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Application manual

KNX 2-channel Dimmer module

EK-GA1-TP

Contents

1 Scope of the document

This application manual describes all application details for the A1.0 release of the ekinex® KNX Dimmer modules EK-GA1-TP (2 channels).

The document is aimed at the system configurator as a description and reference of device features and application programming. For installation, mechanical and electrical details of the device please refer to the technical description datasheet.

Application manual and application programs for ETS are available for download at www.ekinex.com.

Item	*File name (## = release)*	*Version*	*Device rel.*	*Update*
Technical datasheet	STEKGA1TP_EN.pdf	-	A1.0	06 / 2015
Application manual	MAEKGA1TP_EN.pdf	-		
Application program	APEKGA1TP##.knxprod	-		

You can access the most up-to-date version of the full documentation for this device using the following QR codes:

2 Product description

The ekinex® dimmer module EK-GA1-TP is a S-mode KNX modular device for independent switching of 2 dimmable electrical loads.

The device is equipped with an integrated bus communication module and is designed for rail mounting in distribution boards.

For operation, the devices receives KNX telegrams from the bus, sent by another KNX device (such as a pushbutton, a sensor, a display, a timer, etc.); these telegrams cause the activation or deactivation and change of the dimming percentage of the loads.

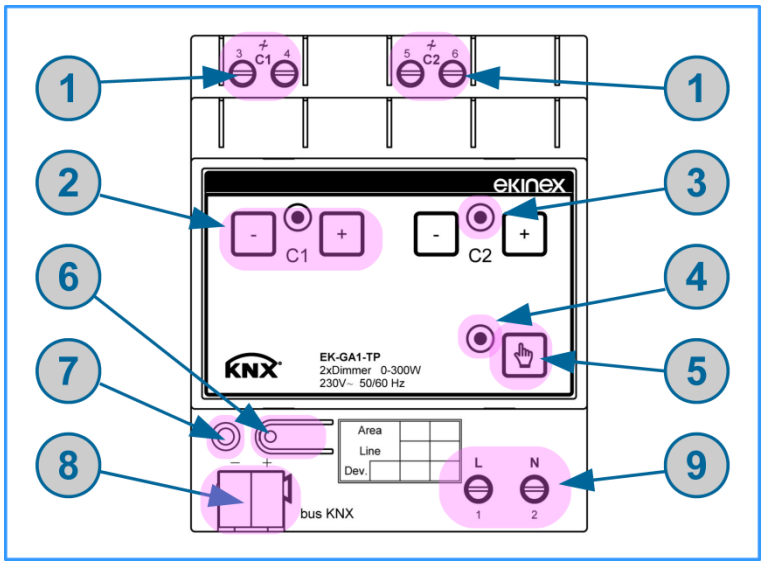
The device is powered by the KNX bus line with a 30 VDC SELV voltage and does not require auxiliary power; all required operation voltages for the input channels are produced inside the device.

For further technical information, please also refer to the product datasheet STEKGA1TP_EN.pdf available on the ekinex website www.ekinex.com.

3 Switching, display and connection elements

The device is equipped with:

- a programming pushbutton and a programming LED
- Membrane keys for manual operation
- A membrane key to switch between manual and online mode
- LED indicators for output status and for manual mode indication
- terminals for input line power and output load connection
- terminals for KNX bus line connection



1) Terminal blocks for outputs
2) Membrane keys for manual operation
3) LED indicators for output status
4) LED for manual mode indication
5) Pushbutton for switching to manual mode
6) Programming pushbutton
7) Programming LED
8) Terminal block for KNX bus line
9) Terminal block for input line power

Fig. 1 - Switching, display and connection elements

4 Configuration

The exact functionality of the device depends on the software settings.

In order to configure and commission the device you need ETS4 or later releases and the proper ekinex® application program **APEKGA1TP##.knxprod**, which can be downloaded from the ekinex® website www.ekinex.com.

The application program allows the configuration of all working parameters for the device.

The device-specific application program has to be loaded into ETS or, as alternative, the whole ekinex® product database can be loaded; at this point, all the instances of the selected device type can be added to the project.

For every single device, ETS allows to set the operating parameters individually for each input as described in detail in the following chapters.

The configuration can, and usually will, be performed completely offline; the actual transfer of the programmed configuration to the device takes place during commissioning phase.

Product code	EAN	No. of channels	ETS application software (## = release)	Communication objects (max nr.)	Group adresses (max nr.)
EK-GA1-TP	8018417181214	2	APEKGA1TP##.knxprod	46	46

Configuration and commissioning of KNX devices require specialized skills. To acquire these skills, you should attend training courses at a training center certified by KNX.

For further information: www.knx.org

5 Commissioning

After the device has been configured within the ETS project according to user requirements, the commissioning of the device requires the following activities:

- electrically connect the device, as described in the product datasheet, to the bus line on the final network or through a properly setup network for programming;
- apply power to the bus;
- switch device operation to programming mode by pressing the programming pushbutton located on the front side of the housing. In this mode of operation, the programming LED is turned on steady;
- upload the configuration (including the physical address) to the device with ETS program.

At the end of the upload, the operation of the device automatically returns to normal mode; in this mode the programming LED is turned off. Now the device is programmed and ready for use on the bus.

6 Function description

The device is a dimming actuator, which activates its output channels according to telegrams sent by other devices on the bus.

It also incorporates additional features such as e.g. timing and logic combination features, described in the following chapters.

6.1 Power-on behaviour

After switching on the bus, which also acts as the main power supply, the device becomes fully functional after a very short time needed for reinitialization; a further delay is programmable for the device to become active on the bus in order to avoid a bus traffic overload during the first moments of startup of the whole network.

A fully unprogrammed device causes no activity on the bus; anyway, outputs can be operated in manual mode (see below) through the membrane key panel on the top.

In case of a bus power failure (voltage lower than 19 V for 1 s or more), the device is switched off; on power-off, all current working values are saved.

As soon as the bus voltage is restored, the device will resume operation in its previous, unless different initialization settings are programmed.

The status of the device after some significant events can be defined by configuration. These events are:

- Device power on, i.e. after the line power supply is applied;
- Bus off, i.e. after a KNX bus failure[1]
- Bus on, i.e. after recovery from a KNX bus failure
- Download of a new or updated configuration from ETS

Further events are associated with specific functions such as the Lock or the Forcing functions.

For each of these events, the status of the outputs can be determined from a set of values that depend on how the output is configured; these sets of values will be listed later in the sections that describe the corresponding functions.

6.2 Offline operation

Since the bus also acts as the power supply for the logic part of the device, a device which is not connected to the KNX bus is effectively inoperable.

6.3 Manual operation

The manual operation works as an alternative to the output switching through bus commands (*bus-controlled* mode); this mode is intended for testing or maintenance purposes.

[1] This parameter is left in place for future expansion; currently, a bus failure causes the device to lose power and therefore switch off.

6.3.1 Status of the outputs across modes

When manual mode is activated, the outputs can be operated using the membrane keys on the front. When manual mode is active, however, the telegrams from the bus still influence the physical outputs.

The manual operation of the outputs on the bus does not cause the generation of any telegram status feedback; the LEDs associated with the outputs will continue anyway to indicate their status.

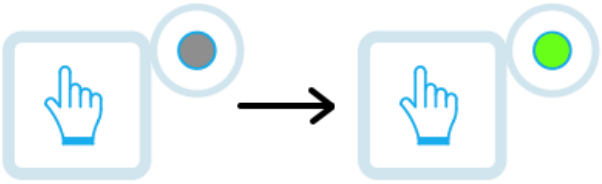
At the returning in manual mode the output status remains the one currently set.

The same considerations made for the bus commands are valid for the switching due to internal timing functions (for example delays in the activation or staircase light function): the changes of state due to internal functions have nonetheless effect even when the manual mode is active.

6.3.2 Activation of manual mode

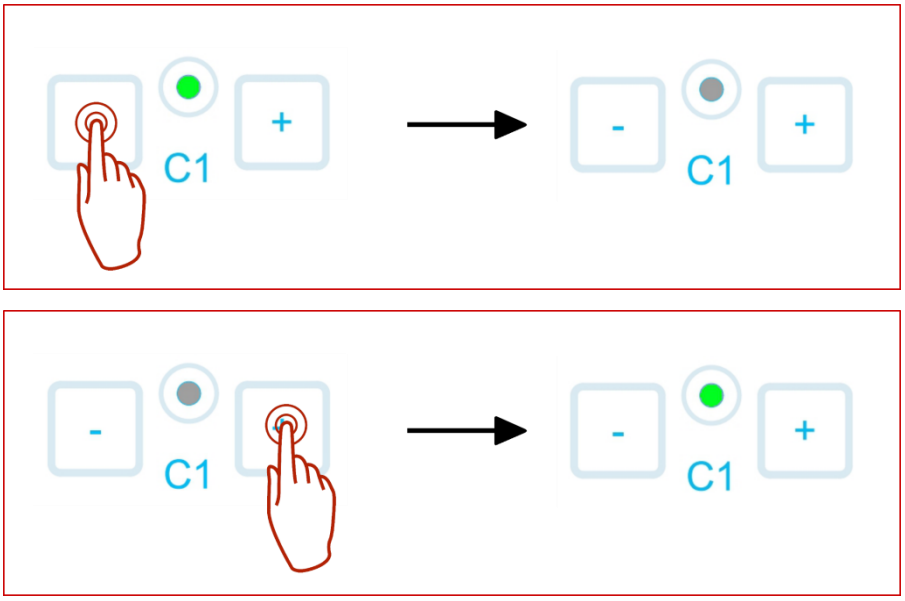
To switch the device to manual operation mode, proceed as follows:

1) Press the manual mode pushbutton. During normal operation the LED is turned off. When the LED turns on, the whole membrane keypad is activated and manual operation is allowed.



