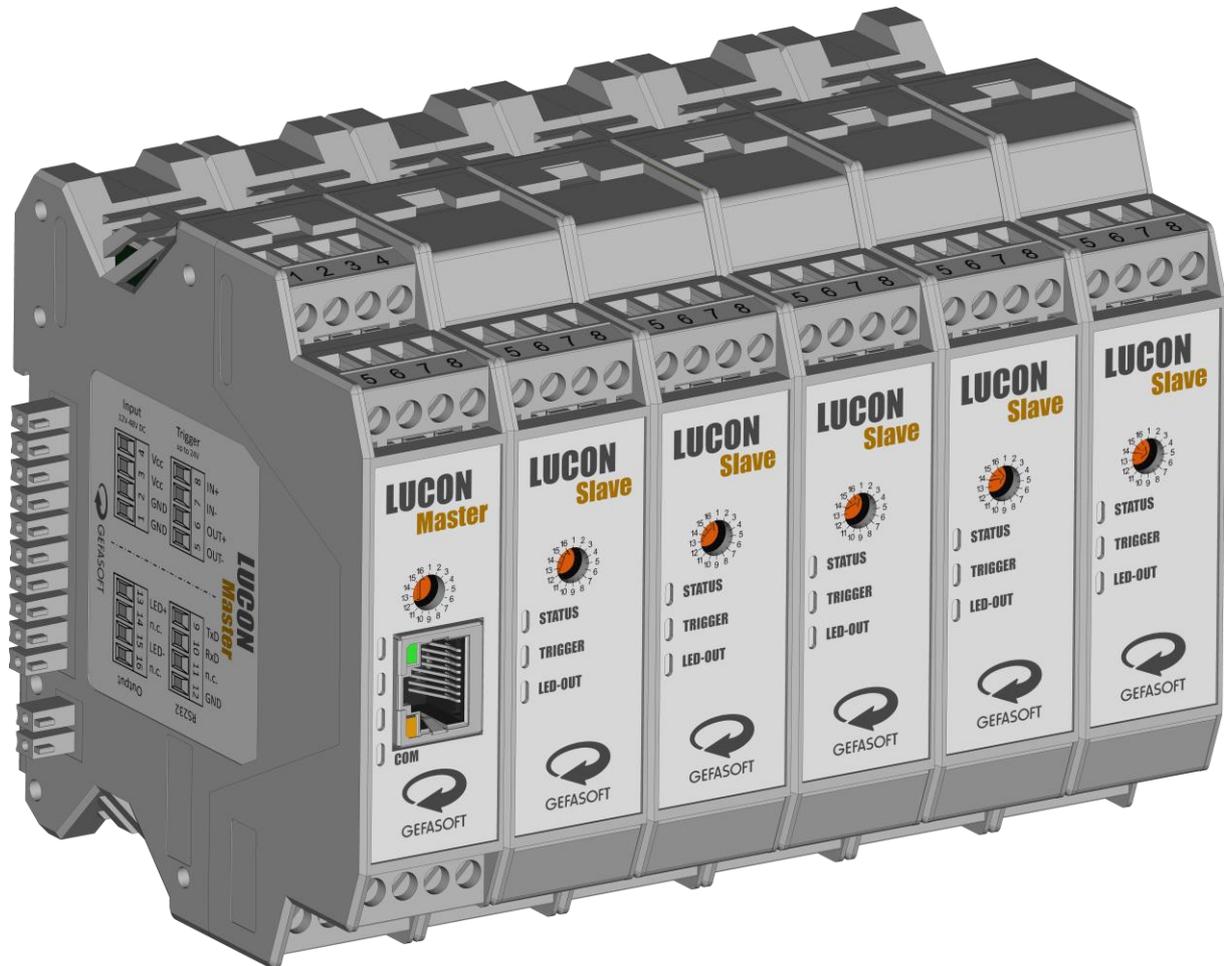




GEFASOFT



LUCON® 2

PRODUCT MANUAL

(original instructions)

Issue date: December 22, 2023
Revision: 1.5

Keep for future reference!

Short description

The LUCON® 2 is a precision light controller with current and voltage control for LED lighting for industrial image processing applications. The lighting can be controlled in both continuous and flash mode. Currents from 1 mA to 20 A are possible.

By regulating current and voltage, a high degree of efficiency and thus lower heat generation is possible.

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1 General

1.1 Identification data

1.1.1 Product

Producer	GEFASOFT Automatisierung und Software GmbH Regensburg	
Article No.	00039600	LUCON® 2 Master
	00039601	LUCON® 2 Slave

1.1.2 Product manual

Revision	1.5
Issue date	December 22, 2023



1.2 Indicators on the light controller

1.2.1 Type plate

In addition to the type of designation, the type plate contains the article number and the serial number. Among other things, it contains the EU conformity mark, which indicates that the product complies with European safety standards.



1.2.2 Warning signs



Warning of dangerous electrical voltage!

Work on the electrical system may only be carried out by a qualified electrician.



Warning of hot surface!

Workpieces and system parts can become very hot.

Failure to observe this warning may result in minor or slight injuries, including burns!

1.2.3 Note

Please also observe other equipment labels!



1.2.4 Software Licensing Information

The software in the Light controller includes the lwIP TCP/IP implementation. The copyright information for this implementation is as follows:

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2 How to use this guide

First of all, read this manual completely so that you can use all the functions correctly and safely.

2.1 Symbols

The following pictograms and key words are used for the information and warnings:



This symbol warns you of an immediate danger to life and human health.

Serious injury or death may result.



This symbol warns you of a hazard for life and human health.

Serious injury or death may result.



This symbol warns you of a possible hazard for human health and/or material damage.

Injury or material damage may result.



Information

Tips and information on the operation of the product!



Note

Commitment to a particular behaviour or activity for the safe handling of the equipment.



Supplementary instructions

Reference to GEFASOFT Automatisierung und Software GmbH supplementary instructions.



Click



3 Safety

3.1 General safety information

The product has been designed and built-in accordance with the applicable standards and other technical specifications. It corresponds to the state of the art and therefore guarantees safety during operation.

The requirements and instructions provided here regarding the work and operational safety of the product apply both to operation by operating staff and to servicing (comprising setting, adjustment, maintenance, care and repair that typically require that the group of people performing these types of work have higher qualifications). It is the responsibility of the user to convey the safety-relevant information in this document to his staff to ensure that the persons entrusted with operation and servicing attain a full understanding of the material. Further written instructions may need to be added to the company's work procedures based on operational conditions.

In the event that these fundamental requirements cannot be guaranteed, life-threatening hazards, risks for the product and other assets owned by the user and possible impairment of the effective performance of the product may result.

In the event of damage, destruction or insufficient functionality of the protective devices, the product is to be deactivated until its functionality has been fully restored. If any of the protective devices need to be disassembled or deactivated for maintenance, repair or another reason, their full functionality is to be restored before recommissioning them.

The risk of accidents is very high during service or maintenance. For this reason, this work is to be performed only when the machine is not in operation. During work on electric and electronic system components, the power cord must also be unplugged, and the system is to be guarded against being turned on again by unauthorized persons.



The product may only be operated and maintained by staff who have been authorized and instructed by the user. The user of the product is responsible for the safety of the operator!

The product may only be operated in accordance with these instructions for use. Ensure that everyone who works with the system has read this guide and also understood it. Persons who are authorized for operation and maintenance must be selected under consideration of the aspects of a high degree of reliability and the equivalent specialist knowledge.

3.2 Intended use

The product is intended exclusively for use as a power source for the control of LED lighting in industrial image processing. For this purpose, mounting in a control cabinet is intended. Furthermore, use on a public DC supply network is not supported.

Make sure that the cables used (power supply, lighting, RS-232, trigger and Ethernet) do not exceed a length of ten metres.

The product is not intended for use in potentially explosive atmospheres. Furthermore, the unit is only intended for use in closed and dry rooms.

If the product is to be used in other environments or for other purposes as described in the operating instructions, the manufacturer GEFASOFT Automatisierung und Software GmbH must be contacted and express permission obtained. Necessary changes and adjustments to the product may only be carried out by the manufacturer.

It must be ensured that the product is only used in a technically perfect condition and in accordance with



its intended use and in a safety-conscious and hazard-conscious manner. Furthermore, the product must be used by authorized personnel in accordance with the specifications in these operating instructions.

3.3 Improper use

A use other than that described under “Intended use” or that goes beyond such use is considered to be improper!

3.4 Residual risks

Electric current

Observe the following safety instruction:

Safety notice



HAZARD

Electric shock!

Defective electrical components may be live. Danger to life when touching these components.

- Defects found in electrical components and equipment must be rectified immediately.
 - The system must be taken out of operation and secured against being switched on again as long as any defects found have not been rectified.
 - The system must not be put back into operation until any defects found have been reliably rectified.
 - For all work, work according to the circuit diagram!
 - Before starting the system, check whether all electrical connections are connected. According to their design, the electrical connections may have to be screwed or locked.
-



4 Design and function

The LUCON® 2 is a precision light controller with current and voltage control for LED lighting for industrial image processing applications. The lighting can be controlled both in continuous operation and in flash mode. Currents of up to 20 A are possible.

By regulating current and voltage, a high degree of efficiency and thus lower heat generation is possible.

Thanks to the modular master/slave architecture, the LUCON® 2 light controllers can be used in a wide range of applications. One LUCON® 2 module is required per lighting. In total, up to 16 independent lighting systems can be controlled. A LUCON® 2 Master consists of both a communication part and a power part. It therefore serves as an interface between the user and the lighting. A LUCON® 2 Slave, on the other hand, consists only of a power section.

All connected channels can be configured conveniently and easily via a single interface on the master module. The respective channel configuration is stored decentral in each module separately.

4.1 Device views

4.1.1 LUCON® 2 Master

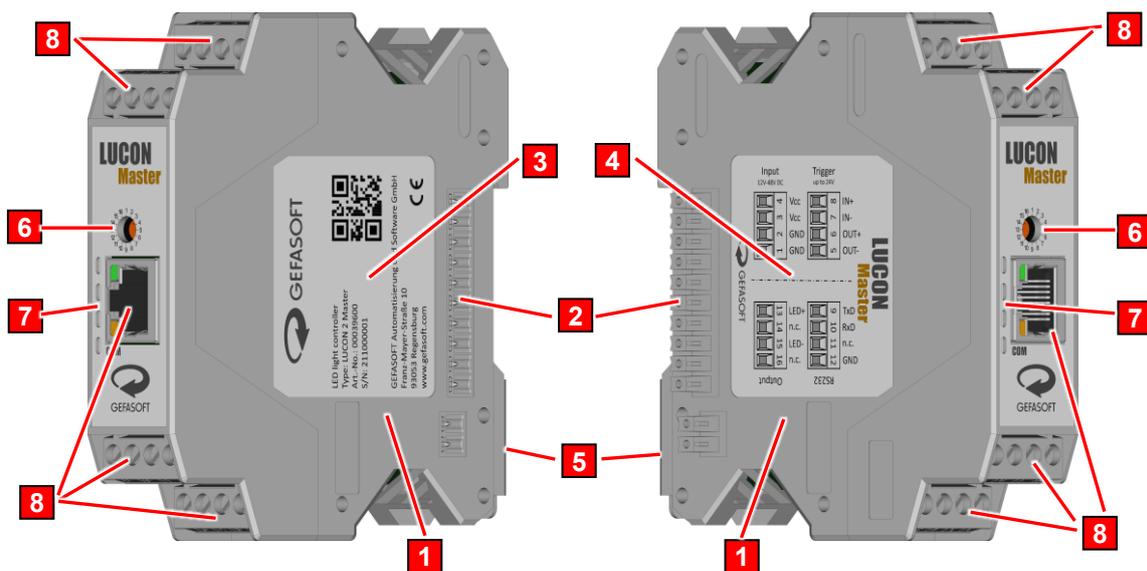


Figure 1: Device views LUCON® 2 Master

- | | | | |
|----------|-----------------------------------|----------|---|
| 1 | Housing | 5 | Mounting bracket |
| 2 | Cross-connector bus | 6 | Rotary switch for address configuration |
| 3 | Sticker with type plate | 7 | Status LED display |
| 4 | Sticker with interface assignment | 8 | Interfaces |



