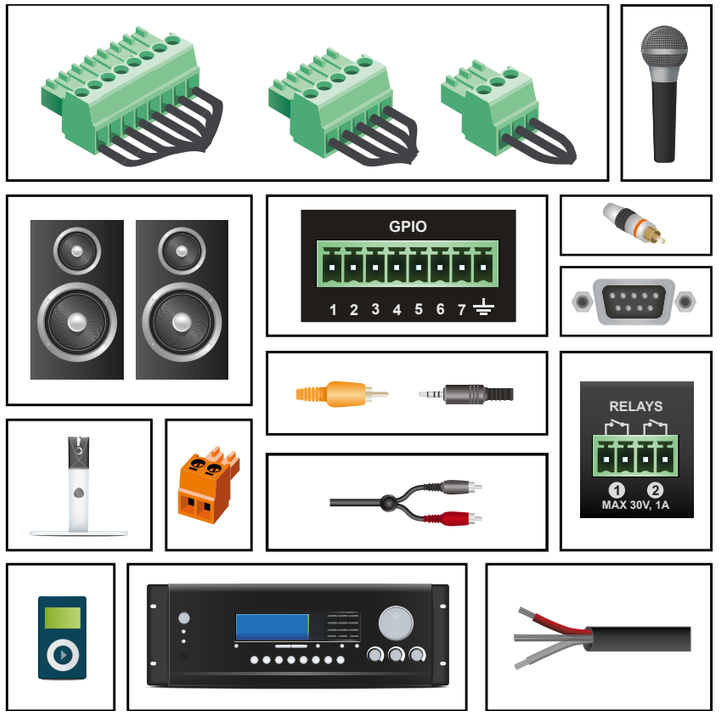
visual engineering
LIGHTWARE

Assembly Guide



Cable Wiring Guide for Lightware Devices

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Document Information

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Introduction

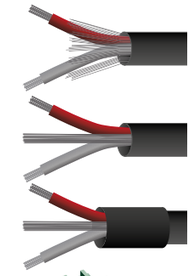
Many Lightware devices contain receptacles that are compatible with Phoenix-type plugs. These widespread connectors are popular in the AV industry thanks to the robust construction and stable connection. Another advantage is that they are easy to assemble. This guide helps users connect third-party devices to these ports.

1.1. Mounting Accessories Overview

To ensure the correct connection of the cables, take care of the mounting process. Always use the proper tools for mounting:

- Appropriate cable
- Cable ties or cable shrink wrap
- Cable stripper
- 2.5 mm flat-head screwdriver

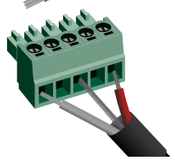
1.2. Basic Assembly Steps



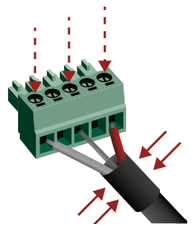
Step 1. Remove the outer jacket of the audio cable with the cable stripper.

Step 2. Spin the shield thoroughly, remove the bare wires. Pre-tinning the shield wires is recommended.

Step 3. Place the cable shrink wrap 1 cm far from the connector.



Step 4. Identify the dedicated wires and paste them into the connector. Take care of the correct order of the wires! For more details, see the Cable Wiring Guide section.



Step 5. Fasten the wires with the screwdriver and fix the cable shrink wrap.

2

Cable Wiring Guide

2.1. Audio Ports, Cables and Connectors

Certain Lightware devices may be supplied with 3-pole Phoenix input for microphone connection and 5-pole Phoenix input and output for analog audio connections.

2.1.1. Symmetric and Asymmetric Ports

Inputs and outputs of audio devices are symmetric or asymmetric. The main advantage of the symmetric lines is the better protection against the noise, therefore they are widely used in the professional audio industry. Symmetric audio is most often referred to as balanced audio, as opposed to asymmetric, which is referred to as unbalanced audio. Lightware products are usually built with 5-pole Phoenix connectors, so we would like to help users assemble their own audio cables. See the most common cases below.

