Up to PL e of EN ISO 13849-1
PNOZ s30

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

Approvals

	PNOZ s30
c UL us LISTED	◆
TÜV	◆
CCC	◆

Unit 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
- See order reference for unit types

Unit description

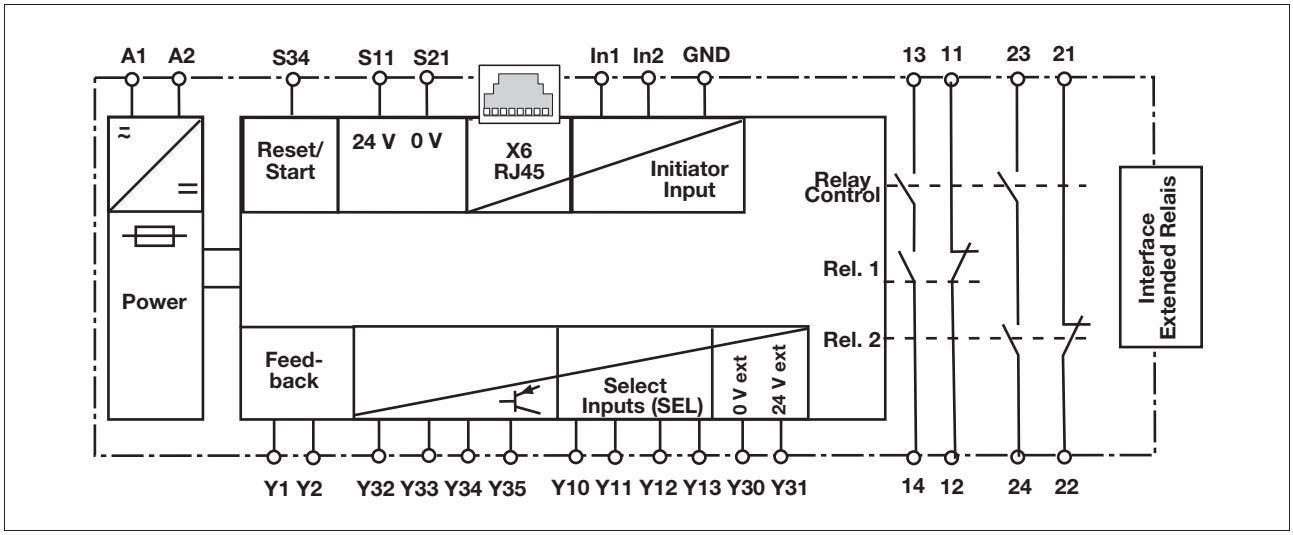
The speed monitor monitors standstill, speed, speed range, position and direction in accordance with
EN ISO 13849-1 up to PL e and
EN IEC 62061 up to SIL CL 3.

Safety features

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.

Block diagram



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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.

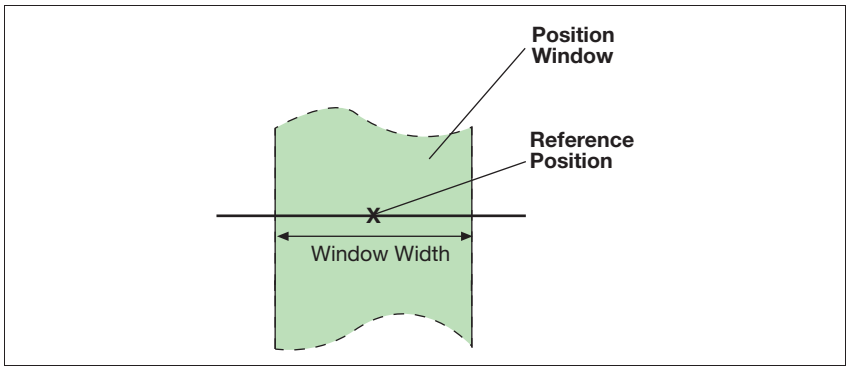
Function description

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.

Monitoring 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.



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

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.

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").

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.