4.1.2 LUCON® 2 Slave

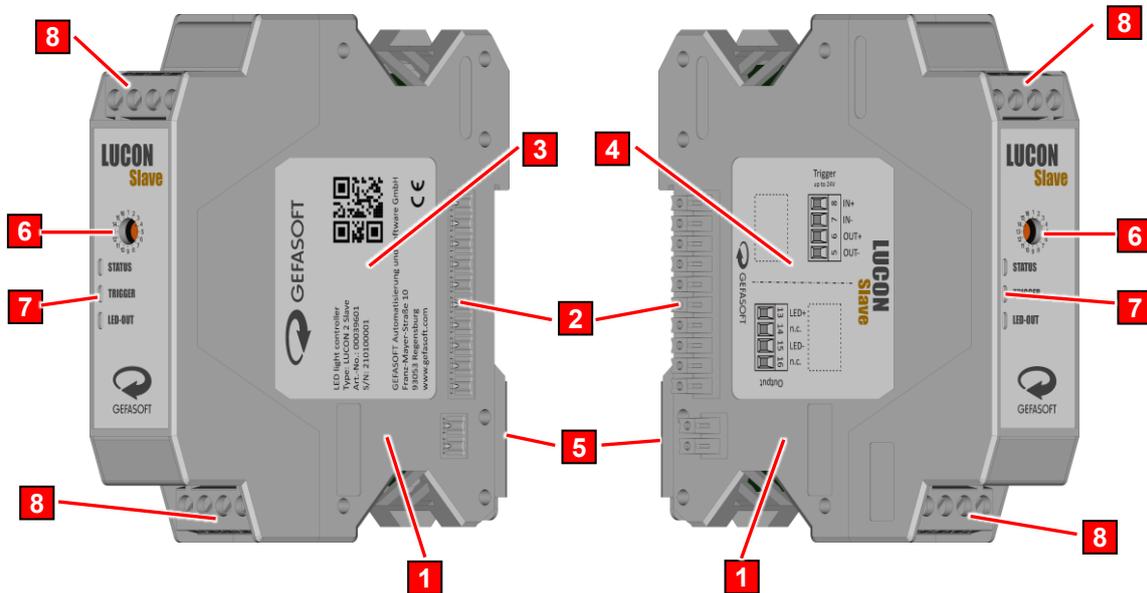


Figure 2: Device views LUCON® 2 Slave

- | | | | |
|----------|-----------------------------------|----------|---|
| 1 | Housing | 5 | Mounting bracket |
| 2 | Cross-connector bus | 6 | Rotary switch for address configuration |
| 3 | Sticker with type plate | 7 | Status LED display |
| 4 | Sticker with interface assignment | 8 | Interfaces |



4.2 Status LED-display

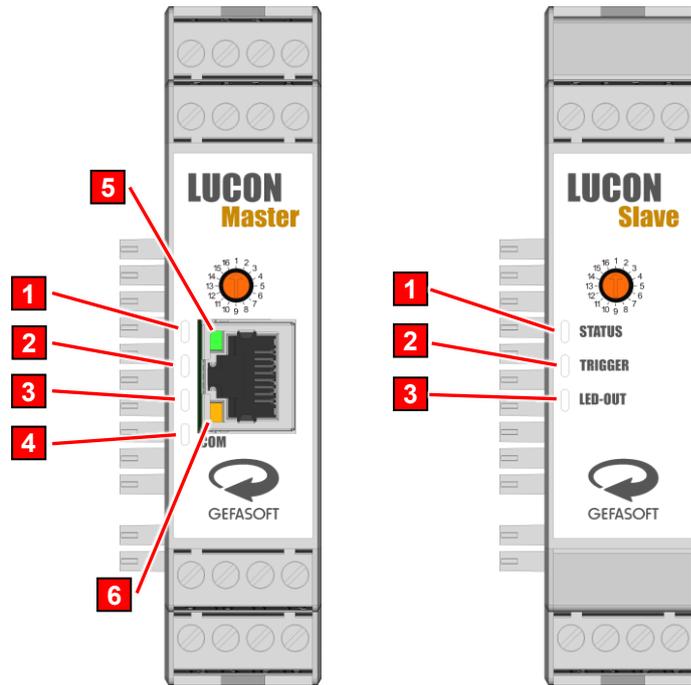


Figure 3: Front views LUCON® 2

- | | | | |
|----------|-------------|----------|----------|
| 1 | Status-LED | 4 | COM-LED |
| 2 | Trigger-LED | 5 | Link-LED |
| 3 | LED-Out-LED | 6 | Act-LED |

LED	Color	Status	Description
Status	red	on	A "small" error has occurred (e.g. voltage limit too small => output still switched)
		flashes (250 ms)	A "major" error has occurred (if status, trigger and LED-OUT LED flash simultaneously) => no operation possible
	green	on	Device is ready and configured
		flashes (500 ms)	LUCON® 2 device is ready but not configured (if status, trigger and LED-OUT LED flash simultaneously)
	blue	flashes (250 ms)	Device is in configuration mode
		flashes (500 ms)	Device updates firmware (when status, trigger and LED-OUT LED flash simultaneously)
pink	flashes (500 ms)	Device is in calibration mode	



LED	Color	Status	Description
Trigger	red	on	Delay before or after pulse execution is active
		flashes (250 ms)	A "major" error has occurred (if status, trigger and LED-OUT LED flash simultaneously) => no operation possible
	green	on	Device is ready for trigger (in pulse and switch mode)
		flashes (500 ms)	LUCON® 2 device is ready, but not configured (if status, trigger and LED-OUT LED flash simultaneously)
	blue	on	Trigger is on
		flashes (500 ms)	Device updates firmware (when status, trigger and LED-OUT LED flash simultaneously)

LED	Color	Status	Description
LED-Out	red	on	Error when switching the lighting
		flashes (250 ms)	A "major" error has occurred (if status, trigger and LED-OUT LED flash simultaneously) => no operation possible
	green	on	Device is ready (in Continuous mode)
		flashes (500 ms)	LUCON® 2 device is ready, but not configured (if status, trigger and LED-OUT LED flash simultaneously)
	blue	on	Lighting is switched on
		flashes (500 ms)	Device updates the firmware of the power module (if status, trigger and LED-OUT LED flash simultaneously)

The following LEDs are only available on the LUCON® 2 Master module.

LED	Color	Status	Description
COM	red	on	Communication error (wrong address, wrong interface configuration, invalid command)
		flashes (500 ms)	Device updates the firmware of the communication module
	green	on	Communication successful and device is ready
		flashes (500 ms)	Device updates the firmware of the communication module

LED	Color	Status	Description
Link	green	on	Network cable connected to remote station

LED	Color	Status	Description
Act	yellow	flashes	Communication via the network interface



4.3 Interfaces and connections

4.3.1 LUCON® 2 Master

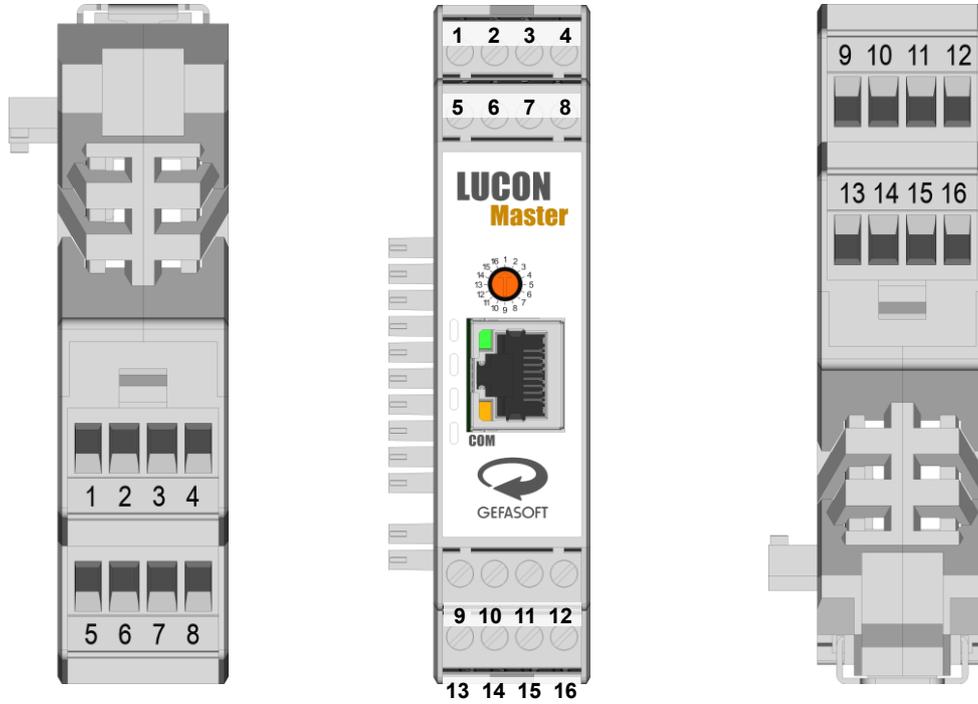


Figure 4: Connections LUCON® 2 Master

Type	Terminal	Assignment	Description
Power Supply	1	GND	Supply GND
	2	GND	Supply GND ¹
	3	V _{CC}	Supply +12 V _{DC} to +48 V _{DC}
	4	V _{CC}	Supply +12 V _{DC} to +48 V _{DC} ¹
Trigger	5	TRO-	Trigger output - (internally <i>not</i> connected to GND)
	6	TRO+	Trigger output +
	7	TRI-	Trigger input - (internally <i>not</i> connected to GND)
	8	TRI+	Trigger input +
RS-232	9	TxD	RxD from PC or PLC
	10	RxD	TxD from PC or PLC
	11	NC	Not connected
	12	GND	GND of RS-232 (internally connected to clamp 1 and 2)
Output	13	+	Output for lighting +
	14	NC	Not connected
	15	-	Output for lighting -
	16	NC	Not connected
Network	17	Ethernet	Network interface RJ45

¹ required if the continuous current over all channels exceeds 12 A



4.3.2 LUCON® 2 Slave

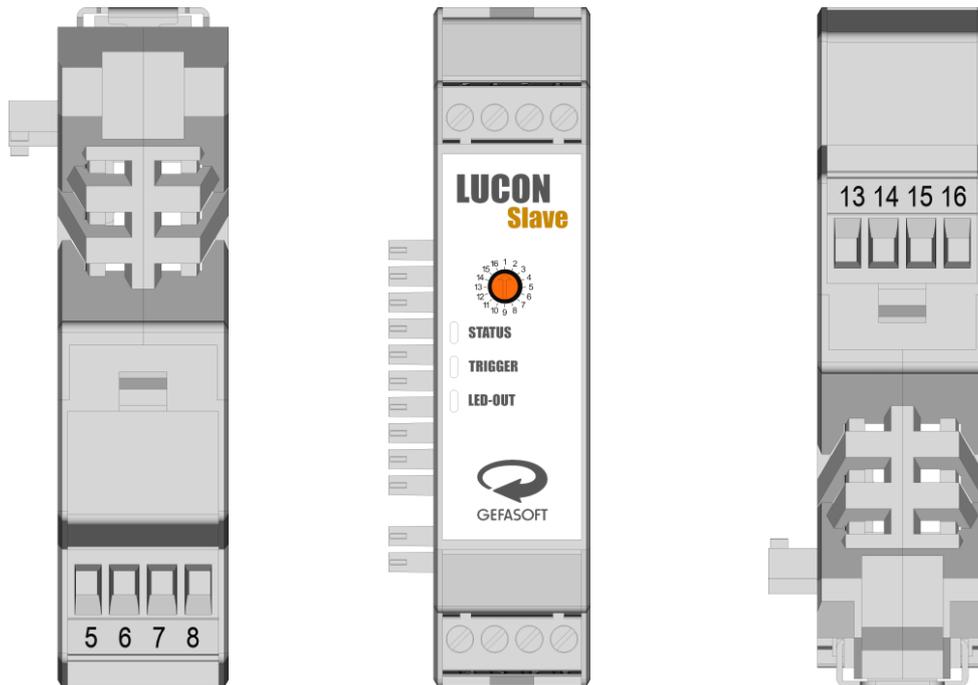


Figure 5: Connections LUCON® 2 Slave

Type	Terminal	Assignment	Description
Trigger	5	TRO-	Trigger output – (internally <i>not</i> connected to GND)
	6	TRO+	Trigger output +
	7	TRI-	Trigger input - (internally <i>not</i> connected to GND)
	8	TRI+	Trigger input +
Output	13	+	Output for lighting +
	14	NC	Not connected
	15	-	Output for lighting -
	16	NC	Not connected



4.3.3 Trigger-Interfaces

The LUCON® 2 lighting controls have both a trigger input (camera triggers lighting control) and a trigger output (lighting control triggers camera). Both are galvanically isolated by means of optocouplers. On the one hand, this serves as protection, but at the same time it allows great flexibility in the voltage levels of the triggers.