ATTENTION! Symmetric and asymmetric lines can be linked with passive accessories (e.g. special cables), but in this case half of the line level is lost.

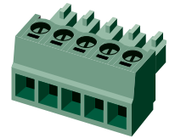
ATTENTION! There are numerous types of regularly used connector and cable types to connect audio devices. Please always make sure that a connector or cable fits your system before use.

ATTENTION! Never join the phase-inverted (negative, cold or - poles (either right or left) to the ground or to each other on the output side, as this can damage the unit.

INFO: Use a galvanic isolation in case of a ground loop.

2.1.2. The Pinout of the 5-pole Phoenix Connector

Pin nr.	Signal
1	Left+
2	Left-
3	Ground
4	Right-
5	Right+



Compatible Plug Type

Phoenix® Combicon series (3.5mm pitch, 5-pole), type: MC 1.5/5-ST-3.5.

2.1.3. The Pinout of the 3-pole Phoenix Connector

The 3-pole Phoenix connector is used for the analog microphone input.

Pin nr.	Signal
1	Ground
2	-
3	+

Compatible Plug Type

Phoenix® Combicon series (3.5mm pitch, 3-pole), type: MC 1.5/3-ST-3.5.

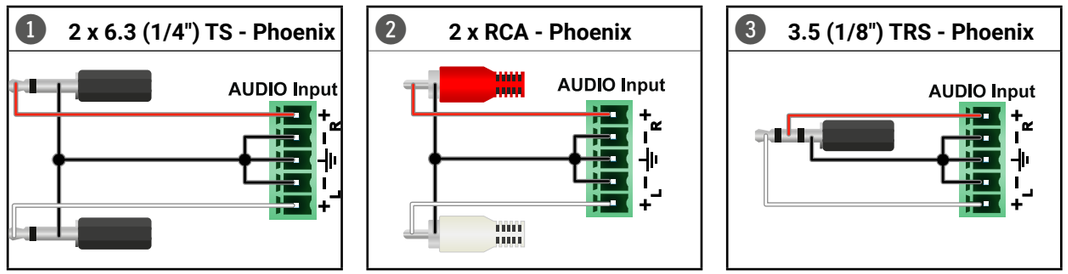
2.1.4. Recommended Cables for Wiring

	Connector type	Recommended cable type	Example nr.
Unbalanced	6.3 (1/4") TS	Instrument cable	1 4
	3.5 (1/8") TRS	Thin stereo audio cable	3 6
	RCA	Stereo audio cable	2 5
Balanced	6.3 (1/4") TRS	Microphone cable	7 8
	XLR		9 10 12
	Phoenix		11

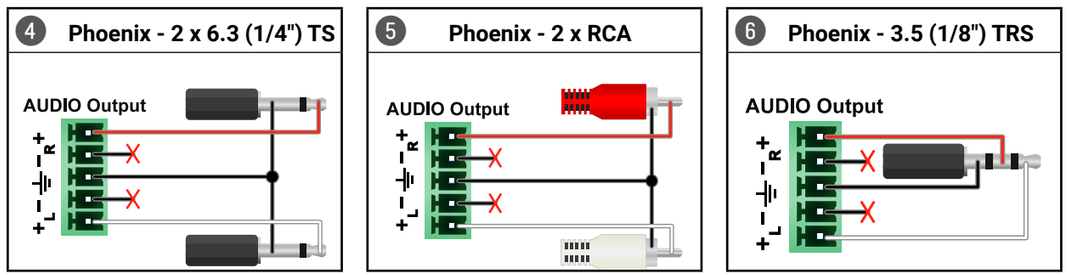
INFO: Microphone cables should be shielded with 2x0.22mm² conductor, max. 50m long.

