LUMITECH PI-LED System Design-In Guide 08/2012

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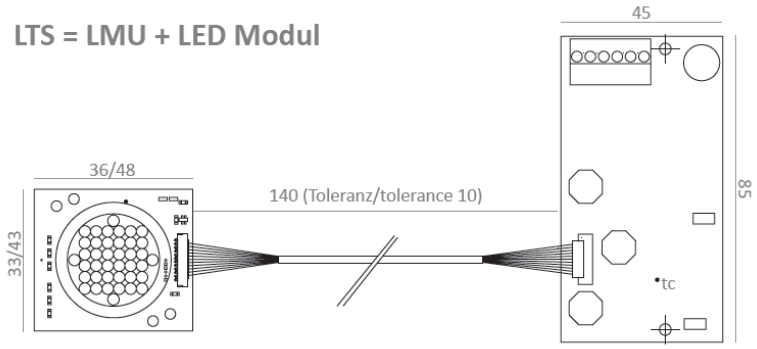
1. Overview of LUMITECH PI-LED System (LTS)



An LTS, consisting of a PI-LED module, an LMU (Light Management Unit) and a connector cable, which has been calibrated as a unit at the factory and is designated by means of a unique serial number. A calibrated unit may only be installed as such, i.e. the combination of different PI-LED modules and LMUs with different serial numbers is not permitted.

2. Installing the LUMITECH PI-LED System (LTS) module

2.1. General remarks

An LTS may only be installed in compliance with all applicable regulations and standards by an electrical engineer. These include, inter alia, general requirements and safety requirements for lights and devices for lamps and/or LED modules. The LMU may only be wired, and the plugs inserted/removed, when the power has been shut down. It is also important to note any possible slow discharge of the SELV constant voltage power supply.

2.2. Subsequent tasks

Subsequent manufacturing processing of the LTS such as cutting, milling, grinding, crushing or drilling is prohibited. Furthermore, other mechanical, thermal or chemical treatments are also prohibited.

2.3. Installing a PI-LED module

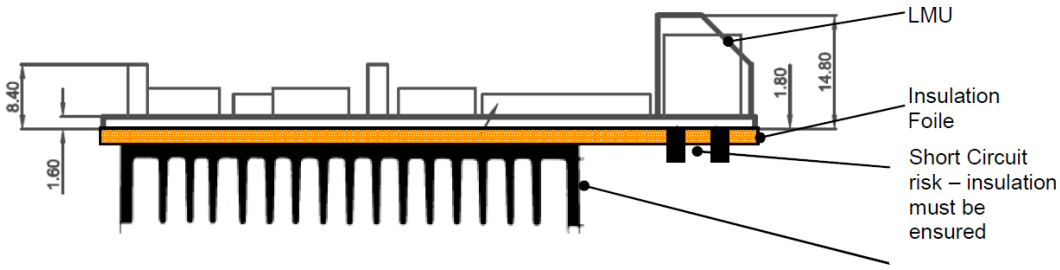
Sufficiently good thermal contact between the PI-LED module and an appropriate heat sink must be ensured in order to be able to effectively dissipate the heat generated during operation. For this purpose, heat-conducting film or paste must be applied to the backside of the PI-LED module when mounting it to the heat sink. In order to achieve higher contact pressure and thus improved thermal conductivity, the PI-LED module can optionally also be bolted to the heat sink using the drill holes provided for this purpose on PI-LED module.

- Caution

The mounting surface must be carefully cleaned before gluing the PI-LED module, and any dirt, dust or grease removed in order to ensure the secure adhesion of the heat-conducting film. The introduction of air inclusions should normally be avoided, as these have a negative impact on thermal conductivity.

2.4. Installing the Light Management Unit (LMU)

The LMU can be either glued in position using an electrically-insulating adhesive tape or bolted to the drill holes provided for that purpose. When bolting the unit into position, do not use plastic washers. The LMU may not be installed on electrically conductive surfaces, as this can cause short circuits and as a consequence, malfunctions or the destruction of the LTS. When electrically insulating the rear side of the circuit board, particular care must be taken with the terminal block insertion contacts. Appropriate space must be provided on the installation surface.



2.5. Processing instructions

LTS contain electronic components which are sensitive to mechanical, thermal, chemical, electrical and electrostatic influence. Loads of this kind can lead to the destruction of the unit, and must therefore be avoided! LTS which appear damaged or which are damaged during processing must not be installed.

2.5.1. Mechanical remarks

During the installation process, it must be ensured that excessive stress, compression, bending, or shear loads on the PI-LED module or the LMU are avoided. Particular care must be taken when gluing PI-LED modules or LMU to the installation surfaces, as well as when applying adhesive films to these components. This is also applicable when handling the components.

- Caution

Excessive mechanical loads can lead to the solder joints in individual components coming loose in the PI-LED module or in the LMU, and as a consequence, to the destruction of the LTS. Any mechanical loading on the LED light points (glob top), such as through finger contact when gluing, can lead to damage to the LEDs and thus to the destruction of the entire PI-LED module.

2.5.2. Electrical remarks

It must be ensured that the individual components on the upper side of the PI-LED module are not short-circuited, as this can lead to the destruction of the module during operation. Particular care must be taken when installing optical elements which are electrically conductive such as metal reflectors.

2.5.3. Thermal remarks

Please refer to the respective LTS installation and operating instructions for permissible PCB temperatures (Tc) for the PI-LED module and LMU.

2.5.4. Chemical remarks

Chemical substances can interact with the LTS in many ways, cause lasting damage to it, and these must therefore be avoided.

3. Properties of the LUMITECH PI-LED system

3.1. DMX

LUMITECH PI-LED systems are also available with DMX (Digital Multiplex) digital light control.

- **Control system options**
  - Brightness adjustable from 10% to 100%
  - Colour temperature adjustable from 2700 K to 6500 K
  - CIE colour coordinates freely adjustable within the defined colour range (these also include "Blood red" and "Cheddar yellow")
  - The three primary colours of the PI-LED module (red, blue, phosphorous ("green-white") are fully independently adjustable

- **Operating elements**
  - DMX control device such as touch panel or PC (not included in the scope of supply)

- **Features**
  - DMX512 support in accordance with DIN 56930-2
  - Only 2 lines required for the control system
  - Each LTS is controlled by the 4 DMX channels
  - Digital brightness control
  - Digital light colour control
  - LTS are software-addressable
  - Group control possible
  - Up to 125 light-addresses and/or group-addresses per DMX universe
  - Up to 32 LTS (lights) can be connected with no DMX signal booster (this number can be increased if required, dependent on the selected booster)

Item nos. and available products can be found in Chapter 9, "Order information".

3.2. Potentiometer

Control options for LTS with potentiometer:

- Brightness steplessly adjustable from 10% to 100%
- Colour temperature steplessly adjustable from 2700 K to 6500 K
- Switching on / off
- Reset function
- Rich colours or other colours such as "Blood red" or "Cheddar yellow" are possible on request for custom modules

- **Operating elements**

Electronic potentiometer with pushbutton control for potentiometer control technology (not included in the scope of supply).

- **Note**

The LTS interface is not compatible with commercially available 1-10V control systems.

