

PNOZ s30

pilz

Safety relays

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SD means Secure Digital.

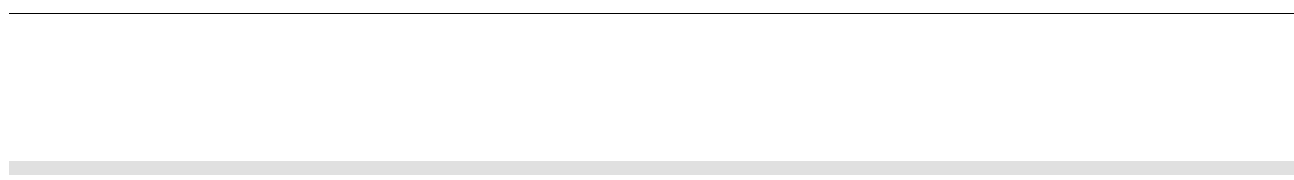
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1 Introduction

1.1 Validity of documentation

This documentation is valid for speed monitors PNOZ s30 from version 2.0. It is valid until new documentation is published.

This operating manual explains the function and operation, describes the installation and provides guidelines on how to connect the product .

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

1.2 Overview of documentation

1 Introduction

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

2 Overview

This chapter provides information on the device's most important features.

3 Safety

This chapter must be read as it contains important information on safety and intended use.

4 Function Description

This chapter describes the mode of operation of the device.

5 Installation

This chapter explains how to install the device.

6 Commissioning

This chapter describes the device's commissioning and wiring.

7 Operation

This chapter describes how to operate the product and gives tips in the case of a fault.

8 Technical Details

9 Examples

1.3 Definition of symbols

Information that is particularly important is 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 unit(s) could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.



INFORMATION

This gives advice on applications and provides information on special features.

1 Introduction

2.1 Unit structure

2.1.1 Range

Scope of supply:

- ▶ Speed monitor **PNOZ s30**
- ▶ Terminator
- ▶ Connection terminals
- ▶ Chip card
- ▶ Chip card holder

2.1.2 Unit features

Using the product **PNOZ s30**:

Speed monitor for safe monitoring of standstill, speed, speed range, position and direction.

The product has the following features:

- ▶ Measured value recorded by
 - Incremental encoder
 - Proximity switch
 - Analogue voltage input
- ▶ Measured variables
 - Standstill
 - Speed
 - Speed range
 - Position
 - Direction
 - Analogue voltage (track S)
- ▶ Positive-guided relay outputs
 - 2 safety contacts
 - 2 auxiliary contacts
- ▶ Semiconductor outputs
 - 4 auxiliary outputs
- ▶ Expansion interface for 2 more safe relay outputs
- ▶ Can be configured via the display on the speed monitor
- ▶ Configuration is stored on a chip card
- ▶ Display
 - Current frequencies
 - Current position
 - Warning and error messages
- ▶ Status and fault LEDs
- ▶ Rotary encoder connection technology:
RJ45 socket

2.2 Front/side view

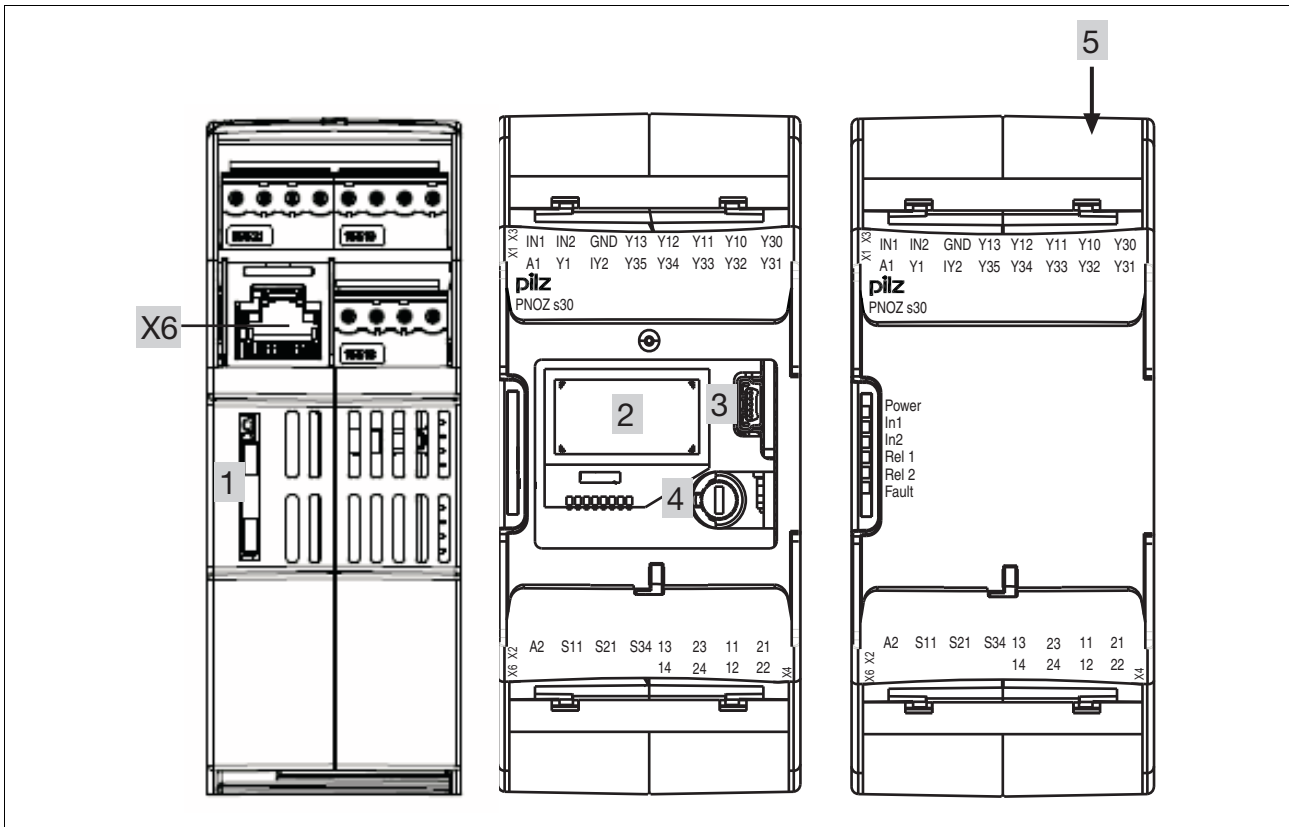


Fig. 2-1: Left: Side view, centre: Front view without cover, right: Front view with cover

Legend:

- ▶ A1, A2:
Supply connections
- ▶ In1, In2, GND:
Proximity switch 1 - In1 (track A) and 2 - In2 (track B) and GND
- ▶ Y10 ... Y13:
Select inputs (SEL1, SEL2, SEL4, SEL8)
- ▶ 13-14 and 23-24:
Relay outputs (safety contacts)
- ▶ 11-12 and 21-22:
Relay outputs (auxiliary contacts)
- ▶ Y32 ... Y35: Semiconductor outputs (auxiliary outputs)
- ▶ S11: +24 V / 30 mA (supply for S34, Y1 and Y2)
- ▶ S21: 0 V (GND for S11, S34, Y1 and Y2)
- ▶ S34: Reset input
- ▶ Y30: 0 V ext (GND for select input and semiconductor outputs)
- ▶ Y31: 24 V ext (supply for semiconductor outputs)

2.2 Front/side view

- ▶ Y1, Y2:
 - Y1: Feedback input for Rel. 1
 - Y2: Feedback input for Rel. 2:
- ▶ X6: RJ45 socket for connecting the encoder (tracks A, /A, B, /B, Z, /Z, S and GND). Proximity switches can be connected via RJ45 socket or connection terminals.
- ▶ 1: Chip card
- ▶ 2: Display
- ▶ 3: USB connection (service only)
- ▶ 4: Rotary knob
- ▶ 5: Expansion interface for 2 more external relay outputs
- ▶ LEDs:
 - Power
 - In1
 - In2
 - Rel 1
 - Rel 2
 - Fault

3.1 Intended use

The speed monitor monitors standstill, speed, speed range, position and direction in accordance with EN ISO 13849-1 up to PL e and EN IEC 62061 up to SIL CL 3.



WARNING!

Users must take appropriate measures to detect or exclude errors (e.g. slippage or broken shearpin) which cause the frequency of the encoder signal to no longer be proportional to the monitored speed.

Appropriate measures are:

- ▶ Using the monitored encoder to also control the drive
- ▶ Mechanical solutions
- ▶ Z-frequency monitoring with an additional proximity switch (Inpnp) on the same axis

3.2 Safety regulations

3.2.1 Use of qualified personnel

The products may only be assembled, installed, programmed, commissioned, operated, maintained and decommissioned by competent persons.

A competent person is someone who, because of their training, experience and current professional activity, has the specialist knowledge required to test, assess and operate the work equipment, devices, systems, plant and machinery in accordance with the general standards and guidelines for safety technology.

It is the company's responsibility only to employ personnel who:

- ▶ Are familiar with the basic regulations concerning health and safety / accident prevention
- ▶ Have read and understood the safety guidelines given in this description
- ▶ Have a good knowledge of the generic and specialist standards applicable to the specific application.

3.2.2 Warranty and liability

All claims to warranty and liability will be rendered invalid if:

- ▶ The product was used contrary to the purpose for which it is intended
- ▶ Damage can be attributed to not having followed the guidelines in the manual
- ▶ Operating personnel are not suitably qualified
- ▶ Any type of modification has been made (e.g. exchanging components on the PCB boards, soldering work etc.).

3.2.3 Disposal

- ▶ In safety-related applications, please comply with the mission time t_M in the safety-related characteristic data.
- ▶ When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).

3.2 Safety regulations

3.2.4 For your safety

- ▶ The device is designed exclusively for use in an industrial environment. It is not suitable for use in a domestic environment, as this can lead to interference.
- ▶ The guarantee is rendered invalid if the housing is opened or unauthorised modifications are carried out.
- ▶ Sufficient fuse protection must be provided on all output contacts with capacitive and inductive loads.

4.1 Introduction

Proximity switches or rotary encoders record measured values, which are evaluated in the speed monitor **PNOZ s30**. There are 9 monitoring functions (F1 ... F9), which are performed simultaneously.

Up to 16 different parameter sets (P0 ... P15) for the monitoring functions can be selected via the select inputs.

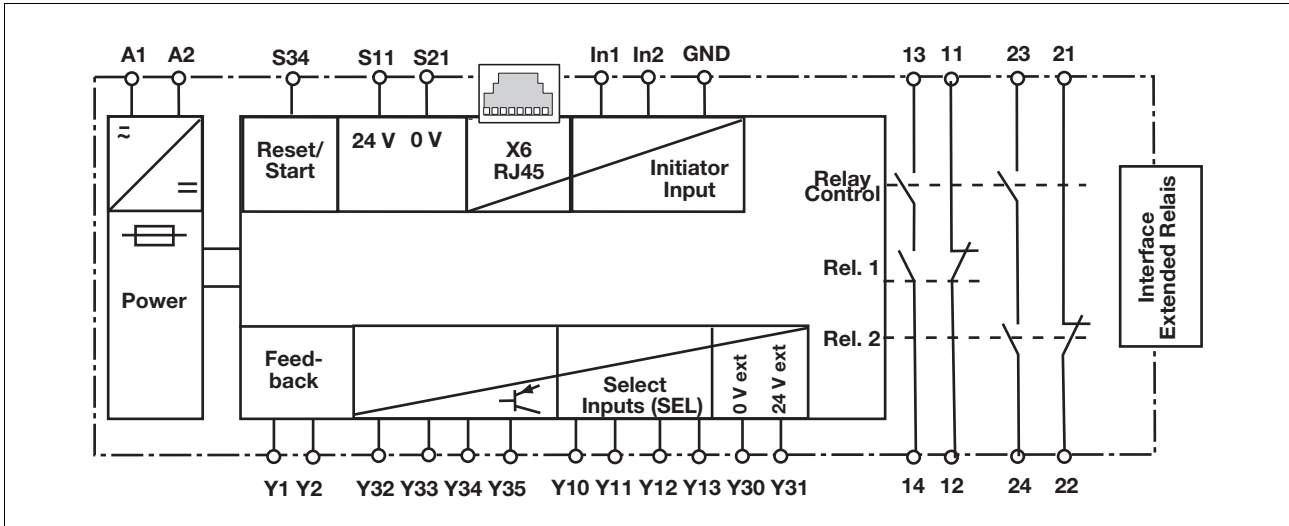
Configuration of the monitoring functions is menu-driven, using a rotary knob. The outputs switch depending on the configuration.

An interface is available to connect a contact expansion module PNOZsigma, enabling the number of outputs to be expanded.

The relay conforms to the following safety criteria:

- ▶ The circuit is redundant with built-in self-monitoring.
- ▶ The safety function remains effective in the case of a component failure.

4.2 Block diagram



NOTICE

The individual blocks are galvanically isolated from each other:

- ▶ Supply voltage: A1, A2
- ▶ Encoder and initiator inputs: GND, In1, In2, RJ45 socket and shield
- ▶ Reset and feedback circuits: S21, S11, S34, Y1, Y2
- ▶ Semiconductor outputs and select inputs: Y30, Y31, Y32, Y33, Y34, Y35, Y10, Y11, Y12, Y13
- ▶ Relay output 13, 14
- ▶ Relay output 11, 12
- ▶ Relay output 23, 24
- ▶ Relay output 21, 22

If possible, the connections for the various earth potentials (GND, S21, Y30 and A2) should not be connected, as noise susceptibility can be increased significantly as a result.

4.3 Functions

The following monitoring functions can be configured:

Standstill

With standstill monitoring, the output is switched on when the value falls below the stated standstill value; if the standstill value is exceeded, the output switches off.

Speed

With overspeed monitoring, the output switches off when the stated value is exceeded.

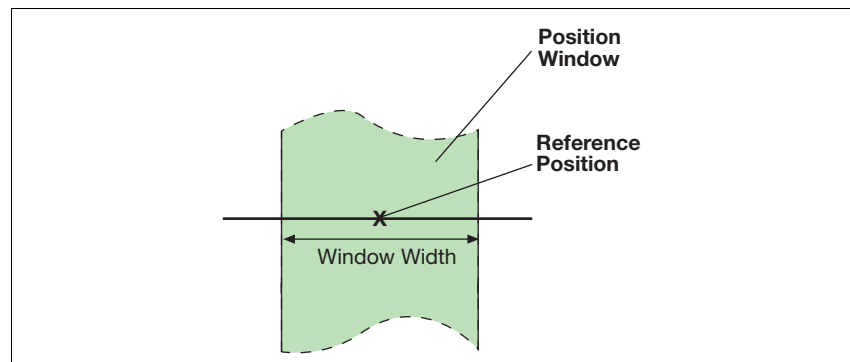
Speed range

With range monitoring, the output switches off if the rotational speed (velocity, frequency) is outside the configured range.

Position

Position monitoring is activated via a rising edge at the reset input. The current position is adopted as a reference position in the middle of the position window (configured window width) and the assigned output is switched on.

The output will stay switched on provided the value is within the position window.



4.3 Functions

If the value moves outside the configured range, position monitoring is reset and the assigned outputs are switched off. Position monitoring can be restarted via a rising edge at the reset input
A max. of 4 positions can be configured to be monitored simultaneously.

Please note:

- ▶ Active position monitoring is not restarted by another rising edge at the reset input.
- ▶ Position monitoring cannot be used if proximity switches are employed.

Direction

If the direction is to be detected safely, this function must be linked to a safety contact.

- ▶ If "Direct. Right" is configured, the safety output is switched on during normal operation in clockwise rotation.
- ▶ If "Direct. Left" is configured, the safety output is switched on during normal operation in anti-clockwise rotation.

