

KNX Dimmer RGB - User Manual



Item No.: LC-013-003

1. Product Description

With the KNX Dimmer RGB it is possible to control of RGB LED or 3 independent channels with integrated KNX BCU. Simple Timer and Flashing: timed ON/OFF Sequences. Full functionality with KNX commissioning software as of version ETS3.0 - Plugin for commissioning available.

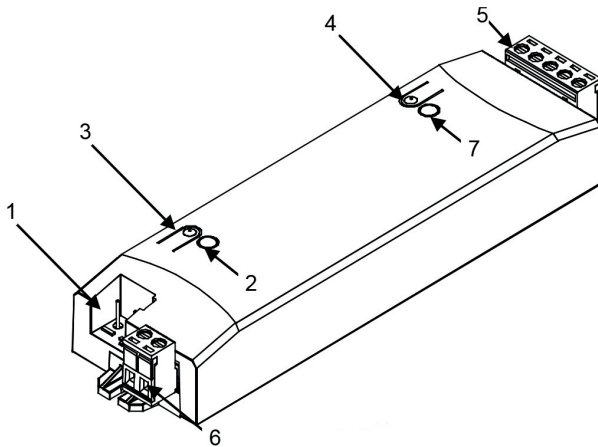
2. Specifications

external power supply	12-24V DC
channels/max power output	3 x 2,5A (90W/12V) oder (180W/24V)
KNX operating voltage	29VDC
KNX power input	145mA
PWM frequency	150, 300, 488 oder 600Hz adjustable
max. wire cross-section	max. 2,5mm ²
Dimensions (L x W x H)	157 x 44 x 22 mm
weight	102g

3. Description

1. Control of RGB LED or 3 independent channels.
2. External power supply required (12 or 24 VDC).
3. LED test function.
4. KNX BCU integrated.
5. Color and brightness control of the channels
6. Custom ON/OFF: possibility of enabling upto to 4 different ON/OFF controls per channel
7. Simple Timer and Flashing: timed ON/OFF sequences
8. Scenes/Sequences: possibility of enabling up to 5 different scenes/sequences per channel, or a custom sequence
9. Full functionality with KNX commissioning available
10. with programming button and programming LED

4. Connection/Buttons



1. KNX Connector
2. KNX programming and internal test LED
3. KNX programming button
4. Test button
5. LED control terminal block
6. External power supply
7. Test and reversed polarity indicator LED

KNX programming button: short button press to set the programming mode. If this button is held while plugging the device into the KNX bus, it goes into safe mode.

KNX programming and internal test LED: the red LED indicates programming mode. When the device goes into safe mode, it blinks red every 0.5 seconds.
The blinking blue LED indicates internal test.

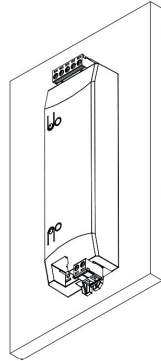
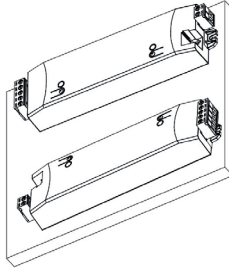
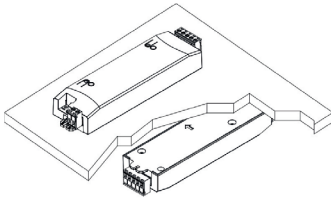
Test button: it tests the functioning of channels connected to the device. Push and hold for 3 seconds to get in/out of the testing mode.

Test LED and polarity: tricolored LED that indicates which channel (red=channel 1/R, green=channel 2/G, blue=channel 3/B) is being tested. Orange light indicates reverse polarity in external power supply.

Recommended installation:

NOT recommended:
Vertical position.

If there is not any other possibility,
install terminal block up (see fig.)



5. CONFIGURATION

5. ETS PARAMETRISATION

To begin with the parameterisation process of LUMENTO X3 it is necessary, once the ETS program has been opened, to import the database of the product (LUMENTO X3 RGB application program).

Next, the device should be added to the project where desired. And then, one rightclick on the device will permit selecting „Edit parameters“, in order to start the configuration.

5.1. DEFAULT CONFIGURATION

This section shows the default device configuration the parameter edition starts from.

1 New Area				
1.1 New Line				
1.1.1 LUMENTO X3				
9: Dimming - 4 bits dimmer ctrl	9	Dimming	4 bits dimmer ctrl	4 bit
10: Precise Dimming - 1 byte dimmer ctrl	10	Precise Dimming	1 byte dimmer ctrl	1 Byte
11: On/Off - 0=Off; 1=On	11	On/Off	0= Off; 1=On	1 bit
29: Dimming Speed 1 - 0%=Min. Speed, 100%=Max. Speed	29	Dimming Speed 1	0%=Min. Speed; 100%=Max. Speed	1 Byte
30: Dimming Speed 2 - 0%=Min. Speed, 100%=Max. Speed	30	Dimming Speed 2	0%=Min. Speed; 100%=Max. Speed	1 Byte
35: RGB Color - 3 bytes RGB ctrl	35	RGB Color	3 bytes RGB ctrl	3 Byte

The following communication objects appear:

Dimming: a 4-bit object destined to step-dimming the general brightness (luminosity) level. Steps (upwards or downwards) of 1%, 2%, 3%, 6%, 12%, 25%, 50% and 100% are possible.

Precise Dimming: a 1-byte object destined to perform a precise dimming over the general brightness level, by setting a concrete percentage value.

On/Off: a 1-bit object destined to perform a general switch-on or switch-off of the LED strip. A switch-on order through this object will recover in any case the colour that was active prior to the switch-off, with either the maximum luminosity (100%) or with the luminosity level it had before the switch-off (depending on the On Light Level parameter; see section 3.2).