4.3.3.1 Trigger input

The trigger input can react to both a rising or a falling edge. This can be configured by means of parameters (see chapter 6.4) or with the integrated website (see chapter 6.4.3).

The electrical limitations and limits are described in the table below.

Parameter	Min.	Typ.	Max.
Input voltage Low	- 0,2 V	0 V	+ 1,4 V
Input voltage High	+ 3 V	+ 24 V	+ 30 V
Input current	1 mA	7,5 mA	10 mA
Input pulse duration	1 μ s		
Input delay (hardware-related) ¹			1 μ s

¹ Delay due to opto-coupler circuitry

There are various options for connecting a camera system to the LUCON® 2 input trigger.

Camera output as NPN or PNP line

Camera outputs are designed as either NPN or PNP lines. The two connection options are shown in Figure 6 and Figure 7.

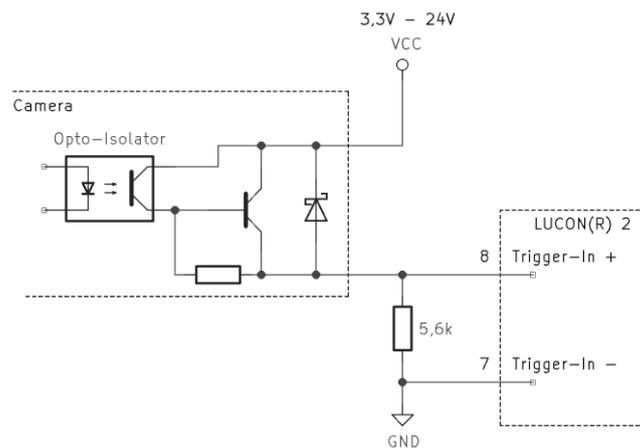


Figure 6: Connection between camera and LUCON® 2 - PNP variation

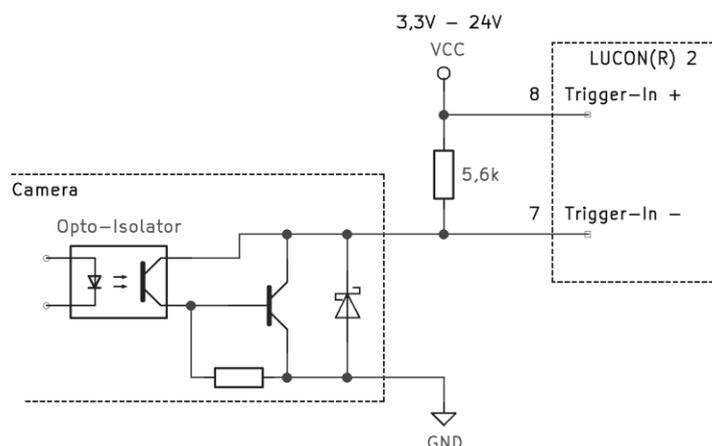


Figure 7: Connection between camera and LUCON® 2 - NPN variation



Not all camera systems offer both connection options. If both options are supported, the PNP connection is recommended.



The resistance in parallel to the trigger input of the LUCON® 2 must not be less than 5,6 kΩ. Larger resistance values are OK but have a negative impact on the timing behaviour of the trigger circuit.

Camera with output driver

Some camera systems are alternatively designed with an output driver. These can be connected to the trigger input of the LUCON® 2 as shown in the schematic Figure 8.

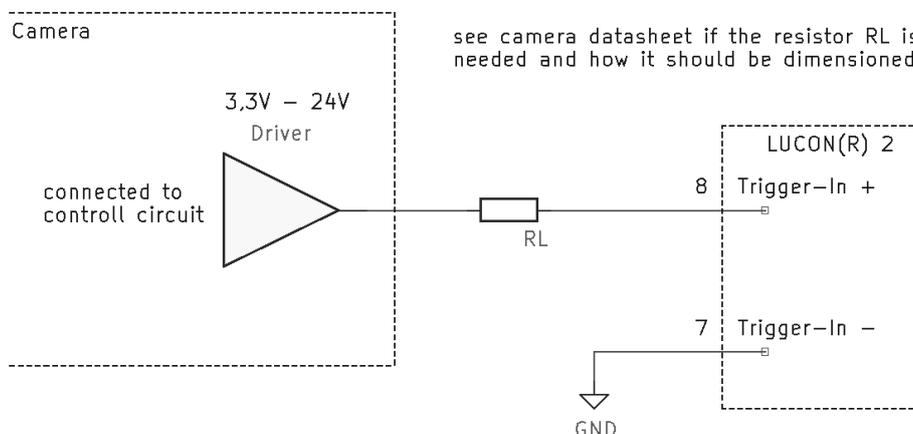


Figure 8: Connection between camera with output driver and LUCON® 2



For some cameras, it is not necessary to insert the series resistor between the camera and LUCON® 2 (labelled RL in Figure 8). The camera data sheet indicates whether the resistor RL is required and how it should be dimensioned.

4.3.3.2 Trigger output

The trigger output can be used optionally and can be triggered by adjustable events (trigger input, lighting activated). In addition, a delay and the duration of the trigger can be set between this event and the setting of the trigger.



The trigger output is an open-collector circuit. This allows the greatest possible flexibility in the selection of the trigger voltage. A pull-up resistor is required to use the trigger output (see Figure 9).

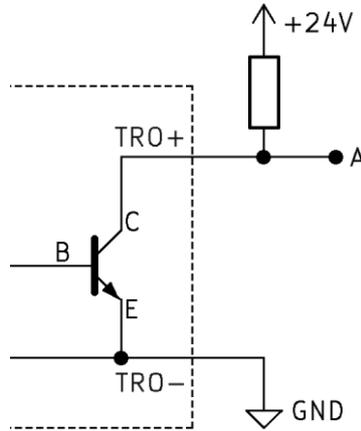


Figure 9: Wiring of the trigger output

Parameter	Min.	Typ.	Max.
Trigger voltage			+ 30 V
Trigger current		25 mA	50 mA
Output pulse duration	25 μ s		
Output delay (hardware-related) ¹			3 μ s

¹ Delay due to opto-coupler circuitry



Due to the different output impedances in an open-collector circuit, the switching edges differ. The falling edge is steeper than the rising edge. If a trigger signal is required that is as fast as possible, a falling edge should be used.



The pull-up resistor must be selected so that the maximum current through the transistor does not exceed 50 mA! The recommended current is 25 mA.

4.3.3.3 Trigger Timing special features

The optocoupler circuitry of the trigger input and output results in minimal delays.

In Figure 10, the trigger output (1 k Ω pull-up resistor, 24 V, 0 μ s delay set) is activated by the trigger input.

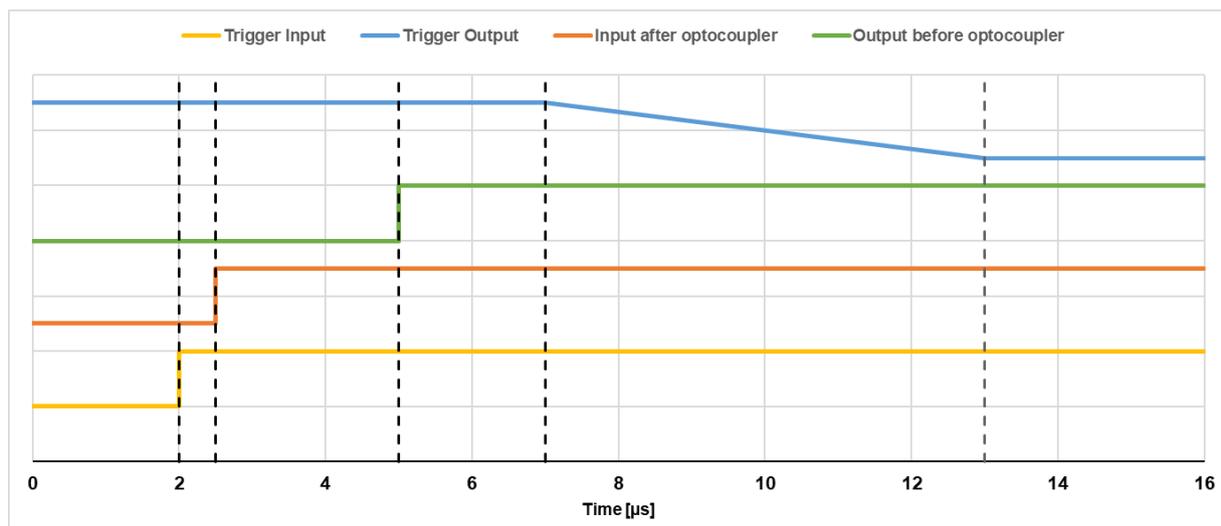


Figure 10: Timing features of the trigger interfaces

If a rising edge occurs at the trigger input (yellow curve in Figure 10), there is a delay ($< 1 \mu\text{s}$) through the optocoupler circuit (area I) before the microcontroller registers this trigger (orange curve) (with an external falling trigger, the delays are identical). It then takes about $2.5 \mu\text{s}$ (area II) until the microcontroller has activated the trigger output (green curve). Due to the optocoupler circuit at the output, there is a delay of about $2 \mu\text{s}$ (area III). With a trigger voltage of 24V and a $1 \text{ k}\Omega$ pull-up resistor, the output circuit needs about $6 \mu\text{s}$ until the voltage reaches 0 V (area IV).



4.4 Technical drawing

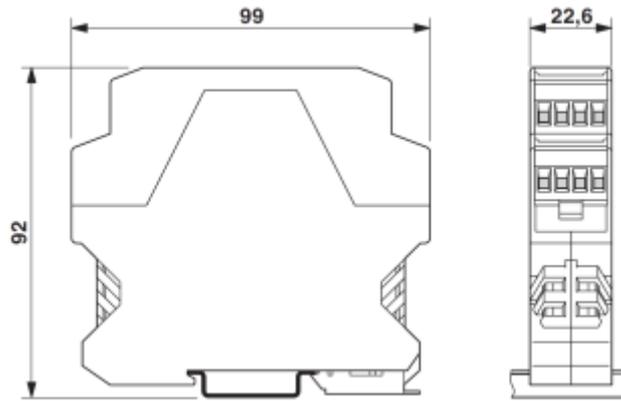
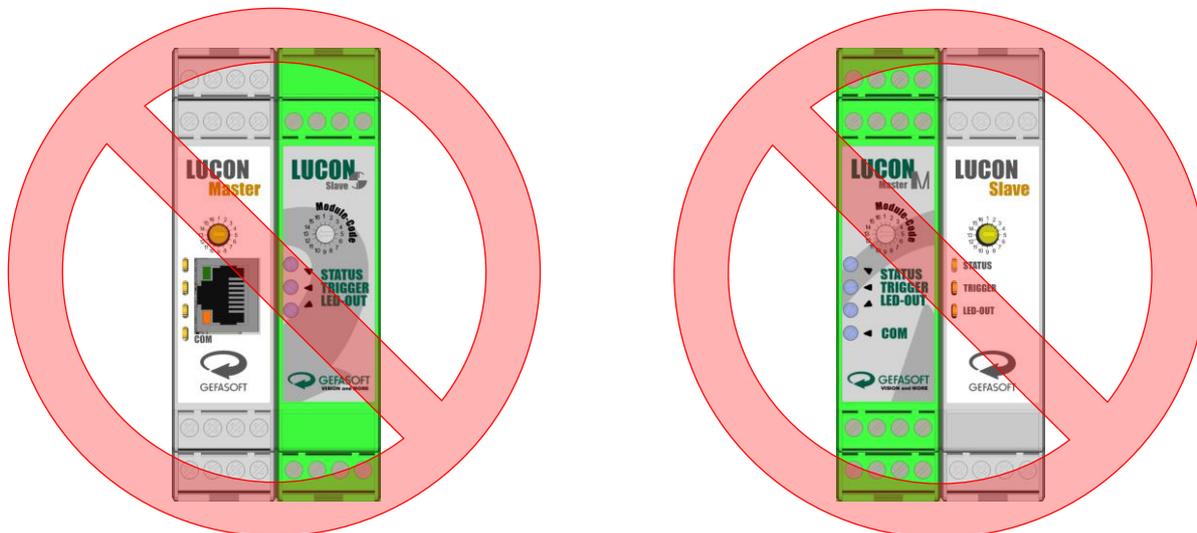


