SERIAL-PROFIBUS-INTERFACE SPI 3

for Fieldbus devices with a serial interface

ASCII | 3964R | RK512

Contents SPI 3 – Controls other than SIMATIC S5/S7 (up to Release 11)

Contents Online Documentation

Doc. version 3.1

Trebing + Himstedt

Prozeßautomation

Dear customer

This online documentation is designed to help you with engineering, connecting up, configuration and parameter setting of the SPI 3. Please feel free to contact our Technical Support department if you need further help:

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Doc. Version 3.1 / December 2003

Table of contents

Introduction

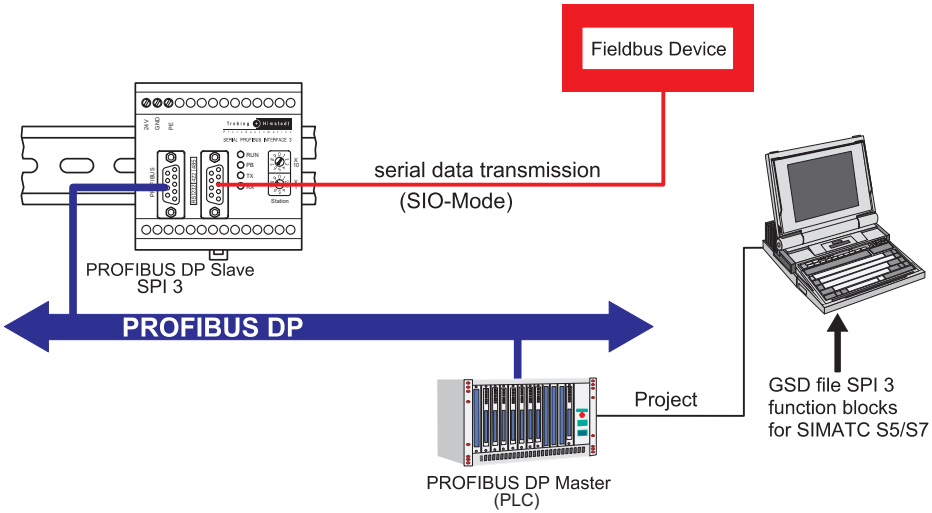
The SPI 3 (SERIAL-PROFIBUS-INTERFACE 3) allows a PROFIBUS-DP master to communicate with a fieldbus device with a serial interface. This allows the fieldbus device to function as a real PROFIBUS station, whereby the SPI 3 converts the data to be exchanged between the PROFIBUS-DP master and the fieldbus device into a format which is compatible with the other device.

Data is exchanged between the DP master and the SPI 3 in the form of telegrams or telegram fragments through a data channel, the size of which can be configured to adapt it to the telegram length and the size of the PLC I/O area. The data channel consists of a send channel and a receive channel.

The SPI 3 is easy to install and configure and a separate program for configuration or parameter setting is not necessary. Configuration is done using the respective PROFIBUS-DP master.

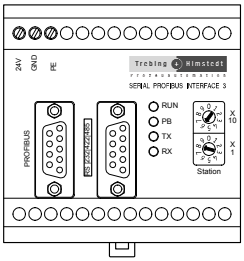
Features of the SPI 3:

- DP slave at up to 12 Mbit/s
- Serial baud rates up to 57.6 kbit/s
- Versions available for RS232, RS422 or RS485 serial interface
- Function blocks for SIMATIC S5/S7 (Included in Documentation & Media-Kit)
- Does not require special configuration software
- Simple and fast Integration in PROFIBUS-DP networks
- I/O range configurable from 2 to 64 data words

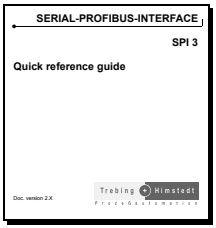


Example for SPI 3 interface module overview

Scope of delivery



SPI 3



Quick start guide

Documentation & Media kit (optional)

The documentation & media kit contains this online documentation, function blocks for SIMATIC S5 and S7, GSD file and example files. You can download the documentation & media kit (www.t-h.de). You need GSD file for the PLC project.

About this Online Documentation

Please read this online documentation before starting the installation work. It contains important information on planning your system, connecting up and configuring the SPI 3 and on parameter setting.

The online documentation uses the following keywords and symbols:

Danger!
Risk of injury to personnel due to electric shock.

Warning!
Risk of damage to equipment.

Note!
Indicates useful tips.

Safety notes

Safety notes for the planning stage

Observe the general rules for PROFIBUS components when planning the SPI 3 installation.

Please observe the following to avoid risk to personnel and damage to equipment and to ensure that the SPI 3 functions correctly:

Safety regulations	– Observe the guidelines in the VDE 0100 regulations for handling electrical components, – Observe the applicable safety and accident prevention regulations.
Assembly personnel	The SPI 3 must only be installed or de-installed by qualified technical personnel with appropriate electrotechnical qualifications.
PROFIBUS standard	Observe the guidelines in the PROFIBUS standard EN 50 170.
Bus cable	Bus wiring should only take place using special screened, twisted pair PROFIBUS cable. The high data transfer rates can only be guaranteed with the correct cable type.
Cable lengths	Refer to the manual for the DP master for information on maximum cable lengths for PROFIBUS.
Terminating resistors	Terminating resistors must be used if the SPI 3 is installed at the beginning or end of the PROFIBUS cable segment. In this case, you should use PROFIBUS connectors which contain an integrated terminating resistor. We recommend you to use connectors from ERNI and Siemens. If the bus is incorrectly terminated, this can lead to errors in data transfer or to damage to other stations on the bus.
Bus connectors	You should only use commercially available PROFIBUS connectors for connecting the bus. We recommend you to use connectors from ERNI and Siemens.
Cable screen	Screened cables are less sensitive to interference due to electromagnetic fields. With screened cables, the interference currents are led to ground through the screening rail, which is electrically connected to the case. To ensure that the interference currents which flow through the screening do not themselves interfere with other devices, it is important to provide a low impedance connection to the protective ground. Observe the following rules for the screens of the PROFIBUS cable and the serial interface cable: – The braiding of the screening should have a degree of coverage of more than 80 %.