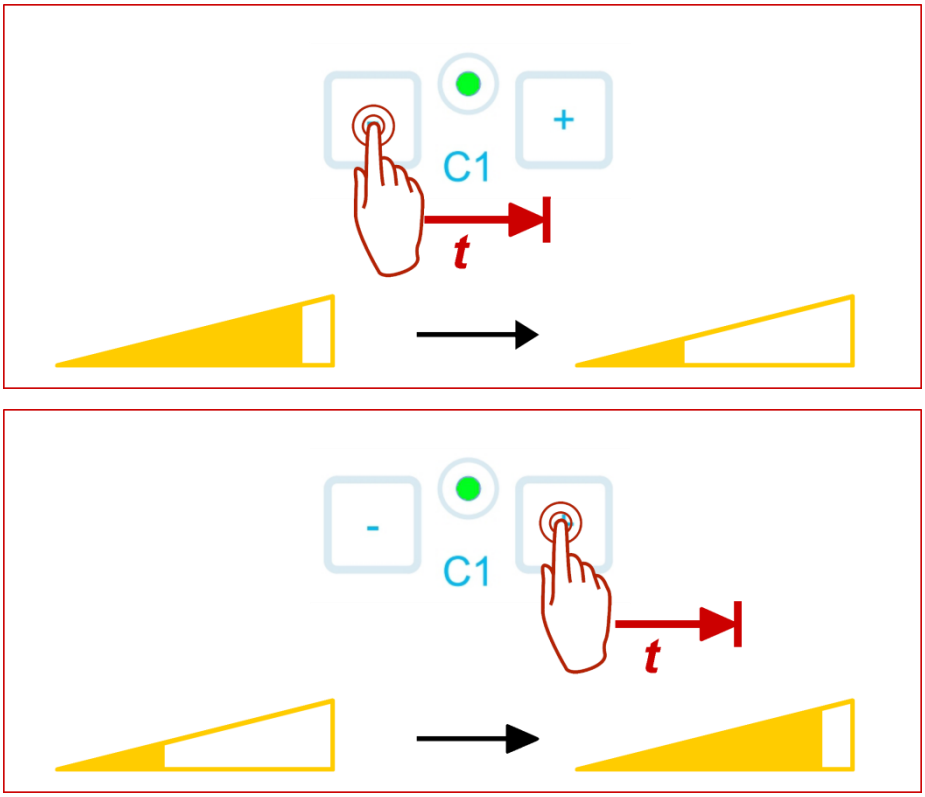
2) Press the pushbutton of the keypad corresponding to the desired channel and function.

A short press causes the load to be switched ON or OFF, respectively for keys “+” or “-“:



The indicator LED shows whether the load is switched ON or off.

A long press causes the output to increase or decrease according to the key pressed:



3) When the required operation is finished, manual mode is turned off by pressing the mode pushbutton again. Upon returning to bus-controlled mode, the output values will be restored as already described.

Switching to manual mode through the front panel can be inhibited in two ways, both selectable through configuration parameters:

- by disabling the manual switching feature altogether;
- through a bus command.

Please notice that the above-mentioned bus command inhibits switching to manual through the panel key; it does not switch modes itself.

If manual mode is neither inhibited by configuration nor controllable through the bus, another parameter allows setting a timeout period after which, whenever the device is left in manual mode, it will be reverted to bus-controlled mode. This prevents the device to be inadvertently left in an unintended state.

6.4 Online operation

The device works as a controlled switch, activating its own outputs according to the commands received from the bus as KNX telegrams.

6.4.1 Software working cycle

The software working cycle can be described as follows:

- Handle incoming telegrams from the KNX bus to update internal state variables
- Implement timing functions and other inbuilt functions to determine effect on physical outputs;
- Drive output relays according to output status
- Respond to bus messages requesting feedback on the status of the outputs and of the device.

There are also special events on which it is possible to trigger additional features. These events are the bus failure and recovery, and the download of a new configuration with ETS.

6.4.2 State variables (Communication objects)

The determination of the status of physical outputs is made basing on internal state variables. These state variables, once assigned a group address, are actually KNX communication objects, which allows other devices on the bus to exploit the features of the device.

State variables undergo the usual rules for communication objects, among which – for instance – the effect of flags to determine how the change of value affects the transmission of the objects.

6.4.3 Output handling features

The outputs are dimmable AC channels; each channel can be driven independently.

Each output is rated for a load ranging from 10W to 300W at 230 V AC.

In the simplest case, three communication objects per channel are provided to drive the outputs:

- **On-Off command**, that switches each channel output directly
- **Dimming command**, that modifies the dimming percentage of a channel in an incremental way, i.e. with “up / down / stop” type commands
- **Absolute setpoint control**, that allows to directly specify the absolute dimming percentage.

One communication objects per channel is provided as a feedback:

- **Actual dimming value**, that returns the current value of the dimming percentage.

6.4.4 Switching feature overview

By setting the device parameters, it is possible to activate additional features, most of which will also affect outputs. These features are:

- Feedback: sends message on each On – Off switching operation or cyclically each period of time
- Time delay block: allows to perform the actual switch with a programmable delay. It is available (with separate delay settings) both for the On-Off and for the Off-On transition.
- Staircase function: performs a retriggerable time period activation of an output.
- Logic function: allows to compute the output value as a logic function based on the value of several communication objects.
- Lock and Force: these functions can temporarily force the output to fixed values and also perform high priority switching operations.
- Scene management: - allows to save and recall a combination of state and values with a single telegram.
- Operating hours / Energy consumption counter: allows a limited tracking of energy consumption by accumulating “On” period durations over time.

The most significant functional blocks are described in the following scheme.

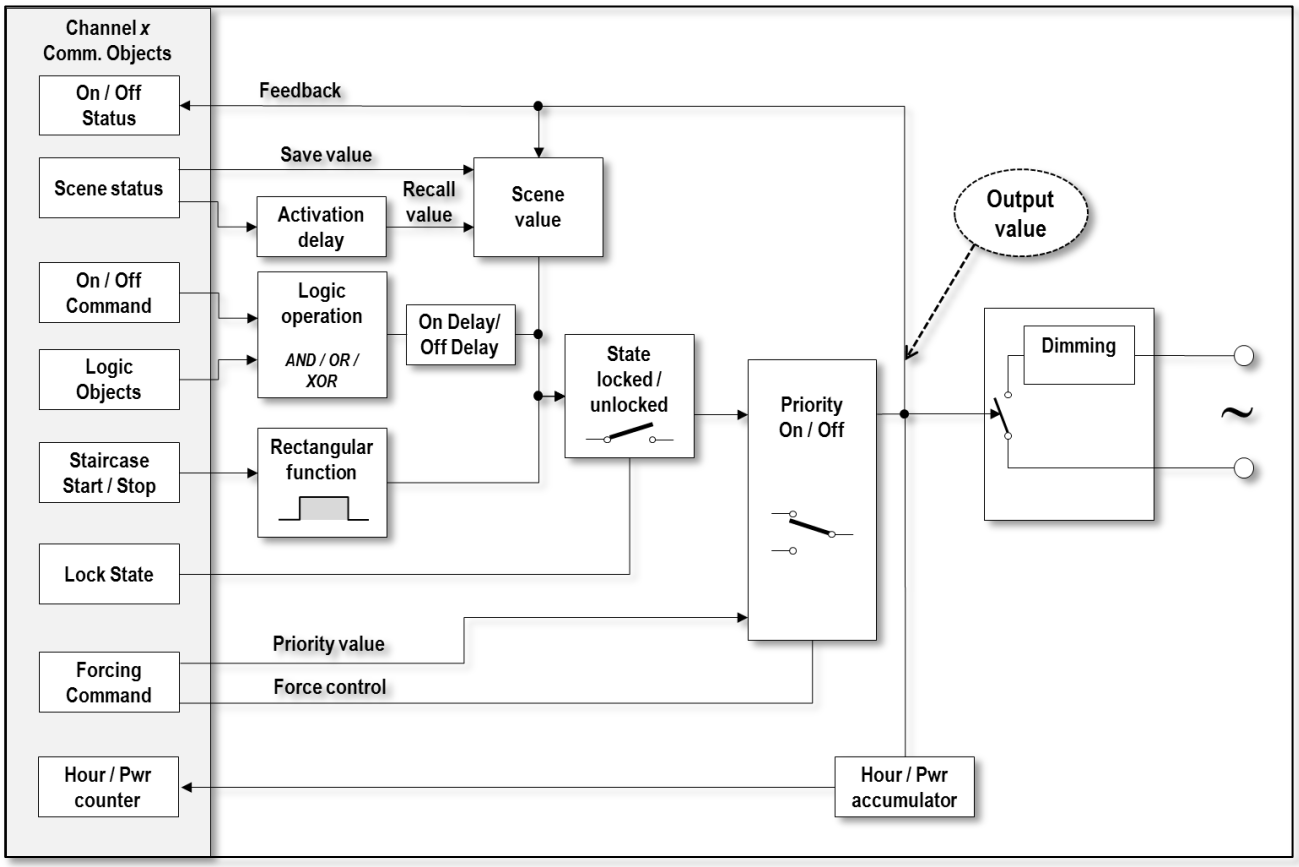


Fig. 2 - Functional blocks

The above functions are mostly, but not all purely digital (i.e. related to an On-Off behaviour); for instance, the scene management involves the definition of the brightness level associated with the scene. More details can be found in the function description in following paragraphs.

6.4.5 Dimming feature overview

Further parameters are available, which are more closely related to the dimming function:

- Type of electrical load (necessary to operate the dimming power stages properly and with optimum regulation)
- Dimming increase / decrease speed
- Dimming value lower limit, to ensure that the “On” state has sufficient brightness
- Brightness value at switch-on
- Type of transition and dimming speed both at switch-on and switch-off.

6.4.6 Functional detail

6.4.6.1 Feedback

When the feedback is enabled, 2 communication objects are available for reading by other devices on the bus: an object indicates the current state of ON / OFF, the other object indicates the current percentage of dimming. These objects report the actual state of the logic output, which is probably different from that set by the command, as it includes the effect of any other functions currently active.

When these communication objects are defined, they are transmitted automatically at any status change, so that events can be generated at any actual change of the output. It is also possible to configure the objects, so that the transmission also takes place at regular intervals.

When the power-on and / or power-off mode are set to *soft*, the communication object that indicates the current position of dimming provides as feedback the actual value that will reach at the end of the ramp. Similarly during dimming, the final value (maximum or minimum) is provided as feedback and, only after the release of the dimming command, the dimming percentage actually achieved is provided as feedback.

