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Programmable Safety Systems
PSS-Range

PSS SB 3006 ETH
Shortform
Item No. 20 715-03



The spirit of safety.

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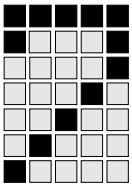
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Introduction

This shortform explains the function and operation of the compact programmable safety system PSS SB 3006 ETH.

More detailed information can be found in the following documents:

- PSS SB 3006 ETH Installation Manual
- Connection to SafetyBUS p:
  - SafetyBUS p System Description
  - SafetyBUS p Installation Manual
- Connection to Ethernet:
  - PSS SB Ethernet
    Operating manual for managing the standard function blocks (data exchange via Ethernet) and their incorporation into a PSS application program.
  - PSS SW Ethernet Parameter Set-up
    Operating manual for managing the software for setting parameters on the Ethernet interface of the PSS SB 3006 ETH
  - Getting Started with Ethernet
    Initial steps in the use of Ethernet with
    - guidance for designing an Ethernet architecture
    - guidance for setting parameters on Ethernet connections
    - application examples

To fully understand this manual you will need to be conversant with the information found in the general documentation for the PSS-range (System Manual, Installation Manual for the compact PSS and Programming Manual).
To fully understand the bus-specific requirements and correlations you will need some knowledge of the design and management of Ethernet networks.

This documentation is intended for instruction and should be retained for future reference.

Validity of documentation

This documentation is valid for the PSS SB 3006 ETH from Version 2.0. It is valid until new documentation is published. The latest documentation is always enclosed with the unit.

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Introduction

Overview of documentation

The documentation is divided into the following chapters:

1 Introduction
The introduction is designed to familiarise you with the contents, structure and specific order of this shortform.

2 Overview
This chapter provides information on the most important features of the PSS SB 3006 ETH.

3 PSS Functionality
This chapter describes the individual components of the PSS: CPU, inputs and test pulse outputs.

4 Ethernet Functionality
This chapter provides a brief overview of how to connect the PSS SB 3006 ETH to Ethernet.

5 Operation
This chapter explains how to commission the safety system and advises on what to do if a fault occurs.

6 Technical Details

7 Appendix

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Terminology

- The term “(Ethernet) interface” is used as the generic term for the Ethernet communications device of a PSS-range programmable safety system.
  On modular programmable safety systems from the PSS-range this corresponds to the communications module for Ethernet.
  On Ethernet-compatible compact programmable safety systems from the PSS-range, this corresponds to the integrated communications device for Ethernet.
  If the description only relates to a specific interface type, the specific product name will be used (e.g. PSS1 Ethernet, PSS SB 3006 ETH).
- The term “PSS” is used as the generic term for all applicable PSS programmable safety systems.
  If the description is only valid for a particular unit, its specific product name will be used (e.g. PSS SB 3006 ETH).
- In this manual, the Pilz system software “PSS SW PG” is frequently referred to as the “programming device”.

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Definition of symbols

Information in this manual that is of particular importance can be identified as follows:



DANGER!

This warning must be heeded! It warns of a **hazardous situation that poses an immediate threat of serious injury and death** and indicates preventive measures that can be taken.



WARNING!

This warning must be heeded! It warns of a **hazardous situation that could lead to serious injury and death** and indicates preventive measures that can be taken.



CAUTION!

This refers to a hazard that can lead to a less serious or minor injury plus material damage, and also provides information on preventive measures that can be taken.



NOTICE

This describes a situation in which the product or devices in its immediate environment could be damaged. It also provides information on preventive measures that can be taken.



INFORMATION

This gives advice on applications and provides information on special features, as well as highlighting areas within the text that are of particular importance.

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Overview

The PSS SB 3006 ETH is a complete programmable safety system in a single unit. The following are all integrated into the housing: CPU, power supply, six integral on-board inputs, two test pulse outputs, one combined RS 232 (with minimum configuration)/RS 485 interface for connecting the programming device and one combined RS 232/RS 485 interface as user interface. The PSS SB 3006 ETH also has interfaces for SafetyBUS p and Ethernet.

Integral on-board inputs

The integral on-board inputs on the PSS SB 3006 ETH can be used to monitor local emergency stops or to trigger an I/O-Group start, for example. They are suitable for connecting single or dual-channel input devices, with or without test pulses. The dedicated test pulse outputs are suitable for testing input devices.

SafetyBus p interface

SafetyBUS p enables you to establish a safe decentralised network of several programmable safety systems and/or to connect periphery modules. The PSS can perform the function of a Management, Logic or Input/Output Device in SafetyBUS p.

Ethernet interface

For non-safety related applications, the PSS can be incorporated into Ethernet as a bus subscriber. Parameters for the Ethernet interface must be set prior to communication.

Setting parameters for the Ethernet interface

Various parameters must be stored in the Ethernet interface in order to be able to exchange data between the PSS and other Ethernet subscribers (communications protocols, IP address etc.). A separate parameter software “PSS SW Ethernet Parameter Set-up” is available for this. It is included in the “PSS SW Ethernet Set”.

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Overview

Standard function blocks for the Ethernet interface

Standard function blocks are available (software packge “PSS SB Ethernet”) for exchanging data between the PSS and other Ethernet subscribers. The standard function blocks must be incorporated in the application program of the ST section of the PSS. They perform all the functions involved in exchanging data between the PSS and other Ethernet subscribers. The software package “PSS SB Ethernet” is supplied with the “PSS SW Ethernet Set”.