– The screening should include a braided screen and should not consist solely of foil screening, since the latter can be easily damaged by cable tension and pressure.
– To ensure good immunity to interference at high frequencies as well, the screening of the cable should be attached to the screening rail at both ends of the cable.

Safety notes for installation and operation of the SPI 3

Please observe the following before connecting up the SPI 3 to avoid risk to personnel and damage to equipment and to ensure that the SPI 3 functions correctly:

– The SPI 3 is designed as an interface between fieldbus devices with serial interfaces and the PROFIBUS. Do not use the SPI 3 for any other purpose.
– The SPI 3 may only be installed or de-installed by qualified technical personnel with appropriate electrotechnical qualifications. When connecting up the SPI 3, you must observe the guidelines in the VDE 0100 regulations for handling electrical equipment.
– Always mount the SPI 3 on a suitable top-hat rail.
– The cables used to connect up the SPI 3 should not apply any mechanical forces to the device.

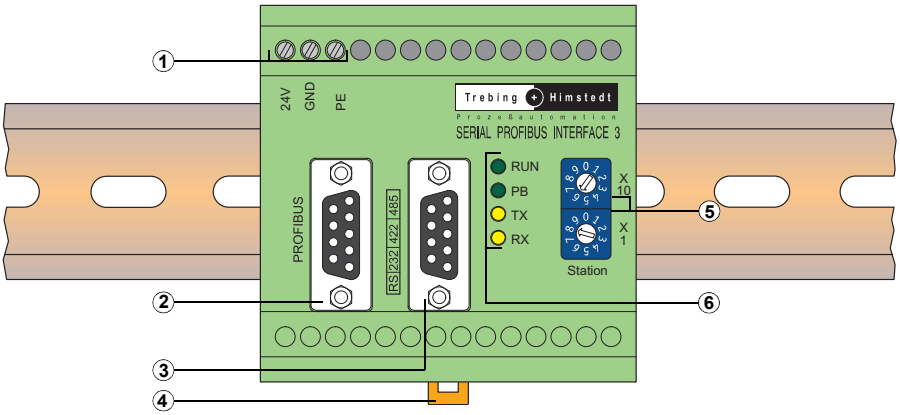
Danger!
Never open the case of the SPI 3 and do not make any modifications to the device.

Warning!
Small objects or liquids must not be allowed to enter the case of the SPI 3 (e.g. through the ventilation slots) since this could damage the device.

Never cover up the ventilation slots in the case.

Large temperature differences between the storage location and installation site can cause condensation to form within the case of the SPI 3, which can damage the device. If large temperature differences are present, you should wait at least 3-4 hours after installing the SPI 3 and before switching on the power.

Overview of the SPI 3



Connections and interfaces

– Power feed ①
  · 24 V Screw terminal for external 24 V power supply
  · GND Signal ground terminal
  · PE Protective ground terminal

– PROFIBUS interface ②

– Serial interface ③ (RS232, RS422 or RS485 see label on SPI 3)

Mounting the device

– Spring-loaded orange clip ④ for releasing the SPI 3 from the top-hat rail

Operating elements

– Two rotary switches ⑤ for setting the PROFIBUS address
  · Switch for setting the tens value
  · Switch for setting the units value

Indicating elements

LEDs ⑥ to indicate operating states (see »Error diagnosis and remedies« on page 19):

– RUN: lights continuously if supply voltage is present, flashes in case of errors

– PB: lights up if the SPI 3 has been configured by the master and is operational, flashes in case of errors

– TX: flashes if data is being sent to the serial interface

– RX: flashes if data is being received from the serial interface

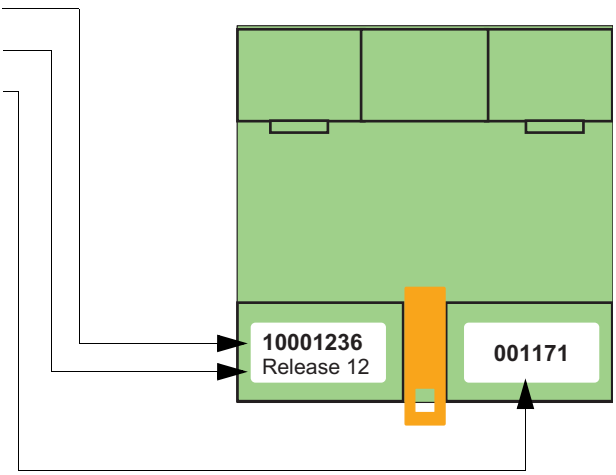
Release

The following information is indicated on the SPI 3 back-panel:

– Article No.

– Release No.

– Serial No.



Mounting and connecting up the SPI 3

Attaching the SPI 3 to the top-hat rail

– Hook the SPI 3 onto the top-hat rail and snap it into place.

In order to remove the SPI 3 from the top-hat rail, pull out the orange locking clip ④ with a suitable tool.

Connecting up the power feed

Danger!
Incorrect grounding of the SPI 3 can injure personnel and damage equipment. Make sure that the SPI 3 is correctly grounded.

Warning! Although the SPI 3 is protected against polarity reversal, connecting up the power feed with incorrect polarity for extended periods can damage the device. Make sure that the power feed is connected with correct polarity.

– Connect the cables for 24 V power feed, ground and protective ground to the corresponding screw terminals 24 V, GND and PE (①).

