Instruction Guide

PHOTON SYSTEMS INSTRUMENTS

FytoScope FS 160/FS 300
AlgaeTron AG 160/AG 300

Please read the Guide before operating this product

Manual Version: 2024/10

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1 WARNINGS AND SAFETY PRECAUTIONS

Please read the following instructions carefully before turning ON the device:

- Remove all packaging and transit protectors before connecting the device to the electricity supply.
- Allow the device to stand upright after transport and **WAIT AT LEAST 24 HOURS** before connecting it to the electricity.
- Keep the device dry and avoid working in a high-humidity environment.
- The manufacturer is not responsible for any damage due to improper operation. Read this manual carefully before operating the device. If you are not sure about something in the manual, contact the manufacturer for clarification.

	**By taking over the device, the customer agrees to follow the instructions in this guide.**

The following table presents basic highlight symbols used in this manual:

Symbol	Description
	Important information, read carefully.
	Complementary and additional information.

Table 1 Used symbols.

General electrical safety guidelines:

- The device is designed for a voltage of 220 - 240 V AC with a frequency of 50 Hz. Its use in networks with different voltages is dangerous and strictly prohibited.
- Replace worn or damaged cords immediately.
- Use appropriate electrical extension cords/power bars and do not overload them.
- Place the devices on a flat and firm surface. Keep them away from wet floors and counters.
- Avoid touching the device, socket outlet, or switch if your hands are wet.
- Do not make any alterations to the electrical part of the devices or their components.
- The internal sockets have the same voltage as the device input. The maximum allowed current is 1.5 A per socket or 3 A as the sum of the currents for all sockets.
- Do not plug in uncertified and unapproved devices into the inner sockets. The manufacturer takes no responsibility for any damage resulting from non-compliance with this principle.
- Do not remove the top cover that houses the electronic equipment, as it may result in an electric shock.

	**The AlgaeTron AG 230 is considered a Class 1M* LED Product. LED radiation may be harmful to the eye. Avoid direct and strongly reflected exposure. It is recommended to use protective glasses.**

**Class 1M: Laser and LED equipment is safe for use with the naked eye under reasonable conditions of operation. However, looking directly into the radiation source by using optics within the beam, such as a magnifying glass, telescope, or microscope, can be potentially hazardous.*

2 General Description

The FytoScope and AlgaeTron series comprise floor-standing growth chambers and incubators, available in two sizes based on internal volume: 160 and 300 liters. The FytoScope FS 160/300 is primarily designed for the cultivation of vascular plants, providing optimal ventilation to prevent disease development. The AlgaeTron AG160/300 is intended for cultivating algae and cyanobacteria, offering a source of air suitable for aerating liquid cultures, and optionally accommodating up to three orbital shakers. Both products share a well-defined, uniform environment, external design and control software.
Common features of both models include compactness combined with a sizable growth area, precise temperature control, and several independently adjustable growth levels — two for the 160 model and four for the 300 model. The smart control software is displayed and easily operated through a touchscreen. The software provides device status information, enables the creation of automatic protocols for temperature and lighting control, and offers visualization and data management capabilities. Each shelf's illumination is separately controllable in terms of intensity, mode, and timing, according to the user's defined protocol. The FS/AG 160/300 series is designed with a minimal footprint, making it ideal for laboratories with limited space.
The internal temperature can be controlled within a range of 10 to 45 °C (with maximum illumination), while the ambient temperature should be between 10 and 35 °C. However, optimal performance of the device is achieved at a normal ambient room temperature of 18–25 °C. To ensure homogeneous temperature distribution inside the incubator, internal airflow fans are built into the chamber.

The AlgaeTron AG 300 is equipped with electrical outlets (EU type) for optional connecting up to three dedicated orbital shakers SHK-2013, while the AlgaeTron AG 160 can utilize one orbital shaker. It is not recommended to use different types of shakers in AlgaeTron.
Another optional piece of equipment for FS and AG is a Gas Mixing System GMS 150, capable of introducing pure or mixed gases into the incubator, enabling cultivation under controlled air compositions. Gas concentration inside the cultivator can be modulated according to the user's defined protocol with the optional high-precision Gas Mixing System GMS 150.

This manual provides technical information about:

- AlgaeTron AG 160
- AlgaeTron AG 300
- FytoScope FS 160
- FytoScope FS 300

The following sections provide a description of the instrumentation delivered with the device and detailed, step-by-step instructions for its installation and operation.

Fig. 1 AlgaeTron and FytoScope in both model sizes.

2.1 FS/AG 160

The illumination is provided by **two** independently controlled light panels using LED lights. The top panel is an in-built light panel integrated into the AlgaeTron/FytoScope AG/FS 160 device body (labelled as the **Main** light). The lower light panel is designed as a removable light shelf (labelled as **Shelf 1 – S1**). The standard lighting consists of cool white LEDs with additional far-red LEDs. The control unit allows modification of intensity, timing steps, and light mode for each panel separately.
The LED panels generate a highly uniform irradiance flux over the entire shelf area. The light intensity of the Main panel is adjustable up to 500 $\mu mol \cdot m^{-2} \cdot s^{-1}$ for AlgaeTron and up to 1,000 $\mu mol \cdot m^{-2} \cdot s^{-1}$ for FytoScope. The lower panel intensity is adjustable up to 350 $\mu mol \cdot m^{-2} \cdot s^{-1}$. Optionally, the light intensity can be increased up to 1,500 $\mu mol \cdot m^{-2} \cdot s^{-1}$ for the Main panel and 500 $\mu mol \cdot m^{-2} \cdot s^{-1}$ for the lower light Shelf 1. Timing steps for various light modes range from minutes to hours. The AG/FS 160 offers a total illuminated cultivation area of 0.38 m^2 on two levels.
Both AlgaeTron and FytoScope maintain constant inner air circulation and optionally allow control of the inner gas composition. For the FytoScope, an integrated air pump with a higher flow rate (nominal 450 l/hour) is used to ensure sufficient ventilation, providing an optimal atmosphere for vascular plants. The AlgaeTron, on the other hand, utilizes an inbuilt air pump with a smaller flow rate (nominal 150 l/hour) but with greater power, allowing for the aeration of liquid cultures of algae or cyanobacteria. The air source can be either non-pressurized ambient room air supplied via the integrated air pump into the cultivation chamber or a defined gas mixture from a pressurized gas source (external gas mixing system, gas tank, air compressor, etc.). Additionally, to control the inlet gas, the AG/FS can be supplemented with a Gas Mixing System GMS 150, bringing pure or mixed gases in a defined concentration into the incubator. Gas Mixing System GMS 150 is used to precisely control the concentration and flow rate of the gas mixture from the gas source.
Optionally, AlgaeTron AG 160 can be supplemented with one orbital shaker with a loading capacity of 5 kg, a platform size of 290 x 258 mm, and a rotation speed range of 30 to 500 rpm. The shaker comes equipped with a non-skid rubber mat, and optional sticky pads or Erlenmeyer attachments of different sizes can be delivered.

2.1.1 FS/AG 160 Components

	Check the contents of the package and compare it with the enclosed standard package list (see below).

List of standard FS/AG 160 Components

- the cultivation unit
- one inbuilt LED light panel
- one pluggable LED light panel
- one metal grid shelving
- two metal shelf holders
- three plastic plugs used to close the gas input connectors
- USB flash disc
- metal drip tray
- power cord
- UTP cable

Optional accessories/components

- An orbital shaker equipped either with a non-skid rubber mat or sticky pads or Erlenmeyer attachment of different sizes – **for the AlgaeTron AG 160 model**
- Gas mixing GMS 150 system

2.1.2 FS/AG 160 TECHNICAL DATA

Volume (l)	163
Illuminated tiers	2
Shelves dimension (cm)	48.5 x 38.5
LED light illumination	Top LED panel (1 piece) - white with added far-red LEDs 735 nm
	Lower LED panel (1 piece) - white with added far-red LEDs 735 nm
Maximum light intensity (PPFD at 30 cm) (µmol·m^{-2}·s^{-1})	Top panel: 500 (AG 160), 1,000 (FS 160) Light upgrade: 1,500
	Lower panel: 350 Light upgrade: 500
Temperature range (°C)	10 – 45
Refrigerant	R290
Air supply (l/h)	150 (AG 160)
	450 (FS 160)
Internal dimensions (w x d x h cm)	51 x 45 x 71
External dimensions (w x d x h cm)	60 x 62 x 114
Operating temperature (°C)	10 - 35
Optimal operating temperature (°C)	18 – 25
Power / Power Input (W)	425
Voltage (V)	220 – 240 AC
Weight (kg, without shaker)	100
Communication ports	Ethernet socket USB port – only for the supplied USB flash disc

2.2 FS/AG 300

The illumination is provided by **four** independently controlled LED light panels. The top panel is an inbuilt light panel integrated into the AlgaeTron/FytoScope AG/FS 300 device body (labelled as the **Main** light). The three lower light panels are designed as removable light shelves (labelled as **Shelf 1 – Shelf 3, S1 – S3**; from top to bottom). The standard lighting consists of cool white LEDs with additional far-red LEDs. The control unit allows modification of intensity, timing intervals, and light modes for each panel separately.
The LED panels generate a highly uniform irradiance across the entire shelf surface. The light intensity of the Main panel is adjustable up to 500 $\mu mol \cdot m^{-2} \cdot s^{-1}$ for AlgaeTron and up to 1,000 $\mu mol \cdot m^{-2} \cdot s^{-1}$ for FytoScope. The lower panel intensity is adjustable up to 350 $\mu mol \cdot m^{-2} \cdot s^{-1}$. Optionally, the light intensity can be upgraded up to 1,500 $\mu mol \cdot m^{-2} \cdot s^{-1}$ for the Main panel and 500 $\mu mol \cdot m^{-2} \cdot s^{-1}$ for the lower light Shelf 1 - 3. Timing steps for various light modes range from minutes to hours. The AG/FS 300 offers a total illuminated cultivation area of 0.75 m^2 on four levels.

	**If the light panels are upgraded to have higher light intensity and all shelves are irradiating at 100% power, the inner temperature control is challenged because of the heat the LEDs produce. The minimal temperature the device can reach with the light upgrade is curtailed to 15 °C or higher.** **A user may consider lowering the intensity of several panels or removing some of the removable shelves.**

Both AlgaeTron and FytoScope systems maintain constant inner air circulation and optionally allow precise control of the inner gas atmosphere. For the FytoScope, an integrated air pump with a higher flow rate (nominal 450 l/hour) is used to ensure sufficient ventilation, providing an optimal atmosphere for vascular plants. The AlgaeTron, on the other hand, utilizes an inbuilt air pump with a smaller flow rate (nominal 150 l/hour) but with greater power, allowing for the aeration of liquid cultures of algae or cyanobacteria. The air source can be either non-pressurized ambient room air supplied via the integrated air pump into the cultivation chamber or a defined gas mixture from a pressurized gas source (external gas mixing system, gas tank, air compressor, etc.). Additionally, to control the inlet gas, the AG/FS can be supplemented with a Gas Mixing System GMS 150, bringing pure or mixed gases in a defined concentration into the incubator. Gas Mixing System GMS 150 is used to precisely control the concentration and flow rate of the gas mixture from the gas source.
Optionally, AlgaeTron AG 300 can be supplemented with up to four orbital shakers with a loading capacity of 5 kg, a platform size of 290 x 258 mm, and a rotation speed range of 30 to 500 rpm. The shakers come equipped with a non-skid rubber mat, and optional sticky pads or Erlenmeyer attachments of different sizes can be delivered.

2.2.1 FS/AG 300 Components

	Check the contents of the package and compare it with the enclosed standard package list (see below).

