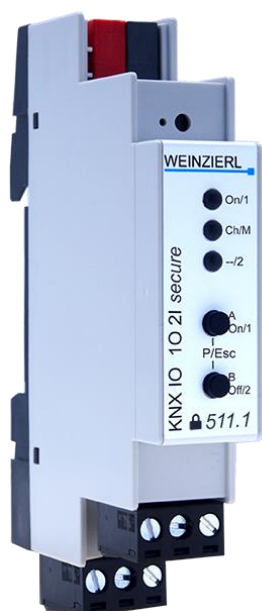# WEINZIERL

Switching actuator with 1 output and 2 binary inputs

KNX IO 511.1 secure (1O2I)

Operation and installation manual

(Art. # 5327)

WEINZIERL ENGINEERING GmbH
Achatz 3-4
84508 Burgkirchen an der Alz
GERMANY

Tel.:   +49 8677 / 916 36 – 0
E-Mail: info@weinzierl.de
Web: www.weinzierl.de

Content

1 Application

The KNX IO 511.1 *secure* (1O2I) is a compact switching actuator with 1 bi-stable output and 2 binary inputs. The actuator provides the function for universal outputs including scene control, timer, staircase lighting and heating valves (PWM for thermoelectric valve drives).
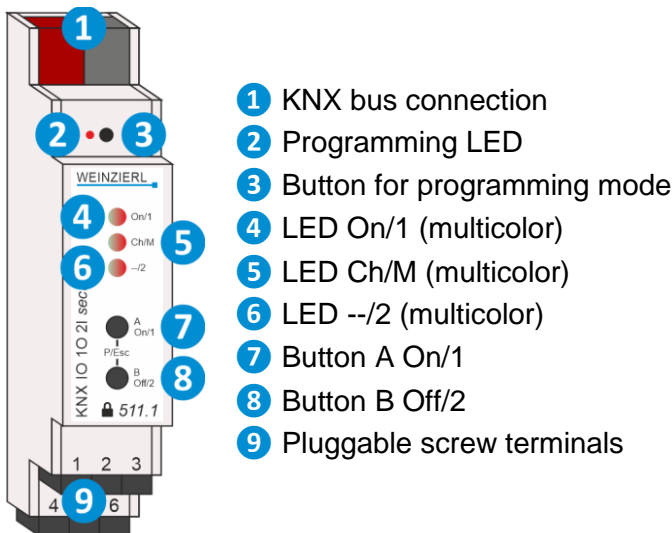
The inputs can be connected to conventional switches with an external voltage of 12 to 230 V. In ex-factory settings the inputs are connected internally to the actuator. The actuator combined with input B1 serves as a latching relay. Input B2 is used for zero crossing detection.

Two push buttons and three LEDs allow a local operation and a visualization of the device state.

In addition to the output and input channels the device includes 16 independent functions for logic or timer control. The device supports KNX Data Security.

2 Installation and connection

The KNX IO 511.1 *secure* (1O2I) is designed for a DIN rail (35 mm) with a width of 1 unit (18 mm). An installation-friendly design with pluggable screw terminals helps to reduce costs of commissioning. The actuator has the following controls and displays:

1. KNX bus connection
2. Programming LED
3. Button for programming mode
4. LED On/1 (multicolor)
5. LED Ch/M (multicolor)
6. LED --/2 (multicolor)
7. Button A On/1
8. Button B Off/2
9. Pluggable screw terminals

This device is powered by the KNX bus. An external power supply is not necessary.

ℹ️ *If the bus voltage is missing, the device is without function.*

2.1   KNX programming mode

The KNX programming mode is activated/deactivated either by pressing the recessed KNX programming button ❸ or by simultaneously pressing the buttons (P/Esc) ❼ and ❽.

When the programming mode is active, the programming LED ❷ and the LED Mode ❺ light up red.

The operation/visualization of the programming mode on the front can be activated/deactivated in the ETS® on page general settings.

2.2   Manual operation and status display

The LED Ch/M ❺ lights up or flashes if the device is successfully powered by the KNX bus.

By pressing button A On/1 ❼ long, the manual operation mode will be entered for the actuator (channel A). This is indicated by cyclic single flashing of LED Ch/M ❺ in orange.

The actuator (channel A) can be switched on with button On /1 ❼ and switched off with button Off/2 ❽. The manual operation mode can be exit by pressing the buttons (P/Esc) ❼ and ❽ simultaneously.

The LED On/1 ❹ is used to display the status of the actuator (channel A). It lights when the channel is on and is switched off when the channel is off.

By pressing button B Off/2 ❽ long, the manual operation mode will be entered for the binary input (channel B). This is indicated by cyclic double flashing of LED Ch/M ❺ in orange.

If manual operation for the binary input (channel B) is activated, the bus telegrams of input 1 and input 2 can be triggered by button A On/1 ❼ and button B Off/2 ❽, if the input channel is configured by ETS. The manual operation mode can be exit by pressing the buttons (P/Esc) ❼ and ❽ simultaneously.

LED On/1 ❹ and LED --/2 ❻ are used to indicate the state of selected input while manual operation. They light green when button A On/1 ❼ or button B Off/2 ❽ is pressed.

Summary of the states of LED Ch/M **⑤** :

LED Status	Meaning
LED lights green	The device operates in normal operating mode.
LED lights red	The programming mode is active.
LED flashes 1x orange	The programming mode is not active. Manual operation is active: Switching actuator (channel A).
LED flashes 2x orange	The programming mode is not active. Manual operation is active: Switching binary inputs (channel B).
LED flashes red	The programming mode is not active. Manual operation is not active. The device is not loaded correctly e.g. after aborting a download.
LED flashes green	The device is currently loaded by the ETS.

3 Reset to factory default settings

It is possible to reset the device to its factory default settings.

- Disconnect the KNX bus connector **①** from the device.
- Press the KNX programming button **③** and keep it pressed down.
- Reconnect the KNX bus connector **①** to the device.
- Keep the KNX programming button **③** pressed for at least another 6 seconds.
- A short flashing of all LEDs (**②④⑤⑥**) visualizes the successful reset of the device to factory default settings.

In the factory default settings, the device has the physical address 15.15.255 and no group addresses are connected. Also, KNX Data Security is disabled and the initial key (FDSK) must be used for secure commissioning.

4 Ex-factory behavior

In ex-factory state, the binary inputs are internally connected to the actuator channel.

By applying a voltage pulse to binary input B1, the actuator switches over (toggle function). The device thus behaves like a latching relay. This presetting enables the replacement of a conventional impulse switch by the KNX IO 511.1 *secure* (1O2I) without programming. For this function, the device must be connected to the KNX bus voltage. The KNX IO 511.1 *secure* (1O2I) can then be programmed and integrated into the KNX system.

