

PIT m3.1p



Operator terminals

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

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SD means Secure Digital.

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1.1 Validity of documentation

This documentation is valid for the product **PIT m3.1p**. It is valid until new documentation is published.

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

1.1.1 Retaining the documentation

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

1.2 Overview of documentation

1 Introduction

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

2 Overview

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

3 Safety

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

4 Function description

This chapter describes the product's mode of operation.

5 Installation

This chapter explains how to install the product.

6 Wiring

This chapter describes the product's commissioning and wiring.

7 Operation

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

8 Technical Details

1.3 Definition of symbols

Information that is particularly important is identified as follows:



DANGER!

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



WARNING!

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



CAUTION!

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



NOTICE

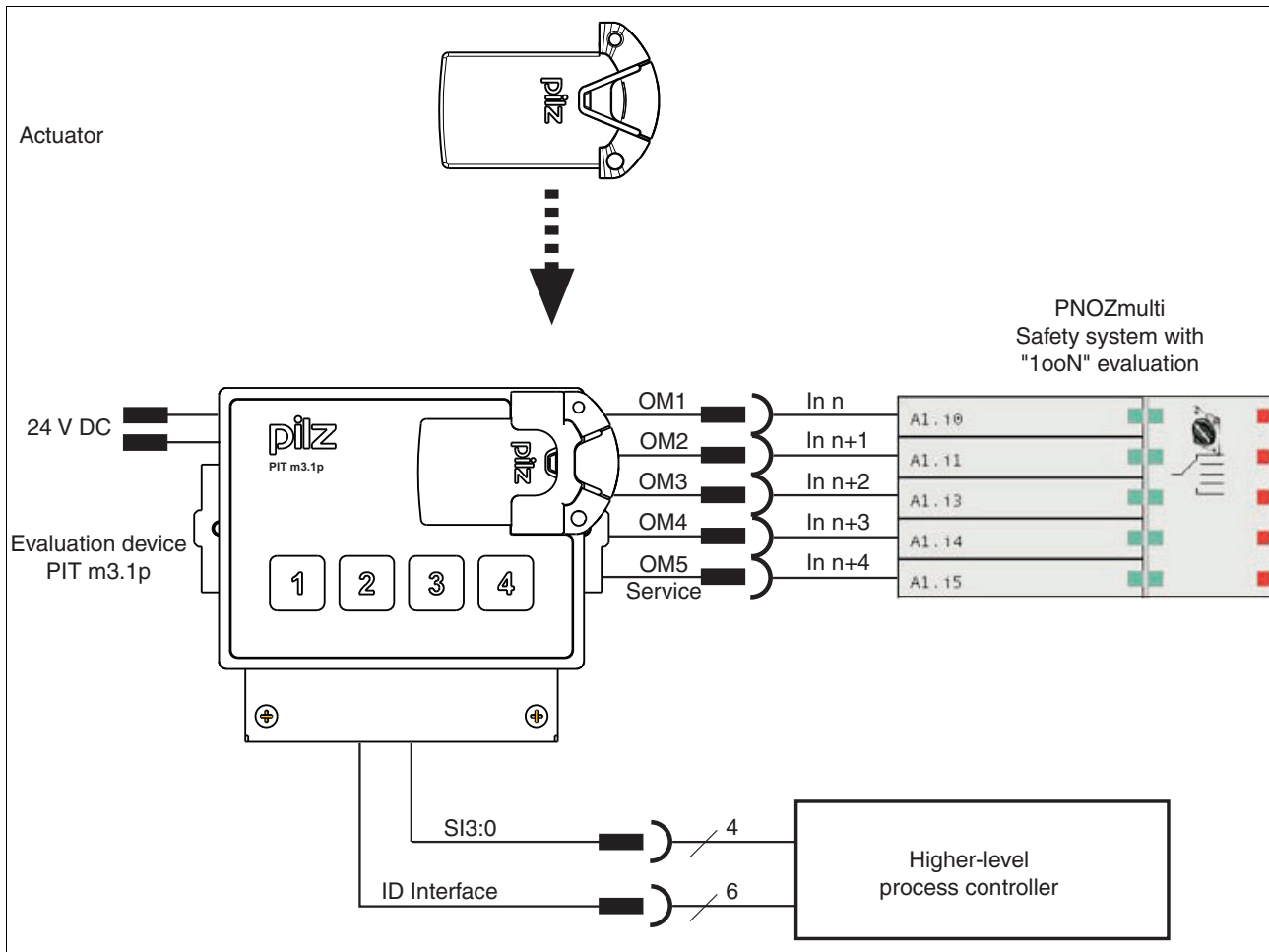
This describes a situation in which the unit(s) could be damaged and also provides information on preventive measures that can be taken. It also highlights areas within the text that are of particular importance.



INFORMATION

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

The operating mode selector switch PIT m3.1p can only be operated in conjunction with an actuator. 5 actuators are available, each with different authorisations.



2.1 Features of the operating mode selector switch

- ▶ Supply voltage 24 VDC
- ▶ 4 buttons for switching and displaying the operating mode
- ▶ Button is back-lit when operated
- ▶ 4 operating modes
- ▶ 1 special service mode
- ▶ 5 monitored semiconductor outputs (24 V) for each operating mode (OM1 ... OM5)
- ▶ 4 signal outputs (24 V) for status information, divided into information classes (SI0 ... SI3):
 - Selected operating mode
 - Set authorisation
 - Messages (e.g. user error and fault)
- ▶ Interface (signal outputs IDsync, IDclock, IDo0, IDo1 and inputs IDi0 and IDi1) for downloading the Key ID number of the connected actuator

2.2 Actuator features

The actuator has a write-protected area in which the permitted operating modes and a Key ID number are stored.

- ▶ Replaces the mechanical key
- ▶ Memory for authorisations

The following coding is printed on the actuator:

Designation	Marking	Authorisation for operating mode
Key Mode 01	Key Mode 1	OM1
Key Mode 02	Key Mode 2	OM1+ 2
Key Mode 03	Key Mode 3	OM1+ 2 + 3
Key Mode 04	Key Mode 4	OM1+ 2 + 3 + 4
Key Mode Service	Key Mode 5	OM1+ 2 + 3 + 4 + 5 (Service)

3.1 Intended use

The operating mode selector switch enables you to switch between defined operating modes such as set-up, shutdown, automatic operation and service. An actuator is used to assign access rights and authorisation to switch operating modes.

A safety system must be used to evaluate the operating modes. Switching must not initiate a hazardous movement, nor can it cancel an existing control command.

