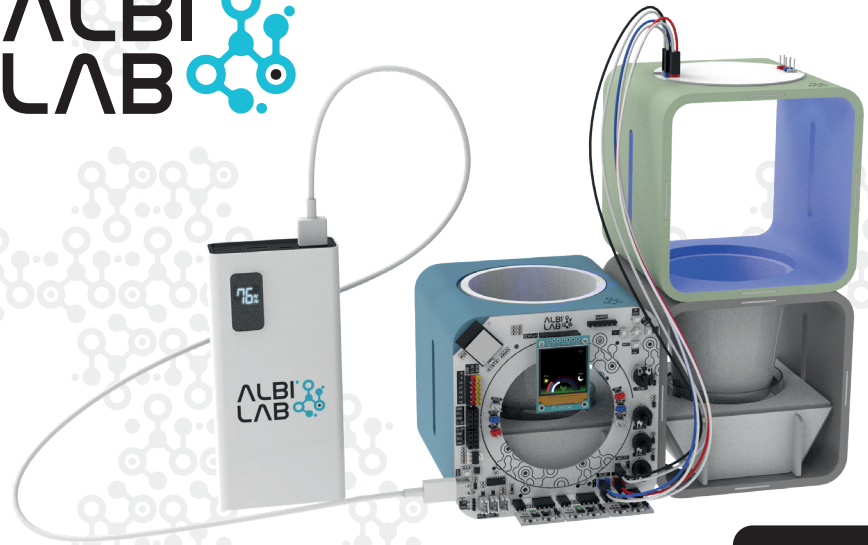
ALBI LAB



MANUAL

CONTENTS

INTRODUCTION

The AlbiLAB electronic kit is designed for children from 14 years of age. Children under 14 can only use the kit under adult supervision.

Warning:
The kit is not a toy. The packaging includes small parts. There is a choking risk.
Not suitable for children under 3 years.

MAINTENANCE: ALWAYS RETURN ANY UNUSED ELECTRONIC PARTS TO THE ANTISTATIC BAG AND ENSURE THAT THE COMPONENTS ARE CLEAN.

www.albi.eu

Downloadable 3D models

Welcome to the fascinating world of plants and science where innovation and fun come together!
You now possess a unique **opportunity to create your own scientific station** consisting of magnetic cubes and programmable electronics. Experiment with growing *mouse-ear cress** and investigate how you can have the best possible influence on it. Monitor its growth, change the light spectrum and/or set up your own light conditions. The electronic kit is super fun, intuitive (easily understandable) and modular.
This means that you can always add new things and improve your station. Moreover, you can easily transform the kit into a physical or chemical laboratory at any time.
And that's not all! You can also extend your AlbiLAB using 3D printing. The files can be easily downloaded from the internet. You now have all the options in your hands.
So come, be a scientist and show us what you've got!

We know you can't wait to get your hands on your first kit and start the exciting journey of growing plants. But before you start, turn the page and read everything carefully.

*) Thale cress, officially known as *Arabidopsis thaliana*, is frequently used in research and in the field of genetics and molecular biology. Its compact growth and short lifecycle mean that it is easy to grow and study under laboratory conditions. This plant plays a key role when researching genetic mechanisms, photosynthesis and other biological processes.

WARNINGS

FIRST OF ALL, READ ABOUT HOW TO HANDLE THE KIT CORRECTLY SO THAT IT IS NOT DAMAGED.

ALWAYS!
Always ensure that the connections are made according to the manual and the marked polarity, 

as failure to do so may lead to a short circuit that could damage the entire kit.

NEVER!
Never reverse the polarity of the power source or any other marked parts 

.

Never connect the circuit or any of the parts to domestic power sockets (there is the risk of an electric shock).

Never place the electronic parts onto conductive objects or surfaces, because this could lead to a short circuit and a malfunction in the product.

Only put liquid in the designated container and avoid any contact with the control electronics or the power bank.

CLEANING

REGULARLY
Clean the magnetic connectors of any grease, dust and small metal particles in order to ensure their optimum magnetic attraction.

Carry out regular maintenance of the connectors, ideally after every connection change or whenever you notice any soiling. Soiling may lead to insufficient contact and influence the functionality of the device.

When cleaning, use only products designed for cleaning printed circuit boards. Clean the device only when the power supply is disconnected. The device can be reconnected when the electronics are dry.

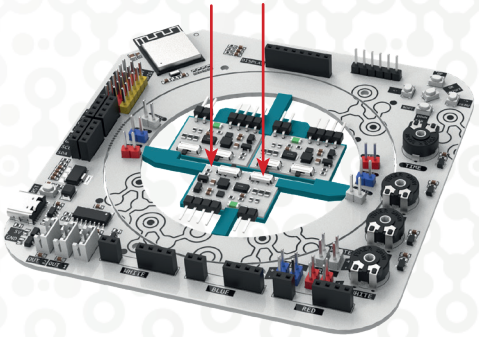
TO KEEP YOUR KIT IN GOOD CONDITION AND EXTEND ITS LIFE, FOLLOW THESE INSTRUCTIONS CAREFULLY.