Connecting up to a fieldbus device with serial interface

Note!
To ensure that the SPI 3 functions without errors, you should use a screened cable for connecting to the serial fieldbus device.

– Ensure that the Sub-D connector for the serial interface uses the pin assignments shown in »Technical specifications« on page 21 (connect the cable screen to the case of the sub-D connector).
– Attach the sub-D connector for the serial interface to the serial interface socket ③ on the SPI 3.

Connecting up to the PROFIBUS

Note!
You should only use commercially available PROFIBUS connectors for connecting to the bus. We recommend you to use connectors from ERNI and Siemens.
If the SPI 3 is installed at the beginning or end of the PROFIBUS cable segment, you should use PROFIBUS connectors which contain an integrated terminating resistor. We recommend you to use connectors from ERNI and Siemens.
To ensure that the SPI 3 functions without errors, you must ground the screen of the PROFIBUS cable.

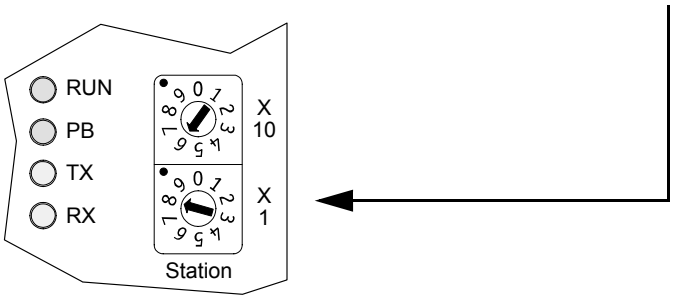
– Ensure that the PROFIBUS connector uses the pin assignments shown in »Technical specifications« on page 21.
– Attach the PROFIBUS connector to the PROFIBUS interface socket ② on the SPI 3 and secure the connector with the retaining screws.

Setting the PROFIBUS address

Note!
The SPI 3 only updates its PROFIBUS address during a restart. Set the PROFIBUS address on the SPI 3 before switching on the power, or turn off the power briefly after changing the PROFIBUS address.
PROFIBUS addresses 00 to 02 are reserved. You should only use addresses between 03 and 99.

– The PROFIBUS address is set with the two rotary switches ⑤.

Example: In order to set the PROFIBUS address 68, turn the rotary switch for the 10's to 6, and the rotary switch for the units to 8.



Setting up the SPI 3

In order to set up the SPI 3, you need to configure it, set the parameters and install the function blocks in your PLC programming software or, if you do not use SIMATIC control, establish the function blocks (see following chapter).

When configuring the SPI 3 from the DP master using a commercially-available PROFIBUS configurator program, refer to the on-line help for information on specifying the parameters. Since there are a large number of different PROFIBUS configurators on the market, it is only possible to give a general overview of the process of configuration and parameter setting:

– Start the PROFIBUS configurator on the DP master.
– Load the SPI 3 GSD file THDP0091.GSD in the configurator.
– Configure the SPI 3 and set the parameters as described in the configurator's online help or user manual.

Note!
If you do not want to use a PROFIBUS configurator program, you need to create your own configuration and/or parameter telegram. See »Creating a configuration telegram« on page 22 for more information.

Configuring the SPI 3

When configuring the SPI 3 with the PROFIBUS configurator, you will be prompted to choose a firmware module from the menu. Choose a module from the following list according to the required I/O area and data transfer protocol:

Module name	I/O area	Data transfer protocol
ASCII, 3964R, RK512 modules with simple parameters (for application in connection with FBs 100, 101, 103, 200, 201, 203 – control data stamp/mirror in byte 0 and byte 1)		
MODUL_C1C1C101	2 words	unstructured ASCII driver, 3964R, RK512
MODUL_C1C3C301	4 words	unstructured ASCII driver, 3964R, RK512
MODUL_C1CFCF01	16 words	unstructured ASCII driver, 3964R, RK512
MODUL_C1DFDF01	32 words	unstructured ASCII driver, 3964R, RK512
MODUL_C1FFFF01	64 words	unstructured ASCII driver, 3964R, RK512
ASCII, 3964R, RK512 modules with extended parameters (for application of release 12 an higher in connection with FBs 100, 101, 103, 200, 201, 203 – control data stamp/mirror in byte 0 and byte 1)		
ASCII_Prm+____2W_i/o	2 words	unstructured ASCII driver, 3964R, RK512
ASCII_Prm+____4W_i/o	4 words	unstructured ASCII driver, 3964R, RK512
ASCII_Prm+___16W_i/o	16 words	unstructured ASCII driver, 3964R, RK512
ASCII_Prm+___32W_i/o	32 words	unstructured ASCII driver, 3964R, RK512
ASCII_Prm+___64W_i/o	64 words	unstructured ASCII driver, 3964R, RK512
Application-specific modules (only for application in connection with manufacturer-specific devices and FBs – control data stamp/mirror in byte 0 and byte 1)		
MODUL_C1414101_____		
MODUL_C1434301_____		
MODUL_C1858703_____		
MODUL_C1858C03_____		
MODUL_C1C2C303_____		
MODUL_82000004_____		
MODUL_C1CFCF07_____		
MODUL_C1DFDF07_____		
MODUL_C1FFFF07_____		

Note!
You should only configure one module for the SPI 3 device.
After configuring the SPI 3, you need to set the parameters. This is described in »Setting parameters for the SPI 3« on page 12.
Definitions for any modules not indicated there can be found in the online documentation.
Module selection depends on the respective SPI 3 application. For ASCII, 3964R and RK512, you can only apply the above-stated modules.

Setting parameters for the SPI 3

When you configure the SPI 3 with the PROFIBUS configurator, you will be prompted to choose the required parameters from a menu.

