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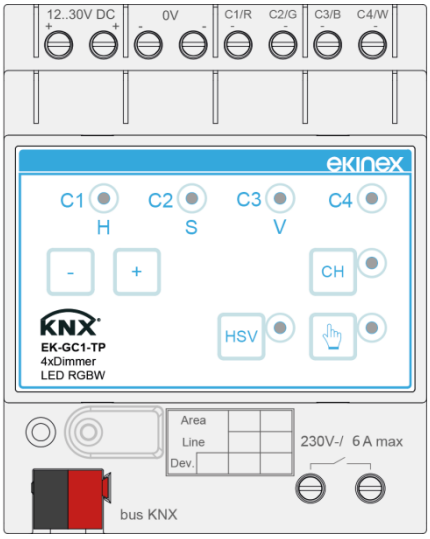
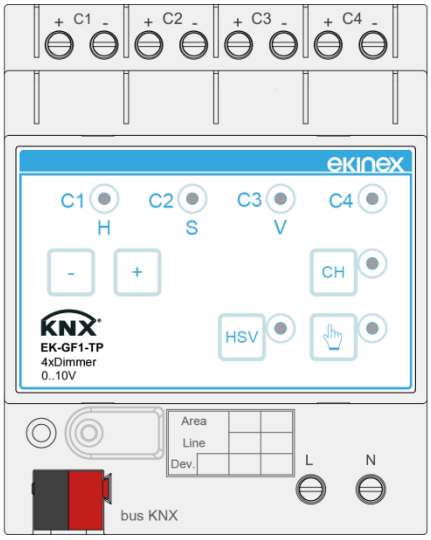
Application manual





KNX 4-channel RGBW Dimmer LED module

EK-GC1-TP - PWM power outputs

EK-GF1-TP - 0..10V control outputs

Contents

Revisione	Modifiche	Data	Redatto	Verificato
1.2	Adapt to Ekinex S.p.A.	2018-12-01	G. Schiochet	
1.1	Typos fixed	2017-03-15	G.Croci C.	
1.0	First issue	2017-03-01	G.Croci C.	

1. Scope of the document

This application manual describes application details for the A1.0 release of the ekinex® KNX Dimmer LED modules below:

- 4-channel LED PWM power dimmer EK-GC1-TP
- 4-channel LED control dimmer EK-GF1-TP.

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	STEKGC1TP_IT.pdf STEKGF1TP_IT.pdf	-	A1.0	01 Mar 2017
Application manual	MAEKGC1GF1TP_IT.pdf	-		
Application program	APEKGC1TP##.knxprod APEKGF1TP##.knxprod	-		

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

EK-GC1-TP

EK-GF1-TP

2. Product description

The ekinex® dimmer moduled **EK-GC1-TP** and **EK-GF1-TP** are modular devices used to drive LED light sources and fixtures.

The devices have the same set of functional featues, but differ in some regards which will be described below.

Throughout the manual, both devices will be referenced indifferently; the respective different features will be pointed out wherever required.

2.1 Common features

The device is equipped with an integrated KNX bus interface module; it is designed for rail mounting in distribution boards.

During operation, the device receives communication telegrams sent by other devices (e.g. manual switching points, sensors, timers...) on the KNX bus. These telegrams effect the activation or deactivation of outputs, the variation of the dimming percentage on the output channels, plus the activation or of several other functions featured by the device, as cofigured during the programmin phase.

As far as the logic control board is concerned, the power for the device is provided by the KNX bus, with a SELV 30V DC voltage. No other auxiliary power sources are required for this device section; all required voltages are internally generated within the device itself.

A power supply is, however, always required for the output section and the loads; without this supply, the device remains responsive as far as the bus communication and the internal function execution are concerned (e.g. timings, logic block processing), although it is no longer able to drive the connected loads.

2.2 Features of the EK-GC1-TP power dimmer

The EK-GC1-TP power dimmer is a PWM driver for four independent low-voltage (12..30V) DC electrical loads; the loads must be of constant-voltage (CV) type. The maximum switchable current for each output is 4 Amps.

Loads are connected with common anode (switching occurs on the low side of the load); the output section is galvanically isolated from the KNX bus.

A pull-up resistor integrated in the output stage allows the output PWM signal, if required, to be used as a control signal to drive external power stages.

The load power supply must be connected to the device terminals in order to supply power also to the output driver section (whereas, as already mentioned, the logic section is fed independently through the KNX bus).

A dry power contact from an internal relay is also made available on two device terminals (max rating 6 Amp @230 VAC). This contact may be used either to switch off the load power supply in standby condition, when all outputs are off, or as a contact free for general purposes.

2.3 Features of the EK-GF1-TP control dimmer

The EK-GF1-TP control dimmer is intended to control power drivers having a high-impedance input with a 0..10 VDC range. Several units can be connected in parallel; the maximum rated current for each output is 50 mA.

The four outputs have the negative terminal in common; however, they are galvanically isolated from the KNX bus (and the logic section of the device).

The device requires a 230 VAC auxiliary supply voltage to drive the output stages (max power consumption 3 W).

For further technical information, please also refer to the product datasheet STEKGC1TP_EN.pdf available on the ekinex website www.ekinex.com.

3. Switching, display and connection elements

The device is equipped with:

- Programming pushbutton and a programming LED
- Membrane keys for output control and selection of manual operation modes
- Membrane key to switch between manual and online mode
- LED indicators for the status of the outputs and for the indication of manual mode
- Screw terminals for input line power and output load connection
- Screw terminals for output load connection
- Plug terminal for the KNX bus line connection

3.1 EK-GC1-TP panel description

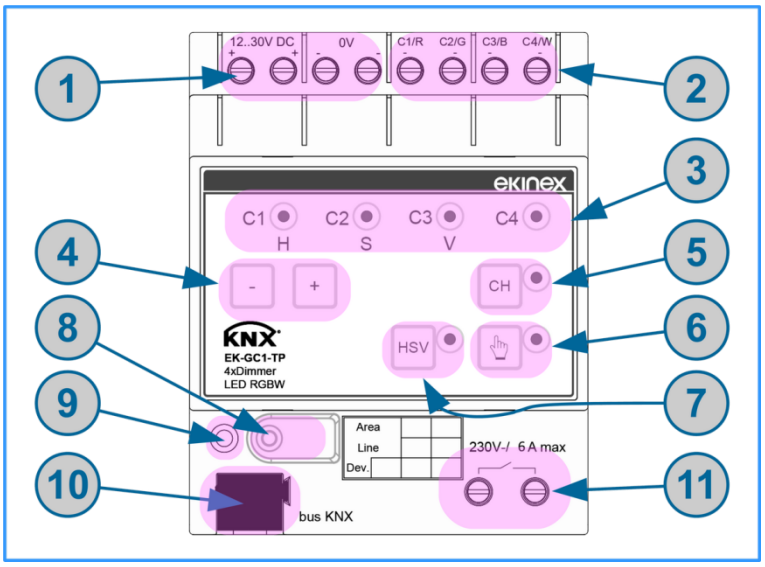


Fig. 1 - Switching, display and connection elements - EK-GC1-TP

1. Terminals for 12..30V DC **output power supply**
2. Terminals for **load output channels 1..4** (or R/G/B/W)
3. LED indicators for selected **output or command parameter**
4. Membrane key for **manual operation** of the selected output or parameter
5. Membrane key for **output or command parameter** (H/S/V parameter) **selection**
6. Membrane key and LED indicator for the activation of **manual mode**
7. Membrane key and LED indicator for the **selection of RGB / HSV mode** (when in manual / color mode)
8. Programming pushbutton
9. Programming mode LED indicator
10. Terminal plug for KNX bus line
11. Terminals for **internal auxiliary relay contact**

3.2 EK-GF1-TP panel description

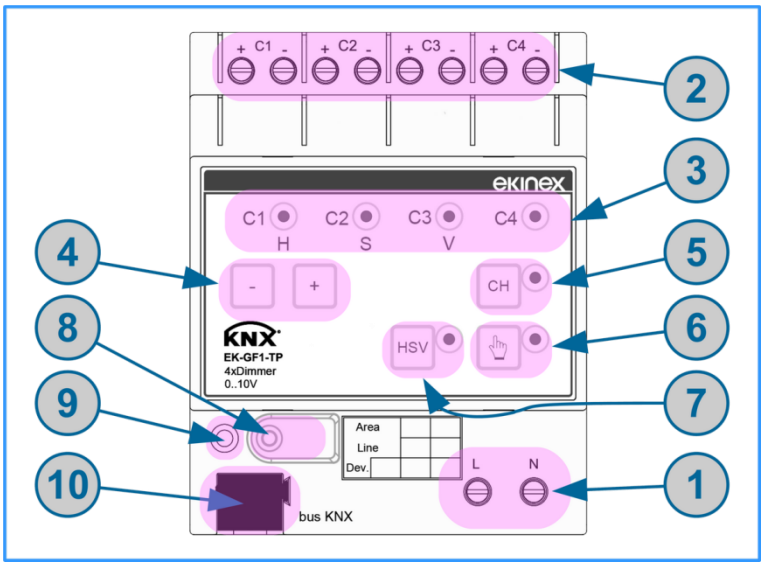


Fig. 2 - Switching, display and connection elements - EK-GF1-TP

1. Terminals for 230 VAC **output power supply**
2. Terminals for **output channels 1..4** (or R/G/B/W)
3. LED indicators for selected **output or command parameter**
4. Membrane key for **manual operation** of the selected output or parameter
5. Membrane key for **output or command parameter** (H/S/V parameter) **selection**
6. Membrane key and LED indicator for the activation of **manual mode**
7. Membrane key and LED indicator for the **selection of RGB / HSV mode** (when in manual / color mode)
8. Programming pushbutton
9. Programming mode LED indicator
10. Terminal plug for KNX bus line

WARNING:

Power supply terminals have different positions and electrical properties between the two models.

Pay attention to correctly locate the proper connection terminals for the device you are employing, in order to prevent short-circuits that are likely to cause damage to the device and severe harm to people.

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 (named respectively **APEKGA1TP##.knxprod** or **APEKGF1TP##.knxprod**); this 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 in the commissioning phase as described in the next paragraph.

Product code	EAN	No. of channels	ETS application software (## = release)	Communication objects (max nr.)	Group adresses (max nr.)
EK-GC1-TP	8018417185205	4	APEKGC1TP##.knxprod	160	160
EK-GF1-TP	8018417185243	4	APEKGF1TP##.knxprod	160	160

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 purposely setup network for programming;
- apply power to the bus;
- switch the 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 the 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 for low voltage (12...30Vdc) LED lamps or strips, operating at constant voltage, which activates and dims its output channels according to telegrams sent by other devices on the bus.

The device is equipped with 4 outputs, which can be used in 3 different modes:

1. Independent channels: each output controls a different LED lamp or strip (typically a white one);
2. Dual White channels: each couple of outputs controls a lamp or strip equipped with a double warm white / cold white light, in order to dim the tone of the resulting white light;
3. Single color channel: each one of the 4 outputs controls a section of an RGBW (or RGB) lamp or strip.

The power supply of the interface for both bus and logic command section is provided by the KNX bus: as for power loads, an external power supply is required, having proper voltage and current characteristics suitable to the characteristics of the device and the application.

It is possible, when needed, to use the outputs for the command of high-impedance control inputs of other devices. In power mode, the common terminal of the loads is connected to the positive terminal of the power supply (common anode), and the negative load terminals are switched; a 4.7 kΩ pull-up resistance is added, allowing a positive level on the outputs in signal mode provided that the impedance of the connected input is sufficiently high. The required input impedance value depends on the signal level accepted by the input itself.

A N.O. voltage free contact is available, which is able to switch a 6A at 250Vac load. This output can be automatically disabled if there are no active channels, in order to disconnect the power supply to eliminate the standby current consumption. If such function is not desired, the output can be freely programmed through a proper communication object.

