PNOZmulti Modular Safety System
Special Applications

pilz
more than automation
safe automation

Configuration guide

COMPLETE Safety & Control AUTOMATION

Supplement to Technical Catalogue 3.4 – October 2008 edition

Suggestions and comments for improving this documentation will be gratefully received.

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Introduction
Overview

The “Special applications” configuration guide supplements the PNOZmulti technical catalogue.

The configuration guide is divided into the following chapters:

1 **Introduction**
The introduction is designed to familiarise you with the contents, structure and specific order of this manual.
2 **Communication with fieldbus modules**
This chapter describes the options for communicating with the fieldbus modules.
3 **Diagnostic interface**
This chapter describes the communication options available with the serial diagnostic interface (RS 232) of the base units from the PNOZmulti modular safety system.
4 **Muting**
This chapter describes the muting function in conjunction with the PNOZmulti. It includes information on configuring and connecting the PNOZmulti units.
5 **Safety mat**
This chapter includes information on configuring and connecting safety mats to PNOZmulti units.
6 **Diagnostic word**
This chapter describes the diagnostic words in the modular PNOZmulti safety system. By evaluating the diagnostic words you can obtain important information on operating conditions and malfunctions within your application.

Definition of symbols

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

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

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

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

NOTICE
This describes a situation in which the unit(s) could be damaged and also provides information on preventive measures that can be taken.

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

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Introduction
Overview

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Communication with fieldbus modules

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Communication with fieldbus modules	

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Communication with fieldbus modules
Basics

Communication with fieldbus systems

The input and output range is each reserved an area of 20 Bytes for communication via fieldbuses; this is updated approx. every 15 ms. The Master can send 20 Bytes to the PNOZmulti and receive 20 Bytes from the PNOZmulti. The Master can process the information in bytes, words or in double words.

- Input data (to the PNOZmulti)

Double word	Word	Byte	Contents
0	0	0	Status of inputs
		1	
	1	2	
		3	Reserved
1	2	4	Table no.
		5	Segment no.
	3	6	Reserved
		7	Reserved
2	4	8	Reserved
		9	Reserved
	5	10	Reserved
		11	Reserved
3	6	12	Reserved
		13	Reserved
	7	14	Reserved
		15	Reserved
4	8	16	Reserved
		17	Reserved
	9	18	Reserved
		19	Reserved

- Output data (from the PNOZmulti)

Double word	Word	Byte	Contents
0	0	0	Status of outputs
		1	
	1	2	
		3	LED status
1	2	4	Table no.
		5	Segment no.
	3	6	Segment Byte 0
		7	Segment Byte 1
2	4	8	.
		9	.
	5	10	.
		11	.
3	6	12	.
		13	.
	7	14	.
		15	.
4	8	16	.
		17	.
	9	18	Segment Byte 12
		19	Reserved

- Note on the PNOZ mc6p (CANopen):

The output data on the PNOZmulti is stored as follows:

Byte	Object Index (hex)	Sub-index (hex)	PDO	COB-ID
0	2000	1	TPDO 1	180 + node address
1	2000	2		
2	2000	3		
3	2000	4		
4	2000	5		
5	2000	6		
6	2000	7		
7	2000	8		
8	2000	9	TPDO 2	280 + node address
9	2000	A		
10	2000	B		
11	2000	C		
12	2000	D		
13	2000	E		
14	2000	F		
15	2000	10		
16	2000	11	TPDO 3	1C0 + node address
17	2000	12		
18	2000	13		
19	2000	14		

The input data on the PNOZmulti is stored as follows:

Byte	Object Index (hex)	Sub-index (hex)	PDO	COB-ID
0	2100	1	RPDO 1	200 + node address
1	2100	2		
2	2100	3		
3	2100	4		
4	2100	5		
5	2100	6		
6	2100	7		
7	2100	8		
8	2100	9	RPDO 2	300 + node address
9	2100	A		
10	2100	B		
11	2100	C		
12	2100	D		
13	2100	E		
14	2100	F		
15	2100	10		
16	2100	11	RPDO 3	240 + node address
17	2100	12		
18	2100	13		
19	2100	14		

Key is as follows:
TPDO Transmit Process Data Object
RPDO Receive Process Data Object
COB-ID Communication Object Identifier

The current status of the outputs configured for the fieldbus plus the current status of the LED are always stored in Byte 0 ... Byte 3. All other information is stored in various tables.

Assignment of Byte 0 ... Byte 3

•Input range
The inputs are defined in the master and transferred to the PNOZmulti. Each input has a number, e.g. the input Bit 4 of Byte 1 has the number i12.

Byte								
0	i7	i6	i5	i4	i3	i2	i1	i0
1	i15	i14	i13	i12	i11	i10	i9	i8
2	i23	i22	i21	i20	i19	i18	i17	i16

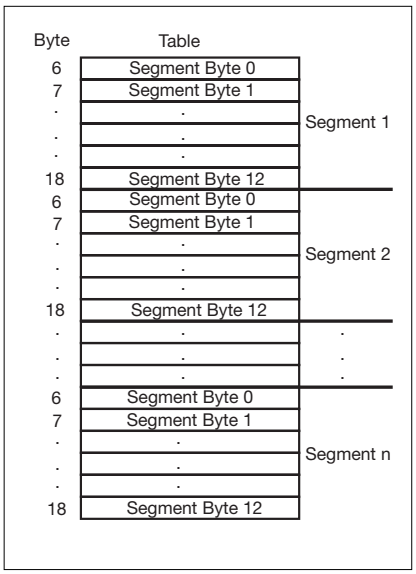
•Output range
The inputs are defined in the master and transferred to the PNOZmulti. Each output that is used is given a number there, e.g. o0, o5... The status of output o0 is stored in Bit 0 of Byte 0; the status of output o5 is stored in Bit 5 of Byte 0 etc.

Byte								
0	o7	o6	o5	o4	o3	o2	o1	o0
1	o15	o14	o13	o12	o11	o10	o9	o8
2	o23	o22	o21	o20	o19	o18	o17	o16

Communication with fieldbus modules
Basics

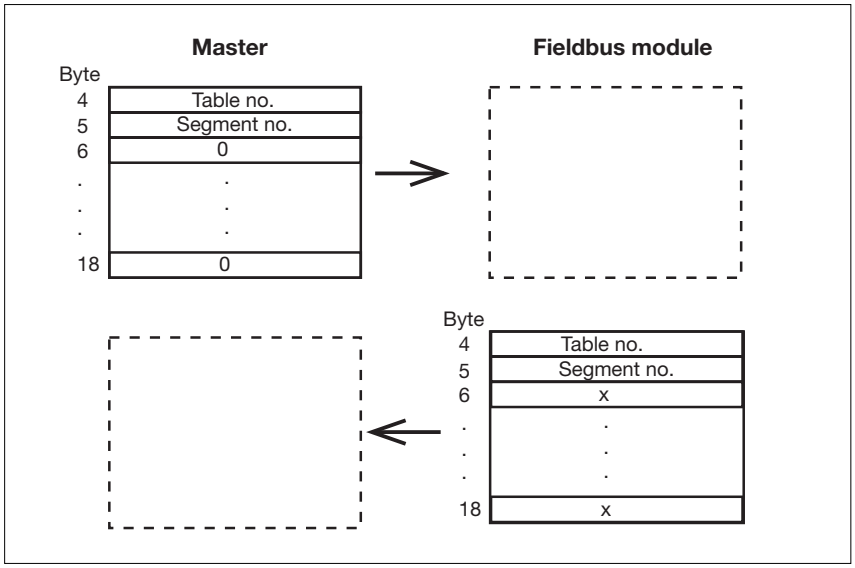
The status of the LEDs is stored in Byte 3 (output range only):
Bit 0 = 1: LED OFAULT is lit or flashes
Bit 1 = 1: LED IFAULT is lit or flashes
Bit 2 = 1: LED FAULT is lit or flashes
Bit 3 = 1: LED DIAG is lit
Bit 4 = 1: LED RUN is lit
Bit 5 = 1: If communication between the PNOZmulti and the fieldbus is working
Bit 6: Reserved
Bit 7: Reserved

Assignment of Byte 4 ... Byte 18



Each table consists of one or more segments. Each segment is made up of 13 Bytes. There are 8 tables, whose assignment is fixed.

The Master requests the required data using the table number and segment number. The Slave (e.g. PNOZ mc3p) repeats the two numbers and sends the requested data. If data is requested that is not available, the Slave sends the error message “FF” instead of the segment number.
The segments may be requested in any sequence.



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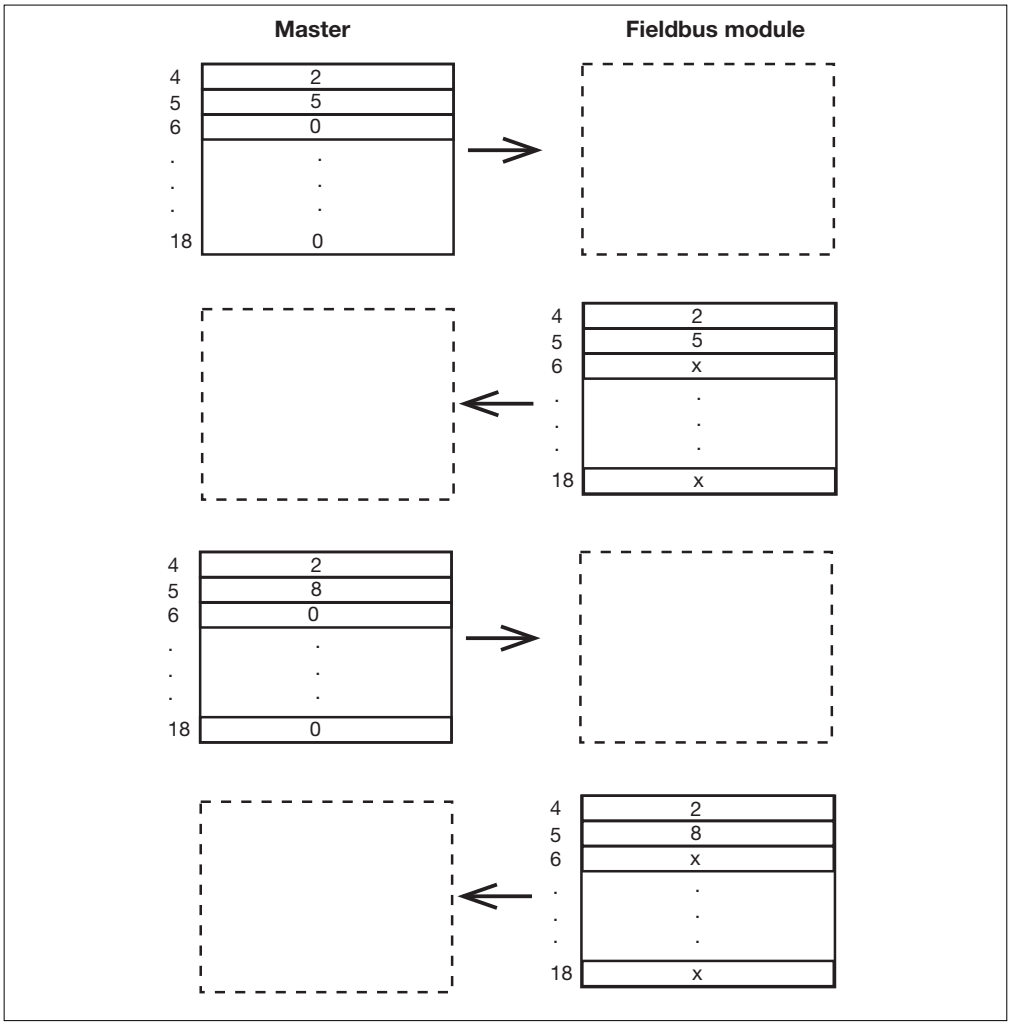
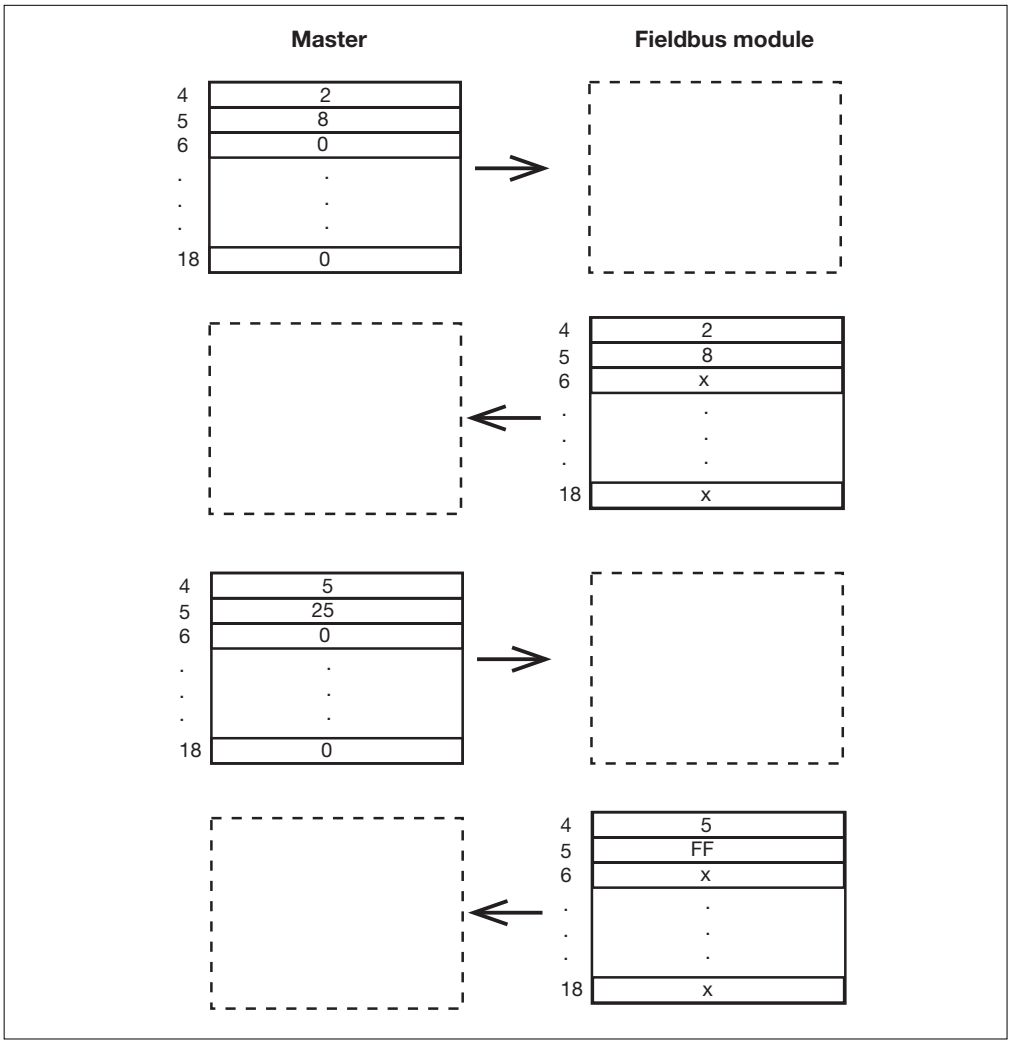
Communication with fieldbus modules
Basics

Example 1:
The Master requests segment 5 from table 2. The fieldbus module repeats both these details and sends segment 5. Then the data from segment 8 in table 2 is transmitted.



Communication with fieldbus modules
Basics

Example 2:
The Master requests segment 8 from table 2. The fieldbus module repeats both of these details and sends segment 8. Then the Master requests segment 25 from table 5. As this table does not contain a segment 25, the Slave registers an error and sends back “FF”.



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Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table assignment

There are a total of 6 tables, with the following contents:
Table 1: Configuration
Table 2: Reserved
Table 3: Input status
Table 4: Output status
Table 5: LED status
Table 6: Reserved
Table 7: Diagnostic word
Table 8: Element types

Table 1
Table 1 consists of 8 segments, each of which has 13 Bytes. It contains device data from the base unit and the project data defined in the PNOZmulti Configurator.

Segment	Byte	Contents	Example/Comment
0	0	Product number (hex)	Product number 773 100: 000BCBEC hex Byte 0: 00, Byte 1: 0B, Byte 2: CB, Byte 3: EC
	1		
	2		
	3		
	4	Unit version (hex)	Unit version 20: 14 hex Byte 4: 00, Byte 5: 00, Byte 6: 00, Byte 7: 14
	5		
	6		
	7		
	8	Serial number (hex)	Serial number 123 456: 0001E240 hex. Byte 8: 00, Byte 9: 01, Byte 10: E2, Byte 11: 40
	9		
	10		
	11		
	12	Free	
1	0	Project check sum (hex)	Check sum A1B2 hex: Byte 0: A1, Byte 1: B2
	1		
	2	Chip card check sum (hex)	Check sum 3C5A hex: Byte 2: 3C, Byte 3: 5A
	3		
	4	Project creation date (hex)	Creation date : 28.11.2003 Byte 4: 1C, Byte 5: 0B, Byte 6: 07, Byte 7: D3
	5		
	6		
	7		
	8	Operating hours counter (hex)	Byte 8: x 10000 hex Byte 9: x 100 hex Byte 10: x 1 hex Operating hours: 106786 Byte 8: 01, Byte 9: A1, Byte 10: 22
	9		
	10		
	11	Type of base unit (hex)	PNOZ m1p: 00 PNOZ mop: 02 PNOZ m2p: 04
	12	Free	Free

Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 1, Segment 2 and 3

Segment	Byte(s)	Contents	Example/Comment
2	0	Configuration, fieldbus module/RS 232	Byte 0 contains the Hex code for a fieldbus module (installed on the left) or for inputs and outputs via RS 232: Fieldbus modules PNOZ mc.. : 30 Virtual inputs and outputs via RS 232: 40 Additional input modules on the left: PNOZml1p: See Table 1, Segment 8 Byte 1 ... 8 contains the Hex code for the expansion modules on the right : PNOZ mi1p: 08 PNOZ mi2p: 38 PNOZ mo1p: 18 PNOZ mo2p: 10 PNOZ mo3p: 30 PNOZ mo4p: 28 PNOZ mc1p: 20 PNOZ ms3p: 68 PNOZ ms4p: 78 PNOZ ms1p/PNOZ ms2p: 88 No expansion module: 00
	1	Configuration, 1st expansion module right	
	2	Configuration, 2nd expansion module right	
	3	Configuration, 3rd expansion module right	
	4	Configuration, 4th expansion module right	
	5	Configuration, 5th expansion module right	
	6	Configuration, 6th expansion module right	
	7	Configuration, 7th expansion module right	
	8	Configuration, 8th expansion module right	
	9	Free	
	10	Free	
	11	Free	
	12	Free	
3	0		Byte 0 ... 12 of the project name defined in the PNOZm Config under “Enter project data”; this is stored in UNICODE format, 2 Bytes contain the Hex code of the individual UNICODE characters
	1	1st character	
	2		
	3	2nd character	
	4		
	5	3rd character	
	6		
	7	4th character	
	8		
	9	5th character	
	10		
	11	6th character	
	12	7th character (High Byte)	

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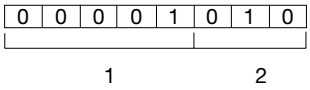
Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 1, Segment 4 and 5

Segment	Byte	Contents	Example/Comment
4	0	7th character (Low Byte)	Project name Byte 13 ... 25
	1	8th character	
	2		
	3	9th character	
	4		
	5	10th character	
	6		
	7	11th character	
	8		
	9	12th character	
	10		
	11	13th character	
	12		
5	0	14th character	Project name Byte 26 ... 31
	1		
	2	15th character	
	3		
	4	16th character	
	5		
	6	End character FF	The end of the character string is signalled with “FFFF”.
	7	End character FF	
	8	Free	
	9	Free	
	10	Free	
	11	Free	
	12	Free	

Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 1, Segment 6 to 8

Segment	Byte	Contents	Example/Comment
6	0	Day	Date on which the program on the chip card was last modified Date modified : 28.11.2003 Byte 0: 1C, Byte 1: 0B, Byte 2: 07, Byte 3: D3 Time: 14 hours 25 minutes Byte 4: 0E, Byte 5: 19 Time zone 1: Byte 6 : 01
	1	Month	
	2	Year	
	3		
	4	Hour	
	5	Minute	
	6	Time zone	
	7	Reserved	
	8	Reserved	
	9	Reserved	
	10	Reserved	
	11	Reserved	
	12	Reserved	
7	0	Fieldbus type (hex)	Profibus: 0001 Interbus: 0010 Interbus 2M: 0011 DeviceNet: 0025 CanOpen: 0020 Ethernet IP/ Modbus TCP: 0083 PROFINET: 0084 CC Link: 0090
	1		
	2	Software version	5 Bits for version, 3 Bits for sub-number Version: 1.2 Byte 2 
	3 ... 12	Reserved	
8	0	Configuration, 1st expansion module left	Byte 0 ... 5 contains the Hex code for the expansion modules to the left of the base unit. Any fieldbus module in this segment will not be considered (see Table 1, Segment 2). PNOZ ml1p: A8 PNOZ ma1p: B8
	1	Configuration, 2nd expansion module left	
	2	Configuration, 3rd expansion module left	
	3	Configuration, 4th expansion module left	
	4	Configuration, 5th expansion module left	
	5	Configuration, 6th expansion module left	
	6 ... 12	Free	

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Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 3
This table consists of 4 segments. It contains the status of the inputs.