SEPARATING THE ELECTRONIC PARTS

THE SET CONTAINS ELECTRONIC PARTS THAT NEED TO BE SEPARATED FROM ONE ANOTHER AND SUBSEQUENTLY CORRECTLY CONNECTED IN LINE WITH THESE INSTRUCTIONS.

The individual parts of the set are connected with a plastics and can be detached using a simple levering movement, during which the parts are separated from one another. When separating the parts, be ready for the fact that you will have to use a certain amount of force.

1. Press on the cut part with the LED drivers with your thumb so that you break it off (see the figure). It will be necessary to exert significant force. Take care of the contacts and connections. Then break off the individual drivers.
If you are unable to detach a part, watch the video tutorial.



2. Then remove the individual drivers as well. If you can't remove the piece, watch the video tutorial.

VIDEO MANUAL

PACKAGE CONTENTS

The individual components are clearly arranged in so-called modules so that they are easy to find.

1. Central module = the test tube stand
2. Thale cress seeds
3. TFT LCD colour display (1.54")
4. Knife
5. Scientific journal
6. Assembly manual

Electronics module and accessories:

7. Mainboard (1×)
8. LED ring (2×)
9. Connecting wires (9×)
10. Front cover with opening (3×)
11. Front cover (clear) (6×)
12. Front cover (black) (6×)
13. Metallic adhesive tapes
14. Sand paper (2×)
15. Hole punch
16. Trimmer shafts (4×)
17. LED cover

Power bank module:

18. 20,000 mAh power bank (1×)
19. USB – USB-C cable (1×)
20. 5V/2A adapter (1×)

Test tube module:

21. Sieve (3×)
22. Test tube cap (3×)
23. Test tube (3×)

Small laboratory tools module:

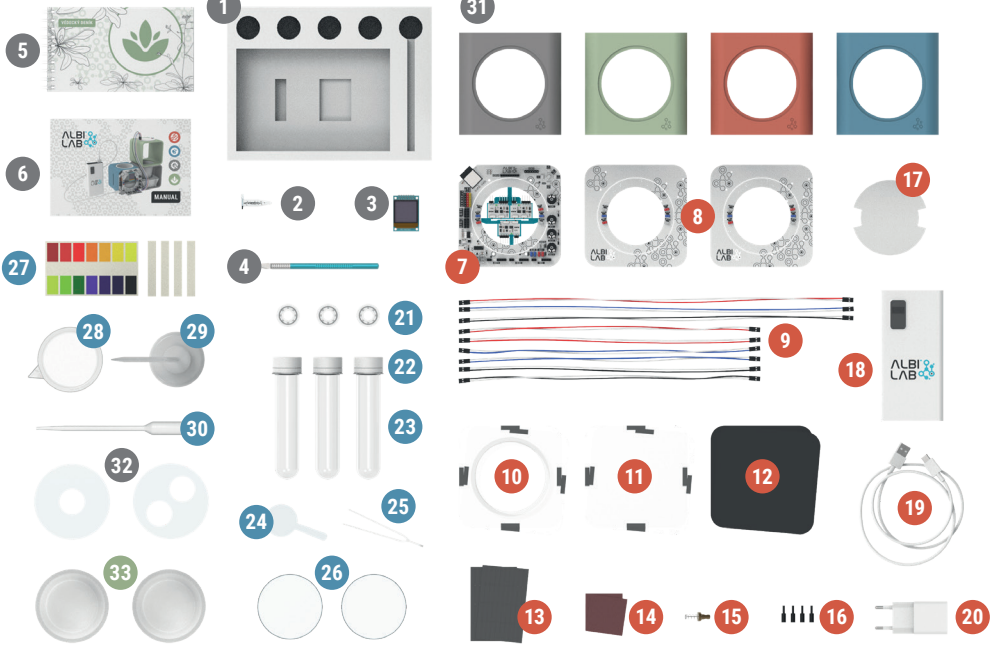
24. Magnifying glass
25. Tweezers
26. Petri dish (2×)
27. pH strips

Large laboratory tools module:

28. 100 ml beaker
29. 150 ml wash bottle
30. 5 ml pipette

31. Magnetic cube – growing chamber for plants (4×)
32. Test tube adapter (2×)
33. Cultivation container (2×)

- Substrate (not depicted)
- Zeolite (not depicted)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MANUAL

This is the basic building block that constitutes the backbone of the entire scientific station. Each cube is equipped with eight magnets, the orientation of which is depicted in the figure. The cubes and magnets can be connected without any limits when they are correctly aligned. The correct orientation of the magnets is apparent according to the pictogram located on the upper side of the cube: it should always be located on the right-hand side of the cube nearest to you.

