PNOZ ms2p TTL

▸ Configurable, safe small controllers PNOZmulti Classic

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THE SPIRIT OF SAFETY

Contents

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1 Introduction

1.1 Validity of documentation

This documentation is valid for the product PNOZ ms2p TTL (Coated Version). 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.

1.2 Using the documentation

This document is intended for instruction. Only install and commission the product if you have read and understood this document. The document should be retained for future reference.

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 product or devices 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.

2 Overview

2.1 Scope

▸ Expansion module PNOZ ms2p TTL (Coated Version)

▸ Jumper

2.2 Unit features

Application of the product PNOZ ms2p TTL (Coated Version):

Speed monitor for connection to a base unit from the configurable control system PNOZmulti

The product has the following features:

▸ Monitoring of 2 independent axes

▸ Connection per axis

  – 1 incremental encoder
    or

  – 2 proximity switches
    or

  – 1 incremental encoder and 1 proximity switch

▸ Measured variables:

  – Standstill

  – Speed (8 values can be set)

  – Direction of rotation

▸ Axis types, input device types and start mode can be selected in the PNOZmulti Configurator

▸ Status indicators for

  – Supply voltage

  – Incremental encoder

  – Proximity switch

  – Axis status, standstill and excess speed

  – Faults on the system

▸ Proximity switch connection technology: Plug-in connection terminals (either cage clamp terminal or screw terminal)

▸ Incremental encoder connection technology:
  RJ45 female connector

▸ Galvanic isolation between the connections X1, X12 and X22

▸ Max. 4 speed monitors can be connected to the base unit

▸ Coated version:

  Increased environmental requirements (see Technical details [📖 29])

2.3 Front view
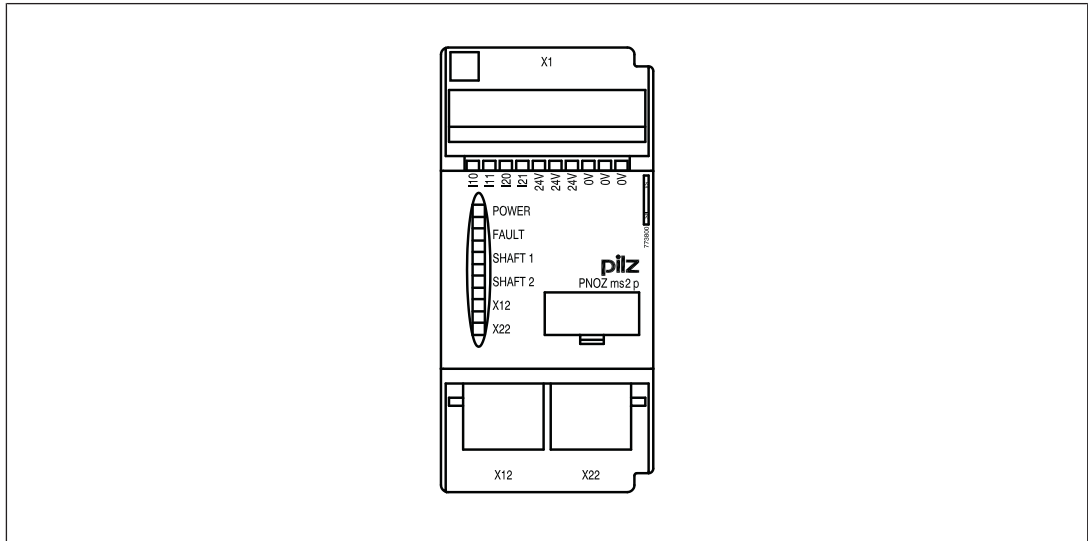
Key:

▶ X1:

– I10, I11:

connection terminals for proximity switch at axis 1

– I20, I21:

connection terminals for proximity switch at axis 2

– 0 V, 24 V:

supply connections

▶ X12:

– female connector for the connection of an incremental encoder at axis 1

▶ X22:

– female connector for the connection of an incremental encoder at axis 2

▶ LEDs:

– POWER

– FAULT

– SHAFT 1

– SHAFT 2

– X12

– X22

3 Safety

3.1 Intended use

The expansion module monitors standstill, speed and direction of rotation in accordance with EN ISO 13849-1 up to PL e and EN IEC 62061 up to SIL CL 3.

The expansion module may only be connected to a base unit from the PNOZmulti system (please refer to the document "PNOZmulti System Expansion" for details of the base units that can be connected).

The configurable small control systems PNOZmulti are used for the safety-related interruption of safety circuits and are designed for use in:

▸ E-STOP equipment

▸ Safety circuits in accordance with VDE 0113 Part 1 and EN 60204-1

> **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
>
> – Monitoring for broken shearpin by means of the speed monitor

> **WARNING!**
>
> A single-channel open circuit/input device error is recognised and leads to a safe condition of the outputs at the relevant axis.
>
> For applications in accordance with PL e and SIL CL 3, the "Overspeed" output must be integrated into the safety function in **every** operating mode and evaluated so that a shutdown occurs if the output switches to a safe condition ("Overspeed" output = "0").

CAUTION!

If there are frequency differences between tracks A and B of the incremental encoder and/or between the proximity switches on inputs I10 (I20) and I11 (I21), the PNOZmulti switches to a safe state if a frequency exceeds the configured standstill frequency and is greater than 2 Hz. If the speed monitor detects different directions of rotation, please note:

– With version 1.X devices the PNOZmulti changes to STOP.

– With devices from version 2.0, the axis in question switches to a safe condition. The safe condition is cleared again as soon as the error is remedied. Hazards that can arise through an automatic restart must be excluded within the user program.

The coated version of the product PNOZ ms2p TTL (Coated Version) is suitable for use where there are increased environmental requirements (see Technical details [29]).

The following is deemed improper use in particular

▶ Any component, technical or electrical modification to the product,

▶ Use of the product outside the areas described in this manual,

▶ Use of the product outside the technical details (see Technical details [29]).

NOTICE

EMC-compliant electrical installation

The product is designed for use in an industrial environment. The product may cause interference if installed in other environments. If installed in other environments, measures should be taken to comply with the applicable standards and directives for the respective installation site with regard to interference.

3.2 System requirements

Please refer to the "Product Modifications PNOZmulti" document in the "Version overview" section for details of which versions of the base unit and PNOZmulti Configurator can be used for this product.

3.3 Safety regulations

3.3.1 Safety assessment

Before using a device it is necessary to perform a safety assessment in accordance with the Machinery Directive.

Functional safety is guaranteed for the product as a single component. However, this does not guarantee the functional safety of the overall plant/machine. In order to achieve the required safety level for the overall plant/machine, define the safety requirements for the plant/machine and then define how these must be implemented from a technical and organisational standpoint.

3.3.2 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 information provided in this description under "Safety",

▸ And have a good knowledge of the generic and specialist standards applicable to the specific application.

3.3.3 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.).

3.3.4 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).

3.3.5 For your safety

The unit meets all the necessary conditions for safe operation. However, you should always ensure that the following safety requirements are met:

▸ This operating manual only describes the basic functions of the unit. The expanded functions are described in the PNOZmulti Configurator's online help. Only use these functions once you have read and understood the documentations.

▸ Do not open the housing or make any unauthorised modifications.

▸ Please make sure you shut down the supply voltage when performing maintenance work (e.g. exchanging contactors).

4 Function description

4.1 Integrated protection mechanisms

The relay meets the following safety requirements:

▸ The circuit is redundant with built-in self-monitoring.