List of standard FS/AG 300 Components

- the cultivation unit
- one inbuilt LED light panel
- three pluggable LED light panels
- three pieces of metal grid shelving
- six metal shelf holders
- five plastic plugs used to close the gas input connectors
- USB flash disc
- metal drip tray
- power cord
- UTP cable

Optional accessories/components

- Up to three orbital shakers equipped either with a non-skid rubber mat or sticky pads or Erlenmeyer attachments of different sizes – **for the AlgaeTron AG 300 model**
- Gas mixing GMS 150 system

2.2.2 FS/AG 300 TECHNICAL DATA

Volume (l)	307
Illuminated tiers	4
Shelves dimension (cm)	48.5 x 38.5
LED light illumination	Top LED panel (1 piece) - white with added far-red LEDs 735 nm
	Lower LED panel (3 pieces) - white with added far-red LEDs 735 nm
Maximum light intensity (PPFD at 30 cm) ($\mu mol \cdot m^{-2} \cdot s^{-1}$)	Top panel: 500 (AG 300), 1,000 (FS 300) Light upgrade: 1,500
	Lower panel: 350 Light upgrade: 500
Temperature range (°C)	10 – 45 15 – 45 with light upgrade
Refrigerant	R290
Air supply (l/h)	150 (AG 300)
	450 (FS 300)
Internal dimensions (w x d x h cm)	51 x 45 x 135
External dimensions (w x d x h cm)	60 x 62 x 177
Operating temperature (°C)	10 - 35
Optimal operating temperature (°C)	18 – 25
Power / Power Input (W)	670
Voltage (V)	220 – 240 AC
Weight (kg, without shakers)	150
Communication ports	Ethernet socket USB port – only for the supplied USB flash disc

3 INSTALLATION

- Place the device on a flat, firm, and dry surface.

	**IMPORTANT NOTE: Allow the AlgaeTron/FytoScope device to stand and wait for at least 24 hours before it can be connected to electrical power.**

- Place the device in a dry, dust-free and well-ventilated room. The ambient temperature should be in the range of 10 - 35 °C. The optimal performance of the device is ensured in the range of 18 – 25 °C.
- Position the device in a way that assures a minimum of 15 cm of free space around it on all sides. This is crucial for proper ventilation and heat dissipation! Do not block the ventilation openings and fan outlets.
- Do not place any objects on top of the device.
- Use only a power cord of the approved type (Fig. 2**Chyba! Nenalezen zdroj odkazů.**A).

Fig. 2 Power cord [A] and Lockable wheel example [B].

Wheels Locking

Both AlgaeTron and FytoScope models are placed on four wheels for easy manipulation. The two front wheels can be locked to ensure the device stands firmly and does not move unintentionally.

By rotating the orange adjustment disc on the wheel assembly (Fig. 2B), the rubber pad at the bottom is extended or retracted. When the pad is extended to the point where the drive wheel is off the ground, the cultivation chamber is secured against movement. This adjustment needs to be performed on both front wheels equally to ensure stability. Before relocating the chamber, screw the rubber pad back in so that the wheel is in contact with the ground again.

3.1 REAR PANEL DESCRIPTION AND POWER SUPPLY CONNECTION

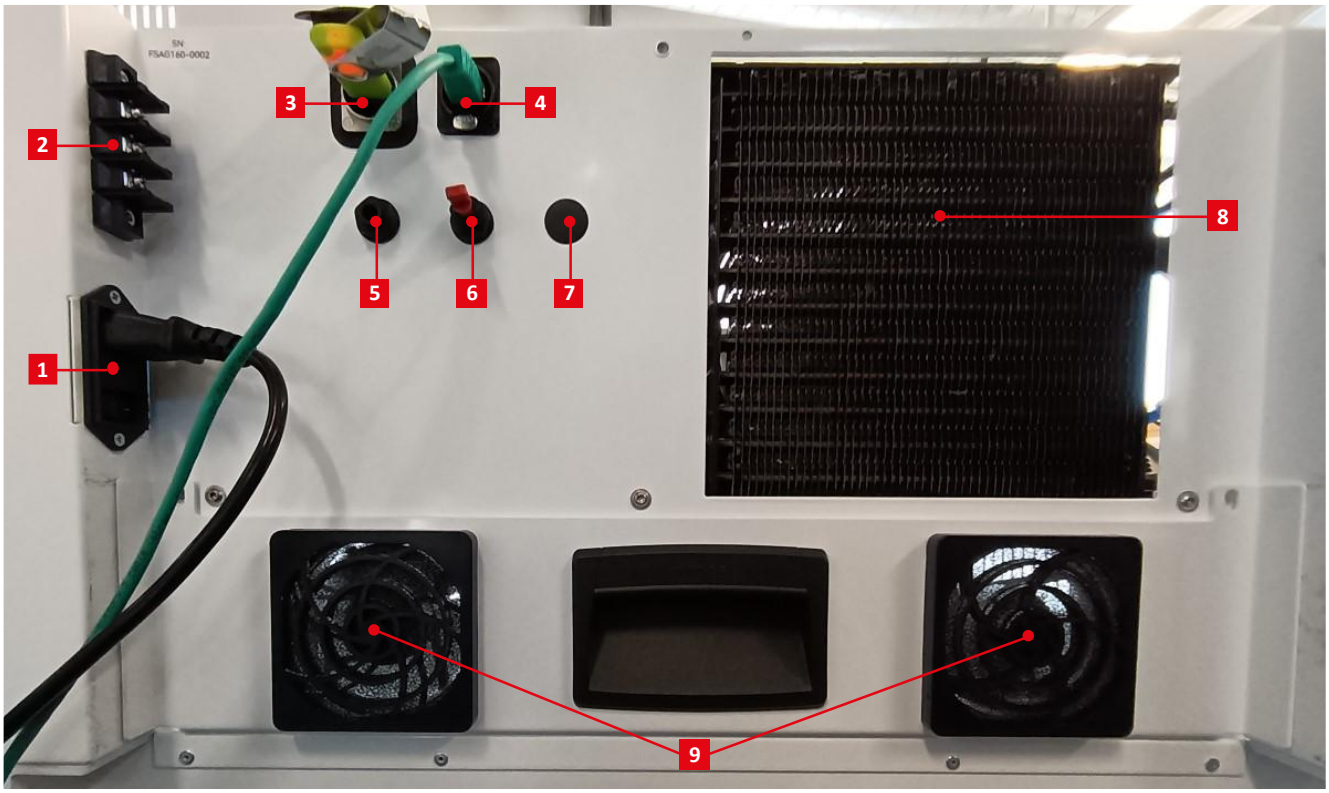


Fig. 3 FytoScope/AlgaeTron 160/300 rear panel.

[1] Main power connector and power switch. [2] Terminal for external alarm connection. [3] USB port with connected flash disc. [4] Ethernet socket RJ45. [5] Gas input 1 - for the inbuilt pump. [6] Gas input 2 – pump bypass. [7] Gas output. [8] Compressor condenser. [9] Fans cooling the Main light panel.

A detailed description can be found below.

[1] ON/OFF Main power switch and connector.

[2] Terminal for the connection of an external acoustic alarm or a warning beacon.

[3] USB port used only for connecting the supplied flash disc. The disc's purpose is to store the software database data.

[4] Ethernet RJ45 socket for connecting the device to the internet, which is useful for software updates, protocol management and data export.

[5] Gas input 1 utilizes a non-pressurized gas source (usually the ambient air) and leads to the inbuilt air pump. **It must be open when the pump is active. More info in the chapter 3.3.**

[6] Gas input 2 is intended to use a pressurized gas source (e. g. Gas Mixing System GMS 150, gas cylinder coupled with a pressure-reducing valve or other source). **When the inbuilt air pump is active, the Gas input 2 must be closed, usually by a plastic plug supplied by the manufacturer. More info in the chapter 3.3.**

[7] Gas outlet. It serves to exhaust air from the chamber, making it crucial for proper ventilation. **Do not block.**

[8] Compressor condenser providing excess heat dissipation. It should not be blocked and must be cleaned periodically.

[9] Cooling fans for the Main light panel. Because of the high light intensity, the LED panel produces a significant amount of heat and needs to be cooled. **Do not block the grids and clean the mesh filter periodically.**

3.2 INTERIOR DESCRIPTION

[1] Airflow fan ensuring inner air circulation.
The air is forced through the space behind the stainless-steel backplate, where the temperature control system (cooler and heater) is located. **Do not cover the inlet grid.**

[2] Electric socket (3 pieces in FS/AG 300; 1 piece in FS/AG 160). The maximum allowed current is 1.5 A per socket and 3 A for the sum of all sockets.

[3] Shelf holder.

[4] Shelf-mounting strip for a variable height adjustment.
The holes are spaced 2.5 cm apart.

[5] Shelf grid.
Separates the illuminated shelf itself from the objects placed on it (shaker, flowerpots, Petri dishes, etc.)

[6] Pluggable light shelf (3 pieces in FS/AG 300; one in FS/AG 160).

[7] Airflow outlet.
It ensures even and gentle airflow in the chamber. **Please, do not cover.**

Fig. 4 FS/AG 300 Inner space organization.

FS/AG 160 differs only in total height, the number of shelves and the number of electric sockets.

Fig. 5 Holders, connectors, inlets/outlets and plugs.

[A] Overview of connectors, inlets and outlets, [1] represents a correctly placed shelf holder. [B] Detail of shelf connector, gas outlet (one piece for the whole chamber) and gas inlet (one for each shelf). [C] Gas supply inlet blocked by a plug (Quick-Connect fitting).

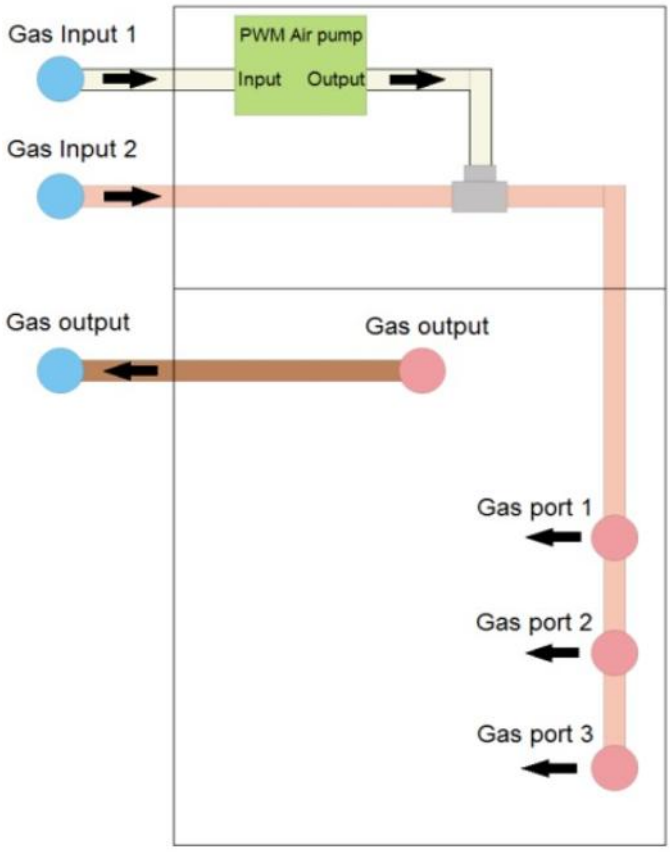
The LED panels use plug-in connectors (Fig. 5 [B]) that do not require screwing. Simply push the connector into place or pull it out to disconnect.

	**The gas outlet serves as an air exhaust to ensure proper ventilation, do not block it in any way!**

Fig. 6 LED light panels.

[A] Top panel – Main. [B] Pluggable LED light shelf. The LED color is cool white with additional far-red LEDs.

3.3 Gas Distribution System



Gases from external sources are distributed via an inbuilt tubing system with a quick-connect fittings on each inlet and outlet. The introduction of gases into the chamber is possible in two ways:

1.**Inbuilt PWM air pump.** An unpressurized ambient air is delivered inside by an inbuilt pump. In this case, the Gas Input 1 on the outside rear panel needs to remain open. **The Gas Input 2 must remain closed by the plug.**

2.**External source of pressurized gas.** Gas Input 2 is used, while Gas Input 1 must be closed and the air pump must be turned off via the software control! (see page 21).

