

PIT m2.1p DMG

Operator terminals

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SD means Secure Digital

Section 1	Introduction	5
	1.1	Validity of documentation 5
	1.1.1	Retaining the documentation 5
	1.2	Definition of symbols 6
Section 2	Overview	7
	2.1	Features of the operating mode selector switch 8
	2.2	Features of the transponder key 9
Section 3	Safety	10
	3.1	Intended use 10
	3.2	Safety regulations 11
	3.2.1	Use of qualified personnel 11
	3.2.2	Warranty and liability 11
	3.2.3	Disposal 11
Section 4	Function description	12
	4.1	Interface for status information 14
	4.1.1	Timing diagrams for operator actions 16
	4.1.2	Timing diagram for device error 17
	4.1.3	Timing diagrams for user error: "No authorisation" 18
	4.1.4	Timing diagrams for user error: "Button operated incorrectly" 20
	4.2	Operating mode interface 22
	4.2.1	Switch behaviour after a transponder key is removed 22
	4.2.2	Control program requirements 23
	4.3	Key ID interface 24
	4.3.1	Key ID number of the transponder key 24
	4.3.2	Communication mode for downloading the Key ID number 26
	4.3.2.1	Transmitter-controlled communication mode 26
	4.3.2.2	Handshake-controlled communication mode 27
	4.3.3	Evaluation by a control system 28
	4.3.3.1	Evaluation of the Key ID number with transmitter-controlled communication 28
	4.3.3.2	Evaluation of the Key ID number with handshake-controlled communication 31
Section 5	Installation	35
	5.1	General installation guidelines 35
	5.2	Dimensions 36
Section 6	Wiring	37
	6.1	Terminal configuration 37
	6.2	Connecting the unit 38
	6.3	Connection to a control system 39
Section 7	Operation	42
	7.1	Select operating modes OM1 ... OM4 43
	7.2	Select special mode OM5 (Service) 44

7.3	Monitoring of operating time	45
7.4	Switchover delay t1	45
7.5	Troubleshooting	46
7.6	Diagnostics	47
7.6.1	Status information about the interface for status information	47
7.6.2	Status information about pushbutton backlighting	47
Section 8	Technical details	48
8.1	Safety characteristic data	50
Section 9	Supplementary data	51
9.1	Radio approval	51
Section 10	Order reference	52
10.1	Product	52
10.2	Accessories	52

1 Introduction

1.1 Validity of documentation

This documentation is valid for the product PIT m2.1p DMG. 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 Definition of symbols

Information that is particularly important is identified as follows:



DANGER!

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



WARNING!

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



CAUTION!

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



NOTICE

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



INFORMATION

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

2 Overview

The operating mode selector switch may only be operated in conjunction with the transponder key *Smart key*®. 6 transponder keys are available, each with different authorisations.

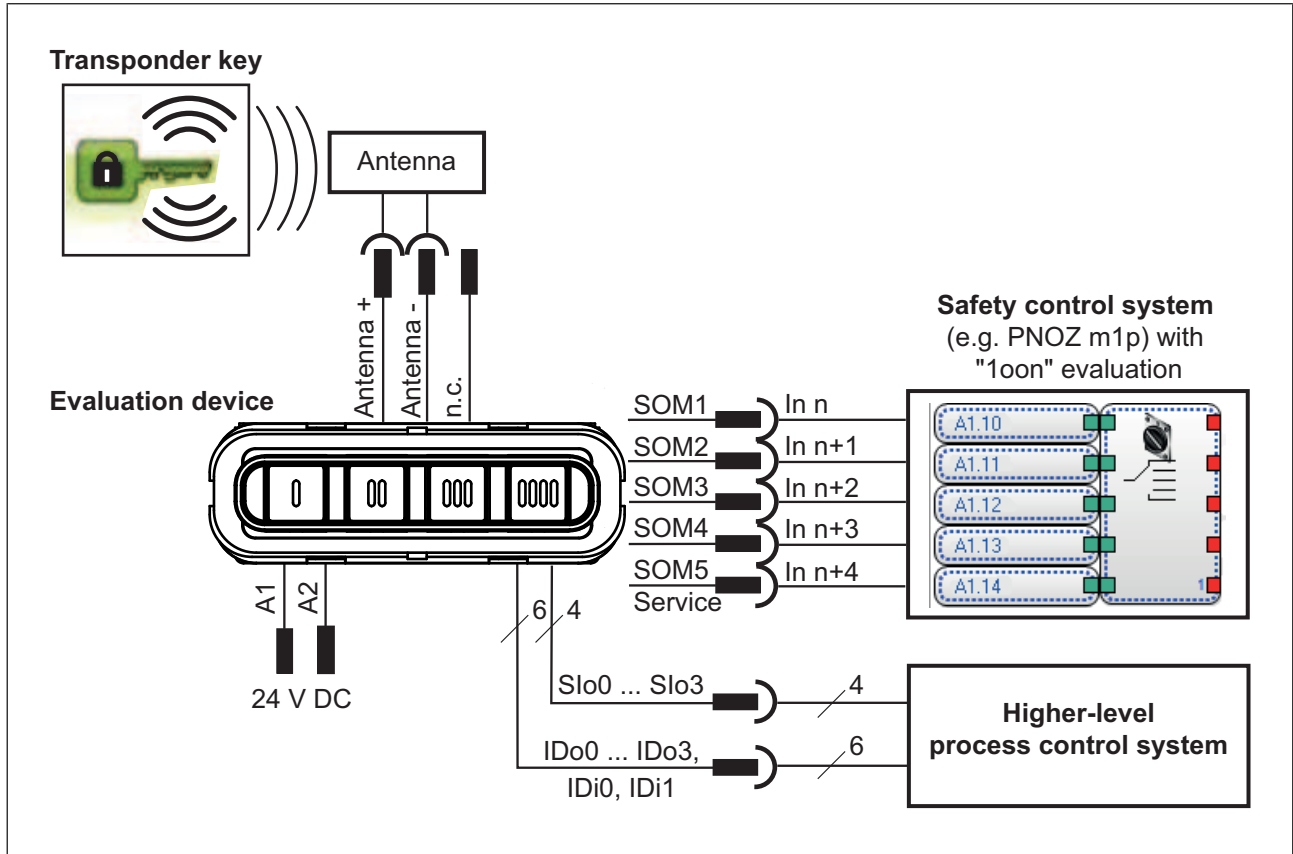


Fig.: Operating mode selector switch in an application (principle)

2.1 Features of the operating mode selector switch

The product has the following features:

- ▶ Supply voltage 24 V DC
- ▶ 4 pushbuttons for switching the operating mode
- ▶ Selected operating mode is displayed through pushbutton backlighting
- ▶ 4 operating modes OM1 ... OM4
- ▶ 1 special mode OM5 (Service)
- ▶ 1 master authorisation
- ▶ 5 monitored semiconductor outputs (24 V) in accordance with EN 61496-1;
1 semiconductor output per operating mode
- ▶ Interface for status information, consisting of 4 signal outputs (24 V)
- ▶ Status information is divided into information classes:
 - Operator actions
 - Select transponder key
 - Remove transponder key
 - Select operating mode
 - Messages (e.g. user error, fault)
- ▶ Interface (Key ID interface) for downloading the Key ID number of the transponder key you are using, consisting of
 - 4 semiconductor outputs (24 V)
 - 2 inputs
- ▶ Configurable communication mode for downloading the Key ID number
 - Transmitter-controlled communication mode
 - Handshake-controlled communication mode

2.2 Features of the transponder key

A transponder key contains a Key ID number and the authorisations to which you can switch with that transponder key.

Features:

- ▶ Replaces the mechanical key
- ▶ Different authorisations
- ▶ Authorisations are identified via printed "Key Mode".

3 Safety

3.1 Intended use

The operating mode selector switch is suitable for machines that can be operated in multiple operating modes with different protective measures and/or work procedures. It enables you to switch between defined operating modes, such as:

- ▶ Set-up mode
- ▶ Manual mode
- ▶ Automatic mode
- ▶ Service

The operating mode selector switch meets the following safety requirements:

- ▶ Interlock to protect against unauthorised switching
Contact with a transponder key is required in order to switch to an operating mode.
- ▶ Access authorisations are restricted to certain groups
A transponder key with the relevant authorisation is required in order to switch to a certain operating mode.
- ▶ Prevents unintentional switching
The switch to a different operating mode is only recognised once the corresponding (selection) pushbutton has been operated for a defined period ("deliberate operator action"). Multiple operation of (selection) pushbuttons is detected.
- ▶ Safe "1 from n" circuit of the operating mode outputs
The operating mode selector switch only ever leads to one operating mode output "1" signal.

A Smart key® must be used as the transponder key.

Depending on the application area and its respective regulations, the operating mode selector switch can be used up to SIL CL 2 (EN IEC 62061) and up to PL d (EN ISO 13849-1), if the operating modes are evaluated by a safety control system with safe "1oon" evaluation.

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 information provided in this description under "Safety"
- ▶ And 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

- ▶ When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).

4 Function description

The operating mode selector switch enables you to switch between 5 different operating modes (operating modes OM1 ... OM4 and special operating mode OM5 (Service)).

For OM1 ... OM4, one button each is available. For the special operating mode (Service), button OM1 must be operated for a certain period (see [Monitoring of operating time](#) [45]). Each button is assigned a monitored semiconductor output. Operating the button changes the semiconductor output from a "0" signal to a "1" signal. The operating mode selector switch guarantees that only one of the semiconductor outputs has a "1" signal at any one time.

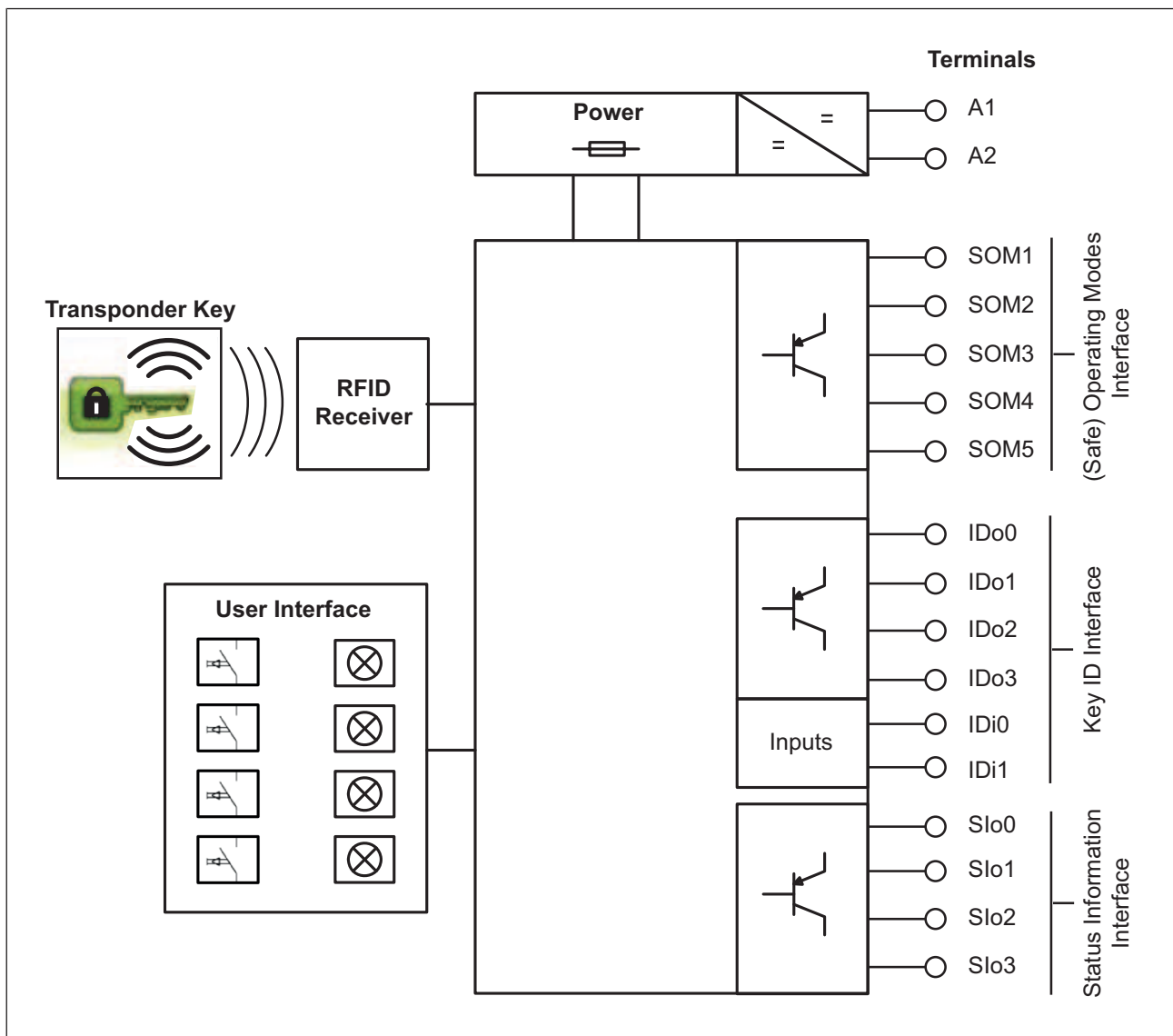


Fig.: Block diagram

Legend:

- | | |
|-----------------|---|
| Transponder key | Electronic key to enable a change of operating mode |
| User interface | Pushbutton to select an operating mode |
| A1, A2 | Supply voltage |







SOM1 ... SOM5	Operating mode interface Interface for displaying the selected operating mode; consists of 5 monitored outputs
IDo0 ... IDo3 and IDi0 ... IDi1	Key ID interface Interface for downloading the Key ID number to a control system; consists of 4 outputs and 2 inputs
Slo0 ... Slo3	Interface for status information Interface for providing status information; consists of 4 signal outputs

The operating mode selector switch is protected against unauthorised operation. A switch between operating modes must be enabled via a transponder key.

Transponder key authorisations

A total of 6 transponder keys are available for an operating mode selector switch. Each transponder key provides authorisation to switch up to 5 operating modes, including special authorisations. A transponder key can be identified via the printed key mode.

Assignment of key modes to authorisations

Designation	Marking on transponder key	Authorisation for operating mode
Key Mode 01		OM1
Key Mode 02		OM1 + OM2
Key Mode 03		OM1 + OM2 + OM3
Key Mode 04		OM1 + OM2 + OM3 + OM4
Key Service		OM1 + OM2 + OM3 + OM4 + OM5 (Service) + Master authorisation
Key Master		OM1 + OM2 + OM3 + OM4 + Master authorisation

Master authorisation ("Key Master")

With master authorisation, the user can be granted special authorisation on the machine control system via the Key ID number. The "Key Master" transponder key can be used to select OM1 ... OM4.

4.1 Interface for status information

Various status information can be signalled via the interface for status information (see [Block diagram \[12\]](#)). The status information can be evaluated through a control system.

The status information is subdivided into the following information classes:

- ▶ Operator actions
 - Insert transponder key
 - Remove transponder key
 - Select operating mode
- ▶ Messages (e.g. user error, fault)



NOTICE

When the operating mode is selected (Slo3 ... Slo0 = 3h, 8h ... Bh) and when there is a device error (Dh) the information remains indefinitely present. All other information stays active for just **200 ms**. After that time the selected operating mode is again displayed.

Status information	Information class	Slo3 (MSB)	Slo2	Slo1	Slo0 (LSB)	Value (in Hex)
Reserved	- - -	0	0	0	0	0h
Reserved	- - -	0	0	0	1	1h
Transponder key 5 – Inserted [1]	Operator action	0	0	1	0	2h
OM5 selected	Operator action	0	0	1	1	3h
Transponder key 1 – Inserted [1]	Operator action	0	1	0	0	4h
Transponder key 2 – Inserted [1]	Operator action	0	1	0	1	5h
Transponder key 3 – Inserted [1]	Operator action	0	1	1	0	6h
Transponder key 4 – Inserted [1]	Operator action	0	1	1	1	7h
OM1 selected	Operator action	1	0	0	0	8h
OM2 selected	Operator action	1	0	0	1	9h
OM3 selected	Operator action	1	0	1	0	Ah
OM4 selected	Operator action	1	0	1	1	Bh
No authorisation [2]	User error	1	1	0	0	Ch
Device error [3]	Error	1	1	0	1	Dh
Pushbutton operated incorrectly [4]	User error	1	1	1	0	Eh
Transponder key removed	Operator action	1	1	1	1	Fh

[1] When a pushbutton is released, information as to which transponder key is used will be displayed for 200 ms (see Status information 2h and 4h ... 7h). The selected operating mode is then displayed (see Status information 3h and 8h ... Bh).

Please refer to the [Timing diagrams for operator actions](#)  16].

[2] The fault "No authorisation" (Ch) is registered in the following cases:

- ▶ Operating mode selected without transponder key
- ▶ Operating mode selected with a transponder key that is not authorised for the selected operating mode
- ▶ Transponder key is not authorised for the active operating mode
- ▶ Transponder key is not inserted in time before the operating mode is selected

Please refer to the [Timing diagrams for user error: "No authorisation"](#)  18].

[3] "Device error" (Dh) is signalled in the event of an internal device error or when one of the operating mode outputs SOM1... SOM5 are stuck because of external voltage (stuck-at-1 or stuck-at-0).

Remedy:

- ▶ Rectify error, switch supply voltage off and then on again
- ▶ Change the unit

Please refer to the [Timing diagram for device error](#)  17].

[4] The fault "Pushbutton operated incorrectly" (Eh) is displayed in the following cases:

- ▶ Multiple operation of pushbuttons
- ▶ Pushbutton operated for too long (timeout for OM1 to OM4 = 5 s and timeout for OM5 = 10 s)
Note: If a key is operated for < 50 ms this will not be evaluated, so there will be no reaction.
- ▶ Pushbutton was released after the transponder key was removed

Please refer to the [Timing diagrams for user error: "Button operated incorrectly"](#)  20].

4.1.1 Timing diagrams for operator actions

The following timing diagrams show how status information is registered at outputs Slo0 ... Slo3, based on operator actions.

Legend:

	Message is displayed constantly
	Message is displayed briefly (200 ms)

Select operating mode

1. Start position: OM1 is selected
2. Operator action: Insert transponder key
(e.g. Authorisation Key Mode 02)
3. Operator action: Select operating mode
(e.g. Press pushbutton "2" for OM2)
4. Operator action: Remove transponder key

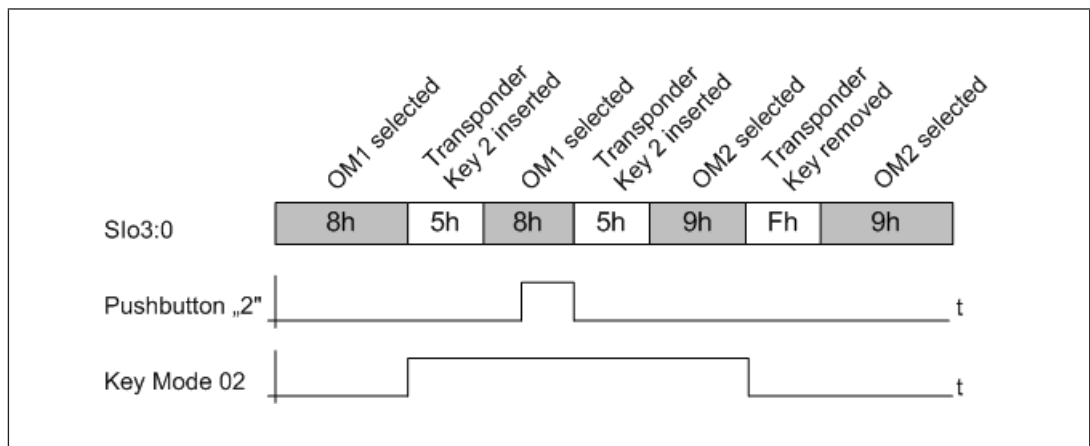


Fig.: Timing diagram for "Select operating mode"

Remove transponder key

1. Start position:
 - OM5 is selected and the transponder key "Key Service" is inserted
 - or
 - One of the operating modes OM1 ... OM4 is selected and a transponder key with the relevant authorisation is inserted
2. Operator action: Remove transponder key

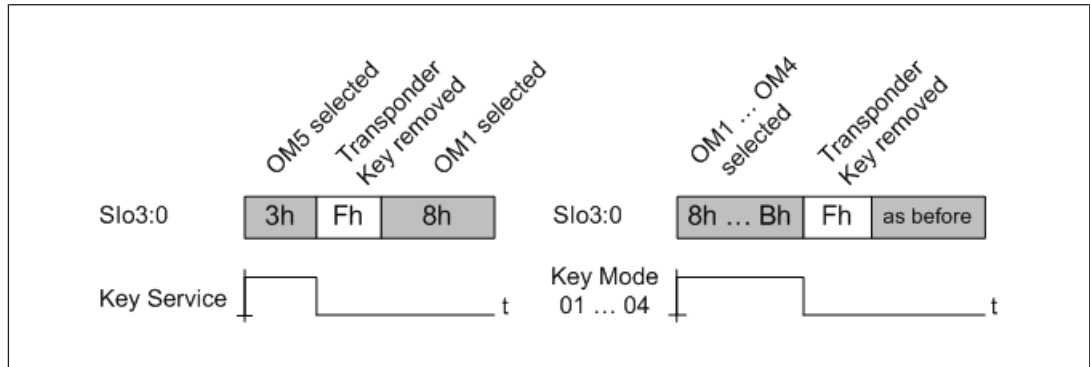


Fig.: Timing diagram for "Remove transponder key"

4.1.2 Timing diagram for device error

The following timing diagram shows how status information is registered at outputs Slo0 ... Slo3, based on a device error.

Legend:

	Message is displayed constantly
	Message is displayed briefly (200 ms)

Device error

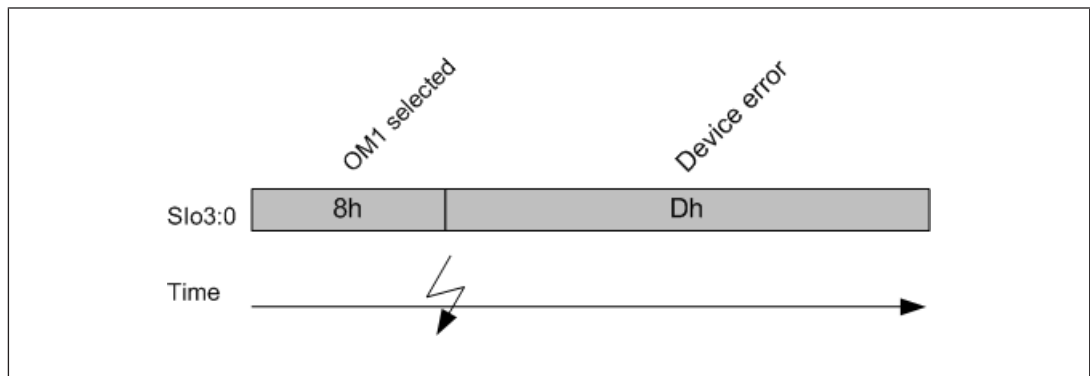


Fig.: Timing diagram in the event of a device error

4.1.3 Timing diagrams for user error: "No authorisation"

The following timing diagram shows how status information is registered at outputs Slo0 ... Slo3, based on the user error "No authorisation".

