Product Description

LightScape GT1 is a temperature gradient table with configurable lighting conditions.

The temperature gradient is obtained along the left-right sides of the table, with the left end being the cold side and the right end being the warm side. The table top is made of a thick aluminium plate, insulated on the bottom, allowing for heat transfer between the warm and cold ends, thus achieving the temperature gradient.

Above the table-top there is a pivoting table lid installed. On the lower surface of the lid, addressable RGB LED strips are installed. In the rear end of the lid, high power RGB LEDs are installed for a higher light intensity. The entire table lid can move up-down, thus varying the distance between the LEDs and the table top.

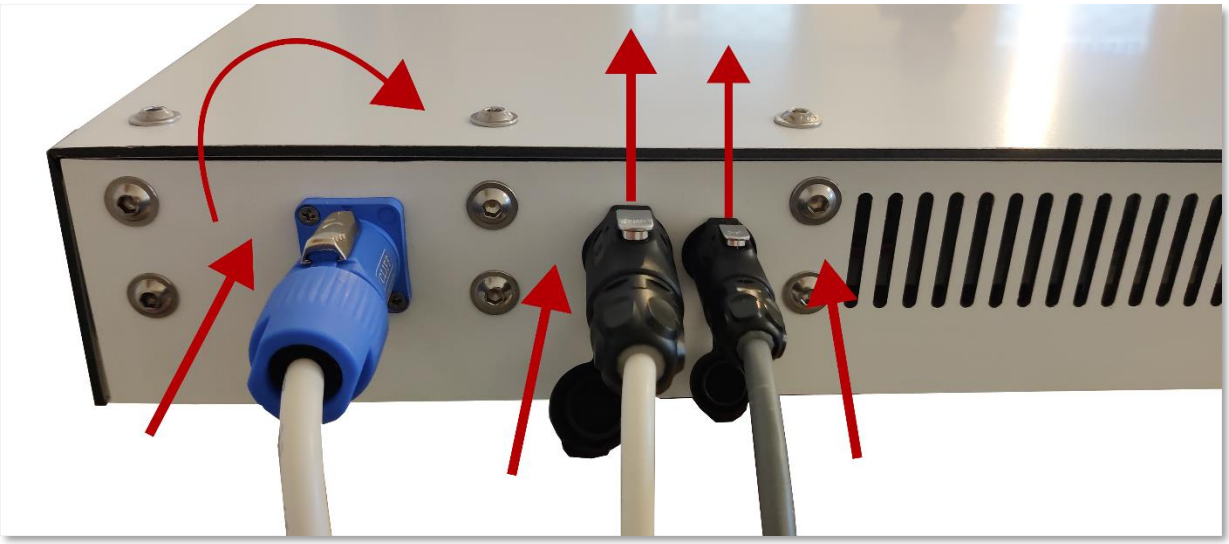
Product Specifications

- Weight: 200 kg (approx)
- Dimensions: 1300 x 1200 x 1150 mm (approx)
- Working area: 1200 x 600 mm
- Operating temperature range (ambient):5 – 30 $°C$
- Power input: 230 VAC, 50 Hz
- Power consumption:
    - Chiller: Typical 300 W, Maximum 650 W (see EXC-900 User Manual)
    - Gradient Table: Typical 1200 W, Maximum 3300 W (see below).
- Temperature range cold side: $-3\ °C$ … $Ambient - 5\ °C$
- Temperature range warm side: $Ambient + 5\ °C$ … $40\ °C$
- Temperature stability: $\pm 0.5\ °C$
- RGB configurable LEDs
- Maximum white light intensity: above 50 000 LUX
- Adaptive active cooling of LEDs

Installation steps:

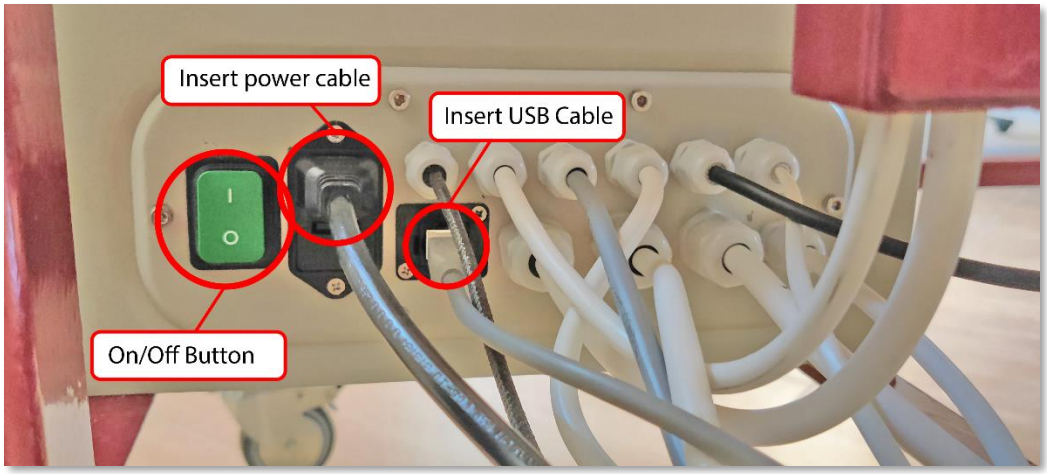
Caution: After transportation, wait 24 hours before powering on the chiller.