3.2 Safety regulations

3.2.1 Use of qualified personnel

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

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

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

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

3.2.2 Warranty and liability

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

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

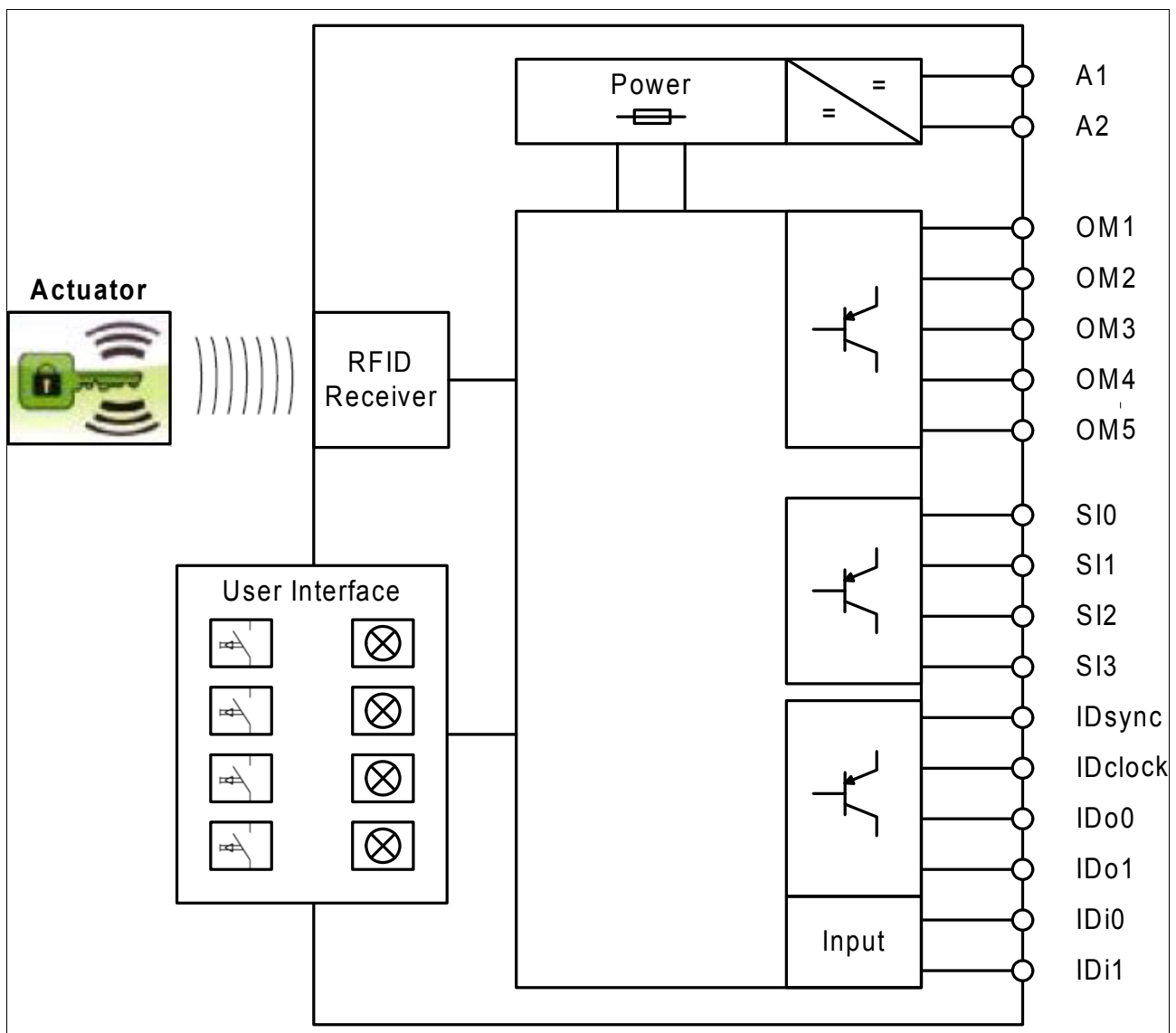
3.2.3 Disposal

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

The operating mode selector switch enables you to switch between 5 different operating modes. Operating modes OM1 ... OM4 plus a special service mode (OM5.)

For OM1 ... OM4, one button each is available. For the special service mode (OM5), button 1 must be operated for a certain time period (see Time monitoring -> Operating time). Each button is assigned a monitored semiconductor output. Operating the button changes the semiconductor output from low to high. The semiconductor outputs must be evaluated via a safety control system. The operating mode selector switch guarantees that only one of the semiconductor outputs is high at any one time.

Block diagram:



The operating mode selector switch is protected against unauthorised operation. A switch between operating modes must be enabled via an actuator.

There are 5 actuators in total; each actuator provides authorisation to switch up to 5 operating modes, including special authorisations:

- ▶ Actuator Key Mode 01: OM 1
- ▶ Actuator Key Mode 02: OM 1 and 2
- ▶ Actuator Key Mode 03: OM 1 and 2 and 3
- ▶ Actuator Key Mode 04: OM 1 and 2 and 3 and 4
- ▶ Actuator Key Mode Service: OM 1 and 2 and 3 and 4 and 5 (Service)

When the actuator is removed, the set operating modes OM1 – OM4 are retained.

Service mode (OM5) is an exception. When the "Service" actuator is removed, the mode switches to OM1.

4.1 Key ID number of the actuator

Once an actuator has been connected, the actuator's unique Key ID number is downloaded to the higher-level process controller using a defined protocol.

The Key ID number is used to clearly identify the actuator and is unique. It is printed on the actuator's type label as a 9-digit decimal figure.



INFORMATION

Please note that the Key ID number is not printed on the actuator packaging.

If the actuator is lost, it is impossible to supply a replacement actuator with an identical Key ID number.

The Key ID number consists of two parts:

- ▶ Bit 27 ... 24 is the Key Mode
- ▶ Bit 23 ... 0 is the consecutive number.