- **Features**
  - Switching between Brightness and Colour temperature operation modes by button operation on the potentiometer
  - Group control for up to 45 LTS (lights) per potentiometer
  - Only 2 lines required for the control system
  - Line lengths of up to 200 m are possible (potentiometer to LMU)

Item nos. and available products can be found in Chapter 9, "Order information".

3.3. Pushbuttons

Control options for LTS with pushbutton interface:

- **Control system options**
  - Brightness steplessly adjustable from 10% to 100%
  - Colour temperature steplessly adjustable from 2700 K to 6500 K
  - Switching on and off
  - Reset function
  - Rich colours or other colours such as "Blood red" or "Cheddar yellow" are possible on request for custom modules

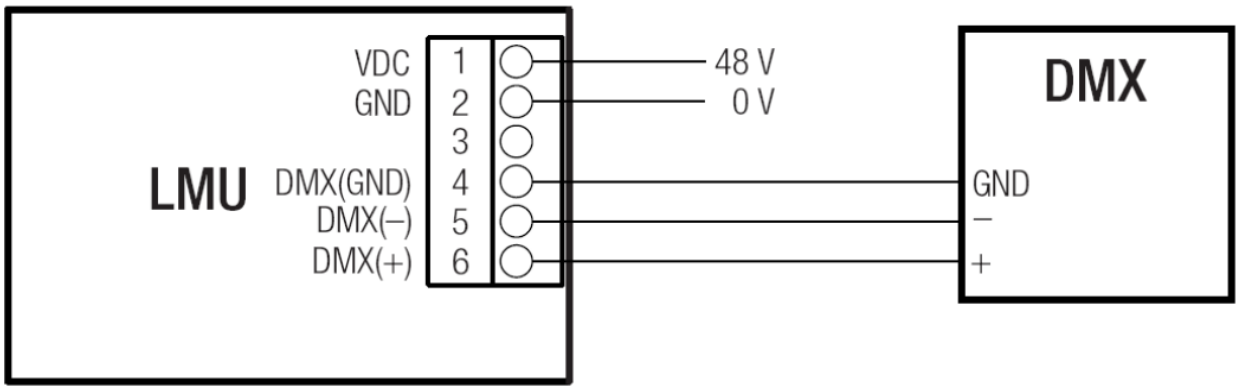
- **Features**
  - Switching between Brightness and Colour temperature operation modes by duplicated pushbutton operation
  - Only 2 lines required for the control system
  - Line lengths of up to 200 m are possible (potentiometer to LMU)

Item nos. and available products can be found in Chapter 9, "Order information".

4. Installation and operation with DMX

4.1. Connecting the LUMITECH PI-LED System (LTS) Light Management Unit (LMU)

The image below illustrates the setup for the LTS.



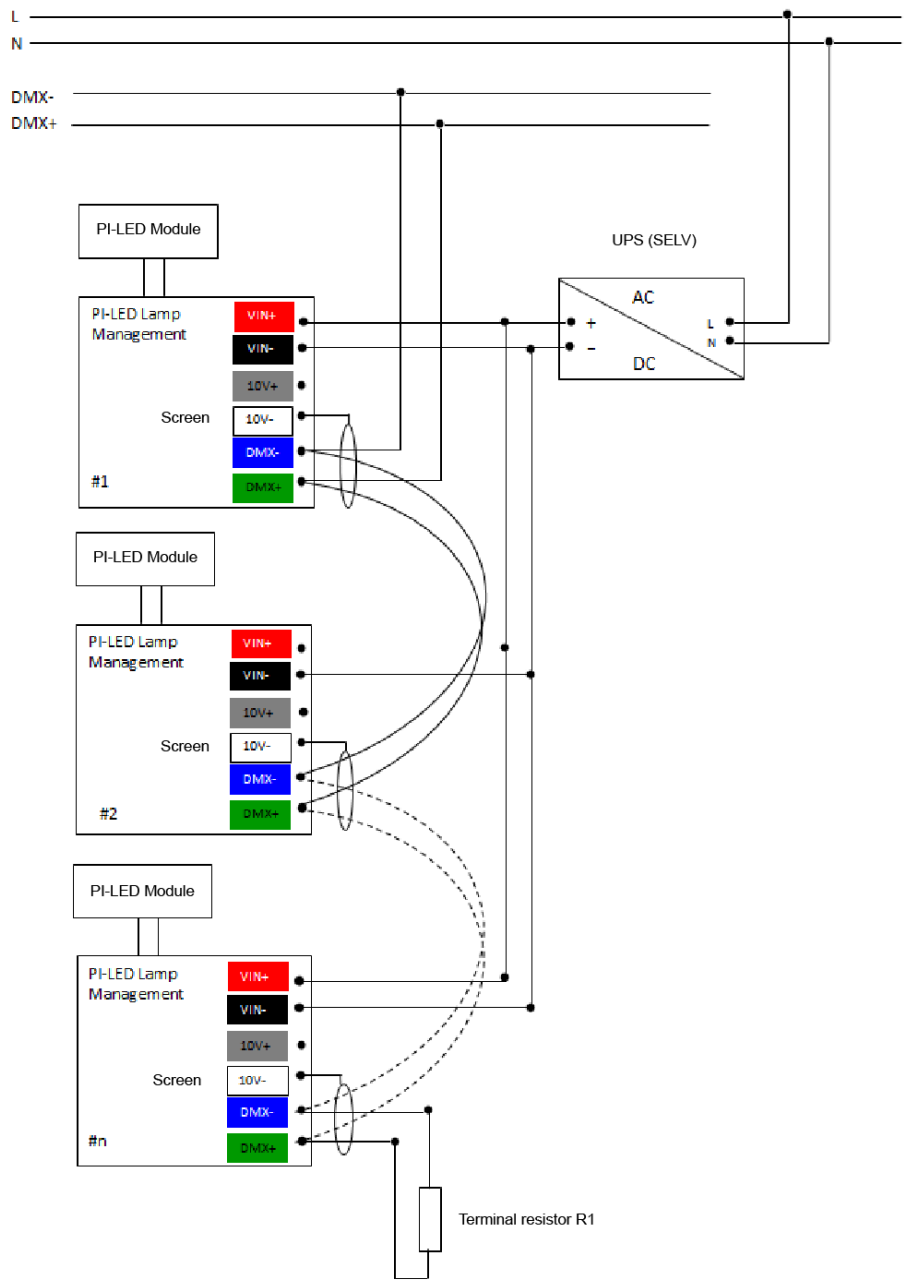
The connectors required for DMX control are "DMX-" (pin 5) and "DMX+" (pin 6) - be sure that the polarity is correct.

- **Note**

When controlling the LTS with DMX, connector pins 3 & 4 must not be used for 1-10V lines. Information on the power supply wiring (pins 1 & 2) can be found in the respective LTS installation and operating instructions.

Clamp-on conductor cross-section: min. 0.5 mm² - max. 1.5 mm²

4.2. Wiring



VIN 48V

A shielded twisted-wire cable must be used for the DMX line (pins 5 & 6), and the earth shielding line must be connected to the "Screen / 10V-" connector (pin 4).