The device is also equipped with many auxiliary functions, such as timing and logic combination functions for output activation, which will be described in the next chapters.

7. Power-on behaviour

After switching on the bus, which also acts as the power supply for logics, the device becomes fully functional after a very short time (some milliseconds) 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 start-up of the whole network.

A fully unprogrammed device causes no activity on the bus; it 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
- 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.

8. 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, even when the power supply is connected.

9. 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.

9.1 Status of the outputs across modes

When manual mode is activated, the outputs can be operated using the membrane keys on the front panel. When the manual mode is active, however, the telegrams from the bus have no influence on the outputs.

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

Upon returning to online mode, the current output status does not change.

The timings associated with internal functions (e.g. programmed sequences, switching delays or staircase timer) are suspended, or "frozen", during manual mode; upon returning to the online mode, all timings pick up again from the point where they were interrupted.

9.2 Activation of manual mode

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

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

   The device is now in direct control mode of the output channel. The "**HSV**" LED is off and the "**C1 / H**" LED is on, indicating that the output is active.

2) The "**+ / -**" pushbuttons directly control the state of the active output, in this case output C1 (corresponding to red channel, if in color mode); a key press causes the output level to increase or decrease accordingly.

3) By pressing the "**CH**" pushbutton once again, it is possible to sequentially select the other outputs, controlling their value as just explained.

   In case of devices connected to color LED lamps or strips, changing the first three channels will result in changing the R-G-B values, thus changing the overall color and brightness. However, for a more intuitive use of these parameters, it is usually more convenient to switch to HSV mode, as explained below.

4) Any time, by pressing the "**HSV**" pushbutton, the corresponding LED switches on and HSV mode activates.

   The "**C1 / H**" LED will be on again, but in this case will indicate the possibility to act on the "**H**" (*Hue)* channel.

5) By pressing the "**CH**" pushbutton again, it is possible to sequentially select the parameters "**S**" (*Saturation*) and "**V**" (*Value*), thus controlling their value as explained.

6) A further press on the "**CH**" pushbutton selects the "**C4 / W**" channel. While the variation of H-S-V parameters acted simultaneously on the first three channels, the command on "W" channel acts directly on output C4 just like non-HSV mode.

7) By pressing again the "**HSV**" pushbutton, HSV mode is turned off/on.

8) By pressing the "**manual**" pushbutton, manual mode is turned off and normal operation is restored.

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

If manual mode is neither inhibited by configuration nor controllable through the bus, another parameter allows to set 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.

10. Online operation

Besides direct activation, the device is equipped with auxiliary functions, such as timing functions and logic combination of inputs. Such functions are described in detail in the next paragraphs.

10.1 Output control modes

Outputs are PWM channels powered by low continuous voltage; channels can be controlled either in independent or in coordinated mode, through proper color composition functions provided by the device in the previously explained operating modes.

Each channel is designed to work at nominal voltage (12..30 VDC) and 4A per channel maximum current.

Generally speaking, there are 3 main output control modes:

- **Individual (independent) channel mode.** This mode is used if channels are dedicated to independent loads (typically white); each output corresponds to a channel.
- ***Dual white* channel mode.** A Dual White channel is made by two light emitters with different white light hues (warm and cold), which are combined according to variable proportions in order to obtain the desired hue. In this mode, each pair of outputs corresponds to a channel.
- **Color mode.** This mode is used to control a single light source, i.e. a channel, both in terms of color and brightness.

  The first three outputs are meant for controlling red, green and blue emitters (R/G/B); the fourth output, if used, is meant for controlling a white light source. During parametrization, a value will be paired to the color channel (RGB) and another value will be paired to the white channel (W).

  In terms of configuration, colors can be defined with **RGBW (Red, Green, Blue, White)** or **HSV** (**Hue, Saturation, Value)** parameters, plus white; their definition will be better explained in the *Palette* paragaph.

  The two types of parameters can exist simultaneously: every combination of RGBW parameters matches a combination of HSV parameters, thus by setting the values for any of the two modes, the values for the other are automatically defined.

From now on, the word "intensity" will indicate, in all modes, the state to be assigned to the output channels.

In each mode, the parameters relevant to the majority of the used functions can be defined either for each available channel (respectively four, two or one) or in a collective way for all channels.

The mode selection mostly affects the configuration options available in ETS, which are grouped by channel; moreover, the communication objects are also grouped by channel when it comes to advanced function, though all objects for direct command remain available for each single output, thus allowing a more flexible and independent control by, e.g., an external supervision system.

As for the electrical command of the outputs, different options are available, allowing to control different parameters. These options are listed below:

- **Dimming frequency** (PWM). Selectable frequencies are: 300-488-600 Hz.

- **Brightness curve**. In order to align the dimming frequency and the perceived light value, two curves are available, which compensate between the command value and the effective control value. These curves are called “compensated” (the perceived brightness matches the set control value) and “linear” (the dimming frequency matches the set control value).
- **Auxiliary contact management**. As previously mentioned, the device is equipped with an electric auxiliary contact which allows the external power supply to be shut down in case all channels are controlled to a 0% value. This parameter indicates if such contact is used for that purpose or if it is available for other user defined purposes (through a proper communication object).

10.2 Output values definition (palette)

In order to simplify the indication of color to be associated to the device functions, in all configuration parameter a code is used, which identifies one of the color defined in the *palette*.

The palette, only available if the device is in color mode, is a list made by a maximum of 16 entries and defined in a proper section of the application program. For each entry, the following parameters are available:

- A **name** to be assigned to the color; this wil appear as a reminder, in various sections of the application program, every time a color code is inserted;
- A color definition, either through **R-G-B (Red, Green, Blue)** values or **HSV (Hue, Saturation, Value)** values;
- The value of the fourth channel **W (white)**.

10.3 Output direct command

Both control modes make some communication objects available for each channel:

- **On-Off command**: turns the channel off and on.
  The on-off command is always related to the channel: the latter corresponds to a single output in independent mode, to a couple of outputs in *Dual White* mode, and to all 4 outputs in color mode.
  In color mode, also the on-off commands related to the single outputs (i.e. R-G-B-W channels) are available.
  Each on-off command has associated its own state object.

- **Dimming command**: it modifies the dimming percentage of a channel in an incremental way, i.e. with “up / down / stop” type commands.
  There are dimming commands related to each channel parameter, such as:
  - Independent mode: intensity;
  - *Dual White* mode: intensity and balance;
  - Color mode: intensity of R, G, B, W; value of H, S and V; value of V+W.

- **Absolute setpoint control**: it allows a direct specification of the absolute dimming percentage.
  Besides direct values of the single outputs (also corresponding to R / G / B / W), always available, in color mode it is possible to directly set also the values of H, S, V and V+W.
  Both objects related to a single parameter and objects which group more parameters in a single value (R+G+B, H+S+V) are available.

- **Direct color**: in color mode only, it is possible to set as output value, through its own code, one ofthe colors of the palette defined in the ETS application program.

As for the configurable parameters for dimming, they will be explained in the next paragraphs.

10.4 Status indication and alarms

10.4.1 Channel status indication

Several communication objects for a feedback on channels' status are available:

- **On/Off status**: each single output has its own communication object, besides a general object.

  Independent channels mode: the general object indicates "Off" if all channels are off; it is possible to select to show the "On" indication when at least a channel is not off (i.e. if its value is above 0%) or when all channels are at 100% (or, to be more specific, at the value defined as maximum in the relevant parameter). Also for the objects related to the single channels, it is possible to select either the first or the second behaviour.

  Dual White and color mode: both the general object and the objects related to the single outputs show the first behaviour.

- Actual channel control value: it contains the actual value set for the channel. More specifically, this corresponds to:
  - In independent channels mode: the direct intensity value of the corresponding single outputs;
  - In *Dual White* mode: the intensity and balance values for each of the two channels;
  - In color mode: in this case, disregarding to the mode set for the channel, both **R**, **G**, **B**, **W** and **H**, **S**, **V** values are always available; moreover, RGB and HSV groups are also available as a unique 3-byte communication object (DPT [232.600]).

As for the communication objects described above, it is possible to decide if an automatic sending must be enabled (either cyclic or upon change).

In case of dimming, it is possible to select whether the value has to be sent upon change or even while changing (in this case a maximum frequency needs to selected); it is also possible to decide if feedbacks have to be sent while executing a sequence or a scene.

In *Dual White* mode, both intensity and balance values are always sent as status telegrams.

In color mode, it is possible to choose which feedback objects available for the color channel need to be automatically sent. In order to avoid a traffic overload, it is possible to select only one type of available objects (R+G+B, 3 x 1 byte; H+S+V, 3 x 1 byte; RGB, 1 x 3 byte; HSV, 1 x 3 byte). If a single 3-byte object is selected, it is also possible to set sending while changing.

As for W channel, in this mode, the same options described for independent channels are available.

10.4.2 Alarm information

As for the device alarm indicators / anomalies, the following communication objects are available:

- **Power supply failure alarm**. It is activated if DC power supply voltage is missing (unless followed by the activation of the standby auxiliary contact, if configured for such function).
- **Overcurrent alarm**, activated if at least one channel detects an excessive current consumption. 4 more communication objects related to the single channels are available for the very same purpose.

Through a proper communication object, it is possible to specify whether an active alarm has to be cyclically sent on the bus and to which interval.

Note: in case of overcurrent alarm, only a general alarm is sent, not those for the single channels.

10.5 Initializations

It is possible to define a device status based on several initialization events, such as:

- KNX bus activation
- KNX bus deactivation
- DC power supply activation
- Download from ETS completed

When the KNX bus is activated, the output channels can be set in one of the following states:

  - On
  - Off
  - No change
  - Previous value
  - Programmed color (in color mode) / Programmed intensity (in independent channel mode).

All settings activating an output will be effective only if the auxiliary power supply is present; otherwise, besides being impossible to power the loads, the states defined for the “DC power supply activation” event will have the priority.

The difference between “No change” and “Previous value” (this option is available only for the “DC power supply activation” event) is that in the former case the output remains unaltered after the event; the latter case is meaningful when, from the corresponding “Off” event, the output could have modified in manual mode. In that case, such modifications would be cancelled and the output would return to its previous value.

Nonetheless, it is important to point out that if such modifications are caused by internal operations or bus commands, their effects would be retained.

For each available event, if the option “Programmed intensity / color” is selected, it is possible to specify the value for the corresponding channel.

The “DC power supply activation” event only refers to a restore following an external power supply failure, and does not apply if the power supply is restored through the auxiliary standby contact.

For the very same events described above, it is also possible to decide the state of the auxiliary contact if the latter has been configured for a generic use; in that case, the available options are: On, Off, Previous state (bus activation) / No change (other cases).

An option to activate a delayed transmission on the bus (with configurable delay) is also available in case any restore event happens. The sent state objects will be the same configured for sending in the related section.

11. Feature overview

Through the configuration of the device parameters, it is possible to activate a number of advanced features.

Most of these features affect the output activation, i.e. operates on their on/off status without altering their dimming status (brightness and color); others are related to the variation of such parameters (dimming).

This is a summary of such features:

Dimming functions:

- ***Direct dimming command.*** It allows the definition of different speeds associated to different transitions.

Switching features:

- **Time delay block**: allows performing 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 computing the output value as a logic function based on the value of several communication objects; logic blocks have their own communication objects both for inputs and for outputs, thus allowing their use independently from the device operation.
- **Lock and Force**: these functions can temporarily force the output to fixed values and perform high priority switching operations.

Other features:

- **Scene management**: it allows the definition of combinations of state and values or entire sequences, including dimming transitions, triggerable with proper scene codes.
- **Operating hours / Energy consumption counter**: allows a limited tracking of energy consumption by accumulating “On” period durations over time.

The above functions are mostly, but not all purely digital (i.e. related to an On-Off behavior); 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.