▸ The safety device remains effective in the case of a component failure.

4.2 Operation

The speed monitor can independently monitor two axes for standstill, speed and direction of rotation. The speed monitor signals the status of the monitored values to the base unit. Depending on the safety circuit loaded, the values can be transferred from the base unit, e.g. to a relay output on the safety system. Incremental encoders and/or proximity detectors can be used to record the values.

The configuration of the speed monitor is described in detail in the PNOZmulti Configurator's online help.

4.3 Block diagram
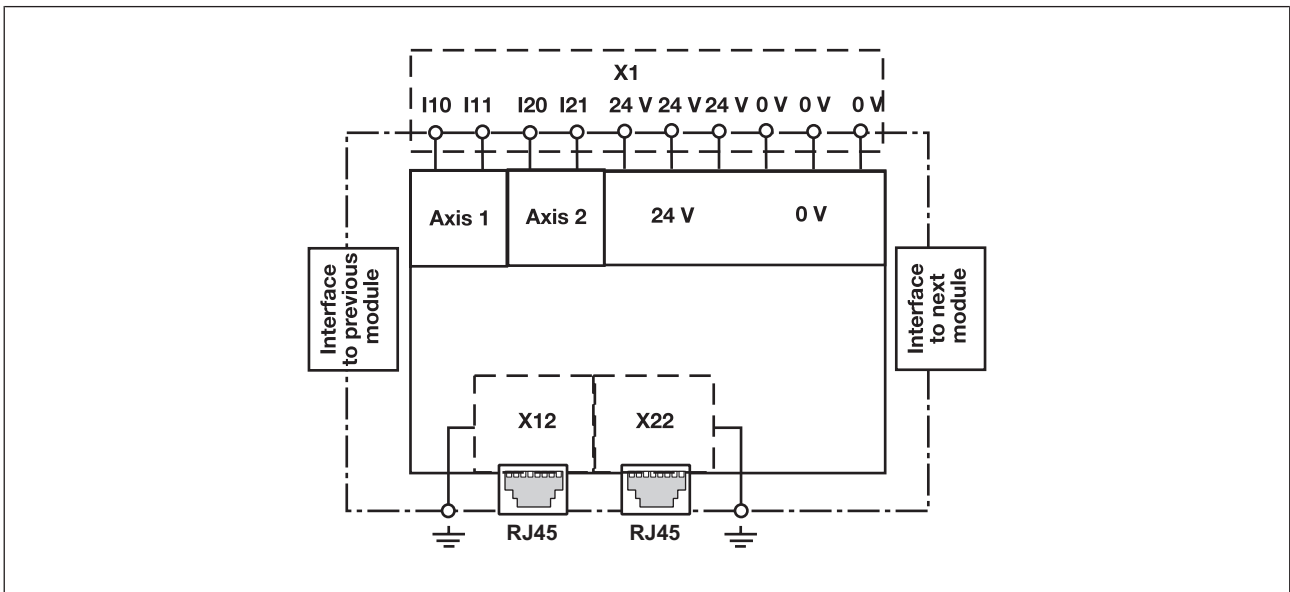
4.4 Input device types

4.4.1 Proximity switch

4.4.1.1 Requirements of the proximity switches

▸ Only "pnp" type proximity switches may be used (N/O contact, switching to positive).

▸ The proximity switches require a 24 VDC supply.

▸ The proximity switches must be fitted so that at least one is always activated (carries a high signal).

▸ The proximity switches must be fitted so that the recorded signals overlap.

▸ When monitoring with proximity switches we recommend you use proximity switches with hysteresis in order to prevent bounce and therefore incorrect measurements.

Proximity switch 1
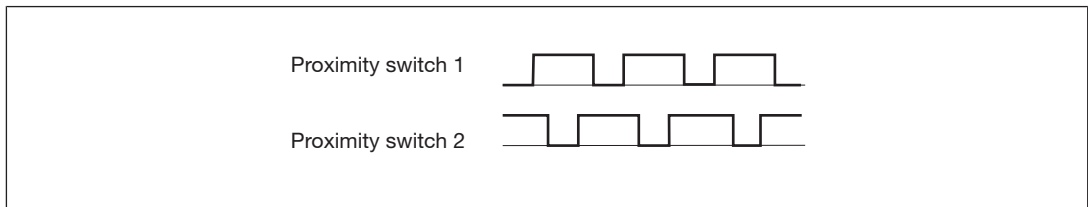
Proximity switch 2

Fig.: Example proximity switch signal behaviour

> **CAUTION!**
>
> Appropriate installation measures should be taken to prevent a foreign body coming between the signal encoder and the proximity switch. The foreign body could cause one of the proximity switches to be constantly energised (constant high signal).

▸ Please note the values stated in the technical details

4.4.2 Incremental encoders

4.4.2.1 Requirements of the incremental encoders

▸ Only incremental encoders with a differential output of the following type are permitted

– Sin/Cos

– TTL (RS422)

▸ Please note the values stated in the technical details

4.4.2.2 Adapter for incremental encoders

The adapter records the data between the encoder and drive and makes it available to the PNOZ ms2p TTL (Coated Version) 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.

4.4.3 Incremental encoder and proximity switch on one axis

In order to increase the availability, a proximity switch and an incremental encoder can be configured on one axis for the speed monitor. The speed monitor then monitors 3 signals on an axis: Track A and track B of the incremental encoder and the proximity switch

Standstill monitoring

Standstill is detected when at least two of these signals fall below the standstill frequency.

Monitoring for broken shearpins

If the Broken shearpin monitoring option is activated, a shearpin break is recognised if

▸ both signals of the incremental encoder fall below the set standstill frequency (standstill) and

▸ the proximity switch exceeds the set standstill frequency (rotating shaft).

The recognised broken shearpin leads to safe condition (see status B2 in "Signal statuses" table in Chapter 8 of the operating manual). If individual or multiple signals change, the system may leave a safe state (see "Signal statuses" table).

Hazards that can arise through an automatic restart must be excluded from the user program.

5 Installation

5.1 General installation guidelines

▸ The control system should be installed in a control cabinet with a protection type of at least IP54. Fit the control system to a horizontal mounting rail. The venting slots must face upward and downward. Other mounting positions could destroy the control system.

▸ Use the locking elements on the rear of the unit to attach it to a mounting rail. Connect the control system to the mounting rail in an upright position, so that the earthing springs on the control system are pressed on to the mounting rail.

▸ The ambient temperature of the devices in the control cabinet must not exceed the figure stated in the technical details. Air conditioning may otherwise be required.

▸ To comply with EMC requirements, the mounting rail must have a low impedance connection to the control cabinet housing.

> **NOTICE**
>
> 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 armband.