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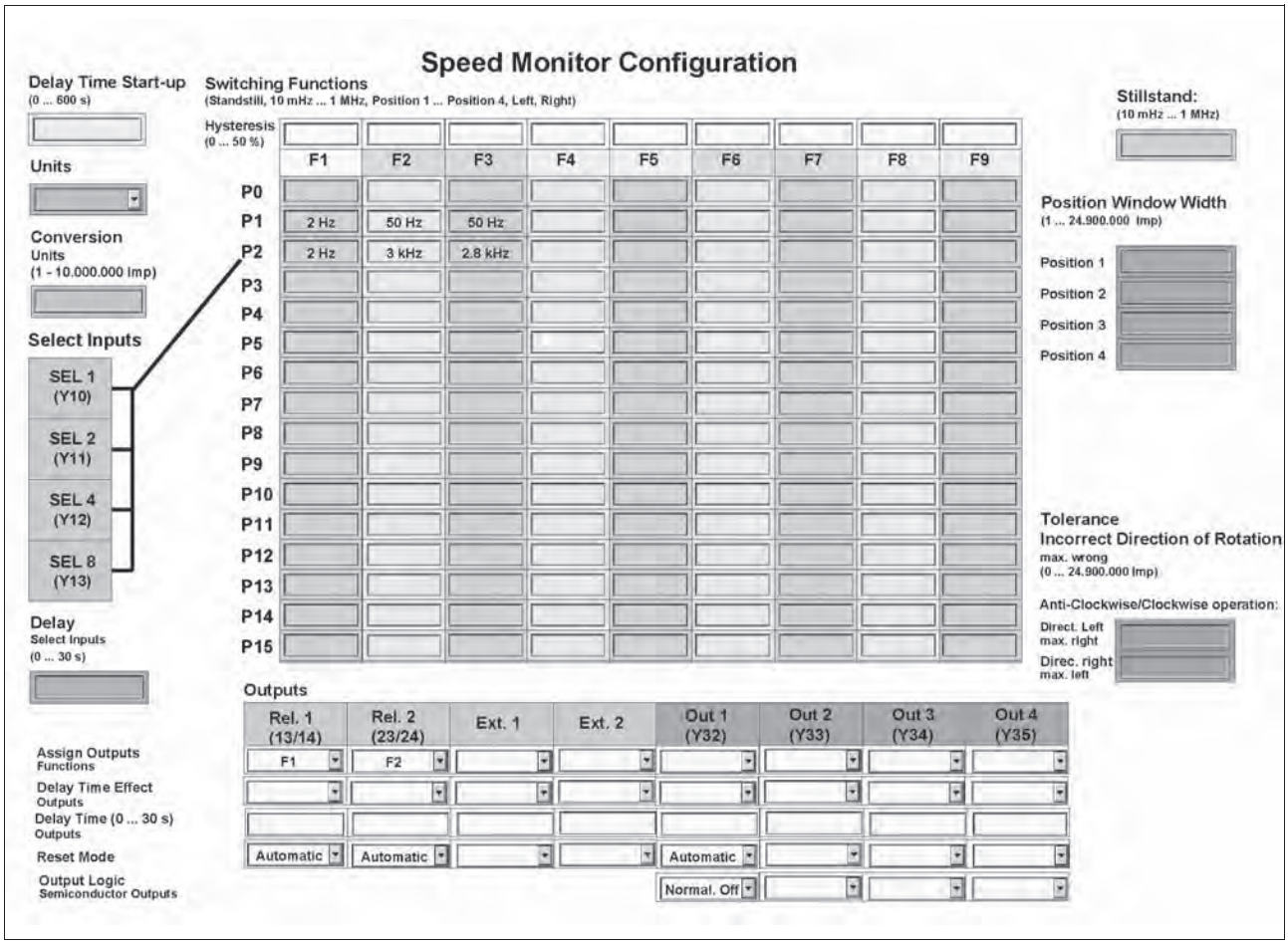
INFORMATION
2 basic configurations are available for standard applications, for simple configuration within the display menu. A basic configuration contains limited menu functions adapted for standard applications, with partly pre-defined parameters. Further information about basic configurations can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

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



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).

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.

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

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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.

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.

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
    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.

