VIPA Networking Solutions

PBR | 920-1xB50 | Manual

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PROFIBUS MultiRepeater - PBMR-B5-R/RD

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920-1xB50_000_PBMR-B5-R/RD,2,GB -

Table of contents

1 General ... 5
1.1 Copyright © VIPA GmbH ... 5
1.2 About this manual ... 6
1.3 Safety information ... 7
1.4 Important Notices ... 7
2 Product Description ... 9
2.1 General ... 9
2.2 Product features ... 10
2.3 Application areas ... 11
2.4 Additional Benefits ... 11
2.5 Channel Structure ... 11
2.6 Grounding System ... 12
2.7 Cable lengths for PROFIBUS DP ... 12
2.8 Cable types for PROFIBUS DP ... 13
2.9 Status display ... 14
3 Installation Instructions ... 15
3.1 Location ... 15
3.2 Position ... 15
3.3 Mounting ... 15
3.4 Power Supply ... 15
3.5 Grounding of the power ... 17
3.6 Relay contact ... 17
3.7 Backbone ... 18
3.8 Spur Segments ... 19
3.9 Termination ... 19
3.10 Baudrate switch ... 20
3.11 Channel Redundancy ... 22
4 Diagnostics Device ... 23
4.1 Setting up the Diagnostics Device ... 23
4.1.1 Enabling the Diagnostics Device ... 23
4.1.2 Changing the default PROFIBUS address ... 24
4.1.3 GSD file ... 24
4.2 Configuring the Diagnostic Device ... 24
4.2.1 Info data (mandatory module) ... 24
4.2.2 Alarm Confirmation ... 24
4.2.3 Redundant Status ... 24
4.2.4 Baudrate Status ... 25
4.2.5 Relay Status ... 25
4.2.6 Power Status ... 26
4.2.7 Termination Status ... 26
4.2.8 Channel Status ... 27
4.2.9 Livelist Status ... 27
4.2.10 Statistics (short format, long format) ... 28
4.3 Parameterizing the Diagnostic Device ... 30
4.3.1 Diagnostics ... 30
4.3.2 Statistics ... 31
4.3.3 Extended Diagnostics on Events change ... 32

4.3.4 Extended Diagnostics on Statistics change..... 32
4.3.5 Alarm Relay on Events change..... 33
4.3.6 Alarm Relay on Statistics change..... 33
4.3.7 Changing the Diagnostics duration/timeout..... 34
4.3.8 Changing the Device Lost timeout..... 34
4.3.9 Changing the data format..... 35
4.4 ProfiTrace plugin for the Diagnostic Device..... 35
4.4.1 Installing the Plugin..... 36
4.4.2 Using the Plugin..... 36
5 Technical data **38**
6 Glossary..... **41**

1 General

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1.2 About this manual

Objective and contents

This manual describes the PROFIBUS MultiRepeater B5-R/RD 920-1xB50 from VIPA. It contains a description of the construction, project implementation and usage.

Product	Order number	as of state: HW
PBMR-B5-R/RD	920-1xB50	01

Target audience

The manual is targeted at users who have a background in automation technology.

1.3 Safety information

Applications conforming with specifications

The system is constructed and produced for:

- communication and process control
- industrial applications
- operation within the environmental conditions specified in the technical data
- installation into a cubicle

DANGER!
This device is not certified for applications in

– in explosive environments (EX-zone)

Documentation

The manual must be available to all personnel in the

- project design department
- installation department
- commissioning
- operation

CAUTION!
The following conditions must be met before using or commissioning the components described in this manual:

– Hardware modifications to the process control system should only be carried out when the system has been disconnected from power!
– Installation and hardware modifications only by properly trained personnel.
– The national rules and regulations of the respective country must be satisfied (installation, safety, EMC ...)

Disposal

National rules and regulations apply to the disposal of the unit!

1.4 Important Notices

CAUTION!
When the product is in use at an ambient temperature of 63 degrees Celsius or 145 degrees Fahrenheit, the housing of the device 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.

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

CAUTION!
When the product is in use at an ambient temperature of 63 degrees Celsius or 145 degrees Fahrenheit, the housing of the device 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 100 Watt.

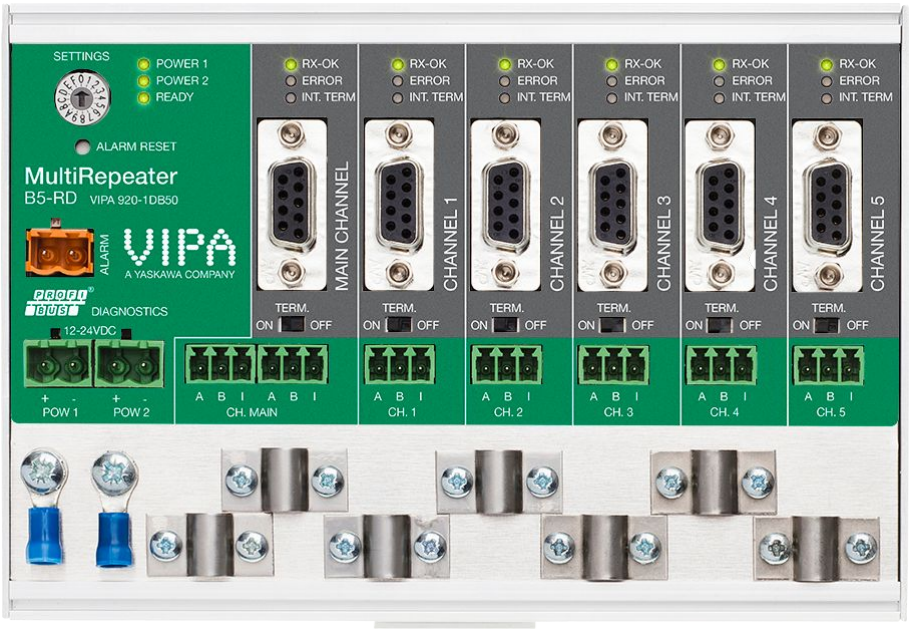
According to UL60950-1, if a copper PROFIBUS cable is used outside, it is required to install surge protection that is suitable for PROFIBUS.

To comply with UL certification regulations the device is to be used on altitudes under 2000 m.

2 Product Description

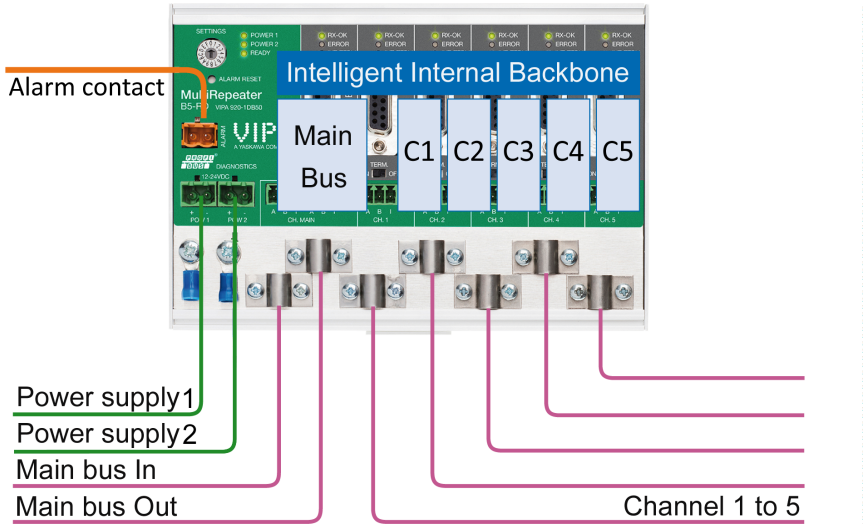
2.1 General

The PROFIBUS MultiRepeater B5-R/RD is an advanced, flexible and robust network component for PROFIBUS DP installations, to create backbone structures and long multi-device star/tree segments.

