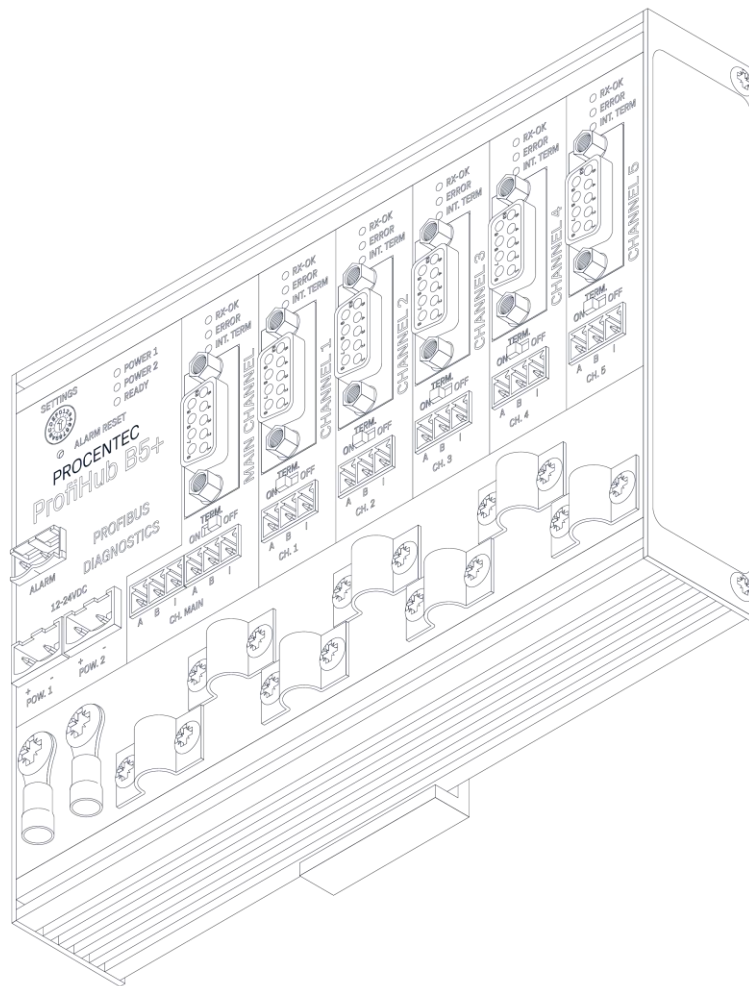


# PROCENTEC

Member of the HMS group.



## ProfiHub B2FOR+/B4FOR+

User manual

## **B 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 follows 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.

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# Important information

## **Purpose of the Manual**

This manual explains how to put the ProfiHub B2FOR+ / B4FOR+ 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 your old equipment, please contact:

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## **Document Updates**

You can obtain constantly updated information on PROCEN TEC products on the Internet at [www.procentec.com](http://www.procentec.com)

You can also contact PROCEN TEC Customer Support:

- by phone at +31-(0)174-671800
- by fax at +31-(0)174-671801
- by email at [support@procentec.com](mailto:support@procentec.com)

## Important notices

### Safety of laser products

- ▶ The devices of the product contain LED / laser components in accordance with IEC 60825-1:2014: Class 1 laser/LED-product.



### Warning!

- ▶ Do not look into in the beam of the optical transceivers with optical instruments (eg, lenses, microscope)! Ignoring this warning may result in eye damage.
- ▶ Do not look into the optical transmitter. The bundled and - dependent on the wavelength - visible or invisible light can cause eye damage.

## WARNING

When the product is in use at an ambient temperature of 63 degrees Celsius or 145 degrees Fahrenheit, the housing of the ProfiHub B2FOR+ / B4FOR+ will be hot. **Do not touch the housing!**

At normal operating temperatures of 25 degrees Celsius, the temperature of the housing will not exceed 35 degrees Celsius.

## WARNING

When the product is in use at an ambient temperature of 63 degrees Celsius or 145 degrees Fahrenheit, the housing of the ProfiHub B2FOR+ / B4FOR+ will be hot. **Do not touch wires which are in contact with the housing!**

## WARNING

When the product is in use at an ambient temperature of 63 degrees Celsius or 145 degrees Fahrenheit, the housing of the ProfiHub B2FOR+ / B4FOR+ will be hot. **Use wires suitable for these temperatures!**

HOT HOUSING warning located on the side of the housing. Make sure this warning is visible after wall installation. UL certification demands the warning to be visible during operation.

To comply with UL certification regulations (UL60950-1) the power supply must be a Limited Power Source (LPS) or NEC Class 2 or CEC Class 2 that cannot exceed 100VA.

According to UL60950-1, if a copper PROFIBUS cable is used outside, it is required to install surge protection that is suitable for PROFIBUS.

To comply with UL certification regulations the ProfiHub B2FOR+ / B4FOR+ is to be used on altitudes under 2000 m.

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# 1. Product Description

This innovative network component is an essential element when it comes down to maintaining PROFIBUS DP systems when a host system must be involved. In the past, the application software was not able to identify bus diagnostic information and act accordingly. With the ProfiHub B2FOR+ MM/SM and B4FOR+ MM/SM this information is fully available in a PLC/DCS system with the DP-V0 protocol or in a ComBricks system. The information can be visualized with a SCADA/WINCC system or with the WEB-based interface of the ComBricks system. Even the location of certain devices behind the channels of the ProfiHub can easily be verified, and it is very useful to identify the topology from a host system point of view.

The ProfiHub B2FOR+ MM/SM and B4FOR+ MM/SM are robust network components providing reliable solutions for fiber rings, spur lines and star-shaped structures in PROFIBUS DP networks.

The user provides the ProfiHub with a bus address (software set slave address function). By means of the GSD file the user can configure the data that is required from the ProfiHub. The cyclical data can contain simple statistics up to complex structures identifying channel problems.

The ProfiHub B2FOR+ MM/SM and B4FOR+ MM/SM have one fiber optic channel with two ports and two or four galvanic isolated RS485 channels. With the two fiber optic ports, a ring or line/bus structure can be realized whereby each HUB has two or four RS485 channels on which 31 devices or other HUBs can be connected. The plug-able screw terminals with integrated termination of the RS485 channels can be used with an end point of a segment. Also, the DB9 connectors could be used with a segment end point or for monitoring purposes. Another application of the DB9 connector is, to connect the HUB to any place in a segment.

If bus redundancy is enabled, the two rightmost RS485 channels will form a redundant pair. In combination with another ProfiHubHUB, cable redundancy can be realized.

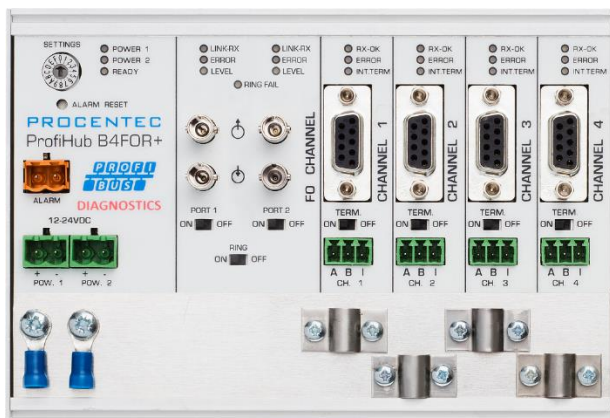


Fig. 1 - ProfiHub B4FOR+



## 1.1 Product Features

- PROFIBUS DP Slave for network diagnostics and statistics (*DP-V0, configurable with modules*)
- Diagnostic information and statistics available in ComBricks system with WEB-based interface
- One Fiber Optic channel, split into two ports
- 2 or 4 galvanic isolated RS485 channels
- Fiber Optic redundancy with signal strength and ring status (LEDs, DP-V0 and WEB-based on ComBricks system)
- RS485 Cable redundancy
- Redundant power supply
- Robust repeating mode
- Supporting line/bus, ring, star and tree topology
- Alarm contact
- Monitoring port on all RS 485 channels
- Short circuit protection on all RS 485 segments
- Configurable grounding system
- Glitch recovery
- Low power consumption
- No limit in cascading RS485 channels (*only limited by busparameters of the master*)
- Integrated Termination per channel

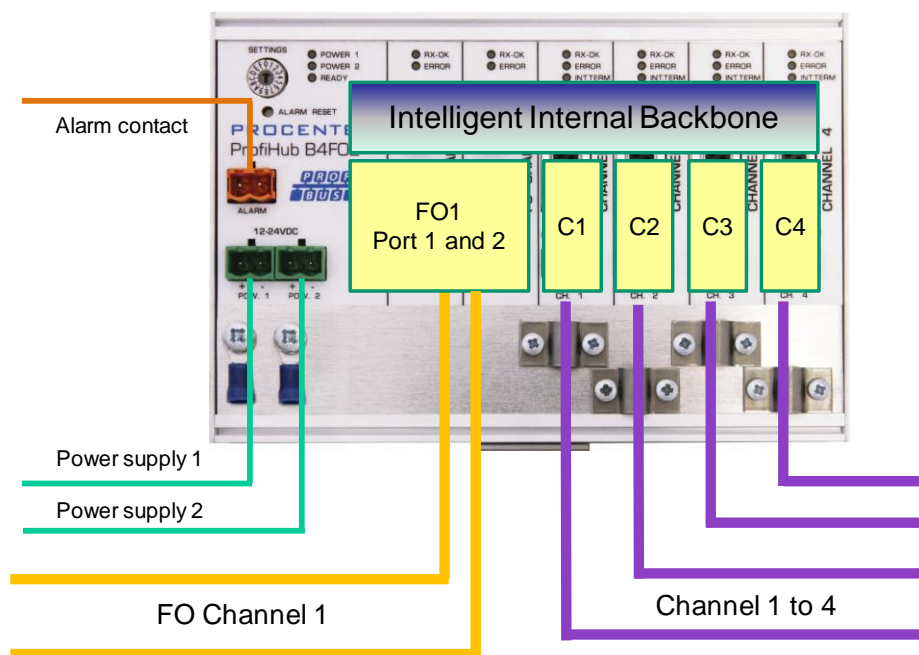


Fig. 2 - ProfiHub connections

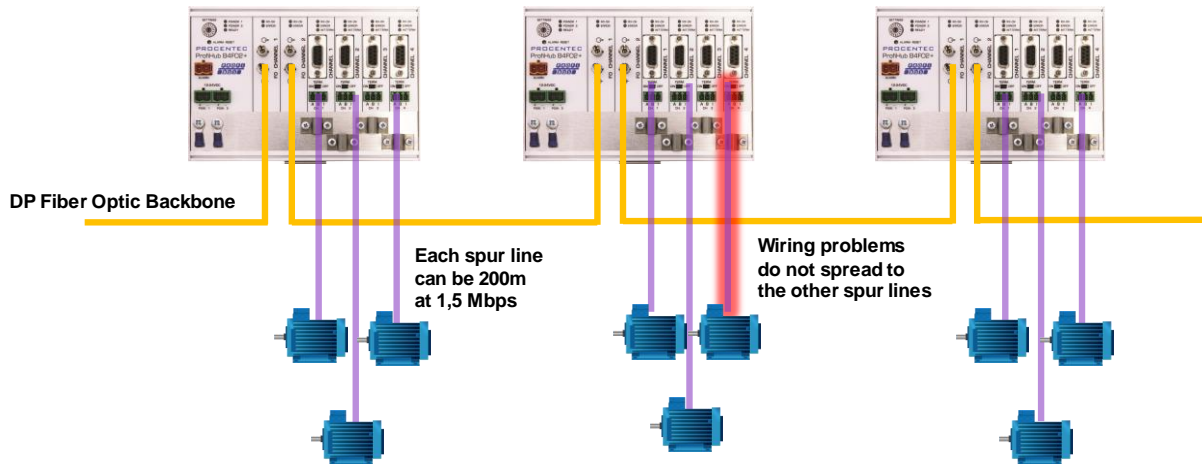


Fig. 3 - Long spur lines to instruments and the possibility to remove/insert them during operation. Short circuit protection on each spur line is automatically provided.

## 1.2 Application areas

- Create Fiber Optic backbones and rings
- Dynamic spur lines to actuators, flow meters and pH analyzers
- Removable drives and motors
- Pull/Plug motor control centers (drawers)
- Roof mounted devices in tank farms
- Barrier for non-galvanic isolated equipment
- Networks with requirement for High Availability/uptime
- Large star/tree structured networks

## 1.3 Additional Benefits

- Hot slave insertion and removal during operation
- Short circuit protection on each Channel
- Option to create a redundant path to other Hubs or ComBricks
- Compact and robust construction
- Status and error LEDs (per Channel)
- Suitable for all DP cables
- Conveniently arranged networks
- Easy extendable installations
- On-board DB9 female connector on each channel for maintenance activities
- Cost Savings

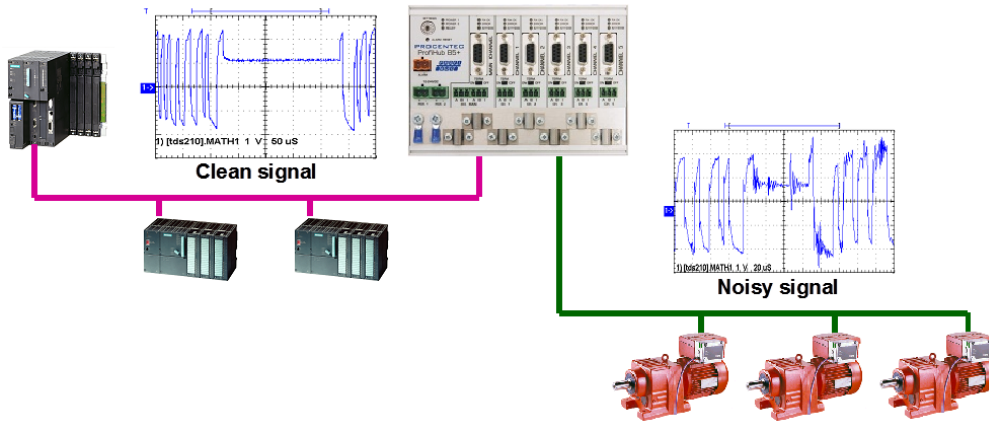


Fig. 4 - Because of the isolation and intelligence the ProfiHub provides, it can be used as a barrier for electrically sensitive segments. This keeps the backbone and other Channels clean.