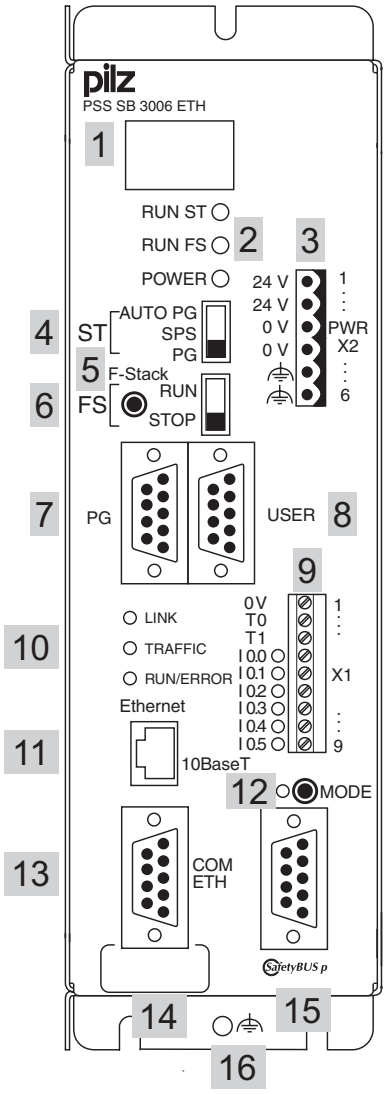
Programming device versions

The programming device must support the use of the PSS SB 3006 ETH compact programmable safety system. The programming device supports the PSS SB 3006 ETH from the following version number onwards:

- Programming device PSS SW PG from Version 4.10

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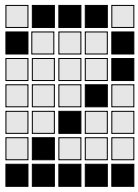
Front view



1: 4-digit display
2: LEDs for PSS operating mode and supply voltage
3: Supply voltage connection (24 VDC)
4: 3-position switch for selecting the standard section's operating mode
5: Button for scrolling the error stack
6: 2-position switch for selecting the failsafe section's operating mode
7: Programming device interface (RS 232/RS 485)
8: User interface (RS 232/RS 485)
9: Inputs and test pulse outputs
10: Status LEDs for the Ethernet interface:
- RUN/ERROR: Operating status
- LINK: Network connection status
- TRAFFIC: Data traffic status
11: Ethernet port for connection to
- a network via hub or switch
- a point-to-point connection (requires cable with cross over data lines)
12: LED for status of SafetyBUS p and button to select operating mode
13: Combined interface (RS 232/RS 485) for setting parameters on the Ethernet interface
14: Labelling strip for Ethernet address
15: SafetyBUS p interface
16: Functional earth connection

Fig. 2-1: Front view of PSS SB 3006 ETH

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Notes

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PSS Functionality

CPU

The CPU controls the test pulse outputs, reads the inputs and processes / stores the application program and variable data. It operates through three diverse channels, i.e. three different CPUs process the application program independently.

A four-digit display and several LEDs provide information on the status of the safety system and indicate any errors.

The CPU provides the following interfaces:

- Combined RS 232 (minimum configuration)/RS 485 interface as programming device interface
- Combined RS 232/RS 485 interface as user interface
- RJ45 interface for connection to Ethernet
- Combined RS 232/RS 485 port for setting parameters on the Ethernet interface
- Interface for connection to SafetyBUS p

For further information please refer to the “PSS-Range System Manual” and “SafetyBUS p System Manual”.

Inputs

The PSS SB 3006 ETH has six integral on-board inputs, which are suitable for connecting single and dual-channel input devices, with or without test pulses.

Input signals must show a “High” of 24 VDC (+15 ... +30 VDC) and a “Low” of 0 VDC (-3 ... +5 VDC). All inputs have input filters.

NOTICE
Inputs are not galvanically isolated.

LEDs indicate the status of the inputs. An LED lights up as soon as a “1” signal is present at the input.
Diagnostic circuitry checks the function of the inputs, including the input

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filter. If an error occurs, the PSS will switch to a STOP condition and output a message to the CPU display. In addition, all the decentralised outputs in the I/O-Groups assigned to the PSS Logic Device will be switched off (see also “SafetyBUS p System Description”).

Where test pulses are not used, inputs with single-channel input devices can be used in applications up to and including category 2 in accordance with EN 954-1; in the case of dual-channel input devices, this extends to category 3 applications. The device should be suitably wired to eliminate the risk of a short circuit in the external wiring between the different inputs and also between the PSS supply and Ethernet.

Test pulses must be used for applications with single-channel input devices above category 2 and for applications with dual-channel input devices above category 3. Connection diagrams can be found in the “PSS SB 3006 ETH Installation Manual”.

Test pulse outputs

The two test pulse outputs T_0 and T_1 are suitable for testing the wiring of input devices. All safety-related inputs must operate in accordance with the failsafe principle (on switching off).
Test pulses are allocated to inputs via the configurator in the programming device.

Each test pulse has a maximum load capacity of 0.5 A.

INFORMATION
Test pulse outputs on the PSS SB 3006 ETH cannot be used as digital outputs for safety functions.

Configuration coding

The inputs are located on a sub-slot, which is allocated a code:

Slot	Sub-slot	Inputs/Outputs	Code
0	0	E0.0 - E0.5	8004_H

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Ethernet Functionality

The PSS SB 3006 ETH operates as an Ethernet subscriber with the help of the Ethernet interface. The Ethernet interface supports various network protocols: TCP/IP, UDP/IP and SINEC-H1 plus the Application Header SINEC S5 Application Protocol, SINEC S7 Application Protocol and Modbus TCP/IP.

Data transfer on the Ethernet interface occurs at the fixed rate of 10 MBit/s (10BaseT).

To commission and operate the Ethernet interface you will need the corresponding software packages “PSS SB Ethernet” and “PSS SW Ethernet Parameter Set-up”. Both software packages are part of the “PSS SW Ethernet Set”.

A Dual-Port-RAM forms the interface between the PSS SB 3006 ETH and Ethernet. It stores all the information required for data transfer as well as the data received and the data to be sent. The PSS addresses the Dual-Port-RAM as an addressable module via the standard bus. It occupies 2048 words. However, the start address 0 (XW0 ... XW2047) is fixed and cannot be amended.