The upper opening has been adapted for the placement of the cultivation container, the test tube adapter and/or an LED ring. The side opening enables the connecting cables and/or irrigation equipment (the irrigation equipment does not come with this set, but can be purchased independently) to pass through the cube.

The bottom opening is used as a space for the plant if you are using the cubes in a multi-layered configuration. If you have several cubes on top of one another, this opening affixes the part positioned in the cube below it (the adapter or the LED ring). That is why this opening is smaller than these parts. On the other hand, the cultivation container has a smaller diameter in order to enable the plant to be easily removed, including during the course of the experiment (for example, for the purposes of measuring), without the kit having to be disassembled.

The cube is designated as a growing chamber in the experiments with plants.

ASSEMBLY

Place all the cubes that you wish to connect on a pad in front of you so that the pictogram on the right-hand side is located on the edge nearest to you. You can then assemble the cubes either next to or on top of one another, as you wish. Also use cubes from other kits if you wish to construct a large scientific station.

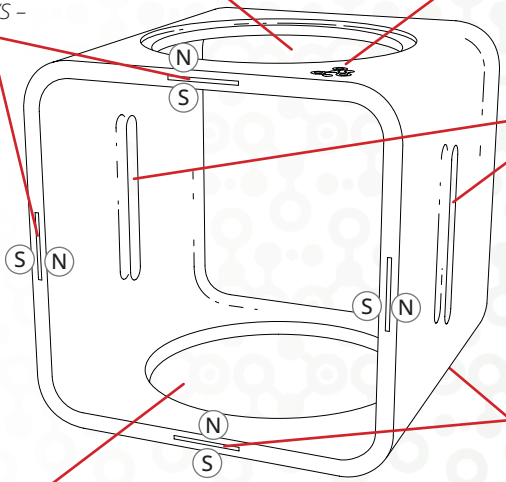
The magnets are used to ensure the correct placement of the cubes. The resulting assembly is not suitable for transfer to a different site.

The upper opening for placing the cultivation container, an LED ring or the test tube adapter.

The AlbiLAB logo is always located on the right-hand side nearest to you.

Magnets oriented N/S – North, South

The openings for the connecting cables and irrigation



Magnets oriented N/S – North, South

The bottom opening (it affixes the component located in the cube below it)

THE FRONT COVER - CLEAR

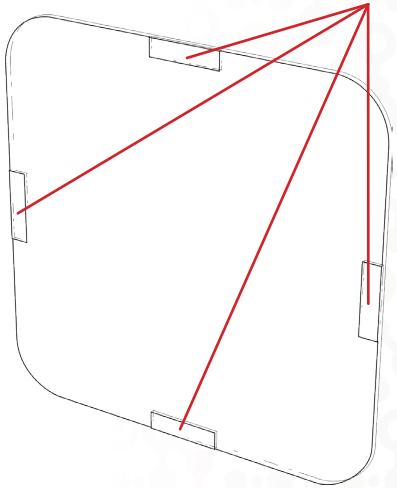
Use the front covers to **create the appropriate microclimate**. These covers assist in maintaining humidity, preventing draughts and protecting the plant against cold, which also slows the drying out of the substrate. Every cover is equipped with grooves with dimensions of 5 × 20 mm that have been designed for the attachment of the metallic tapes.
This will enable you to safely attach the cover to the cube.

PREPARING THE COMPONENTS/PARTS
Place the cover on a pad or desk with the grooves facing upwards. Then take the **sheet with the metallic tapes** (you'll find them in the Electronics and accessories module/box). Remove one tape from the sheet and place it in the groove with the adhesive side down and press it on well for about 30 seconds. The tape has a self-adhesive layer, so it is not necessary to use any glue. Repeat this procedure for all the transparent covers.

If a tape becomes unstuck, this means that the cover is soiled. Clean out the grooves thoroughly and leave them to dry. Adhere a new tape.

ASSEMBLY
Place the cover on the front/rear side of the cube with the magnetic tapes towards the cube. This means that the magnetic attraction is greater than if the tapes were located in the direction towards you. If you were to turn the cover around, the plastic between the tape and the magnet would result in a reduction of the magnetic force between the components and would thus reduce the attractive force that holds the part onto the cube.

The areas for attaching the metallic tapes



The transparent covers help reduce water evaporation, which means **increased humidity in the growing chamber**. The necessary humidity increases the plant's growth rate. The plant is thus isolated from any external influences and a **microclimate** is created in the growing chamber.

