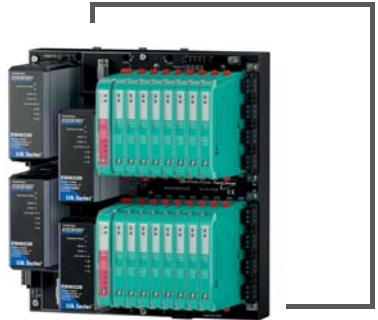


MANUAL

**FIELDBUS POWER HUB
COMPACT**
INVENSYS FBM 228
FBTA-228-BPFB-R-8R



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"

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1 Safety

1.1 Validity

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

1.2 Symbols used

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

Safety-relevant symbols



Danger!

This symbol indicates a warning about a 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 warns of 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 marks an acting paragraph.

1.3 System Operator and Personnel

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

Mounting, commissioning, operation, maintenance and dismounting 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.

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 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.

The device must not be installed at locations where corrosive vapors may be present.

1.6.1 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.

1.7 Housing

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

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

1.8 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.

1.9 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® Compact Power Hub is a high-performance power supply for FOUNDATION Field-bus H1 with redundant configuration as standard for eight 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® Compact Power Hubs feature superior design elements. The main design points are re-dundancy, 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 operate in 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 field-bus 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.

When applied to fieldbus in hazardous areas, the Power Hub feeds fieldbus segments following the High-Power Trunk concept for explosion protection. High power level on the trunk line is fed to the field instrument via couplers such as FieldBarriers or Segment Protectors. The Power Hub powers segment installed as non-arcing (Ex nA).

FieldBarriers enable live maintenance in Zone 0/1 as outputs are classified Ex ia. Thus power limitations of intrinsically safe explosion protection are overcome enabling maximum cable lengths and highest number of devices in any hazardous 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:

Features	User benefit
Lowest 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...500 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

2.2

System components

2.2.1

Motherboard

FBTA-228-BPFB-R-8R

The motherboard FBTA-228-BPFB-R-8R allows the redundant supply of eight fieldbus segments and provides four sockets for FBM 228 host modules. Connections to Invensys control systems are possible via standard Sub-D 9-Connectors. The 16 sockets will hold the power supply modules, two each supply one of the four segments redundantly. Two extra sockets will hold diagnostic modules.

The motherboard provides dual connections for bulk power supply, from Foxboro or separate external bulk power, each with redundancy. The FBM 228 modules are always connected to Foxboro bulk power. The user has a choice of external or Foxboro bulk power to power the fieldbus segments. This feature is configurable via bridges, which are fixed to external contacts.

2.2.2 Power Supply Modules HCD2-FBPS-*

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.

For different application requirements special Power Supply Modules are available:

Designation	Application
HCD2-FBPS-1.500	general purpose

2.2.3 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.

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:

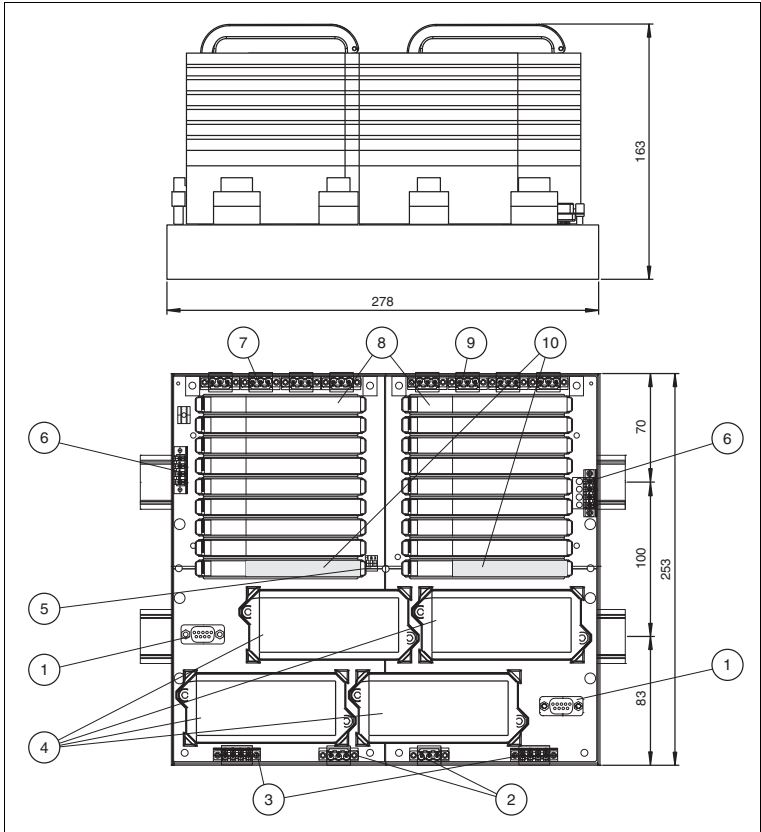
- A Maintenance Required alarm
- An Out Of Specification alarm

