installed device. Avoid electrostatic charge.

The devices may be installed in a corrosive location acc. to ISA-S71.04-1985, severity level G3.

The permitted ambient temperature range of the device depends on the monting orientation:

- Horizontal -40...40 °C
- Vertical -40...60 °C

See chapter 3.1.2

Segment Protector

The permitted temperature range is -40...70 °C.

Cable

The temperature range of the cable must be chosen according to the application.

The cable must be suitable for the specified ambient temperature range at the intended location. The allowed temperature range is -40 to 70 °C, even if the specified ambient temperature range for the cable is higher.

Other Equipment

All used devices and components must be suitable for the specified ambient temperature range at the intended location.

1.8.4 Mounting Instructions for Segment Protector

Instructions for Zone 1

The devices may only be installed and operated in zone 1 if mounted in an enclosure for which an EC-type-examination certificate according to 94/9/EC for at least category 2G exists.

Instructions for Zone 2

The devices may only be installed and operated in zone 2 if they have been mounted in an enclosure with degree of protection IP 54 according to IEC/EN 60529. The enclosure must have a declaration of conformity according to 94/9/EC for at least category 3G.

Instructions for Zone 21

The devices may only be installed and operated in zone 21 if mounted in an enclosure for which an EC-type-examination certificate acc. 94/9/EG for at least category 2D exists.

Instructions for Zone 22

The devices may only be installed and operated in zone 22 if mounted in an enclosure for which an EC-type-examination certificate acc. 94/9/EG for at least category 3D exists.

1.8.5 Ex i

The following instructions are valid for both the DART Power Hub and the DART Segment Protector:

Circuits of type of protection "Ex i" (intrinsically safe) which have been operated with circuits of other type of protections must not be used as "Ex i" circuits afterwards.

Intrinsically safe circuits of associated apparatus (installed in safe areas) can be led into hazardous areas, whereby special attention must be paid to maintain separation distances to all non-intrinsically safe circuits according to the requirements in IEC/EN 60079-14.

The respective peak values of the field device and the associated apparatus with regard to explosion protection should be considered when connecting intrinsically safe field devices with intrinsically safe circuits of associated apparatus (verification of intrinsic safety). Make sure to observe IEC/EN 60079-14 and IEC/EN 60079-25.

All separation distances between two adjacent intrinsically safe circuits need to be observed in accordance with IEC/EN 60079-14.

1.9 Housing

The following instructions are valid for both the DART Power Hub and the DART Segment Protector:

The device must be mounted with at least a degree of protection of IP 54 according to IEC/EN 60529.

If additional housings are needed for installation in hazardous areas, the following points must be considered / evaluated:

- Degree of protection according to per IEC/EN 60529
- Light resistance according to IEC/EN 60079-0
- Impact strength according to IEC/EN 60079-0
- Chemical resistance according to IEC/EN 60079-0
- Heat resistance according to IEC/EN 60079-0
- Electrostatics according to IEC/EN 60079-0

To ensure the IP degree of protection:

- all seals must be undamaged and correctly fitted
- all screws of the housing / housing cover must be tightened with the appropriate torque
- only cable of the appropriate size must be used in the cable glands
- all cable glands must be tightened with the appropriate torque
- all empty cable glands must be sealed with sealing plugs

1.10 Repair and Maintenance

The devices must not be repaired, changed or manipulated. If there is a defect, the product must always be replaced with an original device.

1.11 Disposal

Disposing of devices, packaging material, and possibly contained batteries must be in compliance with the applicable laws and guidelines of the respective country.

2 Specification

2.1 Overview

The FieldConnex® DART Fieldbus for FOUNDATION Fieldbus consists of high-performance power supplies (Power Hubs) with redundant configuration and Segment Protectors for intrinsically safe segments in Zone 1 Gas Groups IIC hazardous area. DART Fieldbus enables completely intrinsically safe fieldbus segments for all existing field instrumentation that complies with the Entity standard.

Compared to conventional intrinsically safe fieldbus concepts such as FISCO or Fieldbus Entity, DART Fieldbus offers more than five times more intrinsically safe power and true load-sharing redundancy of power supplies. The high intrinsically safe power supports fieldbus topologies with long cable lengths and a high number of field devices, similar to non-intrinsically safe fieldbus solutions. Live maintenance without gas clearance is permitted at any point of the DART Segment Couplers Fieldbus system.

The simplicity of use, particularly the validation of DART Fieldbus Systems, reduces the safety documentation to a minimum.

The motherboards of the FieldConnex® DART Fieldbus Power Hub provide connections for four fieldbus segments. Sockets for plug-in modules carry two power supply modules per segment and one diagnostic module. Fieldbus host systems with a dedicated system connector can be connected through a customized system cable. Solutions for connecting the DART Power Hub to Pepperl+Fuchs PROFIBUS PA to PROFIBUS DP Segment Couplers are available.

The Power Hub features superior design elements. The main design points are redundancy, passive impedance generation, well balanced circuitry, and low heat dissipation. They are characteristic for FieldConnex® and enable superior availability of the fieldbus infrastructure and make FieldConnex® Power Hubs easy to install and maintain. All active electronic components are located in the plug-in modules, thus making the motherboard extremely reliable.

Power supplies in redundant configuration are actively sharing the current load of a fieldbus segment. Thus both power supplies are always operational. In the event of a failure the healthy power supply takes over the full load current seamlessly, ensuring that the fieldbus segment is continuously powered. All modules can be exchanged while the system is energized without the use of tools, thus ensuring very high system availability.

Impedance generation prevents the data signal from being short circuited by the power supply's low internal resistance. This impedance generation is designed with passive components such as inductances and resistors with very long durability.

A fully balanced circuit and segment design is important for undisturbed fieldbus operation. An external disturbance through EMI impacts both leads of the shielded twisted-pair cable symmetrically. The data signal thus remains undisturbed. Low heat dissipation allows highest packing density inside the cabinet and a very long service life.

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Dedicated DART Segment Protectors, which are connected to the intrinsically safe segment, allow feeding of standard Entity certified field devices. Devices are installed in hazardous area Zone 1 gas groups IIC and must conform to Foundation Fieldbus profile specification FF-816. Limiting electric fault conditions at the spur, Segment Protectors ensure proper operation of the fieldbus segment during faults or hot work at the spur.

The optional Advanced Diagnostic Module (ADM) can be plugged into the DART Power Hub. This module monitors the physical layer online and in real-time, enabling detection of degradation and faults during operation. In addition, the ADM continuously monitors the health of the redundant 24 V power feed as well as the fieldbus power modules.

Measurement data and alarms about the physical layer are transmitted to the control room thus bringing visibility to the fieldbus physical layer, which can now be treated as active component in Plant Asset Management systems. Operators are enabled to decide on proactive measures to avoid unwanted situations while the plant is running smoothly.

2.2 System components

2.2.1 Architecture

The DART Fieldbus System consists of a DART Power Hub with up to four redundant powered fieldbus segments including backplane and DART Fieldbus power supplies.

The DART Power Hub offers dedicated interfaces to connect fieldbus hosts and Pepperl+Fuchs PROFIBUS Segment Couplers to DART fieldbus segments using customized cables sets. A maximum of four DART Segment Protectors with up to 12 spur outputs are allowed to be connected to a DART trunk. The Power Hub comprises one fixed built in fieldbus terminator for each segment. A DART Segment Protector contains a selectable DART fieldbus terminator.

Dedicated DART Surge Protectors are allowed to be connected to the DART trunk to protect Power Hub and Segment Protectors from over-voltages. The cable used for the trunk is required to be a 100 Ω fieldbus cable. Trunk cable length is supported up to 1000 m, spur cable length up to 120 m. Auxiliary devices as handhelds are allowed to be connected to trunk and spur.

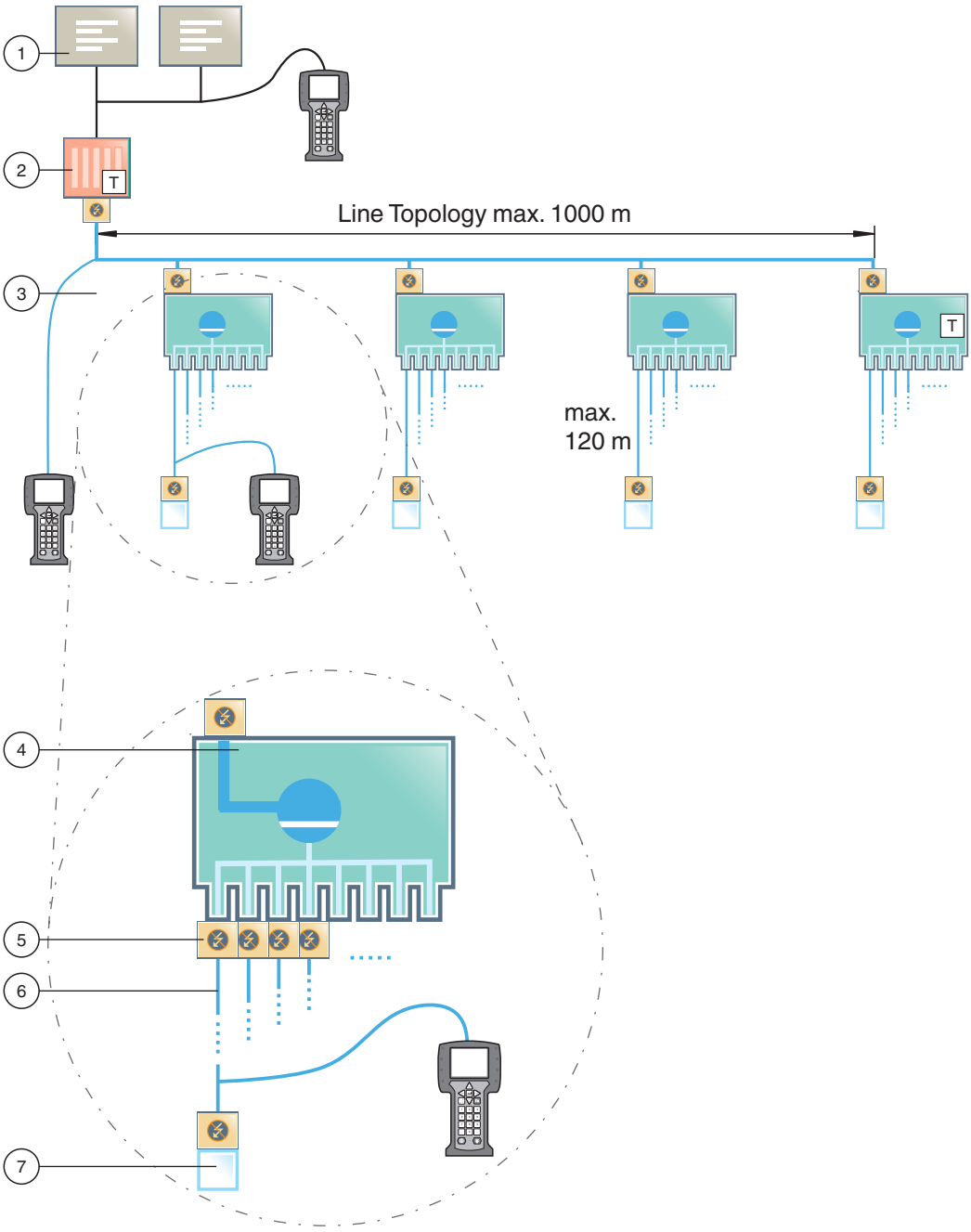

Figure 2.1 DART system architecture

1 Redundant host
2 DART Power Hub
3 DART trunk
4 DART Segment Protector
5 Surge Protector
6 Spur
7 Field device

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2.2.2 DART Motherboard

MBHD-FB-D-4R.GEN

The motherboard MBHD-FB-D-4R.GEN allows for the redundant supply of four intrinsically safe Ex ib fieldbus segments. Eight sockets hold the power supply modules, two power supply modules supplying each of the four segments redundantly. Fieldbus host systems with a dedicated system connector can be connected through a customized system cable. Solutions for connecting the DART Power Hub to Pepperl+Fuchs PROFIBUS PA to PROFIBUS DP segment couplers are available.

