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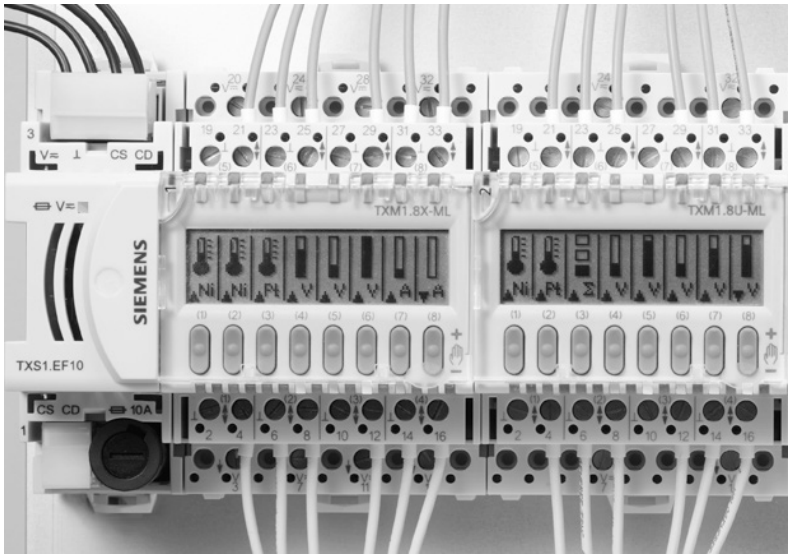

10562p001

TX-I/O™
Functions and operation

CM110561en_08
2018-10-25

Building Technologies

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1 Introduction

1.1 Revision history

10.2018, Rev. _08	• **Section 2.6, 4.1 Correction for PT100 4-wire**
08.2012, Rev. _07	• Detail information concerning MO Steps (multistate maintained contact)
02.2012, Rev. _06	• New modules with new functions • New signal types designations (for a comparison between signal types of different building automation and control systems see N8170) • Described all functions of the TX-I/O modules, even if not supported by all building automation and control systems
07.2010, Rev. _05	• New: Section 5.3 Maintained contact, bistable • Section 5.1 Correction concerning fault response • As a rule, all information depending on an individual building automation and control system was moved to document CM110562 (support of signal types, TX-I/O functions, resolution, etc.)
04.2009, Rev. _04	Section 1.5: Intranet address Section 4.1: Note on open circuit detection with U10
01.2009, Rev. _03	Added Version 4 functions
01.2008, Rev. _02	Section 5.1: Note on 4QD-M2 Section 5.9: Note on synchronization
03.2007, Rev. _01	First edition

1.2 Key target groups

- Project managers
- Consulting engineers
- Service engineers
- Control panel manufacturers

1.3 Contents and validity of this manual

This manual describes all functions available in conjunction with the TX-I/O modules. The description is limited to modules and field devices.

Note!

A specific building automation and control system may not support all functions described hereafter.
Configuration and parameter-setting for each building automation and control system is described in the respective online help.

1.4 Other applicable documents

	Document	Number
[1]	TX-I/O™ Range overview data sheet	CM2N8170
[2]	TX-I/O™ Module data sheets	CM2N8172 ff
[3]	TX-I/O™ Power supply module / bus connection module data sheet	CM2N8183
[4]	P-bus bus Interface module data sheet	CM2N8180
[5]	Profinet BIM data sheet	CM2N8186
[6]	TX-I/O™ Engineering and installation guide	CM110562
[7]	Replacement of legacy modules	CM110563

1.5 Before you start

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1.6 TX-IO™ terms and definitions

Term	Description
Bus master	Device with supervisory function for an assigned set of I/O devices (room automation station, automation station or bus interface module BIM)
Island bus (TX-I/O module bus)	• Communications bus between the bus master (room automation station, automation station or bus interface module) and the connected TX-I/O modules. • Simultaneously carries the supply voltages for the modules and the field devices. • The bus is created automatically through the interconnection of the TX-I/O modules.
Power supply module	"Active" power supply module that converts AC 24 V to DC 24 V. It supplies power for operation of the module electronics and of DC 24 V and AC 24 V field devices)
Bus connection module	"Passive" module which passes communication signals and DC 24 V between multiple I/O rows and/or serves as a connection point for additional AC / DC 12 … 24 V supply for field devices.
Bus interface module (BIM)	Interface between the island bus and another bus. Acts as an island bus master.
P-Bus-BIM	Interface between a P-Bus automation station (Desigo, Unigyr, Visonik) and the island bus.
PROFINET BIM	Interface between a PROFINET system and the island bus.
I/O island	All TX-I/O devices that are physically connected to the same island bus segment and linked to the same bus master.
I/O row	One I/O island may consist of several rows of modules, each referred to as an "I/O row". Each I/O row starts either with a bus master, or a power supply module, or a bus connection module.
I/O module (assembly)	Device in which the physical signals from the field devices are converted into software process values and vice versa. An I/O module has a specific number of I/O points, determined by the module type. The I/O module assemblies (normally called I/O modules) consist of a terminal base and a plug-in module.
I/O point	Smallest addressable unit in an I/O module. One or more I/O points (e.g. three-stage switching output) correspond to each data point /channel on the room automation station / automation station.
Terminal	The cables of the field devices (peripheral devices) are connected to the terminals.
Plug-in module	The plug-in component with the module electronics that can be removed from the terminal base.
Terminal base	The base unit for the TX-I/O module, which is mounted on the standard mounting rail and to which the wiring is connected. The terminals have the function of control panel terminal strips.
Address key	Accessory, which must be plugged into the plug-in module. The module address is assigned via the mechanical coding of the key.
Reset key	Serves to reset the module function to the factory state. Is inserted in place of the address key and can then be removed.
Addressing	From the perspective of the building automation and control system, the module address consists of a module number (range 1…120) and an I/O point number (range 1…16).
I/O function	The function of an I/O point, which determines how it operates (e.g. signal input, 0…10 V voltage output etc.). Certain functions may use more than one I/O point (e.g. multi-stage switching output).
Process value	Software image of the physical value in the field device. Communicated on the bus.
Configuration	Defining the functionality of an I/O point by setting an I/O function and its parameters. Any I/O function (existing in a module before the download) and its I/O points are disabled first. For details refer to the TX I/O engineering documentation [8], [9]
Parameter setting	Changing the properties of an I/O function during configuration or at runtime. For details refer to the TX I/O engineering documentation [8], [9]
Local override device, Tool override, "Functional test", etc.	Each BACS has its own tools.
Signal type	Designation of the signal of a physical input
TRA	Total Room Automation → New: Desigo Room automation

1.7 Overview of TX-I/O™ functions

The following functions are available in the TX-IO range:

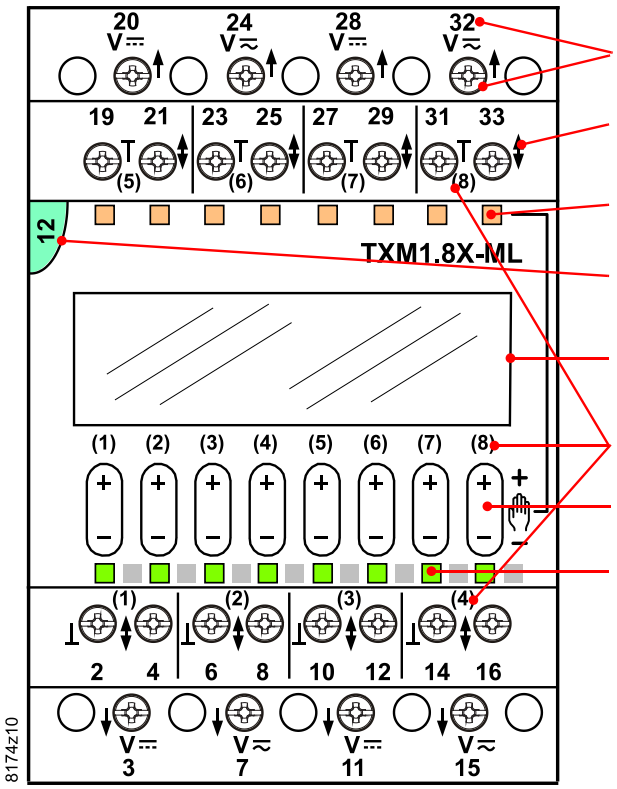
Signal type (TRA) (Signal types designation in other systems: see TX-I/O assortment overview [1])	Description	Number of I/O points per function	Max. number of functions per module											
			TXM1.8D	TXM1.16D	TXM1.8U	TXM1.8U-ML	TXM1.8X	TXM1.8X-ML	TXM1.8P	TXM1.6R	TXM1.6R-M	TXM1.6RL	TXM1.8RB	TXM1.8T
Digital inputs														
BI NO	Status indication, volt-free maintained contact, N/O contact	**1**	**8**	**16**	**8**	**8**	**8**	**8**						
BI NC	Status indication, volt-free maintained contact, N/C contact	**1**	**8**	**16**	**8**	**8**	**8**	**8**						
BI Pulse NO	Status indication, volt-free pulsed contact, ***N/O***	**1**	**8**	**16**	**8**	**8**	**8**	**8**						
BI Push NO BI Push NC	Button input single / dual, N/O Button input single / dual, N/C	**1/2**	**8/4**	**16/8**										
MI Switch	Multistate input	**2...8**	**4...1**	**8...2**										
	Count, volt-free pulse contact, mechanical or electronic, normally open, max. 10 Hz, with debouncing	**1**	**8**	**8**										
CI Mech (10/25Hz)	max. 25 Hz, with debouncing	**1**			**8**	**8**	**8**	**8**						
CI EI (100Hz)	Electronic contact max. 100 Hz	**1**			**8**	**8**	**8**	**8**						
Analog inputs														
AI Pt100 4 Wire	Temperature Pt100 Ω (4-wire)	**1**							**8**					
AI Pt100	Resistance 250 Ω (Pt 100)	**1**							**8**					
AI 250 Ohm	Resistance 250 Ω	**1**							**8**					
AI PT1K385	Temperature Pt 1000	**1**			**8**	**8**	**8**	**8**	**8**					
AI PT1K375	Temperature Pt 1000	**1**			**8**	**8**	**8**	**8**	**8**					
AI Ni1000 extended	Temperature LG-Ni 1000 up to 180 °C	**1**			**8**	**8**	**8**	**8**	**8**					
AI Ni1000	Temperature LG-Ni 1000	**1**			**8**	**8**	**8**	**8**	**8**					
AI 2500 Ohm	Resistance 2500 Ω	**1**			**8**	**8**	**8**	**8**	**8**					
AI Pt1000	Resistance 2500 Ω (Pt 1000)	**1**			**8**	**8**	**8**	**8**	**8**					
AI NTC10K	Temperature NTC 10 K	**1**			**8**	**8**	**8**	**8**						
AI NTC100K	Temperature NTC 100 K	**1**			**8**	**8**	**8**	**8**						
AI T1 (PTC)	Temperature T1 (PTC)	**1**			**8**	**8**	**8**	**8**						
AI 0-10V	Voltage DC 0 .. 10V	**1**			**8**	**8**	**8**	**8**						
AI 4-20mA	Current DC 4 .. 20 mA	**1**					**8**	**8**						
AI 0-20mA	Current ***DC 0…20 mA*** *(for 25 mA see CM10563)*	**1**					**8**	**8**						
Digital outputs														
BO Relay NO 250V BO Relay NC 250V	Maintained contact, relay, changeover switch, N/O, N/C contact	**1**								**6**	**6**			
BO Triac NO BO Triac NC	Maintained contact, triac, changeover switch, N/O, N/C contact	**1**												**8**
BO Bistable NO BO Bistable NC	Maintained contact, single-pole, bistable, N/O, N/C contact	**1**										**6**		
BO Pulse	Pulse	**1**								**6**	**6**			
BO Pulse On-Off	On/off pulse (N/O and N/C contact)	**2**								**3**	**3**			
MO Steps	Multistate-maintained contact	**1…6**								**6…1**	**6…1**			
MO Pulse	Multistate pulse	**2…6**								**3…1**	**3…1**			
BO 3-Pos Relay	Pulse, control signal, three-pos.output, internal stroke algorithm (relay)	**2**								**3**	**3**			
BO 3-PosTriac	Pulse, control signal, three-pos.output, internal stroke algorithm (triac, AC 24 V)	**2**												**4**
BO PWM	Pulse width modulation, output AC 24 V	**1**												**8**
BO Blind Relay	Blinds control with 2/3 end switches	**2/3**											**4/2**	
Analog outputs														
AO 0-10V	Proportional control signal DC 0...10 V	**1**			**8**	**8**	**8**	**8**						
AO 4-20mA	Proportional control signal DC 4…20 mA	**1**					**4**	**4**						
Indication and local override														
	Local override					**X**		**X**			**X**			
	LCD display					**X**		**X**						
	Green I/O status LEDs			**X**	**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**	**X**
	3-color I/O status LEDs (if supported by signal type)	**X**									**X**			

Example of a read operation

The Y250T function (control signal, three-position output) uses 2 I/O points.
One TXM1.6R relay module can accommodate 3 actuators.

2 Indicators and operator controls

2.1 Overview (example: super universal module)



Connection terminals (No. 1 screwdriver for slotted or recessed-head * screws)
with test point (1.8 ... 2 mm pins) and terminal number

Signal designation

Override status LEDs (yellow, types with local override only)

Address key and module status LED

LCD panel (not available on all types)

I/O point numbers

Override button (not available on all types)

I/O status LEDs (green – on certain types: three-color)

* Combined slotted / recessed-head screws from mid-2012

2.2 LED indicators

2.2.1 Module status LEDs

- The module status LED (green) is located on the I/O module under the transparent address key. It shows the status of the **module as a whole** (as opposed to the status of the I/O points):

Description	LED	
Normal	ON	• Module OK, all functions working correctly
Inactive	OFF	• No module supply • Plug-in module is in parked position • Faulty module (hardware error)
Reminders / Errors	Various flashing patterns	For details about errors please refer to the section "Indication, operation, and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

2.2.2 I/O status LEDs

- The status LEDs for individual I/O points (green or three colors [1]) are situated on the plug-in I/O module.
  They show the status of the input or output.
- The LEDs are labeled with the I/O point number.
- The display depends on the type of input/output signal:

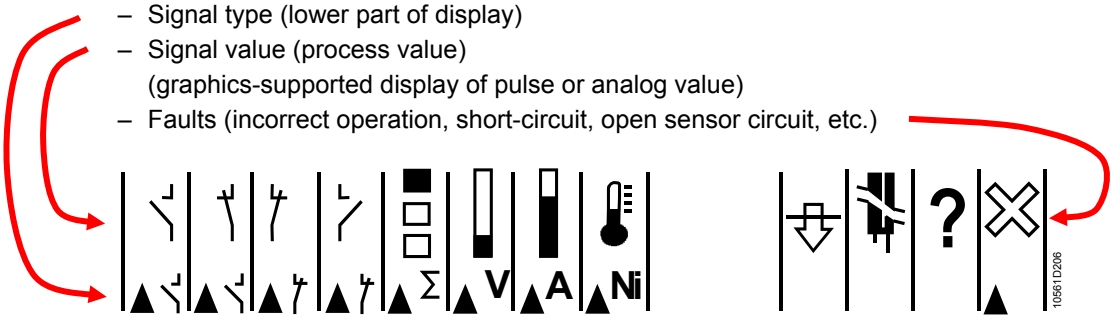
Description	LED (green) [1]	Field devices
Normal	OFF	N/O or N/C contact inactive, relay inactive
	ON	N/O or N/C contact active, relay active
	Brightness varies in proportion to input value	Analog input (current, voltage, temperature, resistance)
	No display	Analog input (temperature; P-bus BIM: also resistance)
	Brightness varies in proportion to output value	Analog output (current, voltage)
Reminders / Errors	Several flashing patterns	For details about errors please refer to the section "Indication, operation, and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

[1] On certain module types the LEDs are three-color. If the I/O function supports it, the LED can display Alarm = Red and Service = Yellow, in addition to Normal = Green (default).