11.1 Dimming functions

The main parameters related to dimming functions are the following:

- **Maximum and minimum intensity limits**: These values define the maximum brightness of the lamp, those associated with the “on” state (intensity and balance or color) and the limits used for dimming operations.
- **Dimming time**: it refers to a complete 0% to 100% transition. In case narrower variations are defined (e.g. in sequences), times will be proportionally shorter.
  Different times can be defined for the following transitions:
  - Absolute dimming (when the desired percentage is directly set)
  - Relative dimming (obtained with “up” / “down” commands)
  - Switch on (when an “on” command is received)
  - Switch off (when an “off” command is received)

In case of independent or Dual White mode, the parameter can defined either for each channel or for all channel at once.

11.1.1 Intensity limits: independent channel mode

It is possible to define some parameters to limit the intensity excursion, both for technical (e.g. flicker or overcurrent prevention) and for functional purposes (e.g. optimization of exploitable ranges or maximum/minimum desired brightness).

The following parameters can be defined in order to limit the excursion of the outputs’ level under different conditions:

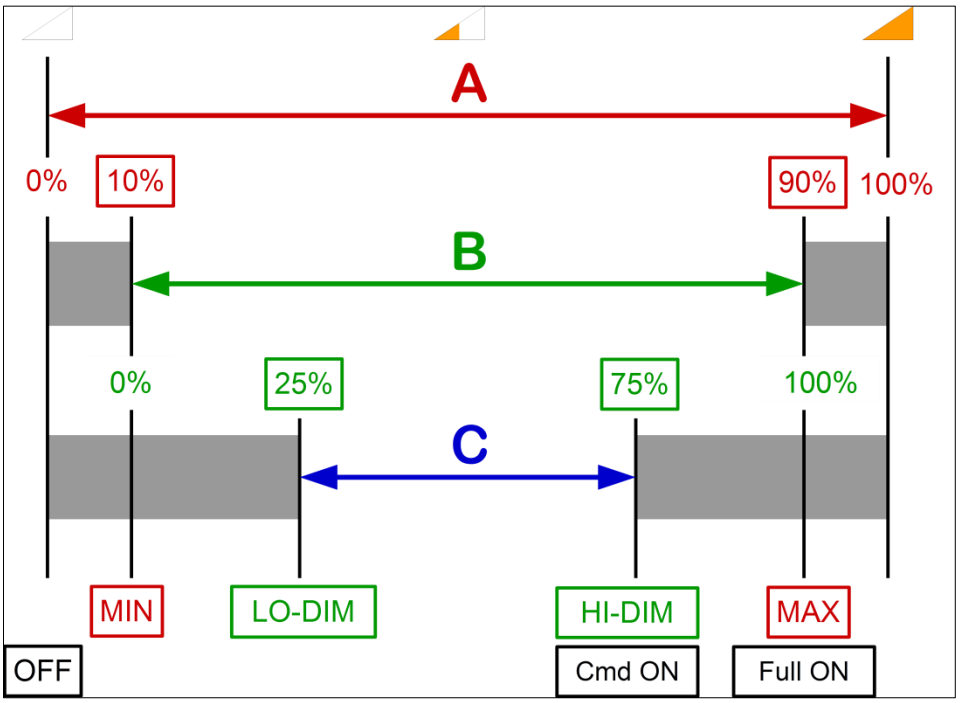
Maximum output value (MAX): it is the value associated to the maximum brightness achievable from the lamp under any condition; it is considered as the 100% of the dimming percentage.

On value (HI-DIM): it is the value associated to the “fully on” status, and acts as a superior limit for relative dimming commands.

Minimum on value (LO-DIM): it is the value associated to the minimum on status, and acts as an inferior limit for relative dimming commands.

Minimum output value (MIN): it is the value associated to the lowest selectable output level; it is considered as the 0% of the dimming percentage.

For a better understanding of the meaning of such parameters, please refer to the following figure:



The red percentages refer to the physically possible output brightness excursion ("A" range, see figure), where 0% stands for completely off and 100% for the maximum command value; these percentages are only used in the ETS device configuration, in particular when "MIN" and "MAX" parameters are defined.

"MIN" and "MAX" parameters respectively represent the minimum and maximum brightness limits for the lamp to be commanded ("B" range, see figure). A command value from 0% to 100% will correspond to a physical output excursion going from MIN (e.g., 10%) to MAX (e.g. 90%)[1]; a simple value scaling is performed.

MIN and MAX limit definition is useful to limit the outputs' electrical command, thus avoiding both flickering when dimming is too low, and an excessive brightness or electrical load in case of overpowered lamps.

The green percentage range ("B" in figure) then corresponds to the effective output range; in particular, 0% and 100% (MIN and MAX points) respectively stand for minimum and maximum selectable lamp brightness.

Moreover, this range is:

- referred to the intensity values specified in the configuration parameters
- where the feedback values are
- The entity of the range whose dimming ramp times refer to

The "LO-DIM" and "HI-DIM" parameters, defined in terms of dimming percentage, represent the brightness excursion limits ("C" range, see figure) under relative commands, i.e. under up/down commands. Values within

[1] Please note that the command value of an output normally is not equal to its dimming value, as compensation curves for perceived brightness are usually applied.

"MIN" and "LO-DIM" or within "HI-DIM" and "MAX" are reachable only through absolute commands (direct assignment of percentage value).

Warning: the step amplitude specified in relative dimming commands refers to "MIN" / "MAX" range, not "LO-DIM" / "HI-DIM".

In the previous example: if I sent a "Dimming Step Up 50%" command while at "LO-DIM" point (minimum value achievable with relative commands), brightness would go at "HI-DIM" point, not in the middle between the two points.

When the device receives an "on" command, both externally and from internal function, it is possible to choose which value to consider as status "ON": "HI-DIM", "MAX" (full on) or the last value before power off. On the contrary, an "off" command always brings the channel into state "OFF".

If the channel has a value within "MIN" and "LO-DIM" or within "HI-DIM" and "MAX" following an absolute command[2] and it receives a relative command, the device has the following behavior:

- If the direction of the variation is towards the allowed range for relative commands ("C" range), the command is executed without any discontinuity in light intensity;
- If the direction is the opposite, the command is not executed.

The relative command "down" brings the brightness only to a value not lower than "LO-DIM" ; in order to achieve a power off it is necessary to send an "OFF" command.

11.1.2 Intensity limits: Dual White mode

In *Dual White* mode, the definition of ranges and percentages is the same as described above only for the *Brightness* parameter; in particular, two ranges will be defined: "B" (MIN / MAX) and "C" (LO-DIM / HI-DIM).
As for the Balance parameter, a "Full On" value is defined, having the following meaning.
If the channel is configured to read the "On" command as "Full On" and not as "Previous state" (*Dimming restore level* parameter), when such command is received the balance is restored at configured "Full On" level (and 100% brightness value).
Balance can be modified later on, and is not altered by the dimming operations until it receives a new "On" command.

11.1.3 Intensity limits: color mode

In color mode, the definition of ranges and percentages is the same as described above, with the following differences:

- In case of dimming on V parameter, limitations of range "C" (LO-DIM / HI-DIM) apply, for relative dimming operations;
- In case of dimming on any other commands (R, G, B, H, S; absolute or relative dimming), limitation of range "B" (MIN / MAX) only apply.

[2] Or, e.g., if the value "Full on" is selected as restore value (and the latter is set at a greater percentage value than "HI-DIM").

Please note that these limitations, which refer to the output command, do not directly refer to intensity parameters related to more than one output (e.g. global intensity): in these cases, MIN and MAX have to be defined such as the required limits for the single outputs are not overcome for any color combination or intensity. Please note that such range is defined globally and not separately for each channel.

- Also for color, as for Dual White, a restore color can be defined, to be used with the “Full On” option same as already described above.

Given the complexity between these limits and all possible settings for the different command modes, it is recommended to use them only if needed.

11.2 Switching features

Switching features apply to On/Off commands: dimming commands do not have any effect on them and are carried out independently.

The value for activation (ON) can be defined through “Restore level” parameter; in Dual White and color mode, in some cases it is possible to specify a color or tone linked to the activation.

11.2.1 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 apply to switches carried out through direct command and/or logic objects, not to those caused by other functions (e.g. staircase lights or scenes).

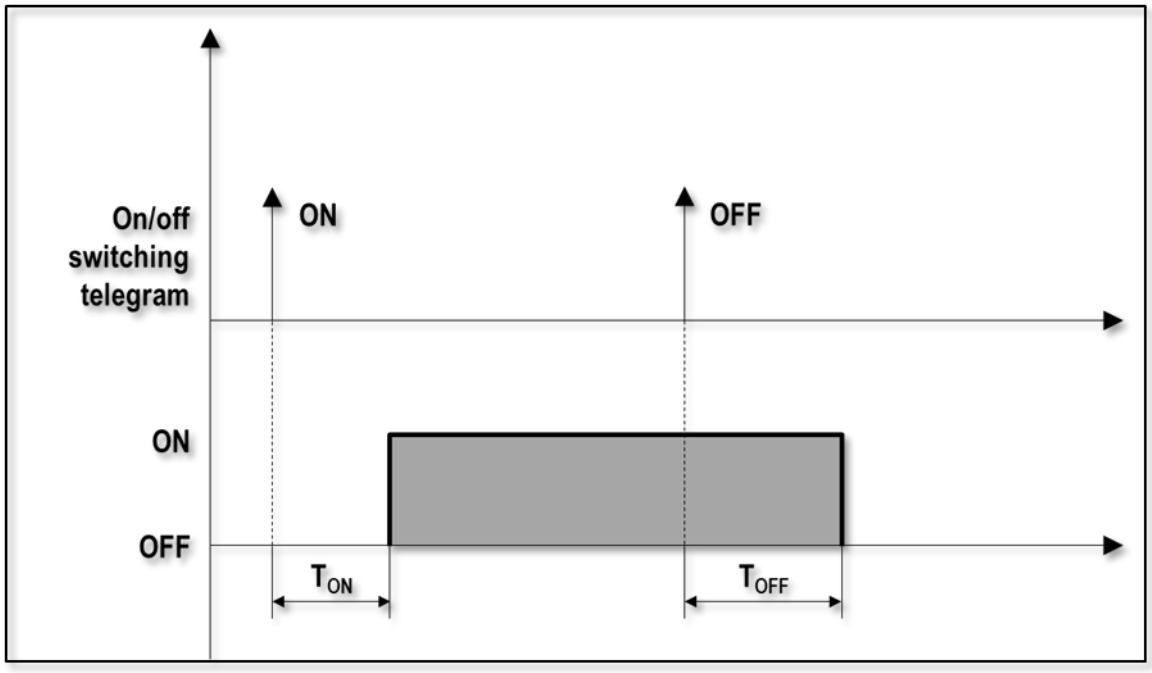


Fig. 3 - Time delay

11.2.2 Staircase function

This function provides 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:

