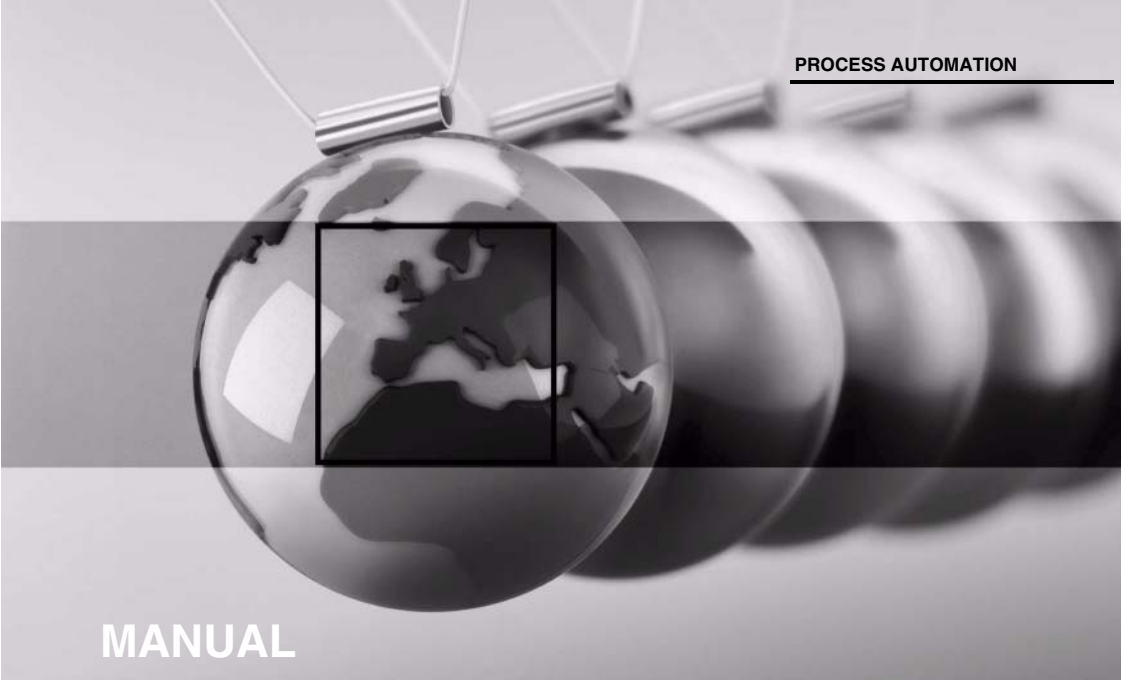
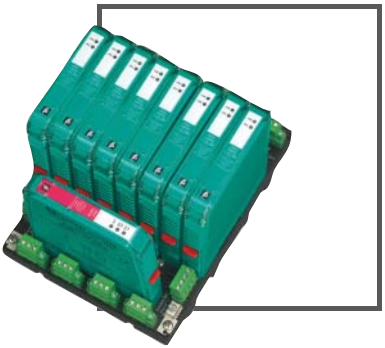


MANUAL

FIELDBUS POWER HUB HIGH DENSITY



PEPPERL+FUCHS
PROTECTING YOUR PROCESS

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1 Used Symbols

Safety-relevant Symbols

Danger!
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

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

In the event the warning is ignored, the consequences may couse personal injury or heaviest property damage

Caution!
This symbol warns of a possible fault.

Failure to observe the instructions given in this warning may result in the devices and any connected facilities or systems develop a fault or fail completely.

Informative Symbols

Note!
This symbol brings important information to your attention.

Action

This symbol marks an acting paragraph.

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2 Safety Information

Protection of operating personnel and the system is not ensured if the product is not used in accordance with its intended purpose.

The operator of the system is responsible in terms of planning, mounting, commissioning, operating and maintenance.

If devices are operated in general electrical systems, they must thereafter not be operated in electrical systems that are connected with hazardous areas.

Installation and commissioning of all devices must be performed by a trained professional only.

Devices being operated in connection with hazardous areas may not be changed or manipulated. If there is a defect, the product must always be replaced with an original part.

In case of defect, the device must be removed and replaced with a new one.

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

Devices must be mounted for installation in the safe area in a housing which corresponds at least to protection class IP 20 per EN 60529.