There are three inner Gas Supply ports in FS/AG 300 and one in FS/AG 160. The ports can be opened or closed as needed.

⚠	**At least one Gas supply port must be left open all the time!**

Fig. 7 Gas Distribution System.

3.4 STARTING THE DEVICE

- Before starting the device for the first time, please check it is placed correctly as described on page 10. **After delivery, the device must be left standing at least for 24 hours before connecting to electricity!**
- Connect the provided USB flash disc to the respective port (see Fig. 3).
- Connect the power cord and plug it into electricity.
- Turn on the device by the Main power switch.

	After switching the AlgaeTron/FytoScope off, please wait at least 3 minutes before turning it back on!

4 SOFTWARE CONTROL

On the front panel of the device is located a touchscreen display of a compact computer controlling the chamber. The software is designed to be clear, intuitive, and user-friendly. It allows control of individual light panels, internal temperature, inner sockets and the air pump. Settings can be adjusted manually or in automatic mode using user-defined protocols. Device data are visualized in a chart which can be zoomed in and browsed. Data can also be exported and processed externally. All important events, including errors, are automatically logged.

4.1 OVERVIEW SCREEN AND MAIN MENU

Most of the time, the Overview screen is displayed, to which the software GUI switches after 30 seconds of user inactivity (Fig. 8). It shows key operational information, providing users with a quick overview of the device's status: the current system time, which light panels are active, current temperature and relative humidity, and whether any user protocol is currently running.

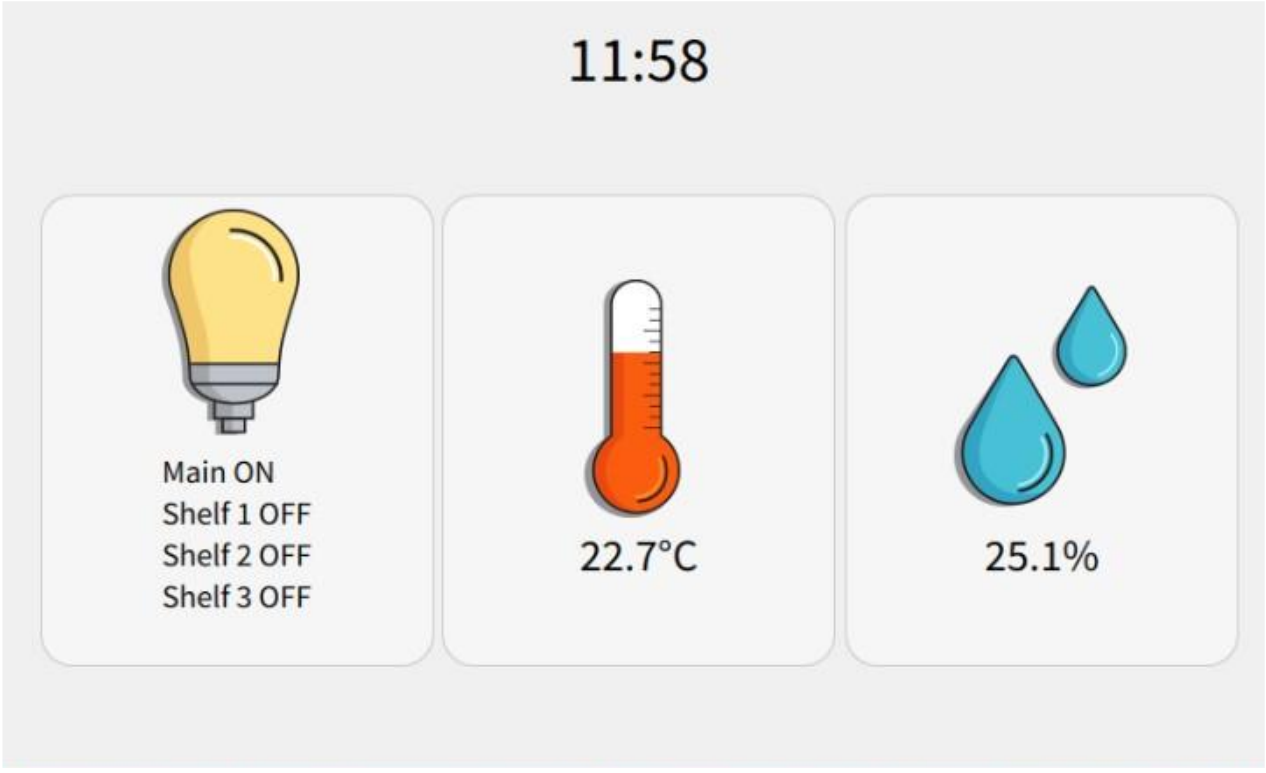


Fig. 8 Overview screen.

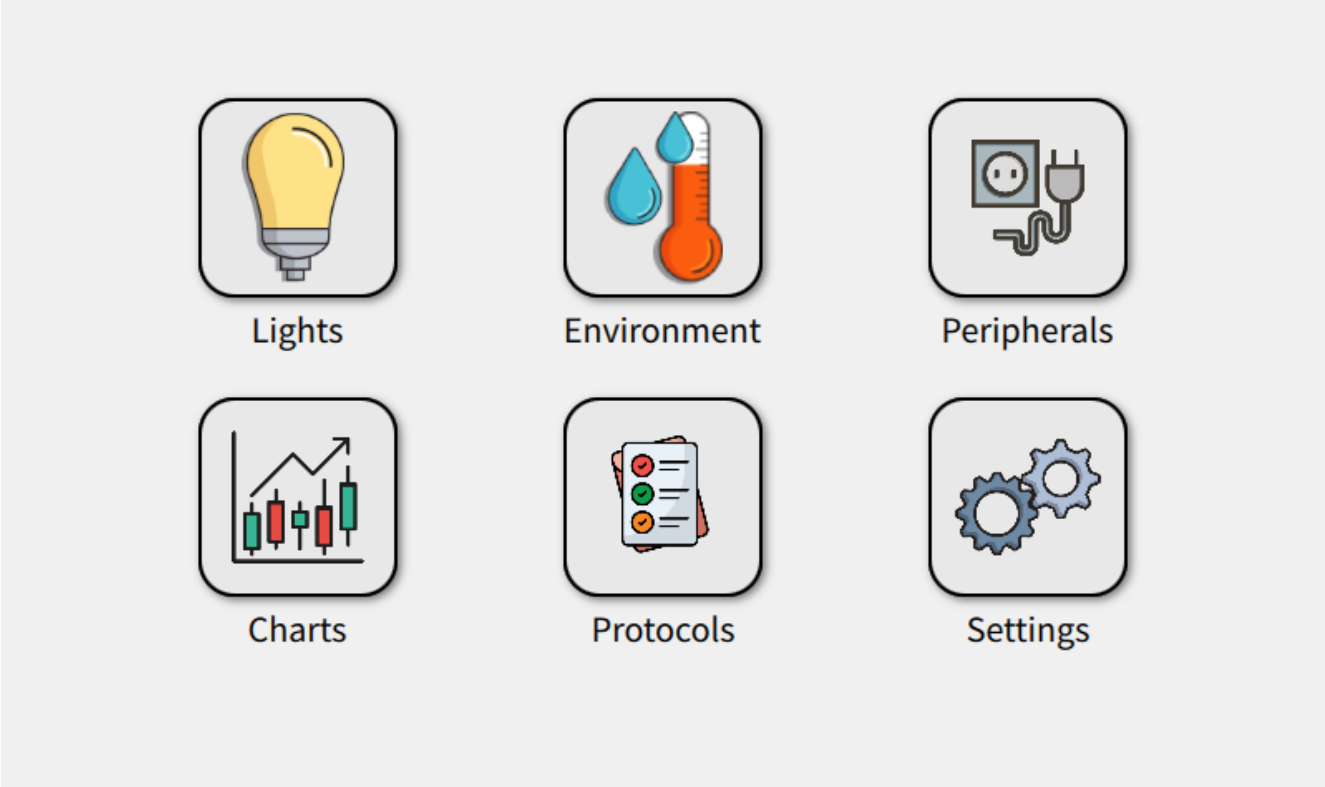


Fig. 9 Main Menu.

Upon touching the display, the main menu opens, serving as a hub for device control and management. The first item is the Lights setting, followed by Environment (currently, only temperature control is available) and Peripherals for sockets and air pump control. Additional submenus include Charts, Protocols, and Settings. The following paragraphs provide more detailed description of each section.

4.2 LIGHTS

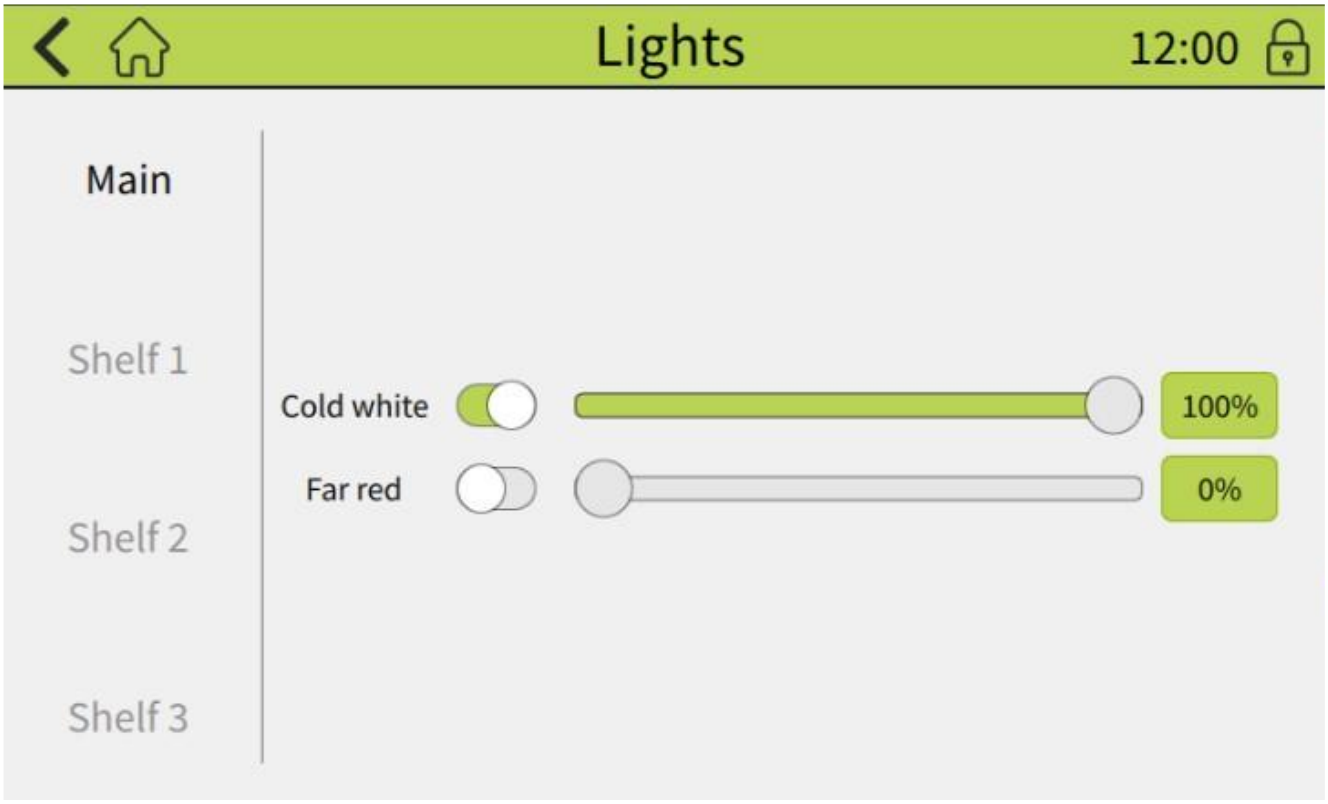
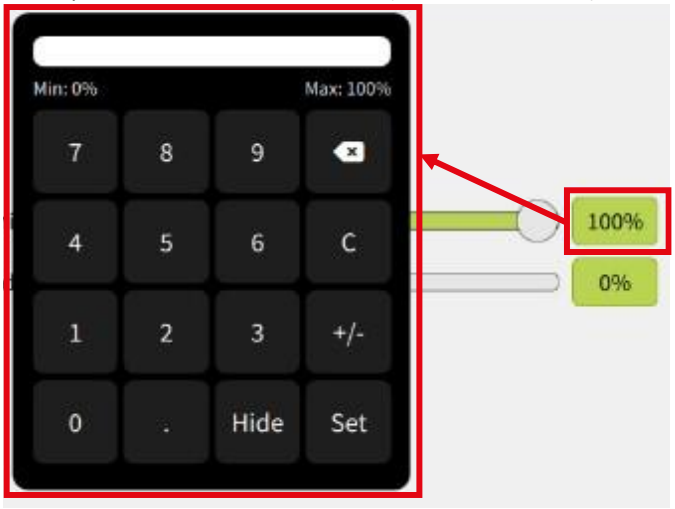


Fig. 10 Lights submenu.