## 1.4 Channel Structure

Each 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).

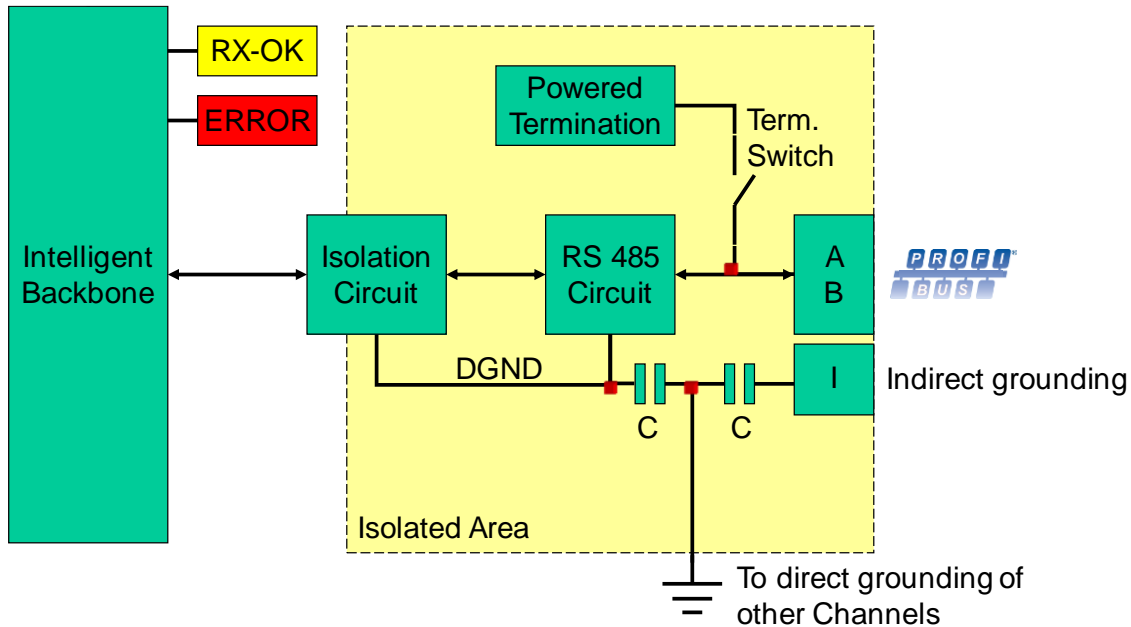


Fig. 5 - Channel structure

## 1.5 Grounding System

The ProfiHub B2FOR+ / B4FOR+ can be grounded by 3 methods:

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

The power supply must be grounded directly on the Ground Rail. 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. 5), ensuring protection of the signal against non-DC disturbances.

If the ground is accidentally connected to the indirect ground on a channel, the connection to the Direct Grounding bypasses the capacitor of 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 must comply with the PROFIBUS DP cable specifications for RS 485 (Fig. 6).

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 length (feet)	3940	3940	3940	3940	3280	1310	656	328	328	328

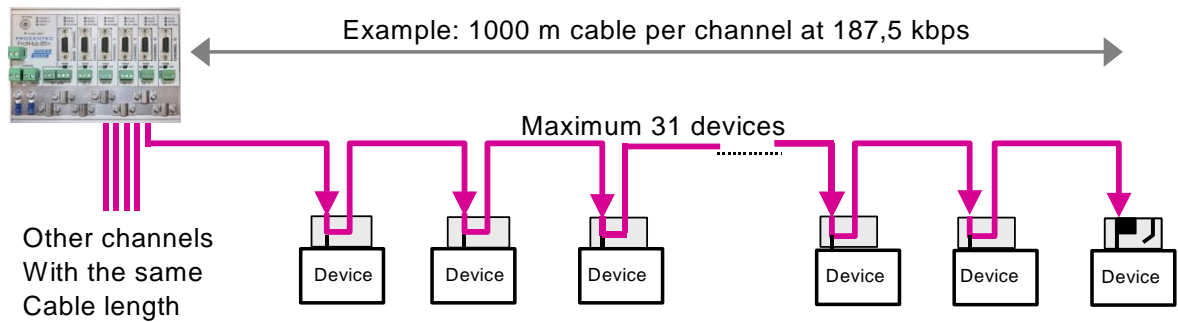


Fig. 6 - Cable lengths for PROFIBUS DP

## 1.7 Cable types for PROFIBUS DP

The cable type must comply with the PROFIBUS DP cable specifications for RS 485 (Fig. 7).

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 <sup>2</sup>

Fig. 7 - PROFIBUS DP cable specifications

The ProfiHub B2FOR+ / B4FOR+ can handle cables based on multiple protection sheaths with an overall cable diameter between 6 to 12 mm (Fig. 8).

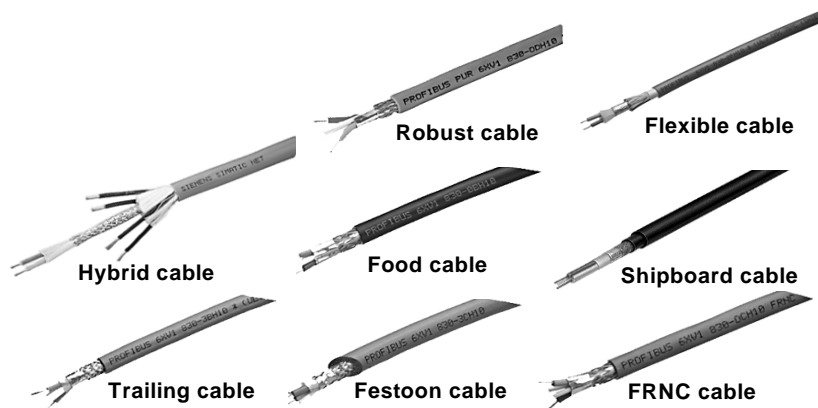


Fig. 8 - Cables with different protection sheaths.

## 1.8 Cable lengths for fiber optic

The maximum cable length for fiber optic cables is 5 kilometers with the multimode transceivers (B2FOR+MM and B4FOR+MM) and 30 kilometers with single mode transceivers (B2FOR+SM and B4FOR+SM).

## 1.9 Cable types for fiber optic

The following cable types can be used with the ProfiHub B2FOR+ and B4FOR+:

ProfiHub type:	B2FOR+MM	B2FOR+SM	B4FOR+MM	B4FOR+SM
Fiber Optic wavelength	Multimode 1310 nm	Single mode 1310 nm	Multimode 1310 nm	Single mode 1310 nm
Cable type	Fiber 50 / 125 $\mu$ m (OM2, OM3, OM4, OM5 compatible)	Fiber 9 / 125 $\mu$ m (OS1 and OS2 compatible)	Fiber 50 / 125 $\mu$ m (OM2, OM3, OM4, OM5 compatible)	Fiber 9 / 125 $\mu$ m (OS1 and OS2 compatible)
	Fiber 62.5 / 125 $\mu$ m (OM1 compatible)		Fiber 62.5 / 125 $\mu$ m (OM1 compatible)	
Cable length	Max. 5 km (1dB / km)	Max. 30 km (0.4dB / km)	Max. 5 km (1dB / km)	Max. 30 km (0.4dB / km)
Optical budget	13 dB	17 dB	13 dB	17 dB
Connectors	4 x ST/BFOC (one channel, two ports)			
Topologies	Ring, point-to-point (direct, hub, split, star)			
Cascading depth	No limit, only busparameter limitation of the master			

## 1.10 Status LEDs

The Status LEDs on the ProfiHub are very useful for diagnostics.

LED	OFF	Blinking	ON
<b>POWER 1 / 2</b>	☺ Power is not switched on or an internal failure	☹ Power was bad, now OK (alarm pending).	☺ Power supply OK.
<b>READY</b>	☺ 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.
<b>Fiber Link RX-OK</b>	☹ No communication detected	☺ Receiving valid PROFIBUS messages	☺ Fiber connection to next link established
<b>Fiber Port ERROR</b>	☺ No problem has been detected	☹ Signal was too low, now fixed (alarm pending)	☹ Signal too low, no connection to next link
<b>Fiber Level</b>	☺ No problem has been detected	☹ Signal was critical, now fixed (alarm pending)	☹ critical signal, but messages could still be received
<b>Fiber Ring Fail</b>	☺ No problem has been detected	☹ Ring was broken, now fixed (alarm pending)	☹ Ring is broken
<b>RS 485 RX-OK</b>	☺ There is no communication detected (on this Channel)	☺ one or more devices communicating (on this Channel)	☺ one or more devices communicating (on this Channel)
<b>RS485 ERROR</b>	☺ No problem has been detected	☹ Problem in the cabling has been detected on this Channel, see 1.11	☹ Problem in the cabling has been detected on this Channel, see 1.11
<b>RS 485 INT. TERM</b>	Termination for this channel is OFF	Internal failure	Termination for this channel is ON

## 1.11 The red error LED

The red error LEDs on a channel will blink shortly if a corrupt message enters the ProfiHub. More specifically, this can be a Parity error (the parity checksum of the byte is incorrect) or a Framing error (the FCS byte is different than the real message). It is necessary to investigate further with an oscilloscope to find out what the problem is. This can easily be done with ProfiTrace.

Another reason for the red error LED for channel 1 or 2 of the B2FOR+ MM/SM or channel 4 and 5 of the B4FOR+ MM/SM is a problem in the redundant cabling (if the ProfiHub is set to redundant; rotary switch position 2 and 5). The red error LED is ON with a problem in one or both cables and blinking if there was a problem but now fixed. A cable redundancy alarm is pending. Press the 'Alarm Reset' button to reset the pending Alarm. This can also be done remotely with the conformation module of the diagnostic slave (DP-V0) or in the Diagnostic slave info WEB-page of the ComBricks Head station.

It can also be that the baudrate is not locked (no PROFIBUS master on the bus). If a baudrate has been locked and the master disappears from the bus, the current baud rate will be unlocked after 50 seconds.

## 2 Installation Instructions ProfiHub B2FOR+ / B4FOR+

### 2.1 Location

The ProfiHub can be installed everywhere in a non-hazardous area that complies with IP 20 (DIN 40 050) and the specified temperature range of -25 to +70° Celsius.

### 2.2 Position

The ProfiHub can be installed in every position, but it is recommended to install it with the cables pointing down. In this position it is also easier to read the status LEDs.

### 2.3 Mounting

The ProfiHub can be mounted on 35 mm DIN-rail with a minimum width of 167 mm. The ProfiHub B2FOR+ / B4FOR+ has only been UL approved with 35 mm DIN-rail mounting!

The supplied rubber studs need to be placed on the backside of the housing of the ProfiHub B2FOR+ / B4FOR+ for extra fixation. This is to prevent the product to potentially slide off the DIN-rail. See Fig. 9 for an example.



Fig. 9 – Rubber studs on backside of housing



## 2.4 Power Supply

To comply with UL certification regulations the power supply must be a Limited Power Source (LPS) or NEC Class 2 or CEC Class 2 that cannot exceed 100VA.

The two 2-pin screw type power connectors are located on the left of the ProfiHub B2FOR+ / B4FOR+ (Fig. 10).

1 = + (left)

2 = - (right)

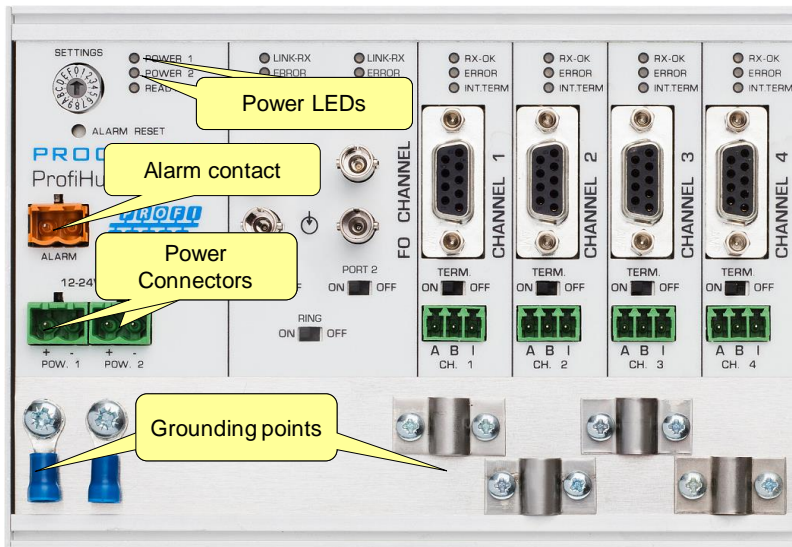


Fig. 10 - Power connectors and LEDs

Both power connectors are linked 1-on-1 to the internal power supply of the B2FOR+ / B4FOR+. If one power supply fails, the other power connection takes over, maintaining the supply voltage. When redundancy is not required, it is sufficient to use one power connector. Please note that when using only one power supply, a voltage of max. 0.25 V will exist on the other unconnected power connector, as shown in Fig. 11.

If only one power supply is used, the alarm contact is closed and an alarm is triggered (pending alarm). If two power sources are connected after a pending alarm, the contact can be opened by resetting the alarm (see paragraph '2.6 Relay contact'). As soon as one of the power supplies fails, the contact will close again with pending alarm and the Power Indicator LED will blink.