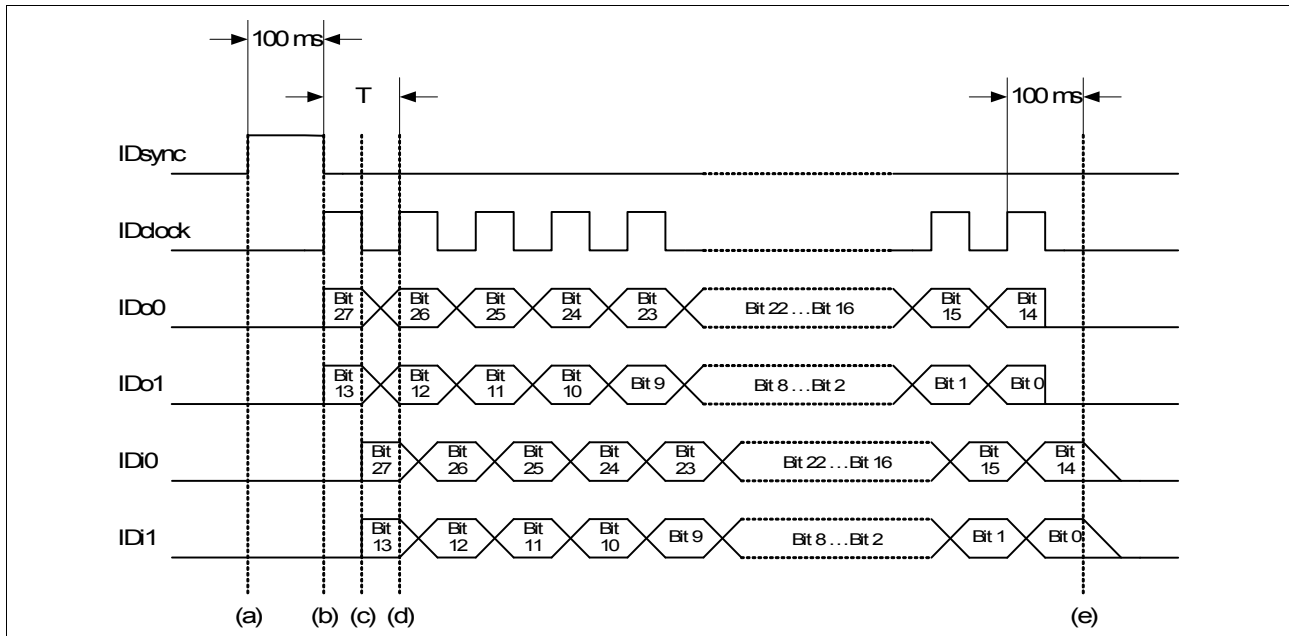
Bit 27 ... Bit 24					Bit 23 ... Bit 16				Bit 15 ... Bit 8				Bit 7 ... Bit 0			
					consecutive number											

Key Mode	Bit 27	Bit 26	Bit 25	Bit 24
01	0	0	0	1
02	0	0	1	0
03	0	0	1	1
04	0	1	0	0
Service	1	1	0	1

Example:

Key-ID-Nummer: 130000044 (Key Mode Service)			
1101	00000000	00000000	00101100
Key-ID-Nummer: 020000510 (Key Mode 02)			
0010	00000000	00000001	11111110

4.2 Communication with the control system



Key:

- IDsync
 - The "IDsync" signal indicates that the download has started
 - The "IDsync" signal is present for 100 ms
- IDclock
 - $T = 100 \text{ ms}$
 - Duty cycle = 50 %
 - The "IDclock" signal is driven by the operating mode selector switch
- IDo0, IDo1
 - Data output;
 - these signal lines are used to download the Key ID number from the operating mode selector switch to the control system.
 - Bit 27 ... Bit 14 are sent via the data line IDo0.
 - Bit 13 ... Bit 0 are sent via the data line IDo1.
- IDi0, IDi1
 - Data input;
 - The control system uses these signal lines to confirm receipt of the previous Key ID number (Bit 27 ... Bit 0) to the operating mode selector switch.
 - Bit 27 ... Bit 14 are received via the data line IDi0.
 - Bit 13 ... Bit 0 are received via the data line IDi1.

Download procedure:

- (a) The operating mode selector switch sets the "IDsync" signal, thereby signalling to the control system that transmission is starting
- (b) A rising edge at the "IDclock" signal indicates that the data ("IDo0" and "IDo1") is present and valid and is being read in by the control system.
- (c) The control system must output the data that was read in to lines "IDi0" and "IDi1" by the time there is a falling edge at the "IDclock" signal.
- (d) With a rising edge at the "IDclock" signal, the operating mode selector switch reads the feedback from the control system at IDi0 and IDi1 and checks it for equivalence.
- (e) Even at the end of the download, the control system must leave the data for at least 100 ms after the last rising edge at the "IDclock" signal.

4.2 Communication with the control system



INFORMATION

If the control system does not feed back the previously read Bits correctly, the download is aborted and restarted. The "IDsync" signal is set once again. The download is repeated until the Key ID number is downloaded completely.

The download of the Key ID number takes 1.4 s.