Depending on the application, for DC termination, the two furthest ends of the entire DMX line (transmitter and last receiver in the chain) can be provided with a terminating resistor
R1 = 120 Ω (see wiring diagram). The decision whether or not to use terminating resistors is largely dependent on total line length and the signal quality of the application.

Up to 32 LTS can be connected to the BUS system without a booster. This number can be increased if required, depending on the selected DMX signal booster (not included in the scope of supply).

We recommend reading Item 4.3, "Commissioning" before wiring the LTS.

- **Note**

When wiring, ensure that each pin in the LTS is operating with the specified voltages, as there is otherwise a hazard which may destroy the unit and a risk of subsequent damage.

4.2.1. State with no DMX connector wiring

It is possible to leave the LMU's DMX control connectors (pins 5 & 6) open, meaning that these have no contact. DMX control is not possible in this case. The LTS will light with 100% brightness and the factory-set colour temperature of 2700K. See Item 7.2, "Behaviour upon disconnection of the control line", for further information.

4.3. Commissioning

The LTS is commissioned on the basis of the following principle:

1. **Defining group switching:** Wiring for all LTS to be grouped together under a single address (see 4.2, "Wiring")
2. **Addressing:** Assigning an individual address using defined sequential instruction sequences with a DMX control device (not included in the scope of supply)
3. **Confirmation:** The addressing is confirmed when the LTS flashes
4. Repeat steps 1 to 3 for each further addressing process

- **Note**

LTS, which are addressed in a single group circuit, have a common address and cannot therefore be individually controlled.

4.3.1. Addressing

Each LTS with DMX interface is controlled by 4 DMX channels. This means that up to 125 light addresses can be assigned per DMX universe (512 channels). Furthermore, group switching is possible. The table below illustrates this in schematic form:

Absolute DMX channel no.	1	2	3	4	5	6	7	8	…	497	498	499	500	501	…	512
	LTS #1				LTS #2				…	LTS #25				Service channels		
Relative DMX channel no.	1	2	3	4	1	2	3	4	…	1	2	3	4			

The addressing must be performed using the service channels. These service channels are applicable for all light groups connected to a DMX universe – regardless of their start address.

	Service channels											
Absolute DMX channel	501	502	503	504	505	506	507	508	509	510	511	512
Addressing function	Mode	Select address A (1-255)	Select address B (256-497)	Save address A	Save address B	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Mode
Permissible DMX value range	0; 2	0-255	0-241	0; 255	0; 255	0	0	0	0	0	0	0; 2

Once the service channels are sequentially assigned with the defined values, the light groups wired in Item 4.2 can be assigned a start address using the software. For this purpose, either an address in address range A (1-255) or an address in address range B (256-497) must be selected. If a start address in address range A (1-255) is selected, the following value combinations must be set **in succession**:

Absolute DMX channel	501	502	503	504	505	506	507	508	509	510	511	512
1. Addressing mode	2	0	0	0	0	0	0	0	0	0	0	2
2. Select address	2	Value	0	0	0	0	0	0	0	0	0	2
3. Save address	2	Value	0	255	0	0	0	0	0	0	0	2
4. Confirm	LTS for affected light group flashes											
5. Exit mode	0	0	0	0	0	0	0	0	0	0	0	0
In this instance, the light group is assigned the start address corresponding to "Value"												

If a start address in address range B (256-497) is selected, the following value combinations must be set in succession:

Absolute DMX channel	501	502	503	504	505	506	507	508	509	510	511	512
1. Addressing mode	2	0	0	0	0	0	0	0	0	0	0	2
2. Select address	2		Value	0	0	0	0	0	0	0	0	2
3. Save address	2		Value	0	255	0	0	0	0	0	0	2
4. Confirm	LTS for affected light group flashes											
5. Exit mode	0	0	0	0	0	0	0	0	0	0	0	0
In this instance, the light group is assigned the start address corresponding to "Value"												

The table below shows the main relationships between DMX values and start addresses:

DMX value of absolute DMX channel #502 (address range A)	Start address
0	1
1	1
2	2
3	3
10	10
100	100
241	241
255	255

DMX value of absolute DMX channel #502 (address range B)	Start address
0	256
1	257
2	258
3	259
10	266
100	356
241	497
242-255	n.a.

Note: When "0" is assigned to absolute DMX channel no. 502, value "1" is also assigned to start address #1. Furthermore, it is not possible to assign a start address > 497. Two examples of individual addressing are shown below.

Example 1: To assign address "3" to a light group:

Absolute DMX channel	501	502	503	504	505	506	507	508	509	510	511	512
1. Addressing mode	2	0	0	0	0	0	0	0	0	0	0	2
2. Select address	2	3	0	0	0	0	0	0	0	0	0	2
3. Save address	2	3	0	255	0	0	0	0	0	0	0	2
4. Confirm	LTS for affected light group flashes											
5. Exit mode	0	0	0	0	0	0	0	0	0	0	0	0
In this instance, the light group is assigned the start address corresponding to "3"												

Example 2: To assign address "259" to a light group:

Absolute DMX channel	501	502	503	504	505	506	507	508	509	510	511	512
1. Addressing mode	2	0	0	0	0	0	0	0	0	0	0	2
2. Select address	2	0	3	0	0	0	0	0	0	0	0	2
3. Save address	2	0	3	0	255	0	0	0	0	0	0	2
4. Confirm	LTS for affected light group flashes											
5. Exit mode	0	0	0	0	0	0	0	0	0	0	0	0
In this instance, the light group is assigned the start address corresponding to "259"												

4.3.2. Operation

An appropriate DMX control device such as a touch panel (not included in the scope of supply) provides the following control options:

- Adjustable brightness
- Switch-off (Standby)
- Three operating modes are available: Colour temperature, CIE colour coordination and Red-phosphorous-blue

- **Operating modes**
  - **Colour temperature (CTC mode):** Colour temperatures adjustable from 2700 K to 6500 K
  - **CIE colour coordinates (CIE mode):** CIE colour coordinates can be freely selected within the PI-LED colour range (e.g. "Blood red" and "Cheddar yellow")
  - **Red-phosphorous-blue (RPB mode):** These three PI-LED primary colours are independently adjustable – any combination of colours can be generated within the PI-LED colour range

As described under Item 4.3.1, "Addressing", absolute DMX channel addresses are defined relative to the address of the first LTS channel.

The table below shows an overview of the permissible value ranges, which are available for controlling the operating modes. To switch an LTS to a defined operating mode, on the relevant defined DMX channels must have a value ">0", all other DMX channels must have a value "0" (it is not otherwise possible to control the LTS).

	LUMITECH PI-LED system			
Relative DMX channel no.	**1**	**2**	**3**	**4**
Absolute DMX channel no.	Address	Address + 1	Address + 2	Address + 3
Control system functions	Mode selection	Brightness	Colour temperature	n.a.
DMX value range	0 - 255	0 - 255	0 - 255	0 - 255

Colour temperature CTC operating mode

Control system functions	Mode selection	Brightness	Colour temperature	n.a.
Permissible DMX control range	0 - 100	0; 26 - 255	0 - 255	0
Practical control range	n.a.	0; 10% - 100%	2700 K - 6500 K	n.a.
Practical resolution	n.a.	0.35%	15 K	n.a.