For both directions, a tolerance can be entered for the wrong direction. In other words, the drive can run in the wrong direction up to the set tolerance value, without the assigned output switching off.

If an output has been switched off, it cannot switch back on again until the drive has been run in the right direction up to the tolerance value.

Please note: Direction cannot be detected if proximity switches are used.

Monitoring for broken shearpins

An additional proximity switch can be connected to track Z to monitor for broken shearpins

Hysteresis

For each switching function F1 ... F9 (with the exception of direction and position), a hysteresis can be configured. This prevents the outputs on the speed monitor from bouncing if there are fluctuations around the response value. The hysteresis becomes effective when the output is switched on:

Switch-on value = switching threshold – hysteresis

For the lower range limit:

Switch-on value = switching threshold + hysteresis

4.3 Functions

Reset modes

You can choose between the following reset modes:

▶ **Automatic reset**

If an automatic reset is configured, the output switches on automatically if the speed does not reach the limit value, for example.

▶ **Monitored reset with rising edge**

If a monitored reset with rising edge is configured, the output switches on if the speed does not reach the limit value and then a rising edge is detected at S34.

▶ **Monitored reset with falling edge**

If a monitored reset with falling edge is configured, the output switches on if the speed does not reach the limit value and then a falling edge is detected at S34.

Switch delay

A delay time can be set for each output (see technical details). The outputs will not switch until the set time has elapsed. It is possible to configure whether the delay time is to be activated when switching on, switching off, or switching on and off.



WARNING!

Potential loss of safety function due to increased reaction time

The output switch-off delay (t_{do} , Off) when overspeed is reached will increase the speed monitor's reaction time by the stated value (see technical details). This must not delay the arrival of a safe condition by more than the permitted time. The configuration of the switch-off delay must be considered in the risk assessment as regards hazards, reaction time and safety distance.

4.3 Functions

Feedback loops

Feedback loops are used to monitor external contactors or relays. If a relay output is activated, it will not switch on until the corresponding feedback loop is closed.

Start-up delay

To avoid spurious output signals, during the machine's start-up phase, evaluation of the encoder signals can be delayed after the supply voltage is switched on (see technical details).

Switching direction on semiconductor outputs

The semiconductor outputs can be operated in normally de-energised or normally energised mode.

Units

The values to be configured can be entered in various units. Depending on the axis type (linear or rotational axis), various units can be selected for speed and distance (see chapter entitled "Menu overview").

4.4 Speed configuration

The speed monitor is configured using the rotary knob on the device.

Up to 16 parameter sets (P0 ... P15), each with a max. of 9 switch functions (F1 ... F9) can be configured to monitor various operating modes, for example.

One of the 16 parameter sets is selected via 4 select inputs SEL1 (Y10), SEL2 (Y11), SEL4 (Y12), SEL8 (Y13).

The switch functions are monitored simultaneously.

Each of a switch function's 16 parameters can be configured as

- ▶ Standstill limit
- ▶ Speed limit
- ▶ Upper or lower limit of speed range
- ▶ Right-hand direction monitoring
- ▶ Left-hand direction monitoring
- ▶ Position monitoring 1 to 4 with width of position window 1 to 4

Exactly one switch function can be assigned to each output. The same switch function can be assigned to several outputs. With range monitoring, a range is assigned to an output (F2-F3, F4-F5, F6-F7 or F8-F9).

A switch delay and reset mode can be configured for each output.

If only one parameter set is used, configure the parameter set P0. Then it is not necessary to connect a select input.



INFORMATION

2 basic configurations are available for standard applications, for simple configuration within the display menu. A basic configuration contains limited menu functions adapted for standard applications, with partly pre-defined parameters. Further information about basic configurations can be found in this chapter, under "Basic configuration".

4.4 Speed configuration

Example configuration:

2 parameter sets for 2 operating modes are configured:

- ▶ Set-up: P1
- ▶ Automatic mode: P2

The parameter set P2, "Automatic mode", is selected for speed monitoring (selection via the select inputs, see next chapter "Select inputs").

The following switch functions are selected for the parameter set P2:

- ▶ F1: Standstill 2 Hz
- ▶ F2: Overspeed: 3000 Hz
- ▶ F3: Warning threshold: 2800 Hz

The following outputs are assigned to the switch functions:

- ▶ F1: Relay output Rel. 1
- ▶ F2: Relay output Rel. 2
- ▶ F3: Semiconductor output Out 1

Speed Monitor Configuration

Delay Time Start-up
(0 ... 600 s)

Units

Conversion Units
(1 - 10.000.000 Imp)

Select Inputs

SEL 1 (Y10)

SEL 2 (Y11)

SEL 4 (Y12)

SEL 8 (Y13)

Delay Select Inputs
(0 ... 30 s)

Assign Outputs Functions

Delay Time Effect Outputs
Delay Time (0 ... 30 s) Outputs

Reset Mode

Output Logic Semiconductor Outputs

Switching Functions
(Standstill, 10 mHz ... 1 MHz, Position 1 ... Position 4, Left, Right)

Hysteresis (0 ... 50%)

	F1	F2	F3	F4	F5	F6	F7	F8	F9
P0									
P1	2 Hz	50 Hz	50 Hz						
P2	2 Hz	3 kHz	2.8 kHz						
P3									
P4									
P5									
P6									
P7									
P8									
P9									
P10									
P11									
P12									
P13									
P14									
P15									

Outputs

	Rel. 1 (13/14)	Rel. 2 (23/24)	Ext. 1	Ext. 2	Out 1 (Y32)	Out 2 (Y33)	Out 3 (Y34)	Out 4 (Y35)
F1								
F2								
F3								
F4								
F5								
F6								
F7								
F8								
F9								

Stillstand:
(10 mHz ... 1 MHz)

Position Window Width
(1 ... 24.900.000 Imp)

Position 1

Position 2

Position 3

Position 4

Tolerance Incorrect Direction of Rotation
max. wrong (0 ... 24.900.000 Imp)

Anti-Clockwise/Clockwise operation:

Direct. Left max. right

Direct. right max. left

4.4 Speed configuration

For documentation and a better overview of the device settings, we recommend that you fill in this configuration overview before setting the device parameters (link to form, see "Create configuration overview" chapter).

4.4.1 Select Inputs

The parameter sets are selected via the 4 select inputs SEL1 (Y10), SEL2 (Y11), SEL4 (Y12), SEL8 (Y13). Only one of the configured parameter sets can be selected.

For applications up to PL e of EN ISO 13849-1 and up to SIL CL 3 of EN IEC 62061 max. 4 parameter sets can be configured: P1, P2, P4 and P8 (or P0 if only 1 parameter set is used).

Parameter set	Signal states of the select inputs			
	SEL 8	SEL 4	SEL 2	SEL 1
P1	0	0	0	1
P2	0	0	1	0
P4	0	1	0	0
P8	1	0	0	0

In all other parameter sets (P0, P3, P5 ... P7, P9 ... P15), the default value "Standstill" must be configured for each switch function.

When using these 4 parameter sets, the following safety features are met:

If there is an error when activating the select inputs, such as

- ▶ Short circuits and shorts between contacts
- ▶ Open circuit
- ▶ Input drift

a parameter set other than P1, P2, P4 or P8 is selected. This means that standstill is monitored.

If necessary, the number of parameter sets can be increased to max. 16. These can only be used for applications up to max. PL d of EN ISO 13849-1 and up to SIL CL 2 of EN IEC 62061.

4.4 Speed configuration

Parameter set	Signal states of the select inputs			
	SEL 8	SEL 4	SEL 2	SEL 1
P0	0	0	0	0
P1	0	0	0	1
P2	0	0	1	0
P3	0	0	1	1
P4	0	1	0	0
P5	0	1	0	1
P6	0	1	1	0
P7	0	1	1	1
P8	1	0	0	0
P9	1	0	0	1
P10	1	0	1	0
P11	1	0	1	1
P12	1	1	0	0
P13	1	1	0	1
P14	1	1	1	0
P15	1	1	1	1

When using the expanded parameter sets, please note:

If an open circuit occurs when the select inputs are activated, the system will switch to a parameter set with a lower number (e.g. P7 -> P3 if an open circuit occurs at SEL4).

The limit values for the switch functions should therefore be entered in ascending order. (Parameter set P0 -> lowest values, parameter set P15 -> highest values).

Delay on the select inputs

A reaction time can be entered for the select inputs. That way it is possible to filter out invalid signals (e.g. contact bounce) that occur when switching.

4.4 Speed configuration

4.4.2 Switch functions

The following switch functions can be configured:

▶ **Standstill**

The standstill frequency is configured centrally. The standstill frequency should be the lowest frequency in the configuration.

All switch function parameters are pre-configured to the default setting "Standstill" ex works.

▶ **Speed**

Limit values can be configured to monitor for overspeed.

Limit values should be entered in ascending order (Parameter set P0 -> lowest values, parameter set P15 -> highest values)

▶ **Speed range**

Up to 4 speed ranges can be monitored simultaneously.

Configure two switch functions to monitor a range:

- F2 and F3,
- F4 and F5,
- F6 and F7 or
- F8 and F9.

The switch function with the lower number (e.g. F2) operates as the lower range limit; the switch function with the higher number (e.g. F3) operates as the upper range limit.

Both switch functions can be assigned to one or more outputs.

▶ **Position**

Up to 4 different position windows can be monitored: Position 1 ... Position 4.

Each position to be monitored can be entered as often as necessary in parameter sets P0 to P15 and switch functions F1 to F9.

▶ **Direction**

The monitoring functions "Direct. Left" and "Direct. Right" can be configured as a switch function as often as necessary.

For both directions, a tolerance can be entered for the wrong direction.

4.4 Speed configuration

4.4.3 Basic configuration

Two basic configurations are available for standard applications, for simple configuration within the display menu. A basic configuration contains limited menu functions adapted for standard applications, with partly pre-defined parameters.

The following basic configurations are available:

Basic configuration 1: Ini pnp pnp (proximity switch)

Pre-defined settings and configuration options:

- ▶ **Encoder type**
 - 2 pnp type proximity switches
- ▶ **Switch functions**
 - **Standstill (F1)**
 - ⇒ Standstill frequency configurable in Hz
 - **Speed (F2)**
 - ⇒ Max. frequency (v max) configurable in Hz
- ▶ **Parameter set/select input**
 - P0, select inputs must be "0" (unconnected)
- ▶ **Hysteresis**
 - Standstill and speed, 2 % each
- ▶ **Output assignment**
 - Standstill: Relay output Rel. 1 and semiconductor output Out 1
 - Speed: Relay output Rel. 2 and semiconductor output Out 2
- ▶ **Reset mode**
 - Rel. 1, Rel. 2 Out 1, Out 2: Automatic reset
- ▶ **Switch delay**
 - None
- ▶ **Max. encoder frequency**
 - 3.5 kHz

Basic configuration 2: Rotary encoder

- ▶ **Encoder type**
 - Rotary encoder
 - ⇒ Rotary encoder type configurable
- ▶ **Switch functions**
 - **Standstill (F1)**
 - ⇒ Standstill frequency configurable in Hz
 - **Speed (F2)**
 - ⇒ Max. frequency (v max) configurable in Hz
 - **Direction (F3)**
 - Direction left

4.4 Speed configuration

- Tolerance for wrong direction = 10 Imp
- **Direction (F4)**
 - Direction right
 - Tolerance for wrong direction = 10 Imp
- ▶ **Parameter set/select input**
 - P0, select inputs must be "0" (unconnected)
- ▶ **Hysteresis**
 - Standstill and speed, 2 % each
- ▶ **Output assignment**
 - Standstill: Relay output Rel. 1 and semiconductor output Out 1
 - Speed: Relay output Rel. 2 and semiconductor output Out 2
 - Direction left: External output Ext. 1 and semiconductor output Out 3
 - Direction right: External output Ext. 2 and semiconductor output Out 4
- ▶ **Reset mode**
 - All outputs: Automatic reset
- ▶ **Switch delay**
 - None
- ▶ **Max. encoder frequency**
 - 1 MHz

For details of how to configure the basic configurations, see the chapter entitled Commissioning/Display Menu - Configuration.

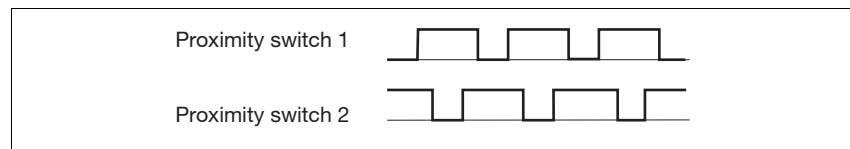
4.4.4 Chip card

The set parameters, the name of the configuration and the passwords are stored on the chip card (see section entitled "Using the chip card").

4.5 Input device types

4.5.1 Proximity switch

- ▶ The following proximity switches can be used:
 - pnp
 - npn
- ▶ The proximity switches must be fitted so that at least one is always activated. In other words, the proximity switches must be fitted such that the recorded signals overlap.
- ▶ The supply voltage of the proximity switches should be monitored via track S.



CAUTION!

Appropriate installation measures should be taken to prevent a foreign body coming between the signal encoder and the proximity switch. If not, the foreign body could cause invalid signals.

- ▶ Please note the values stated in the technical details
- ▶ The maximum frequency of the used encoders must be entered for a complete configuration ("Encoder" Menu -> "Track AB" -> "Track AB fmax" / "Track Z" -> "Track Z fmax").

4.5 Input device types

4.5.2 Rotary encoders

- ▶ The following rotary encoders can be used:
 - TTL, HTL (single-ended or differential signals)
 - sin/cos 1 Vss
 - Hiperface
- ▶ The rotary encoders can be connected with or without Z index (0 index)
- ▶ A proximity switch can also be connected to track Z for monitoring broken shearpins
- ▶ Track S can be used:
 - To connect an encoder's error output
 - To monitor voltages between 0 V and 30 V for a permitted upper and lower limit. For example, the encoder's supply voltage can be monitored.
- ▶ The maximum frequency of the used encoders must be entered for a complete configuration ("Encoder" Menu -> "Track AB" -> "Track AB fmax" / "Track Z" -> "Track Z fmax").

Please note the values stated in the technical details

4.5.2.1 Adapter for incremental encoders

The adapter records the data between the incremental encoder and the drive and makes it available to the speed monitor via the RJ45 socket.

Pilz supplies complete adapters as well as ready-made cable with RJ45 connector, which can be used when making your own adapter. The range of products in this area is constantly being expanded. Please contact us about the range of adapters that is currently available.

4 Function description

5.1 General installation guidelines

Install base unit without contact expander module:

- ▶ Ensure that the plug terminator is inserted at the side of the unit.

Connect base unit and PNOZsigma contact expander module:

- ▶ Remove the plug terminator at the side of the base unit and at the contact expander module.
- ▶ Connect the base unit and the contact expander module to the supplied connector before mounting the units to the DIN rail.

Control cabinet installation

- ▶ The unit should be installed in a control cabinet with a protection type of at least IP54.
- ▶ It is preferable to install the device on a horizontal DIN rail in order to ensure the best possible convection.
- ▶ Use the locking element on the rear of the device to attach it to the DIN rail.
- ▶ Push the device upwards or downwards before lifting it from the DIN rail.



CAUTION!