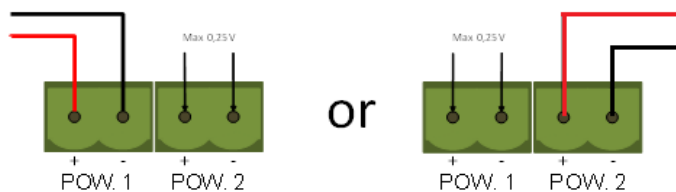


Fig. 11 – Maximum voltage on unconnected Power Connector

For UL certified installations the power supply must comply with the following specifications:

- Limited Power Source (LPS) or NEC Class 2 or CEC Class 2
- Voltage: 12 - 24 VDC
- Current: min 130 mA
- Wire diameter: < 2.5 mm<sup>2</sup>

## Procedure

To connect the 24V supply to the 2-pin screw-type terminal, proceed as follows:

- Strip the insulation from the cable or the conductors for the 24V power supply.
- Add cable crimp terminals/wire ferrules to the conductors.
- Secure the crimp terminals in the screw-type terminal.

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:

- LEDs should be blinking in a circular animation for a short time.
- The POWER LED of the respective power connector (1, 2 or both) is ON.
- The READY LED is ON or Blinking, depending on baud rate lock.

## 2.5 Grounding of the power



It is recommended to use a power supply with a ground lead (3-wire). Connect the ground lead of the power lead to the Ground Rail of the ProfiHub. Connect the Ground Rail to the common ground with a separate ground lead. See Fig. 12 for an example.

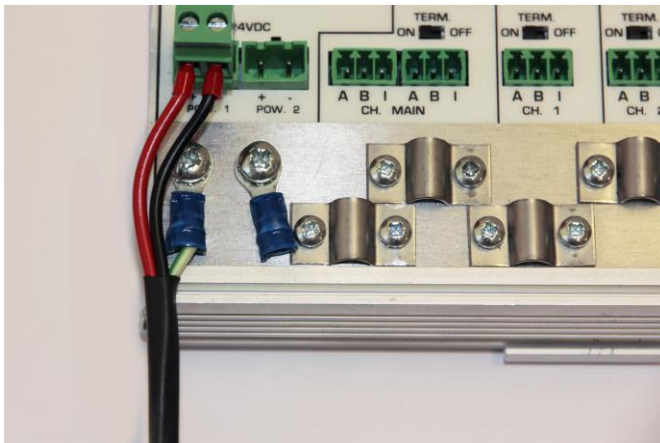


Fig. 12 - Connection to Ground Rail

## 2.6 Relay contact

The ProfiHub features a potential-free relay contact. This alarm contact can be used to monitor the power supplies. Example applications are: Connect a LED tower, alarm buzzer, SMS server or use it as a digital signal for the PLC. The relay can also be used for alarming in case of retries, illegals, or other events. For more information refer to Chapter 3.

If only one power supply is used, the alarm contact is closed after 60 seconds after start-up. If two power supplies are connected, the contact is open. When one of the power supplies fails for 3 seconds or more, the contact will close and the Power Indicator LED will blink. If you are using only one power source and wish to use the Relay contact, simply connect Power 1 to Power 2.

In the case of an interrupted power supply you can reset the contact by pressing the 'Reset' button. The contact will open and the LEDs will stop blinking.

The Alarm contact is also switched when the ProfiHub is in Redundant mode and one of the redundant paths fails, or when the fiber ring fails or one of the fiber signals is low or off.

The maximum power to be connected to the alarm contact is 24 VDC. The maximum current consumption is 500 mA.

It is advised to use a Limited Power Source (LPS) of NEC Class 2 or CEC Class 2 for powering the alarm contact.

## 2.7 Backbone

The fiber channel can be used to create a backbone together with a ComBricks set. The ComBricks can retrieve all the diagnostic information (a ComBricks FOR-MM1 or FOR-SM1 is required). It is also possible to connect the ComBricks via copper to one of the copper channels of the ProfiHub B2FOR+ or B4FOR+.

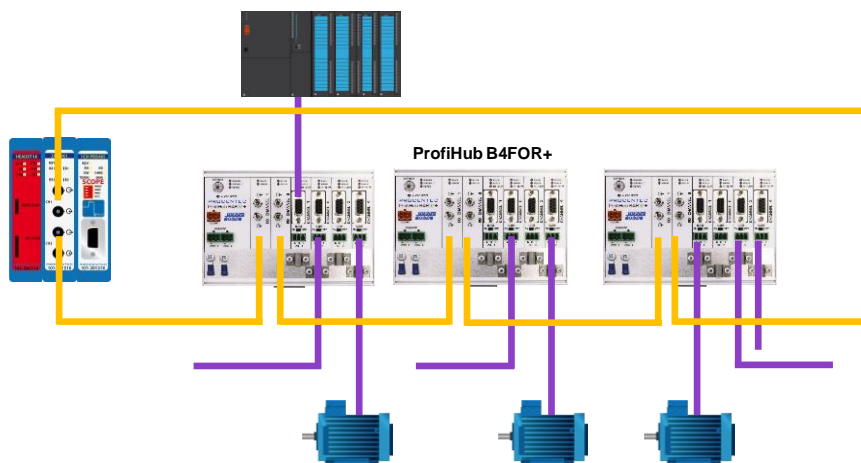


Fig. 13 - Example topology for a fiber backbone with ProfiHubs

## 2.8 Calculating the delay time

Fiber optic applications require a delay time calculation to adjust the  $Max_{TSDR}$  and Slottime ( $T_{slot}$ ) busparameters in the configuration of the master(s). The B2FOR+ / B4FOR+ complies with the following formulas:

$$T_{SLOT} \geq Max_{TSDR} + ((FO_{length} \times FO_{delay}) + (N_{FO-modules} \times N_{delay})) \times 2$$

- $FO_{length}$  = Total length of fiber optic cable in km
- $FO_{delay}$  = Delay of fiber optic cable per km in bit times (see table)
- $N_{FO-modules}$  = Number of fiber optic modules in cascade
- $N_{delay}$  = Delay of one fiber optic module (see table)

The delay time is multiplied by 2 for a request and response message.

Baudrate	$Max_{TSDR}$ [Tbit]	$FO_{delay}$ [Tbit/km]	$N_{delay}$ Normal mode [Tbit]	$N_{delay}$ Robust and Red. Mode [Tbit]
12 Mbps	800	60	47	59
6 Mbps	450	30	25	36
3 Mbps	250	15	14.5	25
1.5 Mbps	150	7.5	9	20
500 kbps	100	2.5	5	16
187.5 kbps	60	0.94	4.5	15.5
93.75 kbps	60	0.47	4.5	15.5
45.45 kbps	400	0.23	4.5	15.5
19.2 kbps	60	0.1	4	15
9.6 kbps	60	0.05	4	15

Note:  $FO_{delay} = (FO_{cable\_length} / FO_{cablelatency}) / Bit_{time}$

Example  $FO_{delay}$ , 1km, 1.5Mbps:  $(1000 \text{ m} / 200 \text{ } \mu\text{sec/m}) / 0.666 \text{ } \mu\text{sec} = 7.5 \text{ Tbit/km}$

### Example 1: 1.5 Mbps, 5 km FO cable (total ring or line length), 6 units Normal mode

$$T_{SLOT} \geq Max_{TSDR} + ((FO_{length} \times FO_{delay}) + (N_{FO-modules} \times N_{delay})) \times 2$$

$$T_{SLOT} \geq 150 + ((5 \times 7.5) + (6 \times 9)) \times 2 \geq \mathbf{333 \text{ bit times}}$$

### Example 2: 6 Mbps, 25 km FO cable (total ring or line length), 10 units in cascade, robust mode

$$T_{SLOT} \geq Max_{TSDR} + ((FO_{length} \times FO_{delay}) + (N_{FO-modules} \times N_{delay})) \times 2$$

$$T_{SLOT} \geq 450 + ((10 \times 30) + (10 \times 36)) \times 2 \geq \mathbf{1470 \text{ bit times}}$$

## 2.9 Fiber ports and Ring

The two fiber ports are one fiber channel in the B2FOR+ and B4FOR+. Each port can be individually enabled or disabled with the switches below the ports (see Fig. 14). If one of the two ports is not used, for example in a line structure, make sure to disable the unused port to prevent signal errors. If the port is on but no cable is connected, this can trigger a 'No signal' alarm.

If the 'Ring' switch is on, then both fiber ports must be enabled and connected to ring ports of other compatible Hubs.

## 2.10 Spur Segments

Connect the spur segments to the connectors of the green screw channels (Fig. 14). The second method is to place a PROFIBUS standardized plug on the DB9 connector of the specific Channel.

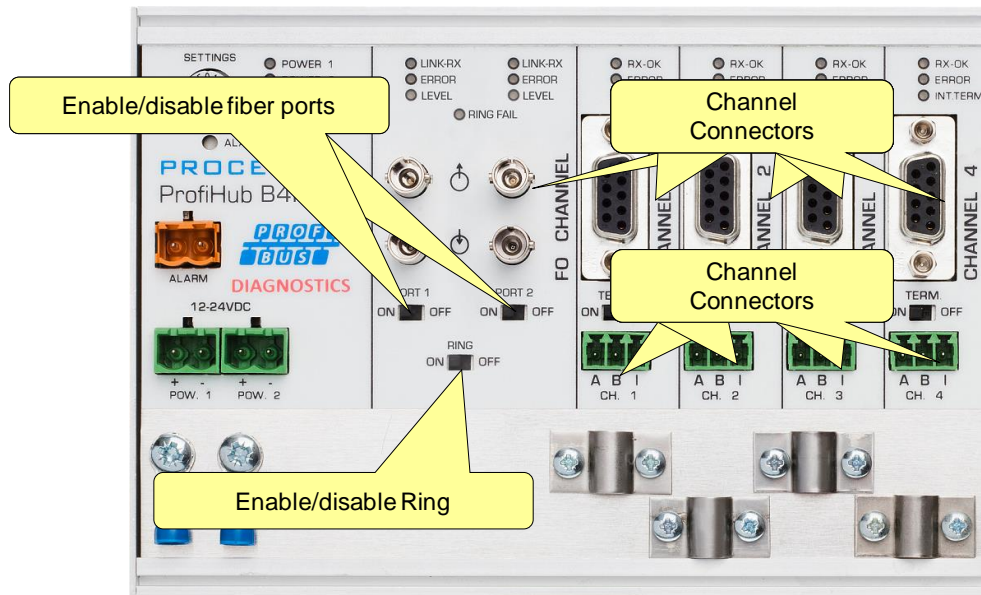


Fig. 14 - PROFIBUS DP spur connectors

### Pin layout of the screw terminals:

Pin "A": Green wire

Pin "B": Red wire

Pin "I": Indirect cable shielding

Note: Connecting the Indirect cable shielding is not required when the ground clips are used.

### Testing

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

According to UL60950-1, if a copper PROFIBUS cable is used outside, it is required to install surge protection that is suitable for PROFIBUS.

## 2.11 Termination

The terminations of the Channels have been set to ON by default, because it is assumed that the new segment is started at the ProfiHub (Fig. 15).

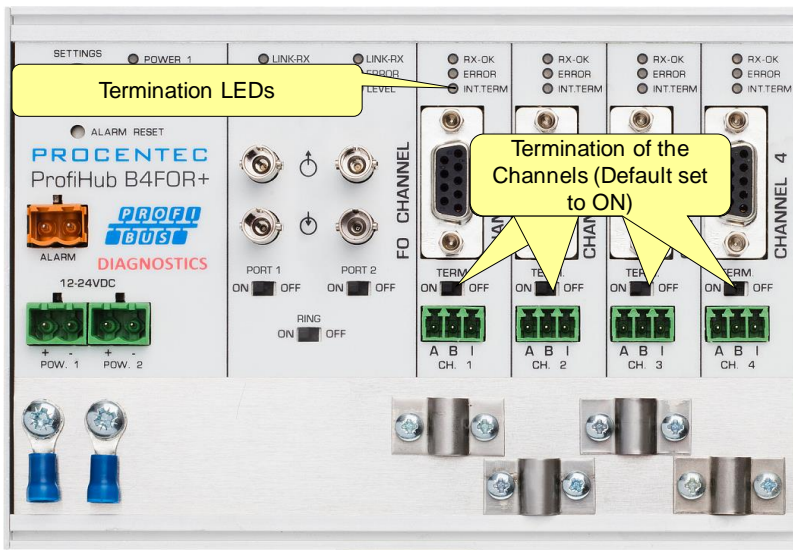


Fig. 15 - Termination Switches

The termination LED of the corresponding Channel is activated when the termination switch is set to ON.

- i When the DB9 connector is used and the cable starts at the ProfiHub, it is recommended to use the termination on the DB9 plug and NOT the ProfiHub. This way, the connector can be removed while maintaining termination on the bus.

## 2.12 Baudrate switch

To set the rotary switch, use a 3 mm screwdriver.

The rotary switch for the B2FOR+ / B4FOR+ has the following options:  
Switch values:

Rotary switch	Auto detect	Robust repeating	Redundancy	Diagnostic slave
0	•			
1	•	•		
2	•	•	•	
3	•			•
4	•	•		•
5	•	•	•	•
6-F	•			

A change of the rotary switch setting is immediately active without restarting the device.

The auto baudrate detect feature will search for the correct baud rate within 10 seconds of receiving the first telegram. This baud rate lock will be lost after 50 seconds of incorrect or no message reception.

In robust repeating mode, only messages starting with a valid PROFIBUS start delimiter are repeated (SD1, SD2, SD3, SD4 and Short Acknowledge). In Normal mode, every bit is transferred immediately onto the other channels.

## 2.13 Robust Repeating Mode

The B2FOR+ / B4FOR+ has two repeating modes: normal (rotary switch setting 0 and 3) and Robust Repeating (rotary switch setting 1, 2, 4 or 5). In normal mode the bits are transferred directly on the other channel with a minimal delay (see delay times in the Technical Data chapter). In Robust mode, the first byte is checked to verify if the following bits are a real PROFIBUS message. If the byte is corrupt, the message will not be transferred to the other channel. This helps network stability in EMC sensitive environments.