6.4.6.2 Time delay

The actual change of state of an output can be set to take place after a configurable delay from the change of the value of the corresponding communication object; this applies both to the on-off and the off-on transitions, each with its individually configurable delay value (T_{on} and T_{off} respectively).

These delays are applied to the transitions through a direct command and/or logical objects, but not to those caused by other functions (e.g.: staircase or scene).

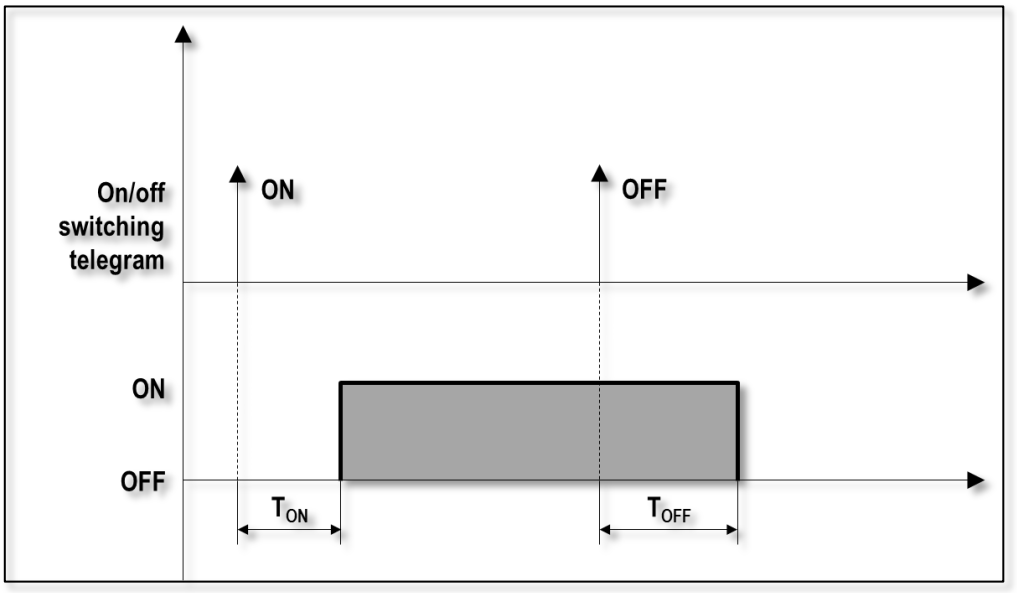


Fig. 3 - Time delay

6.4.6.3 Staircase function

This function is intended to provide a simple and flexible way to manage the switching of staircase lights. These have following peculiar requirements:

- The light is activated by a “start” command (e.g. through a pushbutton or a presence sensor), and normally remain lit for a programmed time duration;
- There is a provision to enable a “stop” (Manual Off) command, again through a pushbutton or other events, that allows to switch the light off before the programmed time expires (e.g. because the person who triggered the presence sensor has surely left the building through an exit);
- There is a provision to allow another “start” command (Retriggering), received during activation, to restart the time duration counter;
- A further optional “pre-warning” function allows to briefly switch off the load a certain time before expiration (both times, i.e. pause duration and time before expiration, are configurable) in order to warn the user that the activation time is about to end.

Following pictures show the *Manual Off* feature:

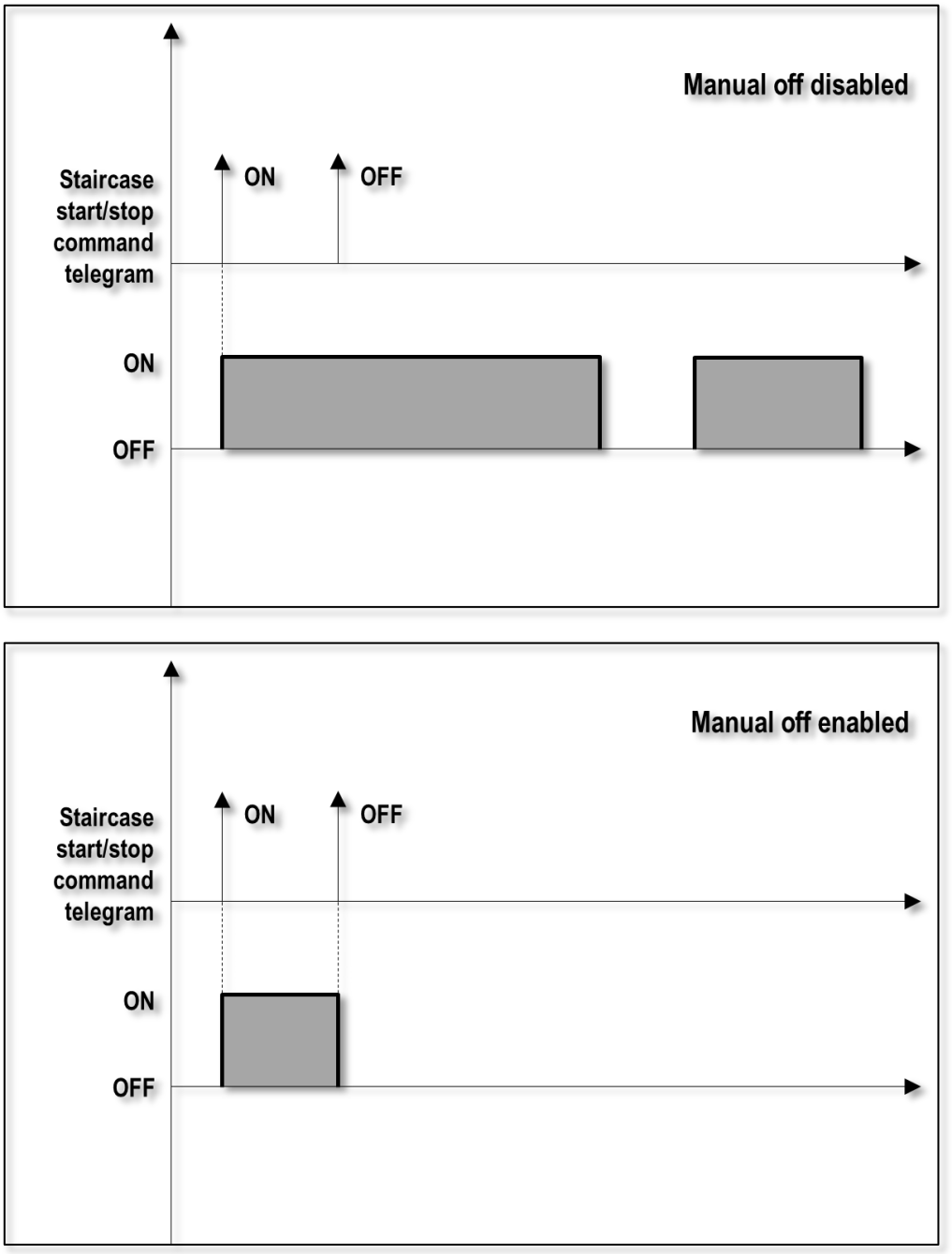


Fig. 4 - Manual Off feature

Following pictures show the *Retrigger* feature:

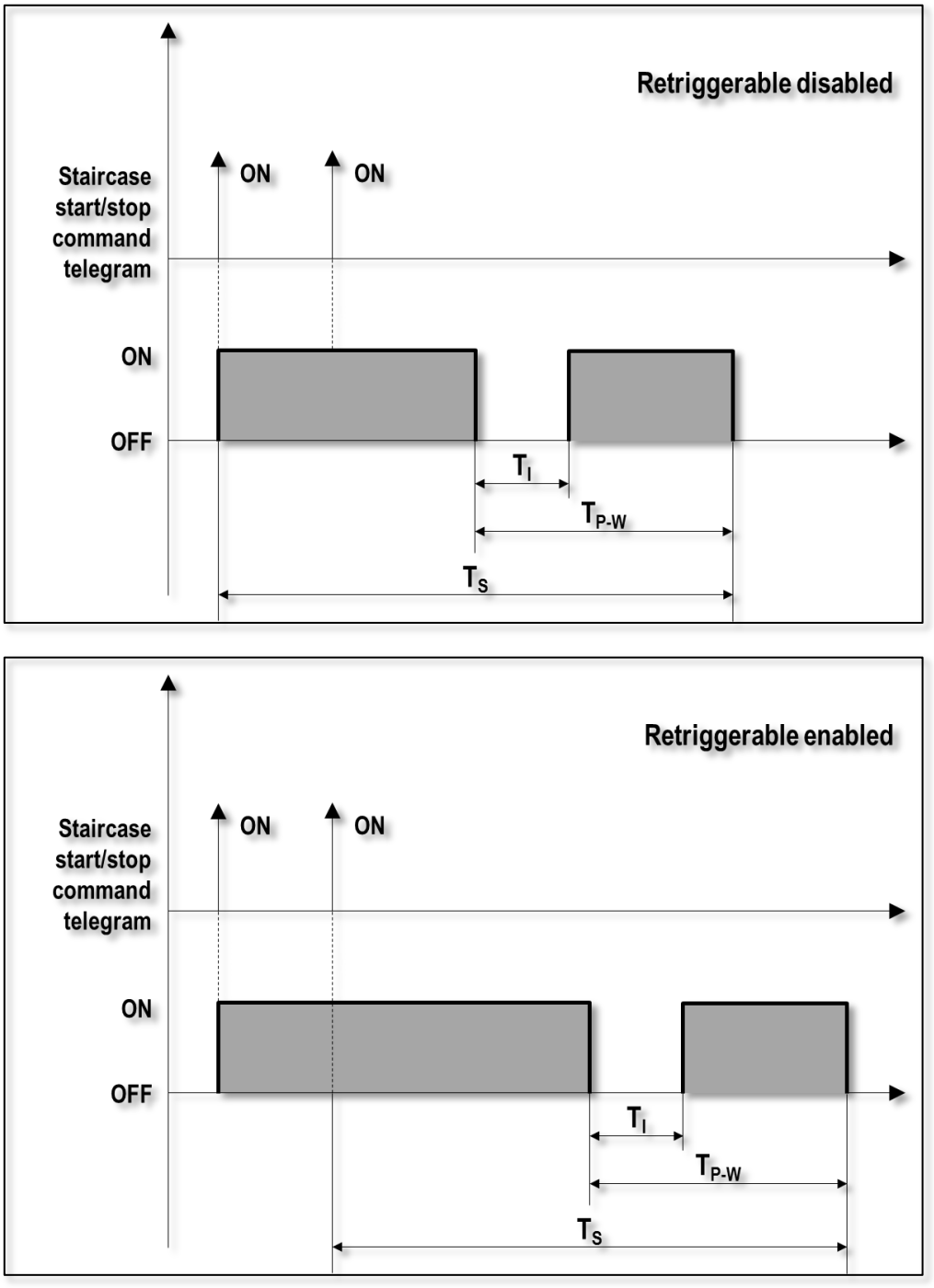


Fig. 5 - Retrigger feature

Following pictures show the *Pre-warning* feature:

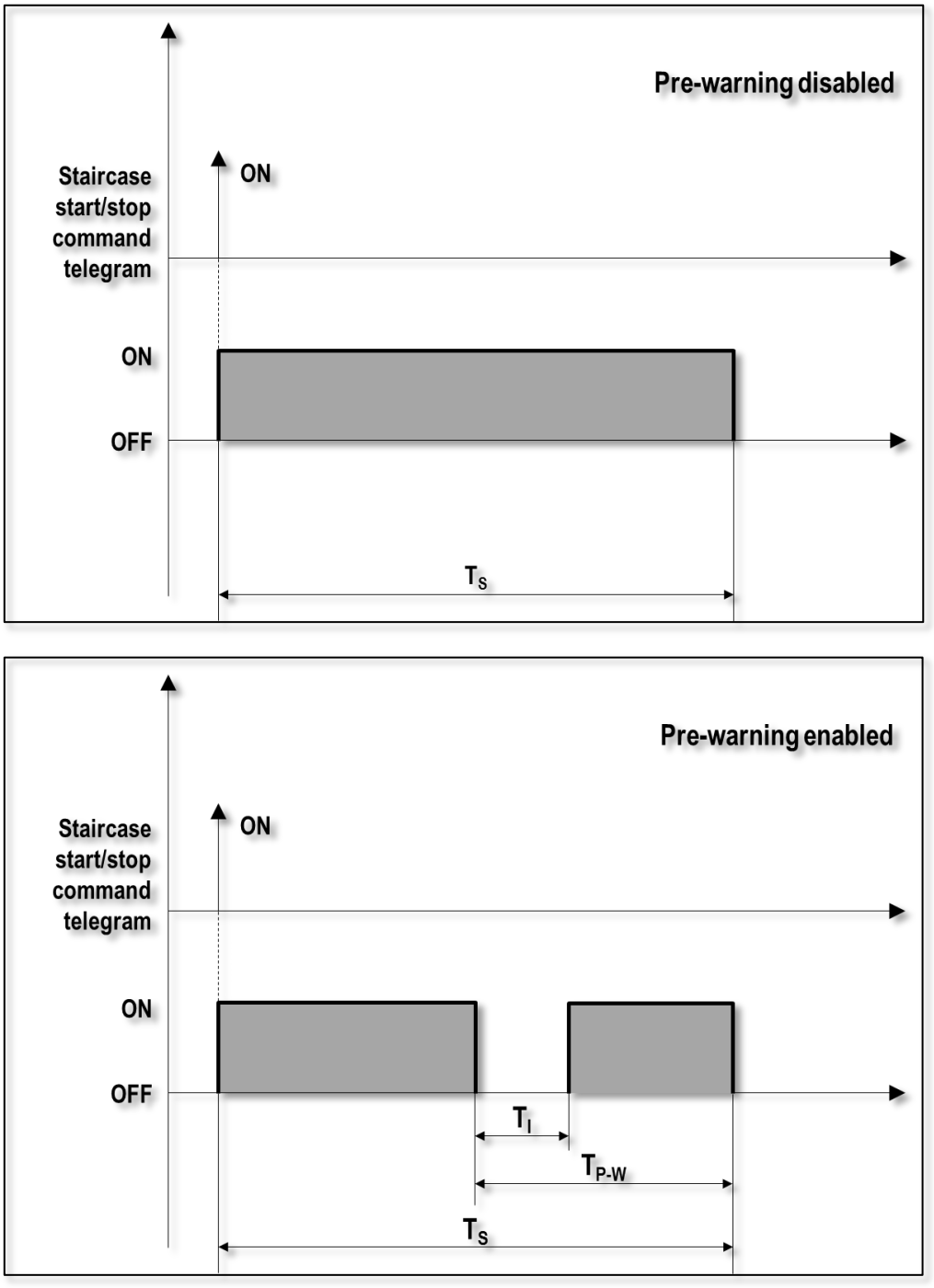


Fig. 6 - Pre-warning feature

6.4.6.4 Logic function

The device has a limited provision for the logic processing of internal variables in order to condition the status of outputs.

A given incoming output command can be used as an input to a logic block which operation is selectable between OR, AND and XOR (exclusive OR). Up to other 8 objects can be defined as additional inputs to the same block (each with an optional negation operation); these objects are directly accessible to other devices from the bus and they can be used as desired.

The input objects are logically combined as in following picture:

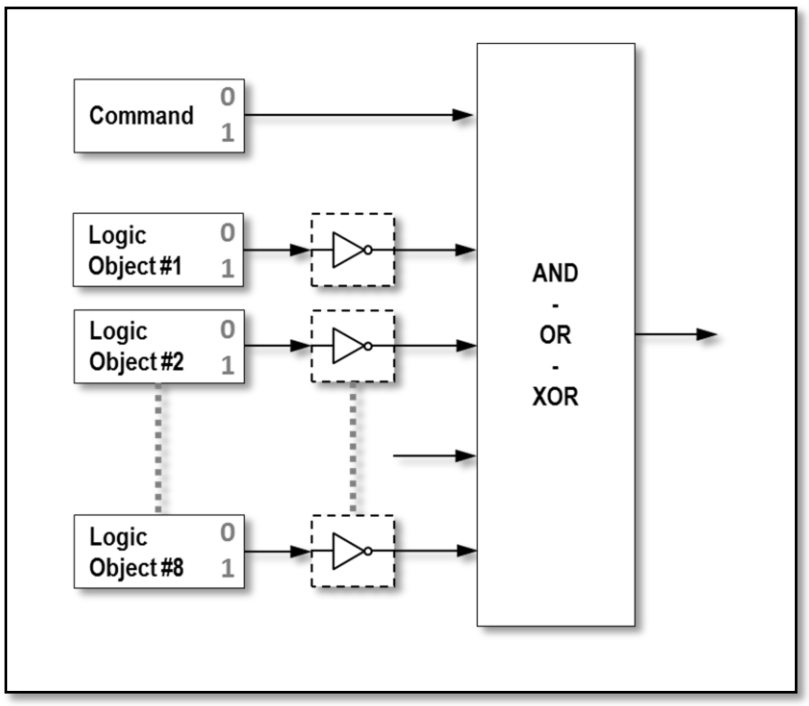


Fig. 7 - Logic functions

The logic combination block on the right works as follow according to which logical operation is selected:

- OR – the output is ON whenever any one of the inputs is ON;
- AND – the output is ON only if all of the inputs are ON;
- XOR – the output is ON if an ODD number of inputs are ON.
  This latter operation is more intuitive when thinking of two inputs only: in this case, the output is ON when one input or the other is ON, but not both.

It must be noted that, in the above description, “input” and “output” are referred to the logical block; for the purpose of operation, the actual “inputs” are the logic objects, thus the optional inverters must be factored in.
This structure allows to implement complex logical combinations; a more generic and powerful programming capability would add more complexity and therefore it would be far beyond the scope of an output module that is simple to use.
In the following pictures, the basic logic functions are illustrated, assuming the output command and one logic object are used:

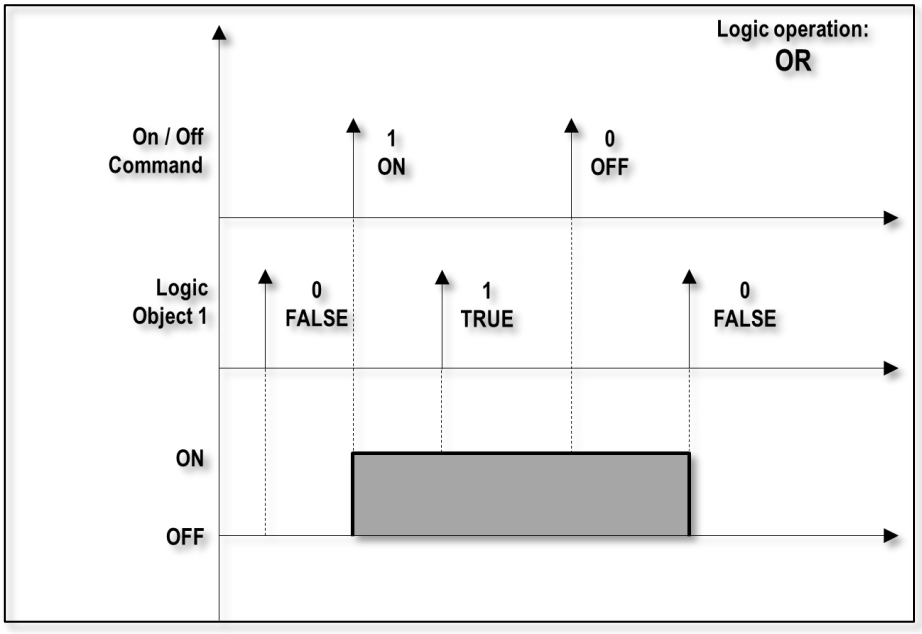


Fig. 8 - Logic OR function

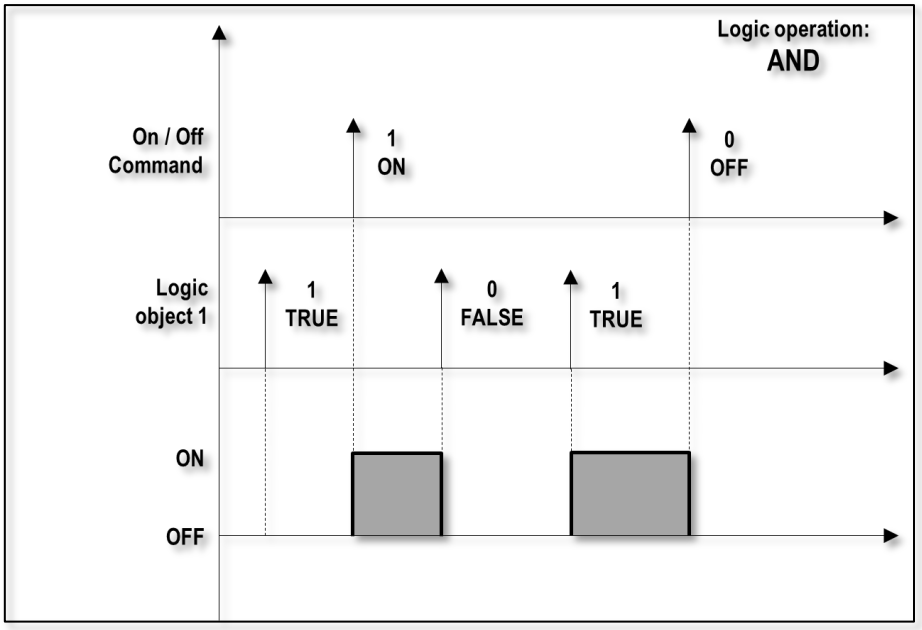


Fig. 9 - Logic AND function

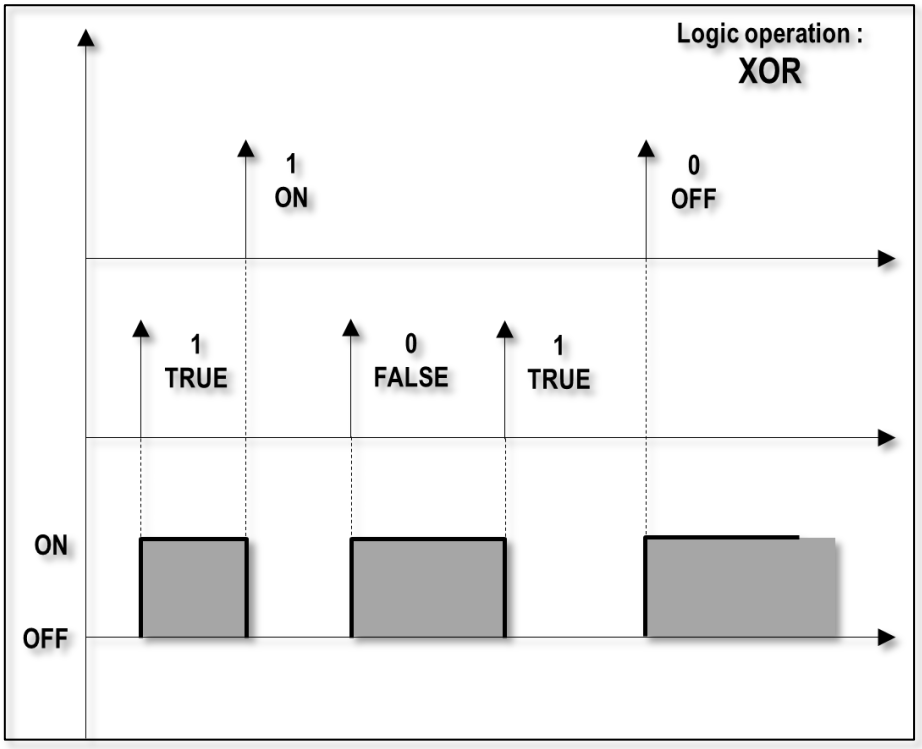


Fig. 10 - Logic XOR function

6.4.6.5 Lock function

If the locking feature is enabled, the operation of a channel can be inhibited by writing a value in a communication object. The value written is of the KNX type “enable”; please beware that the meaning of this value is “*activate lock*”, which is not to be confused either with “enable *locking function*” or with “enable output”. The meaning of the value can be optionally inverted through a configuration parameter (an “enable on” value can be interpreted as “lock off”).

A locked output ignores the switching commands that are received for the duration of the lock, thereby maintaining the status it has upon lock entry. The status of the output can be set to a particular value both when the lock is set and when it is released; it is also possible to determine whether the lock status should be maintained or changed on recovery after a bus power-off.

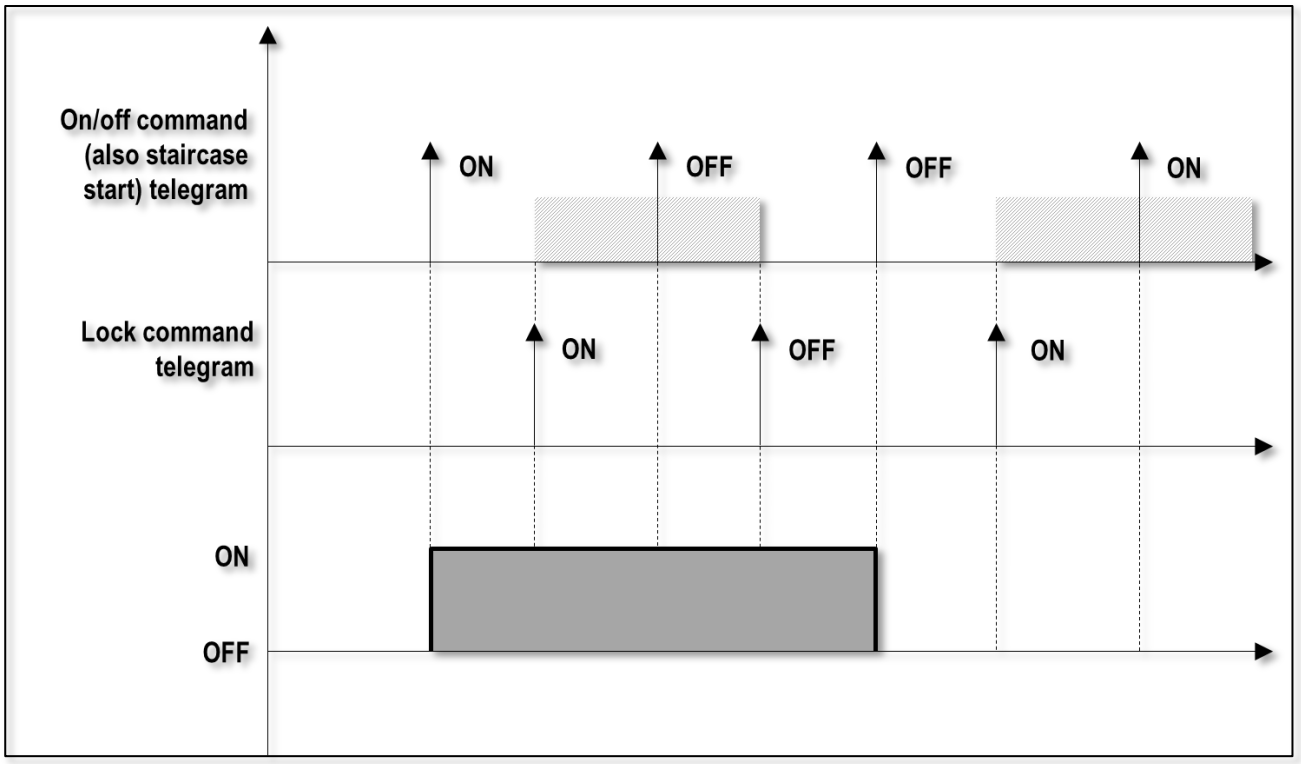


Fig. 11 - Lock function

6.4.6.6 Forcing function

The forced control is very similar to the basic direct command of the output value, but with the peculiarity that it overrides both the “regular” set value and every other value conditioning feature (i.e. logic function, staircase timing etc.).

It is possible to set what value the output should assume both when the output forcing is released and also on recovery after a bus power-off if forcing was previously in effect.

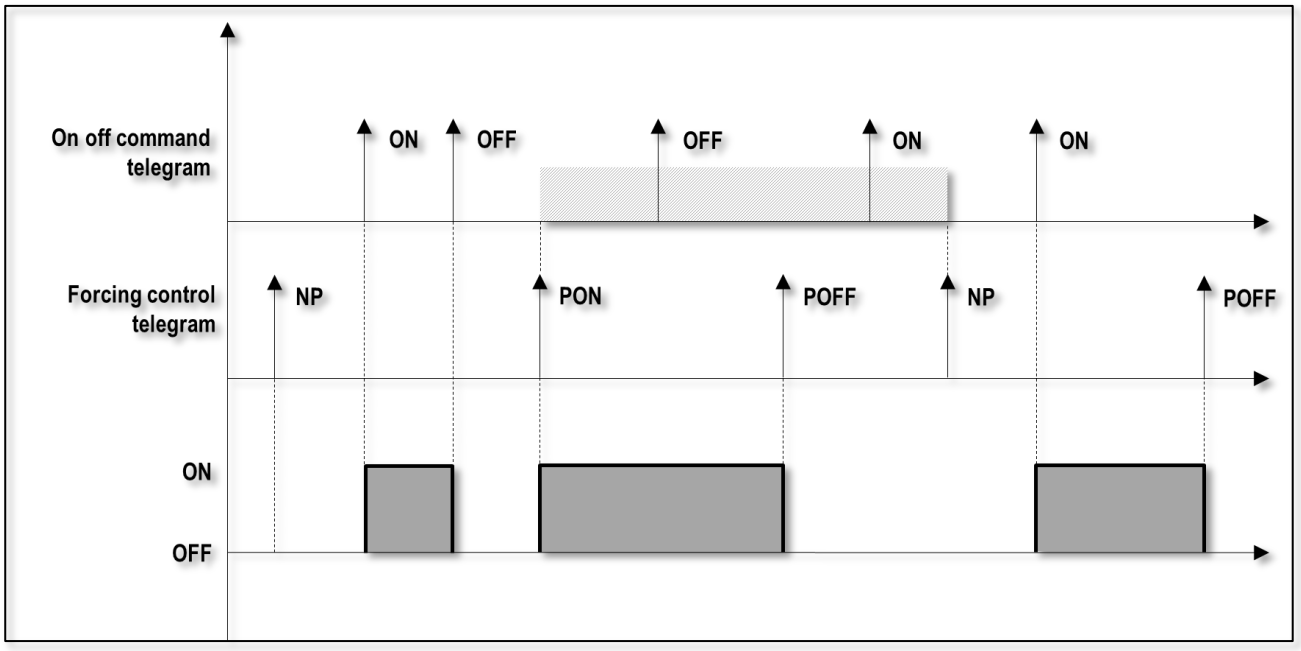


Fig. 12 - Forcing function

The “Force” command has priority over Locking (which acts on the ordinary on-off command); therefore, a locked output can still be operated through “Force” commands.

