Zennio
Passion for KNX innovation

LUMENTO X4 LED

4-Channel Constant Voltage Dimmer for Independent Single-Colour LED Loads

ZN1DI-RGBX4

Application program version: [1.2]
User manual edition: [1.2]_a

USER MANUAL

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DOCUMENT UPDATES

Version	Changes	Page(s)
[1.2]_a	Changes in application program: • Unconditional transmission of the ON/OFF status object after a switch-on or switch-off order (through any of the objects that permit it), even if it did not imply an actual switch of the previous state and with independence of the parameterised minimum time between transmissions (which is only considered for the Luminosity level status object). • Change in the smooth dimming algorithm on the reception of successive orders: increments are applied to the final luminosity of the previous order, no matter if the dimming process was interrupted.	-
	Example added about the “Multiply” parameter.	17-19
	Brief clarification about the Start-up function.	23-24
	General revision of texts and styles	-
[1.1]_b	Changes in application program : • New dimming type: “Smooth 2”. • Possibility of applying different dimming times for the 4-bit control and for the 1-byte precise control. • Removed the immediate dimming for the 4-bit control. • Smooth Dimming 2 now available for functions Custom On/Off, Simple Timer, Flashing and Scenes	-

1 INTRODUCTION

1.1 LUMENTO X4

LUMENTO X4 is the LED dimming solution from Zennio for single-colour LED diode modules or combined LED DC diode modules of up to four colours (Red, Green, Blue and White).

It offers four independent output channels, for modules powered with 12/24 VDC (up to 2.5 A each).

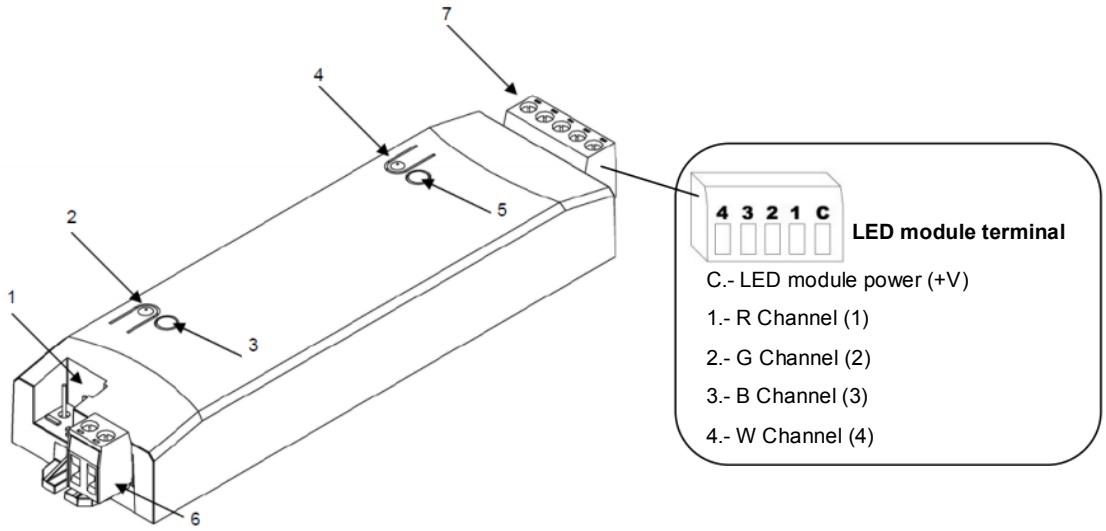
The device may be programmed with three different application programs, depending on the type of the LED modules to be controlled:

- **LUMENTO X4 LED**: independent control over up to four monochrome LED modules, i.e., each channel connected to the output corresponds to an independent single-colour module, which will generally be installed and operated independently of the other modules.
- **LUMENTO X4 RGBW**: joint control over one four-color (RGBW) LED module, i.e., each channel connected to the output corresponds to one color component (R, G, B or W) of the same module, requiring this module to be controlled jointly.
- **LUMENTO X4 WHITE**: control over Cool/Warm white LED modules (CW), i.e., four white LED strips (two of them Cool and two of them Warm) can be controlled, both jointly and separately for warm LEDs and cool LEDs.

Figure 1. LED Dimmer

1.2 INSTALLATION

Figure 2 shows the connection scheme of LUMENTO X4:



1.- KNX Connector 2.- Programming Button 3.- Programming Indicator 4.- Test Button 5.- Test / Reverse Polarity Indicator 6.- External Voltage Terminal 7.- LED Control Terminal

Figure 2. Connection scheme

The device connects to the KNX bus via the incorporated terminal (1), which provides the device with bus power. On the other hand, an additional power supply (12 – 24 VDC, depending on the specific LED module) is needed for dimming the LEDs. The external power supply is connected to the device through the corresponding screw terminal block included in the original packaging (6). The polarity of the external supply must be respected: the positive pole of the external power supply corresponds to the positive pole (+) of the terminal block, and analogously for the negative pole (-). If, for whatever reason, the connection of the power supply is carried out in the inverse way, LUMENTO X4 will report this event through the Test/Reverse Polarity Indicator (5), which will turn orange.

Also provided with the device is a second screw terminal block (7), where every LED module must be connected, as well as the power line (+V). The scheme of the terminal block is shown in Figure 2.

Note: *the output terminal block can be cabled before it is inserted into the device.*

Note: *keep in mind that only **LED loads** can be connected to LUMENTO X4.*

Once the device is provided with bus power, both the physical address and the application program can be downloaded, even if no external power is being provided.

After the first connection to the KNX bus or after a download, the programming indicator (3) will typically start blinking in blue while the Test/Reverse polarity indicator (5) remains in constant blue for about 25 seconds. Before performing any action over the device, it is important to wait until both indicators turn off again (i.e., they are not lighting in blue anymore), since LUMENTO X4 is carrying out an internal update.

Note: *if the device is found to be only connected to the KNX bus and the external power is not being supplied, this internal update will be postponed until it is.*

The functionality of the main elements of the device is described below:

- **Programming button**: a short press on this button sets the device into the programming mode, while the associated indicator turns red. If this button is held while plugging the device into the KNX bus, LUMENTO X4 goes into the secure mode. The indicator blinks in red.