Figure 11: Technical drawing - specifications in mm

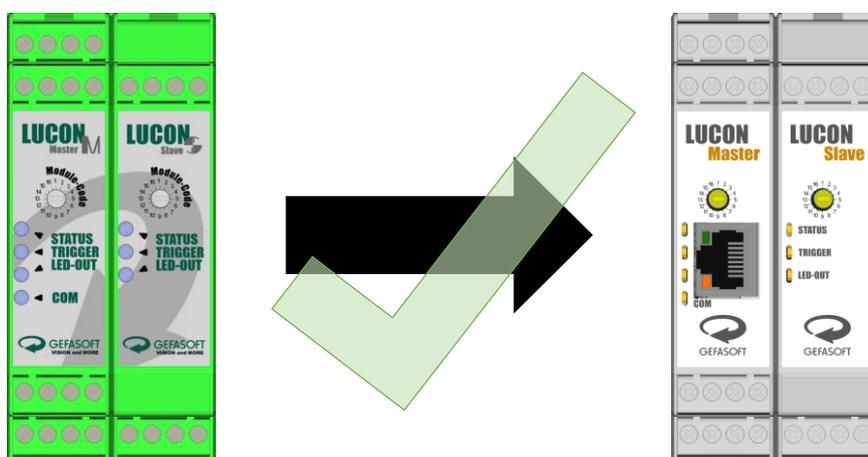


4.5 Backwards compatibility

LUCON® 1 and LUCON® 2 are largely compatible with each other. However, it is not allowed to use them together. It is not allowed to connect a Master of the first generation with Slaves of the new generation. Also, a Master of the new generation must not be connected to Slaves of the old generation.



If old devices have to be replaced, all interconnected devices must always be replaced!





5 Commissioning

5.1 Mount LUCON® 2 light controller

Depending on the number of lightings, connect a LUCON® 2 Master module with a corresponding number of LUCON® 2 Slave modules (max. 15 slave modules).

Safety notice



HAZARD

Electric shock!

Only install the light controllers and connect the cables when the power is switched off and disconnected from the mains.

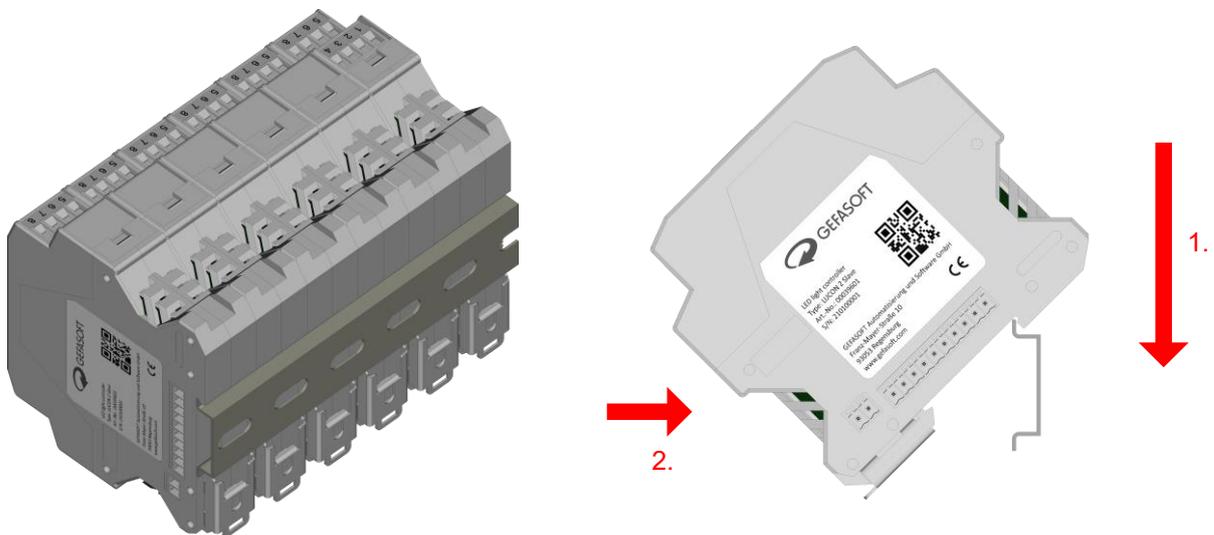


Figure 12: LUCON® 2 mounted on top-hat rail

Place the LUCON® 2 light controllers individually onto the top-hat rail at an angle from above. Then press lightly against the light controller to snap the mounting clip onto the top-hat rail.



Observe the mounting direction! The mounting bracket must be on the underside of the top-hat rail (see Figure 12).



Observe module order! LUCON® 2 Master module is to be mounted on the far left and the LUCON® 2 Slave modules on the right with increasing channel number (see Figure 13).

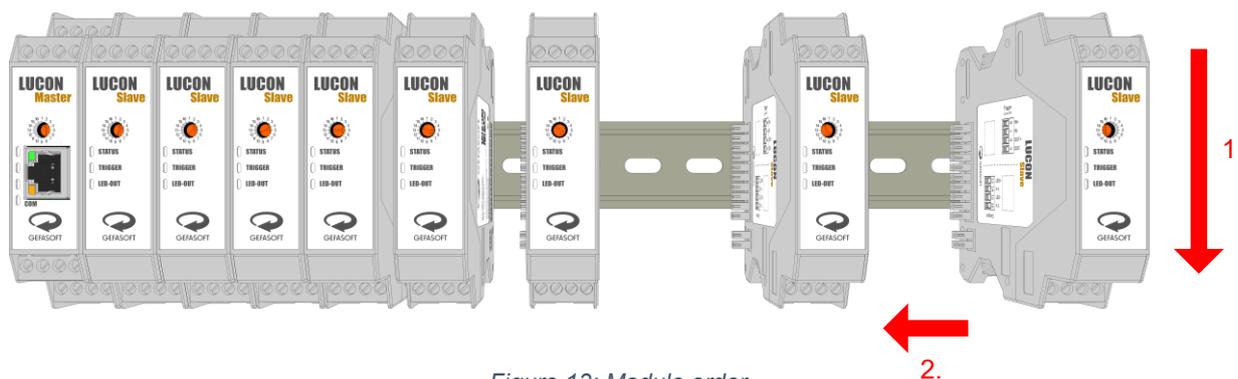


Figure 13: Module order



The LUCON® 2 light controllers are not hot-pluggable. This means that all modules must be mounted in a voltage-free state! The power supply can only be activated once all modules have been mounted. Do not install any modules if the LUCON® 2 Master module is live!

5.2 Connecting the light controller

Safety notice



HAZARD

Electric shock!

Only install the light controllers and connect the cables when the device is switched off and de-energised.

Sicherheitshinweis



CAUTION

Damage to the cables!

- Observe minimum bending radii.
- Provide strain relief for cables.
- Observe the specification of the cables.

When connecting, first connect the lights, then the trigger and communication interfaces and finally the power supply to the LUCON® 2 light controllers.

Care should be taken to use twisted cables for the lighting. In addition, the cables to the lighting should not be longer than necessary to reduce parasitic line losses.



A maximum cable length of ten metres must not be exceeded. This applies to all interfaces.

Safety notice



CAUTION

Wrong wiring!

Always connect the lights to the designated contacts (see Figure 4 and Figure 5). Never connect the lighting directly to VCC or GND. This can damage both the lighting and the light controller.



5.3 Configure channel numbers

On the front of the device (see Figure 14) there is a rotary coding switch which can be set with a slotted screwdriver. This sets the channel number.

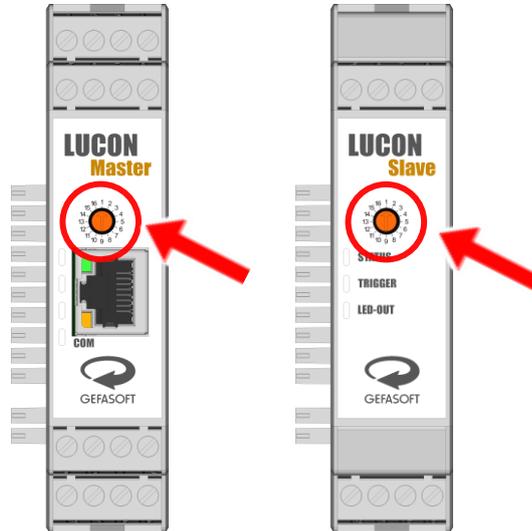


Figure 14: Configure channel numbers (marked area)



To simplify troubleshooting or maintenance, it is advisable to give the LUCON® 2 Master module the number 01. Then number the channels in ascending order.



The channel number may only be changed when the light controllers are voltage-free. Changing the numbers during operation leads to errors and the controllers must be restarted by disconnecting the power supply.



Each channel number may only be used once. If a number is used more than once, error-free operation cannot be guaranteed.

5.4 Initial commissioning

After connecting all cables and setting the channel number, the initial commissioning can take place. To do this, supply the LUCON® 2 Master module with voltage. The LEDs of the LUCON® 2 Slave modules as well as the LEDs of the power section in the LUCON® 2 Master module flash green after a short time (see chapter 4.2).

If no network cable is connected to the LUCON® 2 Master module, the COM LED lights up red after a few seconds. Only after the first successful communication does the LED change to green.

If a network cable is used, the COM LED is green from the beginning and the LEDs on the RJ45 socket indicate activity.



6 Operating

The parameters are configured either via commands (RS-232 or UDP, see chapter 6.2) or via the integrated configuration website (see chapter 6.4.3).

The commands are downward compatible with the LUCON® 2 Master and LUCON® 2 Slave of the first generation. This means that the light controllers can be exchanged in existing applications without adjustments to the software.

6.1 Operational readiness

After connecting the supply voltage, the units need a moment to fully boot up. As soon as it is ready, the communication module in the LUCON® 2 Master sends a message via the RS-232 and UDP interface. The message looks like this:

```
:S RUNNING...\r\n>
```

For RS-232, the interface is configured by default as shown in section 6.3.1 **Fehler! Verweisquelle konnte nicht gefunden werden.** If the baud rate has been changed (see the command R00BS and S00BS in chapter 6.4.2.2), the user-defined baud rate for configuring the RS-232 interface is used.

In order to be able to send a message via Ethernet using the UDP protocol, it is absolutely necessary to know the IP address and the UDP port of the remote station. When starting for the first time, this remote station is not known, which is why no message can be sent here either. However, as soon as commands are received via UDP for the first time, the IP address and the UDP port of the sender are saved. If the LUCON® 2 receives messages from another remote station, the saved parameters are overwritten. After a restart, the message is sent to the last known remote station.

6.2 Operating modes and control modes

6.2.1 Operating modes

Each power module can be set in one of the following operating modes:

- Continuous current mode (software mode):
The connected lighting is switched on and off by software via a PC or PLC using the corresponding command. The lighting is operated with the current value contained in the command until a command to switch it off is received (exception: temperature limit is exceeded). Currents of up to 3 A can be used in this mode.
- Switch mode:
In this mode, the desired current value is first set via command or web interface. Then the corresponding channel reacts to the trigger input. The lighting is switched on as long as a trigger signal is present (or not present, depending on the desired setting) (exception: temperature limit is exceeded). Currents of up to 20 A can be used in this mode.
- Pulse mode:
In this mode, the desired current value is first set via command or web interface. Then the corresponding channel reacts to an edge change at the trigger input (rising, falling or both => configurable). The lighting is then switched on for a previously set time. Currents of up to 20 A can be used in this mode.
- None mode:
In this mode, the output for lighting is permanently deactivated and the triggers are also not



evaluated (default state during initial commissioning). This mode is useful if the set parameters are to be stored in the permanent memory, but not a specific operating mode or state.