The KNX command code for the “Force” operation is a 2 bit value; the *priority* bit determines whether the output value must be forced, in which case the *value* bit is assigned to the output.

In the figure above, NP means that the *priority* bit is 0 (No Priority), while the PON and POFF codes indicate the values with *priority* = 1 and *value* respectively 1 or 0.

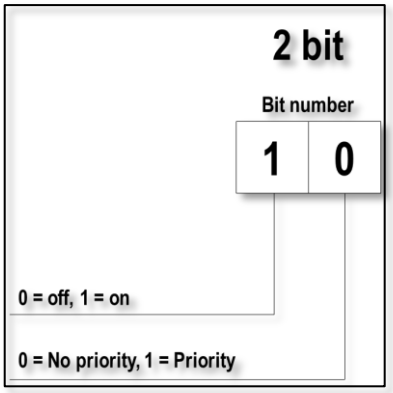


Fig. 13 - Force command bits

6.4.6.7 Scene management

Each output can be linked to up to 8 scene codes; when one of these scene codes is recalled through a bus command originated by any controller device, the output will assume a preset value (which includes both the On – Off status and the dimming value). An additional delay can be defined for the output activation (or deactivation) from the moment the scene code is recalled.

The output value for a scene can either be fixed and chosen in the configuration phase, or it can be defined as reprogrammable through a Scene Learning command.

If this latter option is enabled (for each single output), whenever a Scene Learning command is received on the bus for a specific scene code to which the output has an association, the device will store the current output status value for that scene. This value will then be recalled in subsequent scene activations.

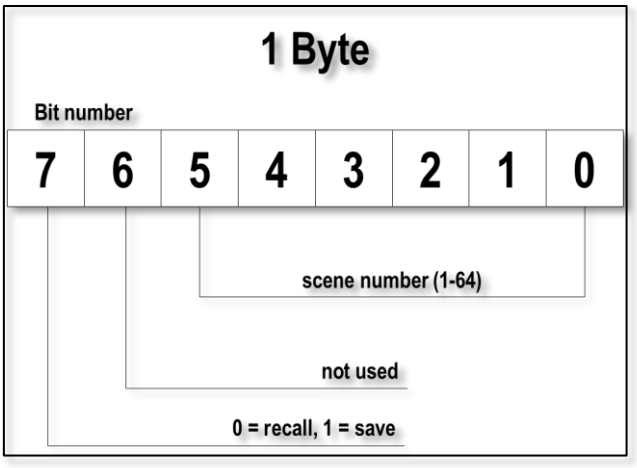


Fig. 14 - Scene store / recall command code

6.4.6.8 Operating hours / Energy consumption counter

For each output, an activation counter can be associated, which accumulates the count of hours that the output passed in the “on” state. In terms of communication objects, this counter has the format of a KNX hour counter, thus it also has a “reset” command ad a “runout” alarm in case the maximum value is overflowed.

The power counter also has an associated KNX “kWh counter” communication object with its own reset command. An additional parameter allows to define a conventional electrical power value in W which is associated to the load.

Although this is not a “real” power metering, but merely a proportional factor between activation time and the estimated consumed power, nonetheless it can supply a useful indication for approximate power monitoring, particularly for resistive or fixed-power loads like lights or many other home or office appliances .

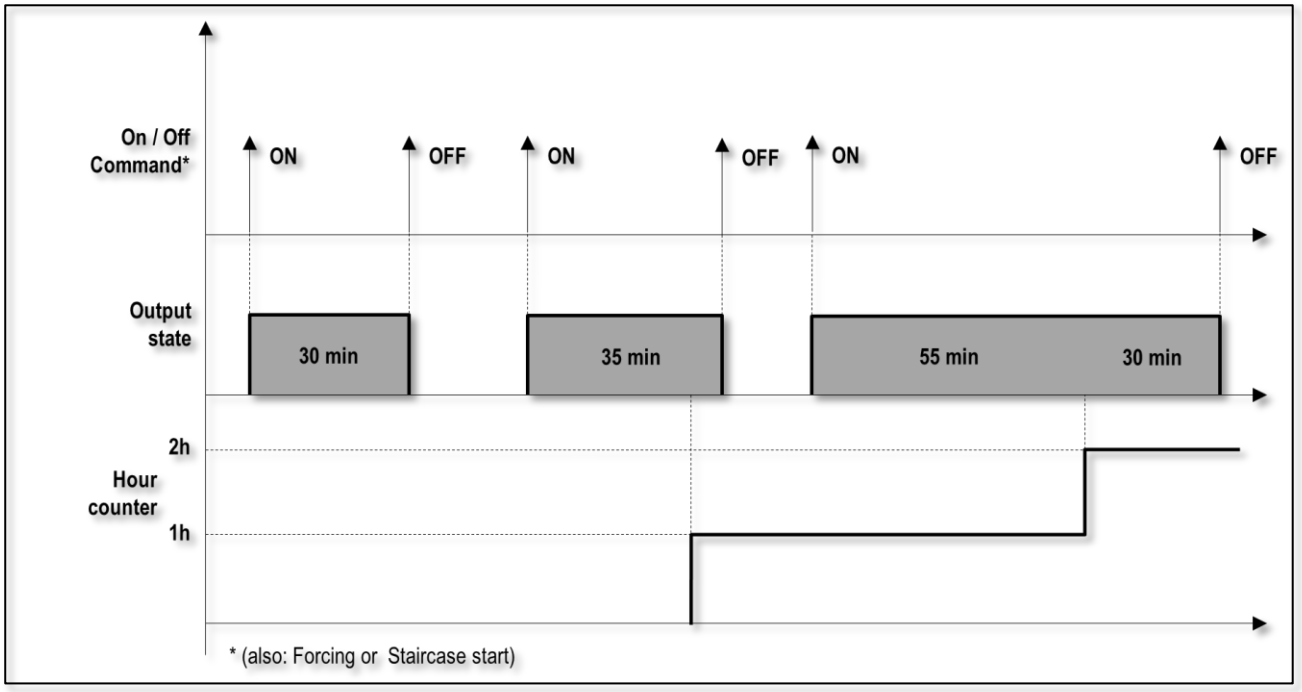


Fig. 15 – Operating hours and Energy counter

6.5 Device settings

This section lists all configurable parameters and describes related communication objects.

Every channel offers the same set of communication objects and parameters, but they may all be independently configured. Hereafter, a generic channel number is referenced as “x” (where x = 1…2).

The parameter values highlighted in bold represent the default value.

The device settings are divided in three main groups: the general device settings, the general channel configuration settings and the channel-specific settings.

6.5.1 General device configuration

Parameter name	*Conditions*	*Settings*
Manual operation	-	**enabled** disabled
	Enables the front panel pushbutton that activates manual mode.	
Disable from bus	Manual operation = enabled	**yes** no
	Allows to disable manual mode through a bus command	
Restore auto mode time	Manual operation = enabled Disable from bus = yes	hh:mm:ss (**00:15:00**)
	Sets the time after which the manual operation mode is reverted to automatic. *A zero time duration (00:00:00) means that the device may remain in manual mode indefinitely.*	
Power off alarm	-	enabled **disabled**
	Makes an alarm communication objects available which signals when the bus power supply fails.	

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Disable front pushbuttons	Manual operation = enabled Disable from bus = yes	1 bit	C-W--	[1.002] boolean	0
Power off alarm	Device power off alarm = enabled	1 bit	CR-T-	[1.005] alarm	1

6.5.2 Channels configuration

These settings configure which channels of the device are active.

Activating a channel causes the creation of the described main communication objects, which are the basic controls to drive the outputs through bus telegrams.

For output 2, other two options are possible:

- The channel configuration can be copied from channel 1. In this case, the channel takes the same configuration as the source channel, though it has its own copy of the communication objects which therefore can take their own values; this allows to spare time in configuring the device, at the same time assuring that there is no inconsistency between two channels that are meant to be configured in exactly the same way. It must be noted that to copy the configuration from another channel is just a shortcut for the selection of configuration options; the two channels do not share any of the involved communication objects. If the configuration of the original channel is varied, then so is the "derived" channel; in the same fashion, if the original channel is disabled, so is also the derived one.
- The channel can be put in parallel with channel 1. In this case, both the configuration and the values of parameters are the same; there is only one set of communication objects, internally associated to both channels.

Note: the parameters are prearranged for future versions of the unit with more than two channels. In that versions, the configuration of a channel can to be copied from any of the preceding channels, but a given channel can be put in parallel only with the one which is respectively coupled. The present disposition of the parameters reflects this arrangement.

Parameter name	*Conditions*	*Settings*
Output *x*	-	disabled **enabled** in parallel with channel 1* copy parameters from channel*
	Enable output Channel. ** This option is only available for channels nr. 2.*	
Output *2* – Channel to copy from	Output 2 = copy parameters from channel	**1**
	The value is forced – see notes about prospect versions with more than two channels.	

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Output X – On/off Command	Channel *x* = enabled / copy parameters from...	1 bit	CRWTU	[1.001] on/off	2, 24
	Standard "handle" for switching the output through a bus command.				
Output X – Dimming command	Channel *x* = enabled / copy parameters from...	2 bit	C-W--	[3.007] Dimming control	3, 25
	Control point for relative (i.e. up / down) dimming.				
Output X – Absolute setpoint control	Channel *x* = enabled / copy parameters from...	8 bit unsigned	C-W--	[5.001] Percentage 0..100%	4, 26
	Control point for setting the absolute dimming value.				