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.

2.3 Component Identity



1. Ethernet Trunk Fieldbus Connection
2. Connections for Foxboro A&B Power Supply
3. Connections for External Bulk Power Supply for Power Supply Modules
4. INVENSYSTM FBM 228 FOUNDATION Fieldbus Modules
5. ID Dip Switch array
6. Fault output (Relay) and Diagnostic Bus
7. Fieldbus Trunk Connections 5-8
8. Power Supply Modules
9. Fieldbus Trunk Connections 1-4
10. Diagnostic Modules

2.4

Technical Data

System Specification

Ambient conditions	
Ambient temperature	-20 ... 60 °C (-40 ... 140 °F)
Storage temperature	-40 ... 85 °C
Relative humidity	< 95 % non-condensing
Shock resistance	10 g , 11 ms
Vibration resistance	1 g , 10 ... 150 Hz
Mechanical specifications	
Connection type	plug with retaining screws
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

FBTA-288-BPFB-R-8R

Supply	
Rated current	16 A
Terminating resistor	100 Ω integrated
Mechanical specifications	
Housing material	Steel, coated
Housing width	278 mm
Housing height	253 mm
Housing depth	69 mm
Protection degree	IP20
Mass	3200 g
Mounting	two DIN rails

Isolated Power Supply Module Type HCD2-FBPS-1.500

Supply	
Rated voltage	19.2 ... 35 V DC
Power loss	typ. 1.6 W
Fieldbus interface	
Rated voltage	28 ... 30 V
Rated current	500 ... 10 mA
Short-circuit current	550 mA
Indicators/operating means	
LED ERR	red flashing: short-circuit or undervoltage at output
LED PWR	green if $U_{out} > 28$ 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 1 A, 50 V DC, normally closed

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

Supply

Fault signal	VFC alarm 1 A, 50 V DC, normally closed
DIP-switch	diagnostic address 1...247, binary coded