1. **Caution:** When handling the table for movement, do NOT handle it by the lid. Use the red table legs for moving the table.
2. Unpack the gradient table. Remove all packing material.
3. Inspect for damage during transport.
4. Place the table in the work area.
5. Unpack the cables from the right side of the table.

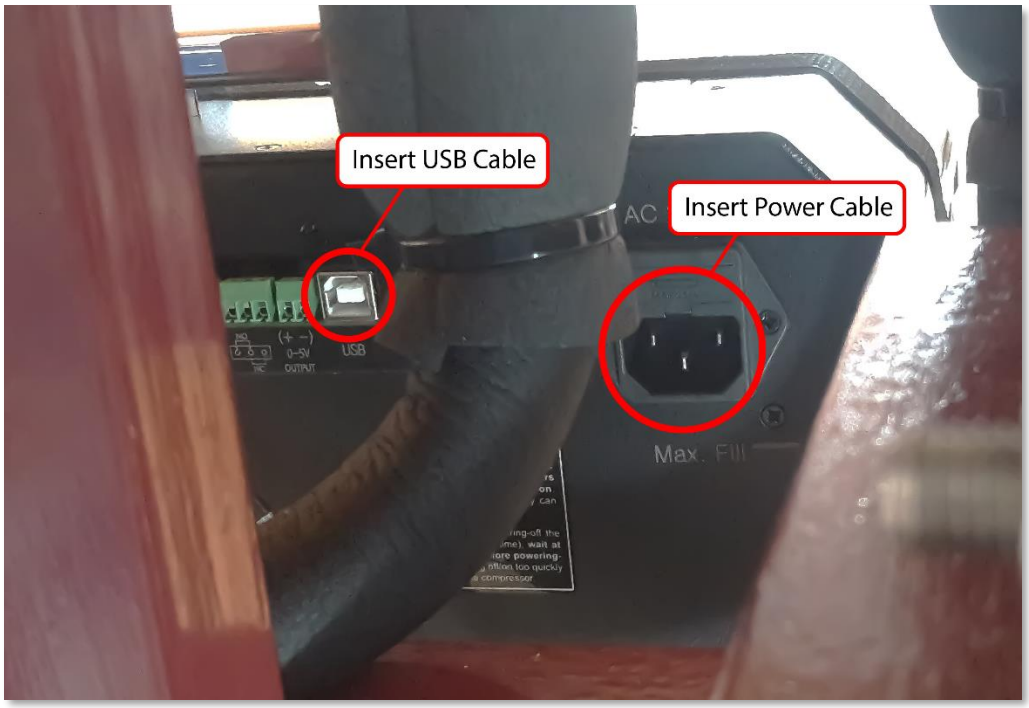


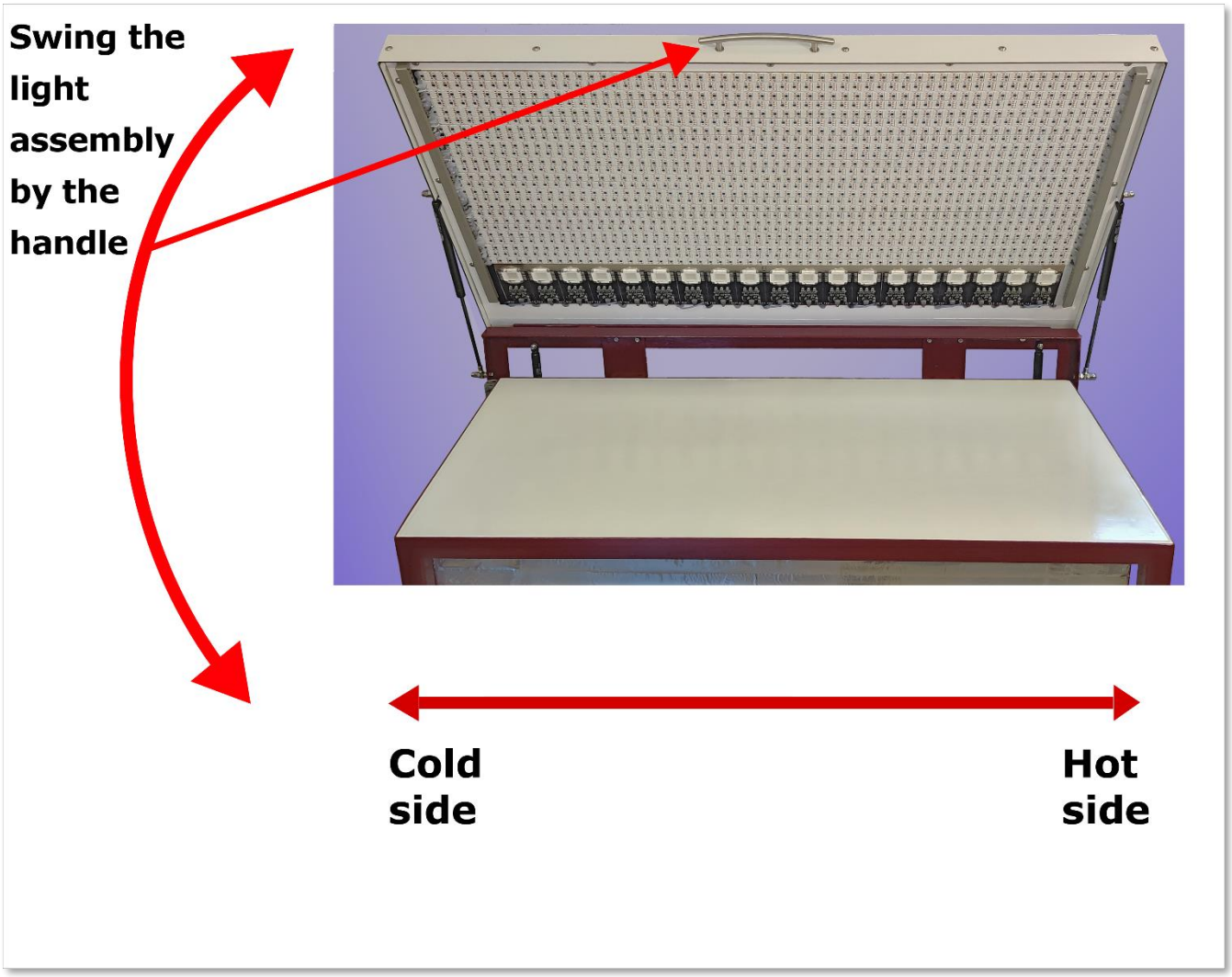
6. Connect the 3 cables from the table control box to the back of the light assembly. Insert the blue connector and twist clockwise until the silver latch is seated. Insert the black connectors until the silver latch is in the up position.