2.1.5. Common Wiring Examples

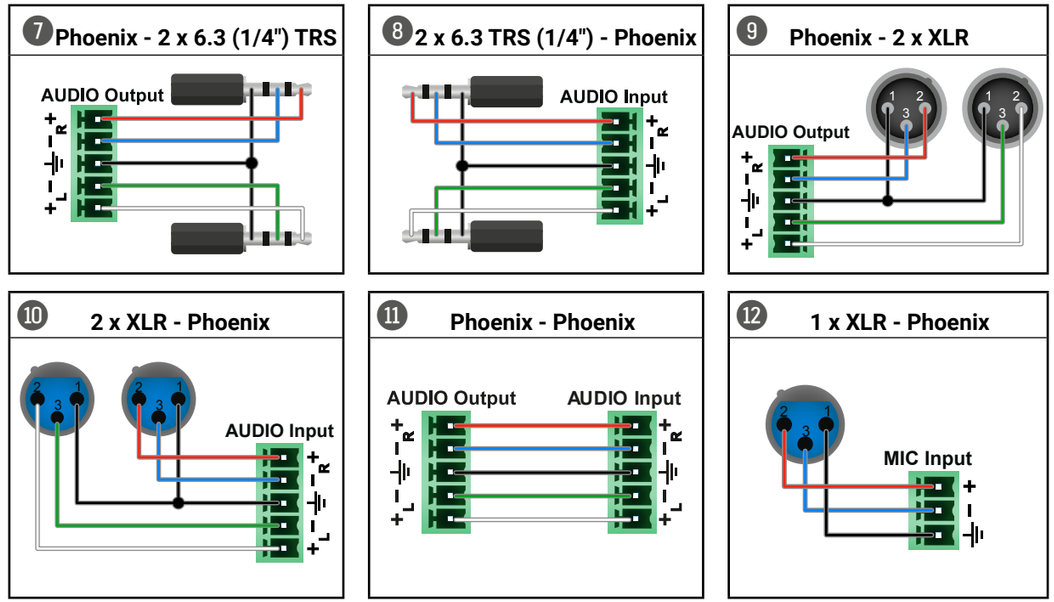
From Unbalanced Output to Balanced Input



From Balanced Output to Unbalanced Input



From Balanced Output to Balanced Input



ATTENTION! Always check the correct wiring of the microphone cable! Never apply phantom power with an unbalanced cable, because it can cause damage!

2.2. Serial Ports, Connectors and Infra Port

2.2.1. The Pinout of the 3-pole Phoenix Connector

The 3-pole Phoenix connector is used for the RS-232 serial communication.

Pin nr.	Signal
1	Ground
2	Transmitted data
3	Received data

Compatible Plug Type

Phoenix® Combicon series (3.5mm pitch, 3-pole), type: MC 1.5/3-ST-3.5.

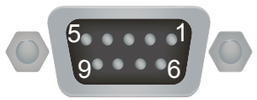
2.2.2. The Pinout of a DE-9 Type Serial Connector

The DE-9 type (D-subminiature, or D-sub) male or female connector is also used for RS-232 serial communication. There are two types of devices in general serial communication:

Data Terminal Equipment (DTE): This is an end instrument that converts user information into signals or reconverts received signals. Typical DTE devices: computers, LCD touch panels and control systems.

Data Circuit-terminating Equipment (DCE): This kind of device is placed between the DTE and a data transmission circuit. It is also called data communication equipment and data carrier equipment. Typical DCE devices: projectors, industrial monitors and amplifiers.

The pinout of DTE and DCE devices are different:

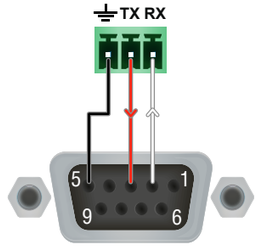


Pin nr.	Signal (DTE)	Signal (DCE)
1	device-dependent	
2	**Received data**	**Transmitted data**
3	**Transmitted data**	**Received data**
4	device-dependent	
5	**Ground**	**Ground**
6	device-dependent	
7	device-dependent	
8	device-dependent	
9	device-dependent	

