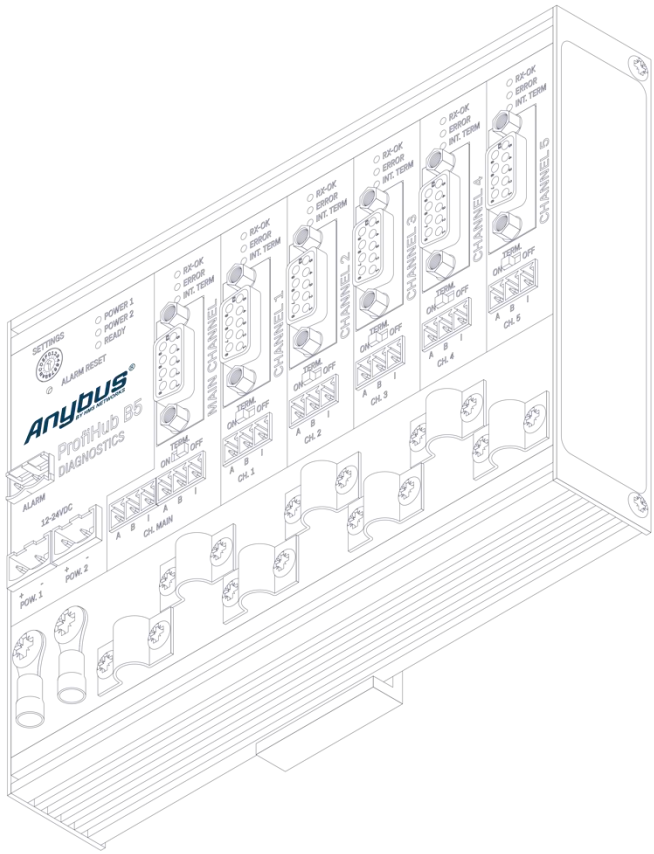
Anybus® BY HMS NETWORKS



ProfiHub A5

User Manual

User Manual ProfiHub A5



- 5 Isolated Channels
- Transparent for all PROFIBUS DP protocols
- RS 485 specifications for each channel
- Max. 12 Mbps
- Max. 31 devices per channel
- Max. 1200 m spur line length
- No limit in serial placement
- No address required
- Integrated termination facilities
- Configurable grounding system
- IP 65 classification

"5 channel DP spur and repeater component"

Safety Guidelines

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning sign and are marked as followed according to the level of danger:



Draws your attention to important information on handling the product, a particular part of the documentation or the correct functioning of the product.

Warning

This device and its components may only be used for the applications described in this manual and only in connection with devices or components that comply with PROFIBUS and an RS 485 interface.
This product can only function correctly and safely if it is transported, stored, set up, installed, operated and maintained as recommended.

Qualified Technicians

Only qualified technicians should be allowed to install and work with this equipment. Qualified technicians are defined as persons who are authorized to commission, to ground, to tag circuits and systems in accordance with established safety practices and standards. It is recommended that the technicians carry a Certified PROFIBUS Installer or Certified PROFIBUS Engineer certificate.

Disclaimer of Liability

We have checked the contents of this manual as much as possible. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the content in this manual is reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

Copyright © HMS Networks

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior written permission of the publisher.

Important information

Purpose of the Manual
This manual explains how to put the ProfiHub A5 into operation.

Recycling and Disposal
The parts of the ProfiHub can be recycled. For further information about environment-friendly recycling and the procedure for disposing of your old equipment, please contact:

HMS Technology Center B.V.
Vlasmarkt 1
3011 PW, Rotterdam
The Netherlands

T: +31-(0)174-671800
F: +31-(0)174-671801
E: info.nl@hms-networks.com

Content

User Manual ProfiHub A5 2

Important information 4

1. The Product 6
   - 1.1 Product Features 7
   - 1.2 Application areas 7
   - 1.3 Additional Benefits 8
   - 1.4 Channel Structure 8
   - 1.5 Grounding System 9
   - 1.6 Cable lengths for PROFIBUS DP 9
   - 1.7 Cable types for PROFIBUS DP 10
   - 1.8 Status Display 11
   - 1.9 Comparison Table 12

2. Installation Instructions ProfiHub A5 13
   - 2.1 Location 13
   - 2.2 Position 13
   - 2.3 Mounting 13
   - 2.4 Power Supply 13
   - 2.5 Backbone 14
   - 2.6 Spur Segments 15
   - 2.7 Termination 16
   - 2.8 Baudrate switch 16

3. Technical Data ProfiHub A5 18

4. Glossary 20

5. Certificates 23

6. Revision History 26

1. The Product

The ProfiHub A5 is an advanced, flexible and robust network component for PROFIBUS DP installations, to implement long multi-device spur lines and backbone structures with star/tree segments.



PROFIBUS DP is a high speed communication bus that has to comply with strict rules concerning spur lines, because of possible reflections that could lead to communication disturbances. If spur lines or star segments are required, costly investments in repeaters have to be done.