Segment	Byte	Contents		Example/Comment
0	0	I0 ... I7	Base unit	The safety system consists of a base unit and one PNOZ mi1p.
	1	I8 ... I15	Base unit	
	2	I16 ... I19	Base unit	Byte 0: I7 I6 I5 I4 I3 I2 I1 I0 PNOZ m1p
	3	0		Byte 1: I15 I14 I13 I12 I11 I10 I9 I8 PNOZ m1p
	4	0		Byte 2: 0 0 0 0 I19 I18 I17 I16 PNOZ m1p
	5	I0 ... I7	1st expansion module right	Byte 3: 0 0 0 0 0 0 0 0
	6	I0 ... I7	2nd expansion module right	Byte 4: 0 0 0 0 0 0 0 0
	7	I0 ... I7	3rd expansion module right	Byte 5: I7 I6 I5 I4 I3 I2 I1 I0 PNOZ mi1p
	8	I0 ... I7	4th expansion module right	
	9	I0 ... I7	5th expansion module right	If an input has a high signal, the corresponding Bit will contain “1”; if the input is open (low signal), the Bit will contain “0”.
	10	I0 ... I7	6th expansion module right	
	11	I0 ... I7	7th expansion module right	
	12	I0 ... I7	8th expansion module right	
1	0	I0 ... I7	1st expansion module left	Virtual inputs on the 2nd PNOZ ml1p connection module:
	1	I8 ... I15	1st expansion module left	
	2	I16 ... I23	1st expansion module left	
	3	I24 ... I31	1st expansion module left	Byte 4: I7 I6 I5 I4 I3 I2 I1 I0
	4	I0 ... I7	2nd expansion module left	Byte 5: I15 I14 I13 I12 I11 I10 I9 I8
	5	I8 ... I15	2nd expansion module left	Byte 6: I23 I22 I21 I20 I19 I18 I17 I16
	6	I16 ... I23	2nd expansion module left	Byte 7: I31 I30 I29 I28 I27 I26 I25 I24
	7	I24 ... I31	2nd expansion module left	
	8	I0 ... I7	3rd expansion module left	If an input has a high signal, the corresponding Bit will contain “1”; if the input is open (low signal), the Bit will contain “0”.
	9	I8 ... I15	3rd expansion module left	
	10	I16 ... I23	3rd expansion module left	
	11	I24 ... I31	3rd expansion module left	
	12	Free		Analogue inputs on the analogue input module PNOZ ma1p:
2	0	I0 ... I7	4th expansion module left	Byte 0: Analogue Input 0 Analogue Value High Byte
	1	I8 ... I15	4th expansion module left	Byte 1: Analogue Input 0 Analogue Value Low Byte
	2	I16 ... I23	4th expansion module left	Byte 2: Analogue Input 1 Analogue Value High Byte
	3	I24 ... I31	4th expansion module left	Byte 3: Analogue Input 1 Analogue Value Low Byte
	4	I0 ... I7	5th expansion module left	
	5	I8 ... I15	5th expansion module left	Bytes 0 and 1 are to be interpreted as words and will be displayed as a scaled value.
	6	I16 ... I23	5th expansion module left	A distinction is made between voltage and current measurement.
	7	I24 ... I31	5th expansion module left	The following applies when current is measured: 1 Bit = 6.25 µA
	8	I0 ... I7	6th expansion module left	e.g.: Byte 0 = 0x01; Byte 1 = 0xff
	9	I8 ... I15	6th expansion module left	-> 0x01ff * 6.25 µA = 3.19 mA
	10	I16 ... I23	6th expansion module left	The following applies when voltage is measured: 1 Bit = 2.5 mV
	11	I24 ... I31	6th expansion module left	Please note:
	12	Free		With voltage measurement, negative values are also valid. The negative value is formed via the two’s complement.
				e.g.: Byte 0 = 0x01; Byte 1 = 0xff
				-> 0x01ff * 2.5 mV = 1.28 V
				e.g.: Byte 0 = 0x0F8; Byte 1 = 0x30
				-> 0xF830 = -5 V

Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 4
This table consists of 4 segments. It contains the status of the outputs.

Segment	Byte	Contents	Example/Comment
0	0	0	Assignment of Bytes depends on the unit:
	1	0	PNOZ m0p, PNOZ m1p, PNOZ m2p
	2	0	Segment 0, Byte 3:
	3	O0 ... O3 of the base unit	0 0 1 1 O3 O2 O1 O0
	4	O4 and O5 of the base unit	Segment 0, Byte 4:
	5	O0 ... O7 1st expansion module right	0 0 0 0 0 0 O5 O4
	6	O0 ... O7 2nd expansion module right	PNOZ mo1p
	7	O0 ... O7 3rd expansion module right	Segment 0, Byte 5 ... 12:
	8	O0 ... O7 4th expansion module right	0 0 1 1 O3 O2 O1 O0
	9	O0 ... O7 5th expansion module right	Segment 1, Byte 5 ... 12:
	10	O0 ... O7 6th expansion module right	0 0 0 0 0 0 0 0
	11	O0 ... O7 7th expansion module right	PNOZ mo2p, PNOZ mo3p
	12	O0 ... O7 8th expansion module right	Segment 0, Byte 5 ... 12:
1	0	0	0 0 0 0 0 0 O1 O0
	1	0	Segment 1, Byte 5 ... 12:
	2	0	0 0 0 0 0 0 0 0
	3	0	PNOZ mo4p
	4	0	Segment 0, Byte 5 ... 12:
	5	O8 ... O15 1st expansion module right	0 0 0 0 O3 O2 O1 O0
	6	O8 ... O15 2nd expansion module right	Segment 1, Byte 5 ... 12:
	7	O8 ... O15 3rd expansion module right	0 0 0 0 0 0 0 0
	8	O8 ... O15 4th expansion module right	PNOZ mc1p
	9	O8 ... O15 5th expansion module right	Segment 0, Byte 5 ... 12:
	10	O8 ... O15 6th expansion module right	A7 A6 A5 A4 A3 A2 A1 A0
	11	O8 ... O15 7th expansion module right	Segment 1, Byte 5 ... 12:
	12	O8 ... O15 8th expansion module right	A15 A14 A13 A12 A11 A10 A9 A8
			If an output has a high signal, the corresponding Bit will contain “1”; if the output is open (low signal), the Bit will contain “0”.

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Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 4, Segments 2 and 3

Segment	Byte	Contents	Example/Comment
2	0	O0 ... O7 1st PNOZ ml1p connection module left	Virtual outputs on the 3rd PNOZ ml1p connection module: Segment 2 Byte 8: O7 O6 O5 O4 O3 O2 O1 O0 Byte 9: O15 O14 O13 O12 O11 O10 O9 O8 Byte 10: O23 O22 O21 O20 O19 O18 O17 O16 Byte 11: O31 O30 O29 O28 O27 O26 O25 O24 If an output has a high signal, the corresponding Bit will contain “1”; if the output is open (low signal), the Bit will contain “0”.
	1	O8 ... O15 1st PNOZ ml1p connection module left	
	2	O16 ... O23 1st PNOZ ml1p connection module left	
	3	O24 ... O31 1st PNOZ ml1p connection module left	
	4	O0 ... O7 2nd PNOZ ml1p connection module left	
	5	O8 ... I15 2nd PNOZ ml1p connection module left	
	6	O16 ... O23 2nd PNOZ ml1p connection module left	
	7	O24 ... O31 2nd PNOZ ml1p connection module left	
	8	O0 ... O7 3rd PNOZ ml1p connection module left	
	9	O8 ... O15 3rd PNOZ ml1p connection module left	
	10	O16 ... O23 3rd PNOZ ml1p connection module left	
	11	O24 ... O31 3rd PNOZ ml1p connection module left	
	12	Free	
3	0	O0 ... O7 4th PNOZ ml1p connection module left	
	1	O8 ... O15 4th PNOZ ml1p connection module left	
	2	O16 ... O23 4th PNOZ ml1p connection module left	
	3	O24 ... O31 4th PNOZ ml1p connection module left	
	4	O0 ... O7 5th PNOZ ml1p connection module left	
	5	O8 ... I15 5th PNOZ ml1p connection module left	
	6	O16 ... O23 5th PNOZ ml1p connection module left	
	7	O24 ... O31 5th PNOZ ml1p connection module left	
	8	O0 ... O7 6th PNOZ ml1p connection module left	
	9	O8 ... O15 6th PNOZ ml1p connection module left	
	10	O16 ... O23 6th PNOZ ml1p connection module left	
	11	O24 ... O31 6th PNOZ ml1p connection module left	
	12	Free	

Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 5
This table consists of 5 segments. It contains the LED status.

Segment	Byte	Contents	Example/Comment
0	0	RUN	Depending on the LED status, the following Hex code will be in Byte 0 ... 12: 00 hex: LED off FF hex: LED on 30 hex: LED flashes
	1	DIAG	
	2	FAULT	
	3	IFAULT	
	4	OFAULT	
	5	FAULT 1st expansion module right	
	6	FAULT 2nd expansion module right	
	7	FAULT 3rd expansion module right	
	8	FAULT 4th expansion module right	
	9	FAULT 5th expansion module right	
	10	FAULT 6th expansion module right	
	11	FAULT 7th expansion module right	
	12	FAULT 8th expansion module right	
1	0	LED I0 ... I7 base unit	PNOZ mi1p Bytes 5 ... 12, Bit 7 6 5 4 3 3 1 0 Input: I7 I6 I5 I4 I3 I2 I1 I0 Example: The safety system consists of a base unit and one PNOZ mi1p. Byte 0 I7 I6 I5 I4 I3 I2 I1 I0 Base unit Byte 1 I15 I14 I13 I12 I11 I10 I9 I8 Base unit Byte 2 0 0 0 0 I19 I18 I17 I16 Base unit Byte 3 0 0 0 0 0 0 0 0 Byte 4 0 0 0 0 0 0 0 0 Byte 5 I7 I6 I5 I4 I3 I2 I1 I0 PNOZ mi1p If the LED on an input is flashing, the corresponding bit contains “1”; if the LED is not flashing, the bit contains “0”. PNOZ ms1p, PNOZ ms2p from Version 2.0, PNOZ ms3p, PNOZ ms4p LED axis 1 = “SHAFT 1” LED axis 2 = “SHAFT 2” (not on PNOZ ms4p) Byte 5 ... 12 Axis 2 Axis 1 Bit 7 6 5 4 3 2 1 0 LED off 0 0 0 0 0 0 0 0 LED on 1 1 1 1 1 1 1 1 LED flashes 0 0 1 1 0 0 1 1 LED flashes once 0 1 0 1 0 1 0 1 The LED functions are described in the PNOZ ms1p, PNOZ ms 2p operating instructions.
	1	LED I8 ... I15 base unit	
	2	LED I16 ... I19 base unit	
	3	0	
	4	0	
	5	LED 1st expansion module right	
	6	LED 2nd expansion module right	
	7	LED 3rd expansion module right	
	8	LED 4th expansion module right	
	9	LED 5th expansion module right	
	10	LED 6th expansion module right	
	11	LED 7th expansion module right	
	12	LED 8th expansion module right	

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Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 5, Segment 2 to 4

Segment	Byte	Contents	Example/Comment
2	0	LED1: Status of fieldbus module	Position of LED1 ... LED4:  LED off 0 0 0 0 0 0 0 0 LED green 0 0 0 0 0 0 0 1 LED red 0 0 0 0 0 0 1 0 The functions of the LED are described in the relevant operating manual.
	1	LED2: Status of fieldbus module	
	2	LED3: Status of fieldbus module	
	3	LED4: Status of fieldbus module	
	4	Free	
	5	Free	
	6	Free	
	7	Free	
	8	Free	
	9	Free	
	10	Free	
	11	Free	
	12	Free	

Segment	Byte	Contents	Example/Comment
3	0	Speed monitor 1 - Encoder on axis 1	Status of LEDs on the speed monitors PNOZ ms1p/PNOZ ms2p: I10, I11, I20, I21, X12, X22 PNOZ ms3p: X12 and X22 PNOZ ms4p: X12 Bit: 7 6 5 4 3 2 1 0 Axis 1: 0 0 I11 I11 I10 I10 0 X12 Axis 2: 0 0 I21 I21 I20 I20 0 X22 LEDs for proximity switch: I10, I11, I20, I21: If the LED is lit, the corresponding Bit will contain “1”; The proximity switch is energised. LEDs for incremental encoder: X12 and X22: If the LED is lit, the corresponding Bit will contain “1”; The incremental encoder is connected correctly The LED functions are described in the PNOZ ms1p, PNOZ ms 2p operating instructions.
	1	Speed monitor 1 - Encoder on axis 2	
	2	Speed monitor 2 - Encoder on axis 1	
	3	Speed monitor 2 - Encoder on axis 2	
	4	Speed monitor 3 - Encoder on axis 1	
	5	Speed monitor 3 - Encoder on axis 2	
	6	Speed monitor 4 - Encoder on axis 1	
	7	Speed monitor 4 - Encoder on axis 2	
	8	Free	
	9	Free	
	10	Free	
	11	Free	
	12	Free	
4	0	FAULT 1st expansion module left	Depending on the LED status, the following Hex code will be in Byte 0 ... 5: 00 hex: LED off FF hex: LED on 30 hex: LED flashes
	1	FAULT 2nd expansion module left	
	2	FAULT 3rd expansion module left	
	3	FAULT 4th expansion module left	
	4	FAULT 5th expansion module left	
	5	FAULT 6th expansion module left	
	6	Free	
	7	Free	
	8	Free	
	9	Free	
	10	Free	
	11	Free	
	12	Free	

Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 7 and 8

System requirements
Communication with fieldbus modules is only possible with units from the stated version number onwards:
- PNOZ mc.. from Version 1.0
- PNOZ m0p from Version 1.0
- PNOZ m1p from Version 4.0
- PNOZ m2p from Version 1.0

Table 7
This table consists of 20 segments. It contains information on the elements within the Configurator and on the diagnostic word.

Segment	Byte	Contents	Example/Comment
0	0	Number of elements that can store a status	
	1	Reserved	
	2	Reserved	
	3	Reserved	
	4	Reserved	
	5	Reserved	
	6	Reserved	
	7	Reserved	
	8	Reserved	
	9	Reserved	
	10	Reserved	
	11	Reserved	
	12	Reserved	
1	0	Element ID = 1 ... 8	Each element is assigned an ID in the PNOZmulti Configurator. If the output on the element = 0 (no enable), the corresponding Bit will be set.
	1	Element ID = 9 ... 16	
	2	Element ID = 17 ... 24	
	3	Element ID = 25 ... 32	
	4	Element ID = 33 ... 40	
	5	Element ID = 41 ... 48	
	6	Element ID = 49 ... 56	
	7	Element ID = 57 ... 64	
	8	Element ID = 65 ... 72	
	9	Element ID = 73 ... 80	
	10	Element ID = 81 ... 88	
	11	Element ID = 89 ... 96	
	12	Element ID = 97 ... 100	

Element ID

Byte 0	8	7	6	4	4	3	2	1
Byte 1	16	15	14	13	12	11	10	9
Byte 2	24	23	22	21	20	19	18	17
...				...				
Byte 10	88	87	86	85	84	83	82	81
Byte 11	96	95	94	93	92	91	90	89
Byte 12	-	-	-	-	100	99	98	97

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Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 7, Segment 2 to 4

Segment	Byte	Contents	Example/Comment
2	0	Reserved	
	1	Reserved	
	2	Reserved	
	3	Reserved	
	4	Reserved	
	5	Reserved	
	6	Reserved	
	7	Reserved	
	8	Reserved	
	9	Reserved	
	10	Reserved	
	11	Reserved	
	12	Reserved	
3	0, 1	Diagnostic word. Element ID = 1	The diagnostic word is displayed in the PNOZmulti Configurator and on the PVIS expanded diagnostics (see Chapter 6, diagnostic word, plus the online help for the PNOZmulti Configurator) Element D = 1, e.g. diagnostic word of switch type 6 (element type 1C hex): Byte 0 (High Byte) 0 0 0 0 0 0 0 1 Byte 1 (Low Byte) 0 0 0 0 0 0 0 0 Message: wiring error, clock error
	2, 3	Diagnostic word. Element ID = 2	
	4, 5	Diagnostic word. Element ID = 3	
	6, 7	Diagnostic word. Element ID = 4	
	8, 9	Diagnostic word. Element ID = 5	
	10,11	Diagnostic word. Element ID = 6	
	12	Reserved	
4	0, 1	Diagnostic word. Element ID = 7	
	2, 3	Diagnostic word. Element ID = 8	
	4, 5	Diagnostic word. Element ID = 9	
	6, 7	Diagnostic word. Element ID = 10	
	8, 9	Diagnostic word. Element ID = 11	
	10,11	Diagnostic word. Element ID = 12	
	12	Reserved	

Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 7, Segment 5 to 8

Segment	Byte	Contents
5	0, 1	Diagnostic word. Element ID = 13
	2, 3	Diagnostic word. Element ID = 14
	4, 5	Diagnostic word. Element ID = 15
	6, 7	Diagnostic word. Element ID = 16
	8, 9	Diagnostic word. Element ID = 17
	10,11	Diagnostic word. Element ID = 18
	12	Reserved
6	0, 1	Diagnostic word. Element ID = 19
	2, 3	Diagnostic word. Element ID = 20
	4, 5	Diagnostic word. Element ID = 21
	6, 7	Diagnostic word. Element ID = 22
	8, 9	Diagnostic word. Element ID = 23
	10,11	Diagnostic word. Element ID = 24
	12	Reserved
7	0, 1	Diagnostic word. Element ID = 25
	2, 3	Diagnostic word. Element ID = 26
	4, 5	Diagnostic word. Element ID = 27
	6, 7	Diagnostic word. Element ID = 28
	8, 9	Diagnostic word. Element ID = 29
	10,11	Diagnostic word. Element ID = 30
	12	Reserved
8	0, 1	Diagnostic word. Element ID = 31
	2, 3	Diagnostic word. Element ID = 32
	4, 5	Diagnostic word. Element ID = 33
	6, 7	Diagnostic word. Element ID = 34
	8, 9	Diagnostic word. Element ID = 35
	10,11	Diagnostic word. Element ID = 36
	12	Reserved

Table 7, Segment 9 to 12

Segment	Byte	Contents
9	0, 1	Diagnostic word. Element ID = 37
	2, 3	Diagnostic word. Element ID = 38
	4, 5	Diagnostic word. Element ID = 39
	6, 7	Diagnostic word. Element ID = 40
	8, 9	Diagnostic word. Element ID = 41
	10,11	Diagnostic word. Element ID = 42
	12	Reserved
10	0, 1	Diagnostic word. Element ID = 43
	2, 3	Diagnostic word. Element ID = 44
	4, 5	Diagnostic word. Element ID = 45
	6, 7	Diagnostic word. Element ID = 46
	8, 9	Diagnostic word. Element ID = 47
	10,11	Diagnostic word. Element ID = 48
	12	Reserved
11	0, 1	Diagnostic word. Element ID = 49
	2, 3	Diagnostic word. Element ID = 50
	4, 5	Diagnostic word. Element ID = 51
	6, 7	Diagnostic word. Element ID = 52
	8, 9	Diagnostic word. Element ID = 53
	10,11	Diagnostic word. Element ID = 54
	12	Reserved
12	0, 1	Diagnostic word. Element ID = 55
	2, 3	Diagnostic word. Element ID = 56
	4, 5	Diagnostic word. Element ID = 57
	6, 7	Diagnostic word. Element ID = 58
	8, 9	Diagnostic word. Element ID = 59
	10,11	Diagnostic word. Element ID = 60
	12	Reserved

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Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 7, Segment 13 to 16

Segment	Byte	Contents
13	0, 1	Diagnostic word. Element ID = 61
	2, 3	Diagnostic word. Element ID = 62
	4, 5	Diagnostic word. Element ID = 63
	6, 7	Diagnostic word. Element ID = 64
	8, 9	Diagnostic word. Element ID = 65
	10,11	Diagnostic word. Element ID = 66
	12	Reserved
14	0, 1	Diagnostic word. Element ID = 67
	2, 3	Diagnostic word. Element ID = 68
	4, 5	Diagnostic word. Element ID = 69
	6, 7	Diagnostic word. Element ID = 70
	8, 9	Diagnostic word. Element ID = 71
	10,11	Diagnostic word. Element ID = 72
	12	Reserved
15	0, 1	Diagnostic word. Element ID = 73
	2, 3	Diagnostic word. Element ID = 74
	4, 5	Diagnostic word. Element ID = 75
	6, 7	Diagnostic word. Element ID = 76
	8, 9	Diagnostic word. Element ID = 77
	10,11	Diagnostic word. Element ID = 78
	12	Reserved
16	0, 1	Diagnostic word. Element ID = 79
	2, 3	Diagnostic word. Element ID = 80
	4, 5	Diagnostic word. Element ID = 81
	6, 7	Diagnostic word. Element ID = 82
	8, 9	Diagnostic word. Element ID = 83
	10,11	Diagnostic word. Element ID = 84
	12	Reserved

Table 7, Segment 17 to 19

Segment	Byte	Contents
17	0, 1	Diagnostic word. Element ID = 85
	2, 3	Diagnostic word. Element ID = 86
	4, 5	Diagnostic word. Element ID = 87
	6, 7	Diagnostic word. Element ID = 88
	8, 9	Diagnostic word. Element ID = 89
	10,11	Diagnostic word. Element ID = 90
	12	Reserved
18	0, 1	Diagnostic word. Element ID = 91
	2, 3	Diagnostic word. Element ID = 92
	4, 5	Diagnostic word. Element ID = 93
	6, 7	Diagnostic word. Element ID = 94
	8, 9	Diagnostic word. Element ID = 95
	10,11	Diagnostic word. Element ID = 96
	12	Reserved
19	0, 1	Diagnostic word. Element ID = 97
	2, 3	Diagnostic word. Element ID = 98
	4, 5	Diagnostic word. Element ID = 99
	6, 7	Diagnostic word. Element ID = 100
	8, 9	Reserved
	10,11	Reserved
	12	Reserved

Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 8
This table consists of 8 segments. It contains the element type with the corresponding Element ID. The available element types are listed after this table.