Dimming Speed 1: a 1-byte object that allows modifying, in runtime, the speed of the “Smooth 1” dimming (see section 3.2).

Dimming Speed 2: similar to Dimming Speed 1, but referred to the “Smooth 2” dimming.

RGB Color: 3-byte object that permits selecting a particular colour by precisely specifying the luminosity level of each output channel (R, G and B). Therefore, each of the three bytes is related to one specific channel.

When entering the parameter edition of LUMENTO X3 RGB for the first time, the following window will be shown:

<<GENERAL>>	
PWM Frequency	488 Hz
Smooth Dimming	
Smooth Dimming Time 1 [0% to 100% in x0.1 sec]	10
Smooth Dimming Time 2 [0% to 100% in x0.1 sec]	10
Dimming times	
Precise Dimming	At Once
Dimming	Smooth 1
On/Off	At Once
On Light Level	Previous
Max Light Level (%)	100
Independent channel control	No
Error Identification	No

As seen in Figure 5, the parameterisation window is divided into two main tabs, which will be explained in detail in the next sections:

General: permits parameterising global features of the device.

Functions: permits enabling and configuring specific functions of the device.

5.2. GENERAL WINDOW

This section of the parameter edition allows setting several global features of

LUMENTO X3 RGB:

PWM frequency: the working frequency of the LED regulator. The available values are: 150, 300, 488 and 600 Hz. The default frequency is 488 Hz.

Smooth Dimming: the time LUMENTO X3 takes to perform soft luminosity transitions. Two different smooth transition modes are available (Smooth 1 and Smooth 2). The times here refer to the complete transition, from 0% to 100%, and the permitted values are from 3 to 65535 tenths of a second. Both parameters are 10 (i.e., 1 second), by default.

The Smooth Dimming Times 1 and 2 can be decreased (although not increased) in runtime, via the „Dimming Speed 1“ and „Dimming Speed 2“ communication objects, respectively. Please refer to Table 1 for the relationship between the most common speed values and their associated dimming times.

Dimming Speed	Dimming Times (T = parameterised time)
0%	T
25%	$\frac{3}{4}T$
33%	$\frac{2}{3}T$
50%	$\frac{1}{2}T$
75%	$\frac{1}{4}T$
100%	0*

(*) The minimum dimming time is actually 3 tenths of a second.

Example:

Let the parameterised time for the Smooth Dimming Time 1 be equal to 20 seconds. At a given time during the execution, the smooth dimming is required to be performed in half the time, so this time becomes 10 seconds. To achieve this, the value 50% should be sent to the „Dimming Speed 1“ object. If the original time were to be reduced to the fourth part (from 20 to 5 seconds) it should be “75%” the value to be sent to the mentioned object. Sending the value “0%” through „Dimming Speed 1“ will recover the original smooth dimming time 1 (20 seconds)

Smooth dimming from/to values other than 0% - 100% (on-off) is also performed at the same speed, so the time required to carry it out will always be proportional to (and lower than) that parameterised under “Smooth Dimming Time”.

Example:

Let the parameterised value for the „Smooth dimming time 1“ be 10 seconds (“100”). A global switch-on order is then sent when the output is off, so it will take 10 seconds to reach the maximum brightness level (if the „Dimming“ parameter has been configured as “Smooth 1”). However, if the LEDs were already at a brightness percentage of 50%, the time required to reach the full brightness (100%) will be 5 seconds (one half of the 10 seconds parameterised).

Three more parameters are shown next, grouped as “Dimming Times”:

Precise Dimming: this field can be used to define whether transitions commanded through both the general and the channel-dependent “Precise Dimming” objects, and also through the 3-byte “RGB Color” object (in other words, dimming orders performed by sending a certain luminosity value, in percentage) should be At once (immediate), Smooth 1 (a progressive transition, according to the defined Smooth Time 1) or Smooth 2 (a progressive transition, according to Smooth Time 2).

Dimming: defines whether step-by-step transitions (i.e., through the 4-bit Dimming objects, both the global object and those referring to each channel independently) should be Smooth 1 (a progressive transition will be performed, according to the defined Smooth Time 1) or Smooth 2 (progressive transition according to the defined Smooth Time 2).

On/Off: permits defining the transition type (At once, Smooth 1 or Smooth 2) that will apply to the switch-on or switch-off orders.

Note: smooth dimming is intended to let the user appreciate a progressive change in the luminosity level, with the option to interrupt it once the desired level is reached. Therefore, this function is typically linked to a pushbutton that, once released by the user, stops the smooth dimming that began when it was pressed. Because of this, it is advisable to parameterise a dimming step of 100%, so a sole long press (instead of successive long presses) is enough to step through all the available light levels and to stop at the most comfortable one.

On Light Level: sets the desired level of luminosity for the switch-on orders received through the global On/Off object. In other words, it permits setting whether the LEDs will acquire the maximum brightness level (“100%”) or the one they had prior to the switch-off (“Previous”) whenever a switch-on order arrives. On the very first switch-on, the luminosity will be set at 100% (and the colour will be white).

Note: on a global switch-on, the LED module recovers the colour it had prior to the switch-off, although the luminosity itself will turn maximum or not depending on the option selected for this parameter. Apart from the exception of the first switch-on (which will imply white colour and full luminosity), in the particular case of performing the switch-on after having set, accidentally or not, all three channels to zero through their respective dimming (or precise dimming) objects, the colour acquired on the switch-on will as well be white (and the luminosity, maximum).

Max Light Level (%): defines the maximum effective brightness, in percentage (from 5% to 100%), that can be applied to the channels through a dimming order. If this parameter is set to a value other than 100%, a proportional reduction of the luminosity will apply. However, for coordination and update purposes, LUMENTO X3 will always send to the KNX bus the theoretical luminosity value, between 0% and 100%.

Example:

Let the value of this parameter be “70%”. In such case, dimming orders for a luminosity of 100% will actually set the luminosity to 70% (although the status object will in fact show the value “100%”).