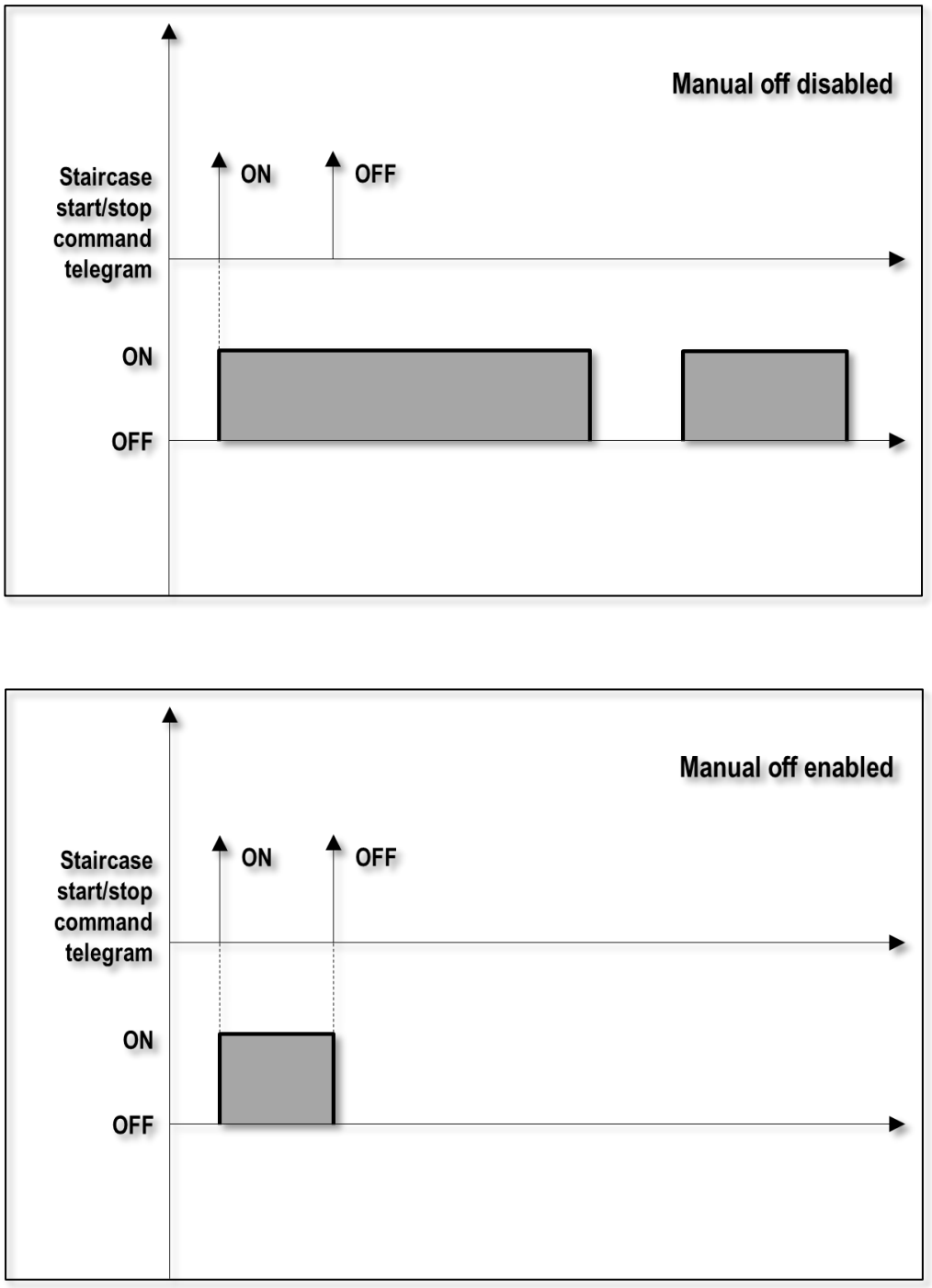


Fig. 4 - Manual Off feature

Following pictures show the *Retrigger* feature:

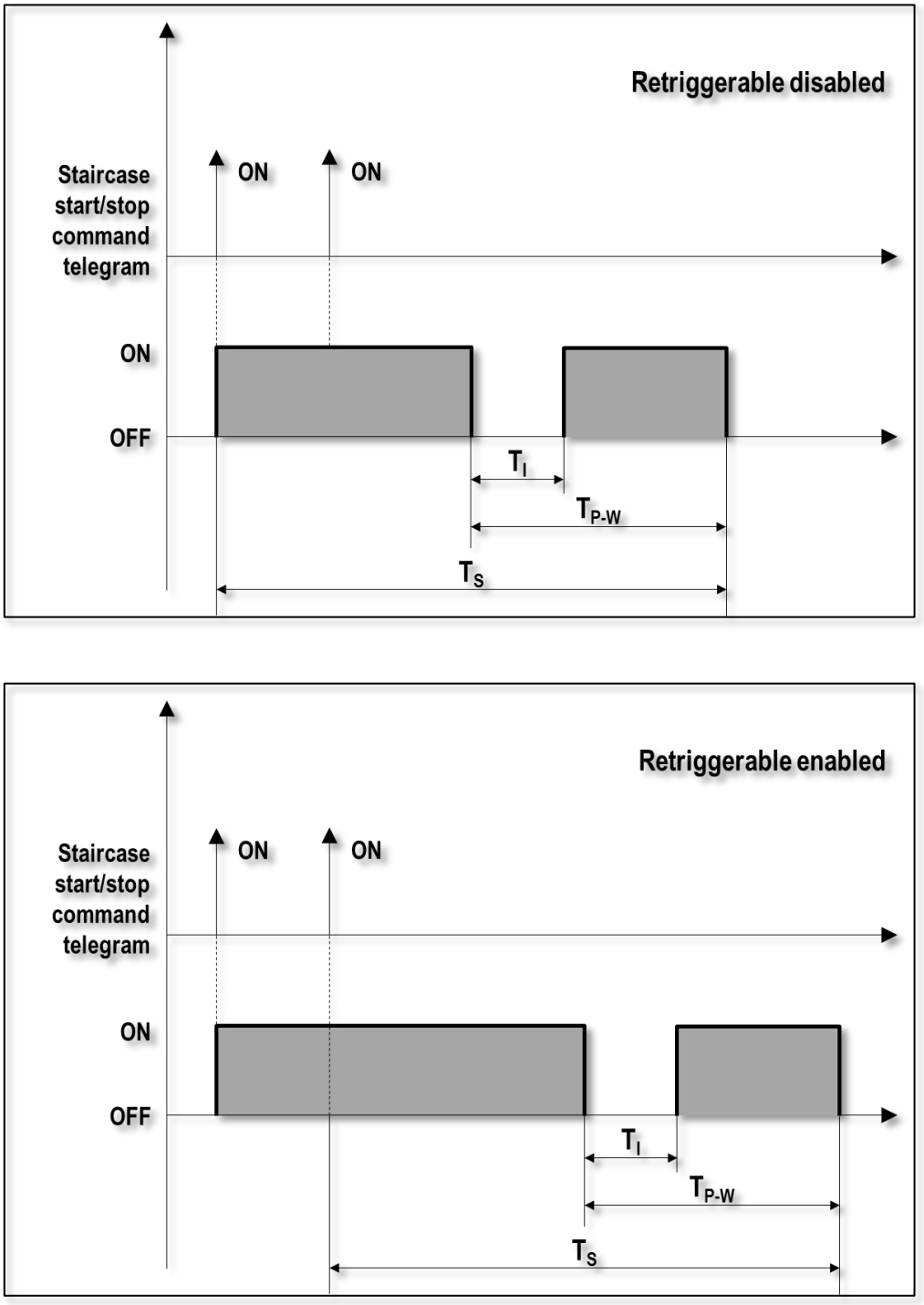


Fig. 5 - Retrigger feature

Following pictures show the *Pre-warning* feature:

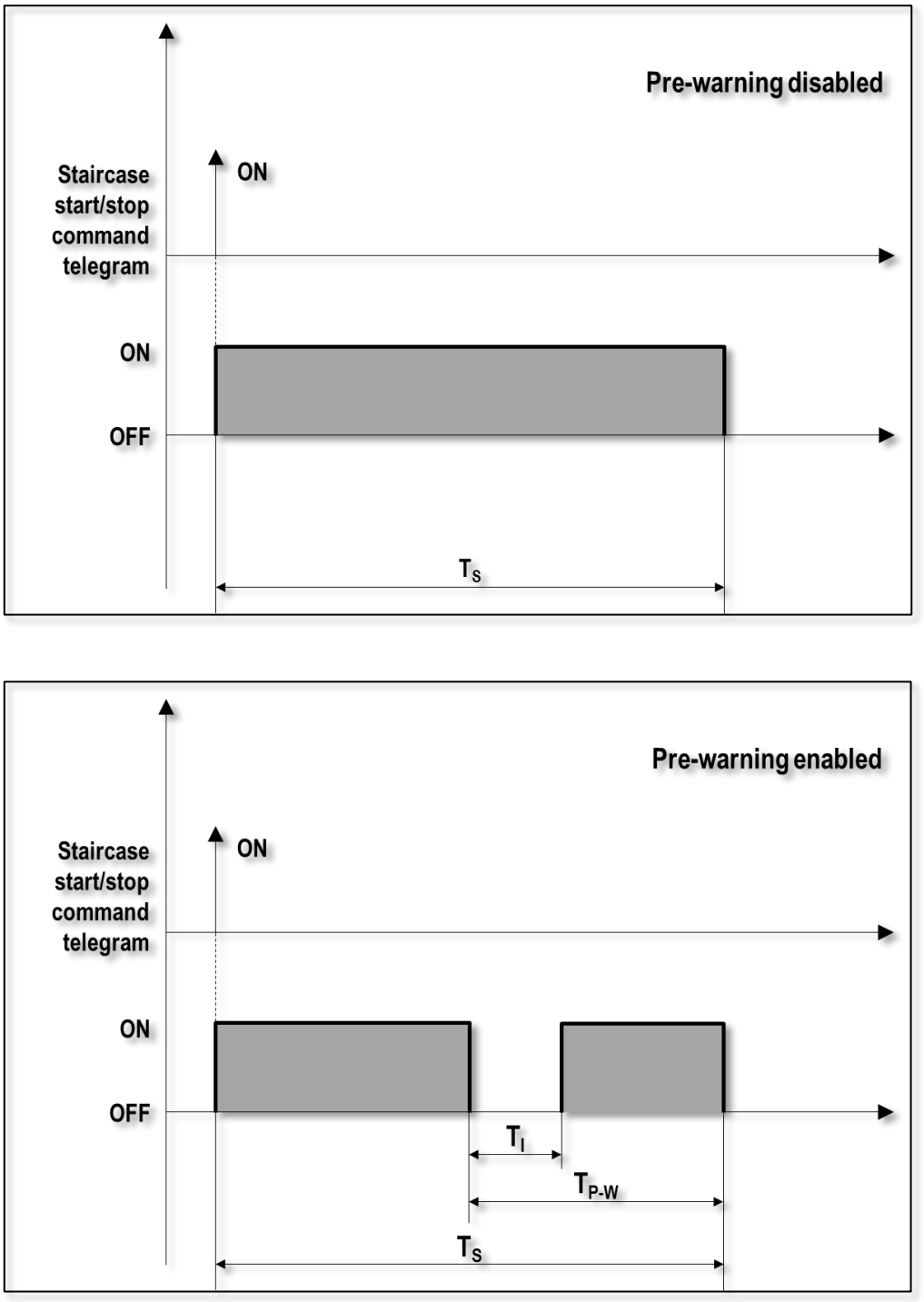


Fig. 6 - Pre-warning feature

- Pre-warning time must be less than staircase time ($T_{P-W} < T_S$) and interruption time must be less than pre-warning time ($T_I < T_{P-W}$).
- Set on / off delays do not affect the staircase function.

- An ongoing time function will be terminated by a device reset (voltage failure and restore or download from ETS) or by any function affecting the output (e.g. direct command, forced command, logic function, scene recall) even though the output on / off value is not affected by the used function.
- In case the function is terminated by force, the output value remains the same it was before termination; this is valid also if termination takes place during pre-warning time.

11.2.3 Logic function

The devices has 8 independent logic blocks for processing more evolved command logics. Each logic block performs a logic operation selectable among *AND*, *OR* or *Exclusive OR (XOR)*.

Up to 4 values can be provided as inputs, all linked to communication objects (accessible to other devices from the bus). For each object:

- A negative operator inverting the value can be individually applied, if needed;
- A request upon startup of the corresponding value can be set, through proper telegram;
- A default value for startup can be defined, in case of value not received (or not requested).

Also the output is linked to a communication object; in order for it to be used, it is necessary to connect to the destination communication object through group address. This feature, even though it requires some specific group addresses to be configured, allows a great flexibility, because it allows the use of logic blocks also for functions which have nothing to do with the device operation.