You can set the following parameters:

Unstructured ASCII driver, 3964R, RK512 see »SPI 3-specific parameters« on page 23

Data transfer rate
Flags (only available in modules with extended parameters)
Handshake mode
ASCII code for the Xon character
(only required for Xon/Xoff handshake)
ASCII code for the Xoff character
(only required for Xon/Xoff handshake)
Parity
Character frame
Character timeout, response timeout
(see »Glossary« on page 25)
Data transfer mode
Priority
Start sign (only available in modules with extended parameters)
Stop sign (only available in modules with extended parameters)
Telegram length (only available in modules with extended parameters)

Choose the parameter values according to the serial fieldbus device you are using. If necessary, refer to the descriptions of the required parameters in this manual.

Creating function blocks

The function blocks (FB's) on the supplied diskette are only suitable for SIMATIC controllers.If you are not using a SIMATIC controller, you will need to create new function blocks yourself.

Data is exchanged between the DP master and the SPI 3 in the form of telegrams or telegram fragments through a data channel, the size of which can be configured to adapt it to the telegram length and the size of the PLC I/O area. The size of the data channel can be configured for 2, 4, 16, 32 or 64 words. The examples in this chapter are for a 4-word I/O area. For a 2-word I/O area, only bytes 2 and 3 are available for user data.

The I/O buffer contains both control data and user data as follows:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Control data		User data (fragment)					

User data
contains the usable information in the form of telegrams or telegram fragments.

Control data
controls the exchange of data between the DP master and the SPI 3. It is used to:

- Indicate new data,
- control the exchange of telegrams which are larger than the configured data channel,
- arrange flow control between the DP master and the SPI 3.

Two bytes are available for the control data:

- The command byte ("stamp") is used to send commands to the SPI 3:
  The DP master uses it to indicate:
  - the start of a new telegram,
  - the start of user data, or
  - the end of the job.
- The status byte ("mirror") is used to receive status information from the SPI 3:
  The SPI 3 places a copy of the stamp in the mirror to indicate:
  - that it is ready for data exchange,
  - that the user data is being processed,
  - the end of the job.

If it is required to exchange a telegram which is larger than the available data channel (2 or 4 words), it must be split up and transferred in several parts (fragments).

The data channel consist of a send and a receive channel.

The send channel
consists of an input byte (input byte 0) for the send mirror and 7 output bytes consisting of the send stamp (output byte 0) and the user data (output bytes 2 - 7).

Input byte:

Byte 0
Send mirror

Output bytes:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Send stamp		User data					

The receive channel
consists of an output byte for the receive stamp (output byte 1) and 7 input bytes consisting of the receive mirror (input byte 1) and the user data (input bytes 2 - 7).

Output byte:

Byte 0	Byte 1
	Receive stamp

Input byte:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
	Receive mirror	User data					

Output byte 0 contains the send stamp:
– Send stamp = 0 indicates that the DP master is ready to send,
– Send stamp ≠ 0 indicates that user data now follows or that the job is completed.

Output byte 1 contains the receive stamp
– Receive stamp = 0 indicates that the DP master is ready to receive,
– Receive stamp ≠ 0 indicates that user data has been requested or that the job is completed.

Output byte 2 contains:
– At the start of the send job (send stamp = 0): information on the length of the user data,
– Following that (send stamp ≠ 0): user data.

Output bytes 3 - 7 contain:
– At the start of the send job (send stamp = 0): no data,
– Following that (send stamp ≠ 0): user data (user data fragments).

Output byte for send stamp = 0

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x00	0x01	0x06					
Send stamp	Receive stamp	Length of user data					

Output byte for send stamp ≠ 0

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x01	0x01	a	b	c	d	e	f
Send stamp	Receive stamp	User data 6 bytes					

Input byte 0 contains the send stamp:
– Send stamp = 0 indicates that the SPI 3 is ready for data exchange,
– Send stamp ≠ 0 indicates that user data now follows or that the job is completed.

Input byte 1 contains the receive stamp:
– Receive stamp = 0 indicates that the SPI 3 is ready for data exchange,
– Receive stamp ≠ 0 indicates that user data is being processed or that the job is completed.

Input byte 2 contains:
– At the start of the data exchange (receive mirror = 0): information on the length of the user data,
– Following that (receive mirror ≠ 0) user data.

Input bytes 3 - 7 contain:
– At the start of the data exchange (receive mirror = 0): no data,
– Following that (receive mirror ≠ 0): user data (user data fragments).

Input byte for receive mirror = 0

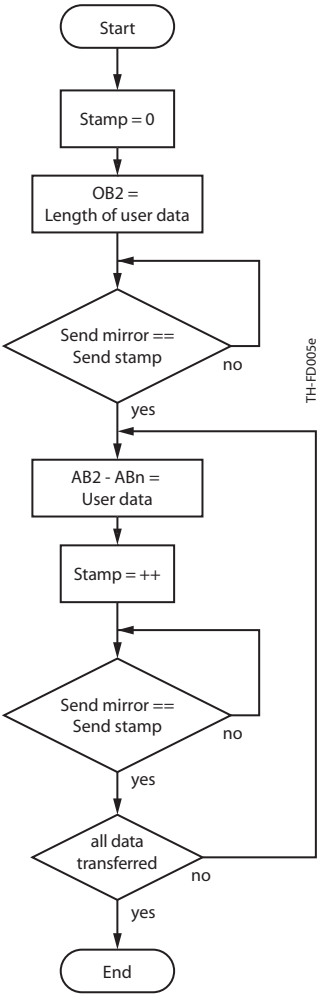
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x01	0x00	0x06					
Send stamp	Receive stamp	Length of user data					

Input byte for receive mirror ≠ 0

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x01	0x01	a	b	c	d	e	f
Send stamp	Receive stamp	User data 6 bytes					