Chip card

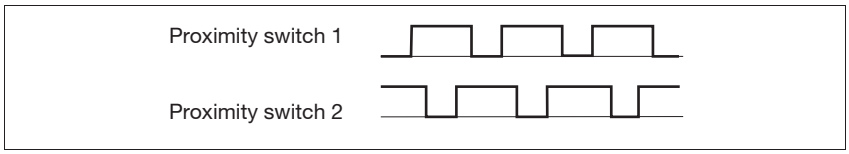
The set parameters, the name of the configuration and the passwords are stored on the chip card (see section entitled "Using the chip card").

Integrated protection mechanisms

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.

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").

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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

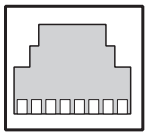
Adapter for incremental encoders

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.

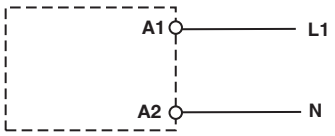
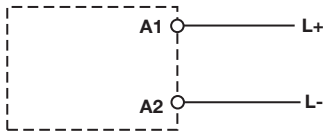
Wiring

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.

Pin assignment of the RJ45 female connector

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

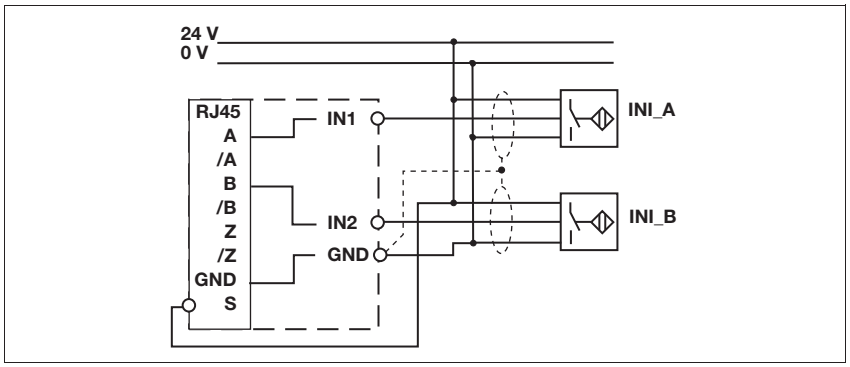
Supply voltage

Supply voltage	AC	DC
		

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.



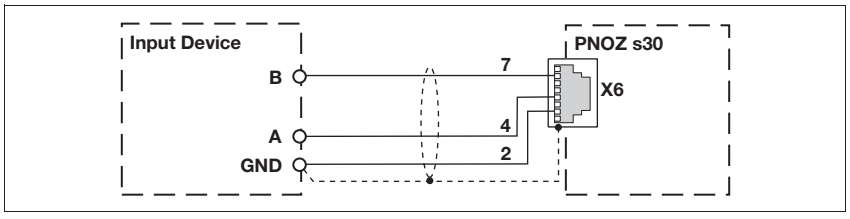
Connection of a rotary encoder

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.

Connect rotary encoder to speed monitor

Encoder types:
- TTL single ended
- HTL single ended

Please note:
- Tracks /A and /B must remain free



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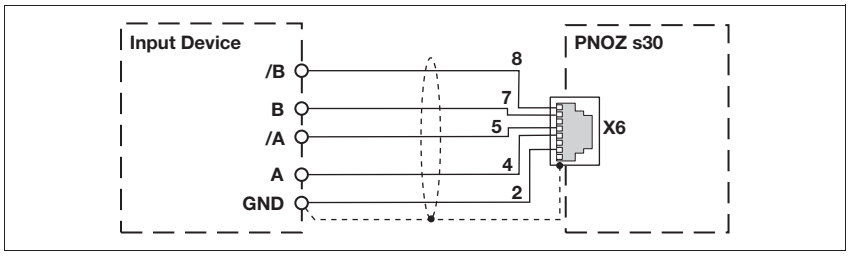
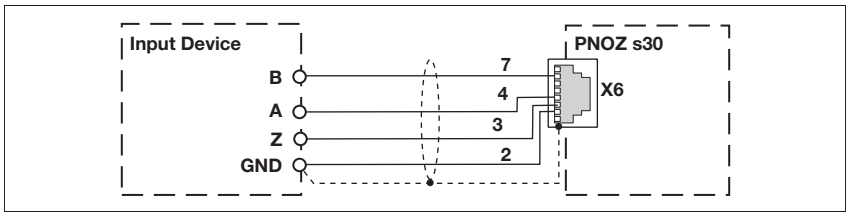
Encoder types:
- TTL differential
- HTL differential
- sin/cos 1 Vss
- Hiperface