The following figure shows the structure of the blocks:

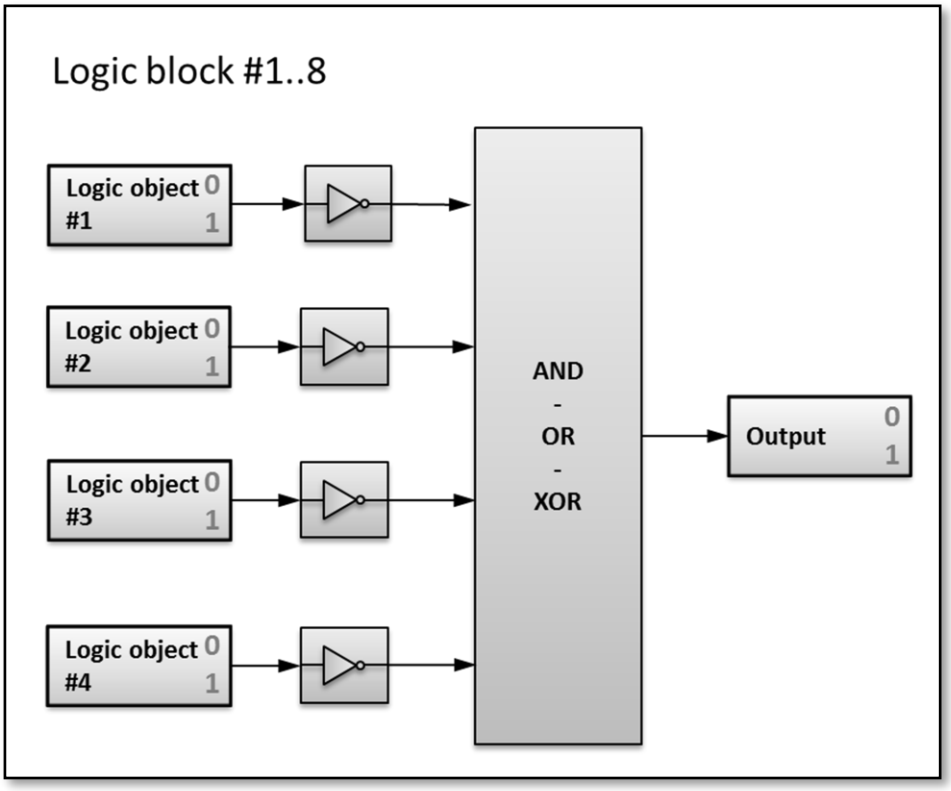


Fig. 7 – Logic functions

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 is ON, but not both.

11.2.4 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.

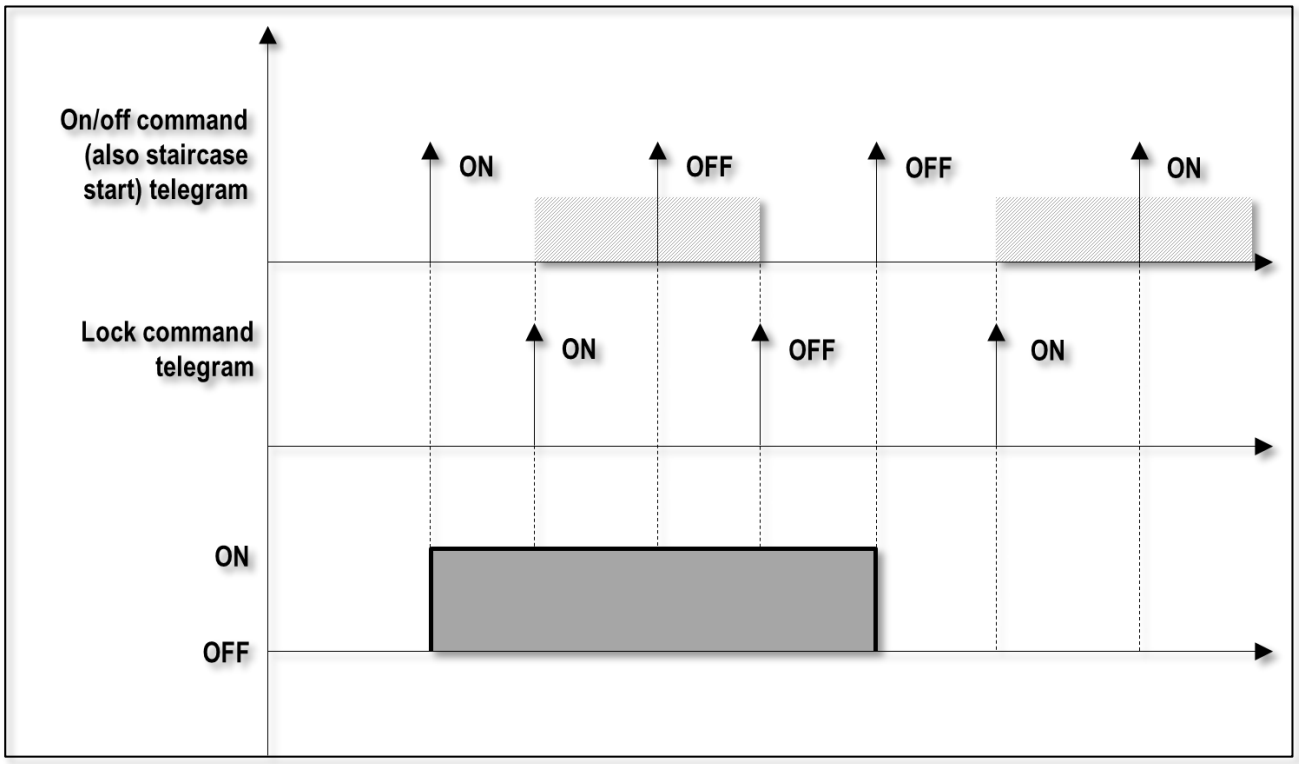


Fig. 8 – Lock function

11.2.5 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.

It is also possible to indicate if, upon recovery, an existing forcing has to be retained or not.

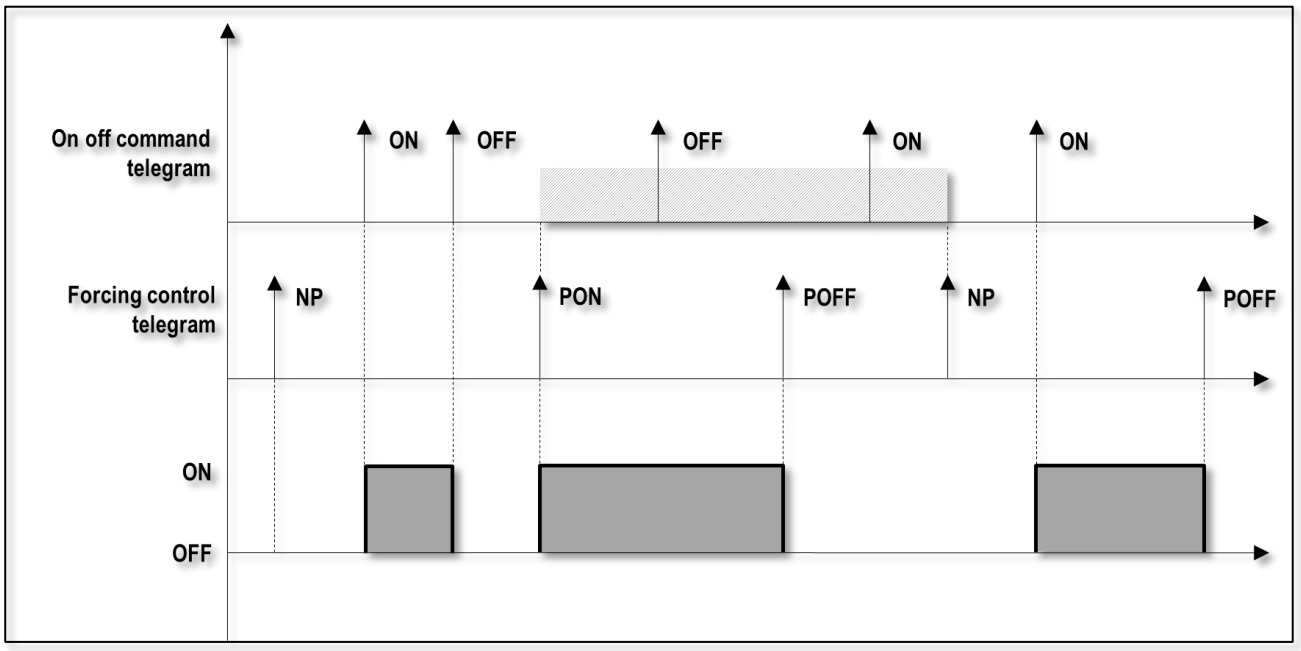


Fig. 9 - Forcing function

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.

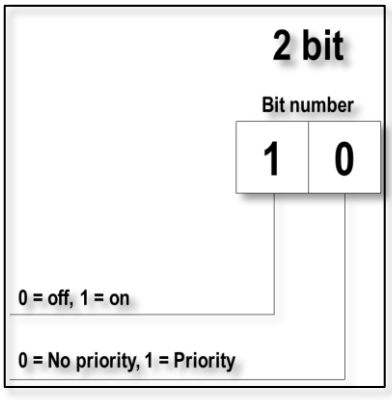


Fig. 10 – Force command bits

11.3 Scene management

The device can hold up to 16 preprogrammed activations or *scenes*.

The word “scene” indicates two different kinds of activation:

- **Fixed activations**, i.e. particular output intensity / color values;
- **Sequences**, i.e. a series of transitions among preset values.

Each one of the 16 available scenes can be defined as *Fixed scene* or *Sequence*. Both fixed scenes and sequences will be explained in detail later on.

In *color* mode, a scene includes the configuration of both RGB and W channels; in *independent* mode, the scene will apply to the channel for which it is recalled (every channel has a related object for scene activation[3]).

It is possible to define a delay for the actual application of the scene after the related command is issued.

Besides the activation of scenes through the usual DPT [18.001] object, it is also possible – by enabling the proper function – to activate up to 4 selectable scenes (called *Quick scenes*) through an **On/Off command**.

11.3.1 Fixed scenes

In case of fixed scene, the output channel takes an intensity / color value which remains constant for all the scene duration; however, it is possible to specify a transition time between the channel state during activation and the final state achievement.

The output value for a scene can be either fixed or chosen during 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. Then this value will be recalled in subsequent scene activations. The communication object used for reprogramming is the same used for recalling.

Reprogramming the value does not change the configured transition time.

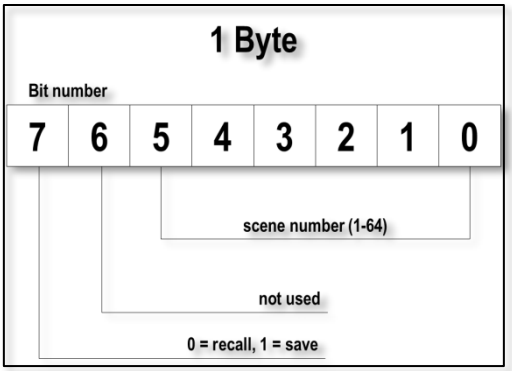


Fig. 11 – Scene store / recall command code

[3] More precisely, a group of objects; see following pages for details.

11.3.2 Sequences

A sequence is defined by a series of *phases* (up to 8 for each sequence).

Each phase is defined by:

- An **intensity / color** value
- A **duration**
- A **transition time** between the starting state and the state associated to the phase. Transition time is expressed as a percentage of the total phase duration.

Enabled phases are activated sequentially, thus realizing a *base sequence*.

Once the base sequence is over, it is possible to configure a number of options, in detail:

- To simply terminate the sequence execution
- To switch to another sequence[4]
- To start over the base sequence *ad infinitum*

In the first two cases, it is also possible to define a number or repetitions to perform, if a periodic longer sequence is desired.