The motherboard provides connections for redundant 24 V input power. An extra socket holds one optional physical layer diagnostic module. Connectors are available to link voltage free failure alarms and a diagnostic bus to the host control system. For each fieldbus segment a non-selectable fieldbus terminator is built in.

The motherboard is designed to be mounted on a horizontal 35 mm DIN rail. The defined temperature rating is only valid for mounting on a horizontal 35 mm DIN rail.
For vertical mounting see derating specification .

2.2.3 DART Power Supply Modules

HD2-FBPS-IBD-1.24.360

DART Power Supply Modules provide full galvanic isolation between bulk power supply, fieldbus segments and H1 Host System connection. Designed for fieldbus systems according to IEC 61158-2 such as FOUNDATION Fieldbus H1, the power supply modules fulfil the power supply test specification FF-831. They provide optimal system reliability for applications where cabling and wiring are routed through critical or harsh electrical environments, i.e. where superior protection from electromagnetic interference (EMI) is mandatory.

Power Modules are connected to the motherboards via sockets. They can be exchanged while the system is in operation. The Host interface offers fieldbus power for H1 Host interface cards. Two redundant power supply modules share the current load of one fieldbus segment. Thus both power supplies are always operational. In the event of a failure, the healthy power supply takes over the full current load seamlessly, ensuring that the fieldbus segment is continuously powered. LED indicators provide information about the health of the fieldbus segment and the power supply itself.

2.2.4 Diagnostic Modules

Basic Diagnostic Module

The Basic Diagnostic Module provides basic system diagnostics. It monitors the input voltage of the bulk power supply and each segment for overload and short-circuit conditions. Each Power Supply Module is checked for proper function. Power Modules operating in redundant configuration are checked for compatibility. Status and faults are indicated by LEDs and can be transmitted via dry contact.

Advanced Diagnostic Module

The Advanced Diagnostic Module is a comprehensive measurement tool for the fieldbus physical layer. It is well suited for commissioning, online monitoring and maintenance. The module provides the exact segment and individual device data needed for detection of changes in the fieldbus physical layer. Segment measurements include fieldbus voltage and load current; device specific measurements are: signal level, noise and jitter. All data is transmitted to the control room via Ethernet. The Diagnostic Manager – Basic Edition shows all data on easy to use displays.

The Diagnostic Manager - Professional Edition offers additional functionality: the Commissioning Wizard generates automated reports; the software displays clear-text messages for troubleshooting of out-of spec behavior. The OPC server transmits user-selectable summary alarms to the DCS.

For further information please refer to the manual Advanced Diagnostic Module HD2-DM-A.

Advanced Diagnostic Module, Relay Output

The Advanced Diagnostic Module, Relay Output is a tool to permanently monitor the fieldbus physical layer. For each physical layer parameter monitored, limit ranges can be configured using DIP switches.

The module distinguishes between two alarm types:

- A Maintenance Required alarm
- An Out Of Specification alarm

The Maintenance Required alarm serves to make proactive diagnosis possible. If a value violates the limit, a relay contact will open and the respective segment LED will start flashing yellow. By means of this proactive diagnosis, changes within the fieldbus installation will be detected early on and fault sources can be found before communication fails.

If an Out Of Specification alarm appears (LED flashing red), one of the physical layer parameters monitored has rapidly declined and moved out of the range of the Maintenance Required alarm. A fast examination of the segment affected is crucial to prevent a total dropout of this segment in the near future.

To set up appropriate limit values for your fieldbus installation, a comprehensive diagnostic solution such as the Pepperl+Fuchs Mobile Advanced Diagnostic Module is required during commissioning to derive the DIP switches positions.

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2.2.5 DART Segment Protector

R3-SP-IBD12

The DART Segment Protector is a fieldbus device coupler for connection of up to twelve intrinsically safe Entity certified field instruments to a DART segment. Designed for fieldbus systems according to IEC 61158-2 such as FOUNDATION Fieldbus H1, it fulfils the device coupler test specification FF-846.

The R3-SP-IBD12 Segment Protector is designed for DIN-Rail installation with simple snap hooks included. It can be installed in a field junction box or in a control cabinet. Various choices of tailored solutions are offered by the Pepperl+Fuchs Group.

Field instruments are connected one per output, also named spur. The Segment Protector is certified for installation in Zone 1. Maintenance at the field device level in Zone 1 is permitted at any time without the need of a hot work permit.

Each spur is equipped with short-circuit current limitation. If a spur has a short circuit or failure, the fieldbus trunk and all other field devices remain in operation. As soon as the fault is repaired, the Segment Protector automatically resumes operation of the spur.

The Segment Protector is connected to the trunk via a T-connector. Exchanging and modifying one Segment Protector is possible while the fieldbus segment is still in operation, without effect on other parts of the same fieldbus segment. All connectors feature plugs with retaining screws, providing the necessary durability and availability for process automation.

A DART Fieldbus Terminator with high-availability design is included in the Segment Protector, located at the end of the trunk. LEDs indicate bus communication activity and power on the trunk. Each output is equipped with an LED for indication of a short-circuit condition or fault at the spur.

2.2.6 Surge Protectors

The FieldConnex® Surge Protector will protect fieldbus components and control units from damage caused by voltage surges and secondary lightning strikes. Surge Voltages between the fieldbus wire (plus and minus) and between either wire and ground will be safely limited in an overvoltage event.

The Surge Protectors are designed for use in fieldbus communication topologies according to IEC 61158-2. They conform to IEC 60079-11: FISCO and Entity concepts and are also ‘DART Intrinsically Safe Compatible’ (models without diagnostic). The Surge Protectors allow the coordinated use in an ‘EMC-orientated Lightning Protection Zones Concept’, in accordance with IEC 61312-1. The protective effect is adapted to the EMC interference immunity (conducted high-energy interference impulses) for fieldbus measuring, control and equipment.

Versions with different mounting options are available:

-LBF-I1.36

The *-LBF-I1.36* Surge Protector is designed for DIN rail installation with simple snap hooks included. For further information see data sheet and manual.

*-LBF-IA1.36.IE.0

The TSC-LBF* and SCP-LBF* series Surge Protectors consist of pluggable units, designed to fit directly into 3-pin terminals sockets of Pepperl+Fuchs fieldbus components as Power Hubs and Segment Protectors, to protect trunk and spur connections of a fieldbus installation. This leads to a significant reduction in design and installation time/cost and significantly reduces the overall equipment footprint. For further information please consult the data sheet and the manual.

2.2.7 Auxiliary Components

For testing or configuration purposes, auxiliary devices such as handhelds may be connected to a DART installation temporarily.

- **Connection of auxiliary devices to the host interfaces**
  Auxiliary devices are allowed to be connected to the host interface as long as the maximum safety voltage (U_m) feed into the host interface is lower than 35 V.
- **Connection of auxiliary devices to the DART trunk**
  Auxiliary devices such as handhelds may be connected to the DART trunk if they are passive, non-feeding and if no hazardous atmosphere is present in the installation (hot work permit).
- **Connection of auxiliary devices to the outputs of a Segment Protector**
  Entity certified auxiliary devices are allowed to be connected to the Segment Protector (see chapter 4.4).

2.3 Component Identity

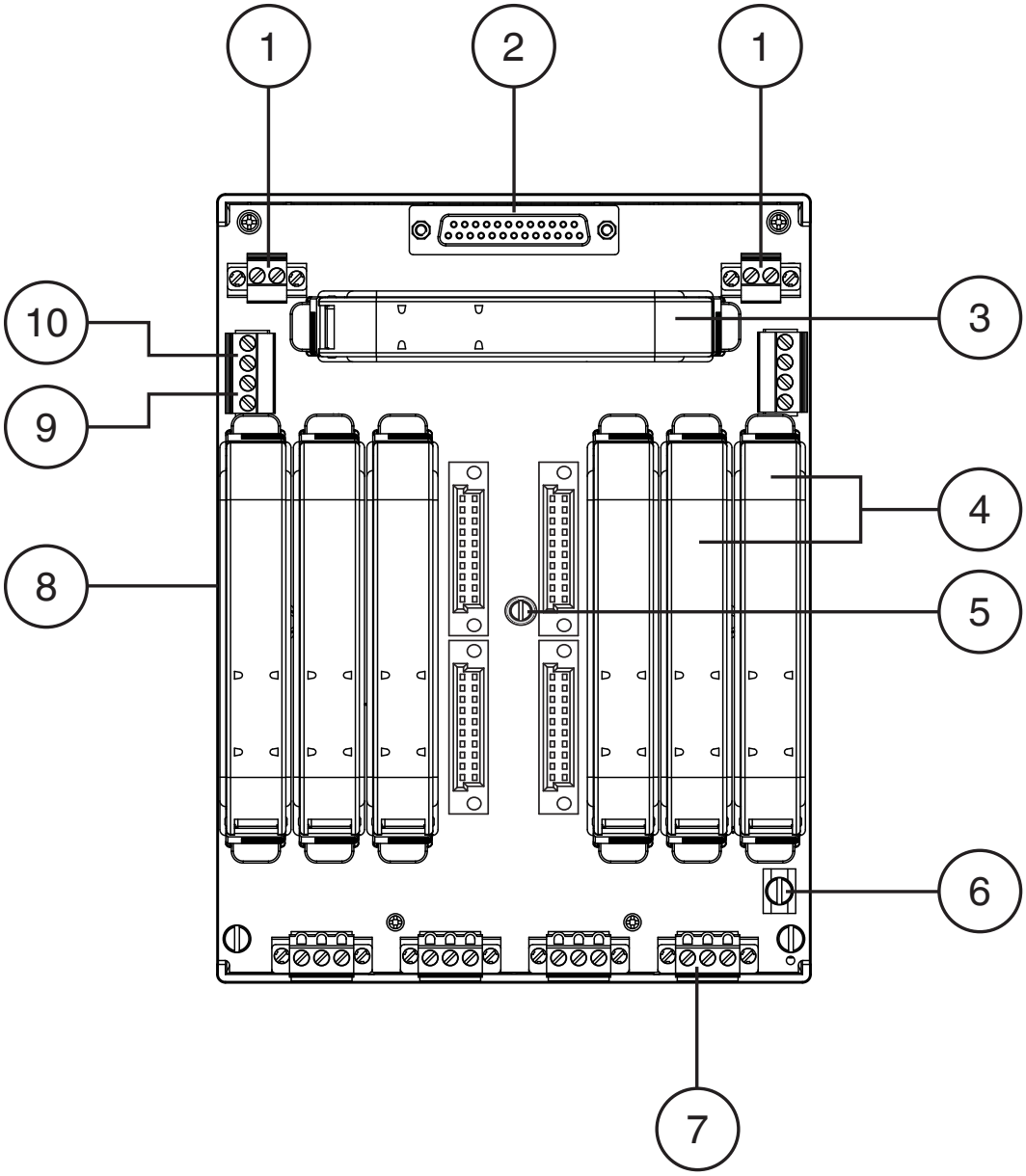

Figure 2.2DART motherboard with DART Power Supply Modules and Diagnostic Module

1 Bulk power connections
2 Host connection for customized system interfaces
3 Diagnostic module
4 Redundant power modules (segment 4)
5 Motherboard fastening screw
6 Screen/ground connection clamp
7 Trunk connection (segment 4)
8 DIN rail slot
9 Diagnostic bus connection
10 Common alarm voltage-free contact