5.2 Dimensions
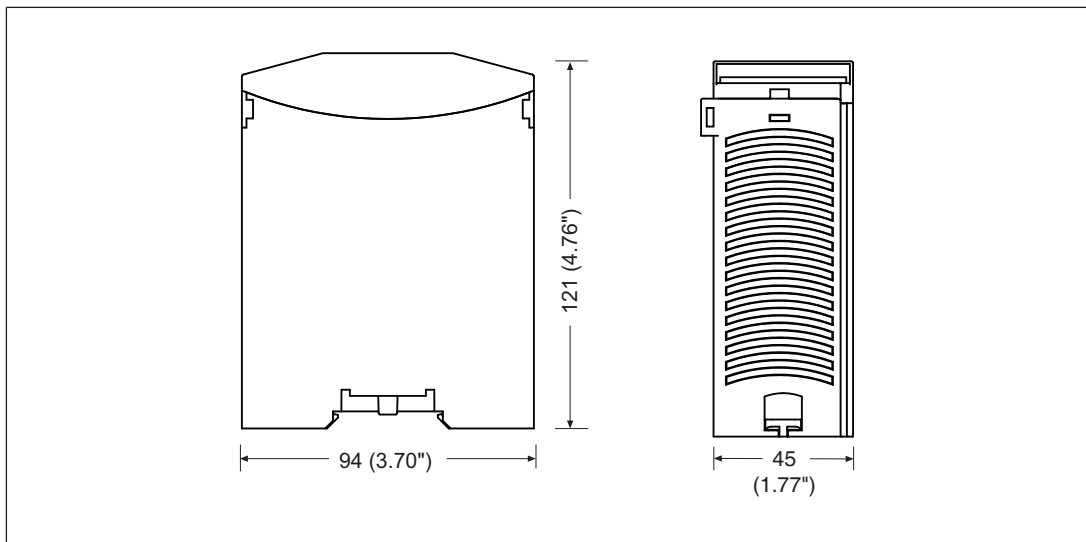
5.3 Connecting the base unit and expansion modules

Connect the base unit and the expansion modules as described in the operating manuals for the base modules.

▸ The terminator must be fitted to the last expansion module

▸ Install the expansion module in the position configured in the PNOZmulti Configurator.

The position of the expansion modules is defined in the PNOZmulti Configurator. The expansion modules are connected to the left or right of the base unit, depending on the type.

Please refer to the document "PNOZmulti System Expansion" for details of the number of modules that can be connected to the base unit and the module types.

6 Commissioning

6.1 General wiring guidelines

The wiring is defined in the circuit diagram of the PNOZmulti Configurator.

Details of the input type, axis type and reset mode, plus the values for standstill, speed monitoring and direction of rotation are also defined in the PNOZmulti Configurator.

Please note:

▸ Information given in the Technical details [📖 29] must be followed.

▸ Use copper wiring with a temperature stability of 75 °C.
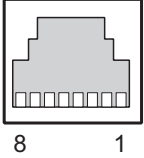
> ⚠️ **CAUTION!**
>
> The configurable switch-off delay when reaching the overspeed increases the reaction time of the system of base unit and speed monitor by the entered value (see technical details). This must not delay the arrival of a safe condition by more than the permitted time. The configuration of the switch-off delay must be considered in the risk assessment as regards hazards, reaction time and safety distance.

On each of the 2 axes you can connect as required:

▸ 1 incremental encoder

or

▸ 2 proximity switches

or

▸ 1 incremental encoder and 1 proximity switch

	Incremental encoder	Proximity switch
Connection axis 1	X12	-
	-	I10, I11, 0 V
	X12	I10, 0 V
Connection axis 2	X22	-
	-	I20, I21, 0 V
	X22	I20, 0 V

6.2 Pin assignment of RJ45 socket

RJ45 socket 8-pin	PIN	Track
	1	n.c.
	2	0 V
	3	n.c.
	4	A
	5	/A
	6	n.c.
	7	B
	8	/B

6.3 Connection of proximity switches

Proceed as follows when connecting proximity switches:

▶ Terminals I10 and I11: connect the proximity switch for axis 1

▶ Terminals I20 and I21: connect the proximity switch for axis 2.

▶ If only one axis is to be monitored, either terminals I10 and I11 or terminals I20 and I21 will remain free.

▶ When connecting incremental encoders and proximity switches on one axis:

   – Terminals I10: connect proximity switch for axis 1 (I11 is not used)

   – Terminals I20: connect proximity switch for axis 2 (I21 is not used)

▶ The proximity switch must always be connected to a 0 V terminal of the speed monitor. The 0 V terminals are connected internally.

▶ Connect proximity switch to 24 VDC of the power supply or the speed monitor (the 24 V terminals of the speed monitor are connected internally)
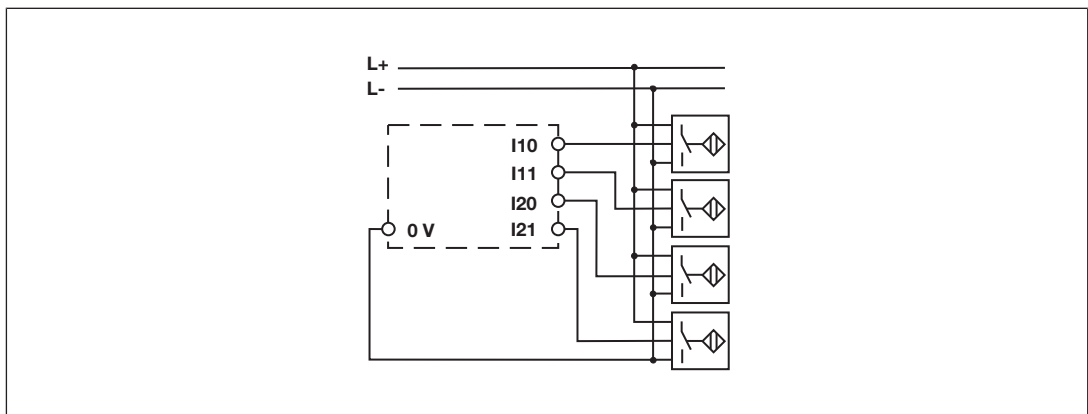
6.4 Connection of the incremental encoder

Proceed as follows when connecting the incremental encoder:

▸ The incremental encoder may be connected via an adapter or directly to the speed monitor.

▸ The incremental encoder on connector X12 monitors axis 1; the incremental encoder on connector X22 monitors axis 2.

▸ Use only shielded cables for all connections

▸ 0 V from the incremental encoder and speed monitor should always be connected.

▸ Position the terminating resistors of the signal lines as close as possible to the speed monitor input.

6.4.1 Connect signals of the incremental encoder to the speed monitor

Encoder types: 1 Vss, 5 V-TTL

▸ Apply 5 VDC to incremental encoder only

▸ Terminate incremental encoder with Z_0 = 120 Ohm
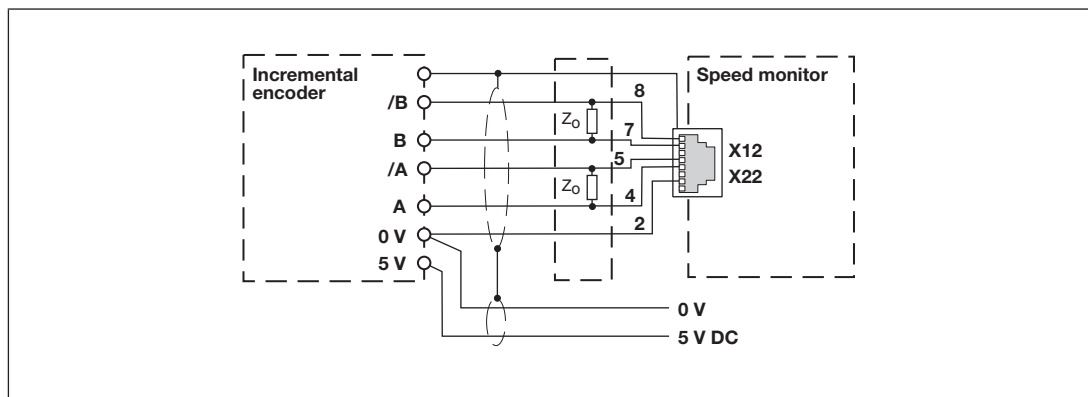
Fig.: Connection to incremental encoder type 1 Vss, 5 V-TTL

6.4.2 Connect incremental encoder to the speed monitor via an adapter

▸ The adapter is connected between the incremental encoder and the drive. The output on the adapter is connected to the female RJ45 connector on the speed monitor.