Binary input B2 is configured as zero crossing detection. If the input is connected to phase (L), the actuator switches at zero crossing of the mains voltage. This protects the relay contacts, especially with capacitive loads (switching power supplies / LED lights) and increases the life time of the device. If input B2 is not connected, the actuator switches without taking into account the zero crossing.
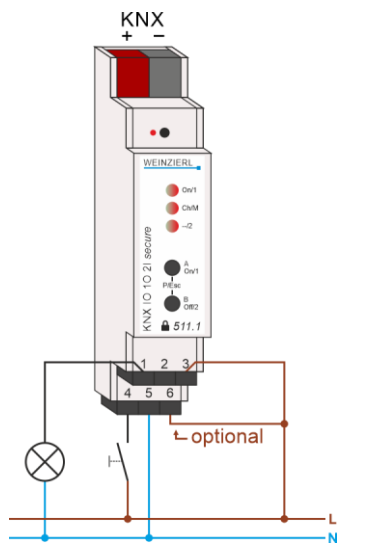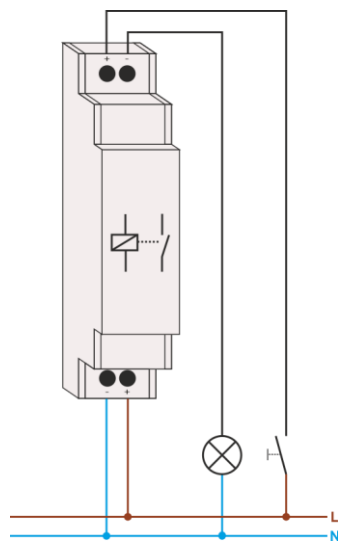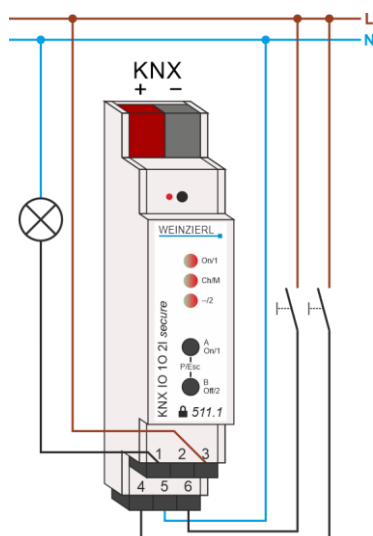

KNX IO 511.1 *secure* (1O2I)   Conventional latching relay

5 Wiring scheme

5.1 Pluggable screw terminals

Ch A Out	Ch A Out	Ch A In
Ch B In 1	Ch B Cm	Ch B In 2

Terminal top (channel A)

The top pluggable screw terminal ❾ on the left/middle terminal pins Ch A Out are used as closer. On the right terminal pin Ch A In the common pin is contacted e.g. the voltage to be switched.

Terminal bottom (channel B)

The bottom pluggable screw terminal ❾ is used for the binary inputs. The middle terminal pin Ch B Cm (Common) shall be connected to the common wire (neutral for 230V AC and GND for DC). The left and right terminal pins Ch B In 1/2 shall be connected to the corresponding switches / push buttons.

It is allowed to connect on the top terminal compared to the bottom terminal a different phase or voltage.

5.2 Pin assignment

Connection	Icon	Description
1	Ch A Out	Connection channel A Output connected as closing contact
2	Ch A Out	Connection channel A Output connected as closing contact
3	Ch A In	Common connection for channel A e.g. the voltage to be switched
4	Ch B In 1	Connection channel B Input for corresponding switch / push button
5	Ch B Cm	Common connection for channel B Neutral for 230V AC and GND for DC
6	Ch B In 2	Connection channel B Input for corresponding switch / push button
KNX	+	Positive connection for KNX bus
KNX	-	Ground connection for KNX bus

6 KNX Security

The KNX standard was extended by KNX Security to protect KNX installations from unauthorized access. KNX Security reliably prevents the monitoring of communication as well as the manipulation of the system.

The specification for KNX Security distinguishes between KNX IP Security and KNX Data Security. KNX IP Security protects the communication over IP while on KNX TP the communication remains unencrypted. Thus, KNX IP Security can also be used in existing KNX systems and with non-secure KNX TP devices.

KNX Data Security describes the encryption on telegram level. This means that the telegrams on the twisted pair bus or via RF (radio frequency) are also encrypted.

Encrypted telegrams are longer than the previously used unencrypted ones. For secure programming via the bus, it is therefore necessary that the interface used (e.g. USB) and any intermediate line couplers support the so called KNX long frames.
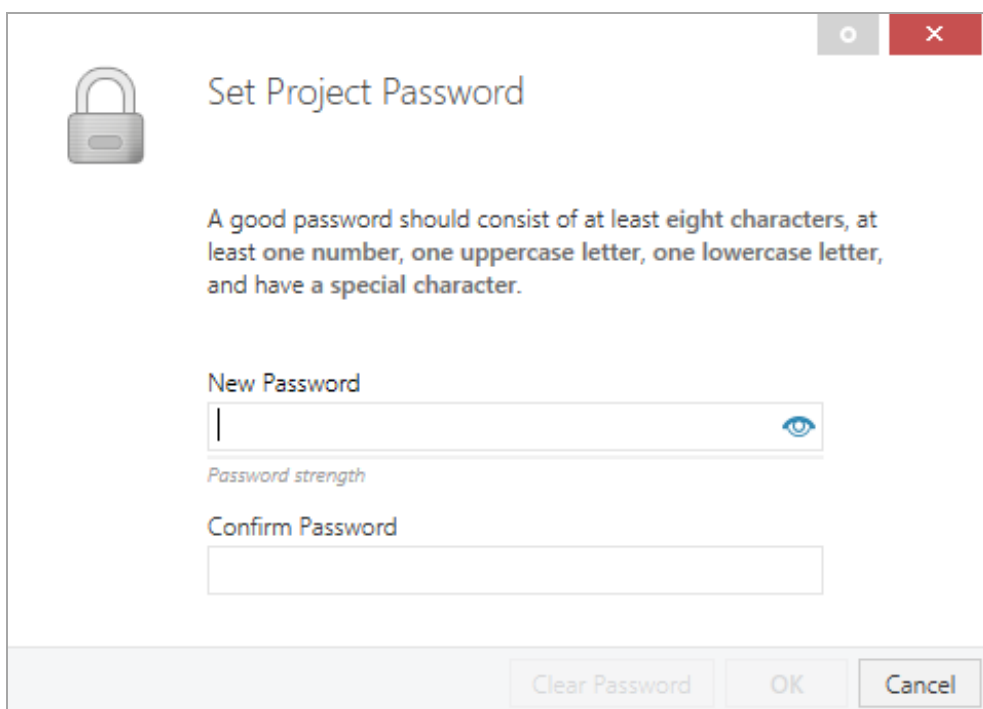
7 ETS database

The ETS5 database (for ETS 5.7 or newer) can be downloaded from the product website of the KNX IO 511.1 *secure* (1O2I) (www.weinzierl.de) or from the ETS online catalogue.

The KNX IO 511.1 *secure* (1O2I) supports KNX Data Security to protect the device against unauthorized access from the KNX bus. If the device is programmed via the KNX bus, this is done with encrypted telegrams.

7.1 Secure commissioning

If the first product is inserted into a project with KNX Security, the ETS prompts you to enter a project password.

This password protects the ETS project from unauthorized access. This password is not a key that is used for KNX communication. The entry of the password can be bypassed with "Cancel", but this is not recommended for security reasons.