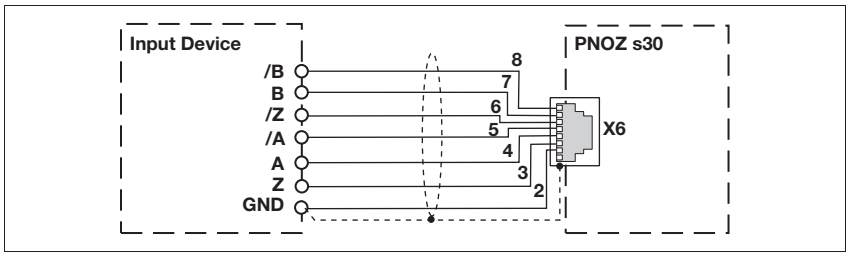
Connect rotary encoder with Z index to speed monitor

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



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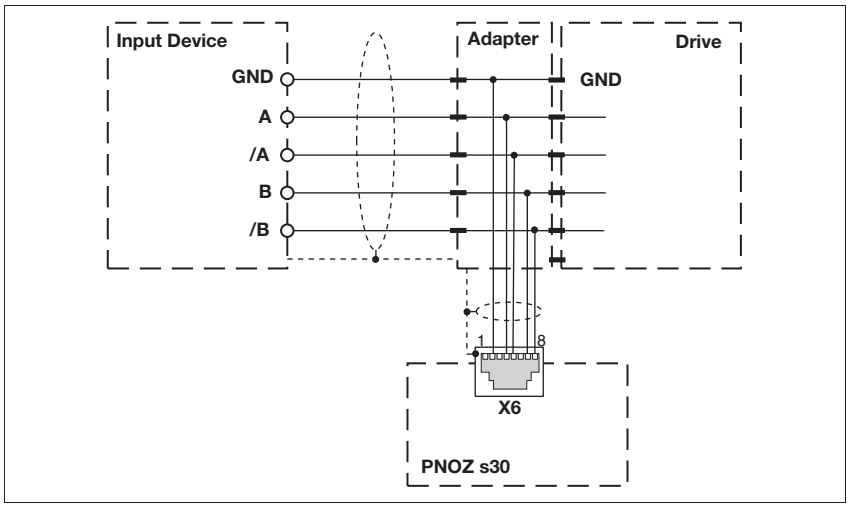
Connect rotary encoder to the speed monitor via an adapter

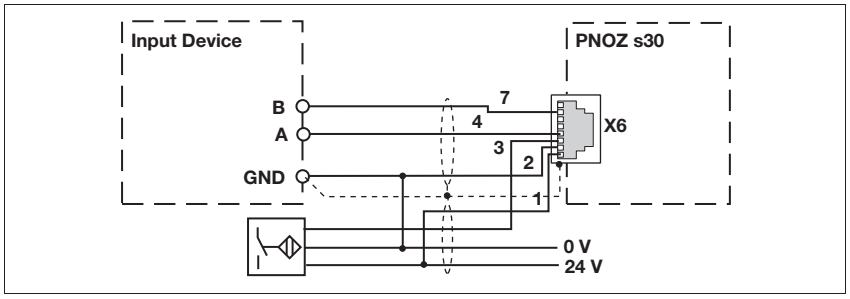
The adapter (e.g. PNOZ msi6p) is connected between the rotary encoder and the drive. The output on the adapter is connected to the RJ45 socket on the speed monitor.



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.