Red-Phosphorous-Blue operating mode

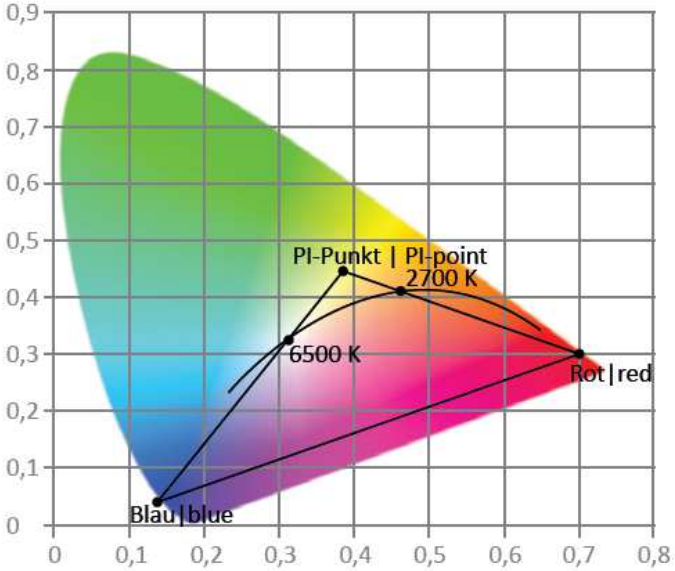
Control system functions	Mode selection	Brightness - Red	Brightness - Pi	Brightness - Blue
Permissible DMX control range	101 - 200	0 - 255	0 - 255	0 - 255
Practical control range	n.a.	0 - 100%	0 - 100%	0 - 100%
Practical resolution	n.a.	0.39%	0.39%	0.39%

CIE colour coordination operating mode

Control system functions	Mode selection	Brightness	CIE x-value	CIE y-value
Permissible DMX control range	201-255	0 - 255	0 - 255	0 - 255
Practical control range	n.a.	0; 10% - 100%	0.17 – 0.65	0.08 – 0.47
Practical resolution	n.a.	0.35%	0.00188	0.00153

4.3.3. PI-LED colour range

The colour range available for the LUMITECH PI-LED system is defined using a triangle in the CIE chart with the corners marking the three primary colours of the LEDs in the PI-LED module (red, phosphorous and blue).



If a colour coordinate is set outside this colour range, this is rejected by the LTS and the module flashes in the latest light colour set within the PI-LED colour range. In this case, a colour point within the PI-LED colour range must be selected.

4.3.4. Colour temperature operating mode

The following value ranges can be used to control colour temperatures and brightness:

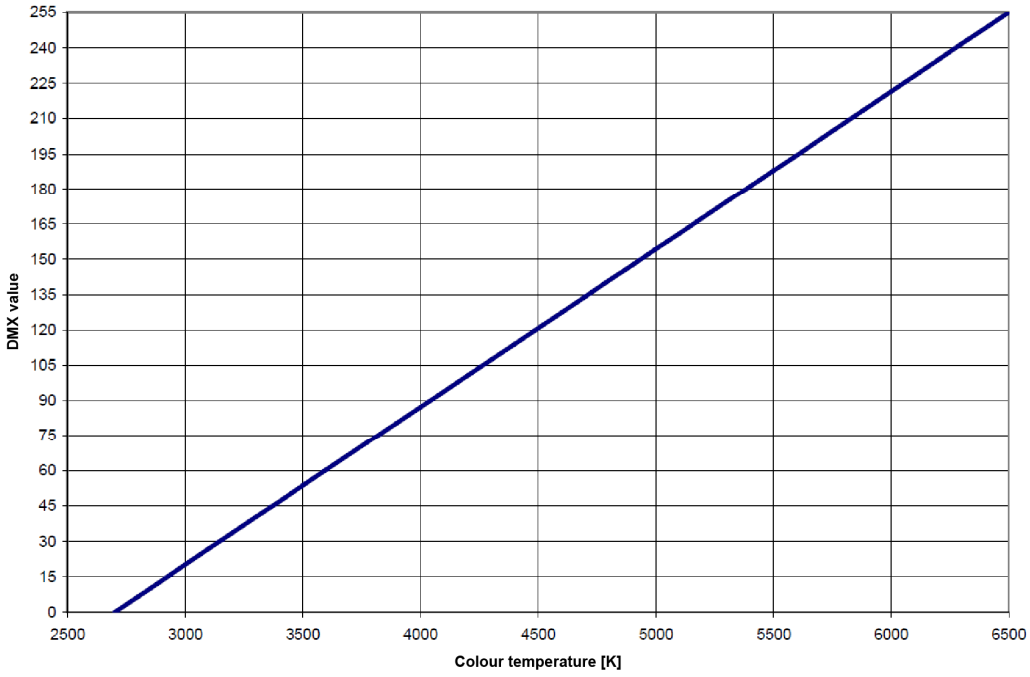
	LUMITECH PI-LED system			
Relative DMX channel no.	**1**	**2**	**3**	**4**
Absolute DMX channel no.	Address	Address + 1	Address + 2	Address + 3
Control system functions	Mode selection	Brightness	Colour temperature	n.a.
Permissible DMX control range	0-100	0; 26 - 255	0 - 255	0
Practical control range	n.a.	0; 10% - 100%	2700 K - 6500 K	n.a.
Practical resolution	n.a.	0.35%	15 K	n.a.

*Brightness settings in DMX value range 1-25 (equivalent to 1-9%) are not allowed. Value "0" indicates standby state "Off".

DMX values for channel no. 3 can be determined dependent on the desired colour temperature using the calculation formula or the diagram below. The result of the calculation is rounded in order to obtain an integer DMX value.

$$DMX_{\#3} = \frac{CCT - 2700}{6500 - 2700} \times 255$$

$DMX_{\#3}$ … DMX value for channel no. 3
CCT …Colour temperature [K]



4.3.5. Red-Phosphorous-Blue operating mode

The three primary colours of the PI-LED module can be controlled independently using this operating mode. The result is a light which is mixed in accordance with the principle of additive colour mixing.

	LUMITECH PI-LED system			
Relative DMX channel no.	**1**	**2**	**3**	**4**
Absolute DMX channel no.	Address	Address + 1	Address + 2	Address + 3
Control system functions	Mode selection	Brightness	Colour temperature	n.a.
Permissible DMX control range	101 - 200	0 - 255	0 - 255	0 - 255
Practical control range	n.a.	0 - 100%	0 - 100%	0 - 100%
Practical resolution	n.a.	0.39%	0.39%	0.39%

4.3.6. CIE colour coordination operating mode

CIE colour coordinates can be set using two DMX channels (channel no. 3 for "x" and channel no. 4 for "y"). Example applications include the colours "Cheddar yellow" and "Blood red" for food product presentations. When selecting colour coordinates, it must be ensured that only colour points within the PI-LED colour range are selected.