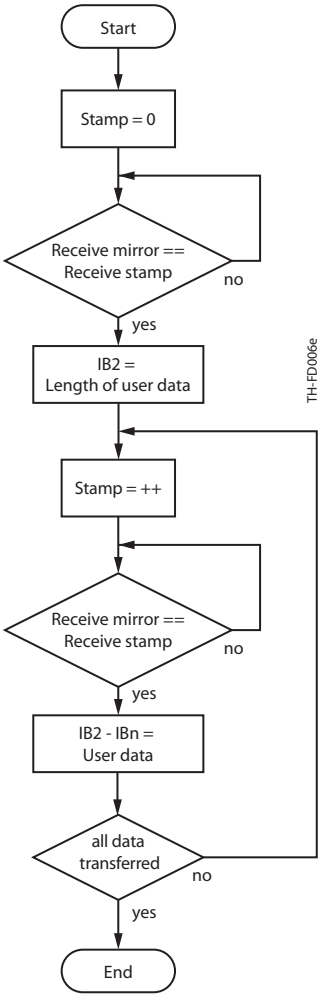
The following flow diagrams illustrate the steps necessary for data exchange:

Send data



= set to
== compare with
++ increment by 1
OB Output byte

Receive data



= set to
== compare with
++ increment by 1
IB Input byte

Checking the SPI 3 for correct operation

Several checks should be made before using the SPI 3 to transfer data.

Checking the SPI 3 power feed

– At this stage, do not attach either the PROFIBUS interface or the serial interface,

– switch on the power feed for the SPI 3.

The RUN LED should light continuously. If this is not the case, there is a fault in the 24 V power feed. Refer to »Error diagnosis and remedies« on page 19 for details of how to locate the fault.

Checking the PROFIBUS communication

– Connect up the PROFIBUS interface cable,

– switch on the power feed for the SPI 3,

– start the DP master, which has been configured previously.

The PB LED should light continuously. If this is not the case, there is an error in the PROFIBUS communication. Refer to »Error diagnosis and remedies« on page 19 for details of how to locate the fault.

Checking the serial interface communication

– Connect up the PROFIBUS interface cable and the serial interface cable,

– switch on the power feed for the SPI 3,

– start the DP master, which has been configured previously,

– start the communication with the serial device.

The RUN LED should light continuously. If it does not light, or it only flashes, there is an error in the communication with the serial device. Refer to »Error diagnosis and remedies« on page 19 for details of how to locate the fault.

If no errors were detected, the SPI 3 is ready for use and you can use it for transferring data.

The TX LED should flash when data is being transmitted over the serial interface and the RX LED should flash when data is being received over the serial interface (see »Indicating elements« on page 7).

Error diagnosis and remedies

If errors are detected, the pattern of flashing of the PB and RUN LED's on the SPI 3 can be used for error diagnosis. The LED's can flash with the following patterns (this is called the "LED code"):

LED off	LED short	LED medium	LED long	LED on
				
LED always off	LED is ¾ off ¼ on	LED is ½ off ½ on	LED is ¼ off ¾ on	LED always on

Note!
If the PB LED ("PROFIBUS") is off, the RUN LED is on continuously and no longer indicates a valid LED code. Accordingly, the RUN LED can only be used for diagnosis when the PB LED is lit. The PROFIBUS diagnostics and error statuses are reset when the error is no longer present or when the slave gets new parameter and configuration values

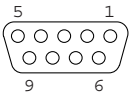
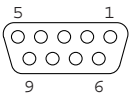
PB LED code	Status	Significance	Remedy
PB LED off	Correct data transfer rate could not be determined	– No PROFIBUS master in the network	– Connect up the DP master – Check the wiring
PB LED short	No DP master available	– A master is available but it is not a DP master – A master is available but communication is not taking place with PROFIBUS-DP	– Check DP configuration of the master – Check address setting on the SPI 3
PB LED medium	Incorrect parameter	– Parameter telegram faulty	– Check the DP parameter telegram, use the correct GSD file
PB LED long	Incorrect configuration	– Configuration telegram faulty	– Check the number of modules (only one module is allowed in the configuration)
PB LED on	Data exchange OK	– Data exchange is currently taking place	– SPI 3 working correctly

RUN LED code	Status	Significance	Remedy
RUN LED off	SPI 3 not ready	– 24 V supply not present	– Check external power supply – Check the wiring
RUN LED short	Interface error	– Interface parameters invalid	– Check the parity (e.g. you have chosen 7 data bits without parity although 7 data bits requires parity)
RUN LED medium	Send error	– Error when sending	– Check the wiring – Check whether the partner station is ready (this error should only occur with 3964 and derived protocols)
RUN LED long	Receive error	– Error when receiving	– Check character format and data transfer rate of partner station
RUN LED on	Communication OK	– Serial partner communicating correctly with the SPI 3	– SPI 3 working correctly

If errors occur during communication, you can also carry out PROFIBUS diagnostics with the DP master. The device-specific diagnostics data contains the following information:

1 byte header for device-related diagnostics	0x02
1 byte bit-mapped to indicate the error	Bit 0 = 1 Parameter error Bit 1 = 1 Send error (3964R · RK512) Bit 2 = 1 Receive error