Analogously, orders for a luminosity of 50% will actually set it to 35% (although the status object will show “50%”).

Independent Channel Control (RGB): enabling this option brings up several communication objects that make it possible to switch on/off each channel independently (“[X] On/Off”), as well as to control their luminosity levels separately (“[X] Dimming” and “[X] Precise dimming”). If after sending a control order to an individual channel (precise dimming, step dimming, dimming stop order, etc.) an additional global dimming order (precise or by steps) is also sent, the last colour proportion will be taken as the new base for the global regulation.

Example:

Assume that the initial colour is (20, 0, 60). A precise dimming order is then sent to the blue channel (“[B] Precise Dimming” = 50%), so the new base colour becomes (20, 0, 128). If a global dimming to the three channels is then sent (for example, “Precise dimming” = 25%), the resulting colour will be (10, 0, 64).

Error Identification: this option displays two 1-bit communication objects to report anomalous behaviours that may arise when LUMENTO X3 is working:

„Error: Overheating“. Object through which LUMENTO X3 notifies it is exposed to an excessive temperature (higher than 90°C), by sending the value „1“. In that moment, LUMENTO X3 will reduce the brightness level of the channels to 50% (only if their current level is higher) and the working frequency will be set to its minimum value (150 Hz). When the temperature is again lower than 80°C, LUMENTO X3 will send the value „0“ through this object, thus showing the end of this event and it will recover the brightness and frequency values it had before the error. If 15 minutes after the beginning of the Overheating error the temperature is still not lower, LUMENTO X3 will directly switch off its output, for safety reasons.

Note: take into account that, even if the error identification has not been enabled by parameter, the overheating protection is always enabled, although in that case the bus will not be notified.

„Error: External Voltage“.

Object through which LUMENTO X3 notifies that the received external power is incorrect, due to any of these events: too low voltage, total absence of power (source disconnected) or inversion in the polarity of the power supply (this is also visually notified by the Test indicator, which turns on in orange). When LUMENTO X3 detects any of these anomalous situations, it sends the value „1“ through this object. When the event finishes, it sends a „0“.

5.3. FUNCTIONS

LUMENTO X3 RGB offers a set of different functions (see Figure 6), which may be selectively enabled, depending on the requirements of the KNX system.

The screenshot shows a configuration window for LUMENTO X3 RGB. On the left, a sidebar contains two menu items: '<<GENERAL>>' and '<<FUNCTIONS>>', with the latter selected. The main area is titled '<<FUNCTIONS>>' and contains a list of seven settings, each with a label and a dropdown menu:

Function	Setting
Status Object	No
Color Selection Objects	No
Custom On/Off	No
Simple Timer	No
Flashing	No
Scenes/Sequences	No
Block	No
Start-Up	Default

The available functions are detailed next.

5.3.1. STATUS OBJECTS

This function allows enabling a 1-bit status object („On/Off Status“) and a 1-byte status object („Luminosity (Status)“), responsible for reporting the general state of the output at any time, thus updating other devices in the KNX system, if required.

Status Object	Yes
Send On/Off=1 when	Luminosity is not equal to 0%
Send Luminosity when LEDs are dimming	Yes
Min. time between status sending [x 1 sec.]	1
Independent Status Objects	No

Send On/Off=1 when:

sets when the value „1“ (on) is sent through the „On/Off (Status)“ object to the bus, being the following options possible:

Luminosity is not equal to 0%:

when the brightness level gets to a value different from 0%, the object „On/Off (status)“ will be send the value „1“. The value „0“ will be only sent when the luminosity reaches 0%.

Luminosity is equal to 100%:

the „On/Off (Status)“ object will only send the value „1“ when the brightness level gets equal to 100%. The value „0“ will be only sent when the luminosity reaches 0%. The ON/OFF status object is sent in any case after the reception of an ON/OFF order through the analogous control object.

Send Luminosity when the LEDs are Dimming:

this option allows selecting

whether to send the brightness status of the output (through the „Luminosity (Status)“ object) or not (default option). If enabled, the following field will be also shown:

Minimum Time Between Status Sending:

sets the minimum time (in seconds) between consecutive brightness values sent to the bus through the „Luminosity (Status)“ object. This restriction applies to smooth dimming.

Independent Status Objects:

activates eight additional communication objects which report the state of each channel, independently and at any time. These objects are „[X] On/Off (Status)“ and „[X] Luminosity (Status)“, which behave analogously to the general status objects.

5.3.2. COLOUR SELECTION OBJECTS

Enabling this function brings up two new communication objects: “Direct color” (1 byte) and “Color shift” (1 bit).

Direct Color:

it is a 1-byte communication object that permits directly selecting one of the 22 colours of the predefined palette. It works similarly to „Scene“ objects. Every predefined colour is associated to a certain number (from 1 to 22), as shown in Table 2.

If one of these values (decremented by 1) is written to the „Direct color“ object, the LED module will change to the corresponding colour immediately (regardless of the dimming types At once, Smooth 1 or Smooth 2– parameterised under the General screen).

Scene (Value)	Colour	R	G	B
1 (0)	OFF	0	0	0
2 (1)	White	0	0	0
3 (2)	White – Light	0	0	0
4 (3)	Blue	0	0	255
5 (4)	Blue – Light	102	204	255
6 (5)	Blue – Navy	0	0	102
7 (6)	Blue – Cyan	0	255	255
8 (7)	Blue – Turquoise	0	255	77
9 (8)	Blue – Lavender	128	128	255
10 (9)	Green	0	255	0
11 (10)	Green – Light	128	255	51
12 (11)	Green – Dark	0	102	0
13 (12)	Green – Lime	128	255	0
14 (13)	Red	255	0	0
15 (14)	Red – Pink	255	0	77
16 (15)	Red – Dark	102	0	0
17 (16)	Red – Magenta	255	0	255
18 (17)	Red – Fuchsia	255	26	51
19 (18)	Yellow	255	255	0
20 (19)	Orange	255	51	0
21 (20)	Lilac	255	128	128
22 (21)	Purple	170	0	255




Table 2. Predefined colour palette.