The Statement of Conformity and any included "special conditions for safe use“ must be observed.

If plastic enclosures are used in the hazardous area, they must be constructed in such a way that if used as intended, ignition dangers from electrostatic charge during maintenance and cleaning are avoided.

The connection and disconnection of non-power-limited circuits carrying current is permitted only during installation or maintenance, or for purposes of repair.

The Declaration of Conformity and Certificate of Compliance of all parts belonging to the Fieldbus Power Hub system must be observed. It is especially important to pay attention to any special conditions for safe use that are indicated.

The Fieldbus Power Hub should be installed in a protection class IP 54 or better enclosure in accordance with EN 60529.

Only devices which are suitable for operation in hazardous areas Zone 2/ Div. 2 and the conditions present at the place of operation (see Declaration of Conformity or Certificate of Compliance), shall be connected to non-energy limited circuits in Zone 2, resp. Class I, Div. 2.

In a Zone 2 installation, connection or disconnection of energized non-energy-limited circuits on the trunk is only permitted during installation, maintenance or for repair purposes since the presence of an explosive atmosphere during the short period of installation, maintenance or repair is considered as improbable.

Special care must be taken if Power Supplies are to be used in conjunction with Pepperl+Fuchs Segment Protectors for energy limited, non-incendive field wiring. A check must be made to ensure that the correct Power Supply type is used in relation to its output values. For example, the output voltage must be equal or less than the maximum voltage of the connected field devices.

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3 Introduction

This document describes the Fieldbus Power Hub System, which consists of the following products:

Product	Specification
MBHD-FB-4R	Motherboard 4x redundant Fieldbus segments (8x Power Supplies + 1x Diagnostic module)
HD2-FBPS-1.25.360	Isolated Fieldbus Power Supply, 25 - 27 V, 360 mA output
HD2-DM-B	Basic Diagnostic Module
HD2-DM-A	Advanced Diagnostic Module (general description only, see corresponding manual and data sheet)

These operating instructions assume technical knowledge and experience with FOUNDATION Fieldbus technology as well as explosion protection.Laws and regulations applicable to the usage or planned purpose of usage must be observed.Devices are only approved for proper usage in accordance with intended purpose. Improper handling will result in voiding of any warrantee or manufacturer's responsibility.

The Declaration of Conformity, Certificate of Compliance and data sheets are an integral part of this document. The data sheet contains the electrical data of the Declaration of Conformity and the Certificate of Compliance.

The documents mentioned are available from http://www.pepperl-fuchs.com or contact your local Pepperl+Fuchs representative.

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4 Instructions

4.1 Intended Use

The Fieldbus Power Hub HD product range is intended to power up to four FOUNDATION Fieldbus H1 segments in redundant mode according to IEC 61158-2. It is intended for the use of HD2-FBPS-1.25.360 Power Supply Modules only.

The Fieldbus Power Hub HD product range may be installed in Zone 2 or Class I Division 2 hazardous areas. Type of protection is EEx nA (non-arcing) for Zone 2 Gas Groups IIC, IIB, IIA, and non-incendive for use in Class I Division 2 Gas Groups A, B, C and D.

Laws and/or regulations governing the use or intended use must be observed. The Fieldbus Power Hub HD products are only approved for proper professional use in accordance with the intended purposes. Improper handling will void any claim made under the warranty as well as any manufacturer's liability.

The Fieldbus Power Hub HD must only be operated by trained professionals in accordance with this manual.

4.2 Marking

The Fieldbus Power Hub product range is product-specifically marked with:

Motherboard	Power Supply Module	Basic Diagnostic Module
Pepperl+Fuchs GmbH	Pepperl+Fuchs GmbH	Pepperl+Fuchs GmbH
Fieldbus Power Hub	Fieldbus Power Hub	Fieldbus Power Hub
MBHD-FB-****	HD2-FBPS-1.25.360	HD2-DM-B
TÜV 06 ATEX 553229 X	TÜV 06 ATEX 553229 X	TÜV 04 ATEX 2500 X
II 3 G Ex nA II T4	II 3 G Ex nA II T4	II 3 G EEx nA C IIC T4