6.5.3 Channel *x* configuration

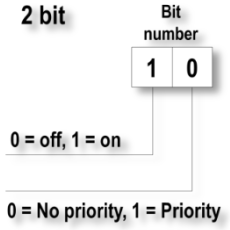
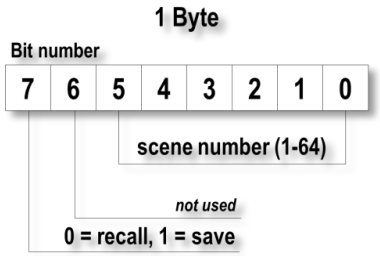
6.5.3.1 Main parameters

Parameter name	*Conditions*	*Settings*
Load type	-	**incandescent lamp (R)** with electronic transformer (RC) with magnetic transformer (RL)
	Specifies the type of electrical load that the dimmer is expected to drive. ***Please make sure to specify the correct value in order to prevent malfunctions of the device.***	
Full range dimming time	-	hh:mm:ss.fff (**00:00:04.000**)
	The time it takes the dimmer to bring the output value from 0% to 100%; in other words, the speed of the brightness variation when the setpoint is changed through an "up/down" type command. *Changing the absolute setpoint has immediate effect on the output value.*	
Minimum dimming value %	-	1..100% slider (**50%**)
	Allows to ensure that, in the "ON" state, the output guarantees a minimum brightness level.	
Intensity when switch on	-	**last value** new value
	Specifies the output value when the output is switched on through a bus command.	
Intensity when switch on – Light intensity %	Intensity when switch on = new value	1..100% slider (**50%**)
	Specifies the new value for switch-on.	
Switch on type	-	instant on **soft**
	Specifies whether the device should reach the setpoint gradually when the output is switched on.	
Ramp time for on	Switch-on type = soft	hh:mm:ss.fff (**00:00:02.000**)
	Specifies the transition time at switch-on. *The specified time refers to the time required to complete an excursion from 0% to 100%. For example, if you set the value 00: 01: 00: 000, to bring to 50% the corresponding output it takes 30 s.*	
Switch off type	-	instant off **soft**
	Specifies whether the device should reach the zero brightness state gradually when the output is switched off.	
Ramp time for off	Switch-off type = soft	hh:mm:ss.fff (**00:00:02.000**)
	Specifies the transition time at switch-off. *The specified time refers to the time required to complete an excursion from 100% to 0%. For example, if you set the value 00: 01: 00: 000, to bring to 0% the corresponding output, starting from 50%, it takes 30 s.*	
Behavior at power on	-	off on **no change** previous value
	Allows to determine the value of the output to be set when the power is first applied or returns after a power fail.	

Parameter name	*Conditions*	*Settings*
Behavior at bus off	-	off on **no change**
	Allows to determine the state of the output when a bus voltage failure is detected.	
Behavior at bus on	-	off on **no change** previous state
	Allows to determine the state of the output after bus recovery.	
Behavior after download	-	off on **no change**
	Allows to determine the state of the output when the device resumes operation after a new parametrization has been downloaded.	
Status feedback telegram	-	**enabled** / disabled
	Enables or disables the automatic sending of a feedback telegram following an output change; this refers to both the On/off status and an intensity variation.	
Delay after bus voltage recovery	Status feedback telegram = enabled	hh:mm:ss.fff (**00:00:03.000**)
	Time after bus voltage recovery before status feedback telegrams begin to be sent. *The delay has no effect on the behaviour of the outputs; only the feedback telegrams are delayed. The outputs can therefore be activated during the delay after a bus voltage recovery.* *During this delay, no feedback telegram will be transmitted even if a switching occurs; the feedback telegram for a switch during the delay period is lost.*	
Transmission cycle time	Status feedback telegram = enabled	hh:mm:ss (**00:00:00**)
	Interval between cyclical transmissions. *A zero value (00:00:00) means no cyclical transmission (feedback telegrams are only sent on value change).* *Values less than "00:00:10" (ten seconds) are considered by the firmware in any case as 10 (ten) seconds; the maximum value is 18:12:15.*	
On delay time	-	hh:mm:ss.fff (**00:00:00.000**)
	Delay between the "On" command telegram and the actual output activation. *This time delay does not affect the output of the staircase and forced control functions.* *For the scene function the delay can be set separately.* *Updating the object from "ON" to "ON" or from "OFF" to "OFF" retriggers the delay time.*	
Off delay time	-	hh:mm:ss.fff (**00:00:00.000**)
	Delay between the "Off" command telegram and the actual output deactivation. *Same comments as for the "On delay time" parameter apply.*	
Staircase lighting function	-	enabled / **disabled**
	Enables or disables the staircase lighting feature. *For further details and parameter descriptions see the corresponding section below.*	
Lock function	-	enabled / **disabled**
	Enables or disables the capability of locking the input through a remote command. *For further details and parameter descriptions see the corresponding section below.*	
Forced function	-	enabled / **disabled**

Parameter name	*Conditions*	*Settings*
	Enables or disables the capability of forcing the input through a remote command. *For further details and parameter descriptions see the corresponding section below.*	
Behavior end forced control	Forcing function = enabled	off on **no change** previous value
	Allows to determine the state of the output when the forcing is released.	
Behaviour after bus recovery	Forcing function = enabled	off on **no change** previous value
	Allows to determine the state of the output when the device resumes operation after bus voltage recovery. *After bus voltage recovery, forcing is implicitly released, and the output value is set according to this setting.*	
Logic function	-	enabled / **disabled**
	Enables or disables the Logic input conditioning feature. *For further details and parameter descriptions see the corresponding section below.*	
Scenes function	-	enabled / **disabled**
	Enables or disables the Scene function. *For further details and parameter descriptions see the corresponding section below.*	
Operating energy / time counter	-	enabled / **disabled**
	Enables or disables the energy /time counter function. *For further details and parameter descriptions see the corresponding section below.*	

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Output *x* – On off status	Status feedback telegram = enabled	1 bit	CR-T-	[1.001] switch	5, 27
	Sent at any change of the output state and also periodically, as configured.				
Output *x* – Actual dimming value	Status feedback telegram = enabled	8 bit unsigned	CR-T-	[5.001] Percentage 0..100%	6, 28
	Sent at any change of the output state and also periodically, as configured.				
Output *x* – Staircase lighting start stop command	Staircase lighting function = enabled	1 bit	C-W--	[1.001] on/off	7, 29
	Starts the staircase light timing with an On value. *The timed activation automatically stops at the end of the preset time.* *If "Manual off" is enabled, the communication object will stop the timing with an Off value.* *If "Retriggerable" is enabled, the transmission of a new "On" value will restart the timing.*				
Output *x* – Lock command	Locking function = enabled	1 bit	C-W--	[1.003] enable	8,30
	Inhibits both the switching and value setting commands for the output when an "enable" telegram is received, and unlocks them when a "disable" telegram is received.				

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Output *x* – Forcing command	Forcing function = enabled	2 bit	C-W--	[2.001] switch control	9, 31
	Allows to force the status of an output (with respect to the "On/Off" status only) *It is composed of 2 bits: the first one is used for the priority value (i.e. defines whether the forcing is in effect, "Priority", or not) and the second one for the imposed value (which is not considered if forcing is not effective).* 				
Output *x* – Logic object *n*	Forcing function = enabled Logic object *n* = enabled	1 bit	CRWTU	[1.*] *generic 1-bit*	*Output 1*: 10...17 *Output. 2*:32...39
	For each channel, it indicates the sequence of corresponding numbers for all 8 available logic objects.				
Output *x* – Scene number	Scene function = enabled	1 Byte	C-W--	[17.001] scene number [18.001] scene control	18, 40
	Allows to recall a scene setting for the status of the output, and to store current status (both On/Off status and dimming value) in association to the specified scene. 				
Output *x* – kWh counter	Operating hours / energy counter = enabled	4-byte signed counter	CR-T-	[13.013] active energy [kWh]	19, 41
	Stores the current counter value of the accumulated energy.				
Output *x* – kWh counter reset command	Operating hours / energy counter = enabled	1 bit	C-W--	[1.015] reset	20, 42
	Resets the energy counter to 0.				
Output *x* – Hours counter	Operating hours / energy counter = enabled	2-byte unsigned counter	CR-T-	[7.007] time [h]	21, 43
	Stores the current counter value of the accumulated operating time.				
Output *x* – Hours counter reset command	Operating hours / energy counter = enabled	1 bit	C-W--	[1.015] reset	22, 44
	Resets the operating hour counter to 0.				

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Output *x* – Hours counter runout	Operating hours / energy counter = enabled	1 bit	CR-T-	[1.005] alarm	23, 45
	1-bit alarm sent when the time counter reaches the maximum value of 65535 hours.				

6.5.3.2 Staircase lighting function

Parameter name	*Conditions*	*Settings*
Staircase lighting time	Staircase lighting function = enabled	hh:mm:ss (**00:01:00**)
	Duration of staircase lighting time. *This time is the one shown on the time diagram in the descriptive section of this manual as "**Ts**".*	
Manual off	Staircase lighting function = enabled	enabled / **disabled**
	When enabled, it allows an "Off" command to terminate the lighting time. *The "Off" command can be sent at any time with the same effect, including when the pre-warning is activated.*	
Retriggerable	Staircase lighting function = enabled	enabled / **disabled**
	When enabled, it allows a new "On" command to restart the timing. *The "On" command can be sent at any time with the same effect, including when the pre-warning is activated.*	
Pre-warning	Staircase lighting function = enabled	enabled / **disabled**
	Activates the pre-warning feature. *For a detailed description see the corresponding section of this manual.*	
Pre-warning – Pre-warning time	Staircase lighting function = enabled **Pre-warning = enabled**	hh:mm:ss (**00:00:10**)
	Specifies how much time before the end of the timing a pre-warning light interruption will be carried out. *The time interval specified includes the interruption time.* *The maximum value is 18:12:15.* *This time is the one shown on the time diagram in the descriptive section of this manual as "**Tp-w**".*	
Pre-warning – Interruption time	Staircase lighting function = enabled **Pre-warning = enabled**	hh:mm:ss.fff (**00:00:00.500**)
	Specifies the duration of the pre-warning interruption. *This time is the one shown on the time diagram in the descriptive section of this manual as "**Ti**".*	

- The pre-warning time should be shorter than the staircase time ($T_{P-W} < T_S$) and the interruption time shorter than the pre-warning time ($T_I < T_{P-W}$).
- Time delays have no influence on the staircase function (if enabled).
- A staircase timing in progress will be terminated by a reset of the actuator (bus voltage recovery or ETS reprogramming) or by using any function that affects the output (i.e. normal switching, forced control, logic function, scene recall), even if the function does not cause an actual change in the output value.
- On a forced termination, the value of the output remains unchanged; the same that is true also if the termination occurs during pre-warning time.