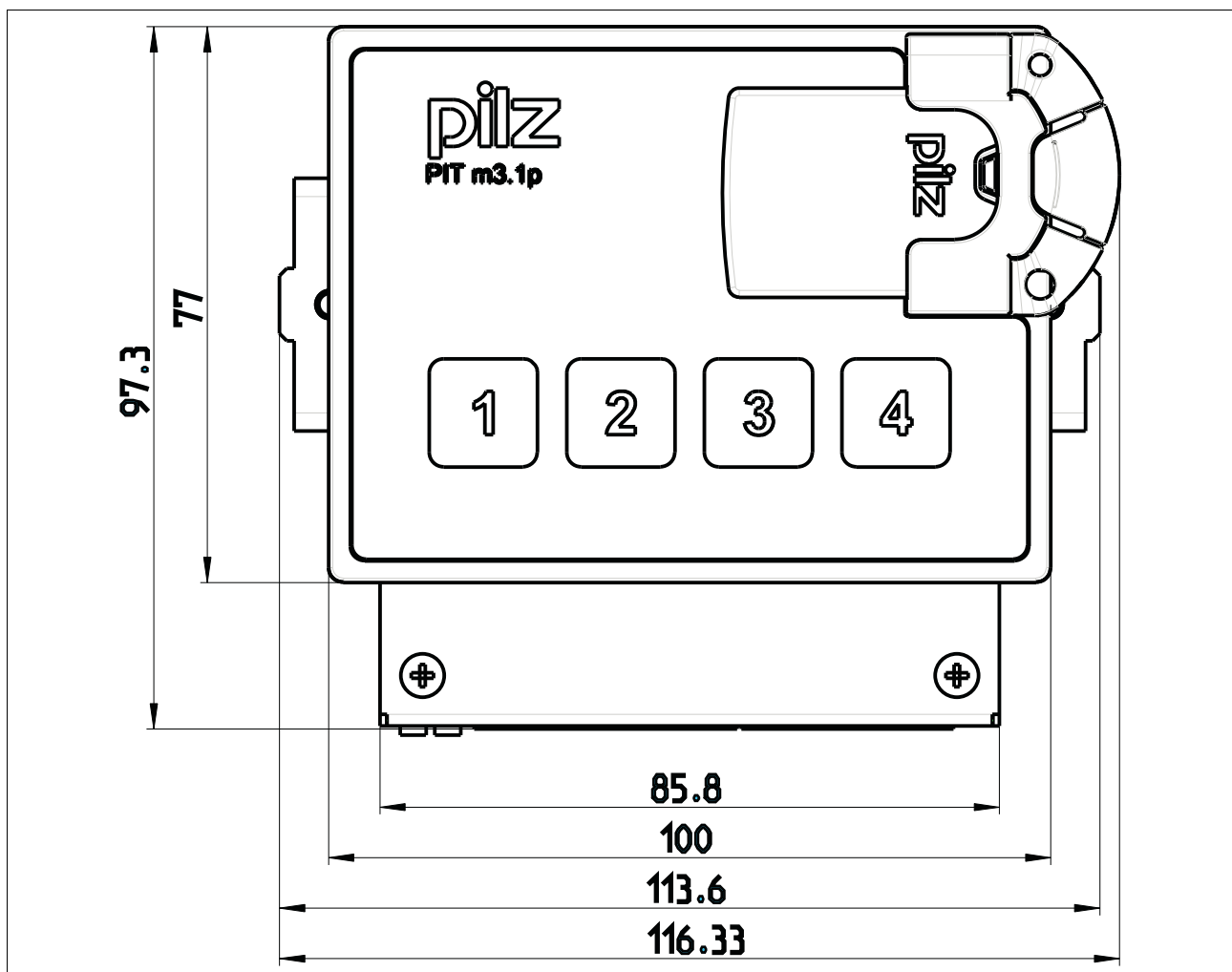
4 Function description

5.1 General installation guidelines

- ▶ The installation site must conform to the protection type IP54.
- ▶ Ensure that the operating mode selector switch has sufficient ventilation.
- ▶ Attach the operating mode selector switch using the brackets provided.
- ▶ Make sure that the gasket is seated correctly.