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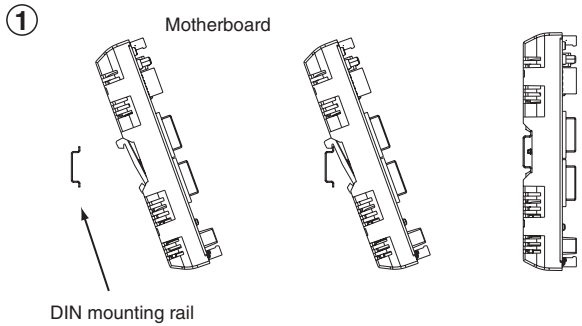
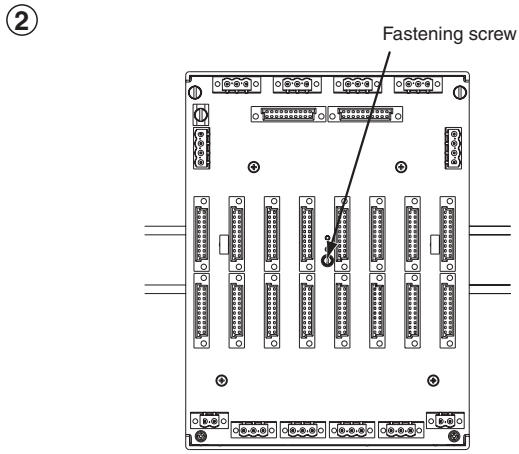
4.3 Mounting and Dismounting

Mounting of Fieldbus Motherboards on 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 to attach the motherboard on the DIN rail.





The motherboard has been mounted.

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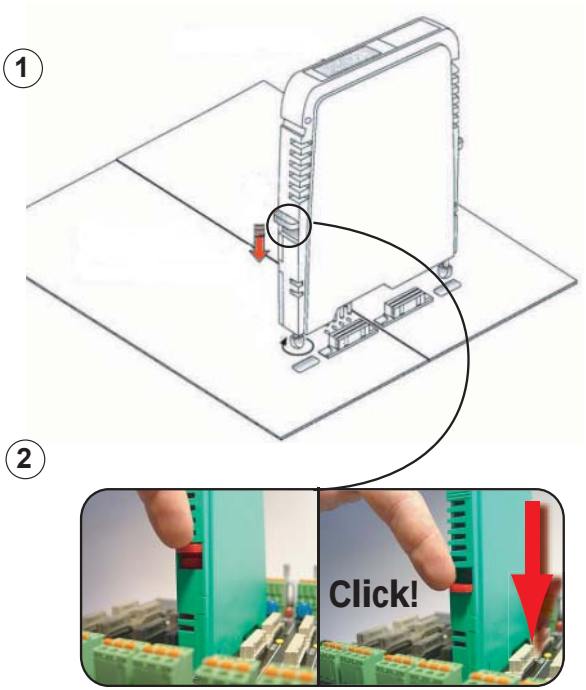
Mounting of HD2*-Modules on the motherboard

Caution!

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.

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Dismounting of HD2* Modules from the Motherboard

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

Push the red Quick LOK bars upwards and lift off the entire module gently.

The module has been removed from the motherboard.

4.4 Repair and Maintenance

If a motherboard is defective, it can be removed from a chain of Power Hubs by linking the two adjacent motherboards by means of a relief connection. The replacement of any part of the Fieldbus Power Hub may be done under live conditions.

Tasks for eleminating malfunctions must only be performed by specialists who are specially trained and authorized for the task.

4.5 Disposal

Disposal of devices and their packaging material must be performed in compliance with the applicable laws and guidelines of the corresponding country.

The devices do not contain batteries which need to be disposed of separately from the products.

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5 Specification

5.1 Overview

The FieldConnex High-density Power Hub is a high-performance power supply for FOUNDATION Fieldbus with redundant configuration as standard for four segments. It consists of a motherboard with sockets for plug-in modules: Two power supply modules per segment and a diagnostic module. The Power Hub is designed for use with fieldbus systems in accordance with IEC 61158-2. This standard specifies how power and communication are transmitted sharing one shielded twisted-pair cable. Communication between field devices and a host system is established by modulating the data signal onto the power stream utilizing Manchester Bus Powered (MBP) transmission.