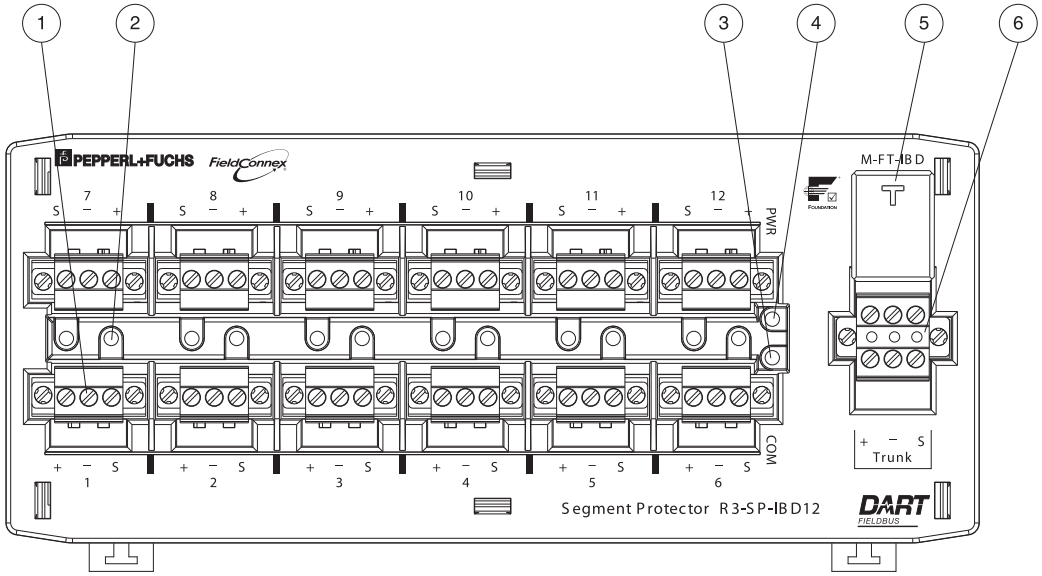

Figure 2.3 DART Segment Protector

1 Spur 1 connection
2 LED ERR Spur 1 (red, short-circuit)
3 LED COM (Communication)
4 LED PWR (Power)
5 Terminator M-FT-IBD, removable
6 T-connector T-CON.3

2.4 Technical Data

The table "System Specifications" below applies to all components listed in this section unless otherwise specified in the table of a certain component.

System Specification	
Ambient conditions	
Ambient temperature	-40 ... 60 °C
Storage temperature	-40 ... 85 °C
Shock resistance	15 g , 11 ms
Vibration resistance	1 g , 10 ... 150 Hz
Relative humidity	< 95 % non-condensing
Mechanical specifications	
Connection type	screw terminals
Core cross-section	2.5 mm^2
Protection degree	IP20
Standard conformity	
Electromagnetic compatibility	NE 21:2006
Protection degree	IEC 60529
Fieldbus standard	IEC 61158-2
Shock resistance	EN 60068-2-27
Vibration resistance	EN 60068-2-6

Motherboard Types MBHD-FB-D-4R*	
Supply	
Rated voltage	19.2 ... 35 V SELV/PELV
Maximum safe voltage	35 V
Rated current	16 A
Power loss	typ. 2.7 W per segment at maximium load
Terminating resistor	100 Ω , integrated
Fault signal	VFC alarm output via connectors
Rated voltage	35 V SELV/PELV
Rated current	1 A

Isolated Power Supply Module Type HD2-FBPS-IBD-1.24.360	
Supply	
Rated voltage	19.2 ... 35 V SELV/PELV
Power loss	typ. 2.7 W per segment at maximium load
Fieldbus interface	
Rated voltage	20.8 ... 22.3 V
Rated current	360 ... 10 mA
Short-circuit current	413 mA
Host-rated voltage	10.2 ... 10.8 V

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Isolated Power Supply Module Type HD2-FBPS-IBD-1.24.360	
Host-rated current	... 40 mA
Host short-circuit current	... 50 mA
Maximum safe voltage	35 V
Indicators/operating means	
LED ERR	red flashing: short-circuit or undervoltage at output
LED PWR	green if U_{out} > 21 V

Basic Diagnostic Module Type HD2-DM-B	
Supply	
Rated voltage Rated current	19.2 ... 35 V
Rated current	20 mA
Power loss	Max. 0.5 W
Indicators/operating means	
LED PRI PWR	green: on, primary bulk power supply connected
LED SEC PWR	green: on, secondary bulk power supply connected
LED ERR	red: 2 Hz flashing, power supply fault (short-circuit, undervoltage), redundancy fault
Fault signal	VFC alarm

Advanced Diagnostic Module Type HD2-DM-A.RO	
Supply	
Rated voltage	19.2 ... 35 V
Rated current	40 ... 25 mA
Power loss	max. 1 W
Fieldbus interface	
Number of segments	4
Rated voltage	9 ... 32 V
Indicators/operating means	
LED PRI PWR	green: on, primary bulk power supply connected
LED SEC PWR	green: on, secondary bulk power supply connected
LED Seg 1...4	yellow: bus activity; yellow 2 Hz flashing: Maintenance required; red 2 Hz flashing: specification limit violated; red: hardware error
Fault signal	VFC alarm
DIP-switch	fieldbus type , redundant supply , Signal level , Noise level , Jitter

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Advanced Diagnostic Module Type HD2-DM-A	
Supply	
Rated voltage	19.2 ... 35 V
Rated current	110 ... 30 mA
Power loss	max. 2 W
Fieldbus interface	
Number of segments	4
Rated voltage	9 ... 32 V
Indicators/operating means	
LED PRI PWR	green: on, primary bulk power supply connected
LED SEC PWR	green: on, secondary bulk power supply connected
LED Seg 1...4	yellow: bus activity; red 2 Hz flashing: alarm; red: hardware error
Fault signal	VFC alarm
DIP-switch	diagnostic address 1...247, binary coded

DART Segment Protector R3-SP-IBD12	
Fieldbus interface	
Main cable (Trunk)	
Rated voltage	14.5 ... 24 V DC
Rated current	max. 4.5 A
Outputs	
Number of outputs	12
Number of devices per output	1
Rated voltage	min 10.5 V, max. 24 V
Rated current	max. 34 mA
Short-circuit current	max. 47 mA
Voltage drop main cable/outputs	max. 4 V
Voltage drop trunk In/Out	0 V
Terminating resistor	external type M-FT-IBD 100 Ω +/- 10 %
Ambient conditions	
Ambient temperature	-40 ... 70 °C
Storage temperature	-50 ... 85 °C
Relative humidity	< 95 % non-condensing
Shock resistance	15 g 11 ms
Vibration resistance	1 g , 10 ... 150 Hz
Mechanical specifications	
Connection type	screw terminals, removable, with retaining screws
Core cross-section	max. 2.5 mm^2 /AWG 12-24

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Accessories	
Power Hub	
ACC-MB-HDC	Diagnostic link cable Coupling of diagnostic bus between two motherboards, length 6 cm
TP-CON.3.BU	Plug with test probe, 3 pole with screw flange, colour blue, packing unit 4 pcs
Segment Protector	
M-FT-IBD	Fieldbus Terminator for Segment Protector
T-CON.3.BU	Plug with double screw connection for T-connection, 3 pole with screw flange, colour blue, packing unit 4 pcs
TP-CON.3.BU	Plug with test probe, 3 pole with screw flange, colour blue, packing unit 4 pcs

2.5 Dimensional Drawings

All dimensions in millimeters and inches (values in brackets) and without tolerance indication.