6.2.2 Control modes

In principle, two control modes are available:

- Command-based operation:
The LUCON® 2 Master module is connected to a control system (e.g. PC or PLC) via a communication interface (RS-232 or network). Commands are used to switch the lighting on the various channels on and off, change their brightness or switch between operating modes.
- Stand-alone operation:
If an operating mode (switch or pulse mode) including all parameter settings is permanently stored in the respective channel, this operating mode is automatically restored after renewed power-up. Thus, connection and communication with a PC is only required during initial start-up.

6.2.3 Limitations in switch and pulse mode

The LUCON® 2 lighting controls work with a capacitor at the output, which is discharged into the lighting with a regulated current. The capacitor must be recharged after a pulse. For currents below 3 A, charging is as fast as discharging. This allows the pulses to be (theoretically) infinitely long (provided that no thermal limitation occurs).

Furthermore, it must be taken into account that with currents above 3 A, voltage regulation no longer takes place (this leads to an increased thermal load on the light controller). Therefore, currents above 3 A cannot be used in continuous current mode (software mode). This also has the consequence that the maximum pulse length for currents above 3 A in switch and pulse mode is limited by thermal limits. Therefore, a pause for cooling down is always necessary after a pulse. During the cooling time, the trigger interfaces are deactivated.

Furthermore, it should be noted that 100% thermal compensation is not possible in the light controller. This means that in the cold state the current is minimally higher than in the warm state. If the image processing is set up for the cold state, the result image could be too dark in the warm state. Therefore, to get an optimal result, the light controller should first be "flashed" warm by triggering it a few hundred times.

When a current value for a pulse or a length for a pulse is entered, the light controller automatically determines whether this combination is permissible and also calculates the necessary cooling time (command: PCD, see chapter 6.4.2.3).

Figure 12 shows the relationship between pulse length and pulse current.

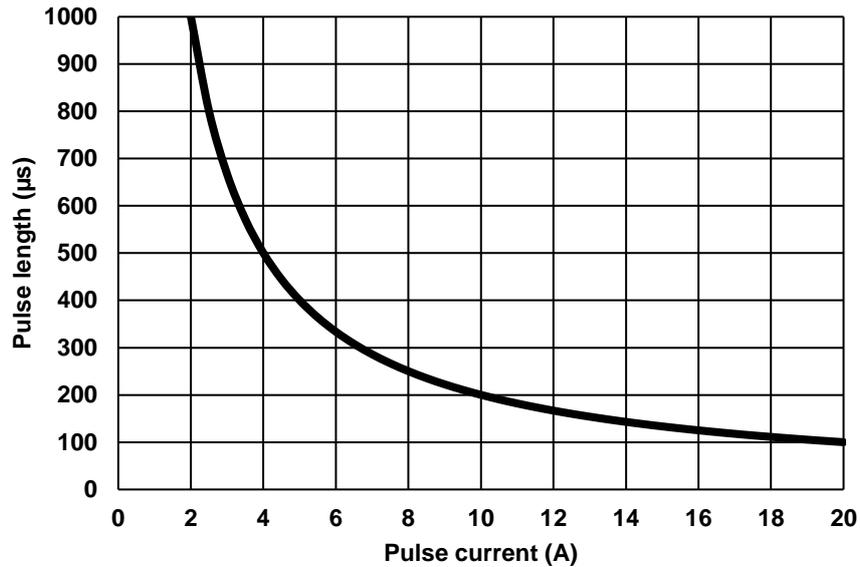


Figure 15: Pulse length as a function of pulse current

The maximum possible pulse length (in seconds) can be determined from the following equation (I = current in A):

$$t_{max} = \frac{0,002}{I}$$

Figure 16 provides an overview of the necessary cooling time.

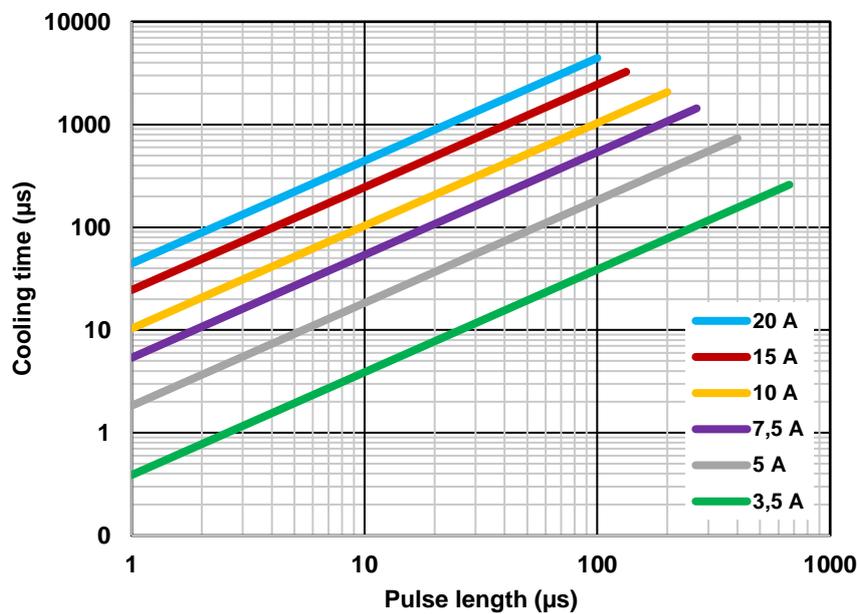


Figure 16: Necessary cooling times depending on pulse length and pulse current

The following formula can also be used for exact calculation (I = current in A, t_{Pulse} = pulse length in s, result in s):

$$t_{Pause} = \left(\frac{17}{150} * I^2 * t_{Puls} \right) - t_{Puls}$$



6.2.4 Temporal peculiarities in current control

Internally, the LUCON® 2 light controllers have different measuring ranges to achieve the highest possible precision in current control. Due to circuitry reasons, there are differences in the times required until the current is regulated. Figure 17 shows the relationship between current and delay time graphically.

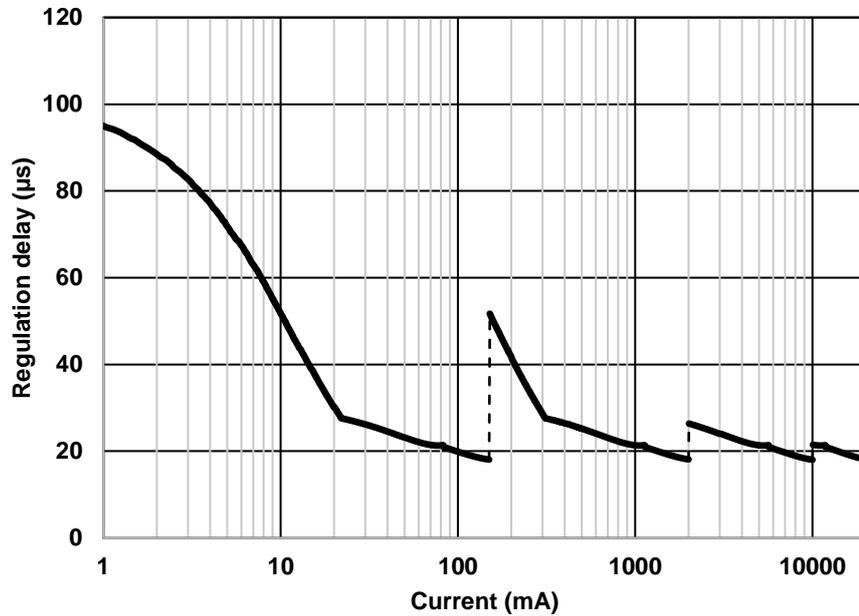


Figure 17: Control delays for different currents

In pulse mode, this delay is taken into account so that the length of the pulses is always constant, regardless of the current. However, the switch-on delay varies depending on the current. In addition, it should be noted that a delay occurs between the trigger input and the start of regulation (see chapter 4.3.3.3).



6.3 Communication interfaces

6.3.1 RS-232

Type	Serial interface
Protocol	RS-232
Baud rate	57600 bps
Databits	8
Equality	None
Stopbits	1
Flow control	None

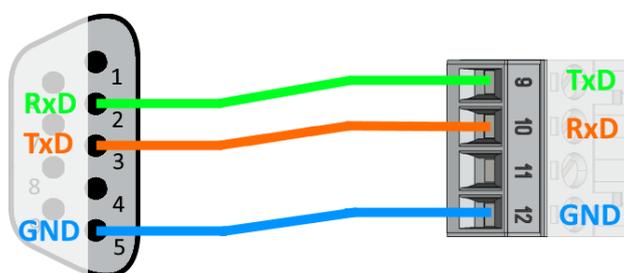


Figure 18: RS-232 pin assignment on the 9-pin Sub-D connector

6.3.2 Ethernet

Type	Ethernet interface (RJ45)
IP	10.0.30.2
Subnet	255.255.255.0
Protocol	UDP
Port	50 000

When using the network interface, make sure that both the light controller and the remote station (e.g. PC) are in the same subnet, otherwise no connection can be established. The LUCON® 2 Master light controller can be connected to a switch (see Figure 19) as well as directly to a remote station, since the light controller supports Auto-MDI-X.

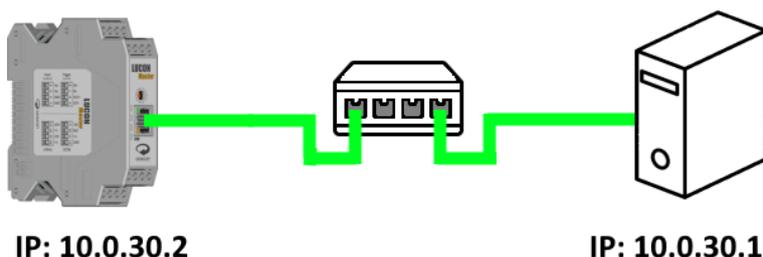


Figure 19: Network setup with LUCON® 2 Master light controller



6.4 Parameterisation

The LUCON® 2 light controllers can be configured and operated with a variety of parameters and settings. The parameters can be set using commands (see chapter 6.4.2) or using the integrated web interface (see chapter 6.4.3). An overview of all possible parameters is provided in chapter 6.4.2.2 and chapter 6.4.2.3.

The two most important parameters, the limits for current and voltage, are explained in more detail below.

6.4.1 Setting the current and voltage limits

Limits for current and voltage can be set to protect the connected lighting and the light controller. The current limit primarily serves to protect the lighting, the voltage limit is intended to reduce the thermal load on the LUCON® 2 light controller.

6.4.1.1 Determining the current limit

Depending on the lighting used, information on the maximum permissible current can be found directly on the housing. Often a distinction is made between continuous operation and flash operation. The value for flash operation can be many times higher than the value for continuous operation. However, these are only intended for flashes with a duration of a few milliseconds or even microseconds. If there is no value for flash mode, the existing value usually refers to continuous mode.



If there is no value for flash operation on the housing of the lighting device or in the data sheet, the lighting device may not be suitable for flash operation. In this case, contact the manufacturer of the lighting.

If instead of the maximum current there are only values for the voltage and the power on the lighting, the current limit can be calculated with the following equation (P = power in W, U = voltage in V, result in A):

$$I = \frac{P}{U}$$

The current limit is then entered in mA. Multiply the value calculated above by 1000.

6.4.1.2 Determining the voltage limit

As a first indicator, the voltage value from the housing or data sheet of the lighting can be taken. However, if the lighting is to be operated close to the current limit, this voltage limit is often too low and the desired current and thus the desired brightness cannot be achieved. The deviation stems from manufacturing and production-specific deviations in the manufacture of LED lighting.

In the following, the necessary steps to determine the correct voltage limit are shown using channel 01 as an example. If another channel is used instead, the channel number must be exchanged with the desired number in the commands.

To find the correct value for the voltage limit, the lighting should first be operated in continuous mode. To do this, use the command S01MC|xx (see chapter 6.4.2.3) or the sliders on the website (see chapter 6.4.3.2) (xx stands for the desired current in mA).