6.5.3.3 Lock function

Parameter name	*Conditions*	*Settings*
Lock device signal	Locking function = enabled	**not inverted** / inverted
	Allows to interpret a "lock activate" telegram as unlock and vice-versa.	
After bus recovery	Locking function = enabled	unlock lock **previous state**
	Defines how to set the lock status after bus voltage recovery.	
Behaviour at locking	Locking function = enabled	**off** on no change
	Defines how to set the output value when the lock is activated.	
Behaviour at unlocking	Locking function = enabled	**off** on no change updated value value before locking
	Defines how to set the output value when the lock is deactivated. ***Updated value*** *is the latest one that the output would assume if it had not been locked, i.e. it includes the output value change generated by whatever other function in the meantime.* ***Value before locking*** *is the value that the output had before the lock was activated.*	

6.5.3.4 Logic function

This folder is enabled if *Channel X* ⇒ *Main parameters* ⇒ *Logic function* = enabled.

Parameter name	*Conditions*	*Settings*
Logic operation type	Logic function = enabled	**OR** AND XOR
	Defines the logic operation to perform on allowable inputs.	
Read delay after bus recovery	Logic function = enabled	hh:mm:ss.fff (**00:00:10.000**)
	After a bus voltage recovery, the device waits for the specified time before validating the logic objects used as inputs; a request is sent for each logical object value which has not arrived within the read delay. *The maximum value is 00:10:55.350.*	
Logic object *n*	Logic function = enabled	**disabled** / enabled
	Defines which logic object is used as input. *Disabled logic objects are completely ignored and corresponding communication objects do not appear.*	
Logic object *n* – Logic object *n* negated	Logic function = enabled **Logic object *n* = enabled**	**no** / yes
	Applies a logical negation to the value of the input object.	

The logic function is carried out only if, and whenever, at least one of the enabled input objects is updated by a bus telegram.

6.5.3.5 Scenes function

This folder is enabled if *Channel X* ⇒ *Main parameters* ⇒ *Scenes function* = enabled.

Parameter name	*Conditions*	*Settings*
Download overwrites learned behavior	Scenes function = enabled	no / **yes**
	Defines whether the download of a program on the device should erase and overwrite the stored scene output values previously learned and stored in the device. *When the device is put into operation for the first time, this parameter should be set to "yes" (default value) so that the output is initialized with valid scene values. Otherwise, the values are set to "0" (off) for all scenes.*	
Scene *n*	Scenes function = enabled	enabled / **disabled**
	Enables or disables a new scene code to be assigned to the output.	
Scene *n* – Scene number	Scenes function = enabled **Scene *n* = enabled**	1…64 (**1**)
	Scene number to be assigned to the output. The output will respond to scene commands that match the specified number.	
Scene *n* – Output behavior	Scenes function = enabled **Scene *n* = enabled**	off / **on**
	(Initial) output value for the selected scene. This value will be possibly overwritten by a scene "store" command if the "Learning mode" option is enabled.	
Scene *n* – Light intensity %	Scenes function = enabled **Scene *n* = enabled**	1..100% slider (**50%**)
	Specifies the dimming value for the selected scene.	
Scene *n* – Activation delay	Scenes function = enabled **Scene *n* = enabled**	hh:mm:ss.ff (**00:00:00.00**)
	Delay between a scene "recall" command and the actual output switching. *The maximum value is 01:49:13.50.*	
Scene *n* – Learning mode	Scenes function = enabled **Scene *n* = enabled**	**disabled** / enabled
	When disabled, the scene "store" commands are ignored and only the output values set in the configuration are used.	

- Each scene recall telegram restarts the activation delay.
- If a new scene recall telegram is received while a delay is active (scene recall not yet executed), the old - and not yet recalled - scene will be rejected and the newest scene value will be in effect.
- The scene recall delay has no influence on the saving of scene values when the learning mode is active.
- If the same scene number is set for several scene entries, only the scene with the lowest entry number (1...8) will be considered. The other internal scenes will be ignored in this case.
- The scene recall can be overridden by a *forced control* or a *lock* function.

6.5.3.6 Energy / Time counter

Parameter name	*Conditions*	*Settings*
Output load [W]	Operating hours / energy counter = enabled	-671088640…+670760960 (**1000**)
	Defines the nominal rated power to be considered in computing the accumulated power consumption for the load connected to this output. *The total energy consumed [kWh] is calculated as the product of the specified value [W] and the operating hours [h].*	
Energy/time cyclic sending	Operating hours / energy counter = enabled	hh:mm:ss (**00:00:00**)
	Defines the time interval for the cyclic retransmission of the counter values (both for accumulated time and energy). *A value of zero (00:00:00) disables cyclic transmission.*	

- The manual activation of the outputs through the relays' maneuvering lever does not affect the operation time counter.
- During ETS programming or bus voltage failure, the counter stops counting even if the output is on.

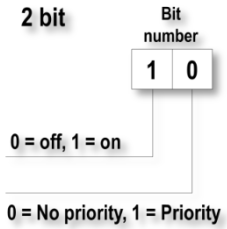
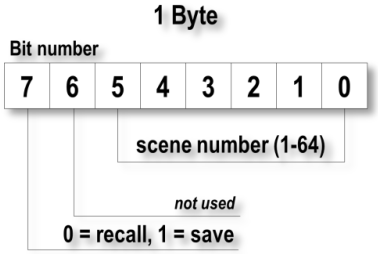
7 Appendix

7.1 Communication objects table

Following is a summary of all KNX Communication Objects (CO) and corresponding Data Point Types (DPT) defined by the application program according to configuration options.

The listing order is generally by CO number.

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Disable front pushbuttons	Manual operation = enabled Disable from bus = yes	1 bit	C-W--	[1.002] boolean	0
Power off alarm	Device power off alarm = enabled	1 bit	CR-T-	[1.005] alarm	1
Output X – On/off Command	Channel *x* = enabled / copy parameters from...	1 bit	CRWTU	[1.001] on/off	2, 24
	Standard "handle" for switching the output through a bus command.				
Output X – Dimming command	Channel *x* = enabled / copy parameters from...	2 bit	C-W--	[3.007] Dimming control	3, 25
	Control point for relative (i.e. up / down) dimming.				
Output X – Absolute setpoint control	Channel *x* = enabled / copy parameters from...	8 bit unsigned	C-W--	[5.001] Percentage 0..100%	4, 26
	Control point for setting the absolute dimming value.				
Output *x* – On off status	Status feedback telegram = enabled	1 bit	CR-T-	[1.001] switch	5, 27
	Sent at any change of the output state and also periodically, as configured. *Not sent when activated manually through maneuvering lever.-*				
Output *x* – Actual dimming value	Status feedback telegram = enabled	8 bit unsigned	CR-T-	[5.001] Percentage 0..100%	6, 28
	Sent at any change of the output state and also periodically, as configured.				
Output *x* – Staircase lighting start stop command	Staircase lighting function = enabled	1 bit	C-W--	[1.001] on/off	7, 29
	Starts the staircase light timing with an On value. *The timed activation automatically stops at the end of the preset time.* *If "Manual off" is enabled, the communication object will stop the timing with an Off value.* *If "Retriggerable" is enabled, the transmission of a new "On" value will restart the timing.*				
Output *x* – Lock command	Locking function = enabled	1 bit	C-W--	[1.003] enable	8,30
	Inhibits both the switching and value setting commands for the output when an "enable" telegram is received, and unlocks them when a "disable" telegram is received.				

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Output *x* – Forcing command	Forcing function = enabled	2 bit	C-W--	[2.001] switch control	9, 31
	Allows to force the status of an output (with respect to the "On/Off" status only) *It is composed of 2 bits: the first one is used for the priority value (i.e. defines whether the forcing is in effect, "Priority", or not) and the second one for the imposed value (which is not considered if forcing is not effective).* 				
Channel *x* – Logic Object *n*	Logic function = enabled **Logic object *n* = enabled**	1 bit	CRWTU	[1.*] *generic 1-bit*	*Ch. 1*: 10...17 *Ch. 2*: 32...39
	For each channel, the CO numbers corresponding to logic objects 1 to 8 are listed.				
Output *x* – Scene number	Scene function = enabled	1 Byte	C-W--	[17.001] scene number [18.001] scene control	18, 40
	Allows to recall a scene setting for the status of the output, and to store current status (both On/Off status and dimming value) in association to the specified scene. 				
Output *x* – kWh counter	Operating hours / energy counter = enabled	4-byte signed counter	CR-T-	[13.013] active energy [kWh]	19, 41
	Stores the current counter value of the accumulated energy.				
Output *x* – kWh counter reset command	Operating hours / energy counter = enabled	1 bit	C-W--	[1.015] reset	20, 42
	Resets the energy counter to 0.				
Output *x* – Hours counter	Operating hours / energy counter = enabled	2-byte unsigned counter	CR-T-	[7.007] time [h]	21, 43
	Stores the current counter value of the accumulated operating time.				
Output *x* – Hours counter reset command	Operating hours / energy counter = enabled	1 bit	C-W--	[1.015] reset	22, 44
	Resets the operating hour counter to 0.				

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Output *x* – Hours counter runout	Operating hours / energy counter = enabled	1 bit	CR-T-	[1.005] alarm	23, 45
	1-bit alarm sent when the time counter reaches the maximum value of 65535 hours.				

7.2 Warning

- Installation, electrical connection, configuration and commissioning of the device can only be carried out by qualified personnel
- Opening the housing of the device causes the immediate end of the warranty period
- ekinex® KNX defective devices must be returned to the manufacturer at the following address: SBS S.p.A. Via Circonvallazione s / n, I-28010 Miasino (NO) Italy

7.3 Other information

- This application manual is aimed at installers, system integrators and planners
- For further information on the product, please contact the ekinex® technical support at the e-mail address: support@ekinex.com or visit the website www.ekinex.com
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- KNX® and ETS® are registered trademarks of KNX Association cvba, Brussels