All FieldConnex Power Hubs feature superior design elements. The main design points are redundancy, passive impedance generation, well balanced circuitry and low heat dissipation.

All active electronic components are located in the plug-in modules. Each module holds the electronic components for only one segment and two modules build a redundant configuration. When an exchange becomes necessary only the smallest amount of electronic components is exchanged compared to block configurations for power supplies. 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 is thus undisturbed. Low heat dissipation allows highest packing density inside the cabinet and a very long service life.

The Power Hub feeds fieldbus segments following the High-Power Trunk concept for explosion protection. High energy level on the trunk line is fed to the field instrument via FieldBarriers or Segment Protectors – wiring blocks with energy limitation according to FISCO, Entity, or if you have ever purchased a device: FNICO at each spur. The instrument can be installed in Zone 0/Div. 1 and maintained while the system is energized. Thus limitations for explosion protection are overcome enabling maximum cable lengths and highest number of devices in any explosive area.

A plug-in Advanced Diagnostic Module for fieldbus is available. This module monitors the physical layer online and in real time enabling detection of degradation and faults during operation. Measurement data and alarms 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 and while the plant is running smoothly.

The following table summarizes the main features and benefits of the Power Hub:

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Features	User benefit
Low heat dissipation of less than 2 W per segment under full load condition.	Long service life. Very high packing density and reduced cooling requirements.
Exchange of modules while the system is energized and load share between power modules.	Increased segment availability
Full balance of electric circuitry with high isolation against RF and in-band interference	High resistance to external disturbance such as EMI.
High-integrity passive power conditioners	Long service life.
Local and remote alarm annunciation	Easy maintenance and troubleshooting
Tolerance against inrush currents during segment start	Long-term, robust operation with tolerance towards field device misbehavior
Full current span operation from 10…350 mA	Flexible segment design and tolerance against live working on field devices
Advanced Diagnostic Module for physical layer fieldbus diagnostics	Improved and known quality of fieldbus installation. Live supervision for preventive and pro-active maintenance. Professional Tools for easy fieldbus troubleshooting

5.2 System components

5.2.1 Motherboard

MBHD-FB-4R

The motherboard MBHD-FB-4R allows the redundant supply of four fieldbus segments and the connection of the FOUNDATION Fieldbus H1 Host system. The eight sockets will hold the power supply modules, two each supply one of the four segments redundantly. The extra socket will hold a diagnostic module.

5.2.2 Power Supply Module HD2-FBPS-1.25.360

Modules providing full galvanic isolation between bulk power supply and fieldbus segments are called “Power Supply Modules“. 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. In redundant configuration load is shared between two power modules.

5.2.3 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.

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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.

5.3 Fieldbus Power Hub Basic Diagnostics

Self-supervision functions consist of circuitry located in the motherboard, the Power Modules and an optional diagnostic module. Basic Diagnostics monitor the Power Hub System for the following conditions:

- Availability of bulk power supplies
- Output voltage and overload or short circuit conditions per segment
- Module failure

Basic diagnostics provide a system integrity check: A missing or not available power supply module on a given segment is visually annunciated by the Basic Diagnostic Module.

Visual alarm notification, which meets the requirements of NAMUR BE44, is provided by both the Power Supply and Diagnostic Modules. Green LEDs and a normally closed, potential-free contact indicate normal system operation. If an abnormal system condition is detected, a red LED starts flashing. Simultaneously, the relay contact opens.