- **Test button**: a long press on this button, of at least 3 seconds (until the associated indicator lights in white) activates the Test Mode of the device, which allows verifying the correct connection of the LED modules. This test is carried out as follows: **once the Test Mode is activated, every time the button is short-pressed, the associated indicator colour will change (Red-Green-Blue-White-Red...) while the LED channels turn on successively, making the different LED strips light (1-2-3-4-1…)**, depending on the channel enabled with every press. If the LED modules are properly connected to the device, the colour that will turn on with every press (red, green or blue) will be the same as in the Test indicator, meaning that no channel was interchanged during the connection process. To leave the Test Mode, just push the Test button at least for 3 seconds (until the associated indicator and the LED module switch off).

Note: *while the Test Mode is active, any order received from the KNX bus will be ignored until the deactivation of the mode.*

To obtain detailed information about the technical features of LUMENTO X4 as well as on security and on the installation process, please refer to the Datasheet, included in the original packaging of the device and also available at: www.zennio.com.

2 CONFIGURATION

The LUMENTO X4 LED application allows, as stated in the previous section, independently controlling the luminosity level of up to 4 single-colour LED modules. Moreover, it permits configuring a set of additional functionalities, which makes LUMENTO X4 a very versatile device:

- **Two dimming controls** for each colour channel:
  - One **4-bit object** for per-channel step dimming,
  - One **1-byte object** for per-channel precise dimming, that is, for selecting particular luminosity levels.
- 3 dimming types for each channel and for each of the above two objects: **At once** (immediate) and **Smooth 1** / **Smooth 2** (progressive dimming with configurable times).
- **Custom ON/OFF**: possibility of enabling up to four different ON/OFF controls per channel, with a certain luminosity value and dimming type each.
- **Simple Timer and Flashing**: timed ON/OFF sequences of the LED modules.
- **Scenes/Sequences**: possibility of enabling up to five different scenes/sequences per channel, which can consist in a single **luminosity change** or a **custom sequence** (5 customisable steps).
- **Block**: option to lock/unlock the control of each output channel.
- **Start-up**: permits selecting a custom start-up state after a bus failure for each LED module connected to the device, as well as sending the status objects to the KNX bus (immediately or after a delay).
- Possibility of restricting the **maximum light level**.
- **Error identification**: detection of anomalous situations affecting the correct behaviour of the device: external voltage errors and overheating errors.

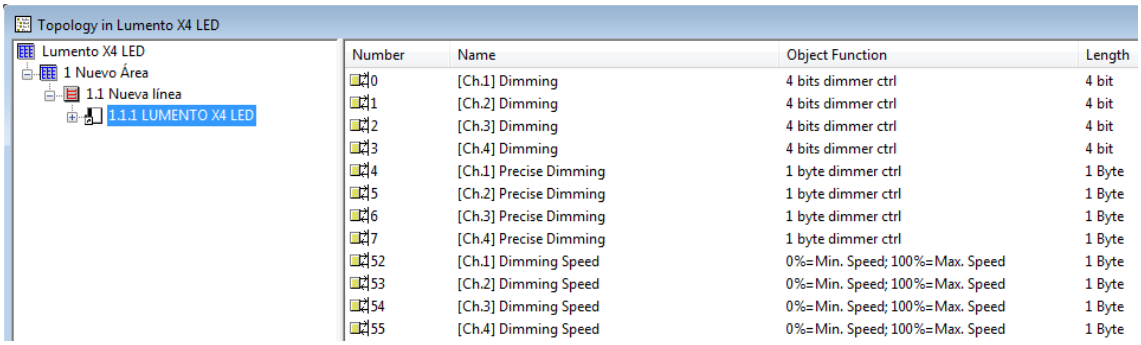
3 ETS PARAMETRISATION

To begin with the parameterisation process of LUMENTO X4 it is necessary, once the ETS program has been opened, to import the database of the product (**LUMENTO X4 LED** application program).

Next, the device should be added to the project where desired. And then, one right-click on the device will permit selecting "Edit parameters", in order to start the configuration.

3.1 DEFAULT CONFIGURATION

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



Number	Name	Object Function	Length
0	[Ch.1] Dimming	4 bits dimmer ctrl	4 bit
1	[Ch.2] Dimming	4 bits dimmer ctrl	4 bit
2	[Ch.3] Dimming	4 bits dimmer ctrl	4 bit
3	[Ch.4] Dimming	4 bits dimmer ctrl	4 bit
4	[Ch.1] Precise Dimming	1 byte dimmer ctrl	1 Byte
5	[Ch.2] Precise Dimming	1 byte dimmer ctrl	1 Byte
6	[Ch.3] Precise Dimming	1 byte dimmer ctrl	1 Byte
7	[Ch.4] Precise Dimming	1 byte dimmer ctrl	1 Byte
52	[Ch.1] Dimming Speed	0%=Min. Speed; 100%=Max. Speed	1 Byte
53	[Ch.2] Dimming Speed	0%=Min. Speed; 100%=Max. Speed	1 Byte
54	[Ch.3] Dimming Speed	0%=Min. Speed; 100%=Max. Speed	1 Byte
55	[Ch.4] Dimming Speed	0%=Min. Speed; 100%=Max. Speed	1 Byte

Figure 3. LUMENTO X4 LED Default topology

The following communication objects appear:

- **[Ch.x] Dimming**: 4-bit objects (one per channel) destined to perform independent brightness (luminosity) changes (increasing/decreasing), step by step. Steps of 1%, 2%, 3%, 6%, 12%, 25%, 50% and 100% are permitted.

- **[Ch.x] Precise Dimming**: 1-byte objects (one per channel) destined to perform precise dimming over each channel, by setting a concrete luminosity percentage.

- **[Ch.x] Dimming Speed 1**: four 1-byte objects (one per channel) that allow modifying, in runtime, the speed of the “Smooth 1” dimming of channel “x”. (See section 3.3).

- **[Ch.x] Dimming Speed 2**: similar to Dimming Speed 1, but referred to the "Smooth 2" dimming of channel "x".