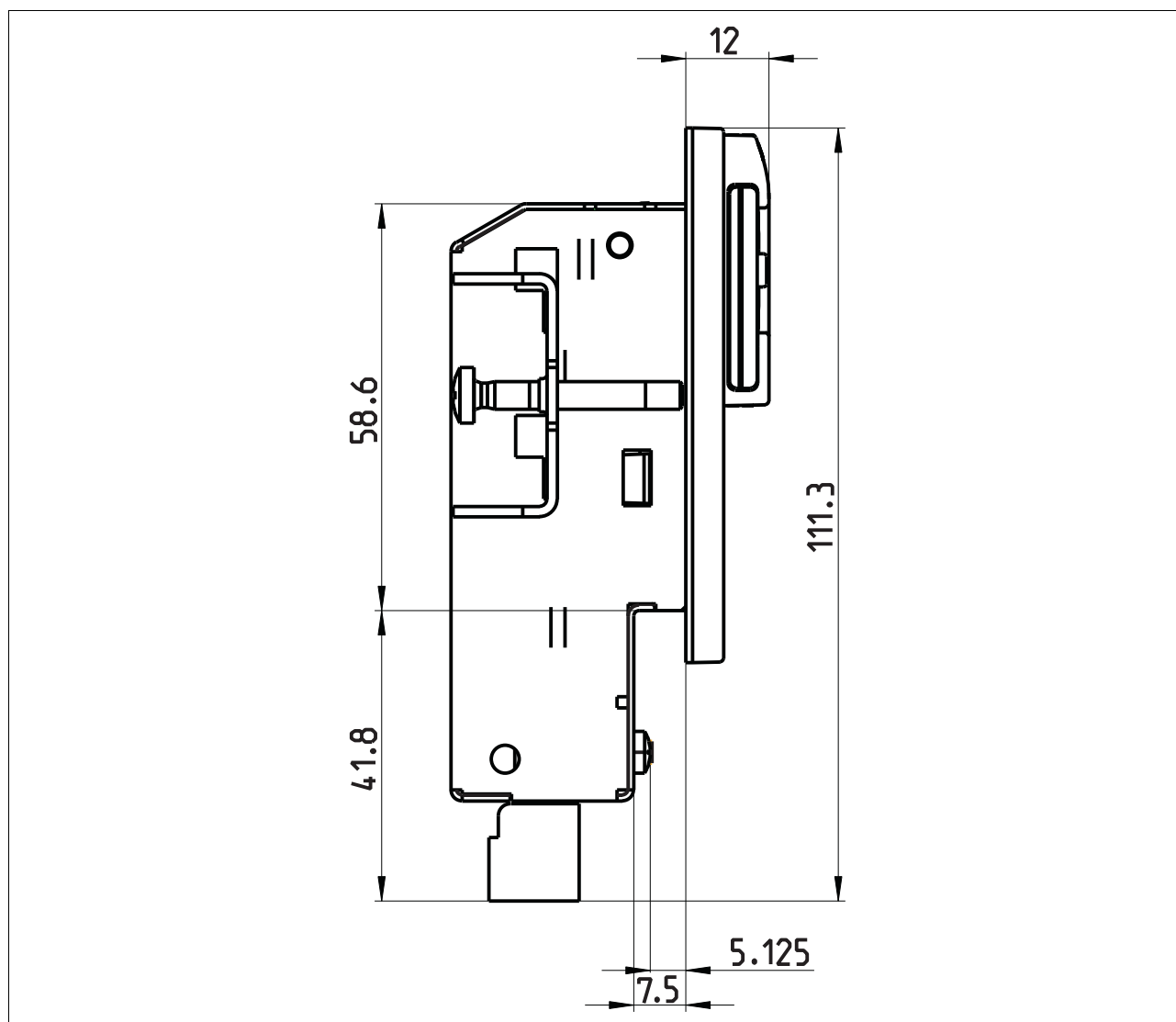
5.1.1 Dimensions

Front view

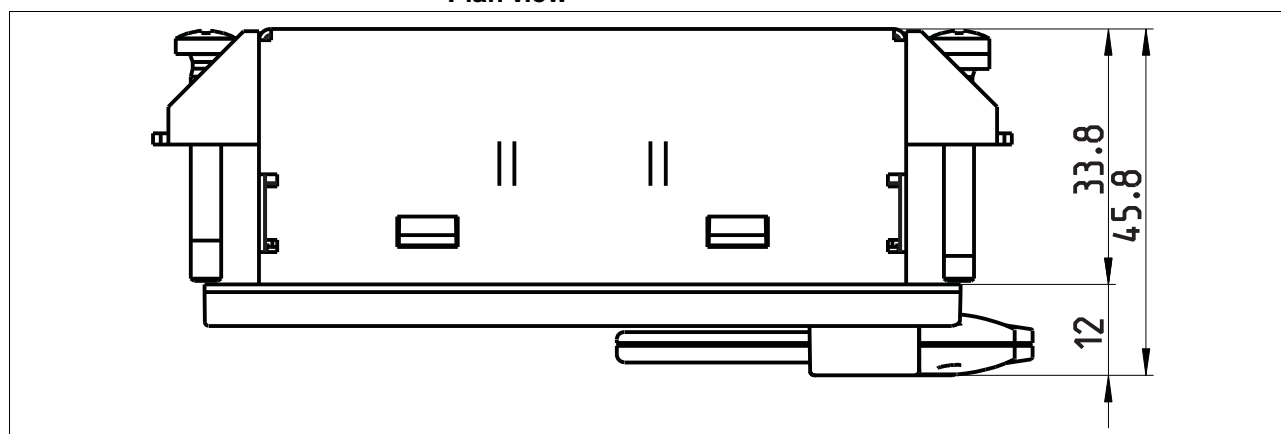


5.1 General installation guidelines

Side view

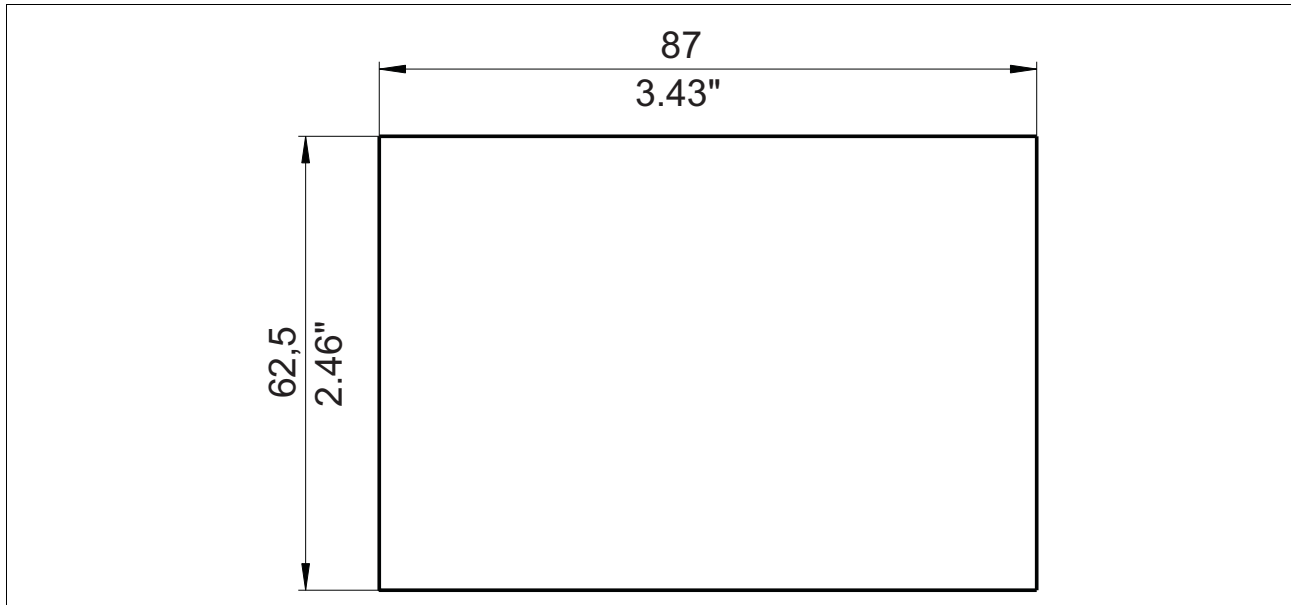


Plan view