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

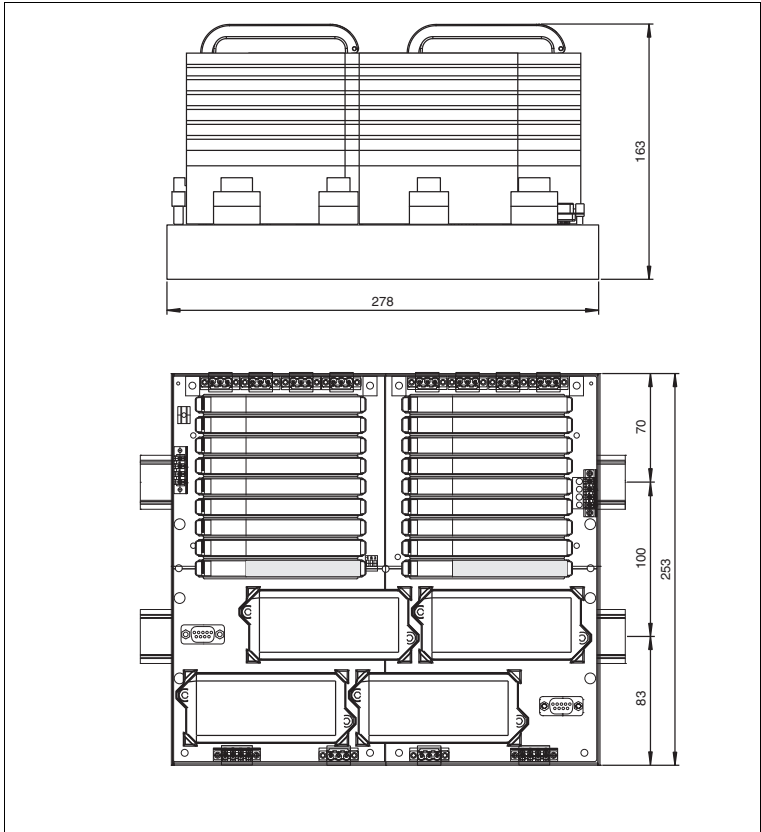
Indicators/operating means

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 1 A, 50 V DC, normally closed
DIP-switch	fieldbus type , redundant supply , Signal level , Noise level , Jitter

Accessories

ACC-MB-HDC	Diagnostic link cable Coupling of diagnostic bus between two motherboards, length 6 cm
ACC-MB-HSK	Earth bar and 4 cable clamps used to simplify shield connection on the trunk cable

2.5 Dimensional Drawings



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

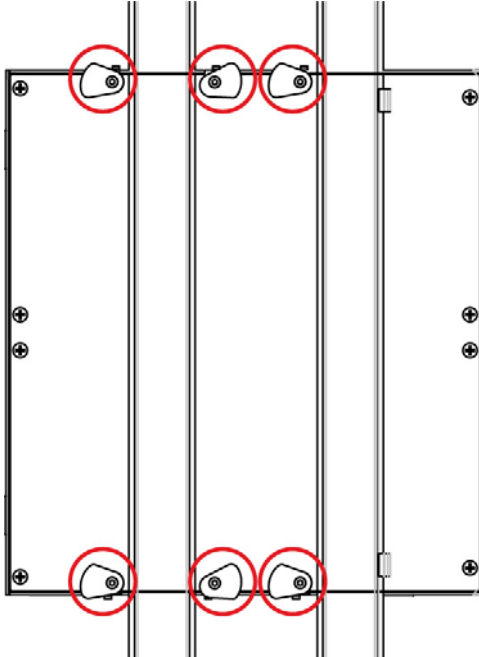
3 Installation and Commissioning

3.1 Mounting and Dismounting

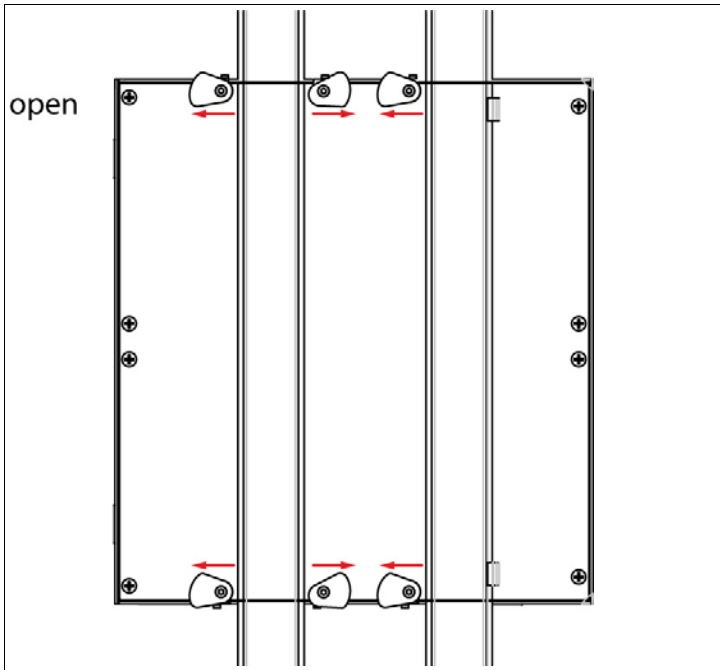


Mounting on DIN rail

There are 6 fastening hooks at the back: 3 at the top of the motherboard and 3 at the bottom of the motherboard.