Legend:

	Message is displayed constantly
	Message is displayed briefly (200 ms)

Operating mode selected without transponder key

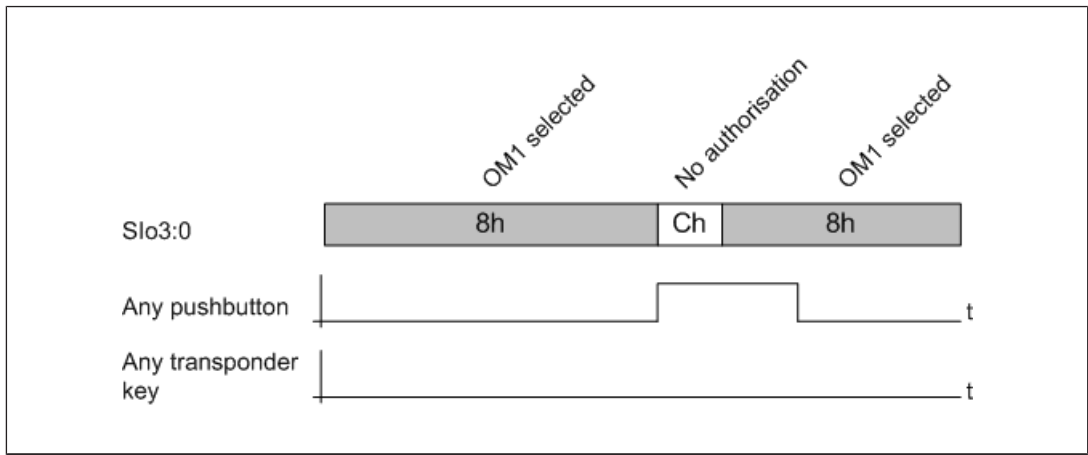


Fig.: Timing diagram for "Operating mode selected without transponder key"

Operating mode selected with a transponder key that is not authorised for the selected operating mode

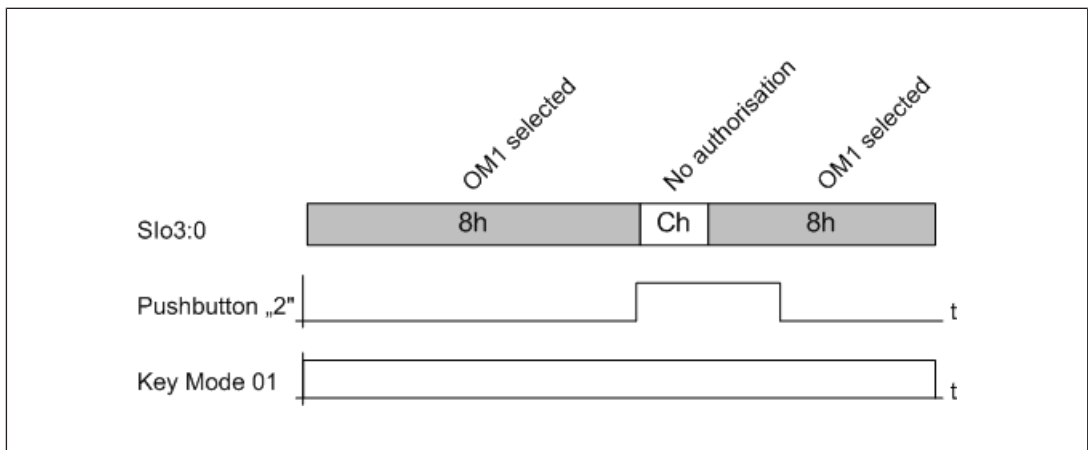


Fig.: Timing diagram for operating mode selection where there is insufficient authorisation for the operating mode requiring selection

Operating mode selected with a transponder key that is not authorised for the active operating mode

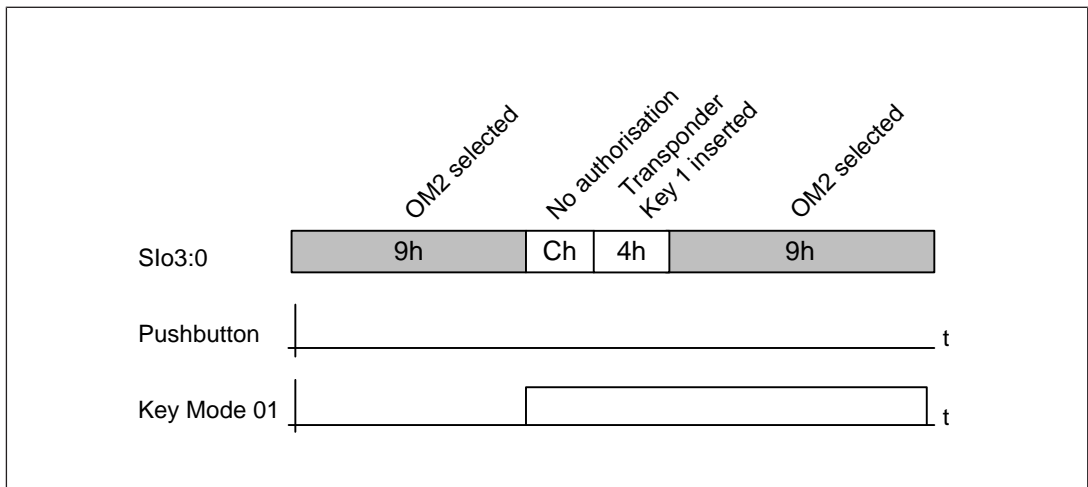


Fig.: Timing diagram for operating mode selection where there is insufficient authorisation for the active operating mode

Transponder key is not inserted in time before the operating mode is selected

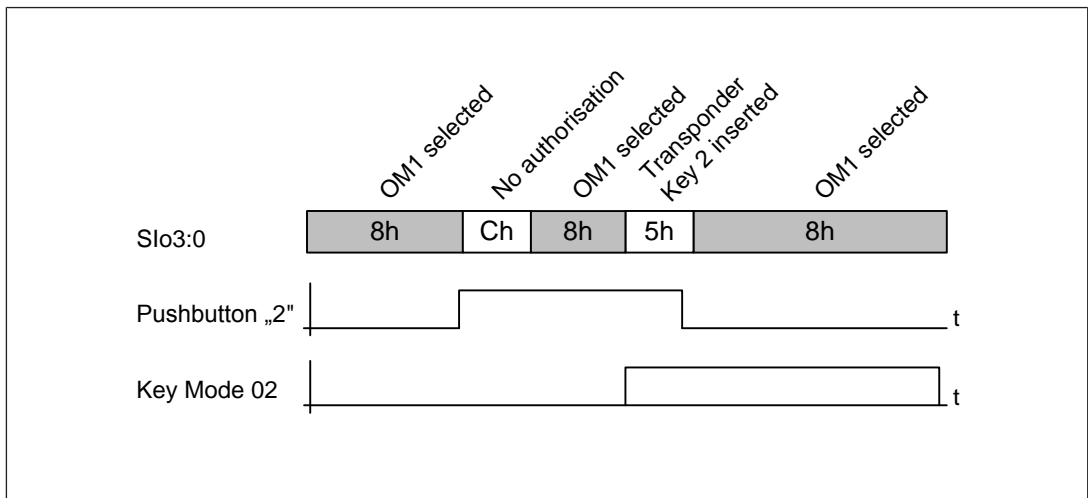




Fig.: Timing diagram for selecting the operating mode before the transponder key is inserted

4.1.4 Timing diagrams for user error: "Button operated incorrectly"

The following timing diagram shows how status information is registered at outputs Slo0 ... Slo3, based on the user error "Button operated incorrectly"

Legend:

	Message is displayed constantly
	Message is displayed briefly (200 ms)

Multiple operation of pushbuttons

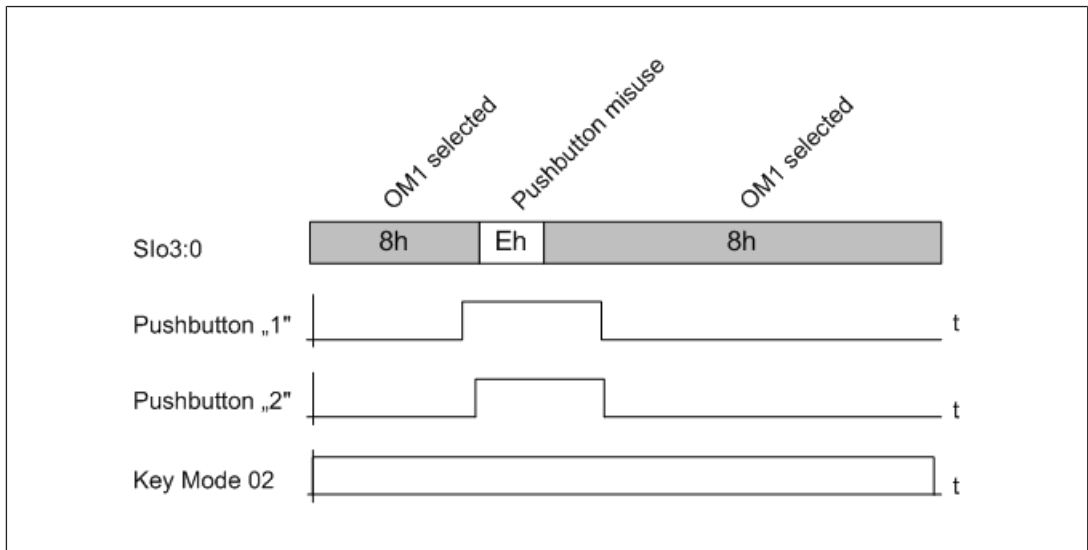


Fig.: Timing diagram for "Multiple operation of buttons"

Button operated for too long

- ▶ "Button operated for too long" with authorisations "Key Mode 01" ... "Key Mode 04" or
- ▶ "Button operated for too long" with authorisation "Key Service"

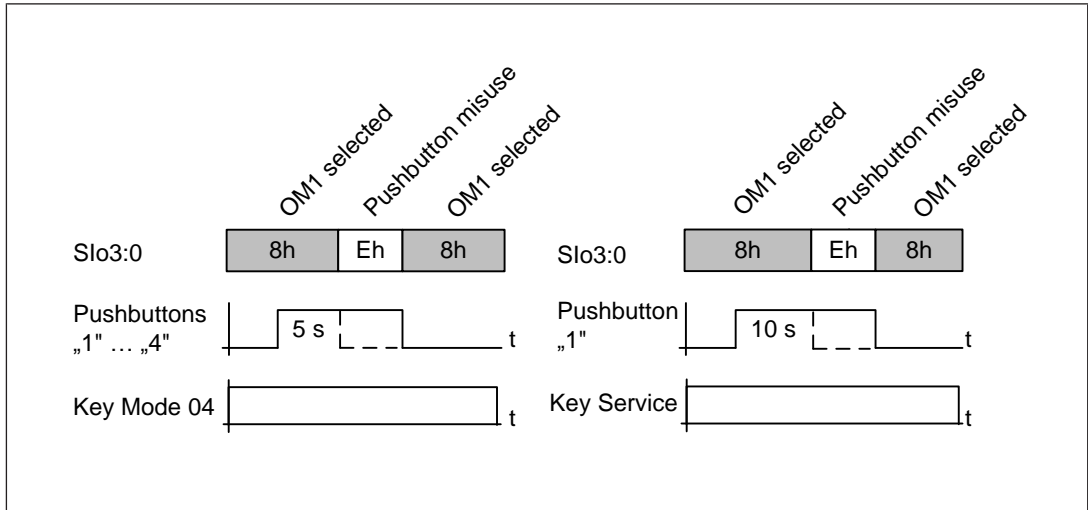


Fig.: Timing diagram for "Button operated for too long"