Technical specifications

Electrical data				
Nominal supply voltage	V DC	24 (20.4…28.8)		
Current consumption	mA	200		
Galvanic isolation, PROFIBUS interface	V DC	500		
Ambient conditions				
Operating temperature	°C	0…60		
Case				
Protection class	IP	20		
Dimensions W × H × D	mm	75 × 75 × 53		
PROFIBUS interface				
Interface type		RS 485		
Data transfer rate	Bit/s	9.600; 19.200; 93.750; 187.500; 0,5M; 1,5M; 3M; 6M; 12M, automatic detection of the data transfer rate		
Pin assignment Sub-D connector  	Pin 1 Pin 2 Pin 3 Pin 4 Pin 5 Pin 6 Pin 7 Pin 8 Pin 9	Screen Unused B-line Request to Send (RTS) Ground for 5 V (M5) +5 V (galvanically isolated P5) Unused A-line Unused		
Serial interface				
Interface type		RS 232* / RS 422* / RS 485*		
Data transfer rate**	Bit/s	110; 300; 600; 1.200; 2.400; 4.800; 9.600; 19.200; 28.800; 38.400; 57.600		
Data frame**	Bit	7 / 8		
Parity**		Even, odd, none, mark, space		
Pin assignment Sub-D connector  		RS 232	RS 422	RS 485
	Pin 1	Screen	Screen	Screen
	Pin 2	TXD (out)	Unused	Unused
	Pin 3	RXD (in)	REC-P	BUS-P
	Pin 4	Unused	TRANS-P	Unused
	Pin 5	GND	GND	GND
	Pin 6	+5 V	+5 V	+5 V
	Pin 7	CTS (in)	Unused	Unused
	Pin 8	RTS (out)	REC-N	BUS-N
	Pin 9	Unused	TRANS-N	Unused
Other				
I/O area (PROFIBUS-DP)**	words	2, 4, 16, 32, 64		
Certification		CE		
Max. number of fieldbus devices**		32 (RS 485); 1 (RS 232, RS 422)		

* See label on the SPI 3 for information on the serial interface which is fitted
** Depends on the protocol

Appendix

Creating a configuration telegram

Depending on the number and size of the inputs and outputs, the configuration telegram contains one or more module codes. The module codes are used to select the operating mode of the SPI 3 (see »Configuring the SPI 3« on page 11).

The module codes in the configuration telegram should be specified as follows:

	extended parameters (Release 12 and higher)	simple parameters
– 2 words I/O area:	ASCII_Prm+____2W_i/o	C1C1C101
– 4 words I/O area:	ASCII_Prm+____4W_i/o	C1C3C301
– 16 words I/O area:	ASCII_Prm+____16W_i/o	C1CFCF01
– 32 words I/O area:	ASCII_Prm+____32W_i/o	C1DFDF01
– 64 words I/O area:	ASCII_Prm+____64W_i/o	C1FFFF01

Creating a parameter telegram

If you cannot or do not want to use a configurator for setting the SPI3 parameters, you will need to create a parameter telegram. The parameter telegram contains both standardized bus-related parameters and device-specific parameters for the SPI 3.

Standard bus-related parameters

The first 7 bytes (bytes 0…6) of the parameter telegram contain bus-related parameters which are standardized in EN 50 170. Bytes 4 and 5 contain the vendor ID (Trebing & Himstedt = hex 0x0091). The settings of the other 5 bytes depend on your network configuration (see EN 50 170).

SPI 3-specific parameters

The following 18 bytes of the parameter telegram (bytes 7 to 24) contain SPI 3-specific parameters (see table). The specific parameters are valid for SPI 3 release 12 and higher.

Note!
The hex value for character timeout/response timeout must be specified in Motorola format (high byte first).
If you use an RS 485 interface, you must set handshake to NONE.
Bytes 12, 22, 23 and 24 are only available in case of modules with extended paratmeters (Release 12 and higher).

Byte	Parameter	Value	Hex code	Default
7…9	Constant	Cannot be changed	0x00	0x00
10	Constant	Cannot be changed	Module-dependent 0x01 0x08	Module-dependent 0x01 0x08
11	Data transfer rate	110 Bit/s 300 Bit/s 600 Bit/s 1200 Bit/s 2400 Bit/s 4800 Bit/s 9600 Bit/s 19200 Bit/s 28800 Bit/s 38400 Bit/s 57600 Bit/s	0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x09 0x0A	9600 (0x06)
12	Flags	Lock diagnosis alarms Release diagnosis alarms	0x00 0x01	Release diagnosis alarms (0x01)
13	Handshake method	Xon/Xoff RTS/CTS none	0x00 0x01 0x02	none (0x02)
14	Xon	ASCII code of the Xon character 0…255	0x11	17 (0x11)
15	Xoff	ASCII code of the Xoff character 0…255	0x13	19 (0x13)
16	Parity	none even odd mark space	0x00 0x01 0x02 0x03 0x04	even (0x01)
17	Data frame	7 data bits 8 data bits	0x07 0x08	8 Bit (0x08)

Byte	Parameter	Value	Hex code	Default
18+19	Character timeout (unstructured ASCII data) Response timeout (for 3964 and RK512)	Both parameters in units of 10 ms: (0…65535) × 10 ms	0x0000 to 0xFFFF	200 (0x00, 0xC8)
20	SIO mode	unstructured ASCII driver CT[1)] 3964R (checksum) RK512 (checksum) 3964R (no checksum) RK512 (no checksum) ASCII driver fixed length [2)] ASCII driver Stop sign [3)] ASCII driver Start/Stop sign [4)]	0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x07	ASCII driver CT (0x00)
21	Priority for 3964R	low high	0x00 0x01	low (0x00)
22	Start sign [5)]	ASCII code of the Start sign 0…255	0x01 to 0xFF	STX (0x02)
23	Stop sign [6)]	ASCII code of the Stop sign 0…255	0x01 to 0xFF	ETX (0x03)
24	Telegram length [7)]	1…255 (in byte)	0x01 to 0xFF	1 (0x01)

1) The adjusted »character timeout« is used for final telegram identification.
2) The adjusted »telegram length« is used for final telegram identification.
3) The adjusted »Stop sign« is used for final telegram identification.
4) The adjusted »Start sign« or »Stop sign« is used for final telegram identification.
5) Does only apply if »ASCII driver Start/Stop sign« transfer mode has been selected.
6) Does only apply if »ASCII driver Stop sign« or »ASCII driver Start/Stop sign« transfer mode has been selected.
7) Does only apply if »ASCII driver fixed length« transfer mode has been selected.