Color Shift:

a 1-bit object that lets the user trigger an automatic scan through the entire colour palette, making it possible to stop the scan as soon as the desired colour is found.

This object is supposed to be combined with a “hold and release” push button, so that pressing it (the value “1” is sent) starts the scan, and releasing it (the value “0” is sent), stops it.

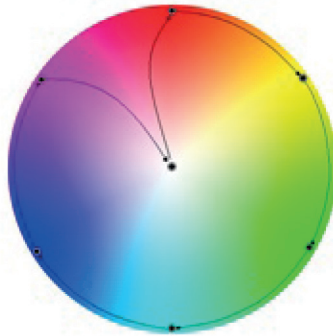


Figure 7. Colour scan

The colour scan takes place according to the steps shown in Figure 7, however the starting point will not necessarily always be the same; instead, the closest point to the current colour will be adopted as the initial stage.

The complete cycle takes 15 seconds and it does not affect the current luminosity at all, so no colour scan will take place if all the channels have been set to 0%.

Note: the colour scan will be interrupted not only on the reception of the value “0” through the “Color shift” object, but also on the arrival of any valid order through the following objects:

“Scenes/Sequences” (1 byte), “Block” (1 bit), “Start/stop sequence” (1 bit) and “Direct color” (1 byte).

5.3.3. CUSTOM ON/OFF

Once enabled, this function offers up to 4 additional ON/OFF controls, independently customisable:

<<GENERAL>>	
<<FUNCTIONS>>	
Custom On/Off	
On/Off 1	No
On/Off 2	No
On/Off 3	No
On/Off 4	No

The following parameters can be set for each of the custom ON/OFF controls:

The screenshot shows a configuration window for 'On/Off 1'. On the left, a sidebar contains a tree view with 'On/Off 1' selected. The main area is titled 'On/Off 1' and contains the following settings:

Off Action	Luminosity
Luminosity	0
Off Type	At Once
On Action	Luminosity
Luminosity	255
On Type	At Once

Off Action:

sets the action to be run over the LED module when LUMENTO X3 receives the value "0" through the "Custom ON/OFF" 1-bit object. This can consist in a change in the luminosity ("Luminosity", which will display a new parameter to set the desired value) or a colour change, being possible to select a specific colour from the predefined palette ("Predefined color", which displays a drop-down list with all the possible values; see Table 2) or a manually defined colour ("RGB Color", which will permit inserting numeric values –from 0 to 255– for every colour component: R, G or B).

Off Type:

sets the desired dimming type for the switch-off of the LED module:
At once, Smooth 1 and Smooth 2.

On Action:

sets the action that will be executed on the LED module when LUMENTO X3 receives the value „1“ through the „Custom On/Off X“ 1-bit object. Analogously to the "Off action" mentioned above, a luminosity or colour change is possible, as well as state-recovery switch on ("Last color"), so that whenever LUMENTO X3 receives a „0“ through the corresponding „Custom On/Off“ object, it saves into memory the value of the current colour of the LED module. After that, when the ON order arrives ("Custom On/Off" = 1), LUMENTO X3 will set the LED module back to the previous colour.

Example:

Suppose that Custom On/Off control number 2 is parameterised with "Off Action" = "Blue" and "On Action" = "Last color", and that at a certain time the active colour of the module is yellow. A switch-off order (value "0") then arrives through the "Custom On/Off 2" object, so the LEDs will turn blue (Off Action), prior to which LUMENTO X3 stores in memory the colour of the LED module that was active before the switch-off (yellow).

When a new switch-on order (value "1") is received, the LEDs will light again in the colour stored before the switch-off (yellow).

On Type: sets the desired dimming type for the switch-on of the LED strip: At once, Smooth 1 or Smooth 2.

5.3.4. SIMPLE TIMER

This function allows performing a switch-on of the LED module connected to LUMENTO X3 and a later, automatic (timed) switch-off, being also possible to insert delays. The time length, the luminosity level and the switch-on type can also be parameterised.

This function may be useful when a switch-on (of a certain duration, i.e., the LEDs will be automatically switched off afterwards) is required, for example, upon movement detection.

Simple Timer	
On Delay [x0.1 sec] (0 = No delay)	50
Off Delay [x0.1 sec] (0 = No delay)	0
On Duration [x0.1 sec] (0 = Endless)	50
Multiply	Yes
On Color	Predefined Color
Predefined Color	WHITE
On Type	Smooth 1

On Delay:

this parameter sets the time LUMENTO X3 will wait since the reception of the Timer ON order ("Simple Timer" = 1) and the actual switchon of the LED module. This value must be set in tenths of a second (e.g. for a delay of 2.5 seconds, typing "25" is required). If no delay is needed, this field must remain zero.

Off Delay:

this parameter sets the time to be waited between the reception of the Timer OFF order ("Simple Timer" = 0) and the actual switch-off of the LED module. Works similarly to the On Delay.

On Duration:

this parameter sets the time the LED module will stay on before switching off again. A 0 in this field means endless, i.e., no timing is applied to the switch-on. In other words, the behaviour of the simple timer is as follows:

When LUMENTO X3 receives a „1“ through the „Simple Timer“ communication object, an ON order is sent to the output, applying the On Delay (if parameterised). The output stays on, depending on the On Duration, and then turns off (unless this duration has been parameterised with "0").

When LUMENTO X3 receives a „0“ through the „Simple Timer“ communication object, the output is switched off with the corresponding Off Delay (if parameterised).