2.2.3 LCD display

The following information is displayed for each I/O function:
– Signal type (lower part of display)
– Signal value (process value)
  (graphics-supported display of pulse or analog value)
– Faults (incorrect operation, short-circuit, open sensor circuit, etc.)

Examples



For details please refer to the section "Indication, operation, and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

Example: digital input

Signal type		Contact	I/O status LED	LCD	Process value
D20	N/O contact	Open	OFF		0
		Closed	ON ("N/O contact active")		1
D20R *)	N/C contact	Open	ON		0
		Closed	OFF ("N/C contact active")		1

*) If D20R is not supported: use D20 with *Polarity* = *Inverse*.

2.3 Local override

The local override and LCD facilities are available only on certain modules.
In principle, plug-in I/O modules with and without a local LCD panel/operator controls are compatible and interchangeable.

Only outputs can be overwritten. Any attempt to overwrite an input results in an error indication.

Local override also operates without a bus master, provided that the DC 24 V module supply is present and the address key is plugged in.

With a change from automatic mode to local override, the last state is retained.
The bus master resumes control when the system is switched back to Auto.

The bus master is notified of local overrides and the associated values, and they are permanently saved in the module (in CFC this is visible as follows:
StaFlg = Overridden, PrVal = set value).

Local override can be disabled for each single I/O function,

⚠ **Warning**

- **All safety-related functions must be implemented with external solutions**
- **The local override must not be used for safety switch-off**
- **In compliance with the standard (ISO 16 484-2, Section 3.110), the module executes all local overrides directly, without safety precautions or interlocks.**
  ➔ Full responsibility for all operations lies with the operator. ←
- For multistate outputs the outputs are locked electronically against each other.

2.3.1 Override buttons

Pressing an override button in the middle enables or disables the local override (press until the override status LED changes to ON or OFF).

When local override is enabled:
- Pressing "+" increases an output value or activates the relay.
- Pressing "–" reduces an output value or disables the relay.
- Repeated or sustained pressure changes the value by several stages until the function stops at the highest/lowest stage.
- The I/O status LED and LCD display change accordingly.

Pressing "+" or "–" when local override is disabled produces an "error" indication.

2.3.2 Override status LED

The yellow "Override" LED indicates that local override is active:

Description	LED (yellow)
Normal (Automatic operation)	OFF
Local override active	ON
Multi-stage function	• The function can be overridden on any I/O point associated to the function • LEDs of all the associated I/O points flash when operated
Reminders / Errors	For details about errors please refer to the section "Indication, operation, and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

2.3.3 Priority

Local override has first priority, followed by the various "functional tests" and (lastly) operation via process value.

2.4 Address key

- Without an address key, the module is in a secure, inactive state
- With the address key inserted, the module has its full functionality
- The module address is mechanically encoded in the address key
- Based on to the address the module receives information via the bus indicating which field devices are connected to this address, and which function is required for the field devices.
- When replacing the plug-in I/O module, the address key must FIRST be swiveled outward. This causes the load to be switched off and the values to be saved in the bus master. The key remains plugged into the terminal base and can indicate the required function to the new plug-in I/O module.

2.5 Function of the modules within the I/O subsystem

Start-up response of the modules

0.5 seconds after switching on the module supply DC 24 V via bus the modules are ready for communication.

I/O subsystem

Overall functionality of the I/O modules is based on the interaction of the following elements:
– Module (hardware)
– Firmware (functions)
– Configuration and parameter-setting of the I/O functions (see [8], [9])
– Communication via the bus
– Measurement and control application in the room automation station / the automation station

2.6 Fault messages

Quality value / Signal type	Normal	Invalid	No Output (DC 24 V)	No Output (AC 24 V)	Unreliable Other	Multistate Fault	Over Range	Under Range	Shorted Loop	Open Loop	No Sensor	Quality Value = part of process value
BI NO / NC	x	x										
BI Pulse NO / NC	x	x										
BI Push NO / NC	x	x										
CI Mech (10/25Hz), CI El (100Hz)	x	x										
BO Relay NO / NC 250V	x	x	x									
BO Triac NO / NC	x	x		x								
BO Bistable NO / NC	x	x	x		x							
BO Pulse On-Off	x	x	x									
BO Pulse	x	x	x									
MI Switch	x	x				x						
MO Steps	x	x	x			x						
MO Pulse	x	x	x			x						
AI xxx	x	x			x		x	x	x	x	x	
AO 0-10V, AO 4-20mA	x	x		x			x	x				
BO 3-Pos Relay	x	x	x									
BO 3-Pos Triac	x	x		x								
BO Blind Relay												x
BO PWM	x	x		x			x	x				

Quality value	Description
Normal	The function operates under normal conditions.
Invalid	The function is not operating. The process value is not valid.
No Output (DC 24 V)	Reliable operation can't be guaranteed due to low DC 24 V operating voltage. This item will only be sent if a switching operation has to be commanded.
No Output (AC 24 V)	Reliable operation can't be guaranteed due to missing / failed AC voltage. This item will be modified immediately when the AC voltage fails. The output will be switched off/inactive.
Unreliable Other BO Bistable	AC / DC24 V is not present. The “PowerDownModeAC24V” becomes active. Remark: Ifparameter [PowerDown ModeAC24V] is set to “Keep”, the “PowerDownModeAC24V” will not become active and the fault will not be set. With modules from **Series D**, however, it is compulsory to feed AC 24 V to bus conductor " V≂" . The module always monitors this supply. ***Simatic***: It is also admissible to connect DC 24 V to bus conductor " V≂".
Unreliable Other AI Measure	– The voltage on G8 is below a certain level. The external device delivering the current may be unreliable (for current measuring SignalTypes only). – The voltage on AC / DC 24 V is below a certain level. The external device delivering the voltage may be unreliable (for voltage measuring SignalTypes only).
Multistate Fault	Mapping error in multistate function.
Over Range	The sensor connected to the input is reading a value higher than the normal operating range.
Under Range	The sensor connected to the input is reading a value lower than the normal operating range.
Shorted Loop	The connection between the defined object and the physical device is providing a value indicating a short circuit condition.
Open Loop	The connection between the defined object and the physical device is providing a value indicating an open circuit condition. Exception: Pt 4-wire, open circuit of a single conductor.
No Sensor	4...20 mA current measuring signal type measures no current.
Quality Value = part of process value	The status and quality information are coded in the process value (raw data).

3 Digital input functions

I/O functions

The following functions for digital inputs are available in the TX-IO™ range:

Description	Signal type (TRA)	Signal type
Status indication, maintained contact N/O or N/C	BI NO BI NC	D20
Status indication, maintained contact N/C (***P-Bus-BIM only***)	--	D20R
Status indication, pulse contact N/O	BI Pulse NO	D20S
Pushbutton input single / dual	BI Push NO BI Push NC	--
Counting, pulse contact N/O	CI Mech (10/25Hz) CI El (100Hz)	C
Multistate input	MI Switch	--

3.1 Status indication, maintained contact (BI NO, BI NC / D20, D20R)

Application

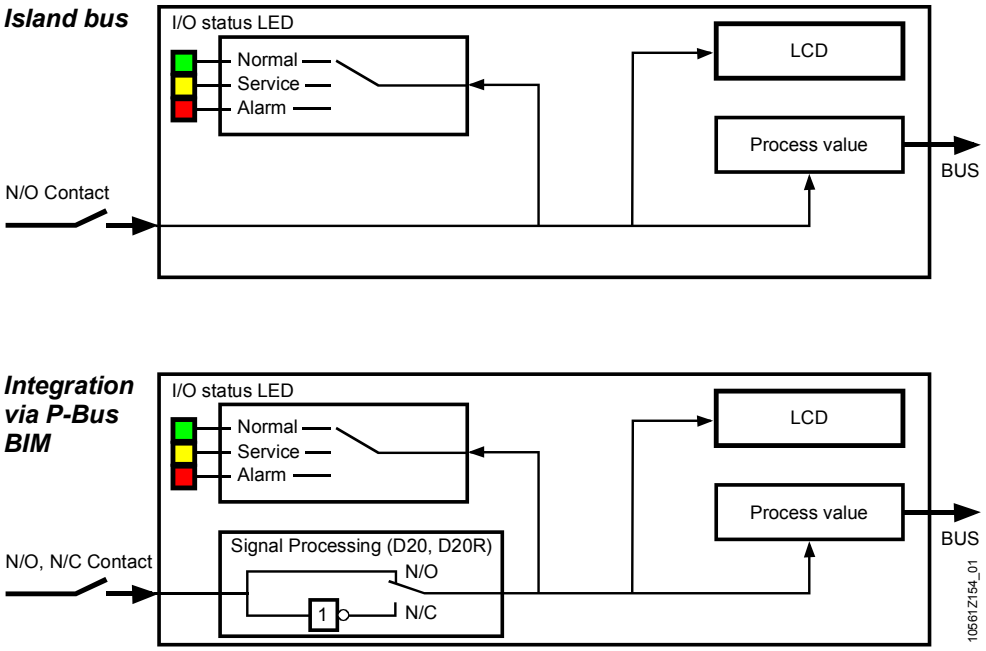
Acquisition of **status signals** from volt-free contacts and electronic switching devices such as transistors and optocouplers.

The status signals can be triggered by
- Two-position transmitters such as thermostats and pressure switches etc.
- Status contacts of devices and auxiliary contacts of starters / switches
- Electronic switching devices such as transistors and optocouplers
- Pushbuttons

Hardware

The function requires one I/O point.

Function



Block diagram of function

- The signal is read at regular intervals and debounced on hardware level
- An additional debounce time is available: 0…25.5 s (default = 0 s)
- Pulses of more than 20 ms from pushbuttons are registered and kept ready for polling
- ***Desigo XWORKS plus:*** Only D20 (N/O) is available. Inversion (D20R, N/C) must be realized via inverting in the parameterization.
- ***P-Bus BIM*** : The configuration (D20. D20R) sets the contact type (N/O or N/C)
- The meaning of the I/O status LED can be parameterized (TXM1.8D only): Normal = green (default) / Alarm = Red / Service = Yellow.
- The signal operation can be selected: Contact_NO (default), Contact_NC)
- As a result
  - The **I/O status LED** is activated.
  - The **process value** is communicated over the bus
  - The **LCD** is activated

Local override

Digital inputs cannot be overridden locally. The override button has no effect, and if an attempt is made to operate it, an error is displayed.

Display

- The **I/O status LED** shows the source signal
- The **LCD panel** (if available) shows the source signal type (status contact, N/O or N/C contact) and the state of the contact:

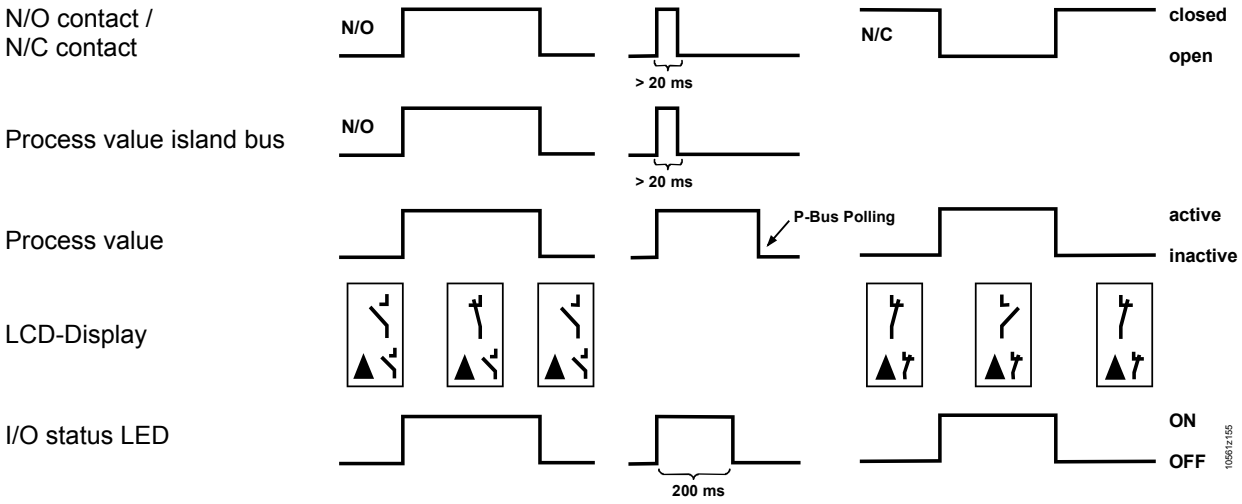


Diagram: Cause and effect

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

3.2 Status indication, pulse contact (BI Pulse NO / D20S)

(Function for ***P-bus BIM***: See section 3.3)

Application

Used for the acquisition of **status pulses** from volt-free pulse contacts and electronic pulse transmitters such as transistors and optocouplers.

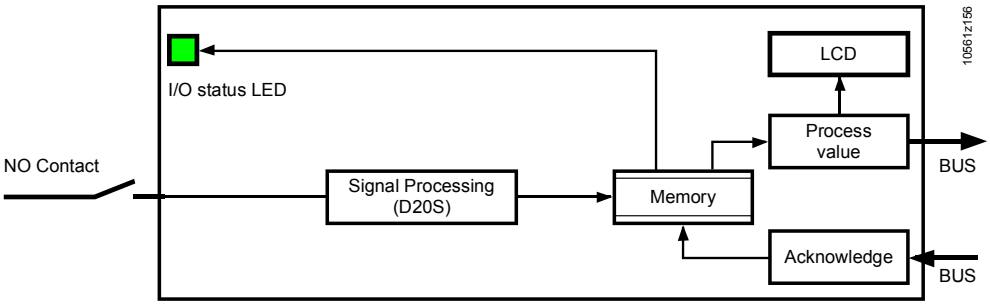
The pulses can be triggered by:

– Mains voltage monitoring systems
– Emergency pushbutton signals, e.g. in elevators
– Start-up monitoring for analysis of faults

Hardware

- The function requires one I/O point

Function



Block diagram of function

- The signal is read and debounced on hardware level
- An additional debounce time is available: 0…25.5 s (default = 0 s)
- The pulse is then saved and transmitted to the bus master
- The bus master acknowledges receipt (Acknowledge)
- The memory is cleared, the LED goes off, and the input is ready for a new pulse
  Additional incoming pulses before the Acknowledge are ignored.
- The signal operation can be selected: Contact_NO (default), Contact_NC)

Local override

Digital inputs cannot be overridden locally. The override button has no effect, and if an attempt is made to operate it, an error is displayed.

