SafetyBUS p Fiberoptic Router

SBR-FX/RMD

User manual

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Documentation for SafetyBUS p Fiberoptic Router
SBR-FX/RMD Version 2.0

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Our products are continously improved. Due to this fact specifications may be changed at any time and without announcement.

WARNING: SBR-FX/RMD hardware and software may not be used in applications where damage to life, health or private property may result from failures in or caused by these components.

Content

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1 Overview

1.1 Attributes

- Optical fiber based Ethernet/CAN router for the connection of SafetyBUS p subnetworks
- Powerful 32bit ARM7 microcontroller Nuvoton W90N740
- Abolition of the extension/datarate restrictions between two CAN bus segments
- Optical fiber extensions up to 15/40 km possible (2 different device types)
- Automatic detection of the used baudrate

1.2 General Description

The rail mountable router SBR-FX/RMD transmits data between SafetyBUS p networks using optical fiber. To achieve the connection two devices are linked back-to-back, the transmission protocol used on the optical fiber is the UDP/IP protocol. The use of UDP/IP abolishes the length/datarate restrictions between two CAN bus segments. Depending on the type of the device, extensions up to 15km or 40km are possible.

SBR-FX/RMD automatically detects the baud rate on the controlling side. The I/O side can be run with the baudrate detected on the controlling side or an independently customized baudrate.

1.3 Ordering Information

12-20-540-yy	**SBR FX-15000/RMD V2.0** SafetyBUS p Fiberoptic Router, rail mountable, range up to 15km
12-20-541-yy	**SBR FX-40000/RMD V2.0** SafetyBUS p Fiberoptic Router, rail mountable, range up to 40km
12-20-540-80	**SBR FX-15000/RMD Master V2.0** SafetyBUS p Fiberoptic Router, rail mountable, range up to 15km
12-20-540-81	**SBR FX-15000/RMD Slave V2.0** SafetyBUS p Fiberoptic Router, rail mountable, range up to 15km
12-20-541-80	**SBR FX-40000/RMD Master V2.0** SafetyBUS p Fiberoptic Router, rail mountable, range up to 40km
12-20-541-81	**SBR FX-40000/RMD Slave V2.0** SafetyBUS p Fiberoptic Router, rail mountable, range up to 40km

Note: yy denotes language of delivery:

10 German
20 English

2 Hardware

SBR-FX/RMD includes a Nuvoton W90N740 (ARM7 core) controller with 80Mhz clock and an embedded Linux operating system. In addition, the device has 16MB SDRAM and 2MB Flash. The connection to the CAN bus is provided by a CAN controller of type Philips SJA1000.

LEDs

Explanation of the different LEDs on SBR FX/RMD (only applicable LED states are listed):

Power:

on:	power is supplied to the module
off:	no power is supplied or internal power fail

SB Active:

blinking:	traffic on the CAN bus

FX Active:

blinking:	traffic on the optical link

FX Link:

on:	devices have been connected via the optical link

Status1:

blinking:	logical connection between devices in progress
on:	logical connection established

Status2:

blinking:	SafetyBUS initialization in progress
on:	SafetyBUS communication OK

3 Software

3.1 General Configuration

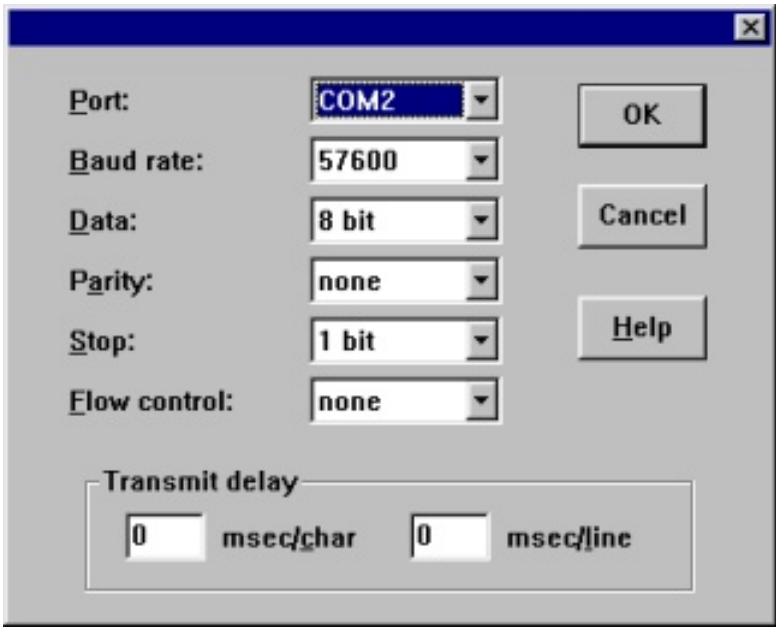
To review or change the IP configuration, you can access SBR-FX/RMD using a terminal program connected to its RS232 port.