The Lights submenu (Fig. 10) allows manual control of the settings for individual light panels and light channels. On the left side of the menu, you can switch between shelves (Main and Shelf 1 - 3).



In the middle section, the available light channels are displayed. In this example, two channels are shown: cool white and far-red. Intensity is expressed as a percentage of the maximum value (according to the device specification and the calibration sheet provided with the chamber) and can be adjusted in the range of 0 - 100%, with a minimum step of 1%.
Each light channel can be turned on or off using the button located to the right of the channel name. Intensity settings can be adjusted either by sliding the bar or by clicking on the intensity box, which opens a dialog window (Fig. 11).

Fig. 11 Dialog window for entering the values manually.

4.3 ENVIRONMENT

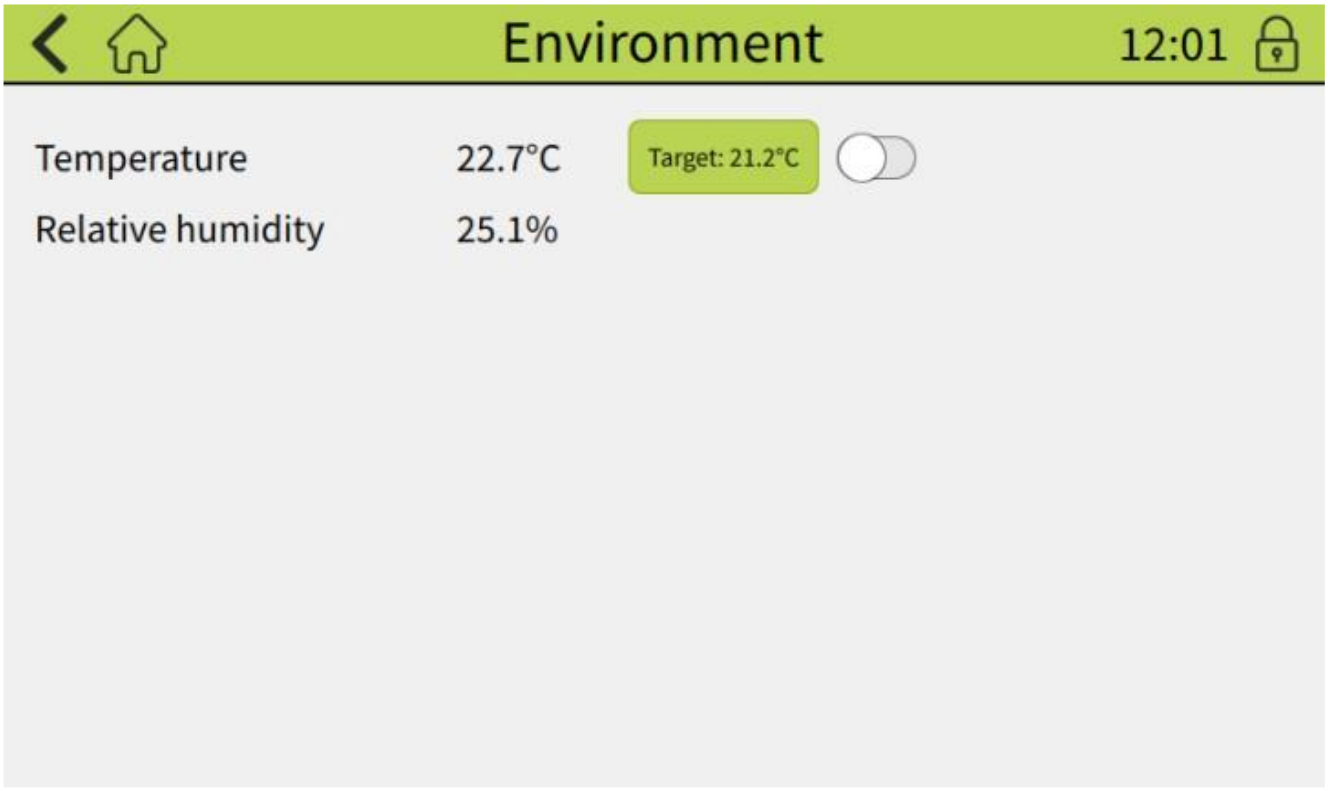


Fig. 12 Environment submenu.

The Environment submenu allows for temperature settings and provides information about the current relative humidity. The target temperature can be set by clicking on the respective field, opening a dialog window similar to the one in the Lights settings. Temperature control can be enabled or disabled using the toggle switch to the right of the Target Temperature field.

	The Lights and Temperature control described in chapters 4.2 and 4.3 is not available if an automated protocol is running. **The values set in these submenus are also overridden once a protocol starts!**

4.4 CHARTS

Fig. 13 Charts submenu.

[1] Maximize button. [2] Zoom mode toggling button. [3] Calendar. [4] Filter button and respective dialog window menu. [5] Refresh button.

The chart visually displays recorded data from the device for a single calendar day. Navigation between days is easily done using arrows or by opening a calendar dialog, accessible by clicking the current date. The parameters shown in the graph can be easily filtered using the Filter button and the associated dialog window. The chart is zoomable, and in the zoomed view, it can be scrolled (Fig. 14).
Data visualized in the chart are stored in the device's internal database. The database can be exported as a .csv file to a USB drive. Export is available in the **Settings** submenu (Chapter 4.6).

Fig. 14 Zooming and scrolling the chart.

[A] Selection. Toggle the zoom button and select the area to be zoomed. [B] Zoomed area view. [C] Scrolling. Unselect the zoom button and scroll through the chart while staying zoomed. [D] Maximizing. By pressing the respective button, the chart is displayed without the zoom again.

4.5 PROTOCOLS

The Protocols submenu, as the name suggests, is used for creating and managing automatically executed protocols. The shortest time unit that can be controlled is one second. Created protocols can be saved for future use and edited as needed. The progress of individual phases and set parameters is displayed in a simple, easy-to-read graph.

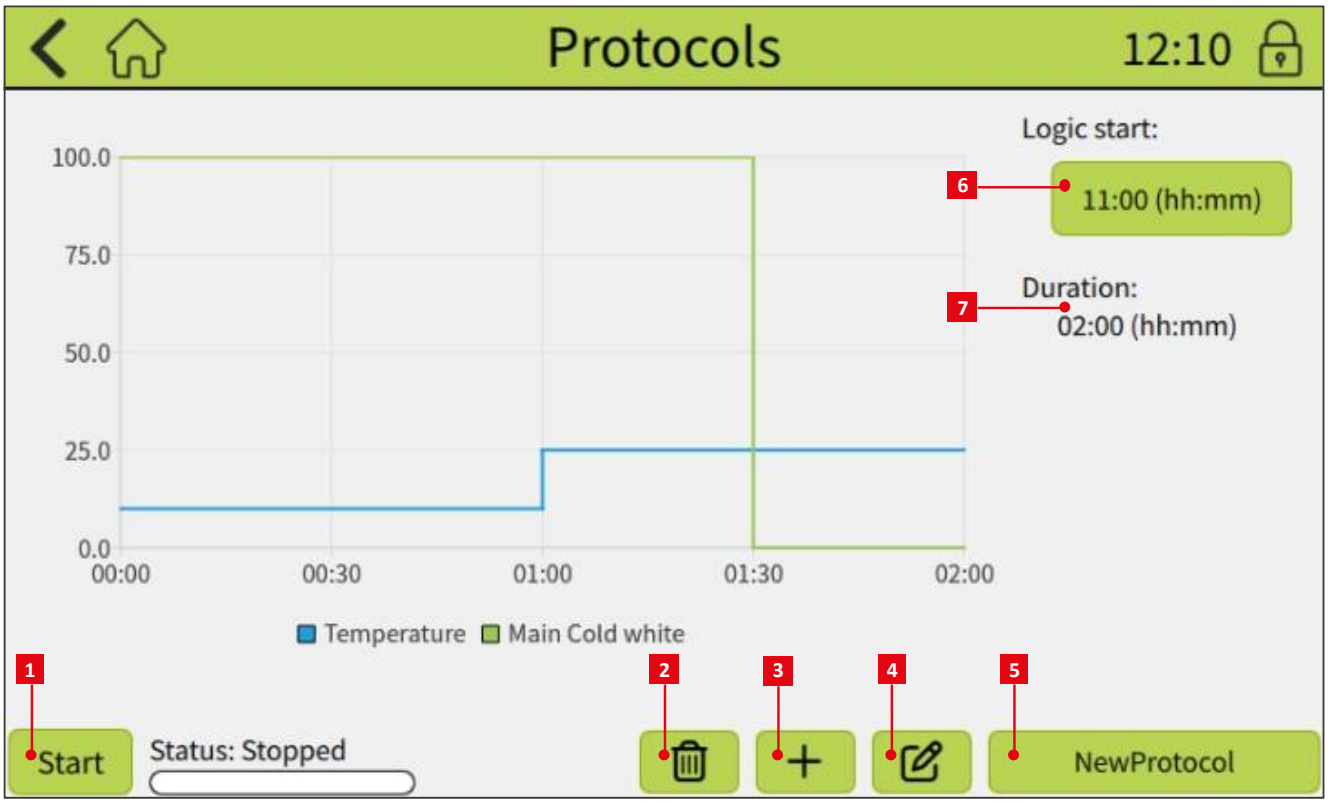


Fig. 15 Protocols submenu.

[1] Start/Stop button. [2] Delete the protocol. [3] Create a new protocol. [4] Edit the protocol. [5] Protocol selection button. [6] Logic start time. [7] Protocol duration.

4.5.1 PROTOCOL EDITOR

The protocol editor opens when a new protocol is created or an existing one is edited. The basic unit of the protocol is called a phase. A phase represents a constant setting of a specific parameter for a defined period of time. By chaining phases together, a protocol with the desired sequence of actions is created.

The parameters that can be controlled by the protocol include:

- Temperature
- Inbuilt air pump (ON/OFF control)
- Inbuilt sockets (ON/OFF control of electricity supply)
- Light channels (each light panel independently)

There are **two ways to access the Protocol Editor**:

- Click the **'+' button** to create a brand-new protocol.
- To edit an existing protocol, click the **name of the current protocol** (Fig. 15 [5]), select the desired one from the list, and then click the **Edit protocol** button (Fig. 15 [4]). This allows the user to open and modify any previously saved protocol.