It is possible to stop a sequence:

By using the proper commmunication object *Stop sequence*

By selecting another scene (even an undefined one)

If the related option is active, by directly commanding the output values

[4] If the next sequence is not defined, the execution will be terminated.

11.4 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; both these commands are communication objects as well.

Together with the counter, a “kWh counter”-type object is created, equipped with a communication object with its own reset command as well. The parameter indicating the electrical power value (W) associated to the load has to be defined for each one of the 4 device outputs, both in color and in independent mode. When estimating the consumed energy, the dimming percentage of the output is taken into account, sampled every 1 s.

Although this is not a “real” power metering, but merely a conversion 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.

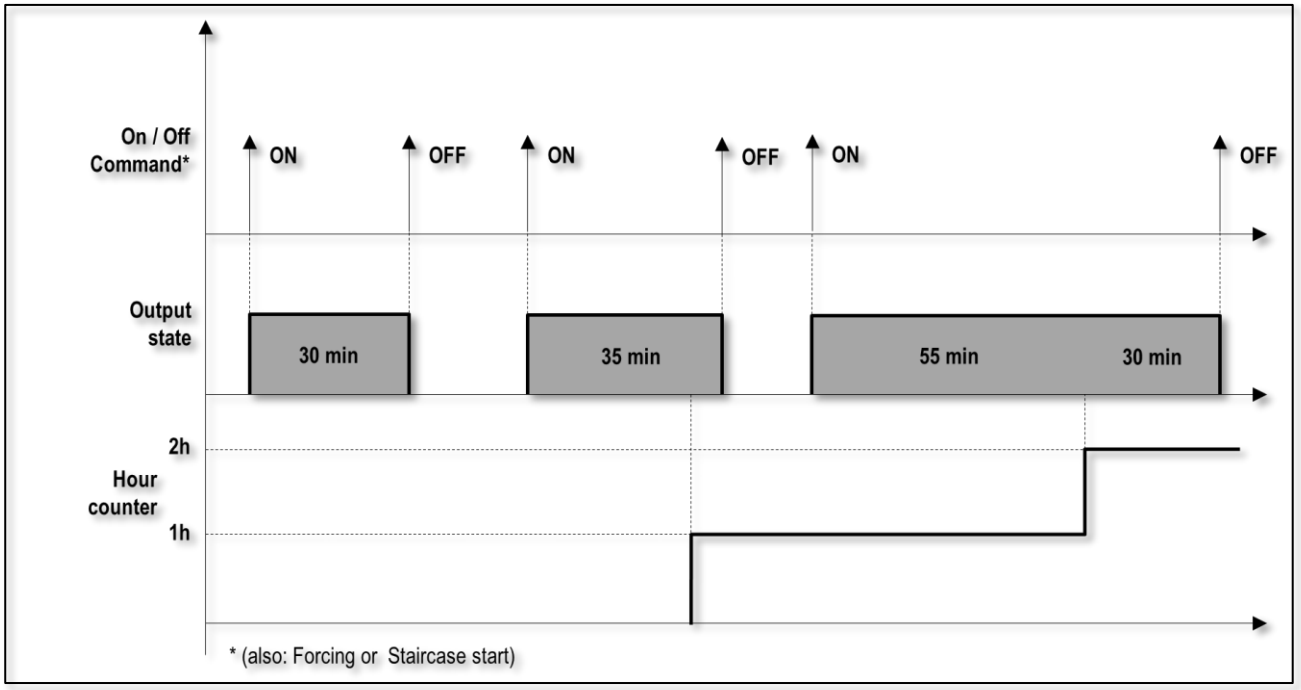


Fig. 12 - Operating hours and Energy counter

12. Device settings

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

The default values for each parameter are printed in **bold**.

The description of parameters is articulated in following sections:

- General device parameters
- General channel parameters
- Auxiliary functions
- Palette definition
- Parameters for scenes / sequences.

The parameter groups belonging to each one of the three operation modes (Independent channels, Dual White and Color) are very similar, although possibly listed under different menus; in the following description, the parameter groups for each mode will normally be listed separately.

For clarity's sake, the condition that indicates the relevant operation mode will not be included in the condition list; this information will be shown by means of the "I", "D", "C" boxes.

12.1 General device configuration

12.1.1 General parameters

These parameters are listed under the menu *General.*

Parameter name	*Conditions*				*Values*
Channel control	-				**Independent** Dual white RGB+W
Manual operations	**I**	**D**	**C**	-	**Enable** Disable
Disable from bus	**I**	**D**	**C**	Manual operations = Enable	Yes **No**
Tempo ripristino Auto	**I**	**D**	**C**	Manual operations = Enable Disable from bus = Y	[hhmmss]
Aux contact	**I**	**D**	**C**	-	Free use **If channels 0%**
Aux contact - Behavior at power on	**I**	**D**	**C**	Aux contact = Free use	On **Off** No change
Aux contact - Behavior at bus on	**I**	**D**	**C**	Aux contact = Free use	On **Off** No change
Aux contact - Behavior at download end	**I**	**D**	**C**	Aux contact = Free use	On **Off** No change
Logic functions	**I**	**D**	**C**	-	Enabled **Disabled**
PWM frequency	**I**	**D**	**C**	-	300 Hz **488 Hz** 600 Hz
Brightness correction	**I**	**D**	**C**	-	lineare **compensata**
Automatic alarm sending	**I**	**D**	**C**	-	**no** 30s...120min
Status telegram emission	**I**	**D**			No During dimming **End of dimming**
Status telegram emission for color			**C**		No During dimming **End of dimming**

Parameter name	*Conditions*				*Values*
Color status telegram type			**C**	Status telegram emission for color: During dimming / End of dimming	**R + G + B** H + S + V HSV 3byte RGB 3byte
Status telegram emission for W			**C**	-	No During dimming **End of dimming**
Minimum time between sending	**I**	**D**	**C**		x 1s **[00:00:00]**
Dimming parameters	**I**	**D**		-	**Collective** Individual

12.2 Channel configuration parameters

12.2.1 Common command parameters

These parameters are listed under the menu *General*, when in ***Independent channels*** or ***Dual White*** modes.

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Absolute dimming time	**I**	**D**		Dimming parameters =Collective	x 0.1s **[20]**
Relative dimming time	**I**	**D**		Dimming parameters =Collective	x 0.1s **[20]**
Dimming time for On	**I**	**D**		Dimming parameters =Collective	x 0.1s **[0]**
Dimming time for Off	**I**	**D**		Dimming parameters =Collective	x 0.1s **[0]**
Full On Intensity	**I**	**D**		Dimming parameters =Collective	0%..100% **[100%]**
Full On Balance		**D**		Dimming parameters =Collective	0%..100% **[50%]**
Max intensity for dimming	**I**	**D**		Dimming parameters =Collective	0%..100% **[100%]**
Min intensity for dimming	**I**	**D**		Dimming parameters =Collective	0%..100% **[0%]**
Min intensity	**I**	**D**		Dimming parameters =Collective	0%..100% **[0%]**
On level for dimming	**I**	**D**		Dimming parameters =Collective	**Previous** MaxDim Full On
Channel is On if intensity:	**I**	**D**		-	**>0%** Max

12.2.2 Channel command parameters - Color

These parameters are listed under the menu *General*, when in ***Color*** mode.

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Absolute dimming time			**C**	-	x 0.1s **[20]**
Relative dimming time			**C**	-	x 0.1s **[20]**
Dimming time for On			**C**	-	x 0.1s **[0]**
Dimming time for Off			**C**	-	x 0.1s **[0]**
Full On Color			**C**	-	1..16 **[1]**
Full On Intensity Channel R			**C**	-	0%..100% **[100%]**
Full On Intensity Channel G			**C**	-	0%..100% **[100%]**
Full On Intensity Channel B			**C**	-	0%..100% **[100%]**
Full On Intensity Channel W			**C**	-	0%..100% **[100%]**
Max intensity for dimming			**C**	-	0%..100% **[100%]**
Min intensity for dimming			**C**	-	0%..100% **[0%]**
Min intensity Channel R			**C**	-	0%..100% **[0%]**
Min intensity Channel G			**C**	-	0%..100% **[0%]**
Min intensity Channel B			**C**	-	0%..100% **[0%]**
Min intensity Channel W			**C**	-	0%..100% **[0%]**
On level for dimming			**C**	-	**Previous** Max dimming Full On

12.2.3 Channel command parameters - Independent channels / Dual White

These parameters are listed under the menu *Channel <n> / Parameters.*

In Independent channel mode, 4 parameters groups will be visible (channels 1..4); in *Dual White* mode, 2 parameters groups will be visible (channels 1..2, corresponding to outputs 1+2 and 3+4).

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Absolute dimming time	**I**	**D**		Dimming parameters = Individual	x 0.1s **[20]**
Relative dimming time	**I**	**D**		Dimming parameters = Individual	x 0.1s **[20]**
Dimming time for On	**I**	**D**		Dimming parameters = Individual	x 0.1s **[0s]**
Dimming time for Off	**I**	**D**		Dimming parameters = Individual	x 0.1s **[0s]**
Full On Intensity	**I**	**D**		Dimming parameters = Individual	0%..100% **[100%]**
Full On Balance		**D**		Dimming parameters = Individual	0%..100% **[50%]**
Max intensity for dimming	**I**	**D**		Dimming parameters = Individual	0%..100% **[100%]**
Min intensity for dimming	**I**	**D**		Dimming parameters = Individual	0%..100% **[0%]**
Min intensity	**I**	**D**		Dimming parameters = Individual	0%..100% **[0%]**
On level for dimming	**I**	**D**		Dimming parameters = Individual	**Previous** Max dimming Full On
Channel is On if intensity:	**I**	**D**		Dimming parameters = Individual	>0% Max

12.2.4 Channel initial values - Color

These parameters are listed under the menu *RGB+W channel* / *Initial values*, when in ***Color*** mode.

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Behavior at power ON			**C**	-	**Off** On No change Previous value Color
Color at power ON			**C**	Behavior at power ON = Color	1..16 **[1]**
Behavior at bus ON			**C**	-	**Off** On No change Color
Colore at bus ON			**C**	Behavior at bus ON = Color	1..16 **[1]**
Behavior at bus OFF			**C**	-	**Off** On No change Color
Colore at bus OFF			**C**	Behavior at bus OFF = Color	1..16 **[1]**
Behavior at download end			**C**	-	**Off** On No change Color
Color at download end			**C**	Behavior at download end = Color	1..16 **[1]**
Status sending at reset			**C**	-	**Yes** No
Sending delay			**C**	Status sending at reset = Y	hh:mm:ss **[00:00:00]**

12.2.5 Channel initial values – Independent channels / Dual White

These parameters are listed under the menu *Channel <n> / Initial values.*

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Behavior at power ON	**I**	**D**		-	**Off** On No change Previous value Intensity
Initial intensity	**I**	**D**		Behavior at power ON = Intensity	0%..100% **[100%]**
Initial balance		**D**		Behavior at power ON = Intensity	0%..100% **[50%]**
Behavior at bus ON	**I**	**D**		-	**Off** On No change Intensity
Initial intensity	**I**	**D**		Behavior at bus ON = Intensity	0%..100% **[100%]**
Initial balance		**D**		Behavior at bus ON = Intensity	0%..100% **[50%]**
Behavior at bus OFF	**I**	**D**		-	**Off** On No change Intensity
Initial intensity	**I**	**D**		Behavior at bus OFF = Intensity	0%..100% **[100%]**
Initial balance		**D**		Behavior at bus OFF = Intensity	0%..100% **[50%]**
Behavior at download end	**I**	**D**		-	**Off** On No change Intensity
Initial intensity	**I**	**D**		Behavior at download end = Intensity	0%..100% **[100%]**
Initial balance		**D**		Behavior at download end = Intensity	0%..100% **[50%]**
Status sending at reset	**I**	**D**		-	**Yes** No
Sending delay	**I**	**D**		Status sending at reset = Y	hh:mm:ss **[00:00:00]**