ETS requires a device certificate for each device with KNX Security that is created in the ETS. This certificate contains the serial number of the device as well as an initial key (FDSK = Factory Default Setup Key).
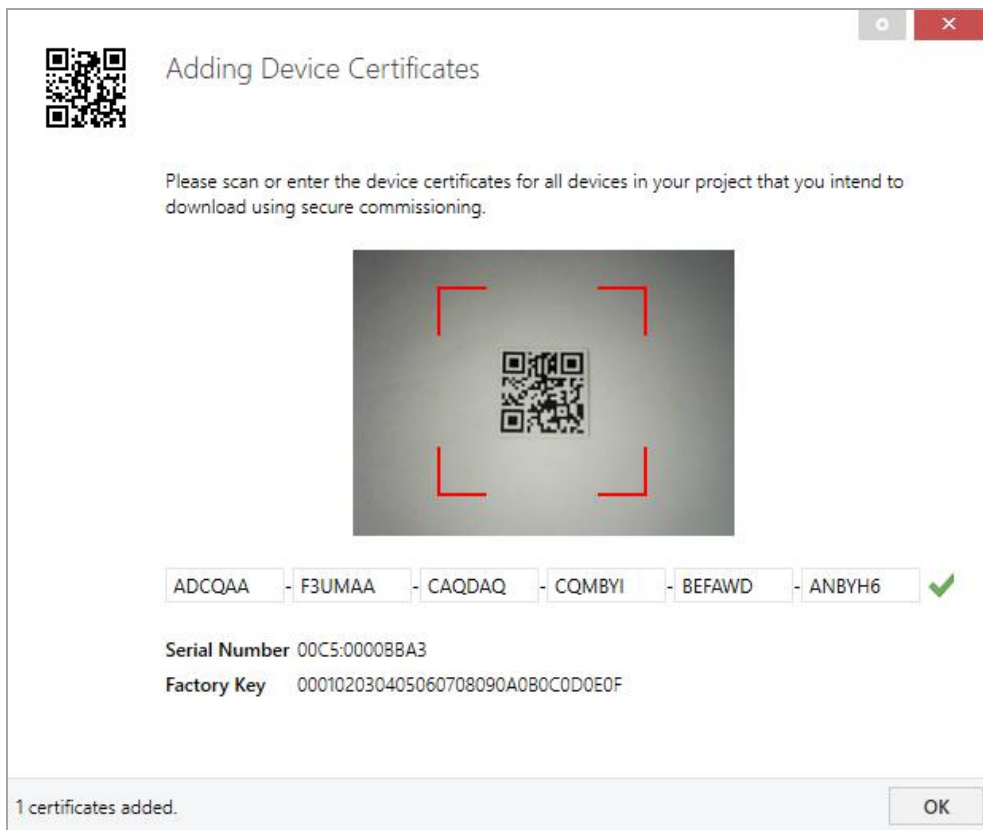
The certificate is printed as text on the device. It can also be scanned from the printed QR code via a webcam.

The list of all device certificates can be managed in the ETS panel Reports – Project Security.

This initial key is required to safely put a device into operation from the start. Even if the ETS download is recorded by a third party, the third party has no access to the secured devices afterwards. During the first secure download, the initial key is replaced by the ETS with a new key that is generated individually for each device. This prevents persons or devices who may know the initial key from accessing the device. The initial key is reactivated after a reset to factory default settings.

The serial number in the certificate enables the ETS to assign the correct key to a device during a download.

In the ETS project in the properties of the device, secure commissioning can be activated and the device certificate can be added:
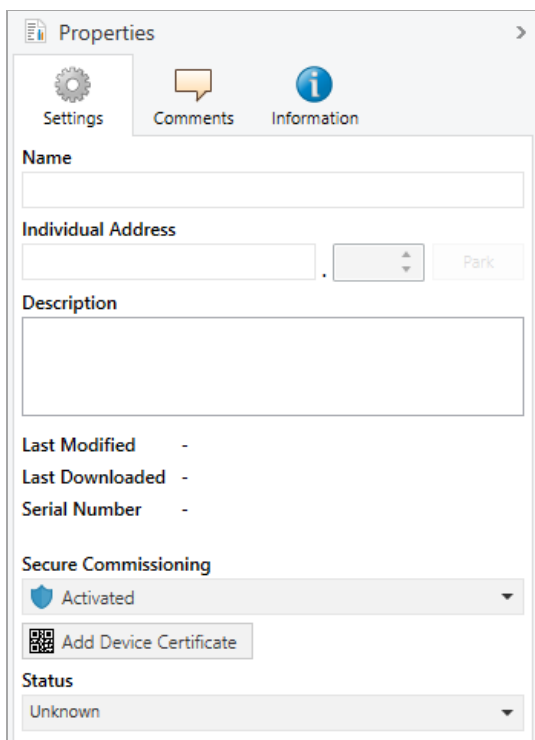

7.2   Secure group communication

Each object of the device can communicate either encrypted or unencrypted. The encryption is set under "Security" in the properties of the used group address:
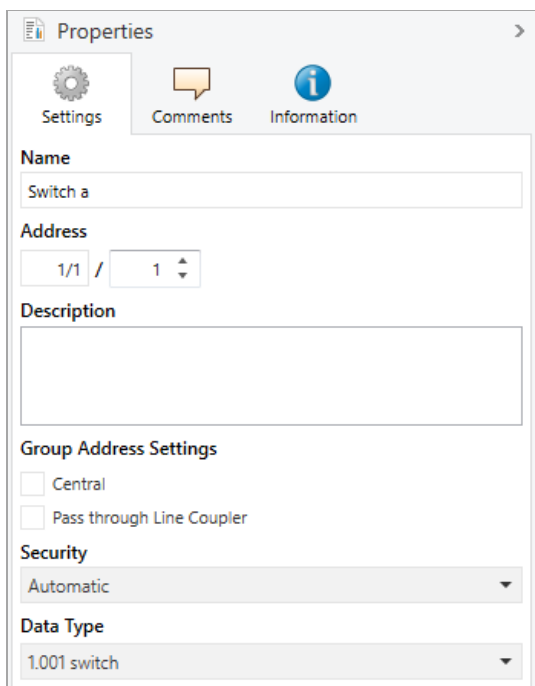
The setting "Automatic" activates encryption if both objects to be connected can communicate encrypted. Otherwise encrypted communication between the objects is not possible.

In the overview of communication objects in the ETS project, secured objects can be recognized by a shield symbol:

	Security	Number ▲	Name	Object Function	Description	Group Address
■⇄	🛡	11	Button A0: Object a	Switch	Switch a	1/1/1
■⇄		12	Button A0: Object b	Switch	Switch b	1/1/2
■⇄	🛡	21	Button A1: Object a	Switch	Switch a	1/1/1
■⇄		22	Button A1: Object b	Switch	Switch b	1/1/2

A separate key is automatically generated by the ETS for each secured group address. These keys can also be checked in the ETS panel Reports – Project Security. To enable all devices to communicate with a secure group address, the keys must be known to all. Therefore a download must be made into all devices that use this group address when a key is created or changed. A key is changed by the ETS e.g. when the encryption of a group address is switched off and on again.

7.3 Description

KNX IO 511.1 secure (1O2I)
Switching actuator with 1 output
and 2 binary inputs

WEINZIERL

The KNX IO 511.1 secure (1O2I) is a compact switching actuator with 1 bi-stable output and 2 binary inputs.

The actuator provides the function for universal outputs including scene control, timer, staircase lighting and heating valves (PWM for thermoelectric valve drives).