7. Connect the USB and power cables to the control box.



8. Copy files on the USB stick to a folder on the local drive.
9. Driver installation:
    a. At this step, the table does not need to be powered on.
    b. Connect the table (white box) to a Windows PC with a USB cable.
    c. Open *Device Manager* on the PC.
    d. Under *Other Devices*, locate *CP210x* as unknown device.
    e. Right click *CP210x* and select *Update driver*.
    f. In the update driver dialog, select *Browse my computer for drivers (locate and install manually)*. Point the dialog in the folder where you copied the files from the USB stick, inside the folder *CP210x*.
10. Connect the USB and power cables to the chiller.


Insert USB Cable
Insert Power Cable
AC
USB
Max. Fill



Details:

1. Mechanical

The lid can be pivoted manually from the handle in the front. Do NOT use this handle or the light assembly to move the table. The table can be moved by the table legs.

The table top is an aluminium plate with the dimensions of 1200 x 600 x 30 mm. Along the 1200 mm direction the temperature gradient is obtained.

The active heating and cooling zones have a length of 150 mm at each end, therefore the temperature gradient zone length is 900 mm (approx).

The table top is insulated on the bottom side with 100 mm of polystyrene and ceramic wool. The top side of the table top is painted and covered with a thin layer of varnish

The LEDs are mounted on a heat sink which can move up-down with respect to the table top. This movement is made possible by using 2 cnc linear axes. The entire light assembly can pivot.

Distance from LEDs to the table top: 25 mm – 200 mm, adjustable from the software.

Mild steel and aluminium are used as structural materials.

The table is equipped with 4 pivoting wheels, each with its own braking clamp.

2. Temperature

Cooling is done by using a Koolance EXC-900 recirculating chiller. The left end of the table top is cooled by using a copper-aluminium heat exchanger with the surface area of 500 mm x 150 mm.

The recirculating liquid used is "Koolance 702 Liquid Coolant, High-Performance, UV Green", with -15 °C freezing point. For more information, consult the producer's documentation:

https://koolance.com/portable-900W-recirculating-chiller-exc-900-220v

https://koolance.com/liq-702-liquid-coolant-bottle-high-performance-700ml-uv-green

For regulating and measuring the cold temperature there are 2 sensors installed in the left side of the table top:

- One K-Type Thermocouple for the EXC-900 chiller. This is used for regulating the temperature.
- One Pt-100 sensor for the PC software. This is used only for on-screen readings.

Caution! Do not allow the cooling liquid to go below $-5\ °C$.

Warming is done by using cartridge heating elements. These heating elements are placed in two aluminium blocks. The heating zone has a surface area of 500 x 150 mm. The total heating power is 1200 W.

Warm temperature regulation and reading are done using a Pt-100 sensor installed inside the table top, in the middle of the warm zone.

The area between the cooling and the heating ends is the temperature gradient zone, with a surface size of 600 mm x 900 mm.

The widest temperature range achievable is: -3 °C … 40 °C.

After setting the temperatures, allow for 1 hour to pass in order to enter normal regime: the temperatures to stabilize and for the temperature gradient to form along the table.

3. Light

For achieving configurable lighting conditions, addressable RGB strips and addressable high power LEDs are installed.

There are 25 strips installed, each strip having 58 groups of 3 RGB LEDs. Each group of 3 LEDs is considered as an individual unit (the user may set the RGB values only per group of 3 LEDs). This gives a total of 174 LEDs per strip, and a total of 4350 LEDs for the entire table.

In the back side of the table, there are 19 high power addressable RGB LEDs installed which can give even more light. Each high power LED can be individually set by RGB values.

Each strip has a maximum power consumption of approx 30 W.

Each high power LED has a maximum power consumption of 30 W.