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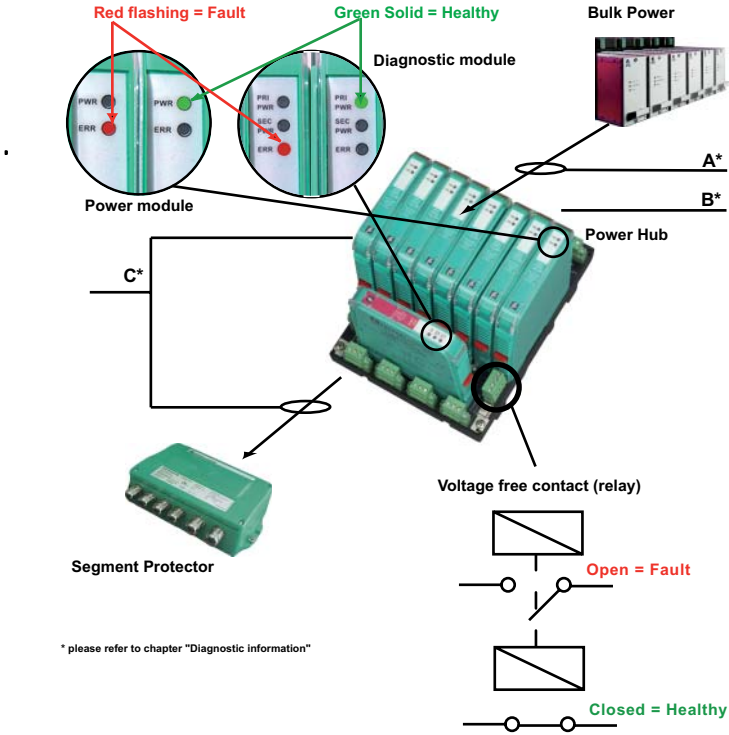
The following figure illustrates the locations of the LEDs on the Modules. The table in chapter “Basic diagnostic information” details possible system conditions and respective indication at the Power Hub.



5.3.1 Basic 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

Fault	Relay Contact	Diagnostic Module	Power Module
< 17.5 V DC +/- 4 % > 36.8 V DC +/- 4 %[a]		○ PRI PWR ○ SEC PWR ● ERR	○ PWR ● ERR

B: Power Module compatibility

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

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Fault	Relay Contact	Diagnostic Module	Power Module
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

a: For the Diagnostic Module, the power (PWR) indicator will show the status of each bulk power connection. Example: If the primary supply fails, the Primary Bulk Power LED (PRI PWR) will go out and the ERR LED will flash. The Secondary Bulk Power LED (SEC PWR) will continue to show green.

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5.4 Mobile Advanced Diagnostic Module DM-AM

The Mobile Advanced Diagnostic Module DM-AM is aUSB powered universal tool to analyze the PhysicalLayer parameters of a fieldbus segment. The integratedUSB 2.0 fullspeed interface permits a simple handlingand the necessary convenient portability in the field:It can be connected anywhere on the Fieldbus network.

Used in conjunction with the FDT/DTM based PC software package itprovides basic analysis of signal and segment parameters e. g. measurementof specific system and node physical layer values e. g. increasingnoise or jitter levels and unbalance detection. The integratedpowerful oscilloscope function enables to visualize the communicationat a segment. The continuous monitoring of all relevant physical layerparameters allows to detect proactive degradations before the segmentcommunication fails.

As a part of the PACTware™FieldConnex®DTM collection, a DTM isoffered which supports e. g. alarming, trending, report generation andoscilloscope function.

Note!

A special manual and/or datasheet is available for this particular product! Please refer to the respective documentation for further information. You can download it from www.pepperl-fuchs.com.

5.5 Technical Data

System Specification	
Ambient Conditions	
Ambient temperature	-40 ... 60 °C
Storage temperature	-40 ... 85 °C
Shock resistance	15 g 11 ms
Vibration resistance	1 g, 58 to 150 Hz
Humidity	< 95 % non condensing
Mechanical specification	
Connection type for external wiring	Plug with screw flange
Cross core section	Up to 2.5 mm^2
Protection degree	IP 20 acc. to EN 60529
Motherboard mounting	DIN rail 35 mm
Standards	
Shock resistance	DIN EN 60068-2-27
Vibration resistance	DIN EN 60068-2-6
EMC	Namur NE 21 EN 61326 IEC 61158-2
Fieldbus	IEC 61158-2

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System Specification	
Hazardous area classification	
Approvals	Zone 2 II 3 G EEx nA II T4 Class I Division 2 Gas Groups A-D

Basic Diagnostic Module Type HD2-DM-B	
Supply	
Rated voltage	19.2 ... 35 V DC
Rated current	20 mA
Power dissipation	Max. 0.5 W
Indicators/operating means	
LED Pri Power	Green: primary input power connected
LED Sec Power	Green: secondary input power connected
LED ERR	red: 2 Hz flashing, power supply fault (short circuit, undervoltage), redundancy fault
Fault Signal	VFC alarm 1 A, 50 V AC, normally closed