2.2.3. 3-pole Phoenix and D-sub Connector Wiring

Lightware device and a DCE

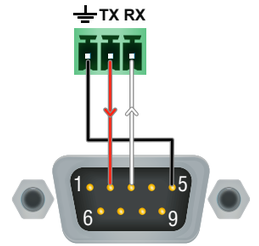
D-SUB 9 (female) and Phoenix



2: TX data
3: RX data
5: Ground

Lightware device and a DTE

D-SUB 9 (male) and Phoenix

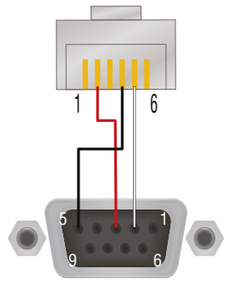


2: RX data
3: TX data
5: Ground

2.2.4. RJ12 and D-sub Connector Wiring

Lightware device and a DCE

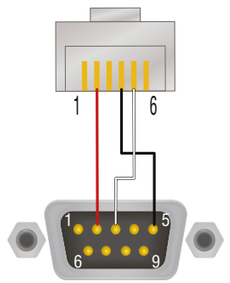
D-SUB 9 (female) and RJ12



2: TX data
3: RX data
5: Ground

Lightware device and a DTE

D-SUB 9 (male) and RJ12



2: RX data
3: TX data
5: Ground

2.2.5. The Pinout of the 2-pole Phoenix Connector

Certain Lightware devices contain a 2-pole Phoenix connector. Depending on the destination port, it can be used for TTL serial data output or Infra emitter.

Pin nr.	Signal
1	Ground
2	Transmitted data

TTL digital signal levels can be set to high or low level (Push-Pull).

Using a receiver with at least 1k impedance to any voltage between 0V and 5V, the output voltages are:

- Logic low level: 0 .. 0.25V
- Logic high level: 4.75 .. 5.0V

In that case the actual current is:

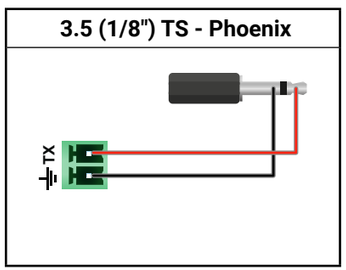
- Logic low level: -5mA < current < 0mA (sink)
- Logic high level: 0mA < current < 5mA (source)

Compatible Plug Type

Phoenix® Combicon series (3.5mm pitch, 2-pole), type: MC 1.5/2-ST-3.5.

2.2.6. 3-pole Phoenix and TS Connector Wiring

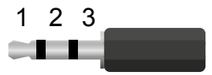
3.5 (1/8") TS - Phoenix



2.2.7. The Pinout of the TS and TRS Infra Ports

Input

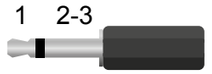
An IR detector and IR emitter can be connected to the device with TRS (Tip, Ring, and Sleeve) connectors. They are also known as (3.5 mm or approx. 1/8”) audio jack, phone jack, phone plug, and mini-jack plug. The pin assignments are the following for the detector:



Detector – 3-pole-TRS	
1 Tip	Signal (active low)
2 Ring	GND
3 Sleeve	+5V

Output

The pin assignments are the following for the emitter:



Emitter – 2-pole-TS	
1 Tip	+5V
2 Ring	Signal (active low)
3 Sleeve	

INFO: Ring pole of the emitter is optional. If your IR emitter has a three-pole TRS plug, then the Ring and the Sleeve are the same signal (Output -).

2.2.8. USB-Serial Cable Wiring (FTDI)

ATTENTION! Please note that below description refers to original FTDI cables.

Most of the computers and laptops are supplied without a dedicated connector for serial data transmission. In these cases, the USB port of the computer can be used as a serial port if the proper FTDI adaptor cable is applied. The FTDI cable below is a USB to Serial (TTL level) converter, which allows a simple way to connect TTL interface devices to USB. The USB connector contains a small circuit board featuring the FTDI serial UART interface IC.

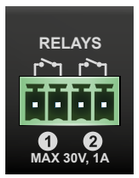
Wire	Signal
Black	**Ground**
Brown	CTS#
Red	VCC
Orange	**TX data**
Yellow	**RX data**
Green	RTS#

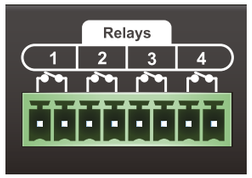
2.3. Relay Connector

Certain Lightware devices contain relay connectors that can be accessed by a 4-pole or 8-pole Phoenix connector (it depends on the device). The relays can be controlled by Lightware protocol commands (LW3), and Event manager actions can be assigned to the port.