▸ The adapter can also be used without connecting to a drive. The signal lines can then be terminated directly at the adapter with Z_O = 120 Ohm.

▸ If the signal lines in the drive are already terminated with Z_O = 120 Ohm, the incremental encoder may no longer be terminated.

▸ The signals relevant for the speed monitor are utilised in parallel by the adapter. The information stated under "Connect incremental encoder signals to the speed monitor" and in the adapter operating manual must be observed when connecting the supply voltage.

▸ Supply only incremental encoder with 5 VDC.

CAUTION!

Communication errors may occur if the adapter cable is too long or there are any external sources of interference. The length of the adapter cable should be <5 m. Lay the adapter cable separately from any potential sources of interference, such as drive cables leading to the motor, for example.
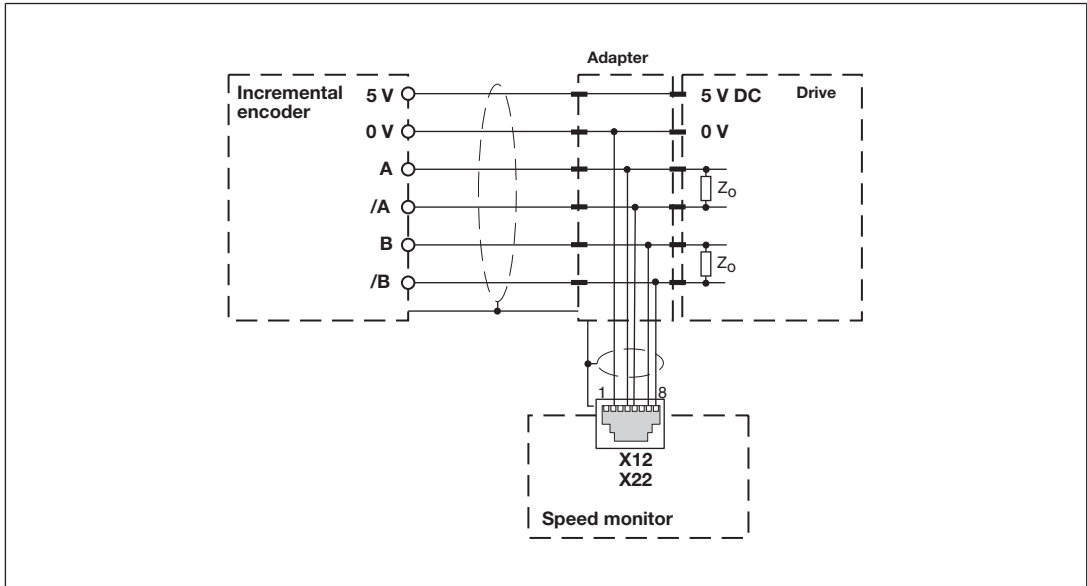
Fig.: Connection via adapter and drive
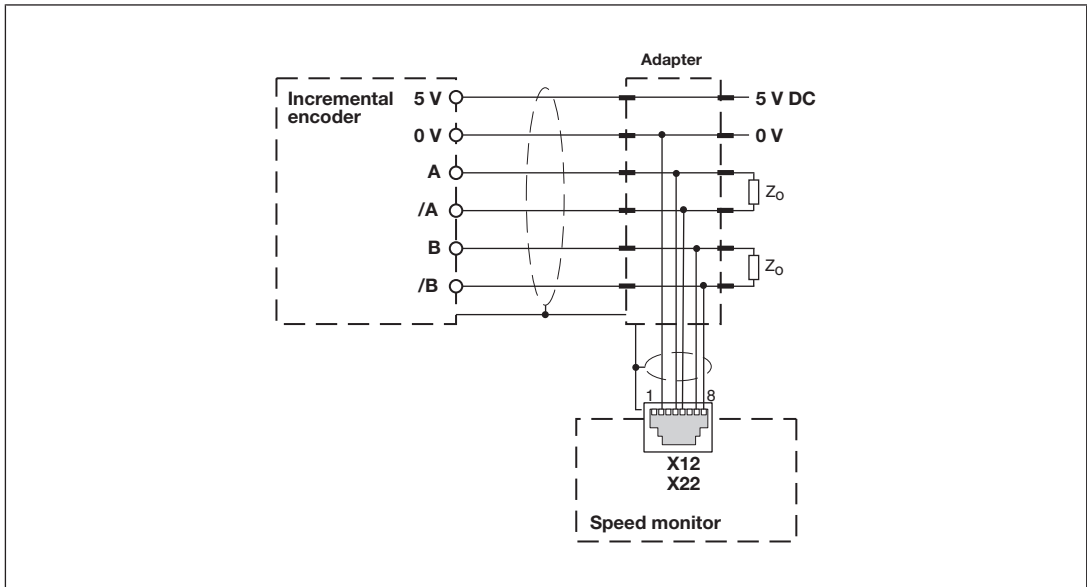
Fig.: Connection via adapter

6.5 Connection of proximity switches and incremental encoder

6.5.1 Proximity switch and incremental encoder on various axes

Axis 1:
Proximity switch at I10, I11
or
incremental encoder at X12

Axis 2:
Proximity switch at I20, I21
or
incremental encoder at X22
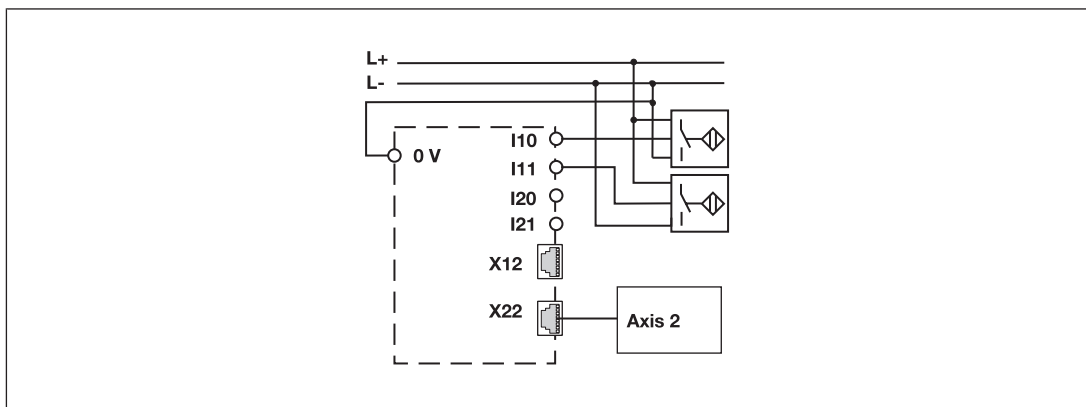
Fig.: Proximity switch and incremental encoder on various axes