1. Ensure that all fastening hooks are in position **Open**.



2. Place the motherboard on the DIN rails as shown in the picture below.

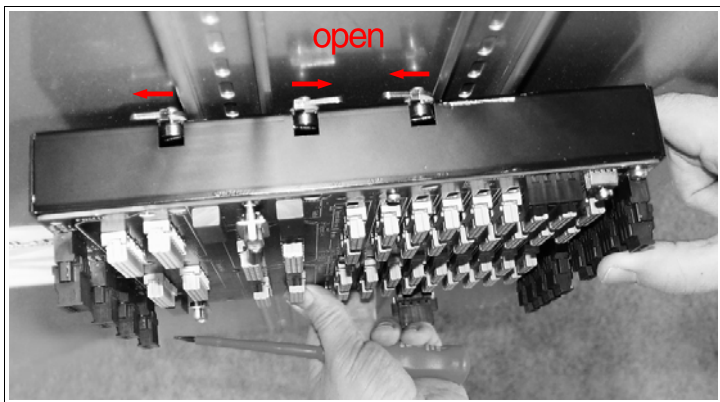


Figure 3.1: Motherboard on DIN rail

3. To tighten the fastening hooks: use a screwdriver to tighten the screws in the direction of the arrows.

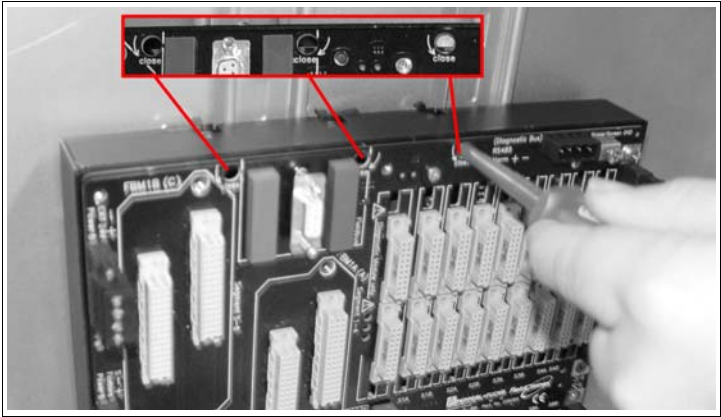
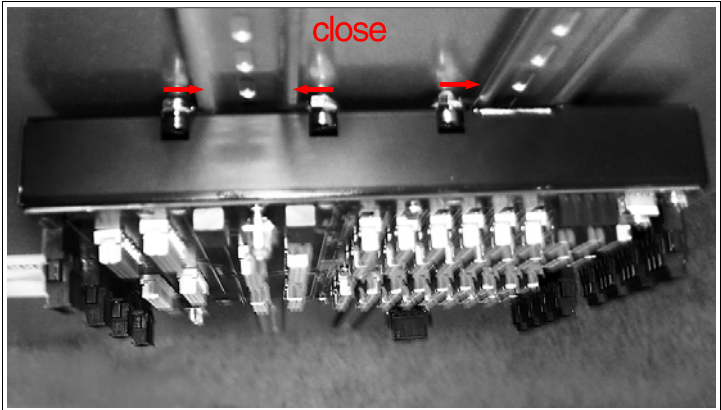


Figure 3.2: The fastening hooks are in position **Close**.

↳ The motherboard is mounted.





Mounting of Modules on the motherboard



Caution!

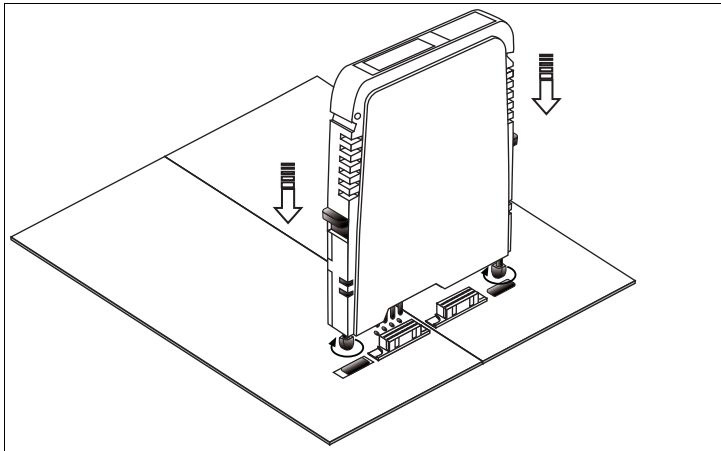
Hardware Damage

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:

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

↳ The module has been removed from the motherboard.