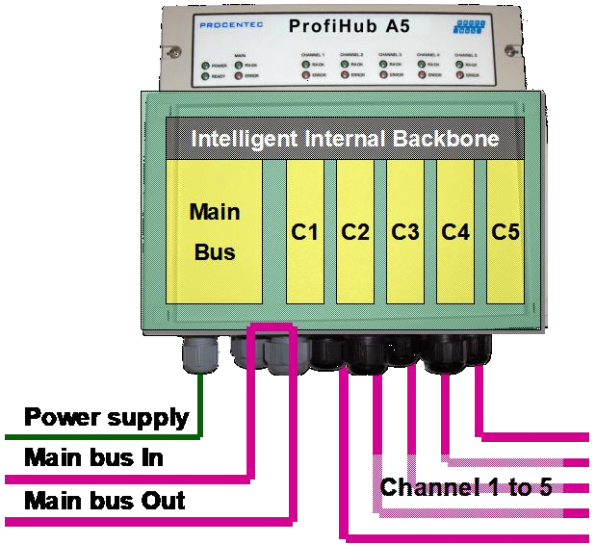
An innovative component for such applications is the ProfiHub A5. This is a perfect economic solution to implement reliable spur lines in high speed DP networks. It has the functionality of 5 galvanic isolated transparent repeaters. This allows network structures with extended spur lines that individually can handle a maximum of 31 devices and a length equal to the main bus. The ProfiHub A5 refreshes a received message on one Channel and transfers it to all the other Channels (chicken foot topology).

Because the ProfiHub A5 creates isolated segments, the devices can now be removed and added during operation. Also electrical bus problems and EMC disturbances in a spur do not spread to the other segments. The intelligent logic and isolation circuits of the ProfiHub does not change the bit width. This means the ProfiHub does not have limitations in serial placement. The logic also detects the transmission speed automatically.

To assist the installation work, termination is integrated and can be switched on/off. The grounding concept is also selectable: direct or capacitive grounding. The ProfiHub A5 is powered by a 10 to 32 DC Voltage (110/230V AC versions are also available). For troubleshooting, maintenance and commissioning the ProfiHub A5 is equipped with a LED display on the outside, which indicates the status of each Channel (Data and Error).

1.1 Product Features

- 5 Galvanic isolated channels (repeater segments)
- Transparent for all PROFIBUS DP protocols
- DP - RS 485 specifications for each channel
- 9,6 Kbps to 12 Mbps
- 31 devices per channel
- 1200 m spur line length (depends on transmission speed)
- No limit in serial placement or cascading of ProfiHubs
- No address required
- Integrated termination facilities (switches)
- Configurable grounding system (direct or capacitive)
- IP 65 classification



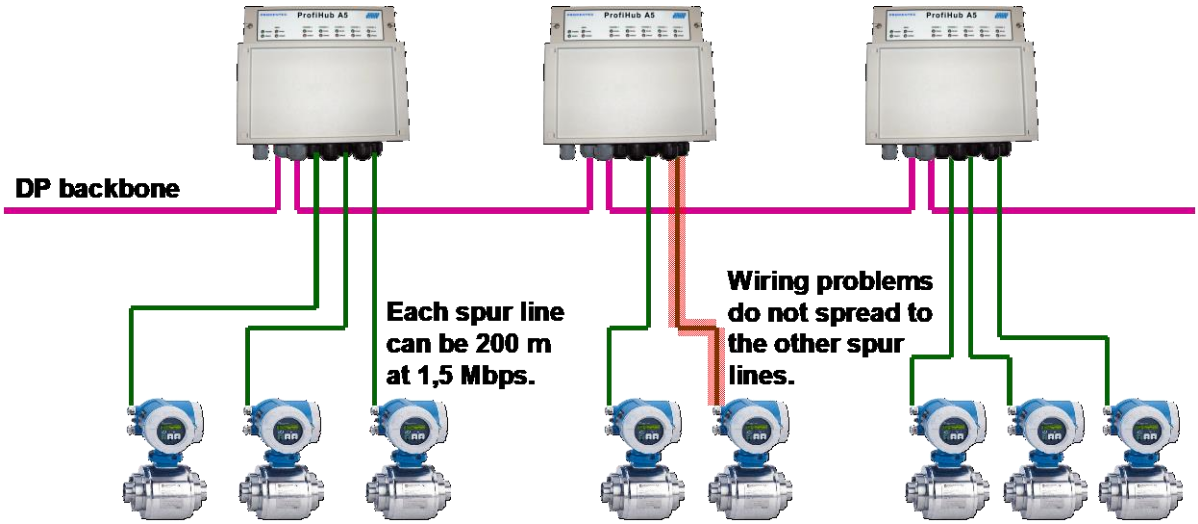


Fig. 1- Long spur lines to instruments and the possibility to remove/insert them during operation. Short circuit protection on each spur line is automatically provided.

1.2 Application areas

- Dynamic spur lines to actuators, flow meters and pH analysers
- Removable drives and motors
- Pull/plug motor control centres (drawers)
- Roof mounted devices in tank farms
- Dirty and humid environments
- Barrier for non-galvanic isolated equipment
- Large star/tree structured networks
- Outdoor applications with device and cable stress

1.3 Additional Benefits

- Hot slave insertion and removal during operation
- Short circuit protection on each channel
- Compact and robust construction
- Status and error display (per channel)
- Suitable for all DP cables
- Conveniently arranged networks
- Easy extendable installations
- Standard glands can be replaced with M12
- On-board DB9 female connector for maintenance activities
- Cost savings