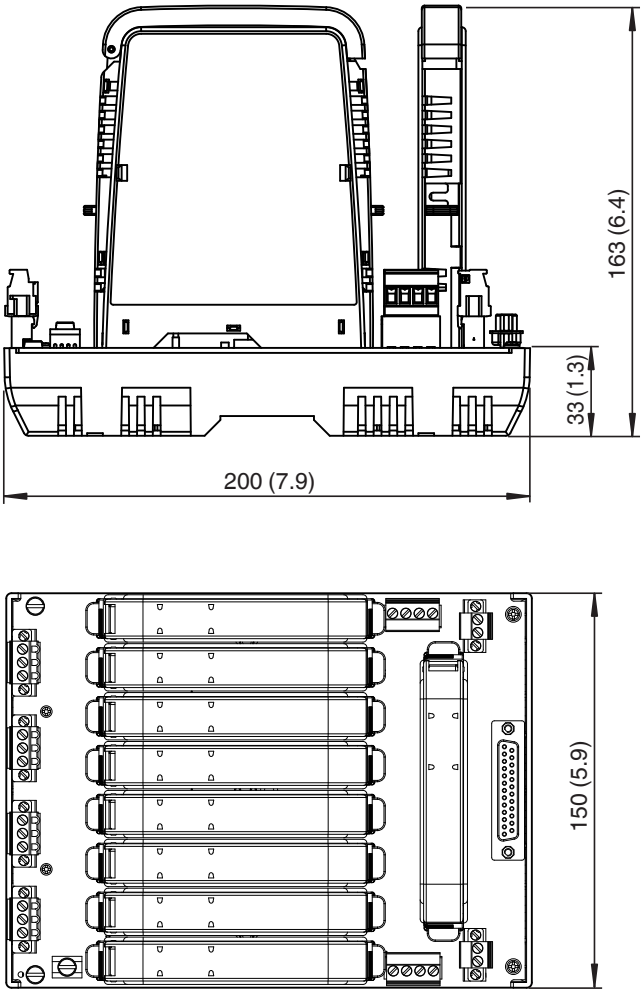


Figure 2.4Dimensions Motherboard MBHD-FB-D-4R.GEN

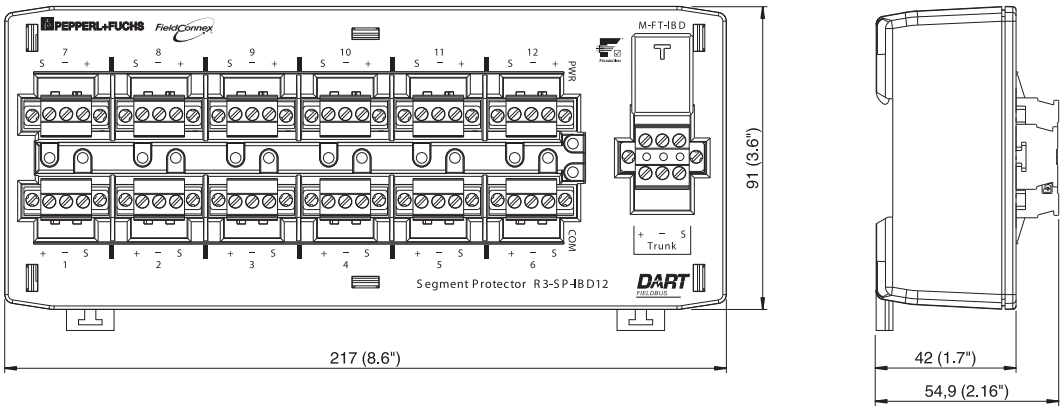


Figure 2.5Dimensions Segment Protector R3-SP-IBD12

3 Installation and Commissioning

3.1 Motherboard and Modules

Observe the recognized rules of technology and setup requirements during mounting, installation and dismounting. For tasks on electrical systems observe the respective safety requirements.

Pay special attention to the following points:

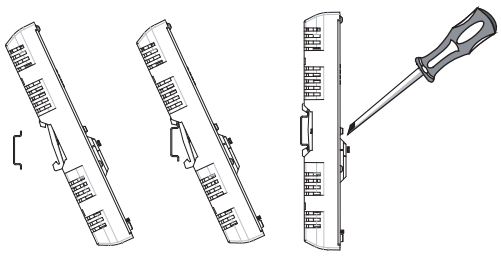
- The Fieldbus Power Supply is installed in accordance with the specification.
- All devices, equipment and cables are free of damage.
- The IP protection is ensured.
- All mounted modules are mechanically locked.

3.1.1 Mounting and Dismounting

Mounting Fieldbus Motherboards on a DIN Mounting Rail

To mount a motherboard on a DIN mounting rail, proceed as follows:

1. Place the motherboard on the mounting rail.
2. Tighten the fastening screw in the middle of the motherboard to attach the motherboard to the DIN rail.



The motherboard has been mounted.

Mounting of Modules on the Motherboard

Caution!
Hardware Damage

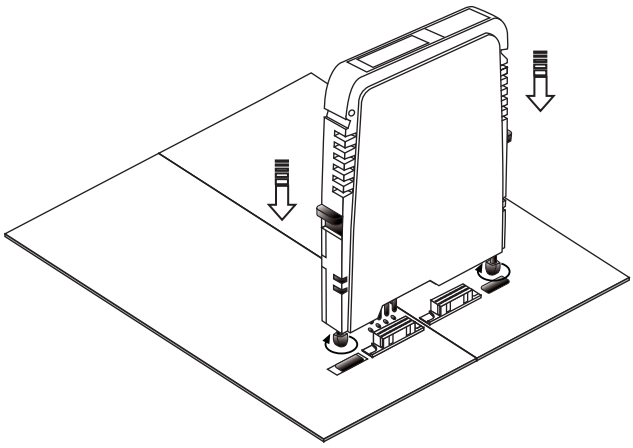
There is a special connection slot for the diagnostic modules HD2-DM* on the Power Hub motherboard, which is labeled “Diagnostic Module only“.

Do not try to plug other modules into this connection slot. Other modules may be damaged.

To install a new module on the motherboard, proceed as follows:

1. Carefully center the polarisation holes and mate the two connectors, then gently press down the module.

2. Push down the red Quick Lok Bars on each side of the module to fix it to the panel (no tools required).



The new module has been installed.

Dismounting of Modules from the Motherboard

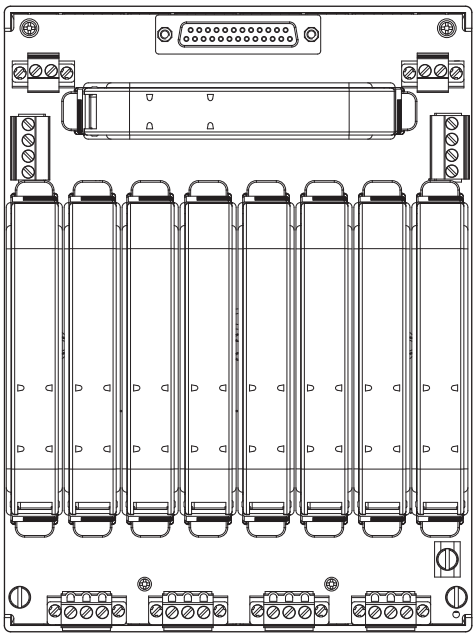
To dismount a module from the motherboard, proceed as follows:

Pull up the red Quick Lok Bars on each side of the module and lift off the entire module carefully.

The module has been removed from the motherboard.

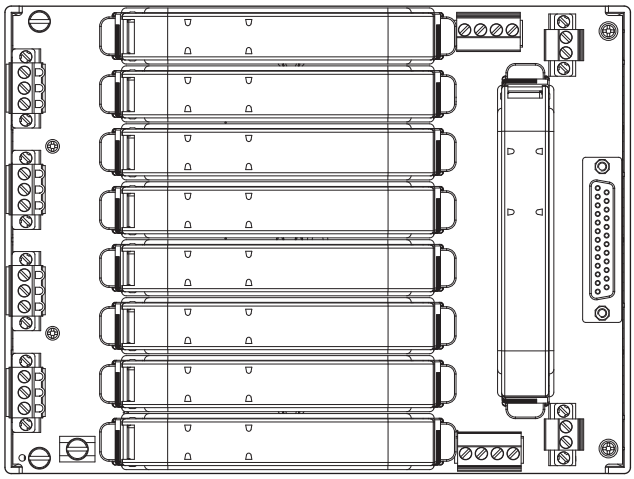
3.1.2 Motherboard Mounting Positions

Vertical Mounting



Permitted temperature range for vertical alignment -40°C to +60°C

Horizontal Mounting



Permitted temperature range for horizontal alignment -40°C to +40°C

3.1.3 Shielding and Grounding

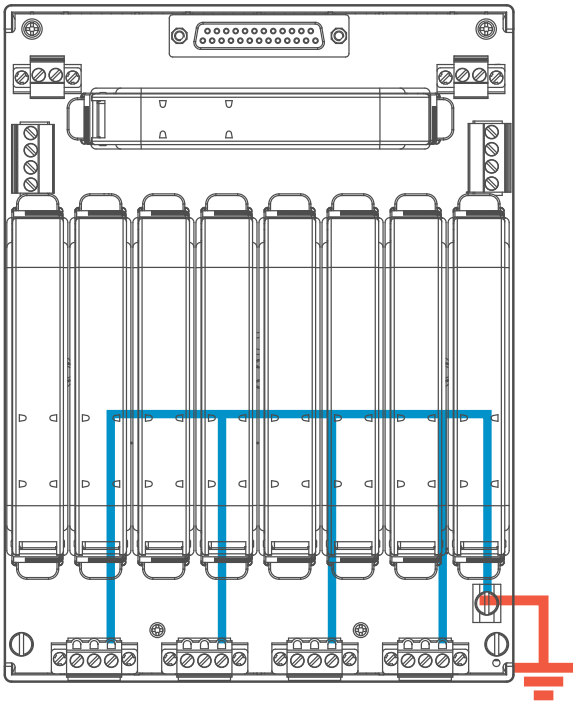


Figure 3.1Internal connections betweeen trunk connectors and ground connection clamp

Connect the motherboards screen/ground clamp to an equal potential bonding system. Use a cable with a minimum cross core section of 4 mm².

The screen/shield connections of the trunks are internally directly connected to the screen/ground clamp.

Each screen/shield host connection is internally connected to the screen/ground clamp through a capacitor of 12 nF.

Caution!
This is not a safety earth.

Under certain conditions, it may be necessary to ground any exposed metal parts to ground.

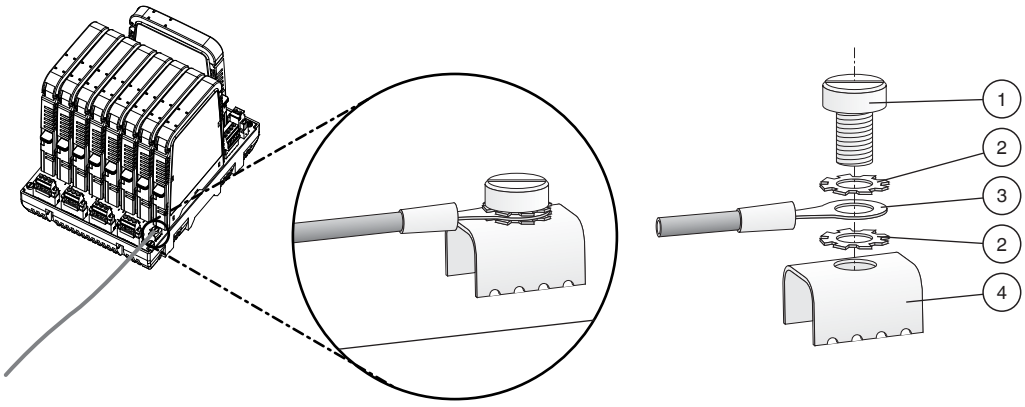
Note that a correct grounding must be guaranteed at all times.

Connecting the ground connection cable

Note!

Use cable with a minimum cross core section of 4 mm².

1. Connect the ground cable to a cable lug.
2. Position the cable lug over the ground connection clamp so that the cable points downwards.
3. Screw the cable lug to the ground connection clamp using two toothed lock washers (see on page 27).
4. Tighten the screw with a torque of 1,5 Nm so that the cable lug can not move.