Foxboro Bulk Power Supplies and external Bulk Power Supply

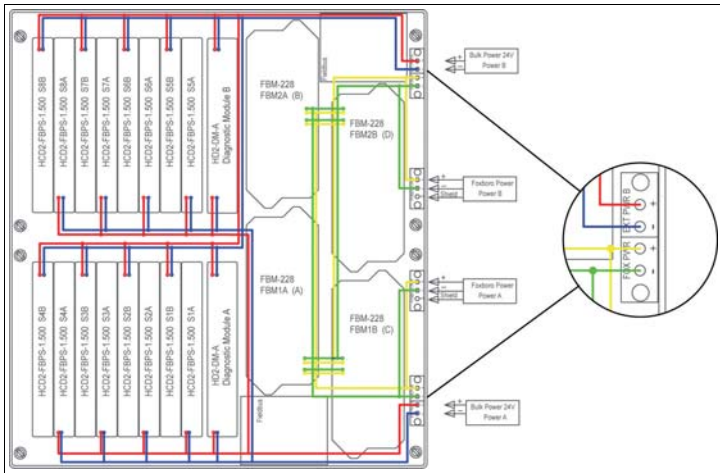


Warning!

Short Circuit

To avoid damage or malfunction to the motherboard and bulk power supplies
Remove the jumpers from Power A 24V and Power B 24V connectors.

1. Connect the Foxboro bulk power supply to the Fox Power A and Fox Power B connectors.
2. Connect the external bulk power supply to the Ext Power A and Ext Power B connectors.

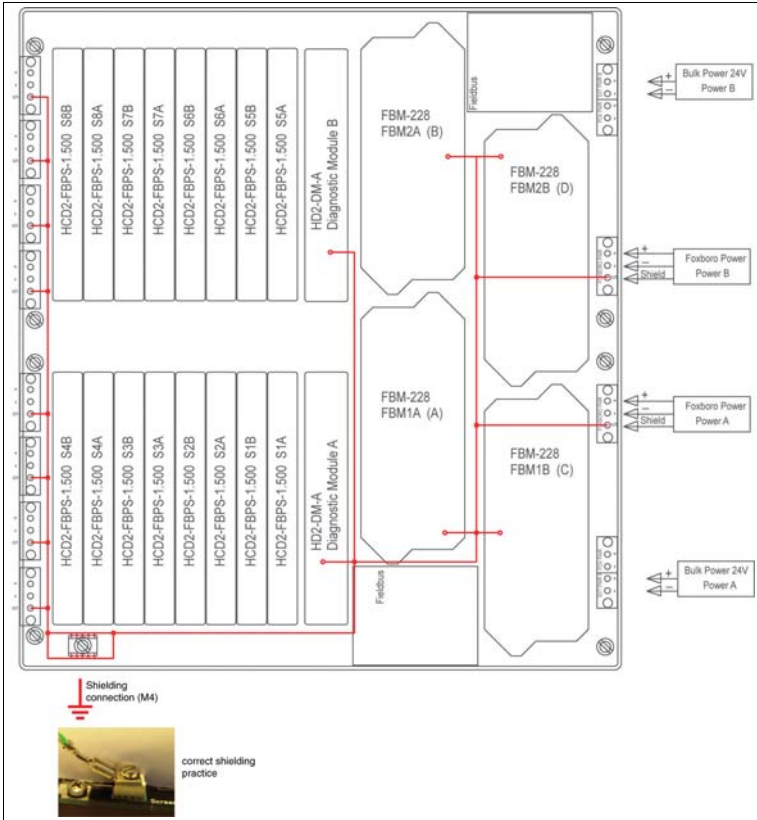


3.3 DIP Settings

A closed switch (position **on**) sets the bit=0
An opened switch (position **off**) sets the bit=1