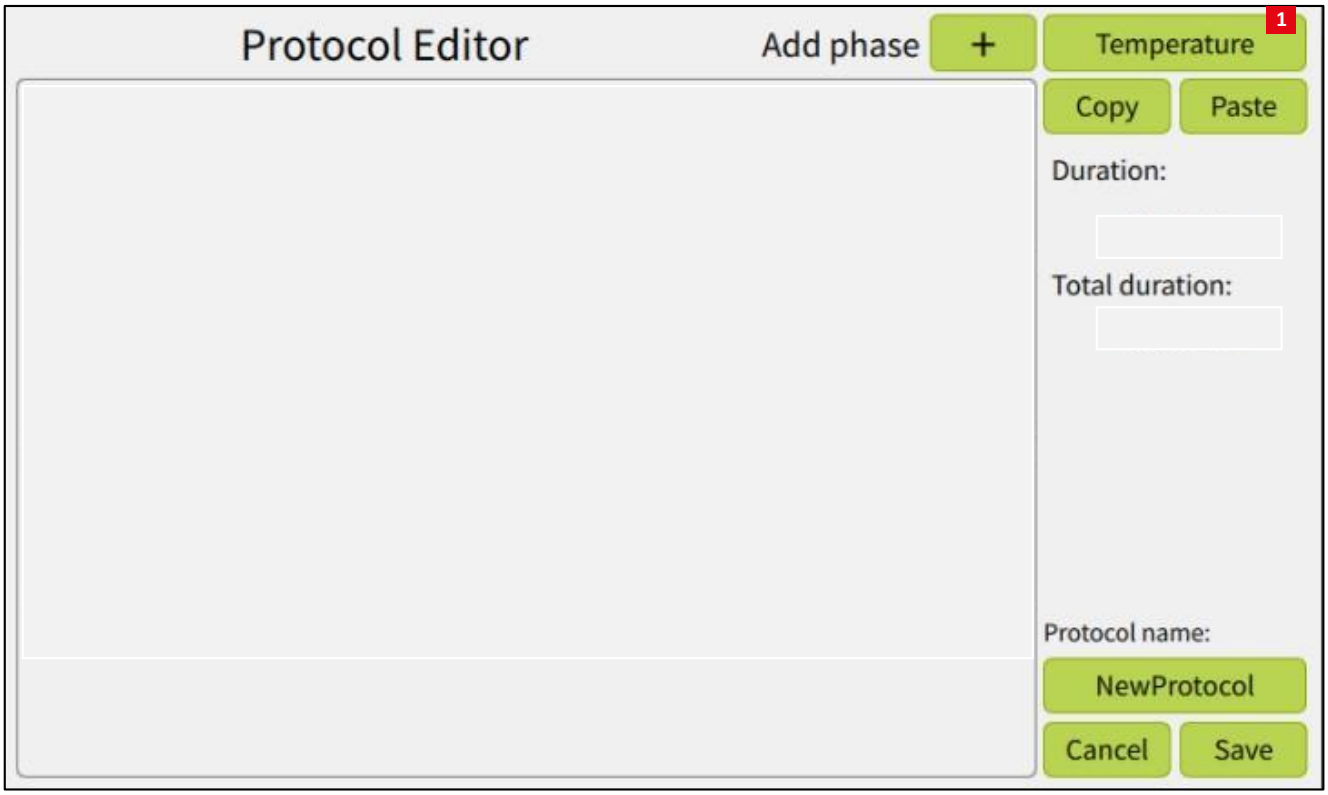
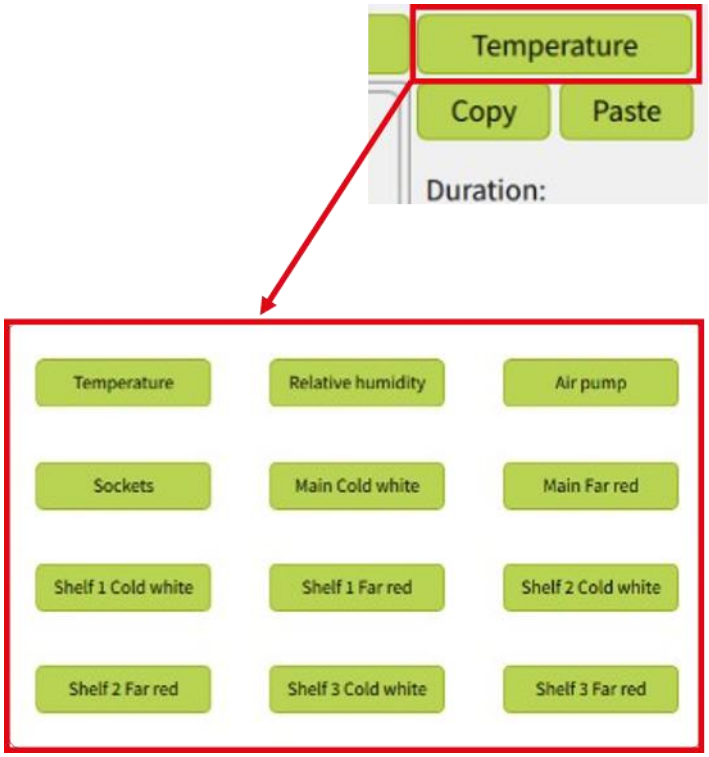


Fig. 16 Protocol Editor – empty window.

[1] Parameter selection button. The parameter Temperature is selected.

Once a new protocol is created or an existing one is edited, the Protocol Editor window opens. At first, the window will be empty. The protocol creation starts with selecting a parameter (Fig. 16 [1], Fig. 17). Then, add individual phases using the **Add phase** button (Fig. 18 [1]). For each phase, set the duration and the desired value (temperature in °C, light intensity in %, activity of the pump, and devices plugged into sockets as ON/OFF).



A created phase can be copied and pasted within the sequence of the same parameter or to another parameter sequence, though note that the value units may not be compatible between different parameters. You can also copy and paste the entire phase sequence for a specific parameter (Fig.18 [7]).

The item titled **Duration** indicates the total duration of all phases for the given parameter. **Total Duration** represents the duration of the entire protocol. **The Duration and Total Duration should match for all parameters to ensure the correct execution of the protocol.** A parameter that is not included in the protocol cannot be controlled while the protocol is running.

The Protocol Editor also allows for changing the protocol name (Fig. 21). The **Save** button must be used to keep changes, otherwise they will be discarded.

Fig. 17 Protocol parameters for FS/AG 300.

4.5.2 CREATING A PROTOCOL

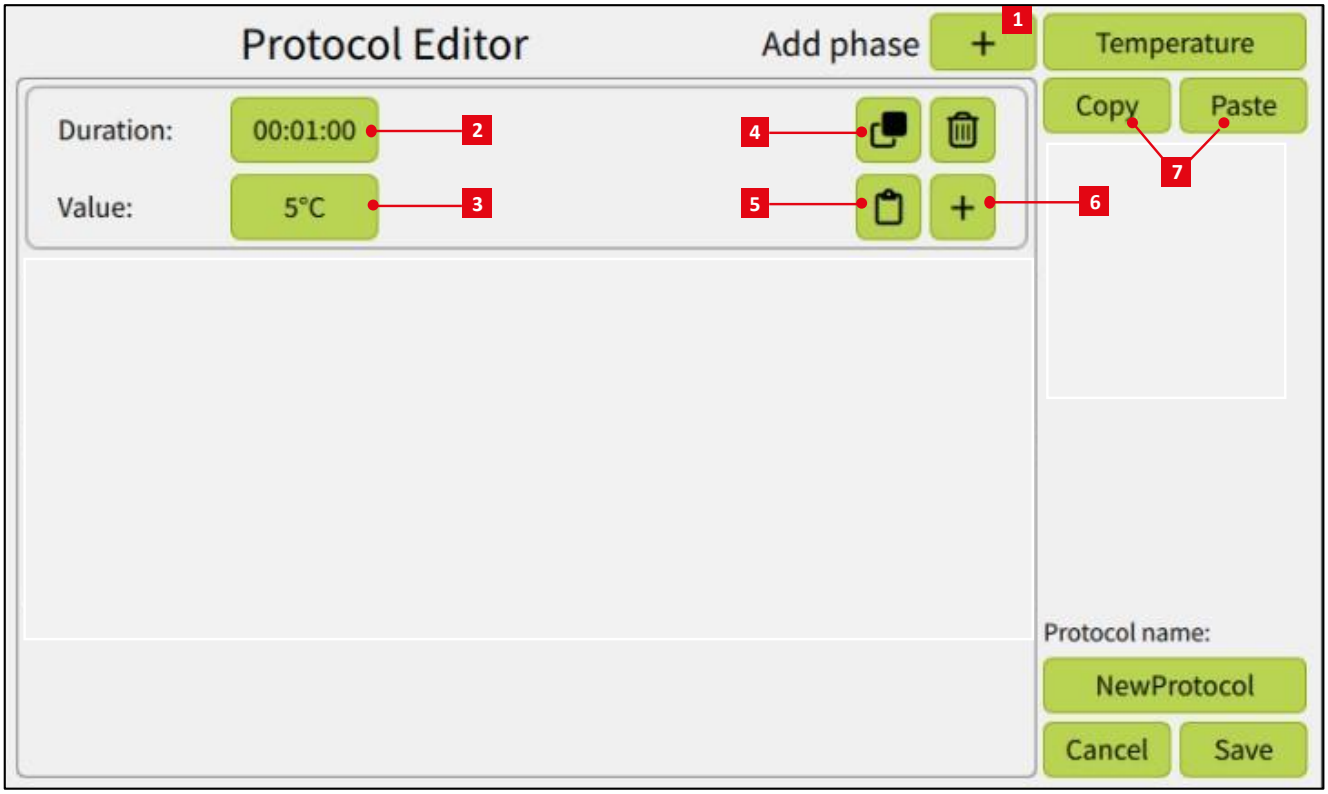


Fig. 18 Phase management. Parameter "Temperature" is selected.

[1] Add phase button. Will add a phase on the beginning of the protocol. [2] Phase duration button. [3] Phase value setting button. [4] Copy phase. [5] Paste phase. [6] Add a new phase under the existing one. [7] Copy & Paste buttons for all phases of the selected parameter.

When creating a new protocol, a blank **Protocol Editor** window opens (Fig. 16). The user must first select the parameter they wish to configure (Fig. 17). At this point, individual protocol phases can be added. Each phase represents a constant setting of the selected parameter over a defined period. Although a phase cannot have a dynamic progression, the minimum duration is just 1 second, allowing users to build complex, curve-like sequences through multiple short steps. To add a phase, click the "+" button in the Protocol Editor (Fig. 18 [1]). In the example shown, the Temperature parameter is selected. The phase has an adjustable duration [2] and a set value for the parameter [3] during that phase. Clicking on these buttons will open the familiar dialog box shown in Fig. 11. Using this dialog, the user can set the duration (hh:mm:ss) and the parameter value (°C, % of light intensity, 0/1 = on/off for the air pump and power supply to the socket). In Fig. 18, the phase duration is set to 1 minute with a value of 5 °C.

Another phase can be added either by clicking the "+" button in the box of the existing phase [6], in which case the new phase will be placed after the current one. If you press the original Add Phase "+" button [1] on the top toolbar, the new phase will be added at the very beginning of the sequence (first position). The settings of an existing phase can be copied to a new one using the Copy [4] and Paste [5] buttons.

The entire sequence of phases created for one parameter can also be copied to the settings of another parameter using the Copy and Paste buttons located under the parameter name [7]. This feature is especially useful when configuring multiple light settings.
Phases are not limited to being copied only between parameters of the same type (e.g. between different light channels). Users can freely copy sequences between any parameters, such as from a light setting to a temperature setting. In such cases, the number of phases and their durations will be preserved. However, the values themselves must be set manually, since units differ (e.g. °C for temperature vs. % for light intensity), and cannot be automatically converted.