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Ethernet Functionality

Connection options

RJ45 interface (“10BaseT”)

Requirements of the connection cable and connector

The requirements of the Ethernet standard 10BaseT (min. category 5) must be met. You will also require double-shielded Twisted Pair cable for industrial Ethernet use. Use of shielded RJ45 connectors (industrial connectors) is also specified (see PSS SB 3006 ETH Installation Manual).

Exchanging process data

Use of the RJ45 interface enables process data to be exchanged with other Ethernet subscribers. Operation on Ethernet occurs by connecting to a hub (Hub, Switch). To connect to a hub you will need a connection cable on which the data signals are uncrossed.

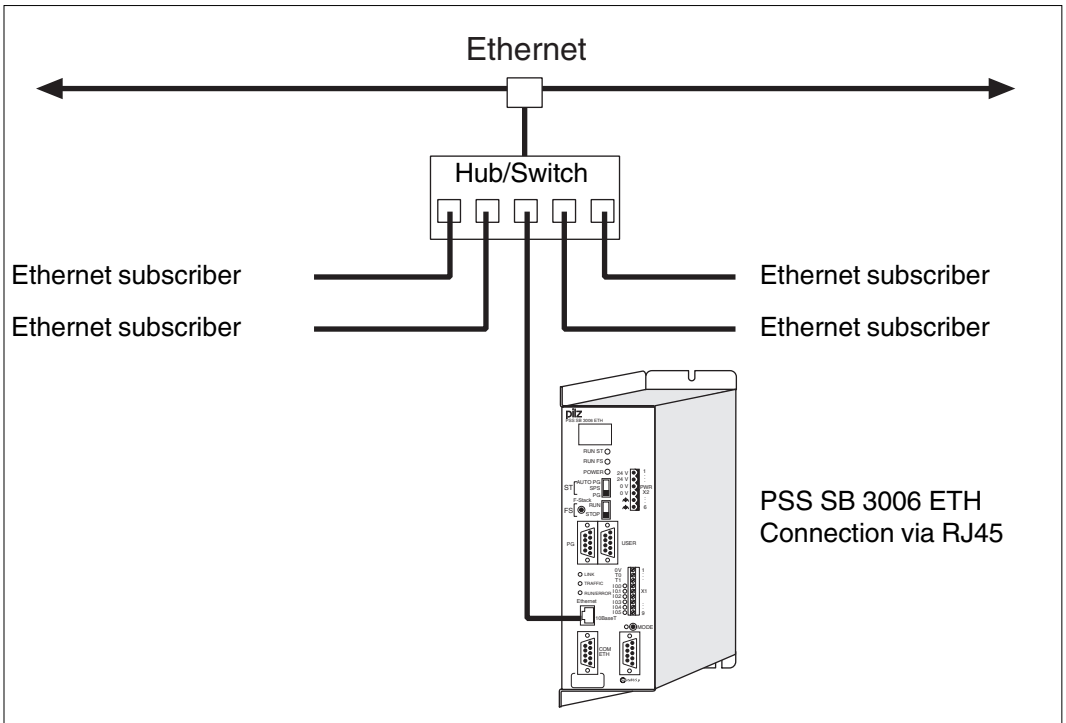


Fig. 4-1: Connection to Ethernet via RJ45 (example)

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Setting parameters remotely

Connection to the RJ45 interface enables parameters on the Ethernet interface to be set remotely via Ethernet. To set parameters on the Ethernet interface you will require a PC with an Ethernet card. You will also need the Pilz parameter set-up software “PSS SW Ethernet Parameter Set-up”. A connection cable on which the data signals are uncrossed is also required.

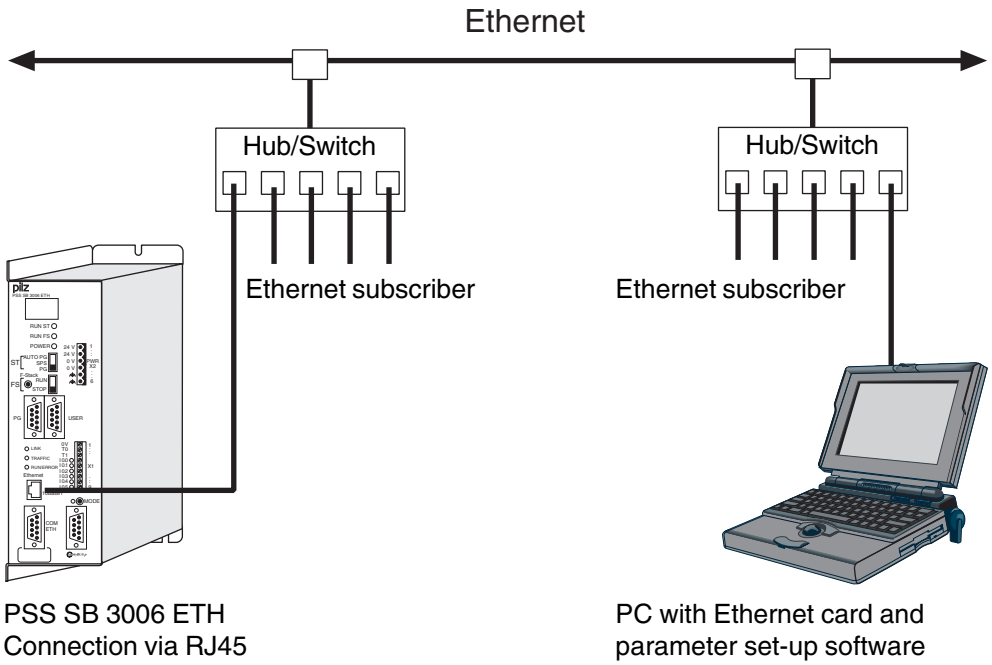


Fig. 4-2: Setting parameters remotely via Ethernet (example)

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Ethernet Functionality

Point-to-point connection for process data exchange

Using the RJ45 interface enables a point-to-point connection with an additional Ethernet subscriber, in order to exchange process data. A point-to-point connection requires a cable on which the data signals have a cross over connection.