When entering the parameter edition of LUMENTO X4 LED for the first time, the following window will be shown:

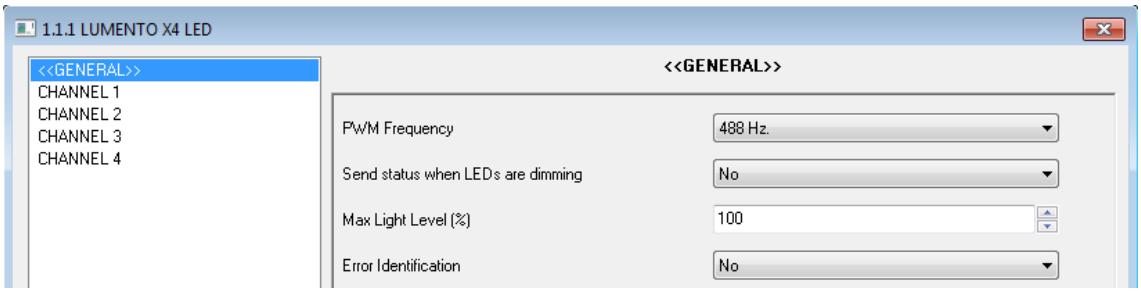


Figure 4. Parameterisation screen by default

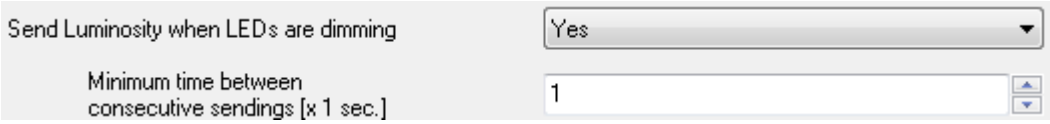
As seen in Figure 4, the parameterisation window is divided into two main types of screen, which will be explained in detail in the next sections:

- **General**: permits parameterising global features of the device.
- **Channels 1-4**: permit enabling and configuring specific functionalities of each channel.

3.2 GENERAL WINDOW

This section of the parameter edition allows setting several global features of LUMENTO X4 LED:

- **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.
- **Send Luminosity when LEDs are dimming**: this option allows selecting whether to send the brightness status of the output (through the "[Ch. X] Luminosity (Status)" object) or not (default option). This only applies if the status objects have been enabled (see section 3.3.1).



- **Minimum time between status sending**: sets the minimum time (in seconds) between consecutive transmissions of the current brightness level to the KNX bus. This limitation applies to smooth dimming.

- **Max Light Level (%)**: defines the maximum effective brightness, in percentage (from 5 to 100%), to be applied to the outputs when a dimming order is received. If this parameter is set to a value other than 100%, a proportional reduction in the luminosity will apply. However, for coordination and update purposes, LUMENTO X4 will always send to the KNX bus the theoretical luminosity value, between 0% and 100%.

Example:

Suppose that "70%" is the value of this parameter. In that case, dimming orders for a luminosity of 100% will actually set the luminosity to 70% (although the status object will still show the value "100%"). Analogously, orders for a luminosity of 50% will actually set it to 35% (although the status object will show "50%").

- **Error identification**: this option displays two 1-bit communication objects to report anomalous behaviours that may arise when LUMENTO X4 is working:

  - **"Error: Overheating".** Object through which LUMENTO X4 notifies it is exposed to an excessive temperature (higher than 90ºC), by sending the value "1". In that moment, LUMENTO X4 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 80ºC, LUMENTO X4 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 X4 will directly switch off its output, for safety reasons.

  - **"Error: External voltage".** Object through which LUMENTO X4 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 X4 detects any of

these anomalous situations, it sends the value "1" through this object. When the event finishes, it sends a "0".

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.*

3.3 CHANNELS

Each of the four channels of LUMENTO X4 LED offers a set of different functions, disabled by default (see Figure 5), than can be enabled through their respective configuration screen. These functions may be selectively enabled, depending on the needs of the installation.

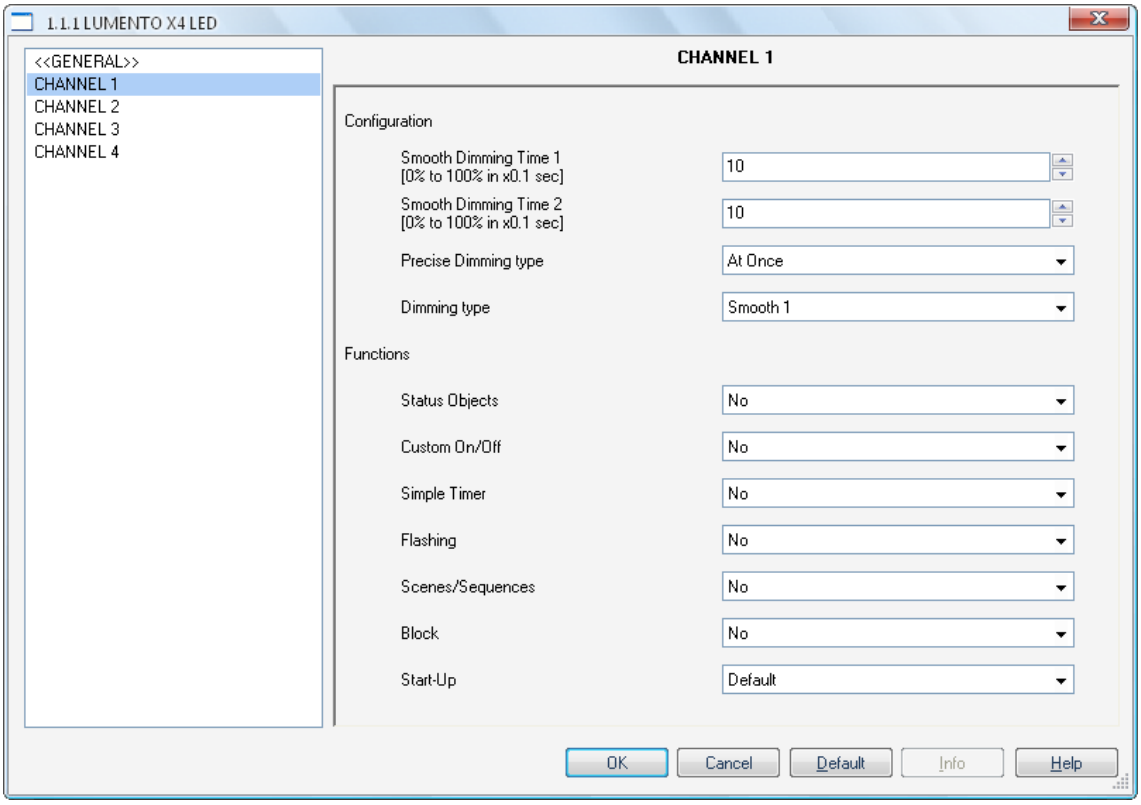
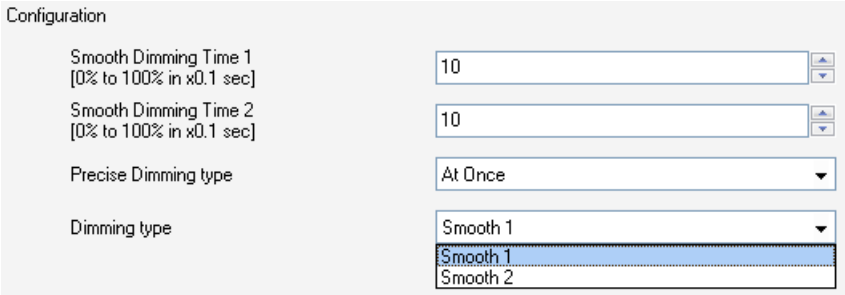