Multiply:

allows progressively increasing (multiplying), in runtime, the On Duration time or the On/Off delays of the output. Two situations are distinguished:

No Multiply:

- If the On delay count is already running, it will be reset every time a new "1" is received through the "Simple Timer" object.
- If the output has already been activated and the On Duration time is counting, it will be reset whenever a new "1" is received.
- If the Off delay count is already running, it will be reset every time a new "0" is received.

Multiply:

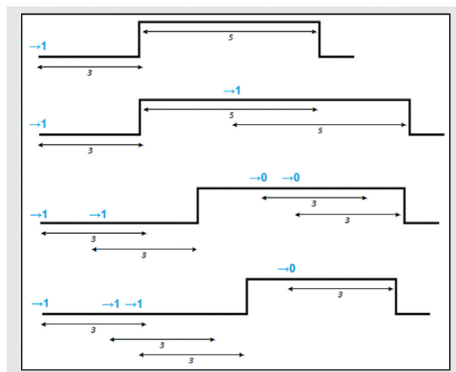
- If the On delay count is already running and the value "1" is received several times through the "Simple Timer" object, then the actual delay time will be "n" times the parameterised time, being "n" the number of times the value "1" is received.
- If the output has already been activated and while the On Duration time is counting the value "1" is received several times, then the actual duration will be "n" times the parameterised time, being "n" the number of times the value "1" is received.
- If the Off delay count is already running and the value "0" is received several times, then the actual delay time will be "n" times the parameterised time, being "n" the number of times the value "0" is received.

Note: the multiply option may result particularly useful under parameterisations with no ON and OFF delays. Nevertheless, as already explained and as the following example shows, these delay times, if parameterised with a value other than 0, do also admit multiplication.

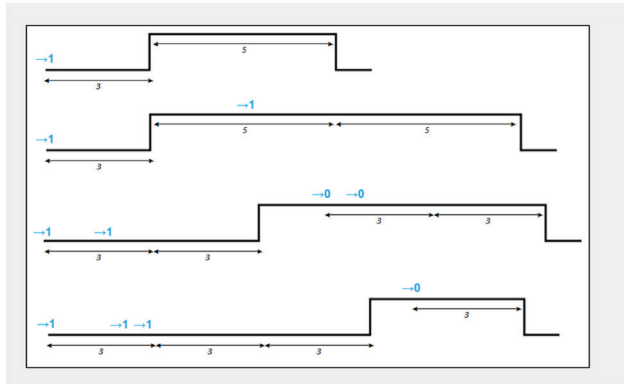
Example:

Let the following be parameterised: On Delay = 3 seconds; Off Delay = 3 seconds, On Duration = 5 seconds. The graphs below reflect some possible situations if the values "0" or "1" are received from the (which is represented as 0 and 1), respectively for the cases of having the "multiply" option enabled and disabled.

With no multiplication:



With multiplication:



On Color:

sets the colour desired in the LEDs during the ON state. Either a predefined colour (see Table 2) or a custom colour (by manually configuring each of the RGB colour components) can be selected.

On Type:

sets the dimming type to be applied during the timed switch-on of the LED module, being the possible options: At once, Smooth 1 and Smooth 2. See section 3.2 for the parameterisation of the dimming types.

5.3.5. FLASHING

This function allows executing ON-OFF-ON-OFF sequences in the LED module, where it is possible to parameterise the length of the ON/OFF stages. Moreover, the number of repeats can be set by parameter, as well as the luminosity for the "on" state and the final luminosity of the LEDs after the last repetition.

The intermittence will start when LUMENTO X3 receives a „1“ through the „Flashing“ object and stops after executing all the configured repetitions (endless repetition is possible by setting the value „0“ in the corresponding box, as shown later). It is possible to stop the flashing at any time, by sending the value „0“ through the „Flashing“ object, or by sending any other control order that affects the output (like an on/off, a sequence, etc.). If, during the flashing execution, LUMENTO X3 receives a new order to start the flashing sequence („Flashing“ = 1), it will be reset no matter what the current stage of the sequence is.

<<GENERAL>> <<FUNCTIONS>> Flashing	Flashing
On Duration [x0.1 sec]	20
Off Duration [x0.1 sec]	20
Number of Repetitions (0 = Endless)	0
On Color	Predefined Color
Predefined Color	WHITE
Final Color	Predefined Color
Predefined Color	OFF

These are the parameters that can be configured for the flashing function:

On Duration:

sets the length of "ON" stages of the flashing sequence, i.e. the time the channels will remain on before turning off again.

Off Duration:

sets the length of "OFF" stages of the flashing sequence, i.e. the time the channels will remain off before turning on again.

Number of Repetitions:

defines the number of times the ON/OFF sequence will be repeated when the flashing function is triggered. For an unlimited number of repeats, the value "0" should be typed here (the sequence will be repeated until the reception of an order to deactivate the flashing).

On Color:

sets the colour to be adopted by the LEDs during the "on" stages. Either a predefined colour (see Table 2) or a custom colour (by manually defining each of the RGB colour components) can be selected.

Final Color:

sets the colour to be adopted by the LEDs once the last flashing sequence ends, as well as when the "Flashing" = 0 order is received. Either a predefined colour (see Table 2) or a custom colour (by manually defining each of the RGB colour components) can be selected.

5.3.6. SCENES/SEQUENCES

This function allows defining different scenes, which consist in a specific light ambient or a dimming sequence, so they can be triggered when the corresponding value is received from the bus through the "Scenes/Sequences" 1-byte object.

The „Start/Stop Sequence“ 1-bit object will be displayed to allow re-executing the last sequence played (by writing the value „1“) or stopping the current sequence in execution („0“).

Note: the "Start/Stop Sequence" object only applies to dimming sequences, and has no effect over static scenes. Moreover, after a download from ETS (partial or complete), if the value „1“ is sent through this object, the triggered sequence will be the first one that was parameterised, unless it is of the „Fixed Color“ type; in such case the first one different from this type will be executed.