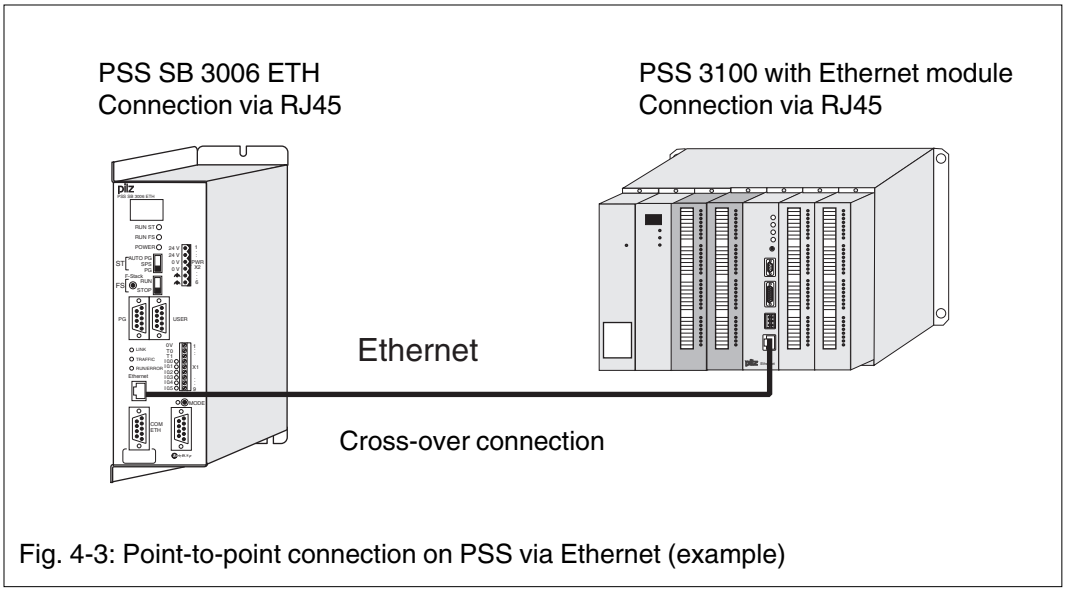


Fig. 4-3: Point-to-point connection on PSS via Ethernet (example)

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Point-to-point connection for setting parameters directly

Using the RJ45 interface enables the parameters on the Ethernet interface to be set directly via a point-to-point connection. To set parameters on the Ethernet interface you will require a PC with an Ethernet card. You will also need the Pilz parameter set-up software “PSS SW Ethernet Parameter Set-up”. A connection cable on which the data signals have a cross over connection is also required.

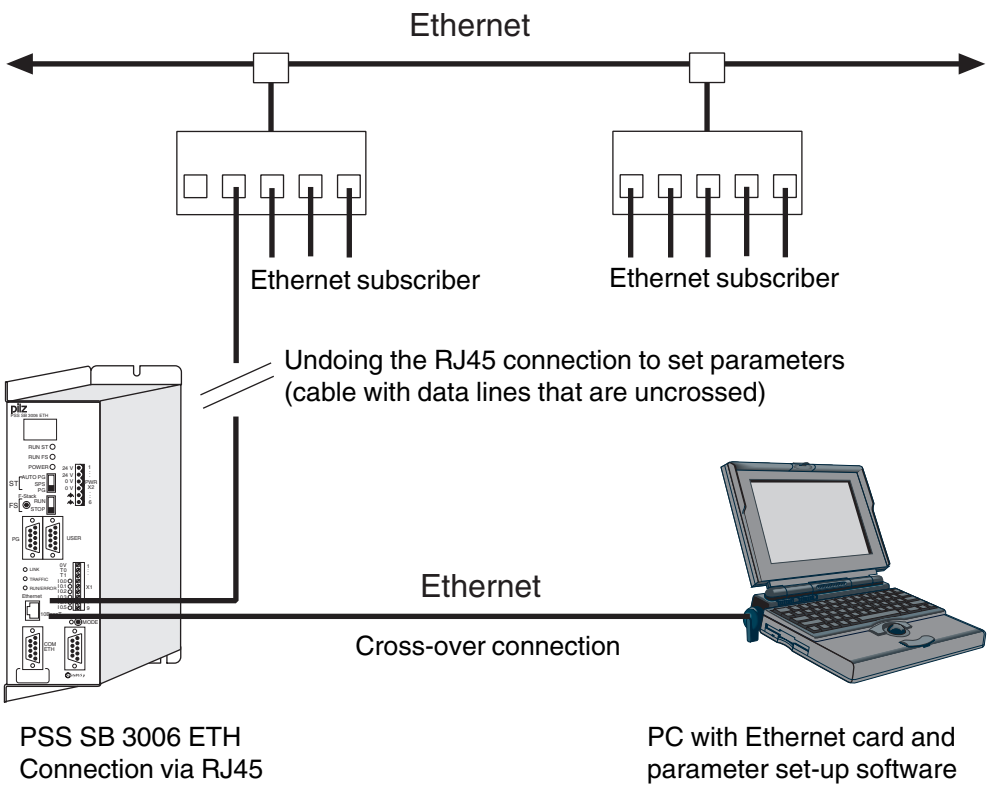


Fig. 4-4: Setting parameters directly (example)

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Ethernet Functionality

COM port (“COM ETH”)

Point-to-point connection for setting parameters directly

The connection labelled “COM ETH” is a combined interface (RS 232/RS 485) for the serial parameterization of the Ethernet interface via a point-to-point connection. To set parameters for the Ethernet interface you will require a PC. Parameters are set using the Pilz parameter set-up software “PSS SW Ethernet Parameter Set-up”.