6.5.2 Proximity switch and incremental encoder on one axis

Axis 1:
Proximity switch at I10 (I11 is unused)
and
Incremental encoder at X12
Axis 2:
Proximity switch at I20 (I21 is unused)
and
Incremental encoder at X22
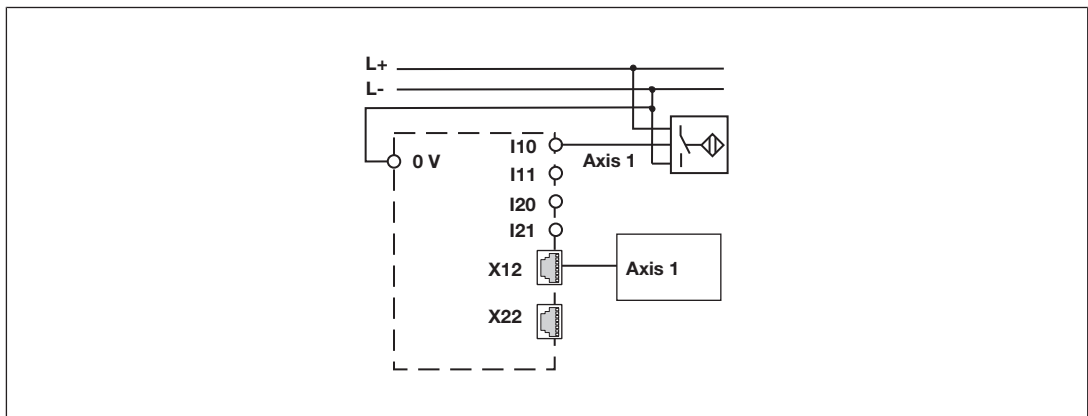
Fig.: Proximity switch and incremental encoder on one axis

6.6 Connection examples

6.6.1 Connection of 2 proximity switches and an incremental encoder

Description

▸ 2 proximity switches, pnp-switching

▸ 1 incremental encoder
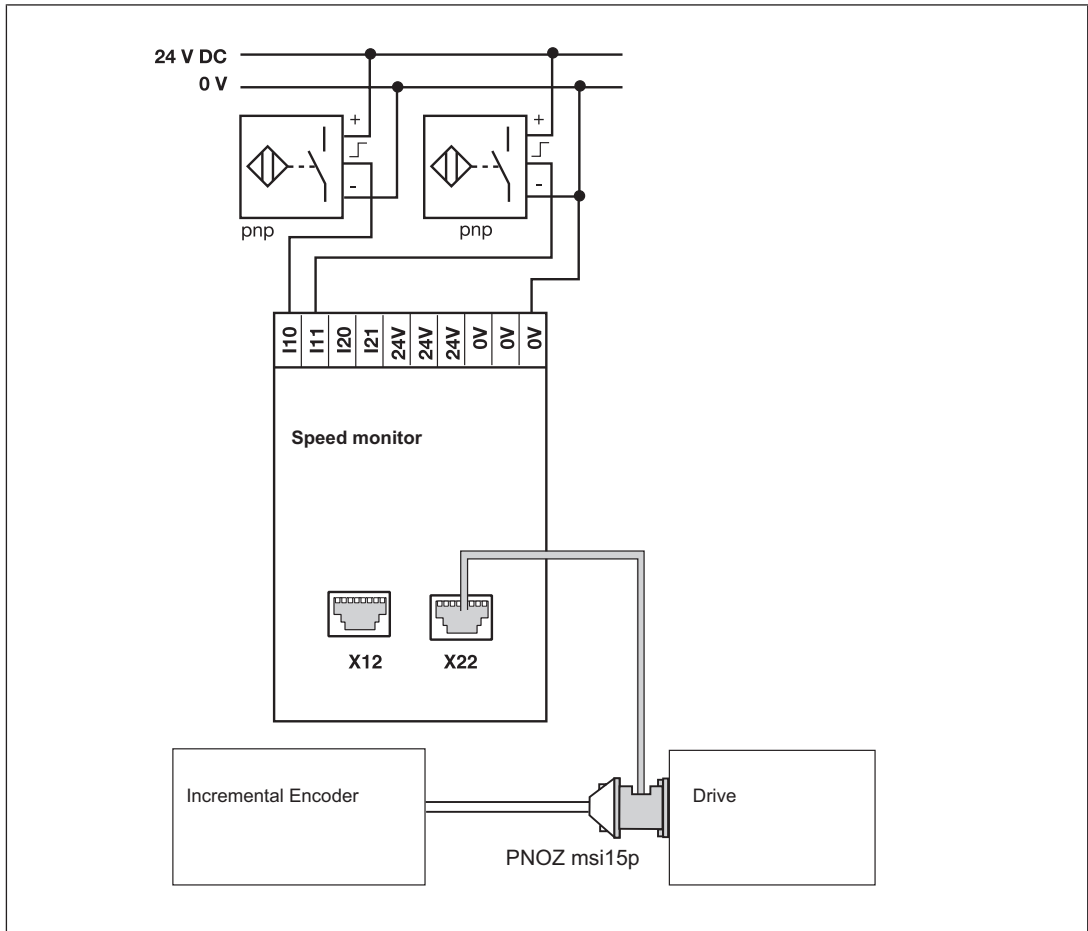
Fig.: Connection of 2 proximity switches, pnp-switching, one incremental encoder

6.6.2 Connection of 4 proximity switches

Description

▸ 4 proximity switches, pnp-switching

▸ Connection through 24 V terminals and 0 V
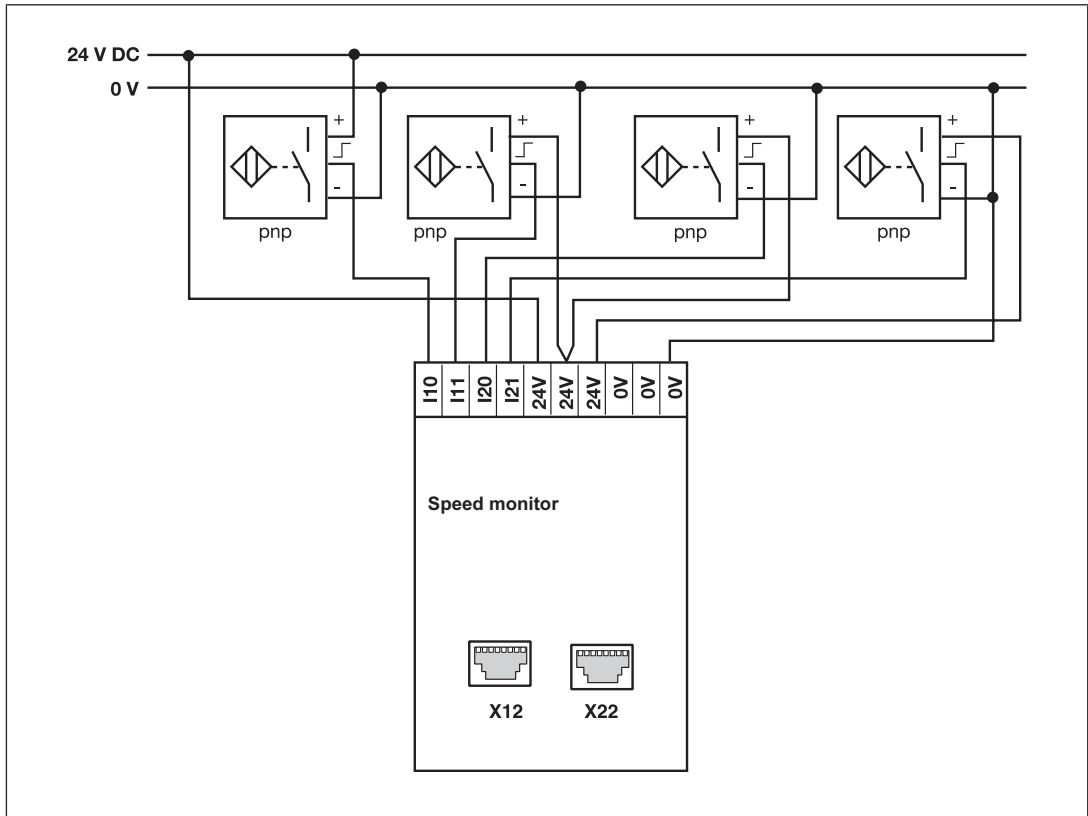
Fig.: Connection of 4 proximity switches, pnp-switching, connection through 24 V terminals and 0 V