You can further influence the conditions by setting the light intensity and the length of illumination. If you submit the growing chamber to the effects of the sun's rays, the light passing through the covers changes into warmth and the growing chamber will be much warmer than the surrounding environment. In this way, you can create you very own **micro-greenhouse**.

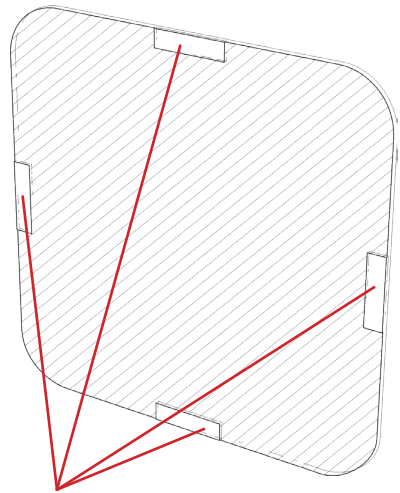
If you want to change the clear cover for an opaque one, **you will create** an area that is completely different to the surrounding environment and it will then be entirely up to you what **conditions** you subject the plant to.

THE FRONT COVER - OPAQUE

This cover is designed for **experiments with photo-synthesis**, the induction of artificial night/darkness and especially for **creating a completely isolated environment** for experiments with light conditions. Just like the clear cover, it maintains humidity better, prevents draughts/coldness and slows the drying out of the substrate. Every cover includes 5 × 20 mm grooves designed for attaching the metallic tapes. They help it to stay on the cube.

PREPARING THE COMPONENTS/PARTS
Repeat the same procedure as for the previous component (the clear front cover).

ASSEMBLY
See the section on the clear front cover.



The areas for attaching the metallic tapes

THE FRONT COVER WITH AN OPENING - CLEAR

This component is used for experiments with light and its impact on plant growth. This cover can be used to install side lighting to influence the light conditions and thus also the plant growth.

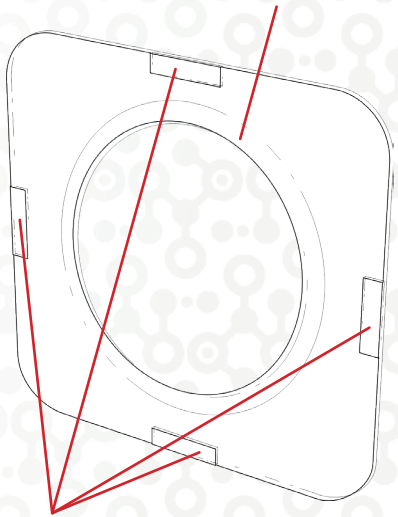
PREPARING THE COMPONENTS/PARTS

Repeat the same procedure as for the previous components (the clear front cover, the black front cover).

ASSEMBLY

Place the cover on a pad or a desk with the grooves facing upwards. Place an independent LED ring into the round, reduced profile so that the LED lights are facing the pad. Then place another cover onto the LED ring, once again with the grooves facing upwards.
Affix both covers at several points using the adhesive tape. Adhere the metallic tapes to the grooves (see the procedure for the previous covers).

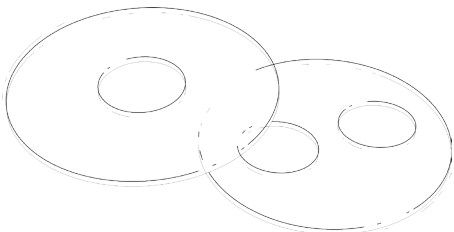
A reduced profile for mounting an LED ring



The areas for attaching the metallic tapes

THE TEST TUBE ADAPTER

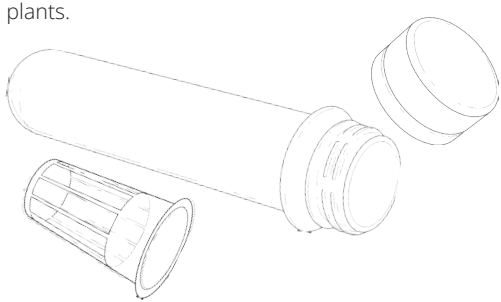
ASSEMBLY
Insert the test tube adapter into the top opening in the cube and then place a test tube with a sieve into the adapter.



TIP: *You can also take another test tube and cultivation container adapter from the **Large Laboratory Tools** module or you can make one yourself out of cardboard.*

THE TEST TUBE

This is a frequent piece of lab equipment.
It is a tube with a rounded base and in this case with a closable cap. It is possible to place a sieve in the test tube, which can then be used for experiments in the hydroponic cultivation of plants.