Pushbutton was released after the transponder key was removed

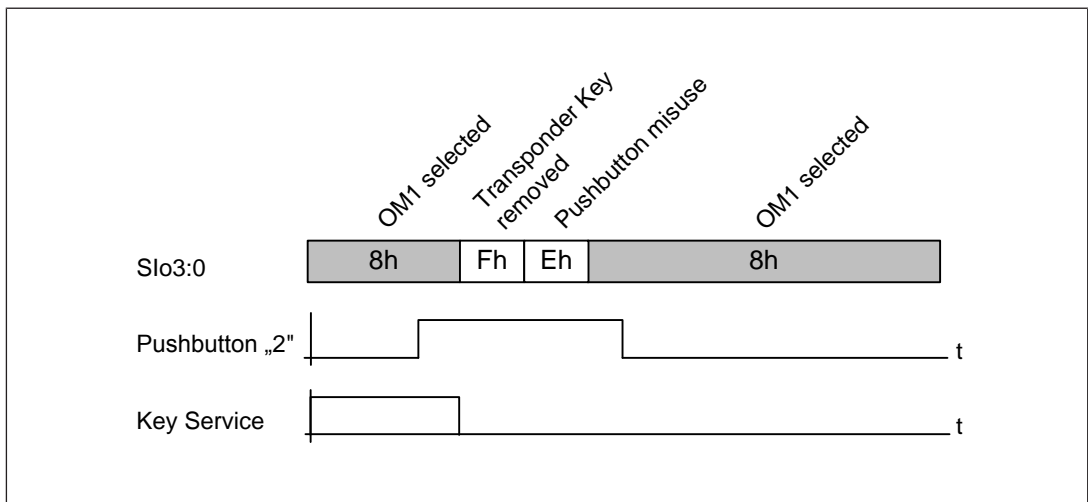


Fig.: Timing diagram for user errors when releasing the button

4.2 Operating mode interface

The operating mode interface consists of the monitored outputs SOM1 ... SOM5 (see [Block diagram \[12\]](#)). "SOM" stands for "Safe Operating Mode". The outputs are assigned to buttons, which can be used to select an operating mode if they have the relevant authorisation (transponder key):

Pushbutton	Output	Operating mode	
1	SOM1	OM1	The operating mode OM1/OM5 is selected based on the operating time of button 1 (see Monitoring of operating time [45])
	SOM5	OM5	
2	SOM2	OM2	
3	SOM3	OM3	
4	SOM4	OM4	

4.2.1 Switch behaviour after a transponder key is removed

The change of operating mode is completed by removing the transponder key. Once the transponder key has been removed, the operating mode selector switch behaves as follows:

Selected operating mode	Assigned output	Behaviour after the transponder key is removed
OM1	SOM1	<ul style="list-style-type: none"> ▶ The previously selected operating mode is maintained. ▶ The assigned pushbutton is backlit. ▶ The assigned output has a "1" signal.
OM2	SOM2	
OM3	SOM3	
OM4	SOM4	
OM5	SOM5	<ul style="list-style-type: none"> ▶ Switch to OM1 ▶ Pushbutton 1 is backlit ▶ SOM1 has a "1" signal


4.2.2 Control program requirements

In order to achieve SIL CL 2 (EN IEC 62061)/PL d (EN ISO 13849-1) in an application, the evaluation must be carried out by a safety-related function block. The safety-related function block must meet the following requirements:

- ▶ The function block must enable safe "1oon" evaluation of the output signals at SOM1 ... SOM5.
- ▶ If two or more operating modes are present at the same time, this must be detected as an error.



INFORMATION

The function block must bridge the t1 switchover delay (see [Switchover delay t1](#) [ 45]).

If a PNOZmulti (e.g. PNOZ m1p) is used as the safety control system in conjunction with an "operating mode selector switch" function element, then this requirement is met automatically.

4.3 Key ID interface

The Key ID interface (see [Block diagram \[12\]](#)) is used to download the Key ID number to a control system.

4.3.1 Key ID number of the transponder key

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



NOTICE

Please note:

The Key ID number is **not** printed on the transponder key packaging. If the transponder key is lost, it is impossible to supply a replacement transponder key with an identical Key ID number.

The Key ID number consists of two parts:

- ▶ Bit 27 = 24: Key Mode (0 ... 15_D)
- ▶ Bit 23 = 00: Consecutive number (0 ... 999999999_D)

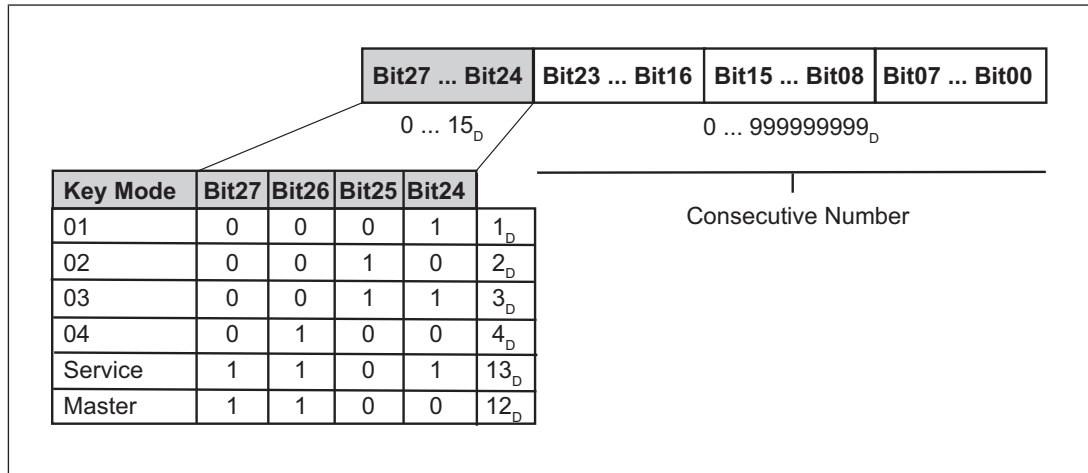
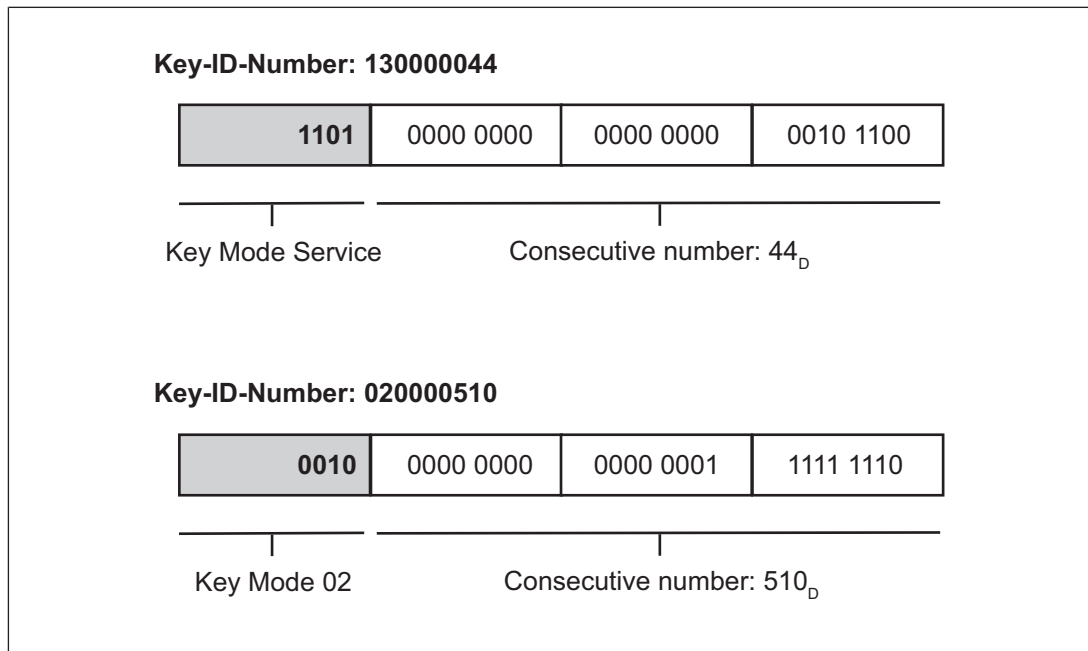


Fig.: Structure of the Key ID number

Examples:



4.3.2 Communication mode for downloading the Key ID number

The unique Key ID number for the relevant transponder key is downloaded to the higher-level process control system using a defined protocol, depending on the configured communication mode. The communication mode is configured on the Key ID interface of the operating mode selector switch (jumpers available/not available).

The operating mode selector switch detects the configured communication mode at each power-on. As long as voltage is applied to the operating mode selector switch, the configured communication mode will be active; the change in communication mode does not come into effect until the supply voltage is switched off and then on again.

It's possible to choose between the following communication modes:

- ▶ Transmitter-controlled communication mode
- ▶ Handshake-controlled communication mode

4.3.2.1 Transmitter-controlled communication mode

With transmitter-controlled communication mode, the download of the Key ID number is started by the operating mode selector switch (= transmitter).

Features of this communication mode:

- ▶ Download of Key ID number starts once the transponder key is connected
- ▶ Constant bit rate (100 ms)
- ▶ Download on 2 data lines
- ▶ Constant download time (typ. 1.8 s)
- ▶ Monitored data download
- ▶ Input/outputs required on the control system: 4 inputs and 2 outputs
- ▶ Download is repeated by reconnecting the transponder key
or
if the transponder key is inserted, via the control system by sending a "1" signal to IDi0 for at least 50 ms.

No special coding is required on the Key ID interface in order to download the Key ID number of a transponder key to the control system in transmitter-controlled communication mode. The terminals on the Key ID interface are used as follows:

Key ID interface	Brief description of application	Coding via jumpers
IDo0	IDsync	No configuration required
IDo1	IDclock	
IDo2	IDout0	
IDo3	IDout1	
IDi0	IDin0	
IDi1	IDin1	

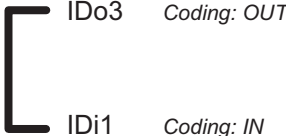
4.3.2.2 Handshake-controlled communication mode

With handshake-controlled communication mode, the download of the Key ID number is started by the control system (Request).

Features of this communication mode:

- ▶ Download starts via a request to the control system, once the transponder key is connected
- ▶ Download is repeated by a renewed request to the control system
- ▶ Variable bit rate (min. 2 PLC cycles per bit)
- ▶ Download on 1 data line
- ▶ Min. download time: 28 Bit * (20 ms + 2 * PLC cycle)
- ▶ Identifier for ID end for feasibility check
- ▶ Input/outputs required on the control system: 3 inputs and 1 output

The Key ID interface must be coded with a jumper between IDo3 and IDi1 in order to download the Key ID number of a transponder key to the control system in handshake-controlled communication mode. The terminals on the Key ID interface are used as follows:

Key ID interface	Brief description of application	Coding via jumpers
IDo0	IDsync	
IDo1	IDresponse	
IDo2	IDdata	
IDo3	<i>Coding: OUT</i>	
IDi0	IDrequest	
IDi1	<i>Coding: IN</i>	

In handshake-controlled communication mode, the operating mode selector switch can be operated in a functional variant. In this case the Key ID number of the transponder key is not downloaded to the control system. The control system is only used to evaluate IDo0 on the Key ID interface. In this case IDo0 is used as a signal output, enabling the control system to recognise whether the transponder key is valid/invalid. With this functional variant, only 1 input is required on the control system. The unused terminals on the Key ID interface (IDo1, IDo2 and IDi0) may remain unwired ("open").