Segment	Byte	Contents	Example/Comment
0	0	Element type. Element ID = 1	Element with ID = 1: Single-pole semiconductor output with feedback loop Byte 0: 51 hex
	1	Element type. Element ID = 2	
	2	Element type. Element ID = 3	
	3	Element type. Element ID = 4	
	4	Element type. Element ID = 5	
	5	Element type. Element ID = 6	
	6	Element type. Element ID = 7	
	7	Element type. Element ID = 8	
	8	Element type. Element ID = 9	
	9	Element type. Element ID = 10	
	10	Element type. Element ID = 11	
	11	Element type. Element ID = 12	
	12	Element type. Element ID = 13	
1	0	Element type. Element ID = 14	
	1	Element type. Element ID = 15	
	2	Element type. Element ID = 16	
	3	Element type. Element ID = 17	
	4	Element type. Element ID = 18	
	5	Element type. Element ID = 19	
	6	Element type. Element ID = 20	
	7	Element type. Element ID = 21	
	8	Element type. Element ID = 22	
	9	Element type. Element ID = 23	
	10	Element type. Element ID = 24	
	11	Element type. Element ID = 25	
	12	Element type. Element ID = 26	

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Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 8, Segment 2 and 3

Segment	Byte	Contents
2	0	Element type. Element ID = 27
	1	Element type. Element ID = 28
	2	Element type. Element ID = 29
	3	Element type. Element ID = 30
	4	Element type. Element ID = 31
	5	Element type. Element ID = 32
	6	Element type. Element ID = 33
	7	Element type. Element ID = 34
	8	Element type. Element ID = 35
	9	Element type. Element ID = 36
	10	Element type. Element ID = 37
	11	Element type. Element ID = 38
	12	Element type. Element ID = 39
3	0	Element type. Element ID = 40
	1	Element type. Element ID = 41
	2	Element type. Element ID = 42
	3	Element type. Element ID = 43
	4	Element type. Element ID = 44
	5	Element type. Element ID = 45
	6	Element type. Element ID = 46
	7	Element type. Element ID = 47
	8	Element type. Element ID = 48
	9	Element type. Element ID = 49
	10	Element type. Element ID = 50
	11	Element type. Element ID = 51
	12	Element type. Element ID = 52

Table 8, Segment 4 and 5

Segment	Byte	Contents
4	0	Element type. Element ID = 53
	1	Element type. Element ID = 54
	2	Element type. Element ID = 55
	3	Element type. Element ID = 56
	4	Element type. Element ID = 57
	5	Element type. Element ID = 58
	6	Element type. Element ID = 59
	7	Element type. Element ID = 60
	8	Element type. Element ID = 61
	9	Element type. Element ID = 62
	10	Element type. Element ID = 63
	11	Element type. Element ID = 64
	12	Element type. Element ID = 65
5	0	Element type. Element ID = 66
	1	Element type. Element ID = 67
	2	Element type. Element ID = 68
	3	Element type. Element ID = 69
	4	Element type. Element ID = 70
	5	Element type. Element ID = 71
	6	Element type. Element ID = 72
	7	Element type. Element ID = 73
	8	Element type. Element ID = 74
	9	Element type. Element ID = 75
	10	Element type. Element ID = 76
	11	Element type. Element ID = 77
	12	Element type. Element ID = 78

Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Table 8, Segment 6 and 7

Segment	Byte	Contents
6	0	Element type. Element ID = 79
	1	Element type. Element ID = 80
	2	Element type. Element ID = 81
	3	Element type. Element ID = 82
	4	Element type. Element ID = 83
	5	Element type. Element ID = 84
	6	Element type. Element ID = 85
	7	Element type. Element ID = 86
	8	Element type. Element ID = 87
	9	Element type. Element ID = 88
	10	Element type. Element ID = 89
	11	Element type. Element ID = 90
	12	Element type. Element ID = 91
7	0	Element type. Element ID = 92
	1	Element type. Element ID = 93
	2	Element type. Element ID = 94
	3	Element type. Element ID = 95
	4	Element type. Element ID = 96
	5	Element type. Element ID = 97
	6	Element type. Element ID = 98
	7	Element type. Element ID = 99
	8	Element type. Element ID = 100
	9	Reserved
	10	Reserved
	11	Reserved
	12	Reserved

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Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Element types
The available element types are listed below. Details of the element type's byte are given in Table 8.
N/C. Normally closed contact
N/O: Normally open contact

Element type (Byte)	Element
	Function Elements
01	Switch type 1: N/C
02	Switch type 1: N/C, monitored reset
03	Switch type 1: N/C, manual reset
04	Switch type 1: N/C, start-up test
05	Switch type 1: N/C, start-up test, monitored reset
06	Switch type 1: N/C, start-up test, manual
07	Switch type 2: N/C, N/O
08	Switch type 2: N/C, N/O, monitored reset
09	Switch type 2: N/C, N/O, manual reset
0A	Switch type 2: N/C, N/O, start-up test
0B	Switch type 2: N/C, N/O, start-up test, monitored reset
0C	Switch type 2: N/C, N/O, start-up test, manual reset
0D	Switch type 3: N/C, N/C
0E	Switch type 3: N/C, N/C, monitored reset
0F	Switch type 3: N/C, N/C, manual reset
10	Switch type 3: N/C, N/C, start-up test
11	Switch type 3: N/C, N/C, start-up test, monitored reset
12	Switch type 3: N/C, N/C, start-up test, manual reset

Element type (Byte)	Element
13	Switch type 4: N/C, N/C, N/O
14	Switch type 4: N/C, N/C, N/O, monitored reset
15	Switch type 4: N/C, N/C, N/O, manual reset
16	Switch type 4: N/C, N/C, N/O, start-up test
17	Switch type 4: N/C, N/C, N/O, start-up test, monitored reset
18	Switch type 4: N/C, N/C, N/O, start-up test, manual reset
19	Switch type 5: N/C, N/C, N/C
1A	Switch type 5: N/C, N/C, N/C, monitored reset
1B	Switch type 5: N/C, N/C, N/C, manual reset
1C	Switch type 6: Two-hand, N/C N/O
1D	Switch type 7: Two-hand, N/O
1E	Operating mode selector switch 1 from 2
1F	Operating mode selector switch 1 from 3
20	Operating mode selector switch 1 from 4
21	Operating mode selector switch 1 from 5
22	Safety mat, with automatic reset
23	Safety mat, with start-up test
24	Safety mat, with reset button
25	Cascading input
26	Switch type 5: N/C, N/C, N/C, start-up test

Communication with fieldbus modules
PNOZ mc3p ... PNOZ mc9p

Element type (Byte)	Element
27	Switch type 5: N/C, N/C, N/C, start-up test, monitored reset
28	Switch type 5: N/C, N/C, N/C, start-up test, manual reset
2D	Operating mode selector switch 1 from 6
2E	Operating mode selector switch 1 from 7
2F	Operating mode selector switch 1 from 8
	Output elements
51	Single-pole semiconductor output with feedback loop
53	Single-pole, redundant semi-conductor output with feedback loop
55	Single-pole relay output with feedback loop
57	Single-pole, redundant relay output with feedback loop
59	Cascading output
5A	Single Valve
5B	Double Valve
5C	Directional Valve
5E	Dual-pole semiconductor output with feedback loop
60	Dual-pole, redundant semi-conductor output with feedback loop
	Logic Elements
80	Muting sensor: Cross muting
81	Muting sensor: Parallel muting
82	Muting sensor: Sequential muting
90	Reset element, manual reset
91	Reset element, monitored reset
92	RS flip-flops
93	Reset element, non-safety-related reset button, manual reset
94	Reset element, non-safety-related reset button, monitored reset
B1	Press-related element; set-up mode
B2	Press-related element; single-stroke
B3	Press-related element; automatic mode

Element type (Byte)	Element
B4	Press-related element; camshaft
B5	Press-related element; run monitoring
B6	Press-related element; light curtain in standard mode
B7	Press-related element; light curtain in Sweden mode
C1	Speed monitor PNOZ ms3p, automatic reset
C2	Speed monitor PNOZ ms3p, manual reset
C3	Speed monitor PNOZ ms3p, monitored reset
C4	Speed monitor PNOZ ms1p, PNOZ ms2p, incremental encoder (with proximity switch), automatic reset
C5	Speed monitor PNOZ ms1p, PNOZ ms2p, incremental encoder (with proximity switch), manual reset
C6	Speed monitor PNOZ ms1p, PNOZ ms2p, incremental encoder (with proximity switch), monitored reset
C7	Speed monitor PNOZ ms1p, PNOZ ms2p, proximity switch, automatic reset
C8	Speed monitor PNOZ ms1p, PNOZ ms2p, proximity switch, manual reset
C9	Speed monitor PNOZ ms1p, PNOZ ms2p, proximity switch, monitored reset
CA	Speed monitor PNOZ ms4p, automatic reset
CB	Speed monitor PNOZ ms4p, manual reset
CC	Speed monitor PNOZ ms4p, monitored reset

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Communication with fieldbus modules
PNOZ mc6p via SDOs

Service Data Object (SDO)

Overview

All the CANopen objects (variables and parameters) that are relevant for these units are entered in the CANopen object directory. Service Data Objects (SDOs) are used for read and write access.
The object directory is available as an EDS file (Electronic Data Sheet), enabling the PNOZ mc6p fieldbus module to be incorporated easily into a CANopen network.

The manufacturer-specific part of the object directory is structured as follows:

INFORMATION

Index	Contents
2000	Output data
2001	Diagnostic word (Low Byte)
2002	Diagnostic word (High Byte)
2003	Input status
	Status of input LED
	Output status
	LED status
2004	Configuration
2005	Element types
2006 ... 200A	Input assignments of elements with Element ID
2100	Input data

Data with indices 2001 to 2003 is updated by the PNOZmulti piece by piece in each cycle. This may mean that interdependent data is inconsistent. Updating all of the data can take up to 500 ms.

System requirements

Communication via SDOs is only possible with units from the stated version number onwards:
- PNOZ mc6p from Version 1.1
- PNOZ m0p from Version 1.0
- PNOZ m1p from Version 4.0
- PNOZ m2p from Version 1.0

INFORMATION
Indices 2006 ... 200A are no longer supported by base units from the following version number upwards:
- PNOZ m0p from Version 2.3
- PNOZ m1p from Version 5.3
- PNOZ m2p from Version 2.3

Communication with fieldbus modules
PNOZ mc6p via SDOs

Object Directory (Manufacturer Specific Profile Area)

Index 2000
This index contains the output data

Index (hex)	Sub-Index (dec)	Contents		Example/Comment
2000	1	Outputs Bit 0 … 7 fieldbus module		For information on the sub-indices please see section entitled "Communication with fieldbus systems" on page 2.10-44
	2	Outputs Bit 8 … 15 fieldbus module		
	3	Outputs Bit 16 … 23 fieldbus module		
	4	LED status		
	5	Table number		
	6	Segment number		
	7	Byte 0		
	8	Byte 1		
	9	Byte 2		
	10	Byte 3		
	11	Byte 4		
	12	Byte 5		
	13	Byte 6		
	14	Byte 7		
	15	Byte 8		
	16	Byte 9		
	17	Byte 10		
	18	Byte 11		
	19	Byte 12		
	20 ... 79	Reserved		
	80	I0 ... I7	1st PNOZ ml1p connection module left	Virtual inputs on the 2nd PNOZ ml1p connection module: Sub-Index 84: I7 I6 I5 I4 I3 I2 I1 I0 Sub-Index 85: I15 I14 I13 I12 I11 I10 I9 I8 Sub-Index 86: I23 I22 I21 I20 I19 I18 I17 I16 Sub-Index 87: I31 I30 I29 I28 I27 I26 I25 I24 If an input has a high signal, the corresponding Bit will contain "1"; if the input is open (low signal), the Bit will contain "0".
	81	I8 ... I15	1st PNOZ ml1p connection module left	
	82	I16 ... I23	1st PNOZ ml1p connection module left	
	83	I24 ... I31	1st PNOZ ml1p connection module left	
	84	I0 ... I7	2nd PNOZ ml1p connection module left	
	85	I8 ... I15	2nd PNOZ ml1p connection module left	
	86	I16 ... I23	2nd PNOZ ml1p connection module left	
	87	I24 ... I31	2nd PNOZ ml1p connection module left	
	88	I0 ... I7	3rd PNOZ ml1p connection module left	
	89	I8 ... I15	3rd PNOZ ml1p connection module left	
	90	I16 ... I23	3rd PNOZ ml1p connection module left	
	91	I24 ... I31	3rd PNOZ ml1p connection module left	
	92	I0 ... I7	4th PNOZ ml1p connection module left	
	93	I8 ... I15	4th PNOZ ml1p connection module left	
	94	I16 ... I23	4th PNOZ ml1p connection module left	
	95	I24 ... I31	4th PNOZ ml1p connection module left	
	96	I0 ... I7	5th PNOZ ml1p connection module left	
	97	I8 ... I15	5th PNOZ ml1p connection module left	
	98	I16 ... I23	5th PNOZ ml1p connection module left	
	99	I24 ... I31	5th PNOZ ml1p connection module left	
	100	I0 ... I7	5th PNOZ ml1p connection module left	
	101	I8 ... I15	6th PNOZ ml1p connection module left	
	102	I16 ... I23	6th PNOZ ml1p connection module left	
	103	I24 ... I31	6th PNOZ ml1p connection module left	

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Communication with fieldbus modules
PNOZ mc6p via SDOs

Index (hex)	Sub-Index (dec)	Contents		Example/Comment
2000	104	O0 ... O7	1st PNOZ ml1p connection module left	Virtual outputs on the 3rd PNOZ ml1p connection module: Segment 1 Sub-Index 112: O7 O6 O5 O4 O3 O2 O1 O0 Sub-Index 113: O15 O14 O13 O12 O11 O10 O9 O8 Sub-Index 114: O23 O22 O21 O20 O19 O18 O17 O16 Sub-Index 115: O31 O30 O29 O28 O27 O26 O25 O24 If an output has a high signal, the corresponding Bit will contain “1”; if the input is open (low signal), the Bit will contain “0”.
	105	O8 ... O15	1st PNOZ ml1p connection module left	
	106	O16 ... O23	1st PNOZ ml1p connection module left	
	107	O24 ... O31	1st PNOZ ml1p connection module left	
	108	O0 ... O7	2nd PNOZ ml1p connection module left	
	109	O8 ... I15	2nd PNOZ ml1p connection module left	
	110	O16 ... O23	2nd PNOZ ml1p connection module left	
	111	O24 ... O31	2nd PNOZ ml1p connection module left	
	112	O0 ... O7	3rd PNOZ ml1p connection module left	
	113	O8 ... O15	3rd PNOZ ml1p connection module left	
	114	O16 ... O23	3rd PNOZ ml1p connection module left	
	115	O24 ... O31	3rd PNOZ ml1p connection module left	
	116	O0 ... O7	4th PNOZ ml1p connection module left	
	117	O8 ... O15	4th PNOZ ml1p connection module left	
	118	O16 ... O23	4th PNOZ ml1p connection module left	
	119	O24 ... O31	4th PNOZ ml1p connection module left	
	120	O0 ... O7	5th PNOZ ml1p connection module left	
	121	O8 ... I15	5th PNOZ ml1p connection module left	
	122	O16 ... O23	5th PNOZ ml1p connection module left	
	123	O24 ... O31	5th PNOZ ml1p connection module left	
	124	O0 ... O7	6th PNOZ ml1p connection module left	
	125	O8 ... O15	6th PNOZ ml1p connection module left	
	126	O16 ... O23	6th PNOZ ml1p connection module left	
	127	O24 ... O31	6th PNOZ ml1p connection module left	
	128	Reserved		

Communication with fieldbus modules
PNOZ mc6p via SDOs

Index 2001 and 2002
This index contains the diagnostic words and the output bits for the Element IDs.

Index (hex)	Sub-Index (dec)	Contents	Example/Comment
2001	1	Low Byte diagnostic word. Element ID = 1	The diagnostic word is displayed in the PNOZmulti Configurator (see section 2.8.1, Operation and Fault Diagnostics, plus the online help on the PNOZmulti Configurator) Element ID = 1, e.g. E-STOP's diagnostic word: Low Byte: 0 0 0 0 0 0 1 0 Message: Pushbutton operated
	...		
	100	Low Byte diagnostic word. Element ID = 100	
	101 ... 113	Output bit of Element ID = 1 ... 100	Each element is assigned an ID in the PNOZmulti Configurator. If the element's output = 0 (no enable), the corresponding bit is set. Sub-Index / Element ID 101: 8 7 6 4 4 3 2 1 102: 16 15 14 13 12 11 10 9 103: 24 23 22 21 20 19 18 17 ... 111: 88 87 86 85 84 83 82 81 112: 96 95 94 93 92 91 90 89 113: - - - - 100 99 98 97
	114 ... 128	Reserved	

Index (hex)	Sub-Index (dec)	Contents	Example/Comment
2002	1	High Byte diagnostic word. Element ID = 1	See Index 2001 for comment Element ID = 1, e.g. E-STOP's diagnostic word: High Byte: 0 0 0 0 0 0 0 1 Message: wiring error, clock error
	...	...	
	100	High Byte diagnostic word. Element ID = 100	
	101 ... 128	Reserved	

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Communication with fieldbus modules
PNOZ mc6p via SDOs

Index 2003
This index contains the status of the inputs, outputs and LEDs

Index (hex)	Sub-Index (dec)	Contents	Example/Comment
2003	1	I0 ... I7 base unit	The safety system consists of a base unit and one PNOZ mi1p.
	2	I8 ... I15 base unit	
	3	I16 ... I19 base unit	
	4	0	
	5	0	
	6	I0 ... I7 1st expansion module right	
	7	I0 ... I7 2nd expansion module right	
	8	I0 ... I7 3rd expansion module right	
	9	I0 ... I7 4th expansion module right	
	10	I0 ... I7 5th expansion module right	
	11	I0 ... I7 6th expansion module right	
	12	I0 ... I7 7th expansion module right	
	13	I0 ... I7 8th expansion module right	If an input has a high signal, the corresponding Bit will contain “1”; if the input is open (low signal), the Bit will contain “0”.
	14 ... 16	Reserved	

Sub-Index 1: PNOZ m1p

I7	I6	I5	I4	I3	I2	I1	I0

Sub-Index 2: PNOZ m1p

I15	I14	I13	I12	I11	I10	I9	I8

Sub-Index 3: PNOZ m1p

0	0	0	0	I19	I18	I17	I16

Sub-Index 4:

0	0	0	0	0	0	0	0

Sub-Index 5:

0	0	0	0	0	0	0	0

Sub-Index 6: PNOZ mi1p

I7	I6	I5	I4	I3	I2	I1	I0

Index (hex)	Sub-Index (dec)	Contents	Example/Comment
2003	17	LED I0 ... I7 base unit	The safety system consists of a base unit and one PNOZ mi1p.
	18	LED I8 ... I15 base unit	
	19	LED I16 ... I19 base unit	
	20, 21	0	
	22	LED I0 ... I7 1st expansion module right	
	23	LED I0 ... I7 2nd expansion module right	
	24	LED I0 ... I7 3rd expansion module right	
	25	LED I0 ... I7 4th expansion module right	
	26	LED I0 ... I7 5th expansion module right	
	27	LED I0 ... I7 6th expansion module right	
	28	LED I0 ... I7 7th expansion module right	
	29	LED I0 ... I7 8th expansion module right	If the LED on an input is flashing, the corresponding bit contains “1”; if the LED is not flashing, the bit contains “0”.
	30 ... 32	Reserved	

Sub-Index 17: PNOZ m1p

I7	I6	I5	I4	I3	I2	I1	I0

Sub-Index 18: PNOZ m1p

I15	I14	I13	I12	I11	I10	I9	I8

Sub-Index 19: PNOZ m1p

0	0	0	0	I19	I18	I17	I16

Sub-Index 20:

0	0	0	0	0	0	0	0

Sub-Index 21:

0	0	0	0	0	0	0	0

Sub-Index 22: PNOZ mi1p

I7	I6	I5	I4	I3	I2	I1	I0

Communication with fieldbus modules
PNOZ mc6p via SDOs

Index (hex)	Sub-Index (dec)	Contents	Example/Comment
2003	33 ... 35	0	Assignment of Bytes depends on the unit: PNOZ m0p, PNOZ m1p, PNOZ m2p Sub-Index 36: 0 | 0 | 1 | 1 | O3 | O2 | O1 | O0 Sub-Index 37: 0 | 0 | 0 | 0 | 0 | 0 | O5 | O4 PNOZ mo1p Sub-Index 38 ... 45: 0 | 0 | 0 | 0 | O3 | O2 | O1 | O0 Sub-Index 54 ... 61: 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 PNOZ mo2p Sub-Index 38 ... 45: 0 | 0 | 0 | 0 | 0 | 0 | O1 | O0 Sub-Index 54 ... 61: 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 PNOZ mo4p Sub-Index 38 ... 45: 0 | 0 | 0 | 0 | O3 | O2 | O1 | O0 Sub-Index 54 ... 61: 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 PNOZ mc1p Sub-Index 38 ... 45: A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 Sub-Index 54 ... 61: A15 | A14 | A13 | A12 | A11 | A10 | A9 | A8 If an output has a high signal, the corresponding Bit will contain “1”; if the output is open (low signal), the Bit will contain “0”.
	34	Reserved	
	36	O0 ... O3 of the base unit	
	37	O4 and O5 of the base unit	
	38	O0 ... O7 1st expansion module right	
	39	O0 ... O7 2nd expansion module right	
	40	O0 ... O7 3rd expansion module right	
	41	O0 ... O7 4th expansion module right	
	42	O0 ... O7 5th expansion module right	
	43	O0 ... O7 6th expansion module right	
	44	O0 ... O7 7th expansion module right	
	45	O0 ... O7 8th expansion module right	
	46 ... 48	Reserved	
	49 ... 53	0	
	54	O8 ... O15 1st expansion module right	
	55	O8 ... O15 2nd expansion module right	
	56	O8 ... O15 3rd expansion module right	
	57	O8 ... O15 4th expansion module right	
	58	O8 ... O15 5th expansion module right	
	59	O8 ... O15 6th expansion module right	
	60	O8 ... O15 7th expansion module right	
	61	O8 ... O15 8th expansion module right	
	62 ... 64	Reserved	

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Communication with fieldbus modules
PNOZ mc6p via SDOs

Index (hex)	Sub-Index (dec)	Contents	Example/Comment
2003	65	RUN	Depending on the LED status, the following Hex code will be in Sub-Index 65 ... 77: 00 hex: LED off FF hex: LED on 30 hex: LED flashes
	66	DIAG	
	67	FAULT	
	68	IFAULT	
	69	OFAULT	
	70	FAULT 1st expansion module right	
	71	FAULT 2nd expansion module right	
	72	FAULT 3rd expansion module right	
	73	FAULT 4th expansion module right	
	74	FAULT 5th expansion module right	
	75	FAULT 6th expansion module right	
	76	FAULT 7th expansion module right	
	77	FAULT 8th expansion module right	
	78	FAULT 1st expansion module left	Depending on the LED status, the following Hex code will be in Sub-Index 78 ... 83: 00 hex: LED off FF hex: LED on 30 hex: LED flashes
	79	FAULT 2nd expansion module left	
	80	FAULT 3rd expansion module left	
	81	FAULT 4th expansion module left	
	82	FAULT 5th expansion module left	
	83	FAULT 6th expansion module left	
	84 - 128	Reserved	