- Connect a serial cable to the RS232 port of SBR-FX/RMD.

- Connect the other end to a free COM port of your PC.

Note: The serial cable should have the pins 2 and 3 crossed and pins 5 connected directly.

- Start your terminal software. Configure your software for a direct connection using the PC´s COM port. See the communication parameters to use in the following image.



Notice that the ´flow control´ parameter within the serial monitor running on the PC has to be turned off. If this parameter can not be changed, supplemental bridges (between pins 4-6 and pins 7-8) have to be inserted on the PC sided connector of the serial cable described above.

- Power on SBR-FX/RMD

- On the terminal window you will see the output from the startup procedure. If the procedure was successful, you will see a prompt that enables you to input commands.

- Enter the command `fltool - r IP` to inquire the IP address.
- Enter the command `fltool - r HOSTNAME` to inquire the HOSTNAME.
- Enter the command `fltool - r NETMASK` to inquire the NETMASK.

- To change the IP configuration, you can use the same application, but with the parameter ´-w´.

  Examples:

```
fltool -w IP 192.168.0.93
fltool -w HOSTNAME sbr1
fltool -w NETMASK 255.255.255.0
```

The IP configuration information is stored within the flash of SBR-FX/RMD. The parameters become valid after a reboot.

The following command line parameters are available for the ´fltool´:

fltool -r IP
inquire the IP address of the device

fltool -r HOSTNAME
inquire the hostname of the device

fltool -r NETMASK
inquire the netmask of the device

fltool -w IP xxx.xxx.xxx.xxx
change the IP address of the device

fltool -w HOSTNAME name
change the hostname of the device

fltool -w NETMASK xxx.xxx.xxx.xxx
change the netmask of the device

fltool -l
show a list of all active user commands

In addition, the user can specify certain actions by setting user specific parameters (including the quotation signs):

fltool -w USER_X "command to execute"
where ´x´ can be a number between 1 and 4

A user command specified by

fltool -w USER_x "command"
can be retrieved by a call to

fltool -r USER_x

To delete an action specified within one of the USER_x slots you can use the ´fltool´ command with just 2 quotation marks.

Example:
fltool -w USER_X""

3.2 SafetyBUS p Startup Configuration

The software running on SBR-FX/RMD devices is started upon boot time and normally needs no intervention from the user.

It is however possible to modify application start parameters. This is useful to change from automatic baudrate detection (default) to a fixed baudrate on the slave side.

When using the fixed baudrate feature, always choose the highest possible baudrate to avoid latency problems and consider the usage of the filtering algorithm to reduce the traffic on the slave segment.

Please notice that only the following baudrates are allowed with SafetyBUS p:

500kBaud, 250kBaud, 125kBaud, 50Baud, 20kBaud.

Parameters using automatic baudrate detection:

Master: sdtpsrv - -dest-ip SLAVE_IP -w
Slave: sdtpsrv - -dest-ip MASTER_IP -w

Parameters using a fixed baudrate on the slave side:

Master: sdtpsrv - -dest-ip SLAVE_IP -w
Slave: sdtpsrv - -dest-ip MASTER_IP -w -b BAUDRATE

The start parameters can be changed using the ´fltool´ program described within the preceding chapter.

The following parameters are available:

--dest-ip:	the destination IP address (notice the double hyphen)
-w:	trigger the watchdog
-b:	the fixed baudrate, only available on the slave side
-f:	enable filtering, must be activated on both sides (master and slave)

Example for a master with IP 192.168.0.93 connecting to a slave with IP 192.168.0.94 and fixed baudrate:

Master

```
fltool -w USER_1 \
"sdtpsrv --dest-ip 192.168.0.94 \ -w"
```

Slave

```
fltool -w USER_1 \
"sdtpsrv --dest-ip 192.168.0.93 \ -b 500 -w"
```

Please notice that the commands have to be written into a single line (without the ´\´).

4 Electrical Characteristics

4.1 Absolute Limiting Values

Any (also temporary) stress in excess of the limiting values may cause permanent damage on SBR-FX/RMD. Exposure to limiting conditions for extended periods may affect the reliability and shorten the life time of the device.