Then some voltages have to be determined:

- The supply voltage V_{SUPPLY} (Supply-Voltage, *R01USU*),
- the voltage across the illumination V_{LED} (Voltage over LED, *R01UL*)
- and the voltage at the cathode of the lighting V_{IN} (LED-Input-Voltage, *R01ULI*).

The values can also be conveniently displayed in the web interface (see chapter 6.4.3.2).

The following table provides an explanation of how to proceed in which situations:

State	Cause	Solution
$V_{\text{SUPPLY}} > V_{\text{LED}}$ and $V_{\text{IN}} < 2000 \text{ mV}$	Voltage limit too low	Increase voltage limit by 100 mV and measure again
$V_{\text{SUPPLY}} \approx 48000 \text{ mV}$ and $V_{\text{IN}} < 2000 \text{ mV}$	Supply voltage too low	Supply voltage already at the limit. Lighting unsuitable for LUCON® 2 light controller
$V_{\text{SUPPLY}} \approx V_{\text{LED}}$ and $V_{\text{SUPPLY}} < 48000 \text{ mV}$ and $V_{\text{IN}} < 2000 \text{ mV}$	Supply voltage too low	Increase the supply voltage (Attention: Check whether other devices can tolerate higher voltage).



The displayed values are subject to certain measurement tolerances. They therefore only serve as a rough guide.

In flash mode with currents below 3000 mA, the voltage limit is unfortunately not so easy to set. Here, the voltage limit should first be set about 5000 mV higher than indicated on the lighting. Then test whether the desired brightness has been reached. Now gradually reduce the limit by 100 mV and test whether the brightness is still achieved. If the brightness decreases, increase the limit by 500 mV. Now the optimal voltage limit should be reached.

If the lighting is operated in flash mode above 3000 mA, voltage regulation no longer takes place. In this case, the entered value for the voltage limit is ignored. For this reason, pulses above 3000 mA are also limited in time, as otherwise there is a risk of the light controller overheating.



6.4.2 Parameterisation via commands



Basically, all settings and parameters are initially only stored in the temporary memory. This means that they are lost after a restart (power failure or software restart). The configuration must also be stored in the permanent memory (commands: S00S, S01S, ...).

6.4.2.1 Command structure

Each command consists of the following structure:

'S' or 'R' + channel number + command + (| + values +) delimiter

e.g.: R00F\r\n, R01T\r\n, S00BS|57600\r\n, S01MC|100\r\n

'S' or 'R'	'S' describes a SET command, 'R' describes a READ command
Channel number	Channel number of the module from 00 to 16; 00 addresses a command to the communication module (LUCON® 2 Master) 01 to 16 addresses a power module (LUCON® 2 Master or LUCON® 2 Slave)
command	Command consisting of one to three characters describing the command
values	Depends on the command: READ commands do not require a value; SET commands can be given one to sixteen values. Each value is introduced with a pipe character " ".
Delimiter	The delimiter terminates the telegram. For increased compatibility of the communication, different delimiter configurations are accepted: <div style="margin-left: 40px;"> \r\n (Carriage Return: 0x0D, Line Feed: 0x0A) \r (Carriage Return: 0x0D) \n (Line Feed: 0x0A) </div>

If the SET command is successful, the command sent is sent back as a reply and a > is appended. If an error occurred, an error message is displayed. If, for example, the command S01MC|100\r\n is sent, the response looks like this:

S01MC|100\r\n>

Be In the case of a READ command, the command sent is returned as the answer, followed by the requested value with delimiter and >. For example, the answer to R01T\r\n can look as follows:

R01T\r\n
31\r\n>



6.4.2.2 Command overview communication module (address: 00)

SET-command		
Command	Description	Example
MCM	Set current in continuous mode on several output modules; syntax of the values is: "channel", "current value" "channel", "current value"...	S00MCM 01,60 04,120 (Set channel 01 to 60mA and channel 04 to 120mA)
S	Save all parameters in permanent memory	S00S
BS	Set baud rate	S00BS 57600 (allowed values: 9600, 19200, 38400, 57600 or 115200)
IP	Set IP-address (is only taken over after a restart)	S00IP 10.0.30.2
SM	Set subnetmask (is only taken over after a restart)	S00SM 255.255.255.0
FR	Restore factory settings	S00FR
R	Restart LUCON® 2 Master modul	S00R
DB	Set debug-output; Syntax of the values: "interface", "level"	S00DB 1,128
SR	Save all parameters in permanent memory and restart module	S00SR
SIP	Set IP address with serial number check; syntax: "serial number", "IP address" (will only be taken over after a restart)	S00SIP 123456789,10.0.30.2
RM	Restart Multi; Restart all connected channels (0 = Com controller is not restarted, echo from the controller only comes when all power controllers have been restarted; 1 = Com-controller is also restarted, echo from the controller comes immediately, but the controller can only be reached again when it has sent :S RUNNING... \r\n>, see chapter 6.1)	S00RM 0 S00RM 1



READ command		
Command	Description	Example / Response (without delimiter)
DB	Debug output status	R00DB Response e.g.: 'RS-232,1+4+8'
F	Firmware version	R00F Response e.g.: '1.0.2'
IP	IP address	R00IP Response e.g. '192.168.123.10'
SM	Subnetmask	R00SM Response e.g. '255.255.255.0'
UDP	UDP-port	R00UDP Response: '50000'
MAC	MAC address	R00MAC Response e.g.: '54:10:EC:9A:A7:11'
SN	Serial number	R00SN Response e.g.: '200320001'
BS	Baud rate (for RS-232)	R00BS Response e.g.: '57600'
BLV	Bootloader version	R00BLV Response e.g.: '1.0'
EQ	Are the parameters in the permanent memory identical to those in the non-permanent memory?	R00EQ Response: '0' (not identical) or '1' (identical)
RT	Query which channels are connected	R00RT Response e.g.: 'Online: 01, 02, 14'
RFM	Firmware Version Multi Firmware version of all connected channels	R00RFM Response e.g.: '00:1.0.0, 01:1.0.1, 02:1.0.1, 03:1.0.0'



6.4.2.3 Command overview power module (address: 01 to 16)

SET command		
Command	Description	Example
MC	Continuous mode (software mode) Set current value (mA) in continuous mode. For current values ≤ 50 mA, input to 1/10 mA is possible (e.g. 45.4 mA). Max.: 3000 mA	S01MC 10.9 S01MC 1230
MT	Switch mode Set current value (mA) in switch mode (current is output while trigger is active/inactive). Max.: 20 000 mA (with auto. switch-off)	S01MT 4500 S01MT 5.9
MD	Pulse mode (delay in ms) Set current value (mA) in pulse mode (current is set when trigger rises/falls). Syntax: "current (mA)" "delay (ms)" "duration (μ s)" Max.: 20 000 mA (with auto. switch-off)	S01MD 10 0 100000 (current: 10 mA, delay: 0 ms, duration: 100 ms)
MDU	Pulse mode (delay in μ s) Set current value (mA) in pulse mode (current is set when trigger rises/falls). Syntax: "Current (mA)" "Delay (μ s)" "Duration (μ s)" Max.: 20 000 mA (with aut. switch-off)	S01MDU 10 100 100 (current: 10 mA, delay: 100 μ s, duration: 100 μ s)
MN	None mode The output and the trigger interface are deactivated.	S01MN
L	Set current limit (mA) To protect the lighting from incorrect inputs	S01L 3000
V	Set voltage limit (mV) To protect the light controller from overheating	S01V 30000
ST	Set input trigger polarity in switch mode. (0 = output active when trigger low, 1 = output active when trigger high)	S01ST 0 S01ST 1
I	Set input trigger polarity in pulse mode. (0 or R = activate pulses when trigger rises, 1 or F = activate pulses when trigger falls, 2 or B = activate pulses when trigger rises or falls).	S01I R S01I 1 S01I 2



O	Activate/deactivate output trigger (0 = output trigger disabled, 1 = output trigger enabled)	S01O 0 S01O 1
OTE	Set output trigger polarity (0 or R = output trigger should rise, 1 or F = output trigger should fall)	S01OTE R S01OTE 0 S01OTE F
OTS	Set output trigger source (0 = input trigger, 2 = activate lighting)	S01OTS 0 S01OTS 1
OTD	Set output trigger delay (μ s) 0 - 1,000,000 μ s (at 0 μ s only hardware-related delay, see chapter 4.3.3.2))	S01OTD 500
OTL	Set output trigger length (μ s) 20 - 1,000,000 μ s	S01OTL 5000
R	Restart LUCON® 2 Slave modul	S01R
FR	Restore factory settings	S01FR
S	Save all parameters in permanent memory	S01S
DB	Set debug output; syntax of the values: "Interface", "Level	S00DB 1,128
SR	Save all parameters in permanent memory and restart module	S01SR



READ command		
Command	Description	Example / Response (without delimiter)
T	Temperature (°C) of the channel	R01T Response e.g.: '45'
F	Firmware version	R01F Response e.g.: '1.0.2'
C	Current value (mA) Response syntax: "Actual", "Target" (only useful in continuous mode)	R01C Response e.g. '49 50'
PC	Pulse current (mA) Response the set value for the current in pulse mode.	R01PC Response e.g. '4500'
SC	Switch current (mA) Response the set value for the current in switch mode.	R01SC Response e.g.: '5000'
L	Current limit (mA) To protect the lighting from incorrect inputs	R01L Response e.g.: '2000'
V	Voltage limit (mV) To protect the light controller from overheating	R01V Response e.g.: '24000'
D	Read pulse width (µs) How long should the current pulse be active?	R01D Response e.g.: '100'
Y	Pulse delay (ms) How long should be waited between the occurrence of the input trigger and the pulse activation?	R01Y Response e.g.: '100'
PDU	Pulse delay (µs) How long should be waited between the occurrence of the input trigger and the pulse activation?	R01PDU Response e.g.: '100'
PCD	Cooling time after a pulse Value is automatically calculated from pulse current and pulse length. No further pulses are possible during this time.	R01PCD Response e.g.: '1005'
U	Div. system voltages (mV) Response syntax: "V _{OUT} " "V _{IN} " "V _{GATE} " "V _{SHUNT} "	R01U Response e.g.: '26000 2000 3500 1250'
UL	Voltage across the illumination (mV)	R01UL Response e.g.: '24000'
USU	Supply voltage (mV)	R01USU Response e.g.: '36000'



ULI	Voltage at the cathode of the illumination (mV)	R01ULI Response e.g.: '2000'
ULO	Voltage at the anode of the lighting (mV)	R01ULO Response e.g.: '36000'
I	Input trigger polarity (for pulse mode) 0 = pulses when trigger rises, 1 = pulses when trigger falls, 2 = pulses when trigger rises or falls).	R01I Response e.g.: '0'
ST	Input trigger polarity (for switch mode) (0 = output active when trigger low, 1 = output active when trigger high)	R01ST Response e.g.: '0'
O	Output trigger status 0 = output trigger deactivated, 1 = output trigger activated	R01O Response e.g.: '0'
OTE	Output trigger polarity 0 = Rising edge, 1 = Falling edge	R01OTE Response e.g.: '0'
OTS	Output trigger source 0 = Input trigger, 1 = Activate lighting output	R01OTS Response e.g.: '0'
OTD	Output trigger delay (μ s)	R01OTD Response e.g.: '500'
OTL	Output trigger length (μ s)	R01OTL Response e.g.: '50'
SN	Serial number	R01SN Response e.g.: '200380001'
BLV	Bootloader version	R01BLV Response e.g.: '1.0'
EQ	Are the parameters in the permanent memory identical to those in the non-permanent memory?	R01EQ Response: '0' (not identical) or '1' (identical)
DB	Debug output status	R01DB Response e.g.: 'CAN,1+4+8'



6.4.3 Parameterisation via configuration website

In addition to configuration via commands, the LUCON® 2 Master module offers the possibility of parameterising the light controller via a web interface. The prerequisite for this is the use of the Ethernet interface (see chapter 6.3.2).

To access the web interface, the IP address of the LUCON® 2 Master module must be entered as the target address in a browser (default: 10.0.30.2, see 6.4.2.2, command: R00IP). After successful entry, the web interface should appear as shown in Figure 20.