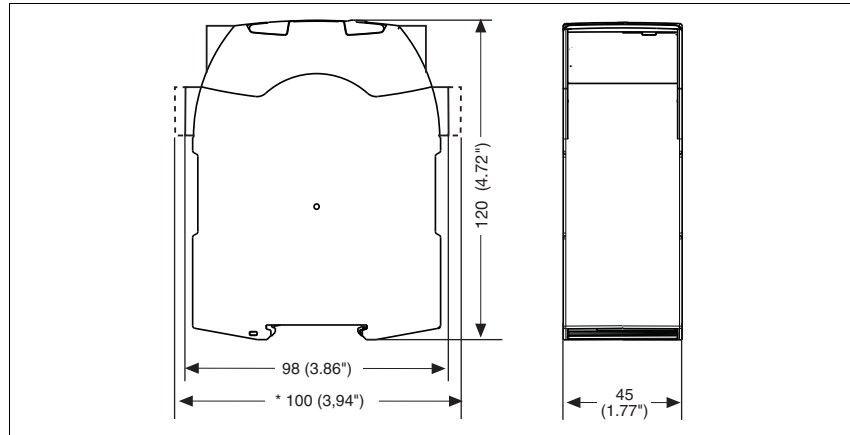
Damage due to electrostatic discharge!

Electrostatic discharge can damage components. Ensure against discharge before touching the product, e.g. by touching an earthed, conductive surface or by wearing an earthed arm-band.

5.1 General installation guidelines

5.1.1 Dimensions

*with spring-loaded terminals



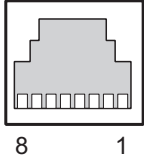
6.1 Wiring

6.1.1 General wiring guidelines

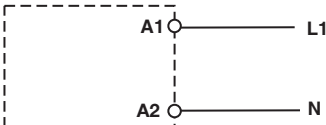
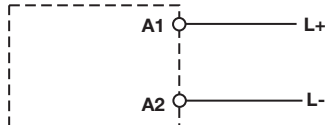
Note:

- ▶ Information given in the "Technical details" must be followed.
- ▶ Use copper wire that can withstand 75 °C.
- ▶ The cable used to connect the rotary encoder and proximity switch must be shielded (see connection diagrams in this chapter).
- ▶ If possible, the connections for the various earth potentials (GND, S21, Y30 and A2) should not be connected, as noise susceptibility can be increased significantly as a result.

6.1.2 Pin assignment of RJ45 socket

RJ45 socket 8-pin	PIN	Track
	1	S
	2	GND
	3	Z
	4	A
	5	/A
	6	/Z
	7	B
	8	/B

6.1.3 Supply voltage

Supply voltage	AC	DC
		

6.1 Wiring

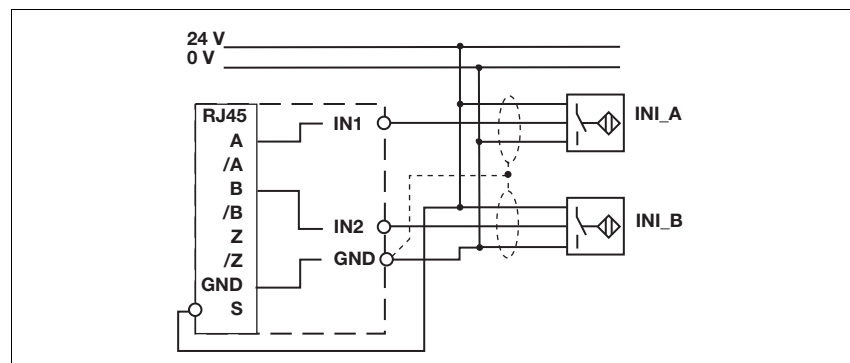
6.1.4 Connection of proximity switches

The following proximity switch combinations can be connected:

- ▶ A: pnp, B: pnp
- ▶ A: npn, B: npn
- ▶ A: pnp, B: npn
- ▶ A: npn, B: pnp

When connecting proximity switches please note:

- ▶ Proximity switches can either be connected to terminals In1, In2 and GND or to tracks A and B plus GND on the RJ45 socket.
- ▶ Track S should be used to monitor the supply voltage (see drawing).
- ▶ A permitted voltage range can be entered in the menu.
- ▶ Connect the proximity switch to 24 VDC of the power supply.



6.1 Wiring

6.1.5 Connection of a rotary encoder

Proceed as follows when connecting the rotary encoder:

- ▶ The rotary encoder be connected via an adapter (e.g. PNOZ msi6p) or can be connected directly to the speed monitor.
- ▶ Use only shielded cables for all connections
- ▶ Always connect GND on the rotary encoder to GND on the RJ45 connector.

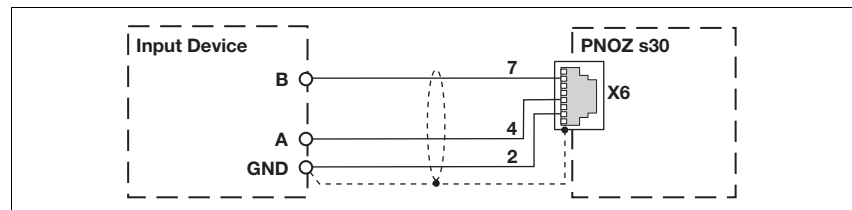
6.1.5.1 Connect rotary encoder to speed monitor

Encoder types:

- ▶ TTL single ended
- ▶ HTL single ended

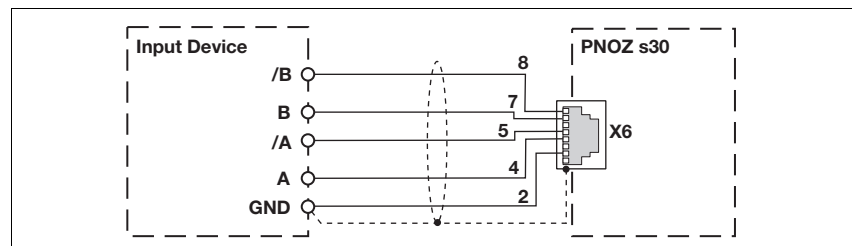
Please note:

- ▶ Tracks /A and /B must remain free



Encoder types:

- ▶ TTL differential
- ▶ HTL differential
- ▶ sin/cos 1 Vss
- ▶ Hiperface



6.1 Wiring

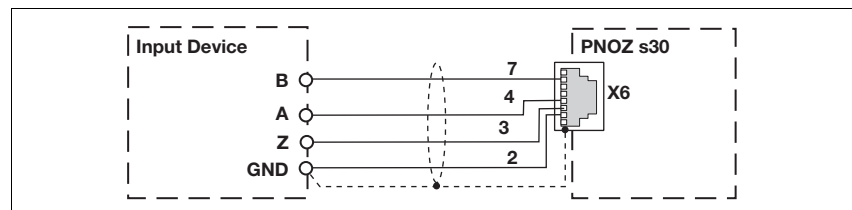
6.1.5.2 Connect rotary encoder with Z index to speed monitor

Encoder types:

- ▶ TTL single Z Index
- ▶ HTL single Z Index

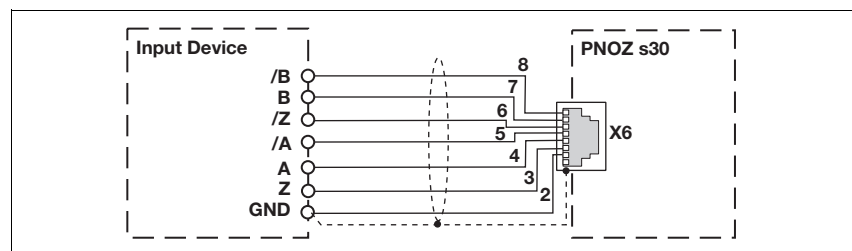
Please note:

- ▶ Tracks /A, /B and /Z must remain free



Encoder types:

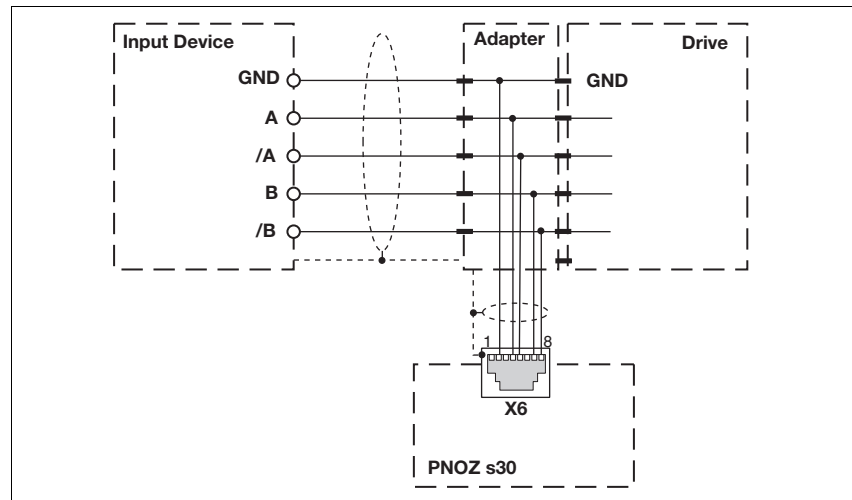
- ▶ TTL diff. Z Index
- ▶ HTL diff. Z Index
- ▶ sin/cos 1 Vss Z Index



6.1 Wiring

6.1.5.3 Connect rotary encoder to the speed monitor via an adapter

The adapter (e.g. PNOZ msi6p) is connected between the rotary encoder and the drive. The output on the adapter is connected to the RJ45 socket on the speed monitor.



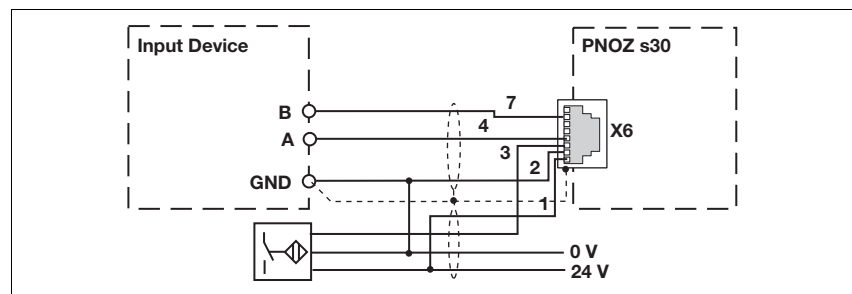
6.1.6 Connection of proximity switch and rotary encoder

Encoder types:

- ▶ TTL single Z Freq. Ini pnp
- ▶ HTL single Z Freq. Ini pnp

Please note:

Tracks /A, /B and /Z must remain free.



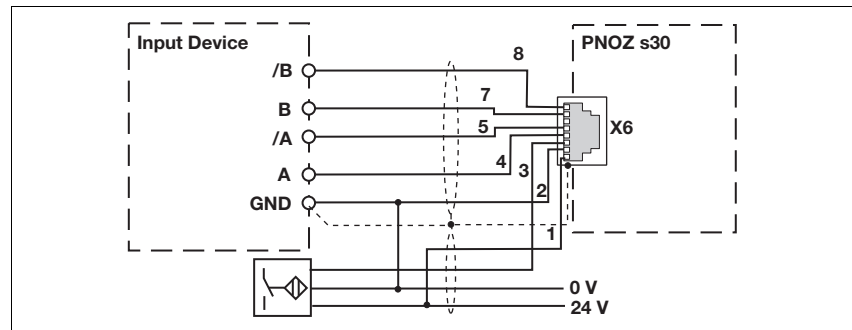
6.1 Wiring

Encoder types:

- ▶ TTL differential Z Freq. Ini pnp
- ▶ HTL differential Z Freq. Ini pnp
- ▶ sin/cos 1 Vss Z Freq. Ini pnp
- ▶ Hiperface Z Freq. Ini pnp

Please note:

Track /Z must remain free!!



6.1.7 Reset circuit

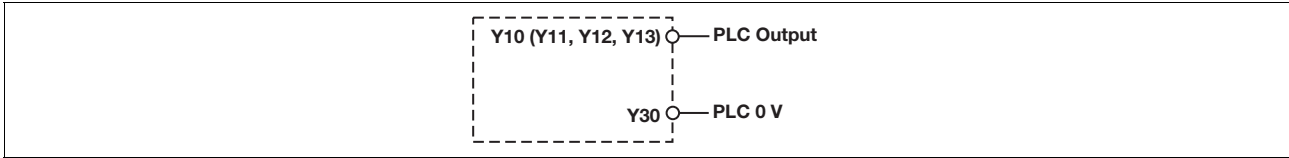
Automatic reset	Monitored reset
Automatic reset must only be configured No wiring necessary!	

6.1.8 Feedback circuit

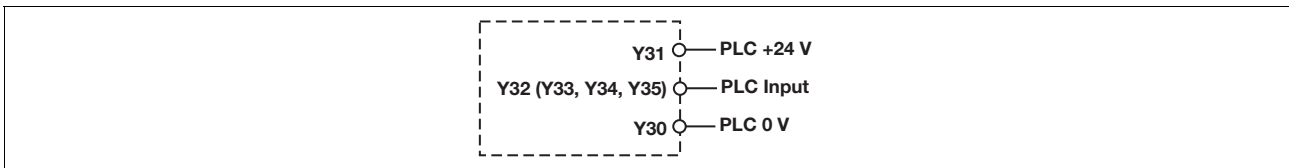
Link	Contacts from external contactors

6.1 Wiring

6.1.9 Select inputs



6.1.10 Semiconductor outputs



6.2 Display menu - Configuration

The menu settings are made on the unit's display via a rotary knob. You have the option to make the settings on the knob by hand or with a screwdriver. If you make the settings with a screwdriver, the knob can remain within the unit.

6.2.1 Create configuration overview

For a better overview, before entering the configuration values we recommend that they are entered in the attached form

[PNOZ_s30_Config_Overview](#).

Speed Monitor Configuration

Delay Time Start-up
(0 ... 600 s)

Units

Conversion Units
(1 - 10.000.000 Imp)

Select Inputs

SEL 1 (Y10)

SEL 2 (Y11)

SEL 4 (Y12)

SEL 8 (Y13)

Delay Select Inputs
(0 ... 30 s)

Assign Outputs Functions

Delay Time Effect Outputs

Delay Time (0 ... 30 s) Outputs

Reset Mode

Output Logic Semiconductor Outputs

Switching Functions
(Standstill, 10 mHz ... 1 MHz, Position 1 ... Position 4, Left, Right)

Hysteresis (0 ... 50 %)

	F1	F2	F3	F4	F5	F6	F7	F8	F9
P0									
P1									
P2									
P3									
P4									
P5									
P6									
P7									
P8									
P9									
P10									
P11									
P12									
P13									
P14									
P15									

Outputs

Rel. 1 (13/14)	Rel. 2 (23/24)	Ext. 1	Ext. 2	Out 1 (Y32)	Out 2 (Y33)	Out 3 (Y34)	Out 4 (Y35)

Stillstand:
(10 mHz ... 1 MHz)

Position Window Width
(1 ... 24.900.000 Imp)

Position 1

Position 2

Position 3

Position 4

Tolerance Incorrect Direction of Rotation
max. wrong (0 ... 24.900.000 Imp)

Anti-Clockwise/Clockwise operation:

Direct. Left max. right

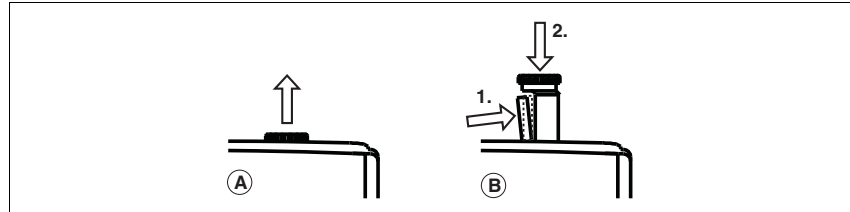
Direct. right max. left

6-8

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6.2 Display menu - Configuration

6.2.2 Operate rotary knob



The rotary knob:

- ▶ (A) should be pulled out until it clicks into position
- ▶ (B) then released and retracted back into the unit:
 - Press the latch on the side of the rotary knob (1) towards the centre of the knob. This releases the rotary knob.
 - Press the knob downwards (2) while keeping the latch held down.