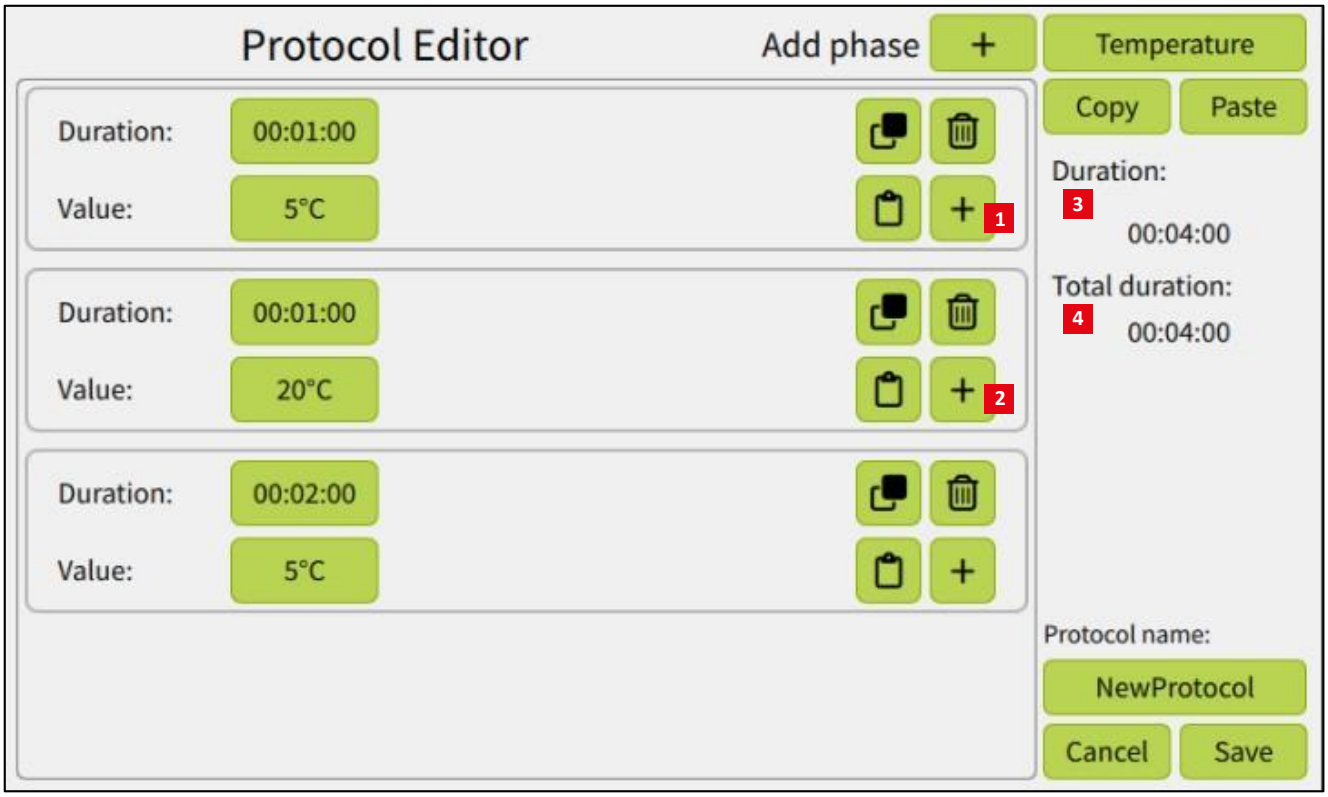


Fig. 19 Multiple phases in the protocol.

In the protocol created in the previous step, two additional phases were added. After the "+" button was clicked next to the previous phase (Fig. 19 [1]), a second phase was added, where the duration was set to 1 minute and the temperature to 20°C. Next, by clicking the "+" button next to this phase, a third phase was added [2], with a duration of 2 minutes and a temperature of 5°C.

On the right side of the menu, the total duration of all phases combined is displayed [3], as well as the overall protocol duration [4], which is determined by the longest-running parameter. In this example, only the Temperature parameter has been set, which is why the **Duration** and Total **Duration** values are identical.

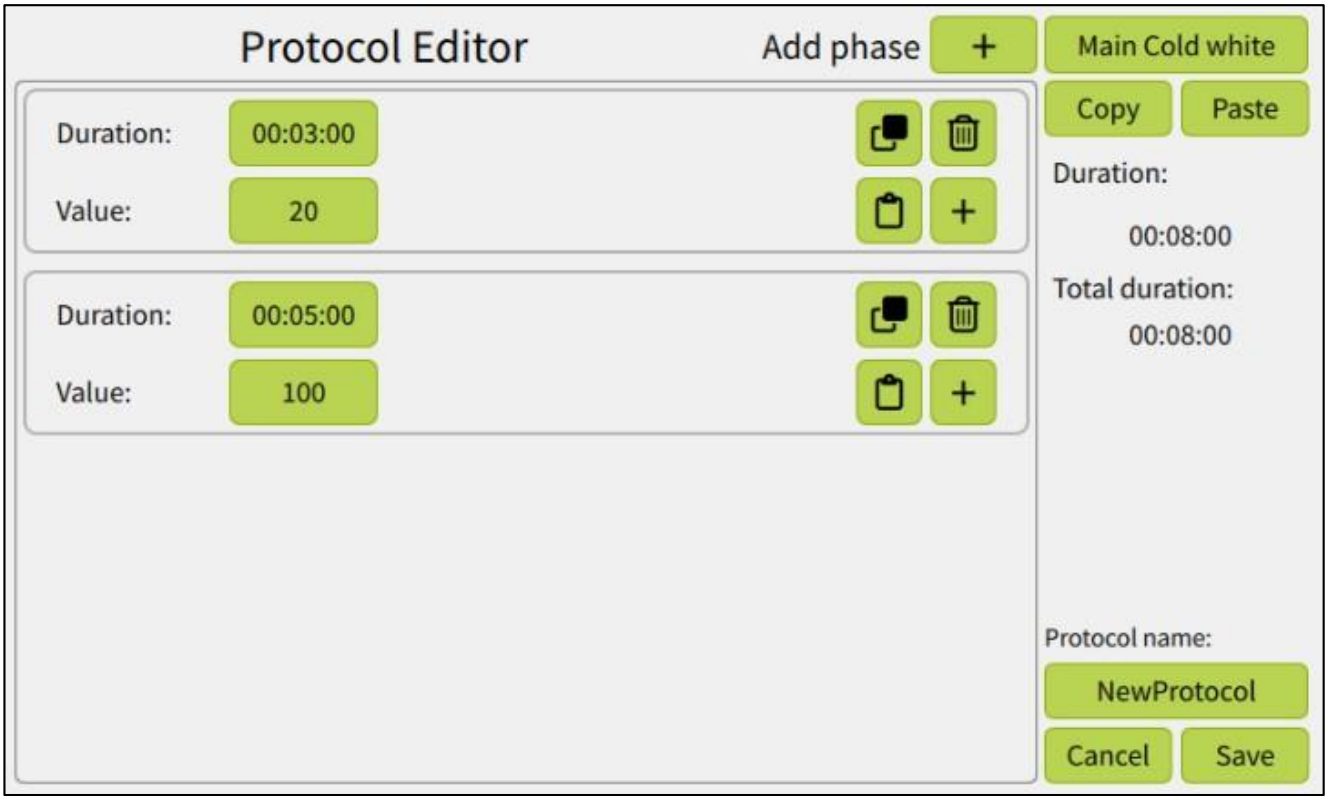


Fig. 20 Phase example for the light control.

Fig. 20 illustrates the process of creating a protocol for a light parameter. The protocol is still the one named "NewProtocol," where temperature regulation was previously set. The "Main cold white" parameter, which controls the intensity of white light on the top panel, has now been selected. This intensity can be adjusted from 0 % to 100 % of the maximum value. The parameter was selected from the menu shown in Fig. 17. For this parameter, two phases were created: the first with an intensity of 20 % and a duration of 3 minutes, and the second with an intensity of 100 % and a duration of 5 minutes. On the right side of the screen, the "Total Duration" of the entire protocol is now displayed as 8 minutes, reflecting the updated configuration.

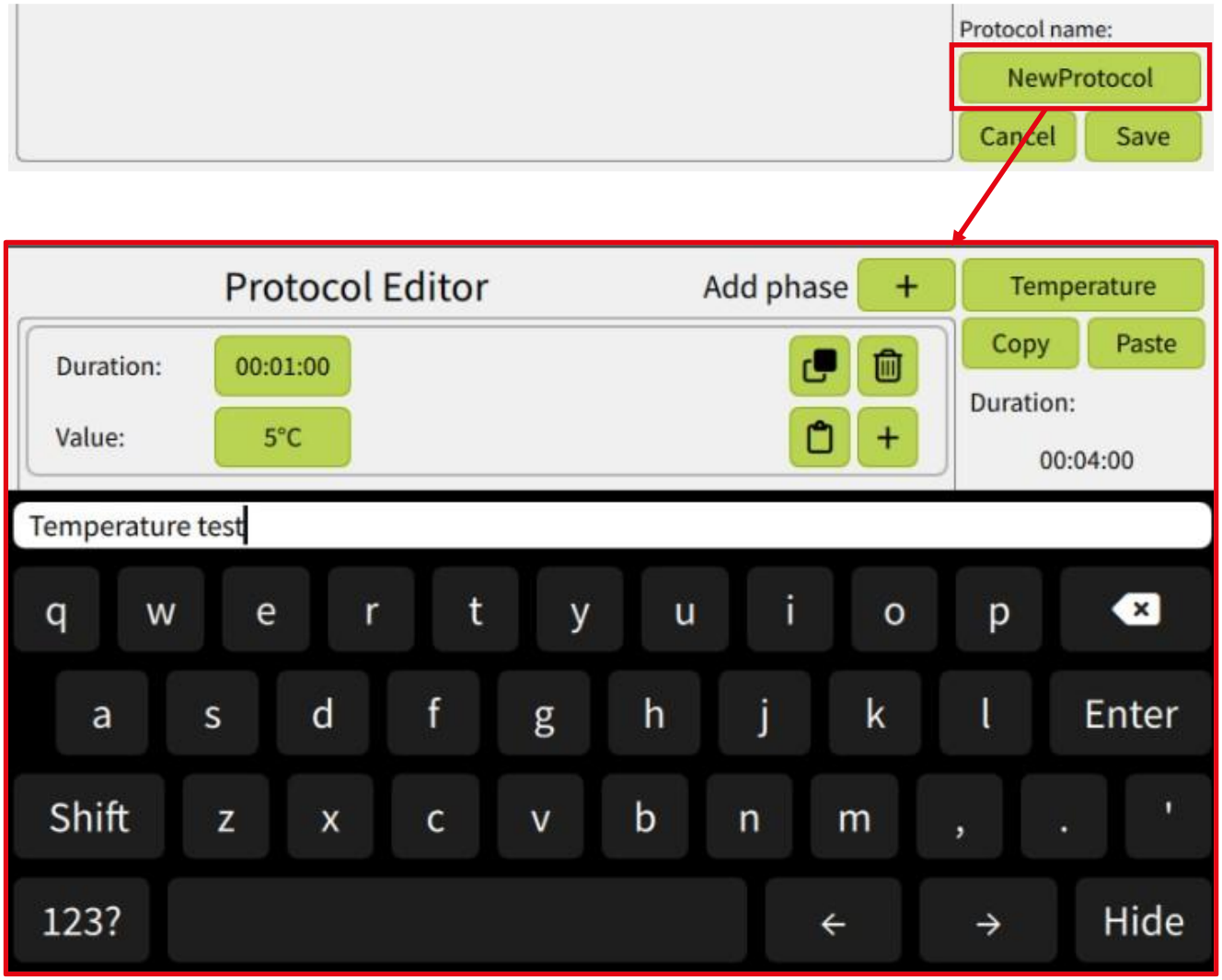


Fig. 21 Renaming the protocol.

The protocol can be renamed directly in the Protocol Editor by clicking on its current name. This action opens an on-screen keyboard, allowing the user to assign any desired name to the protocol. In the example the protocol has been renamed to "Temperature test". Once the user is satisfied with the protocol setting, tapping the **Save** button stores the protocol in the device's internal database.