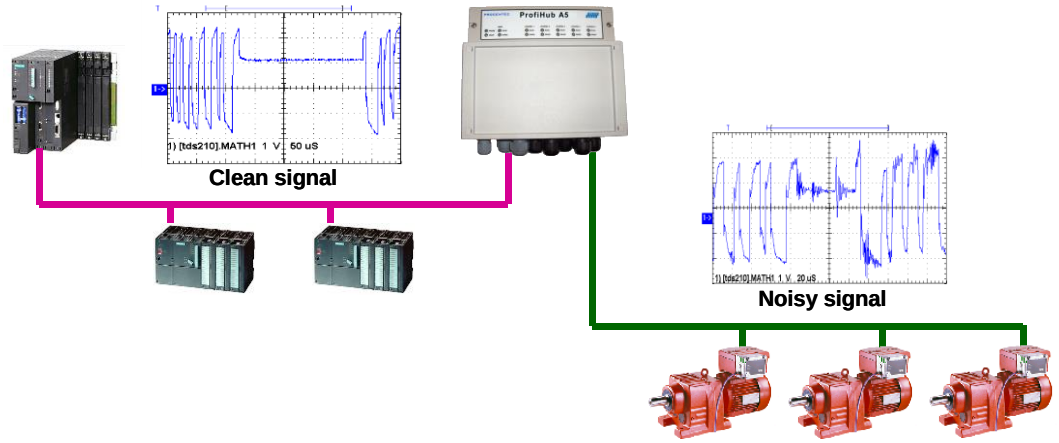


Fig. 2- Because of the isolation and intelligence the ProfiHub provides, it can be used as a barrier for electrically sensitive segments. This keeps the backbone and other Channels clean.

1.4 Channel Structure

Every Channel is electrically isolated and internally connected to the transparent intelligent backbone. The termination is switchable and powered by the ProfiHub. The shielding of the PROFIBUS cable can be directly grounded or indirectly grounded (see the next paragraph).

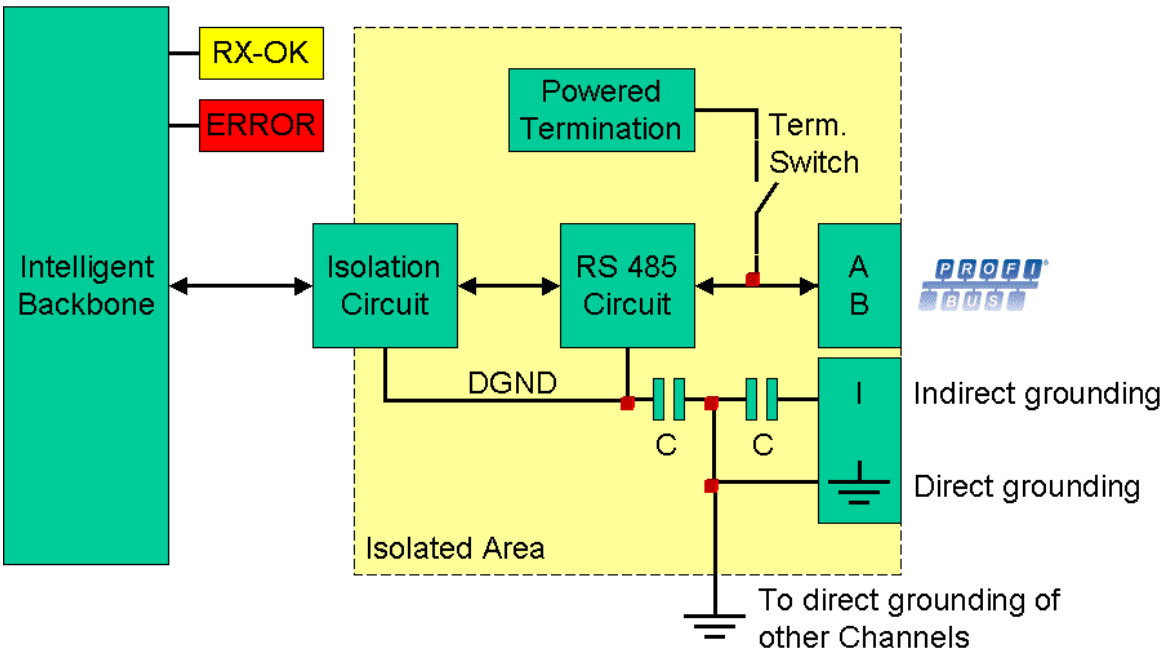


Fig. 3- Channel structure

1.5 Grounding System

The ProfiHub A5 can be grounded by 3 methods:

1. Direct grounding
2. Indirect grounding (through a capacitor)
3. Combination of direct and indirect

The power supply must be grounded directly on the power connector. The shielding of the PROFIBUS cables can be directly or indirectly grounded. If you do not want to ground all or some cables to the common ground, i.e. compensating current, the cable shielding must be connected to pin 'I' which stands for Indirect grounding. A capacitor with a parallel high value resistor will separate the 2 potentials (Fig. 3), ensuring protection of the signal against non-DC disturbances.

If by accident on 1 channel the Direct Grounding is connected with the Indirect Grounding, the connection to the Direct Grounding bypasses the capacitor in the Indirect Ground connection. The current on the shield will flow to Direct Ground.

1.6 Cable lengths for PROFIBUS DP

The cables on the Channels and the Main-Channel should comply with the PROFIBUS DP cable specifications for RS 485 (Fig. 4).