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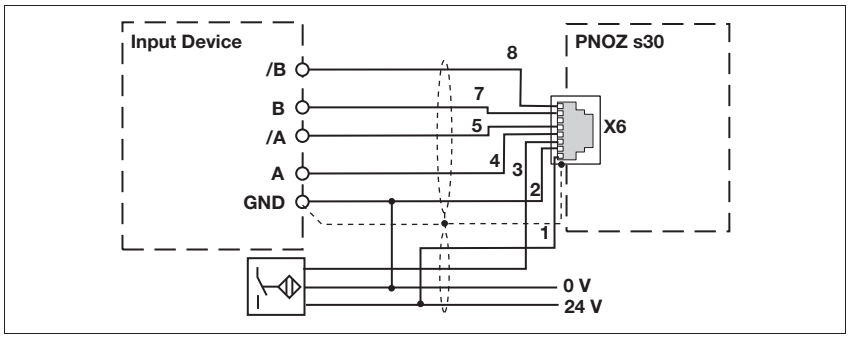
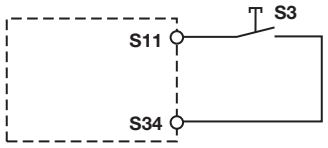
Encoder types:
- TTL differential Z Freq. Ini pnp
- HTL differential Z Freq. Ini pnp
- sin/cos 1 Vss Z Freq. Ini pnp
- Hiperface Z Freq. Ini pnp

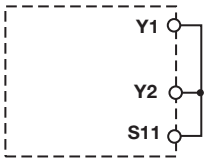
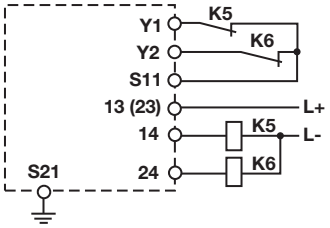
Please note:
Track /Z must remain free!!



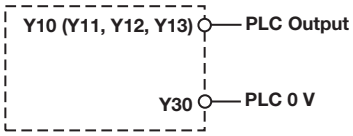
Reset circuit

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

Feedback circuit

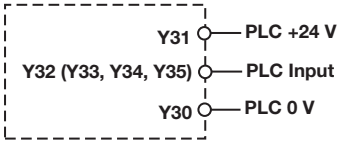
Link	Contacts from external contactors
	

Select inputs

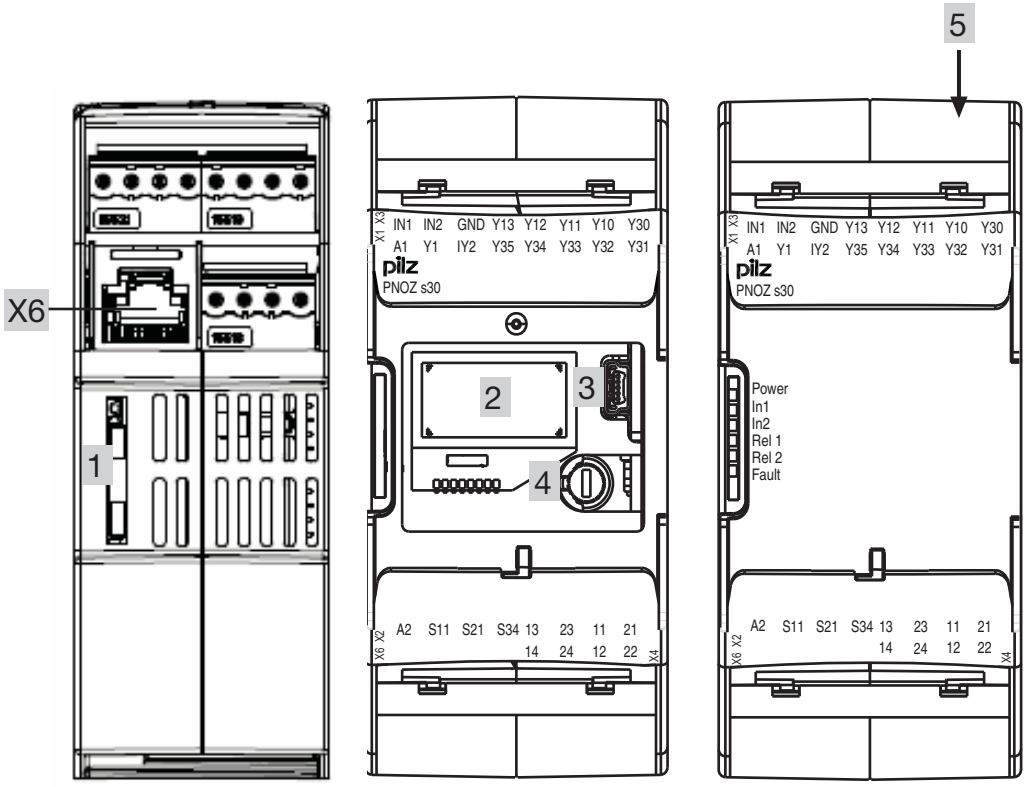


Up to PL e of EN ISO 13849-1
PNOZ s30

Semiconductor outputs



Terminal configuration



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Installation

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:

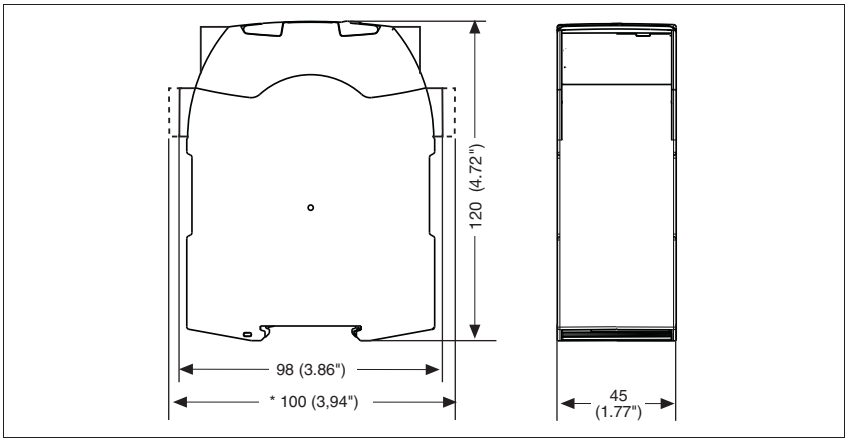
- Remove the plug terminator at the side of the base unit and at the contact expander module.
- Connect the base unit and the contact expander module to the supplied connector before mounting the units to the DIN rail.

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.

Dimensions

*with spring-loaded terminals



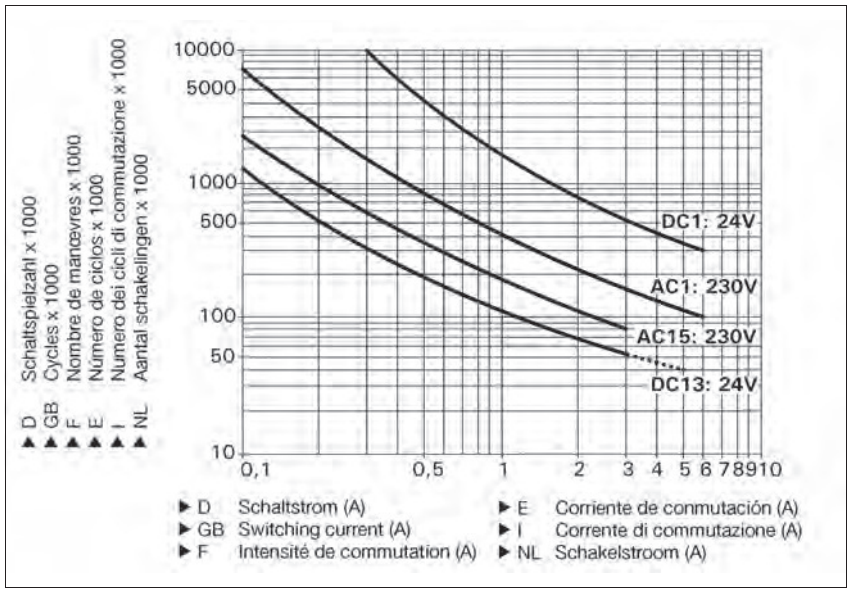
Up to PL e of EN ISO 13849-1
PNOZ s30

Notice

This data sheet is only intended for use during configuration. Please refer to the operating manual for installation and operation.

Service life graph

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.

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**

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Up to PL e of EN ISO 13849-1
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Electrical data	
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 Vss**
Phase position for the differential signals A,/A and B,/B	**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%**
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**

Relay outputs	
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**
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**

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Up to PL e of EN ISO 13849-1
PNOZ s30

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.

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.