Display

- The **I/O status LED** does not show the source signal, but the state of the **signal memory**
- The **LCD panel** (if available) shows the **source signal type** (status contact, N/O or N/C contact)
- **The LCD panel** shows the **change** (a block of 3 fields which change with each pulse):

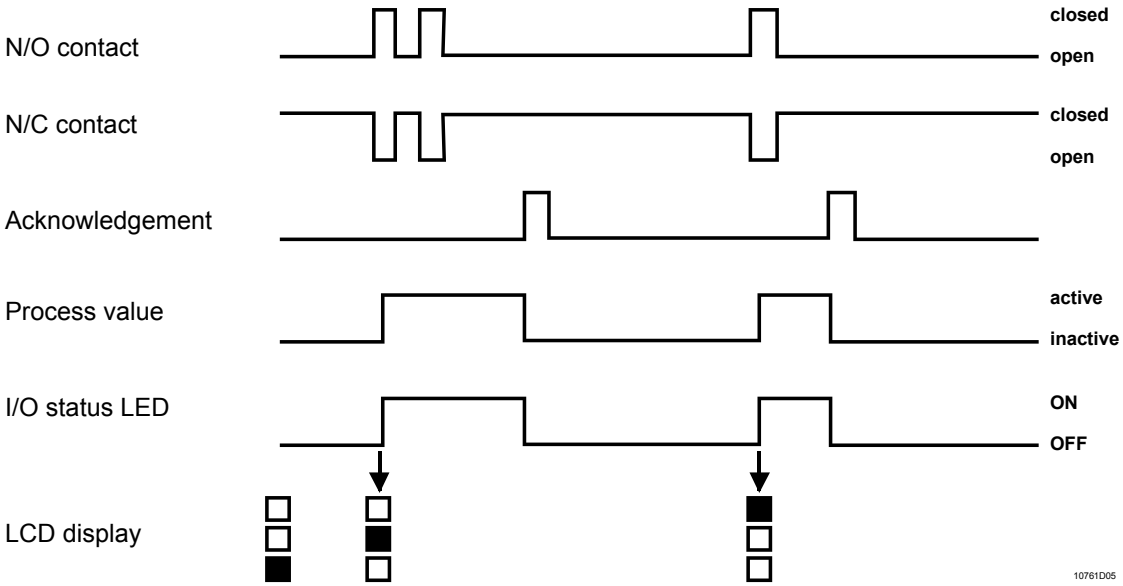


Diagram: Cause and effect

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" the TX-I/O™ Engineering and installation guide [6].

Response in the event of a fault

In the event of an **interruption in communication** with the bus master, it makes no sense to store old pulses. Therefore, the memory and the acknowledgment are bypassed and the pulses are displayed directly.

3.3 Status indication, pulse contact *(P-Bus-BIM)* (D20S, realized with BI Static)

(Function for island bus: See section 3.2)

Application

Used for the acquisition of **status pulses** from volt-free pulse contacts and electronic pulse transmitters such as transistors and optocouplers.

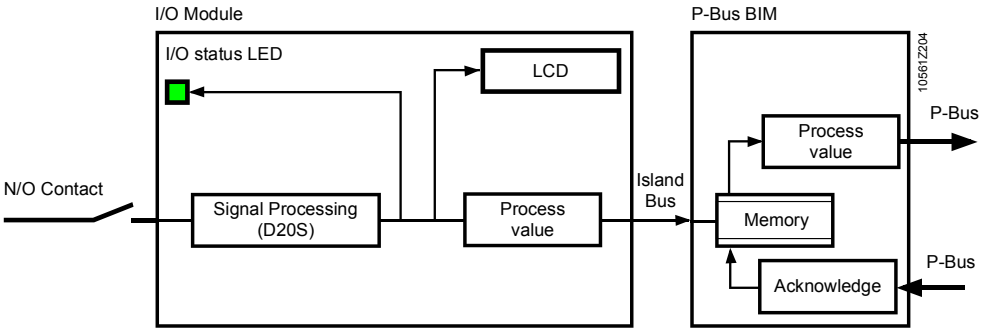
The pulses can be triggered by:

– Mains voltage monitoring systems
– Emergency pushbutton signals, e.g. in elevators
– Start-up monitoring for analysis of faults

Hardware

- The function requires one I/O point
- The TX-I/O modules support only inputs with N/O contacts.

Function



Block diagram of function

- The signal is read and debounced (pulses longer than 20 ms)
- The pulse is then saved in the P-bus BIM and transmitted to the automation station
- The automation station acknowledges receipt (Acknowledge)
- The memory is cleared, and the input is ready for a new pulse
  Additional incoming pulses before the Acknowledge are ignored.

Local override

Digital inputs cannot be overridden locally. The override button has no effect, and if an attempt is made to operate it, an error is displayed.

Display

- The **I/O status LED** shows the source signal
- The **LCD panel** (if available) shows the **source signal type** (status contact, N/O) and the activity of the contact
- However, for quickly changing signals, a maximum changing frequency of 5 Hz is maintained by the displays.

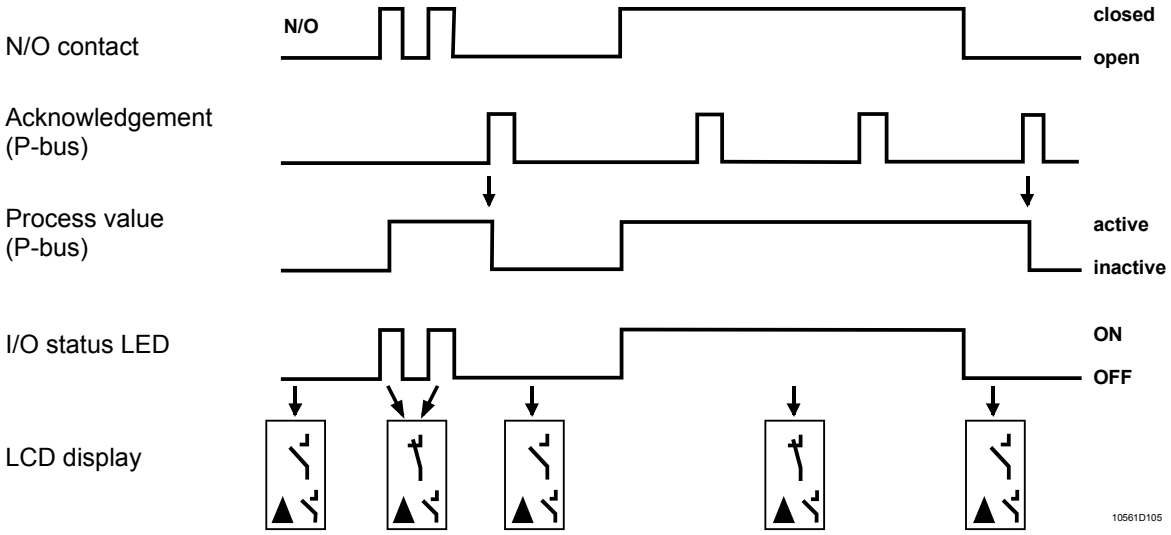


Diagram: Cause and effect

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" the TX-I/O™ Engineering and installation guide [6].

Response in the event of a fault

In the event of an **interruption in communication** with the automation station, the last unpolled pulse is stored in the module. and the incoming pulses on the module continue to be displayed..

3.4 **Pushbutton input** (BI Push NO, BI Push NC)

Application

Acquire potential-free **button pulses** (simple button/dual button).

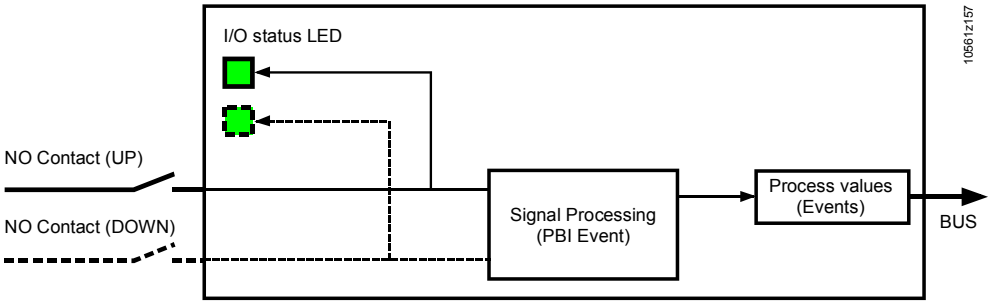
The process values (event telegrams) are evaluated in the bus master and help to control:

– Blinds
– Lighting applications
– Other applications controlled by pulses

Hardware

- The function uses one or two I/O points (simple/dual button).
  In case of a dual button, both I/O points must be located next to each other on the same module pattern.
- Only modules from series D support this function.

Function



Function diagram

- The signals are read and debounced on hardware level
- The pulses are interpreted and converted to corresponding events.
  The function then sends events at the start, the end, and partially during the pulse (standard pulse patterns are:
  – Short pulse
  – Long pulse
  – Short double-click
  – Short/long double-click
  – Long double-click
  – Dual click (simultaneous clicking of two buttons)
- The events are sent immediately on the island bus
- A new event prior to sending overwrites a previous event. *Exceptions:*
  – *Repeat does not overwrite start*
  – *Heartbeat (due to COVperiod) does not overwrite upcoming events*
- The signal operation can be selected: Contact_NO (default), Contact_NC)

Process value

The following events (telegrams) are used:

Event	Description
Tg 1	Report on current status (for COV repetition)
Tg 2	Rising slope (start of short or long pulse)
Tg 3	Click completed
Tg 4	Start of a long pulse
Tg 5	Repeat, long pulse active
Tg 6	Long pulse completed
Tg 7	Start short double-click
Tg 8	Short double-click completed
Tg 9	Start short/long double-click
Tg 10	Start long double-click (two clicks with one long pulse at start)
Tg 11	Long double-click completed
Tg 12	Dual click (both buttons pressed simultaneously)
Tg 13	Dual click completed

Parameterization

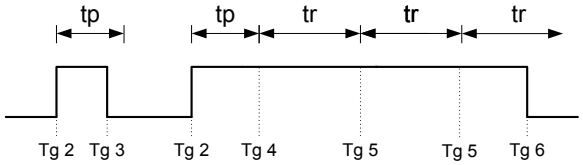
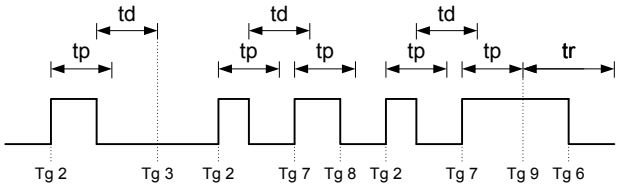
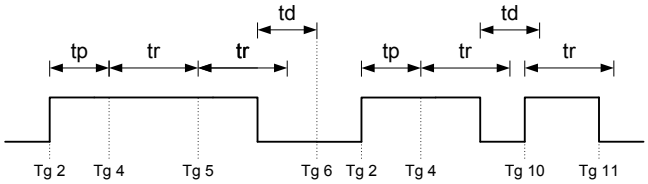
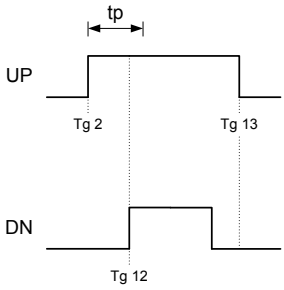
Normally, preparameterized buttons are used that are customized for the blinds/lighting applications to be used.

If individual parameterization is required, the function provides great flexibility to implement any operating philosophy.
The following parameters are available:

Parameter	Description			Default
Source.Size	1 or 2 (simple/dual button)			1
tp	Pulse length	0.1...25.5 s	(increment 0.1 s)	0.5 s
tr	Repeat length	0.1...25.5 s	(increment 0.1 s)	1.0 s
td	Double-click length	0.1...25.5 s	(increment 0.1 s)	0.5 s

Enable Flags	If set	If not set	Default
Positive Edge Enable	Rising slope sent	Rising slope not sent	Disabled
Stop Long Enable	Sends Tg 6 at the end of a long pulse	Falling slope for long pulse (Tg 6) not sent.	Disabled
Stop Long Double Enable	Sends Tg 11 at the end of a long double-click	Falling slope for long double-click (Tg 11) not setn	Disabled
Repeat Enable	Repeats Tg 5 with interval of tr while button is pressed	Sends no Tg 5	Enabled
ShortDoubleClick Enable	Sends Tg7, Tg8, Tg9, if short or long/short double-click is identified (second rising slope before expiration of td td)	Sends no Tg 7, Tg 8, Tg 9. Also no status transition to first pulse.	Disabled
LongDoubleClick Enable	Sends Tg 10, if long double-click identified (second rising slope after long pulse)	Sends no Tg 10 and no Tg 11. Also no status transition to Long Pulse.	Disabled
DualClick Enable	Sends Tg12, Tg13, if both buttons pressed within tp	Sends no Tg 12, Tg 13. Also no status transition to DualClick	Disabled

Examples

Events identified	Zeitlicher Ablauf mit gesendeten Events	Flags
• Rising slope • Short pulse • Long pulse • Very long pulse (Tg 5 activated) • Falling slope		ShortDoubleClick disabled
• Rising slope • Short pulse • Short double-click • Short/long double-click • Falling slope		ShortDoubleClick enabled
• Rising slope • Long pulse • Long double-click • Falling slope		LongDoubleClick enabled
• Rising slope • Dual click (both buttons simultaneously) • Falling slope		DualClick enabled

Local override

Digital inputs cannot be operated locally.

Display

The I/O status LED is ON when when the N/O connected contact is closed

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

3.5 Multistate input maintained contact (MI Switch)

Application

- Mapping of several digital inputs to a single multistate value.
- 3 different mapping kinds are available:
  - 1 to n mapping
  - Up-down mapping
  - Binary mapping

Signal types

This feature covers the following signal type.

Signal type	Description
MI Switch	Maintained contact, multistate, NO contact.

Hardware

- This function uses one I/O point for each stage.
- The I/O points must be on the same module and adjacent to each other.
- 2...8 I/O points are admissible.

Function

- The signal operation can be selected: Contact_NO (default), Contact_NC)
- Depending on the mapping kind, the I/O points can be active one by one or simultaneously.
- The following mapping kinds can be parameterized (parameter *Mapping Kind*):
  - 1 to n mapping
  - Up-down mapping
  - Binary mapping

1 to n mapping

- The multistate process value is mapped so that the mapping table defines just one input to be active.
  Before the process value *MIValue* changes, a time delay *SwitchOverTime* must elapse, in order to debounce mechanical contacts (0...22.5 s, Default = 0.4 s).
- In the *Mapping Table* parameter, the default assignment of the I/O points to the values of *MIValue* can be changed (for*1 to n mapping* only!).
- If more than one input is active, a Reliability Error message is transmitted (Quality = MULTISTATE_FAULT) and the last valid process value stays active.

Default mapping table

Active I/O point	MIValue	Stage
None	0	0
n	1	1
n + 1	2	2
n + 2	3	3
n + 3	4	4
:	:	:
n + 7	7	7

Example of a modified table

Active I/O point	MIValue	Stage
None	2	0 / Auto
n	1	1
n + 1	3	2
n + 2	4	3

Up-down mapping

- The multistate process value is mapped so that the mapping table specifies one or more inputs to be active.
- It is possible to have several active inputs, but only in a fixed coding.
- Examples: Enabling additional electrical heating or burner stages
- If no input combination corresponding to the process value is found in the mapping table, a Reliability Error message is transmitted (Quality = MULTISTATE_FAULT) and the last valid process value stays active.

Active I/O points	MIValue	Stage
None	0	0
n	1	1
n, n+1	2	2
n, n+1, n+2	3	3
n, n+1, n+2, n+3	4	4
:	:	:
n, n+1, n+2, n+3, ..., n+7	8	8

Binary mapping

- The multistate process value is mapped so that the mapping table specifies one or more inputs to be active.
- It is possible to have several active inputs.
- Examples: Enabling additional electrical heating or burner stages.

Active I/O points						MIValue	Stage
n	n+1	n+2	n+3	...	n+7		
0	0	0	0		0	0	0
1	0	0	0		0	1	1
0	**1**	0	0		0	2	2
1	**1**	0	0		0	3	3
0	0	**1**	0		0	4	4
:	:	:	:		:	:	:
1	**1**	**1**	**1**	**...**	**1**	255	255

Display

- The **I/O status LEDs** indicate the activity of the **inputs**
- In the case of an error the module status LED and all the I/O status LEDs assigned to the function flash.

Local override

Inputs cannot be operated on the module.