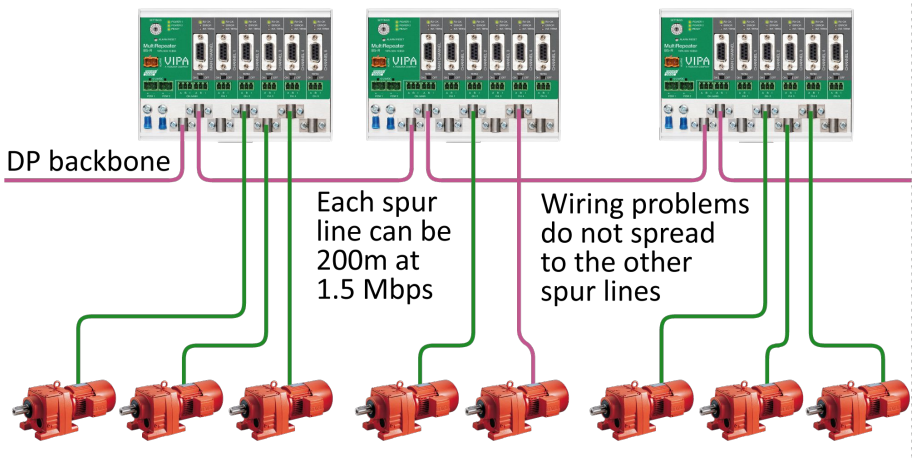


- PROFIBUS DP is a high speed communication bus that must comply with strict rules concerning spur lines, because of possible reflections that could lead to communication disturbances. If spur lines or star segments are required, costly investments in repeaters have to be done.
- The innovative PROFIBUS MultiRepeater B5-R/RD is the perfect component for such applications. It is an economic solution to realise reliable spur lines in high speed DP networks. They have 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 PROFIBUS MultiRepeater B5-R/RD refreshes a received message on one channel and transfers it to all the other channels (chicken foot topology).
- Because the PROFIBUS MultiRepeater B5-R/RD creates isolated segments, the devices can now be removed and added during operation. Also most electrical bus problems and EMC disturbances in a spur do not spread to the other segments. The intelligent logic and isolation circuits of the Repeaters do not change the bit width. This means the MultiRepeaters do 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 MultiRepeaters are powered by a 10 to 24 DC voltage. For troubleshooting, maintenance and commissioning the MultiRepeaters are equipped with LEDs on the outside, which indicate the status of each channel (Data and Error).

2.2 Product features



- 5 Galvanic isolated outgoing channels (repeater segments)
- Advanced Diagnostic capabilities (B5-RD)
- Transparent for all PROFIBUS DP protocols
- DP - RS 485 specifications for each channel
- Cable redundancy for channel 4+5
- 9.6 Kbps to 12 Mbps
- 31 devices per channel
- 1200 m spur line length (depends on transmission speed)
- Redundant power supply
- No limit in serial placement or cascading of MultiRepeaters
- Alarm contact, with manual reset button
- No address required (except for the B5-RD option)
- Integrated termination facilities (switches)
- Configurable grounding system (direct or capacitive)
- IP 20 classification
- Increased temperature range
- DNV / offshore Certification (request pending, to be removed on approval)
- UL approval (request pending, to be removed on approval)



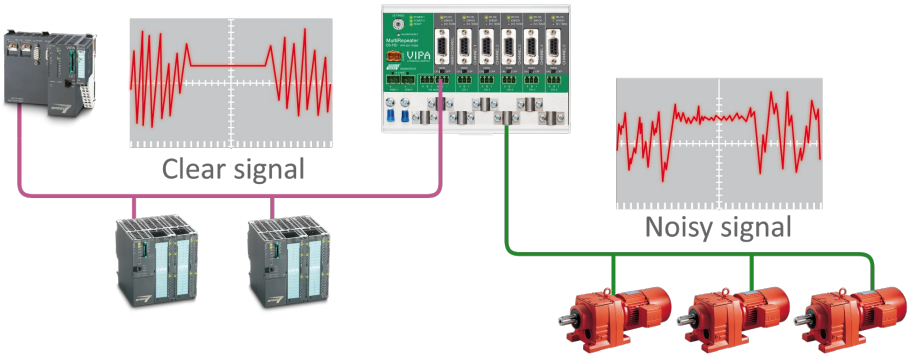
Long spur lines to instruments and the possibility to remove/insert them during operation. Short circuit protection on each spur line is automatically provided.

2.3 Application areas

- Dynamic spur lines to actuators, flow meter and pH analyzers
- Removable drives and motors
- Pull/Plug motor control centres (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

2.4 Additional Benefits

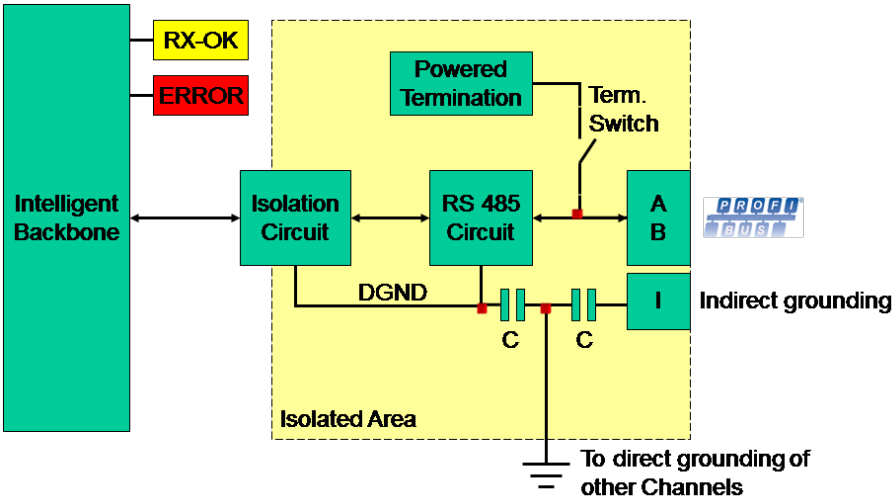
- Hot slave insertion and removal during operation
- Short circuit protection on each Channel
- Option to create a redundant path to other Repeaters
- Compact and robust construction
- Status and error display (per Channel)
- Suitable for all DP cables
- Conveniently arranged networks
- Easy extendable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



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

2.5 Channel Structure

Each channel is electrically isolated and internally connected to the transparent intelligent backbone. The termination is switchable and powered by the MultiRepeater. The shielding of the PROFIBUS cable can be directly grounded or indirectly grounded.



2.6 Grounding System

The PROFIBUS MultiRepeater can be grounded by 3 methods:

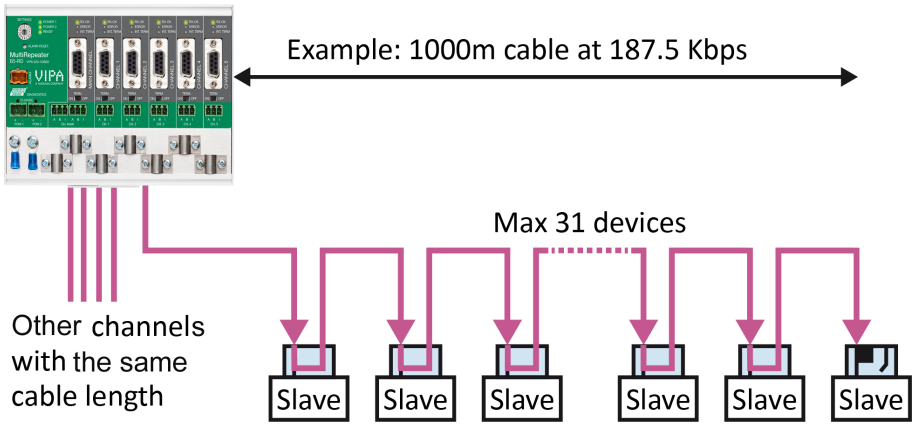
- Direct grounding on the Ground Rail
- Indirect grounding (through a capacitor)
- Combination of direct and indirect

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, 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.

2.7 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.

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

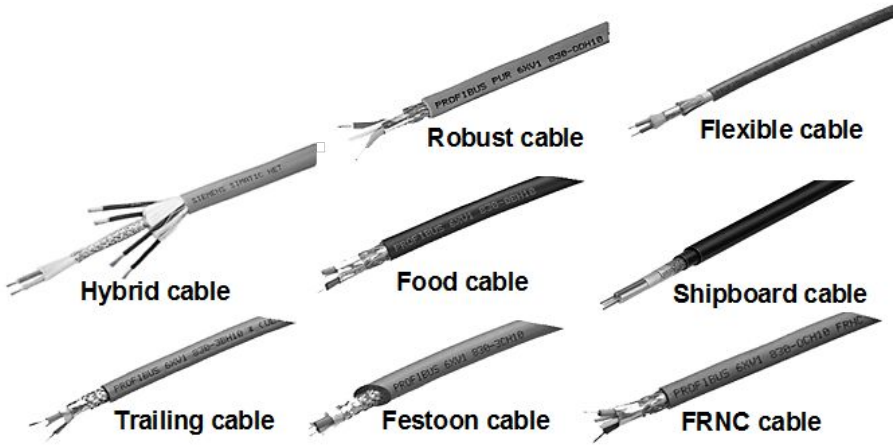


2.8 Cable types for PROFIBUS DP

The cable type must comply with the PROFIBUS DP cable specifications for RS485.