Advanced Diagnostic Module Type HD2-DM-A	
Supply	
Rated voltage	19.2 ... 35 V
Rated current	110 ... 30 mA
Power dissipation	Max. 2 W
Fieldbus interface	
Number of segments	4
Rated Voltage	9 ... 32 V
Indicators/operating means	
LED PRI PWR	Green: primary input power connected
LED SEC PWR	Green: secondary input power connected
LED Seg 1 ... 4	Yellow: Bus activity. Red (flashing with 2 Hz): Alarm Red: Hardware Error
Fault Signal	VFC alarm 1 A, 50 V AC, normally closed
DIP Switch	Diagnostic Address 1 to 247, binary coded

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Motherboard Connectors	
Trunk terminals	Plug with screw flange
Host terminals	Plug with screw flange
Alarm terminals	2.5 mm^2, screw type x 4, connector

Accessories		
Description	**Part No.**	**Components**
Diagnostic link cable	ACC-MB-HDC	Coupling of diagnostic bus between two motherboards, length 6 cm

5.6 Ordering Information

Power Hub Ordering Summary		
Designation	Part Number	Description
HD2-FBPS-1.25.360	189516	Isolated Fieldbus Power Supply Module with 25 ... 27 V DC and 360 mA output.
HD2-DM-B	131001	Basic Diagnostic Module with LED indication and common relay fault output.
HD2-DM-A	131000	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.
MBHD-FB-4R	190521	General purpose 4x redundant segment Fieldbus motherboard with redundant bulk power feed and diagnostic interface, all connectors screw terminal type.
ACC-MB-HDC	133733	Diagnostic link cable for daisy chaining of motherboards.

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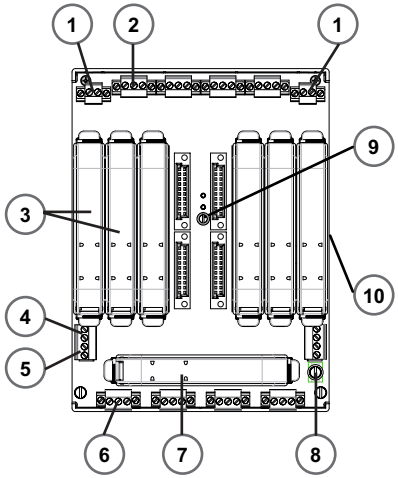
5.7 Component Identity



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

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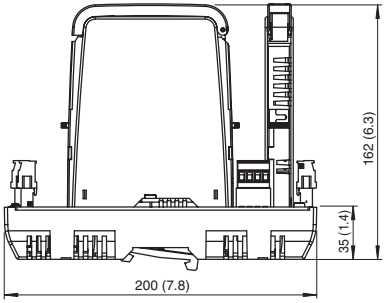
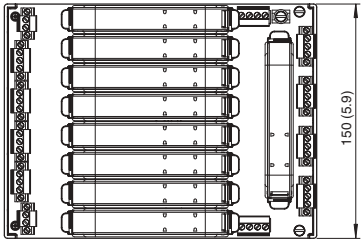
5.8 Dimensional Drawings





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

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6 Installation and commissioning

6.1 Shielding and Grounding

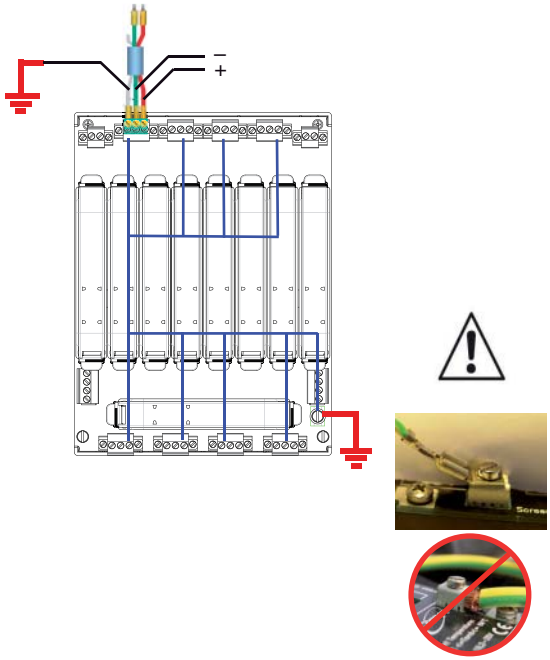

Figure 6.1: The shield at the host side (top left of the picture) can be left open, but not loose, or, if shields are locally connected to earth and the host shield is connected, the shields of the motherboard must be left open if the 2 earthpoints do not have the same potential. This is to prevent earth loops.