Up to PL e of EN ISO 13849-1
PNOZ s30

Categories

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)

2.3

Standard rotary encoder

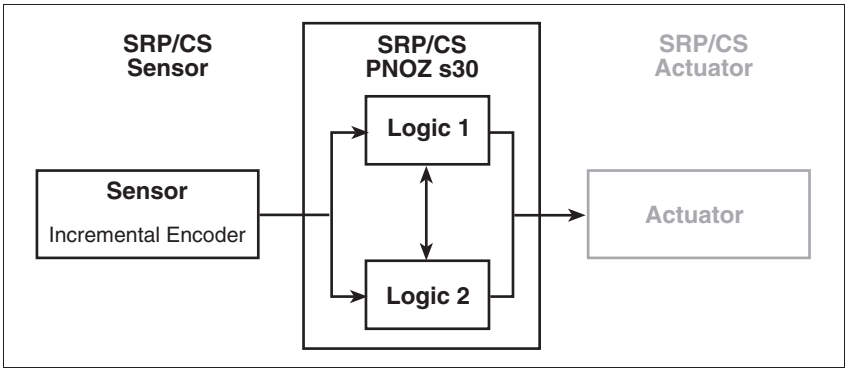
Max. achievable safety-related characteristic data

- 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".

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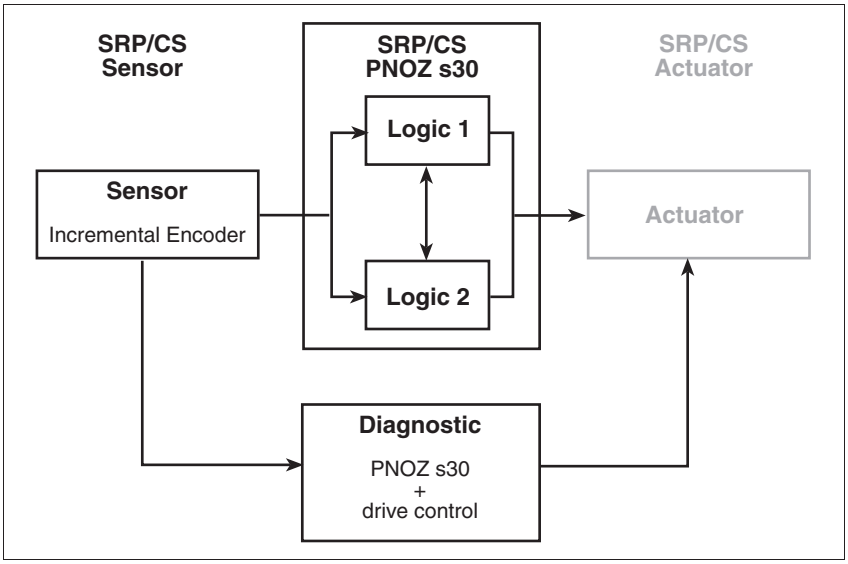
Up to PL e of EN ISO 13849-1
PNOZ s30

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

Up to PL e of EN ISO 13849-1
PNOZ s30

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 stabile 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).