To ensure a working temperature of below 45 °C for the LEDs, both the strips and the LEDs are mounted on a heat sink which is actively cooled by 8 fans placed on top. There is a Pt-100 temperature sensor installed on the heat sink to monitor its temperature. The fans change speed automatically depending on the heat sink temperature.

Caution! The total electric power installed for the lights is approx 1300 W. Cooling is done by using ambient air. The gradient table is NOT designed to operate at maximum lighting conditions for an extended period of time (more than a few minutes). This is because the LEDs will overheat and their lifespan will be greatly diminished. The fans will go at maximum speed around 40 °C. After reaching the temperature of 70 °C on the heat sink, the table is programmed to turn off the lights, and enter into a lock-in state. It will highlight this in the PC interface and will not respond to commands from the PC interface. To resume operation, allow for the heat sink to cool down and power cycle the table.

Note: It is recommended to choose lighting conditions allow the temperature of the heat sink to remain below 45 °C.

The maximum white intensity achievable by the strips is around 50 000 LUX.

The maximum white intensity achievable by the high power LEDs is around 100 000 LUX.

4. Motor

The entire lighting assembly can be moved up-down (closer / farther away from the table top). The distance can be varied in the interval: 25 mm – 200 mm.

At instrument power up, the motor position is unknown. The instrument can function without problem in this condition.

If a particular distance between the LEDs and the table top is required, then the motor position must be initialized by pressing the *Home* button. This will send the LEDs in the farthest position from the table top.

After motor initialization, any distance can set via the software.

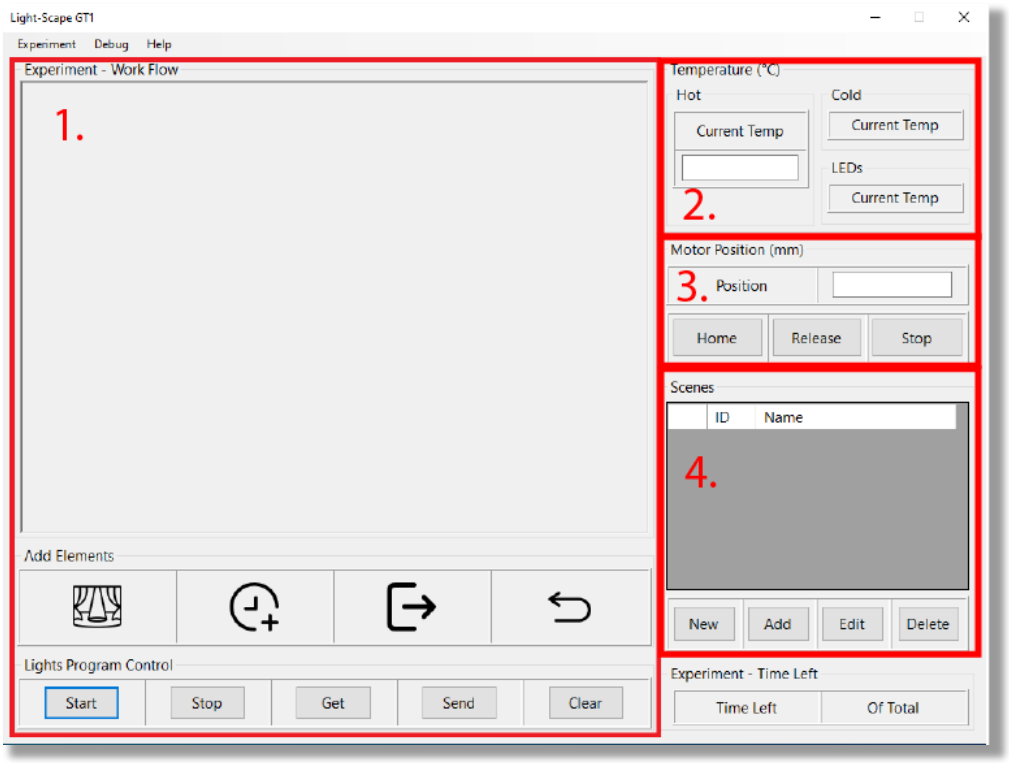
5. Software

5.1. Software for lighting and heating - Gradient Table.exe

Main window

It is divided into 4 categories:

- 1. Experiment
- 2. Temperature
- 3. Motor
- 4. Scenes



Experiment

Under this group, the work flow of the lights is defined (the working cycle / program).

Using the *Experiment* menu, the work flow can be saved or loaded from a PC file.

There are four active elements which can be added to an experiment:

Scene, Delay, Loop Start, Loop End

The program will go through these elements, in the order they were added. This constitutes the work flow.

The elements are added left to right, and interpreted in the same order: the left most being the first one, the rest following thereafter.

To add an element to the work flow, left click on the element's pictogram in the *Add Elements* group.

To remove an element from the work flow, right click on the element's pictogram or around the pictogram area in *Experiment – Work Flow* area.