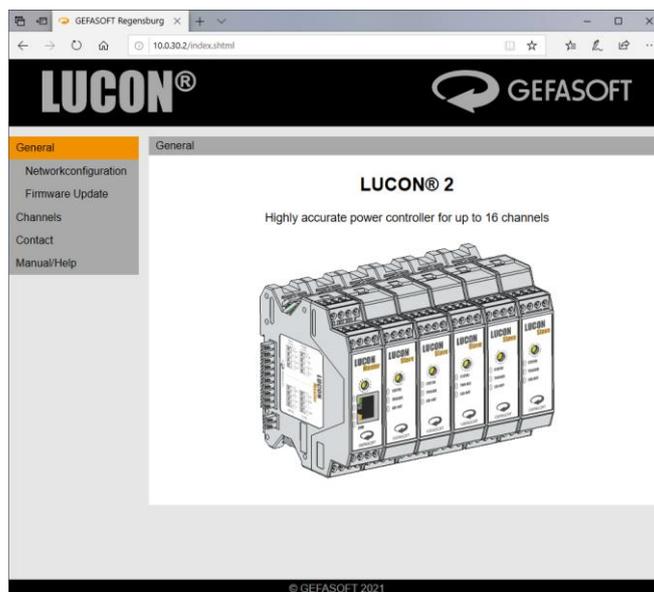


Figure 20: Start page of the configuration website

The menu on the left-hand side contains various sub-items, such as the network configuration, the option for a firmware update and the configuration of the individual channels.



6.4.3.1 Network configuration



The network settings are only adopted after a restart of the LUCON® 2 Master module. However, the temporary parameters ("Save temporary") are deleted again after a restart.

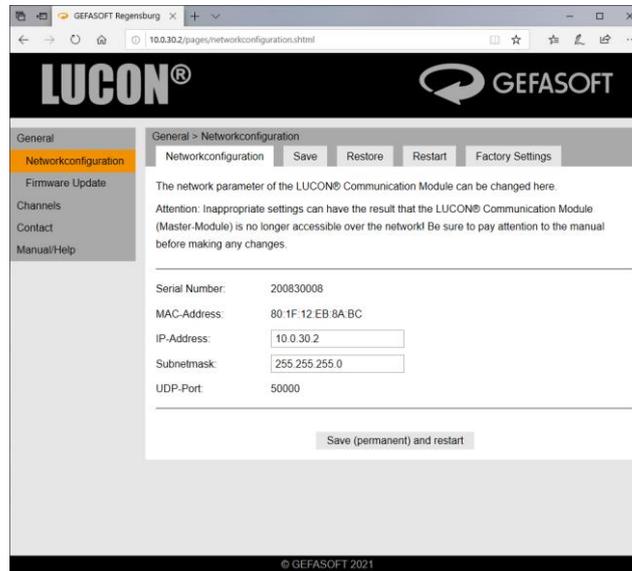


Figure 21: LUCON® 2 network configuration (1)

In the upper section of this page there are also links to sub-pages. There it is possible to save the network configuration to a file ("Save") and to restore it from a file ("Restore"). In addition, the communication module can be restarted under "Restart" and the factory settings can be restored under "Factory Settings".

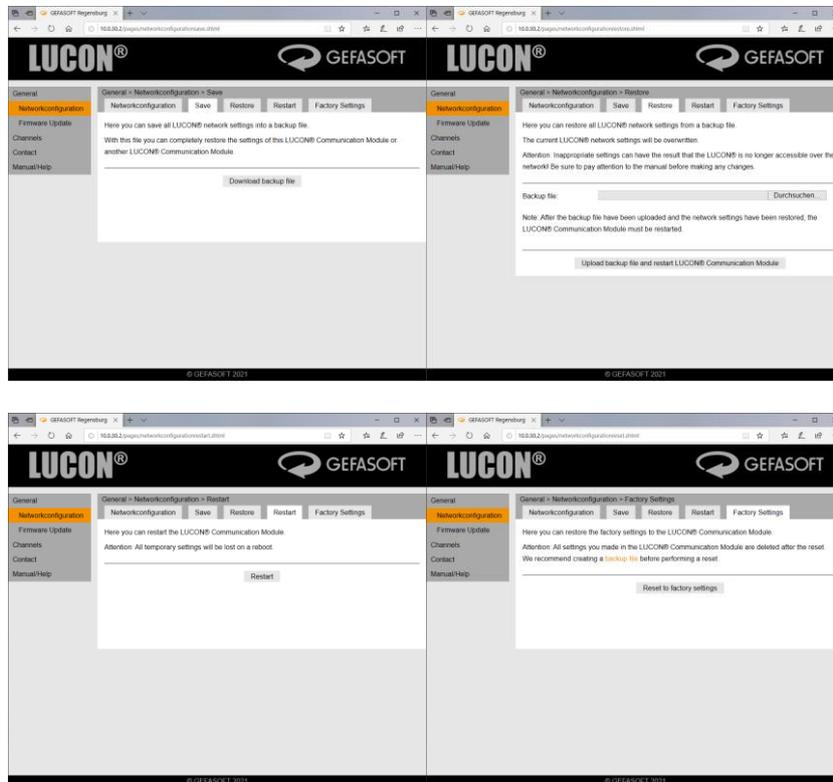


Figure 22: LUCON® 2 network configuration (2)



6.4.3.2 Channel configuration

In the main menu on the left, the channels can be configured under the item "Channels". First, the main page of the channels appears with sliders for the current outputs (see Figure 23, the respective channels must be configured for use). In addition, configuration files for all channels can be created and restored here.

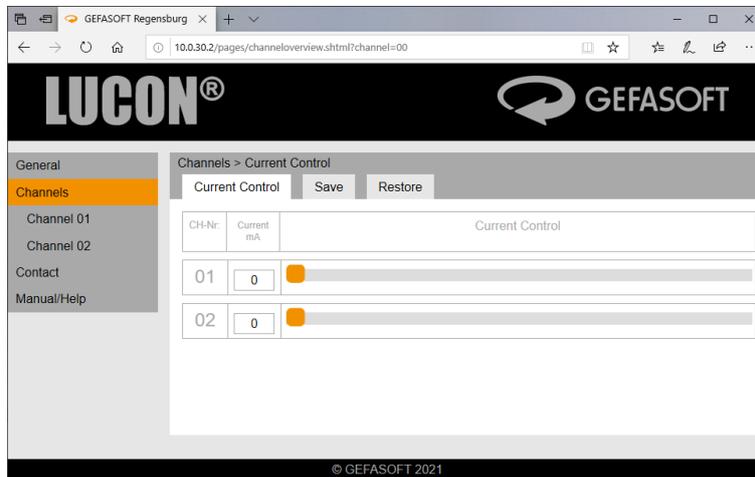


Figure 23: LUCON® 2 Channel overview

In the "Channels" menu, all connected and available channels are displayed as sub-items. The "Status" page contains some general information about the selected channel (see Figure 24).

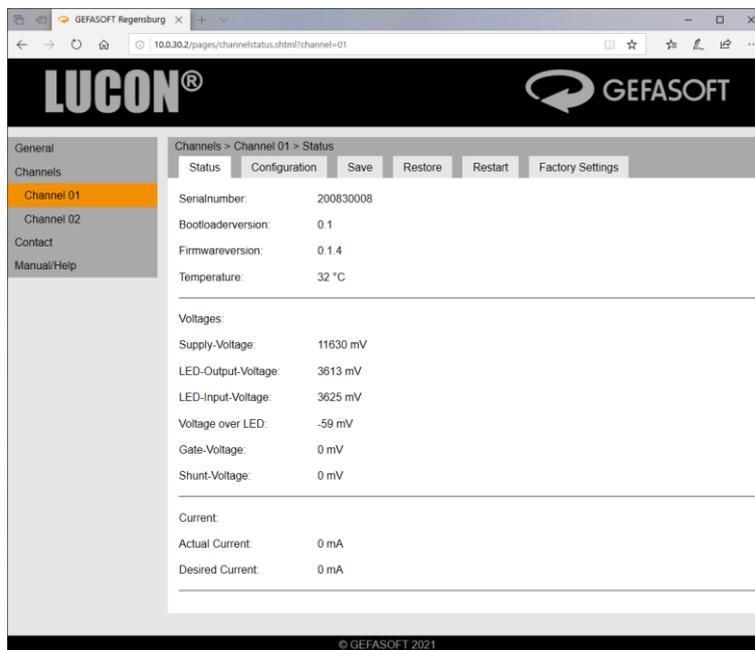


Figure 24: Status page of a channel



The main configuration of the channel is done under the "Configuration" tab (see Figure 25).

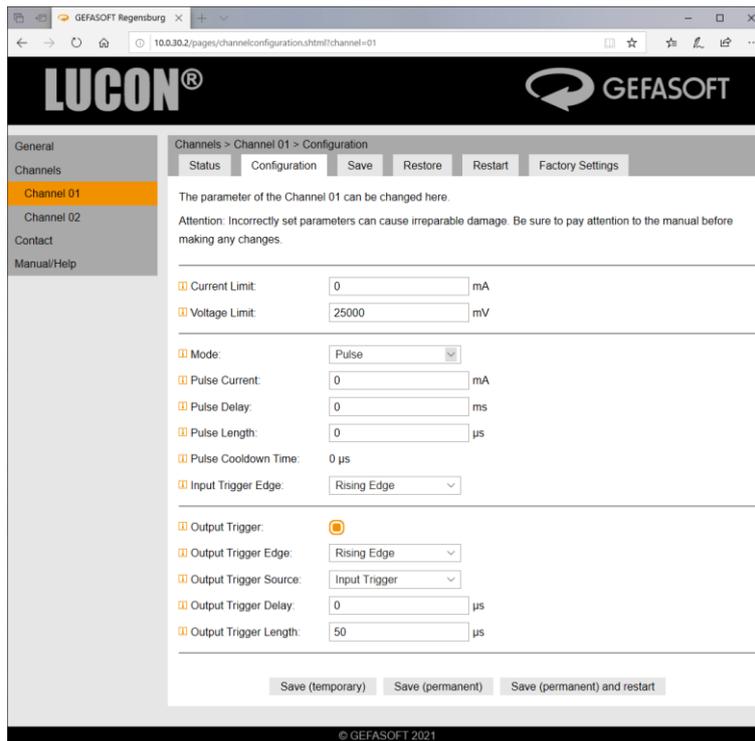


Figure 25: Channel configuration

Furthermore, there are the tabs "Save", "Restore", "Restart" and "Factory Settings". Here you can create and restore individual configuration files for each channel, restart the channels and restore the factory settings.



6.4.3.3 Firmware update of the communication module in the LUCON® 2 Master



A firmware update is always associated with a risk. For example, a power failure during the process may mean that the module can no longer be used and must be replaced. Therefore, an update should only be carried out on advice and in consultation with GEFASOFT Automatisierung und Software GmbH.

The subpage for updating the firmware is reached via the menu items "General" and then "Firmware Update". This differentiates between "Communication Module" (LUCON® 2 Master only) and "Power Module" (LUCON® 2 Master and LUCON® 2 Slave).

For the communication module, the possible entries are limited to the password and the firmware file (see Figure 26). Both are available after consultation with GEFASOFT Automatisierung und Software GmbH.

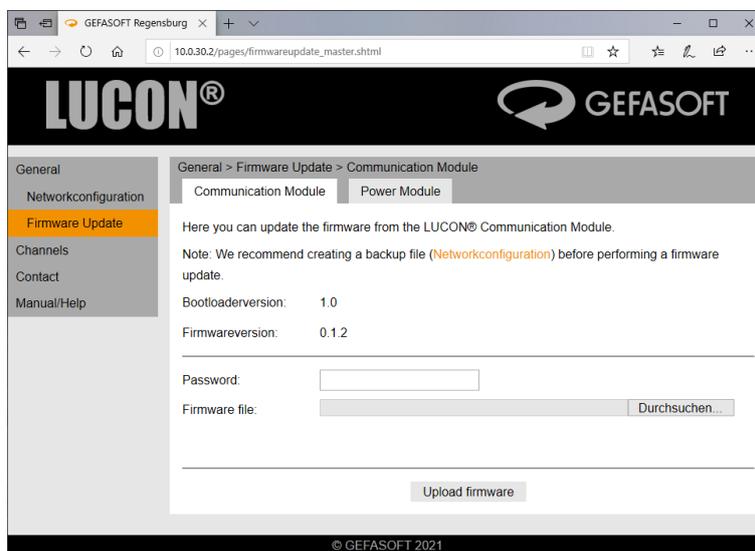


Figure 26: Firmware update of the communication module



6.4.3.4 Firmware update of the communication module in the LUCON® 2 Master and LUCON® 2 Slave



A firmware update is always associated with a risk. For example, a power failure during the process may mean that the module can no longer be used and must be replaced. Therefore, an update should only be carried out on advice and in consultation with GEFASOFT Automatisierung und Software GmbH.