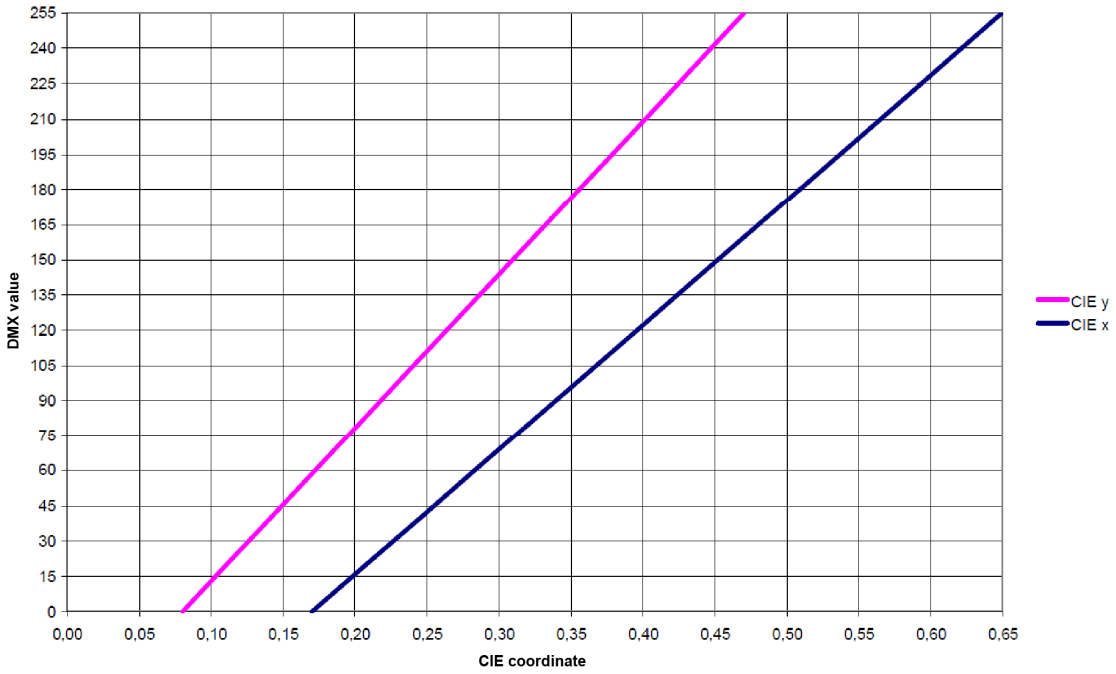
	LUMITECH PI-LED system			
Relative DMX channel no.	**1**	**2**	**3**	**4**
Absolute DMX channel no.	Address	Address + 1	Address + 2	Address + 3
Control system functions	Mode selection	Brightness	CIE x-value	CIE y-value
Permissible DMX control range	201 - 255	0 - 255	0 - 255	0 - 255
Practical control range	n.a.	0; 10% - 100%	0.17 - 0.65	0.08 - 0.47
Practical resolution	n.a.	0.35%	0.00188	0.00153

DMX values for channels no. 3 and 4 can be determined dependent on the desired colour temperature using the calculation formulae or the diagram below. The result of the calculation is rounded in order to obtain an integer DMX value.

$$DMX_{\#3} = \frac{x_{CIE} - 0{,}17}{0{,}00188}$$

$$DMX_{\#4} = \frac{y_{CIE} - 0{,}08}{0{,}00153}$$

$DMX_{\#3}$ … DMX value for channel no. 3
$DMX_{\#4}$ … DMX value for channel no. 4
x_{CIE} … x – coordinate
y_{CIE} … y – coordinate



4.4. Service function (broadcast commands)

A specific service function can be performed on all LTS DMX connected to a DMX universe using a batch command (broadcast command) via the service channels (# 501 - # 512). These service functions and broadcast commands operate "globally" and are thus independent of the individual start address lights and / or light groups.
The following service functions are available:

- Reset start addresses (broadcast command)
- Global control (broadcast command)
- Addressing (broadcast command)

- Caution

In the event of a broadcast command, all LTS DMX which are connected to the DMX bus and supplied with power are addressed, reset or controlled, depending on the type of command! Particular care must therefore be taken with the two commands "Reset start addresses" and "Addressing", as these overwrite all addresses in the connected LTS DMX. There is no "Undo"! The wiring for any light not intended for the relevant broadcast command must be disconnected as per the description in Item 4.2 before triggering the broadcast command!

4.4.1. Reset start addresses

This function resets the start addresses for all LTS DMX connected to the DMX universe to their factory setting (start address #1). As confirmation, all of the affected LTS DMX flash until the mode is exited using step 4, "Exit mode".

Absolute DMX channel	501	502	503	504	505	506	507	508	509	510	511	512
1. Start reset mode	1	10	20	30	40	50	60	70	80	90	100	0
2. Execute	1	10	20	30	40	50	60	70	80	90	100	1
3. Confirm	LTS flashes											
4. Exit mode	0	0	0	0	0	0	0	0	0	0	0	0
In this case, the start addresses for all affected LTS are reset to "1".												

4.4.2. Global control

This function enables all LTS in a DMX universe to be controlled, regardless of their start addresses, using the operating modes given in chapter 4.3 (CTC mode, RPB mode and CIE mode). The 4 relative DMX channels are set to broadcast mode using the absolute DMX channels #502 - #505.

Absolute DMX channel	501	502	503	504	505	506	507	508	509	510	511	512
1. Start broadcast mode	3	0	0	0	0	0	0	0	0	0	0	3
2. Execute	1	Rel. channel #1	Rel. channel #2	Rel. channel #3	Rel. channel #4	0	0	0	0	0	0	3
3. Exit mode	0	0	0	0	0	0	0	0	0	0	0	0

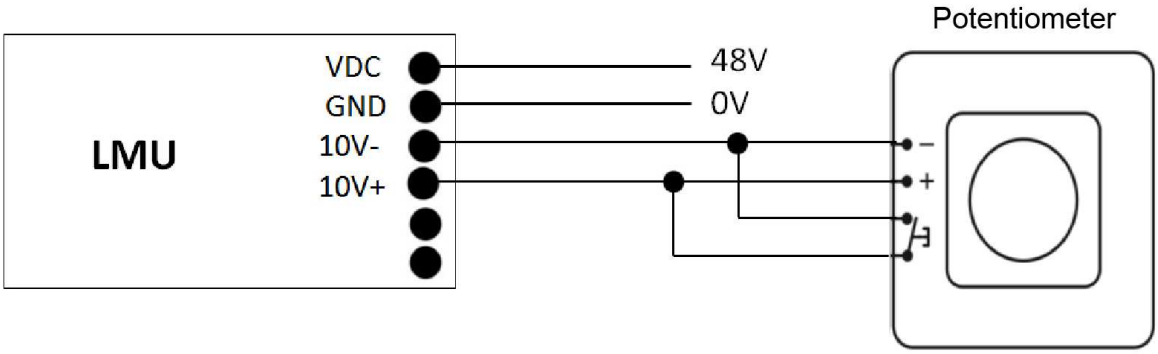
4.4.3. Addressing

LTS addressing uses software addressing. This requires 4 relative DMX channels to be set aside in the DMX universe. Hardware addressing is not supported by the LTS. A detailed description of software addressing can be found in Chapter 4.3.

5. Installation and operation with potentiometer

5.1. Connecting the LUMITECH PI-LED System (LTS) Light Management Unit (LMU)

The image below illustrates the setup for the LTS.