Communication with fieldbus modules
PNOZ mc6p via SDOs

Index 2004
This index contains the PNOZmulti's configuration data

Index (hex)	Sub-Index (dec)	Contents	Example/Comment
2004	1	Data transfer	Sub-index 1: Bit 1 = 1: All configuration data has been downloaded to the fieldbus module
	2	Reserved	
	3	Number of elements	Number of configured elements with Element ID
	4 ... 16	Reserved	
	17 ... 20	Product number (hex)	Product number 773 100: 000BCBEC hex Sub-Index 17: 00, Sub-Index 18: 0B, Sub-Index 19: CB, Sub-Index 20: EC
	21 ... 24	Unit version (hex)	Unit version 20: 14 hex Sub-Index 21: 00, Sub-Index 22: 00, Sub-Index 23: 00, Sub-Index 24: 14
	25 ... 28	Serial number (hex)	Serial number 123 456: 0001E240 hex Sub-Index 25: 00, Sub-Index 26: 01, Sub-Index 27: E2, Sub-Index 28: 40
	29 ... 30	Project check sum (hex)	Check sum A1B2 hex: Sub-Index 29: A1, Sub-Index 30: B2
	31 ... 32	Chip card check sum (hex)	Check sum 3C5A hex: Sub-Index 31: 3C, Byte 32: 5A
	33 ... 36	Reserved	
	37 ... 40	Project creation date (hex)	Creation date: 28.11.2003 Sub-Index 37: 1C, Sub-Index 38: 0B, Sub-Index 39: 07, Sub-Index 40: D3
	41 ... 43	Reserved	
	44	Configuration, fieldbus module/RS 232	Sub-Index 44 contains the Hex code for a fieldbus module (installed on the left) or for inputs and outputs via RS 232: Fieldbus modules PNOZ mc.. : 30 Virtual inputs and outputs via RS 232: 40 Additional input modules on the left: PNOZml1p: See Sub-Index 90 ... 95 Sub-Index 45 ... 52 contains the Hex code for the expansion modules on the right : PNOZ mi1p: 08 PNOZ mi2p: 38 PNOZ mo1p: 18 PNOZ mo2p: 10 PNOZ mo3p: 30 PNOZ mo4p: 28 PNOZ mc1p: 20 PNOZ ms3p: 68 PNOZ ms4p: 78 PNOZ ms1p/PNOZ ms2p: 88 No expansion module: 00
	45	Configuration, 1st expansion module right	
	46	Configuration, 2nd expansion module right	
	47	Configuration, 3rd expansion module right	
	48	Configuration, 4th expansion module right	
	49	Configuration, 5th expansion module right	
	50	Configuration, 6th expansion module right	
	51	Configuration, 7th expansion module right	
	52	Configuration, 8th expansion module right	
	53 ... 56	Reserved	

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Communication with fieldbus modules
PNOZ mc6p via SDOs

Index (hex)	Sub-Index (dec)	Contents	Example/Comment
2004	57	1st character (Low Byte)	Sub-Index 57 ... 88 contains the project name defined in the PNOZmultil Configurator under “Enter project data”; this is stored in UNICODE format, 2 Bytes contain the Hex code of the individual UNICODE characters
	58	1st character (High Byte)	
	59	2nd character (Low Byte)	
	60	2nd character (High Byte)	
	61	3rd character (Low Byte)	
	62	3rd character (High Byte)	
	63	4th character (Low Byte)	
	64	4th character (High Byte)	
	65	5th character (Low Byte)	
	66	5th character (High Byte)	
	67	6th character (Low Byte)	
	68	6th character (High Byte)	
	69	7th character (High Byte)	
	70	7th character (Low Byte)	
	71	8th character (Low Byte)	
	72	8th character (High Byte)	
	73	9th character (Low Byte)	
	74	9th character (High Byte)	
	75	10th character (Low Byte)	
	76	10th character (High Byte)	
	77	11th character (Low Byte)	
	78	11th character (High Byte)	
	79	12th character (Low Byte)	
	80	12th character (High Byte)	
	81	13th character (Low Byte)	
	82	13th character (High Byte)	
	83	14th character (Low Byte)	
	84	14th character (High Byte)	
	85	15th character (Low Byte)	
	86	15th character (High Byte)	
	87	16th character (Low Byte)	
	88	16th character (High Byte)	
	89	Day	Date on which the program on the chip card was last modified Date modified : 28.11.2003 Sub-Index 89: 1C, Sub-Index 90: 0B, Sub-Index 91: 07, Sub-Index 92: D3 Time: 14 hours 25 minutes Sub-Index 93: 0E, Sub-Index 94: 19 Time zone 1: Sub-Index 95: 01
	90	Month	
	91	Year (High Byte)	
	92	Year (Low Byte)	
	93	Hour	
	94	Minute	
	95	Time zone	
	96	Configuration, 1st expansion module left	Sub-Index 96 ... 101 contains the Hex code for the expansion modules to the left of the base unit. Any fieldbus module in these Sub-Indices will not be considered (see Index 2004, Sub-Index 44). PNOZ ml1p: A8
	97	Configuration, 2nd expansion module left	
	98	Configuration, 3rd expansion module left	
	99	Configuration, 4th expansion module left	
	100	Configuration, 5th expansion module left	
	101	Configuration, 6th expansion module left	
	102 ... 128	Reserved	

Communication with fieldbus modules
PNOZ mc6p via SDOs

Index 2005
This index contains the element types.

Index (hex)	Sub-Index (dec)	Contents	Example/Comment
2005	1	Element type. Element ID = 1	Element with ID = 1: Single-pole semi-conductor output with feedback loop Sub-Index 1: 51 hex See list containing the element types on page 3-2-15
	...		
	100	Element type. Element ID = 100	
	101 ... 128	Reserved	

Index 2006 ... 200A
This index contains the input assignments of elements with Element ID

INFORMATION
Indices 2006 ... 200A are no longer supported by base units from the following version number upwards:
- PNOZ m0p from Version 2.3
- PNOZ m1p from Version 5.3
- PNOZ m2p from Version 2.3

Index (hex)	Sub-Index (hex)	Contents	Example/Comment
2006	1	1st input of element with Element ID = 1	The configured position and bit number can be assigned for a maximum of 5 inputs from elements with Element ID.
	...	...	
	100	1st input of element with Element ID = 100	Bit: 7 6 5 4 | 3 2 1 0 Configured position Bit number
	101 ... 128	Reserved	
2007	1	2nd input of element with Element ID = 1	
	...	...	Example:
	100	2nd input of element with Element ID = 100	for Element ID= 1: 1st input in Index 2006, Sub-Index 1 2nd input in Index 2007, Sub-Index 1 3rd input in Index 2008, Sub-Index 1 4th input in Index 2009, Sub-Index 1 5th input in Index 200A, Sub-Index 1
	101 ... 128	Reserved	
2008	1	3rd input of element with Element ID = 1	
	...	...	0 1 1 0 | 0 1 0 1 Configuration position = 6 = 2nd expansion module Bit number = 5 (input I5) For the status of the inputs, refer also to Index 2003, Sub-Index 1 ... 13 For addressing the inputs, see table opposite.
	100	3rd input of element with Element ID = 100	
	101 ... 128	Reserved	
2009	1	4th input of element with Element ID = 1	
	...	...	
2009	100	4th input of element with Element ID = 100	
	101 ... 128	Reserved	
200A	1	5th input of element with Element ID = 1	
	...	...	
	100	5th input of element with Element ID = 100	
	101 ... 128	Reserved	

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Communication with fieldbus modules
PNOZ mc6p via SDOs

Addressing the inputs

Input	Configuration	Bit number
I0 ... I7	0	0 ... 7
I8 ... I15	1	0 ... 7
I16 ... I19	2	0 ... 3
No inputs	3	-
No inputs	4	-
I0 ... I7 1st expansion module right	5	0 ... 7
I0 ... I7 2nd expansion module right	6	0 ... 7
I0 ... I7 3rd expansion module right	7	0 ... 7
I0 ... I7 4th expansion module right	8	0 ... 7
I0 ... I7 5th expansion module right	9	0 ... 7
I0 ... I7 6th expansion module right	10	0 ... 7
I0 ... I7 7th expansion module right	11	0 ... 7
I0 ... I7 8th expansion module right	12	0 ... 7

Index 2100
This index contains the input data

Index (hex)	Sub-Index (dec)	Contents	Example/Comment
2100	1	Inputs Bit 0 … 7	For information on the sub-indices please see section entitled “Communication with fieldbus systems” on page 3.1-1
	2	Inputs Bit 8 … 15	
	3	Inputs Bit 16 … 23	
	4	Reserved	
	5	Table number	
	6	Segment number	
	7 ... 128	Reserved	

Communication with fieldbus modules
PNOZ mc6p via SDOs

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Communication with fieldbus modules
PNOZ mc8p Ethernet IP / Modbus TCP

Introduction

This chapter describes the special features of communication with the PNOZ mc8p expansion module on Ethernet IP and Modbus TCP. Access to PNOZmulti data via tables and segments is described in Chapters 2.1 and 2.2.

Overview

The PNOZ mc8p expansion module uses Ethernet to connect the PNOZmulti modular safety system to control systems that support the Ethernet IP and Modbus TCP protocols.

Ethernet IP and Modbus TCP are designed for fast data exchange at field level. The PNOZ mc8p expansion module is a passive Ethernet IP (adapter) or Modbus TCP (slave) subscriber. The basic functions of communication with Ethernet IP or Modbus TCP conform to IEEE 802.3.

The central controller (master) reads input information from the slaves and writes output information to the slaves as part of each cycle. As well as the cyclical transfer of usable data, the PNOZ mc8p can also be used for diagnostics and commissioning functions.

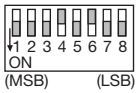
Module features:
- Can be configured using the PNOZmulti Configurator
- Network protocols: Ethernet IP, Modbus TCP
- Status indicators for communication and for errors
- Transmission rate 10 MBit/s (10BaseT) and 100 MBit/s (100BaseTX), full and half duplex
- IP address is set via DIP switches on the front panel

Assigning the IP address to your PC

- Details of the procedure can be found in the manual for your operating system.
- Set the IP address, e.g. 192.168.0.1 with subnet mask 255.255.255.0.

Setting the IP address of the expansion module

- The IP address of the PNOZ mc8p is set using DIP switches on the front panel.
- Please note: Only set the IP address when the supply voltage is switched off.
- The first three bytes of the IP address are:
  IP address: 192.168.0
  Subnet mask: 255.255.255.0
- The last byte is configured using the DIP switches. Value range: 1 ... 255
  Please note: The IP address of the PNOZ mc8p should not be the same as the IP address for the PC.
- Example:
  DIP switch: 00010100 (20 decimal)



  IP address: 192.168.0.20
- Once the IP address has been set via the DIP switches you can connect the supply voltage to the base unit.

Changing the IP settings

You can change the IP settings of the PNOZ after configuring the IP addresses of the computer and the PNOZ mc8p.
- Connect the PNOZ mc8p to the computer.
- Call up the following html page: http://192.168.0.20/config.htm
- Configure the settings for the PNOZ mc8p.
  Example:
  IP address: 172.16.216.139
  Subnet mask: 255.255.0.0
  Gateway address: —
  DNS1 address: —
  DNS1 address: —
  Host name: —-
  Domain name: —
  SMTP server: —
  DHCP enabled: No
- Click the Store Configuration button. The settings are transferred to the expansion module.
- Switch off the supply voltage.
- Set all DIP switches to zero.
- Switch on the supply voltage. The new IP address for the unit is now set.

Communication with fieldbus modules
PNOZ mc8p Ethernet IP / Modbus TCP

Data exchange

20 bytes must always be sent and received for communication with the PNOZmulti.

Ethernet IP

The input/output data from the PNOZmulti can be polled using the assembly object (Class 04h).

- Data from the PNOZmulti is requested using Instance 64h.
- Instance 96h writes the data from the Ethernet IP scanner to the PNOZmulti.

Modbus TCP

- There is no need to configure a connection on the PNOZ mc8p. Port 502 is used in accordance with the Modbus TCP specification.
- Modbus TCP supports the following function codes:

Function code	Name of function
1	Read coils
2	Read input discretes
3	Read multiple registers
4	Read input registers
5	Write coil
6	Write single register
7	Read exception status
15	Force multiple coils
16	Force multiple registers
22	Mask write register
23	Read/Write registers

- The address input range begins with Register 0. The address output range begins with Register 1024.
  The byte sequence of a word is high byte/low byte

Word	
Left byte	Right byte
Low byte	High byte
(Bit 07 ... 00)	(Bit 15 ... 08)

- Error codes on Modbus TCP

Code	Name	Description
01	Invalid function	The PNOZ mc8p does not support the function code in the enquiry.
02	Invalid data address	The data address received in the enquiry is outside the memory range.
03	Invalid data	Invalid data requested.

Web interface for commissioning and testing

A Pilz web interface can be used when commissioning or as a testing aid. It can be used to poll data from the PNOZmulti.

- Commission a base unit and PNOZ mc8p as described in the operating instructions.
- Connect the PNOZ mc8p to the computer.
- Enter the IP address (URL) in your browser's address bar, e.g.: http://172.16.216.139
- The input mask provides access to the inputs and outputs on the PNOZmulti system and to the table segments.

Restricting access

In principle, each Ethernet subscriber can set up a connection to the PNOZ mc8p. This access can be restricted.

- To establish a connection to the FTP site, enter the IP address (URL) of the PNOZ mc8p in your browser's address bar.
  A login window appears.
- The default access data is:
  User name: User
  Password: Password
  Log in. You will now have access to the PNOZ mc8p user area.
- Save the file ip_access.cfg on to your computer and open it using an editor.
  Once opened the file contains the following information:

```
[MODBUS/TCP]
*.*.*.*
[Ethernet/IP]
*.*.*.*
```

- If *.*.*.* is entered, all subscribers will have unrestricted access.
- Instead of the characters *.*.*.*, enter the IP addresses of the subscribers to which you wish to grant restricted access, e.g.:

```
[MODBUS/TCP]
172.16.205.24
172.16.205.40
[Ethernet/IP]
172.16.205.96
```

- Save the file ip_access.cfg on your computer.
- Download the file to the PNOZ mc8p.
- Restart the PNOZmulti.

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Communication with fieldbus modules
PNOZ mc8p Ethernet IP / Modbus TCP

Input and output data

The data is structured as follows:

- Input range
  The inputs are defined in the master and transferred to the PNOZmulti. Each input has a number, e.g. the input bit 4 of byte 1 has the number i12.
- Output range
  The outputs are defined in the PNOZmulti Configurator. Each output that is used is given a number there, e.g. o0, o5... The status of output o0 is stored in bit 0 of byte 0; the status of output o5 is stored in bit 5 of byte 0 etc.
- Output range only: Byte 3
  - Bit 0 ... 4: Status of LEDs on the PNOZmulti
    - Bit 0: OFAULT
    - Bit 1: IFAULT
    - Bit 2: FAULT
    - Bit 3: DIAG
    - Bit 4: RUN
  - Bit 5: Data is being exchanged.

INFORMATION
Please also refer to the section entitled “Basics” on page 2.1-1.

Assigning the inputs/outputs in the PNOZmulti Configurator to the Ethernet IP/Modbus TCP input/ output data

Inputs on PNOZmulti Configurator	I0 ... I7	I8 ... I15	I16 ... I23
Input data, Ethernet IP or Modbus TCP	Byte 0 : Bit 0 … 7	Byte 1 : Bit 0 … 7	Byte 2 : Bit 0 … 7
Outputs on PNOZmulti Configurator	O0 ... O7	O8 ... O15	O16 ... O23
Output data, Ethernet IP or Modbus TCP	Byte 0 : Bit 0 … 7	Byte 1 : Bit 0 … 7	Byte 2 : Bit 0 … 7

LEDs

- ● LED off
- ☼ LED on
- ◐ LED flashes

LED	LED status	Key
LINK	☼ green	Bus connection available
	●	Bus connection not available
	◐ green	PNOZ mc8p is receiving/sending data
STAT	●	No supply voltage at the PNOZ mc8p.
	☼ green	The PNOZ mc8p is operating correctly.
	◐ green	The PNOZ mc8p is not configured.
	◐ red	Recoverable fault
	☼ red	Major internal error (not recoverable)
	◐ green-red	Self test after switching on the supply voltage
NET	●	No supply voltage present or no IP address assigned
	☼ green	The PNOZ mc8p has established at least one connection.
	◐ green	The PNOZ mc8p has not established a connection.
	◐ red	Timeout for at least one connection. Re-establish connection or reset PNOZ mc8p.
	☼ red	IP address is already in use.
	◐ green-red	Self test after switching on the supply voltage
ACT	◐ green	Data sent/received

Communication with fieldbus modules
PNOZ mc8p Ethernet IP / Modbus TCP

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Diagnostic Interface

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Diagnostic Interface	
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Overview	3.2-1
Intended Use	3.3-1
Data Exchange	3.4-1
Requirements	3.5-1
Error Management	3.6-1

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Diagnostic Interface
Introduction

This chapter describes the communication options available with the serial diagnostic interface (RS 232) of the base units from the PNOZmulti modular safety system.

For details of how to operate the modular PNOZmulti safety system, please refer to the operating manual for the respective device.

Overview of the chapters

This manual is divided into the following chapters:

3.1 Introduction
The introduction you are reading familiarises you with the content of the manual.

3.2 Overview
This chapter gives you a brief overview of the function of the PNOZmulti serial interface and also the data exchange structure.

3.3 IntendedUse
This chapter contains information about the intended use of the PNOZmulti serial interface.

3.4 Date exchange
This chapter contains important information about the sequence of communication between the PNOZmulti and the user program.

3.5 Requests
This chapter contains the individual requests and describes the structure of the data blocks.

3.6 Error Management
This chapter describes potential errors and how to deal with them.

Diagnostic Interface
Introduction

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Diagnostic Interface
Diagnostic Data

The diagnostic interface on the PNOZmulti provides access to a variety of data from the safety system. This data can be read using a communications partner (e.g. a PC or PLC).

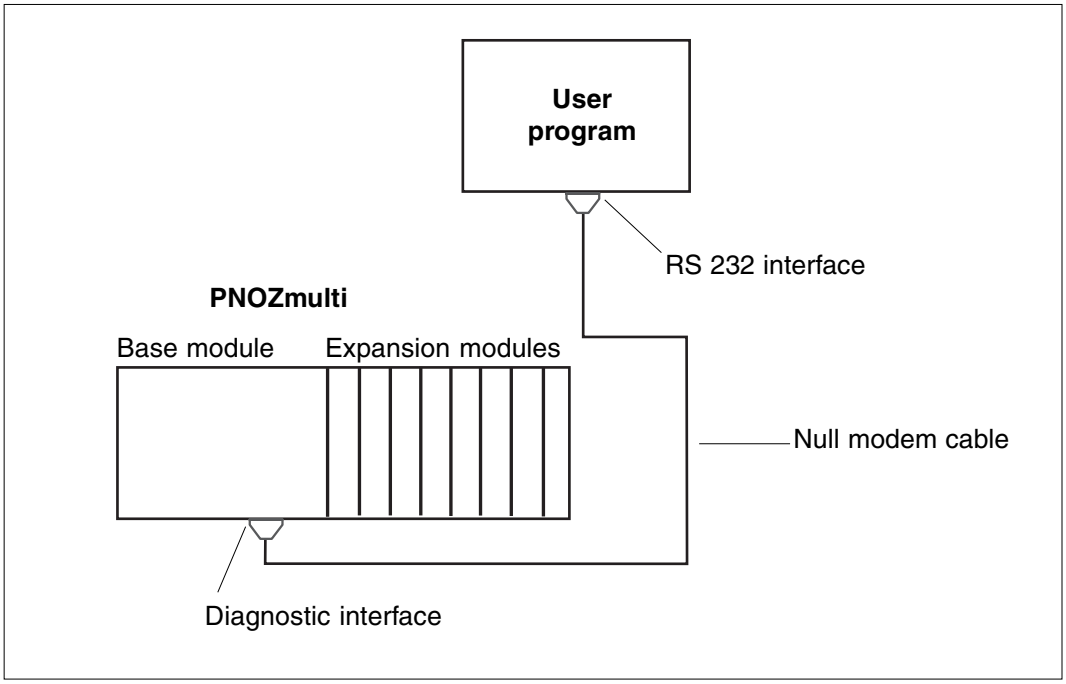
Communication occurs via the serial RS 232 interface of the communications partner. The communications partner represents the Master; the PNOZmulti acts as Slave.
A null modem cable is used to make the connection between the RS 232 interface on the communications partner and the diagnostic interface on the base unit.

Transmission rate:
19.2 KBit with
- 8 bits of data
- 1 start bit
- 2 stop bits
- 1 parity bit
- Even parity

Diagnostic data

Diagnostic data on the PNOZmulti modular safety system comprises:

- **Version:**
  Product number, device version, serial number
- **Status of inputs/outputs:**
  Indicates whether inputs and outputs are active or inactive (open/closed)
- **LED status:**
  Indicates the status of the LEDs on the base unit and expansion modules (on/off/flashes), plus the operating mode (start up, RUN, STOP)
- **Simplified status scan:**
  Shows group messages relating to the safety sytem: signal changes, LEDs, operating statuses
- **virtual inputs and outputs:**
  Virtual inputs can be set. The status of the virtual inputs and outputs can be scanned.
- **Diagnostic word:**
  The diagnostic word contains the status of elements from the user program within the PNOZmulti
- **Test data:**
  To check commmunication.
- **Data in table form**
  This is structured data (arranged in tables and segments) from the PNOZmulti, as it could also be read via a fieldbus module:
  - Configuration
  - Status of the inputs and outputs
  - LED status
  - Diagnostic word
  - Element types



Diagnostic Interface
Diagnostic Data

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Diagnostic Interface
Intended Use

Diagnostic interface

The serial interface on the PNOZmulti modular safety system is used to transfer diagnostic data to a user program. The diagnostic data may only be used for non-safety purposes, e.g. visualization.

NOTICE
For details of the intended use and application of the modular PNOZmulti safety system, please refer to the operating instructions for the respective unit.

Diagnostic Interface
Intended Use

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Diagnostic Interface
Data Exchange

This chapter explains the principle of communication between a user program and the PNOZmulti. The requests and data blocks are shown in detail in Chapter 3.5.

Communication procedure

Each communication is started by sending a request to the PNOZmulti. Requests are used to receive data from or send data to the PNOZmulti:

1. Request:
   The user sends a request to the PNOZmulti via the user program.
2. Acknowledgement:
   The PNOZmulti sends an acknowledgement to the user program, confirming that the request has been received without error. With various requests the user program must send another data block after the acknowledgement, specifying the request more precisely. The PNOZmulti again sends an acknowledgement upon receipt (see Fig. 4-2).
3. Data block:
   A data block is sent from the PNOZmulti or from the user program, depending on the request. The size of the data block depends on the request (Fig. 4-1).
4. Information message:
   The user sends an acknowledgement via the user program, confirming that the data block has been received without error.

Each communications partner uses a communications timer.

- At each stage of communication, the PNOZmulti waits 500 ms for a response. If it does not receive a response, it resets the communication. Communication must be restarted with a request from the user program.
- At each stage of communication, the user program waits 550 ms for a response. If it does not receive a response, it resets the communications timer. Communication must be restarted with a request from the user program.