### **ATTENTION:**

Using the ProfiHub B2FOR+ / B4FOR+ in Robust Repeating mode causes a delay in processing the telegrams. It is required to increase the default MinTSDR in the PLC busparameters slightly. Recommended is to increase the MinTSDR with a value according to the Delay Time table, column 'Robust Mode', described in the Technical Data chapter. Generally a MinTSDR of 25 is sufficient.

## 2.14 Channel Redundancy

To use the Redundancy option of the B2FOR+ / B4FOR+, set the rotary switch to 2 or 5.

This enables the last two copper channels to be one redundant path to any other ProfiHub, to a redundant ComBricks, or to any other supporting product. See Fig. 16 for an example.

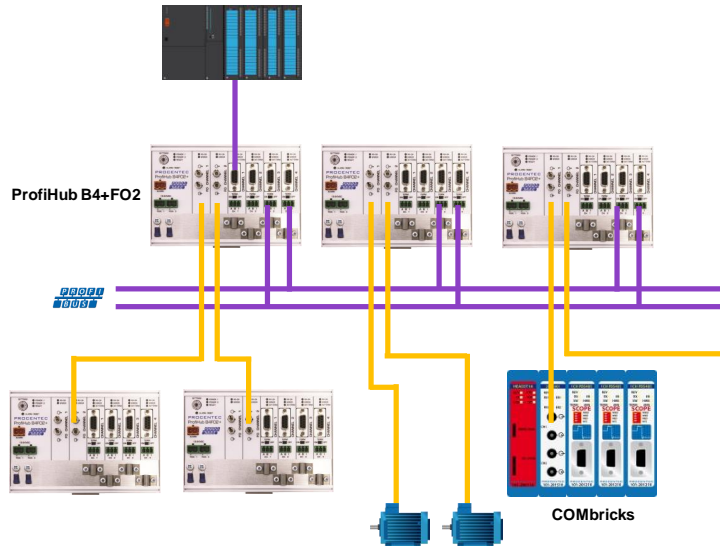


Fig. 16 - Redundant path between multiple ProfiHubs

The telegrams are transferred onto both redundant channels. The logic inside the ProfiHub determines which telegram is used to be transferred onto the other channels. A message received by a redundant channel is repeated on all other channels, except the other redundant channel. A message received by a normal channel is repeated on all other channels.

When one redundant cable breaks, the other cable ensures safe delivery of the telegram. In this event the built-in alarm contact will close. The red 'ERROR' LED will blink with an interval of 100ms. When the redundant path is fixed, press the 'ALARM RESET' pushbutton to reset the alarm.

### **ATTENTION:**

Using the ProfiHub B2FOR+ / B4FOR+ in Redundancy mode causes a delay in processing the telegrams. It is required to increase the default MinTSDR in the PLC busparameters slightly. Recommended is to increase the MinTSDR with a value according to the Delay Time table, column 'Robust Mode', described in the Technical Data chapter. Generally a MinTSDR of 25 is sufficient.



### 3 Diagnostics Device

The B2FOR+ / B4FOR+ comes with a built-in Diagnostics Device. The Diagnostics Device is a very versatile statistics/diagnostics logger. It can be used to keep track of the overall PROFIBUS network health and inform the PLC or DCS of any network failure such as Fiber ring failures or signal strength, repeats or illegals, missing ProfiHub termination, live list changes, or power supply problems. Audible or visible feedback is also possible by automatically switching the integrated alarm relay.

You can use a ComBricks to display the most important diagnostics of every channel. The information of this ProfiHub Diagnostics slave is displayed as follows:

**PROCENTEC ComBricks**

- [Status](#)
- [System log](#)
- [Channel list](#)
- [Diagnostic slave info](#)

**ProfiTrace OE:**

- [Live list](#)
- [Statistics](#)
- [Message recording](#)
- [Network event log](#)
- [E-mail & Log event config](#)
- [Output event config](#)
- [SNMP event config](#)
- [Tag-name config](#)

**Special modules:**

- [Oscilloscope images](#)
- [Oscilloscope errors](#)
- [Bargraph images](#)
- [Oscilloscope config](#)
- [Fiber optic config](#)

**Configuration:**

- [General config](#)
- [Network config](#)
- [IP config](#)
- [Password & user config](#)
- [E-mail account config](#)
- [Device management](#)
- [User message](#)
- [Diagnostic slave config](#)
- [Update license](#)
- [Downloads](#)

Not logged in.

---

### ProfiHub diagnostic slave info

ProfiHub B4FOR+ (Address: 30, Serial#: 1)

Diagnostic slave info	
Last update:	27-Jun-2019 13:38:50
ProfiHub type and serial number:	ProfiHub B4FOR+ (Serial#: 1)
ProfiHub firmware version:	V2.2
ProfiHub diagnostic slave address:	30
Connected to this ComBricks:	Network 1 (Module 10, Channel 1)
Redundancy status:	● Redundancy OK
Power 1 connected:	Yes
Power 2 connected:	Yes
Alarm status:	<b>Active due to the following reason(s):</b> Fiber optic channel 1 error Fiber optic ring error <input type="button" value="Reset alarm"/>
Fiber optic port 1 status:	● Signal error <input type="button" value="Multi mode"/>
Fiber optic port 2 status:	● Signal OK <input type="button" value="Multi mode"/>
Fiber optic ring status:	● Ring error <input type="button" value="Ring mode"/>

SETTINGS	LINK	LINK	LINK	LINK	LINK	LINK
POWER 1	LEVEL	LEVEL	INT-TERM	INT-TERM	INT-TERM	INT-TERM
POWER 2	LINK	LINK	LINK	LINK	LINK	LINK
READY	LEVEL	LEVEL	INT-TERM	INT-TERM	INT-TERM	INT-TERM
ALARM RESET	● RING FAIL					
PROCENTEC ProfiHub						
ALARM	PORT 1 ON OFF	PORT 2 ON OFF	TERM ON OFF	TERM ON OFF	TERM ON OFF	TERM ON OFF
DIAGNOSTICS	RING ON OFF		A B I	A B I	A B I	A B I
12-24VDC						
POW. 1						
POW. 2						

Termination:	-	On	On	On	On
Illegals:	0	0	0	0	0

Internal Diag slave	FO Ch	Ch 1	Ch 2	RED Ch 3	RED Ch 4
30	0	1	40	50	
	10		41		
	11		42		

Fig. 17 - Information window of the Diagnostic slave

It displays the following information:

- PROFIBUS slave address and Tag-name of the Diagnostic slave
- Type and serial number of the Diagnostic slave
- Firmware version of the Diagnostic slave
- Connection to the Network, Module and Channel number of the ComBricks
- Redundancy status of the ProfiHub
- Power status of the ProfiHub
- Alarm status (of the relay)
- Fiber optic signal status of both channels, and an indication of fiber type
- Status of the fiber optic ring
- Termination status of all channels
- Illegal count for all channels
- A live list of all channels

For more information see the ComBricks manual, paragraph ‘Diagnostic Slave info’.

The diagnostic information can also be read easily with ProfiTrace because the Diagnostic Device sends this data over PROFIBUS. This enables maintenance engineers to immediately identify the affected segment in case of cable problems or instrument failure. Having a Diagnostics Device in your network dramatically decreases downtime because problems can be solved much quicker; it tells you where to look. SCADA applications can make this even easier.

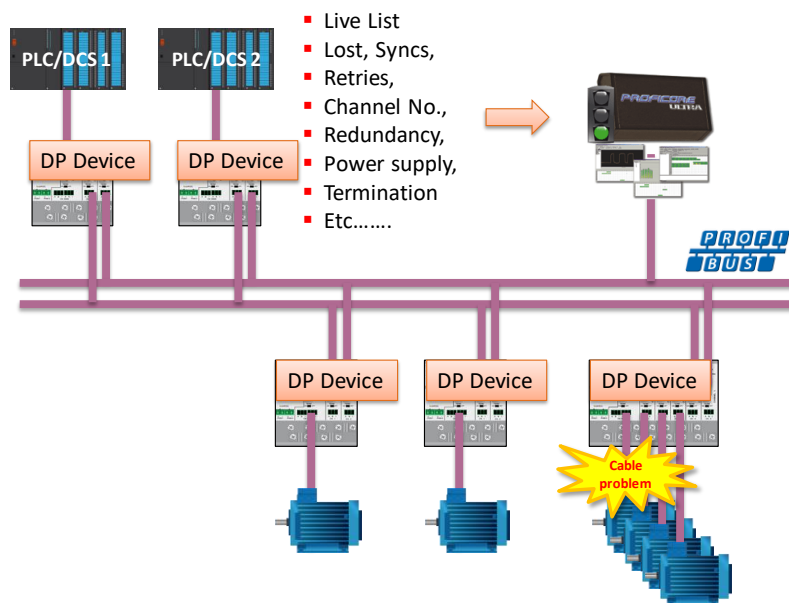


Fig. 18 – Cable problems or node loss can be identified by the ProfiHub channel and send this information over PROFIBUS to the PLC. ProfiTrace can also read this.

The following statistics and events are continuously monitored:

Events:	Statistics:
Alarm Relay opened/closed	Losses
Fiber optic ring change	Syncs
Fiber signal level change	Repeats (total)
Cable Redundancy change	Repeats (max. changed in 1 cycle)
Baudrate change	Illegals
Power input changed	Internal Diagnostics
Termination of Channel changed	External Diagnostics
Communication on Channel stopped/started	Diagnostics while in Data Exchange
Livelist changed (station removed or added)	

All of these events and statistics can be transferred in five different ways, so that the PLC/DCS or user can be warned that something is happening in the PROFIBUS network: a PROFIBUS input message, a diagnostic message, an external diagnostics message, a trigger of the built-in alarm relay, or a message to the ComBricks where it can be visualized and used for further alarming (via SNMP for example).

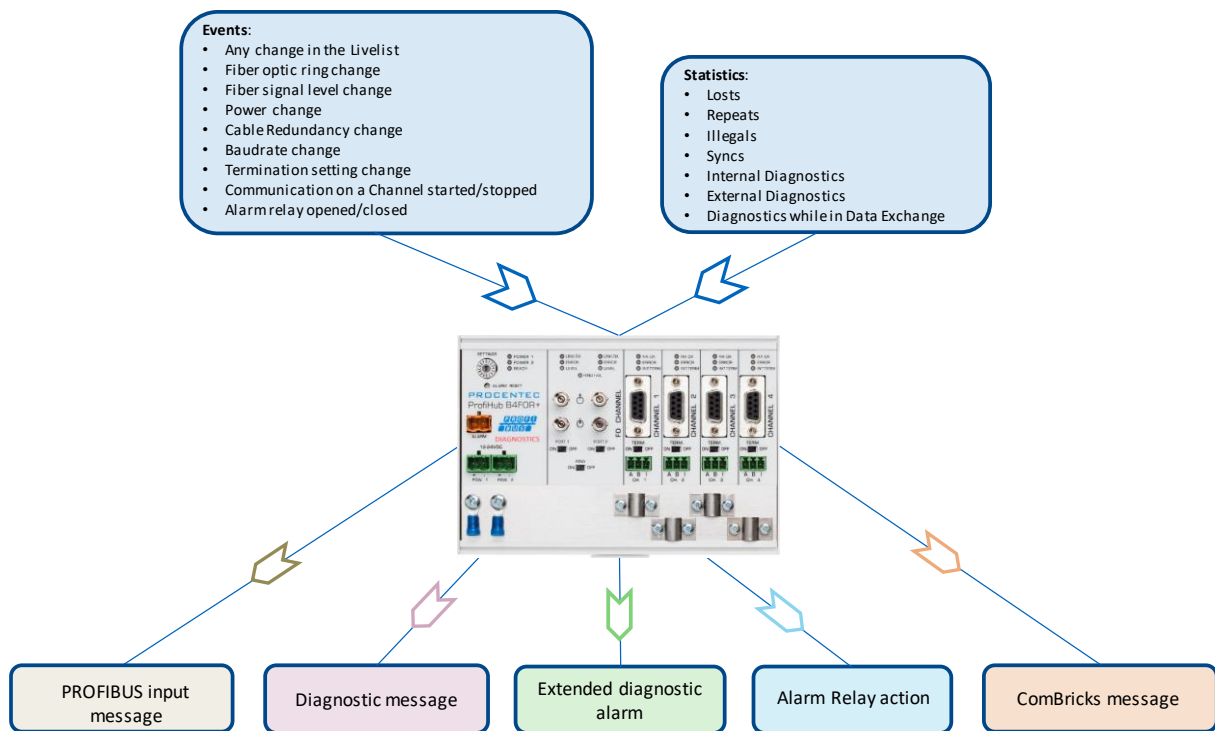


Fig. 19 - Ways of notifying the user in case of problems

### 3.1 Setting up the Diagnostics Device

#### 3.1.1 Enabling the Diagnostics Device

To enable the Diagnostics Device in the ProfiHub, set the rotary switch on the top left side to position 3, 4 or 5 (for a complete list of rotary switch settings, refer to the Technical Data chapter).

#### 3.1.2 Changing the default PROFIBUS Slave address

By default the address of the Diagnostic PROFIBUS Slave of the ProfiHub is set to 126. To change the address, use a configuration tool which supports the 'Set Slave Address' command. Most configuration tools support this feature.

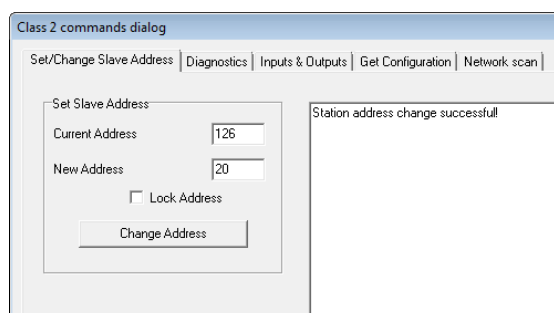


Fig. 20 - ProfiCaptain changes the address from 126 to 20

### 3.1.3 GSD file

Locate and download the appropriate GSD file for the Diagnostics Device on [www.procentec.com/downloads](http://www.procentec.com/downloads). The correct GSD file for the ProfiHub B2FOR+ is: **PROC6975.gsd**. The correct GSD file for the ProfiHub B4FOR+ is: **PROC6976.gsd**. The zip file also contains the corresponding .bmp (Bitmap) files. Import the GSD file into your configuration tool and insert the device in the PLC hardware configuration.