Connecting the ground connection cable

1 Screw
2 Toothed lock washer
3 Cable lug
4 Ground connection clamp on motherboard

3.1.4 Connections

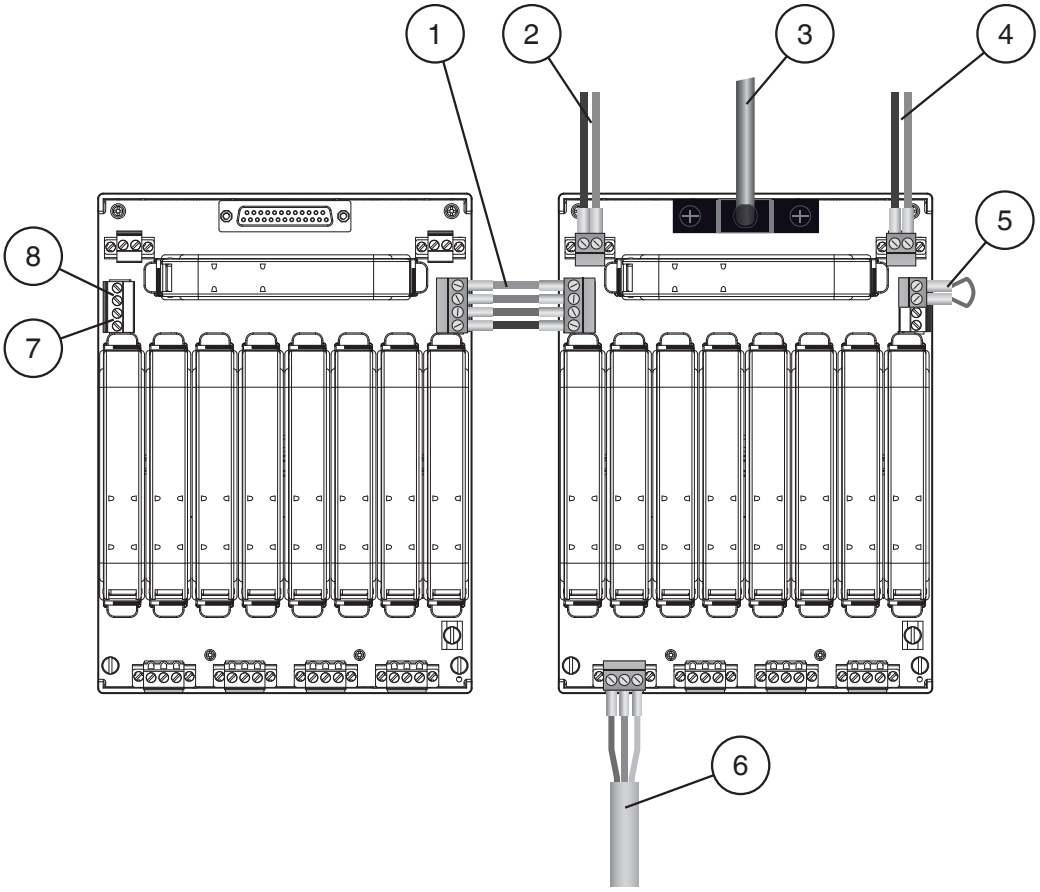


Figure 3.2Connections of the motherboard

1 Diagnostic link cable ACC-MB-HDC for series connection of motherboards
2 Primary connection to bulk power supply
3 Host connection
4 Secondary connection to bulk power supply
5 Final motherboard link (The alarm contact has to be looped at the last motherboard)
6 Connections for fieldbus trunk
7 Diagnostic bus connection
8 Common alarm voltage-free contact

3.1.5 Bulk Power Supply Connections

Each segment (trunk) S1 to S4 is supplied with a pair of redundant power supply modules SEG1A to SEG4A and SEG1B to SEG4B. The bulk power connection consists of two connectors PRI PWR and SEC PWR whilst PRI PWR will feed SEG1A to SEG4A power supply modules and SEC PWR will feed power supply modules SEG1B to SEG4B.

In order to power both power supplies of a segment PRI PWR and SEC PWR must to be connected to an appropriate power source.

3.1.6 Trunk Connections

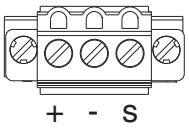
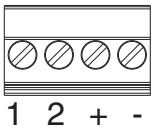


Figure 3.3 Trunk connection layout

Cable and Connection Information

- Permissible cross core section is 0,2 to 0,5 mm²
- Insulation stripping length is 7 mm
- Use end splices to protect strand ends, if stranded conductors are used
- Connectors must be mechanically locked
- Tight the screws with a torque of 0,4 to 0,5 Nm

3.1.7 Diagnostic Link Connections



1 Alarm connection
2 Alarm connection
+ + Diagnostic bus connection
- - Diagnostic bus connection

Cable and Connection Information

- Permissible cross core section is 0,2 to 0,5 mm²
- Insulation stripping length is 7 mm
- Use end splices to protect strand ends, if stranded conductors are used
- Connectors must be mechanically locked
- Tight the screws with a torque of 0,4 to 0,5 Nm

Note!

Use ACC-MB-HDC cable for daisy chaining. This ready-to-use cable with a lenght of 60 mm is available as accesssory.

3.1.8 Segment Termination

Motherboards got integrated terminators for each fieldbus segment.

Caution!
Communication Problems

Wrong termination may cause communication problems or a total communication loss.

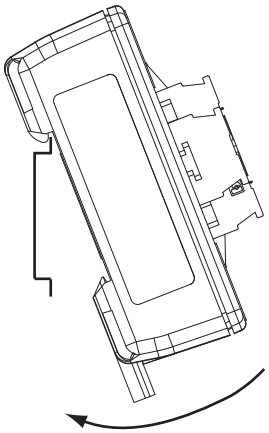
- Make sure that there are two terminators activated on each trunk line.
- One terminator should be located on each end of the trunk line.

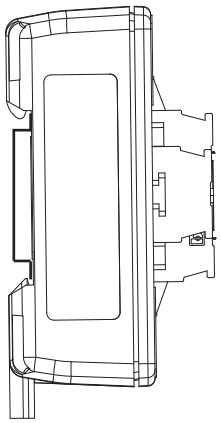
3.2 Segment Protector

3.2.1 Mounting and Dismounting

Mounting the Segment Protector on a DIN rail

1. Place the Segment Protector on the DIN rail.
2. Gently press the Segment Protector to the DIN rail till it is locked in place.





The DIN rail mounting of the Segment Protectors must mesh securely with the rail.

The Segment Protectors must be fixed firmly on the rail.

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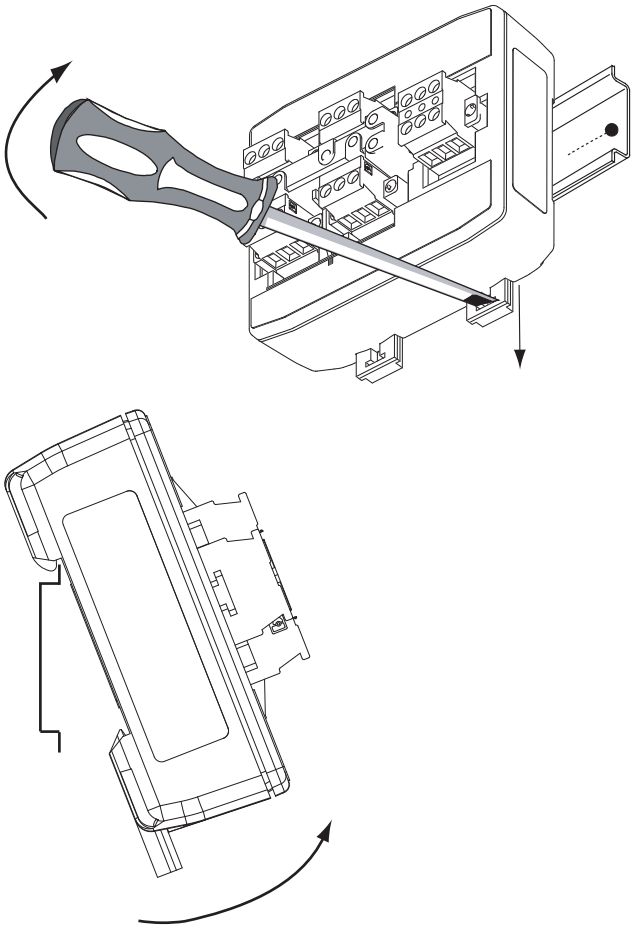
Dismounting is performed in the reverse order.

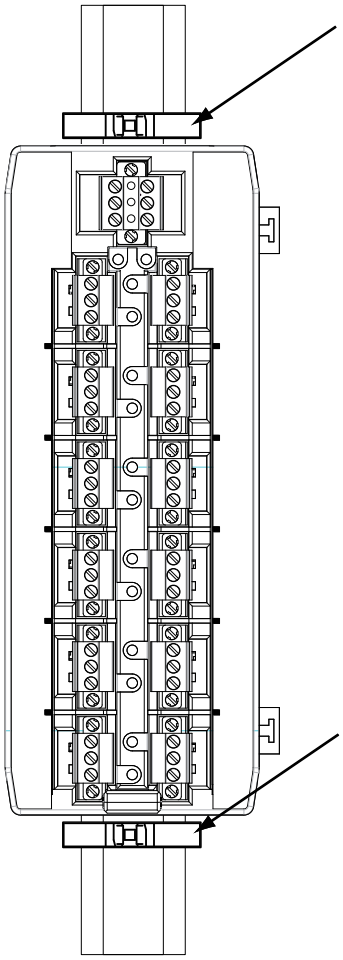
Dismounting the Segment Protector

1. Use a slotted screwdriver to open both latches.
2. Then lift up the device in a semicircular motion.



3.2.2 Additional Information Vertical Mounting

If a Segment Protector is mounted vertically, use end brackets / end clamps on both sides of the Segment Protector to prevent shifting of the device.



Pepperl+Fuchs recommends using the following Phoenix Contact parts:

- Clipfix 35, snap-on end bracket, PHOENIX CONTACT part no: 3022218
- E/UK, screw-fastening end bracket, PHOENIX CONTACT part no: 1201442

For further information please refer to www.phoenixcontact.com.

3.2.3 Grounding / Shielding of Fieldbus Transmission Lines

All shields of the Fieldbus transmission lines (trunks and spurs) are connected inside the Segment Protector. They have no connection to ground/DIN rail.

Warning!
Wrong Wiring Practice

Connection of signal poles of the spur lines to the earth potential or the cable shield may cause major damage.

Do not connect any signal poles of spur lines to earth potential or cable shield.

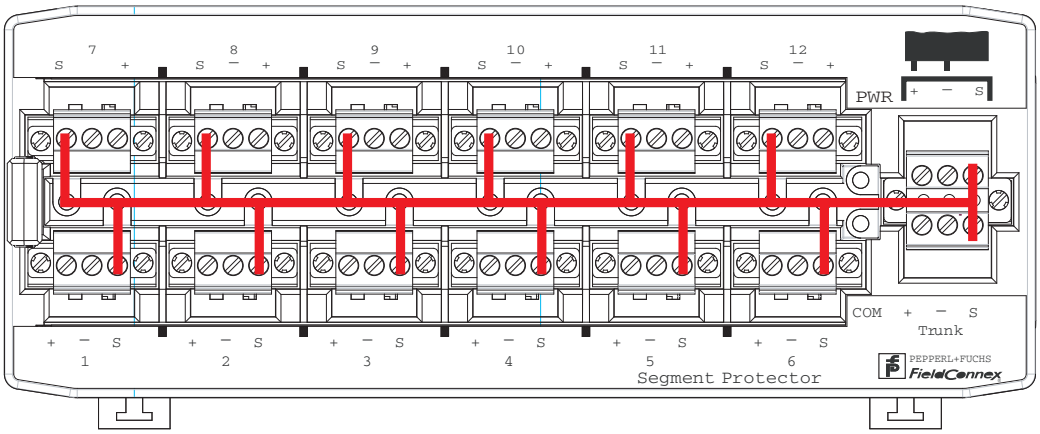
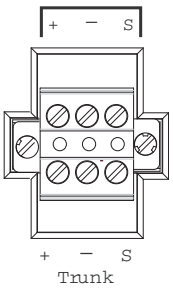


Figure 3.4 Stylized composition of the shield lines within the Segment Protector

If the shield of the trunk or of the spurs of a Fieldbus transmission line is grounded due to EMC considerations, the EN 60079-14 and the corresponding sections of the FOUNDATION Fieldbus Application Guides should be closely observed.