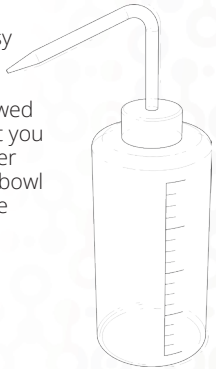


Did you know that: *the test tubes are actually PET preforms (semi-products used to create PET bottles)?*

THE 150 ML WASH BOTTLE

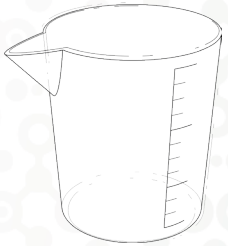
A type of laboratory equipment. This involves a container with a bent plastic or glass tube passing through a waterproof closure and reaching to the bottom. The external side of the tube is bent and narrowed at the end. The container is plastic, so that it can be squeezed by hand.

It is used for easy water dosage during watering. The bent, narrowed tube means that you can aim the water stream into the bowl or onto a precise plant.



THE 100 ML BEAKER

The most common type of laboratory equipment used for storing, mixing or measuring liquids and solutions.

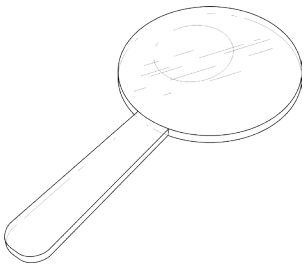


THE PIPETTE

Used for precisely measuring liquid volumes.

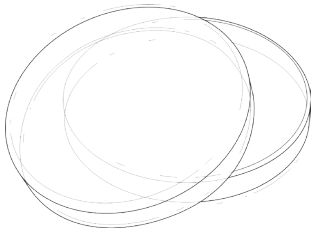
THE MAGNIFYING GLASS

The magnifying glass with its converging lens enables you to better observe the plant details.



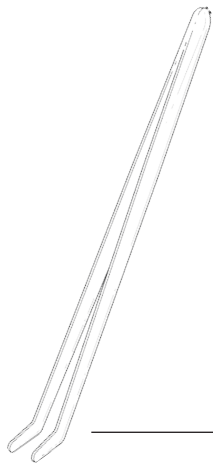
THE PETRI DISH

You can use the petri dish with its freely fitting lid to observe germination and as a base under the cultivation container.



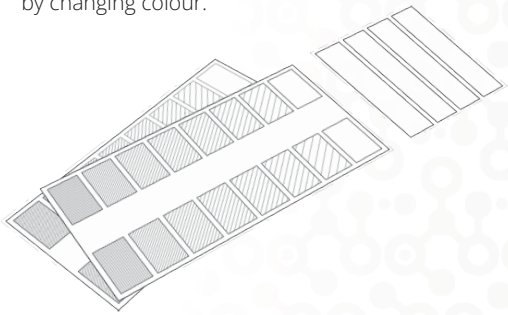
THE TWEEZERS

A useful tool for removing excess plants from the cultivation container.



PH PAPER

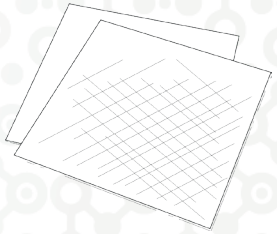
Indicative paper strips containing a mixture of so-called acid-base indicators. The pigments react to changes in the pH at certain intervals by changing colour.



Did you know that: *you can also find this kind of pigment in black tea? It changes colour if you add lemon to it. The pigment thus reacts to the acidic environment.*

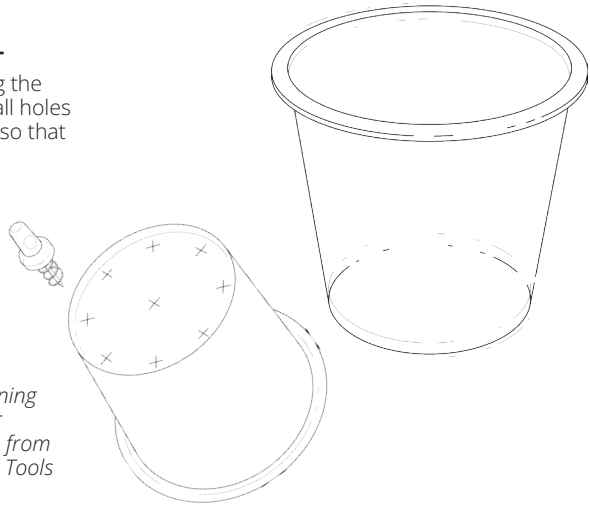
SANDPAPER

Did you know that: *emery is a very hard metamorphic rock, whose main component is corundum (aluminium oxide) (Al_2O_3). It occurs as a result of the metamorphosis of ferrous bauxites. The name is derived from the name of the city of Smyrna (now Izmir) on the western bank of Turkey, where it was mined and used in ancient times.*
(Source: Wikipedie)



THE GROWING CONTAINER

PREPARING THE COMPONENT/PART
Use the hole punch (you'll find it among the accessories) to punch a number of small holes in the base of the cultivation container so that any excess water can drain out.