Baudrate (kbit/s)	9.6	19.2	45.45	93.75	187.5	500	1500	3000	6000	12000
Segment length (m)	1200	1200	1200	1200	1000	400	200	100	100	100
Segment lenght (feet)	3940	3940	3940	3940	3280	1310	656	328	328	328

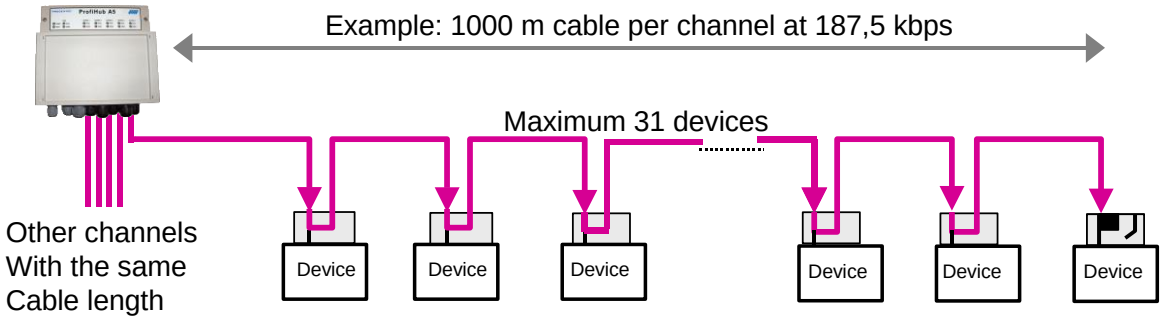


Fig. 4- Cable lengths for PROFIBUS DP

1.7 Cable types for PROFIBUS DP

The cable type should comply with the PROFIBUS DP cable specifications for RS 485 (Fig. 5).

Parameter	Value
Wires	2 (twisted)
Impedance	135 .. 165 Ohm at 3 to 20 MHz
Capacity	< 30 pF/m
Loop resistance	< 110 Ohm/km
Wire diameter	> 0.64 mm
Wire area	> 0.32 mm^2

Fig. 5- PROFIBUS DP cable specifications

The ProfiHub A5 can handle cables based on multiple protection sheaths with a diameter between 6 to 12 mm (Fig. 6).

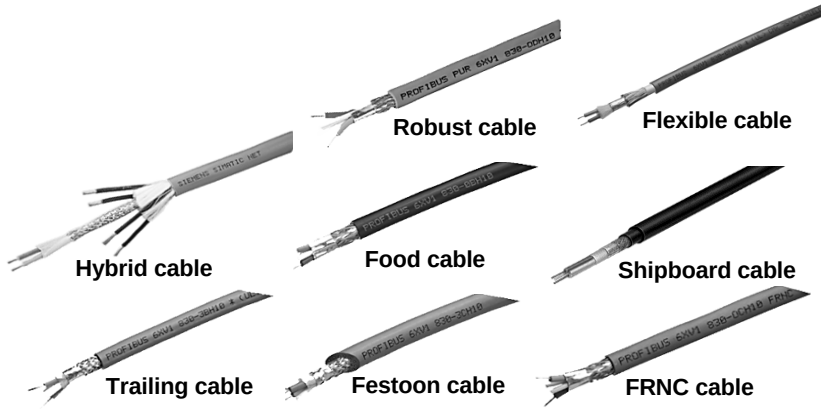


Fig. 6- Cables with different protection sheaths

1.8 Status Display

The Status Display on the ProfiHubs is very useful for diagnostics.

	OFF	Blinking	ON
POWER	😐 Power is not switched on or an internal failure.	☹ Power supply not stable or an internal failure.	☺ Power supply OK.
Main READY	😐 Power is not switched on or an internal failure.	☹ Trying to detect the transmission speed, but has not locked it yet.	☺ The transmission speed has been detected.
Main RX-OK	☹ No communication detected on the Main-Channel.	☺ 1 or more devices communicating on the Main-Channel.	☺ 1 or more devices communicating on the Main-Channel.
Main ERROR	☺ No problem has been detected.	☹ Problem in the cabling has been detected (Main Channel).	☹ Problem in the cabling has been detected (Main Channel).
Channel RX-OK	😐 There is no communication detected (on this Channel).	☺ 1 or more devices communicating (on this Channel).	☺ 1 or more devices communicating (on this Channel).
Channel ERROR	☺ No problem has been detected.	☹ Problem in the cabling has been detected (on this Channel).	☹ Problem in the cabling has been detected (on this Channel).

1.9 Comparison Table

	ProfiHub A5	**ProfiHub B5+R**
Area	IP 65	IP 20
Housing	Plastic	Metal
Mounting	Corner screws	DIN-rail
Weight	800 g	650 g
Dimensions	213 x 210 x 95 mm	167 x 111 x 32 mm
PROFIBUS connectors	Screw terminals (inside) Glands (outside)	Screw terminals and DB9 connectors
Redundant channels	No	Yes
Diagnostics slave	No	Optional (B5+RD)

2. Installation Instructions ProfiHub A5

2.1 Location

The ProfiHub A5 can be installed everywhere in a non-hazardous area that complies with IP 65 (DIN 40 050) and the specified temperature range of -40 to +75° Celsius.

2.2 Position

The ProfiHub A5 can be installed in every position, but it is recommended to install it with the cable glands pointing down to create a more reliable protection against moist and dust (water compartment and glands). In this position it is also easier to read the status display.

2.3 Mounting

The ProfiHub A5 has 4 mounting holes for 4..5 mm screws (Fig. 7). To reach the holes on position 1 and 2, the top lid has to be removed.