To insert an element before an existing element in the work flow:

- Select the element before which to insert a new element by double clicking its pictogram
- Add one or more new elements by selecting them from *Add Elements*
- Deselect the highlighted element by double clicking it again

Program Element	**Description, parameters**
Scene	Adds a scene to the experiment from the scene list in *Scenes* by ID. Transition time in hours, minutes, and seconds represents the time in which the lights transition from the previous old scene to this new scene. Each color channel (R, G and B) transitions linear from the old value to the new value within the set time. If the transition time is set to zero, then the new scene is displayed immediately.
Delay	Add a delay in hours, minutes and seconds. This acts as a "hold on" time for the current scene.
Loop Start	Marks the start of a loop. It has no parameters
Loop End	Marks the end of a loop. It has the number of loops as parameter. Zero marks infinitely looping.

Caution! The software does not check for loop consistency (correct behavior is not warranted if loops are not placed correctly). The loop logic is the same as mathematical parenthesis logic, allowing for nested loops, etc.

After defining the experiment work flow (the lights program), in order to execute it, it must be sent to the instrument (to the MCU handling the lights) and then it must be given the start command.

This can be achieved using the *Lights Program Control* buttons.

Button name	**Description**

Start	Starts the light program stored in the instrument's MCU
Stop	Stops the light program and turns off the lights
Get	Retrieves the light program stored in the instrument's MCU
Send	Sends the light program in *Experiment – Work Flow* to the instrument's MCU
Clear	Clears the program in *Experiment – Work Flow*. Has no effect on the MCU

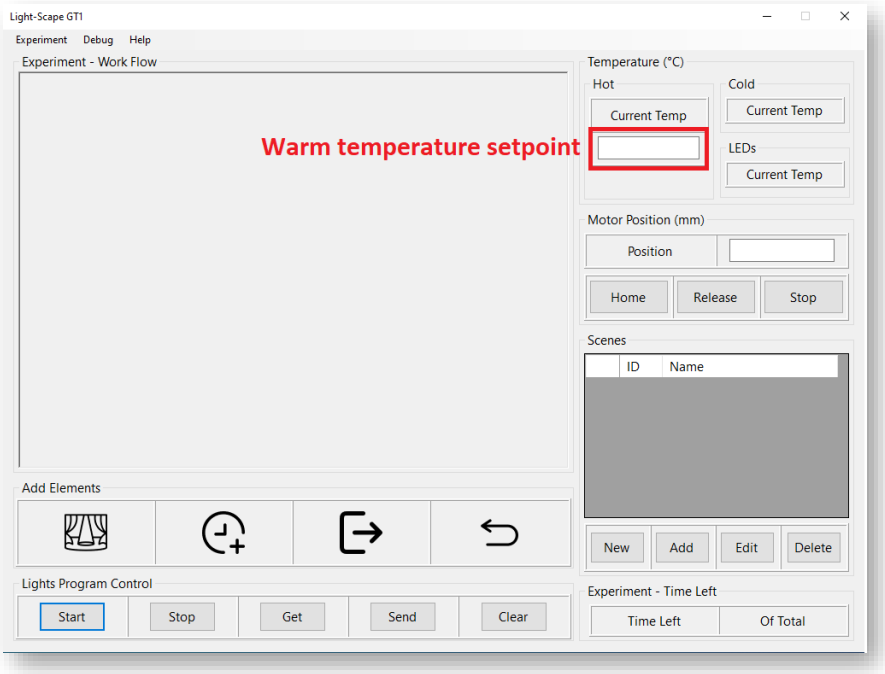
Note: The Experiment Work Flow is stored in the volatile memory of the MCU, and will be lost on power down. To save it, use *Save As* to store it as a file on the PC.

Temperature

Set warm temperature using the text box in *Hot* group. Type in the desired number and hit *Enter*.

Temperature monitoring is available for the warm and cold zones, as well as for the LED heat sink.

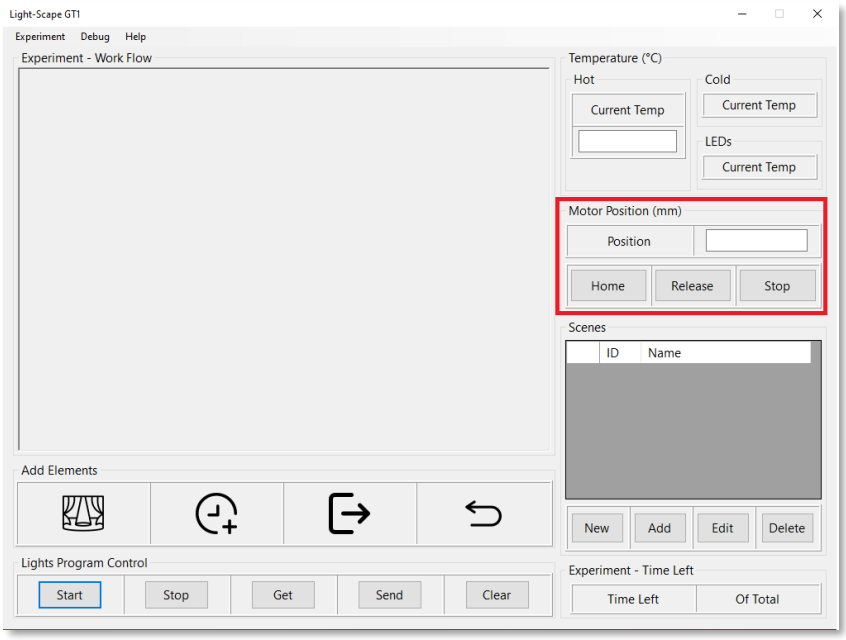
The cold temperature is set by using the chiller's dedicated software.