3.2.4 Segment Protector Connection Layout of the Trunk



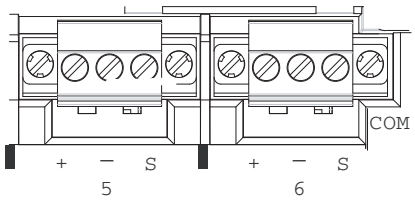
+ Segment +
- Segment -
S Shield connection

The trunk terminals must be fixed with screws to protect against loosening.

Cable and Connection Information

- Permissible cross core section is 0,2 to 0,5 mm²
- Insulation stripping length is 7 mm
- Use end splices to protect strand ends, if stranded conductors are used
- Connectors must be mechanically locked
- Tight the screws with a torque of 0,4 to 0,5 Nm

3.2.5 Segment Protector Connection Layout of the Spurs



5 Spur 5 connector
+ Spur +
- Spur -
S Shield connection

Cable and Connection Information

- Permissible cross core section is 0,2 to 0,5 mm²
- Insulation stripping length is 7 mm
- Use end splices to protect strand ends, if stranded conductors are used
- Connectors must be mechanically locked
- Tight the screws with a torque of 0,4 to 0,5 Nm

3.2.6 Series Connection and Termination

To realize a series connection of several Segment Protectors, loop the Trunk line using T-connectors.

For exchange or maintenance of a Segment Protector within a series connection, pull off the respective T-connector without loosening the Trunk lines. The connection to the remaining Segment Protectors persists.

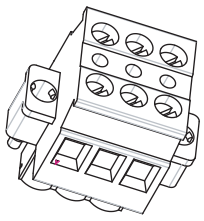


Figure 3.5 T-connector for Trunk and Terminator connection

Mount the delivered Terminator at the last T-connector of the segment to provide segment termination.

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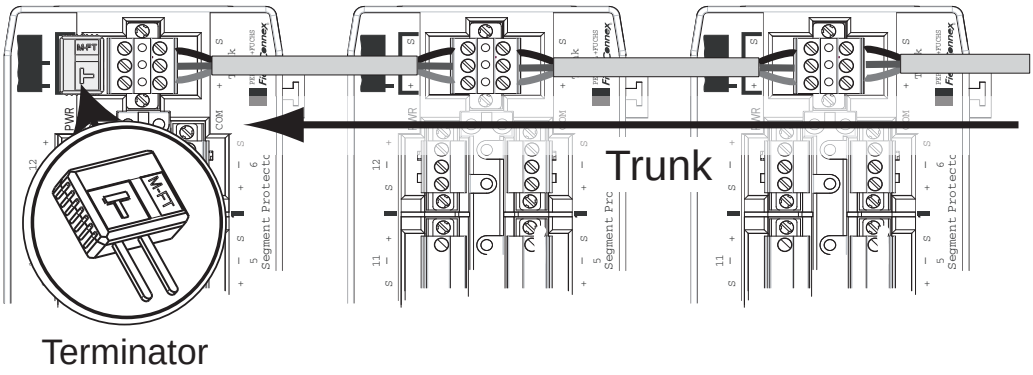


Figure 3.6 Stylized series connection and termination

Note!

As wrong termination may cause communication problems make sure that each trunk is terminated with exactly two Terminators. Only use terminators of the type M-FT-IBD.

4 Hazardous Area Usage

4.1 Installation of the DART Power Hub in Zone 2

The DART Power Hub may be installed in Zone 2. Connection or disconnection of energized non-intrinsically safe circuits is only permitted in the absence of a hazardous atmosphere.

4.2 Intrinsically Safe Circuits

The intrinsically safe circuits of the associated apparatus (DART Power Hub) may lead into hazardous areas Zone 2 Gas Groups IIC, IIB, IIA. Make sure to observe all relevant distances (creepage distances, clearances) to all non-intrinsically safe circuits in accordance with IEC/EN 60079-14.

Up to four DART Segment Protectors R3-SP-IBD* and up to five Surge Protectors *-LBF-I1.36* may be connected to the intrinsically safe outputs of the DART Power Hub.

Circuits in ignition protection class "Ex ib" which have been operated with circuits of other ignition protection classes may not be used as "Ex ib" circuits afterwards.

When connecting intrinsically safe field devices to intrinsically safe circuit spurs of the DART Segment Protector, observe the relevant maximum values of the field devices and DART Segment Protector specified in the explosion protection documentation (certificate of intrinsic safety). Make sure to observe IEC/EN 60079-14 and IEC/EN 60079-25.

The DART Power Hub must be installed at least in an environment according to pollution degree 2.

4.3 Safety Assessment of DART Trunk Connections

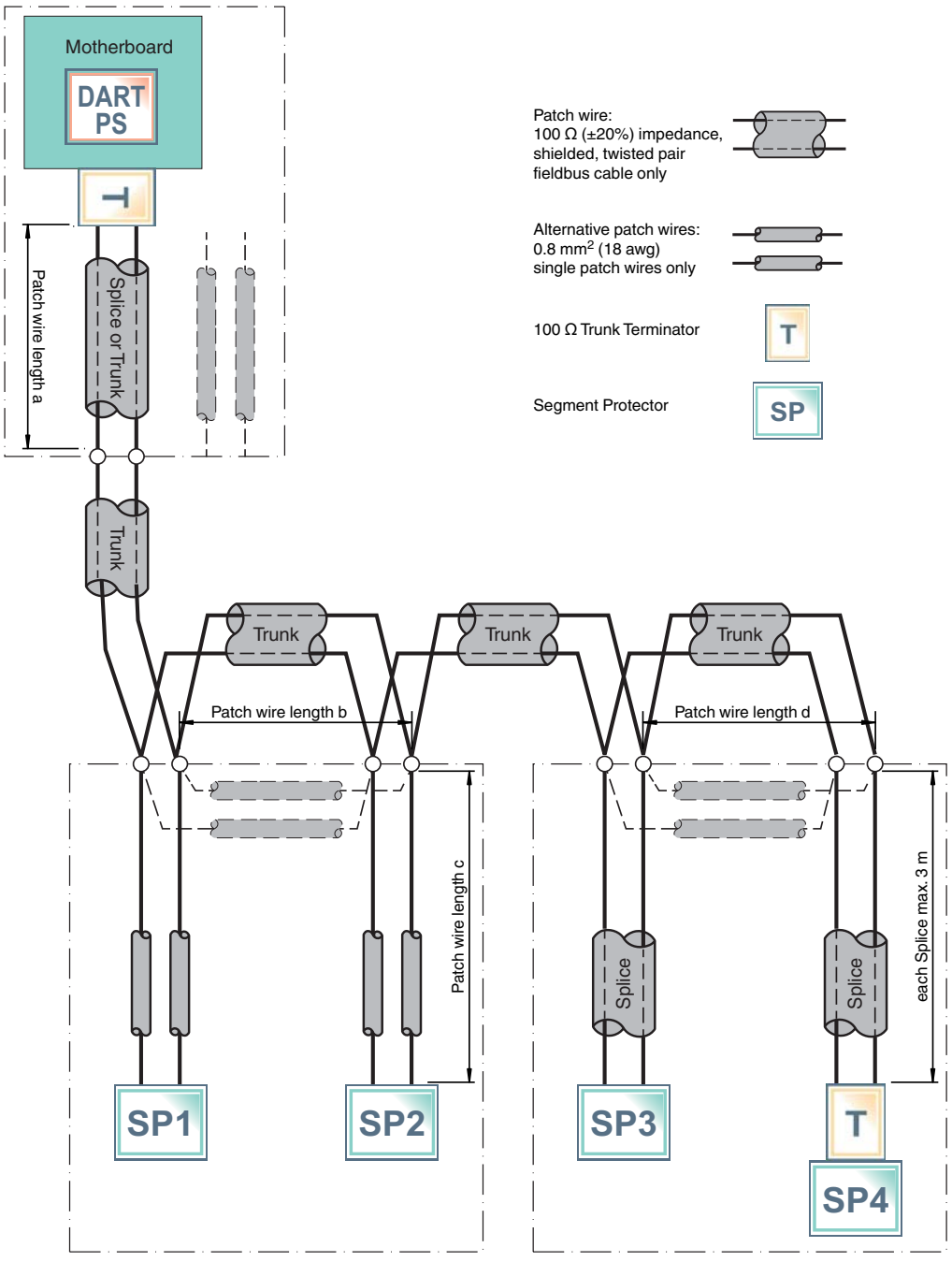
Only DART certified equipment may be connected to the trunk of a DART segment. This includes the DART Power Hub populated with DART Power Supplies HD2-FBPS-IBD*, DART Segment Protectors R3-SP-IBD*, DART fieldbus terminator M-FT-IBD and DART Surge Protectors *-LBF-I1*.

The type of fieldbus cable must be a 100 Ω ±20% shielded fieldbus cable. Depending on the cable resistance, the maximum trunk cable length and the maximum number of DART Segment Protectors connected to a DART trunk are limited.

Cross core section	≥ 0.823 mm² (AWG18)	≥ 1.309 mm² (AWG16)	≥ 2.081 mm² (AWG14)
Max. number of Segment Protectors	Max. trunk cable length Segment Protectors connected in line topology		
1	1000 m	1000 m	1000 m
2	800 m	1000 m	1000 m
3	700 m	1000 m	1000 m
4	600 m	900 m	1000 m

Up to a maximum length of 1000 m, the DART trunk is intrinsically safe. The trunk must be build up in a line topology with a terminator on each end.

The assessment of the DART trunk is limited to a list of DART products, the type of fieldbus cable, and the verification of the cable.



If the Power Supply, Segment Protectors or Surge Protectors are connected via splice cables through a wiring interface to the trunk cable (used to connect the DART components to the trunk), the splice cable may differ from the type of cable used for the trunk, as long the characteristic impedance of 100Ω ±20% is maintained and it is shielded.

The length of the intermediate splice cable is limited to 3 m per connection. If short cable connections are required, to interconnect wiring interface terminals for example, individual 0,8 mm² (18 AWG) patch wires may be used, of up to a total length of 1 m per DART segment. The minimum required core cross sectional area of the patch wires must be 0,8 mm² (18 AWG).