12.3 Auxiliary functions

12.3.1 Auxiliary function selection

These parameters are listed under the menu *Channel <n> / Functions.*

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Off-On delay	**I**	**D**	**C**	-	hh:mm:ss:ff **[00:00:00.00]**
On-Off delay	**I**	**D**	**C**	-	hh:mm:ss:ff **[00:00:00.00]**
Command inversion	**I**	**D**	**C**	-	**No** Yes
Scene function	**I**	**D**	**C**	-	**No** Yes
Forcing function	**I**	**D**	**C**	-	**No** Yes
Behavior at end of forcing	**I**	**D**	**C**	Forcing function = Y	Off On **No change** Previous value Color
Maintain forcing at bus ON	**I**	**D**	**C**	Forcing function = Y	Yes **No**
Lock function	**I**	**D**	**C**	-	**No** Yes
Behavior at lock ON	**I**	**D**	**C**	Lock function = Y	On Off **No change** Previous value Color
Intensity at lock ON	**I**	**D**		Lock function = Y Behavior at lock ON = Intensity	0%..100% **[0%]**
Balance at lock ON		**D**		Lock function = Y Behavior at lock ON = Intensity	0%..100% **[50%]**
Color at lock ON			**C**	Lock function = Y Behavior at lock ON = Color	1..16 **[1]**
Behavior at lock OFF	**I**	**D**	**C**	Lock function = Y	Off On **No change** Previous value Color

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Intensity at lock OFF	**I**	**D**		Lock function = Y Behavior at lock Off = Intensity	0%..100% **[0%]**
Balance at lock OFF		**D**		Lock function = Y Behavior at lock Off = Intensity	0%..100% **[50%]**
Color at lock OFF			**C**	Lock function = Y Behavior at lock Off = Color	1..16 **[1]**
Lock status at bus ON	**I**	**D**	**C**	Lock function = Y	Off On **No change**
Staircase function	**I**	**D**	**C**	-	**No** Yes
Stairlight time	**I**	**D**	**C**	Staircase function = Y	hh:mm:ss:fff **[00:01:00.000]**
Manual Off	**I**	**D**	**C**	Staircase function = Y	**Disabled** Enabled
Retriggering	**I**	**D**	**C**	Staircase function = Y	**Disabled** Enabled
Prewarning	**I**	**D**	**C**	Staircase function = Y	**Disabled** Enabled
Prewarning time	**I**	**D**	**C**	Staircase function = Y Prewarning =Y	hh:mm:ss:ff **[00:00:10.00]**
Gap time	**I**	**D**	**C**	Staircase function = Y Prewarning =Y	x 0.1s **[10s]**
Intensity during prewarning	**I**	**D**		Staircase function = Y Prewarning =Y	0%..100% **[50%]**
Balance during prewarning		**D**		Staircase function = Y Prewarning =Y	0%..100% **[50%]**
Color during prewarning			**C**	Staircase function = Y Prewarning =Y	1..16 **[1]**
Time/Energy counter	**I**	**D**	**C**	-	**No** Yes
Output load [W]	**I**			Time/Energy counter = Y	0..255 **[100]**
Output load cool tone [W]		**D**		Time/Energy counter = Y	0..255 **[100]**
Output load warm tone [W]		**D**		Time/Energy counter = Y	0..255 **[100]**

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Output load R channel [W]			**C**	Time/Energy counter = Y	0..255 **[100]**
Output load G channel [W]			**C**	Time/Energy counter = Y	0..255 **[100]**
Output load B channel [W]			**C**	Time/Energy counter = Y	0..255 **[100]**
Output load W channel [W]			**C**	Time/Energy counter = Y	0..255 **[100]**
Time/Energy repeated send	**I**	**D**	**C**	Time/Energy counter = Y	**No** 30s...120min

12.4 Color palette

Through the color palette, a set of colors can be defined; these colors can be simply referenced in every parameter that requires a color specification, for instance in the definition of Scenes and Sequences.

Following parameters are only displayed in *Color* mode, under the *Palette* menu.

Each color can be defined both throught R-G-B and H-S-V parameters; beside these, the additiopnal value for channel W can always be specified.

The name of the color is merely a mnemonic label, which is used to help to easily identify colors when they are assigned to the parameters.

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Name			**C**	-	[text field]
RGB value			**C**	-	[selector]
W value			**C**	-	0..255

Warning: the color value (both as RGB or HSV can be selected by means of a dedicated screen control mask.This control might fail to appear in certain older ETS4 versions; in such case, the desired color value will have to be specified through its HTML code (i.e. '#RRGGBB', where 'RR', 'GG' and 'BB' are the hexadecimal values 00..FF of the corresponding color component.

12.5 Logic functions

Logic functions blocks are completely independent from other application features; therefore, the corresponding parameters are displayed regardless of the operating mode.

Following parameters are repeated for every logic block under the menu *Logic functions.*

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Logic function [1..8]	**I**	**D**	**C**	Logic functions =Y	**Disabled** Enabled
Logic operation	**I**	**D**	**C**	Logic functions =Y, Logic function<n> Enabled = Y	**OR** AND X-OR
Output cyclic sending interval	**I**	**D**	**C**	Logic functions =Y, Logic function<n> Enabled = Y	**No** 30s...120min
Delay after bus voltage recovery	**I**	**D**	**C**	Logic functions =Y, Logic function<n> Enabled = Y	hh:mm:ss:ff **[00:00:04.00]**

Following parameters are repeated for every logic object in each enabled logic block:

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Logic object [1..4]	**I**	**D**	**C**	Logic functions =Y, Logic function <n> Enabled = Y	**Disabled** Enabled
Logic object [1..4] negated	**I**	**D**	**C**	Logic functions =Y, Logic function <n> Enabled = Y, Logic object <i> Enabled = Y	**No** Yes
Logic object [1..4]: default value	**I**	**D**	**C**	Logic functions =Y, Logic function <n> Enabled = Y, Logic object <i> Enabled = Y	**None** Off On
Logic object [1..4]: read at startup	**I**	**D**	**C**	Logic functions =Y, Logic function <n> Enabled = Y, Logic object <i> Enabled = Y	**No** Yes

12.6 Scenes and sequences

The parameters related to scenes and sequences are displayed in all modes; in *Color* mode they will contain references to Palette colors, while in other modes intensity and balance values will be defined locally.

In the following sections, for the sake of simplicity, the term *Scene* will be used to reference both Scenes and Sequences, except where it will be necessary to highlight the differences.

12.6.1 Scene general parameters

Following parameters are repeated for every enabled Scene, under the menu *Channel<n>* / *Scenes.*

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Scene [1..16] Enabled	**I**	**D**	**C**	Scene function = enabled	Yes **No**
Quick scene activation	**I**	**D**	**C**	Scene function = enabled	Yes **No**

12.6.2 Parameters for individual Scenes

Following parameters are repeated for every enabled Scene, under the menu *Channel<n>* / *Scenes* / *Scene <n>.*

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Scene number	**I**	**D**	**C**	Scene function = enabled	1..64
Scene type	**I**	**D**	**C**	Scene function = enabled	**Scene** Sequence
Activation delay	**I**	**D**	**C**	Scene function = enabled	hh:mm:ss:fff **[00:00:00.000]**
Learning enabled	**I**	**D**	**C**	Scene function = enabled Scene Type = Scene	**No** Yes
Download overwrites learned behavior	**I**	**D**	**C**	Scene function = enabled Scene Type = Scene Learning Enabled =Y	**No** Yes
Dimming intro time	**I**	**D**	**C**	Scene function = enabled Scene Type = Scene	hh:mm:ss.ff **[00:00:00.00]**
Intensity	**I**	**D**		Scene function = enabled Scene Type = Scene	0%..100% **[100%]**
Balance		**D**		Scene function = enabled Scene Type = Scene	0%..100% **[50%]**
Color			**C**	Scene function = enabled Scene Type = Scene	1...16 **[1]**
Direct value setting stops sequence	**I**	**D**	**C**	Scene function = enabled Scene Type = Scene	**Yes** No
Number of steps (1..8)	**I**	**D**	**C**	Scene function = enabled Scene Type = Sequence	1..8 **[1]**

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
After the end	**I**	**D**	**C**	Scene function = enabled Scene Type = Sequence	**Stop** Restart Start other sequence
Following sequence	**I**	**D**	**C**	Scene function = enabled Scene Type = Sequence After the end = Start other sequence	1..16 **[1]**
Number of repetitions	**I**	**D**	**C**	Scene function = enabled Scene Type = Sequence After the end = Start other sequence	0…255 **[1]**

12.6.3 Definition of sequence steps

Following parameters are repeated for every enabled sequence step, under the menu *Channel<n> / Scenes / Scene <n>.*

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Duration	**I**	**D**	**C**	Scene function = enabled Type = Sequence	hh:mm:ss:fff **[00:00:05.000]**
Dimming intro time (% of duration)	**I**	**D**	**C**	Scene function = enabled Type = Sequence	0%..100% **[20%]**
Intensity	**I**	**D**		Scene function = enabled Type = Sequence	0%..100% **[100%]**
Balance		**D**		Scene function = enabled Type = Sequence	0%..100% **[50%]**
Color			**C**	Scene function = enabled Type = Sequence	1...32 **[1]**

12.6.4 Quick scene activation

Following parameters are related to the quick activation of a specific scene through the transmission of a simple bit object (e.g. one that controls a switching function); they are displayed under the menu *Channel<n> / Scenes.*

Parameter name	*I*	*D*	*C*	*Conditions*	*Values*
Quick scene number 1	**I**	**D**	**C**	Scene function = enabled Quick scenes =Y	1..64 **[1]**
Quick scene number 2	**I**	**D**	**C**	Scene function = enabled Quick scenes =Y	1..64 **[2]**
Quick scene number 3	**I**	**D**	**C**	Scene function = enabled Quick scenes =Y	1..64 **[3]**
Quick scene number 4	**I**	**D**	**C**	Scene function = enabled Quick scenes =Y	1..64 **[4]**

13. KNX 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.

For better convenience of reading, some objects that are used in different operating modes have been listed more than once under the sections of respective operating modes.