The inputs can be connected to conventional switches with an external voltage of 12 to 230 V. In ex-factory settings the inputs are connected internally to the actuator.
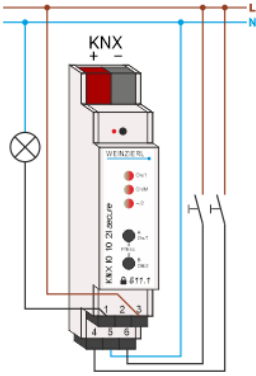
The actuator combined with input B1 serves as a latching relay. Input B2 is used for zero crossing detection. Two push buttons and three LEDs allow a local operation and a visualization of the device state.

In addition to the output and input channels the device includes 16 independent functions for logic or timer control. The device supports KNX Data Security.

Wiring scheme:

Please consult device data sheet and manual for further information.

Contact:

WEINZIERL ENGINEERING GmbH
Achatz 3-4
84508 Burgkirchen an der Alz
GERMANY
www.weinzierl.de
info@weinzierl.de

This page shows the device description and the corresponding connection diagram.

7.1 General settings

-.-.- KNX IO 511.1 secure (1O2I) > **General settings**

Description	
General settings	
+ Channel A: Actuator	
+ Channel B: Input 1	
+ Channel B: Input 2	
+ Logic / Timer	

Device name	KNX IO 511.1 secure (1O2I)
Send delay after bus power return	5 s
Prog. mode on device front	○ Disabled ● Enabled
Manual operation on device	Enabled with time limit 10 min
Heartbeat	○ Disabled ● Enabled
Cycle time	5 min
Binary inputs	
Long button press after	1.2 s

Device name *(30 characters)*

An arbitrary name can be assigned for the KNX IO 510.1 *secure* (2O). The device name should be meaningful, e.g. "Living Room". This helps the clarity of the ETS project.

Send delay after bus power return

A send delay of telegrams after the return of the bus voltage can be set via this parameter. In this case, telegrams from the device are sent to the KNX bus in a delayed manner by the set time. This results in a reduction of the bus load at a bus power return. Other functions such as receiving telegrams of switching operations of the actuator are not affected by this parameter.

Prog. mode on device front

In addition to the normal programming button ❸ the device allows activating the programming mode on the device front without opening the switchboard cover. The programming mode can be activated and deactivated via pressing simultaneously both buttons ❼ and ❽.

This feature can be enabled and disabled via the parameter "Prog. mode on device front". The recessed programming button ❸ (next to the Programming LED ❷) is always enabled and not influenced by this parameter.

Manual operation on device

This parameter is used to configure the manual operation on the device. The manual operation mode can be disabled or activated (with or without time limitation). The time limit defines the duration until the automatic return from the manual operation mode back into the normal operating mode.

The device is in normal operating mode when the manual control is not active. In the manual operating mode, received switching telegrams are ignored. When the manual operation mode is terminated (after expiry of the time limit or manually), the last state of the outputs remains, until a new switching telegram is received again.

The following options are selectable:

- Disabled
- Enabled with time limit 1 min
- Enabled with time limit 10 min
- Enabled with time limit 30 min
- Enabled without time limit

Heartbeat

Cyclic sending of values to the KNX bus, to indicate that the device is operational. For the Cycle time values between 1 min and 24 h are selectable.

Group object	Type KNX	Size	Direction
GO 1 Heartbeat – Trigger	1.001	1 bit	To KNX

Furthermore, the parameters **Heartbeat** and **Cycle time** are used as configuration for cyclic sending, in case that switching is configured as state query. For a more detailed description regarding state query please take a look at "Input B1 / B2: Switching – State query".

7.2 Actuator A: General

Name *(30 characters)*

An arbitrary name can be assigned for the channel. However, this should be clear and meaningful, this makes it easier to work with the associated group objects, because the given name is displayed there as a label. If no name is assigned, the group objects are named "Actuator A: …".

Function

This parameter defines the functionality of the actuator. The following options are selectable:

- Disabled
- Universal output
- On/Off delay
- Staircase function
- Valve actuator (PWM for thermal servo)

> More detailed descriptions of the functions can be found in the sections "Actuator A: …".

Scene function *(only for function "Universal output")*

With this parameter the scene function can be enabled or disabled. If this functionality is enabled, the respective group object as well as the parameter page "Actuator A: Scene function" are displayed for further configuration of scenes 1 – 16.

Group object	Type KNX	Size	Direction
GO 12 Actuator A: Scene – Activ./Lrn.	18.001	1 bit	From KNX

Behavior on bus power failure *(for function != "Disabled")*

The behavior which is held at the output during the bus power failure can be configured here.

The following options are selectable:

- No reaction
- Switch on
- Switch off

Behavior after bus power return *(for function != "Disabled")*

Here the behavior of the output after bus power return can be configured. This behavior will be set after every device restart (e.g. also on restart after ETS download).

The following options are selectable:

- No reaction
- Switch on
- Switch off
- State like before bus power failure

Send state *(for function != "Disabled")*

This parameter defines the behavior of the state objects:

- Disabled
  State objects are deactivated and not displayed
- Only on read
  State objects send only on request
- On change
  State objects send on value change
- Cyclic and on change
  State objects send cyclically and on value change

Group object	Type KNX	Size	Direction
GO 18 Actuator A: Output – State	1.001	1 bit	To KNX
GO 19 Actuator A: Valve actuator (PWM) – State*	5.001	1 byte	To KNX

* for function = "Valve actuator (PWM for thermal servo)"

Time for cyclic state

Is selected state object "Cyclic and on change", in this parameter the cycle time can be set.

Lock function *(for function "Universal output", "On/Off delay" or "Staircase function")*

With this parameter the lock function can be enabled. If this functionality is activated, the associated group objects as well as the parameter page "Actuator A: Lock function" are displayed for further configuration. If the lock has been activated via the group object "Lock", the received switching telegrams are not executed.

In addition to the lock object, there is also a priority object, which can be switched independently of the lock. Thus, it is possible to set an output state without affecting other functions.

Group object	Type KNX	Size	Direction
GO 15 Actuator A: Lock – Activate	1.001	1 bit	From KNX
GO 16 Actuator A: Prior. output – Switch	1.001	1 bit	From KNX

Lock function *(for function "Valve actuator (PWM for thermal servo)")*

With this parameter the lock function can be disabled or enabled. If this functionality is activated, the associated group objects as well as the parameter page "Actuator A: Lock function" are displayed for further configuration. If the lock has been activated via the group object "Lock", the received switching telegrams are not executed.

In addition to the lock object, there is also a priority object, which can be used to set a control value independently of the lock. Thus, it is possible to set an output PWM without affecting other functions.

When the lock is ended, the last received value (not priority object) is represented as PWM at the output.

Group object	Type KNX	Size	Direction
GO 15 Actuator A: Lock – Activate	1.001	1 bit	From KNX
GO 17 Actuator A: Prior. valve actuator (PWM) – Control value	5.001	1 byte	From KNX

Example of the priority object:

In the case of events in public buildings or in restaurants, the normal operation can be set into an inoperative state by the lock group object. Thus it is possible to lock during the lecture or concert, switches that are accessible to unauthorized persons, in order to prevent unmeant switching. Nevertheless, the individual lamps can controlled by use of the priority object without canceling the lock.