## 3.2 Configuring the Diagnostic Device

The Diagnostic Device has many configuration options. It can be configured modularly. This paragraph describes all the available options per module in list order.

### 3.2.1 Info data (mandatory module)

There is only one mandatory module, which is the first module in the list (“INFO DATA MANDATORY ON 1<sup>st</sup> SLOT”). It has 4 input bytes with the following meaning:

- Byte 1: Input Identifier byte (always 0xDE)
- Byte 2: Device type byte (0xE4 is ProfiHub B4FOR+)
- Byte 3: Version byte: 0x01
- Byte 4: Data format byte (0x00 is Little Endian, 0x01 is Big Endian)

### 3.2.2 Alarm Confirmation

Input Identifier byte: 0x01

The Alarm Confirmation module has one Output, which can be used to reset the alarm. If the Alarm Relay has been triggered by any event (see paragraph 3.3.1), it can be reset by the PLC by sending 0x01 or higher to the output of this module.

### 3.2.3 Redundant Status

Input Identifier byte: 0x10

The next input byte is to indicate the status of the redundant path. It is divided in nibble 0..3 and 4..7.

Nibble 1 (0..3)	Meaning
1 dec	Redundancy not used
2 dec	Redundancy error left channel
3 dec	Redundancy error right channel
4 dec	Redundancy error both channels
5 dec	Redundancy OK
Nibble 2 (4..7)	
1 dec	Pending Alarm: Redundancy error left channel
2 dec	Pending Alarm: Redundancy error right channel
3 dec	Pending Alarm: Redundancy error both channels

Examples: 0x12 means Redundancy error on Left Channel, Pending alarm on Left Channel  
0x05 means Redundancy OK

### 3.2.4 Baudrate Status

Input Identifier byte: 0x11

The next input byte is to indicate the baudrate lock status.

Dec	Meaning
1	No baudrate detected
2	9.6 Kbit
3	19.2 Kbit
4	45.45 Kbit
5	93.75 Kbit
6	187.5 Kbit
7	500 Kbit
8	1.5 Mbit
9	3 Mbit
10	6 Mbit
11	12 Mbit

### 3.2.5 Relay Status

Input Identifier byte: 0x12

The next input byte is to indicate the alarm relay status.

Hex	Meaning
00	Relay is off
01	Relay is on

### 3.2.6 Power Status

Input Identifier byte: 0x13

The next input byte is to indicate the status of the power inputs.

Nibble 1 (bit 0..3)	Meaning
0	Power 1 is active
1	Power 2 is active
<b>Nibble 2 (bit 4..7)</b>	
4	Pending Alarm: Power 1 not active
5	Pending Alarm: Power 2 not active

Examples: 0x03: Power 1 and 2 are active  
0x21: Power 1 is active, pending alarm: Power 2 not active  
0x32: Power 2 is active, pending alarm: Power 1 and 2 not active  
(Relay should be reset in this case)

### 3.2.7 Termination Status

Input Identifier byte: 0x14

The next input byte is to indicate the status of the termination switches on the ProfiHub channels.

Bit	Meaning
0	-
1	Channel 1 termination ON
2	Channel 2 termination ON
3	Channel 3 termination ON
4	Channel 4 termination ON

Examples:        0x3C = All terminations are ON  
                  0x04 = Only Channel 1 termination is ON

### 3.2.8 Channel Status

Input Identifier byte: 0x15

The next input byte is to indicate the communication status of the individual channels.

Bit	Meaning
0	Communication on FO Channel
1	Communication on Channel 1
2	Communication on Channel 2
3	Communication on Channel 3
4	Communication on Channel 4

Examples:        0x06 = Communication on Channel 2 and Channel 1  
                  0x01 = Communication on Channel 1

### 3.2.9 Fiber Optic Status

Input Identifier byte: 0x16

The next two input bytes indicate the status of the two Fiber Optic ports.

**Byte 1:**

Bit (1..0)	Meaning
0 dec	Fiber optic port 1 switched off
1 dec	Fiber optic port 1 signal error
2 dec	Fiber optic port 1 signal warning critical level
3 dec	Fiber optic port 1 Ok
Bit (3..2)	Meaning
0 dec	Fiber optic port 2 switched off
1 dec	Fiber optic port 2 signal error
2 dec	Fiber optic port 2 signal warning critical level
3 dec	Fiber optic port 2 Ok
Bit (5..4)	Meaning
0 dec	Ring mode off (line mode)
1 dec	Ring Failure
2 dec	Ring Ok

Bit 6	Meaning
0 dec	Multimode transceiver Port 1
1 dec	Single mode transceiver Port 1
Bit 7	Meaning
0 dec	Multimode transceiver Port 2
1 dec	Single mode transceiver Port 2

Examples: 0x2F means Port 1, Port 2 and Ring are Ok, Port 1 and Port 2 Multi mode transceivers  
0x1D means Port 1 signal error, Port 2 Ok, Port 1 and Port 2 Multi mode transceivers

Pending flags will stay active after the Fiber optic signal error or warning status is all right again to indicate an event in the past. Pending flags are cleared with the Reset push button on the device, ComBricks Headstation Webpage alarm clear button or with the DPVO Alarm Conformation module (see paragraph 3.2.2).

#### Byte 2:

Bit 0	Meaning
0 dec	Port 1 Fiber optic no signal error pending
1 dec	Port 1 Fiber optic signal error pending
Bit 1	Meaning
0 dec	Port 1 Fiber optic no signal warning pending
1 dec	Port 1 Fiber optic Signal warning critical level pending
Bit 2	Meaning
0 dec	Port 2 Fiber optic no signal error pending
1 dec	Port 2 Fiber optic signal error pending
Bit 3	Meaning
0 dec	Port 2 Fiber optic no signal warning pending
1 dec	Port 2 Fiber optic Signal warning critical level pending
Bit 4	Meaning
0 dec	Ring Fail no pending
1 dec	Ring Fail pending

Examples: 0x00 means Port 1, Port 2 no signal pending  
0x11 means Port 1 signal error pending, Ring Fail pending

### 3.2.10 Livelist Status

Input Identifier byte: 0x20

The next input byte is to indicate which Channel is selected to display the Livelist status.

Hex	Meaning
80	Livelist of FO Channel
81	Livelist of Channel 1
82	Livelist of Channel 2
83	Livelist of Channel 3
84	Livelist of Channel 4
85	None
86	Livelist of this ProfiHub
FF	Livelist of all channels (entire network)

The next 32 input bytes are used for the actual Livelist data. Each address uses two bits. So the first two bits of the first byte are for address 0, the next two bits of the first byte are for address 1 and so on. The bits are used to indicate if the station is a slave device, master device or both.

Device:	Bit 1:	Bit 0:
None	0	0
Slave Device	0	1
Controller	1	0
Both	1	1

Example: If there is a master device on address 2, and a slave device on address 3, then the first byte will be 0x60, because it will look like this:

Bit	7	6	5	4	3	2	1	0
Value	0	1	1	0	0	0	0	0
	Address 3		Address 2		Address 1		Address 0	

This module also has 2 Output bytes. The first Output byte is used to select the Livelist of a specific Channel. This selection can be read-back in the Input byte described above.

Hex	Meaning
80	Livelist of FO Channel
81	Livelist of Channel 1
82	Livelist of Channel 2
83	Livelist of Channel 3
84	Livelist of Channel 4
85	None
86	Livelist of this ProfiHub
FF	Livelist of all channels (entire network)

The next Output byte can be used to reset the Livelist. Write 0x01 to this Output byte to reset the Livelist.

### 3.2.11 Statistics (Short Format, Long Format )

Input Identifier byte: 0x30 (short format) or 0x31 (Long Format)

The next byte is used to display the current selection of statistics that it sends.

Hex	Meaning
00..7E	Statistics for device 0..126
7F	Statistics for undefined devices
80	Statistics of FO Channel
81	Statistics of Channel 1
82	Statistics of Channel 2
83	Statistics of Channel 3
84	Statistics of Channel 4
85	None
86	Statistics of this ProfiHub
FF	Statistics of all channels (entire network)



The next 16 bytes (Short Format) or 32 bytes (Long Format) are used to transfer the statistics of the selected address, selected Channel or all Channels of the ProfiHub. Each statistic uses 2 bytes (Short Format, so a maximum of 65535 decimal per statistic) or 4 bytes (Long Format) and is sent in the following order:

1. Lost count
2. Sync count
3. Repeats total count
4. Repeats max per cycle count
5. Illegals count
6. Int. diagnostics count
7. Ext. diagnostics count
8. Diagnostics while in Data Exchange count

This module also has 2 output bytes. The first byte is used to configure the ProfiHub Statistics; you can choose which stations or Channels will display statistics. Configure it by sending the following output value:

Hex	Meaning
<b>00..7E</b>	Statistics for device 0..126
<b>7F</b>	Statistics for undefined devices
<b>80</b>	Statistics of FO Channel
<b>81</b>	Statistics of Channel 1
<b>82</b>	Statistics of Channel 2
<b>83</b>	Statistics of Channel 3
<b>84</b>	Statistics of Channel 4
<b>85</b>	None
<b>86</b>	Statistics of this ProfiHub
<b>FF</b>	Statistics of all channels (entire network)

The next output byte can be used for clearing the statistics. Please note that the selected statistics of ALL node addresses and/or ProfiHub channels are cleared, not only for the displayed address or channel.

Bit	Meaning
<b>0</b>	Clear LOST statistics
<b>1</b>	Clear SYNC statistics
<b>2</b>	Clear REPEATS TOTAL statistics
<b>3</b>	Clear REPEATS MAX statistics
<b>4</b>	Clear ILLEGALS statistics
<b>5</b>	Clear INT. DIAG statistics
<b>6</b>	Clear EXT. DIAG statistics
<b>7</b>	Clear DIAG WHILE IN DX statistics

Example:           To clear all LOST and ILLEGALS statistics, send 0x11  
                       To clear all statistics, send 0xFF

### 3.3 Parameterizing the Diagnostic Device

The Diagnostic Device has many user-definable parameters that can be changed, to alter the behaviour and options of the ProfiHub Diagnostics Device.

#### 3.3.1 Diagnostics

The Diagnostics Device sends a diagnostic message on PROFIBUS whenever certain conditions are changed. These changes can be any of the following:

- Livelist change (a station added or removed)
- Fiber optic ring or signal level change
- Bitrate error
- Alarm relay active
- Power status changed (one of the two power sources added or removed)
- Redundancy status change (one of the redundant cables added or removed)
- Termination status change (a termination switch on the ProfiHub has been changed)
- Channel status change (communication stopped or started on a channel)
- Statistics change (any statistic has changed)

In your configuration tool you can toggle the diagnostics for each item.

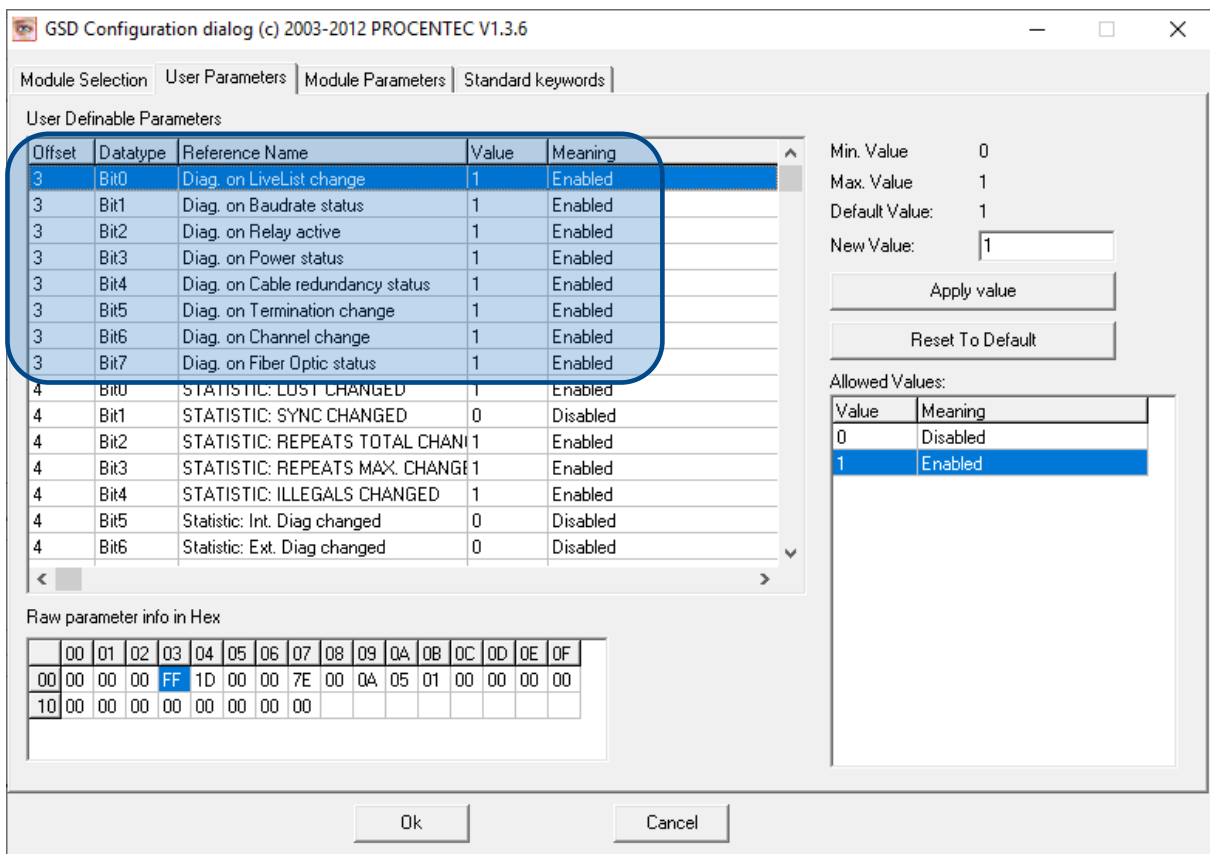


Fig. 21 - Screenshot of ProfiCaptain - User Parameter window

The 8<sup>th</sup> byte of a diagnostic message from the Diagnostic Device indicates which options have been enabled or disabled. In this byte, bit 0 to 6 correspond with the parameter message. Bit 7 indicates that at least one of the Statistic Change options has been enabled. Bit 7 of byte 18 of a diagnostics byte indicates that the Diagnostics on Fiber optic has been enabled.