INFORMATION
Please note the following:

- At the moment the parameter set-up software only provides drivers for Windows NT and Windows 95.
- An interface adapter may be required if you are using the RS 485 interface (e.g. PSS CONV RS232/485 from Pilz GmbH & Co.)
- If you are using the RS 232 interface, a specific layout is required on the connection cable (see PSS SB 3006 ETH Installation Manual).

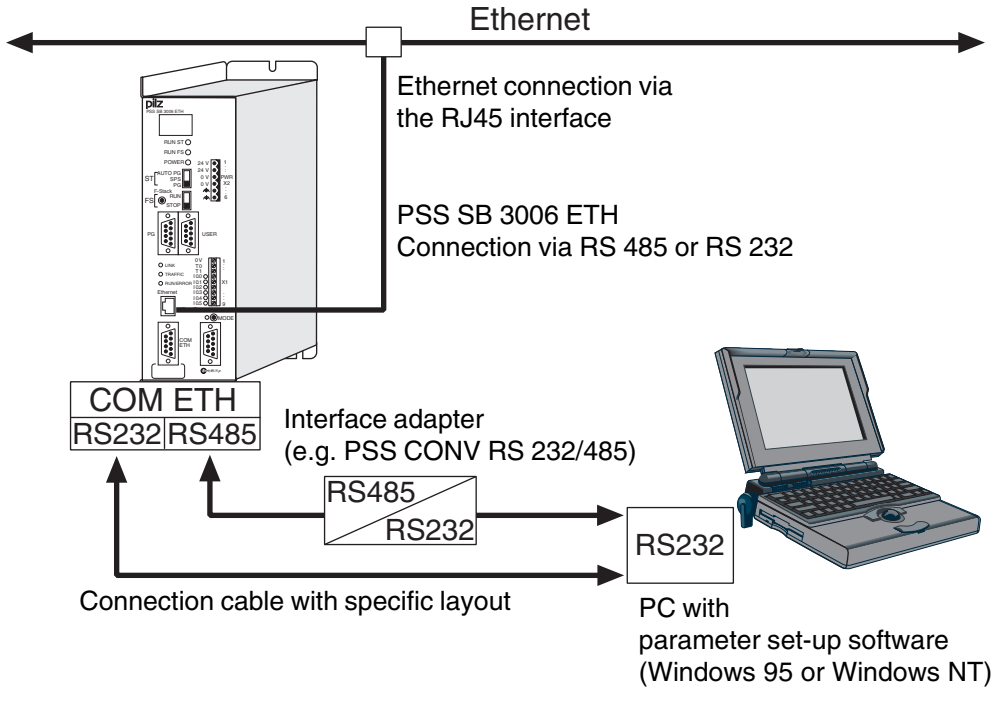


Fig. 4-5: Setting parameters directly via the COM ETH port (example)

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Ethernet address

The Ethernet address (MAC-ID) is the physical address of a bus subscriber in Ethernet.
On Pilz Ethernet interfaces it is possible to read the respective Ethernet address from the front panel.

Software for setting parameters

Various parameters (IP address, communications protocol per connection etc.) must be set and then stored in the Ethernet interface. The parameter set-up software “PSS SW Ethernet Parameter Set-up” is available for this purpose.
The precise procedure for setting parameters is documented in a separate manual, “PSS SW Ethernet Parameter Set-up”.

Ethernet communications protocols

Various network protocols are available for exchanging data via Ethernet. The main difference is in their data security mechanisms.

Application Header

The Application Header is required if data in the data target is to be stored directly in a flag, data block, etc. The following Application Headers are supported:

- SINEC S5 Application Protocol
- SINEC S7 Application Protocol
- Modbus TCP

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Ethernet Functionality

PLC Header

The PLC Header was developed by INAT GmbH. It is used to combine several short data blocks into larger data blocks during data transfer, using end identifiers. At the moment, the PLC Header is only supported by modules from Pilz GmbH & Co. and INAT GmbH.

TCP/IP

The TCP/IP communications protocol provides secured data transfer. It is used on logical point-to-point connections, for example.

UDP/IP

The UDP/IP communications protocol provides unsecured data transfer. Data is not acknowledged. UDP/IP is used with broadcast frames, for example.

H1
RFC1006

H1 is an Ethernet protocol that was developed by Siemens. This network protocol is primarily used for local networks (LAN).
A special form of communication is used to exchange data on extended networks (WAN) such as an Intranet or the Internet. In this case, H1 telegrams are transported via TCP/IP. This type of H1 network protocol is standardised in RFC1006.

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Communications protocols for the Ethernet interface

Communication is via the network protocols TCP/IP, UDP/IP, H1 and RFC1006. Communication with the above network protocols may be simultaneous or parallel. The two diagrams below provide an overview of the Ethernet interface's potential network protocols. Further information can be found in the "PSS SW Ethernet Parameter Set-up" manual.