Diagnostic Interface
Data Exchange

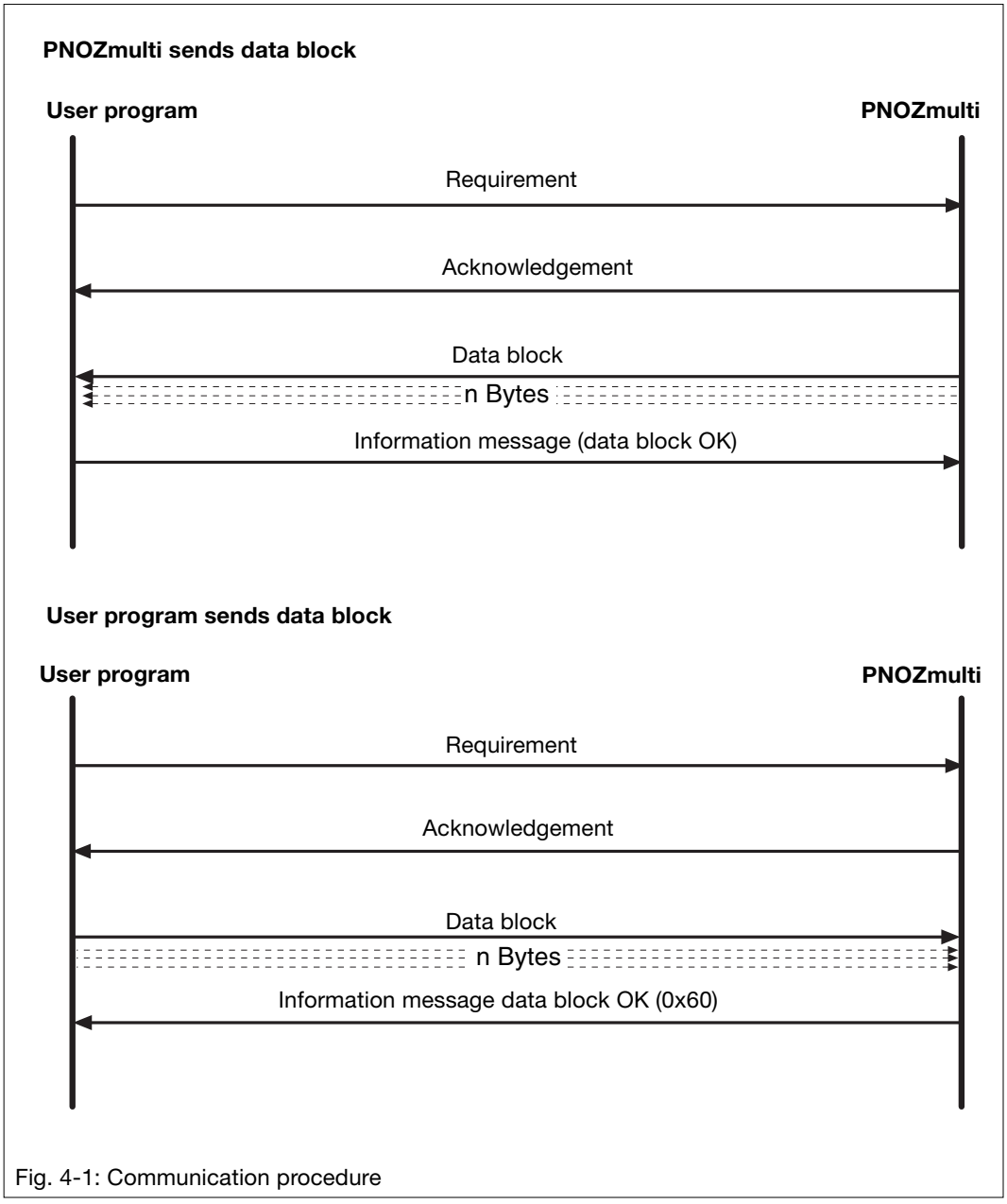

Fig. 4-1: Communication procedure

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Diagnostic Interface
Data Exchange

Extended communication

After the acknowledgement, the user program sends a data block to the PNOZmulti, specifying the request more precisely.

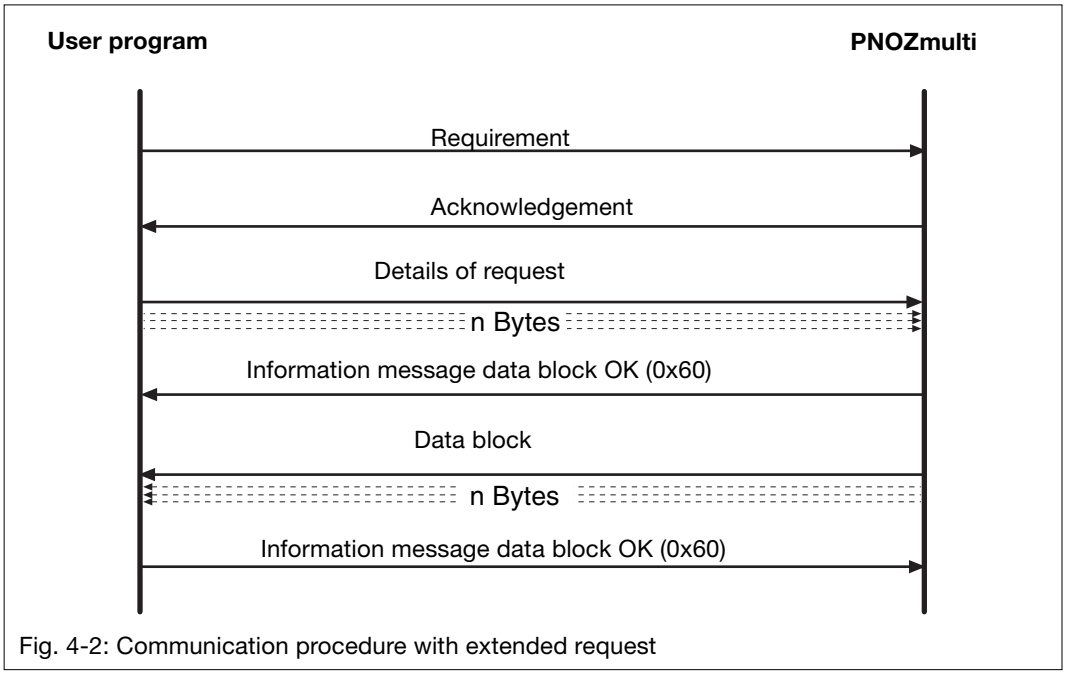

Fig. 4-2: Communication procedure with extended request

Requirements

Only one request can be processed at a time. At least 15 ms must elapse between the previous communication (e.g. an information message) and any new request.

INFORMATION
The individual requests are described in detail in Chapter 5.

Acknowledgements

When the PNOZmulti receives a request from the user program it sends back an acknowledgement, which will either confirm that the request was received successfully or contain an error / information message.

Confirmation of receipt

If the PNOZmulti has received a request without error, it will send the following confirmation of receipt:

ID code	Meaning	Reaction (User program)
Request ID + 0x80	Request received, everything OK	Continue communication

Diagnostic Interface
Data Exchange

Error messages and information messages

The user program or the PNOZmulti sends one Byte as an error message or for information.

INFORMATION
Further information on error management can be found on page 3.6-1

ID-Code	Sent by	Key	Reaction
0x60	User PNOZmulti	Data block received, everything OK	Continue communication
0x62	User PNOZmulti	Data block not received correctly	User program or PNOZmulti: Send data block again
			Repeat request in user program
0x64	PNOZmulti	Request not understood	Repeat request
0x65	PNOZmulti	Communication reset because the time was exceeded	

Data Blocks

The data is sent within data blocks. A data block consists of a varying number of data bytes. The length of a data block depends on the request. Each data block has the same structure.

- **Application data**
  The first n data bytes contain the data requested via the command.
- **Information data**
  - The penultimate data byte is always 0x00.
  - The last byte of each data block is the check sum (Block Control Check = BCC).
    A data block with 34 bytes, for example, has the following check sum:
    BCC = 0x00 - (Data byte 0 + ... + Data byte 31 + 0x00)

Data block

Data byte 0
Data byte 1
Data byte 2
....
Data byte n
0x00
BCC

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Diagnostic Interface
Data Exchange

Example

- The user program requests input and output data from the PNOZmulti.
- The PNOZmulti sends an acknowledgement, which consists of the relevant request 0x41 and the confirmation of receipt 0x80 (0x41 + 0x80 = 0xC1).
- When the data is received, a fault is detected; an information message is sent to the PNOZmulti via the user program.
- The PNOZmulti sends the data again.
- Receipt of the data block is confirmed via the user program, using an information message.

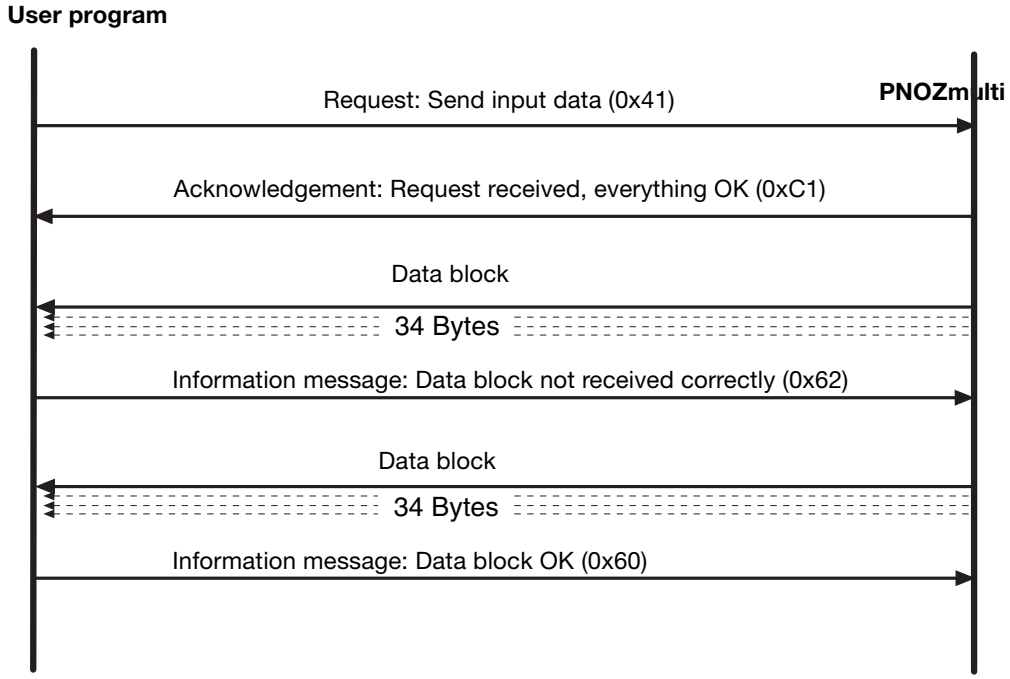

Fig. 4-3: Example for request 0x41

Diagnostic Interface
Data Exchange

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Diagnostic Interface
Requirements

Overview

This chapter describes the requests that the user program sends to the PNOZmulti and the data blocks defined with the request.

The following requests are available:

Request	Meaning	Data block length	Required base unit	Page
0x14	Send virtual inputs to PNOZmulti	10	PNOZ m0p V1.0	3-5-2
0x2C	Send status of virtual inputs and outputs from the PNOZmulti	10	PNOZ m1p V4.0 PNOZ m2p V1.0	3-5-3
0x2D	Send diagnostic word from the PNOZmulti	4		3-5-4
0x50	Send data from the PNOZmulti in table form	15		3-5-17
0x40	Send version data from the PNOZmulti	34	PNOZ m0p V1.0	3-5-6
0x41	Send all input and output data	34	PNOZ m1p V3.0	3-5-8
0x43	Send all LED data	34	PNOZ m2p V1.0	3-5-12
0x44	Send simplified status scan (group messages) from the PNOZmulti	4		3-5-16
0x5F	Send test	34		3-5-20

Diagnostic Interface
Requirements

Request 0x14 - Send virtual inputs to the PNOZmulti

Requirement

The user program employs request 0x14 to send 24 virtual inputs to the PNOZmulti.

Data block

The data block consists of 10 Bytes. Bytes 3 to 5 form the one's complement of Byte 1 to 3.

The PNOZmulti sends the error message 0x62:
- If Bytes 3 to 5 are not the one's complement of Bytes 0 to 2.
- If the BCC is incorrect.

Byte No.	Data	Note
0	Virtual inputs i7 to i0	Example: 0100 0010
1	Virtual inputs i15 to i8	Sets virtual inputs
2	Virtual inputs i23 to i16	I6 and I1 = 1
3	One's complement of virtual inputs i7 to i0	
4	One's complement of virtual inputs i15 to i8	
5	One's complement of virtual inputs i23 to i16	
6	0x00	
7	0x00	
8	0x00	
10	BCC = 3	

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Diagnostic Interface
Requirements

Request 0x2C - Send status of virtual inputs and outputs from the PNOZmulti

Request

The user program employs request 0x2C to request the status of the 24 virtual inputs and outputs from the PNOZmulti.

Data block

The data block consists of 10 Bytes.

Byte No.	Data	Note
0	Virtual inputs i7 to i0	Example: 0100 0010
1	Virtual inputs i15 to i8	Status of virtual inputs
2	Virtual inputs i23 to i16	I6 and I1 = 1
3	Virtual outputs o7 to o0	Example: 0011 0100
4	Virtual outputs o15 to o8	Status of virtual outputs
5	Virtual outputs o23 to o16	O5, O4 and O2 = 1
6	Reserved	
7	Reserved	
8	0x00	
10	BCC	

Diagnostic Interface
Requirements

Request 0x2D - Send diagnostic word from the PNOZmulti

Request

The user program employs request 0x2D to request the diagnostic word for a specific Element ID from the PNOZmulti.

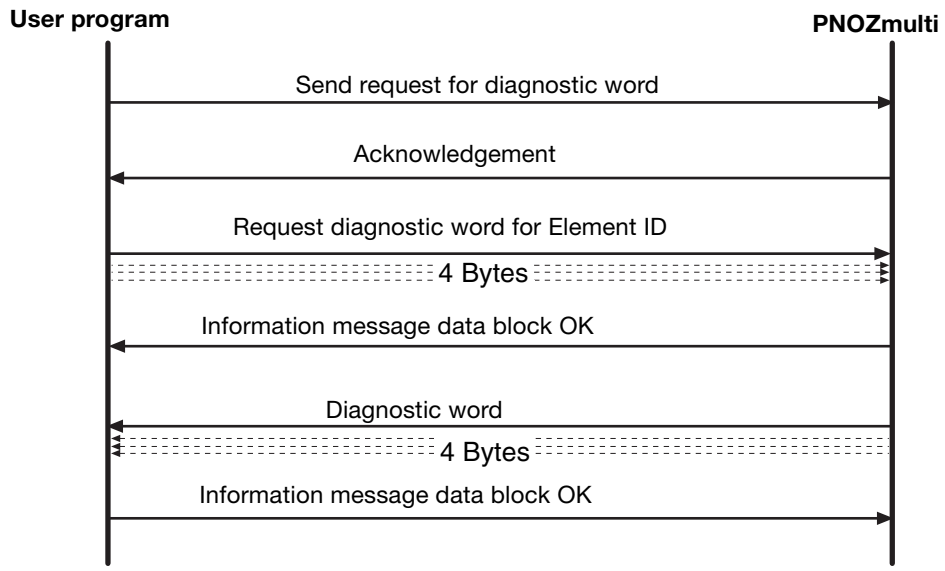

Fig. 5-1: Communication procedure

Data block

The data block that the user program employs to specify a diagnostic word for a specific Element ID consists of 4 Bytes.

Byte No.	Data	Note
0	Element ID = 1 ... 100	e.g. 21 hex for Element ID = 33
1	0x00	
2	0x00	
3	BCC	

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Diagnostic Interface
Requirements

The data block containing the
diagnostic data consists of 4 Bytes.

Byte No.	Data	Note
0	Diagnostic word High Byte for requested Element ID	
1	Diagnostic word Low Byte for requested Element ID	
2	0x00	
3	BCC	

Diagnostic Interface
Requirements

Request 0x40 - Version data from the PNOZmulti

Request

The user program employs request 0x40 to request the version data from the PNOZmulti.

Data block

The data block consists of 34 Bytes.

Byte No.	Data	Note
0 .. 3	Product number	
4 ... 7	Device number	
8 ... 11	Serial number	
12 and 13	Check sum of user program in the PNOZmulti Configurator	
14 and 15	Check sum of user data on the chip card	
16 ... 19	Creation date of user program	Day, month, year
20	Hardware registry: Expansion module left	No expansion module: 00 Virtual inputs and outputs: 40
21 ... 28	Hardware registry: Expansion module right	No expansion module: 00 Expansion modules: PNOZ mi1p: 08 PNOZ mo1p: 18 PNOZ mo2p: 10 PNOZ mo4p: 28 PNOZ mc1p: 20 PNOZ ms3p: 68 PNOZ ms4p: 78 PNOZ ms1p/PNOZ ms2p: 88
29 ... 31	Reserved	
32	0x00	
33	BCC	

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Diagnostic Interface
Requirements

Example

- Product number:: 773100
- Device number: 31
- Serial number: 108668
- Check sum user program: 55448
- Check sum chip card 43795
- Creation date: 11.05.2002
- Without fieldbus module or virtual inputs Inputs
- 2 expansion modules

Byte No.	Data	Value
0	HH Byte product number	0x00
1	HL Byte product number	0x0B
2	LH Byte product number	0xCB
3	LL Byte product number	0xE
4	HH Byte device number	0x00
5	HL Byte device number	0x00
6	LH Byte device number	0x00
7	LL Byte device number	0x1F
8	HH Byte serial number	0x00
9	HL Byte serial number	0x01
10	LH Byte serial number	0xA8
11	LL Byte serial number	0x7C
12	High Byte check sum user program	0xD8
13	Low Byte check sum user program	0x98
14	High Byte check sum chip card	0xAB
15	Low Byte check sum chip card	0x13
16	Creation date (day)	0x0B
17	Creation date (month)	0x05
18	High Byte creation date (year)	0x07
19	Low Byte creation date (year)	0xD2
20	Fieldbus module	0x00
21	Expansion module 1	0x08
22	Expansion module 2	0x08
23 ... 28	Expansion module 3 - 8	0x00
29 ... 31	Reserved	0x00
32	0x00	0x00
33	BCC	0x00

Diagnostic Interface
Requirements

Request 0x41 - Send all input and output data

Request

The user program employs request 0x41 to request the input and output data from the PNOZmulti.

Data block

The data block consists of 34 Bytes.

Byte No.	Data	Note
0	Inputs of base unit I0 to I7	
1	Inputs of base unit I8 to I15	
2	Inputs of base unit I16 to I19	Bits 4 to 7 reserved
3	Outputs of base unit O0 to O3	Bits 4 to 7 reserved
4	Outputs of base unit Outputs O4 to O5	Bits 2 to 7 reserved
5	Byte1 for expansion module 1	
6	Byte2 for expansion module 1	
7	Byte1 for expansion module 2	
8	Byte2 for expansion module 2	
9	Byte1 for expansion module 3	
10	Byte2 for expansion module 3	
11	Byte1 for expansion module 4	
12	Byte2 for expansion module 4	
13	Byte1 for expansion module 5	
14	Byte2 for expansion module 5	
15	Byte1 for expansion module 6	
16	Byte2 for expansion module 6	
17	Byte1 for expansion module 7	
18	Byte2 for expansion module 7	
19	Byte1 for expansion module 8	
20	Byte2 for expansion module 8	
21 -31	Reserved	
32	0x00	
33	BCC	

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Diagnostic Interface
Requirements

Byte 1 and Byte 2 for the expansion modules

As the expansion modules may be input, output or signal modules, the Bytes contain different data.

- Input module:

Byte 1	I7	I6	I5	I4	I3	I2	I1	I0
Byte 2	Reserved							

- Relay output module:

Byte 1	x	x	x	x	x	x	O1	O0
Byte2	Reserved							

- Semiconductor output module:

Byte 1	x	x	x	x	O3	O2	O1	O0
Byte 2	Reserved							

- Signal module:

Byte 1	A7	A6	A5	A4	A3	A2	A1	A0
Byte 2	A15	A14	A13	A12	A11	A10	A9	A8

Diagnostic Interface
Requirements

Example

- Base unit with 7 expansion modules, as shown in the following diagram
- Assumption: all the inputs and outputs are closed (Bit = 1)

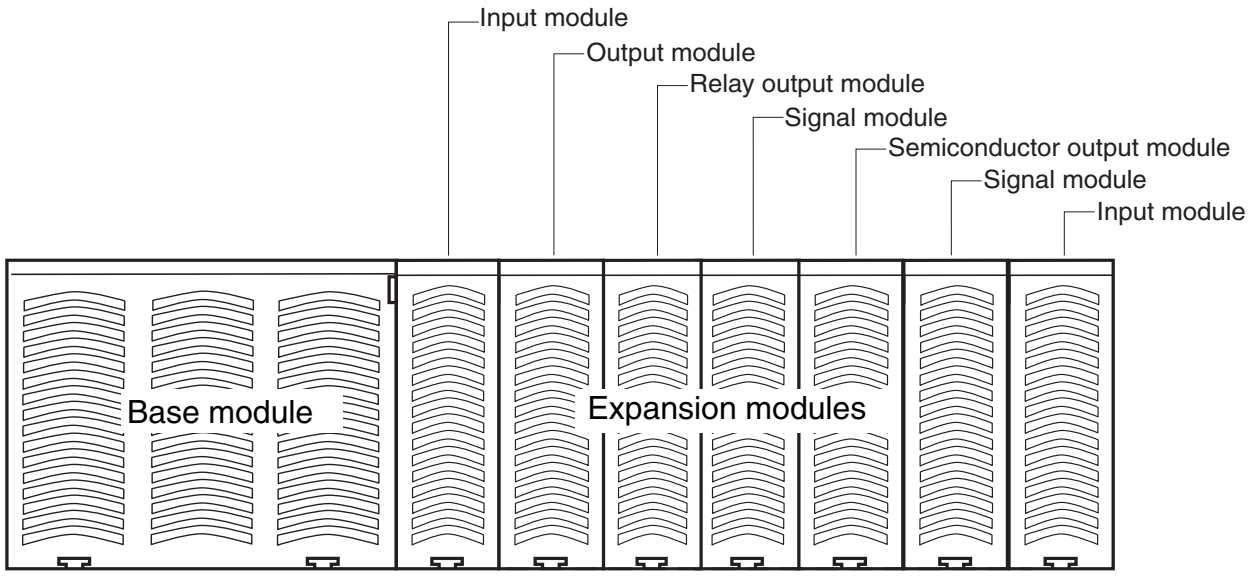

Fig. 5-2: Example PNOZmulti modular safety system

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Diagnostic Interface
Requirements

Status of data block

Byte No.	Assignment	Data	Device
0	1111 1111	Inputs I0 to I7	Base module
1	1111 1111	Inputs I8 to I15	
2	xxxx 1111	Inputs I16 to I19	
3	xxxx 1111	Outputs O0 to O3	
4	xxxx xx11	Outputs O4 to O5	
5	1111 1111	Inputs I0 to I7	Expansion module 1
6	xxxx xxxx		(input module)
7	1111 1111	Inputs I0 to I7	Expansion module 2
8	xxxx xxxx		(input module)
9	xxxx xx11	Outputs O0 to O1	Expansion module 3
10	xxxx xxxx		(relay output module)
11	1111 1111	0 to 7	Expansion module 4
12	1111 1111	8 to 15	(signal module)
13	xxxx 1111	Outputs O0 to O3	Expansion module 5
14	xxxx xxxx		(semiconductor output module)
15	1111 1111	0 to 7	Expansion module 6
16	1111 1111	8 to 15	(signal module)
17	1111 1111	Inputs I0 to I7	Expansion module 7
18	xxxx xxxx		(input module)
19	xxxx xxxx		
20	xxxx xxxx		

x = Contents are irrelevant
1 = Relevant bit

Diagnostic Interface
Requirements

Request 0x43 - Send LED data

Request

The user program employs request 0x43 to request data about the status of the LEDs and the safety system's operating status.