5.1 General installation guidelines

5.1.2 Mounting cutout

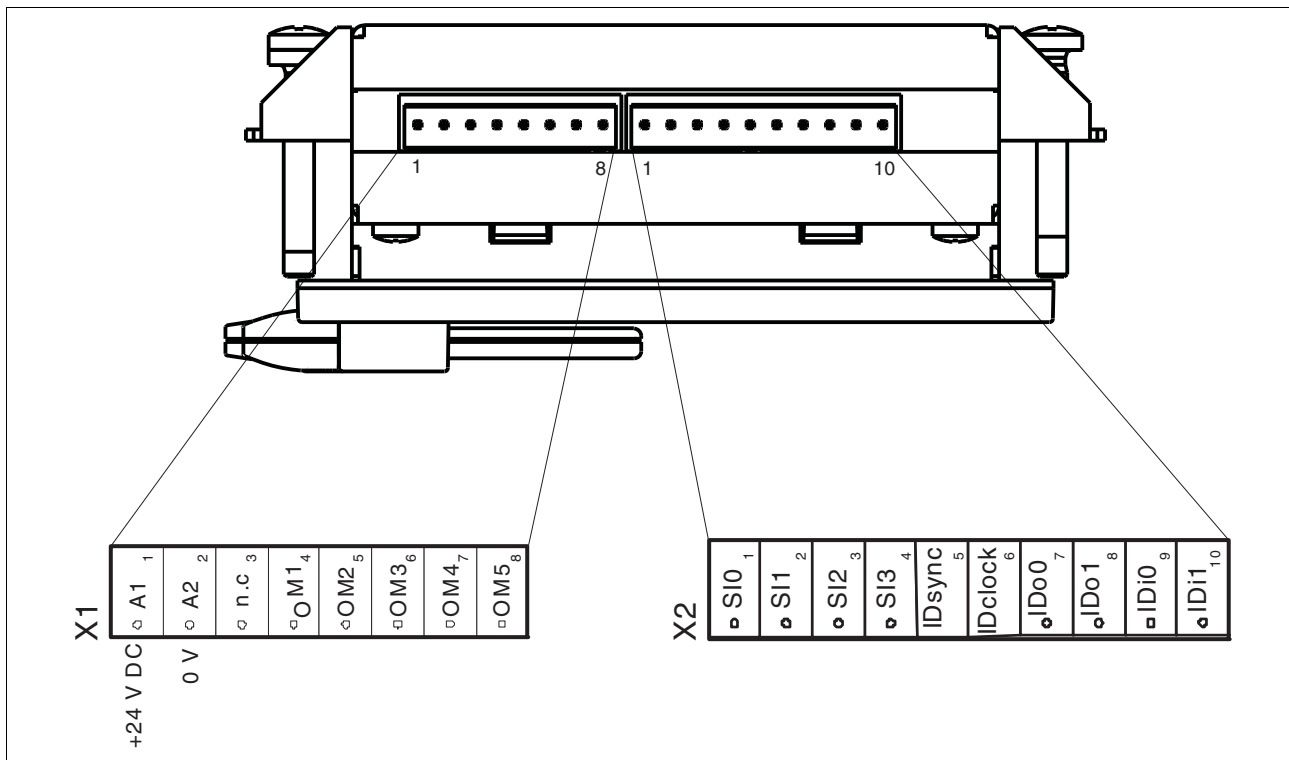


6.1 Terminal Configuration



INFORMATION

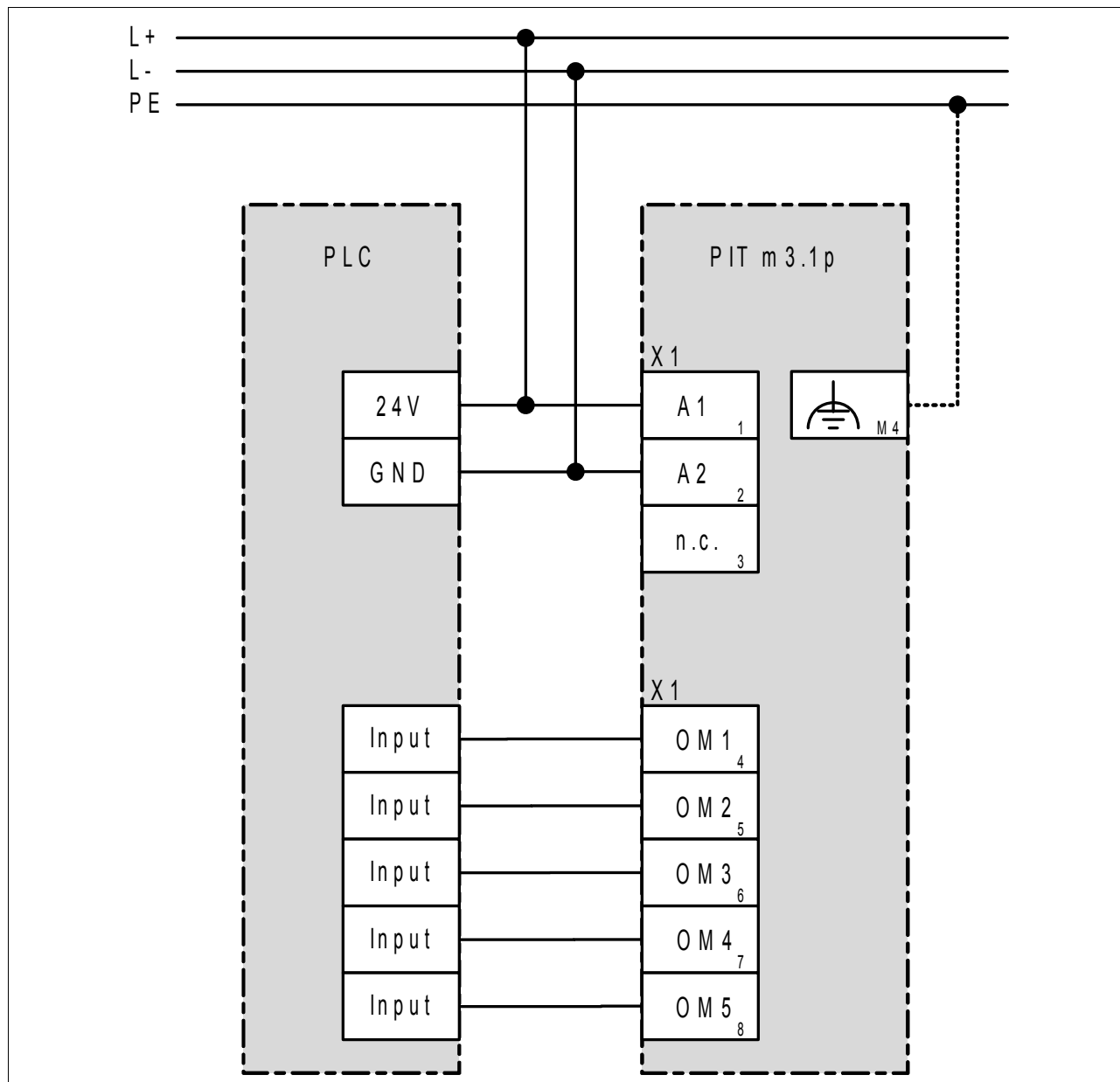
The connection terminals are not supplied with the unit.