6.6.3 Connection of an incremental encoder and proximity switch on an axis

Description

▸ 1 proximity switch, pnp-switching

▸ 1 incremental encoder

▸ Incremental encoder and proximity switch on one axis
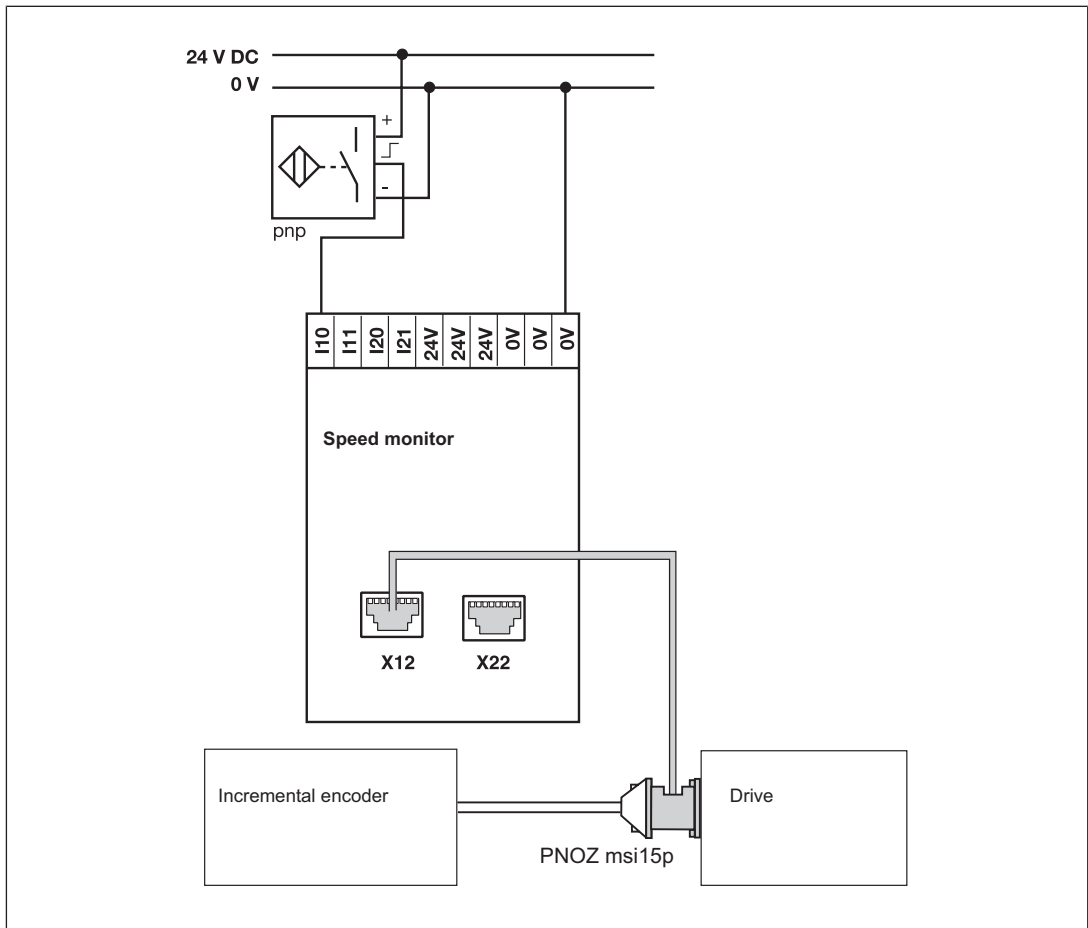
Fig.: Connection of an incremental encoder and proximity switch, pnp-switching, on an axis

7 Operation

When the supply voltage is switched on, the PNOZmulti copies the configuration from the chip card.

The PNOZmulti safety system is ready for operation when the "POWER" and "RUN" LEDs on the base unit and the "READY" LED on the PNOZ ms2p TTL (Coated Version) are lit continuously.

7.1 LED indicators

Legend

☼	LED on
◖	LED flashes
◖⚡	LED flashes briefly
●	LED off

LED	LED status	Meaning
POWER	☼	Supply voltage is present
FAULT	☼	External fault leading to a safe condition; the fault is at the incremental encoder inputs whose LEDs are flashing, e.g. short across the contacts
	◖	Internal fault leading to safe condition
SHAFT1 SHAFT2	◖⚡	Encoder or wiring fault
	●	Axis 1 and/or axis 2 are in the normal range (no standstill, no overspeed)
	☼	Axis 1 and/or axis 2 signalling standstill
	◖	Axis 1 and/or axis 2 signalling overdrive
X12 X22	☼	Incremental encoders on terminals X12 and/or X22 are connected correctly
I10, I11, I20, I21	☼	Proximity switch on terminal I10, I11, I20, I21 is energised

7.2 Signal statuses

Status	Meaning	Encoder inputs***)			Outputs		Diagnostic word ****)			
		Incremental encoder track A	Incremental encoder track B	Proximity switch	Standstill	Overspeed, no error on the speed monitor	Bit 9: Proximity switch fault	Bit 9: Incremental encoder fault	Bit 10: Frequency difference track AB	Entry in error stack
A	Standstill, no fault	0	0	0	1	1	0	0	0	0
B1 *)	Standstill, fault at proximity switch	0	0	1	1	1	0	1	0	0
B2 *)	Broken shearpin	0	0	1	0	0	0	1	0	1
C	Standstill, unwanted signal change, track A	0	1	0	1	1	0	0	0	0
D	Rotating shaft, fault, track A	0	1	1	0	0/1 **)	0	0	1	1
E	Standstill, unwanted signal change, track B	1	0	0	1	1	0	0	0	0
F	Rotating shaft, fault, track B	1	0	1	0	0/1 **)	0	0	1	1
G	Rotating shaft, fault at proximity switch	1	1	0	0	0/1 **)	1	0	0	1
H	Rotating shaft, no fault	1	1	1	0	0/1 **)	0	0	0	0

*) The status B then only leads to a safe shut down when the option "broken shearpin monitoring" is activated (B2). If the option is not activated (B1), then only the bit 9 of the diagnostic word is set.

**) The output speed is "1" when the configured overspeed is not exceeded.

***) Input = 1: Speed monitor detects impulses

Input = 0: Speed monitor detects no impulses

****) For explanations on the diagnostic word of the speed monitor, see online help for the PNOZmulti Configurator

7.3 Faults - malfunctions

Monitoring the direction of rotation: If an internal error occurs or there is an error due to a defective incremental encoder ("FAULT" LED illuminates or flashes), an incorrect direction of rotation may be signalled for approx. 500 ms.