The connectors required for the potentiometer control system technology are pin 3/ 10V+ and pin 4/ 10V-.

Notes:
An LTS with potentiometer technology cannot be controlled using DMX. The relevant connectors (pins 5 & 6) must not be used.

Clamp-on conductor cross-section: min. 0.5 mm^2 – max. 1.5 mm^2.

5.2. Wiring

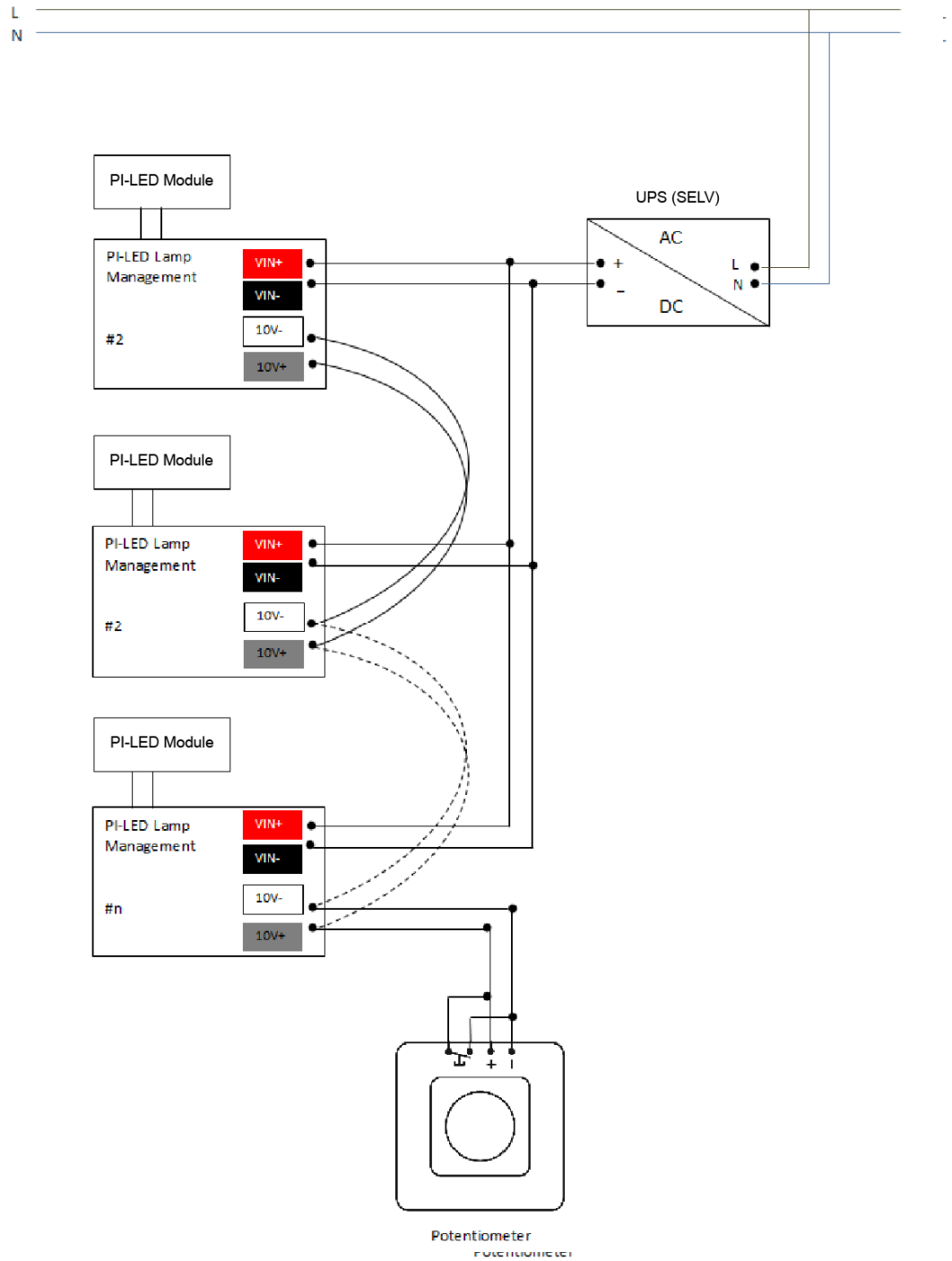
In order to be able to use an LTS with potentiometer control technology, an electronic potentiometer with pushbutton functions (contacts) for 1 – 10 V technology is required (not included in the scope of supply).

LUMITECH recommends the following operating element:
"Electronic potentiometer with pushbutton function for 10V control input"
Manufacturer: GIRA /www.gira.de, item no. 0308 00

Or an appropriately designed potentiometer with linear characteristics:

- **Note**

The LTS interface is **not** compatible with commercially available 1 - 10 V control systems.



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On the basis of the circuit wiring shown, group switching of up to 45 LTS is possible.
The length of the control line can be max. 200 m.

- **Note**

When wiring, ensure that each pin in the LTS LMU is operating with the specified voltages, as there is otherwise a hazard which may destroy the LTS and a risk of subsequent damage.

5.2.1. State with no potentiometer connector wiring

It is possible to leave the LTS LMU potentiometer control connectors (pins 3 & 4) open, meaning that these have no contact. Control is not possible in this case. The LTS lights with 100% brightness and the last selected colour temperature is set. If the colour temperature has never been changed manually, as is the case during commissioning, the factory-set default colour temperature of 2700 K is set.

5.3. Commissioning

The electronic potentiometer's trim resistor must be turned to its minimum setting. This will ensure that the unit initializes the minimum value of the potentiometer cleanly.

5.4. Operation

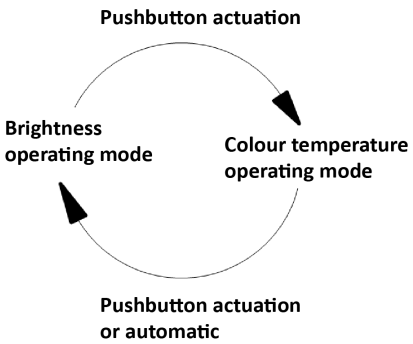
The potentiometer provides the following control options:

- Brightness steplessly adjustable from 10% to 100%
- Colour temperature steplessly adjustable from 2700 K to 6500K
- Switch-off (Standby) at the lowest potentiometer setting
- In addition, the pushbuttons also provide the following control options:
    - Switching between Brightness and Colour temperature operation modes
    - Reset function
    - Parameter settings: Enabling and disabling the standby function

5.4.1. Brightness and colour temperature operating modes

The LTS differentiates between the Brightness and Colour temperature operation modes. Depending on the currently active operating mode, the potentiometer can be used to steplessly adjust either the brightness or the colour temperature.

Press a button to switch between the two operating modes. This switchover is confirmed by means of the LED module briefly dimming on and off.