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

The PROFIBUS MultiRepeater can handle cables based on multiple protection sheaths with an overall cable diameter between 6 ... 12 mm.



2.9 Status display

The Status LEDs on the PROFIBUS MultiRepeater 920-1xB50 are very useful for diagnostics.

	OFF	Blinking	ON
POWER 1 / 2	Power is not switched on or an internal failure	Power supply not stable, redundant power supply interrupted or an internal failure	Power supply OK
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)
INT. TERM	Termination for this channel is OFF	Internal failure	Termination for this channel is ON

3 Installation Instructions

3.1 Location

The PROFIBUS MultiRepeater B5-R/RD can be installed everywhere in a non-hazardous area that complies with IP 20 (DIN 40 050) and the specified temperature range of -25 ... +70° C or -13 ... +158° Fahrenheit.

3.2 Position

Der PROFIBUS MultiRepeater B5-R/RD 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.

3.3 Mounting

The PROFIBUS MultiRepeater B5-R/RD can be mounted on 35 mm DIN rail with a minimum width of 167 mm. Mounting brackets are available for mounting the Repeater directly on a wall. The MultiRepeater has only been UL and DNV approved with 35 mm DIN-rail mounting!

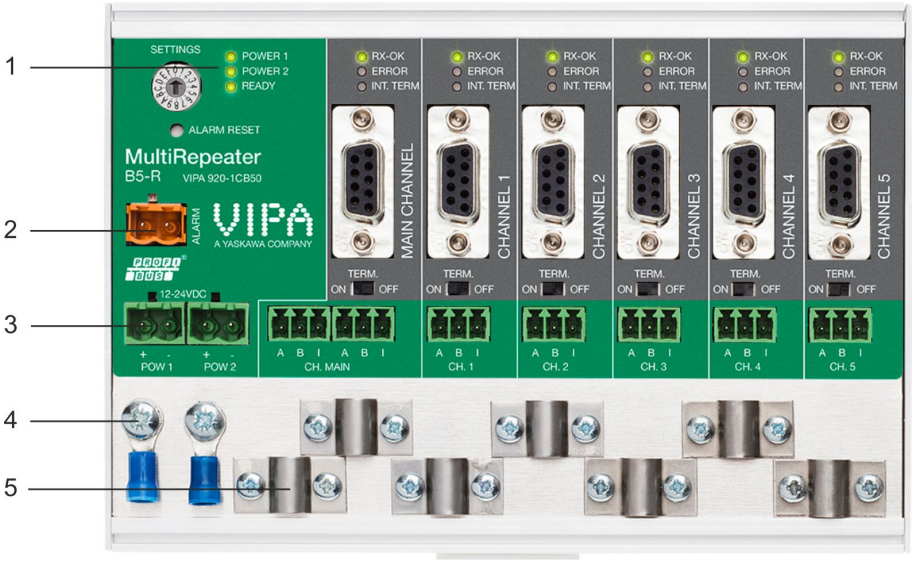
The supplied rubber studs need to be placed on the back of the housing of the Repeater for extra fixation. This is to prevent the product to potentially slide off the DIN rail. When used in DNV environments these rubber studs need to be installed!

3.4 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.

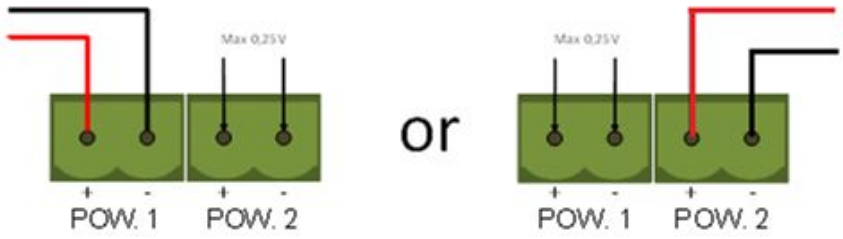
The two 2-pin screw type power connectors are located on the left of the PROFIBUS MultiRepeater B5-R/RD.

- 1 = **+** (left)
- 2 = **-** (right)



1 Power LEDs
2 Alarm contact
3 Power connector
4 Grounding points
5 Grounding points

Both power connectors are linked 1-on-1 to the internal power supply of the Repeater. If one power supply fails, the other takes over without delay time. 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.



If only one power supply is used, the alarm contact is closed. If two power sources are connected, the contact is open. As soon as one of the power supplies fails, the contact will close and the Power Indicator LED will blink.

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 V DC
- Current: min. 275 mA
- Wire diameter: < 2.5 mm^2

Procedure

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

1. Strip the insulation from the cable or the conductors for the 24V power supply.
2. Add cable crimp terminals/wire ferrules to the conductors.
3. 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.

3.5 Grounding of the power

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

1. Connect the ground lead of the power lead to the Ground Rail of the PROFIBUS MultiRepeater.
2. Connect the Ground Rail to the common ground with a separate ground lead.

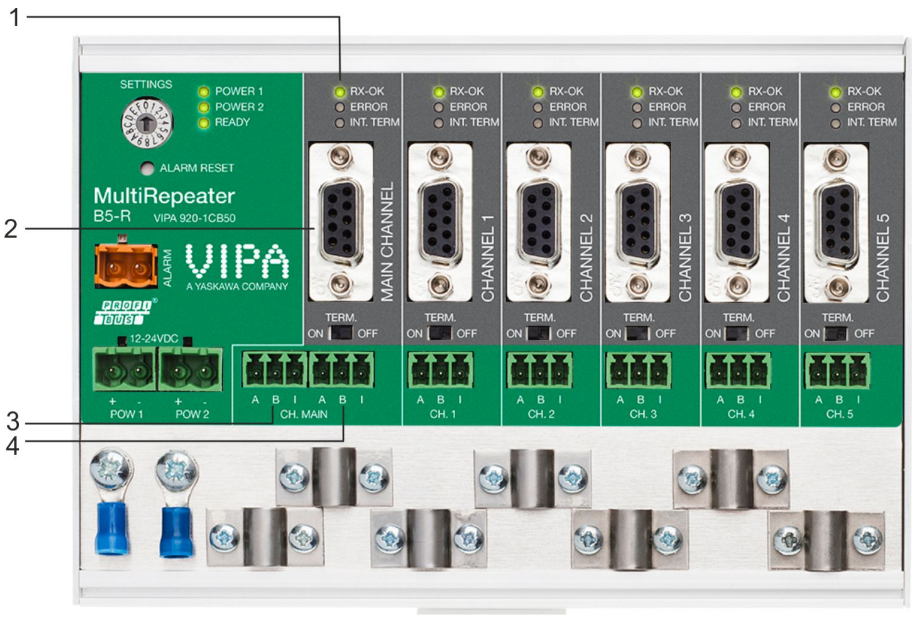
3.6 Relay contact

The PROFIBUS MultiRepeater B5-R/RD 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. On the B5-RD version the relay can also be used for alarming in case of "retires", "illegals" or other events.

- If only one power supply is used, the alarm contact is closed. If two power sources are connected, the contact is open. As soon as one of the power supplies fails, the contact will close and the Power Indicator LED will blink.
- 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 MultiRepeater is in Redundant mode and one of the redundant paths fails.
- The maximum power to be connected to the alarm contact is 24 VDC. The maximum switching current 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.

3.7 Backbone

Connect the DP backbone cable to the bottom-left connector of the main channel. If the MultiRepeater is not the last device on the bus segment, connect the Bus-Out cable to the right connector of the main channel. The second method is to place a PROFIBUS standardized plug with an in/out cable on the DB9 connector.



1 Communication status LEDs
2 DB9 Bus In/Out connector
3 Bus In connector
4 Bus Out connector

Pin layout of the screw terminals

Pin	Wiring
A	Green wire
B	Red wire
I	Indirect cable shielding

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

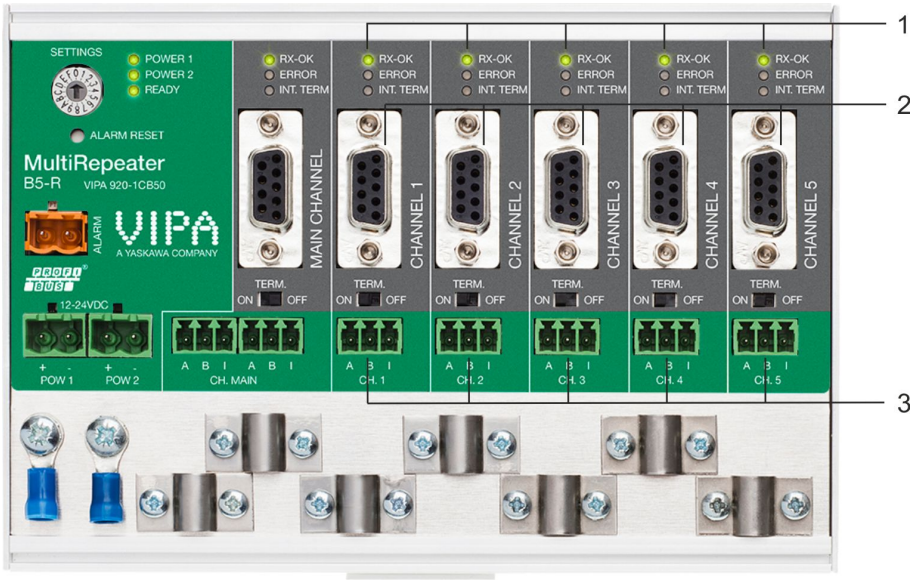
Testing

If the main channel recognizes valid PROFIBUS messages from one or more connected devices, the "RX-OK" LED of the main 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.