4.3.3 Evaluation by a control system

4.3.3.1 Evaluation of the Key ID number with transmitter-controlled communication

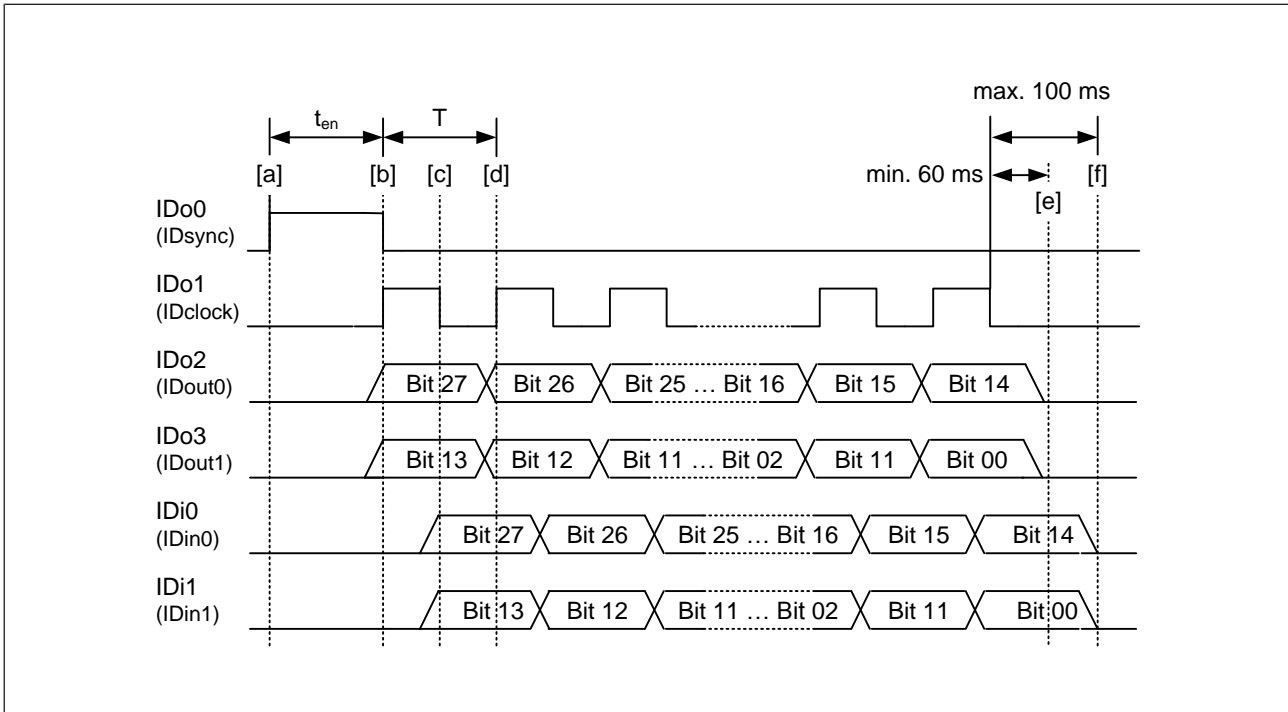


Fig.: Timing diagram for transmitter-controlled signal download

Legend:

The additional terminal designations (IDsync, IDclock, IDout0 etc.) are abbreviations for the terminal signal's application.

IDo0	Control line The signal is generated by the operating mode selector switch.
"0" signal	No transponder key is connected or the transponder key that is connected is invalid.
"1" signal	A valid transponder key is created. The operating mode selector switch signals to the control system when the download starts. The signal is present for 100 ms.
IDo1	Test pulse line The signal is generated by the operating mode selector switch and indicates the validity of the data bits at IDo2 and IDo3. <ul style="list-style-type: none"> ▶ T = 100 ms ▶ Duty cycle = 50%
IDo2, IDo3	Data lines for transmitting the Key ID number The operating mode selector switch sends the Key ID number to the control system via these two data lines. IDo2: Send Bit 27 ... Bit 14 IDo3: Send Bit 13 ... Bit 00
IDi0, IDi1	Data line for reading back the Key ID number The control system sends the previously received Key ID number back to the operating mode selector switch via these two data lines. IDi0: Receive Bit 27 ... Bit 14 IDi1: Receive Bit 13 ... Bit 00

Download procedure

- [a] The operating mode selector switch sets the signal at IDo0 (IDsync: control line) to "1" for 100 ms, thereby signalling to the control system that transmission has started.
- [b] A rising edge at IDo1 (IDclock: test pulse line) indicates that the data at data lines IDo2 and IDo3 is present and valid and can be read by the control system.
- [c] By the time there is a falling edge at IDo1 (IDclock: test pulse line), the control system must have sent the previously read bit back to the operating mode selector switch via the data lines IDi0 and IDi1.
- [d] Before the rising edge at IDo1 (IDclock: test pulse line), the operating mode selector switch reads the bits sent back to IDi0 and IDi1 by the control system and checks it for equivalence.
- [e] At least 60 ms after the falling edge at IDo1 (IDclock: test pulse line), the last bit sent back by the control system must be present at data lines IDi0 and IDi1.
- [f] A maximum of 100 ms after the falling edge at IDo1 (IDclock: test pulse line), the last bit sent back by the control system must be present at data lines IDi0 and IDi1; in other words, by this point at the latest, data transfer must be completed and the data lines must have a "0" signal.

**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 typically takes 1.8 s.

Flowchart for evaluating the Key ID interface

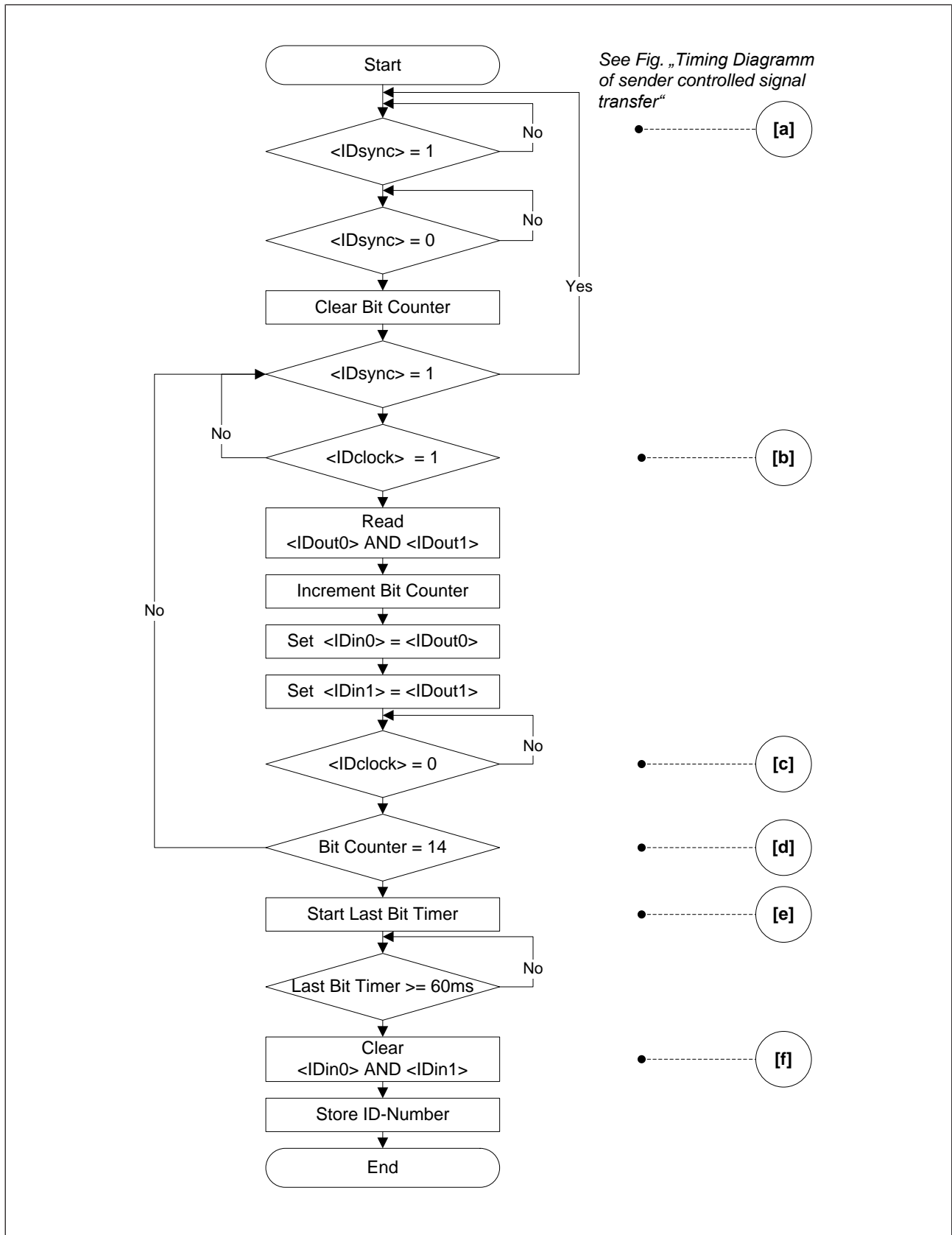


Fig.: Evaluation of the Key ID number via a control system (principle)

4.3.3.2 Evaluation of the Key ID number with handshake-controlled communication

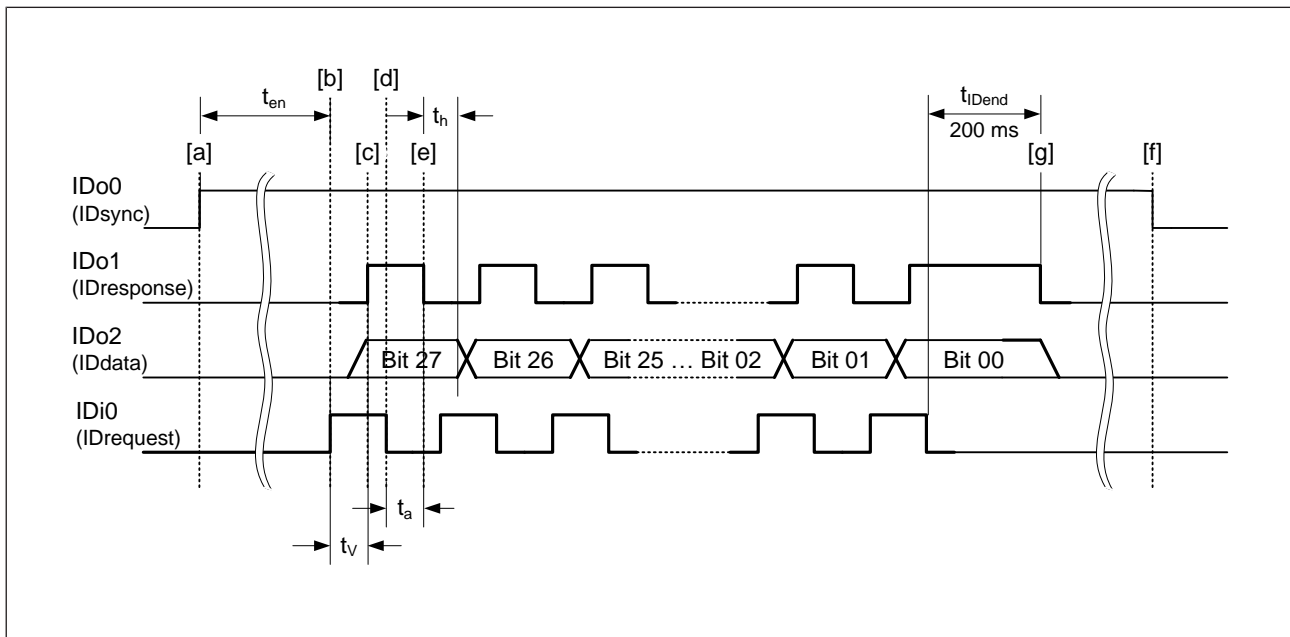


Fig.: Timing diagram for handshake-controlled signal download

Legend:

The additional terminal designations (IDsync, IDresponse, IDdata and IDrequest etc.) are abbreviations for the terminal signal's application.

IDo0 Control line

The signal is generated by the operating mode selector switch.

"0" signal No transponder key is connected or the transponder key that is connected is invalid. The control system cannot request the Key ID number.