7.3 Actuator A: Lock function

Condition:

Function is "Universal output", "On/Off delay" or "Staircase function".

-.-.- KNX IO 511.1 secure (1O2I) > Channel A: Actuator > Actuator A: Lock function		
Description	Polarity of object	⊙ Lock active on 1 ○ Lock active on 0
General settings	Behavior on start	No reaction ▾
− Channel A: Actuator	Behavior at end	No reaction ▾
Actuator A: General		
Actuator A: Lock function		
+ Channel B: Input 1		
+ Channel B: Input 2		
+ Logic / Timer		

Polarity of object

This parameter defines, if the lock should be activated by receiving a 1 or by receiving a 0.

The following options are selectable:

- Lock active on 1
- Lock active on 0

Behavior on start

This parameter configures, which state the output should set, if the lock activates.

The following options are selectable:

- No reaction
- Switch on
- Switch of

This output state can still be changed by the priority object.

Behavior at end

This parameter defines, which state the output should set, if the lock deactivates.

The following options are selectable:

- No reaction
- Switch on
- Switch off

- State before lock
  This restores the original state before the lock was activated. Switching telegrams received during the lock are ignored.

- State without lock
  Here the state of the last received switching telegram is restored. This takes into account the received switching telegrams during the lock. Thus, when the lock is deactivated, the last received switching telegram is set.

Condition:

Function is "Valve actuator (PWM for thermal servo)".

Polarity of object

This parameter defines, if the lock should be activated by receiving a 1 or by receiving a 0.

The following options are selectable:

- Lock active on 1
- Lock active on 0

Behavior on start

This parameter defines, which behavior the output should represent, if the lock activates.

The following options are selectable:

- No reaction
  The PWM value remains as to begin of the lock function.
- Value
  When the lock is activated, a defined PWM value is represented on the output.

Control value (PWM)

If a defined PWM value should be set to the output when the lock is activated, this value can be set with this parameter.

7.4 Actuator A: Universal output

If the universal output is selected on the parameter page "Actuator A: General", the actuator can be used as a switching output. A parameter for the scene function is also displayed.

Group object	Type KNX	Size	Direction
GO 11 Actuator A: Output – Switch	1.001	1 bit	From KNX

7.5 Actuator A: Scene function

Scene 1 – 16

These parameters can be used to configure the state, which is set at the output when the respective scene is executed.

The following options are selectable:

- No reaction
- Switch on
- Switch off
- Learnable
  By using a scene control telegram, the current state at the output can be saved for the respective scene. This allows the user to customize the scene without ETS download.

Number

This parameter sets any scene number between 1 and 64 to the scene. There must not configured any scene numbers twice.

7.6 Actuator A: On/Off delay

If the on/off delay is selected on the parameter page "Actuator A: General", delayed switching times can be configured. The "Actuator A: On/Off Delay" parameter page is displayed for this purpose.

Group object	Type KNX	Size	Direction
GO 11 Actuator A: Output – Switch	1.001	1 bit	From KNX

On delay time

The duration of the switch-on delay is configured in this parameter.

```
Input:  --1---------0------
Output: --|-T-1-----0------
```

Off delay time

The duration of the switch-off delay is configured in this parameter.

Input: `--1---------0------`
Output: `--1---------|-T-0--`

Retriggerable

If these parameters are activated, the respective delay time is restarted upon receipt of the corresponding switching signal.

7.7 Actuator A: Staircase function

If the staircase function is selected on the parameter page "Actuator A: General", a group object for the staircase function appears in addition to the normal switching object. Via the additional parameter page "Actuator A: Staircase function" this function can be configured.

Group object	Type KNX	Size	Direction
GO 11 Actuator A: Output – Switch	1.001	1 bit	From KNX
GO 13 Actuator A: Staircase function – Trigger	1.010	1 bit	From KNX

Switch off time

The time for which the output is activated after an ON telegram (object of the staircase function) has been received, can set in this parameter.

Input: `--1---------0------`
Output: `--1-T-0------------`

Retriggerable

This parameter can be used to set whether the follow-up time is to be restarted when an ON telegram is received on the object of the staircase function.

Reaction on 'OFF' telegram

This parameter can be used to set whether an OFF telegram on the object of the staircase function should be processed or ignored.

Time for warning before switch off

The time between pre-warning and deactivation is configured, or the pre-warning is deactivated with this parameter. If the pre-warning time is longer than the actual follow-up time, no pre-warning is carried out.

Time of interrupt

The pre-warning is indicated by a brief interruption (switch off – switch on). The duration of this interrupt is configured in this parameter.

> *LED lamps often have a long follow-up time, in which the lamp still lights even though it is already switched off. With such lamps longer interrupt times must be set to generate a "visible" interruption.*

7.8 Actuator A: Valve actuator (PWM for thermal servo)

The function valve actuator is foreseen to control thermoelectric valve drives which are used for floor heating but also for radiators. It maps the continuous position (0 % – 100 %) to an ongoing On/Off sequence called PWM (pulse width modulation) signal.

If the valve actuator is selected on the parameter page "Actuator A: General", a group object for the valve actuator appears instead of the normal switching object. This allows the current PWM at the output to be set via KNX (0 % – 100 %). An additional parameter page "Actuator A: Valve actuator" appears for the configuration of the valve actuator.

The received control value is saved automatically by the device, to continue faultless after a possible bus power loss.

Group object	Type KNX	Size	Direction
GO 14 Actuator A: Valve actuator (PWM) – Control value	5.001	1 byte	From KNX

Cyclic time (PWM)

The cyclic time of the PWM, which is used to control a servo drive, is configured with this parameter. One cycle involves a time range in which the output is switched on and one in which the output is switched off. The cyclic time corresponds to the period between two rising edges (state change at the output from OFF to ON). The longer the flow of the heating circuit (tube / pipe length), the higher the cyclic time should be set.

Typical thermal servo require several minutes for a valve change of 100 %.

Maximum control value (PWM)

This parameter can be used to limit the maximum control value. The control value is expressed in percent and defines the period during which the output is switched on in one cycle.

Example:

Cyclic time = 10 min
Maximum control value (PWM) = 80 %
Maximal output state = ON for 8 min / OFF for 2 min

Stuck protection

With the stuck protection, it is intended to prevent the valve from being damaged by corrosion or calcification, that it can no longer be moved. In case stuck protection is enabled, this is only triggered if the value is permanently 0 % or 100 %. On every other control value the servo already moves, so there is no need for a stuck protection.

Example:

Control value 0 % = Open servo for the set time
Control value 100 % = Close servo for the set time

In case the valve is not allowed to open, the stuck protection must be disabled.

Execution time *(only for activated stuck protection)*

If the stuck protection is activated, this parameter is used to set the duration of the state change.

Monitoring interval *(only for activated stuck protection)*

If the stuck protection is activated, this parameter sets the monitoring interval. If the state of the output remains unchanged for this time, the lock protection is triggered.

Protection on missing control value

This parameter enables the protection function on missing control value telegrams. This is necessary in order to prevent unwanted and uncontrolled overheating or cooling down of the room, when the control value is missing.

Protection takes effect, as soon as no telegrams are received from the controller over a longer period of time. As soon as this extended telegram pause has occurred, it can be assumed that the corresponding controller has failed or the connection between the controller and the valve actuator has been interrupted.