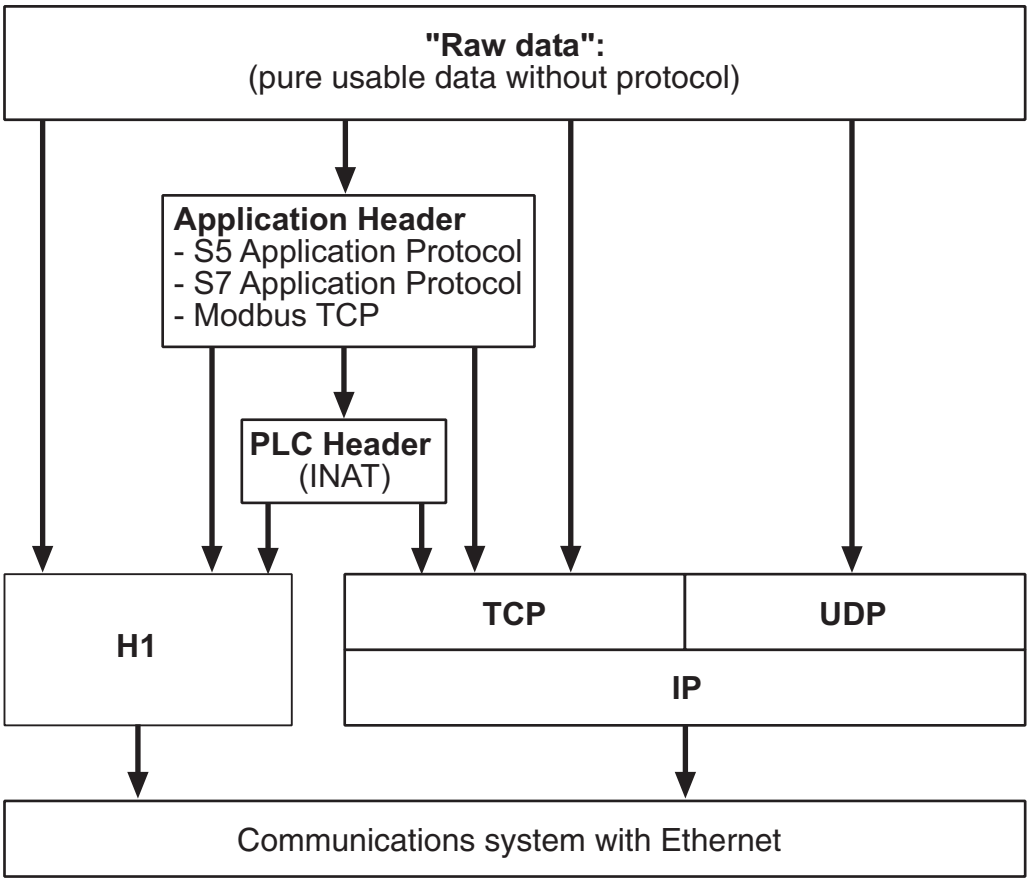


Fig. 4-6: Network protocols (example for send data)

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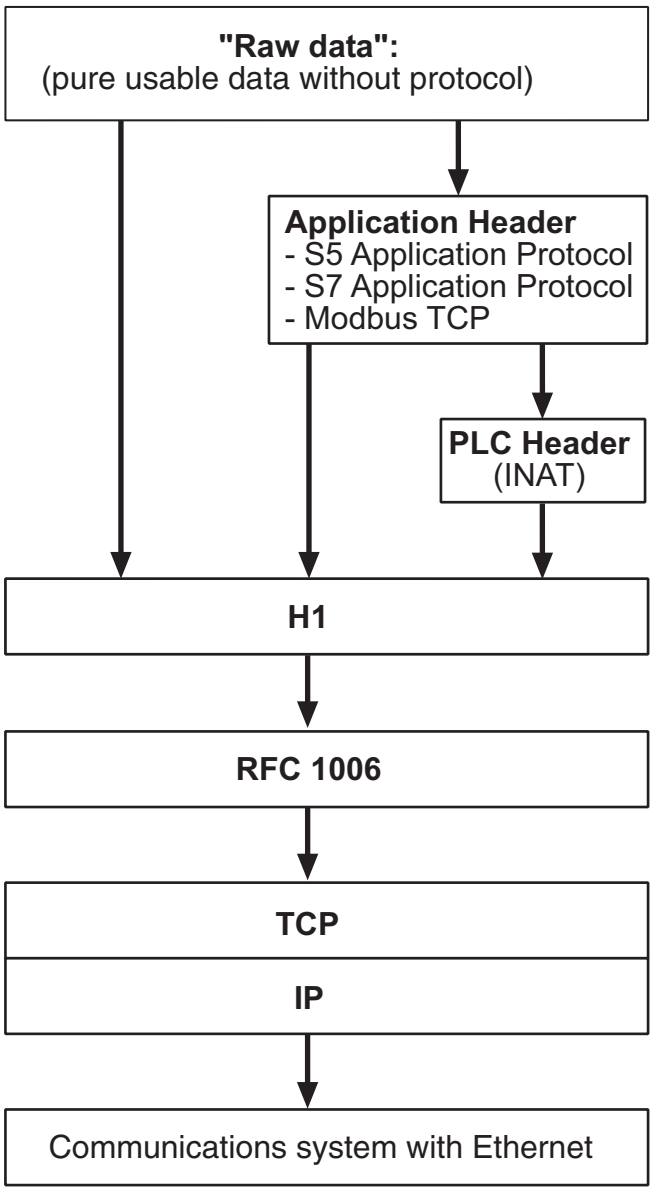


Fig. 4-7: Network protocols in accordance with RFC1006, H1 via TCP/IP (example for send data)

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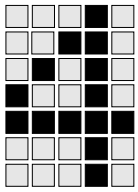
Operation of the Ethernet interface

Ethernet connects network stations from a number of different manufacturers, so that each station can communicate with all the others. Network stations may be PCs, industrial computers, programmable logic controllers etc.
A network station operates in accordance with the principle of random bus access (CSMA/CD). This method detects and controls collisions during bus access.
Each bus subscriber can access the bus as required. If the bus is free, the bus subscriber is permitted to transfer data. If not, it aborts its send activities and starts again after a random period of time.
Each bus subscriber constantly monitors all network activities. Due to the single, unique subscriber address, a bus subscriber is able to recognise and accept data that is intended for it.

To relieve the load on the PSS, the Ethernet interface has a powerful intrinsic intelligence, which manages data traffic automatically.

Data exchange (pure usable data) between the PSS and the Ethernet interface occurs via the XW range of the PSS using the standard function blocks.
During a send operation, the PSS fetches the usable data from the stated data areas and transfers them to the Ethernet interface for further processing. During a receive operation, the PSS fetches the usable data from the Ethernet interface and stores it in the stated data areas. Data areas may be PSS flag ranges, I/O ranges or data blocks.

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Notes

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Operation

Commissioning

Testing the components

Before operating the module, ensure that the following points have been met:

PSS

- The programmable safety system must be installed correctly (see “PSS SB 3006 ETH Installation Manual”).
- The integral on-board inputs and test pulse outputs must be connected correctly (see “PSS SB 3006 ETH Installation Manual”).