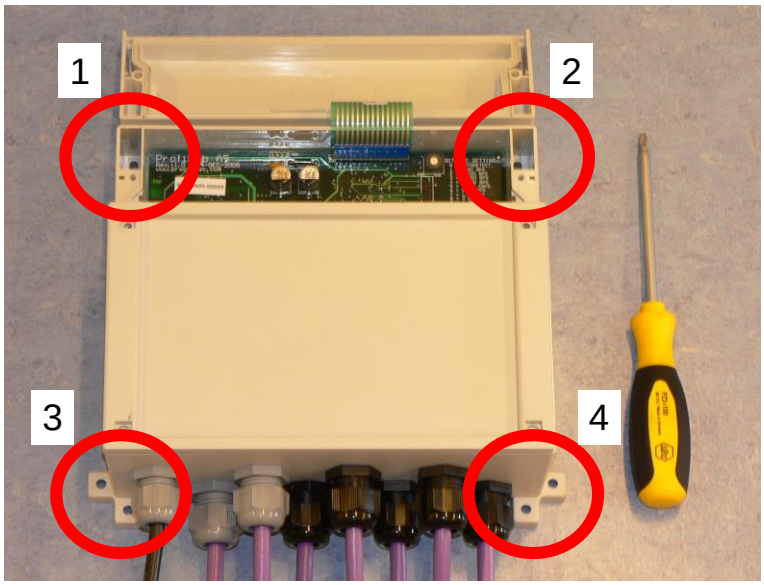


Fig. 7- Positions of the mounting holes.

It is recommended to mount the ProfiHub A5 with at least 4 suitable screws/bolts in position 1, 2, 3 and 4.
Be careful with the flat cable that connects the lid with the PCB.

2.4 Power Supply

The 4-pin screw type power connector is located on the bottom left of the PCB (Fig. 8).

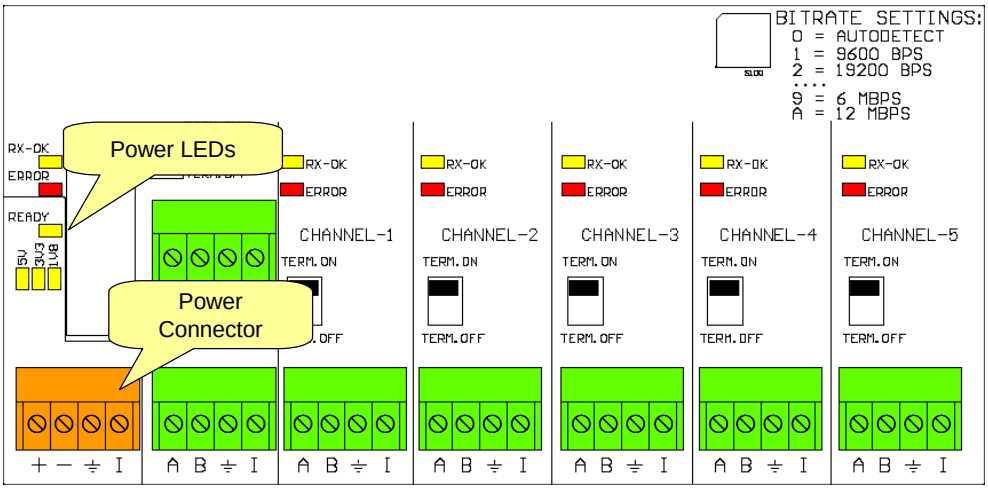


Fig. 8- Power connector and LEDs

The power supply has to comply with the following specifications:

- Voltage: 10 to 32 Vdc
- Current: Min. 130 mA
- Wire diameter: < 2,5 mm^2
- Cable thickness: 5 to 10 mm

Procedure

To connect the 24V supply to the 4-pin screw-type terminal, proceed as follows:

- Strip the insulation from the cable or the conductors for the 24V power supply
- Secure the conductors in the screw-type terminal

Note: There is a grounding point that can be used.

To connect the power supply, you need a 3 mm screwdriver.

Testing

If the power is switched on it can be diagnosed by the following indicators on the PCB:

- All the LEDs should be shortly blinking
- The READY LED is ON or Blinking
- The voltage LEDs are ON (5V, 3V3 and 1V8)

It is recommended to use a power supply with a ground lead (3-wire).

2.5 Backbone

Connect the DP backbone cable to the bottom connector of the Main-Channel (Fig. 9). If the ProfiHub is not the last device on the bus segment, connect the Bus-Out cable to the top connector of the Main-Channel (Fig. 9).

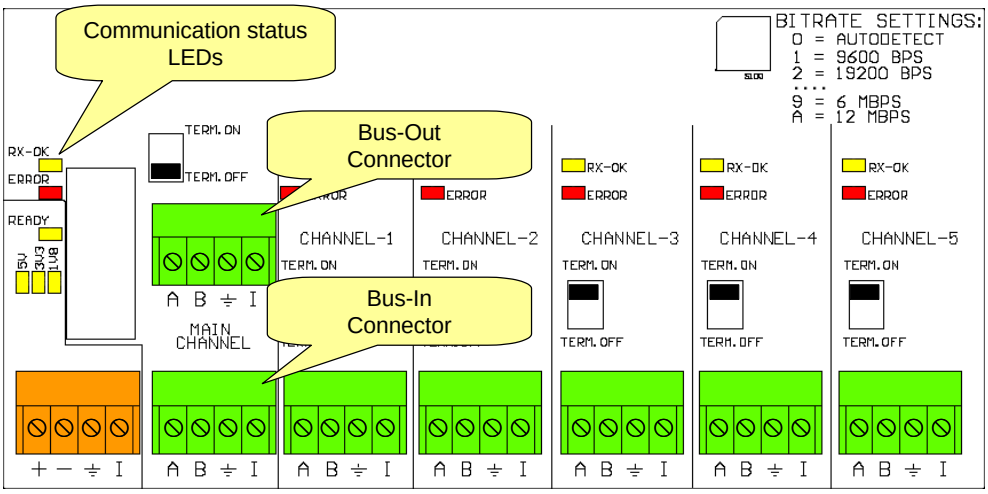


Fig. 9- PROFIBUS DP backbone connection

Pin Layout of the screw terminals

Pin “A”: Green wire

Pin “B”: Red wire

Pin “I”: Cable shielding *OR*

Pin “⏚”: Cable shielding

Testing

If the Main-Channel recognizes valid PROFIBUS messages from 1 or more connected devices, the RX-OK LED of this Channel should be blinking.