Figure 5. Channel configuration

Moreover, it is possible to configure the smooth dimming times and the dimming types to be applied to the channel on the reception of step or precise dim orders:



- **Smooth Dimming Times 1 and 2**: this is the time LUMENTO X4 takes to perform soft luminosity transitions on the particular channel. There are two possible smooth transitions (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 values are initially 10 (0.1 seconds), by default.

  Smooth dimming times 1 and 2 can be decreased (although not increased) in execution time, via the "**[Ch.x] Dimming Speed 1**" and "**[Ch.x] Dimming Speed 2**" communication objects, respectively. Please check Table 3.1 for the relation between several dimming speed values (the most common) and their associated dimming times.

Dimming Speed	Dimming time (T = parameterised time)
0%	*T*
25%	¾*T*
33%	⅔*T*
50%	½*T*
75%	¼*T*
100%	0*

*Dimming performed in the minimum time allowed for this dimming type: 3 tenths of a second.

Table 1. Dimming speeds and times

Example:

Let the Smooth Dimming Time 1 be 20 seconds. At a given time during the execution, smooth dimming is required to be performed in half the time (regardless of the brightness percentage to reach), so this time must become 10 seconds. To achieve this, the value 50% must be written to the "[Ch. 1] 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 a value other than 0% and to a value other than 100% (off to on) is performed at the same speed, so the time needed to carry it out will always be lower (and proportional) than that parameterised under "Smooth Dimming Time".

Example:

Suppose that 10 seconds ("100") is the parameterised value for the "Smooth dimming time 1" field. A global switch-on order is then sent when the output channel is off, so it will take 10 seconds to achieve the maximum brightness level (if the "Dimming" parameter has been configured as "Smooth 1"). If the channel was already at a brightness percentage of for instance 50%, the time taken to reach full brightness (100%) will be 5 seconds (one half of the 10 seconds parameterised).

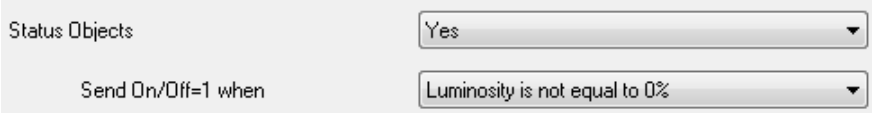
- **Precise Dimming Type**: this box is intended to define whether the type of the transitions performed through the 1-byte object (that is, by sending a certain percentage value to the **Precise Dimming** object of the particular channel) should be **At once** (immediate), **Smooth 1** (a progressive transition based on the defined Smooth 1 time) or **Smooth 2** (a progressive transition based on the defined Smooth 2 time).

- **Dimming Type**: this box is intended to define whether the type of the transitions performed through the 4-bit object (that is, by steps) should be **Smooth 1** (a progressive transition based on the defined Smoot 1 time) or **Smooth 2** (a progressive transition based on the defined Smooth 2 time).

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.*

3.3.1 STATUS OBJECTS

This function allows enabling a 1-bit status object ("**[Ch.x] On/Off Status**") and a 1-byte status object ("**[Ch.x] Luminosity Status**") for every channel, responsible for reporting the channel brightness states at any time, thus updating the status of the devices in the KNX installation, if required.



- **Send On/Off=1 when**: sets when the value "1" (on) is sent through the "[Ch. x] 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 "[Ch.x] 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 "[Ch.x] 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.

3.3.2 CUSTOM ON/OFF

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

Figure 6. Custom ON/OFF

The following parameters can be configured for each of these custom ON/OFF controls:

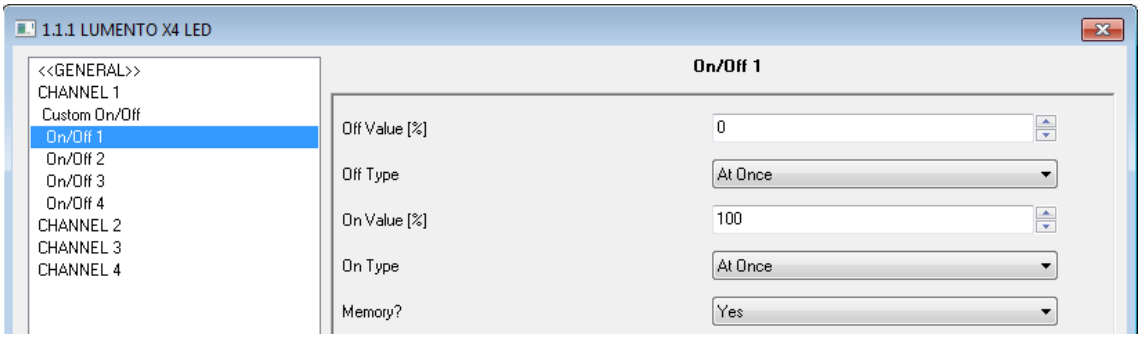


Figure 7. Custom ON/OFF configuration

- **Off value**: sets the desired brightness percentage (0% - 100%) to be applied to the corresponding channel when LUMENTO X4 receives the value "0" through the "**[Ch.x] Custom On/Off Y**" 1-bit communication object.