8 Technical details

General	773811	773816
Certifications	BG, CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed	BG, CCC, CE, EAC (Eurasian), KOSHA, TÜV, cULus Listed
Electrical data	**773811**	**773816**
Supply voltage		
for	Module supply	Module supply
internal	Via base unit	Via base unit
Voltage	5 V	5 V
Kind	DC	DC
Voltage tolerance	-2 %/+2 %	-2 %/+2 %
Power consumption	1 W	1 W
Status indicator	LED	LED
Proximity switch input	**773811**	**773816**
Number of inputs	4	4
Input signal level		
Signal level at "1"	11 - 30 V	11 - 30 V
Signal level at "0"	-3 - 5 V	-3 - 5 V
Input resistance	3 kOhm	3 kOhm
Input's frequency range	0 - 3 kHz	0 - 3 kHz
Configurable monitoring frequency		
Without hysteresis	0,1 Hz - 3 kHz	0,1 Hz - 3 kHz
With hysteresis	0.2 Hz - 3 kHz	0.2 Hz - 3 kHz
Incremental encoder input	**773811**	**773816**
Number of inputs	2	2
Connection type	RJ45 female connector, 8-pin	RJ45 female connector, 8-pin
Input signal level	0,5 - 5 Vss	0,5 - 5 Vss
Phase position for the differential signals A, /A and B,/B	90° ±30°	90° ±30°
Overload protection	-30 - 30 V	-30 - 30 V
Input resistance	10 kOhm	10 kOhm
Input's frequency range	0 - 500 kHz	0 - 500 kHz
Configurable monitoring frequency		
Without hysteresis	0,1 Hz - 500 kHz	0,1 Hz - 500 kHz
With hysteresis	0.2 Hz - 500 kHz	0.2 Hz - 500 kHz
Times	**773811**	**773816**
Configurable switch-off delay	0 - 2.500 ms	0 - 2.500 ms
Supply interruption before de-energisation	20 ms	20 ms

Times	773811	773816
Reaction time		
f>100 Hz: Configurable switch-off delay + switch-off delay of base unit	10 ms	10 ms
f<100 Hz: Configurable switch-off delay + switch-off delay of base unit	10 ms + 1/f	10 ms + 1/f
Environmental data	**773811**	**773816**
Ambient temperature		
In accordance with the standard	EN 60068-2-14	EN 60068-2-14
Temperature range	-25 - 60 °C	0 - 60 °C
Storage temperature		
In accordance with the standard	EN 60068-2-1/-2	EN 60068-2-1/-2
Temperature range	-25 - 70 °C	-25 - 70 °C
Climatic suitability		
In accordance with the standard	EN 60068-2-30, EN 60068-2-78	EN 60068-2-30, EN 60068-2-78
Humidity	93 % r. h. at 40 °C	93 % r. h. at 40 °C
Condensation during operation	Short-term	Not permitted
EMC	EN 61131-2	EN 61131-2
Vibration		
In accordance with the standard	EN 60068-2-6	EN 60068-2-6
Frequency	5 - 500 Hz	10 - 150 Hz
Acceleration	1g	1g
Broadband noise		
In accordance with the standard	EN 60068-2-64	–
Frequency	5 - 500 Hz	–
Acceleration	1,9grms	–
Shock stress		
In accordance with the standard	EN 60068-2-27	EN 60068-2-27
Acceleration	15g	15g
Duration	11 ms	11 ms
Max. operating height above sea level	2000 m	2000 m
Airgap creepage		
In accordance with the standard	EN 61131-2	EN 61131-2
Overvoltage category	III	III
Pollution degree	2	2
Rated insulation voltage	30 V	30 V
Protection type		
In accordance with the standard	EN 60529	EN 60529
Mounting area (e.g. control cabinet)	IP54	IP54
Housing	IP20	IP20
Terminals	IP20	IP20
Mechanical data	**773811**	**773816**
Mounting position	horizontally on mounting rail	horizontally on mounting rail

Mechanical data	773811	773816
DIN rail		
Top hat rail	35 x 7,5 EN 50022	35 x 7,5 EN 50022
Recess width	27 mm	27 mm
Material		
Bottom	PPO UL 94 V0	PPO UL 94 V0
Front	ABS UL 94 V0	ABS UL 94 V0
Connection type	Spring-loaded terminal, screw terminal	Spring-loaded terminal, screw terminal
Conductor cross section with screw terminals		
1 core flexible	0,25 - 1,5 mm², 24 - 16 AWG	0,25 - 1,5 mm², 24 - 16 AWG
2 core with the same cross section, flexible without crimp connectors or with TWIN crimp connectors	0,25 - 0,75 mm², 24 - 20 AWG	0,25 - 0,75 mm², 24 - 20 AWG
Torque setting with screw terminals	0,25 Nm	0,25 Nm
Stripping length with screw terminals	7 mm	7 mm
Conductor cross section with spring-loaded terminals		
1 core flexible without crimp connector	0,25 - 1,5 mm², 24 - 16 AWG	0,25 - 1,5 mm², 24 - 16 AWG
1 core flexible with crimp connector	0,25 - 0,75 mm², 24 - 20 AWG	0,25 - 0,75 mm², 24 - 20 AWG
Spring-loaded terminals: Terminal points per connection	1	1
Stripping length with spring-loaded terminals	9 mm	9 mm
Dimensions		
Height	94 mm	94 mm
Width	45 mm	45 mm
Depth	121 mm	121 mm
Weight	220 g	220 g

Where standards are undated, the 2020-07 latest editions shall apply.

8.1 Safety characteristic data

Operating mode	EN ISO 13849-1: 2015 PL	EN ISO 13849-1: 2015 Category	EN IEC 62061 SIL CL	EN IEC 62061 PFH_D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2015 T_M [year]
Initiator	PL e	Cat. 3	SIL CL 3	3,68E-09	SIL 3	4,84E-05	20
Incremental encoder	PL e	Cat. 3	SIL CL 3	6,73E-09	SIL 3	8,18E-05	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.

9 Order reference

9.1 Product

Product type	Features	Order No.
PNOZ ms2p TTL	Expansion module, speed monitor	773 816
PNOZ ms2p TTL coated version	Expansion module, speed monitor, coated version	773 811

9.2 Accessories

Terminator, jumper

Product type	Features	Order No.
PNOZmulti bus terminator	Terminator	779 110
PNOZmulti bus terminator coated	Terminator, coated version	779 112
KOP-XE	Jumper	774 639
KOP-XE coated	Jumper, coated version	774 640

Connection terminals

Product type	Features	Order no.
Set spring terminals	1 set of spring-loaded terminals	783 800
Set screw terminals	1 set of screw terminals	793 800