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

3.6 Counting, pulse contact
(CI Mech (10/25 Hz), CI EI (100Hz) / C)

Application

Acquisition of **counter pulses** from

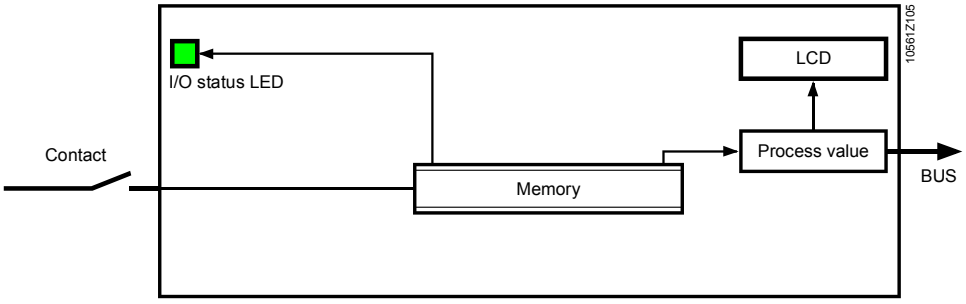
– Heat meters
– Flow meters
– Electricity meters

In conjunction with energy metering, the counter function can also be used for the acquisition of synchronization pulses, which may
– trigger the start of a new measuring period, or
– initiate a switching event (change of tariff, load-shedding).

Hardware

The function requires one I/O point.

Function



Block diagram of function

- The signal is debounced on hardware level and registered
- The function reacts on the closing edge of the signal, registers the counter pulses and accumulates them in the memory.
- You can choose a mechnical or an electric counter under *Pulse Generator*:
  – mechanic contact ⇒ Counting frequency up to 25 Hz
  – electric contact ⇒ Counting frequency up to 100 Hz
- Certain module types support lower frequencies, see module data sheets and the overview in section 1.7.
- The value stored in memory is available in the process value
  – ***P-bus BIM***: The P-bus is limited to 64 units (6 bits). This means that for counting at 25 Hz the cycle time of the automation station must be set to ≤2 s.
  – The memory has a maximum value of $(2^{32})–1$ ($\approx 4.3 \times 10^{9}$).
- The value of the memory can be deleted, or set via one of the parameters *AddCorrValue, SubCorrValue* or *NewCIValue* $(2^{32})–1$
- The behavior of the counter at *Power-Up* can be set as follows (only in the I/O Address Editor):
  – *Reset*
  – *Last value* (last value from buffer)
- *COV Limit* and *COV Period* define the amount of change and the interval for updates to be sent on the island bus by the module.

Local override

Digital inputs cannot be overridden locally. The override button has no effect, and if an attempt is made to operate it, an error is displayed.

Display

- The LED lights up in accordance with the existing signal status
- Modules with an **LCD panel** display the source signal "Σ" (Counter), plus a block of 3 fields which change with each pulse:

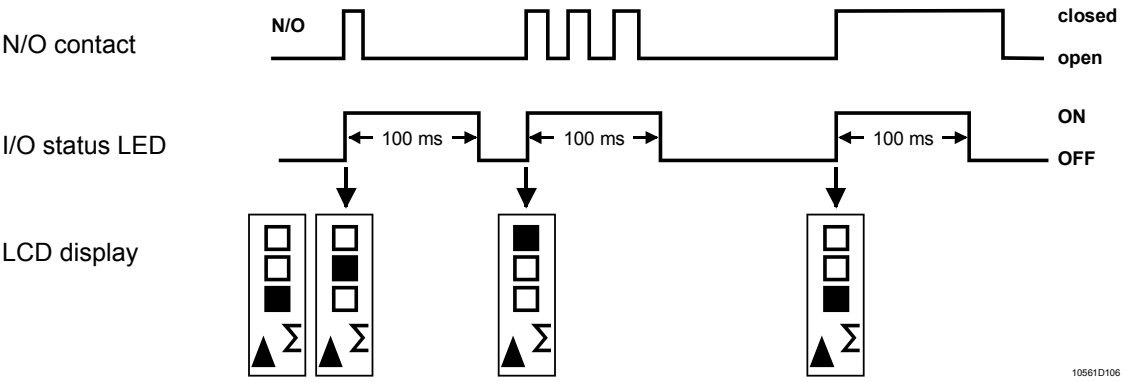


Diagram: Cause and effect

The LEDs and LCD icons take at least 100 ms to change their state, even if the signals have a higher frequency.

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

Response in the event of a fault

- In the event of a **communication failure** the counter function is maintained.
  The counter values
  – continue to be accumulated
  – are indicated by LED
  – periodically buffered
    – only if *Power Up* = Last Value
    – immediately after communication failure, and then each 15 min for max. 3 days (the number of write actions on the FLASH memory are limited).

- In the case of **lacking module supply**, the behavior depends on the configuration value *Power Up*
  – Reset: upon the next start-up, the counter is reset to 0
  – Last Value: upon the next start-up, the counter is reset to the last value of the buffer; some pulses may be lost.

- When communication is restored, the bus master polls the counter reading again.

4 Analog input functions

4.1 Measurement

Application

The following analog variables can be processed:

- Temperature, via resistance sensors
- Resistance
- Voltage
- Current

Configurable signal types

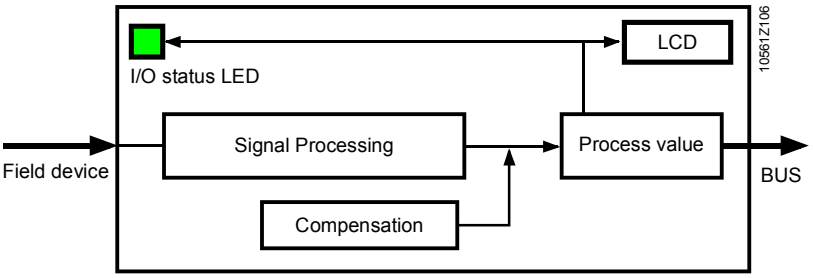
Description	Signal type TRA	Signal type	Range	Under / over range [6]	Reso-lution	I/O status LED	LCD	Error indication: Shorted	Under range	Over range	Open circuit	No current transmitter	Unreliable (gen.) [4]
Resistance & temperature	AI Pt1000	P1K	0...2500 Ω	0...2650 Ω	100 mΩ	OFF	Sensor type			x	x		
	AI Pt100 [2), 8)]	P100	0...250 Ω	0...265 Ω	20 mΩ	OFF	(No LCD)	No LCD [2), 8)]					
	AI 2500 Ohm	R2K5	0...2500 Ω	0...2650 Ω	100 mΩ	variable	variable			x	x		
	AI 250 Ohm [2)]	R250	0...250 Ω	0...265 Ω	10 mΩ	variable	(No LCD)	No LCD [2)]					
Temperature	AI Ni1000	R1K	-50...150°C	-52.5...155 °C	10 mK	OFF	Sensor type	x	x	x	x		
	AI Ni1000 extended	Ni1K	-50...150 (180) °C [1)]	-52.5 ...185 °C	10 mK	OFF	Sensor type	x	x	x	x		
	AI PT1K375 (USA)	Pt1K 375	-50...150 (180) °C [1) 7)]	-52.5 ...185 °C	10 mK	OFF	Sensor type	x	x	x	x		
	AI PT1K385 (Europe)	Pt1K 385	-50...400 (600) °C [1)]	-52.5...610°C	20 mK	OFF	Sensor type	x	x	x	x		
	AI Pt100 4 wire [2), 8)]	Pt100_4	-50...400 (600) °C [1)]	-52.5...610°C	20 mK	OFF	(No LCD)	No LCD [2), 8)]					
	AI NTC10K	NTC10K	-50...130 (150) °C [1)]	-52.5...155 °C	10 mK	OFF	Sensor type	x	x	x	x		
	AI NTC100K	NTC100K	-40...115 °C	-52.5...155°C	10 mK (25 °C)	OFF	Sensor type	x	x	x			
	AI T1 (PTC)	T1	-40...125 °C	-52.5...155°C	10 mK (25 °C)	OFF	Sensor type	x	x	x			
Voltage	AI 0-10V	U10	0...10 V	-1.5...11.5 V	1 mV	variable	variable		x	x	x		x
Current	AI 4-20 mA	I420	4...20 mA	1.6...22.4 mA	1 µA	variable	variable		x	x		x	x
	AI 0-20 mA [5)]	**I25**	***0...20 mA***	-3.0...23 mA	1 µA	variable	variable		x	x			

1) *(180) (600) (150) and NTC only with reduced hum injection, see [6]*
2) The signal types AI Pt100, AI Pt100 4 wire and AI 250 Ohm run on the TXM1.8P module only, which has no LCD display.
   In the case of **direct island bus integration**, AI Pt100 4 wire and AI Pt100 are connected with 4 wires, AI 250 Ohm with 2 wires.
   In the case of **P-bus BIM integration (V4)**, AI Pt100 (P100) is connected with 4 wires, AI 250 Ohm (R250) with 2 wires and jumpers to 4 terminals (as PTM-I/O); connection diagram see data sheet N8176.
   The resolution with island bus is significantly better than with P-bus BIM.
4) The "unreliable (general)" error message is displayed:
   - when *AC 24 V* (terminal V~) for field supply is not available or low (AI 0-10V)
   - when *DC 24 V* (terminal V⎓, CS) for field supply is not available or low (AI 4-20mA, AI 0-20mA)
5) For 25 mA use signal type AI 0-10V and install a shunt of 400 Ohms (1 W, 0.1 %). Details: [7].
6) When the process value is out of range, an error message will be sent.
7) AI PT1K375: No restriction concerning hum injection for TXM1.8U und TXM1.8X.
8) An open circuit of a single conductor cannot be detected for these signal types.

Hardware

The functions require one I/O point.

Function



Block diagram of function

- The function measures the input signal at regular intervals
- The process value is calculated according to the signal
- The admissible range for the input values is monitored so that any signal out of range / sensor short circuit / sensor open circuit is identified. Exception: an open circuit of a single conductor cannot be detected for the signal types AI Pt100 and AI Pt100 4 wire.
  The range monitoring of signal type U10 is done with a short NEGATIVE signal of – 3,1 V, 0.05 mA (open circuit detection). If a field device has an open output, a negative voltage could appear there. This can damage any polarized components (e.g. capacitors).
- For temperature measuring, the process value is corrected by the internal *Compensation* value (0.00…100.00 Ohm, default = 1 Ohm), to compensate for the line resistance. Pt100_4, P100, NTC10K and NTC100K: 0 Ohm.
- If the line resistance differs significantly from 1 Ohm, [Icpt] can be changed in the AI block (see description in [6]).
- *COV Limit* and *COV Period* define the amount of change and the interval for updates to be sent on the island bus by the module.

Note!

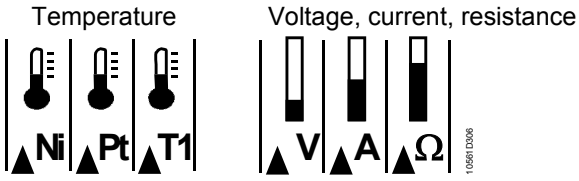
- As a result
  – the **I/O status LED,** which describes the **source signal**, is activated
  – the **process value** is displayed on the **LCD panel** (not for temperatures)
  – the **process value** is communicated over the bus.

Local override

Analog inputs cannot be overridden locally. The override button has no effect, and if an attempt is made to operate it, an error is displayed.

Display

- The **I/O status LED** varies in intensity in proportion to the **input value** (voltage, current, resistance). There is no display for temperature (***P-Bus BIM*** also resistance)
- If an **LCD panel** is available, the input signal is displayed, together with a graphics-based display of the **process value** (voltage and current, resistance).
  There is no variable display for temperature (***P-Bus BIM*** also resistance).



Response in the event of a fault

- **Field device faults** (invalid process value, values below low limit or above high limit, short circuit and open circuit) are displayed on the LCD and reported to the bus master.
- The I/O status LED and the module status LED flash

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

5 Digital output functions

5.1 General information on the digital outputs

I/O functions

The following functions for digital outputs are available in the TX-IO™ range:

Signal type (TRA)	Signal type	Description
BO Relay NO 250V BO Relay NC 250V (Section 5.2)	Q250	Maintained contact, relay, changeover [1] (also control of Step switches, pulse switches, bistable relays)
BO Triac NO BO Triac NC (Section5.3)	--	Maintained contact, triac Control of AC 24 V devices, especially thermic and motoric actuators Admissible load per I/O point: see data sheet N8179.
BO Bistable NO / NC (Section 5.4)	--	Maintained contact, bistable (for lighting applications, behavior in case of power fail and bus fail can be parameterized)
BO Pulse On-Off (Section 5.5)	Q250-P / Q250A-P	On/off pulse, N/O and N/C contact
BO Pulse (Section 5.6)	--	Pulse
MO Steps (Section 5.7)		Maintained contact [1]; mutually exclusive electronic relay interlock
MO Pulse (Section 5.8)	Q-M1…M4	Multistate pulse mutually exclusive electronic relay interlock
BO 3-Pos Relay BO 3-Pos Triac (Section 5.9)	Y250T	Pulse, control signal, three-position output, internal stroke algorithm [1]
BO PWM (Section 5.10)	--	Pulse width modulation, output AC 24 V
BO Blind Relay (Section)	--	Maintained contact relay, blinds control with 2 / 3 end switches Admissible load per I/O point: see data sheet N8178.

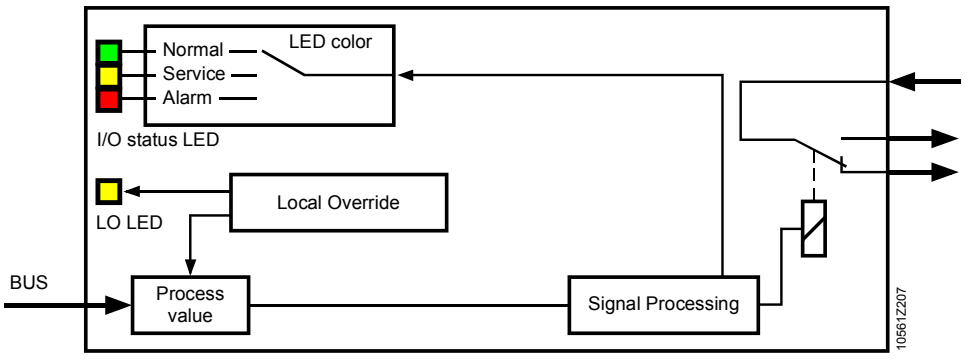
[1] *Feedback must be implemented using separate inputs*

Hardware

All relays in TX-I/O modules are equipped with changeover contacts.
Exceptions:

- TXM1.6RL, see section 5.3)
- TXM1.8RB, see section 5.11)

Function



Block diagram of function

- When detected, a new process value is carried out by the relay according to the I/O function.
- The meaning of the I/O status LED can be parameterized:
  Normal = green (default) / Alarm = Red / Service = Yellow.
- The way in which local override operates depends on the I/O function concerned (one or multi-stage, maintained contact or pulse).

Local override

- Local override has first priority, followed by the various "functional tests" and (lastly) operation via process value.
- Tool override of an I/O point is indicated by the flashing of the module status LED.
- With a change from automatic operation to local override, the process value (and thus the status of the devices concerned) is retained until the user overrides it.
  The same applies after the resumption of automatic operation, until the bus master sends a new process value.
- For each I/O function local override can be disabled in the configuration.

For a full description see section 2.3, local override.

Engineering notes

- Self-latching must be implemented externally to the I/O modules.
- The relay outputs associated with a function are mutually interlocked, which means that these relays cannot be used independently of one another. It is therefore recommended that **contactors always be interlocked by external means** (see the connection diagrams in the data sheets).
- Feedback signals must be implemented separately, via a digital input.