3.8 Spur Segments

→ Connect the spur segments to the connectors of channel 1 to 5. The second method is to place a PROFIBUS standardized plug on the DB9 connector of the specific Channel.



1 Communications status LEDs
2 Channel connectors
3 Channel connectors

Pin layout of the screw terminals

Pin	Wiring
A	Green wire
B	Red wire
I	Indirect cable shielding

Connecting the indirect cable shielding is not required when the ground clips are used.

Testing

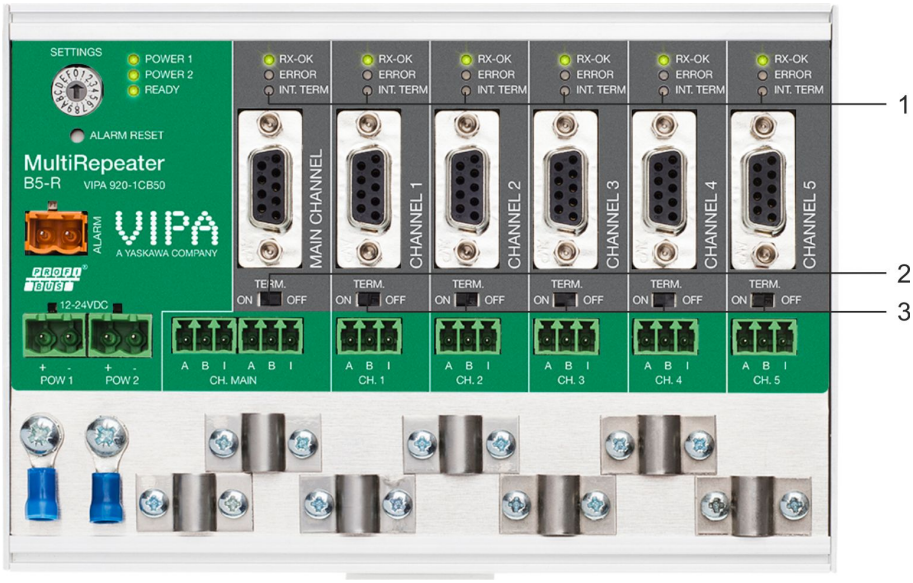
If a channel recognizes valid PROFIBUS messages from one or more connected devices, the "RX-OK" LED of the channel should be blinking.

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

3.9 Termination

The termination of the main channel has been set to OFF by default. If the MultiRepeater is the last device on the segment, the termination must be set to ON.

The termination of the channels have been set to ON by default, because it is assumed that the new segment is started at the MultiRepeater.



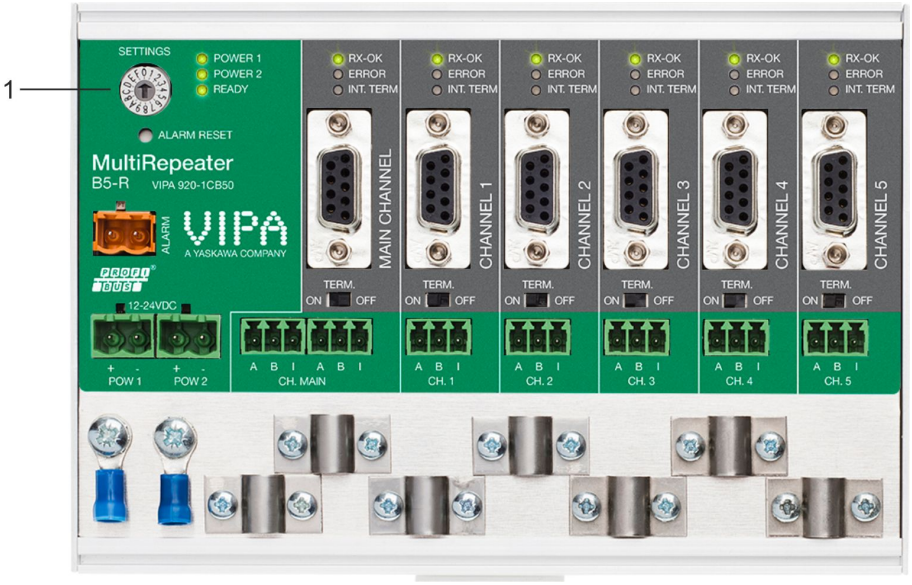
1 Termination LEDs
2 Termination of the main channel (default OFF)
3 Termination of the channels (default ON)

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

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

3.10 Baudrate switch

The PROFIBUS MultiRepeater B5-R/RD recognizes the transmission speed by default. If it is required that the MultiRepeater is locked to a certain transmission speed, the baudrate switch should be set to the required value.



1 Baudrate switch

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

Switch values

For position 1...D on B5-RD: Diagnostics Device ON

0 = Normal repeating, Auto baudrate 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 = Robust repeating, Auto baudrate detect

C = Robust repeating, Auto baudrate detect, redundancy on channel 4 and 5

D = Normal repeating, Auto baudrate detect

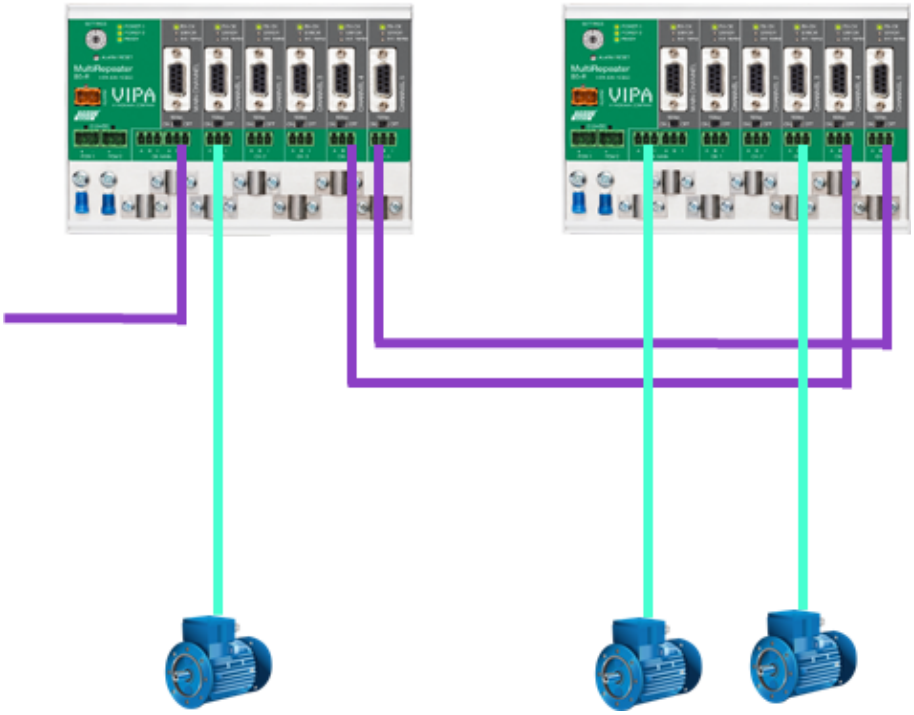
E ... F = Reserved for future use

Please note that the position of the rotary switch is only sampled during start-up. Changing the position of the switch will not have effect during operation.

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.

3.11 Channel Redundancy

To use the Redundancy option of the PROFIBUS MultiRepeaters 920-1xB50, set the rotary switch to the "C" position. This enables the two channels (4 and 5) to be one redundant path to another Repeater or to any other supporting product.



The telegrams are transferred onto both redundant channels. The logic inside the Repeater 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]* push-button to reset the alarm.

4 Diagnostics Device

The PROFIBUS MultiRepeater B5-RD is available with a built-in Diagnostics Device option. 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 of any network failure such as repeats or illegals, missing MultiRepeater termination, Livelist changes, or power supply problems. Audible or visible feedback is also possible by automatically switching the integrated alarm relay. This 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.