Data block

The data block consists of 34 Bytes:
- Byte 0: System's operating status (Start, RUN, STOP)
- Bytes 1 to 13: LED status of the RUN, DIAG, and FAULT-LEDs ((off, on, flashing)
- Byte 14 to 26: Status of the input LEDs (flashing, not flashing)
- Bytes 27 to 29: Status of CI, CO and OA0 LEDs
- Bytes 30 to 31: Reserved

Detailed structure of data block

- **Byte 0 to 13:**

Byte No.	Contents	Op. mode/status/LED	Device
0	0x12	START	
	0x53	RUN	
	0xA2	STOP	
1	0x00	RUN off	
	0xFF	RUN on	
	0x30	RUN flashing	
2	0x00	DIAG off	
	0xFF	DIAG on	
	0x30	DIAG flashing	
3	0x00	FAULT off	
	0xFF	FAULT on	
	0x30	FAULT flashing	
4	0x00	I FAULT off	
	0xFF	I FAULT on	
	0x30	I FAULT flashing	

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Diagnostic Interface
Requirements

Byte No.	Contents	Op. mode/status/LED	Device
5	0x00	O FAULT off	Base unit
	0xFF	O FAULT on	
	0x30	O FAULT flashing	
6	0x00	FAULT off	Expansion module 1
	0xFF	FAULT on	
	0x30	FAULT flashing	
7	0x00	FAULT off	Expansion module 2
	0xFF	FAULT on	
	0x30	FAULT flashing	
8	0x00	FAULT off	Expansion module 3
	0xFF	FAULT on	
	0x30	FAULT flashing	
9	0x00	FAULT off	Expansion module 4
	0xFF	FAULT on	
	0x30	FAULT flashing	
10	0x00	FAULT off	Expansion module 5
	0xFF	FAULT on	
	0x30	FAULT flashing	
11	0x00	FAULT off	Expansion module 6
	0xFF	FAULT on	
	0x30	FAULT flashing	
12	0x00	FAULT off	Expansion module 7
	0xFF	FAULT on	
	0x30	FAULT flashing	
13	0x00	FAULT off	Expansion module 8
	0xFF	FAULT on	
	0x30	FAULT flashing	

Diagnostic Interface
Requirements

- **Byte 14 to 26:**

Bits 0 to 7 correspond respectively to input LEDs I0 to I7, I8 to I15 or I16 to I19 of the base unit, or I0 to I7 of the expansion module.

Byte No.	Input LED	Op. mode/status/LED	Device
14	I0 to I7	Flashing/not flashing	Base unit
15	I8 to I15	Flashing/not flashing	
16	I16 to I19	Flashing/not flashing	
17	Reserved		
18	Reserved		
19	I0 to I7	Flashing/not flashing	Expansion module 1*
20	I0 to I7	Flashing/not flashing	Expansion module 2*
21	I0 to I7	Flashing/not flashing	Expansion module 3*
22	I0 to I7	Flashing/not flashing	Expansion module 4*
23	I0 to I7	Flashing/not flashing	Expansion module 5*
24	I0 to I7	Flashing/not flashing	Expansion module 6*
25	I0 to I7	Flashing/not flashing	Expansion module 7*
26	I0 to I7	Flashing/not flashing	Expansion module 8*

*only if input module

INFORMATION
Bytes 14 to 26 simply show whether or not the input LED is flashing.
- Bit = 0 → LED not flashing
- Bit = 1 → LED flashing

The key to the respective LED status can be found in the technical catalogue or in the operating instructions supplied with the units.

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Diagnostic Interface
Requirements

- **Bytes 27 to 31:**

Byte No.	Contents	Op. mode/status/LED	Device
27	0x00 0xFF	CI off CI on	Base unit
28	0x00 0xFF	CO off CO on	
29	0x00 0xFF	OA0 off OA0 on	
30 to 31		Reserved	

Diagnostic Interface
Requirements

Request 0x44 - Send simplified status scan (group messages) from the PNOZmulti

Request

The user program employs Code ID 0x44 to request group messages from the PNOZmulti.

Data block

The data block consists of 4 Bytes.

Byte No.	Bit	Data	Note
0	0	O FAULT	Error at an output
	1	I FAULT	Error at an input
	2	FAULT	LED FAULT is lit/flashes
	3	DIAG	LED DIAG is lit/flashes
	4	RUN	LED RUN is lit
	5... 7	Reserved	
1	0	Signal change at an input	At least one input signal has changed since the last 0x44 request
	1	Signal change at an output	At least one output signal has changed since the last 0x44 request
	2 ... 7	Reserved	
2		0x00	
3		BCC	

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Diagnostic Interface
Requirements

Code ID: 0x50 - Send data from the PNOZmulti in table form

Request

The user program employs Code ID 0x50 to request data in table form from the PNOZmulti.

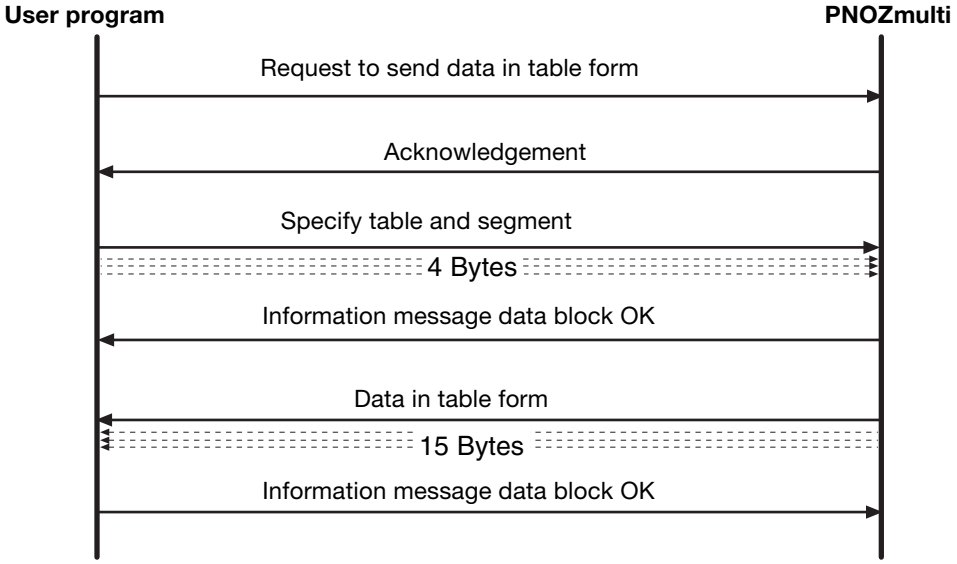

Fig. 5-3: Communication procedure

INFORMATION
The contents of the tables and segments are described in detail in Chapter 2, „Communication with fieldbus modules“.

Diagnostic Interface
Requirements

Data block

The data block that the user program employs to specify the requested data consists of 4 Bytes.

Byte No.	Data	Note
0	Table number	Example: 0x04 for Table 4: Output status
1	Segment number	Example: 0x01 for Segment 1: Status of outputs O8 ... O15 of expansion modules
2	0x00	
3	BCC	0 – (Data byte 0 + Data byte 1)

The data block containing the data in table form consists of 15 Bytes. It contains the data from Segment y of Table x.

Byte No.	Data	Note
0	Byte 0 of Table x, Segment y	
1	Byte 1 of Table x, Segment y	
2	Byte 2 of Table x, Segment y	
3	Byte 3 of Table x, Segment y	
4	Byte 4 of Table x, Segment y	
5	Byte 5 of Table x, Segment y	
6	Byte 6 of Table x, Segment y	
7	Byte 7 of Table x, Segment y	
8	Byte 8 of Table x, Segment y	
9	Byte 9 of Table x, Segment y	
10	Byte 10 of Table x, Segment y	
11	Byte 11 of Table x, Segment y	
12	Byte 12 of Table x, Segment y	
13	0x00	
14	BCC	

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Diagnostic Interface
Requirements

Example

The user program requests the status of the inputs from the PNOZ multi. The safety system consists of one PNOZ m1p and one PNOZ mi1p expansion module

- Code -ID 0x50 - Send data in table form
- The PNOZmulti gives an acknowledgement
- The user specifies its request
  Table 3: Byte 0 -> 0x03
  Segment 0: Byte 1 -> 0x00
  Byte 2 -> 0x00
  BCC: Byte 3 -> 0x00
- PNOZmulti sends the data block.

Byte No.	Data	Note
0	0000 1010	I7 ... I0: Base unit PNOZ m1p
1	1100 1101	I15 ... I8: Base unit PNOZ m1p
2	0000 1010	I19 ... I16: Base unit PNOZ m1p
3	0000 0000	
4	0000 0000	
5	1011 0010	I7 ... I0: PNOZ mi1p expansion module
6	0000 0000	
7	0000 0000	
8	0000 0000	
9	0000 0000	
10	0000 0000	
11	0000 0000	
12	0000 0000	
13	0000 0000	
14	0110 1101	BCC

Diagnostic Interface
Requirements

Request 0x5F - Send test

Request

The user program employs Code ID 0x50 to request test data from the PNOZmulti.
This request provides a simple method for testing communication. For example, if users send a command to the PNOZmulti but get no reaction, they can send the “Send test” request to check whether the connection is still intact.

Data block

The data block that the PNOZmulti sends consists of 34 Bytes. The contents of the data block includes the byte number.

Byte No.	Contents*
0	0
1	1
2	2
3	3
4	4
...	...
28	28
29	29
30	30
31	31
32	00
33	16

The figures in this table are shown in decimal to aid understanding.

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Diagnostic Interface
Error Management

Errors may occur during communication, whether on the PNOZmulti or in the user program. The following tables describe the reactions and procedures for both devices in the case of an error.

User program

Error/message	Reaction/remedy in user program
Receives no acknowledgement of receipt in response to a request.	Wait until the communications timer * has elapsed. If invalid data has been received, or no data at all, repeat the request**.
Receives the message 0x64: Request not understood	Repeat request**.
Receives an irrelevant byte instead of an acknowledgement of receipt in response to a request.	Reject byte and wait until the communications timer* has elapsed. If invalid data has been received, or no data at all, repeat the request**.
Receives the message 0x65: Communication reset because the time was exceeded.	Repeat request**.
Receives a data block which contains fewer bytes than expected.	Wait until the communications timer * has elapsed. If incomplete data has been received, repeat the request**.
Does not receive an acknowledgement 0x60: Data block OK:	Wait until the communications timer * has elapsed. If invalid data has been received, repeat the request**.
Receives a data block whose check sum (BCC) is incorrect.	Send error message 0x62: Data block not received correctly. PNOZmulti will then send the data block again.
Receives the message 0x62: Data block not received correctly.	Send data block again. Do not reset communications timer *.
Does not receive a data block in response to the “Send test” request.	UART/Hardware defect

For details of * and ** please refer to the “Notes” section at the end of this chapter

PNOZmulti

Error/message	Reaction/remedy PNOZmulti
Having sent a data block, after 500 ms has not received acknowledgement 0x60: Data block OK.	Resets communication***. Sends error message 0x65.
Receives a data block which contains fewer bytes than expected.	Wait until the communications timer * has elapsed. Resets communication*** if data has still not been received in its entirety.
Receives error message 0x62: Data block not received correctly.	Sends data block again. Does not reset communications timer*.
Receives a data block whose check sum (BCC) is incorrect.	Sends error message 0x62: Data block not received correctly. User program must send data block again.

For details of * and *** please refer to the “Notes” section at the end of this chapter.

Diagnostic Interface
Error Management

Notes

* A communications timer monitors the length of communication at each stage (e.g. between a request and an acknowledgement). Communication is reset if the time is exceeded. The time is 550 ms for the user program and 500 ms for the PNOZmulti.
** If the user receives invalid data or no data at all, even after repeating the request, the request 0x5F should be used to test communication (see Chapter 5, Request 0x5F - Send test).
*** Resetting communication means resetting the step counter to zero. Communication restarts with a request from the user.

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Muting

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Muting
Introduction

This chapter describes the muting function in conjunction with the PNOZmulti modular safety system units.
The safe inputs and outputs of base modules and expansion modules are suitable.

NOTICE
Please note the operating manuals included with the units for application of the muting function. Please also refer to the PNOZmulti technical catalogue.

This chapter is subdivided as follows:

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

4.2 Safety
This section covers intended use, standards and safety guidelines.

4.3 Configuration
This section provides information on configuring the muting function in the PNOZmulti Configurator.

4.4 Operating modes
This section provides information on operating modes, sequential and parallel muting and cross muting

Muting
Introduction

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Muting
Safety

Intended use

The muting logic element is used to override safety functions (ESPE/ AOPD) for a limited period of time without interrupting the process (muting) in accordance with EN 61496-1.
For a limited period of time, and for a specific operational phase (e.g. when feeding materials), it will suspend the effect of safety devices during the working process. Once completed, it will reset the safety function.

Use of this operating mode and the arrangement of the sensors are machine or plant-specific and depend on the risk assessment of the machine or plant.

Be sure that you observe the warning notes given in the other parts of this configuration guide and in the PNOZmulti technical catalogue. These are highlighted visually through the use of symbols.

CAUTION!
Failure to observe the safety regulations in this configuration guide and in the PNOZmulti technical catalogue will render the warranty invalid.

Standards

To use the muting element correctly, you will need to have a good knowledge of the relevant standards and directives. The following gives an overview of the most important standards:
- EN 61496-1: Safety of machinery – Electrosensitive protective equipment
- EN 60947-5-3: Low voltage control gear - Control circuit devices and switching elements
- EN 999: Safety of machinery – Positioning of protective equipment

Please note this is not an exhaustive list of safety standards and directives.

Safety guidelines

WARNING!
The following information must be heeded!
Failure to comply with these guidelines could result in **serious injury or death**.
- Refer to EN 61 496-1 and EN 60947-5-3 when configuring, setting up and operating the muting device.
- Refer to EN 999 with regard to the layout of the AOPD.
- Measures must be taken to exclude common cause failures, e.g. by the use of non-equivalent signals or diverse sensors.
- Muting switches should be positioned so that it is impossible for a person to trigger the muting function.
- The vehicle should be designed to make it impossible for people to ride on it.
- Limit the size of the entry area by applying appropriate safety measures. People must not be able to enter the danger area during the muting phase.
- If various transport speeds are being used, consider the total duration of the muting phase.
- Remember that a new muting phase can only be introduced once the previous phase has been completed.
- Maintenance gates should be provided if you secure equipment through muting.
- Please note that if the maintenance gates are opened, the plant **absolutely must** be brought to a standstill in accordance with the risk classification.
- Use of muting sensors with contacts:
  Supply the contacts of the muting sensors via test pulse outputs (test pulses).
- Use of ESPE as muting sensors:
  Test pulses cannot be used. Therefore, for fault detection (shorts across contacts), be sure to use an N/O contact as sensor 1 and an N/C contact as sensor 2.
- Laying the connection cable to the sensors in a way that is protected against shorts (i.e. separate) may provide an alternative to non-equivalent sensors.

Muting
Safety

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Muting
Configuration

Function

- Muting via light barriers or limit switches
- Option of overriding in case of fault
- Max. muting time can be set
- Time monitoring of the muting sensors for simultaneity
- Configuration of bounce time for contacting muting sensors
- Sequence monitoring of the muting sensors
- Operating modes
  - Sequential muting
  - Parallel muting
  - Cross muting

Input parameters

- *Muting sensor 1*
  N/O contact of muting sensor 1
  Muting sensor 1 = 0: Not operated
  Muting sensor 1 = 1: Operated
- *Muting sensor 2*
  N/O contact of muting sensor 2
  Muting sensor 2 = 0: Not operated
  Muting sensor 2 = 1: Operated
- *Light curtain*
  Light curtain = 0: Interrupted
  Light curtain = 1: Not interrupted
  Assign the *light curtain* input parameter with the output of the light curtain function element. The light curtain function element must be configured with the automatic reset.
- *Muting sensor 3*
  N/O contact of muting sensor 3
  Muting sensor 3 = 0: Not operated
  Muting sensor 3 = 1: Operated
- *Muting sensor 4*
  N/O contact of muting sensor 4
  Muting sensor 4 = 0: Not operated
  Muting sensor 4 = 1: Operated
- *Muting override*
  Muting override = 1: Suspend the muting function if a fault occurs (override) to override the muting channel.
- *Reset*
  Reset = 0/1 pulse edge: Reset the muting element upon fault or start the muting time.

Output parameters

- *Enable*
  Enable = 0: Fault detected (e.g. simultaneity exceeded)
  Enable = 1: The enable is granted if no error was detected.
- *Muting active*
  Display muting status (e.g. for actuating a lamp)
  Muting active = 0: No muting (light curtain not overridden)
  Muting active = 1: Muting active (light curtain overridden)

Monitoring times

- **Maximum muting time**
  This setting is used to adjust the maximum permitted muting time.
  Permitted value range: 1 to 900 s (= 15 minutes)
- **Simultaneity**
  This setting is used to define the maximum time (synchronisation time) which is permitted to elapse between the actuation (0/1-pulse edge) of MS1 and MS2 or of MS3 and MS4.
  Permitted value range for parallel muting and cross muting: 1 to 3 s
  Permitted value range for sequential muting: 1 to 30 s
- **Bounce time**
  With this setting, the time up to the final contacting of the muting sensors can be set.
  Permitted value range: 50 to 800 ms

Muting override (override)

If there are faults, the muting station can be overridden via the *Muting override* input parameter.

- **Start-up condition**
  Muting override can be switched on if at least one of the muting sensors is active.
  The enable output and *Muting active* output parameter are set during the override. Overriding is monitored and has a maximum duration that corresponds to the set muting time.

- **Switch-off condition**
  Muting override is switched off if
  - the muting time has elapsed
  or
  - no muting sensor is assigned and the light curtain is free
  or
  - muting override is reset to 0 (release override button).

CAUTION!
The following additional safety requirements apply for the muting override:
- The override switch must have a hold-to-run control device (touch-operated switch).
- The override switch must be installed in a fixed position outside the danger zone.
- The danger zone and the muting station must be visible from the override switch position.
- The danger zone must be identified as clear before the override switch is operated and while it is operated.

Reset

Reset resets the muting element after a fault or during start-up if
- no muting sensor is actuated
and
- the light curtain is clear.

Muting
Configuration

CAUTION!

The following additional safety requirements apply for the reset button:

- The danger zone and the muting station must be visible from the reset button position.
- The reset button may not be operated until the danger zone has been viewed and has been identified as clear.

Restarting the muting time

Reset resumes muting and restarts the muting time if

- muting was ended as a result of the muting time elapsing (e.g. by the conveyor feed stopping) and
- the muting sensors and the light curtain remain plausible.

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Muting
Operating modes

The following operating modes can be realised:
- Sequential muting
- Parallel muting
- Cross muting

WARNING!
"During muting safe conditions shall be provided by other means" (EN 954-1). For example, this may be achieved by the conveyed item blocking access to the hazardous area. Even openings in or between the individual parts of the conveyor flow must never enable access.

Terminology

- **Muting On**
  "Muting On" is the switch condition for switching on the muting function. When muting is activated, the *Muting active* output parameter has a 1 signal and time monitoring runs.
- **Muting Off**
  "Muting Off" is the switch condition for ending the muting function.
  When the muting function is ended, output parameter *Muting active* has a 0 signal.

INFORMATION
You will find important additional information on the use of sensors or contacts in the section titled "Safety".

Muting

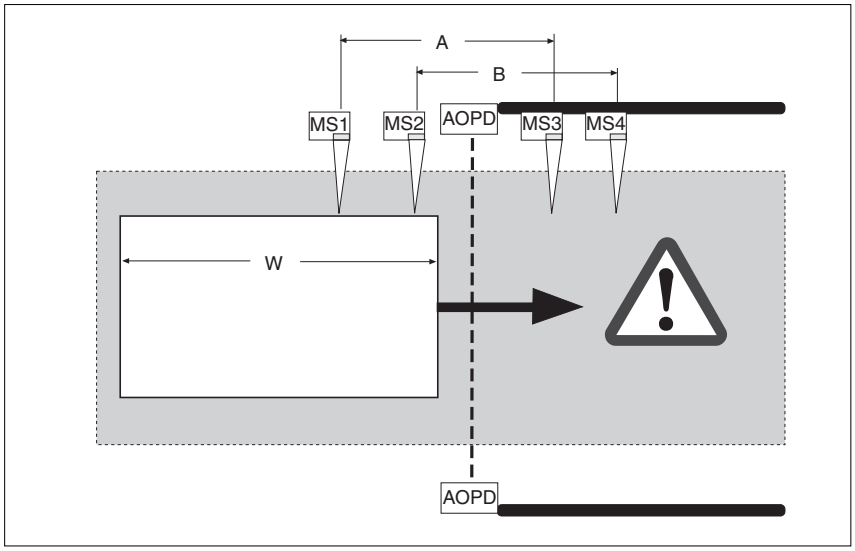
Operating modes - sequential muting

Muting sensor arrangement

- The distance between MS1 and MS2 or MS3 and MS4 muting sensors should be as long as possible.
- Vehicle length W must be greater than the distance between MS1 and MS3 or MS2 and MS4 (W > A and W > B).
- MS2 and MS3 must be positioned as close as possible in front of/ behind the AOPD.

Switch conditions in sequential mode

- **Muting On**
  - Entering the danger zone:
    1. Muting sensors MS1 and MS2 must be operated consecutively (first MS1, then MS2) within the configured simultaneity. Muting is activated by actuating MS2.
    2. Muting sensors MS3 and MS4 must be operated consecutively (first MS3, then MS4) within the configured simultaneity.
    3. MS1 and MS2 must be released consecutively (first MS1, then MS2).
    4. MS3 and MS4 must be released consecutively (first MS3, then MS4).
  - Leaving the danger zone:
    1. Muting sensors MS4 and MS3 must be operated consecutively (first MS4, then MS3) within the configured simultaneity. Muting is activated by actuating MS3.
    2. MS2 and MS1 must be operated consecutively (first MS2, then MS1).
    3. MS4 and MS3 must be released consecutively (first MS4, then MS3).
    4. MS2 and MS1 must be released consecutively (first MS2, then MS1).