Warning!
The shields of the field and host cables are wired together.

If the shield should be connected locally to earth, a connection to one of the shield earthing points must be made.

Caution!
This is not a safety earth, although there may be a requirement to earth all exposed metal parts as a matter or course.

Care must be taken to ensure a clean earth at all times.

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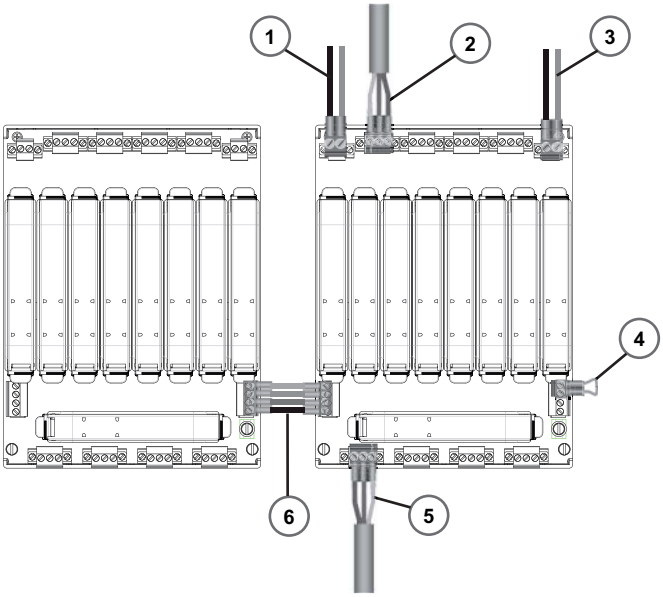
6.2 Connections



1 Primary connection to bulk power supply

2 Host connection

3 Secondary connection to bulk power supply

4 Final motherboard link (The alarm contact has to be looped at the last motherboard)

5 Connections for fieldbus trunk

6 Diagnostic link cable ACC-MB-HDC

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7 Installation in hazardous areas

7.1 Installation of the High Density Power Hub within Zone 2 or Class I Division 2 area

The Fieldbus Power Hub system may be installed in Zone 2 and Class I Division 2 hazardous areas. The type of protection is EEx nA (non-arcing) for Zone 2 Gas Groups IIC, IIB, IIA, and non-incendive for use in Class I, Division 2 Gas Groups A, B, C and D.

The Fieldbus trunk is always rated EEx nA (non-arcing) for Zone 2 applications. Furthermore, the Fieldbus trunk can be placed within a Division 2 area as long as it is installed according to a Division 2 wiring method. The High Density Power Hub, used in conjunction with the Pepperl+Fuchs Segment Protectors (SP), allows the user to 'hot swap' field devices within Zone 2 or Division 2 environment.The maximum output current of the SPs is limited to 45 mA the maximum voltage to 32V. The necessary safety parameters for field instruments suitable for Zone 2 energy limited or Class I Div. 2 non-incendive field wiring applications is:

Type of protection	Safety-relevant parameters
EEx nL Entity	$U_i \geq 32$ V, $L_i \leq$ 20 µH, $C_i \leq 5$ nF

7.2 Energy-limited, non incendive field wiring for field devices using the Fieldbus Power Supply HD2-FBPS-1.25.360

If the general purpose Fieldbus Power Supply HD2-FBPS-1.25.360 is used in conjunction with Pepperl+Fuchs Segment Protectors (SPs), the outputs of the SP will be classified EEx nL (energy limited) or non-incendive field wiring.

Due to the unlimited trunk energy, live work at the trunk is not permitted without gas clearance. However, live connect or disconnect at the output spurs of the SP is allowed, if the following Entity Concept safety evaluation/requirements for the field devices are followed:

- $32\ V \leq U_i$ (field device)
- L_i (field device) + L (cable) ≤ 0.25 mH
- C_i (field device) + C (cable) ≤ 100 nF

No special safety requirements exist for the host interface, provided the host itself is installed in the safe area. If the host interface is installed in Zone 2 or Div. 2, a Declaration of Conformity or a Certificate of Compliance for EEx nA, non-incendive equipment must be provided.