"1" signal A valid transponder key is connected and the control system can request the Key ID number.

IDo1 Handshake line (Response)

The signal is generated by the operating mode selector switch and indicates whether a data bit at IDo2 is valid/invalid.

"0" signal The data bit at IDo2 is invalid and may not be evaluated.

"1" signal The data bit at IDo2 is valid and may be evaluated.

IDo2 Data line for downloading the Key ID number

The Key ID number (28 Bit) is generated by the operating mode selector switch. The download begins with MSB (Bit27 ... Bit00).

IDi0 Handshake line (Request)

The signal is generated by the control system.

"0" signal No bit is requested at IDo2

"1" signal A new bit is requested at IDo2.

t_{en} IDsync Enable Time (min. 0 ms)

t_v Data Output Valid Time (max. 10 ms)

t_h Data Output Hold Time (min. 0 ms)

t_a Data Output Access Time (max. 10 ms)

t_{IDend} End of Key ID Number Transfer (200 ms)
After the last falling edge at IDi0, the operating mode selector switch still has a "1" signal at output IDo1 for 200 ms. In this way, the end of the Key ID number and therefore the end of the download (End of Key ID Number Transfer) is displayed. This can be used for the feasibility check.

Download procedure

- [a] "1" signal at IDo0 (control line):
A valid transponder key is present at the operating mode selector switch.
- [b] "1" signal at IDi0 (handshake line):
The control system requests a data bit at data line IDo2 an (= Request).
- [c] "1" signal at IDo1 (handshake line):
The operating mode selector switch confirms the validity of the data bit at data line IDo2 (= Response).
- [d] "0" signal at IDi0 (handshake line):
The control system confirms that it has read the requested data bit without error.
- [e] "0" signal at IDo1 (handshake line):
The operating mode selector switch is ready to issue a new data bit at data line IDo2.
- [f] "0" signal at IDo0 (control line):
The transponder key has been removed.
- [g] The control system must request all the data bits of a Key ID number (Bit27 ... Bit00). Only then is it possible to start downloading a new Key ID number. The end of the download is indicated by the signal extension (t_{IDend}) at IDo1.

Status diagram for handshake-controlled signal download

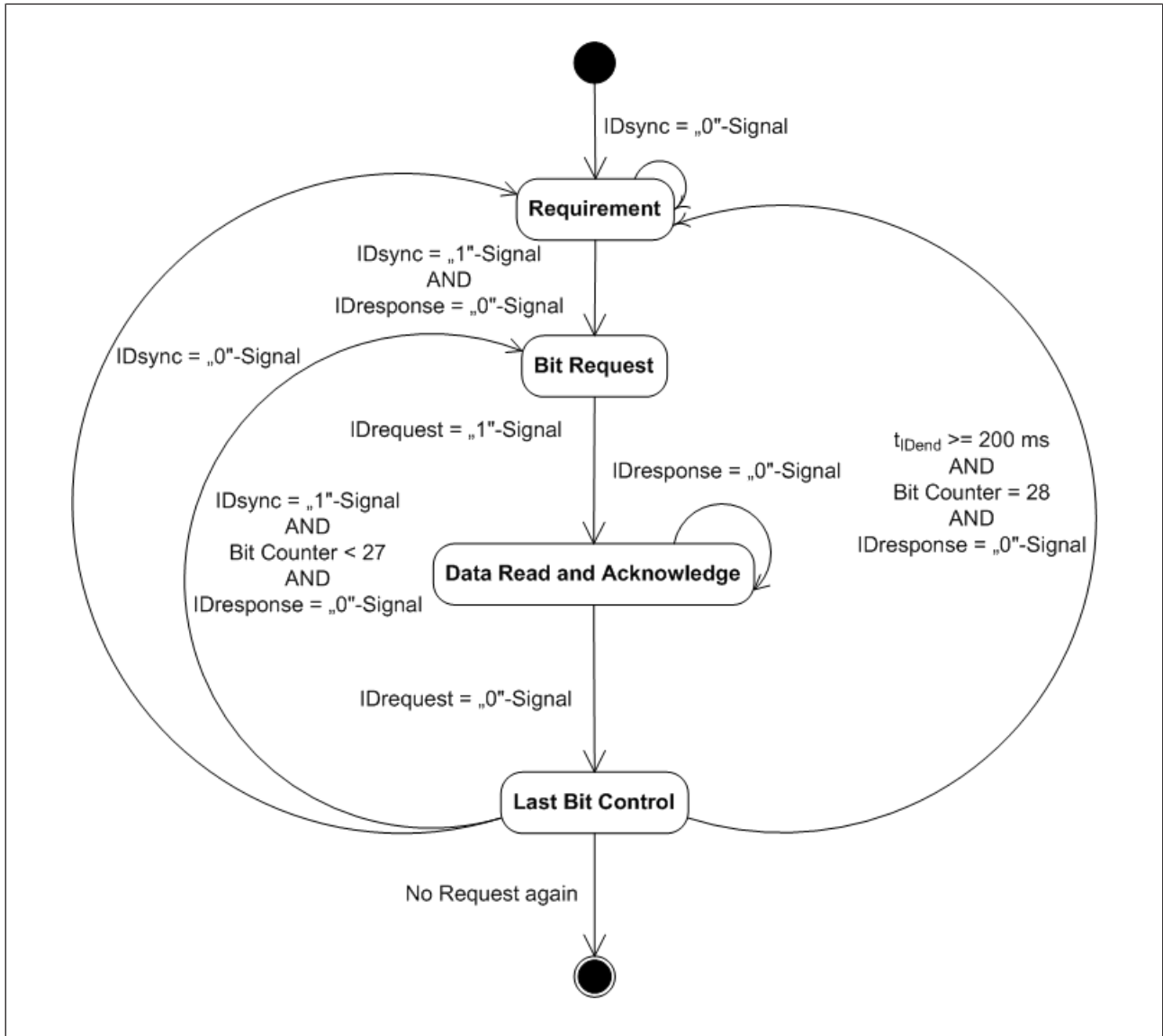


Fig.: Status diagram for handshake-controlled signal download

Flowchart for evaluating the Key ID interface

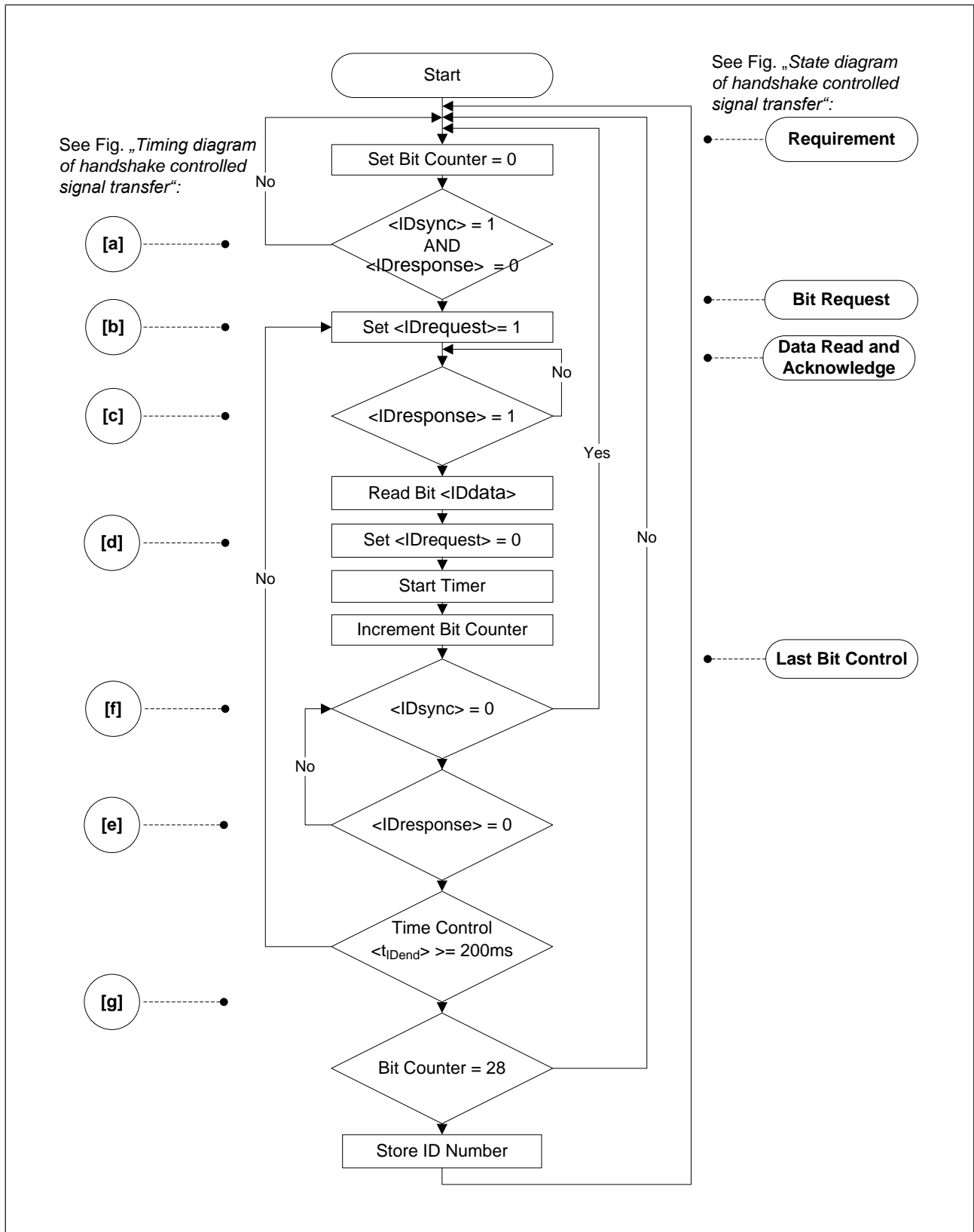


Fig.: Evaluation of the Key ID number via a control system (principle)

5 Installation

5.1 General installation guidelines

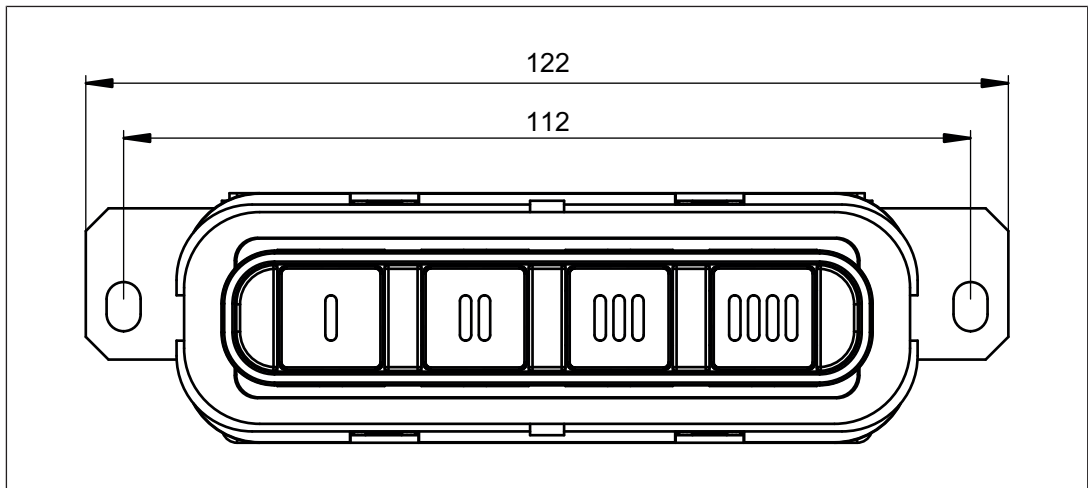
**NOTICE**

Please note that the operating mode selector switch may only be installed in a custom-fit console with a protection type of at least IP54!