2.6 Spur Segments

Connect the spur segments to the connectors of Channel 1 to 5 (Fig. 10).

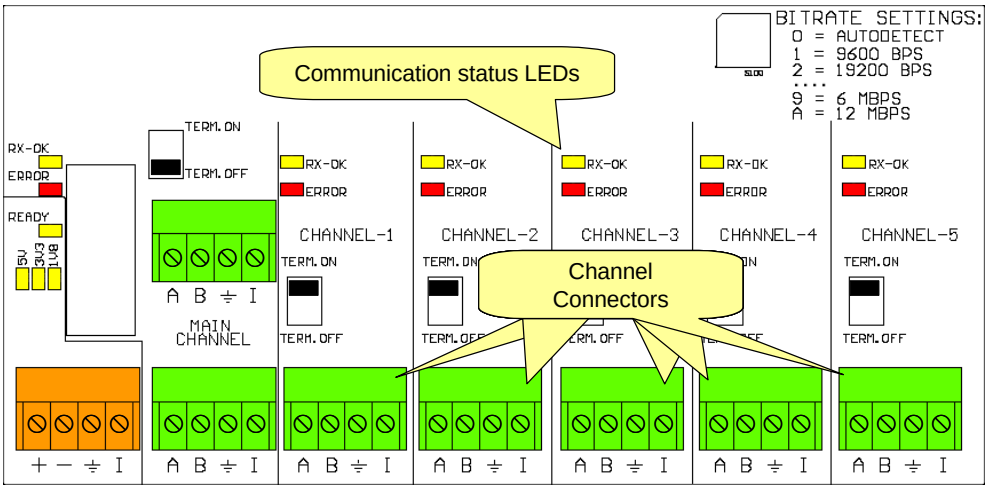


Fig. 10- PROFIBUS DP spur connectors

Pin Layout of the screw terminals

Pin “A”: Green wire

Pin “B”: Red wire

Pin “I”: Cable shielding *OR*

Pin “⏚”: Cable shielding

Testing

If a Channel recognizes valid PROFIBUS messages from 1 or more connected devices, the RX-OK LED of the specific Channel should be blinking.

2.7 Termination

The termination of the Main-Channel has been set to OFF by default. If the ProfiHub is the last/first device on the segment, the termination should be set to ON (Fig. 11).

The termination of the Channels have been set to ON by default. Because it is assumed that the new segment is started at the ProfiHub (Fig. 11).

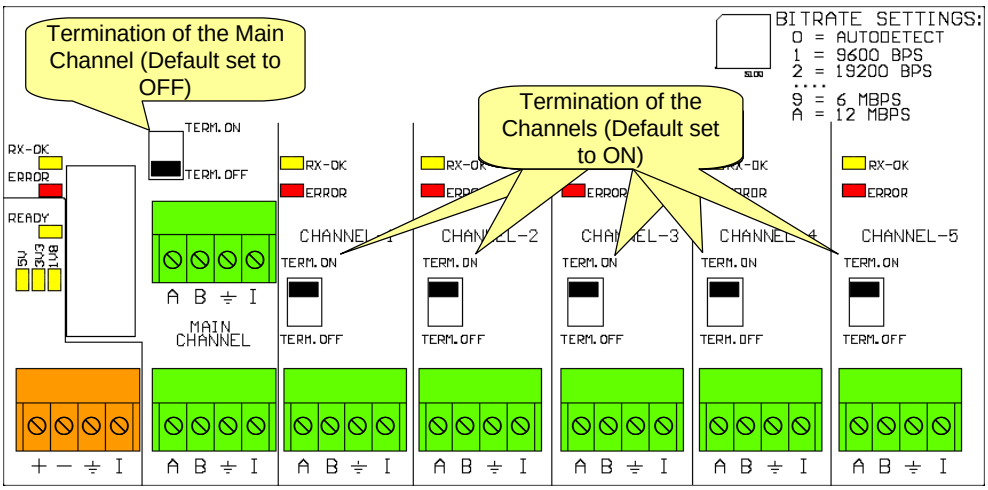


Fig. 11- Termination Switches

Don’t forget to switch the termination ON at the other end of the segment and make sure it is powered continuously.

2.8 Baudrate switch

The ProfiHub recognizes the transmission speed by default. If it is required that the ProfiHub is locked to a certain transmission speed, switch S100 should be set to the required value (Fig. 12). The switch can be reached by removing the top lid.