6.2.3 Configure Speed Monitor



The settings are made via the rotary knob, as follows:

Press the knob

- ▶ Confirm selection/setting
- ▶ Switch to menu

Rotate knob

- ▶ Select menu level
- ▶ Set the parameter/numeric value

The speed with which you turn the knob affects the sequence of the menu and numeric values:

- ▶ Slowly: Units
- ▶ Quickly: Tens
- ▶ Very quickly:
 - Setting the numeric value: Hundreds
 - When switching the menu level: Jump to **CANCEL**



NOTICE

Please note that all parameters are set to their default values on delivery.

Please check all the safety-related parameters at least, and enter the values that correspond to your application.

6.2 Display menu - Configuration



INFORMATION

If no value is set or amended within 30 s of a menu action, the display reverts to the default display. The current setting remains unchanged.

If the master password has been entered, this time increases to 5 minutes.

6.2.4 Password protection

The configuration is protected through passwords. There is a master password and a customer password.

Factory setting for both passwords: 0000

The password levels contain different authorisations:

▶ **Master password**

Display: All settings

Edit: All settings

▶ **Customer password**

Display: All settings

Edit:

- The customer password can be changed.
- The language can be changed.
- The settings can be reset to the factory settings.

▶ **No password**

Edit:

- The language can be changed.
- The settings can be reset to the factory settings.

If the settings are reset to the factory settings, the passwords and the language will also be reset to the factory settings.

The passwords can be changed at any time in the menu.
Enter a password containing 4 characters.

6.2 Display menu - Configuration

6.2.5 Use chip card

The parameters that are set on a unit can be stored on the chip card. The data is stored along with a device identifier, the passwords, the name of the configuration and the check sum. We recommend that you **always** operate the unit with a chip card.

- ▶ If the parameters on a device have been changed due to an error, they can be restored using the backup copy on the chip card.
- ▶ If a unit requires maintenance or needs to be exchanged, the chip card can be used to download the parameters to another unit.



INFORMATION

If you operate the unit without a chip card, the "Fault" LED will light and the following message will appear once only: **Please Insert SIM Card!**. If you change the parameters, the **Please Insert SIM Card!** message will reappear.

The message disappears after 30 s or by pressing the rotary knob.

When the chip card is inside the unit:

- ▶ The chip card is checked to verify the device identifier, valid parameters, and ensure that the data is identical.
- ▶ Unit parameters are automatically saved to the chip card during operation. As a result, the chip card always contains a copy of the unit's current internal data. Exception: If you select **Write configuration to SIM: No**.

6.2 Display menu - Configuration

6.2.5.1 Insert chip card

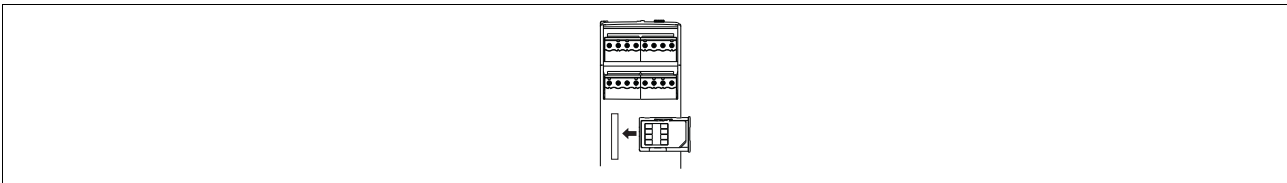


NOTICE

The chip card contact is only guaranteed if the contact surface is clean and undamaged. For this reason please protect the chip card's contact surface from

- ▶ Contamination
- ▶ Contact
- ▶ Mechanical impact, such as scratches.

Make sure that you do not bend the chip card as you insert it into the chip card slot.



6.2.5.2 Write data to chip card

If you are inserting a chip card which has not yet been written by a **PNOZ s30**, you have the option to:

- ▶ Allow data to be written to the chip card

	Insert chip card	1.		2.	Data is written to the chip card
Please insert SIM Card!	Write configuration to SIM: No?		Write configuration to SIM: Yes?		Current menu

- ▶ Do not allow data to be written to the chip card

	Insert chip card	1.	Data is not written to the chip card
Please insert SIM Card!	Write configuration to SIM: No?		Insert rewritable SIM Card!

6.2 Display menu - Configuration

6.2.5.3 Read data from chip card

If you are inserting a chip card which has not yet been written by a **PNOZ s30**, you have the option to:

- ▶ Allow data to be read from the chip card

	Insert chip card (data on chip card different from device)	1.		2.	Data is read into the device
Current menu	SIM: Name of the configuration (8 characters) CRC: 12345 (0 .. 65535) Load SIM: No?		SIM: Name of the configuration (8 characters) CRC: 12345 (0 .. 65535) Load SIM: Yes?		Current menu

- ▶ Do not allow data to be read from the chip card

	Insert chip card (Data on chip card different from device)	1.	Data is not read into the device, data is written to the chip card
Current menu	SIM: Name of the configuration (8 characters) CRC: 12345 (0 .. 65535) Load SIM: No?		Write configuration to SIM: No? (for more details see "Write data to chip card")

6.2.5.4 Transfer device parameters

You can transfer device parameters from one device to another using the chip card.

Proceed as follows:

- ▶ Remove chip card containing the data from device 1.
- ▶ Insert chip card in device 2.
- ▶ Confirm the message **Load SIM Yes?**.
The data is transferred.

6.2 Display menu - Configuration

6.2.5.5 Duplicate chip card

You can also create copies of a chip card and its data.

Proceed as follows:

- ▶ Remove chip card containing the device data.
- ▶ Insert a new chip card into the device.
- ▶ Confirm the message **Write configuration to SIM Yes?**
- ▶ The new chip card is written.

6.2.6 Menu overview

The tables provide an overview of the menu settings.

The attached Excel file provides a detailed view of the setting options:
[PNOZ_s30_Menu_Overview](#).

6.2.6.1 Permanent display

If no settings are made, information regarding the configuration and current values are shown on the display.

You can change the permanent display on the display in the "Settings" menu.

6.2 Display menu - Configuration

6.2.6.2 Basic settings Ini pnp pnp

Settings for basic configuration 1

Level	Designation on the display	Description	Settings
1	Basic Param. Ini pnp pnp Default: Load?	Select the default settings with which the basic configuration menu "Ini pnp pnp" is to be called: - Load : The basic parameters are loaded. Switches afterwards to the basic menu "Ini pnp pnp". The basic parameters should always be loaded when commissioning for the first time. - Change : The basic parameters are not loaded, i.e. all parameters are retained. The basic menu parameters can be changed within the permitted boundaries. - CANCEL : Exits the basic menu.	
2	Standstill Rel.1 Out 1 Default: 2.00 Hz	Enter standstill frequency	100 mHz ... 10.0 Hz
2	v max: Rel.1 Out 2 Default: 500 Hz	Enter the max. permitted speed	10 mHz ... 3.00 kHz

Other, pre-defined settings:

- ▶ **Encoder type**
2 pnp type proximity switches
- ▶ **Parameter set/select input**
P0, select inputs must be "0" (unconnected)
- ▶ **Hysteresis**
Standstill and speed, 2 % each
- ▶ **Output assignment**
 - Standstill: Relay output Rel. 1 and semiconductor output Out 1
 - Speed: Relay output Rel. 2 and semiconductor output Out 2
- ▶ **Reset mode**
 - Rel. 1, Rel. 2 Out 1, Out 2: Automatic reset
- ▶ **Switch delay**
None
- ▶ **Max. encoder frequency**
3.5 kHz

6.2 Display menu - Configuration

6.2.6.3 Basic settings for the rotary encoder

Settings for basic configuration 2

Level	Designation on the display	Description	Settings
1	Basic Param. Encoder: Default: Load?	Select the default settings with which the basic configuration menu "Rotary encoder" is to be called: -Load: The basic parameters are loaded. Switches afterwards to the basic menu "Rotary encoder". The basic parameters should always be loaded when commissioning for the first time. -Change: The basic parameters are not loaded, i.e. all parameters are retained. The basic menu parameters can be changed within the permitted boundaries. -CANCEL: Exits the basic menu.	
2	InputDevice Default: TTL Differential	Select rotary encoder type	-TTL differential (A, /A, B, /B) -TTL single ended -HTL differential (A, /A, B, /B) -HTL single ended -sin/cos 1 Vss (A, /A, B, /B) -Hiperface (A, /A, B, /B)
2	Standstill Rel.1 Out 1 Default: 100 Hz	Enter standstill frequency	10 mHz to 1.00 kHz
2	v max: Rel.2 Out 2 Default: 5.00 kHz	Enter the max. permitted speed	10 mHz to 1.00 MHz

Other, pre-defined settings:

- ▶ **Switch functions**
 - **Direction (F3)**
Direction left
Tolerance for wrong direction = 10 Imp
 - **Direction (F4)**
Direction right
Tolerance for wrong direction = 10 Imp
- ▶ **Parameter set/select input**
P0, select inputs must be "0" (unconnected)
- ▶ **Hysteresis**
Standstill and speed, 2 % each

6.2 Display menu - Configuration

- ▶ **Output assignment**
 - Standstill: Relay output Rel. 1 and semiconductor output Out 1
 - Speed: Relay output Rel. 2 and semiconductor output Out 2
 - Direction left: External output Ext. 1 and semiconductor output Out 3
 - Direction right: External output Ext. 2 and semiconductor output Out 4
- ▶ **Reset mode**
 - All outputs: Automatic reset
- ▶ **Switch delay**
 - None
- ▶ **Max. encoder frequency**
 - 1 MHz

6.2.6.4 Settings

Level	Designation on the display	Description	Settings
1	Permanent display Default: H : Min : Sec (system time) V (current speed of track AB) Position	Permanent display Current values and information regarding configuration are displayed. You can change the permanent display on the display	Display combinations: - vz (current speed of track Z) - v (current speed of track AB) - Position - Switch functions F1 ... F9 - v (current speed of track AB) - Position - Line 1/2: F1/F2, F3/F2, F5/F4, F7/F6 or F9/F8 (parameters selected via select inputs). v (current speed of track AB) - H : Min : Sec (system time:) - v (current speed of track AB) - Position
1	Display Unit Speed: Dist: Default: Hz - Imp	Select unit of speed and distance (position) wählen.	Speed (rotational speed) - Dist. (distance/position) Hz - Imp (pulse) Hz - Edg (edge) m/s - m m/min - m m/h - m rps - rev rpm - rev
1	Conversion Default: 1Hz = 1 Imp / s	Unit conversion. Enter ratio of unit to pulses.	Display 1 Hz = 1 Imp/s 1 Hz = 4 Edg/s 1m = x Imp (x = 1 ... 10.000.000 Imp) 1 rev = x Imp (x = 1 ... 10.000.000 Imp)

6.2 Display menu - Configuration

Level	Designation on the display	Description	Settings
1	InputDevice Settings	Create encoder configuration for the tracks A, /A, B, /B, Z, /Z, S	
2	InputDevice Default: Undefined	Select pre-defined encoder types for the tracks A, B and Z: Proximity switch Rotary encoder - with and without inverted signals - with or without Z index (0 index) - with proximity switch at track Z Note: If "Undefined" is selected, an error message is shown when you confirm the menu	<p>No encoder selected: - Undefined</p> <p>Proximity switch (Ini): - Initiator A: pnp B: pnp - Initiator A: npn B: npn - Initiator A: pnp B: npn - Initiator A: npn B: pnp</p> <p>Rotary encoder: TTL - TTL differential (A, /A, B, /B) - TTL single ended (A, B) TTL with Z index - TTL diff. Z index (A, /A, B, /B, Z, /Z) - TTL single Z index (A, B, Z) HTL - HTL differential (A, /A, B, /B) - HTL single ended (A, B) HTL with Z index - HTL diff. Z Index (A, /A, B, /B, Z, /Z) - HTL single Z Index (A, B, Z) Sin/Cos 1 Vss - sin/cos 1 Vss (A, /A, B, /B) Sin/Cos 1 Vss with Z index - sin/cos 1 Vss Z Index (A, /A, B, /B, Z, /Z) Hiperface - Hiperface (A, /A, B, /B)</p> <p>Rotary encoder + pnp proximity switch TTL + pnp proximity switch - TTL diff. (A, /A, B, /B), Z Freq Inipnp (Z) - TTL single (A, B), Z Freq Inipnp (Z) HTL + pnp proximity switch - HTL diff. (A, /A, B, /B), Z Freq Inipnp (Z) - HTL single (A, B), Z Freq Ini pnp (Z) sin/cos 1 Vss + pnp proximity switch - sin /cos 1 Vss (A, /A, B, /B), Z Freq Inipnp (Z) Hiperface + pnp proximity switch - Hiperface (A, /A, B, /B), Z Freq Inipnp (Z)</p>
2	Track AB	Settings for tracks A and B	
3	Type AB	For information only: Information on configured encoder type on tracks A and B	

6.2 Display menu - Configuration

Level	Designation on the display	Description	Settings
3	Track /A/B	For information only: Information on the use of the inverted tracks /A and /B: No track /A /B or Inverted (inverted tracks /A and /B used) or U _{ref} external (e.g. "Hiperface" encoder type)	
3	AB Direction Default: Normal	Select direction for tracks A and B In-formation: This function is used to display a forward movement as positive linear/rotational speed, irrespective of the installation of the rotary encoder.	- Normal - Inverted
3	Track AB fmax Default: 10 mHz	Enter max. frequency of the encoder on tracks A and B Important: The frequency must be less than or equal to the max. encoder frequency specified in the encoder's data sheet and less than the max. speed of the monitored drive.	10 mHz ... 1.00 MHz
2	Track Z	Settings for track Z	
3	Type Z	For information only: Information on configured encoder type at track Z	
3	Track /Z	For information only: Information on the use of the inverted track /Z: No track /Z or Inverted (inverted track /Z used)	
3	Track Z fmax Default: 10 mHz	Enter max. frequency of the encoder on track Z Important: The frequency must be less than the max. encoder frequency specified in the encoder's data sheet	10 mHz ... 1.00 MHz

6.2 Display menu - Configuration

Level	Designation on the display	Description	Settings
	fAB/fZ Verh. Default: 1,0000 : 1	Enter the ratio of the frequency on tracks AB "fAB" to the frequency on track Z "fZ". Used to check the Z index or for frequency monitoring on track Z Information Calculating the frequency ratio: Enter permanent display: "vz: v: Position:" Switch on drive Read vz and v Divide v/vz Enter result as ratio fAB to fZ	0,0001 ... 400.000
2	Track S	Settings for track S (error track)	
3	Track S Default: Not used	Use of track S: - Not used (track S is not used) - Evaluation (track S is used)	- Not used - Evaluation
3	Track S Umax Default: 6.0 V	Enter max. voltage at track S. If the voltage is > Umax, an error is displayed and the outputs are switched off.	0.0 V ... 30.0 V
3	Track S Umin Default: 2.0 V	Enter min. voltage at track S. If the voltage is < Umin, an error is displayed and the outputs are switched off.	0.0 V ... 30.0 V
1	Delay Time Start-up Default: 0.00 s	Select start-up delay (The start-up phase of the PNOZ s30 is extended by this time. The encoder signals are not evaluated until after the start-up phase.)	0 ... 600 s
1	Function Parameter	Select function parameter	
2	Standstill v max: Default: 2.00 Hz	Select standstill frequency	10 mHz ... 1.00 MHz or the corresponding value in the selected unit
2	(F1 ... F9) Function Parameter	Enter parameter for the switch functions F1 ... F9	
3	(F1 ... F9) (P0 ... P15) Parameter Default: Standstill	16 parameters P0 ... P15 can be configured for each switch function F1 ... F9.	
4	(F1 ... F9) (P0 ... P15) Teach v max: Display: Current linear/rotational speed	The current linear/rotational speed is displayed and can be adopted as a limit value.	