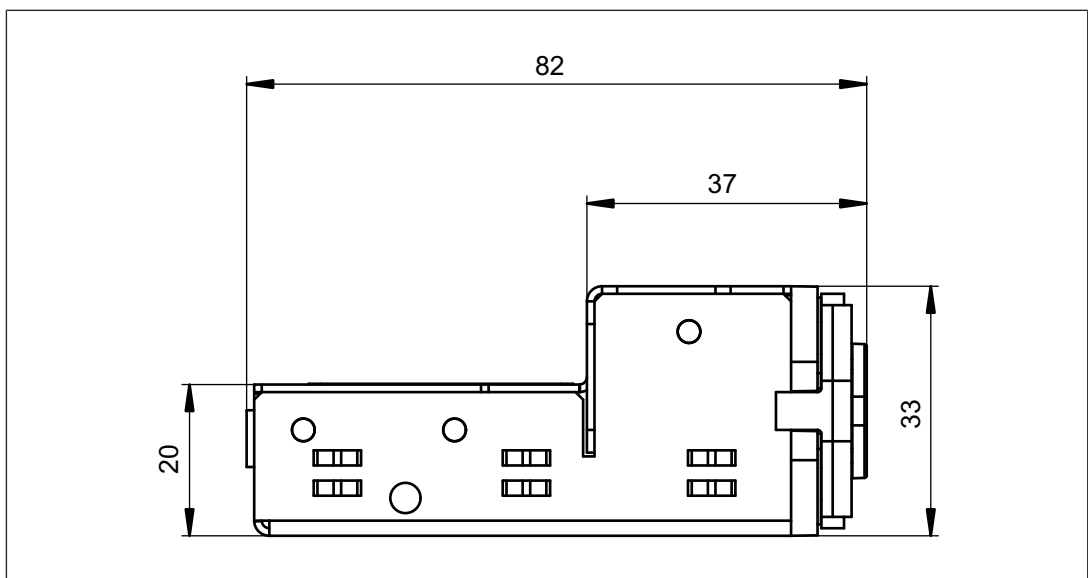
- ▶ The installation site must conform to the protection type IP54.
- ▶ Ensure that the operating mode selector switch has sufficient ventilation.
- ▶ Attach the operating mode selector switch using the brackets provided.
- ▶ Make sure that the gasket is seated correctly.

5.2 Dimensions

Front view



Side view



6.2 Connecting the unit

Proceed as follows:

1. Connecting the supply voltage

⇒ Connect the supply voltage to (A1, A2).


Please note the following:

The power supply must meet the regulations for extra low voltages with protective separation (SELV, PELV).

The cables for the unit's supply voltage (A1, A2) must be fitted with a 4 A fuse, characteristic B/C.

2. Connecting the operating mode interface's semiconductor outputs

⇒ Connect the operating mode interface's semiconductor outputs to a control system that supports "100N" evaluation.

You must read the information concerning intended use (see [Intended use](#) [ 10]).

3. Connecting the interface's terminals for status information

⇒ Connect the terminals (SIo0 ... SIo3) to a control system that supports evaluation of the status information.

4. Configure communication mode for downloading the Key ID number

⇒ To download the Key ID number in handshake-controlled communication mode, connect terminals IDo3 and IDi1 of the Key ID interface.
No configuration is required for transmitter-controlled communication mode.

5. Connecting the terminals of the Key ID interface

⇒ Depending on the selected communication mode, connect the terminals of the Key ID interface to a control system that supports the download of the Key ID number.

or

⇒ Connect IDo0 to a control system, if all you wish to do in handshake-controlled communication mode is evaluate whether the transponder key is valid/invalid. In this case you will only use IDo0 as a signal output. The unused terminals on the Key ID interface (IDo1, IDo2 and IDi0) may remain unwired ("open").

6.3 Connection to a control system

Depending on the application area and its respective regulations, the operating mode selector switch can be used up to SIL CL 2 (EN IEC 62061) and up to PL d (EN ISO 13849-1), if the operating modes are evaluated by a safety control system with safe "1oon" evaluation.

The examples below meet the following conditions:

- ▶ A PNOZ m1p is used as a safety control system.
- ▶ An "operating mode selector switch" function element is configured in the PNOZmulti Configurator for safe "1oon" evaluation.
- ▶ The Key ID interface and the interface for status information are evaluated via a higher-level process control system.
- ▶ The cables for the unit's supply voltage (A1, A2) contain a 4 A fuse, characteristic B/C.

Connection to a control system: Transmitter-controlled communication mode

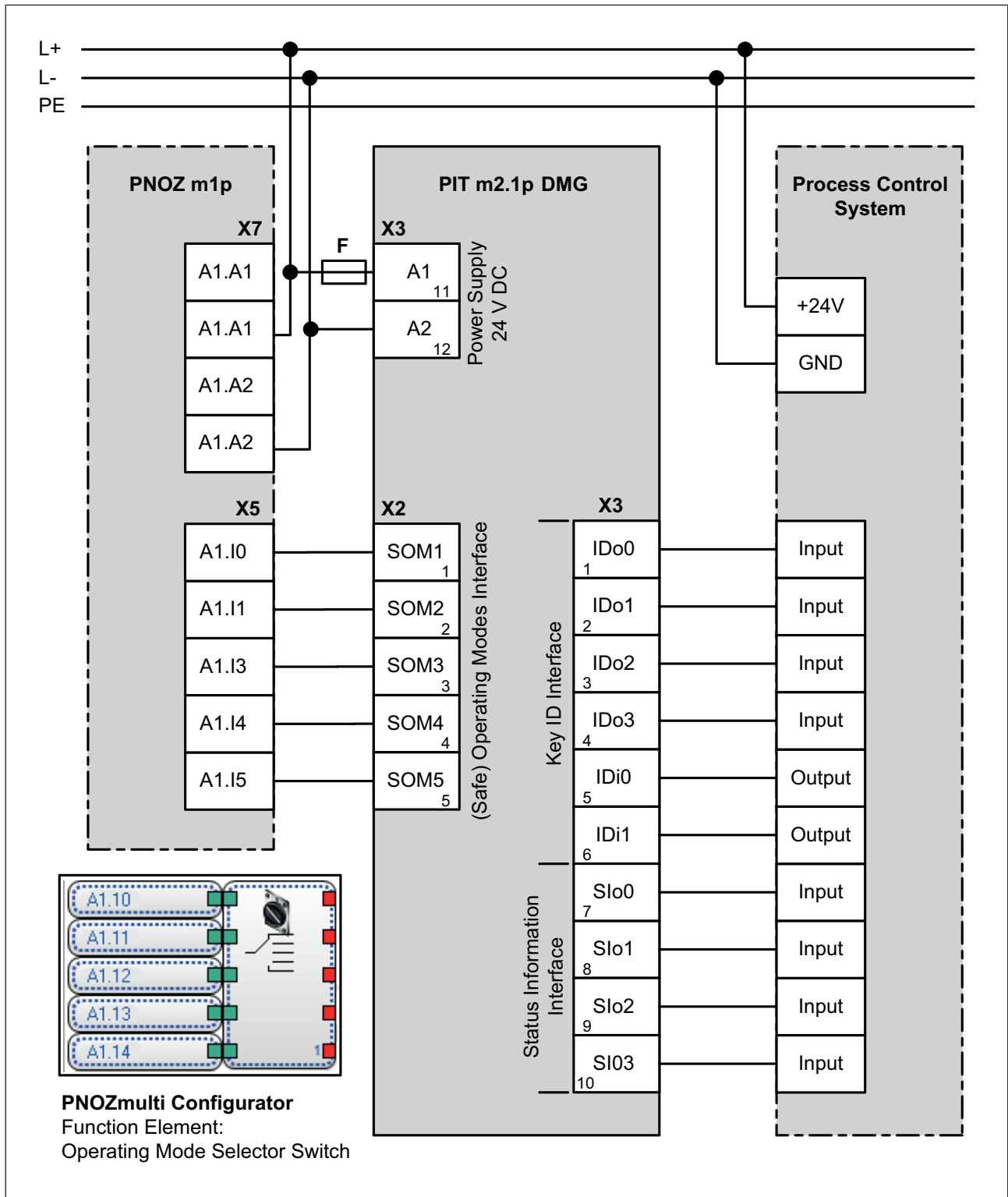


Fig.: Connection for transmitter-controlled communication mode (example)

Connection to a control system: Handshake-controlled communication mode

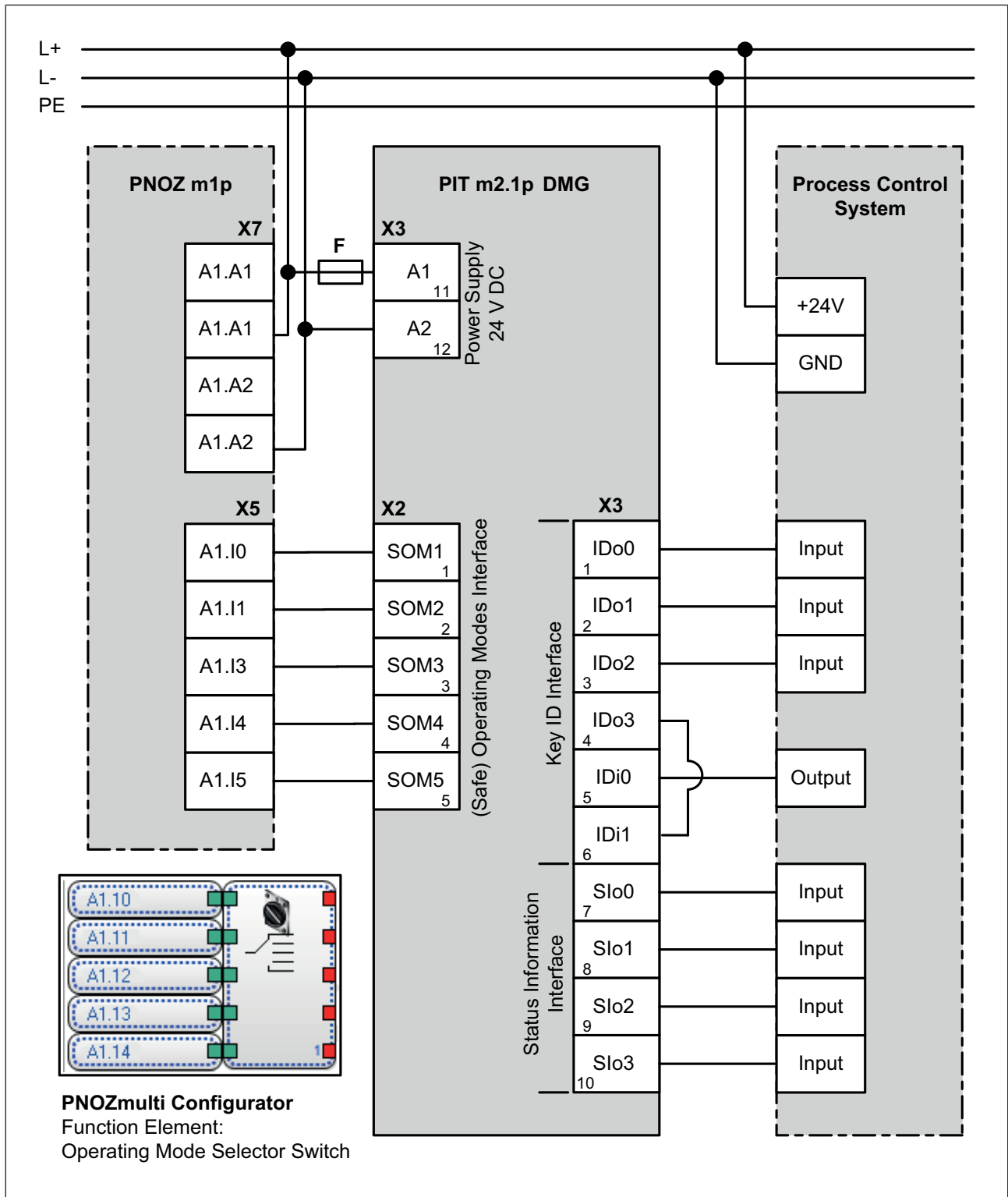


Fig.: Connection for handshake-controlled communication mode (example)

7 Operation

Switch-on behaviour



INFORMATION

After the operating mode selector switch is switched on (Power ON) or after voltage is returned (reset), operating mode OM1 is selected automatically. This also applies if no transponder key is connected, or a transponder key is detected but is invalid.