The number of Surge Protectors which are allowed to be connected to a DART trunk is limited to 5. A maximum of two DART Fieldbus Terminators may be connected to a DART trunk whilst one terminator is built into the DART Power Hub backplane.

Other type of equipment may only be connected to the trunk if the equipment is certified as a passive device, not able to feed energy into a DART trunk, and if no hazardous atmosphere is present (hot work permit).

Number of DART Segment Protectors	≤ 4
Number of DART Surge Protectors per trunk	≤ 5
Number of DART Fieldbus Terminators	max. 2
Max. trunk cable length (100 Ω ±20%)	≤ 1000 m

For further information please refer to the installation drawing on the last page of this manual.

4.4 Safety Assessment DART Segment Protector Spur Connection

Entity certified Fieldbus devices are allowed to be connected to the outputs of DART Segment Protectors. All devices that are connected to the outputs must work as a passive current sink (non-feeding).

The maximum safety values of the outputs are:
U_0 = 23 V
I_0 = 47 mA
P_0 = 1.08 W
C_i negligible
L_i negligible

Two different types of safety assessment may be used (see following sub-sections).

4.4.1 Safety Assessment according to the Simplified Entity Model

According to the simplified safety assessment, any type of fieldbus cable may be used for the spurs under following conditions:

Spur cable length	≤ 120 m
Number of fieldbus devices per spur	= 1
Number of Surge Protectors per spur	≤ 2
Number of auxiliary Entity equipment per spur	≤ 1
U_i (field device, surge protector, auxiliary equipment)	≥ 23 V
I_i (field device, surge protector, auxiliary equipment)	≥ 47 mA
P_i (field device, surge protector, auxiliary equipment)	≥ 1.08 W
C_i (field device, surge protector, auxiliary equipment)	≤ 5 nF
L_i (field device, surge protector, auxiliary equipment)	≤ 20 µH

All devices connected to a spur of a DART Segment Protector must be passive (non-feeding).

4.4.2 Safety Assessment according to the Entity Model

Using the standard method to asses an Entity loop, the entity parameters of the devices (field devices, Surge Protectors, auxiliary equipment) and fieldbus cable connected to the spur output have to be less than the entity output parameter of the intrinsically safe source.

U_i	≥ 23 V
I_i	≥ 47 mA
P_i	≥ 1.08 W
$\sum L_i$	≤ 170 µH (gas group IIC) or 1.0 mH (gas group IIB)
$\sum C_i$	≤ 60 nF (gas group IIC) or 470 nF (gas group IIB)

All devices connected to a spur of a DART Segment Protector must be passive (non-feeding).

4.5 Installation Drawing

Note!

Please see chapter 8.3 of this manual for the installation drawing.

5 Fieldbus Power Hub Basic Diagnostics

The Fieldbus Power Hub System provides integrated self-supervision functionality located within the Power Modules and the Motherboards. Additionally, a Basic Diagnostic Module is available to monitor bulk power supply status and compatibility of the mounted Power Modules in redundant systems. The following conditions are monitored:

- Availability of the bulk power supply
- Output voltage per segment
- Overload or short circuit per segment
- Power Module failure

The status of the Power Hub is shown by LED indication and by a normally closed, voltage-free contact. Normal operating conditions are shown by green LEDs, the voltage-free contact is closed. See table below for detail diagnostic information.

Fault	Relay Contact	Diagnostic Module	Power Module
A: Supply Under/Over Voltage Detection			
> 18.5 V DC +/- 4 % < 35.8 V DC +/- 4 %		PRI PWR SEC PWR ERR	PWR ERR
< 17.5 V DC +/- 4 % > 36.8 V DC +/- 4 %*		PRI PWR SEC PWR ERR	PWR ERR
B: Power Module compatibility redundant system only			
All modules have intact redundancy partner		PRI PWR SEC PWR ERR	PWR ERR
Only one Power Module is fitted to a segment		PRI PWR SEC PWR ERR	PWR ERR
C: Power Module or load status			
Power Module failure		PRI PWR SEC PWR ERR	PWR ERR
Output overload or trunk short circuit		PRI PWR SEC PWR ERR	PWR ERR
All Power Modules fixed and healthy		PRI PWR SEC PWR ERR	PWR ERR

6 Repair and Maintenance

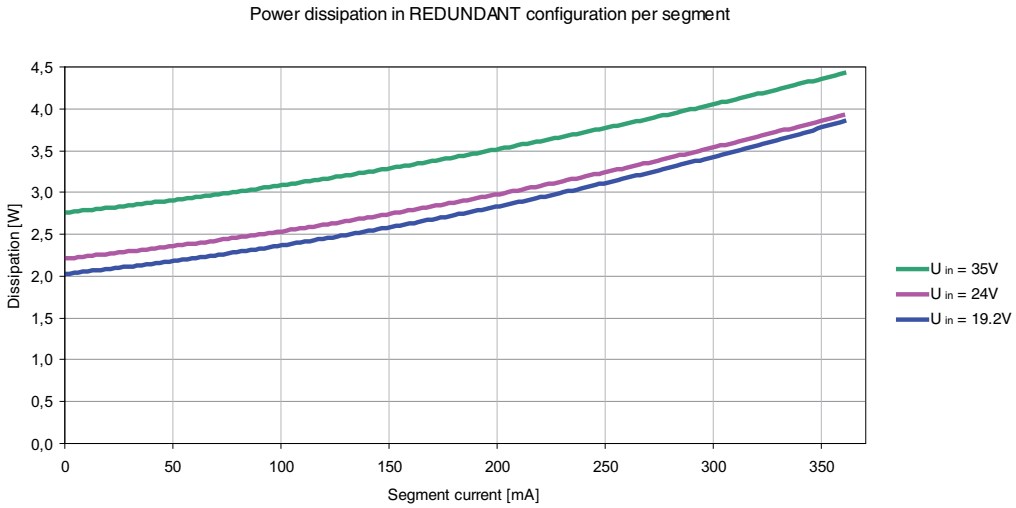
DART Fieldbus components are stable even over long periods of time. Thus regular adjustments or similar tasks are not required.

7 Thermal Dissipation

Thermal Dissipation of HD2-FBPS-IBD-1.24.360

Each Fieldbus Power Supply will dissipate, i. e. lose energy in form of heat. The graph below illustrates typical power dissipation values in Watts for one segment in redundant mode including motherboard power losses for given output currents and supply voltages.

The host interface is loaded with a maximum current of 40 mA.



8 Appendix

8.1 Ordering Information

Designation	Description
HD2-FBPS-IBD-1.24.360	DART Fieldbus Power Supply Module with 20.8 ... 22.3 V DC and 360 mA output.
HD2-DM-B	Basic Diagnostic Module with LED indication and common relay fault output.
HD2-DM-A	The Advanced Diagnostic Module allows, in conjunction with the FDT/DTM based Diagnostic Manager, to analyze signal and segment parameters as well as measurement of specific system and node physical layer values.
HD2-DM-A.RO	The Advanced Diagnostic Module (Relay Output) allows online monitoring of fieldbus segments, Diagnostics for fieldbus physical layer and power supply. Alarm limits configurable via DIP switches.
R3-SP-IBD12	The DART Segment Protector is a fieldbus device coupler for connection of up to twelve intrinsically safe Entity certified field instruments to a DART segment. Certified for installation in Zone 1.
DP-LBF-I1.36.* *-LBF-IA1.36.IE.0	The Surge Protector protects fieldbus equipment safely from damages caused by surge voltages or lightning strikes. For use on a DART fieldbus trunk or on the outputs of a DART Segment Protector.
MBHD-FB-D-4R.GEN	DART 4x redundant segment motherboard for Fieldbus Foundation H1 and PROFIBUS PA with redundant bulk power feed and diagnostic interface, all connectors screw terminal type. Fieldbus host systems with a dedicated system connector can be connected using a customized system cable. Solutions for connecting the DART Power Hub to Pepperl+Fuchs PROFIBUS PA to PROFIBUS DP are available.

Accessories	
Power Hub	
ACC-MB-HDC	Diagnostic link cable Coupling of diagnostic bus between two motherboards, length 6 cm
TP-CON.3.BU	Plug with test probe, 3 pole with screw flange, colour blue, packing unit 4 pcs
Segment Protector	
M-FT-IBD	Fieldbus Terminator for Segment Protector
T-CON.3.BU	Plug with double screw connection for T-connection, 3 pole with screw flange, colour blue, packing unit 4 pcs
TP-CON.3.BU	Plug with test probe, 3 pole with screw flange, colour blue, packing unit 4 pcs

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8.2 Electromagnetic Compatibility Verification in Accordance with EC Council Legislation Directive 2004/108/EC

Compatibility in accordance with EN61326-1:2006 and Namur NE21:2006 recommendation.

The electromagnetic compatibility – EMC – requirements applicable for electrical equipment for measurement, control and laboratory use in general are anchored in the European Standard EN 61326. Three different performance criteria are distinguished in this standard:

A category **A** device operates as intended during the test. This device can withstand the immunity tests without any noticeable performance degradations within the specification limits of the manufacturer.

A category **B** device operates as intended after the test. The device shows temporary degradation or loss of function of performance during the test but self-recovers from that state when the exposures are ceased.

A category **C** device has loss of function, may need manual restoration. During the test a temporary loss of function is allowed as long as an operator can restore the device back to operation.

The requirements of the association for standard and control and regulations of the German chemical industries, defined in the NE21 recommendation, are partly higher compared to the test levels and failure criteria defined in EN61326-1. For the product qualification, failure criteria and test levels have been selected, representing always the worst case conditions.

EN61000-4, as a generic standard, defines the test setups for the specific required test for EN61326-1 and NE21.

Applied standards:

- CE-Conformity 2004/108/EC
- EN61000-4, July 2007
- EN61326-1, October 2006
- EN55011, March 2007
- NE21, Mai 2006

Conducted EMC tests:

Immunity

Standard	Type	Test Level	Category
EN 61000-4-2	Electrostatic discharge, direct contact	6 kV	A
	Electrostatic discharge, indirect, air	8 kV	A
EN 61000-4-3	Electromagnetic field radiated, radio frequency	10 V/m	A
EN 61000-4-4	Fast transients burst on signal lines	1 kV	A
	Fast transients burst on power lines	2 kV	A
EN 61000-4-5	Slow transient surge on signal lines	1 kV	B
	Slow transient surge on shielded lines	2 kV	B
EN 61000-4-6	Conducted immunity, radio frequency	10 V	A
EN 55011	RF conducted emission	Class A	_
	RF radiated emission	Class A	_

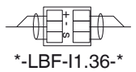
8.3 Installation Drawing

Please see next page to view the installation drawing.

1. INTRINSICALLY SAFE DART CIRCUIT:
THE DASHED LINES ENVELOPE THE DART CIRCUIT. ONLY MATCHED DART CERTIFIED COMPONENTS ARE PERMITTED FOR CONNECTION TO THIS CIRCUIT. FOR PERMITTED DART COMPONENTS, SEE TABLE 3 AND NOTE 7.
STANDARDS: IEC 60079-14 AND IEC 60079-25 APPLY.