6.2 Display menu - Configuration

Level	Designation on the display	Description	Settings
4	(F1 ... F9) (P0 ... P15) v max: Standstill	"Standstill" is displayed and can be adopted Information: The standstill frequency is selected globally in the menu "Standstill v max:" (see above)	
4	(F1 ... F9) (P0 ... P15) v max: 2.00 kHz	Select linear/rotational speed limit	10 mHz ... 1.00 MHz or the corresponding value in the selected unit
4	(F1 ... F9) (P0 ... P15) Function Position (1 ... 4)	Select position monitoring 1 ... 4.	
4	(F1 ... F9) (P0 ... P15) (Direct. Left, Direct. Right)	Select left-hand or right-hand direction monitoring	
1	Assign Outputs	Assign functions to outputs	
2	Output (Rel.1... Out 4) Default: Off	Each output can be assigned a switch function (F1 ... F9) or a range (F2-F3, F4-F5, F6-F7, F8-F9). Each output can also be used as an error output (error) or be switched off (off). When used as an error output, the following applies: Error: Output off No error: Output on For ranges, the following applies: The lower range limit is the switch function with the lower number (e.g. F2), The upper range limit is the switch function with the higher number (e.g. F3). Outputs: Rel.1: Relay output 1 Rel.2: Relay output 2 Ext.3: External output 1 Ext.4: External output 2 Out 1 ... Out 4: Semiconductor outputs 1 ... 4	- Off - F1 ... F9 - F2-F3 - F4-F5 - F6-F7 - F8-F9 - Error
1	Reset Mode	Select reset behaviour	
2	Reset mode (Rel.1... Out 4) Default: Monitored /	Select reset mode for each output separately Automatic: Automatic reset Monitored /: Monitored reset with rising edge at S34 Monitored \: Monitored reset with falling edge at S34	- Automatic - Monitored / - Monitored \

6.2 Display menu - Configuration

6.2.6.5 Advanced settings

Level	Menu designation	Description	Settings
1	Position Parameter	Settings for position monitoring functions	
2	Position (1 ... 4) Window Width Default: 1 Imp	Enter width of position window for position monitoring functions 1 ... 4	1 ... 24.900.000 Imp or the corresponding value in the selected unit
1	Direction Parameter	Settings for direction monitoring	
2	(Direct. Left max. right, Direct. Right max. left) Default: 0 Imp	Enter max. tolerated number of pulses (or Edg, m, rev) in the wrong direction.	1 ... 24.900.000 Imp or the corresponding value in the selected unit
1	Delay Time Select Input Default: 0 ms	Enter delay time of the select inputs Y10 – Y13 Information: The states of the select inputs are only adopted if they were unchanged during the set time.	0 ... 30.0 s
1	Function Hysteresis		
2	(F1 ... F9) Function Hysteresis Default: 1 %	Enter hysteresis for the switch functions F1 ... F9 (not effective with position and direction monitoring)	0 ... 50 %
1	Delay Time Outputs tdO	Setting for the delay effect and delay time for the outputs	
2	Delay Time Output (Rel.1 ... Out 4) Default: On 0 ms (display only)	Setting for the delay time effect and delay time for the respective output	
3	Delay Time Effect (Rel.1 ... Out 4) Default: On delay	Enter whether the delay time is to be activated when switching on, switching off, or switching on and off.	- On - Off - On Off
3	Delay Time (Rel.1 ... Out 4) Default: tdO: 0 ms	Select delay time for the respective output	0 ... 30.0 s
1	Outputs Out Logic	Setting for the switching direction of the semiconductor outputs	

6.2 Display menu - Configuration

Level	Menu designation	Description	Settings
2	Output (Out 1 ... Out 4) Logic Default: N/O contact	Select the switching direction of the semiconductor outputs Out 1 ... Out 4: N/O contact (normally energised mode) N/C contact (normally de-energised mode)	- N/O contact - N/C contact
1	Name of Configuration Default: Default	Enter name of the configuration. The name may be a max. of 8 characters in length It is stored on the chip card
1	Password Settings	Change passwords Note: In the "Default Settings" menu, the passwords are reset to the default setting: 0000.	
2	Master PW	Change master password	0000 ... 9999
2	Customer PW	Change customer password	0000 ... 9999
2	Language Default: English	Select menu language	- English - German
1	Default Settings	Select whether the values are to be reset to the default settings Yes: All parameters are reset to the default values. The language is set to English and all passwords are set to 0000.	- CANCEL - Yes?

6.2 Display menu - Configuration

6.2.6.6 Information

Level	Menu designation	Description	Display/Settings
1	Power-on Time	Time that the device is switched on	xxx.xxx h xx min xx s
1	Max. Speed Track AB	Max. measured linear/rotational speed at tracks A and B The value can be reset to 0	0 ... 4.29 MHz or the corresponding value in the set unit Reset: Reset: Yes?
1	Max. Speed Track Z	Max. measured linear/rotational speed at track Z The value can be reset to 0	0 ... 4.29 MHz or the corresponding value in the set unit Reset: Reset: Yes?
1	Relais (Ctrl, 1, 2) Cycles	Information: Total number of relay operations Relay Ctrl (root relay, common 2nd shutdown route) Relay 1 (relay output 1: 11-12, 13-14) Relay 2 (relay output 2: 21-22, 23-24)	0 ... 6.000.000 x, > 6.000.000 x
1	CRC of Configuration	Check sum of configuration parameters	0 ... 65535
1	Error Stack Entries	Error stack entries Up to 20 error stack entries are displayed Recoverable errors: Level 2, 3 and 4 (can be rectified by user) System errors: Level 2 and 3 (internal error, information for Pilz Service). See section entitled "Error stack entries"	Recoverable error: Level 2: 1. line: Seq. No. "Err.:", error number 2.+3. line: Plain text to describe error for the user Level 3: 1. line: Seq. No. "Recoverable" 2. line: "Power-on Time:" 3. line: Power-on time when the error occurred Level 4: Information for Pilz Service System errors: Level 2: 1. line: Seq. No. "Err.:", error number 2. line: "System Error" 3. line: Power-on time when the error occurred Level 3: Information for Pilz Service
1	Input Module SW Version V	For internal purposes only.	
1	Main Device SW Version Va.b	For internal purposes only.	

6.2 Display menu - Configuration

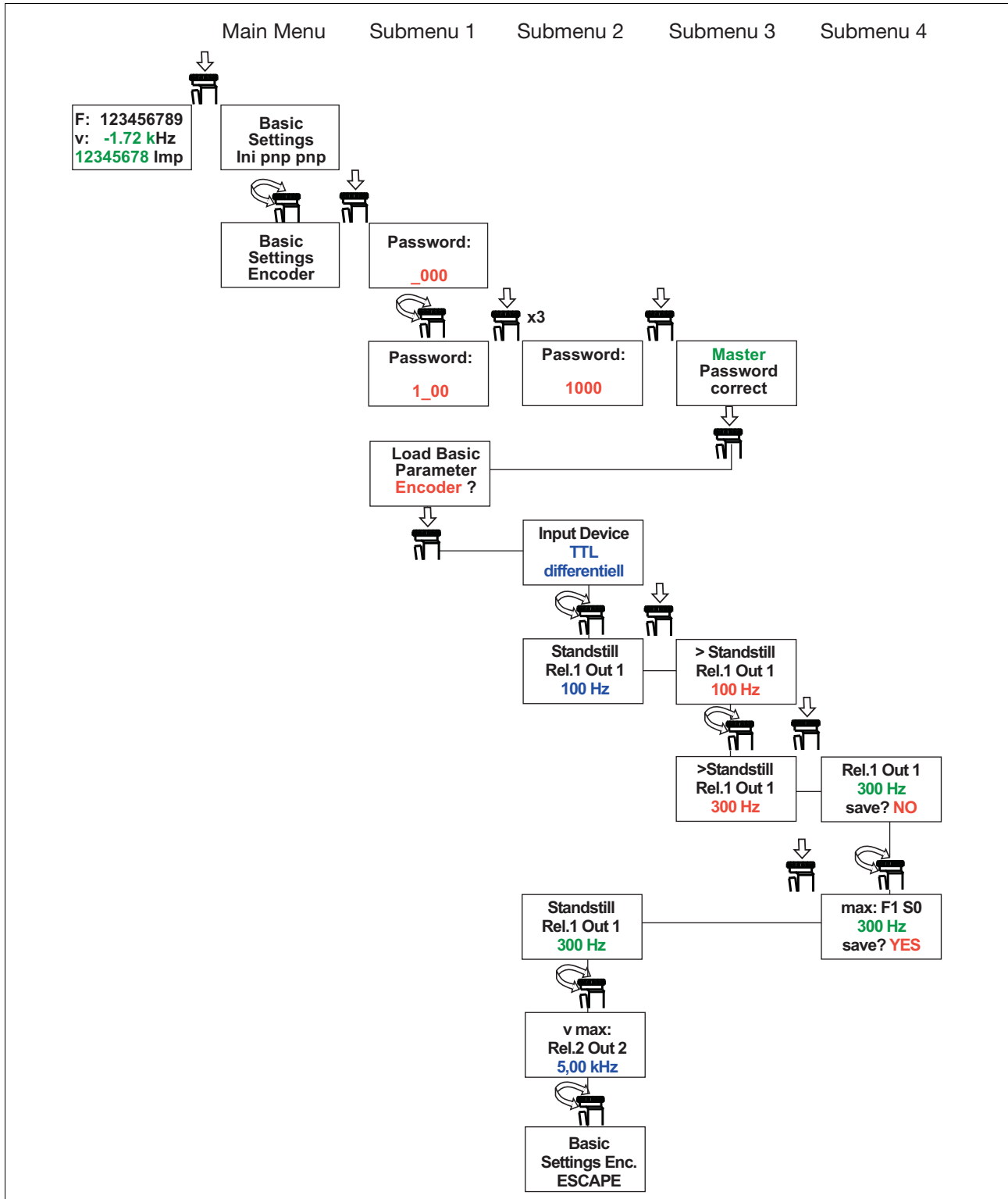
Level	Menu designation	Description	Display/Settings
-	Actual Errors	Up to 8 errors are displayed. Recoverable errors: Level 2, 3 and 4 (can be rectified by user) System errors: Level 2 and 3 (internal error, information for Pilz Service). The error messages can be hidden with "CANCEL".	Recoverable error: Level 2: 1. line: Seq. No. "Err.:", error number 2.+3. line: Plain text to describe error for the user Level 3: 1. line: Seq. No. "Recoverable" 2. line: "Power-on Time:" 3. line: Power-on time when the error occurred Level 4: Information for Pilz Service System errors: Level 2: 1. line: Seq. No. "Err.:", error number 2. line: "System Error" 3. line: Power-on time when the error occurred Level 3: Information for Pilz Service
-	Error Wrong Signal: A/A B/B Z/Z	Error message: Wrong signal at one or more tracks. The message - is continually updated. - can be ignored temporarily.	
-	Warning: AB frequency difference	Error message: Frequency difference between the proximity switches on tracks A and B The message - is continually updated - can be ignored temporarily	
-	Chip card messages		
-	Please insert SIM Card!	Appears when the device is operated without a chip card or when a defective chip card is inserted, appears again when parameters are changed. Information: The message disappears after 30 s or by pressing the rotary knob	
-	Please insert writable SIM Card!	Appears when you reply "No" to "Load SIM" and "Write Configuration to SIM"	
-	SIM: CRC: Load SIM: Default: No?	Appears when device detects a chip card with a valid configuration. -> Select whether the data on the chip card is to be transferred to the device.	- No? - Yes?

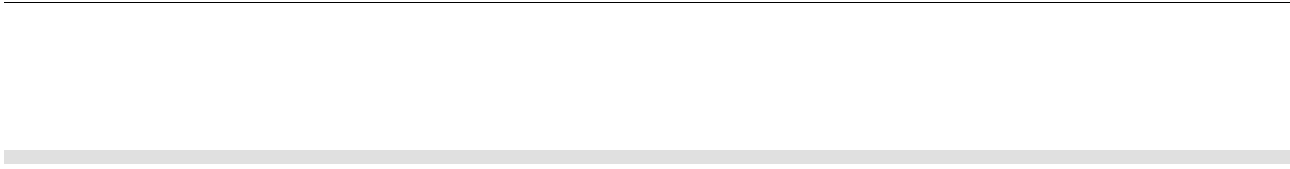
6.2 Display menu - Configuration

Level	Menu designation	Description	Display/Settings
-	Write Configuration to SIM: Default: No?	Appears - When a chip card has been used that does not yet contain data - When a chip card has been used that does not contain any valid data - When Load Sim:no? is selected -> Select whether the data on the chip card is to be saved.	- No? - Yes?
-	Password Messages		
-	Master PW required: Default: 0000	-> Enter master password	0000 ... 9999
-	Password required Default: 0000	-> Enter customer password	0000 ... 9999

6.2 Display menu - Configuration

6.2.7 Example: Configure basic configuration 2


































7.1 Display elements for device diagnostics

7.1.1 LEDs

Key:

	LED on
	LED flashes

LED						Error
Power	In1	In2	Rel 1	Rel 2	Fault	
						Supply voltage is present
						At least one of the internal supply voltages is outside the permitted range.
						A high signal is present on track A (terminal In1 or RJ45).
						Error on track In1 or A
						A high signal is present on track B (terminal In2 or RJ45).
						Error on track In2 or B
						Relay output 1 is switched on
						Error on relay output 1
						Relay output 2 is switched on
						Error on relay output 2
						Fault that can be repaired by the user leading to safe condition.
						Internal error leading to a safe condition.

7.1 Display elements for device diagnostics

7.1.2 Display

7.1.2.1 Error stack entries

Up to 20 status and error messages are stored in the unit and can be called up via the display (see section entitled "Display Menu – Configuration – Menu Overview"). They can also be called up if the error has been rectified and the unit has been restarted.

The following information is shown on the display:

- ▶ Sequential number of an error stack entry (1 ... 20).
- ▶ Error number (0 ... 65 535)
- ▶ Error category
 - Errors that can be rectified by the user are described in the following list
Remedy: Rectify error; if necessary, contact Pilz
 - Internal errors (system errors, all errors that are not described in the list)
Remedy: Switch device on and off, contact Pilz

7.1.2.2 Current error messages

If an error is detected, the "Fault" LED lights up on the device and an error message appears on the display (see error stack).

Up to 8 current error messages are shown on the display.

A message is shown until the error is rectified and the device has been switched off and then on again.