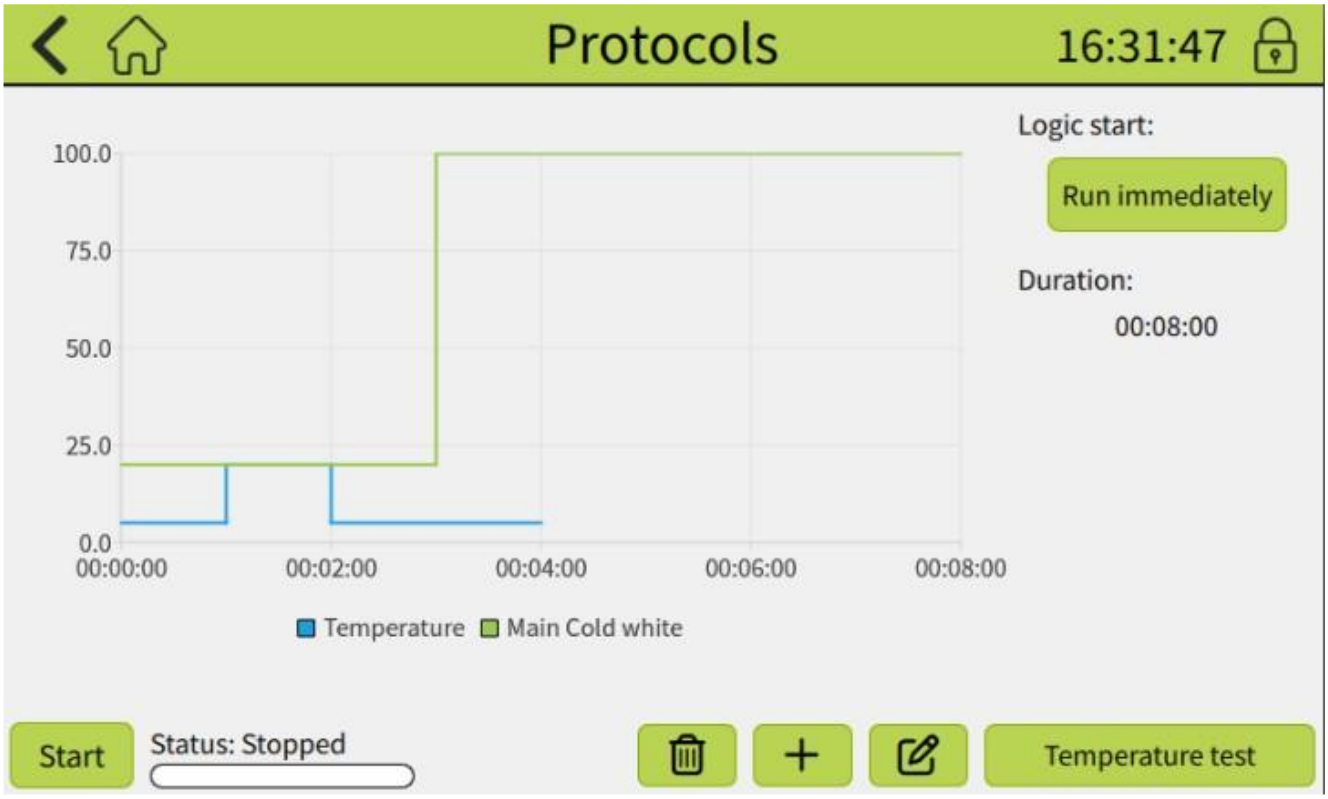


Fig. 22 Protocol visualization.

Back in the main Protocols menu, the created protocol is visualized (Fig. 22), and the automatic execution of the protocol can be initiated. The graph displays the progress of all previously configured parameters.

⚠	**To ensure the proper operation of automatic protocols, it is strongly recommended that the duration of all controlled parameters is the same!**

If the durations of the parameters differ, the behavior of the protocol follows a specific rule: the parameter with the longest total duration determines the overall protocol length. Once this parameter completes its sequence, the entire protocol restarts. For example, in the case shown, the Main White Light is set to run for 8 minutes, while the Temperature parameter has a duration of only 4 minutes. After 4 minutes, the last value for temperature (5 °C) remains active. Once the Main White Light sequence ends at 8 minutes, the protocol restarts from the beginning. This loop continues indefinitely until the user manually stops the protocol.

4.5.3 RUNNING THE PROTOCOL

The protocol is started and stopped using the Start/Stop button. Its progress is visualized through a progress line and a status bar. While the protocol is running, it cannot be edited—it must be stopped before any modifications can be made.
Once the protocol reaches its end, it will automatically restart, repeating in a continuous loop until manually stopped by the user. If needed, a Logic Start condition can be configured before initiating the protocol.

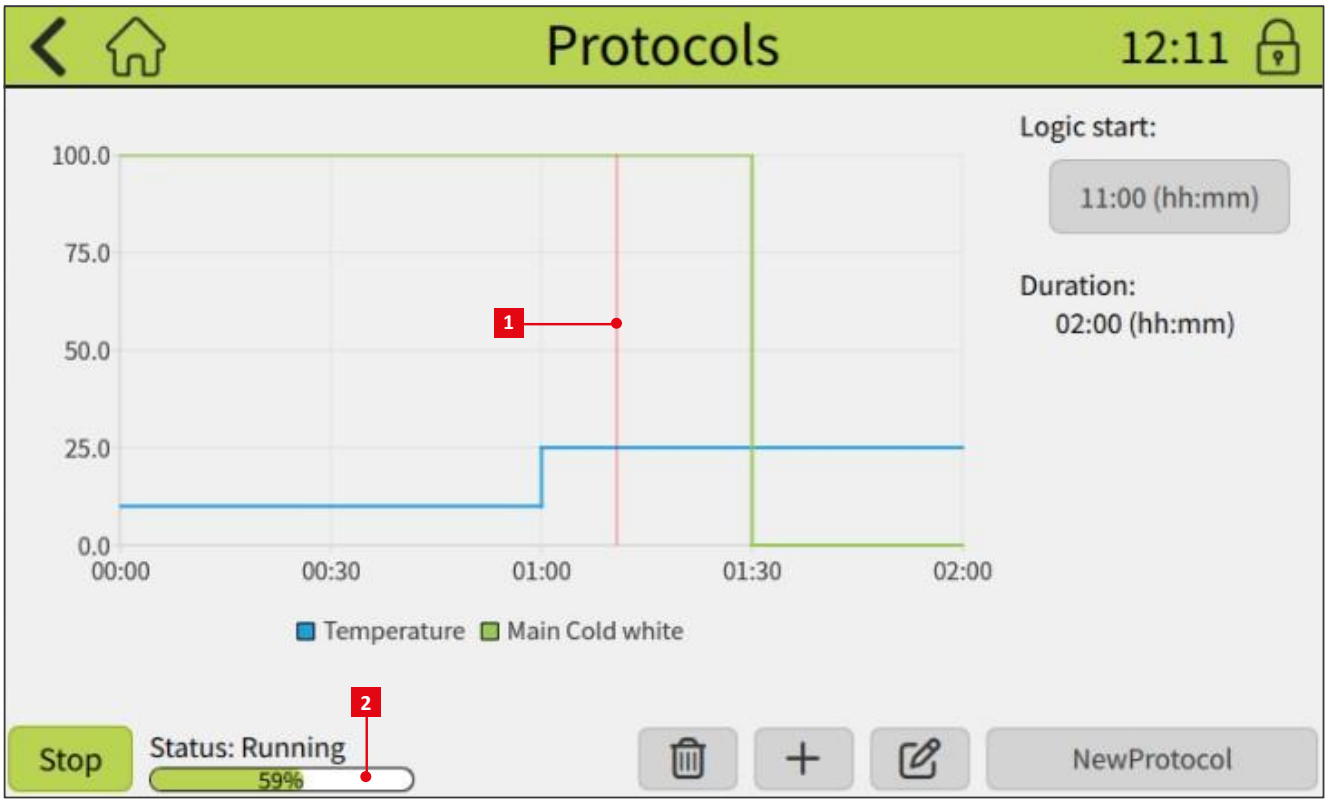


Fig. 23 Running protocol.

[1] Progress line. Shows exactly in which point the protocol is. [2] Status bar. Displays progress in %. Both parameters controlled by this protocol have the same Duration time.

Logic start

Logic start time specifies the start time of the protocol in range from 0:00 to 23:59. If there is any value set, the position in the protocol is immediately recalculated at the protocol start, so it seems it was started at the Logic start time. It is particularly useful for editing the protocol parameters during the protocol execution. If the time is set, stop the protocol, edit parameters and run it again. Protocol resumes the execution immediately and in the correct position.

	Logic Start is especially useful for 24-hour protocols, such as a standard 16 h/8 h day/night cycle. For example, a simple protocol consisting of only two phases can represent this light schedule. If the Logic Start time is set to 06:00, the light phase will run from 06:00 to 22:00, and the dark phase will follow from 22:00 to 06:00. This approach ensures that the protocol aligns with the intended real-world time, even if started manually at a different moment.

By default, Logic start is set to 00:00. To change this setting, click the Logic start button (while the protocol is stopped). This opens a dialog (Fig. 24) where you can either: Set a specific start time for the protocol (e.g. 06:00), or enable the Run immediately option using the toggle switch, which will start the protocol from the beginning, disregarding any Logic Start time. **To run the protocol according to the set Logic start time, make sure to disable the *Run Immediately* option** (Fig. 24).