Behaviour in the event of an error in operating modes OM1 ... OM4



NOTICE

In the event of an error, the unit does **not** change operating mode. The active operating mode (OM1, OM2, OM3 or OM4) is displayed via the backlit button and the assigned semiconductor output has a 1 signal.

Behaviour in the event of an error in special operating mode OM5 (Service)



NOTICE

In the event of an error, the unit does **not** change operating mode. Faulty operation is indicated by the fact that all buttons are either all lit or all out. The assigned semiconductor output has a 1 signal.

7.1 Select operating modes OM1 ... OM4

Prerequisites

- ▶ A transponder key with the relevant authorisations must be present.
- ▶ The operating mode selector switch must recognise the transponder key as valid.
- ▶ The transponder key must be present at the operating mode selector switch for the whole time the button is operated.
- ▶ Several buttons may **not** be operated simultaneously when selecting an operating mode.

Procedure

1. Establish transponder key connection
 - ⇒ Insert the transponder key into the slot
Note: The transponder key must support the operating mode(s) into which you wish to switch.
2. Select operating mode
 - ⇒ Select the operating mode you want by pressing the relevant pushbutton. Please note the required operating time (see [Monitoring of operating time](#) [45]). The operating mode has been selected correctly if the pushbutton is backlit after it is released.
3. Complete operating mode selection
 - ⇒ Complete the operating mode selection by removing the transponder key. Once you have removed the transponder key, the last operating mode to be selected is maintained (see [Switch behaviour after a transponder key is removed](#) [22]).



INFORMATION

You can switch at will between the individual operating modes OM1, OM2, OM3 and OM4; i.e. it is possible to switch from OM1 to OM3 or from OM4 to OM2, for example.

7.2 Select special mode OM5 (Service)

Prerequisites

- ▶ A transponder key must be available with authorisation for special operating mode OM5 (Service).
- ▶ The operating mode selector switch must recognise the transponder key as valid.
- ▶ The transponder key must be present at the operating mode selector switch for the whole time the button is operated.
- ▶ Several buttons may **not** be operated simultaneously when selecting an operating mode.

Procedure

1. Establish transponder key connection
 - ⇒ Insert the transponder key "Key Service" into the slot.
2. Select special mode OM5 (Service)
 - ⇒ Press pushbutton 1 (OM1).
Please note the required operating time (see [Monitoring of operating time](#) [📖 45]). The operating mode has been selected correctly if all 4 pushbuttons flash when pushbutton 1 is released. The pushbuttons flash for as long as you are in special mode OM5 (Service).
3. Complete operating mode selection
 - ⇒ Complete the operating mode selection by removing the transponder key. Once you have removed the transponder key, the operating mode selector switch changes to OM1 (see [Switch behaviour after a transponder key is removed](#) [📖 22]).



INFORMATION

Special operating mode OM5 (Service) can be selected from any of the operating modes OM1 ... OM4.

7.3 Monitoring of operating time

A change of operating modes is only detected if the relevant button has been operated for a defined time period.

Button's operating time

Pushbutton	Operating mode	Output	Operating time
1	OM1	SOM1	> 50 ms and < 5 s
2	OM2	SOM2	
3	OM3	SOM3	
4	OM4	SOM4	
1	OM5 (Service)	SOM5	> 5 s and < 10 s

7.4 Switchover delay t1

Once a button has been released, the assigned output on the operating mode interface switches to a "1" signal after the switchover delay t1 has elapsed (see [Technical details \[48\]](#)). This defined switchover delay guarantees that only one operating mode at a time has a "1" signal at the assigned output.

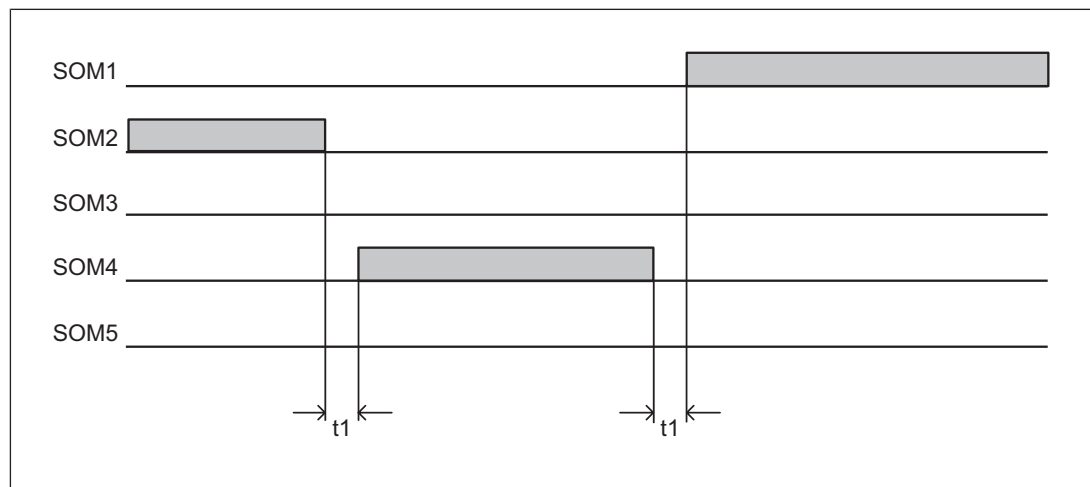


Fig.: Time behaviour when switching operating mode

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.
	Transponder key is not detected	Make sure that the transponder key is connected to the operating mode selector switch or inserted correctly.
	No valid authorisation	Make sure that you use a transponder key that has the required authorisation

7.6 Diagnostics

The operating mode selector switch has various options for displaying status information:

- ▶ Interface for status information (SIo0 ... SIo3)
- ▶ Button backlighting

7.6.1 Status information about the interface for status information

Various status information can be signalled via the interface for status information (see [Block diagram \[12\]](#)). The status information can be evaluated through a control system (see [Interface for status information \[14\]](#)).

7.6.2 Status information about pushbutton backlighting

Pushbuttons 1 ... 4 (see Control elements) have pushbutton backlighting. Pushbutton backlighting is used to indicate which operating mode is active; in other words, which output (SOM 1 ... SOM5) has a "1" signal.

Evaluation of pushbutton backlighting

Legend:

	LED on
	LED flashes
	LED off

LED pushbut- ton 1	LED pushbut- ton 2	LED pushbut- ton 3	LED pushbut- ton 4	Meaning
				▶ No supply voltage
				▶ OM 5 (Service) is active ▶ SOM1 has a "1" signal
				▶ OM 1 is active ▶ SOM1 has a "1" signal
				▶ OM 2 is active ▶ SOM2 has a "1" signal
				▶ OM 3 is active ▶ SOM3 has a "1" signal
				▶ OM 4 is active ▶ SOM4 has a "1" signal

8 Technical details

General	
Approvals	CE, FCC, IC, TÜV, cULus Listed
Sensor's mode of operation	Transponder
Transponder interface	
Energy supply to transponder	passive (battery free)
Operating frequency	125 kHz
Electrical data	
Supply voltage	
Voltage	24,0 V
Kind	DC
Voltage tolerance	-15 %/+10 %
Output of external power supply (DC)	1,0 W
Residual ripple DC	20 %
Continuous duty	100 %
Status indicator	LED
Inputs	
Number	2
Signal level at "0"	-3 - +5 V DC
Signal level at "1"	15 - 30 V DC
Voltage at inputs	24 V DC
Input current range	2,0 mA
Galvanic isolation	No
Semiconductor outputs	
Overall performance ext. loading, semiconductor	3,5 W
Number of positive-switching single-pole semiconductor outputs	13
Switching capability	
Voltage	24 V
Current	20,0 mA
Signal level at "1"	UB - 0,5 V DC
Residual current at "0"	0,4 mA
Short circuit-proof	Yes
Times	
Switch-on delay	
after UB is applied	1,0 s
Supply interruption before de-energisation	20 ms
Switchover delay t1	50 ms
Operating time pushbutton 1 ... 4	50 ms ... 5 s
Operating time, service pushbutton	5 s ... 10 s
Environmental data	
Climatic suitability	DIN IEC 60068-2-3
Ambient temperature	
Temperature range	0 - 55 °C

Environmental data	
Storage temperature	
Temperature range	-25 - 70 °C
Climatic suitability	
In accordance with the standard	EN 60068-2-78
Humidity	95 % r. h. at 40 °C
EMC	EN 60947-5-1
Vibration	
In accordance with the standard	EN 60068-2-6
Frequency	10,0 - 55,0 Hz
Amplitude	0,35 mm
Airgap creepage	
In accordance with the standard	EN 60664-1
Overvoltage category	II
Pollution degree	2
Rated insulation voltage	60 V
Rated impulse withstand voltage	0,80 kV
Protection type	
Mounting area (e.g. control cabinet)	IP54
Housing	IP20
Terminals	IP20
Mechanical data	
Operating distances	
Typical operating distance So	5,0 mm
Max. cable length	1000 m
Material	
Bottom	ST + 10µ Zn
Front	ABS
Fixing screws torque settings	0,30 Nm
Connection type	Spring-loaded terminal, plug-in
Conductor cross section with spring-loaded terminals: Flexible with/without crimp connector	0,20 - 2,50 mm², 24 - 12 AWG
Spring-loaded terminals: Terminal points per connection	1
Stripping length	9 mm
Dimensions	
Height	33,0 mm
Width	117,0 mm
Depth	82,0 mm
Weight	210 g

Where standards are undated, the 2010-02 latest editions shall apply.

8.1 Safety characteristic data

Operating mode	EN ISO 13849-1: 2008 PL	EN ISO 13849-1: 2008 Category	EN 62061 SIL CL	EN 62061 PFH _D [1/h]	IEC 61511 SIL	IEC 61511 PFD	EN ISO 13849-1: 2008 T _M [year]
–	PL d	Cat. 3	SIL CL 2	1,10E-08	SIL 2	5,28E-04	20

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




INFORMATION

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

9 Supplementary data

9.1 Radio approval

FCC/IC approval

USA/Canada
 FCC ID: VT8- PITM2 IC: 7482A- PITM2
<u>FCC/IC-Requirements:</u> This product complies with Part 15 of the FCC Rules and with Industry Canada licence-exempt RSS standards. Operation is subject to the following two conditions: 1) this product may not cause harmful interference, and 2) this product must accept any interference received, including interference that may cause undesired operation. Changes or modifications made to this product not expressly approved by Pilz may void the FCC authorization to operate this equipment. NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Le présent produit est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) le produit ne doit pas produire de brouillage, et (2) l'utilisateur de le produit doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

10 Order reference

10.1 Product

Type	Features	Order no.
PIT m2.1p DMG	Operating mode selector switch with antenna	402 201

10.2 Accessories

Terminals

Type	Features	Order no.
Spring-loaded terminals	1 set	402 304

Antenna

Type	Features	Order no.
PIT m2.1p DMG antenna	Antenna	402 202

Transponder key

Type	Features	Order no.
PIT m2.1 key mode 1	Transponder Key Mode 01	402 051
PIT m2.1 key mode 2	Transponder Key Mode 02	402 052
PIT m2.1 key mode 3	Transponder Key Mode 03	402 053
PIT m2.1 key mode 4	Transponder Key Mode 04	402 054
PIT m2.1 key service	Transponder Key Service	402 055
PIT m2.1 key master	Transponder Key Master	402 056

► Support

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