BASEPLATE	FBM POSITION	Dip-Switch		
		SW 1	SW 2	SW 3
0	1 A	0	0	0
0	2 A	0	0	0
0	3 B	0	0	0
0	4 B	0	0	0
0	1 C	0	0	1
0	2 C	0	0	1
0	3 D	0	0	1
0	4 D	0	0	1
1	1 A	0	1	0
1	2 A	0	1	0
1	3 B	0	1	0
1	4 B	0	1	0
1	1 C	0	1	1
1	2 C	0	1	1
1	3 D	0	1	1
1	4 D	0	1	1
2	1 A	1	0	0
2	2 A	1	0	0
2	3 B	1	0	0
2	4 B	1	0	0
2	1 C	1	0	1
2	2 C	1	0	1
2	3 D	1	0	1
2	4 D	1	0	1
3	1 A	1	1	0
3	2 A	1	1	0
3	3 B	1	1	0
3	4 B	1	1	0
3	1 C	1	1	1
3	2 C	1	1	1
3	3 D	1	1	1
3	4 D	1	1	1

3.4 Shielding and Grounding



To Prevent earth loops

The shield at the host connection can be left open, but not loose.

If host shield is connected and the shields of the field devices are locally connected to earth the shields of the motherboard must be left open if the earthpoints (host/field devices) do not have the same potential.



Caution!

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

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

3.5 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.

4

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

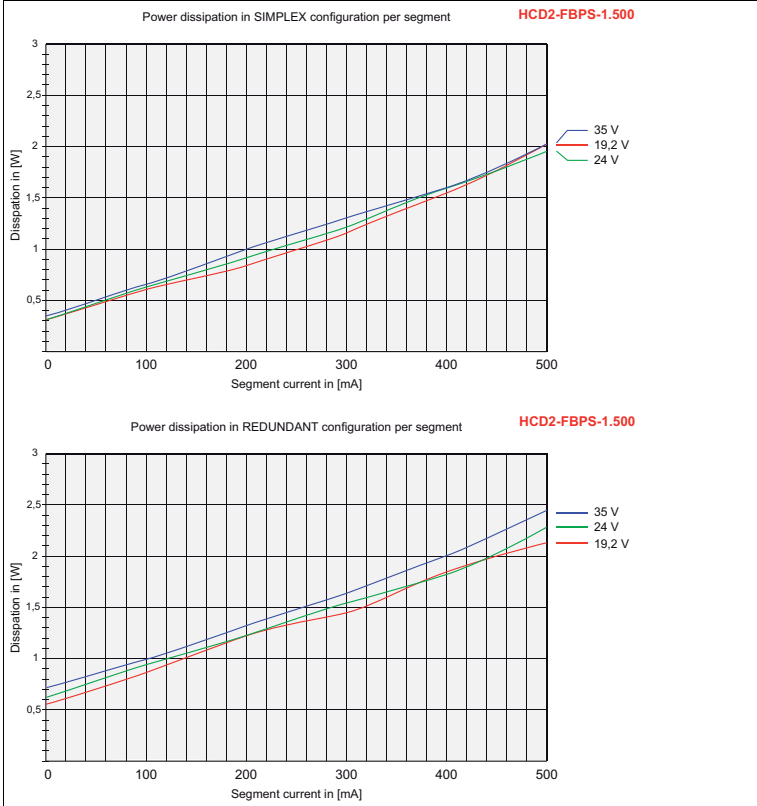
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Fault	Relay Contact	Diagnostic Module	Power Module
All Power Modules fixed and healthy		<ul style="list-style-type: none"> <input checked="" type="radio"/> PRI PWR <input checked="" type="radio"/> SEC PWR <input type="radio"/> ERR 	<ul style="list-style-type: none"> <input checked="" type="radio"/> PWR <input type="radio"/> ERR

5 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 HCD2-FBPS-1.500, including motherboard



6 Appendix

6.1 Ordering Information

Designation	Description
HCD2-FBPS-1.500	General purpose isolated Fieldbus Power Supply Module with 28 ... 30 V DC and 500 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, permanently monitors the physical layer. If a predefined limit value is exceeded, a built-in contact opens to alarm the operator by means of a system alarm input.
FBTA-228-BPFB-R-8R	Foxboro FBM228 purpose 8x redundant segment Fieldbus motherboard with redundant bulk power feed and diagnostic interface, all connectors screw terminal type.
Accessories	
ACC-MB-HDC	Diagnostic link cable Coupling of diagnostic bus between two motherboards, length 6 cm
ACC-MB-HSK	Earth bar and 4 cable clamps used to simplify shield connection on the trunk cable

6.2 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	–

PROCESS AUTOMATION – PROTECTING YOUR PROCESS



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