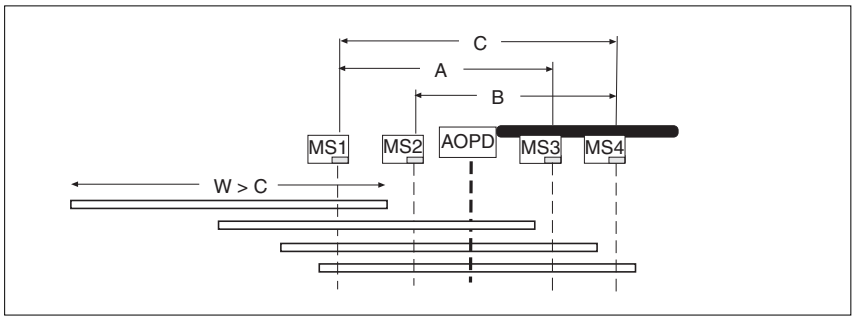


- **Muting Off**
  Overriding of the safety function is cancelled as soon as the penultimate muting sensor (MS2 or MS3) no longer is actuated, i.e. only one muting sensor remains actuated.

Sequence errors

The muting sensors must be actuated in a specific sequence in sequential mode. Once a particular directional movement has started (entry or exit), it must be fully completed. Any deviation from the sequence shown will cause the enable output (*ENBL* = 0) and the *Muting active* output parameter to reset.

- **Vehicle length W greater than distance C between MS1 and MS4**
  All sensors are temporarily actuated when passing through. The first muting sensor (MS1 upon entering, MS4 upon exiting) becomes free only if all muting sensors were actuated.



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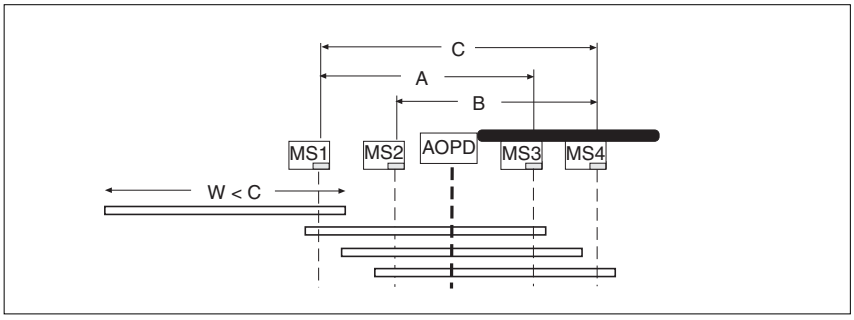
Muting

Operating modes - sequential muting

- **Vehicle length W less than distance C between MS1 and MS4**
  When passing through, the first muting sensor becomes free (MS1 upon entering, MS4 upon exiting) before the last muting sensor is actuated.



MS1	MS2	MS3	MS4	Travel direction
0	0	0	0	
1	0	0	0	
1	1	0	0	
1	1	1	0	
1/0	1	1	1/0	
0	1	1	1	
0	0	1	1	
0	0	0	1	
0	0	0	0	

Diagnostic word

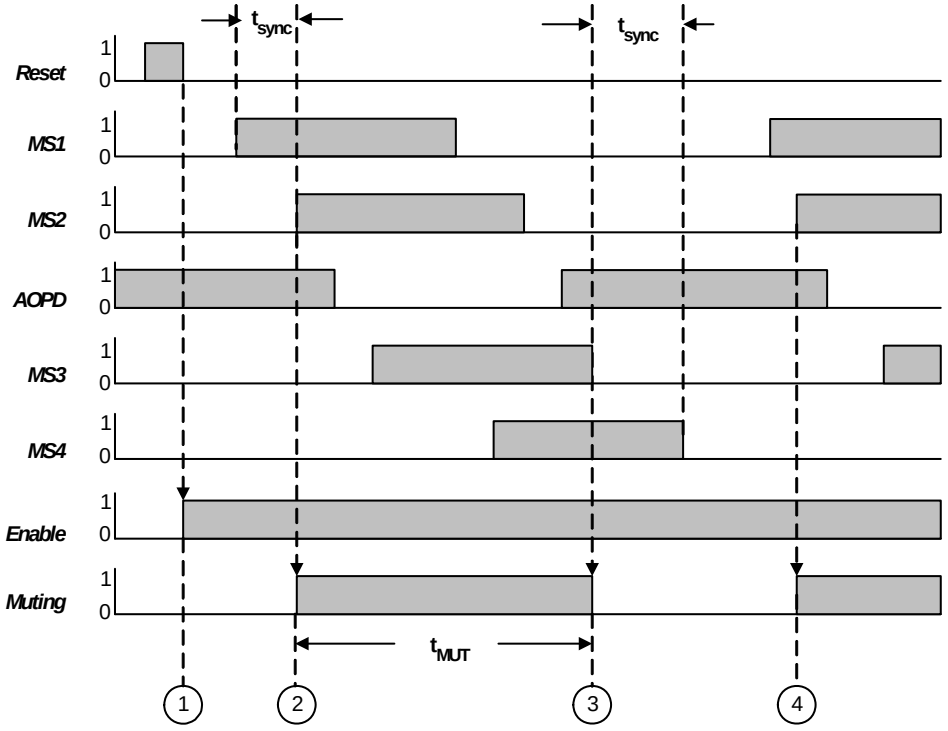
Messages can be queried in the PNOZmulti Configurator in bit mode and additionally linked in the program.

- Bit 1: Light curtain, interrupted (without active muting)
- Bit 2: Waiting for reset
- Bit 3: Unfeasible status of sensors, override required (reset)
- Bit 8: Muting time exceeded
- Bit 9: Feasibility error, muting sensors 1 and 2
  Simultaneity exceeded, only one sensor operated
- Bit 10: Feasibility error, muting sensors 3 and 4

Muting

Operating modes - sequential muting

Timing diagram (example)
Vehicle length W less than distance
C between MS1 and MS4



t_{sync} = simultaneity
t_{MUT} = muting time

①: Set enable with reset
②: Start muting via MS1/MS2
③: End muting by clearing MS3
④: Restart muting via MS1/MS2

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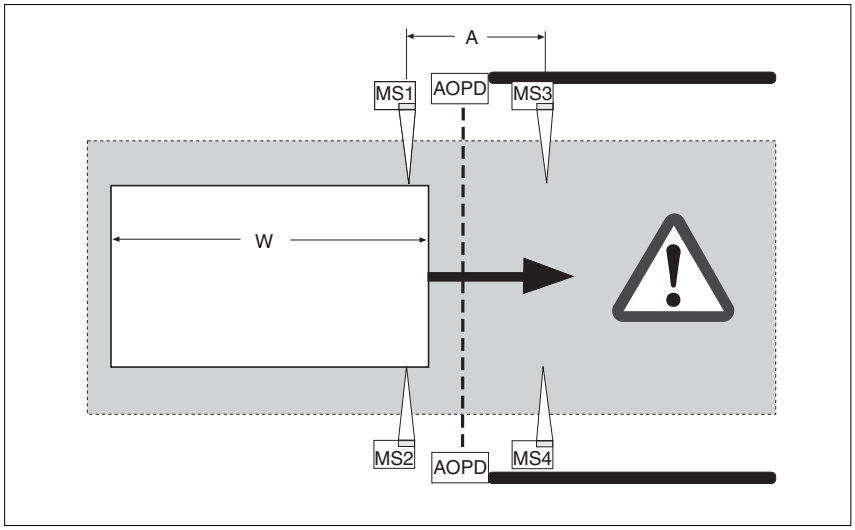
Muting

Operating modes - parallel muting

Muting sensor arrangement

- Muting signals MS1 and MS2/ MS3 and MS4 must be positioned at the same height to the left and right of the vehicle.
- The vehicle length must be greater than the distance between MS1 and MS3/MS2 and MS4.
- The distance between the light curtain and the muting signal must be as short as possible.

- **Muting On**
  - Entering the danger area:
    1. Muting sensors MS1 and MS2 must be operated within the configured simultaneity. Muting is activated.
    2. Muting sensors MS3 and MS4 must be operated within the configured simultaneity before MS1 and MS2 are released.
  - Leaving the danger area:
    1. Muting sensors MS3 and MS4 must be operated within the configured simultaneity. Muting is activated.
    2. Muting sensors MS1 and MS2 must be operated before MS3 and MS4 are released.
- **Muting Off**
  Overriding of the safety function is cancelled as soon as the penultimate muting sensor no longer is actuated upon entering (MS3 or MS4) or exiting (MS1 or MS2), i.e. only one muting sensor remains actuated.



Diagnostic word

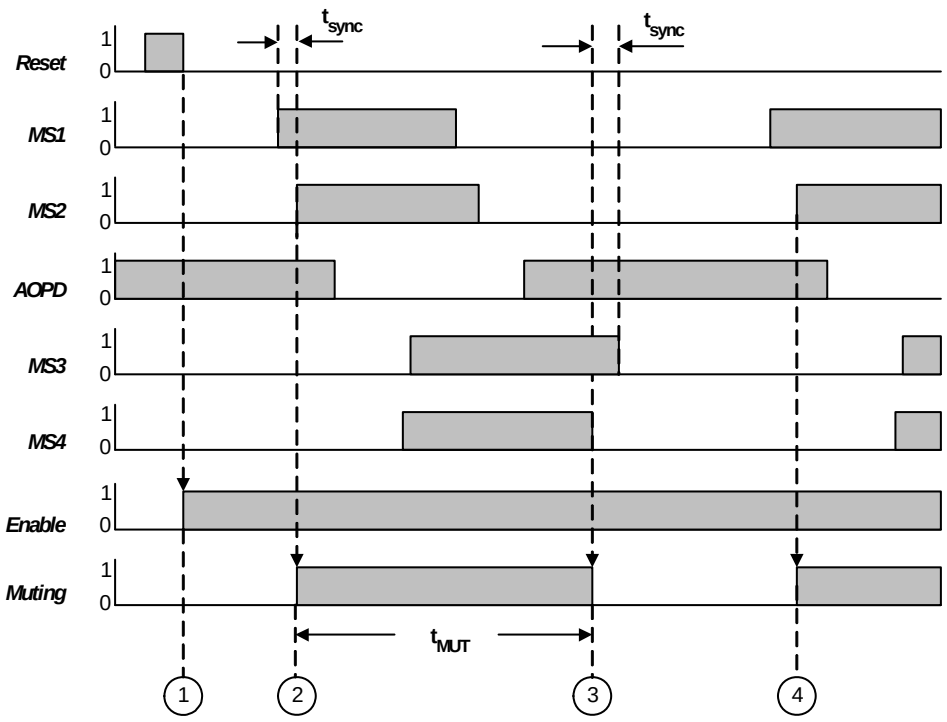
Messages can be queried in the PNOZmulti Configurator in bit mode and additionally linked in the program.

- Bit 1: Light curtain, interrupted (without active muting)
- Bit 2: Waiting for reset (reset)
- Bit 3: Unfeasible status of sensors, override required
- Bit 8: Muting time exceeded
- Bit 9: Feasibility error, muting sensors 1 and 2
  Simultaneity exceeded, only one sensor operated
- Bit 10: Feasibility error, muting sensors 3 and 4
  Simultaneity exceeded, only one sensor operated

Muting

Operating modes - parallel muting

Timing diagram (example)



t_{sync} = simultaneity
t_{MUT} = muting time

①: Set enable with reset
②: Start muting via MS1/MS2
③: End muting by clearing MS3 or MS4
④: Restart muting via MS1/MS2

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Muting
Operating modes - cross muting

Muting sensor arrangement

- Muting signals may come from reflective or send and receive light barriers, for example. The beams must always intersect within the danger area.
- The muting sensors must be arranged such that the light curtain is interrupted before the beams can intersect outside the danger zone.
- Muting sensors MS3 and MS4 are not used.

WARNING!
Ensure that you maintain the installation dimensions shown in the adjacent diagram. If these requirements are not met, the safety of the guard will be lost, which may lead to **serious injury and death**!

- **Muting On**

Muting sensors MS1 and MS2 must be operated within the configured simultaneity.

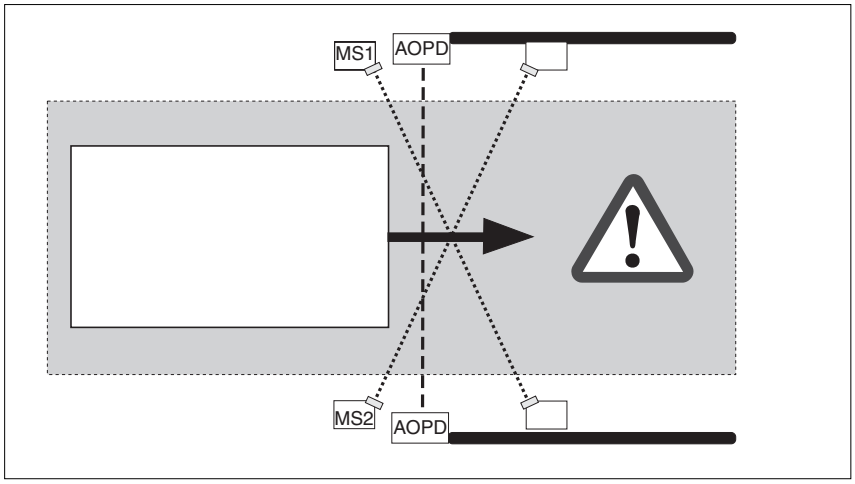
- **Muting Off**

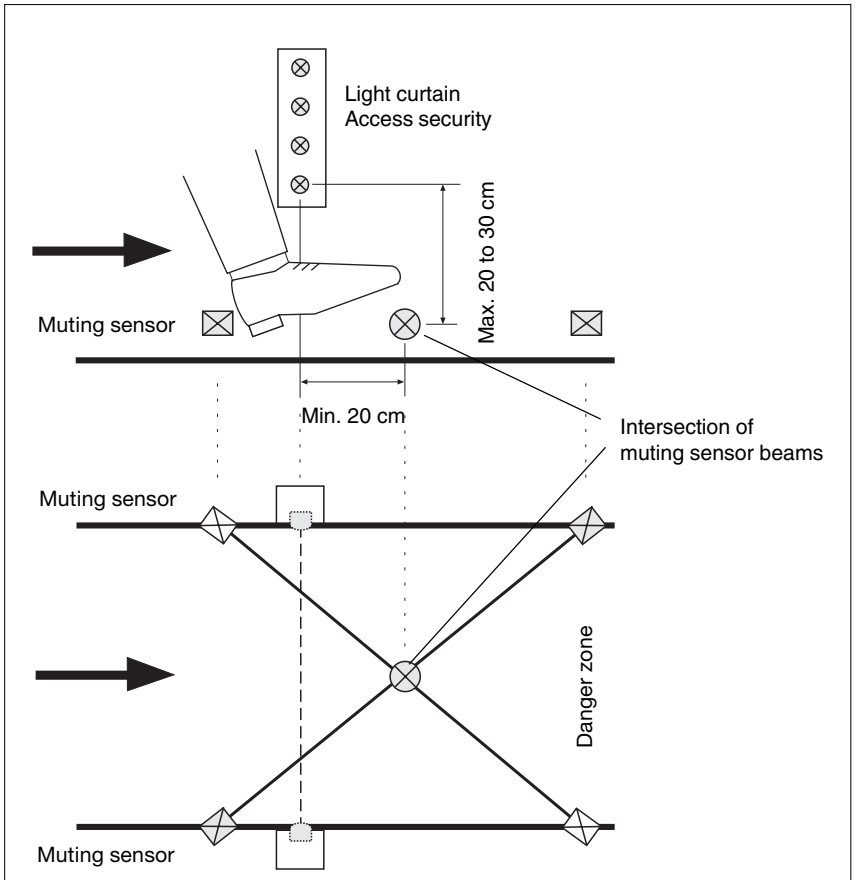
The suspension of the safety function is lifted when one muting sensor at most is still operated.

Diagnostic word

Messages can be queried in the PNOZmulti Configurator in bit mode and additionally linked in the program.

- Bit 1: Light curtain, interrupted (without active muting)
- Bit 2: Waiting for reset (reset)
- Bit 3: Not feasible status of sensors, override required
- Bit 8: Muting time exceeded
- Bit 9: Feasibility error, muting sensors 1 and 2 Simultaneity exceeded, only one sensor operated



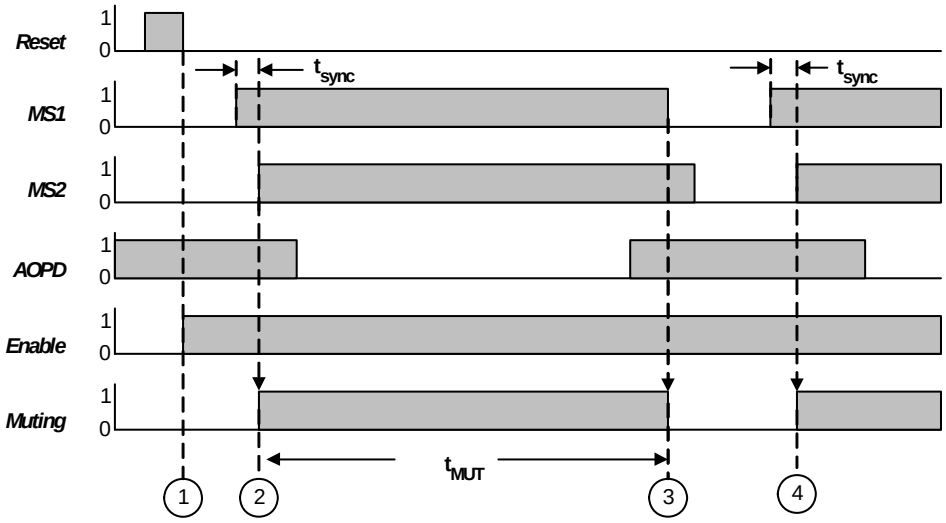


Arrangement of muting sensors (side view and view from top)

Muting

Operating modes - cross muting

Timing diagram (example)



t_{sync} = simultaneity
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①: Set enable with reset
②: Start muting via MS1/MS2
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Safety mat

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Safety mat

This chapter describes the use of safety mats in conjunction with the PNOZmulti.
Please note the following:
- The operating manuals accompanying the PNOZmulti modules
- The PNOZmulti technical catalogue
- The installation manual and user information provided by the respective safety mat manufacturer (see “Intended use”).

Safety mat

- A safety device which detects a person standing on it or stepping on it. The safety mat comprises an input device that responds to applied pressure, signal processing and a shutdown device.
- In a safety mat, the effective actuation area is locally distorted when the input device is actuated.

Function description

The safety mat is supplied with PNOZmulti test pulse outputs. The test pulses are evaluated by PNOZmulti inputs (see section entitled “Commissioning the safety system”). Short across contacts and open circuits are detected.

Intended use

Safety mats can be connected to the base units
- PNOZ m0p
- PNOZ m1p
- PNOZ m1p coated version
- PNOZ m2p

as well as expansion module
- PNOZ mi1p
- The units may only be used as a safety system in conjunction with safety mats in accordance with the 4-wire technology operating principle (without monitoring resistor)
  - Series ESM-50 safety mats from Bircher Reglomat
  - Series SM/BK safety mats from Mayser
- The safety mats must be connected to the inputs on the PNOZmulti units via the PSEN im1 interface or type 1N4007 diodes (see “Commissioning the safety system”)
- Only safety mats without installed terminating resistors are suitable.
- The safety mats trigger only when they are stood on by persons weighing more than 35 kg.
- The following are not permitted: Walking aids such as canes and wheeled vehicles
- The PNOZmulti modular safety system is used for signal processing and as a shutdown device in accordance with EN 1760-1, 09/97.

CAUTION!
When safety mats are connected to the PNOZmulti units, the units (including the coated version) may only be operated at an ambient temperature of 0 to +60 °C.

Safety

- Do not install and commission the safety system until you have read and understood these operating instructions, the technical catalogue and the installation manual from the safety mat manufacturer. You must also be familiar with the applicable regulations for health and safety at work and accident prevention.
- Refer in particular to EN 1760-1.
- In the case of an error, the safety system complies with Category 3 of EN 954-1. Note 3 in clause 4.15 of EN 1760-1 must be considered for the safety mat.
- The EN 954-1-compliant categories for safety mats at machines are specified in type C standards.

Configuration in the PNOZmulti Configurator

- Operating modes
  - Automatic reset (start): The output immediately becomes “1” again after the safety mat is activated and is then cleared.
  - Manual reset (start): The output only becomes “1” if the reset button was pressed. This eliminates the possibility of the reset button being automatically activated and overridden. Resetting is only possible if the safety mat is not activated.
- Start-up test
  The start-up test prevents automatic restarting after a power failure and subsequent-return of voltage. The unit checks that the unactivated safety mat has been activated and then cleared after supply voltage was applied.
- The output of the safety mat function element is “1” if the safety mat is **not** activated. This safety function must be retained for additional connection of this signal in the PNOZmulti Configurator:
  - Semiconductor outputs: High signal
  - Relay outputs: Safety contacts closed

Allocation of the test pulses to the inputs

The test pulses can only be connected to the inputs as follows:
- Input 1: Test T0
  Input 2: Test pulse T1
  or
- Input 1: Test pulse T2
  Input 2: Test pulse T3

INFORMATION
Test pulses which you are using for the safety mat cannot be reused for test pulses in conjunction with other safety devices

Safety mat

Commissioning the safety system

When using safety mats, please note the following:

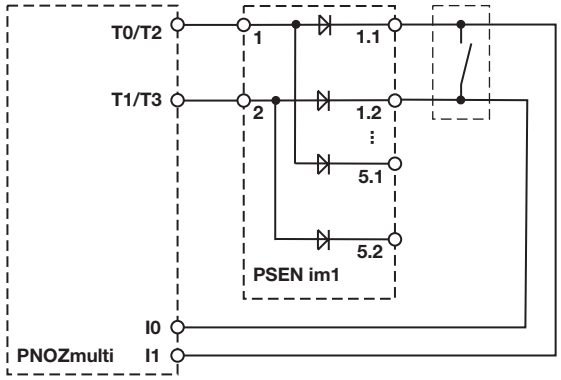
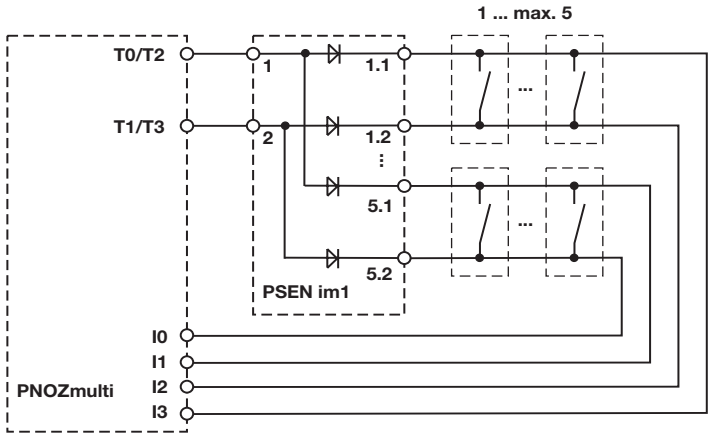
- The safety mats trigger only when they are stood on by persons weighing more than 35 kg.
- The following are not permitted: Walking aids such as canes and wheeled vehicles

Preparing for commissioning:
Please note the following when preparing for commissioning:

- Cables that have to be laid outside the control cabinet must be protected from mechanical damage, e.g. by installing them in a conduit.
- Safety mats may **not** be connected with a resistor.
- Use the configured test pulse outputs exclusively for pulsing the safety mats.
- Be sure to note the information provided in “Technical details”.