ATTENTION! The devices are supplied with normally open (N.O.) contact relays, which means when the unit is not powered (DC plug is disconnected), the relays are open.

The pinout of the Relay is simple: connect the two wires from the controlled device to the desired Relay port.





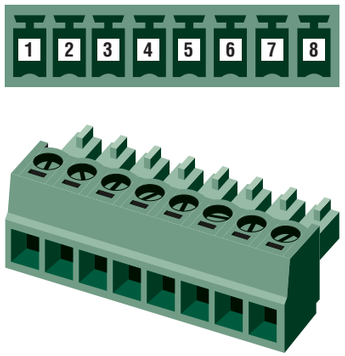
2.4. GPIO Port

Certain Lightware devices contain an 8-pole Phoenix connector with seven GPIO pins that operate at TTL digital signal levels and can be set to high or low level (Push-Pull). The direction of the pins can be input or output (adjustable). Voltage ranges for GPIO inputs are the following:

	Input voltage [V]	Output voltage [V]	Max. current [mA]
Logical low level	0 - 0.8	0 - 0.5	30
Logical high level	2 -5	4.5 - 5	18

INFO: The total maximum current for the seven GPIO pins is 180 mA.

Pin nr.	Level and direction
1	Configurable
2	
3	
4	
5	
6	
7*	
Ground	



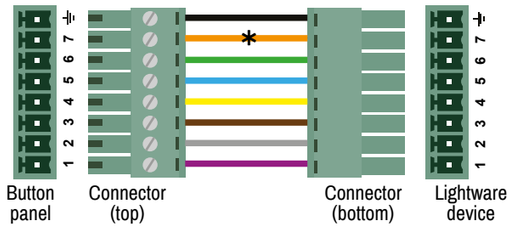
* The 7th pin is not configurable in certain Lightware devices. In that case the 7th pin supplies 5V constantly.

Compatible plug type

Phoenix® Combicon series (3.5mm, pitch 8-pole), type: MC 1.5/5-ST-3.5.

2.4.1. Connecting the Basic Button Panel to a GPIO Port

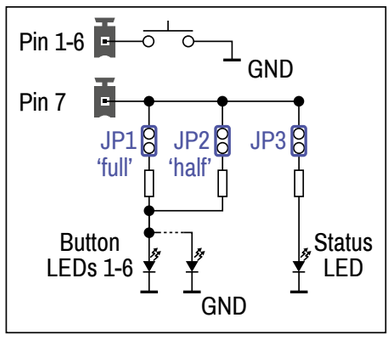
The recommended cable for the connectors is the AWG24 (0.2 mm² diameter) or the generally used 'alarm cable' with 8x0.22 mm² wires.



* The 7th pin of the GPIO connector (Button panel) can be used for different functions. For more information, see the Quick Start Guide of the Button panel.

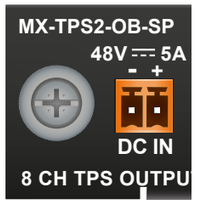
INFO: The cable between the button panel and the GPIO port has been tested by a 50-meter AWG23 type cable. For longer distances, please contact Lightware.

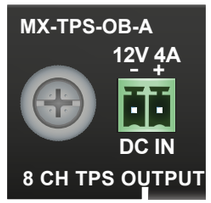
The Simplified Schematic of the Button Panel



2.5. DC Input Connectors

Certain Lightware devices contain a 2-pole Phoenix input connector for DC power input. The compatible adaptor is always equipped with a 2-pole Phoenix plug. The pinout of the connector is always displayed on the device:





Compatible Plug Type

Phoenix® Combicon series (3.5mm pitch, 2-pole), type: MC 1.5/2-ST-3.5

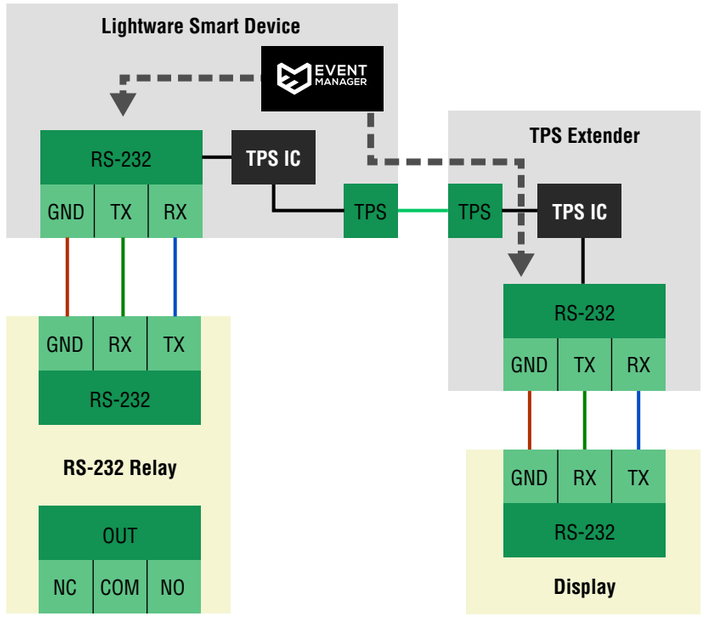
3

Application Examples

This chapter expounds some typical examples on how to connect the Lightware device to the third-party units via serial, relay and GPIO ports.
For more details and examples about Event Manager, please visit our website (www.lightware.com) and download the Event Manager Application Note from the Downloads section.

WARNING! The following sections contain third-party devices connected to the control ports of the Lightware devices. Please always check the technical parameters of the device (Voltage/ Current) and the port of the Lightware device before connecting. Overloading a port could damage the device.

3.1. Controlling a Projector/Monitor via RS-232



NO: normally open; **NC**: normally closed

The example above includes two serial devices:

- The **Relay** device connected to the local RS-232 port (P1), and
- The **Display** device connected to the TPS RS-232 port (P2).

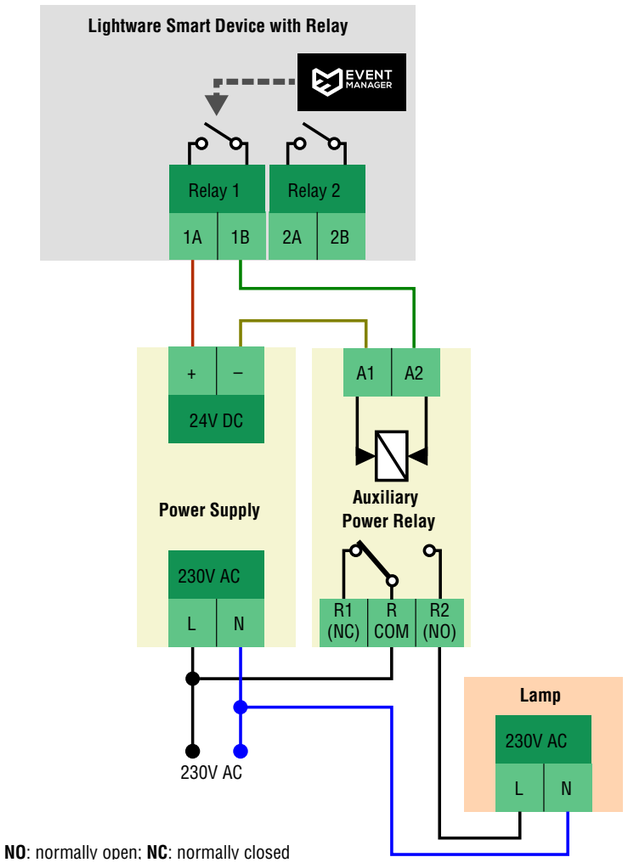
The Smart TPS device is able to send messages to both devices via the local and the TPS RS-232 ports (RS-232 signal is also transmitted via the TPS connection).