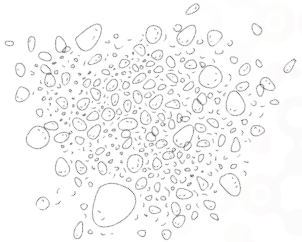


TIP: *You can also use a yoghurt cup, for example, to grow plants.*

If it has a smaller diameter than the opening in the growing chamber, use the adapter (a cardboard ring) which you can detach from the internal side of the Large Laboratory Tools module.

SUBSTRATE

A carefully selected plant growth **mixture with organic and inorganic substances**. It provides the cress with sufficient nutrients throughout its entire lifecycle.



ZEOLITE

An aluminosilicate (mineral) with a highly porous structure. There are many types that differ according to the amounts of the components they contain. When growing plants, it is necessary **to provide** additional **nutrients** in addition to sufficient amounts of water.

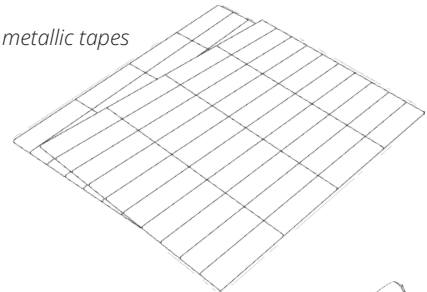
SEEDS

Before you sow the seeds in the cultivation containers, we recommend that you create a small funnel out of a piece of paper, into which you can place the required number of seeds. This makes it easier to sow the correct amount.

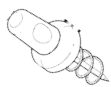
Even though there may only seem to be a small number of seeds, their extremely small size means that there are enough for several experiments.

ACCESSORIES

The metallic tapes



The hole

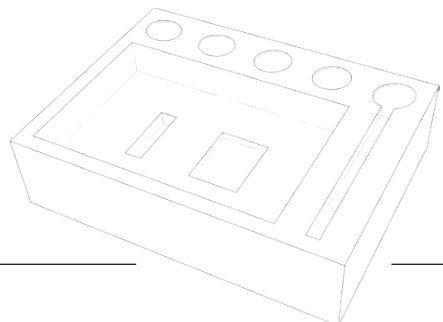


The knife

THE TEST TUBE STAND

Remove the panel securing the display and the cress seeds from the foam bolstering. This will create a separate work surface that is suitable for placing the smaller parts in the set or for examining the plants.

TIP: *You can also place one front cover inside and use it as a suitable base for further investigation of the plants.*
The round openings are designed to hold test tubes.



THE SCIENTIFIC JOURNAL

This is an essential **tool for every scientist**. The front page of the journal will provide you with guides on how to perform your initial experiments with the plants. You will learn how to correctly perform and record the measuring of the plants.

The rear page provides space for the creation and **records of your own experiments**.

There is a wide range of experiments, so they will not all fit into the journal. **We will post other experiments on our website**. If you send us your most interesting experiments, we will post them online.

THE ELECTRONIC PARTS

THE CONTROL BOARD

The heart and brain of the entire kit. It enables you to control the lighting, irrigation and measurements using the sensors.

THE DRIVERS

A total of 3 drivers are connected to the control board. **Each driver is designated for a different LED diode colour.** Follow the manual carefully during assembly so that they are not mixed up.

THE LED RING ON THE CONTROL BOARD

If you wish to **use the LED ring for illumination from above**, detach it. When doing so, pay attention to this point (●) – **it contains a connection to the motherboard** and you could pull out some of the wires if you are not careful. That is why it is necessary to cut the joint carefully.