- **Off type**: sets the desired dimming type for the switch-off of the LED modules: At once, Smooth 1 and Smooth 2. See section 3.3 for the parameterisation of the dimming types.

- **On value**: sets the desired brightness percentage (0% - 100%) to be applied to the corresponding channel when LUMENTO X4 receives the value "1" through the "**[Ch.x] Custom On/Off Y**" 1-bit communication object.

- **On type**: sets the desired dimming type for the switch-on of the LED strip: At once, Smooth 1 or Smooth 2. See section 3.3 for the parameterisation of the dimming types.

- **Memory**: this parameter allows defining a state-recovery switch-on. This way, whenever LUMENTO X4 receives a "0" through the corresponding "**[Ch.x] Custom On/Off Y**" object, it will save the luminosity level of channel “x” into memory. After that, when the ON order arrives ([Ch.x] Custom On/Off Y = 1), LUMENTO X4 will set the channel back again to the same luminosity.

Example:

Suppose the following configuration for Custom On/Off number 2 in channel number 1: Off value = 15%; On Action = 90%. The current luminosity level of the channel is 60%,

and a switch-off order (value "0") arrives through the "[Ch.1] Custom On/Off 2" object. Module no. 1 will then switch to 15% (Off Action), prior to which LUMENTO X4 saves the level that was active before the switch-off. When it then receives the switch-on order ("[Ch.1] Custom On/Off 2=1"), channel number 1 will go back to the level stored before the switch-off (60%)

3.3.3 SIMPLE TIMER

This function allows performing a switch-on of the LED module connected to a channel of LUMENTO X4 and a later, automatic (timed) switch-off, being also possible to introduce delays. Apart from the delays, the time length, luminosity level and 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.

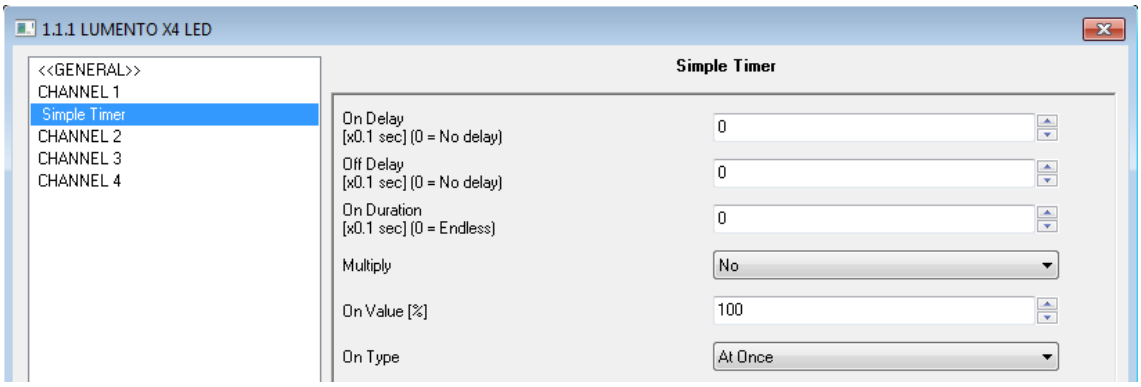


Figure 8. Simple timer

- **On Delay**: this parameter sets the time LUMENTO X4 will wait since the reception of the Timer ON order (**[Ch.x] Simple Timer** = 1) and the actual switch-on 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 (**[Ch.x] 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 X4 receives a "1" through the "**[Ch.x] Simple Timer**" communication object, an ON order is sent to the channel, 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 X4 receives a "0" through the "**[Ch.x] 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 channel. 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 “**[Ch.x] 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 “**[Ch.x] 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

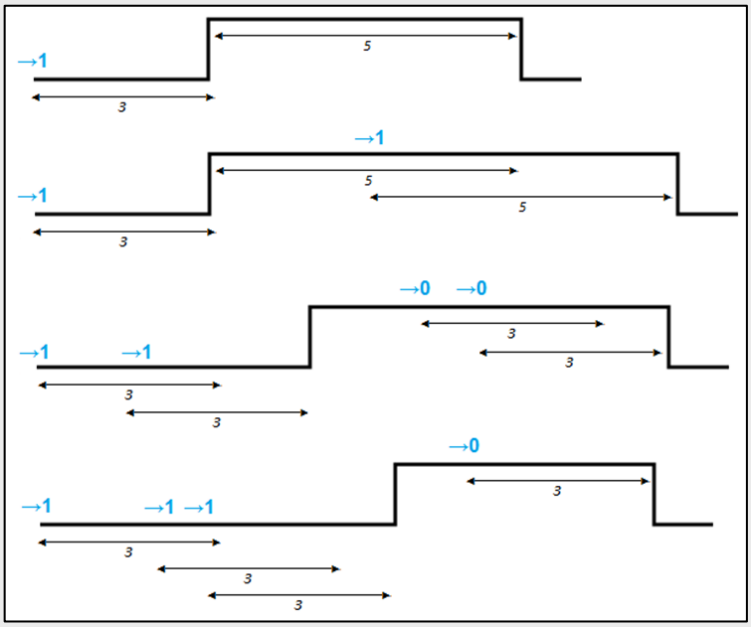
duration will be “n” times the parameterised time, being “n” the number of times the value “1” is received.

- 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.