The subpage for updating the firmware is reached via the menu items "General" and then "Firmware Update". This differentiates between "Communication Module" (LUCON® 2 Master only) and "Power Module" (LUCON® 2 Master and LUCON® 2 Slave).

In the case of the power module, in addition to the password and the firmware file (both are available after consultation with GEFASOFT Automatisierung und Software GmbH), the channels are required for updating (see Figure 27). The selection can consist of one, several or all channels.



Several channels can be selected by holding down the CTRL key on the keyboard and clicking the mouse. If all channels are to be updated, a click on "select all" is sufficient.

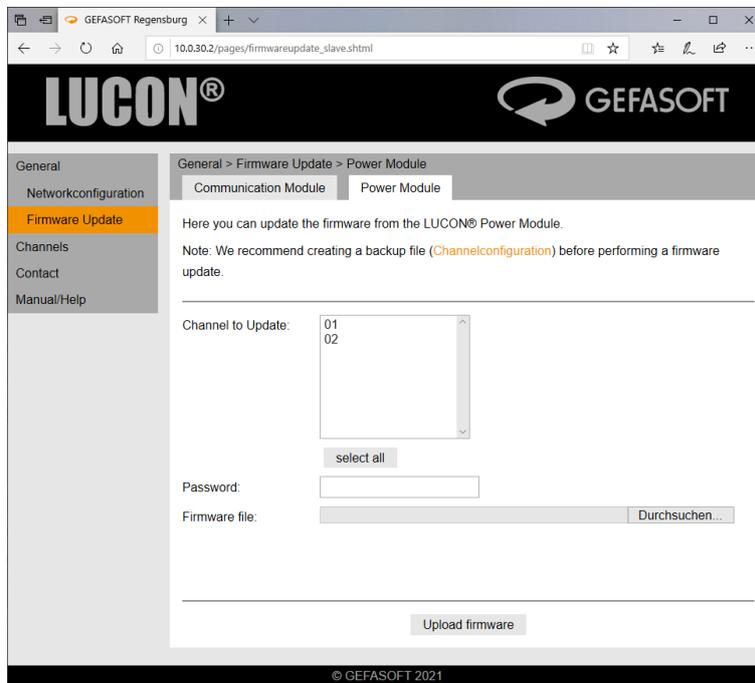


Figure 27: Firmware update of the power module



6.5 Error handling

LUCON® 2 has an integrated error handling. If an error occurs, the communication module in the LUCON® 2 Master sends a message to the connected communication partner (e.g. a computer).

The error message is always preceded by :E and is structured as shown below:

```
:E [error message]r\n>
```

There are two types of error:

- Errors due to incorrect inputs:

Each parameter sent to LUCON® 2 is checked by the device for plausibility. If the parameter or value is invalid, an error message is returned. The value is not saved in the controller. In the case of a command with several parameters, none of the parameters will be saved if at least one value is invalid.

Example of error message (current entered for software mode exceeds current limit set):

```
:E Value is bigger then the current-limit! Max: 1000 mAr\n>
```

- Errors during operation:

The most important system parameters are permanently monitored in the LUCON® 2 lighting controller. These include, for example, the temperature. To protect the device, the current flow to the lighting (= heat source) is interrupted if the limit temperature is exceeded. The corresponding channel then switches to error mode (LEDs on the front of the housing flash red, "major" error, see chapter 4.2) and sends an error message. No parameters can be configured in error mode. When the channel has cooled down sufficiently, parameterization is possible again (LEDs on the front of the housing stop flashing red).

The error message when the temperature limit is exceeded may be as follows::

```
:E Overtemperature on Channel 01r\n>
```

As there is no direct input for this type of error, the error is sent to the last interface used for successful communication. This could be UDP or RS-232.

Other sources of error during operation include:

- Channel number changed during operation (channel number can only be changed when the unit is switched off).

- A channel number occurs more than once (When the controllers are switched on, the set channel numbers are checked. Correct operation is only possible if each channel number is unique. If a channel number occurs more than once, an error message is output and the affected channels flash red. The controllers must then be disconnected from the power supply and the numbers set correctly).

- The voltage limit set for the lighting is too low (the current flow and the voltages are monitored by the lighting controller. Depending on the configuration, the desired current flow cannot be



achieved, e.g. because the voltage limit is set too low (see also section 6.4.1).



7 FAQ

What can I do if I cannot communicate with the LUCON® 2 light controller?

- 1) First of all, it should be determined whether the communication between the LUCON® 2 Master and the remote terminal (computer) is working. It is a good idea to test this with a read command (e.g. R00F, see chapter 6.4.2.2). If this is successful, please continue with point 3).
- 2) Next, it is important to know which interface is used for communication (RS-232 or Ethernet) and it is important to check the wiring.
 - a) Use of RS-232
 - i) With RS-232, it is important that the RX line from the LUCON® 2 Master module (pin 10) is connected to the TX line from the computer. The TX line from the LUCON® 2 Master module (pin 9) must be connected to the RX line from the computer. In addition, the GND of the LUCON® 2 Master module (pin 12) must be connected to the GND of the remote station.
 - ii) If communication is possible but the displayed characters do not make sense, the RS-232 interface is probably incorrectly configured (recommended baud rate: 57600).
 - iii) If communication is still not possible, disconnect the LUCON® 2 Master module briefly from the mains and restart.
 - b) Use of Ethernet
 - i) To check whether the cabling is correct, use the status LEDs on the RJ45 socket on the LUCON® 2 Master module. If one LED lights up and the other flashes, the cabling is OK. If none of the LEDs are lit or both are flashing, there is a problem with the cabling.
 - ii) For Ethernet, correct IP addresses and suitable subnet masks are essential. Both the remote station and the LUCON® 2 Master module must be in the same subnet, but must not have the same IP address (e.g. computer IP: 10.0.30.1, subnet: 255.255.255.0 and LUCON® 2 Master IP: 10.0.30.2, subnet: 255.255.255.0). Important! After changing the LUCON® 2 Master IP address, the device must be restarted.
 - iii) For a simple connection test, the LUCON® 2 can also be pinged. If the ping is successful but communication is still not possible, there is a problem with the stream pools (e.g. the port could be blocked => use another port).
 - iv) If communication is still not possible, briefly disconnect the LUCON® 2 Master module from the power supply and restart it.
- 3) If an error message is displayed, restarting all devices will usually help. To do this, briefly disconnect all connected LUCON® 2 light controllers from the mains. If an error message is still displayed after a restart, please continue with point 5).
- 4) If, on the other hand, no error message is issued, check whether the numbering of the channels is correct (each number used only once) and whether there really is a channel with the desired number (if necessary, try which channels are connected with R01F, R02F, R03F, ..., R16F) => correct the channel numbers on the outside of the respective device.
- 5) If all channel numbers are set correctly and communication is still not possible after restarting all devices, please contact GEFASOFT Automatisierung und Software GmbH for further assistance.

Can I damage my LUCON® controller if the output polarity is wrong?

No, the LUCON® 2 light controller will not be damaged if the polarity of the connected LED light source is reversed. It will also survive a short circuit at the output terminals.

Note, however, that you may damage your LED light source, depending on the specific model and power limits set for the LUCON® 2 module.



Can I damage my LUCON® controller if my input voltage is wrong?

No, the LUCON® 2 LED light controller has an internal protection circuit that prevents damage to the device if the input voltage supply is inverted. Too high an input voltage, on the other hand, can permanently damage the LUCON® 2 LED light controller.

However, the LUCON® 2 may have to be sent to GEFASOFT Automatisierung und Software GmbH for repair, as the protective circuit can be permanently destroyed to prevent serious damage.

I don't know my exact LED specifications - how do I set the LUCON® 2 parameters?

You do not need to know the exact specifications of your light source. It is sufficient to have approximate values for the operating current and the supply voltage. An explanation of how to set the values can be found in chapter 6.4.1.

Can I use more than 20 000 mA current on the output side?

The standard LUCON® 2 system is designed for a maximum output current of 20 000 mA.

As the electronics design and system engineering are developed and operated by GEFASOFT Automatisierung und Software GmbH, you can contact our experts to discuss your specific requirements.

We have supplied customised versions of the LUCON® light controller with modified performance specifications in the past, including higher current output in flash mode.

LUCON® 2 displays an error during operation.

Even without changing the parameters, the LUCON® 2 may suddenly no longer drive the set current for the connected light source. This may be due to the voltage limit being too low (the LED characteristics may change slightly during operation due to thermal effects). Make sure that the voltage limit is set to at least 500 mV higher than the nominal voltage so that the driver circuit can set the correct output current. See also section 6.4.1.

After a conversion from the LUCON® light controller of the first generation to a LUCON® 2 light controller, the latter does not react to the trigger input.

The first step is to check whether the trigger interface has been wired correctly. The pin assignment has changed compared to the first generation. The previous trigger input was internally connected to pin 7 and is now located under pin 8. In addition, the trigger interface is galvanically isolated from the rest of the electronics. This means that an additional ground connection at the trigger interface is mandatory (pin 7). For more information on the pin assignment of the trigger interface, see section 4.3.

If the trigger input still does not work, the following point of this FAQ should be checked.

The LUCON® 2 light controller no longer reacts to the trigger input.

First, check whether a trigger signal actually occurs at the input, what voltage level it has and how long the trigger occurs (for necessary trigger specifications, see chapter 4.3.3). Then check whether the polarity of the trigger is set correctly. Furthermore, check whether the light controller is in the correct mode (see chapter 6.2.1).



If all parameters are correct, it could be that the light controller is in the cooling time after a pulse (see chapter 6.2.3). During this time, trigger signals are ignored, otherwise damage to the light controller could occur.



8 Technical data

	LUCON® 2 Master	LUCON® 2 Slave
Article number	00039600	00039601
Supply voltage (V_{IN})	12 V _{DC} to 48 V _{DC}	
Output voltage (V_{OUT})	0,7 V _{DC} to ($V_{IN} - 2$) V _{DC}	
Output current	Up to 3 A continuous or up to 20 A pulsed	
Output current step size	0,1 mA (1,0 mA to 50,0 mA) 0,5 mA (50,5 mA to 100,0 mA) 1 mA (101 mA to 500 mA) 5 mA (505 mA to 1500 mA) 10 mA (1510 mA to 3000 mA) 25 mA (3025 mA to 10000 mA) 50 mA (10050 mA to 20000 mA)	
Trigger input	High-Level: 3 V - 24 V Low-Level: 0 V - 1,4 V max. 30 V / 10 mA	
Trigger output	Open Collector max. 30 V / 50 mA	
Interface	RS-232 @ 57600 bps RJ45 @ UDP (with configuration website)	
Flash duration	0,005 - 59000 ms	
Switch-on delay	0,023 - 59000 ms	
Installation	35 mm DIN top-hat rail, EN50022; cooling slots upwards	
Dimension (W x D x H)	22,6 mm x 92 mm x 99 mm	
Weight	130 g	106 g
Operating temperature	0 °C - 50 °C	
Overtemperature (switch-off, internal)	80 °C	



9 Disposal

Disposal of electrical appliances of this type in household waste is not permitted!

Please observe the country-specific regulations.



Systems or parts of systems should not be handed in at public collection points for further disposal. In the case of systems and system parts that are not marked with a waste bin, the owner is obliged by law to dispose of them properly. However, even then we are happy to help and can give you information on where and how you can dispose of these systems and system parts.

If requested, GEFASOFT Automatisierung und Software GmbH can be of assistance on **+49(0)941 / 788300**.