Warning

- **All safety-related functions must be implemented with external solutions**
- **The local override must not be used for safety switch-off**
- **In compliance with the standard (ISO 16 484-2, Section 3.110), the module executes all local overrides directly, without safety precautions or interlocks.**
  ➔ Full responsibility for all operations lies with the operator. ←

Behavior in case of a fault

Possible faults

- Address key is swiveled out
- Failure of the module supply voltage DC 24 V (Powerdown)
- Failure of bus master (Masterdown, no datagram received for more than 4 s)

Overview: behavior in case of a fault

Signal type TRA	**Signal type**	**Response in the following cases** – No address key – Powerdown – Masterdown, *integration via P-bus BIM*	**Response in the following case** – Masterdown, *direct island bus integration*	**Behavior when fault has been cleared**
BO Relay NO 250V BO Relay NC 250V	Q250	The relays are de-energized *)	The behavior can be parameterized: the relays are de-energized, keep the last position, or take a parameterized state.	**Automatic operation:** operation according to process value **Tool override or local override:** Operation in the same state as before the fault (the commanded value is saved in the module
BO Triac NO 250V BO Triac NC 250V	--	The Triacs are de-energized	The behavior can be parameterized: the triacs are de-energized, keep the last position, or take a parameterized state.	
BO Relay NO 250V (Schrittschalter, Stromstossrelais, bistabiles Relais)	Q250	The relays are de-energized *) The switch status of the power contactors is maintained (step switch).	The behavior can be parameterized, BUT: *Do NOT parameterize "Keep" or "ON", as only pulses are needed for step switches / bistable relays*	
BO Bistable NO BO Bistable NC	--	*Behavior can be parameterized, see section 5.4*		
BO Pulse On-Off	Q250-P / Q250A-P	The relays are de-energized *) The switch status of the power contactors is maintained (due to self-latching or dual coil relay)	The behavior can NOT be parameterized, The relays are de-energized	
MO Steps	Q-Mx	The relays are de-energized *) The switch status of the power contactors is maintained by means of self-latching.	The behavior can be parameterized: the relays are de-energized, keep the last position, or take a parameterized state.	
MO Pulse	Q250-P1…P5	The relays are de-energized *) The switch status of the power contactors is maintained by means of self-latching.	The behavior can be parameterized: the relays are de-energized, keep the last position, or take a parameterized state.	
AO 3-Pos Relay AO 3-Pos Triac	Y250T	The actuator keeps its last position.	The behavior can be parameterized: the actuator goes to 0%, keeps the last position, or goes to a parameterized position.	
BO PWM	--	The Triacs are de-energized	The behavior can be parameterized: the signal goes to 0 %, keeps the last position, or takes a parameterized state.	
BO Blind Relay	--	The relays are de-energized	The behavior can be parameterized: all outputs are de-energized, the last command is completed, or the blind goes to a parameterized position. Additionally a time delay can be set.	

*) When using a normally-closed contact, a closed contact can be forced even if the relay is de-energized.

5.2 Maintained contact, switchover (BO Relay NO / NC 250V / Q250)

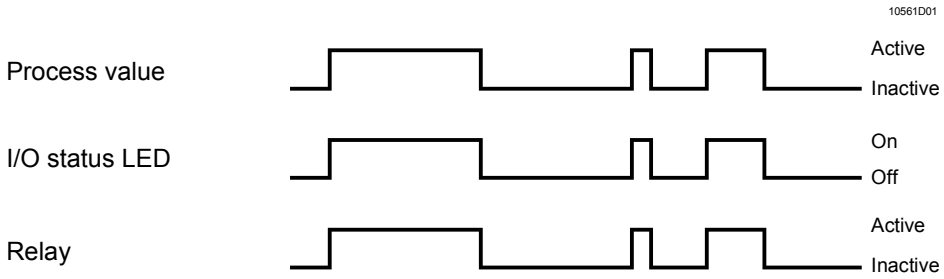
Application

On/off switching of a wide range of devices and loads, e.g.:
- Power contactors
- Relays and semi-conductor relays
- Motors
- Burners (control loop)
- Chillers and heat pumps (control loop)
- Magnetic valves
- Display units and audible indicator units
- Step switches, pulse switches, bistable relays

Hardware

- The function requires one I/O point
- The TX-I/O relay modules have changeover contacts
  By use of a normally-closed contact, a closed contact can be forced even if the relay is de-energized.

Function



The signal operation can be selected: Relay (Default), Relay_NA

Parameterization

In the case of **bus failur**e, with DC 24 V module supply available, the following backup states van be parameterized:
- No (Inactive) (= default)
- Value (Active, Inactive)
- Keep Same value as before the bus failure

Parameterization can be done during operation.

Local override

- Pressing the override button in the middle enables/disables the local override.
  The yellow override status LED indicates that local override is active
- When local override is active:
  Pressing "+" sets the process value to "Active"
  Pressing "–" sets the process value to "Inactive".
- Local operation can be disabled in the configuration.

Warning!

It is not admissible to couple several BOs of type Q250 to one multistate output in the bus master. Reason: local override or each single I/O point is possible, which may create hazardous situations. Use a multistate signal type instead, where the outputs are electronically latched in the module.

Display

- The **I/O status LED** is ON when the **relay** is active, i.e. when the N/O contact is closed and the N/C contact is open.
- In the event of an error, the **I/O status LED** and the **module status LED** flash.
- The meaning of the I/O status LED can be parameterized (TXM1.6R-M only): Normal = green (default) / Alarm = Red / Service = Yellow.

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

5.3 Maintained contact, triac (BO Triac NO / NC)

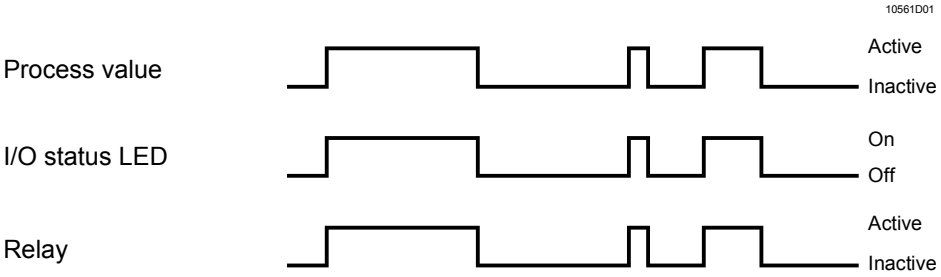
Application

On/off switching of AC 24 V devices, especially:
– Frequent switching (triacs do not have any problems with contact life span)
→ However, check the admissible switching frequency of the connected device and adjust the parameters or the application accordingly.
– Other devices with AC 24 control
– silent switching

Hardware

- The function is supported by module type TXM1.8T only.
- The function requires one I/O point.
- The supply is AC 25 V, the triay closes the contact to ⊥ (system ground).
- Technical data (max. output of the triacs): see data sheet N8179.

Function



The signal operation can be selected: Triac (Default), Triac_NA

Parameterization

In the case of **bus failur**e, with DC 24 V module supply available, the following backup states van be parameterized:
– No (Inactive) (= default)
– Value (Active, Inactive)
– Keep Same value as before the bus failure

Parameterization can be done during runtime.

Display

- The **I/O status LED** is ON when the **triac** is active, i.e. when the N/O contact is closed and the N/C contact is open.
- In the event of an error, the **I/O status LED** and the **module status LED** flash.

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

Local override

TXM1.8T has no local override.

Fault message

The quality value "No_Output" is sent when AC 24 V is absent.
In this case the triac can not be activated → the module switches the output off and sets the process value to 0.

The fault message is only sent when a command is pending.

5.4 Maintained contact, bistable (BO Bistable NO / NC)

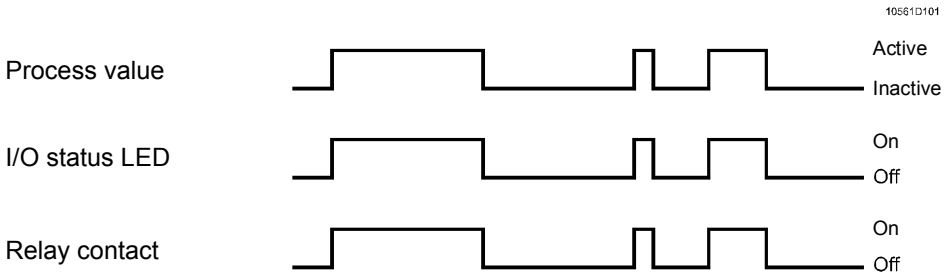
Application

On/off switching of devices and loads.
Interruption of the power supply or the bus communications: the last state of the relays is maintained (bistable relays). In addition, the module supports setting of a backup state as well as a time delay before this backup state becomes effective.
– Light control
– Control of subsystems with uninterruptible operation

Hardware

- The function is supported by module type TXM1.6RL only
- The function requires one I/O point
- The module has N/O contacts only
- The relay contacts are especially adapted for light applications

Function



The signal operation can be selected: Relay (Default), Relay_NA (NA = normally active).

Bus failure

In case of **bus failure** (Masterdown), where the DC 24 V module supply is intact, the following backup states can be parameterized:
– No (Same effect as Value Off)
– Value (On / Off)
– Keep Same value as before the fault (= default)
– Delay before the backup state becomes effective:
(0...6553s, default 120s, steps of 0.1s).

Parameterizing can be made during operation.

Powerfail DC 24 V

A powerfail DC 24 V always induces a bus failure - see above.

Powerfail AC 24 V

In case of **powerfail AC 24 V** (Powerdown AC 24 V), the following backup states can be parameterized:
– No (Same effect as Value Off)
– Value (On / Off)
– Keep Same value as before the fault (= default)

Parameterizing can be made during operation.

This function is available with relay type TXM1.6RL only.
It supports changing to backup values even when the module supply is lost, not only in case of lost communications.

- For this purpose, the AC 24 voltage on the bus is monitored. This monitoring is fast enough to make the relays take their backup positions before the DC 24 V supply breaks down.
- As the relays are bistable, they stay in the backup position even without DC 24 V supply.

Of course this only works if AC 24 V on the bus (conductor " V≂") comes from the very same transformer that supplies the source of the DC 24 V supply.

Note! When backup value " Keep" is parameterized, the module is supposed to take no activity at all, neither with absence nor with presence of bus or AC 24 V. Therefore, it doesn't matter if bus terminal "V≂ " (field device supply) is open or powered if there is a bus connection module.
Modules of **Series C** actually work without AC 24 V connected.

With modules from **Series D**, however, it is compulsory to feed AC 24 V to bus terminal "V≂" (field device supply) if there is a bus connection module. TXM1.6RL The module always monitors this supply.
Simatic: It is also admissible to connect DC 24 V to bus conductor "V≂".

Response to failure

As a summary, the I/O points behave as follows:

Failure			→	**Behavior of relays**			
Address key	Bus	AC 24 V		Off	Backup state Masterdown	Backup delay	Backup state Powerdown
X				**X**			
		X					**X**
	X				**X**	**X**	
	X	**X**					**X**

Remote override

Module type TXM1.6RL does not have a local override device, but remote override is available for all I/O points.

Display

- The I/O status LED is ON when the contact is closed.
- In the event of an error, the **I/O status LED** and the **module status LED** flash.

For details, especially in relation to flashing patterns and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

5.5 Pulse, on/off
(BO Pulse On-Off / Q250-P250A-P)

Application

Switching of single-stage electrical loads (electrical consumers)

- 1 N/O contact and 1 N/C contact for self-latching (Q250-P)
- 2 N/O contacts for two-coil switches (250A-P)

The following functions can be implemented by use of external circuits (and see the connection diagrams in the data sheets):

– If the control voltage for the self-latching mechanism fails, the loads are not automatically enabled when power is restored, even in the case of manual override.
  Example: power restoration circuit
– If the bus master fails, the loads are not disabled.
  Example: lighting controls
– Two or more open loop control circuits can switch the same load.
– Override is also possible from one or more remote switching locations.

Notes

- Connection diagrams: see module data sheets.
- Step switches, pulse switches, bistable relays: see Q250, section 5.2.

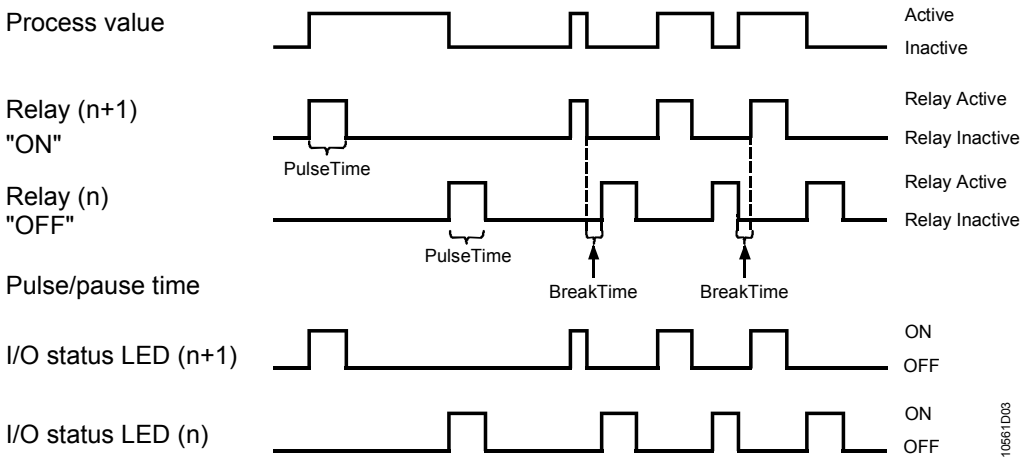
Hardware

- The function uses two I/O points which must be on the same module and adjacent to each other.
- The TX-I/O relay modules have changeover contacts

Function

- The I/O point with the lower number (n) is used for the OFF command
- The I/O point with the higher number (n+1) is used for the ON command
- The process value can be written in "Normal" mode or in "Trigger" mode.
  The latter option is used in cases where there is more than one source, e.g. with lighting applications.
- The pulse times can be set as parameters:
  – 0.1...25.5 s (Parameter *Pulse Time*) (default = 0.5s)
  – ***P-bus BIM***: 0.5...25 s
- The break time can be adjusted 0...25.5 (default = 0.1s)
- ***P-bus BIM***: The break time is fixed to 0.1 s

Each change in the process value generates an ON or OFF command:



Local override

An additional ON or OFF pulse can be generated (e.g. by means of the local override).

- Pressing one of the override buttons (n) or (n+1) in the middle enables/disables local override
- When local override is active:
  Pressing "+" for one of the I/O points generates an ON command (closes relay n+1)
  Pressing "–" for one of the I/O points generates an OFF command (closes relay n)
- The **I/O status LED** of I/O point "n" or "n+1" lights up concurrently with the relay activity.
- Local operation can be disabled in the configuration.

Display

- The **I/O status LED** is ON when the **relay** is active.
- In the case of an error the module status LED and the I/O status LEDs assigned to the function flash.

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

5.6 **Pulse** (BO Pulse)

Application

For control and switching single stage electrical loads by means of pulses.