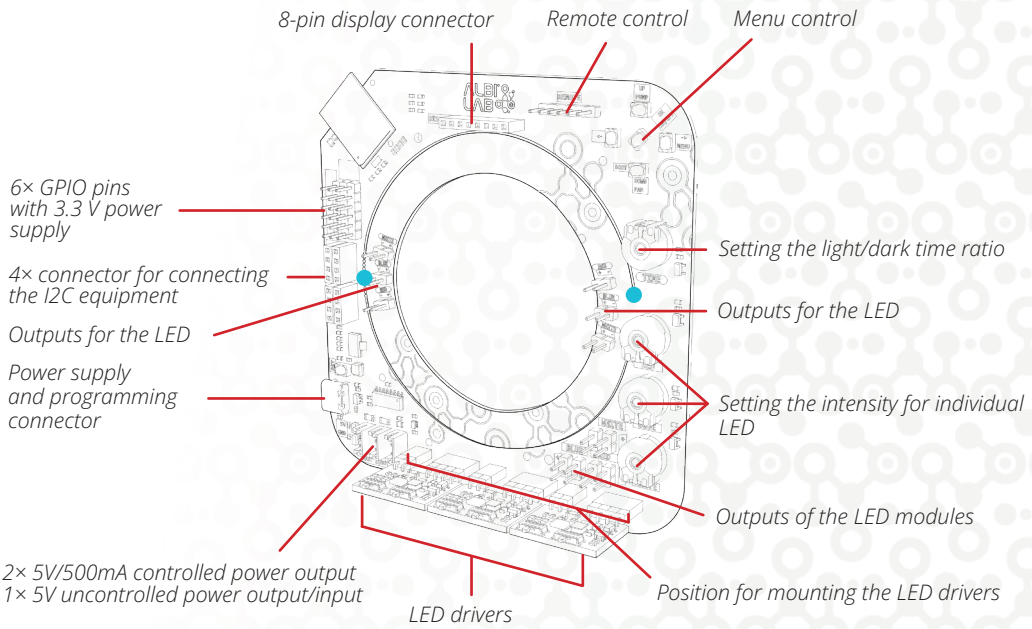
The separation will disrupt the connection to the motherboard, so it will be necessary to connect them using wires (see below). Carefully sand the broken connections on the LED ring using the sandpaper. The main goal is to ensure that the LED ring fits perfectly into the upper opening in the cube. It is recommended that you sand the smaller parts progressively and several times rather than endeavouring to remove everything all at once.

PREPARING THE COMPONENTS/PARTS

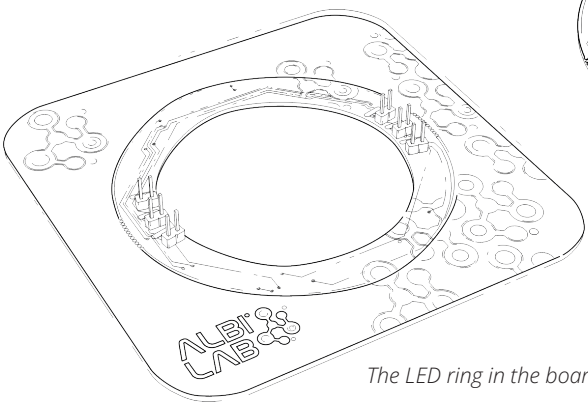
See page 5 – Separating the electronic parts. Upon completion, turn the control board with the contact face down and adhere the metallic tapes to the silver surfaces. The surface, onto which you adhere the tapes, must have been degreased and be dry.

ASSEMBLY

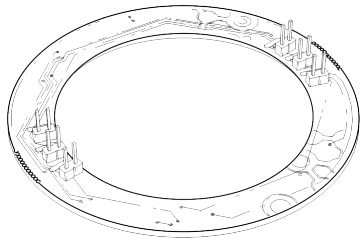
The connection of the control board to the magnetic cubes works on the same principle as the front covers. The connection of the electronics is described in detail for the individual assemblies.


8-pin display connector
Remote control
Menu control
6× GPIO pins with 3.3 V power supply
4× connector for connecting the I2C equipment
Outputs for the LED
Power supply and programming connector
Setting the light/dark time ratio
Outputs for the LED
Setting the intensity for individual LED
Outputs of the LED modules
2× 5V/500mA controlled power output
1× 5V uncontrolled power output/input
LED drivers
Position for mounting the LED drivers

THE LED RING



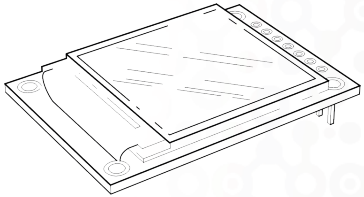
The LED ring in the board



The LED ring after separation from the board

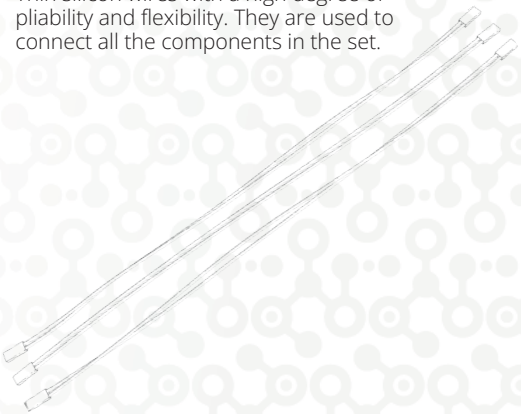
THE DISPLAY

A colour TFT LCD display (1.54").
A thin, flat imaging device consisting of a limited number of pixels. It provides a simple way of setting the device's overall functionality.