Note!
If you have selected one of the transfer modes »ASCI driver fixed length«, »ASCI driver Stop sign« or »ASCII driver Start/Stop sign«, and an additional character timeout » ≠ 0 « has been entered, final telegram identification is additionally executed with the selected character timeout. If final telegram identification is to be executed exclusively by a sign or telegram length, character timeout needs to be set at » = 0 «.
Maximum telegram length cannot exceed 255 bytes. Telegrams are automatically fragmented in case of telegram lengths surpassing this value.

In case of manufacturer-specific application of sartorius scales, you need to select an »even« parity and a smaller character timeout.

Glossary

Address	→ Station address
ANZW	16 bit in-out variable for sending commands to an FB and receiving return values.
Bit	Abbreviation for **bi**nary digi**t**, the smallest unit in the binary system; it can have the value 0 or 1.
Bus	Cable with two defined ends which is used for exchanging data between the connected bus stations.
Bus connector	Plug used to connect the bus stations to the bus cable.
Bus segment	→ Segment
Bus station	Device attached to the bus which can send data over the bus (e.g. DP master), receive data over the bus (e.g. DP slave), or amplify signals (e.g. repeater).
Byte	A byte consists of eight bits and is the smallest addressable amount of memory.
Character timeout	Used to detect the end of a telegram in the case of an unstructured flow of ASCII data. The telegram currently being received is considered to be completed when the time between two received characters is larger than the specified character timeout.
Command byte	→ Stamp
Configuration	During configuration, the modules and the addresses of the DP slave are assigned. The actual configuration describes the modules which are actually present in the slave. the required configuration describes the modules which should be present in the slave. This approach allows an incorrect configuration to be detected when the system is booted.
Configurator	Software for configuring PROFIBUS devices and for setting parameters.
Control information	Used to synchronize and fragment the exchange of telegrams via PROFIBUS DP. Control information is always contained in the first byte (byte 0) of the DP data channel.

CPU	**C**entral **P**rocessing **U**nit
Data block	Special memory area in a PLC which is optimized for storing data; it consists of a specified number of words (or bytes) of memory.
Data channel	A logical channel for exchanging data with the SPI 3. The size of the data channel (i.e. I/O area) is dependent on the SPI 3 configuration. If a telegram is larger than the data channel, it needs to be fragmented.
Data transfer rate	Measurement for the speed of data transfer, specified in bits per second.
Data word	16 bit area of memory in a data block.
Diagnostics	Detection, localization, classification and display of errors, faults and messages.
DP	→ PROFIBUS
DP address	ID number used to uniquely identify each bus device (station) in PROFIBUS DP.
DP standard	Bus protocol for PROFIBUS DB which is standardized in EN 50 170.
Floating	Indicates that a component or circuit is not electrically connected to ground
Fragment	Part of a telegram which is transferred through a data channel.
FREEZE	Control command that a DP slave receives from the DP master. It causes the slave to store (freeze) the current states of its inputs and to transfer the frozen values cyclically to the master. The slave only starts to transfer the cyclically updated values to the master again after it receives the UNFREEZE command.
Function block	Used to control the asynchronous exchange of data between PROFIBUS and a Fieldbus device with serial interface via the SPI 3.

Function code	Used to uniquely specify a function that can be executed in the controller.
Galvanically isolated	With galvanically isolated I/O devices, the reference potentials of control circuits and power circuits are not electrically interconnected.
Ground	Conductive material (e.g. ground wire) whose electrical potential is considered to be zero; all interconnected inactive components of a device which cannot assume dangerous voltages even in case of faults.
GSD	Device Data Base file (DDB), i.e. electronic device data sheet which describes the features of the PROFIBUS device uniquely and completely in a clearly specified syntax. A GSD file for the SPI 3 you can download from the internet (www.t-h.de) and is required to set up the device.
Handshake	Method used to synchronize data exchange. For example, data can only be exchanged between a master and slave after the master and the slave have “agreed” that the exchange should take place.
ID byte	Configures the number and size of the bytes to be transferred in a module.
Input byte	PLC address area which contains the data that the DP slave sends to the DP master.
IP 20	Protection class specification to DIN 40 050. Components of the device which carry voltages are protected against touching with the fingers and against the penetration of solid objects with a diameter of more than 12 mm.
Master	Active bus station that can send data to other bus stations and request data from other bus stations.
Mirror	The input byte 0 of a data channel is called the mirror. The SPI 3 mirrors (returns a copy of) the stamp (q.v.) to confirm the operation or when user data is being processed. Mirror = 0 indicates that the DP slave is ready for data exchange. If mirror = 0, input byte 2 contains information on the length of the following user data. Mirror $\neq$ 0 indicates that user data will now follow or that the operation is completed.

MODBUS	MODBUS RTU is implemented according to the Reference Guide “Modicon PI-MBUS-300, Rev. D”.
Module	Selecting a module during device configuration determines the configuration telegram and thus the size of the PLC I/O area.
MSB	**M**ost **S**ignificant **B**it
Non-floating	With non-floating I/O devices, the reference potentials of control circuits and power circuits are electrically interconnected and are not galvanically isolated.
Non-isolated	With non-isolated I/O devices, the reference potentials of control circuits and power circuits are electrically interconnected.
Output byte	PLC address area which contains data which the DP master sends to the DP slave.
Parameter	Variable used to specify the behavior of a device
Parameter master	When the system is booted, the parameter master passes parameter information to the DP slave. The parameter master can write to and read from the slave and change the configuration of the slave.
Parameter setting	To set the behavior of a DP slave and its modules.
Parameter telegram	Contains all parameters which can be set for a DP slave
Parity	Even parity: The sum of all 1’s in a byte must be an even number. Odd parity: the sum of all 1’s in a byte must be an odd number. The parity bit which can be 1 or 0 is used to create an even or odd parity to allow detection of errors due to lost bits.
PII (Ger: PAE)	Process input image (PII)
PLC	Programmable logic controller, electronic controller whose control function is controlled by the program in its memory.
POI (Ger: PAA)	Process output image (POI)
Potential equalization	Electrical connection between conducting bodies to bring them to an identical or practically identical potential and thus prevent interfering or dangerous voltages between the bodies.