The following statistics and events are continuously monitored:

Event	Statistic
Alarm Relay opened/closed	Losts
Cable Redundancy change	Syncs
Baudrate change	Repeats (total)
Power input changed	Repeats (max. changed in 1 cycle)
Termination of Channel changed	Illegals
Communication on Channel stopped/started	Internal Diagnostics
Livelist changed (station removed or added)	External Diagnostics
	Diagnostics while in Data Exchange

All of these events and statistics can be transferred in four different ways, so that the PLC or user can be warned that something is happening in the PROFIBUS network:

- PROFIBUS input message
- Diagnostic message
- External diagnostics message
- Trigger the built-in alarm relay

4.1 Setting up the Diagnostics Device

4.1.1 Enabling the Diagnostics Device

To enable the Diagnostics Device in the MultiRepeater, set the rotary switch on the top left side to any position from 1 to D (for a complete list of rotary switch settings, refer to the Technical Data chapter). Next, power-cycle the device by removing power and applying the power again. The rotary switch position is only read during start-up of the MultiRepeater.

4.1.2 Changing the default PROFIBUS address

By default the address of the Diagnostic Device 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.

4.1.3 GSD file

Locate and download the appropriate GSD file for the Diagnostics Device on *www.vipa.com*. The correct GSD file for the MultiRepeater B5-RD is: VIPA 6970.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.

4.2 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.

4.2.1 Info data (mandatory module)

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

- Byte 1: Input Identifier byte (always 0xDE)
- Byte 2: Device type byte
  (0xB5 is MultiRepeater B5-R, 0xB2 is MultiRepeater B2)
- Byte 3: Version byte: 0x01
- Byte 4: Data format byte (0x00 is Little Endian, 0x01 is Big Endian)

4.2.2 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, it can be reset by the PLC by sending 0x01 or higher to the output of this module.

4.2.3 Redundant Status

Input Identifier byte: 0x10

The next input byte is to indicate the status of the redundant path.

Bit 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
Bit 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

4.2.4 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

4.2.5 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

4.2.6 Power Status

Input Identifier byte: 0x13

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

Bit 0...3	Meaning
0	Power 1 is active
1	Power 2 is active
Bit 4...7	
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)

4.2.7 Termination Status

Input Identifier byte: 0x14

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

Bit	Meaning
0	Main channel termination ON
1	Channel 1 termination ON
2	Channel 2 termination ON
3	Channel 3 termination ON
4	Channel 4 termination ON
5	Channel 5 termination ON

Examples:

0x3F = All terminations are ON

0x01 = Only main channel termination is ON

0x10 = Only channel 4 termination is ON

4.2.8 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 main channel
1	Communication on channel 1
2	Communication on channel 2
3	Communication on channel 3
4	Communication on channel 4
5	Communication on channel 5

Examples:

0x08 = Communication on channel 3

0x0A = Communication on channels 1 and 3

0x2C = Communication on channels 2, 3 and 5

4.2.9 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 main channel
81	Livelist of channel 1
82	Livelist of channel 2
83	Livelist of channel 3
84	Livelist of channel 4
85	Livelist of channel 5
86	Livelist of this MultiRepeater
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

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 main channel
81	Livelist of channel 1
82	Livelist of channel 2
83	Livelist of channel 3
84	Livelist of channel 4
85	Livelist of channel 5
86	Livelist of this MultiRepeater
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.

4.2.10 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 main channel
81	Statistics of channel 1
82	Statistics of channel 2

Hex	Meaning
83	Statistics of channel 3
84	Statistics of channel 4
85	Statistics of channel 5
86	Statistics of this MultiRepeater
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 MultiRepeater. 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 MultiRepeater Statistics; you can choose which stations or Channels will display statistics. Configure it by sending the following output value:

Hex	Meaning
00...7E	Statistics for device 0...126
7F	Statistics for undefined devices
80	Statistics of main channel
81	Statistics of channel 1
82	Statistics of channel 2
83	Statistics of channel 3
84	Statistics of channel 4
85	Statistics of channel 5
86	Statistics of this MultiRepeater
FF	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 MultiRepeater channels are cleared, not only for the displayed address or channel.

Bit	Meaning
0	Clear lost statistics
1	Clear sync statistics
2	Clear repeats total statistics
3	Clear repeats max statistics
4	Clear illegals statistics
5	Clear int. diag statistics
6	Clear ext. diag statistics
7	Clear diag while in DX statistics

Example:

To clear all "lost" and "illegals" statistics, send 0x11

To clear ALL statistics, send 0xFF

4.3 Parameterizing the Diagnostic Device

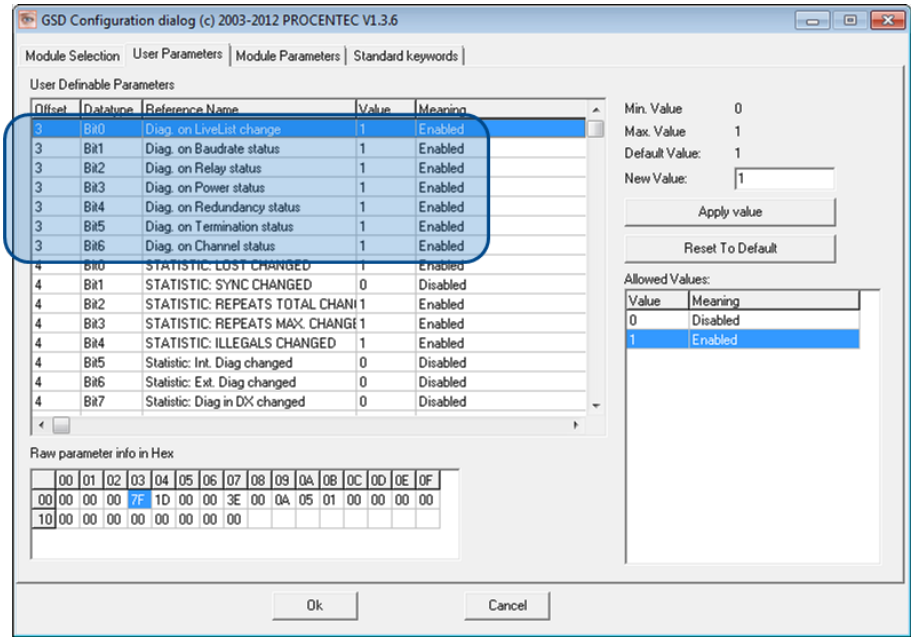
The Diagnostic Device has many user-definable parameters that can be changed, to alter the behaviour and options of the MultiRepeater Diagnostics Device.

4.3.1 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)
- 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 MultiRepeater has been changed)
- Channel status change (communication stopped or started on a channel)
- Statistics change (any statistic has changed)

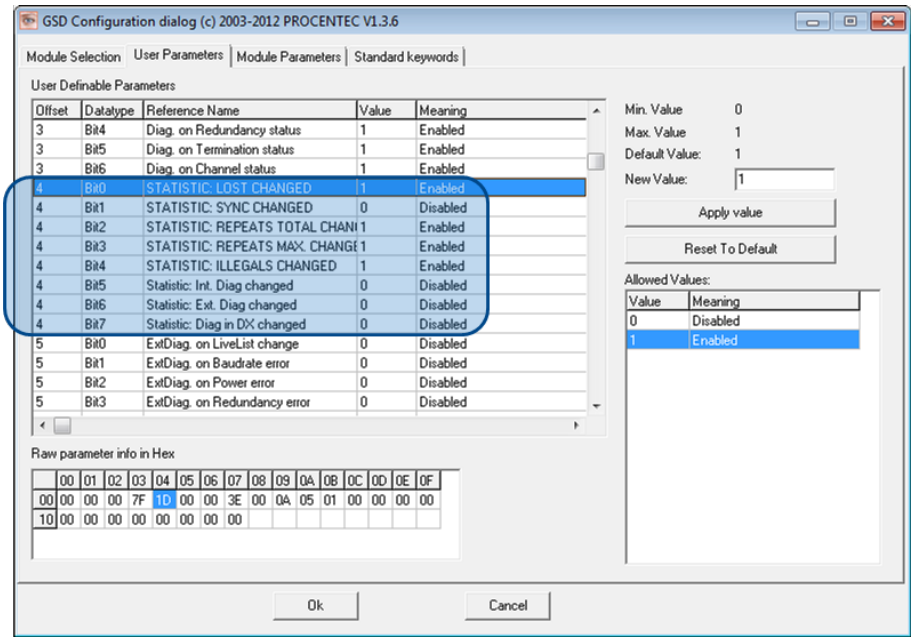
In your configuration tool you can toggle the diagnostics for each item.