SafetyBUS p

- The bus structure must be designed correctly (open circuits excluded etc.)
- The PSS must be connected correctly to SafetyBUS p (see “SafetyBUS p Installation Manual”).
- Make sure that the PSS is configured with the correct device address (see “SafetyBUS p System Description”).

Ethernet interface

- The bus structure must be designed correctly (open circuits excluded etc.)
- The PSS must be connected correctly to the Ethernet (see Chapter 4, section entitled “Connection options” and the “PSS SB 3006 ETH Installation Manual”).
- Parameters on the Ethernet interface must be set correctly (see the manuals “PSS SW Ethernet Set-up” and “Getting Started with Ethernet”).

Preparing the PSS

- Connect the supply voltage for the PSS (“PWR”) and switch on.
- Transfer your application program to the PSS (application program for the standard and failsafe section of the PSS).
- Switch off the supply voltage.

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Operation

Starting

PSS

Once the preparation stages are complete, the PSS SB 3006 ETH can be started up. Follow the steps below:

- Switch on the supply to the PSS. The green “POWER” LED lights up.
- Wait until the PSS SB 3006 ETH has completed its self check and initialisation phase. These processes may take a little time. The initialisation phase is complete when “0000” appears on the display.
- Set the switch for selecting the standard section’s operating mode to “SPS” or “AUTO PG”. The “RUN ST” LED lights up (see section entitled “Display elements”). Further information on commissioning can be found in the “ST System Description” in the “System Manual” for the modular/ compact PSS.
- Set the switch for selecting the failsafe section’s operation mode to “RUN”. The “RUN FS” LED lights up (see section entitled “Display elements”). Further information on commissioning can be found in the “FS System Description” in the “System Manual” for the modular/ compact PSS.

The PSS functionality of the PSS SB 3006 ETH is ready for operation.

SafetyBUS p

A detailed description of the commissioning process can be found in the “SafetyBUS p System Description”.

Ethernet interface

You can tell whether the Ethernet interface is ready for operation from the LEDs “RUN/ERROR”, “LINK” and “TRAFFIC” (see table in the section entitled “Display elements”).

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Faults

PSS and SafetyBUS p functionality

If a fault occurs on the safety system or there is a wiring error, the PSS will switch to a STOP condition and output a message to the display. All the decentralised outputs in the I/O-Groups that are assigned to the LD on the PSS will also be switched off.
The error stack display in the programming device can be used to locate the error (see “PSS-Range System Description”).

Ethernet functionality

Various options for fault diagnostics are available, should the Ethernet interface not achieve the correct operating status:

- Evaluation of the LEDs for operating status
- Evaluation of output parameter *STAT* on the standard function blocks that are used (see PSS SB Ethernet – Software Manual)
- Evaluation of the network connection status using SB 248 for a specifically selected job (see “PSS SB Ethernet - Software Manual”)
- Bus diagnostics via an Ethernet network analyzer
  This type of bus diagnostics will require a corresponding network analyzer for Ethernet (e.g. “Netspector” from INAT GmbH). Further information can be found in the operating manual for the relevant analyzer.

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Operation

Changing the battery

If the battery voltage drops below 2.5 V, the CPU will issue the error message “S-04”. Change the battery (refer to “Technical Details” for details of battery type).

CAUTION!

Always switch off the supply before changing the battery. The CPU will retain data via a capacitor for approx. 2 minutes. If it takes longer to change the battery, data will be lost.

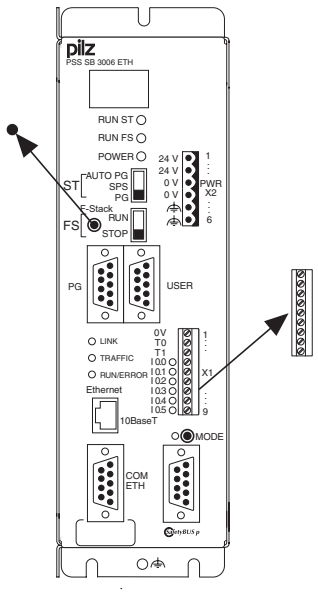
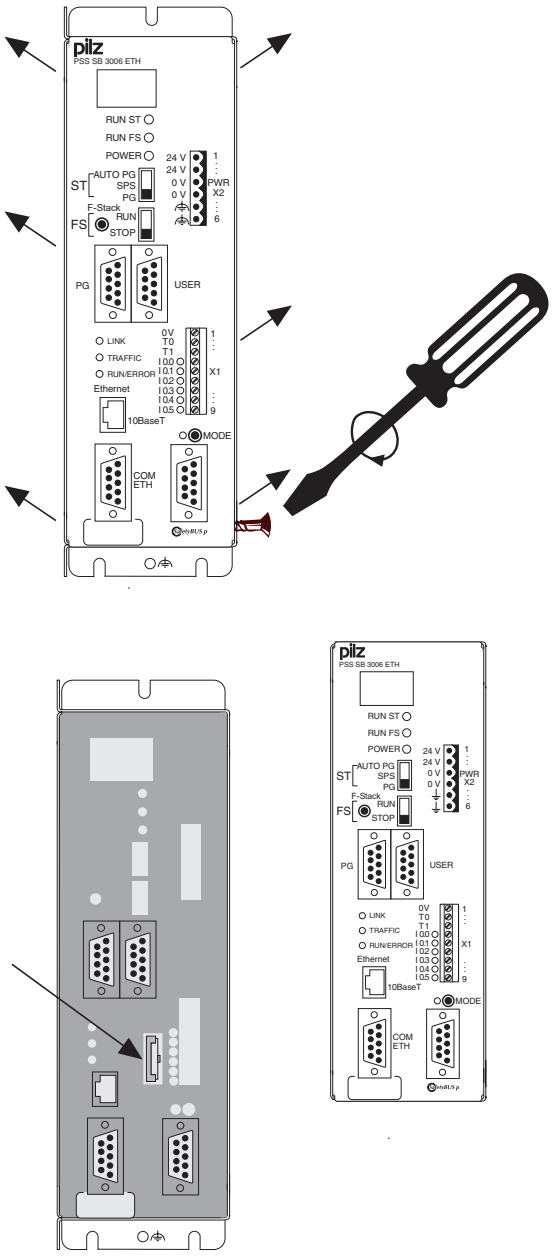


Fig. 5-1: Changing the battery, part 1

Switch off the supply voltage, remove the connector, the cap from the “F-Stack” button and the terminal blocks.