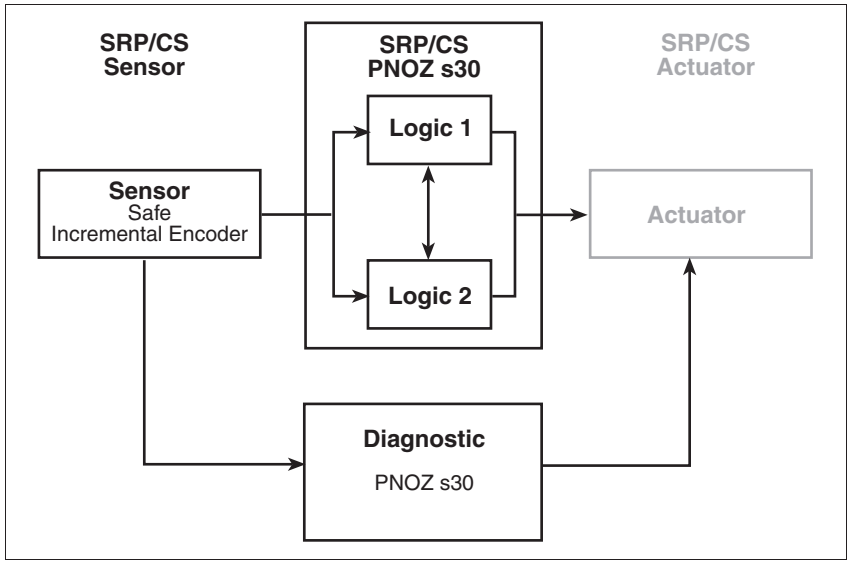
Safe rotary encoder

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

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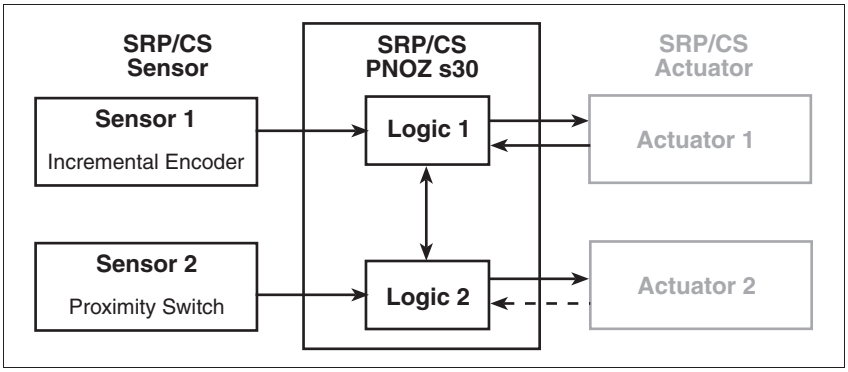
Up to PL e of EN ISO 13849-1
PNOZ s30

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

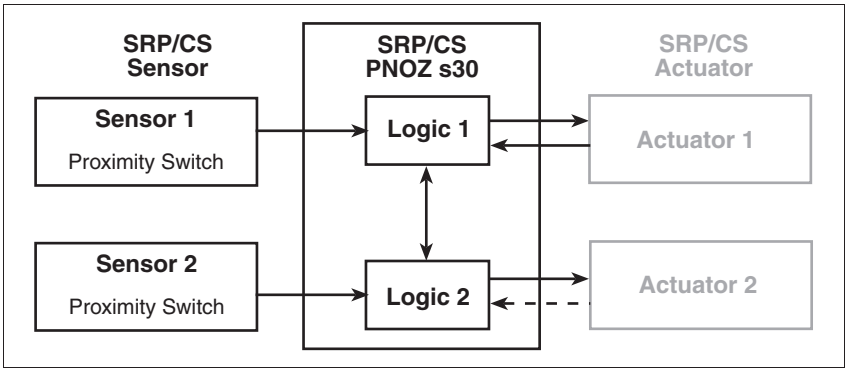
Up to PL e of EN ISO 13849-1
PNOZ s30

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



2.3

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
- 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.

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Up to PL e of EN ISO 13849-1
PNOZ s30

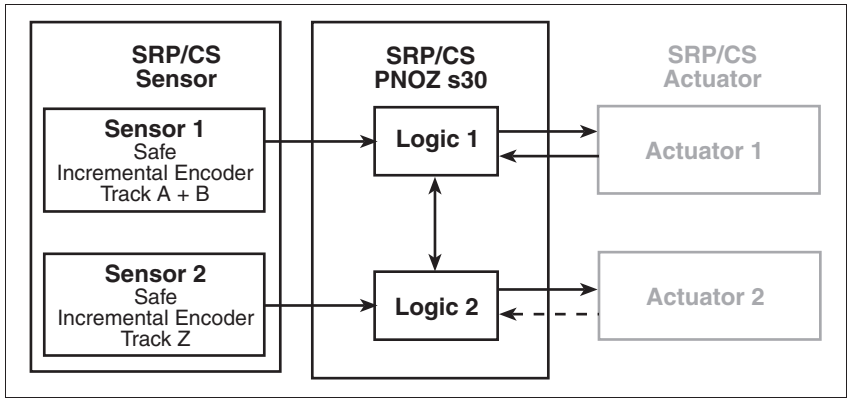
Safe rotary encoder with Z index

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

Up to PL e of EN ISO 13849-1
PNOZ s30

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

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