10 Application Examples

Safe standstill monitoring
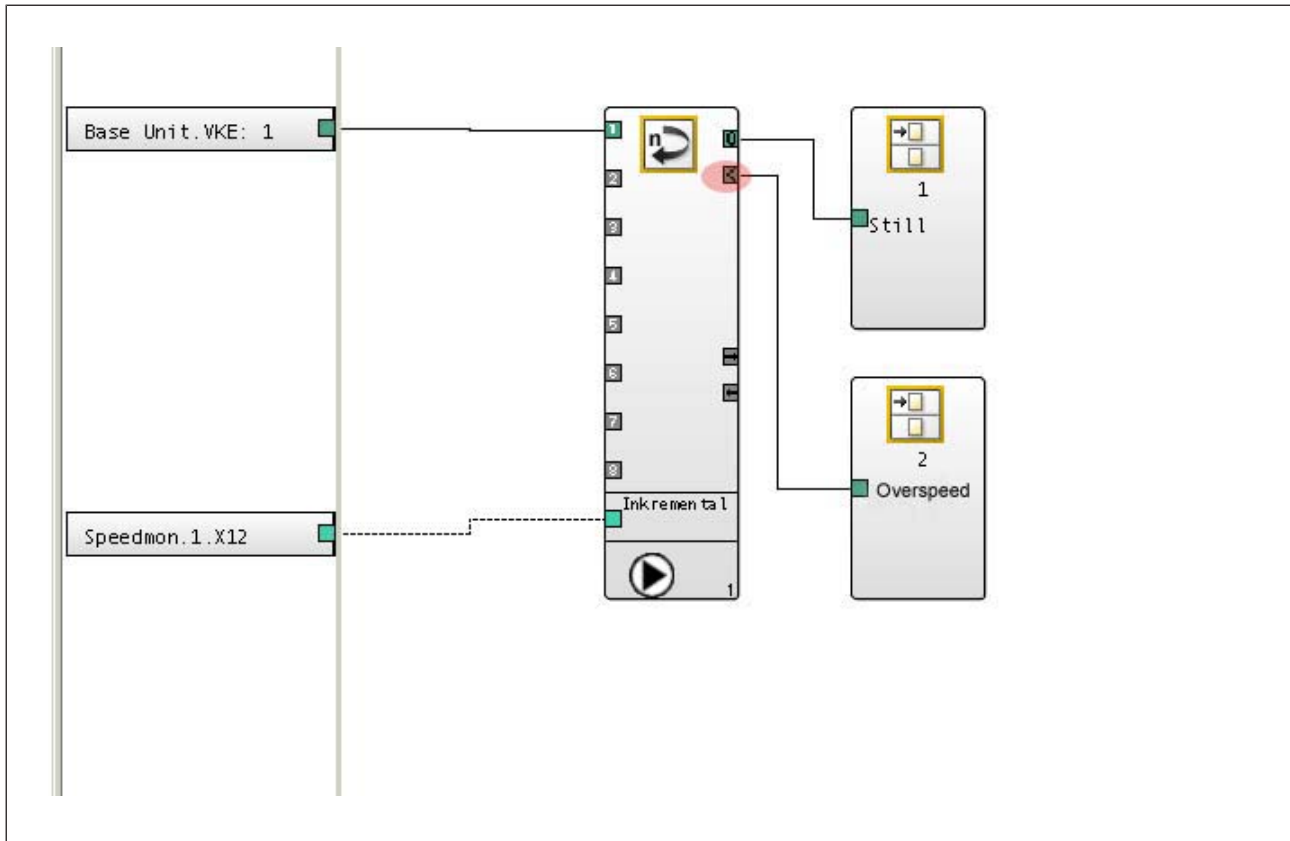
Configuration in the PNOZmulti Configurator

▸ Standstill: depending on requirement

▸ Speed n1: greater than the maximum permitted speed.

If the "Overspeed" output (see red marking) = "0", either the maximum permitted speed has been exceeded or the speed monitor has recognised a fault.
"Overspeed" output = "0" must lead to the shutdown of the relevant axis.

Safe monitoring with "reduced speed" operating mode
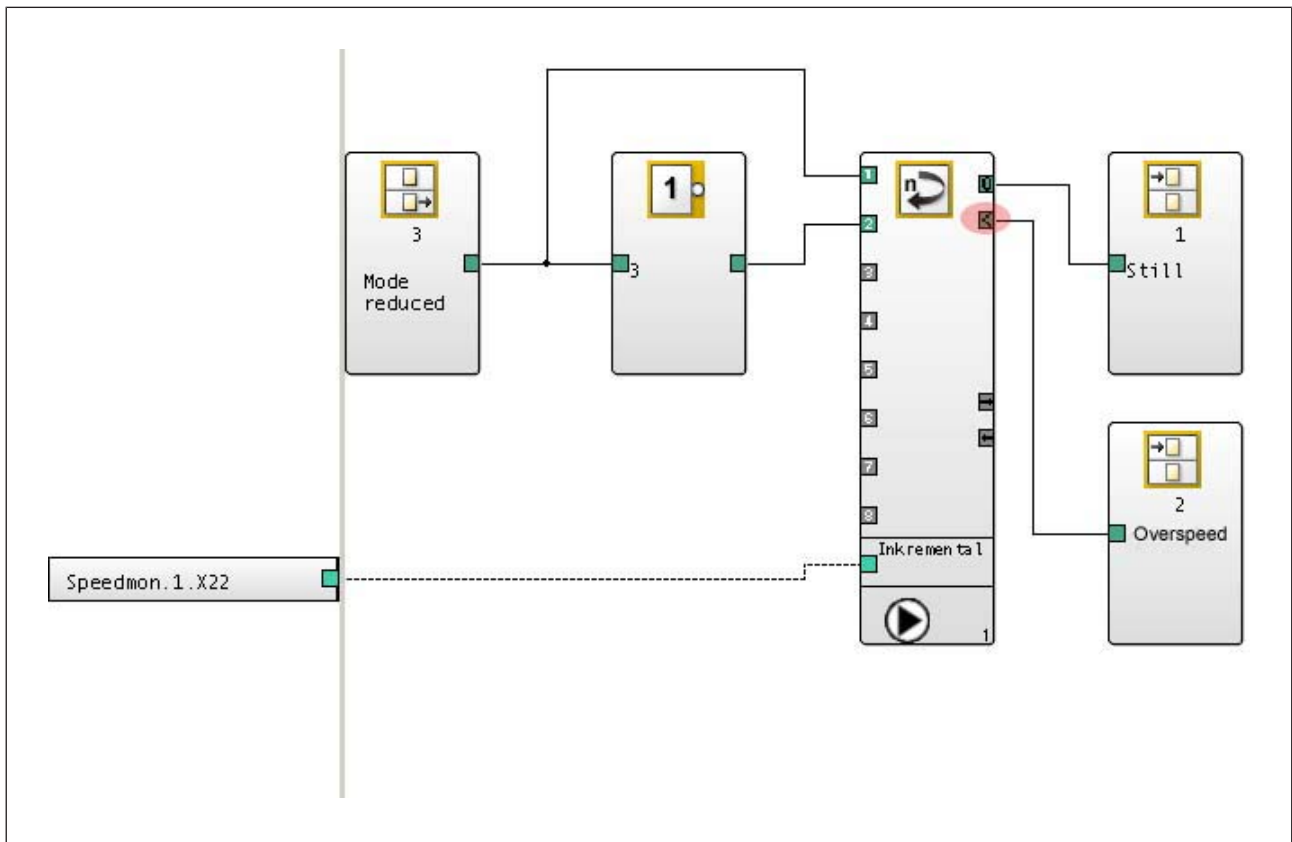
Configuration in the PNOZmulti Configurator

▸ Standstill: depending on requirement

▸ Speed n1: reduced speed, depending on requirement

▸ Speed n2: greater than the maximum permitted speed.

If the "Overspeed" output (see red marking) = "0", either the maximum permitted speed has been exceeded or the speed monitor has recognised a fault.
"Overspeed" output = "0" must lead to the shutdown of the relevant axis, irrespective of whether the "reduced speed" operating mode is active.

▶ Support

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