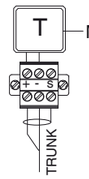
2. INTRINSICALLY SAFE CABLE SHIELD/SCREEN EARTH TO IEC 60079-14 AND 25.
THIS MUST BE CONNECTED TO A CLEAN EQUIPOTENTIAL BONDING SYSTEM TO EARTH.
ALL IS and NON-IS SHIELDS/SCREENS MUST BE CONNECTED TO THE SCREEN (S)TERMINALS OR SOCKET/PLUG PINS.

3. INSTALLATION POSITION OPTIONS FOR SURGE PROTECTOR PART No. *-LBF-I1.36-*
WARNING: A MAXIMUM OF 5 SURGE PROTECTORS CAN BE CONNECTED TO EACH TRUNK AND 2 SURGE PROTECTORS CAN BE CONNECTED TO EACH SPUR. SEE TABLE 2.



-LBF-I1.36-

D See TABLE 3



M-FT-IBD C See TABLE 3

4. A MAXIMUM OF FOUR R3-SP-IBD* SEGMENT PROTECTORS CAN BE CONNECTED.
SEE TABLE 1 FOR TRUNK LENGTH & CABLE SPECIFICATION.
TEMINATOR M-FT-IBD MUST BE FITTED TO THE FINAL SEGMENT PROTECTOR AS ILLUSTRATED RIGHT.
WARNING:
USE ONLY DART APPROVED TERMINATORS PART No. M-FT-IBD.
A MAXIMUM OF ONE TERMINATOR MAY BE INSTALLED IN THE FIELD.

5. DEVICE ENTITY PARAMETERS:
SEE TABLE 2
ALL DEVICES REMAIN PASSIVE; NON FEEDING I < 50µA

6. TO BE MOUNTED IN A SUITABLE ENCLOSURE, WHICH IS CERTIFIED FOR THE PROVIDED USE.

7. AUXILIARY TEST EQUIPMENT (HAND HELD) CONNECTION:
AUXILIARY TEST EQUIPMENT MAY BE CONNECTED TO THE TRUNK, SPUR OR HOST CONNECTION UNDER THE FOLLOWING CONDITIONS:
AUXILIARY TEST EQUIPMENT MUST BE NON-FEEDING, PASSIVE AND CERTIFIED INTRINSICALLY SAFE FOR USE IN ZONE 1 OR ZONE 2.
GAS CLEARANCE (WORKING PERMIT) MUST BE GIVEN WHEN USING NON-DART COMPONENTS ON THE TRUNK.
AUXILIARY TEST EQUIPMENT MAY BE CONNECTED TO THE SPUR OR HOST CIRCUIT WITHOUT GAS CLEARANCE OR WORKING PERMIT.
WHERE THE DART POWER HUB IS INSTALLED IN THE SAFE AREA, HOST CONNECTED AUXILIARY TEST EQUIPMENT MAY NOT NEED TO BE CERTIFIED.
THEY MAY BE FEEDING AND ACTIVE, PROVIDED THAT THEY ARE LIMITED TO AN OUTPUT OF 35 V.

TABLE 1 - TRUNK CABLE AND DEVICES [Ex ib IIC, IIB]			
Cable Cross Sectional Area	≥ 0.823 mm² or 18 AWG	≥ 1.309 mm² or 16 AWG	≥ 2.081 mm² or 14 AWG
No. of Segment Protectors	MAXIMUM TRUNK CABLE LENGTH		
1	1000 m	1000 m	1000 m
2	800 m	1000 m	1000 m
3	700 m	1000 m	1000 m
4	600 m	900 m	1000 m
CABLE IMPEDANCE	100 Ohms +/-20%		
NUMBER OF SURGE PROTECTORS	5 MAXIMUM PER TRUNK - SEE TABLE 3		
NUMBER OF DEVICE COUPLERS	A MAXIMUM OF 4 (FOUR) SEGMENT PROTECTORS ONLY - SEE TABLE 3 & NOTE 4		
AUXILIARY TEST EQUIPMENT:	MAX 1 - SEE NOTE 7, Ui ≥ 24 V, Ii ≥ 413 mA		

TABLE 2 - SPUR CABLE & DEVICES [Ex ib] FOR GAS GROUP IIC (IIB in brackets)				
	SIMPLIFIED ENTITY MODEL			STANDARD ENTITY MODEL
1 PARAMETER	2 DEVICE PARAMETERS	3 SURGE PROTECTOR PARAMETERS	4 NON-FEEDING AUX TEST EQUIPMENT	5 TOTAL SPUR PARAMETERS (The summation of all components including the cable). See note below.
INPUT VOLTAGE Ui	≥ 23 V	≥ 23 V	≥ 23 V	≥ 23 V
INPUT CURRENT Ii	≥ 47 mA	≥ 47 mA	≥ 47 mA	≥ 47 mA
INPUT CAPACITANCE Ci	≤ 5 nF	≤ 5 nF	≤ 5 nF	IIC: ≤ 60 nF, IIB: ≤ 470 nF
INPUT INDUCTANCE Li	≤ 20 µH	≤ 20 µH	≤ 20 µH	IIC: ≤ 170 µH, IIB: ≤ 1 mH
INPUT POWER Pi	≥ 1.08 W	≥ 1.08 W	≥ 1.08 W	≥ 1.08 W
NUMBER OF DEVICES PER SPUR	1 MAXIMUM	2 MAXIMUM	1 MAXIMUM	See left, column 2,3 and 4
SPUR CABLE LENGTH	≤ 120 m			
CABLE IMPEDANCE	100 Ohms +/-20%			
AUX. TEST EQUIPMENT	MAX 1, SEE NOTE 7, SAFETY VALUES AS FOR DEVICES			
NOTE: The entity parameters can be established by meeting the individual parameters in column 2, 3 and 4. Alternatively, the entity parameters can be established by adding up each component's parameters to ensure that the total spur parameters in column 5 are met, which include the cable parameters Li and Ci.				

NON INTRINSICALLY SAFE CIRCUITS MAXIMUM SAFETY INPUT VOLTAGE: Um = 35V PELV/SELV.

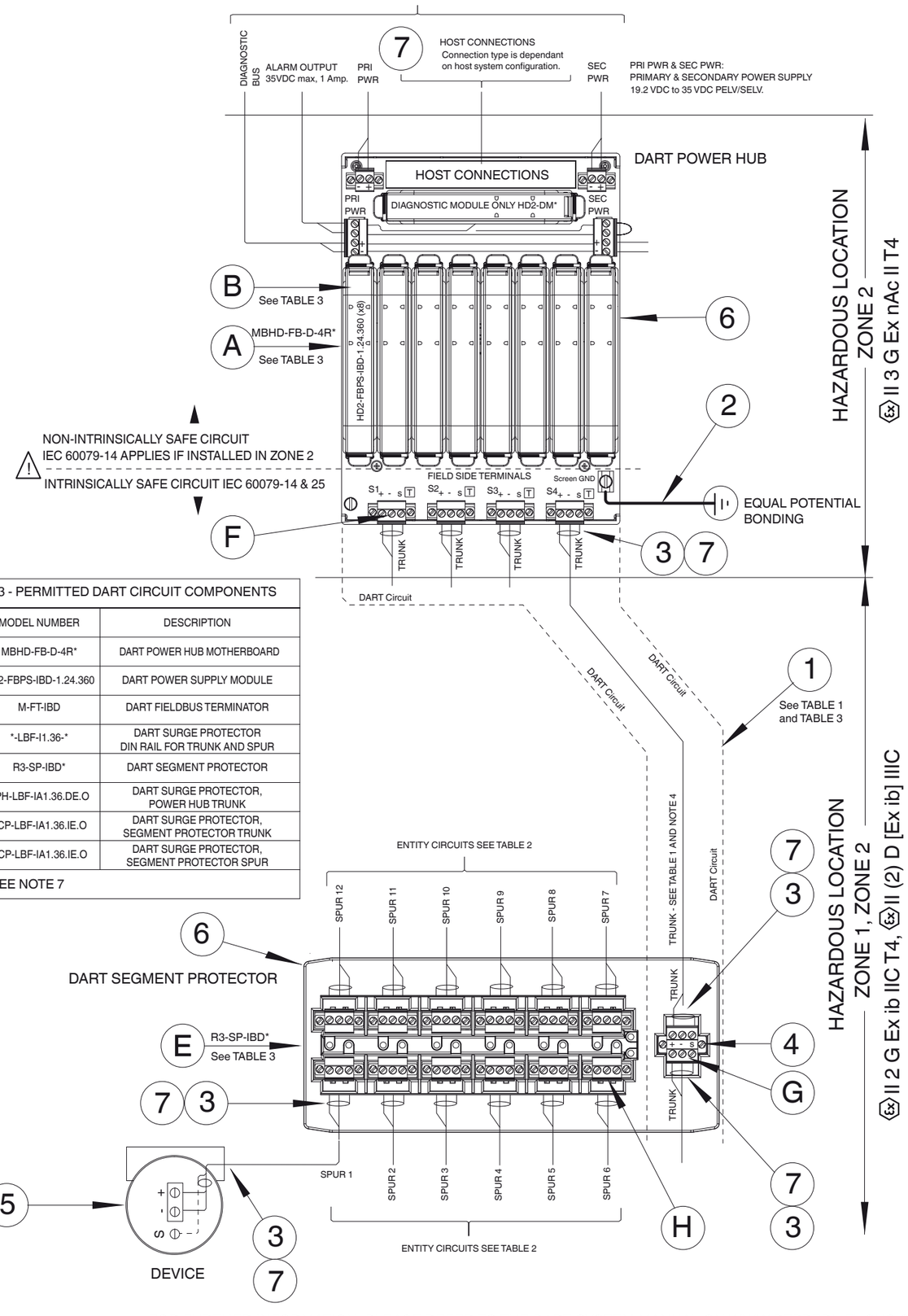


TABLE 3 - PERMITTED DART CIRCUIT COMPONENTS		
No.	MODEL NUMBER	DESCRIPTION
A	MBHD-FB-D-4R*	DART POWER HUB MOTHERBOARD
B	HD2-FBPS-IBD-1.24.360	DART POWER SUPPLY MODULE
C	M-FT-IBD	DART FIELDBUS TERMINATOR
D	*-LBF-I1.36-*	DART SURGE PROTECTOR DIN RAIL FOR TRUNK AND SPUR
E	R3-SP-IBD*	DART SEGMENT PROTECTOR
F	TPH-LBF-IA1.36.DE.O	DART SURGE PROTECTOR, POWER HUB TRUNK
G	TCP-LBF-IA1.36.IE.O	DART SURGE PROTECTOR, SEGMENT PROTECTOR TRUNK
H	SCP-LBF-IA1.36.IE.O	DART SURGE PROTECTOR, SEGMENT PROTECTOR SPUR
ALSO SEE NOTE 7		

FOR FURTHER INFORMATION, PLEASE REFER TO THE DART SYSTEM MANUAL ON WWW.PEPPERL-FUCHS.COM

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