LUMENTO X3 RGB allows configuring up to ten scenes/sequences, which can be individually enabled from "Scenes/Sequences" in ETS.

The screenshot shows the configuration window for "Scene/Sequence 1" in the ETS software. On the left, a tree view shows the navigation structure: <<GENERAL>>, <<FUNCTIONS>>, Scenes/Sequences, and Scene/Sequence 1 (which is selected). The main configuration area is titled "Scene/Sequence 1" and contains the following parameters:

Parameter	Value
Scene/Sequence Number [1 to 64]	1
Scene/Sequence Type	Fixed Color
Color	Predefined Color
Predefined Color	OFF
Dimming Type	At Once

For each of them, the following configurable fields are available:

Scene/Sequence Number:

indicates the scene/sequence identifying number (from 1 to 64) whose reception (decreased by 1, according to the KNX standard) through the “Scenes/Sequences” object will make the device apply the configuration to the LED module.

Scene/Sequence Type: selects the desired action for each enabled scene /sequence:

Fixed Color.

The scene will consist in setting the LED module to a specific colour when the „Scenes/Sequences“ object is received with the configured scene number. Either a predefined colour (see Table 2) or a custom colour (by manually setting the RGB colour components) can be selected. If „Fixed Color“ is selected, besides running the scene it will be also possible to save it: if the device receives a scene save order (values 128-191 through the mentioned object), the current luminosity levels of the LED module will be saved, so when the same scene is executed again, the colour acquired by the LEDs will be the one that was saved (and not the originally parameterised in ETS).

Finally, if “Fixed Color” is selected, the “Dimming type” parameter will also be shown, making it possible to choose an At once, Smooth 1 or Smooth 2 dimming for this action.

Luminosity.

The scene execution will in this case consist in changing the luminosity level, without changing the active colour. This option displays two new parameters: Luminosity (which sets the desired level, from 0 to 255) and Dimming Type (which sets the desired transition type: At once, Smooth 1 or Smooth 2).

Predefined Sequence. Three different pre-set sequences are available:

Colorful, Cool colors and Warm colors.

Scene/Sequence Type	Predefined Sequence
Predefined Sequence	Colorful
Time [x1 min]	Cool colors
Luminosity Sending	Send continuously

Every sequence consists of 5 steps (smooth transitions between different colours) of a particular time length. They behave cyclically, so when the last step of the sequence finishes, it automatically starts over from the first step. The default duration of every cycle is 1 minute, being possible to modify it through the “Time” textbox (the typed value must be in the range [1...255] minutes).

Note: LUMENTO X3 will proportionally modify the action time of every step of the sequence according to the parameterised cycle time. The Luminosity Sending field is intended to set when LUMENTO X3 will send the KNX bus the brightness status objects, being the following options available:

- Send Continuously:

the brightness level will be continuously sent through the „Luminosity (Status)” object (only if the “Send Luminosity when LEDs are dimming” parameter has been enabled from the Functions screen), restricted to the parameterized minimum time for values sent consecutively.

• Don't Send:

No matter if the status sending option is enabled or not under the Functions tab, no status object will be sent to the KNX bus during the execution of the sequence. The next three tables show the predefined colour patterns (and the action times) of the three sequences:

Sequence 1: „Colorful“

Step	Colour (RGB)	Action time
1	Red (255/0/0)	t/5
2	Green (0/255/0)	t/5
3	Blue (0/0/255)	t/5
4	Magenta (255/0/255)	t/5
5	Yellow (255/255/0)	t/5



Sequence 2: „Cool colors“

Step	Colour (RGB)	Action time
1	Blue 1 (100/128/255)	t/5
2	Green 1 (20/255/100)	t/5
3	Green (0/255/0)	t/5
4	Green 2 (0/255/77)	t/5
5	Blue (0/0/255)	t/5



Sequence 3: „Warm Colors“

Step	Colour (RGB)	Action time
1	Red (255/0/0/0)	t/5
2	Magenta (255/0/255/0)	t/5
3	Pink (255/80/128/0)	t/5
4	Orange (255/51/0/0)	t/5
5	Yellow (255/255/0/0)	t/5



Custom Sequence.

Selecting this option will make it possible to customise sequences of up to 5 steps/actions, by setting the following parameters:

- Cyclic:

“Yes” will define a cyclic sequence (after the last parameterised step, the sequence will start over), while “No” will define a non-cyclic sequence (in such case, there is also the possibility of triggering – after the last step of the sequence– another parameterised sequence).

- Luminosity Sending:

this parameter can be set to send continuously (during the light dimming, the brightness level will be sent to the KNX bus through the “Luminosity (Status)” object (as well those corresponding to the individual channels, if enabled), only if the option to send statuses has been activated from the Functions screen) or to Send when sequence ends (the brightness level of the output will be sent to the bus once the last step of the sequence finishes, no matter if the option to send the status objects during the dimming is enabled or not from the General screen). However, in both cases, the status objects need to be enabled by parameter (see section 3.3.1).

Note that the minimum time parameterised for sending the status objects will apply. For every step, the following parameters can be configured:

- Color:

sets the desired colour for the LED module (either RGB or predefined).

- Dimming Type:

At once, Smooth 1, Smooth 2 or Equal to action time. If the latter is selected, the dimming will be carried out gradually, switching from the current level to the new one by taking the time defined for the „Time“ field.

- Time:

sets the time length of the step (i.e., the time LUMENTO X3 will wait before running the next step), in seconds. The steps (or actions) will be executed in order. Thus, when LUMENTO X3 receives the Scene number that triggers the sequence, the first configured step will be executed.

Moreover, if the sequence is cyclical, once the last step finishes, the sequence will be automatically executed again from the beginning. An example of custom sequence configuration is shown in Figure 13, where the first three steps of Sequence 1 have been parameterised.