List of the errors that can be rectified by the user

Error no.	Error message	Description	Remedy
00002	Boot Session completed	The unit is ready for operation (Error stack entry)	For information only
00003	Brown Out occurred	Supply voltage too low	Check supply voltage
02000	Wrong signal line A ... /Z	Unfeasible signal from encoder	-Ensure that there is no open circuit in the wiring of input A... /Z -Ensure that the correct encoder is configured and connected -Ensure that the encoder operates correctly

7.1 Display elements for device diagnostics

Error no.	Error message	Description	Remedy
02001	AB frequency > fmax AB	The maximum frequency of the encoder at tracks AB was exceeded	-Enter a max. frequency for "Track AB fmax" that is not exceeded during normal operation -Ensure that a suitable encoder is connected
02002	A frequency > fmax AB	The maximum frequency of the proximity switch at track A was exceeded	-Enter a max. frequency for "Track AB fmax" that is not exceeded during normal operation -Ensure that a suitable proximity switch is connected
02003	B frequency > fmax AB	The maximum frequency of the proximity switch at track B was exceeded	-Enter a max. frequency for "Track AB fmax" that is not exceeded during normal operation -Ensure that a suitable proximity switch is connected
02004	Z frequency > fmax Z	The maximum frequency of the encoder at track Z was exceeded	Enter a max. frequency for "Track AB fmax" that is not exceeded during normal operation -Ensure that a suitable encoder is connected
04010	FL K1-K2 of Extens.Device	Feedback loop K1-K2 of expansion module open	Ensure that the feedback loop is wired correctly -Ensure that the expansion module operates correctly
04011	FL K3-K4 of Extens.Device	Feedback loop K3-K4 of expansion module open	-Ensure that the feedback loop is wired correctly -Ensure that the expansion module operates correctly
04012	Extension Interface open	The terminator on the expansion interface is not connected	-Connect terminator -Ensure that the expansion module operates correctly
05000	Input Device undefined!	No encoder configured (delivery condition, default values)	-Create the encoder configuration in the "Encoder settings" menu
05003	Pos. or Dir. not with Ini	Position monitoring or direction monitoring configured, although "Initiator" is selected as the encoder	-Do not configure direction or position monitoring - Select rotary encoder
10241	Stuck at High line A or /A	A high signal is always present at track A or /A.	-Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that there is no short circuit in the wiring
10242	Stuck at Low line A or /A	A low signal is always present at track A or /A.	-Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that there is no short circuit in the wiring

7.1 Display elements for device diagnostics

Error no.	Error message	Description	Remedy
10243	Stuck at High line B or /B	A high signal is always present at track B or /B.	<ul style="list-style-type: none"> -Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that there is no short circuit in the wiring
10244	Stuck at Low line B or /B	A low signal is always present at track B or /B.	<ul style="list-style-type: none"> -Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that there is no short circuit in the wiring
10245	Signal Offset line A	The signal at track A has a DC offset	<ul style="list-style-type: none"> -Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that the wiring is correct
10246	Signal Offset line /A	The signal at track /A has a DC offset	<ul style="list-style-type: none"> -Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that the wiring is correct
10247	Signal Offset line B	The signal at track B has a DC offset	<ul style="list-style-type: none"> -Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that the wiring is correct
10248	Signal Offset line /B	The signal at track /B has a DC offset	<ul style="list-style-type: none"> -Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that the wiring is correct
10249	Signal Error AB: Sin2 Cos2	No feasible signal at the tracks AB	<ul style="list-style-type: none"> -Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that the wiring is correct -Check supply voltage.
10250	Difference-Signal Error	No feasible signal at the tracks A and /A or B and /B	<ul style="list-style-type: none"> -Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that the wiring is correct
10251	Z index missing	No index signal at track Z	<ul style="list-style-type: none"> -Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that the wiring is correct -Check the configuration of the frequency ratio fAB to fZ

7.1 Display elements for device diagnostics

Error no.	Error message	Description	Remedy
10252	Z index at wrong posit.	No feasible signal at track Z	<ul style="list-style-type: none"> -Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that the wiring is correct -Check the configuration of the frequency ratio fAB to fZ
10255	Signal on inverted line	The inverted tracks carry a voltage signal Target status: no signal (not connected)	<ul style="list-style-type: none"> -Ensure that the encoders are configured correctly -Ensure that the wiring is correct
10256	Ini pnp pnp both inactive	Both proximity switches are inactive at the same time	<ul style="list-style-type: none"> -Install proximity switches such that one proximity switch is always activated. -Ensure that the encoders are configured correctly -Ensure that the proximity switches operate correctly -Ensure that the supply voltage is present at the proximity switches Ensure that proximity switches are wired correctly
10257	Ini npn npn both inactive	Both proximity switches are inactive at the same time	<ul style="list-style-type: none"> -Install proximity switches such that one proximity switch is always activated. -Ensure that the encoders are configured correctly -Ensure that the proximity switches operate correctly -Ensure that the supply voltage is present at the proximity switches Ensure that proximity switches are wired correctly
10258	Ini pnp npn both inactive	Both proximity switches are inactive at the same time	<ul style="list-style-type: none"> -Install proximity switches such that one proximity switch is always activated. -Ensure that the encoders are configured correctly -Ensure that the proximity switches operate correctly -Ensure that the supply voltage is present at the proximity switches Ensure that the proximity switches are wired correctly
10259	Ini npn pnp both inactive	Both proximity switches are inactive at the same time	<ul style="list-style-type: none"> -Install proximity switches such that one proximity switch is always activated. -Ensure that the encoders are configured correctly -Ensure that the proximity switches operate correctly -Ensure that the supply voltage is present at the proximity switches Ensure that the proximity switches are wired correctly

7.1 Display elements for device diagnostics

Error no.	Error message	Description	Remedy
10260	Ini Signal /A not allowed	Invalid signal at track /A	-Ensure that the encoders are configured correctly -Ensure that the wiring is correct
10261	Ini Signal /B not allowed	Invalid signal at track /B	-Ensure that the encoders are configured correctly -Ensure that the wiring is correct
10262	Ini Signal A not valid	The signal at track A is outside of the permissible voltage range	-Ensure that the encoders are configured correctly -Ensure that the wiring is correct
10263	Ini Signal B not valid	The signal at track B is outside of the permissible voltage range	-Ensure that the encoders are configured correctly -Ensure that the wiring is correct
10264	Track S Error wrong voltage	The voltage at track S is outside of the permissible range (e.g. because the encoder has detected an internal error and signals this via track S)	-Check supply voltage of the encoders -Ensure that the wiring is correct -Check configuration of the min. and max. voltage at track S "Track S Umax / Umin" -Ensure that the encoder operates correctly
10266	Stuck at High line Z or /Z	A high signal is always present at track Z or /Z.	-Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that there is no short circuit in the wiring
10267	Stuck at Low line Z or /Z	A low signal is always present at track Z or /Z.	-Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that there is no short circuit in the wiring
10268	Signal Error line A or B	No feasible signal at the tracks AB	-Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that the wiring is correct -Check supply voltage.
10269	Signal Error line /A or /B	No feasible signal at the tracks /A/B	-Ensure that the encoders are configured correctly -Ensure that the encoder operates correctly -Ensure that the wiring is correct -Check supply voltage.

7.1 Display elements for device diagnostics

7.1.2.3 Open circuit message

If an open circuit error is detected, the "Fault" LED lights up on the device, the outputs are switched off and an error message appears on the display.

The error message is continually updated. It will be displayed until the error is rectified.

The outputs will not switch back on until all the start-up conditions are met.

Error message	Description	Remedy
Error Signal: A/A B/B Z/Z	No feasible signal at one or more tracks	<ul style="list-style-type: none"> - Ensure that there is no open circuit in the wiring of tracks A... /Z - Ensure that the correct encoder is configured and connected - Ensure that the encoder operates correctly.

7.1.2.4 Frequency difference message

If a frequency difference error is detected, the "Fault" LED lights up on the device, all outputs are switched off and an error message appears on the display.

Once the error has been rectified, the behaviour of the error message will depend on the frequency at which the error occurred:

- ▶ Frequency < Configured standstill frequency:
The error message be displayed until the error is rectified.
- ▶ Frequency > Configured standstill frequency:
The error message be displayed until the error is rectified and a rising edge is detected at reset input S34.

The outputs will not switch back on until all the start-up conditions are met.

Error message	Description	Remedy
Warning: AB frequency difference	Frequency of the proximity switch at track A differs from the frequency of the proximity switch at track B for too long and by too much.	<ul style="list-style-type: none"> -Ensure that the proximity switches operate correctly - Check whether a proximity switch constantly switches due to the drive's edge jitter.

8.1 Technical details

Technical details	
Electrical data	
Supply voltage	
Supply voltage U_B AC/DC	24 - 240 V
Voltage tolerance	-15 %/+10 %
Power consumption at U_B AC	9.0 VA
Power consumption at U_B DC	5.5 W
Frequency range AC	50 - 60 Hz
Residual ripple DC	160 %
Continuous duty	100 %
Voltage and current at	
Reset circuit DC: 24.0 V	5.0 mA
Feedback loop DC: 24.0 V	5.0 mA
Max. inrush current impulse	
	0.06 A
Feedback loop	0.06 A
Min. unit fuse protection	1.00 A
Max. unit fuse protection F1	Max. cable cross section
Proximity switch input	
Number of inputs	2
Input signal level	
Signal level at "1"	11 - 30 V
Signal level at "0"	-3 - 5 V
Input resistance	22 kOhm
Input's frequency range	0 - 1,000 kHz
Configurable monitoring frequency without hysteresis	10 mHz - 1,000 kHz
Input for incremental encoder/proximity switch (RJ45 connector)	
Number of inputs	1
Input signal level	0.5 - 30.0 V_{ss}
Phase position for the differential signals A ₁ /A ₂ and B ₁ /B ₂	90° ±30°
Overload protection	-50 - 65 V
Input resistance	20.0 kOhm
Input's frequency range	0 - 1,000 kHz
Configurable monitoring frequency without hysteresis	10 mHz - 1,000 kHz
Connection type (incremental encoder)	RJ45 socket, 8-pin
Select inputs	
Number of inputs	4
Input signal level	
Signal level at "1"	15 - 30 V
Signal level at "0"	-3 - 5 V
Input current	5 mA
Semiconductor outputs	
Number	4
Semiconductor outputs (short circuit proof)	24.0 V DC, 50 mA
External supply voltage	24.0 V DC
Voltage tolerance	-20% / +20%

8.1 Technical details

Relay outputs

Number of output contacts	
Safety contacts (S) instantaneous:	2
Auxiliary contacts (N/C):	2
Utilisation category in accordance with EN 60947-4-1	
Safety contacts: AC1 at 240 V	I_{\min} : 0.01 A , I_{\max} : 4.0 A P_{\max} : 1000 VA
Safety contacts: DC1 at 24 V	I_{\min} : 0.01 A , I_{\max} : 4.0 A P_{\max} : 100 W
Auxiliary contacts: AC1 at 240 V	I_{\min} : 0.01 A , I_{\max} : 4.0 A P_{\max} : 1000 VA
Auxiliary contacts: DC1 at 24 V	I_{\min} : 0.01 A , I_{\max} : 4.0 A P_{\max} : 100 W
Utilisation category in accordance with EN 60947-5-1	
Safety contacts: AC15 at 230 V	I_{\max} : 3.0 A
Safety contacts: DC13 at 24 V (6 cycles/min)	I_{\max} : 4.0 A
Auxiliary contacts: AC15 at 230 V	I_{\max} : 3.0 A
Auxiliary contacts: DC13 at 24 V (6 cycles/min)	I_{\max} : 4.0 A
Conventional thermal current	4.0 A
Contact material	AgCuNi + 0.2 μm Au
External contact fuse protection ($I_K = 1$ kA) to EN 60947-5-1	
Blow-out fuse, quick	
Safety contacts:	6 A
Auxiliary contacts:	6 A
Blow-out fuse, slow	
Safety contacts:	4 A
Auxiliary contacts:	4 A
Circuit breaker 24 VAC/DC, characteristic B/C	
Safety contacts:	4 A
Auxiliary contacts:	4 A
Times	
Switch-on delay	
with automatic reset typ.	15 ms
with automatic reset max.	50 ms
with automatic reset after power on typ.	3,920 ms
with automatic reset after power on max.	4 s
with manual reset typ.	40 ms
with manual reset max.	100 ms
Delay-on de-energisation	
with power failure typ. U_B AC/DC: 24 V	25 ms
with power failure max. U_B AC/DC: 24 V	50 ms
with power failure typ. U_B AC : 240 V	100 ms
with power failure max. U_B AC : 240 V	150 ms
after the safety function is triggered, typ.	8 ms
after the safety function is triggered, max.	15 ms
Recovery time at max. switching frequency 1/s	
after power failure	4 s
after the safety function is triggered	1 s
Reaction time after limit value is exceeded	1/f
Waiting period with a monitored reset	
with rising edge	30 ms
with falling edge	30 ms

8.1 Technical details

Times	
Min. start pulse duration with a monitored reset	
with rising edge	30 ms
with falling edge	30 ms
Supply interruption before de-energisation	20 ms
Switch delay (selectable)	0 - 30 s
Delay on the select inputs (selectable)	0 - 30 s
Start-up delay (selectable)	0 - 600 s
Environmental data	
EMC	EN 60947-5-1, EN 61000-6-2, EN 61000-6-3
Vibration to EN 60068-2-6	
Frequency	10 - 55 Hz
Amplitude	0.35 mm
Climatic suitability	EN 60068-2-78
Airgap creepage in accordance with EN 60947-1	
Pollution degree	2
Overvoltage category	II
Rated insulation voltage	250 V
Rated impulse withstand voltage	4.00 kV
Ambient temperature	-20 - 55 °C
Storage temperature	-40 - 85 °C
Protection type	
Mounting (e.g. cabinet)	IP54
Housing	IP30
Terminals	IP20
Mechanical data	
Housing material	
Housing	PC
Front	PC
Cross section of external conductors with screw terminals	
1 core flexible	0.25 - 2.50 mm² , 24 - 12 AWG No. 750330
2 core, same cross section, flexible:	
with crimp connectors, without insulating sleeve	0.25 - 1.00 mm² , 24 - 16 AWG No. 750330
without crimp connectors or with TWIN crimp connectors	0.20 - 1.50 mm² , 24 - 16 AWG No. 750330
Torque setting with screw terminals	0.50 Nm No. 750330
Connection type	spring-loaded terminal No. 751330 screw terminal No. 750330
Spring-loaded terminals: Terminal points per connection	2 No. 751330
Stripping length	9 mm No. 751330
Dimensions	
Height	100.0 mm No. 751330 98.0 mm No. 750330
Width	45.0 mm
Depth	120.0 mm
Weight	410 g No. 751330 427 g No. 750330

No. stands for order number.

8.1 Technical details

Safety characteristic data						
Unit	Operating mode	EN ISO 13849-1: 2006 PL	EN 954-1 Category	EN IEC 62061 SIL CL	PFH [1/h]	EN ISO 13849-1: 2006 T _M [year]
PNOZ s30	Monitoring 1 input device	PL d (Cat. 2)	Cat. 2	SIL CL 2	3.28E-08	20
PNOZ s30	Monitoring 2 input devices	PL e (Cat. 3)	Cat. 3	SIL CL 3	1.50E-08	20

All the units used within a safety function must be considered when calculating the safety characteristic data.



INFORMATION

A safety function's SIL/PL values are **not** identical to the SIL/PL values of the units that are used and may be different. We recommend that you use the PASCAL software tool to calculate the safety function's SIL/PL values.

The standards current on **2009-06** apply.



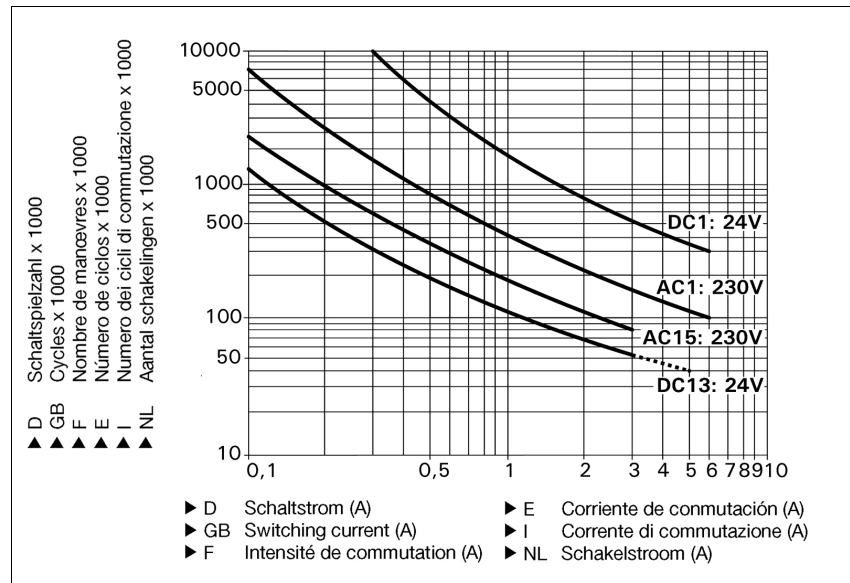
CAUTION!