Protection control value (PWM) *(only for activated protection on missing control value)*

If the protection on missing control value is enabled, this parameter sets a protection control value. This configured PWM value will set the output, if the protection is active.

As soon as telegrams from the controller are received again, the protection control value (PWM) is overwritten by the received value. The protection does not react again, until the waiting time in the set monitoring interval is exceeded between individual telegrams.

Monitoring interval *(only for activated protection on missing control value)*

If the protection on missing control value is enabled, this parameter sets the monitoring interval. If no further telegram is received by the device during this time, the protection function takes effect.

7.9 Input B1 / B2: General

Name *(30 characters)*

An arbitrary name can be assigned for the channel. However, this should be clear and meaningful, this makes it easier to work with the associated group objects, because the given name is displayed there as a label. If no name is assigned, the group objects and parameter pages are named "Input B1 / B2…".with the channel number. The 1st binary input will be described below, the functioning of the other channel is according to the 1st.

Function

This parameter defines the functionality of the connected contact. The following options are selectable:

- Disabled
- Switching
- Dimming
- Shutter
- Send value
- Scene
- Impulse counter

- Latching relay, toggle INTERNAL
- Latching relay, on INTERNAL
- Latching relay, off INTERNAL
  An internal connection from the binary input to the actuator. In this case there will be no telegram on the bus, instead directly the actuator is switched on, off or toggled. With this toggle function it´s possible, to replace a latching relay with the KNX IO 511.1 *secure* (1O2I) and used all existing wiring, without configuring any new KNX group addresses at the device.

- Zero crossing detection INTERNAL
  An internal connection from the binary input to the actuator to switch the relay in the zero crossing at 100 V – 230 V / 50 Hz – 60 Hz. This treats the conducts of the relay wit care and thus increases the lifetime of the relay. In case that the zero crossing cannot detected identically e.g. the phases is not connected to the pin, the relay is switched immediately, like the function is not selected.

> ⚠ *The zero crossing detection must not be used from several cannels at the same time!*

> ⓘ *A more detailed description of the functions can be found in the sections "Input B1 / B2: …" of the respective function.*

Condition:

Function is "Switching", "Dimming", "Shutter", "Send value" or "Scene".

Type

The mode of operation of the contact connected to the input channel can be configured here:

- Normally open contact
- Normally closed contact

Lock function

With this parameter the lock function can be enabled. If this functionality is activated, the associated group objects as well as the parameter page "Input B1: Lock function" are displayed for further configuration. If the lock has been activated via the group object, no telegrams are triggered by state changes of the connected contact.

Group object	Type KNX	Size	Direction
GO 26 Input B1 / B2: Lock – Activate	1.001	1 bit	From KNX

Condition:

Function is "Impulse counter".

Here, the general settings of the impulse counter are made, a scaled counter and/or a counter for the rate of change must also be selected.

Input signal

Here it can be selected whether DC or alternating voltage is applied to the binary input.

Count on

This parameter can be used to determine whether the value of the counter is increased at the rising or falling edge at the input

Scaled counter (e.g. [kWh])

Here, the scaled counter can be activated, the parameter page "Scaled counter" is displayed when activated.

Rate of change (e.g. [kW], [m/s], [km/h])

The counter for a rate of change can be activated here. If activated, the "Rate of change" parameter page is displayed.

7.10 Input B1 / B2: Lock function

Condition:

Function is "Switching", "Dimming", "Shutter", "Send value" or "Scene".

Polarity of object

This parameter defines, if the lock should be activated by receiving a 1 or by receiving a 0. The following options are selectable:

- Lock active on 1
- Lock active on 0

Behavior of (…) on start

The telegram can be configured here, which is sent when the lock is activated.

Behavior of (…) at end

The telegram can be configured here, which is sent when the lock is deactivated.

Condition:

Function is "Impulse counter".
Scaled counter is "Enabled".

Polarity of object

This parameter can be used to determine how the lock is to be activated, either by receiving a 1 or a 0. The corresponding telegram disables the lock again.

Behavior on start of lock

With this parameter the behavior of the counter can be configured when the lock is activated:

- Counter stop
- Counter stop and reset

Behavior on end of lock

With this parameter the behavior of the counter can be configured when the lock is deactivated:

- Counter continue
- Counter reset and continue

7.11 Input B1 / B2: Switching

If the switching function is selected, up to 2 binary switching telegrams can be sent via the following objects:

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Output a – Switch	1.001	1 bit	To KNX
GO 22 Input B1 / B2: Output b – Switch	1.001	1 bit	To KNX

Output b is only visible when activated by parameter.

User control

The parameter "User control" determines whether telegrams are sent when the input is changed (e.g. key switches) or when the input is operated short/long (e.g. switching/dimming switches).

Function of output a/b on press
Function of output a/b on short press
Function of output a/b on release
Function of output a/b on long press

It is selectable for each object, which telegram is sent on opening/closing the contact or on short/long button press.

- No reaction
- Switch on
- Switch off
- Toggle

Output b

Here you can show/hide the parameters and the object for output b.

7.12 Input B1 / B2: Switching – State query

The state query function is used, for example, to monitor window contacts.

The state query mode is recognized automatically by the firmware, if the following parameter setting is configured:

User control = Press / Release
Function of output a/b on press = Switch on
Function of output a/b on release = Switch off

or inverted:

User control = Press / Release
Function of output a/b on press = Switch off
Function of output a/b on release = Switch on

If a state query is configured, the value on the object is kept up to date. The value corresponding to the current state is read. If the lock is active, the object value corresponds to the last state before the lock or to the configured value on lock.

Cyclic sending of this actual value is possible. Via activating the parameter **Heartbeat** on page "General settings" the object value of the state query is sent cyclically on the KNX bus (see **Heartbeat**), but not if the lock is activated. The cycle time is also used from the corresponding parameter of the **Heartbeat**.

7.13 Input B1 / B2: Dimming

On selection of function Dimming following objects are visible:

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Dimming on/off – Switch	1.001	1 bit	To KNX
GO 22 Input B1 / B2: Dimming relative – Brighter/Darker	3.007	4 bits	To KNX

Dimming function

The dimming function parameter determines whether only one switching / dimming direction or 1-button control is to be used:

- On / Dim brighter
- Off / Dim darker
- Toggle direction

If the input detects a short button press, a switching telegram is sent via object 21. On long button press, a relative dimming is sent over the entire dimming range to object 22. When releasing after long button press, a dimming-stop telegram is sent via object 22.

The time for detection of a long button press can be set in the general parameters and is valid for all channels.

7.14 Input B1 / B2: Shutter

On selection of Shutter function following objects are visible:

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Drive start – Up/Down	1.001	1 bit	To KNX
GO 22 Input B1 / B2: Drive stop – Step/Stop	1.001	1 bit	To KNX

Shutter function

The "Shutter function" parameter determines whether only one shutter direction or 1-button control is to be used:

- Up / Step-Stop
- Down / Step-Stop
- Toggle direction

User control

The parameter "User control" determines the sending of telegrams on short and long button press:

- Long = Drive / Short = Step/Stop
  Long button press: Drive command via object 21
  Short button press: Step/stop command via object 22

- Short = Drive / Short = Step/Stop
  Long button press: Not evaluated
  Short button press: Alternately drive command via
  object 21 und step/stop command via object 22

- Pressed = Drive / Release = Stop
  On press: Drive command via object 21
  On release: Step/Stop command via object 22

The time for detection of a long button press can be set in the general parameters and is valid for all channels.