### 3.3.2 Statistics

You can choose which Statistics can trigger a diagnostic message, because not all statistics are interesting in all networks. For example, Syncs have been disabled by default because this is not a statistic that is suitable for PROFIBUS health monitoring.

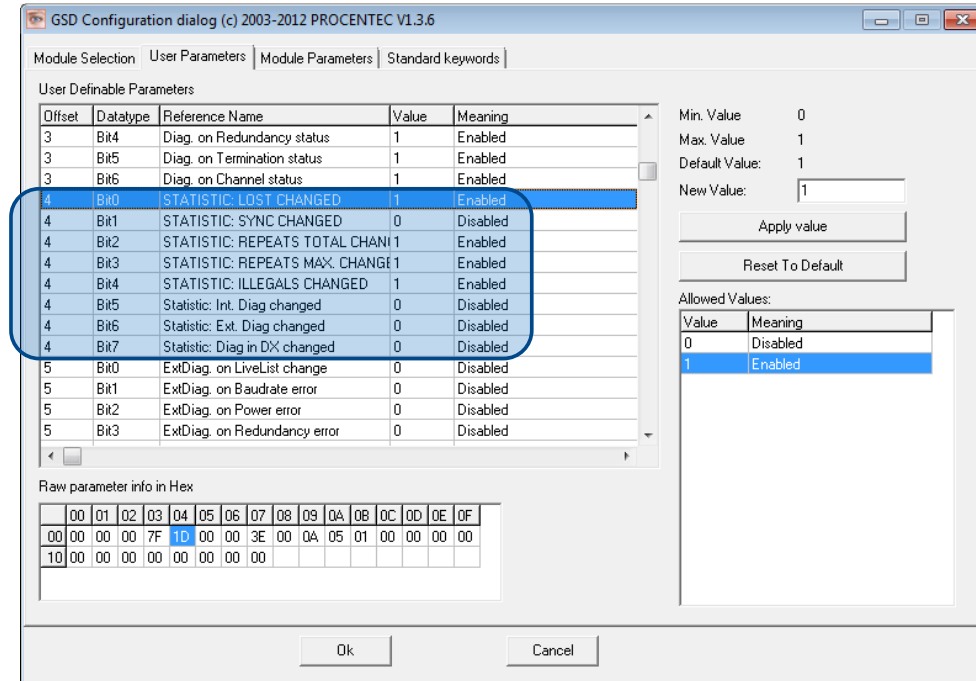


Fig. 22 – You can choose which statistics trigger a diagnostic message

The following Statistics can trigger a diagnostic message of the Diagnostic Device:

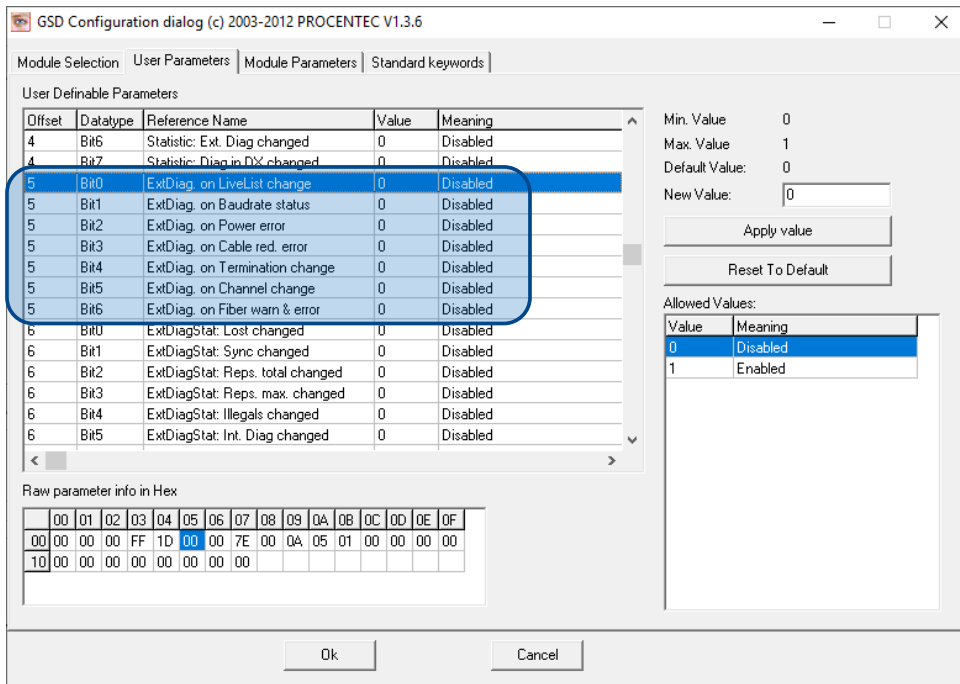
- Lost changed
- Sync changed
- Repeats (total) changed
- Repeats (max) changed
- Illegals changed
- Internal Diagnostics changed
- External Diagnostics changed
- Diagnostics in Data Exchange changed

### 3.3.3 Extended Diagnostics on Events change

For more critical applications you can choose to enable the 'Extended Diagnostics' option for each of the previously mentioned events. In the case of such an event, the Diagnostics Device will send out a diagnostics message with the 'Extended Diagnostic' bit on. In a Busmonitor tool such as ProfiTrace the extended diagnostics bit will appear as a red blinking square.

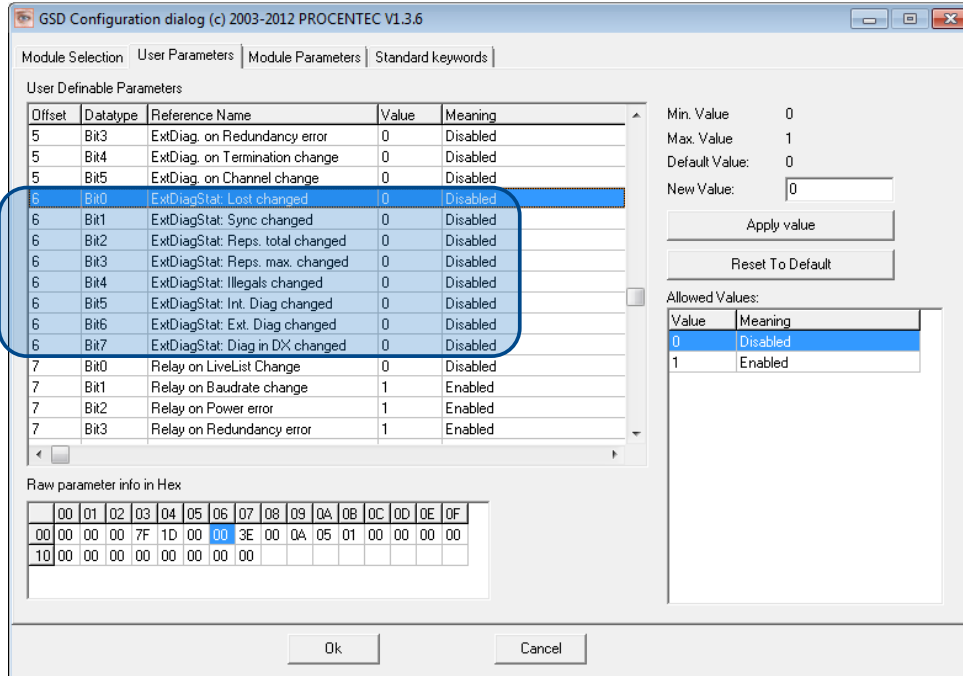
All Events described in paragraph 3.3.1 can trigger the Extended Diagnostic bit of the Diagnostic Device. By default, the Extended Diagnostic option is disabled. Each item can be enabled individually.

40	41
<b>ProfiHub B5+ Diagnostics</b>	51
60	61



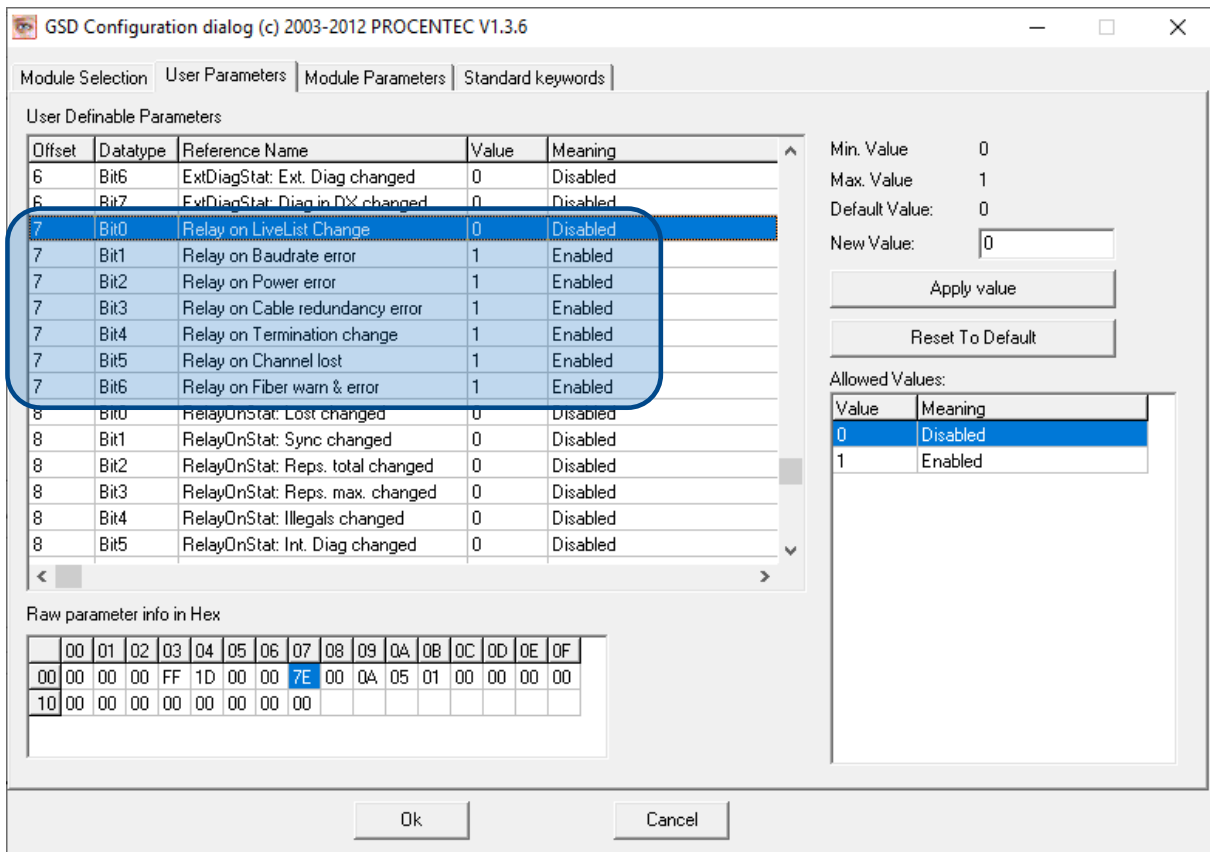
### 3.3.4 Extended Diagnostics on Statistics change

The Extended Diagnostic option can also be enabled for each individual available statistic. This works the same way as the Events described in paragraph 3.3.1.



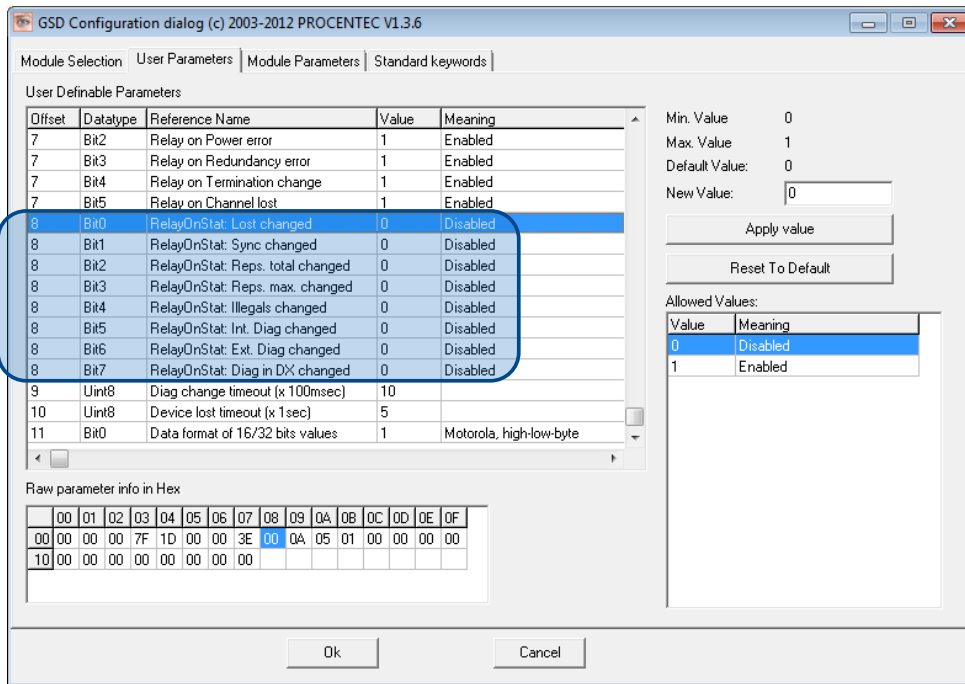
### 3.3.5 Alarm Relay on Events change

The Alarm Relay on the ProfiHub can be switched on each Event described in paragraph 3.3.1. When such an Event occurs, the Relay will be switched immediately without delay. The only Event that can delay the switching of the Alarm Relay is the Lost event.