Parameter	Min.	Max.	Unit
Storage temperature	-25	+70	°C
Operating temperature	0	+50	°C
Supply voltage	-100	+35	V
Voltage on bus connections	-30	+30	V

4.2 Nominal values

Parameter	Min.	Typ.	Max.	Unit
Current consumption	-	80	200	mA
Supply voltage	20	24	30	V
Optical damping (SBR-FX15000)	-	13	-	dB
Optical damping (SBR-FX40000)	4	28	-	dB
Admissible fiber length (SBR-FX15000)	-	15	-	km
Admissible fiber length (SBR-FX40000)	-	40	-	km

All values, unless otherwise specified, refer to a supply voltage of 24V and an environmental temperature of 20°C. Fiber length specifications are valid for a fiber damping of 0,55dB/km without additional patch panels.

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5 Operating Instructions

5.1 Connection Scheme

SBR-FX/RMD includes a CAN segment which can be connected by a plug of type D-Sub9.

Pin	Name	Function
1	-	Reserved
2	CAN_L	CAN_L signal line (dominant low)
3	GND	Ground
4	-	Reserved
5	SHLD	Shield
6	-	Reserved
7	CAN_H	CAN_H signal line (dominant high)
8	VCC	Output 5V (max. 150mA)
9	-	Reserved

The device is supplied via a terminal block.

Pin 1	VCC	Supply 24V
Pin 2	VCC	Supply 24V
Pin 3	GND	Ground
Pin 4	GND	Ground

A serial connector of the type D-Sub9 allows the configuration of SBR-FX/RMD.

Pin	Name	Function
2	RXD	Receiving data line
3	TXD	Sending data line
4	DTR	(Currently not supported)
5	GND	Ground
6	DSR	(Currently not supported)

The optical connection is realized by a pair of single mode fibers (9/125µm diameter) connected via LC terminals.

5.2 Router Correction Time and Cascading

The values listed below are typical values and should fit most system configurations. The values to be used in a specific system may vary based on parameters like busload and numbers of nodes. The use of a router may require higher values for the Event Timeout settings.

If cascading is used, the Correction Time will increase by the values of the following table for each additional segment.

Baudrate	Correction Time
20 kb/s	25 ms
50 kb/s	11 ms
125 kb/s	5 ms
250 kb/s	5 ms
500 kb/s	5 ms

5.3 ESD Precaution

As an ESD precaution the RS232 cable may only be connected during configuration of the device and not at normal operating time.

6 Appendix

6.1 Instruction for Disposal

Electronic Equipment Act (WEEE)

EMS is selling its products exclusively to commercial customers. This is the reason why all devices are designed for commercial use and have to be disposed appropriately. In accordance to § 10 para. 2 clause 3 Electronic Equipment Act (WEEE) the disposal of EMS products is regulated the following way.

The equipment must not be disposed at the public collection points. In accordance with the applicable law the disposal has to be done by the customer for own account. The same applies to products, which have been sold to third parties, if those parties do not take care of a disposal in accordance to the applicable law. As an alternative the products can be returned to EMS free of charge.

6.2 FCC Statement

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

6.3 CE Conformity

Declaration of Conformity

CE

The manufacturer

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hereby declares, that the following products:

Name	Article Number
SBR FX-15000/RMD V2.0	12-20-540-yy
SBR FX-40000/RMD V2.0	12-20-541-yy
SBR FX-15000/RMD Master V2.0	12-20-540-80
SBR FX-15000/RMD Slave V2.0	12-20-540-81
SBR FX-40000/RMD Master V2.0	12-20-541-80
SBR FX-40000/RMD Slave V2.0	12-20-541-81

meet the requirements of the following standards:

Electromagnetic Emission:
DIN EN 55022; VDE 0878-22:2011-12 – Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement (CISPR 22:2008, modified); German version EN 55022:2010

Electromagnetic Immunity:
DIN EN 55024, VDE 0878-24:2016-05 – Information technology equipment – Immunity characteristics – Limits and methods of measurement (CISPR 24:2010 + Cor.:2011 + A1:2015); EN 55024:2010 + A1:2015

and therefore conform with the EU requirements on:

Electromagnetic compatibility (2014/30/EU)

In accordance with the above mentioned EU directives, the EC declarations of conformity and the associated documentation are held at the disposal of the competent authorities.

RoHS 2 EEE

The RoHS 2 Directive (2011/65/EU) commits manufacturers of „Electrical and Electronic Equipment“ (EEE) to secure compliance with the RoHS Directive before placing a CE mark.

Based on technical documentation and to the best of our knowledge, we hereby confirm that the above mentioned products do not contain any of the restricted substances according to Article 4 of the RoHS Directive in excess of the maximum concentration values tolerated by weight in any of their homogeneous materials.

Ilmmünster, 31.05.2016

Dr. Thomas Wünsche

EMS Thomas Wünsche