Notes

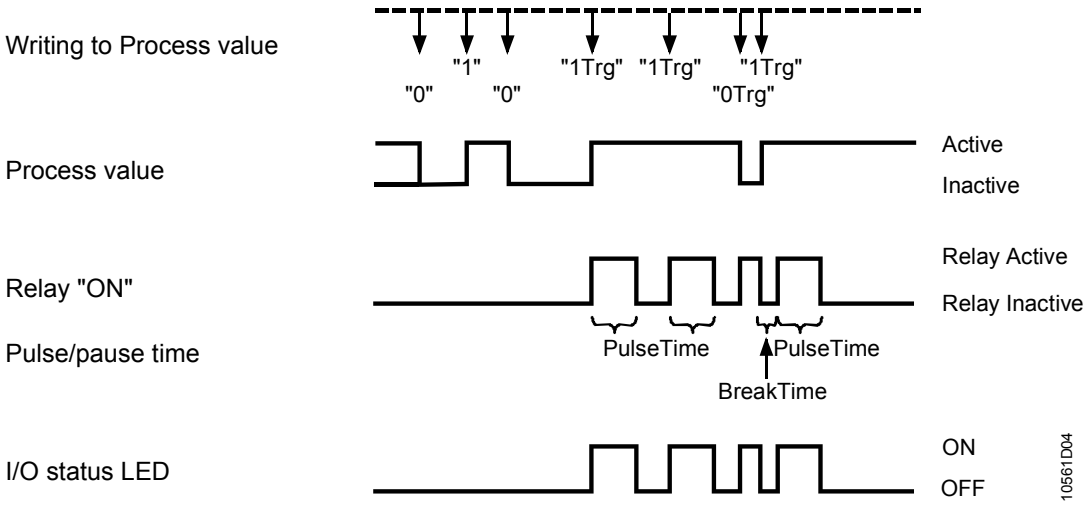
- Connection diagrams: see module data sheets.
- Step switches, pulse switches, bistable relays: see Q250, section 5.2.

Hardware

- The function uses one I/O point.
- The TX-I/O relay modules have changeover contacts

Function

- The process value must be written in "Triger mode". As a result, a pulse will be created on each change of the process value from 0 to 1 or 1 to 0.
  Without the trigger bit, no pulse will be created.
- The pulse time can be adjusted 0.1...25.5 (default = 0.5s)
- The break time can be adjusted 0.1...25.5 (default = 0.1s)
- After start-up, process quality is invalid, as long as no pulse has been generated.



An additional ON or OFF pulse can be generated (e.g. by means of the local override).

Local override

- Pressing the override button (in the middle enables/disables local override
- When local override is active:Pressing "+" or "–" generates a pulse and writes to the process value (with trigger bit).
- The **I/O status LED** lights up concurrently with the relay activity.
- Local operation can be disabled in the configuration.

Display

- The **I/O status LED** is ON when the **relay** is active.
- In the case of an error the module status LED and the I/O status LED flash.

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

5.7 Multistate maintained contact (MO Steps / Q-Mx)

Application

- For control and switching of multispeed motors and other electrical loads or their power contactors
- Can be used to switch one or more control outputs. Examples:
  - Fans
  - Pumps
  - Chillers
  - Heat pumps
  - Electric heating coils
  - Burners

Signal types

This feature covers the following signal type.

Signal type	Description
MO Steps / Q-Mx ***P-bus BIM:*** – Q-M3 only – 1 to n mapping only	Maintained contact, multistate, relays with or without mutually exclusive electronic interlock, depending on mapping kind.

Hardware

This function uses one I/O point for each stage to be switched.
The I/O points must be on the same module and adjacent to each other.

Function

- I/O point No. (n) is used for the switch-ON command of Stage (1).
- depending on the mapping kind, the I/O points are latched or can be activated simultaneously.
- The following mapping kinds can be parameterized (parameter *Mapping Kind*):
  - 1 to n mapping
  - Up-down mapping
  - Binary mapping

1 to n mapping

- The multistate process value is mapped so that the mapping table defines just one output to be driven.
  Despite the interlocking of the contacts inside the module, overlapping "ON" states can occur (due to delayed release of the contactors, or "sticky" contacts) when switching from one stage to another. For this reason the contactors must always be interlocked externally (refer also to the connection diagram in the module data sheet)
- Any previously operated output is switched off before the next output is switched on. The break time is 100 ms.
- In the Mapping Table parameter, the default assignment of the I/O points to the values of MOValue can be changed (for*1 to n mapping* only!).
- If no value corresponding to the process value is found in the mapping table, a Reliability Error message is transmitted (Quality = MULTISTATE_FAULT) and a configurable back-up value is enabled (parameter Backup Value).

MOValue	Stage	Active I/O point
0	0	None
1	1	n
2	2	n + 1
3	3	n + 2
4	4	n + 3
5	5	n + 4
6	6	n + 5

Up-down mapping

- The multistate process value is mapped so that the mapping table specifies one or more outputs to be driven.
- It is possible to have several active outputs, but only in a fixed combination.
- Examples: Enabling additional electrical heating or burner stages

MOValue	Stage	Active I/O points
0	0	None
1	1	n
2	2	n, n+1
3	3	n, n+1, n+2
4	4	n, n+1, n+2, n+3
5	5	n, n+1, n+2, n+3, n+4
6	6	n, n+1, n+2, n+3, n+4, n+5

Binary mapping

- The multistate process value is mapped so that the mapping table specifies one or more outputs to be driven.
- It is possible to have several active outputs.
- Examples: Enabling additional electrical heating or burner stages

MOValue	Stage	Active I/O points					
		n	n+1	n+2	n+3	n+4	n+5
0	0	0	0	0	0	0	0
1	1	**1**	0	0	0	0	0
2	2	0	**1**	0	0	0	0
3	3	**1**	**1**	0	0	0	0
4	4	0	0	**1**	0	0	0
:	:						
63	63	**1**	**1**	**1**	**1**	**1**	**1**

Parameterization

In the case of **bus failur**e, with DC 24 V module supply available, the following backup states van be parameterized:

– No (Inactive) (= default)
– Value (Active, Inactive)
– Keep Same value as before the bus failure

Parameterization can be done during runtime.

Display

- The **I/O status LEDs** indicate the activity of the **relays**
- In the case of an error the module status LED and all the I/O status LEDs assigned to the function flash.

Local override

Pressing the middle of one of the manual switches assigned to the function enables/disables local override.
When local override is active:

- Pressing "+" on one of the I/O points switches the load up one stage.
  Repeated or sustained pressure can be used to switch through several stages until the function reaches the highest stage.
- Pressing "–" on one of the I/O points switches the load down one stage.
  Repeated or sustained pressure can be used to switch through several stages until the function stops at the lowest stage.
- The change from one stage to the next occurs only after a delay of 0.3 s.
  This makes it possible to reach a stage directly (e.g. jump from stage 2 to stage 0 and then to stage 3).
  ➔ Users themselves must know whether switch-off is required before switching to another stage.
- The **Override LED** of all I/O points assigned to the function go off briefly while the switch is pressed.
- The **I/O status LEDs** light up whenever the **relays** are active.
- Local operation can be disabled in the configuration.

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

5.8 **Multistate pulse** (MO Pulse / Q250-Px)

Application

- For pulse control and pulse switching of multistate loads or the associated power contactors with self-latching for each load step.
- Only one control output at a time is active.
- Examples:
  – Fans
  – Pumps
  – Chillers
  – Heat pumps

The following functions can be implemented by use of external circuits (and see the connection diagrams in the module data sheet):

- If the control voltage for the self-latching circuit fails, the loads are not automatically enabled when power is restored, even in the case of manual override. Example: Power restoration circuit
- If the bus master fails, the loads are not disabled.
  Example: lighting controls
- Local override on the module is possible; the contact interlock remains in effect.
- With a change from automatic operation to manual override, the power contactors retain their last switch status.
- Two or more control circuits can switch the same load
  (see connection diagrams in the data sheet).

Note Step switches, pulse switches, bistable relays: see Q250, section 5.2.

Signal types

This feature covers the following signal type.

Signal type	Description
MO Pulse / Q250-Px ***P-bus BIM:*** – Q250-P3 only – 1 to n mapping only ***PROFINET BIM:*** – Q250-P1...P4 only	Pulse, multistate with or without mutually exclusive electronic relay interlock, depending on mapping kind

Hardware

- The function uses one I/O point for each switched stage plus one I/O point for switch-off.
- The I/O points must be on the same module and adjacent to each other.

Function

- I/O point number (n) is always used for the switch-off command
- I/O point number (n+1) is used for the switch-on command for Stage (1), etc.
- Before a stage other than 0 is operated, relay n is switched for a period equivalent to *MinOffTime*, interrupting the self-latching function.
  MinOffTime can be parameterized: 0.1...25.5 s (default = 0.5 s)
  (***P-bus BIM***: *MinOffTime* = 1 cycle period)
- The relay for the required stage is then operated for a period equivalent to *PulseTime*
- *PulseTime* can be parameterized: 0.1...25.5 s (default = 0.5 s)
  (***P-bus BIM***: 0.5...25 s)
- The relays are latched.
- The signal type supports 1 to n mapping only.

- The multistate process value is mapped so that the mapping table defines just one output to be driven by a pulse.
  Despite the interlocking of the contacts inside the module, overlapping "ON" states can occur (due to delayed release of the contactors, or "sticky" contacts) when switching from one stage to another. For this reason the contactors must always be interlocked externally (refer also to the connection diagram in the module data sheet)
- In the Mapping Table parameter, the default assignment of the I/O points to the values of MOValue can be changed (only for *1 to n mapping* !).
- If no value corresponding to the process value is found in the mapping table, a Reliability Error message is transmitted (Quality = MULTISTATE_FAULT) and a configurable back-up value is enabled (parameter Backup Value).

MOValue	Stage	Pulse on I/O point
0	0	n
1	1	First n, then n + 1
2	2	First n, then n + 2
3	3	First n, then n + 3
4	4	First n, then n + 4
5	5	First n, then n + 5

Parameterization

In the case of **bus failur**e, with DC 24 V module supply available, the following backup states van be parameterized:
– No (Inactive) (= default)
– Value (Active, Inactive)
– Keep Same value as before the bus failure

Parameterization can be done during runtime.

Display

- The **I/O status LED** is ON when the **relay** is active.
- In the case of an error the module status LED and all the I/O status LEDs assigned to the function flash.

Local operation

Pressing the middle of one of the override buttons assigned to the function enables/disables local override. When local override is active:
- Pressing "+" on one of the I/O points switches the load up one stage.
  Repeated or sustained pressure can be used to switch several stages until the function reaches the highest stage.
- Pressing "–" on one of the I/O points switches the load down one stage.
  Repeated or sustained pressure can be used to switch several stages until the function stops at the lowest stage.
- The change from one stage to the next occurs only after a delay of 0.3 s.
  This makes it possible to reach a stage directly (e.g. jump from stage 2 to stage 0 and then to stage 3).
- The **Override LED** of all I/O points assigned to the function go off briefly while the switch is pressed.
- The **I/O status LEDs** indicate the activity of the **relays**
- Local operation can be disabled in the configuration.

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

5.9 Three-position control signal (BO 3-Pos Relay, BO-3-Pos Triac / Y250T))

Application

For open/close control of three-position actuators without feedback (position potentiometer), e.g. for

– Valve actuators
– Damper actuators
– Third-party actuators

Hardware

The function uses two I/O points which must be on the same module and adjacent to each other. I/O point (n) = Open, I/O point (n + 1) = Close.

Function

- The function converts the process value into 3-position positioning signals.
  An internal **stroke algorithm** calculates the required length of the OPEN or CLOSE pulses from the actuator runtime and the position specified in the process value.
  No position feedback is required from the actuator.
- The function supports **asymmetrical actuators** with different opening and closing runtimes. However, this function can only be used if it is also supported by the bus master.

Configurable / fixed variables

Value	Description	Value range	(Default)
Rise Time	Time to OPEN	6.3 … 6553.5 s	(150.0 s)
Fall Time	Time to CLOSE	6.3 … 6553.5 s	(150.0 s)
Break time	Pause between opening and closing	0...25.5 s	(0.1 s)
Reaction Time *(Series D and higher)*	Additional runtime when traveling to or from 0 %	0...50.0 s	(0.0 s)
Nz	Dead band	0...10%	(1 %)
Hys	Hysteresis	0...10%	(2 %)
Backup mode	Response of process value in the event of bus failure	Keep = Last active value No = 0% Value = Backup Value	(No)
Backup Value	Backup value if *Backup Mode* = Value	0.01...100%	(0 %)
Synchronization	Synchronization mode	Details see below	
Direction *(Series D and higher)*	Inversion of the outputs to fix incorrect wiring	False (normal) True (inverted)	(False)

Parameter details

Runtime

Asymmetric runtimes can be set as parameters (if supported by the bus master).

Pause

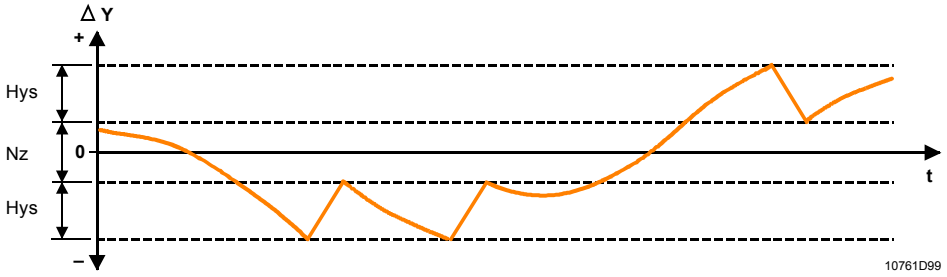
Delay time before the actuator changes direction

Reaction Time *(Series D and higher)*

Additional runtime when traveling to or from 0 % (clearance between motor and drive).
Note: Reaction Time is not part of the stroke model.

Deadband / Hysteresis (Nz, Hys)

- If the difference between the stroke model and the process value (ΔY) is more than half the deadband plus the hysteresis, this generates an OPEN or CLOSE pulse which is long enough to return the actuator to a position within the deadband.
- The minimum pulse length is equal to the runtime multiplied by the hysteresis.



Start synchronization *(series D and higher)*

Start synchronization, if selected, is automatically initiated after reset.
The synchronization is not interrupted by any other event.

- NONE — No synchronization
- SINGLEOPEN — OPEN command during 1.5 x runtime OPEN
- SINGLECLOSE — CLOSE- command during 1.5 x runtime CLOSE

Synchronization in end position

Synchronization when stroke model reaches the end position (0% or 100%):

- **Normal operation:**
  - NONE (**default**) — No synchronization
  - CONTINUOUS — Permanent synchronization (0% and 100%)
  - CONTINOPEN — Permanent synchronization (100%)
  - CONTINCLOSE — Permanent synchronization (0%)
  - SINGLE — 1.5 * Rise Time (100%) or 1.5 * Fall Time (0%)
  - SINGLEOPEN — 1.5 * Rise Time (100%)
  - SINGLECLOSE — 1.5 * Fall Time (0%)
  - EVERY10MIN — 1.5 * Rise Time (100%) or 1.5 * Fall Time (0%) every 10 minutes
  - EVERY10MINOPEN — 1.5 * Rise Time (100%) every 10 minutes
  - EVERY10MINCLOSE — 1.5 * Fall Time (0%) every 10 minutes
  - EVERY20MIN — 1.5 * Rise Time (100%) or 1.5 * Fall Time (0%) every 20 minutes
  - EVERY20MINOPEN — 1.5 * Rise Time (100%) every 20 minutes
  - EVERY20MINCLOSE — 1.5 * Fall Time (0%) every 20 minutes
- **Local override**:
  OPEN or CLOSE relay is active as long as button is pressed, **synchronization is disabled**.
- **Tool override, Remote Overrid**e: in the end positions, **CONTINOPEN / CONTINCLOSE** applies, i.e. OPEN or CLOSE relay goes to **maintained contact.**
  If this behavior is not desired, command the actuator to 0.1% / 99.9% instead of 0% / 100%.

Forced synchronization

For commissioning purposes, a synchronization can be forced:

- NONE — No synchronization
- CONTINOPEN — Continuous OPEN command
- SINGLEOPEN *(series D and higher)* — OPEN command during 1.5 x runtime OPEN
- CONTINCLOSE — Continuous CLOSE command
- SINGLECLOSE *(series D and higher)* — CLOSE- command during 1.5 x runtime CLOSE

Parameterization

In the case of **bus failur**e, with DC 24 V module supply available, the following backup states van be parameterized:
– No (0%) (= default)
– Value (Backup value)
– Keep Same value as before the bus failure

Parameterization can be done during runtime.