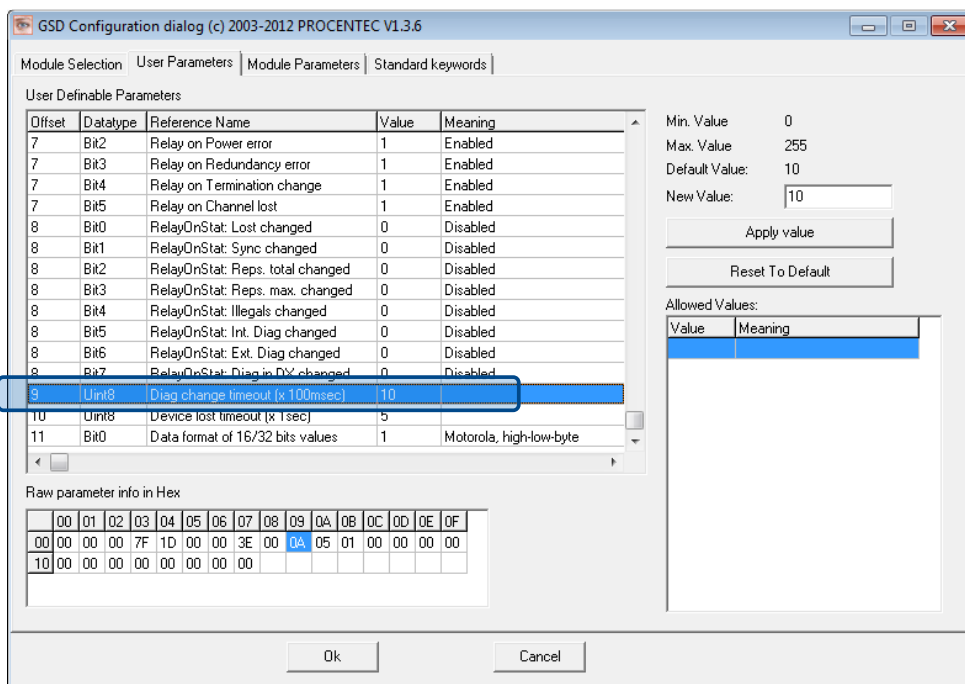
### 3.3.6 Alarm relay on Statistics change

The Alarm Relay on the ProfiHub can be switched (closed) on each change in Statistics, described in paragraph 3.3.2. When such an (enabled) Statistic change occurs, the Relay will be switched immediately without delay. The only Statistic that can delay the closing of the Alarm Relay is the Lost event.



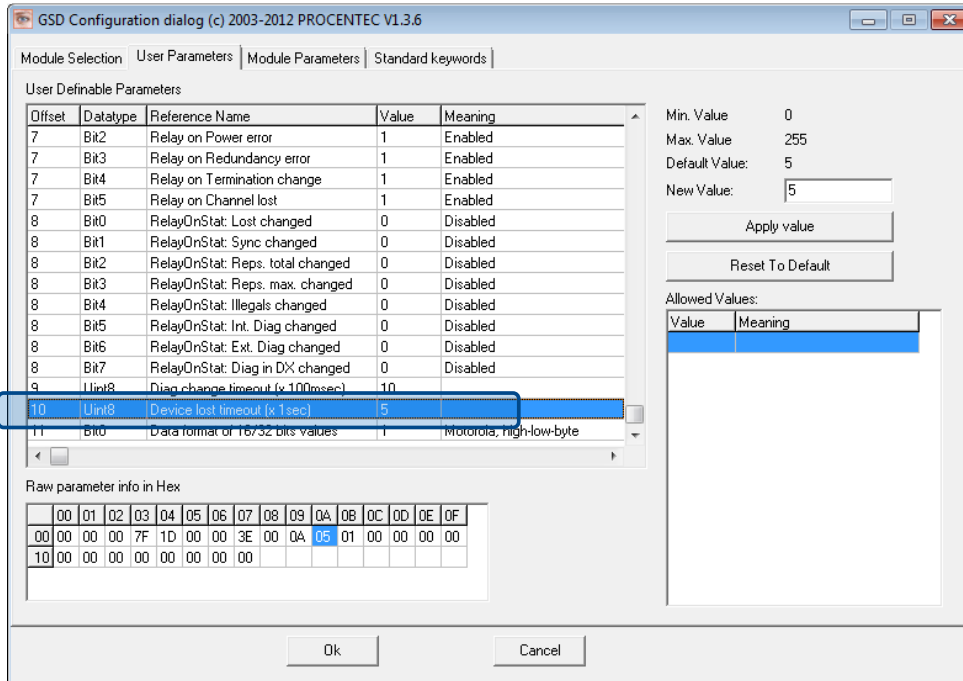
### 3.3.7 Changing the Diagnostics duration/timeout

You can change the duration of the Extended Diagnostics warning in steps of 100 milliseconds. The default value is 10, so 1 second. The maximum value is 255.



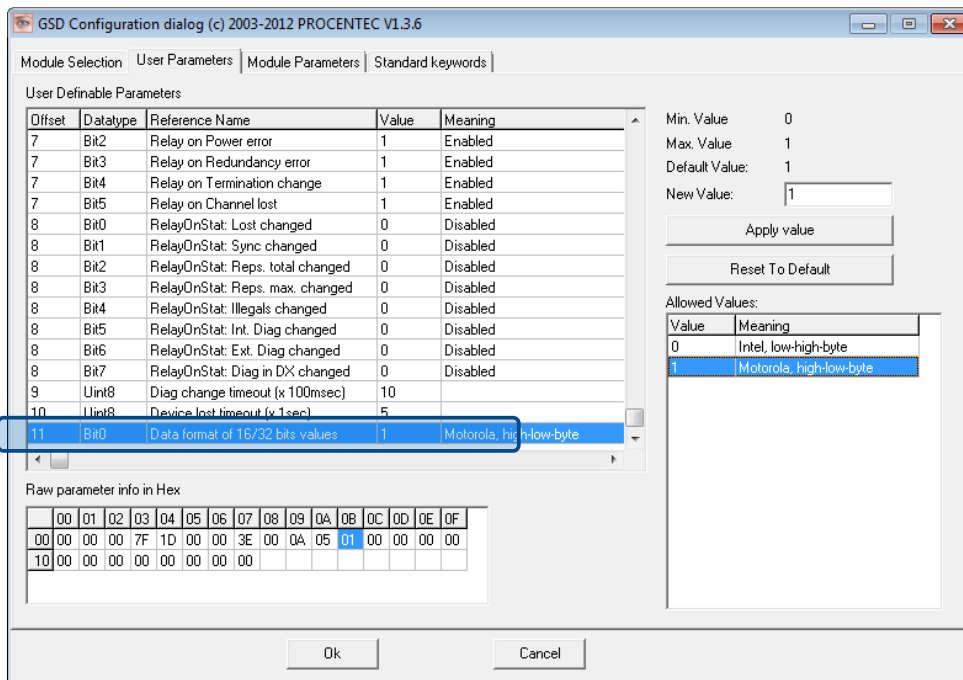
### 3.3.8 Changing the Device Lost timeout

The Diagnostics Device waits for a certain time before it considers a slave to be lost. This works in a similar way as the ProfiTrace Live List, where the background turns yellow when a slave stops communicating. This timeout can be changed in steps of 1 second. Default value is 5, and maximum value is 255.



### 3.3.9 Changing the data format

The data format can be changed if needed. Default is Motorola, high-low-byte format. You can change it to Intel, low-high-byte format.



## 4 Technical Data ProfiHub B2FOR+ / B4FOR+

Technical Data ProfiHub B2FOR+ / B4FOR+																																										
<b>Dimensions and weight</b>	<b>B2FOR+</b>	<b>B4FOR+</b>																																								
Dimensions L x W x H (mm)	129 x 111 x 40 mm (excluding DIN-rail and plug-able connectors)	167 x 111 x 40 mm (excluding DIN-rail and plug-able connectors)																																								
Weight	440 gr. (excluding plug-able connectors, cable brackets and packing material).	565 gr. (excluding plug-able connectors, cable brackets and packing material).																																								
Mounting DIN-rail type	35 mm x 7.5 mm (EN 50022, BS 5584, DIN 46277-3)																																									
<b>Ambient conditions</b>	-25 to +70° Celsius -13 to +158° Fahrenheit																																									
Operating temperature																																										
Isolation class	IP 20 (IEC/EN 60529, DIN 40050)																																									
<b>Protocol and timing specifications</b>	DP-V0, DP- V1, DP-V2, FDL, MPI, FMS, PROFIsafe, PROFIdrive and any other FDL based protocol.																																									
Supported Protocols																																										
Transmission speed	9.6 kbps to 12 Mbps (including 45.45 kbps)																																									
Transmission speed detection	Auto detect																																									
Transmission speed detection time	< 10 s detection and 50 s baudrate switchover time.																																									
Rotary Switch settings	<table border="1"> <thead> <tr> <th>Rotary switch</th> <th>Auto detect</th> <th>Robust repeating</th> <th>Redundancy</th> <th>Diagnostic slave</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>•</td> <td></td> <td></td> <td></td> </tr> <tr> <td>1</td> <td>•</td> <td>•</td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>•</td> <td>•</td> <td>•</td> <td></td> </tr> <tr> <td>3</td> <td>•</td> <td></td> <td></td> <td>•</td> </tr> <tr> <td>4</td> <td>•</td> <td>•</td> <td></td> <td>•</td> </tr> <tr> <td>5</td> <td>•</td> <td>•</td> <td>•</td> <td>•</td> </tr> <tr> <td>6-F</td> <td>•</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Rotary switch	Auto detect	Robust repeating	Redundancy	Diagnostic slave	0	•				1	•	•			2	•	•	•		3	•			•	4	•	•		•	5	•	•	•	•	6-F	•			
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4	•	•		•																																						
5	•	•	•	•																																						
6-F	•																																									
Data delay time unit (RS485 ports)	<table border="1"> <thead> <tr> <th>At baudrate</th> <th>Normal mode</th> <th>Robust/Redundant mode</th> </tr> </thead> <tbody> <tr> <td>9.6 - 500 kbps</td> <td>3.0 Tbit</td> <td>14 Tbit</td> </tr> <tr> <td>1.5 Mbps</td> <td>4.0 Tbit</td> <td>15 Tbit</td> </tr> <tr> <td>3 Mbps</td> <td>4.5 Tbit</td> <td>15 Tbit</td> </tr> <tr> <td>6 Mbps</td> <td>5.0 Tbit</td> <td>16 Tbit</td> </tr> <tr> <td>12 Mbps</td> <td>7.0 Tbit</td> <td>18 Tbit</td> </tr> </tbody> </table>		At baudrate	Normal mode	Robust/Redundant mode	9.6 - 500 kbps	3.0 Tbit	14 Tbit	1.5 Mbps	4.0 Tbit	15 Tbit	3 Mbps	4.5 Tbit	15 Tbit	6 Mbps	5.0 Tbit	16 Tbit	12 Mbps	7.0 Tbit	18 Tbit																						
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12 Mbps	7.0 Tbit	18 Tbit																																								
Jitter per message frame	0.0625 Tbit at 9.6 Kbps - 3 Mbps 0.125 Tbit at 6 Mbps 0.25 Tbit at 12 Mbps																																									
Deviation	2 bit times (over the complete message) for received messages is allowed and is corrected to nominal speed when transmitted.																																									



<b>PROFIBUS Diagnostics Device specifications</b>	
Supported protocol	DP-V0
Ident Number	B2FOR+: 6975 B4FOR+: 6976
GSD filename	B2FOR+: PROC6975.gsd B4FOR+: PROC6976.gsd
Bus address	0-126 (software address only, set by software, default 126)
Transmission speed	9.6 kbps to 12 Mbps (including 45.45 kbps)
Transmission speed detection	Auto Detect
Maximum transferrable data	88 bytes input and 5 bytes output
<b>PROFIBUS cable specifications</b>	
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	10 mm (when the ground rail is used)
Wire diameter	< 2.5 mm <sup>2</sup>
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)
Redundancy	Yes (last two RS485 ports)
Cascading depth	No limits (only limited by busparameters of the master)
	With standard busparameters:
	At baudrate      Normal mode[units]      Robust mode[units]
	9.6 kbps                  6                                  1
	19.2 kbps                 6                                  1
	45.45 kbps                39                                8
	93.75 kbps                6                                  1
	187.5 kbps                6                                  1
	500 kbps                    16                                3
	1.5 Mbps                    20                                5
	3 Mbps                      17                                5
	6 Mbps                      13                                4
	12 Mbps                    13                                5
	Formula to calculate number of cascading units with adjusted Tslot :
	Number cascading units = (Tslot - maxTsdr) / (2× Data_delay_time_unit)
	* Data_delay_time_unit: Normal or Robust mode see table

<b>PROFIBUS Fiber Optic cable specifications</b>		
Fiber Optic wave-length	Multimode 1310 nm	Single mode 1310 nm
Cable type	Fiber 50 / 125 μm (OM2, OM3, OM4, OM5 compatible)  Fiber 62.5 / 125 μm (OM1 compatible)	Fiber 9 / 125 μm (OS1 and OS2 compatible)
Cable length	Max. 5 km (1 dB / km)	Max. 30 km (0.4 dB / km)
Optical budget	13 dB	17 dB
Connectors	4 x ST/BFOC (2 channels)  Ring, point-to-point (direct, hub, split, star)  No limit, only busparameter limitation of the master	
Topologies		
Cascading depth		
<b>Power supply specifications</b>		
Power supply operating voltage	12 to 24 VDC	
Power supply absolute max. rated voltage	9 to 31 VDC	
Redundant power supply	Yes	
Current consumption	250 mA at 24 VDC power supply (all Channels fully loaded)	
Power dissipation	Max. 6 W	
Reverse polarity protection	Yes	
Wire diameter	< 2.5 mm <sup>2</sup> or 14 AWG	
<b>Alarm contact</b>		
Voltage	Max. 24 VDC	
Current	Max. 0.5 A	
Wire diameter	< 2.5 mm <sup>2</sup> or 14 AWG	