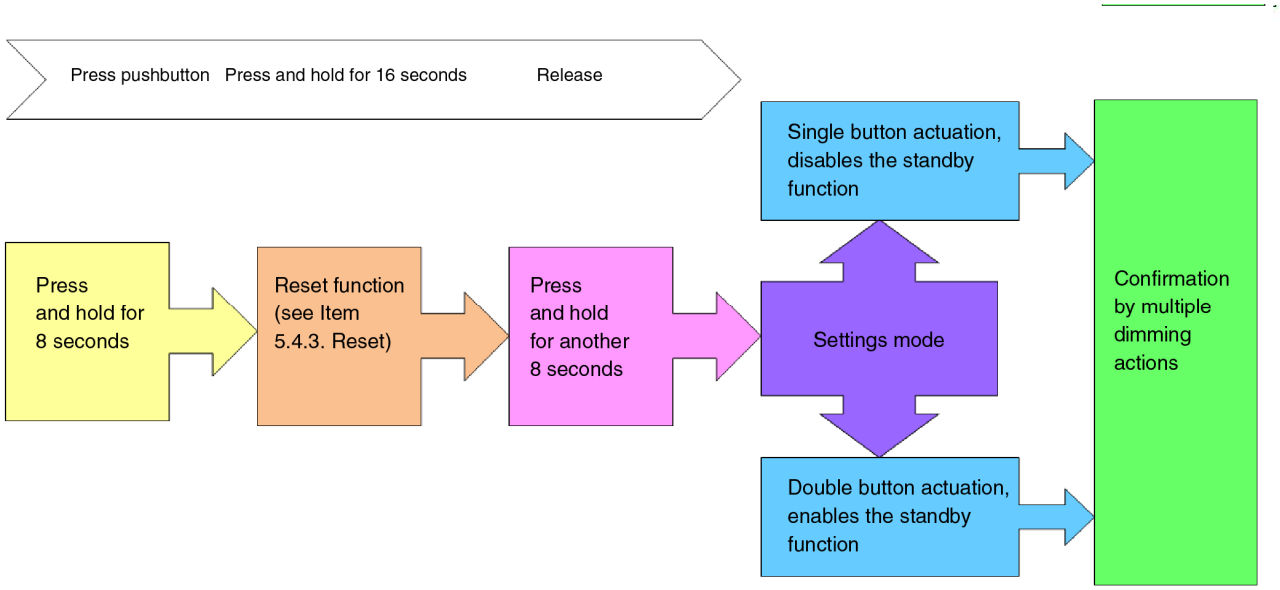


The operating mode is automatically set to "Brightness" when:

- A pushbutton is actuated in Colour temperature operating mode
- After 8 seconds of inactivity in Colour temperature operating mode
- After power is restored
- After switching on using the standby function
- After a reset

5.4.2. Standby

The LTS LMU provides a standby function, meaning that the LTS switches itself off once it reaches the minimum potentiometer setting. This standby function is disabled at the factory. This means that at the lowest potentiometer setting, a brightness level of 10% is set. The status of the standby function can be either enabled or disabled. To change this status, the pushbutton must be held down for 16 secs. (Note: After the first 8 secs. have elapsed, the reset function is executed -> see Item 6.4.3. Reset). Once the 16 sec. time period has elapsed, the LTS confirms the launch of Settings mode by briefly dimming on and off. Within the next 5 seconds, the standby function can then be disabled by pressing the pushbutton once, or enabled by pressing the pushbutton twice. This change is confirmed by the LTS by means of several dimming actions.



- **Note**

When the LTS is switched off using standby, the LUMITECH LTS is not powered down. It must also be ensured that when the standby function is enabled, the possible control range can be reduced at low brightness levels. This means that the minimum adjustable brightness when the standby function is enabled is more than 10%. In contrast, the brightness control range when the standby function is disabled is between 10% and 100%.

5.4.3. Reset

Pressing the pushbutton for 8 seconds resets the LTS to the following values:

- Brightness operating mode
- Brightness 100%
- Colour temperature 2700 K

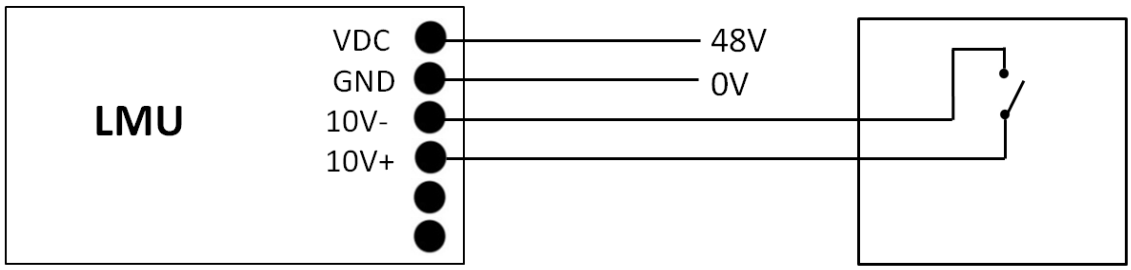
- **Note**

The status of the standby function is not reset during a reset, meaning it is neither enabled or disabled.

6. Installation and operation with pushbuttons

6.1. Connecting the LTS Light Management Unit (LMU)

The image below illustrates the setup for the LTS.



The connectors required for the pushbutton control system technology are pin 3/ 10V+ and pin 4/ 10V-.

- **Note**

An LTS with pushbutton technology cannot be controlled using DMX. The relevant connectors (pins 5 & 6) must not be used. Information on the power supply wiring (pins 1 & 2) can be found in the respective LTS installation and operating instructions.

Clamp-on conductor cross-section: min. 0.5 mm^2 – max. 1.5 mm^2

6.2. Wiring

Commercially available non-sprung pushbuttons can be with used to operate an LTS with pushbutton control technology.

6.2.1. State with no pushbutton connector wiring

It is possible to leave the LTS LMU pushbutton control connectors (pins 3 & 4) open, meaning that these have no contact. Control is not possible in this case. The LTS lights with 100% brightness and the last selected colour temperature is set. If the colour temperature has never been changed manually, as is the case during commissioning, the factory-set default colour temperature of 2700 K is set.

6.3. Commissioning

The LTS must be commissioned with pushbutton contacts in the open position. Otherwise, the device may not start correctly, and may set an incorrect pushbutton value.

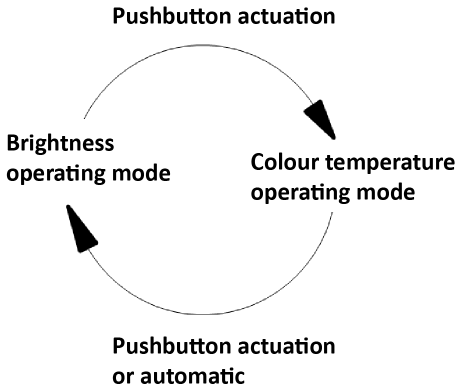
6.4. Operation

The pushbuttons provide the following control options:

- Brightness steplessly adjustable from 10% to 100%
- Colour temperature steplessly adjustable from 2700 K to 6500K
- Switch-off (Standby)
- Switching between Brightness and Colour temperature operation modes
- Reset function

6.4.1. Brightness and colour temperature operating modes

The LTS differentiates between the Brightness and Colour temperature operation modes. Depending on the currently active operating mode, the pushbuttons can be used to steplessly adjust either the brightness or the colour temperature. Press a pushbutton twice to switch between the two operating modes.