The 8th byte of a diagnostic message from the Diagnostic Device indicates which options have been enabled or disabled.

4.3.2 Statistics

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



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

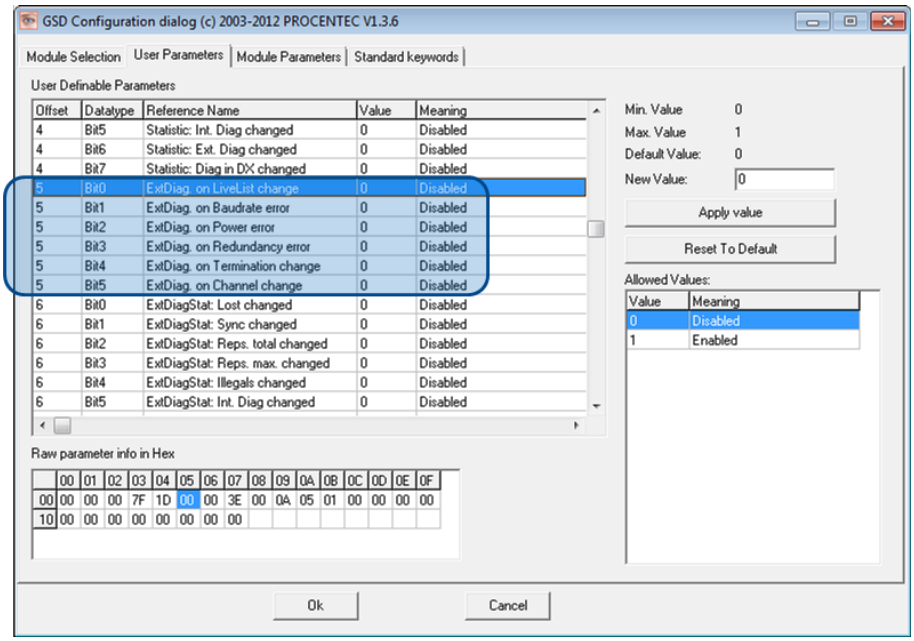
- Lost changed
- Sync changed
- Repeats (total) changed
- Repeats (max) changed

- Illegals changed
- Internal Diagnostics changed
- External Diagnostics changed
- Diagnostics in Data Exchange changed

4.3.3 Extended Diagnostics on Events change

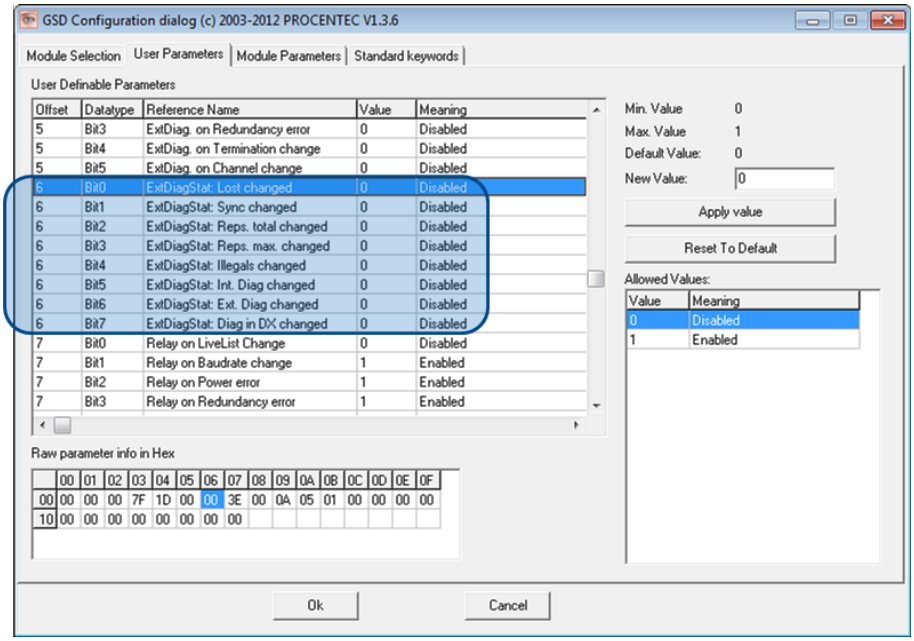
For more critical applications you can choose to enable the Extended Diagnostics option for each of the previously mentioned events. In the case of such an event, the Diagnostics Device will send out a diagnostics message with the Extended Diagnostic bit on. In a Busmonitor tool such as ProfiTrace the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

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



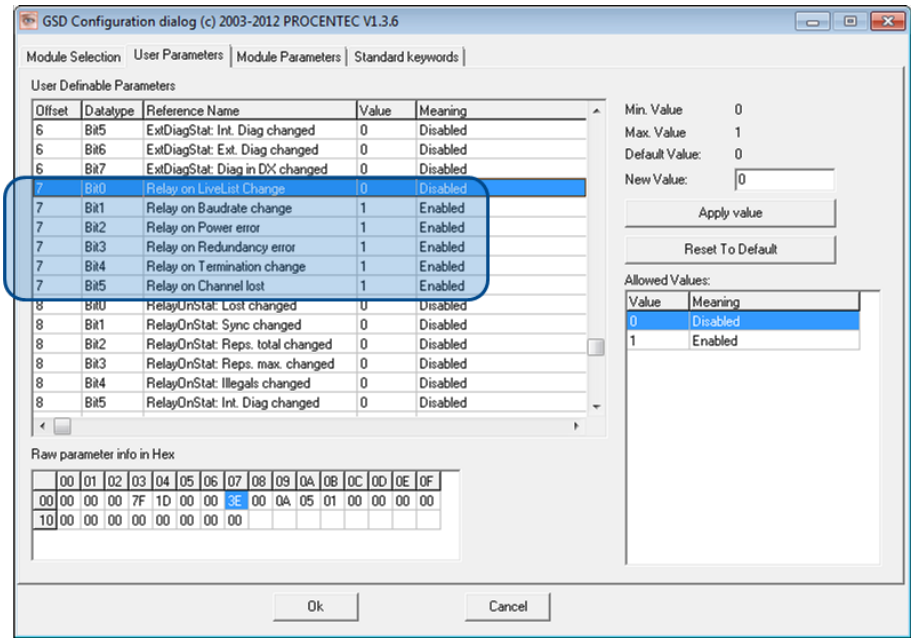
4.3.4 Extended Diagnostics on Statistics change

The Extended Diagnostic option can also be enabled for each individual available statistic.



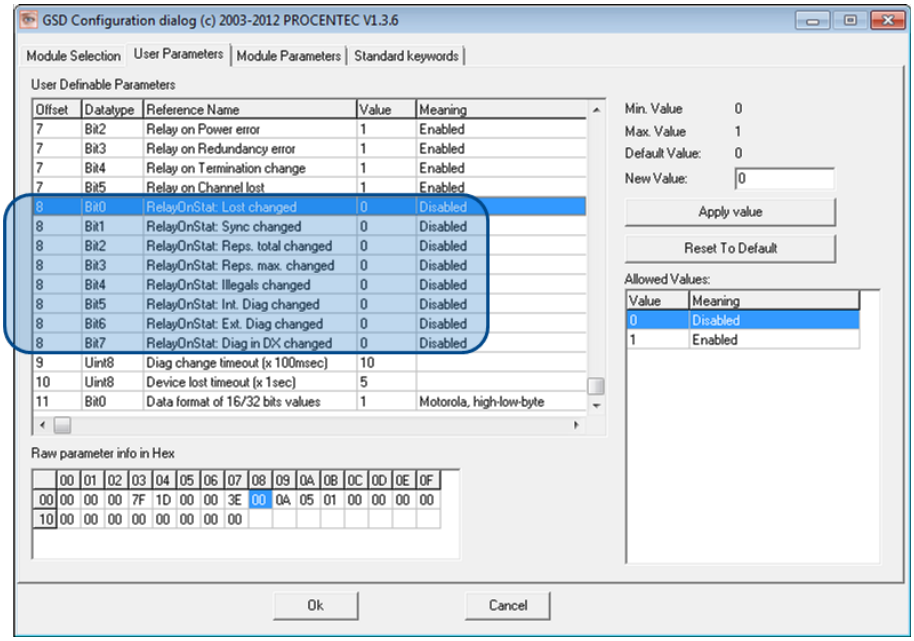
4.3.5 Alarm Relay on Events change

The Alarm Relay on the MultiRepeater can be switched on each described event. 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.