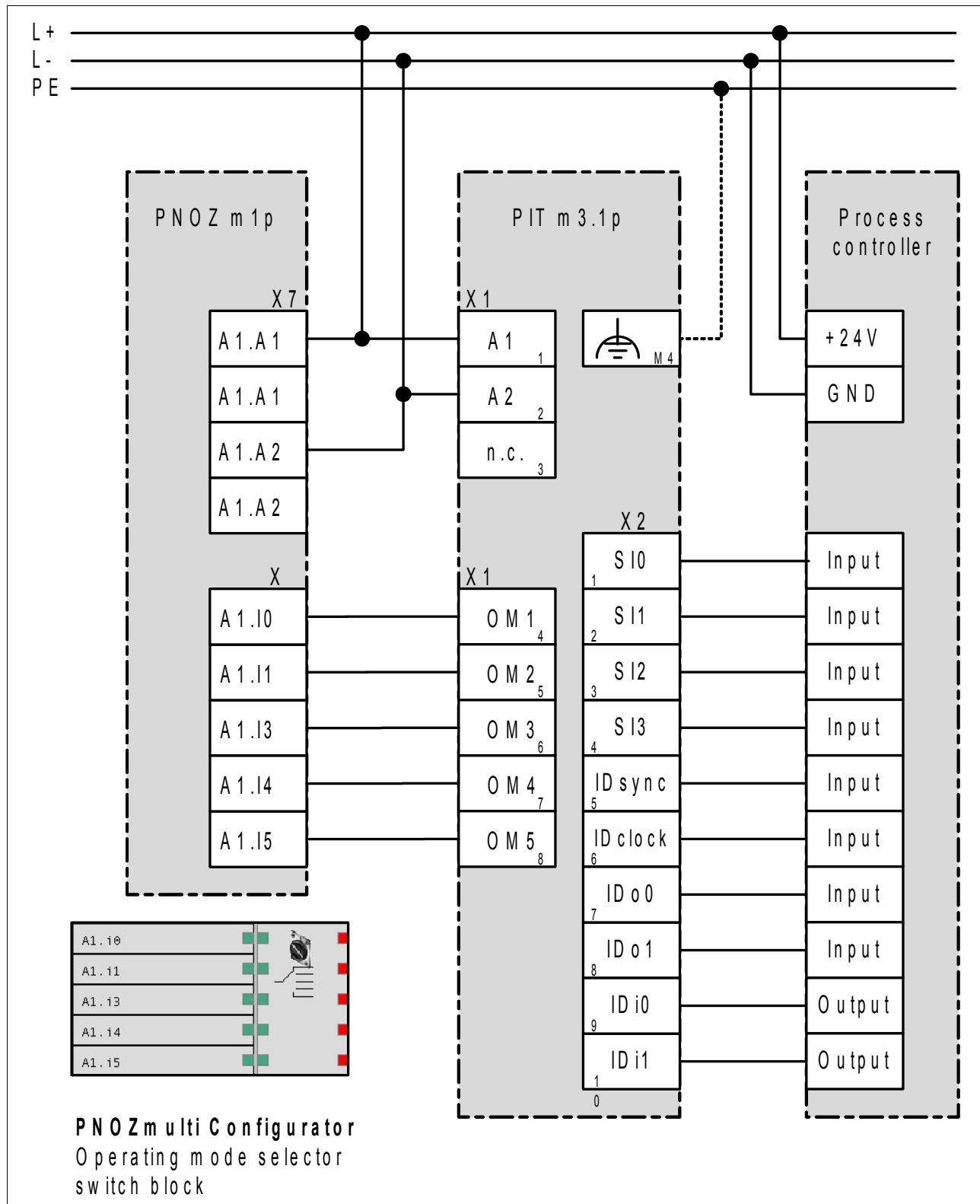
- ▶ Connect the supply voltage X1 (A1/A2). The power supply must meet the regulations for extra low voltages with safe separation (SELV, PELV).
- ▶ Connect the semiconductor outputs X1 (OM1 ... OM5) to a safety system that supports a safe 1 from n evaluation.
- ▶ Connect the signal outputs X2 (SI0 ... SI3) to a control system that supports evaluation of the status information.
- ▶ Connect the interface X2 (signal outputs IDsync, IDclock, IDo0, IDo1 and inputs IDi0 and IDi1) to a control system that supports the download of the Key ID number.
- ▶ Functional earth connection.

6.2 Connection to safety system (example)

Wiring without detection of shorts across contacts



6.3 Connection to PNOZmulti (example: PNOZ m1p)







CAUTION!

The operating mode selector switch PIT m3.1p may only be used in conjunction with the actuator and a safety control system. The safety control system must enable safe "1 from n" evaluation of the semiconductor outputs (OM1 ... OM5) on the operating mode selector switch.



CAUTION!

If an error occurs, the unit will not change operating modes at the semiconductor outputs (OM1 ... OM5).



INFORMATION

When voltage is reapplied, operating mode OM1 is automatically selected, even when no actuator is connected or the actuator is not recognised correctly.

7.1 Select operating mode

An operating mode can only be selected if the corresponding actuator is recognised.

Once an operating mode is selected, the corresponding semiconductor output OM1 ... OM4 and special service mode (OM5) are activated.

The selected operating mode is displayed via the back-lit button and is dual-channel monitored via a safety control system.

You can switch between the individual operating modes OM1, OM2, OM3 and OM4 as required.

7.2 Time monitoring

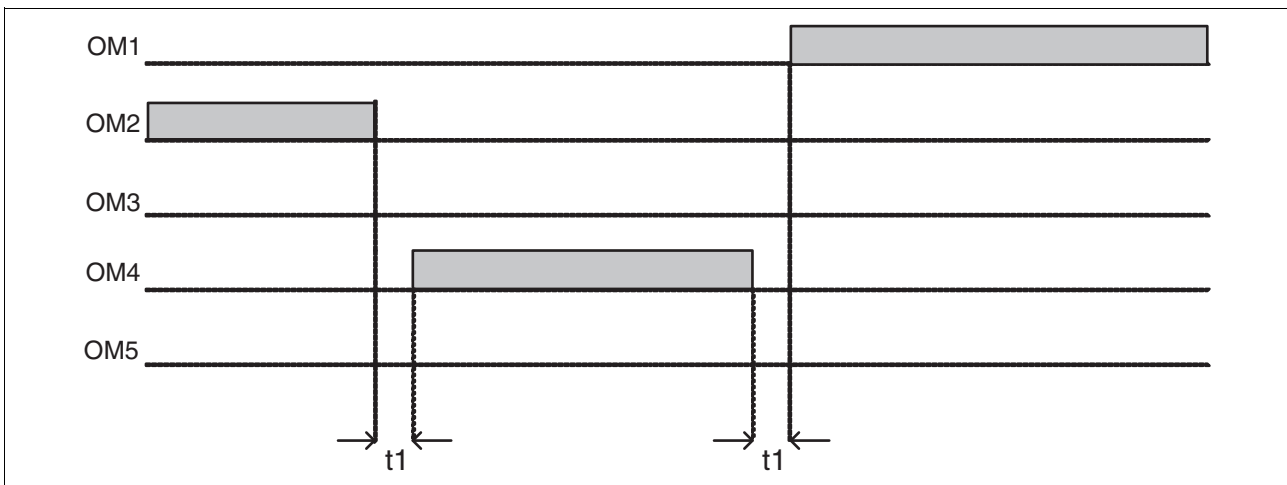
A change of operating modes is only detected once a button has been operated for a certain time period.

Operating time:

- ▶ OM1, OM2, OM3, OM4: > 50 ms and < 5 s
- ▶ Special mode (service) OM5: > 5 s and < 10 s

When a button is released, the semiconductor outputs will switch once the switchover delay t_1 has elapsed (see Technical details).

When changing operating modes, the PIT m3.1p initiates a defined pause of 50 ms to guarantee that the operating modes do not overlap.



To select an operating mode, follow the instructions below:

Select an operating mode by pressing one of the four buttons. The actuator must be connected to the operating mode selector switch for the whole time the button is operated; it can be removed afterwards.

7.3 Select special mode (service)

Special mode (service) OM5 can be selected from any of the operating modes OM1 ... OM4, provided the relevant authorisation has been recognised via the "Key Mode Service" actuator.

Proceed as follows:

- ▶ Slide the "Key Mode Service" actuator on to the bracket of the operating mode selector switch.