<<GENERAL>>		Scene/Sequence 1	
<<FUNCTIONS>>		Scene/Sequence Number [1 to 64]	1
Custom On/Off		Scene/Sequence Type	Custom Sequence
On/Off 1		Cyclic	No
Scenes/Sequences		Next Sequence	No sequence
Scene/Sequence 1		Luminosity Sending	Send when sequence ends
Scene/Sequence 2		Action 1	Yes
Scene/Sequence 3		Color	Predefined Color
Scene/Sequence 4		Predefined Color	RED (Pink)
Scene/Sequence 5		Dimming Type	At Once
Scene/Sequence 6		Time [x1 sec]	5
Scene/Sequence 7		Action 2	Yes
Scene/Sequence 8		Color	Predefined Color
Scene/Sequence 9		Predefined Color	GREEN
Scene/Sequence 10		Dimming Type	Smooth 1
		Time [x1 sec]	15
		Action 3	Yes
		Color	RGBW Color
		R	255
		G	100
		B	65
		Dimming Type	Equal to Action Time
		Time [x1 sec]	10
		Action 4	No
		Action 5	No

5.3.7. BLOCK

This function permits locking the output of the device; i.e., disabling the control of the LED module.

LUMENTO X3 will lock the output when it receives a „1“ through the „Block“ 1-bit communication object, which is displayed after enabling this function. From that moment, any action being executed will be stopped and the LED module will maintain the colour and luminosity it had when the lock order arrived.

While locked, any order received from the KNX bus will be ignored by the device, i.e., the output will perform no actions. LUMENTO X3 will unlock the output when the value „0“ arrives through the „Block“ object. The LEDs will still maintain the colour they had before receiving the lock order. No luminosity change commands received during the lock state will be taken into account by the output, not even after the unlock event.

5.3.8. START-UP

This function permits setting the desired state to be applied to the module when the device starts up. A default or a custom configuration may be selected.

If the default configuration is chosen, the LEDs will stay off after a download from ETS. On the other hand, after a bus voltage recovery the luminosity will be the same as before the bus power failure. Under a custom configuration, it is possible to customise the state of the LED module after a bus voltage recovery and after a download from ETS.

Start-Up	
Initial Status (on BUS voltage recovery)	On
Initial Color	RGB Color
R	0
G	0
B	0
Status Sending	No

The following parameters can be configured:

Initial Status (on bus voltage recovery):

sets the initial status the LED module will adopt when the bus power failure situation ends or after a download from ETS.

Last:

the LED module will recover the same colour and brightness level it had before the bus power failure. Note that this option does not apply after a download (the LEDs will stay off).

Off:

the LEDs will always be initially off.

On:

the LEDs will always be initially on, lighting in the colour defined through the "Initial Color" parameter, which can be an RGB colour or a predefined colour (see Table 2).

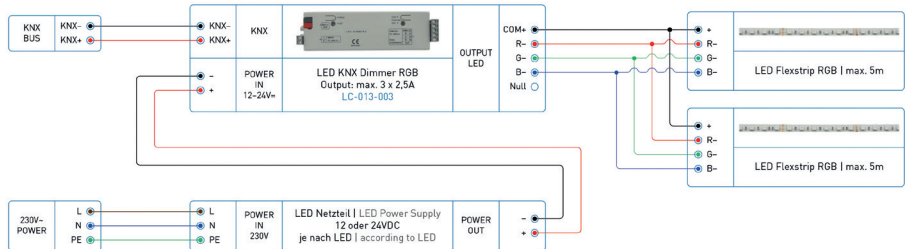
Status Sending:

by enabling this parameter („Yes“), the state of the LED module will be sent to the KNX bus on a power recovery or after a download, thus updating other devices in the KNX system that may need it. When enabled, a new parameter is shown: „Delay“. This field sets the time (in seconds) that LUMENTO X3 waits until it transmits the status objects. To get an immediate transmission (no delay), this field should remain zero. The start-up state transmission is performed through the „On/Off (Status)“ and „Luminosity (Status)“ communication objects (and the analogous objects referred to the separate channels, if enabled). Note that the status objects need to stay enabled (see section 3.3.1).

Note:

bus power failures do not turn the LED module off, unless the external power supply is also affected by the failure.

6. Wiring Diagram



7. Safety warnings

- 7.1. To avoid installed the product in minefield, strong magnetic field and high voltage area.
- 7.2. To ensure the wiring is correct and firm avoiding short circuit damages to components and cause fire.
- 7.3. Please install the product in a well ventilated area to ensure appropriate temperature environment.
- 7.4. The product must be worked with DC constant voltage power supply.
Please check the consistence of input power with the product, if the output voltage of the power comply with that of the product.
- 7.5. Connect the wire with the power on is forbidden. Ensure proper wiring first then check to ensure no short-circuit, then power on.
- 7.6. Don't repair it by yourself whenever an error occur. Contact the supplier for any inquiry.
- 7.7. Do not connect mains voltage (230V) or any other external voltages to any point of the bus.
Connecting an external voltage might put the entire KNX system at risk.
- 7.8. Make sure during the installation that there is always sufficient insulation between the mains voltage 230V and the bus or the extension inputs.
- 7.9. When overheating protection is active, the device will decrease the luminosity level (50%) and control frequency. For further information, please read the user manual.
- 7.10. The voltage of the power supply connected to LUMENTO will never exceed the voltage required for the load, which is specified by the manufacturer. Not following this recommendation would mean a risk for the installation.

ANNEX I. COMMUNICATION OBJECTS

Functional range"

shows the values that, with independence of any other values permitted by the bus according to the object size, may be of any use or have a particular meaning because of the specifications or restrictions from both the KNX standard or the application program itself.