It is essential to consider the relay's service life graphs. The relay outputs' safety-related characteristic data is only valid if the values in the service life graphs are met.

The PFH value depends on the switching frequency and the load on the relay output. If the service life graphs are not accessible, the stated PFH value can be used irrespective of the switching frequency and the load, as the PFH value already considers the relay's B10d value as well as the failure rates of the other components.

8.2 Service life graph of output relays

The service life graphs indicate the number of cycles from which failures due to wear must be expected. The wear is mainly caused by the electrical load; the mechanical load is negligible.



Example

- ▶ Inductive load: 0,2 A
- ▶ Utilisation category: AC15
- ▶ Contact service life: 1,000,000 cycles

Provided the application requires fewer than 1,000,000 cycles, the PFH value (see technical details) can be used in the calculation.

To increase the service life, sufficient spark suppression must be provided on all output contacts. With capacitive loads, any power surges that occur must be noted. With contactors, use freewheel diodes for spark suppression.

8.3 Categories

8.3.1 Safety level

The maximum achievable safety level depends on the encoder, the wiring and the operating mode of the PNOZ s30.



INFORMATION

The safety-related characteristic data of the PNOZ s30 and all other devices that are used must be taken into account when calculating the safety level. We recommend that you use the PAScal software tool to calculate the safety function's SIL/PL values.

The safety assessments below only consider the sensor subsystems and PNOZ s30. The actuator subsystem depends on the application and must also be considered in the overall assessment.

Forced dynamisation:

Within an 8-hour period, the monitored sensors must be moved so that the signal changes on all the connected tracks.

Unless stated otherwise, the safety-related characteristic data applies when using the following monitoring functions:

- ▶ Standstill
- ▶ Overspeed
- ▶ Direction of rotation

Key:

SRP/CS = Safety-related part of a control system (EN 13849-1, Tab. 2)

8.3 Categories

8.3.2 Standard rotary encoder

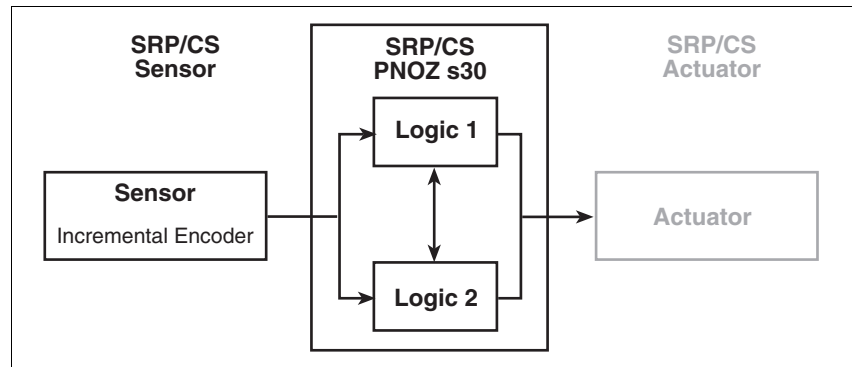
Max. achievable safety-related characteristic data

- ▶ In accordance with EN ISO 13849-1: 2006: PL c (Cat. 1)
- ▶ In accordance with EN IEC 62061: -

Permitted encoder types:

- ▶ Standard rotary encoder
 - sin/cos 1 Vss differential
 - TTL single ended / differential
 - HTL single ended / differential

Safety-related architecture



To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor subsystem		Subsystem PNOZ s30	
MTTF	DC	Operating mode	PFH [1/h]
MTTF (100 % dangerous failures)	0 %	Monitoring 1 encoder	3,28E-08

Recommended values for the sensor, depending on the PL and SIL CL values:

MTTF (year)	PL in accordance with EN ISO 13849-1: 2006	SIL CL in accordance with EN IEC 62061
>100	PL c (Cat. 1)	-

The characteristic data only applies if the rotary encoders are assessed as "well-tried".

8.3 Categories

8.3.3 Standard rotary encoder with additional diagnostics through the drive controller

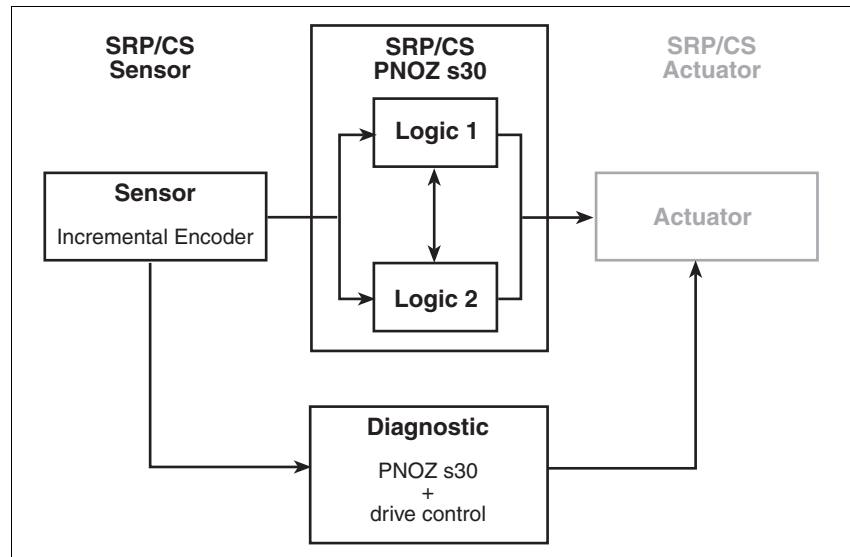
Max. achievable safety-related characteristic data

- ▶ In accordance with EN ISO 13849-1: 2006: PL d (Cat 2.)
- ▶ In accordance with EN IEC 62061: SIL CL 2

Permitted encoder type:

- ▶ Standard rotary encoder
 - sin/cos 1 Vss differential

Safety-related architecture



To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor subsystem		Subsystem PNOZ s30	
MTTF	DC	Operating mode	PFH [1/h]
MTTF (100% dangerous failures)	60 %	Monitoring 1 encoder	3,28E-08

Recommended MTTF values, depending on the PL and SIL CL values:

MTTF (year)	PL in accordance with EN ISO 13849-1: 2006	SIL CL in accordance with EN IEC 62061
>100	PL d (Cat. 2)	SIL CL 2
>75	PL c (Cat. 2)	
>30		SIL CL 1

8.3 Categories

The drive controller must meet the following requirements:

- ▶ Parameters for the control loops and motor control must be set in such a way as to guarantee stable operation.
Drag error detection (see below) must be capable of operating in accordance with the requirements of the safety function.
The motor must be operated with a current impressing control procedure, based on the rotor position (field-oriented control).
- ▶ The drive controller must be in position control operating mode.
- ▶ If a maximum error variable is exceeded (set/true comparison) the drive controller must switch to a fault condition and stop the drive (drag error detection). The error reaction to drag error detection should be a controlled motor stop.
- ▶ Fault detection via the error variable with subsequent shutdown must meet the requirements of the safety function, with regard to reaction times for example.
- ▶ The drive controller must evaluate the same incremental/sincos signals from the encoder for control as are processed by the safe evaluation device (important on encoders with combined analogue/digital interface).

8.3 Categories

8.3.4 Safe rotary encoder

Max. achievable safety-related characteristic data

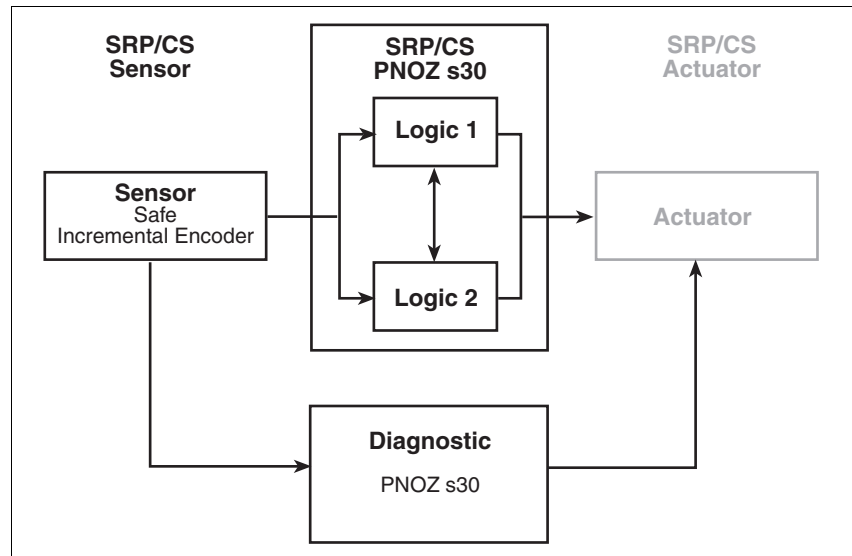
- ▶ In accordance with EN ISO 13849-1: 2006: PL d (Cat 2.)
- ▶ In accordance with EN IEC 62061: SIL CL 2

Permitted encoder type:

- ▶ Safe incremental encoder
 - sin/cos 1 Vss differential

Safe encoders are certified in accordance with EN 61508, EN 13849 and EN 62061. Certain external errors must be detected in order to implement the safety function. The encoder and evaluation device must be compatible.

Safety-related architecture



To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor subsystem			Subsystem PNOZ s30		
EN ISO 13849-1 PL	PFH [1/h]	DC	Operating mode	EN ISO 13849-1 PL	PFH [1/h]
See manufacturer		90 %	Monitoring 1 encoder	PL d (Cat. 2)	3,28E-08

8.3 Categories

8.3.5 Standard rotary encoder and proximity switch

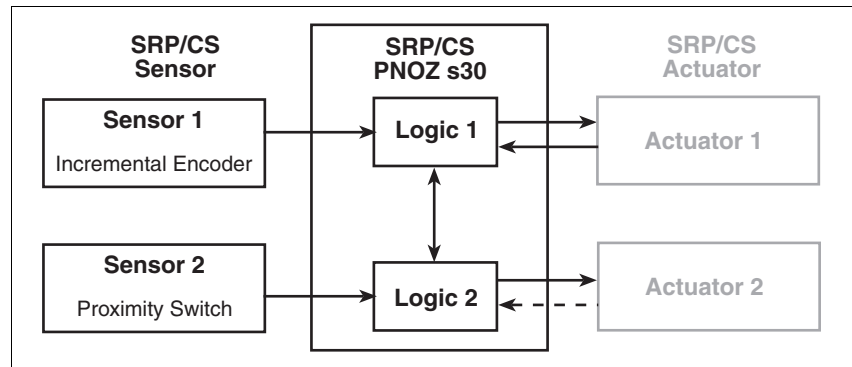
Max. achievable safety-related characteristic data

- ▶ In accordance with EN ISO 13849-1: 2006: PL e (Cat. 3)
- ▶ In accordance with EN IEC 62061: SIL CL 3

Permitted encoder types:

- ▶ Standard rotary encoder + proximity switch
 - sin/cos 1 Vss + pnp
 - TTL + pnp
 - HTL + pnp

Safety-related architecture



To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor subsystem		Subsystem PNOZ s30	
MTTF	DC	Operating mode	PFH [1/h]
MTTF (100 % dangerous failures)	90 %	Monitoring 2 encoders	1,50E-08

Recommended MTTF values, depending on the PL and SIL CL values:

MTTF (year)	PL in accordance with EN ISO 13849-1: 2006	SIL CL in accordance with EN IEC 62061
>100	PL e (Cat. 3)	SIL CL 3
>62	PL d (Cat. 3)	SIL CL 2

The characteristic data only applies for the following monitoring functions:

- ▶ Standstill
- ▶ Overspeed

8.3 Categories

8.3.6 2 proximity switches

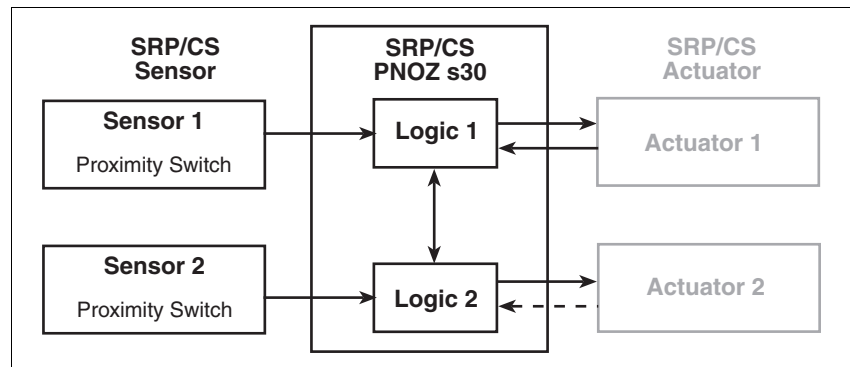
Max. achievable safety-related characteristic data

- ▶ In accordance with EN ISO 13849-1: 2006: PL e (Cat. 3)
- ▶ In accordance with EN IEC 62061: SIL CL 3

Permitted encoder types:

- ▶ Proximity switches
 - npn + npn
 - npn + pnp
 - pnp + npn
 - pnp + pnp

Safety-related architecture



To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor subsystem		Subsystem PNOZ s30	
MTTF	DC	Operating mode	PFH [1/h]
MTTF (100 % dangerous failures)	90 %	Monitoring 2 encoders	1,50E-08

Recommended MTTF values, depending on the PL and SIL CL values:

MTTF (year)	PL in accordance with EN ISO 13849-1: 2006	SIL CL in accordance with EN IEC 62061
>100	PL e (Cat. 3)	SIL CL 3
>62	PL d (Cat. 3)	SIL CL 2

8.3 Categories

The characteristic data only applies

- ▶ When using the monitoring functions
 - Standstill
 - Overspeed
- ▶ When measures are taken against common cause failures:
 - Use of different technology/design or physical principles of sensors 1 and 2, e.g. different manufacturers
 - Evaluation of the encoder supply via track S

If these conditions are not fulfilled, the requirements for Categories 2...4 in accordance with EN ISO 13849-1 are not met.

According to the standard, proximity switches are not well-tried components (necessary for Category 1), so classification to Category B / PL b is all that's possible in this case.

8.3 Categories

8.3.7 Safe rotary encoder with Z index

Max. achievable safety-related characteristic data

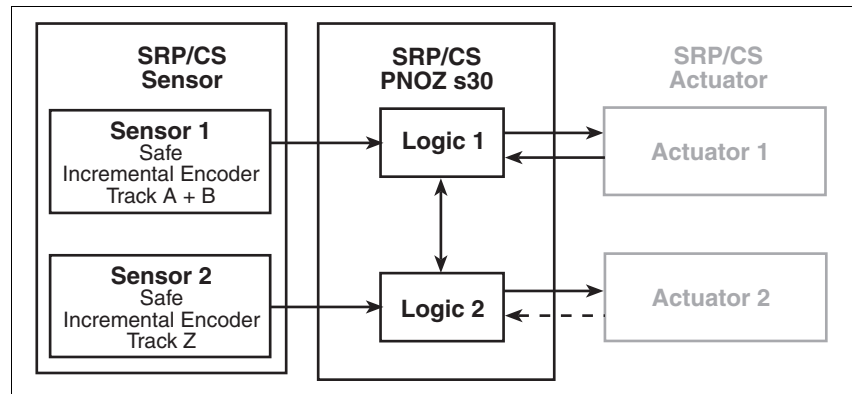
- ▶ In accordance with EN ISO 13849-1: 2006: PL e (Cat. 3)
- ▶ In accordance with EN IEC 62061: SIL CL 3

Permitted encoder type:

- ▶ Safe incremental encoder
 - sin/cos 1 Vss differential

Safe encoders are certified in accordance with EN 61508, EN 13849 and EN 62061. Certain external errors must be detected in order to implement the safety function. The encoder and evaluation device must be compatible.