PROFIBUS	**Pro**cess **Fi**eld **Bus** is an open Fieldbus system used to network PROFIBUS compatible devices. PROFIBUS works with three different protocols: PROFIBUS-DP (Decentral Peripheral), PROFIBUS-FMS (Fieldbus Message Specification), and PROFIBUS-PA (Process Automation). PROFIBUS is standardized in EN 50 170.
Protocol	A set of rules and regulations which control the flow of information in a communication system. The term protocol can refer to either hardware or software.
Receive	The Fieldbus device receives a telegram from the DP master through the SPI 3.
Receive channel	Data channel for data which the SPI 3 receives.
Remote peripheral	I/O device which is not directly integrated in the PLC CPU, but is accessed remotely via the bus.
Response monitoring	If a slave is not accessed within the response monitoring timeout, it switches automatically to a safe status by setting all outputs to 0. The response monitoring timeout is specified during parameter setting.
Response timeout	The duration of time within which the partner device must respond. The response timeout must be configured the same for both partner devices.
Segment	Section of the bus cable between two terminating resistors. A bus segment can support up to 32 bus stations, and several bus segments can be connected together with RS 485 repeaters.
Send	The DP master sends a telegram to a Fieldbus device through the SPI 3.
Send channel	Data channel for data which is sent to the SPI 3.
Slave	Bus station which is only allowed to exchange data with a master, and only on request of the master.

Stamp	The output byte 0 of a data channel is called the stamp. Stamp = 0 indicates that the master is ready for data exchange. If stamp = 0, output byte 2 contains information on the length of the following user data. Stamp ≠ 0 indicates that user data now follows or that the operation is completed.
Station address	Address with which the DP master accesses the PROFIBUS DP slave.
Status byte	→ Mirror
Step 5	Programming language used for user programs for SIMATIC S5 controllers.
Step 7	Programming language used for user programs for SIMATIC S7 controllers.
Step 7 tool	Tool for Step 7 which automates particular programming tasks.
SYNC	Control command that a DP slave receives from the DP master. It causes the slave to store (freeze) the current states of its outputs. When following telegrams are received, it stores the output data, but the states of the outputs remain unchanged. The outputs are only cyclically updated again after the slave receives the UNSYNC command.
Telegram	A data flow which is sent or received through the serial interface (SIO), e.g. when you send a text to a text display or receive a bar code from a bar code scanner.
Telegram fragment	Part of a send or receive telegram. A telegram must be fragmented when it is so large that it cannot be transferred within a single PLC cycle
Terminating resistor	Used to stop electrical reflections and thus signal distortion at the end of the bus cable. Terminating resistors are required at each end of the bus cable.
Tool	Software tool used to specify and change the parameters of a parameter block.

Version code	Indicates the version of a product and is always incremented when the hardware or software in the product is updated or modified. The version code can be seen on the first and second page of this online documentation at the bottom left.
Word	→ Data word
Xon	With software flow control, the Xon control character indicates readiness to receive; complement of Xoff.
Xoff	With software flow control, the Xoff control character indicates unreadiness to receive; complement of Xon.

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Die Hardware enthält elektronische Bauelemente, die gegen elektrostatische Entladung empfindlich sind. Sie sollten darum die elektronischen Bauelemente niemals direkt berühren. Bei Einstellarbeiten an der Platine ist darauf zu achten, den eigenen Körperwiderstand ausreichend zu erden. Dieses kann durch ein Erdungsarmband oder Erdungsschutzstreifen an ESD gerechten Schuhen in Verbindung mit ESD Boden erfolgen. Im einfachsten Fall muss ein elektrisch leitfähiger, geerdeter Gegenstand berührt werden (Heizung, Wasserleitung, blankes Metallteil eines geerdeten Schaltschrankes). Beschädigungen durch elektrostatische Entladung müssen sich nicht sofort fehlerhaft auswirken. Beim späteren Betrieb können folgende Fehler auftreten:
– vorzeitiger Ausfall von Bauelementen und Baugruppen,
– Schwankung typischer Leistungsparameter,
– zeitweilig auftretende Fehler,
– temperaturabhängige Fehler.
Eine elektrostatische Entladung wird vom Menschen erst bei verhältnismäßig hohen Spannungen wahrgenommen. Entladungen unterhalb der Wahrnehmungsgrenze können aber bereits zu Schäden oder Zerstörung der Bauelemente führen.
The hardware contains electronic components which are sensitive to electrostatic discharge. Before touching the printed circuit board, you should first discharge electrostatic voltages from your body by using a grounded anti-static wristband or anti-static shoes and a grounded anti-static carpet. A simple precaution is to touch a grounded, electrically conducting surface such as a heating radiator, water pipe or unpainted surface of a grounded control cabinet. Damage due to electrostatic discharge may not be apparent immediately, and can lead to the following types of fault at a later stage:
– premature failure of components and modules,
– fluctuation of typical performance characteristics,
– intermittent faults,
– temperature-dependent faults.
An electrostatic discharge can only be perceived by humans if the voltage is high enough. However, lower electrostatic voltages which are below the limits of perception can still damage or destroy electronic components.

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