13.1 Comando e stato

13.1.1 Comando e stato globale

Modes: | **I** | **D** | **C** |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Global On/Off command	-	1 bit	C-W-U	[1.001] DPT_Switch	0
Status not OFF	-	1 bit	CR-T-	[1.001] DPT_Switch	1
Status full ON (100%)	-	1 bit	CR-T-	[1.001] DPT_Switch	2
Enable manual operation	Manual operations = Enable	1 bit	C-W-U	[1.003] DPT_Enable	20
Auxiliary contact	Auxiliary contact = Free use	1 bit	C-W-U	[1.001] DPT_Switch	21
Alarm - Power off		1 bit	CR-T-	[1.005] DPT_Alarm	22
Alarm - General overload		1 bit	CR-T-	[1.005] DPT_Alarm	23
Alarm - Overload output 1..4		1 bit	CR-T-	[1.005] DPT_Alarm	90 113 136 159

13.1.2 Comando e stato - Colore

Modes: | | | **C** |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
On/Off command RGBW		1 bit	C-W-U	[1.001] DPT_Switch	3

On/Off command R		1 bit	C-W-U	[1.001] DPT_Switch	69
On/Off command G		1 bit	C-W-U	[1.001] DPT_Switch	92
On/Off command B		1 bit	C-W-U	[1.001] DPT_Switch	115
On/Off command W		1 bit	C-W-U	[1.001] DPT_Switch	138
On/Off status RGBW		1 bit	CR-T-	[1.001] DPT_Switch	4
On/Off status R		1 bit	CR-T-	[1.001] DPT_Switch	72
On/Off status G		1 bit	CR-T-	[1.001] DPT_Switch	95
On/Off status B		1 bit	CR-T-	[1.001] DPT_Switch	118
On/Off status W		1 bit	CR-T-	[1.001] DPT_Switch	141
Color command RGB		3 Byte	C-W-U	[232.600] DPT_Colour_RGB	6
Intensity command R		1 Byte	C-W-U	[5.001] DPT_Scaling	71
Intensity command G		1 Byte	C-W-U	[5.001] DPT_Scaling	94
Intensity command B		1 Byte	C-W-U	[5.001] DPT_Scaling	117
Intensity command W		1 Byte	C-W-U	[5.001] DPT_Scaling	140
Color command HSV		3 Byte	C-W-U	[232.600] DPT_Colour_RGB	8
Intensity command H		1 Byte	C-W-U	[5.003] DPT_Angle	11
Intensity command S		1 Byte	C-W-U	[5.001] DPT_Scaling	14
Intensity command V		1 Byte	C-W-U	[5.001] DPT_Scaling	17
Dimming command RGBW		4 bit	C-W-U	[3.007] DPT_Control_Dimming	5
Dimming command R		4 bit	C-W-U	[3.007] DPT_Control_Dimming	70
Dimming command G		4 bit	C-W-U	[3.007] DPT_Control_Dimming	93
Dimming command B		4 bit	C-W-U	[3.007] DPT_Control_Dimming	116
Dimming command W		4 bit	C-W-U	[3.007] DPT_Control_Dimming	139
Dimming command H		4 bit	C-W-U	[3.007] DPT_Control_Dimming	10
Dimming command S		4 bit	C-W-U	[3.007] DPT_Control_Dimming	13
Dimming command V		4 bit	C-W-U	[3.007] DPT_Control_Dimming	16
Color status RGB		3 Byte	CR-T-	[232.600] DPT_Colour_RGB	7
Intensity status R		1 Byte	CR-T-	[5.001] DPT_Scaling	73
Intensity status G		1 Byte	CR-T-	[5.001] DPT_Scaling	96
Intensity status B		1 Byte	CR-T-	[5.001] DPT_Scaling	119
Intensity status W		1 Byte	CR-T-	[5.001] DPT_Scaling	142

Color status HSV		3 Byte	CR-T-	[232.600] DPT_Colour_RGB	9
Value status H		1 Byte	CR-T-	[5.003] DPT_Angle	12
Value status S		1 Byte	CR-T-	[5.001] DPT_Scaling	15
Value status V		1 Byte	CR-T-	[5.001] DPT_Scaling	18
Palette color		1 Byte	CRW-U	[5.010] DPT_Value_1_Ucount	19

13.1.3 Comando e stato - Dual White

Modes: | | **D** | |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
On/Off command Canale 1 / 2		1 bit	C-W-U	[1.001] DPT_Switch	69 115
On/Off status Channel 1 / 2		1 bit	CR-T-	[1.001] DPT_Switch	72 118
Intensity command Channel 1 / 2		1 Byte	C-W-U	[5.001] DPT_Scaling	71 117
Balance command Channel 1 / 2		1 Byte	C-W-U	[5.001] DPT_Scaling	94 140
Dimming command Channel 1 / 2		4 bit	C-W-U	[3.007] DPT_Control_Dimming	70 116
Balance Dimming command Channel 1 / 2		4 bit	C-W-U	[3.007] DPT_Control_Dimming	93 139
Intensity status Channel 1 / 2		1 Byte	CR-T-	[5.001] DPT_Scaling	73 119
Balance status Channel 1 / 2		1 Byte	CR-T-	[5.001] DPT_Scaling	96 142

13.1.4 Comando e stato - Canali indipendenti

Modes: | **I** | | |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
On/Off command Channel 1/2/3/4		1 bit	C-W-U	[1.001] DPT_Switch	69 92 115 138
On/Off status Channel 1/2/3/4		1 bit	CR-T-	[1.001] DPT_Switch	72 95 118 141
Intensity command Channel 1/2/3/4		1 Byte	C-W-U	[5.001] DPT_Scaling	71 94 117 140
Dimming command Channel 1/2/3/4		4 bit	C-W-U	[3.007] DPT_Control_Dimming	70 93 116 139
Intensity status Channel 1/2/3/4		1 Byte	CR-T-	[5.001] DPT_Scaling	73 96 119 142

13.2 Auxiliary function commands

For Energy Counter related commands, see the corresponding section further below.

13.2.1 Auxiliary function commands - Color

Modes: | | | **C** |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Forcing command	Forcing function = enabled	2 bit	C-W-U	[2.001] DPT_Switch_Control	75
Lock command	Lock function = enabled	1 bit	C-W-U	[1.003] DPT_Enable	76
Staircase light start	Staircase function = enabled	1 bit	C-W-U	[1.010] DPT_Start	77

13.2.2 Auxiliary function commands – Dual White

Modes: | | **D** | |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Forcing command Channel 1 / 2	Forcing function = enabled	2 bit	C-W-U	[2.001] DPT_Switch_Control	75 121
Lock command Channel 1 / 2	Lock function = enabled	1 bit	C-W-U	[1.003] DPT_Enable	76 122
Staircase light start Channel 1 / 2	Staircase function = enabled	1 bit	C-W-U	[1.010] DPT_Start	77 123

13.2.3 Commands and status - Independent channels

Modes: | **I** | | |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Forcing command Channel 1 / 2 / 3 / 4	Forcing function = enabled	2 bit	C-W-U	[2.001] DPT_Switch_Control	75 98 121 144
Lock command Channel 1 / 2 / 3 / 4	Lock function = enabled	1 bit	C-W-U	[1.003] DPT_Enable	76 99 122 145
Staircase light start Channel 1 / 2 / 3 / 4	Staircase function = enabled	1 bit	C-W-U	[1.010] DPT_Start	77 100 123 146

13.3 Energy counter

13.3.1 Energy counter - Color

Modes: | | | **C** |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Energy counter kWh	Energy/Hour counter = enabled	4 Byte	CR-T-	[13.013] DPT_ActiveEnergy_kWh	24
Energy counter reset	Energy/Hour counter = enabled	1 bit	C-W-U	[1.015] DPT_Reset	25
Hour counter	Energy/Hour counter = enabled	2 Byte	CR-T-	[7.007] DPT_TimePeriodHrs	26
Hour counter reset	Energy/Hour counter = enabled	1 bit	C-W-U	[1.015] DPT_Reset	27

13.3.2 Energy counter – General

Modes: | **I** | **D** | **C** |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Energy counter kWh Output 1/2/3/4	Energy/Hour counter = enabled	4 Byte	CR-T-	[13.013] DPT_ActiveEnergy_kWh	85 108 131 154
Energy counter reset Output 1/2/3/4	Energy/Hour counter = enabled	1 bit	C-W-U	[1.015] DPT_Reset	86 109 132 155
Hour counter Output 1/2/3/4	Energy/Hour counter = enabled	2 Byte	CR-T-	[7.007] DPT_TimePeriodHrs	87 110 133 156
Hour counter reset Output 1/2/3/4	Energy/Hour counter = enabled	1 bit	C-W-U	[1.015] DPT_Reset	88 111 134 157

13.4 Scenes and sequences

13.4.1 Scenes and sequences - Color

Modes: | | | **C** |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Scene / Sequence activation	Scene function = enabled	1 Byte	C-W-U	[17.001] DPT_SceneNumber; [18.001] DPT_SceneControl	78
Sequence running	Scene function = enabled	1 bit	CR-T-	[1.001] DPT_Switch	79
Stop running sequence	Scene function = enabled	1 bit	C-W-U	[1.010] DPT_Start	80
Quick activation 1	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	81
Quick activation 2	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	82
Quick activation 3	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	83
Quick activation 4	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	84

13.4.2 Scenes and sequences - Dual White

Modes: | | **D** | |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Scene / Sequence activation Channel 1 / 2	Scene function = enabled	1 Byte	C-W-U	[17.001] DPT_SceneNumber; [18.001] DPT_SceneControl	78 124
Sequence running Channel 1 / 2	Scene function = enabled	1 bit	CR-T-	[1.001] DPT_Switch	79 125
Stop running sequence Channel 1 / 2	Scene function = enabled	1 bit	C-W-U	[1.010] DPT_Start	80 126
Quick activation 1 Channel 1 / 2	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	81 127

Quick activation 2 Channel 1 / 2	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	82 128
Quick activation 3 Channel 1 / 2	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	83 129
Quick activation 4 Channel 1 / 2	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	84 130

13.4.3 Scenes and sequences - Independent channels

Modes: | **I** | | |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Scene / Sequence activation Channel 1 / 2 / 3 / 4	Scene function = enabled	1 Byte	C-W-U	[17.001] DPT_SceneNumber; [18.001] DPT_SceneControl	78 101 124 147
Sequence running Channel 1 / 2 / 3 / 4	Scene function = enabled	1 bit	CR-T-	[1.001] DPT_Switch	79 102 125 148
Stop running sequence Channel 1 / 2 / 3 / 4	Scene function = enabled	1 bit	C-W-U	[1.010] DPT_Start	80 103 126 149
Quick activation 1 Channel 1 / 2 / 3 / 4	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	81 104 127 150
Quick activation 2 Channel 1 / 2 / 3 / 4	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	82 105 128 151
Quick activation 3 Channel 1 / 2 / 3 / 4	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	83 106 129 152
Quick activation 4 Channel 1 / 2 / 3 / 4	Scene function = enabled Quick scenes =Y	1 bit	C-W-U	[1.010] DPT_Start	84 107 130 153

13.5 Logic functions

Modes: | I | D | C |

Object name	*Conditions*	*Size*	*Flags*	*DPT*	*CO number(s)*
Logic function <1..8> Output	Logic functions = Y Logic function <n> = Enabled	1 bit	CR-T-	[1.001] DPT_Switch	29, 34, 39, 44, 49, 54, 59, 64
Logic function <1..8> - Input 1	Logic functions = Y Logic function <n> = Enabled Logic object 1 = Enabled	1 bit	C-W-U	[1.001] DPT_Switch	30, 35, 40, 45, 50, 55, 60, 65
Logic function <1..8> - Input 2	Logic functions = Y Logic function <n> = Enabled Logic object 2 = Enabled	1 bit	C-W-U	[1.001] DPT_Switch	31, 36, 41, 46, 51, 56, 61, 66
Logic function <1..8> - Input 3	Logic functions = Y Logic function <n> = Enabled Logic object 3 = Enabled	1 bit	C-W-U	[1.001] DPT_Switch	32, 37, 42, 47, 52, 57, 62, 67
Logic function <1..8> - Input 4	Logic functions = Y Logic function <n> = Enabled Logic object 4 = Enabled	1 bit	C-W-U	[1.001] DPT_Switch	33, 38, 43, 48, 53, 58, 63, 68

14. Appendix

14.1 Warnings

- 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

14.2 Return of defective products

Defective ekinex® KNX devices can be returned for repair / replacement following the procedure detailed below.

14.2.1 Devices purchased directly from ekinex®

Request an RMA number by sending an E-Mail to the address support@ekinex.com with following mandatory information:

- Exact device model
- Device serial number (can be found on the product label)
- Date of purchase / Order reference
- Detailed description of the fault or issue

The technical assistance team will contact you as quickly as possible to either investigate the problem further, suggest possible solutions or authorize the return of the device for replacement or repair.

If the device should be returned, it should be shipped to the following address:

EKINEX S.p.A. - Via Novara, 37 / SP229 - I-28010 Vaprio d'Agogna (NO) - Italy.

Further arrangements will be made with the technical support team, according to the type of issue and device.

14.2.2 Devices purchased through ekinex® resellers

If the device has been purchased through a reseller, please refer to the reseller's technical support contact. Depending on the issue and other factors, at the decision of ekinex® and after agreement with the reseller, the customer might be instructed to contact ekinex® directly according to the procedure above.

14.3 Altre informazioni

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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