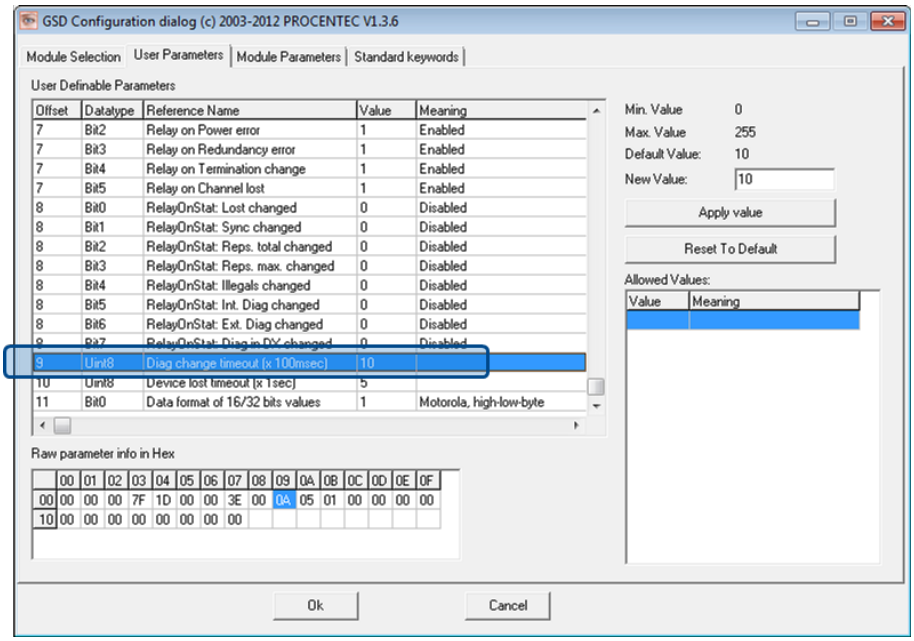
4.3.6 Alarm Relay on Statistics change

The Alarm Relay on the MultiRepeater can be switched (closed) on each described change in statistics. 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.



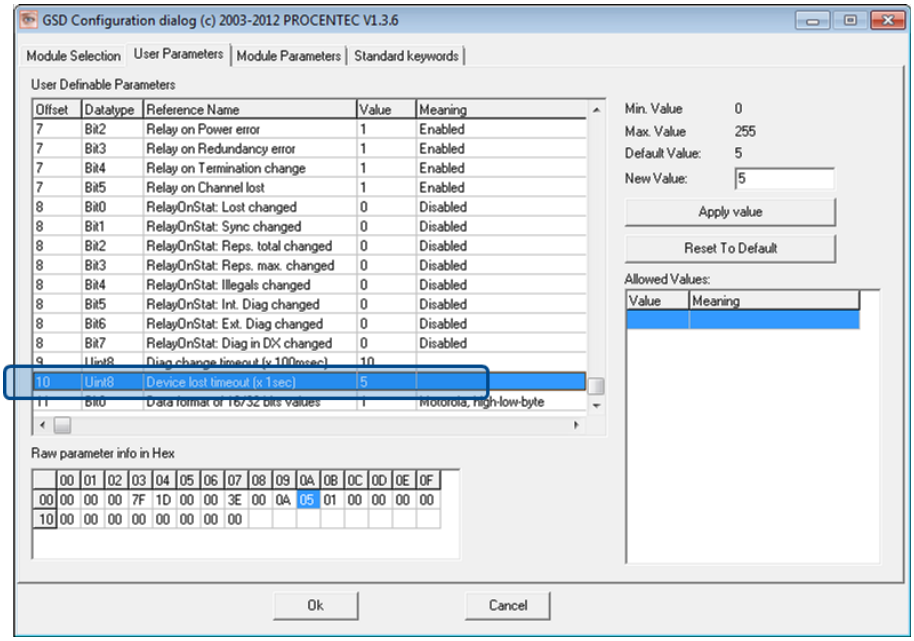
4.3.7 Changing the Diagnostics duration/timeout

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.



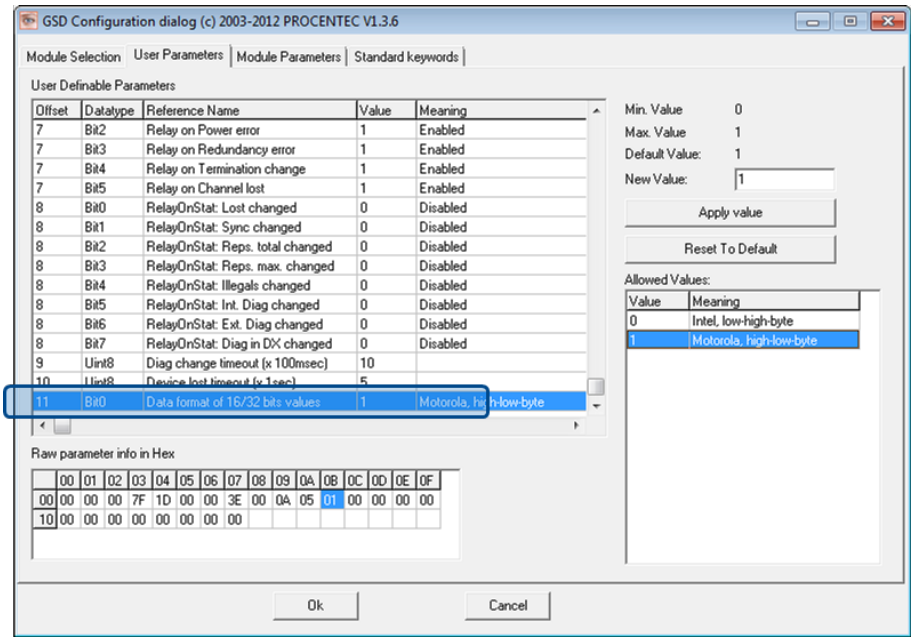
4.3.8 Changing the Device Lost timeout

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.



4.3.9 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.



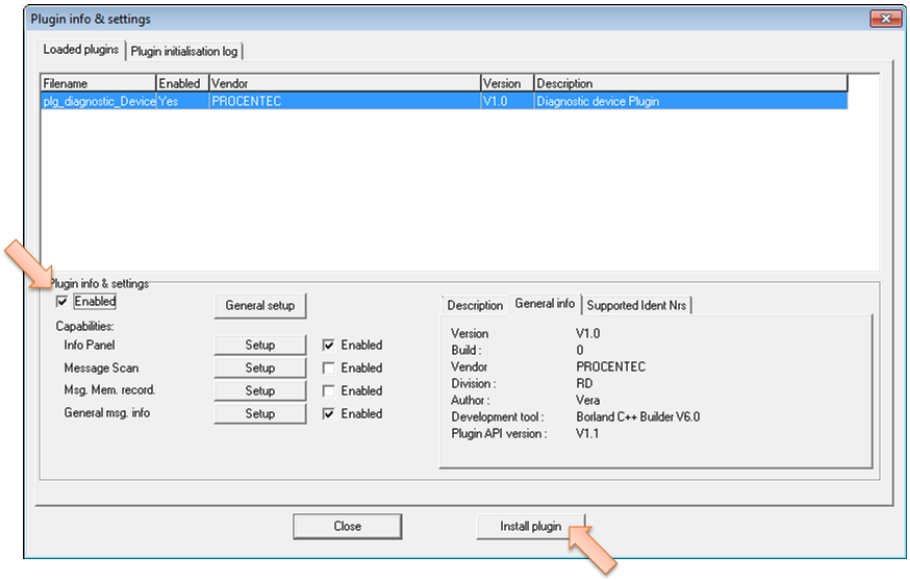
4.4 ProfiTrace plugin for the Diagnostic Device

On the download section of *www.procentec.com* you can download a useful plugin for the Diagnostic Device. It interprets all messages to and from the Diagnostic Device and displays the data in the Info Panel of ProfiTrace.

4.4.1 Installing the Plugin

Once you have downloaded the file and extracted it to your hard drive, start ProfiTrace and choose "Settings - Plugins" to bring up the Plugin window.