Pay attention to the serial port settings:

- Baud rate, Data bits, Stop bits, Parity
- Control mode
- P1 is the local, P2 is the TPS RS-232 port.

3.2. Switching a Power Relay, Turning a Lamp On and Off

The Relay port of a Lightware device can be used to connect and control a Power Relay. A typical example can be seen in the figure below about how to switch a lamp:



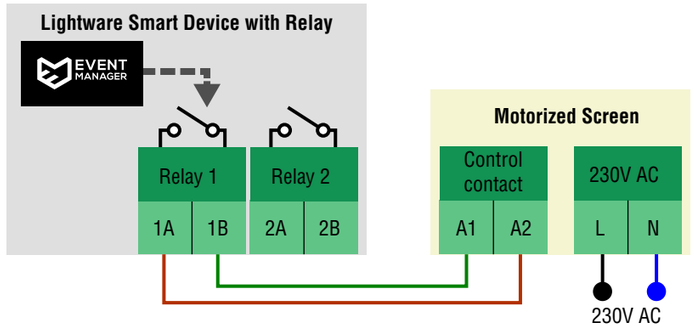
NO: normally open; **NC**: normally closed

Step 1. Set up the circuit as seen in the figure. Connect the wires to the **Relay port**.

Step 2. The default **Connection** of the **Relay ports** is **Open**. When the circuit is **Closed,** the lamp is powered on.

3.3. Controlling a Motorized Screen with Relay

The **Relay port** of a Lightware device can be used to connect and control a Motorized Projection Screen. A typical example can be seen in the figure below:



Rolling the Screen

The projection screen can be controlled via the Control contact pins as follows:

- **Roll down: A1** and **A2** pins are connected (the **Relay** is **Closed**).
- **Roll up: A1** and **A2** pins are not connected (the **Relay** is **Open**).

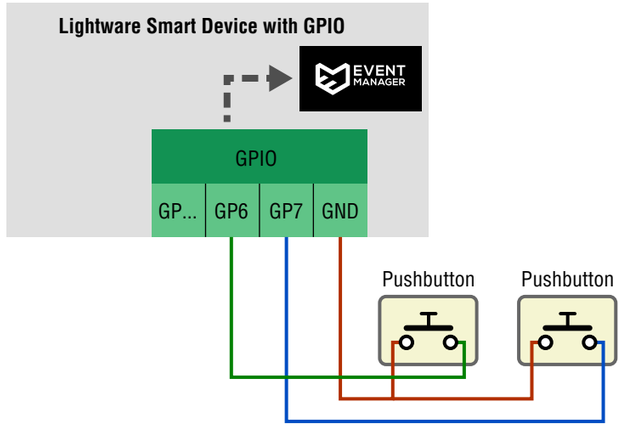
Step 1. Setup the system as seen in the figure.

Step 2. Connect the wires to the **Relay port**.

Step 3. The default **Connection** of the **Relay ports** is **Open**. When the **Relay1** port is **Closed** the screen rolls down. If the **Relay1** port is **Open** the screen rolls up. (These can be used as **Actions**.)

3.4. Using the Connect a Pushbutton with GPIO

DEFINITION: The simple pushbutton below is a dry contact with only one function: closing a circuit.



Step 1. Connect the wires to the button panel and the **GPIO port** as seen in the figure. The brown line is the ground, which is common for both buttons.

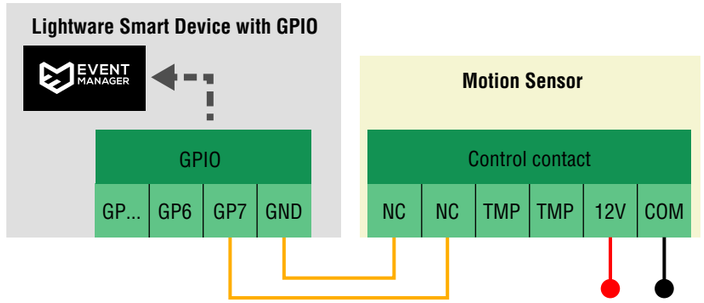
Step 2. Set the **Direction** of the two GPIO pins to **Input**.