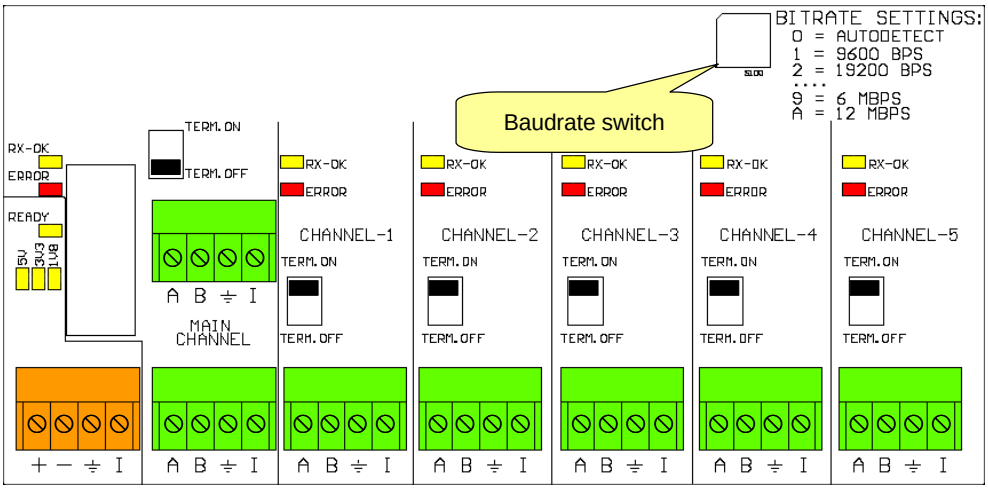


Fig. 12– Baudrate speed switch

To set the transmission speed, you need a 3 mm screwdriver.

Switch values:

0 = Auto detect (default)
1 = 9,6 kbps
2 = 19,2 kbps
3 = 45,45 kbps
4 = 93,75 kbps
5 = 187,5 kbps
6 = 500 kbps
7 = 1500 kbps
8 = 3000 kbps
9 = 6000 kbps
A = 12000 kbps
B .. F = Auto detect

3. Technical Data ProfiHub A5

Technical data ProfiHub A5	
Dimensions and weight	
Dimensions L x W x H (mm) with glands Weight Mounting screws	213 x 210 x 95 mm Approximately 800 g 4 to 5 mm
Ambient conditions	
Operating temperature Isolation class	-40 to +75° Celsius IP 65 (DIN 40 050)
Protocol specifications	
Supported Protocols	DP-V0, DP- V1, DP-V2, FDL, MPI, FMS, PROFIsafe, PROFIdrive and any other FDL based protocol.
Transmission speed Transmission speed detection Transmission speed switch	9,6 kbps to 12 Mbps (including 45,45 kbps) Auto detect (default) or settable with a rotary switch 0 = Auto detect (default) 1 = 9,6 kbps 2 = 19,2 kbps 3 = 45,45 kbps 4 = 93,75 kbps 5 = 187,5 kbps 6 = 500 kbps 7 = 1500 kbps 8 = 3000 kbps 9 = 6000 kbps A = 12000 kbps B .. F = Auto detect
Transmission speed detection time	< 10 s (if it is set to auto detect)
Data delay time	1,25 TBit at 9,6 kbps to 93,75 kbps 1,3 TBit at 187,5 kbps to 500 kbps 1,4 TBit at 1,5 Mbps 1,6 TBit at 3 Mbps 2,0 TBit at 6 Mbps 3,0 TBit at 12 Mbps
Delay time jitter	Max. ¼ bit time

Technical data ProfiHub A5	
PROFIBUS cable specifications	
Cable lengths	1200 m at 9,6 kbps to 93,75 kbps 1000 m at 187,5 kbps 400 m at 500 kbps 200 m at 1,5 Mbps 100 m at 3 Mbps to 12 Mbps
Cable thickness	6 to 12 mm
Wire diameter	< 2,5 mm^2
Wire type	Stranded or Solid core
Number of devices	Maximum 31 per Channel (including ProfiHubs, OLMs, Laptops/PCs, etc)
Termination	Integrated and switchable. Powered according to IEC 61158 (390/220/390 Ohms) - All channels (default on) - Main-channel (default off)
Cascading depth	No limits
Redundancy	No
Power supply specifications	
Nominal supply voltage	10 to 32 Vdc
Current consumption	130 mA at 24 V power supply (all channels fully loaded)
Power dissipation	Max. 4,1 W
Reverse polarity protection	Yes
Cable thickness	5 to 10 mm
Wire diameter	< 2,5 mm^2
Others	
MTBF	Not available

4. Glossary

Address	Unique number of a device connected to the network. With PROFIBUS this can be 0 to 126. 127 is a broadcast address
Analyzer	Software tool to observe the protocol traffic. Combi-analyzers can also inspect the signal quality Other term: Bus Monitor Example: ProfiTrace
Backbone	The primary bus cable. Most of the time only the control systems, ProfiHubs and fiber optic couplers are connected to this cable. The field devices are connected behind the ProfiHubs and fiber optic couplers.
Bit Time (TBit)	The bit time TBit is the time, which elapses during the transmission of one bit. It depends on the baudrate and is calculated as follows TBit = 1 (bit) / baudrate (bps). Examples: 12 Mbps --> TBit = 83 ns 1,5 Mbps --> TBit = 667 ns
Busparameters	Settings that define the timing behavior on the bus. They are defined in the master. Examples: Tslot, MaxTSDR.
C	Capacitance
DGND	Digital ground
DIN	German Institute for Standardization (www.din.de)
DP-V0	DP-V0 is the basic stage of the PROFIBUS DP communication protocol. DP-V0 devices (master and slaves) perform the following basic functionalities: • Cyclic exchange of I/O data between controlling and slave devices • Device, identifier (module) and channel related diagnosis • Parameterization of DP-slaves • Configuration of DP-slaves
DP-V1	DP-V1 is the first stage of extension of PROFIBUS DP after DP-V0. DP-V1 devices shall comply with the following features: • Device related diagnosis is replaced by status and alarms. • The first three octets of the user parameterization data are now standardized • Optionally these devices may support: • Acyclic communication (MS1, MS2) • If alarms are used, MS1 shall be supported