Motor

At instrument power up, the motor position is unknown.

In order to be able to set a distance between the LEDs and the table top, the motor position must be initialized. Type in a number in the interval 25 – 200 *mm* and hit *Enter*.



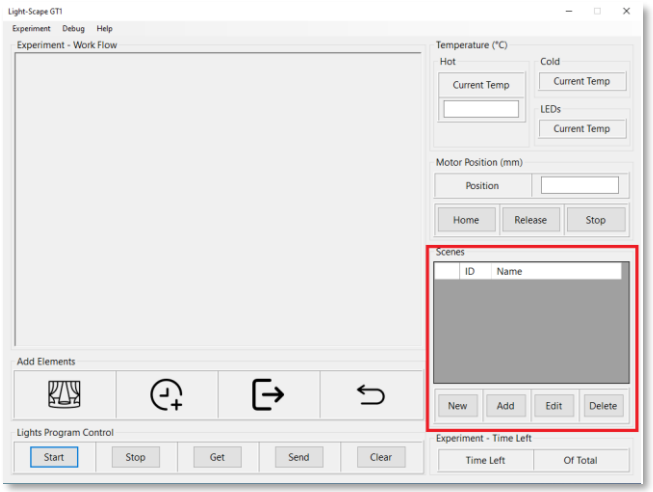
Button	Description
Home	Initialize the motor position. Sends the LEDs to the maximum distance of 200 mm from the table top. Use this after each power up.
Release	Clear an internal fault or error condition and allow the motor to receive commands. Does not cause the motor to move. Caution when using this. This function is for exceptional cases only and not intended for normal operation.
Stop	Acts as an emergency stop for the motors. Immediately stops the movement of the motors. Causes an internal fault condition. Caution when using this. This function is for exceptional cases only and not intended for normal operation.

Scenes

In this group, static lighting scenes can be defined and edited.

The scene list contains all the scenes which can be used in the experiment.

Note: When *Send* button is pressed, all the scenes from the scene list will be sent to the instrument's MCU. For memory considerations, avoid having unused scenes in the scene list.

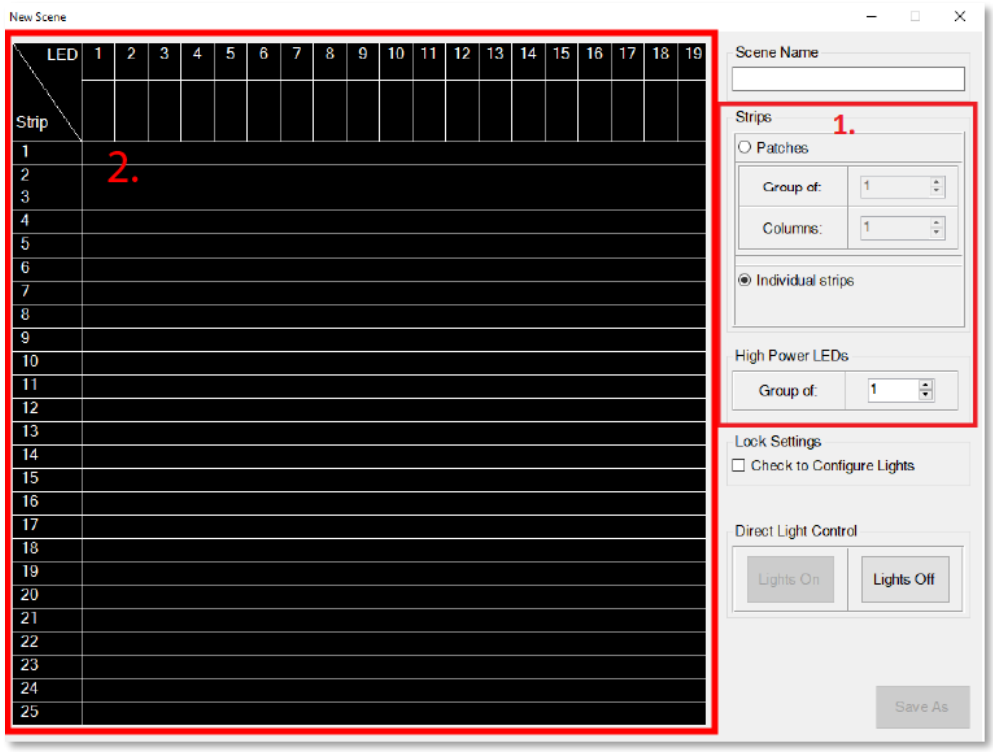


Button	Description
New	Open *Scene Definition* window.
Add	Opens a dialog to add one or multiple scenes saved on PC.
Edit	Open *Scene Definition* window, to edit the selected scene. To select a scene, select its entire row from the scene list. If multiple scenes are selected, this button has no effect.
Delete	Deletes the selected scenes from the scene list. To select one or more scenes, select their entire rows from the scene list.

Scene definition window

It is divided in two categories:

- 1. LED geometry settings
- 2. LED geometry map



LED geometry map

This is a representation of the LED grouping.

A group is the black region (initial coloring) separated by thin white lines.

The RGB light can only be defined per such group.