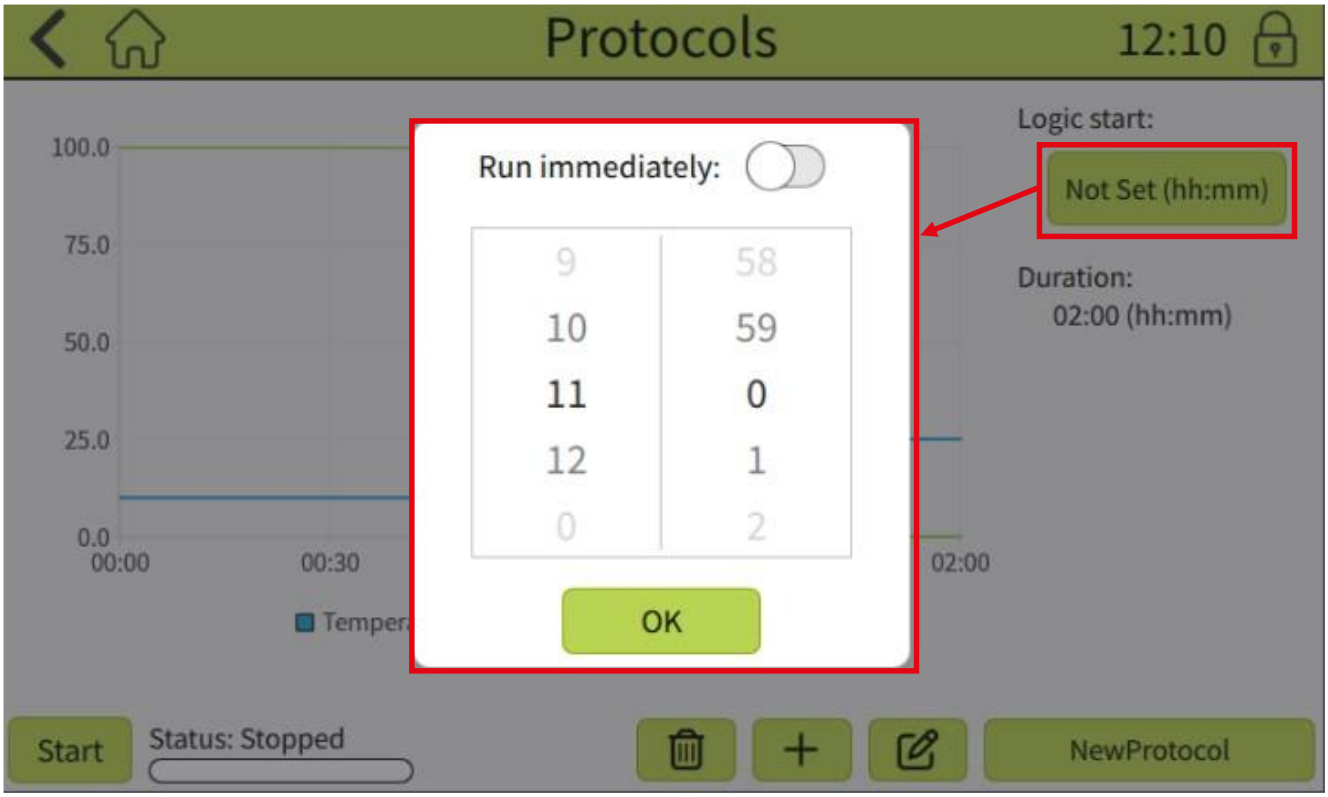
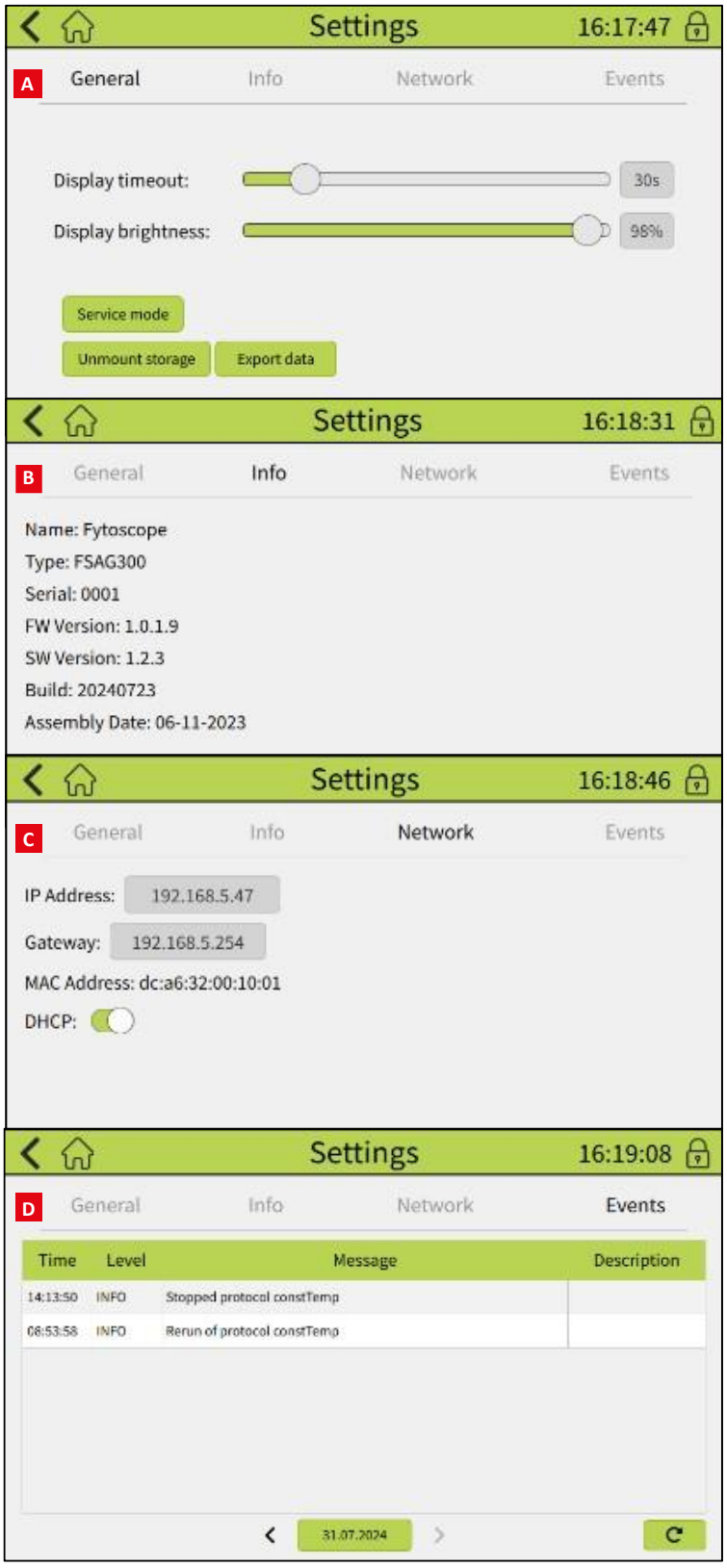


Fig. 24 Setting the Logic start.

4.6 SETTINGS

The **Settings** submenu consists of four tabs: **General, Info, Network** and **Events.**



[A] The **General** tab offers setting of **Display timeout**, which sets the duration of inactivity after which the GUI automatically returns to the **Overview screen** (see Chapter 4.1). Another function is the configuration of **Display brightness.**
There is also a button serving as access to the **Service mode**, which is a service and emergency feature protected by a password and prohibited from standard use.
Additional buttons include the **Mount/Unmount storage** button (for USB flash drives) and the **Export Data** button, which is useful for exporting the stored environmental data from the last 30 days in .csv format to the connected USB drive.

[B] Info tab gives information about the device, e. g. serial number, firmware, software and GUI version, etc.

[C] Network tab provides details about IP address and other network properties and settings of the device.

[D] Events tab contains a log of system notifications, which include standard (device boot, protocol start etc.) and error type messages. The notifications are especially useful in the case of error diagnostics and troubleshooting.

Fig. 25 Settings submenu.

5 General Maintenance

To ensure the safe and long-term operation of the device, please follow these maintenance guidelines:

- Keep the device clean and prevent dust accumulation on all surfaces.
- Clean surfaces using a damp cloth. For disinfection purposes, 70% ethanol may be used. **Ensure that liquids do not penetrate beneath the device casing and into the electronics, as it poses a serious risk of electric shock and irreversible damage to the device!**
- Do not use aggressive or corrosive agents, as they can permanently damage used materials, including stainless steel components.
- Inspect the device regularly and replace any damaged parts, especially power cables, as their damage can be life-threatening.
- Clean the compressor evaporator twice a year using a vacuum cleaner (Fig. 26 [A]). The evaporator is located on the back side of the device.
- Check and empty the drip tray regularly as needed (Fig. 26 [B]). The tray is located at the bottom back side of the device and collects condensed water generated during cooling cycles.
- Check the fans cooling the **Main** LED light panel at least every two months (Fig. 26 [C, D]). Dust can accumulate on the protective mesh, reducing cooling efficiency. To clean, first remove the fan cover to access the mesh.

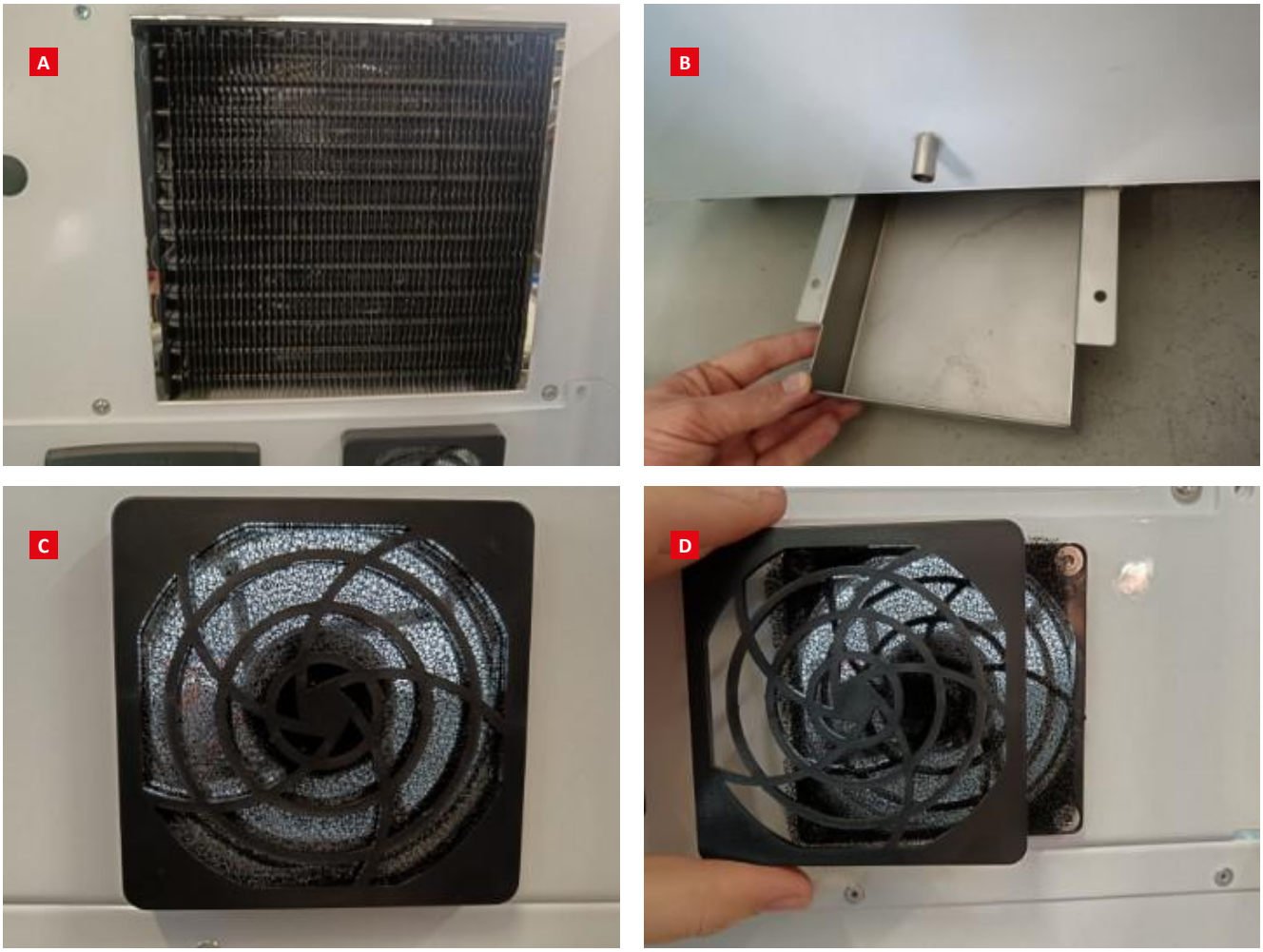


Fig. 26 Parts maintenance.

[A] Compressor evaporator. [B] Drip tray. [C] Fan cover. [D] Accessing the fan mesh.

6 Warranty Terms and Conditions

• Photon Systems Instruments, Ltd. (PSI) warrants all its instruments to be free from defects in materials or workmanship for a period of one year from the date of invoice/shipment from PSI (unless otherwise stated).

• If at any time within this warranty period the instrument does not function as warranted, return it and PSI will repair or replace it at no charge. The customer is responsible for shipping and insurance charges (for the full product value) to PSI. PSI is responsible for shipping and insurance on return of the instrument to the customer.

• No warranty will apply to any instrument that has been (i) modified, altered, or repaired by persons unauthorized by PSI; (ii) subjected to misuse, negligence, or accident; (iii) connected, installed, adjusted, or used otherwise than in accordance with the instructions of PSI.

• The warranty is return-to-base only, and does not include on-site repair charges such as labor, travel, or other expenses associated with the repair or installation of replacement parts at the customer's site.

• PSI repairs or replaces faulty instruments as quickly as possible; the maximum time is one month. PSI will keep spare parts or their adequate substitutes for a period of at least five years.

• Returned instruments must be packaged sufficiently so as not to assume any transit damage. If damage is caused due to insufficient packaging, the instrument will be treated as an out-of-warranty repair and charged as such.

• PSI also offers out-of-warranty repairs. These are usually returned to the customer on a cash-on-delivery basis.

• Any defects caused by fluctuating electricity or inappropriate site preparation cannot be a subject of warranty repair.

• Wear & Tear Items are excluded from this warranty. The term Wear & Tear denotes the damage that naturally and inevitably occurs as a result of normal use or ageing even when an item is used competently and with care and proper maintenance.

• Some PSI instruments use accessories made by other manufacturers. In such cases, these accessories may be covered by a different warranty period.

7 Troubleshooting and Customer Support

In case of troubles and for customer support, please, visit PSI service portal https://psi.cz/support/service-portal or contact your local distributor.

8 LIST OF FIGURES