Field devices with a voltage of $U_i \geq 32$ V, certified EEx nL or EEx i are allowed to be connected to the outputs of the SP under a Zone 2 energy limited, Div. 2 non-incendive field wiring rating.

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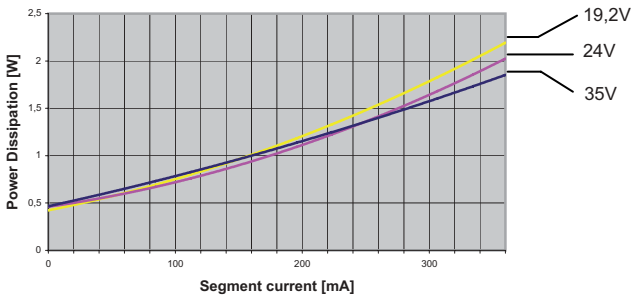
8 Thermal Dissipation

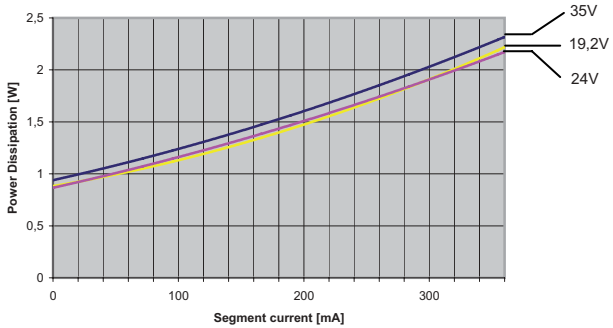
Each Fieldbus Power Supply will dissipate, i. e. lose energy in form of heat. The graphs below illustrate typical power dissipation values in Watts for one segment including motherboard power losses, for given output currents and supply voltages.

Thermal Dissipation of HD2-FBPS-1.25.360, including motherboard

Power dissipation in SIMPLEX configuration per segment



Power dissipation in REDUNDANT configuration per segment



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9 IEC 60079 Codes

Code	Desciption
EX n	Type of protection "n", applied to electrical apparatus such that in normal operation and on certain specified abnormal conditions it is not capable of igniting a surrounding explosive atmosphere. Equivalent US/NEC classification = "non-incendive equipment", apparatus having electrical circuitry that is incapable, under normal operation conditions, of causing ignition of a specified flammable gas-air mixture due to arcing of thermal means.
Ex nA	Non-sparking classified circuits are not allowed to be worked on in life situation if energized, but will under normal conditions not be able of causing ignition of the specified explosive atmosphere. Equivalent US/NEC classification = "non-incendive circuits", a circuit, other than field wiring, in which any arc or thermal effect produced under intended operating conditions of the equipment is not capable, under specified test conditions, of igniting a flammable gas-air, vapor-air or dust-air mixture.
Ex nL	Energy limited circuits which are allowed to be opened and shorted under energized condition. Equivalent US/NEC classification = "non-incendive field wiring", a circuit which under normal conditions of the equipment, is not capable, due to arcing or thermal effects, of igniting a flammable gas-air, vapor-air or dust-air mixture. Normal operation includes opening, shorting or grounding the circuit.
Ex nA [L], Ex nA[nL]	Associated energy limited apparatus, energy limited circuits could be opened and shorted in life situation, e. g. Segment Protector outputs, non-energy limited circuits could only be opened and shorted with gas clearance, e. g. Segment Protector trunk. Equivalent US/NEC classification = "associated non-incendive field wiring apparatus", apparatus in which the circuits are not necessarily non-incendive, but affect the energy in non-incendive field wiring circuits and are relied upon to maintain non-incendive energy levels. Associated non-incendive field wiring apparatus may be either of the following: • Electrical apparatus that has an alternative type of protection for use in the appropriate hazardous (classified) location. • Electrical apparatus not so protected that shall not be used in a hazardous (classified) location. Associated non-incendive field wiring apparatus has designated associated non-incendive field wiring apparatus connections for non-incendive field wiring apparatus and may also have connections for other electrical apparatus.

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