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Remove the blanking plate and undo the screws.

Change the battery and close up the housing.

Fig. 5-2: Changing the battery, part 2

NOTICE

Make sure all the screws are tightened up securely, to ensure the housing is properly connected to the functional earth.

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Display elements

PSS functionality

LED	Signal	Key
RUN ST	LED green	Standard section of PSS in “RUN”
RUN FS	LED green	Failsafe section of PSS in “RUN”
POWER	LED green	The internally-generated 5 V supply is within the permitted range.
I0.0 ... I0.5		Status indicators for the inputs:
	Off	Input has status “0”
	LED green	Input has status “1”

SafetyBUS p functionality

LED “MODE”
The LED lights as soon as the connection to SafetyBUS p is made.

Ethernet functionality

Various operating and fault statuses are displayed via the LEDs on the Ethernet interface.

LED	Signal	Key
RUN/ ERROR	1. Orange-green-red	Self test (after power-up)
	2. LED orange	Initialisation phase
	3a. LED green	Operating status
	3b. LED red	Major internal error (not recoverable)
LINK	Off	No network connection
	LED green	Network connection present
TRAFFIC	Off	No data traffic
	LED flashing green	Data traffic present

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Technical Details

Electrical data	
Supply voltage	24 VDC
Tolerance	20 ... 30 VDC including residual ripple
Current consumption	625 mA plus load currents taken from the test pulse outputs and load currents for fibre-optic couplers (25 mA per fibre-optic coupler)
CPU	
Processors	Motorola 68000 (FS and ST section) Intel 80C186 (FS section) Siemens SAB C165 (FS section)
Processing time for 1000 instructions	Typ. 3 ms
Flags Failsafe section Standard section	 1152 2048
Times	64 in both FS and ST section
Time base	50, 100 ms; 1, 10, 60 s
Counters	64 in both FS and ST section
Data memory Failsafe section Standard section	 16 KByte, **non**-retentive 170 KByte
Program memory Failsafe section Standard section	 Integral 256 KByte Flash memory Integral 512 KByte Flash memory
Display	4-digit
Interfaces	Galvanically isolated: RS 232 (with minimum configuration)/RS 485 for programming device, RS 232/RS 485 as user interface SafetyBUS p RJ45 as Ethernet interface Not galvanically isolated: RS 232/RS 485 Ethernet interface for setting parameters
Battery Service life	Lithium 3.0 V Type CR2032 ca. 2 years

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Technical Details

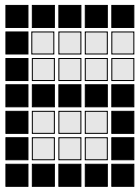
SafetyBUS p	
Status display	LED
Transmission rate	Max. 500 kBit/s
Cable runs	Max. 3500 m
Transmission type	Differential two-wire cable; Fibre-optic cable via fibre-optic coupler
Connection	9-pin D-Sub connector (male)
Ethernet	
Application range	Non-safety-related applications
Bus interface	RJ45
Status display	3 LEDs
Transmission rate	10 MBit/s (fixed)
Ethernet address	Set through parameter set-up software
Data transfer	Word by word
Communications structure	Via standard function blocks
Integral on-board inputs	
Number of inputs	6
Galvanic isolation	No
Potential isolation	No
Polarity protection	Yes
Connection type	Screw connector
Status display	LED
Signal level at “1”	+15 ... +30 VDC
Signal level at “0”	-3 ... +5 VDC
Input current	Typ. 6 mA
Input delay	< 1 ms
Pulse suppression	≤ 300 µs (Requirement: in the PSS Configurator under “Max. delay of digital inputs” or “DI test time” ≥ 3 ms are configured.)

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Dedicated test pulse outputs	
Number	2
Supply	From “PWR” (24 VDC)
Output current at signal level “1”	Max. 0.5 A
Environmental data	
Protection type (EN 60529, 02/00)	IP20
Mounting position	Vertical
Ambient temperature (DIN IEC 68-2-14, 06/87)	0 ... 60 °C
Storage temperature (EN 60068-2-1/-2, 03/95, 08/94)	-25 ... +70 °C
Climatic suitability (DIN IEC 68-2-30, 09/86)	Max. 95 % r.h.
Condensation	Not permitted
Vibration (EN 60068-2-6, 05/96)	Frequency range: 10 ... 150 Hz Amplitude: 0.075 mm, max. 1g
Shock (DIN IEC 68-2-29, 03/95)	30g, 11 ms/10g, 16 ms
EMC	EN 61000-6-2, 03/00 EN 55011, 05/00
Mechanical data	
Weight	1800 g
Dimensions (H x W x D)	246.4 x 74 x 161 mm

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Appendix

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Appendix

Changes in the documentation

Changes from Version I to Version II

Old page	New page	Change
1-1	1-1	Section: Validity of documentation
2-2	2-2	Functional earth connection
6-2	6-2	SafetyBUS p: Fibre-optic cable connection via fibre-optic couplers
6-3	6-3	Environmental data: Details of protection class removed

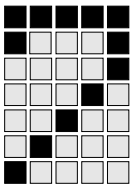
Changes from Version 20 715-03

Old page	New page	Change
1-1	1-1	Section: Validity of documentation
6-2	6-2	Technical data on integral on-board inputs new: Pulse suppression

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