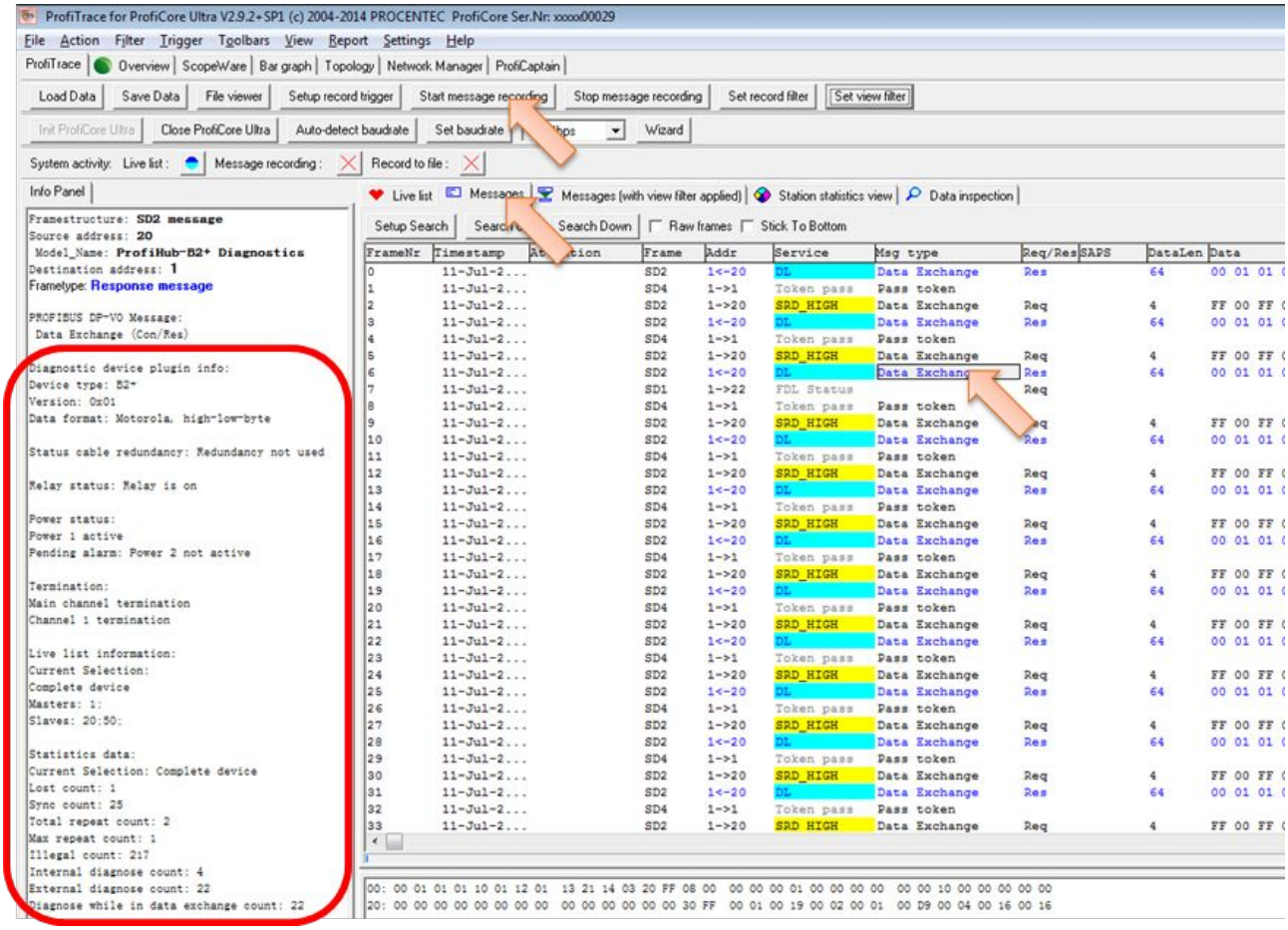
1. Click "Install Plugin" and locate it on your harddrive.
2. Next, click "Enabled" so that ProfiTrace starts the plugin on startup.



4.4.2 Using the Plugin

When the Plugin is correctly started and you have a MultiRepeater with Diagnostics Device running, click "Start Message Recording" in ProfiTrace, and view the screen with messages. If you click on a data exchange message to or from a Diagnostics Device, you will see all the interpreted data bytes in the Info Panel. This is very useful for Troubleshooting activities.

A good example is the statistics. These statistics are available per individual channel or station address, so it is easy to see the source of the problem.


ProfiTrace for ProfiCore Ultra V2.9.2+SP1 (c) 2004-2014 PROCENTEC ProfiCore Ser.Nr: xxxxx00029
File Action Filter Trigger Toolbars View Report Settings Help
ProfiTrace Overview ScopeWare Bar graph Topology Network Manager ProfiCaptain
Load Data Save Data File viewer Setup record trigger Start message recording Stop message recording Set record filter Set view filter
Init ProfiCore Ultra Close ProfiCore Ultra Auto-detect baudrate Set baudrate Wizard
System activity: Live list: Message recording: Record to file:
Info Panel
Framestructure: SD2 message
Source address: 20
Model_Name: ProfiHub-B2+ Diagnostics
Destination address: 1
Frametype: Response message
PROFIBUS DP-V0 Message:
Data Exchange (Con/Res)
Diagnostic device plugin info:
Device type: B2+
Version: 0x01
Data format: Motorola, high-low-byte
Status cable redundancy: Redundancy not used
Relay status: Relay is on
Power status:
Power 1 active
Pending alarm: Power 2 not active
Termination:
Main channel termination
Channel 1 termination
Live list information:
Current Selection:
Complete device
Masters: 1:
Slaves: 20:50:
Statistics data:
Current Selection: Complete device
Lost count: 1
Sync count: 25
Total repeat count: 2
Max repeat count: 1
Illegal count: 217
Internal diagnose count: 4
External diagnose count: 22
Diagnose while in data exchange count: 22
Live list Messages Messages (with view filter applied) Station statistics view Data inspection
Setup Search Search Down Raw frames Stick To Bottom
FrameNr Timestamp Frame Addr Service Msg type Req/Res SAPS DataLen Data

5 Technical data

Order no.	920-1xB50		
Dimensions and weight			
Dimensions L x H x D (mm) with screws	167 x 111 x 32 mm		
Weight	Approx. 650 g		
Ambient conditions			
Operating temperature	-25 ... +70° C		
	-13 ... +158° Fahrenheit		
Isolation class	IP 20 (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	9.6 kbps ... 12 Mbps (including 45.45 kbps)		
Transmission speed detection	Auto detect (default) or selectable with rotary switch		
Transmission speed switch	**For position 1...D on B5-RD: Diagnostics Device ON** 0 = Normal repeating (Auto detect, diag off) (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 = Robust repeating (auto baudrate detect) C = Robust repeating (auto baudrate detect), redundancy on channel 4 and 5 D = Normal repeating (auto baudrate detect) E ... F = Same as 0		
Transmission speed detection time	< 10 s (if it is set to auto detect)		
Data delay time	At baudrate:	Normal mode:	Robust mode:
	9.6 - 93.75 kbps	≤1.7 Tbit	≤13.25 Tbit
	187.5 - 500 kbps	≤1.8 Tbit	≤13.30 Tbit
	1.5 Mbps	≤1.9 Tbit	≤13.40 Tbit
	3 Mbps	≤2.2 Tbit	≤13.60 Tbit
	6 Mbps	≤3.0 Tbit	≤14.00 Tbit

Order no.	920-1xB50		
	12 Mbps	≤4.0 Tbit	≤15.00 Tbit
Delay time jitter	Max. ¼ bit time		
PROFIBUS Diagnostics Device specifications (only for B5-RD)			
Supported protocol	DP-V0		
Ident Number	6970		
GSD filename	VIPA 6970.gsd		
Bus address	0 ... 126 (software address only, set by software)		
Transmission speed	9.6 kbps .. 12 Mbps (including 45.45 kbps)		
Transmission speed detection	Auto Detect		
Maximal transferrable data	85 bytes input and 5 bytes output		
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	10 mm (when the ground rail is used)		
Wire diameter	< 2.5 mm^2		
Wire type	Stranded or Solid core		
Number of devices	Maximum 31 per Channel (including MultiRepeaters, OLMs, Laptops/PCs, etc)		
Termination	Integrated and switchable. Powered according to IEC 61158 (390/220/390 Ohm) ■ All Channels (default: ON) ■ Main-Channel (default: OFF)		
Cascading depth	No limits		
Redundancy	Yes		
Power supply specifications			
Power source	For UL: Limited Power Source (LPS) or NEC Class 2 or CEC Class 2, according to UL-60950-1 regulations		
Nominal supply voltage	12 to 24 V DC		
Redundant power supply	Yes		
Current consumption	Min 275 mA at 12 V power supply (all Channels fully loaded)		
Reverse polarity protection	Yes		
Cable thickness	10 mm (when the ground rail is used)		
Wire diameter	< 2.5 mm^2		
Alarm contact			

Order no.	920-1xB50
Voltage	Max. 24 V DC
Current	0.5 A
Others	
MTBF	T.b.d.

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
Backbone	The primary bus cable. Most of the time only the control systems, MultiRepeaters and fiber optic couplers are connected to this cable. The field devices are connected behind the MultiRepeaters 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 behaviour 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
EMC (Electromagnetic Compatibility)	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.
Stub line	See Spur line
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 user Organization. The 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.