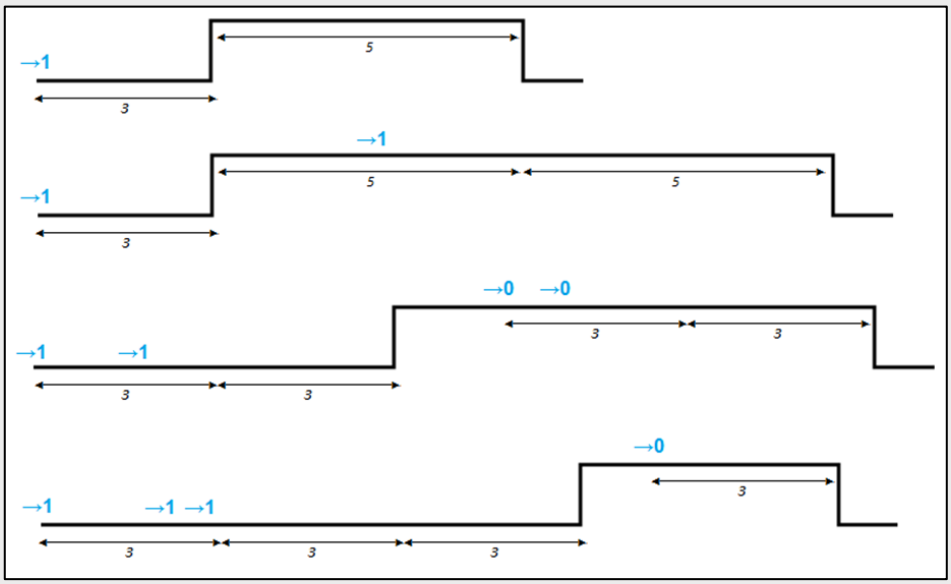
Note: *the multiply option may result particularly useful under parameterisations with no ON and OFF delays. Nevertheless, as already explained and as the following example shows, these delay times, if parameterised with a value other than 0, do also admit multiplication*.

Example: the following is parameterised: On Delay = 3 seconds; Off Delay = 3 seconds, On Duration = 5 seconds. The graphs bellow 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 Value**: sets the luminosity level desired in the LED channel while the timed "ON" status is active.

- **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 3.3 for the parameterisation of the dimming types.

3.3.4 FLASHING

This function allows executing per-channel ON-OFF-ON-OFF sequences, where it is possible to parameterise the length of the ON/OFF switches applied to the LED module. 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 channel will start blinking when LUMENTO X4 receives a "1" through the "**[Ch.x] 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 "**[Ch.x] 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 X4 receives a new order to start the flashing sequence ("[Ch.x] Flashing" = 1), it will be reset no matter what the current stage of the sequence is.

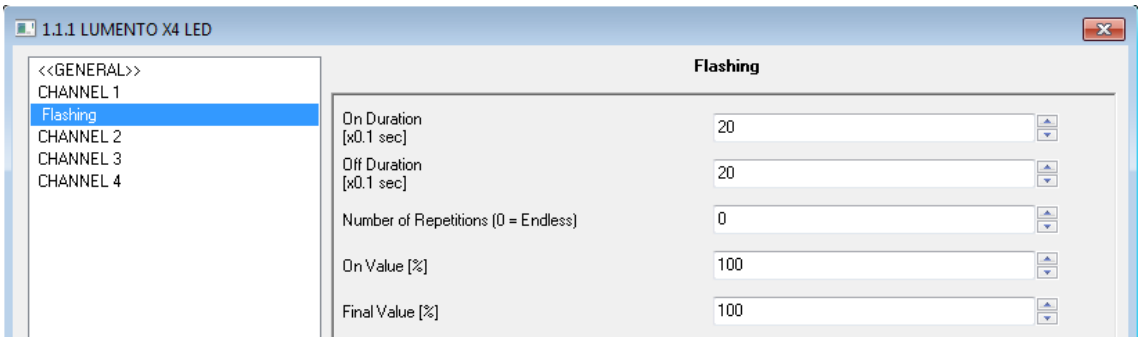


Figure 9. Flashing

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

- **On Duration**: sets the length of “ON” steps of the flashing sequence, i.e. the time the channel will remain on before turning off again.
- **Off Duration**: sets the length of “OFF” steps of the flashing sequence, i.e. the time the channel 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 active. 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 value**: sets the brightness level, in percentage, desired in the LED channel during the “on” stages.
- **Final value**: sets the brightness level desired in the LED channel after the last flashing repetition finishes, or when the **[Ch.x] Flashing** = 0 order is received.

3.3.5 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 “**[Ch.x] Scenes/Sequences**” 1-byte object.

The "**[Ch.x] Start/Stop Sequence**" 1-bit object will be displayed, allowing re-executing the last sequence played (by writing the value "1") or stopping the current sequence in execution ("0").

Note: *the "[Ch.x] 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 first sequence that was parameterised will be executed, unless it is of the "Fixed Color" type; in such case the first one different from this type will be executed.*

LUMENTO X4 LED allows configuring up to **five scenes/sequences per channel**, which can be individually enabled from "Scenes/Sequences" in ETS.

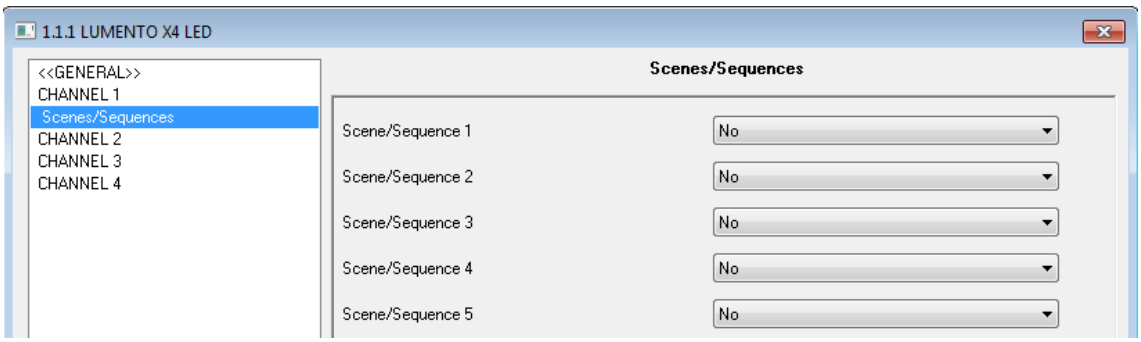


Figure 10. Scenes

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 controller apply the configuration to the output channel.