<p><b>Connector lay-out</b> Power supply POW 1 and POW 2</p> <p>Alarm</p> <p>FO channel port 1 and port 2</p> <p>PROFIBUS screw terminals Channel 1 to 4</p> <p>PROFIBUS DB9 Channel 1 to 4</p>	<p><u>Plug-able screw connector, pitch 5,08 mm</u> Pin + : 12 to 24 VDC Pin - : 0 V Screw: Shield</p> <p><u>Plug-able screw connector, pitch 5,08 mm</u> Pin 1: relay contact (potential-free) Pin 2: relay contact (potential-free)</p> <p>ST / BFOC connector O-&gt; = TX = Out O&lt; = RX = In</p> <p><u>Plug-able screw terminal, pitch 3,81 mm</u> Pin A: PROFIBUS A (green wire) Pin B: PROFIBUS B (red wire) Pin I : Indirect shield</p> <p><u>D Sub connector, 9 contacts (PROFIBUS specification)</u> Pin 1: N.C. Pin 2: N.C. Pin 3: PROFIBUS - B Pin 4: PROFIBUS - RTS Pin 5: GND Pin 6: VPP Pin 7: N.C. Pin 8: PROFIBUS - A Pin 9: N.C. Housing: Shield</p> <p><i>Shield is connected internally to the DIN-rail Pin I is connected internally with 10nF/1MOhm to shield.</i></p>
<p><b>Standards and approvals</b></p> <p>CE</p> <p>FCC</p> <p>UL</p> <p>MTBF</p>	<p>EMC Directive 2014/30/EU, class B Digital Device RoHs Directive 2011/65/EU</p> <p>47 CFR 15, Unintentional Radiator, class B Digital Device.</p> <p>Report reference: E365044-A1-UL</p> <p>Standards for safety: UL 60950-1, Information Technology Equipment - Safety - Part 1 General Requirements</p> <p>CAN/CSA C22.2 No. 60950-1-07, Information Technology Equipment - Safety - Part 1: General Requirements</p> <p>T.b.d.</p>

## 5 Order codes

<b>Component</b>	<b>Order code</b>	<b>Remarks</b>
<b>B2FOR+MM</b>	17230	PROFIBUS Repeater with a Multimode fiber optic channel with two ports and ring redundancy, and two RS485 channels with cable redundancy and an integrated Diagnostic Slave.
<b>B2FOR+SM</b>	17240	PROFIBUS Repeater with a Single mode fiber optic channel with two ports and ring redundancy, and two RS485 channels with cable redundancy and an integrated Diagnostic Slave.
<b>B4FOR+MM</b>	17430	PROFIBUS Repeater with a Multimode fiber optic channel with two ports and ring redundancy, and four RS485 channels with cable redundancy and an integrated Diagnostic Slave.
<b>B4FOR+SM</b>	17440	PROFIBUS Repeater with a Single mode fiber optic channel with two ports and ring redundancy, and four RS485 channels with cable redundancy and an integrated Diagnostic Slave.

## 6 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 $Tbit = 1 \text{ (bit)} / \text{baudrate (bps)}$ . Examples: 12 Mbps --> Tbit = 83 ns 1.5 Mbps --> Tbit = 667 ns
Busparameters	Settings that define the timing behaviour on the bus. They are defined in the master. Examples: Tslot, MaxTSDR.
C	Capacitance.
DGND	Digital Ground.
DIN	German Institute for Standardization ( <a href="http://www.din.de">www.din.de</a> ).
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: <ul style="list-style-type: none"><li>- Cyclic exchange of I/O data between controlling and slave devices</li><li>- Device, Identifier (module) and Channel related Diagnosis</li><li>- Parameterization of DP-slaves</li><li>- Configuration of DP-slaves</li></ul>
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: <ul style="list-style-type: none"><li>- Device related diagnosis is replaced by status and alarms.</li><li>- The first three octets of the user parameterization data are now standardized</li><li>- Optionally these devices may support:</li><li>- Acyclic communication (MS1, MS2)</li><li>- If alarms are used, MS1 shall be supported</li></ul>

DP-V2	<p>DP-V2 is the second stage of extension of PROFIBUS DP after DP-V1. DP-V2 devices shall comply with the following features:</p> <ul style="list-style-type: none"> <li>- Data Exchange Broadcast (DxB) for slave to slave communication (publisher/subscriber principle).</li> <li>- Isochronous Mode (time tick synchronized operating slaves, e.g. drives)</li> <li>- Up- and/or download of Load Region Data (domains)</li> <li>- Clock Control (synchronization within slaves) and Time Stamping</li> <li>- Redundancy.</li> </ul>
Electromagnetic Compatibility	See EMC.
EMC	<p>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.</p>
Hub	<p>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).</p>
MPI	<p>Multiple Protocol Interface. Protocol defined by Siemens which uses the layer 1 and 2 of PROFIBUS (FDL).</p>
PCB	Printed Circuit Board.
PROFIBUS DP	<p>Acronym for "PROFIBUS for Decentralized Peripherals". Specification of an open fieldbus system with the following characteristics:</p> <ul style="list-style-type: none"> <li>- Polling master-slave-system (cyclic communications, MS0)</li> <li>- Flying masters with robin round token passing coordination (MM)</li> <li>- Connection based (MS1) and connectionless (MS2, MS3) acyclic communication between masters and slaves</li> </ul> <p>Options (e.g.):</p> <ul style="list-style-type: none"> <li>- Data exchange broadcast (DXB), i.e. slave to slaves communication</li> <li>- Isochronous mode of slaves</li> <li>- Clock synchronization</li> <li>- Redundancy</li> </ul> <p>PROFIBUS DP is standardized within IEC 61158 and IEC 61784, communication profile families 3/1 and 3/2</p> <p>The term "PROFIBUS DP" also is a synonym for the RS485 based deployments within factory automation.</p>
Repeater	<p>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.</p>
Spur line	<p>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".</p>
Stub line	See <i>Spur line</i> .

Tbit	See <i>Bit Time</i> .
Termination	A (powered) resistor network at both ends of a segment to prevent reflections (with PROFIBUS DP the termination must 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. The German PROFIBUS Organization based in Karlsruhe.
Drop cable	See <i>Spur line</i> .
Reflection	Part of the original signal that is transmitted back along the cable. It corrupts the original signal.

## 8 Revision History

### **Version 1.2.0**

- Content updates
- Conversion to new CI

### **Version 1.0**

- First release.



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For the up to date list of the Sales Offices and Distributors see [www.procentec.com/company/distributors/](http://www.procentec.com/company/distributors/). If your country or region is not listed, please contact us. We are still searching for distributors who can cover complete areas or countries.

## 10 Certificates

# certificate

QualityMasters hereby declares that

**Procentec B.V.**  
Wateringen

has a management system that meets the requirements of the standard

**NEN-EN-ISO 9001:2015**

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	27-01-2017
Valid until	10-02-2019
Certificate number	NL. 6594-uk-a

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.



## 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)



## Certificate

PROFIBUS Nutzerorganisation e.V. grants to

### PROCENTEC

Klopperman 16, 2292 JD Wieringen, The Netherlands

the Certificate No: **Z02188** for the PROFIBUS device:

Model Name: ProfiHub-B5+RD Diagnostics  
Revision: 1.0; SW/FW: 2.0; HW: 1.3  
GSD: PROC6970.GSD File Version: 2.0

This certificate confirms that the product has successfully passed the certification tests with the following scope:

- DP-V0 MS0, Sync, Freeze, Auto\_Baud, Set\_Slave\_Add
- Physical Layer RS485

Test Report Number: PCN208-DPS-01  
Authorized Test Laboratory: PROCENTEC, Wieringen, The Netherlands

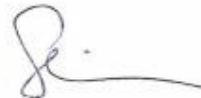
The tests were executed in accordance with the following documents:  
"Test Specifications for PROFIBUS DP Slaves, Version 3.09 from September 2008".  
This certificate is granted according to the document:  
"Framework for testing and certification of PROFIBUS and PROFINET products".  
For all products that are placed in circulation by **January 02, 2022** the certificate is valid for life.

Karlsruhe, January 29, 2019

Board of PROFIBUS Nutzerorganisation e. V.



(Official in Charge)



(Karsten Schneider)



(Dr. Jörg Hähnliche)







## About PROCENTEC

**PROCENTEC are an independent Dutch company that supply products, training and consultancy to the Industrial Automation Market. Of primary focus is the development and manufacturing of automation products for PROFIBUS, PROFINET and Industrial Ethernet.**

Some of our products are the most recognized solutions on the Market today. **ProfiTrace**, our mobile troubleshooting and maintenance tool has established itself as one of the most pioneering, yet essential tools available to engineers. In contrast our robust **ProfiHub** has, over the last decade, established itself as the go-to solution for ensuring a reliable network infrastructure. The combination of these products within our **ComBricks** solution has seen PROCENTEC become the primary manufacturer of network components with the integrated capability for remote monitoring and remote asset-management.

Our training facility, the **PROCENTEC Academy**, has certified over 4000 engineers to implement and maintain their PROFIBUS and PROFINET networks to the highest standards available.

The PROCENTEC **Competence Centre** has established itself as the leading consultancy on PROFIBUS and PROFINET projects worldwide, advising on architecture, engineering, training and commissioning. Once a network is commissioned, we have experts available 24/7 to answer questions with maintenance or help troubleshooting a problem.

### Products

- Atlas and Mercury
- Osiris Software
- EtherTAP and EtherMIRROR
- ProfiHub
- ProfiTrace
- ComBricks
- VPGate
- PROFINET tools
- Cables & Connectors

### Services

- On-site & Online Support
- Network Audit
- Network Certification
- Consultancy
- Testlab & Democenter
- Competence Center

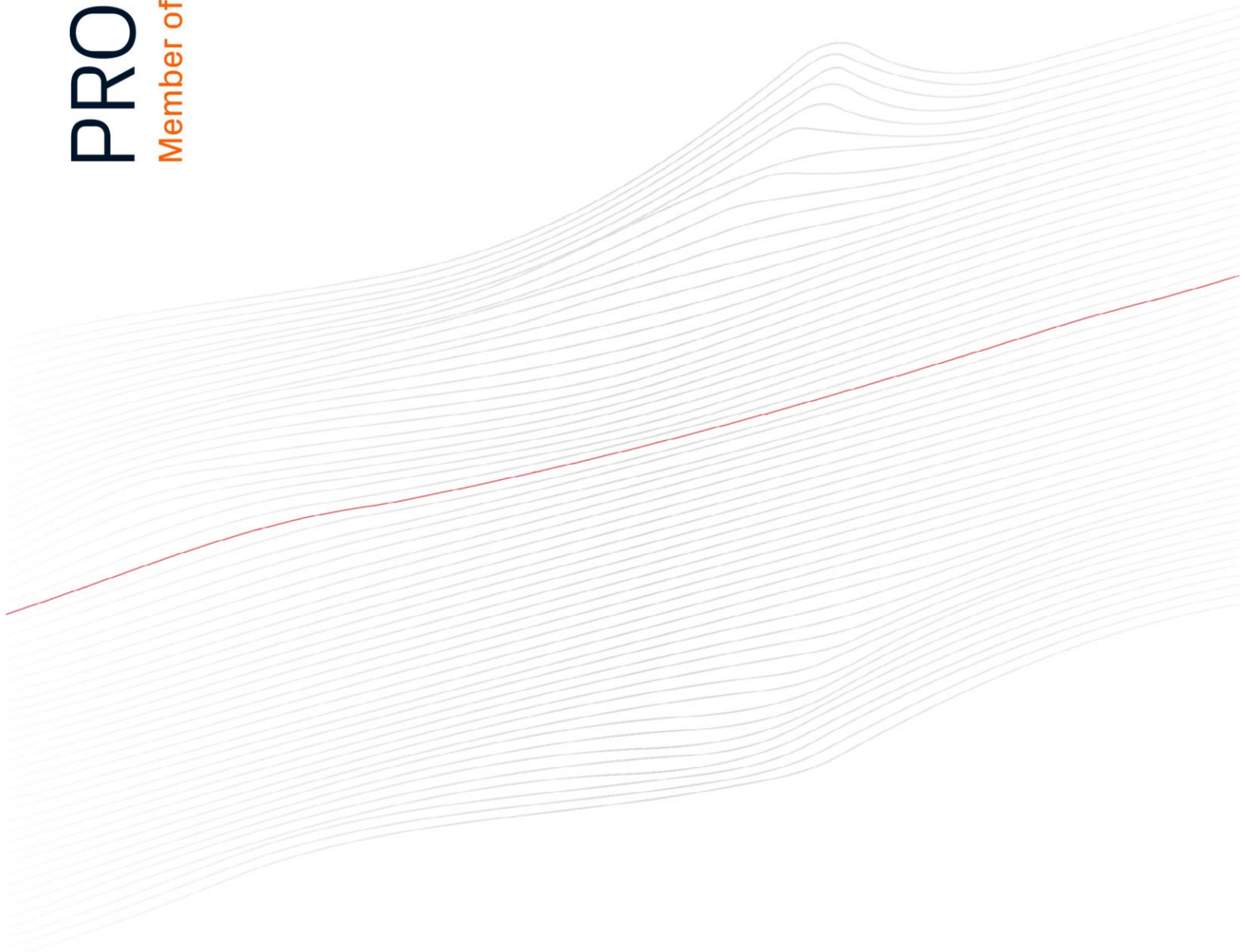
### Training

- PROFIBUS training courses
- PROFINET training courses
- Product training courses

# PROCENTEC

Member of the HMS group.

procentec.com



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Your network partner.

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