DP-V2	DP-V2 is the second stage of extension of PROFIBUS DP after DP-V1. DP-V2 devices shall comply with the following features: • Data Exchange Broadcast (DxB) for slave to slave communication (publisher/subscriber principle) • Isochronous Mode (time tick synchronized operating slaves, e.g. drives) • Up- and/or download of Load Region Data (domains) • Clock Control (synchronization within slaves) and Time Stamping • Redundancy
Electromagnetic Compatibility	See *EMC*
EMC	The extent to which an electric or electronic device will tolerate electrical interference from other equipment (immunity), and will interfere with other equipment. Within the European Community as well as in other countries it is regulated by law that electric and electronic components and equipment comply with basic standards such as IEC 61000-6-2 or IEC 61326 or corresponding individual product standards.
Hub	A Hub refreshes a signal and passes the information on to all nodes which are connected to the Hub. Data frames which were received on one port are transferred to all the other ports (chicken foot topology).
MPI	Multiple Protocol Interface. Protocol defined by Siemens which uses the layer 1 and 2 of PROFIBUS (FDL).
PCB	Printed Circuit Board
PROFIBUS DP	Acronym for "PROFIBUS for Decentralized Peripherals". Specification of an open fieldbus system with the following characteristics: • Polling master-slave-system (cyclic communications, MS0) • Flying masters with robin round token passing coordination (MM) • Connection based (MS1) and connectionless (MS2, MS3) acyclic communication between masters and slaves Options (e.g.): • Data exchange broadcast (DXB), i.e. slave to slaves communication • Isochronous mode of slaves • Clock synchronization • Redundancy PROFIBUS DP is standardized within IEC 61158 and IEC 61784, communication profile families 3/1 and 3/2. The term "PROFIBUS DP" also is a synonym for the RS485 based deployments within factory automation.

Repeater	Active physical layer device that receives and retransmits all signals over a different port to increase the distance and number of devices for which signals can be correctly transferred for a given medium.
Spur line	A cable attached to a bus segment with a T-connection . Spurs are not recommended with PROFIBUS DP. They are prohibited with 12 Mbps and PROFIsafe operations. German term is "Stichleitung".
Stub line	See *Spur line*
TBit	See *Bit Time*
Termination	A (powered) resistor network at both ends of a segment to prevent reflections (with PROFIBUS DP the termination has to be powered).
Topology	In a communications network, the pattern of interconnection between network nodes; e.g. bus, ring, star configuration.
PI	PROFIBUS International, the International PROFIBUS Organization based in Karlsruhe.
PNO	PROFIBUS Nutzer Organization, tThe German PROFIBUS Organization based in Karlsruhe.
Drop cable	See *Spur line*
Reflection	Part of the original signal that is transmitted back along the cable. It corrupts the original signal.

5. Certificates



QualityMasters
ISO Certificering

certificate

QualityMasters hereby declares that

Procentec B.V.
Wateringen

has a management system that meets the requirements of the standard

NEN-EN-ISO 9001:2008

for the scope

Providing training courses, technical support, product development and the exploitation of the test laboratory.

Date of original approval	10-02-2003
Date of issue	25-01-2016
Valid until	10-02-2019
Certificate number	NL 6594-uk

On behalf of Stichting QualityMasters,

N.B. The failure to meet the conditions as set forth in the certification agreement, or non-compliance with the given standard and/or guidelines, may lead to the suspension or cancellation of the certificate.
This certificate remains the property of Stichting QualityMasters, Nieuwland Parc 157, 3351 LJ Papendrecht.

PROFIBUS • PROFINET

Certificate
for a PI Competence Center

PI confirms that

PROCENTEC
Elmer Vis
Klopperman 16
2292 JD Wateringen
NETHERLANDS

is a fully accredited PI Competence Center for
PROFIBUS basic
PROFIBUS Process Automation
PROFIsafe.

This certificate is granted according to the Quality of Services Agreement for PI Competence Centers and is valid for 2 years, until December 31, 2019.

(Official in Charge)

Chairmen of PI

(Karsten Schneider, Chairman)

(Michael Bowne, Deputy Chairman)

PROFIBUS • PROFINET

Certificate

Authorization as PI Test Laboratory for PROFIBUS

PROFIBUS Nutzerorganisation e.V. accepts
PROCENTEC
Klopperman 16
2292 JD Wateringen
The Netherlands

as authorized PI Test Laboratory for:

PROFIBUS Slave Devices

PA Profile Devices

The authorization is based on the assessment dated February 19, 2015, and the related assessment report.

The execution of the tests aimed in the PROFIBUS certification shall be conform to the PROFIBUS Standard and the valid guidelines.

This authorization is valid until December 31, 2016.

(Official in Charge)

Board of PROFIBUS Nutzerorganisation e. V.

(K. Schneider) (K.-P. Lindner)

PROFIBUS®

6. Revision History

V 3.0.0

- Completely changed to new Corporate Identity
- Removed all ProfiHub B5 information
- Updated certificates
- Updated paragraph 1.5