- **Scene/Sequence type**: selects the desired action for each enabled scene/sequence:

  - **Fixed value.** The scene will consist in a luminosity change in the particular LED channel when the "[Ch.x] Scenes/Sequences" object is received with the configured scene number.

    If "Fixed value" is selected, besides running the scene it will be also possible to save it: if the device receives an order to save the scene (values 128-191 through the mentioned object), the current luminosity level of the LED channel will be saved, so when the same scene is executed again, the luminosity to be acquired will be the one that has been saved (and not the originally parameterised in ETS).

Finally, if “Fixed value” is selected, the “**Dimming type**” parameter will also be shown, making it possible to choose an Immediate, Smooth 1 or Smooth 2 dimming for this action. See section 3.3 for the parameterisation of the dimming types.

- **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 “**[Ch.x] Luminosity Status**” object, only if the option to send statuses has been activated from the General screen) or to Send when sequence ends (the brightness level of the channel will be sent to the bus once the last step of the sequence finishes, no matter if the sending of the status during the dimming is enabled or not from the General screen). However, in both cases, the status objects of the channel need to be enabled by parameter (see section 3.3.1).

  For every step, the following parameters can be configured:

  - **Value**: sets the desired luminosity in the channel (as a percentage).

  - **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 as much time as defined in the "Time" box.

  - **Time**: sets the time length of the step (i.e., the action time), in seconds.

The steps (or actions) will be executed in order. In other words, when LUMENTO X4 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 11, where the three first steps of Sequence 1 have been parameterised.

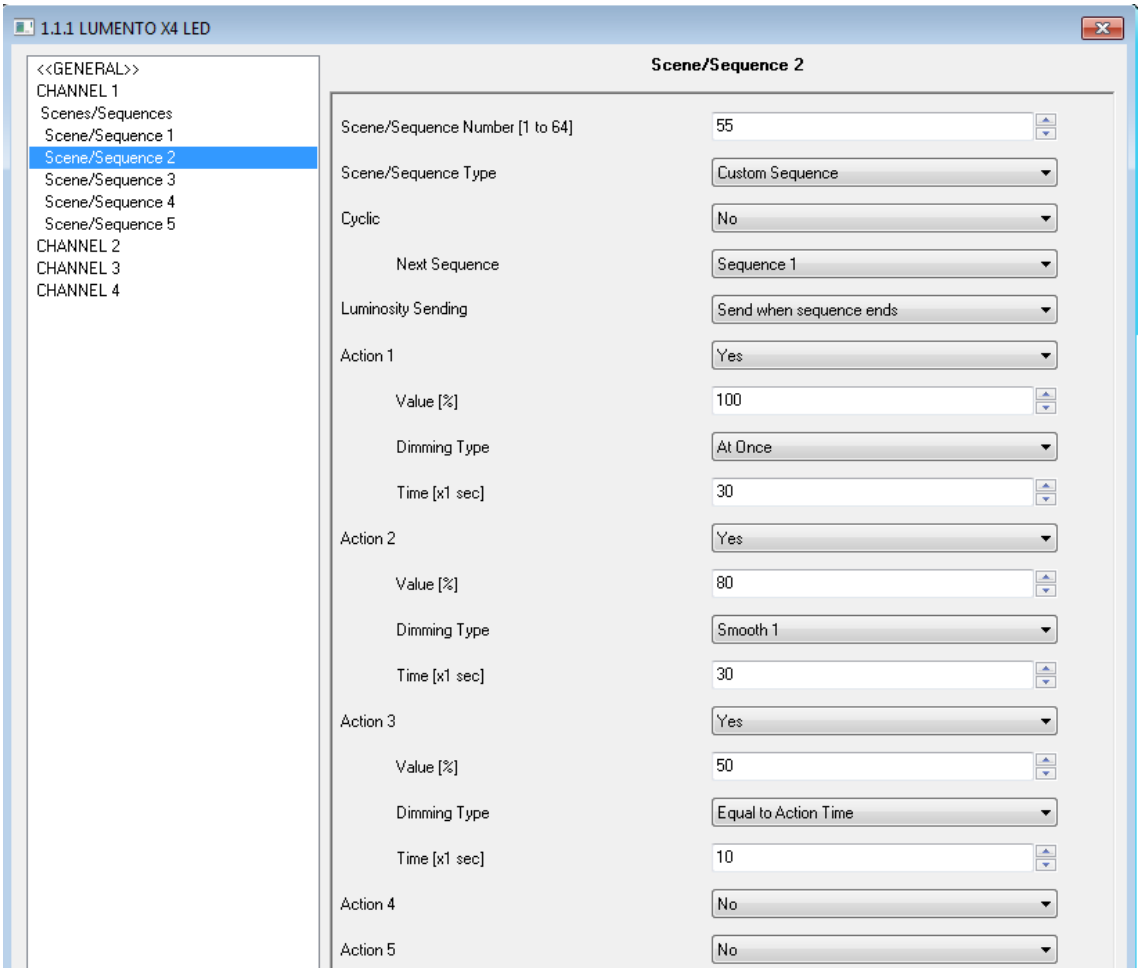


Figure 11. Custom sequence

3.3.6 BLOCK

This function permits independently locking each output channel; i.e., disabling the control of a LED module.

LUMENTO X4 will lock the particular output channel when it receives a "1" through the "**[Ch.x] Block**" 1-bit communication object, which is displayed after enabling this function. From that moment, any action being executed by channel “x” will be stopped and the LED module will maintain the brightness value it had when the lock order arrived.

Under the lock status, any order received from the KNX bus that affects channel “x” will be ignored, i.e., it will not be performed by the output.