"1st boot" shows the cases where an object is assigned a certain value by the application program after a device download or a full reset. In case the value of such assignment can be parameterised, √ is shown in column "P". Objects showing a hyphen (-) are not assigned a particular value and therefore can be assumed to be initialised with the value "0" or with the corresponding updated value in case they depend on an external element (sensors, etc.). Moreover, if the object is sent (or is there an option to send it) to the bus (write or read requests) after a download or a device reset from ETS, the marks (W) or (R) will be shown, respectively for transmissions or read requests.

"Reboot" shows the cases where an object is assigned a certain value by the application program after a bus power failure. In case the value of such assignment can be parameterised, √ is shown in column "P". Objects showing a hyphen (-) are not assigned a particular value and therefore can be assumed to maintain their previous value after the failure or with the corresponding updated value in case they depend on external elements (sensors, etc.). Moreover, if the object is sent (or is there an option to send it) to the bus (write or read requests) after a bus failure, the marks (W) or (R) will be shown, respectively for transmissions or read requests.

Number	Size	I/O	Flags	Data type (DPT)	Implemented range	1st boot	P	Reboot	P	Name	Function
0 - 2	1 bit	I	C - - - W -	DPT_Switch	01 0x0 (Stop) 0x1 (Inc. by 100%) 0x2 (Dec. by 50%) 0x3 (Inc. by 25%) 0x4 (Dec. by 12%) 0x5 (Dec. by 6%) 0x6 (Dec. by 3%) 0x7 (Dec. by 1%) 0x8 (Stop) 0x9 (Inc. by 100%) 0xA (Dec. by 50%) 0xB (Inc. by 25%) 0xC (Inc. by 12%) 0xD (Inc. by 6%) 0xE (Inc. by 3%) 0xF (Inc. by 1%)	-	-	-	-	[X] On/Off	0=Off; 1=On
3 - 5	4 bits	I	C - - - W -	DPT_Control_Dimming	0% - 100%	-	-	-	-	[X] Dimming	4 bits dimmer ctrl
6 - 8	1 bit	O	C - - - W -	DPT_Scaling	0% - 100%	-	-	-	-	[X] Precise Dimming	1 byte dimmer ctrl
9	4 bits	I	C - - - W -	DPT_Control_Dimming	0x0 (Stop) 0x1 (Dec. by 100%) 0x2 (Dec. by 50%) 0x3 (Dec. by 25%)	-	-	-	-	Dimming	4 bits dimmer ctrl

ANNEX I. COMMUNICATION OBJECTS

Number	Size	IO	Flags	Data type (DPT)	Implemented range	1st boot	P	Reboot	P	Name	Function
10	1 Byte	I	C -- W -	DPT_Scaling	0x3 (Dec. by 1%) 0x5 (Dec. by 6%) 0x6 (Dec. by 3%) 0x7 (Dec. by 1%) 0x8 (Step) 0x6 (Inc. by 100%) 0xA (Inc. by 50%) 0xB (Inc. by 25%) 0xC (Inc. by 12%) 0xD (Inc. by 6%) 0xE (Inc. by 3%) 0xF (Inc. by 1%)	-	-	-	-	Precise Dimming	1 byte dimmer ctrl
11	1 Bit	I	C -- W -	DPT_Switch	0/1	-	-	-	-	On/Off	0=Off; 1=On
dic-14	1 Bit	O	C T R --	DPT_Switch	0/1	-W	✓	-W	✓	[X] On/Off (Status)	0=Off; 1=On
15 - 17	1 Byte	O	C T R --	DPT_Scaling	0% - 100%	-W	✓	-W	✓	[X] Luminosity (Status)	0 - 100 %
18	1 Bit	O	C T R --	DPT_Switch	0/1	-W	✓	-W	✓	On/Off (Status)	0=Off; 1=On
19	1 Byte	O	C T R --	DPT_Scaling	0% - 100%	-W	✓	-W	✓	Luminosity (Status)	0 - 100 %
20 - 23	1 Bit	I	C -- W -	DPT_Switch	0/1	-	-	-	-	Custom On/Off X	0=Off; 1=On
24	1 Bit	I	C -- W -	DPT_Switch	0/1	-	-	-	-	Simple Timer	0=Deactivate; 1=Activate
25	1 Bit	I	C -- W -	DPT_Start	0/1	-	-	-	-	Flashing	0=Deactivate; 1=Activate
26	1 Byte	I	C -- W -	DPT_SceneControl	0-63 (run) 128-191 (save)	-	-	-	-	Scenes/Sequences	Scene/Sequence value
27	1 Bit	I	C -- W -	DPT_Enable	0/1	0	-	-	-	Block	0=Unblock; 1=Block
28	1 Bit	I	C -- W -	DPT_Start	0/1	-	-	-	-	Start/Stop Sequence	0=Stop; 1=Start
29	1 Byte	I/O	C - R W -	DPT_Scaling	0% - 100%	-	-	-	-	Dimming Speed 1	0%=Min. Speed; 100%=Max. Speed
30	1 Byte	I/O	C - R W -	DPT_Scaling	0% - 100%	-	-	-	-	Dimming Speed 2	0%=Min. Speed; 100%=Max. Speed loc.
31	1 Byte	I/O	C - R W -	DPT_SceneControl	0-21	-	-	-	-	Direct Color	Color number (Scene 1-22)
32	1 Bit	O	C T R --	DPT_Alarm	0/1	0	-	-	-	Error: External Voltage	0=Normal; 1=Low Ext. Voltage
33	1 Bit	O	C T R --	DPT_Alarm	0/1	0	-	-	-	Error: Overheating	0=Normal; 1=Overheating
34	1 Bit	I	C -- W -	DPT_Start	0/1	-	-	-	-	Color Shift	0=Stop; 1=Start
35	3 Bytes	I	C -- W -	DPT_Colour_RGB	[0% - 100%]* 3	-	-	-	-	RGB Color	3 bytes RGB ctrl