Fault message
(series D and higher)

The quality value "No_Output" will be sent in the following cases:
- **TXM1.8T**: AC 24 V missing. The triac is not able to switch
  → The module switches the output off and stops the stroke model.
  The process value is set to the present position of the stroke model.
- **Other modules**: DC 24 V is insufficient. → The module tries to switch the relays.

The fault message will only be sent when a command is pending.

Local override

Pressing the middle of one of the override buttons associated to the function enables/disables local override.
When local override is active:
- Pressing "+" on one of the I/O points operates the OPEN relay, I/O point (n)
- Pressing "–" on one of the I/O points operates the CLOSE relay, I/O point (n+1)
- The I/O status LED remains ON while the override button is pressed
- The stroke algorithm is updated.
- Local operation can be disabled in the configuration.

Display

- The **I/O status LED** is ON when the **relay** is active.
- In the case of an error the module status LED and the I/O status LEDs assigned to the function flash.

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

5.10 PWM Pulse width modulation (BO PWM, with triac)

Application

Open/close modulating actuators e.g. for

– Thermal valve actuators
– Continuously controlled consumers (e.g. electric heating controlled via current valve)
→ Remember to check the permissible switching frequency of the connected devices and adapt output parameterization.

Hardware

- Only TXM1.8T module supports this function
- The function uses one I/O point
- AC 24 V supply, the triac closes the contact to ⊥ (system neutral)
- Technical data (max triac load): See module data sheet N8179
- The outputs work noise-free

Function

The function converts the analog process value AOValue to a periodic switching pulse of the triac.

Parameterization

Normally, pre-parameterized outputs are used customized to the actuators to be operated.

The following parameters are available for individual parameterization:

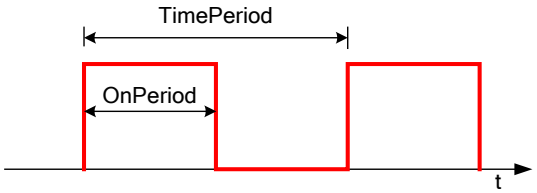
Parameter	Description	Value range	Default	Increment
TimePeriod	Switching cycle (0 = Special behavior)	0…6553.5 s	20 s	0.1 s
MinOnTime	Min. switch-on time – Protection against excessive switching frequency – Preheating ensures that the thermal actuators open quickly	0…25.5 s (1...25.5 s, if *TimePeriod = 0)*	1 s	0.1 s
MinOffTime	Min. switch-off time – Protection against excessive switching frequency – Ensures that the thermal actuators close safely	0…25.5 s (1...25.5 s, if *TimePeriod = 0)*	1 s	0.1 s
BackupMode	Backup state in the case of Masterdown	Keep No Value	No	
AOBackup Value	Pulse duration	0.00…100.00%	0 %	1/100 %

Pulse pattern

These parameters allow for generating the following pulse patterns.

Case A: TimePeriod ≠ 0

The analog output AOValue generates the following switch-on ratio (scan ratio)
OnPeriod = *AOValue * TimePeriod*



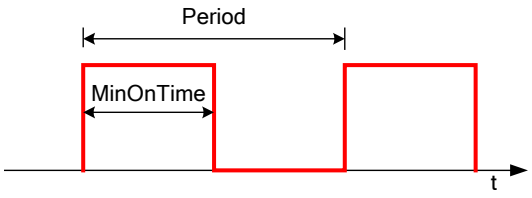
Min. switch-on/-off times can be parameterized as an option to protect against excessive switching frequency. The triac does not switch on/off if the calculated switch-on / switch-off time is less than *MinOnTime / MinOffTime*.

Case B: TimePeriod = 0

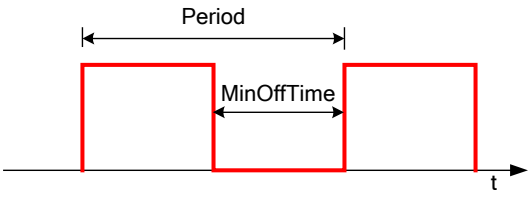
MinOnTime and MinOffTime are used to dynamically define the pulse length (also known as PDM, pulse duration modulation):

- Period = *MinOnTime* / AOValue
  if AOValue <= *MinOnTime* / (*MinOnTime* + *MinOffTime*)
- Period = *MinOffTime* / (1- AOValue)
  if AOValue > *MinOnTime* / (*MinOnTime* + *MinOffTime*)

Process value <= MinOnTime/(MinOnTime+MinOffTime)



Process value > MinOnTime/(MinOnTime+MinOffTime)



Examples for cases A and B

Input	Parameter			Output		
AOValue	***TimePeriod***	***MinOnTime***	***MinOffTime***	**Period**	**ON**	**OFF**
85%	10 s	1 s	1 s	10 s	8.5 s	1.5 s
80% [1]	30 s	4 s	8 s [1]	30 s	30 s	0 s (< MinOff) [1]
70%	30 s	4 s	8 s	30 s	21 s	9 s
50%	20 s	5 s	5 s	20 s	10 s	10 s
40%	30 s	1 s	1 s	30 s	12 s	18 s
20%	0 s	1 s	1 s	5 s	1 s	4 s
50%	0 s	2 s	1 s	4 s	2 s	2 s
50%	0 s	1 s	3 s	6 s	3 s	3 s
60%	0 s	1 s	1 s	2.5 s	1.5 s	1 s
60%	0 s	9 s	1 s	15 s	9 s	6 s
0.01% [2]	0 s	20 s	20 s [2]	6573.5 s [2]	20s	6553.5 s (limited) [2]
0%	any	any	any	--		∞
100%	any	any	any	--	∞	

[1] Avoid. Long *MinOffTime* and *MinOnTime* values require a long *TimePeriod*, because outputs near 0% and 100% are changed to 0% or 100%.

[2] Avoid. Inputs near 0% greatly extend period (process value AOValue has a resolution of 0.01%). The max. limitation of the function is 6553.5 s (1.8 h), but a period this long does not make any sense.
Therefore the minimum AOValue should be limited so that a reasonable max. Period results.

Reaction to changes of AOValue

If the process value (AOValue) changes, the function calculates a new pulse length based on the active pulse.

Display

- The **I/O Status LED** is light proportional to the process value
- In case of error, the I/O status LED is lit together with the module status LED.

Details, blinking pattern and errors in particular: See section "Display, operation and diagnosis" in [6] "TX-I/O™ engineering and installation".

Error message

Quality value "No_Output" is output if AC 24 V is missing.
The triac can then not switch on → The module switches off the output and sets process value to 0.

The error message is sent only if a positioning command is available.

5.11 **Blinds control** (BO Blinds Relay)

Application

Control any kind of blinds.

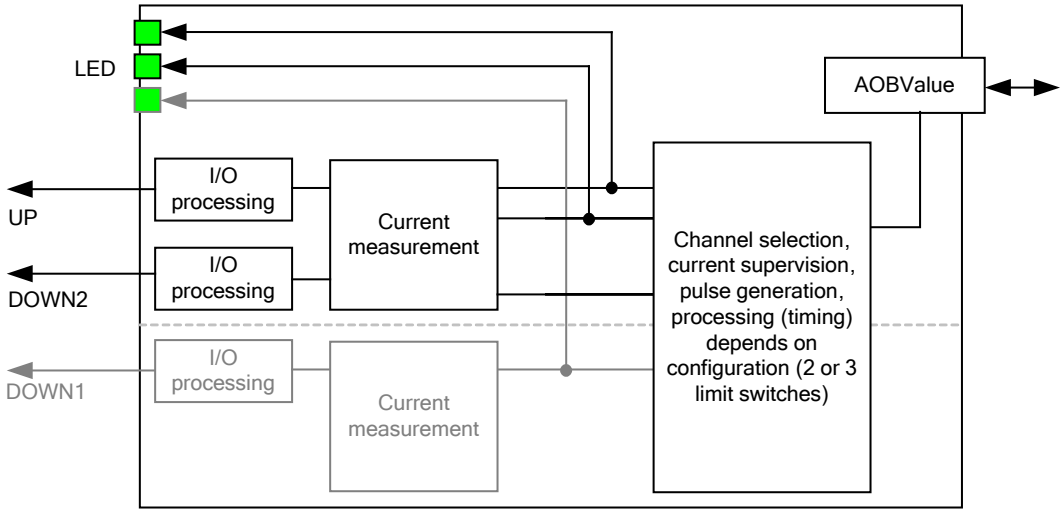
– Without louvers
– With louvers

Hardware

The function uses
– 2 I/O points for actuators with 2 end switches
– 3 I/O points for actuators with 3 end switches
→ the fourth I/O point must remain unused

Function

The function generates switching pulses for the 2 or 3 relays from the structured process value AOBValue.
The blinds control function is shared between module and bus master (application function). The application function in particular is responsible for the louver angle. For this reason, the process value is sent in both directions: to the periphery as a command, and to the bus master as a status signal.



Relay outputs

Actuators with 2 end switches

Output	Command	Description
n	DOWN2 RUN_DOWN	DOWN (to position "0%")
n + 1	UP RUN_UP	UP (to position "100%")

Actuators with 3 end switches

n	DOWN2 RUN_DOWN	DOWN (to position "0%")
n + 1	UP RUN_UP	UP (to position "100%")
n + 2	DOWN1	DOWN to middle position (end switch between position 0 and 100%)
n + 3	--	*Output n+3 must remain free*

Process value

	Command	Description	
Static commands	UP	UP	The commands can have an additional pulse at the end (same direction)
	DOWN2	DOWN	
	DOWN1	DOWN to middle position (3rd end switch)	
	STOP	Stop	
Relative commands	RUN_UP	These commands contain one direction only (UP, DOWN) and one pulse length. They are used specifically to change the louver angle using short pulses in blinds with louvers. Relative commands can also be parameterized for long pulses.	
	RUN_DOWN		
Absolute command	RUN_ABS	If the blinds drive to a defined position with the help of the calculated pulse length on outputs n or n+1	
Status, MarkIDs	Position and status for the blinds and the I/O function are returned to the bus master		
Various	CAL	Command to drive the blinds once all the way to the top and to the bottom to (by measuring motor current) determine the runtime RunTimeDownUp (calibration)	
	GET_MOT_POS	Position query from bus master	

Parameterization

Normally, preparameterized outputs are used customized to the actuators to be operated.

The following parameters are available for individual parameterization:

Parameter	Description	Range (default) Increment = 0.01 s
RunTimeDownUp	Runtime from Down2 to Up	1...655 s (180 s)
RunTimeUpDown	Runtime from Up to Down2	1...655 s (180 s)
RunTimeDown1Down2	Runtime from Down1 to Down2	1...655 s (1.5 s)
BreakTime	Break between opening a relay and closing an other relay (change of ditection)	0.2...25.5 s (0.5 s)
EndPosDetection	Detection of the end positions by measuring the motor current on the relay outputs	Inactive, Active, Once (Active)
MotorDelay	Delay between pulse start and motor action. Some motors take a certain time before they consume current. This parameter prevents the current detection from assuming that the motor is in end position or that there is a fault.	0.01...2.55 s (0.1 s)
MotorOverTravelUp	Delay between pulse end and blinds stop (UP)	0.01...2.55 s (0.1 s)
MotorOverTravelDown	Delay between pulse end and blinds stop (DOWN)	0.01...2.55 s (0.1 s)
BackupMode	Backup status in case of master down	Keep = Last command No = Relay inactive Value = AOBBackup Value (Keep)
AOBBackup Value	Command/pulse length	(UP / 0 s)
BackupDelay	Delay until BackupMode	0...900 s (300 s)

<table>
<tr><th>Parameter</th><th>Description</th><th>Range (default)
Increment = 0.01 s</th></tr>
<tr><td>Direction</td><td>Exchange of outputs (only n and n+1) to correct faulty wiring.<table><tr><th>I/O point</th><th>Direction = False (normal)</th><th>Direction = True (inverted)</th></tr><tr><td>n</td><td>DOWN2</td><td>UP</td></tr><tr><td>n+1</td><td>UP</td><td>DOWN2</td></tr><tr><td>n+2</td><td>DOWN1</td><td>DOWN1</td></tr></table></td><td>BOOL (False)
True / false</td></tr>
</table>

Detect end positions

- If EndPosDetection = **inactive**, the runtimes RunTimeUpDown and RunTimeDownUp must be parameterized.
- If EndPosDetection = **active**, the motor current at the relay feeds is measured. This allows for detecting the end positions and determine the motor runtimes between positions Up and Down2. The runtime measurement RunTimeUpDown and RunTimeDownUp is executed each time when the blinds drives the entire stretch from Up to Down2 or vice-versa.
  Values RunTimeUpDown and RunTimeDownUp are saved to the module's flash memory. They change over time (temperature deviations, aging).
  Changes to the motor runtime are sent to the bus master for subsequent evaluation in the application function.
  Changes > 7% or > 3 s are saved to flash memory.
  Changes > 15% are not saved as unbelievable.
- If EndPosDetection = **once**, the motor current measurement is active, the stroke model is synchronized in the end positions, but the run times are only saved to the flash memory once after start-up.
- Command **CAL** can be used to force runtime measurement.
  If EndPosDetection = Inactive, the module ignores the command.

Note

- Because of the current measurement, interposing relays for the control of several blinds in parallel are not admitted.

Reaction to changes of AOBValue

If process value (AOBValue) changes, the new value overwrites the old value.
The function drives to the new position in case of absolute commands.

Display

- The **I/O status LEDs** are lit when the associated relay is active
- In case of an error, the I/O status LED and the module status LED are lit.

Details, blinking pattern and errors in particular: See section "Display, operation and diagnosis" in [6] "TX-I/O™ engineering and installation".

Response in case of error

- The relays drop off in case of a **DC 24 V bus supply failure**.
  When power is restored, the relays remain inactive until a valid process value is available.
- In case of **bus failure:**
  The behavior can be parameterized for each I/O function:: BackupMode, BackupValue and BackupDelay; see above parameters.

6 Analog output functions

6.1 Proportional control signal

Application

For operation of devices with an analog input (0 ... 10 V, 4 ... 20 mA), e.g.:
- Damper actuators
- Valve actuators
- Proportional three-position converters
- Devices for analog display and acquisition

For connection to other systems, e.g. to transfer:
- Setpoints
- Sensor values
- Reference variables

Hardware

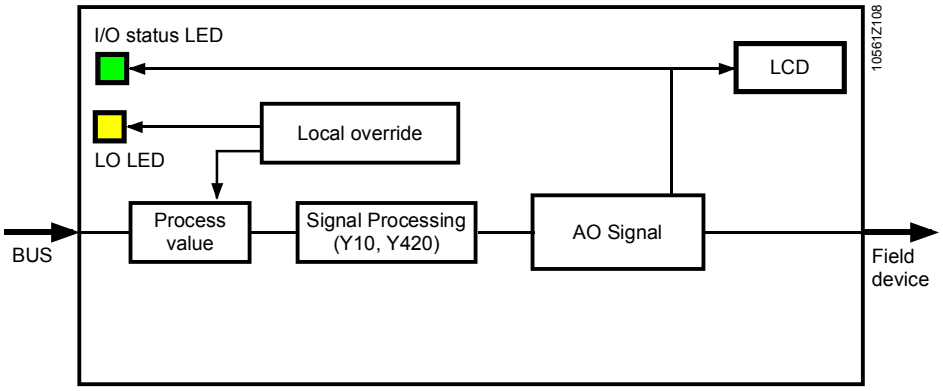
The function uses one I/O point.