7.15 Input B1 / B2: Send value

If function send value is selected, the following telegrams can be sent at button press:

- 1 byte – Percent value

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Send percent value (1 byte) – Set value	5.001	1 byte	To KNX

- 1 byte – Integer value

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Send integer value (1 byte) – Set value	5.010	1 byte	To KNX

- 2 byte – Integer value

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Send integer value (2 byte) – Set value	7.001	2 bytes	To KNX

- 2 byte – Float value

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Send float value (2 byte) – Set value	9.001	2 bytes	To KNX

- 3 byte – RGB value

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Send RGB color value (3 byte) – Set value	232.600	3 bytes	To KNX

- 14 byte – ASCII string

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Send ASCII string (14 byte) – Set value	16.000	14 bytes	To KNX

- Shutter

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Send blind position – Set position	5.001	1 byte	To KNX
GO 22 Input B1 / B2: Send slat position – Set position	5.001	1 byte	To KNX

A field for entering the values to be sent is displayed, as well as the objects appropriate to the selected type.

If the shutter is selected as the value to be sent, height is sent on button press, lamella is sent on releasing the button, if the respective value is used.

7.16 Input B1 / B2: Scene

On selection of Scene function the following object is visible:

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Scene – Activ./Lrn.	18.001	1 byte	To KNX

Scene position 1 – 8

For each position, scene 1 – 64 can be activated.

If only one scene position is activated, it is sent on short button press.

If several scene positions are used, the activated positions are switched through with each short button press.

Reset scene position

The behavior for selection and transmission of the scene positions can be determined via the parameter "Reset scene position":

- Never
  Starting with the first scene position, the next scene position of the list is sent with each short button press, after the last scene position has been sent, the list starts again from the beginning.

- After execution
  Beginning with the first scene position, each short button press switches the scene position by one position within the execution delay, at the end of the execution delay, the current scene position is sent

- 5 s – 10 min
  On each button press the configured delay time is started.
  Starting with the first scene position, the next scene position of the list is sent with each short button press, after the last scene position has been sent, the list starts again from the beginning.
  After the delay time has expired, the list starts again at the first scene position on the next short button press.

When the lock function is used, the scene position is always reset when unlocking.

Condition on long/very long button press

It is also possible to select how a long and very long button press is to be treated:

- No reaction
- Save last scene
  A telegram for "save scene" with the last sent scene is triggered.
- Send scene
  The scene configured in the appearing parameter is sent.
- Reset position
  This function is used to override the behavior as set in the **Reset scene position** parameter.

The duration of time for detecting a very long button press is twice the time for detecting a long button press, as it is parameterized in the general settings.

7.17 Input B1 / B2: Scaled counter

This counter can be used to count values on input impulses, where an integer value or a floating point value can be selected as a counter variable. With this function, e.g. Electrical energy can be counted directly and sent to the bus via an object.

Scaling factor (Value per pulse)

Here, a floating point value is to be entered. It determines the value by which the counter value is increased per pulse.

Datapoint type

The datapoint type of output object of the counter variable can be selected here:

- Integer (32 Bit) – DPT 13

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Counter – Value	13.013	4 bytes	To KNX

- Float (16 Bit) – DPT 9

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Counter – Value	9.024	2 bytes	To KNX

- Float (32 Bit) – DPT 14

Group object	Type KNX	Size	Direction
GO 21 Input B1 / B2: Counter – Value	14.056	4 bytes	To KNX

Send condition

This parameter can be used to determine how the current counter value is to be sent:

- On read
  No independent sending of the counter value by the device. To read the counter value, the read flag of the group object has to be set.

- On change
  An additional parameter is displayed to select the minimal delta from the last sent value for sending a new counter value.

- Cyclically
  An additional parameter is displayed to configure the sending frequency of the counter variable.

- On change and cyclically
  Both sending conditions are active.

If the counter is locked by the object, also cyclic sending is stopped.

Monitoring limit value

When limit monitoring is activated, the following object is displayed:

Group object	Type KNX	Size	Direction
GO 22 Input B1 / B2: Counter threshold – State	1.002	1 bit	To KNX

Limit value *(only for activated monitoring limit value)*

Here you can edit the checked limit value. The datapoint type is the same as the counter value.

Behavior on reaching limit value (object) *(only for activated monitoring limit value)*

Here it is possible to determine whether a 0 or a 1 is sent via the object "Counter threshold – State" when the limit value is reached.

Behavior on reaching limit value (counter) *(only for activated monitoring limit value)*

In addition to the limit value itself, it is possible to determine the behavior of the counter when the limit value is reached:

- Counter continue
  Counter value continues increasing on ever pulse.
- Counter reset and continue
  Counter value is reset to 0 and continues increasing on ever pulse.
- Counter stop
  Counter value stays on limit value and must be reset by object.

Send on device restart

It can be determined with this parameter whether the counter value should be sent when the device is restarted.

Reset via object

If this function is activated, the following object appears:

Group object	Type KNX	Size	Direction
GO 25 Input B1 / B2: Reset – Trigger	1.017	1 bit	From KNX

When a telegram is received via this object, the current count values are reset to 0.

Reset after ETS download

If this parameter is activated, the counter values are reset to 0 after device reset (e.g. after ETS download), otherwise they are retained.

Lock function

The lock function can be activated or deactivated here. If this functionality is activated, the following group object appears, as well as the parameter page "Input B1 / B2: Lock function" for detailed configuration.

Group object	Type KNX	Size	Direction
GO 26 Input B1 / B2: Lock – Activate	1.001	1 bit	From KNX

7.18 Input B1 / B2: Rate of change

This counter is used to connect devices to the bus where the rate of change is critical within a time interval, e.g. an anemometer.

Scaling factor (Value per delta in base time span)

A floating point value is to be entered here. It determines the value by which the counter value is increased on every pulse

Time base

Here the time base of the rate of change can be specified:

- Pulses per second (e.g. [m/s], [km/h])
  Value from parameter Scaling factor is multiplied by 1.
- Pulses per hour (e.g. [kW])
  Value from parameter Scaling factor is multiplied by 3600.

Measurement time span

The measurement time span determines how quickly the counter can react to changes. Therefore, a short sample rate should be selected for fast processes (e.g. anemometer).

The rate of change is calculated using the 3 parameters mentioned above:

The device saves several meter readings per measurement interval, scales it with the scaling factor * time base and divides it by the measuring interval.

Datapoint type

The datapoint type of output object of the counter variable can be selected here:

- Floating point (16 Bit) – DPT 9

Group object	Type KNX	Size	Direction
GO 23 Input B1 / B2: Rate of change – Value	9.024	2 bytes	To KNX

- Floating point (32 Bit) – DPT 14

Group object	Type KNX	Size	Direction
GO 23 Input B1 / B2: Rate of change – Value	14.056	4 bytes	To KNX

Send condition

This parameter can be used to determine how the current counter value is to be sent:

- On read
  No independent sending of the counter value by the device. To read the counter value, the read flag of the group object has to be set.