The operating mode is automatically set to "Brightness" when:

- After 8 seconds of inactivity in Colour temperature operating mode
- After power is restored
- After switching on from Standby by pressing a pushbutton
- After a reset

6.4.2. Standby

The LTS can be switched to standby by pressing a pushbutton once. Similarly, standby can be exited again by pressing a pushbutton once.

- **Note**

When the LTS is switched off using standby, the LTS is not powered down.

6.4.3. Reset

Pressing the pushbutton continuously for 8 seconds resets the LTS to the following values:

- Brightness operating mode
- Brightness 100%
- Colour temperature 2700 K

7. Defined states

7.1. Behaviour following power supply interruptions

7.1.1. DMX

- **Type 1**

When **the DMX values are not modified** following a power supply interruption, each DMX value which was active prior to the power supply interruption will be retrieved from the LTS once the power supply is resumed.

- **Type 2**

When all DMX values are set to value "0" following a power supply interruption, each DMX value which was active prior to the power supply interruption will be retrieved from the
LTS once the power supply is resumed. This means that in this case, "0" values are not retrieved.

- **Type 3**

If **a number of DMX values are set to "#0"** following a power supply interruption, these newly-set DMX values are retrieved once the power supply is resumed.

7.1.2. Potentiometer

Once the power supply is resumed, the Brightness operating mode is activated, and the last input values for brightness and colour temperature are set. If the LTS was switched off using the standby function before the power supply interruption, this state is restored once the power supply is resumed.

7.1.3. Pushbuttons

Once the power supply is resumed, the Brightness operating mode is activated, and the last input values for brightness and colour temperature are set.
If the LTS was on standby before the power supply interruption, this state is restored once the power supply is resumed.

7.2. Behaviour when the control line is disconnected

7.2.1. DMX

Basically, DMX control technology must transmit uninterrupted signals along the control lines. In the event that these DMX signals are interrupted, for example when the control line is disconnected, the following state are restored on the LTS:

- **Type 1**

DMX signal interruption **<= 3 seconds:**
The set brightness and colour temperature values remain stored in the LTS.

- **Type 2**

DMX signal interruption **> 3 seconds:**
The LTS automatically switches to 100% brightness and colour temperature to 2700 K.

7.2.2. Potentiometer

When the potentiometer detects an interruption on the control line, this is detected as maximum resistance. In this instance, the LTS dimmer is set to 100%. In the event that an interruption is detected while colour temperature mode is active, the LTS sets this to 6500 K.

7.2.3. Pushbuttons

Any interruption in the pushbutton control line will have no effect on the current brightness and the colour temperature. No further control is possible, however.

8. Further reference documentation

Updated information on the LUMITECH PI-LED product range is available for download from www.lumitech.at.

9. Ordering information

9.1. DMX

Please refer to the item numbers in the following table when ordering an LTS for DMX control:

Item no.	Product designation	Description
LTS-02002-04-V01	PI-LED Linear 2000 lm, DMX, 350 mA, 140 mm	PI-LED module, linear
LTS-01000-04-V01	PI-LED Spot 1000 lm, DMX, 350 mA, 140 mm	PI-LED module, square
LTS-01500-04-V01	PI-LED Spot 1500 lm, DMX, 500 mA, 140 mm	PI-LED module, square
LTS-02000-04-V01	PI-LED Spot 2000 lm, DMX, 350 mA, 140 mm	PI-LED module, square
LTS-02500-04-V01	PI-LED Spot 2500 lm, DMX, 500 mA, 140 mm	PI-LED module, square
LTS-01001-04-V01	PI-LED Spot ZH 1000 lm, DMX, 350 mA, 140 mm	PI-LED module, Zhaga
LTS-01501-04-V01	PI-LED Spot ZH 1500 lm, DMX, 500 mA, 140 mm	PI-LED module, Zhaga
LTS-02001-04-V01	PI-LED Spot ZH 2000 lm, DMX, 350 mA, 140 mm	PI-LED module, Zhaga
LTS-02501-04-V01	PI-LED Spot ZH 2500 lm, DMX, 500 mA, 140 mm	PI-LED module, Zhaga

- **Note**

The connector cable is not included in the LTS scope of supply.

9.2. Potentiometer

Please refer to the item numbers in the following table when ordering an LTS for potentiometer control:

Item no.	Product designation	Description
LTS-02002-01-V01	PI-LED Linear 2000 lm, 1-10 V, 350 mA, 140 mm	PI-LED module, linear
LTS-01000-01-V01	PI-LED Spot 1000 lm, 1-10 V, 350 mA, 140 mm	PI-LED module, square
LTS-01500-01-V01	PI-LED Spot 1500 lm, 1-10 V, 500 mA, 140 mm	PI-LED module, square
LTS-02000-01-V01	PI-LED Spot 2000 lm, 1-10 V, 350 mA, 140 mm	PI-LED module, square
LTS-02500-01-V01	PI-LED Spot 2500 lm, 1-10 V, 500 mA, 140 mm	PI-LED module, square
LTS-01001-01-V01	PI-LED Spot ZH 1000 lm, 1-10 V, 350 mA, 140 mm	PI-LED module, Zhaga
LTS-01501-01-V01	PI-LED Spot ZH 1500 lm, 1-10 V, 500 mA, 140 mm	PI-LED module, Zhaga
LTS-02001-01-V01	PI-LED Spot ZH 2000 lm, 1-10 V, 350 mA, 140 mm	PI-LED module, Zhaga
LTS-02501-01-V01	PI-LED Spot ZH 2500 lm, 1-10 V, 500 mA, 140 mm	PI-LED module, Zhaga

- **Note**

The connector cable is not included in the LTS scope of supply.

9.3. Pushbuttons

Please refer to the item numbers in the following table when ordering an LTS for pushbutton control:

Item no.	Product designation	Description
LTS-02002-02-V01	PI-LED Linear 2000 lm, 1-10 VT, 350 mA, 140 mm	PI-LED module, linear
LTS-01000-02-V01	PI-LED Spot 1000 lm, 1-10 VT, 350 mA, 140 mm	PI-LED module, square
LTS-01500-02-V01	PI-LED Spot 1500 lm, 1-10 VT, 500 mA, 140 mm	PI-LED module, square
LTS-02000-02-V01	PI-LED Spot 2000 lm, 1-10 VT, 350 mA, 140 mm	PI-LED module, square
LTS-02500-02-V01	PI-LED Spot 2500 lm, 1-10 VT, 500 mA, 140 mm	PI-LED module, square
LTS-01001-02-V01	PI-LED Spot ZH 1000 lm, 1-10 VT, 350 mA, 140 mm	PI-LED module, Zhaga
LTS-01501-02-V01	PI-LED Spot ZH 1500 lm, 1-10 VT, 500 mA, 140 mm	PI-LED module, Zhaga
LTS-02001-02-V01	PI-LED Spot ZH 2000 lm, 1-10 VT, 350 mA, 140 mm	PI-LED module, Zhaga
LTS-02501-02-V01	PI-LED Spot ZH 2500 lm, 1-10 VT, 500 mA, 140 mm	PI-LED module, Zhaga

- **Note**

The connector cable between the LED module and the LMU is included in the LTS scope of supply.

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