Configurable signal types

Description	Signal type	Range (over range) (Under / over range)	Reso-lution	I/O LED	LCD	Error indication Shorted	Under range	Over range	Unreliable output *)
Voltage output	AO 0-10V / Y10S	0 ... 10 V (-0.05...10.6 V)	1 mV	variable	variable		X	X	X
Current output	AO 4-20mA / Y420	4 ... 20 mA (3.92...20.96 mA)	1 µA	variable	variable		X	X	

*) "Unreliable output" is displayed when the DC 24 V supply voltage is insufficient for a Y10S signal.

Function



Block diagram of function

- When detected, a new process value is processed.
- The output is a control voltage in the range DC 0… 10 V or a control current in the range DC 4 ... 20 mA
- The process value is indicated via the I/O status LED, and on the LCD panel, if available
- The output value can be overridden manually

Local override

- Local override has first priority, followed by tool override and (lastly) operation via process value
- Tool override of an I/O point is indicated by the flashing of the module status LED.
- Pressing the override button in the middle enables/disables the local override. The yellow "Override" LED indicates that local override is active
- When local override is active:
  Pressing "+" increases the value of the analog output by 10%.
  Repeated or sustained pressure switches changes the value by several stages until the function stops at the highest value.
  Pressing "–" reduces the value of the analog output by 10%.
  Repeated or sustained pressure switches changes the value by several stages until the function stops at the lowest value.
  The I/O status LED and LCD display change accordingly.
- With a change from automatic operation to local override, the process value (and thus the status of the devices concerned) is retained until the user overrides it.
  the same applies after resumption of automatic operation, until the bus master sends a new process value.

For a full description see page 9.

Display

- The brightness of the **I/O status LED** varies in proportion to the output value
- If an **LCD panel** is available, it indicates the signal type (DC 0 … 10 V, DC 4 ... 20 mA) and displays the value in graphic form.

For details, especially in relation to flashing pattern and errors: refer to the section "Display, operation and diagnostics" in the TX-I/O™ Engineering and installation guide [6].

Response in the event of a fault

- The process values on the bus are monitored for compliance with their admissible range
- The DC 24 V module supply voltage is monitored
- Faults are indicated to the bus master
- In the event of bus failure the module keeps the last valid value.
- If the **DC 24 V bus supply** fails, the output signal always goes to 0. When the supply is restored, the signal remains at 0 until a valid process value becomes available.
- in the case of **bus failure:**
  The behavior can be parameterized for each I/O point:
  – *Backup Mode* = Keep — Last active value
  – *Backup Mode* = No (default) — Smallest value (0V, 4mA)
  – *Backup Mode* = Value — Configurable value (*Backup Value*)

P-bus BIM: The module keeps the last valid values

When fault is repaired

Operation in the same state as before the fault:
automatic operation, remote override or local override

7 Default functions, disabling function

7.1 Default functions

Application

The default functions are downloaded into the modules before they leave the factory. They permit reduced operation and convenient "functional testing" in the control panel before the module parameters have been set.

The various modules have the following default functions:

Modules	Types	Default function	Equivalent function
Digital input modules	TXM1.8D, TXM1.16D	BI Default	BI NO / D20
Universal modules	TXM1.8U, TXM1.8U-ML	UIO Default	Description see next page
Super universal modules	TXM1.8X, TXM1.8X-ML	UIO Default	Description see next page
Resistance measuring module	TXM1.8P	RI Default	Description see next page
Relay modules	TXM1.6R, TXM1.6R-M, TXM1.6RL	BO Default	BO Relay NO 250V / Q250
Triac module	TXM1.8T	BO Default	BO Triac NO
Blinds module	RXM1.8RB	MO Default	4 x MO Steps (2-stage) / Q-M2

Wiring test

The default functions (factory-set I/O module status) have been specially designed for testing without a bus master. With configured modules, each I/O point would react differently according to the signal type.

The default functions allow you to test the wiring that is connected to the I/O points, as soon as the DC 24 V supply is switched on (no connection to a bus master is required).

When the module is powered, the module status LED flashes.
When additionally the address key is swiveled in, the default function is available.

7.2 Null function (Null Function)

Application

The disabling function prevents local override of an I/O point. It should be configured to decommission any unused I/O points.

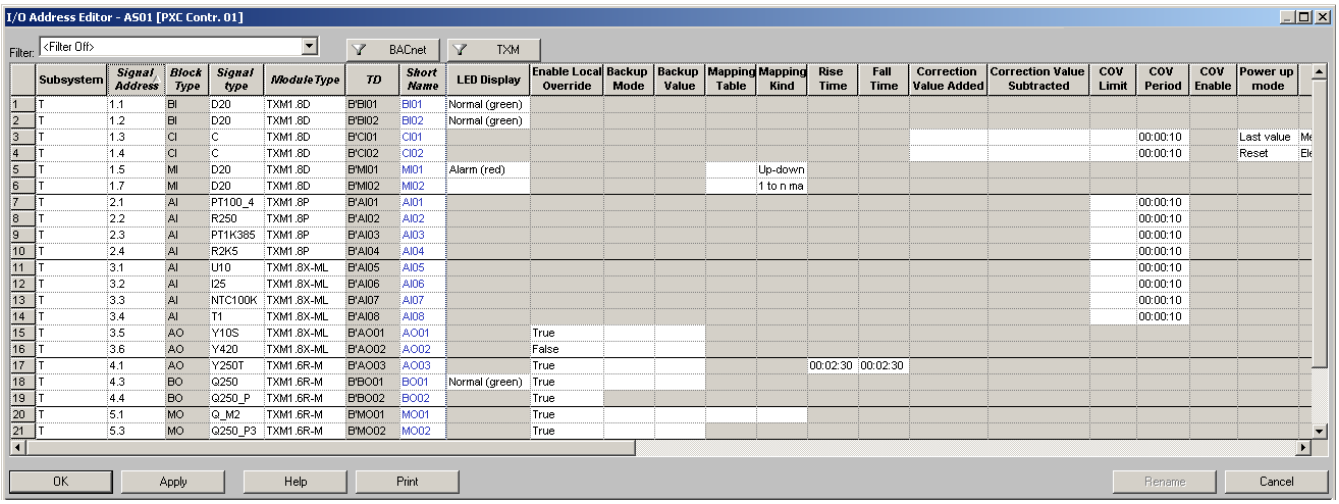
There are no variables to set as parameters, and no island bus inputs or outputs.

Testing options with default functions

Test	Action	I/O status LED	LCD display	Remark
Testing of inputs	**TXM1.8D, 16D** (BI Default)			
	Shorting the input	ON		
	TXM1.8U (-ML), TXM1.8X (-ML) (UIO Default)			
	No voltage (input open or shorted)	OFF		
	–75 ... +75 µA at input	OFF		**High-resistance** conductivity tester ***→ Do not use!***
	>75 µA at input	ON		Correct polarity of **low-resistance** conductivity tester (buzzer)
	< –75 µA at input	Flashing 1 Hz		Incorrect polarity of **low-resistance** conductivity tester (buzzer)
	>11.5 V at input	Flashing 1 Hz		E.g. DC24 V connected by mistake
	AC24 V at input	Flashing 1 Hz		AC24 V connected by mistake
	TXM1.8P (RI Default)			
	< 40 Ohm at input	ON	(no LCD)	Especially short circuit
	> 40 Ohm at input	OFF	(no LCD)	
Testing of digital outputs	**TXM1.6R (-M), TXM1.6RL, TXM1.8T** (BO Default)			
	Local override or tool override enabled	ON / OFF	The module executes all local overrides or tool overrides directly, without safety precautions or interlocks. ***→ Special care is required ←***	
Testing of blinds modules	**TXM1.8RB**			
	Tool override enabled	OFF / Stage 1 / Stage 2		
Testing of analog outputs	**TXM1.8U (-ML), TXM1.8X (-ML)**	UIO Default is an input function. For safety reasons, planned **analog outputs can not be tested with unconfigured modules**. As soon as the modules are configured, you can use the functional tests of the building automation and control system.		

8 Table of the parameters that can be set (example: Desigo / CFC)

The white fields can be edited or filled via dropdown menu.



I/O Address Editor - AS01 [PXC Contr. 01]

Filter: <Filter Off> BACnet TXM

	Subsystem	Signal Address	Block Type	Signal type	Module Type	TD	Short Name	LED Display	Enable Local Override	Backup Mode	Backup Value	Mapping Table	Mapping Kind	Rise Time	Fall Time	Correction Value Added	Correction Value Subtracted	COV Limit	COV Period	COV Enable	Power up mode
1	T	1.1	BI	D20	TXM1.8D	B'BI01	BI01	Normal (green)													
2	T	1.2	BI	D20	TXM1.8D	B'BI02	BI02	Normal (green)													
3	T	1.3	CI	C	TXM1.8D	B'CI01	CI01												00:00:10		Last value
4	T	1.4	CI	C	TXM1.8D	B'CI02	CI02												00:00:10		Reset
5	T	1.5	MI	D20	TXM1.8D	B'MI01	MI01	Alarm (red)					Up-down								
6	T	1.7	MI	D20	TXM1.8D	B'MI02	MI02						1 to n ma								
7	T	2.1	AI	PT100_4	TXM1.8P	B'AI01	AI01												00:00:10		
8	T	2.2	AI	R250	TXM1.8P	B'AI02	AI02												00:00:10		
9	T	2.3	AI	PT1K385	TXM1.8P	B'AI03	AI03												00:00:10		
10	T	2.4	AI	R2K5	TXM1.8P	B'AI04	AI04												00:00:10		
11	T	3.1	AI	U10	TXM1.8X-ML	B'AI05	AI05												00:00:10		
12	T	3.2	AI	I25	TXM1.8X-ML	B'AI06	AI06												00:00:10		
13	T	3.3	AI	NTC100K	TXM1.8X-ML	B'AI07	AI07												00:00:10		
14	T	3.4	AI	T1	TXM1.8X-ML	B'AI08	AI08												00:00:10		
15	T	3.5	AO	Y10S	TXM1.8X-ML	B'AO01	AO01		True												
16	T	3.6	AO	Y420	TXM1.8X-ML	B'AO02	AO02		False												
17	T	4.1	AO	Y250T	TXM1.6R-M	B'AO03	AO03		True					00:02:30	00:02:30						
18	T	4.3	BO	Q250	TXM1.6R-M	B'BO01	BO01	Normal (green)	True												
19	T	4.4	BO	Q250_P	TXM1.6R-M	B'BO02	BO02		True												
20	T	5.1	MO	Q_M2	TXM1.6R-M	B'MO01	MO01		True												
21	T	5.3	MO	Q250_P3	TXM1.6R-M	B'MO02	MO02		True												

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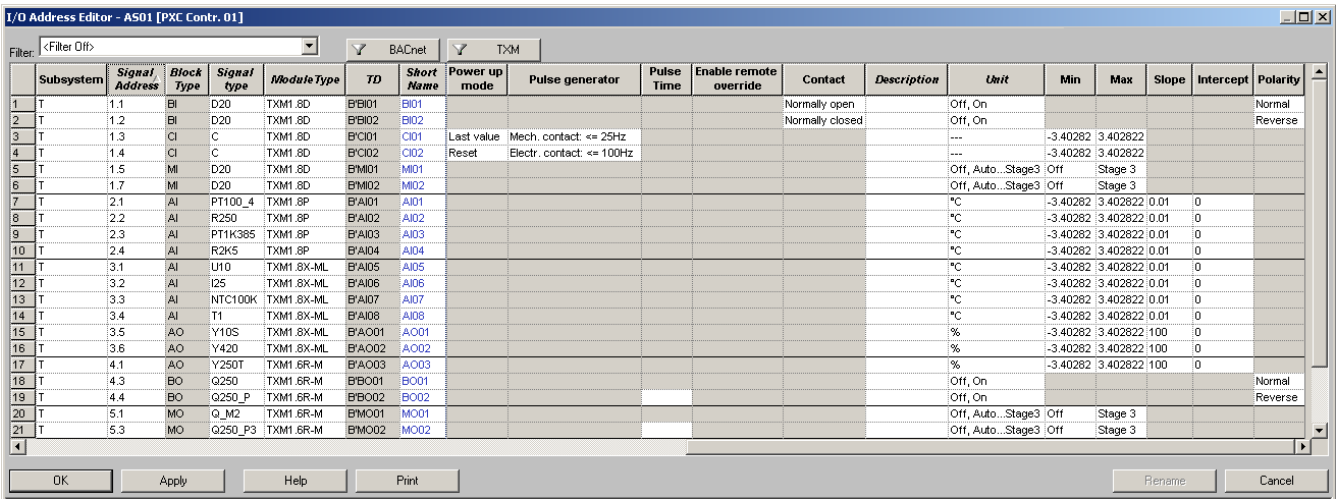

I/O Address Editor - AS01 [PXC Contr. 01]

Filter: <Filter Off> BACnet TXM

	Subsystem	Signal Address	Block Type	Signal type	Module Type	TD	Short Name	Power up mode	Pulse generator	Pulse Time	Enable remote override	Contact	Description	Unit	Min	Max	Slope	Intercept	Polarity
1	T	1.1	BI	D20	TXM1.8D	B'BI01	BI01					Normally open		Off, On					Normal
2	T	1.2	BI	D20	TXM1.8D	B'BI02	BI02					Normally closed		Off, On					Reverse
3	T	1.3	CI	C	TXM1.8D	B'CI01	CI01	Last value	Mech. contact: <= 25Hz					---	-3.40282	3.402822			
4	T	1.4	CI	C	TXM1.8D	B'CI02	CI02	Reset	Electr. contact: <= 100Hz					---	-3.40282	3.402822			
5	T	1.5	MI	D20	TXM1.8D	B'MI01	MI01							Off, Auto...Stage3	Off	Stage 3			
6	T	1.7	MI	D20	TXM1.8D	B'MI02	MI02							Off, Auto...Stage3	Off	Stage 3			
7	T	2.1	AI	PT100_4	TXM1.8P	B'AI01	AI01							°C	-3.40282	3.402822	0.01	0	
8	T	2.2	AI	R250	TXM1.8P	B'AI02	AI02							°C	-3.40282	3.402822	0.01	0	
9	T	2.3	AI	PT1K385	TXM1.8P	B'AI03	AI03							°C	-3.40282	3.402822	0.01	0	
10	T	2.4	AI	R2K5	TXM1.8P	B'AI04	AI04							°C	-3.40282	3.402822	0.01	0	
11	T	3.1	AI	U10	TXM1.8X-ML	B'AI05	AI05							°C	-3.40282	3.402822	0.01	0	
12	T	3.2	AI	I25	TXM1.8X-ML	B'AI06	AI06							°C	-3.40282	3.402822	0.01	0	
13	T	3.3	AI	NTC100K	TXM1.8X-ML	B'AI07	AI07							°C	-3.40282	3.402822	0.01	0	
14	T	3.4	AI	T1	TXM1.8X-ML	B'AI08	AI08							°C	-3.40282	3.402822	0.01	0	
15	T	3.5	AO	Y10S	TXM1.8X-ML	B'AO01	AO01							%	-3.40282	3.402822	100	0	
16	T	3.6	AO	Y420	TXM1.8X-ML	B'AO02	AO02							%	-3.40282	3.402822	100	0	
17	T	4.1	AO	Y250T	TXM1.6R-M	B'AO03	AO03							%	-3.40282	3.402822	100	0	
18	T	4.3	BO	Q250	TXM1.6R-M	B'BO01	BO01							Off, On					Normal
19	T	4.4	BO	Q250_P	TXM1.6R-M	B'BO02	BO02							Off, On					Reverse
20	T	5.1	MO	Q_M2	TXM1.6R-M	B'MO01	MO01							Off, Auto...Stage3	Off	Stage 3			
21	T	5.3	MO	Q250_P3	TXM1.6R-M	B'MO02	MO02							Off, Auto...Stage3	Off	Stage 3			

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Note For settings in other building automation and control systems see the respective online help.

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