Safety-related architecture



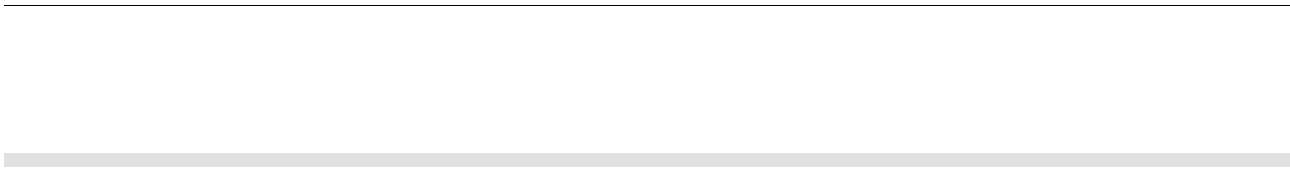
To calculate the safety function you will need the following data for the "sensor" subsystem and "PNOZ s30" subsystem:

Sensor subsystem			Subsystem PNOZ s30		
EN ISO 13849-1 PL	PFH [1/h]	DC	Operating mode	EN ISO 13849-1 PL	PFH [1/h]
See manufacturer		99 %	Monitoring 2 encoders	PL e (Cat. 3)	1,50E-08

8.4 Order reference

Order reference			
Type	Features	Terminals	Order no.
PNOZ s30	24 - 240 VAC/DC	With screw terminals	750 330
PNOZ s30 C	24 - 240 VAC/DC	With spring-loaded terminals	751 330

Order reference: Accessories			
Type	Features		Order no.
PNOZ s terminator plug	Terminator	10 pieces	750 010
PNOZmulti Chipcard	Chip card	8 kB	779 201
PNOZmulti Chipcard Set	Chip card	8 kB	10 pieces 779 200
PNOZmulti Chipcard	Chip card	32 kB	779 211
PNOZmulti Chipcard Set	Chip card	32 kB	10 pieces 779 212
Chipcard Holder	Chip card holder		779 240
PNOZmulti Seal	Chip card seal	10 pieces	779 250
PNOZ s Set3 Screw Loaded Terminals	Set of plug-in screw terminals	1 piece	750 014
PNOZ s Set3 Spring Loaded Terminals	Set of plug-in spring-loaded terminals	1 piece	751 014



9.1 Connection of proximity switch

9.1.1 Features

PNOZ s30

- ▶ Standstill monitoring for enabling the safety gate via Rel. 1:
Standstill is detected at ≤ 2 Hz, the output Rel. 1 switches on and the safety gate can be released with the pushbutton S3.
- ▶ Monitoring for overspeed via Rel. 2:
Overspeed is detected at ≥ 500 Hz and the output Rel. 2 switches off.
- ▶ Feedback loop monitoring for Rel.1 via feedback loop input Y1,
Feedback loop monitoring for Rel.2 via feedback loop input Y2
- ▶ Automatic reset

Encoder

The measured values are detected by two proximity switches (pnp).

PNOZ s4

- ▶ Safety gate monitoring

9.1 Connection of proximity switch

9.1.2 Configuration overview

Speed Monitor Configuration

Delay Time Start-up
(0 ... 600 s)

Units

Conversion Units
(1 - 10.000.000 Imp)

Select Inputs

SEL 1 (Y10)

SEL 2 (Y11)

SEL 4 (Y12)

SEL 8 (Y13)

Delay
Select Inputs
(0 ... 30 s)

Assign Outputs Functions

Delay Time Effect Outputs

Delay Time (0 ... 30 s) Outputs

Reset Mode

Output Logic Semiconductor Outputs

Switching Functions
(Standstill, 10 mHz ... 1 MHz, Position 1 ... Position 4, Left, Right)

Hysteresis (0 ... 50 %)

	F1	F2	F3	F4	F5	F6	F7	F8	F9
P0									
P1	2 Hz	50 Hz	50 Hz						
P2	2 Hz	3 kHz	2.8 kHz						
P3									
P4									
P5									
P6									
P7									
P8									
P9									
P10									
P11									
P12									
P13									
P14									
P15									

Outputs

	Rel. 1 (13/14)	Rel. 2 (23/24)	Ext. 1	Ext. 2	Out 1 (Y32)	Out 2 (Y33)	Out 3 (Y34)	Out 4 (Y35)
F1								
F2								
F3								
F4								
F5								
F6								
F7								
F8								
F9								

Stillstand:
(10 mHz ... 1 MHz)

Position Window Width
(1 ... 24.900.000 Imp)

Position 1

Position 2

Position 3

Position 4

Tolerance Incorrect Direction of Rotation
max. wrong
(0 ... 24.900.000 Imp)

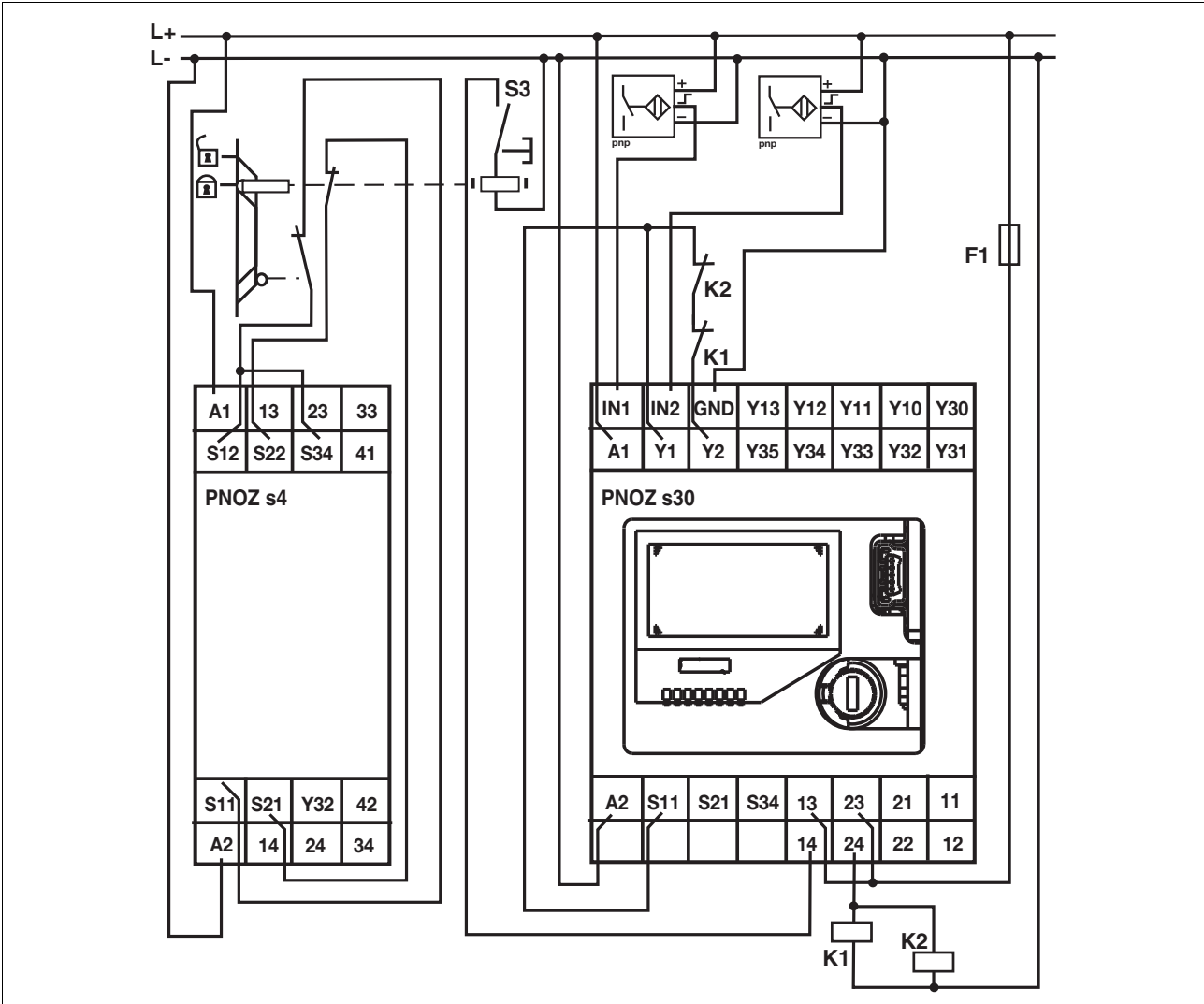
Anti-Clockwise/Clockwise operation:

Direct. Left max. right

Direct. right max. left

9.1 Connection of proximity switch

9.1.3 Connection



9.2 Incremental encoder connection

9.2.1 Features

PNOZ s30

- ▶ Speed monitoring:
Monitoring for overspeed for the operating modes "Setup" and "Automatic", which are selected with the switch S1.
 - The operating mode "Setup" is selected if the select input SEL1 is activated. Overspeed is detected during setup at ≥ 50 Hz and the output Rel. 2 switches off.
 - The operating mode "Automatic" is selected if the select input SEL2 is activated. Overspeed is detected during automatic mode at ≥ 3000 Hz and the output Rel. 2 switches off.
 - If a speed of 2800 Hz is exceeded, the semiconductor output Out1 switches in automatic mode and a message (advance warning) is output via the PLC.
- ▶ Standstill monitoring:
Standstill is detected at ≤ 2 Hz for both operating modes and the output Rel. 1 switches on.
- ▶ Feedback loop monitoring via feedback inputs Y1 and Y2

Encoder:

The measured values are detected by an incremental encoder (sin/cos)

9.2 Incremental encoder connection

9.2.2 Configuration overview

Speed Monitor Configuration

Delay Time Start-up
(0 ... 600 s)

Units

Conversion Units
(1 - 10.000.000 Imp)

Select Inputs

- SEL 1 (Y10)
- SEL 2 (Y11)
- SEL 4 (Y12)
- SEL 8 (Y13)

Delay Select Inputs
(0 ... 30 s)

Assign Outputs Functions

Delay Time Effect Outputs

Delay Time (0 ... 30 s) Outputs

Reset Mode

Output Logic Semiconductor Outputs

Switching Functions
(Standstill, 10 mHz ... 1 MHz, Position 1 ... Position 4, Left, Right)

Hysteresis (0 ... 50%)

	F1	F2	F3	F4	F5	F6	F7	F8	F9
P0									
P1	2 Hz	50 Hz	50 Hz						
P2	2 Hz	3 kHz	2.8 kHz						
P3									
P4									
P5									
P6									
P7									
P8									
P9									
P10									
P11									
P12									
P13									
P14									
P15									

Outputs

Rel. 1 (13/14)	Rel. 2 (23/24)	Ext. 1	Ext. 2	Out 1 (Y32)	Out 2 (Y33)	Out 3 (Y34)	Out 4 (Y35)
F1	F2						
Automatic	Automatic			Automatic			
				Normal. Off			

Stillstand:
(10 mHz ... 1 MHz)

Position Window Width
(1 ... 24.900.000 Imp)

Position 1

Position 2

Position 3

Position 4

Tolerance Incorrect Direction of Rotation
max. wrong (0 ... 24.900.000 Imp)

Anti-Clockwise/Clockwise operation:

Direct. Left

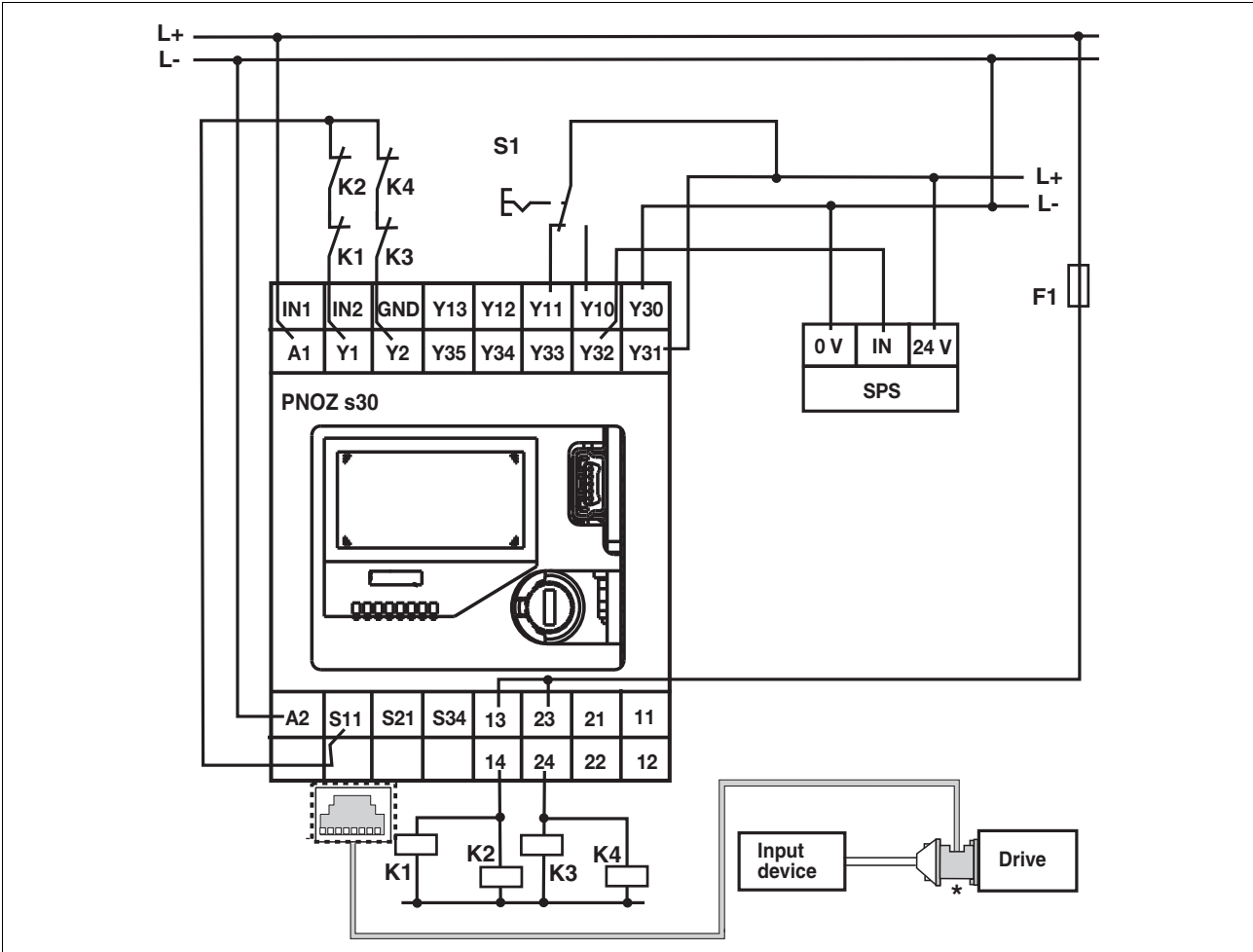
max. right

Direct. right

max. left

9.2 Incremental encoder connection

9.2.3 Connection



* The PNOZ msi adapters are available from Pilz as accessories



► ...
In many countries we are represented by our subsidiaries and sales partners.

Please refer to our homepage for further details or contact our headquarters.

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