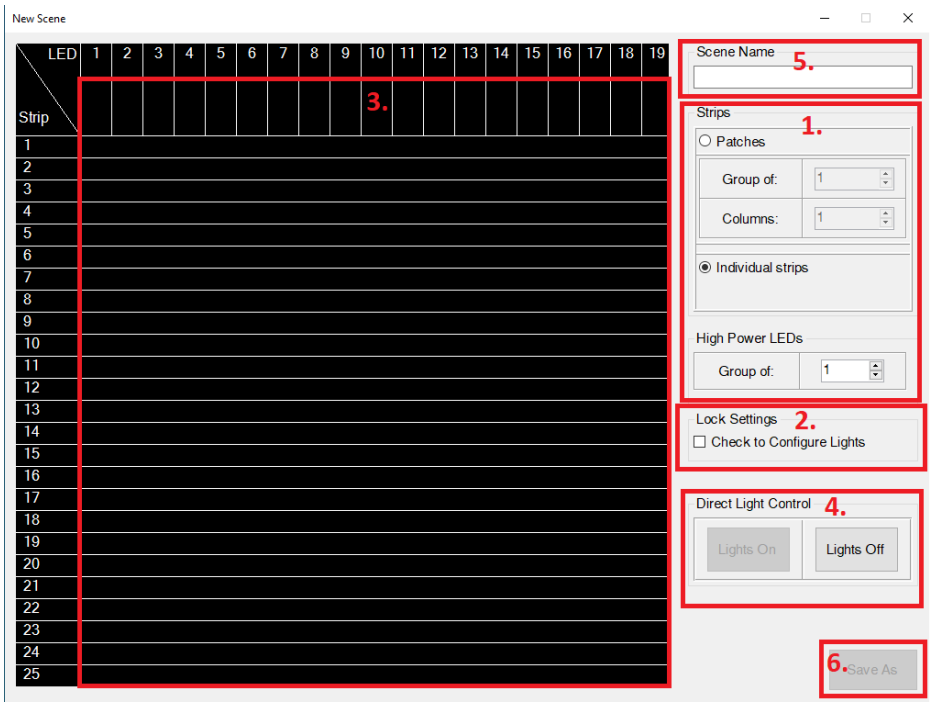
The map is updated when the settings are changed.

If colors are defined and the settings change, then the colors are reset to $(R, G, B) = (0, 0, 0)$.

LED group settings

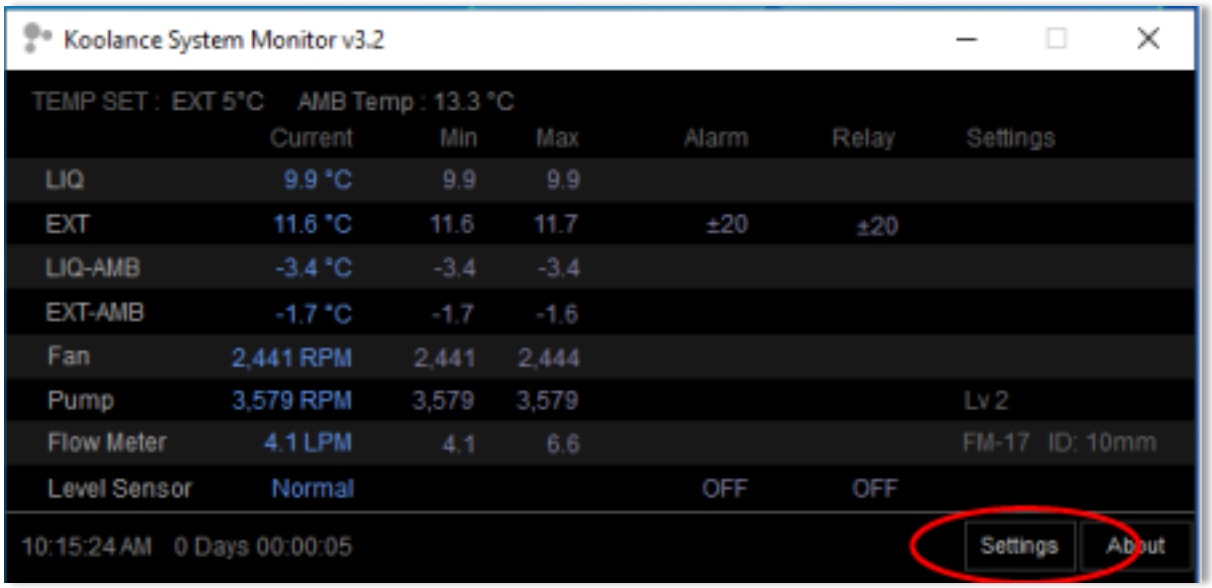
The strip LEDs as well as the high power LEDs can be grouped, thus forming the geometry.

Steps to configure lights:



1. Define the geometry by setting the groups.
2. Check the *Check to Configure Lights* check box.
3. Left click on each group on the map. A color selection dialog will pop up, where RGB values can be set.
4. To send the configuration to the table and preview the settings, use *Lights On* button.
5. Use *Lights Off* button to turn off the lights.
6. Give a name to the scene in the *Scene Name* textbox.
7. Click *Save As* button. If no name was given at step 6, then a random name will be generated.