- On change
  An additional parameter is displayed to select the minimal delta from the last sent value for sending a new counter value

- Cyclically
  An additional parameter is displayed to configure the sending frequency of the counter variable.

- On change and cyclically
  Both sending conditions are active.

Monitoring limit value

When limit monitoring is activated, the following object is displayed:

Group object	Type KNX	Size	Direction
GO 24 Input B1 / B2: Rate threshold – State	1.002	1 bit	To KNX

Limit value

Here you can edit the checked limit value. The datapoint type is the same as rate of change value.

Behavior on exceeding limit value

In addition to the limit value itself, it is possible to determine whether the counter should transmit 0 or 1 via the object if the limit value is exceeded.

Behavior on going below limit value

Here it is possible to determine whether the counter should transmit 0 or 1 via the object if the counter variable goes under limit value.

Example: Electricity meter with S0 interface

From the data sheet of the electricity meter it can be seen that the device delivers 500 pulses per kWh. A device with constant power of 1kW is connected to this current meter for one hour.

The scaled counter measures the energy consumed:

Scaling factor (output in kWh): 1 / 500 = 0.002

The counter for the rate of change measures the current power:

Scaling factor (output in kW): 1/500 = 0.002
*Scaling factor (output in W): 1/500 * 1000 = 2*
Time base: Pulses per hour
Measurement time span: 300 s

Example: Anemometer

From the data sheet of the electricity meter it can be seen that the device delivers 4 pulses/s at a wind speed of 1 m/s.

The counter for the rate of change measures the wind speed:

Scaling factor (output in m/s): 1/4 = 0.25
*Scaling factor (output in km/h): 1/4 * 3.6 = 0.9*
Time base: Pulses per second
Measurement time span: 10 s

7.19 Logic / Timing

Function 1 – 16

These parameters contain the functions timer and logic, whereby all 16 functions are identical.

The following options are available:

- Disabled
  No parameters and group objects for timer and logic.
- Timer
  Parameters and group objects for timer are available.
- Logic
  Parameters and group objects for logic are available.

> *The functions for timer and logic can be linked to one another by means of the associated group objects. This also allows to create complex structures. For this purpose, the output of a function is set to the same group address as the input of the next function.*

7.20 Function 1 – 16: Timer

-.-.- KNX IO 511.1 secure (1O2I) > Logic / Timer > Function 1: Timer		
Description	Function name	
General settings	Timer type	Switch-on delay
+ Channel A: Actuator	Delay time [s]	60
+ Channel B: Input 1	Output	○ Not inverted ○ Inverted
+ Channel B: Input 2		
− Logic / Timer		
Logic / Timer		
Function 1: Timer		
Function 2: Timer		
Function 3: Logic		
Function 4: Logic		

Function name *(10 characters)*

The function name can be chosen freely.

The name is visible in the group object entry in the ETS software. This makes it easier to work with the associated group objects, because the given name is displayed there as a label.

Timer type

Here the type of the timer can be set:

- Switch-on delay
  The ON telegram (1) received on the input is delayed on the output.
  Input: `--1---------0------`
  Output: `--|-T-1-----0------`

Group object	Type KNX	Size	Direction
Timer – Switch-on delayed – Input	1.002	1 Bit	From KNX
Timer – Switch-on delayed – Output	1.002	1 Bit	To KNX

- Switch-off delay
  The OFF telegram (0) received on the input is delayed on the output.
  Input: `--1---------0------`
  Output: `--1---------|-T-0--`

Group object	Type KNX	Size	Direction
Timer – Switch-off delayed – Input	1.002	1 Bit	From KNX
Timer – Switch-off delayed – Output	1.002	1 Bit	To KNX

- Switch-on and -off delay
  The ON/OFF telegram (1/0) received on the input is delayed on the output.
  Input: `--1---------0------`
  Output: `--|-T-1-----|-T-0--`

Group object	Type KNX	Size	Direction
Timer – Switch-on/off delayed – Input	1.002	1 Bit	From KNX
Timer – Switch-on/off delayed – Output	1.002	1 Bit	To KNX

- Impulse (staircase)
  The ON telegram (1) received on the input is sent on the output. After a delay the output sends the OFF telegram (0).
  Input: `--1---------0------`
  Output: `--1-T-0------------`

Group object	Type KNX	Size	Direction
Timer – Impulse (staircase) – Input	1.002	1 Bit	From KNX
Timer – Impulse (staircase) – Output	1.002	1 Bit	To KNX

Each timer can be stopped by sending the opposite value to its input group object. For example: An already started switch-on timer can be stopped by sending OFF (0) to its input group object.

Delay [s]

This parameter defines the delay when sending at the output.

Output

Via this parameter the sent value on the output can be inverted:

- Not inverted
- Inverted

7.21 Function 1 – 16: Logic

Function name *(10 characters)*

The function name can be chosen freely.

The name is visible in the group object entry in the ETS software. This makes it easier to work with the associated group objects, because the given name is displayed there as a label.

Gate type

This parameter defines the type of the logic gate:

- And gate
  The output is triggered ON (1), if both inputs are switched ON (1).
- OR gate
  The output is triggered ON (1), if one or both inputs are switched ON (1).
- XOR gate
  The output is triggered ON (1), if the two inputs are not equal.
- NAND gate
  The output is triggered ON (1), if one or both inputs are switched OFF (0).
- NOR gate
  The output is triggered ON (1), if both inputs are switched OFF (0).
- XNOR gate
  The output is triggered ON (1), if both inputs are equal.

Group object	Type KNX	Size	Direction
Logic – Gate input A – Input	1.002	1 Bit	From KNX
Logic – Gate input B – Input	1.002	1 Bit	From KNX
Logic – Gate output – Output	1.002	1 Bit	To KNX

The output transmits when a telegram is received on one of the inputs. A precondition for this is that both inputs are valid (have received at least one telegram). The output sends a 1 if the respective condition is fulfilled, otherwise a 0.

- INVERTER
  Input ON (1) is converted into output OFF (0). Input OFF (0) is converted into output ON (1).

Group object	Type KNX	Size	Direction
Logic – Gate input – Input	1.002	1 Bit	From KNX
Logic – Gate output – Output	1.002	1 Bit	To KNX

The output transmits when a telegram is received on the input.

⚠ WARNING

- The device must be mounted and commissioned by an authorized electrician.
- The prevailing safety rules must be heeded.
- The device must not be opened.
- For planning and construction of electric installations, the relevant guidelines, regulations and standards of the respective country are to be considered.
- The device is a permanently connected equipment: A readily accessible disconnect device shall be incorporated external to the equipment.
- The installation requires a 16 A fuse for external overcurrent protection.
- The power rating is indicated on the side of the product.

Zero crossing detection using the patent no. EP2107585A2, Eltako GmbH Fellbach.

ETS5 Database
www.weinzierl.de/en/products/511.1/ets5

Data sheet
www.weinzierl.de/en/products/511.1/datasheet

CE Declaration
www.weinzierl.de/en/products/511.1/ce-declaration

WEINZIERL ENGINEERING GmbH
Achatz 3-4
84508 Burgkirchen an der Alz
GERMANY

Tel.: +49 8677 / 916 36 – 0
E-Mail: info@weinzierl.de
Web: www.weinzierl.de

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