LUMENTO X4 will unlock the channel when the value "0" arrives through the "**[Ch.x] Block**" object. The channel will also then maintain the luminosity it had before receiving the lock order. Any luminosity change received during the lock status will not be taken into account by the channel, not even after the unlock event.

3.3.7 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 of the channel will stay off after a download from ETS. On the other hand, after a bus voltage recovery the luminosity will be the same they had before the bus power failure.

Under a custom configuration, it is possible to select by customise the desired state of the particular LED module after a bus voltage recovery and after a download from ETS.

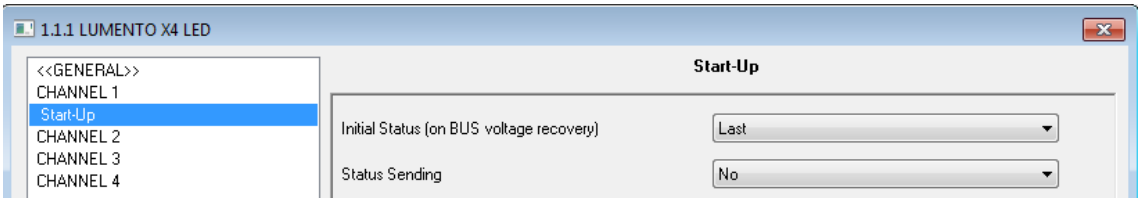


Figure 12. Start-up

The following parameters can be configured:

- **Initial Status (on bus voltage recovery)**: sets, for the particular output channel, the initial status the LED module is required to adopt when the bus power failure situation ends or after a download from ETS. It is possible to select one of these statuses:
  - **Last**: the LED module will recover the same 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 with a luminosity level that can be defined through the "Initial Value" parameter (as a percentage).

- **Status sending**: by enabling this parameter ("Yes"), the state of the LED channel 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 drop-down box is shown: "**Delay**". This field sets the time (in seconds) that LUMENTO X4 waits until it transmits the status objects. To get an immediate transmission (no delay), the value “0” should be typed in for this field. The start-up state transmission is performed through the "**[Ch.x] On/Off (Status)**" and "**[Ch.x] Luminosity (Status)**" communication objects. Note that the status objects of the particular channel need to be enabled (see section 3.3.1).

Note: *bus power failures do not turn the LED modules off, unless the external power supply is also affected by the failure.*

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". 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.

- "**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. 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.

Number	Size	I/O	Flags	Data type (DPT)	Implemented range	1st time	P	Reboot	P	Name	Function
0, 1, 2, 3	4 Bit	I	**C - - W -**	DPT_Control_Dimming	0x0 (Stop) 0x1 (Dec. by 100%) 0x2 (Dec. by 50%) 0x3 (Dec. 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 (Inc. by 50%) 0xB (Inc. by 25%) 0xC (Inc. by 12%) 0xD (Inc. by 6%) 0xE (Inc. by 3%) 0xF (Inc. by 1%)	-		-		**[Ch.x] Dimming**	**4 bits dimmer ctrl**
4, 5, 6, 7	1 Byte	I	**C - - W -**	DPT_Scaling	0% - 100%					**[Ch.x] Precise Dimming**	**1 byte dimmer ctrl**
8, 9, 10, 11	1 Bit	O	**C T R - -**	DPT_Switch	0/1	- **W**	√	- **W**	√	**[Ch.x] On/Off (Status)**	**0=Off; 1=On**
12, 13, 14, 15	1 Byte	O	**C T R - -**	DPT_Scaling	0% - 100%	- **W**	√	- **W**	√	**[Ch.x] Luminosity (Status)**	**0 - 100 %**
16, 20, 24, 28	1 Bit	I	**C - - W -**	DPT_Switch	0/1	-		-		**[Ch.x] Custom On/Off 1**	**0=Off; 1=On**
17, 21, 25, 29	1 Bit	I	**C - - W -**	DPT_Switch	0/1	-		-		**[Ch.x] Custom On/Off 2**	**0=Off; 1=On**

Number	Size	I/O	Flags	Data type (DPT)	Implemented range	1st time	P	Reboot	P	Name	Function
18, 22, 26, 30	1 Bit	I	**C - - W -**	DPT_Switch	0/1	-		-		**[Ch.x] Custom On/Off 3**	**0=Off; 1=On**
19, 23, 27, 31	1 Bit	I	**C - - W -**	DPT_Switch	0/1	-		-		**[Ch.x] Custom On/Off 4**	**0=Off; 1=On**
32, 33, 34, 35	1 Bit	I	**C - - W -**	DPT_Switch	0/1	-		-		**[Ch.x] Simple Timer**	**0=Deactivate; 1=Activate**
36, 37, 38, 39	1 Bit	I	**C - - W -**	DPT_Start	0/1	-		-		**[Ch.x] Flashing**	**0=Deactivate; 1=Activate**
40, 41, 42, 43	1 Byte	I	**C - - W -**	DPT_SceneControl	(0-63) run; (128-191) save	-		-		**[Ch.x] Scenes/Sequences**	**Scene/Sequence value**
44, 45, 46, 47	1 Bit	I	**C - - W -**	DPT_Enable	0/1	0		-		**[Ch.x] Block**	**0=Unblock; 1=Block**
48, 49, 50, 51	1 Bit	I	**C - - W -**	DPT_Start	0/1	-		-		**[Ch.x] Start/Stop Sequence**	**0=Stop; 1=Start**
52, 53, 54, 55	1 Byte	I/O	**C - R W -**	DPT_Scaling	0% - 100%	-		-		**[Ch.x] Dimming Speed 1**	**0%=Min. Speed; 100%=Max. Speed**
56, 57, 58, 59	1 Byte	I/O	**C - R W -**	DPT_Scaling	0% - 100%	-		-		**[Ch.x] Dimming Speed 2**	**0%=Min. Speed; 100%=Max. Speed**
60	1 Bit	O	**C T R - -**	DPT_Alarm	0/1	0		-		**Error: External Voltage**	**0=Normal; 1=Low Ext. Voltage**
61	1 Bit	O	**C T R - -**	DPT_Alarm	0/1	0		-		**Error: Overheating**	**0=Normal; 1=Overheating**

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