5.2 Software for the chiller - KSMv3.exe

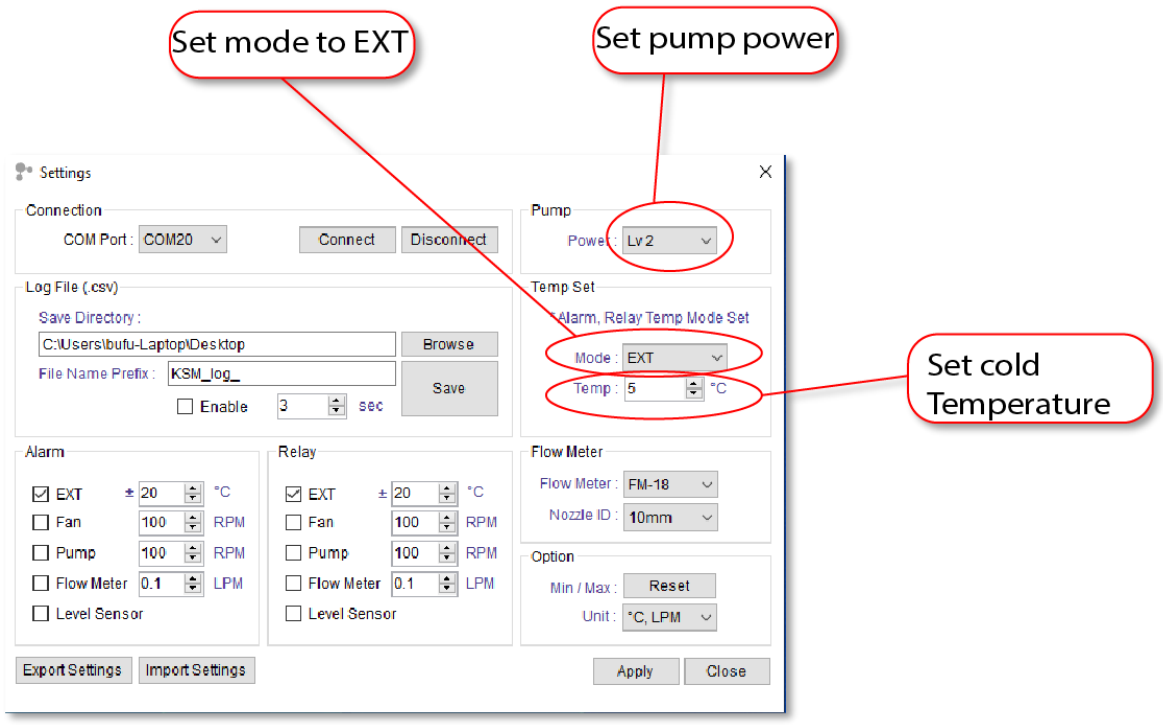


This is the main window of the program.

LIQ - is the temperature of the liquid used to cool the table

EXT - is the temperature given by the sensor mounted in the left side of the table.

This is used to regulate the cold side.



The set up the chiller click the *Settings* button.

In the *Temp Set* area, set the *Mode* to *EXT*.

Set the *Temp* to your required temperature for the cold side.

Set the pump power to your required level.

For other information please consult the help manual of the chiller

- *manual_exc-900_d100eng.pdf*

6. Maintenance

Clean the top of the table with warm water with liquid soap only. Do not use solvents or corrosive substances.

Keep the linear axes at the back of the table dust free. They are lubricated.

Ensure that the ventilation grills at the sides and at the back of the light assembly are not obstructed.

Ensure that the liquid level in the chiller is at the correct level (consult the chiller manual).

Caution! After powering off the chiller, allow for 15 minutes to pass before powering it on again.

Caution! Use the instrument reasonably. Do not spam any controls (software or hardware).

7. Known issues

1. The .exe programs will not function if the USB cables are not correctly plugged in. If USB connection is made and broken, the *Gradient Table.exe* will become unresponsive until USB connection is remade.

2. Make sure that *Display Settings* of your computer is set to 100% (right click on the desktop, select *Display Settings* and choose 100%). The *Gradient Table.exe* program will display incorrectly otherwise.

3. In *Gradient Table.exe*, if you select a work element and insert another element before it, then delete some other work element, the insert function will malfunction. Solution: after inserting work elements, make sure to unselect the highlighted work element.

4. During transportation, the light assembly may drift a bit towards the warm zone, and the cover margin will scratch the table red support when tilted up/down. Solution: give a short but firm hand push (not by hitting) of the entire light assembly from the warm side towards the cold side; this will put it back in its operational position.

8. Limited Warranty

The producer offers warranty for the entire system for a period of one year starting with the date of delivery, but no longer than 16 months from the date of purchase. All repairs will be done at the workshop indicated by the seller for no extra charge. In case of warranty claims, the transport of the defective item to and from the workshop indicated by the seller will be supported by the customer. The warranty is not transferable.

The warranty does not cover and becomes void in the following cases: misuse of the instrument, damage during transport, natural disasters, accidents, subjecting the instrument to conditions against common sense (wrong power supply voltage, extreme temperatures, mechanical shocks, etc.), modification of the instrument without prior approval of the manufacturer, unauthorized interventions on the instrument (without prior approval of the manufacturer).