INFORMATION

The actuator must be connected to the operating mode selector switch for the whole duration of special mode (service).



INFORMATION

Press button 1 and keep it held down for a minimum 5 s/maximum 10 s.



INFORMATION

All four buttons will flash during special mode (service).

If you remove the actuator while the machine is in special service mode (OM5), the machine's operating mode will automatically switch to OM1.

7.4 Evaluation through safety system

Evaluation must take place via a safe function block, which meets the following requirements:

- ▶ The function block must enable safe "1 from n" evaluation of the semiconductor outputs (OM1 ... OM5) on the operating mode selector switch.
- ▶ If two or more operating modes are present at the same time, this must be detected as an error.
- ▶ The function block must bridge the t1 switchover delay.
- ▶ Bridging of the switchover pause should not last longer than one second.

7.5 Troubleshooting

If an error occurs on the operating mode selector switch, the last operating mode to be set will be retained.

Error	Possible cause	Remedy
Unable to switch the operating mode	Multiple operation of buttons	Make sure that only one button is operated.
...	Operating time too long or too short	Make sure that the period of operation is observed.
...	Actuator is not detected	Make sure that the actuator is connected to the operating mode selector switch correctly.
...	No valid authorisation	Make sure that the relevant actuator is used.

7.6 Diagnostics

For monitoring and diagnostics of the operating mode selector switch

4 back-lit buttons and 4 signal outputs are available. The outputs report status information, which is divided into the following information classes:

- ▶ Selected operating mode
- ▶ Set authorisation
- ▶ Messages (e.g. user error and fault)

The status information can be evaluated through a control system.

The back-lit buttons indicate the operating mode selected on the operating mode selector switch.

7.6.1 Signal outputs for status information

The status information indicates the actions performed by the operator. These actions are: actuator connected, actuator removed and operating mode selected.



NOTICE

If OM is selected (SI3:0=8h ... Bh) information remains active indefinitely. All other information stays active for just **200 ms**. After that time the selected operating mode is again displayed.

Status information	SI 3 (MSB)	SI 2	SI 1	SI 0 (LSB)	SI3:0= [hex]
Reserve	0	0	0	0	0h
Reserve	0	0	0	1	1h
Reserve	0	0	1	0	2h
Reserve	0	0	1	1	3h
Key Mode 1 - connected	0	1	0	0	4h
Key Mode 2 - connected	0	1	0	1	5h
Key Mode 3 - connected	0	1	1	0	6h
Key Mode 4 - connected	0	1	1	1	7h
OM1 selected	1	0	0	0	8h
OM2 selected	1	0	0	1	9h
OM3 selected	1	0	1	0	Ah
OM4 selected	1	0	1	1	Bh
No authorisation	1	1	0	0	Ch

7.6 Diagnostics

Status information	SI 3 (MSB)	SI 2	SI 1	SI 0 (LSB)	SI3:0= [hex]
Device error	1	1	0	1	Dh
Button operated incorrectly	1	1	1	0	Eh
Actuator removed	1	1	1	1	Fh

8.1 Technical details

Technical details	
Sensor's mode of operation	Transponder
Typ. operating distance	5.0 mm
Electrical data	
Supply voltage U_B DC	24 V
Voltage tolerance	-15 %/+10 %
Residual ripple DC	20 %
Power consumption at U_B	2.5 W
Times	
Switch-on delay after applying U_B	1.0 s
Supply interruption before de-energisation	20 ms
Switchover delay t_1	50 ms
Operating time of button 1 ... 4	50 ms ... 5 s
Operating time of Service button	5 s ... 10 s
Outputs operating modes	
Number of positive-switching single-pole semiconductor outputs	5
Switching current per output	20 mA/24 V
Short circuit-proof	yes
Residual current at "0"	0.3 mA
Signal level at "1"	U_B - 3.5 V DC at 20 mA
Status display	LED
Signal outputs	
Number	8
Switching current per output	20 mA/24 V
Short circuit-proof	yes
Residual current at "0"	0.3 mA
Signal level at "1"	U_B - 3.5 V DC at 20 mA
Inputs	
Number	2
Voltage and current at Input circuit DC: 24 V DC	1.5 mA
Galvanic isolation	no
Signal level at "0"	-3 - +5 V DC
Signal level at "1"	15 - 30 V DC
Safety-related characteristic data	
PL in accordance with EN ISO 13849-1: 2006	PL d (Cat. 3)
Category in accordance with EN 954-1	Cat. 3
SIL CL in accordance with EN IEC 62061	SIL CL 2
PFH in accordance with EN IEC 62061	5.75E-09
SIL in accordance with IEC 61511	SIL 2
PFD in accordance with IEC 61511	3.19E-04
T_M [year] in accordance with EN ISO 13849-1: 2006	20
Environmental data	
Vibration to EN 60068-2-6	
Frequency	10 - 55 Hz
Amplitude	0.35 mm
EMC	EN 60947-5-1
Climatic suitability	DIN IEC 60068-2-3
Airgap creepage in accordance with EN 60664-1	
Overvoltage category	II
Pollution degree	2
Rated insulation voltage	60 V

8.1 Technical details

Environmental data	
Rated impulse withstand voltage	0.80 kV
Ambient temperature	-10 - 55 °C
Storage temperature	-40 - 85 °C
Climatic suitability in accordance with EN 60068-2-78	95 % r. F. at 40 °C
Mechanical data	
Protection type	
Mounting (e.g. cabinet)	IP54
Housing	IP20
Terminals	IP20
Torque setting for the fixing screws	0.30 Nm
Housing material	
Front	ABS
Housing	ST + 10µ Zn
Maximum cable runs	30 m
Cross section of external conductors with spring-loaded terminals: Flexible with/without crimp connectors	0.20 - 2.50 mm ² , 24 - 12 AWG
Spring-loaded terminals: Terminal points per connection	1
Stripping length	9 mm
Weight	210 g

The standards current on **2010-02** apply.

8.2 Order reference

Order reference

Type	Features	Order No.
PIT m3.1p	Operating mode selector switches	402 220

Order reference: Accessories

Type	Features	Order No.
Spring-loaded terminals	1 set	402 301
PIT m3p key mode 1	Actuator Key Mode 01	402 211
PIT m3p key mode 2	Actuator Key Mode 02	402 212
PIT m3p key mode 3	Actuator Key Mode 03	402 213
PIT m3p key mode 4	Actuator Key Mode 04	402 214
PIT m3p key service	Actuator Key Mode Service	402 215

8 Technical details

8.2 Order reference



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