Preparing the unit for operation:

- Connect the safety mat to the test pulse outputs and the inputs (in examples I0 to I3).
- Please note:
  Always connect the safety mats to the PNOZmulti units via
  - interface PSEN im1,
  - diodes of type 1N4003 to 1N4007,
  - or via the terminal block with filter, order no. 774 195, 774 196.
  0 V may not be connected to the terminal block!

Input circuit	
Connecting **one** safety mat, max. 8 m² safety mat area	
Connection of **multiple** safety mats, permitted per dual-pole input: Max. 5 safety mats in series, max. 8 m² safety mat area	

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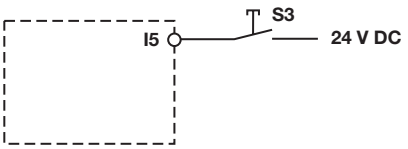
Safety mat

- Set the reset features through wiring of the **reset circuit** (in example I5). Only effective if manual reset is configured in the PNOZmulti Configurator.

Manual reset	

Run

The safety system can only be started when the safety mat is not activated. The unit detects the operating mode set on start-up.

Diagnostic word

Messages can be queried in the PNOZmulti Configurator in bit mode and additionally linked in the program.

- Bit 0: Safety mat free, enable issued
- Bit 2: Safety mat activated
- Bit 3: Waiting for reset
- Bit 4: Waiting for start-up test
- Bit 6: Open circuit detected, signal error

Technical details

Reaction time (actuation of the safety mat until an instantaneous safety output drops out)	
Semiconductor output	max. 50 ms
Relay output	max. 70 ms
Max. area of safety mats per dual-pole input	8 m^2
Max. number of safety mats connected in series per dual-pole input	5
Min. cross section of external conductor	0.5 mm^2
Max. cable runs, PNOZmulti - safety mat	100 m
Max. safety mat resistance	150 ohms

Safety mat

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Diagnostic word

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Diagnostic word
Introduction

This chapter describes the diagnostic words in the modular PNOZmulti safety system. By evaluating the diagnostic words you can obtain important information on operating conditions and malfunctions within your application.

Please refer also to the following chapters in this configuration guide:
- Chapter 2: Communication with fieldbus modules
- Chapter 3: Diagnostic interface

This chapter is subdivided as follows:

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

6.2 Overview
This section contains important information about the diagnostic words.

6.3 Compilation of the diagnostic words
This section lists all the diagnostic words with explanatory notes.

Diagnostic word
Introduction

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Diagnostic word
Overview

Diagnostic word

A diagnostic word can be read out for those elements in the PNOZmulti Configurator that can store a status. The diagnostic word contains information on a particular element, such as:
- Operating status (e.g. safety gate was opened)
- Error messages (e.g. N/C contact failed to switch or switched too late)

Elements with diagnostic word
The diagnostic word is accessed by activating an Element ID. The permitted value range for the Element ID is 1 ... 100. Elements with an element ID include:
- Function elements
  - E-STOP
  - Safety gate
  - Safety gate with guard locking
  - Light curtain
  - Enable switch
  - Foot switch
  - Safety mat
  - Two-hand button
  - Operating mode selector switch
- Cascading
  - Cascading input
  - Cascading output
- Logic elements
  - RS flip-flops
  - Reset element
  - Speed monitor
  - Press-related elements
    - Run monitoring
    - Rotary cam arrangement monitoring
    - Set-up mode
    - Single stroke
    - Automatic
    - Light curtain
  - Muting elements
    - Sequential muting
    - Parallel muting
    - Cross muting
- Output elements
  - Output elements with a feedback loop
  - Safety valve

Structure of the diagnostic word

The diagnostic word has 16 bits:

Bit	15	14	...	2	1	0

- If the diagnostic word = 0, the output of the respective element = 1. The element was enabled. Exceptions: On various function elements the status of the inputs is evaluated (see Chapter 6.3)
- Otherwise, at least one of the bits from 0 ... 15 of the diagnostic word is set and can be evaluated, e.g. Bit 1 =1:
  00000000 00000010
  Key: Safety gate was opened

Evaluate diagnostic word

- **Evaluation in the user program**
  One bit from the diagnostic word can be linked further within the user program. The user selects a bit within a diagnostic word and polls it. An LED can be driven in this way, for example.

- **Evaluation using PVIS expanded diagnostics**
  The bits of a diagnostic word can be configured for PVIS expanded diagnostics in the PNOZmulti Configurator.
  A “Safety Device” diagnostic type is assigned to an element. It contains the diagnostic word as an event message. An event message including remedies (actions) is defined in the diagnostic type for each event, i.e. for every potential element status. The event messages and actions can also be supplmented through additional information, which is helpful during diagnostics (equipment identifier, location description)
  The event messages can be displayed on the PMImicro diag, for example.

INFORMATION
Detailed information on PVIS expanded diagnostics can be found in the PNOZmulti Configurator’s online help.

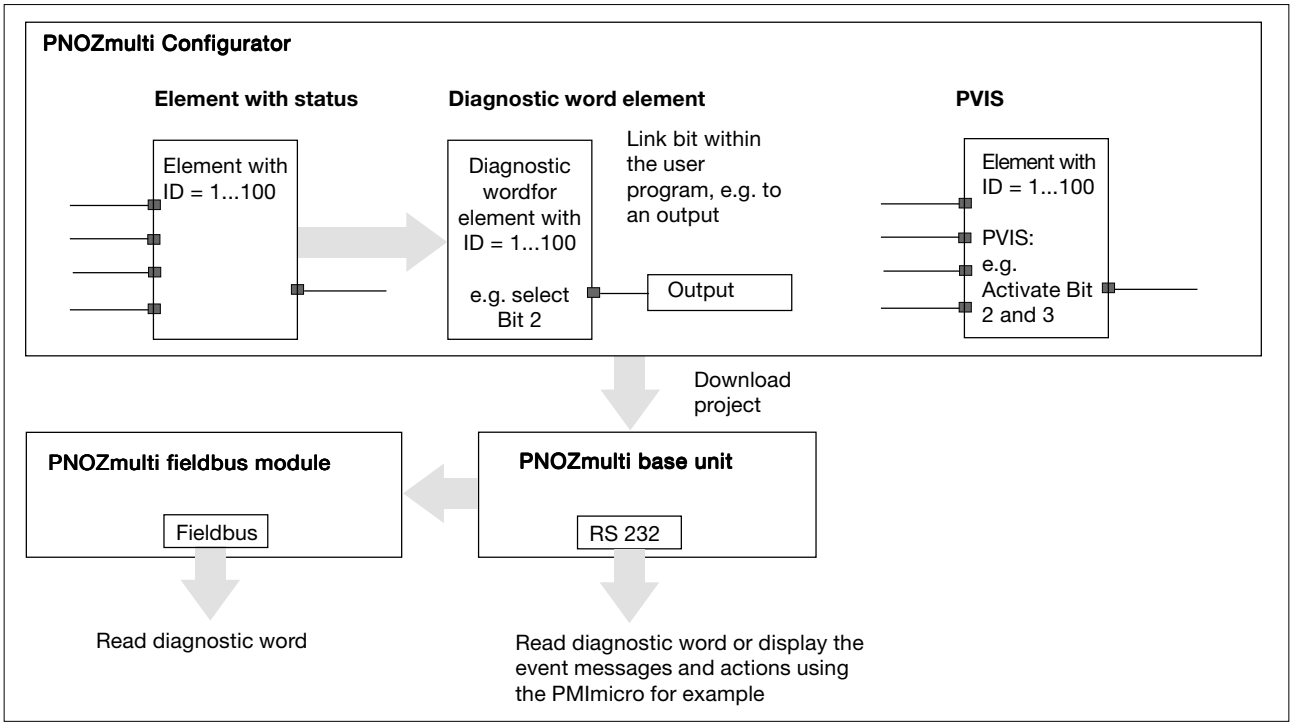
- **Evaluation via the serial interface**
  The diagnostic word is requested via the RS 232 interface on the base unit, using the element’s ID.

INFORMATION
Detailed information can be found in Chapter 3 of this configuration guide:
“Diagnostic interface”

- **Evaluation via a fieldbus**
  The diagnostic word is requested via a connected fieldbus module, via the element’s ID.

INFORMATION
Detailed information can be found in Chapter 2 of this configuration guide:
“Communication with fieldbus modules”

Diagnostic word
Overview



Example

Safety gate with Element ID = 5:
- Dual-channel
- Manual reset
- Start-up test

Evaluation of the following bits:
- Bit 2 = 1: Safety gate is ready for reset. The reset button for manual reset must be operated
- Bit 8 = 1: Error in the test pulse wiring

	Safety gate function element with ID = 5	
	0000 0000 0000 0000	Enable issued
	0000 0000 0000 0001	
	0000 0000 0000 0010	Safety gate was opened
Bit 2	0000 0000 0000 0100	Safety gate is ready for reset
	0000 0000 0000 1000	Function test must be performed
	0000 0000 0001 0000	
	0000 0000 0010 0000	N/C contact failed to switch or switched too late
	0000 0000 0100 0000	
	0000 0000 1000 0000	
Bit 8	0000 0001 0000 0000	Error in the test pulse wiring
	0000 0010 0000 0000	
	0000 0100 0000 0000	
	0000 1000 0000 0000	
	0001 0000 0000 0000	There is a 1 signal at input 1.
	0010 0000 0000 0000	There is a 1 signal at input 2.
	0100 0000 0000 0000	There is a 1 signal at input 3.
	1000 0000 0000 0000	There is a 1 signal at input 4.

Evaluate bit 2 of the diagnostic word logic element for ID =5 within the user program
Poll diagnostic word for ID = 5 via RS 232
Poll diagnostic word for ID = 5 via fieldbus module
Display Bit 2 and 8 of the safety gate function element for ID = 5 (e.g. PMImicro diag)

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Diagnostic word

Compilation of the diagnostic words

Status of the bits

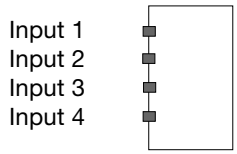
In the following tables, the respective bit =1 when the corresponding message applies. If no bit = 1, i.e. data word DW = 0, then no error is present.
Exception: On some function elements the status of the input signals is polled. The corresponding bit =1 without an error being present.

INFORMATION
If you are using PVIS expanded diagnostics, you will receive additional information (actions) on your display unit alongside the diagnostic word. Please also refer to the explanations regarding element configuration in the PNOZmulti Configurator's online help.

Function elements

- E-STOP
- Safety gate
- Safety gate with guard locking
- Light curtain
- Enable switch
- Foot switch

How the inputs are counted:



Bit	Message	Comment
Bit 1	E-STOP: E-STOP pushbutton was operated.	The safety device was triggered (E-STOP operated, safety gate opened,...)
	Safety gate, safety gate with guard locking: Safety gate was opened.	
	Light curtain: Light curtain was interrupted.	
	Enable switch: Enable switch has not been operated or is fully depressed.	
	Foot switch: Foot switch must be operated.	
Bit 2	- E-STOP pushbutton - Safety gate - Light curtain - Enable switch - Foot switch is ready for reset.	Manual or monitored reset was configured. The reset button has not yet been operated.
Bit 3	Function test must be performed.	A start-up test was configured, but has not yet been run.
Bit 5	N/C contact 1 or 2 failed to switch or switched too late.	Simultaneity is monitored on many switch types.
Bit 8	Error in the test pulse wiring.	
Bit 12	There is a 1 signal at input 1.	Purely for information.
Bit 13	There is a 1 signal at input 2.	Purely for information.
Bit 14	There is a 1 signal at input 3.	Purely for information.
Bit 15	There is a 1 signal at input 4.	Purely for information.

Diagnostic word
Compilation of the diagnostic words

- Safety mat

Bit	Message	Comment
Bit 1	Safety mat was activated.	
Bit 2	Safety mat is ready for reset.	Manual reset has been configured. A reset is only possible if the safety mat has not been activated.
Bit 3	Start-up test must be performed.	A start-up test was configured, but has not yet been run.
Bit 5	Error caused by safety mat.	Open circuit, signal error, wiring error detected

- Two-hand button

DW/Bit	Message	Comment
Bit 1	Two-hand button must be operated.	Switches are in their start position.
Bit 4	Pushbutton 1 or 2 was operated too late.	Simultaneity was exceeded.
Bit 5	Pushbutton 1 or 2 was not operated.	One of the pushbuttons was operated too late or was not operated at all. Or one of the pushbuttons was operated and then released.
Bit 8	Error in the test pulse wiring.	

- Operating mode selector switch

DW/Bit	Message	Comment
Bit 5	The input signals at the operating mode selector switch are faulty	No input is “1”.
Bit 8	Error in the test pulse wiring.	

Cascading

- Cascading output

DW/Bit	Message	Comment
Bit 8	The signal at the CO output is faulty.	For example: Fault, short circuit at CO cascading output

- Cascading input

Bit	Message	Comment
Bit 8	The signal at the CI input is faulty.	CI input is not connected to a CO output.

Logic elements

- RS flip-flop

Bit	Message	Comment
Bit 2	Input S is ready to set.	Input S is “0” after reset
Bit 8	There is a 1 signal at input R.	Input R =1

- Reset element

Bit	Message	Comment
Bit 2	Reset button is ready for reset.	Input signal is present, reset button can be operated.
		No input signal is present.
Bit 3	Reset button is waiting for the input signal.	

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Diagnostic word
Compilation of the diagnostic words

- Speed monitors PNOZ ms1p, PNOZ ms2p

Bit	Message	Comment
Bit 2	Speed monitor is ready for reset.	Manual or monitored reset was configured. The reset button has not yet been operated.
Bit 3	Cannot monitor the speed because no speed has been selected.	With inputs n1 to n8, standstill or speed monitoring is initialised by a “1” signal. Only one input may occupy the “1” signal status.
Bit 8	Selected speed was exceeded.	The speed at one of the active inputs n1 to n8 has been exceeded

- Speed monitors PNOZ ms1p, PNOZ ms2p with proximity switch
  Bit 2, 3 and 8 see speed monitors above

Bit	Message	Comment
Bit 9	No signal from the proximity switches.	
Bit 10	The proximity switches are measuring different speeds.	The bit is set, if the speed differential exceeds the configured standstill frequency.

- Speed monitors PNOZ ms1p, PNOZ ms2p with incremental encoder
  Bit 2, 3 and 8 see speed monitors above

Bit	Message	Comment
Bit 9	No signal from the incremental encoder.	
Bit 10	Different speeds have been measured for track A and track B.	The bit is set, if the speed differential exceeds the configured standstill frequency.
Bit 11	Cannot determine the direction of rotation.	The speed monitor has detected a different direction of rotation on tracks A and B

- Speed monitors PNOZ ms1p, PNOZ ms2p with proximity switch and incremental encoder on one axis
  - Bit 2, 3 and 8 see speed monitors above
  - Bit 9, 10, 11 see speed monitors with incremental encoder above

Bit	Message	Comment
Bit 12	The incremental encoder is signalling standstill and the proximity switch is signalling movement.	The mechanical connection between incremental encoder and shaft has been broken.
Bit 13	The incremental encoder is signalling movement and the proximity switch is signalling standstill.	

- Speed monitor PNOZ ms3p
  - Bit 2, 3 and 8 see speed monitors PNOZ ms1p, PNOZ ms2p above
  - Bit 9, 11 see speed monitors PNOZ ms1p, PNOZ ms2p with incremental encoder above

Bit	Message	Comment
Bit 10	Unfeasible or single-channel signal from the incremental encoder.	
Bit 14	Speed monitoring is deactivated.	

Diagnostic word
Compilation of the diagnostic words

- Speed monitor PNOZ ms4p
  - Bit 2, 8 see speed monitors PNOZ ms1p, PNOZ ms2p
  - Bit 9, 11 see speed monitors PNOZ ms1p, PNOZ ms2p with incremental encoder

Bit	Message	Comment
Bit 3	New speed must be accepted.	
Bit 4	Cannot monitor the speed because the selected speed has not been configured.	
Bit 10	Unfeasible or single-channel signal from the incremental encoder	
Bit 14	Speed monitoring is deactivated	

- Press element: Run monitoring

Bit	Message	Comment
Bit 2	Run monitoring is ready for reset.	Apply 1/0 pulse edge at *Reset* input parameter.
Bit 8	Start-up time was exceeded	The set start-up time has elapsed.
Bit 9	Shaft is broken	- The camshaft is no longer mechanically connected to the shaft - Open circuit in the encoder circuit

- Press element: Rotary cam arrangement monitoring

Bit	Message	Comment
Bit 2	Monitoring of the rotary cam arrangement is ready for reset.	1/0 pulse edge at *Reset* input parameter
Bit 8	Overrun was exceeded.	
Bit 9	The run-up cam failed to switch off when the overrun cam was switched off.	NL: Overrun cam, HL: Run-up cam Plausibility error 1: NL = 1/0 pulse edge and HL = 1
Bit 10	The run-up cam failed to switch on when the overrun cam was switched on.	Plausibility error 2: NL = 0/1 pulse edge and HL = 0
Bit 11	The overrun cam failed to switch off when the run-up cam was switched on.	Plausibility error 3: HL = 0/1 pulse edge and HL = 1
Bit 12	The overrun cam failed to switch on when the run-up cam was switched off.	Plausibility error 4: HL = 1/0 pulse edge and NL = 0

- Press element: Set-up mode

DW/Bit	Message	Comment
DW = 0	“Set-up” mode has been enabled	
Bit 0	“Set-up” mode is not active.	Enable has not been triggered, input parameter *MODE* = 0
Bit 2	Press is ready for reset.	1/0 pulse edge at reset input parameter
Bit 8	Cannot switch on because the start enable (“EN2”) has not been triggered.	No enable because start enable *EN2* = 0
Bit 9	Cannot switch on because the static enable (“EN1”) has not been triggered.	No enable because static enable *EN1* = 0
Bit 11	Press was stopped because the static enable (“EN1”) is missing.	No enable because static enable *EN1* = 0 during operation

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Diagnostic word
Compilation of the diagnostic words

- Press element: Single stroke

DW/Bit	Message	Comment
DW = 0	“Single-stroke” mode has been enabled	
Bit 0	“Single stroke” mode is not active.	Enable has not been triggered, input parameter *MODE* = 0
Bit 2	Press is ready for reset.	1/0 pulse edge at reset input parameter
Bit 8	Cannot switch on because the start enable (“EN2”) has not been triggered.	No enable because start enable *EN2* = 0
Bit 9	Cannot switch on because the static enable (“EN1”) has not been triggered.	No enable because static enable *EN1* = 0
Bit 10	Cannot switch on because the safety enable (“EN3”) has not been triggered.	No enable because there is no safety enable *EN3* = 0
Bit 11	Press was stopped because the static enable (“EN1”) is missing.	No enable because static enable *EN1* = 0 during operation
Bit 12	Safety enable (“EN3“) is missing.	No enable because safety enable *EN3* = 0 during operation

- Press element: Automatic mode

DW/Bit	Message	Comment
DW = 0	“Automatic” mode has been enabled	
Bit 0	“Automatic” mode is not active.	Enable has not been triggered, input parameter *MODE* = 0
Bit 2	Press is ready for reset.	1/0 pulse edge at reset input parameter
Bit 8	Cannot switch on because the start enable (“EN2”) has not been triggered.	No enable because start enable *EN2* = 0
Bit 9	Cannot switch on because the static enable (“EN1”) has not been triggered.	No enable because static enable *EN1* = 0
Bit 11	Press was stopped because the static enable (“EN1”) is missing.	No enable because static enable *EN1* = 0 during operation
Bit 13	Cannot switch on because the stop button has been operated.	No enable because input parameter *STOP* = 0

- Press element: Light curtain

DW/Bit	Message	Comment
DW = 0	“Break” mode has been enabled	
Bit 0	“Break” mode is not active.	Enable has not been triggered, input parameter *MODE* = 0
Bit 2	Light curtain is ready for break mode.	Break mode is active, waiting for break
Bit 8	Enable must be performed.	1/0 pulse edge at *Reset* input parameter, wait for reset

- Sequential muting, parallel muting, cross muting

DW/Bit	Message	Comment
DW = 0	Enable triggered	
Bit 1	Optical safety device was triggered, although muting is inactive.	Lght curtain interrupted (without active muting), resets muting after error or starts muting
Bit 2	Safety device is ready for reset.	Waiting for reset (reset)
Bit 3	There is an object in the muting zone or the optical safety device is faulty.	Sensor status unfeasable, override required
Bit 8	An object passed through the muting zone too slowly.	Muting time exceeded, only one sensor operated
Bit 9	Error caused by muting sensor 1 and/or muting sensor 2.	Feasibility error, muting sensors 1 and 2
Bit 10	Error caused by muting sensor 3 and/or muting sensor 4.	Feasibility error, muting sensors 3 and 4, not in the case of cross muting

Diagnostic word
Compilation of the diagnostic words

Output elements

- Output elements with a feedback loop

DW/Bit	Message	Comment
DW = 0	Enable triggered	
Bit 8	Feedback loop monitoring is registering an error.	- When the output was switched on, the feedback loop was not closed (= 1). - After the output was switched on the feedback loop was not opened within 3 s (= 0).

- Safety valve

Bit	Message	Comment
Bit 0	Valve is not being driven.	
Bit 2	Valve is ready for reset.	Reset error messages on the reset input
Bit 8	Cannot switch on because, according to the feedback loop, the valve is already switched on.	Start attempt with feedback loop open
Bit 11	When the valve was switched on, the feedback loop failed to open or opened too late.	Power-up monitoring time TOn exceeded, feedback loop did not open during TOn
Bit 12	When the valve was switched off, the feedback loop failed to close or closed too late.	Switch off monitoring time T0ff exceeded, feedback loop did not close during TOff
Bit 13	Error caused by valve or feedback loop	Feedback loop closes when the valve is driven

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