Step 3. The default **Input level** of the GPIO pins is **High**. When a button is pressed, the circuit is closed and the given pin got **Low** state. (That change can be used as a **Condition** in the **Event Manager**.)

Step 4. When the button is released the level of the pin is changed to **High** again.

3.5. Controlling a Motion Sensor with GPIO

DEFINITION: The Motion sensor below is a device that keeps the connected circuit closed in default idle state. When the sensor gets activated (Alarm), the circuit is opened.



NC: normally closed; **TMP**: tamper contact

The working method is similar to the case of the pushbutton, as the motion sensor can be used to change the **Input level** of a **GPIO pin** (and use it as a **Condition**).

Step 1. Connect the wires to the motion sensor and the **GPIO port** as seen in the figure.

Step 2. Set the **Direction** of the GPIO pin to **Input**.

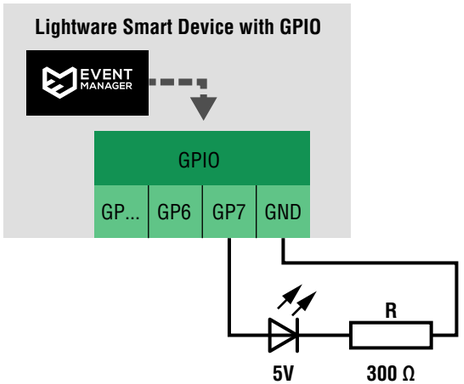
Step 3. The default **Input level** of the GPIO pins is **High**. The circuit (towards the GPIO port) is closed by the motion sensor as default so the pin got **Low** state. When the Motion sensor gets activated (Alarm), the circuit will be opened and the GPIO pin level changes to **High**. (This change can be used as a **Condition**.)

Step 4. When the circuit is closed by the motion sensor, the level of the pin changes to **Low** again.

3.6. Supplying a LED Directly with GPIO

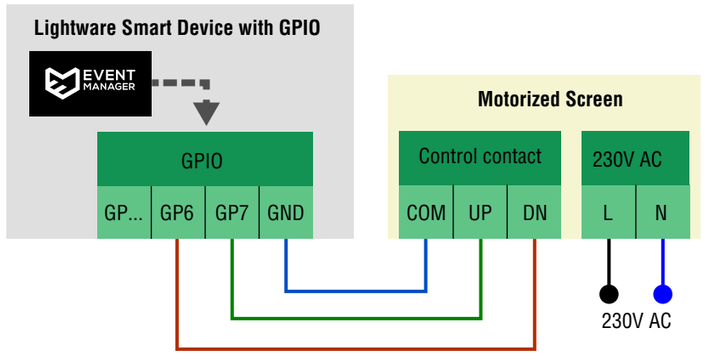
The technical structure of the GPIO port allows supplying simple devices working at low power consumption. In the example below a +5V LED is connected to a GPIO pin.

ATTENTION! A GPIO pin can supply at most 30mA (5V), and the total load of the seven GPIO pins must not be more than 180mA. Always check the technical parameters of the third-party device to avoid overload.



3.7. Controlling a Motorized Screen with GPIO

The **GPIO port** of a Lightware device can be used to connect and control a Motorized Projection Screen. In this example the GPIO pins will be used as **Outputs**. A typical example can be seen in the figure below:



Rolling the Screen

The Motorized Screen can be controlled via the COM|UP|DN contact pins as follows:

- **The screen rolls up:** if the **UP** and **COM** pins are connected (**DN** is not connected to **COM**).
- **The screen rolls down:** if the **DN** and **COM** pins are connected (**UP** is not connected to **COM**).

Step 1. Set up the circuit as seen in the figure.

Step 2. Set the **Direction** of the GP6 and GP7 pins to **Output**.

Step 3. The default **Output level** of the GPIO pins is **High**. The screen control can be arranged by setting the GP6 and GP7 pins as **Actions** by the **Event Manager,** set as follows:

	GP6 level is low	**GP6 state is high**
GP7 level is low	-	screen rolls up
GP7 level is high	screen rolls down	-