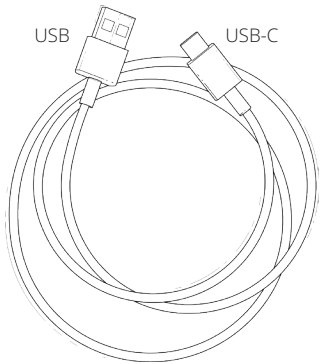
THE CONNECTING CABLES

Thin silicon wires with a high degree of pliability and flexibility. They are used to connect all the components in the set.



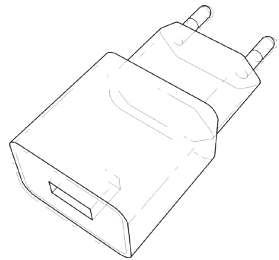
THE USB – USB-C CABLE

This is the connecting cable between the adapter and the power bank (charging) or the power bank and the control board (power supply).



THE 5V/2A ADAPTER

This adapter is designed for charging the power bank.



THE ADAPTER IS NOT DESIGNED TO SUPPLY POWER DIRECTLY TO THE KIT.

THE POWER BANK

The endurance of the power bank depends on the number of connected rings, the set light intensity and the length of the illumination period.

HOW TO CHARGE THE POWER BANK

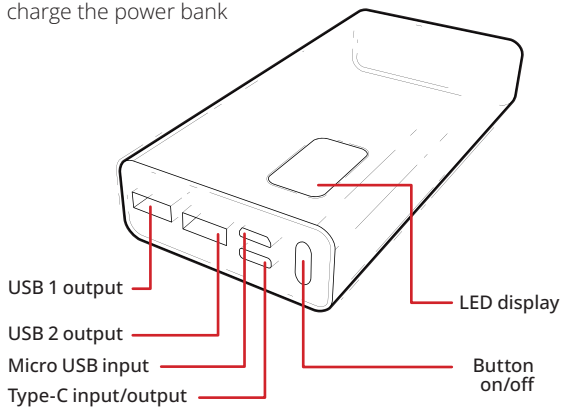
FULLY CHARGE THE POWER BANK BEFORE FIRST USING IT.

How to charge the power bank
Press the button to ascertain the current charge status. If the LED display (charge indicator) does not light up, the battery status is low and needs to be charged. Charging can be undertaken in one of the following two ways:

Charging using a connection to a computer
Disconnect the devices that were connected to the power bank and the cable leading to the power bank. Insert the USB-C connector into the power bank's TYPE-C port. Insert the other USB connector into the USB port on the computer. The indicator will flash when charging. It will display the value 100% when fully charged.

Charging using the USB adapter
Disconnect the devices that were connected to the power bank and the cable leading to the power bank. Connect the cable and the adapter: insert the USB connector into the USB port on the DC-5V adapter and put the USB-C connector on the other end of the cable into the TYPE-C port on the power bank. The indicator will flash when charging. It will display the value 100% when fully charged.

USB 1: 22.5 W – output: it can be used to charge digital devices
USB 2: 22.5 W – output: it can be used to charge digital devices
USB-C: 18 W – input/output: it can be used to charge the power bank or feed power to the AlbiLAB greenhouse
Micro USB: 15 W – it can be used to charge the power bank
LED display: the charge indicator



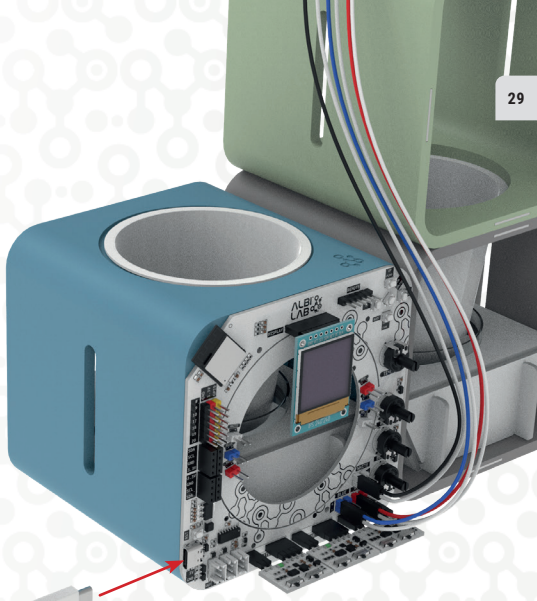
THE POWER BANK

The best time for **charging the power bank is during any downtime**, i.e. the period when the plant lighting is deactivated.
The device may reset after you connect the adapter (this is a normal occurrence) and this may change the time countdown for activation by up to one hour (for example, you will suddenly see 8:00 despite a remaining downtime of 7:36).

This change by up to one hour has been implemented for the purpose of **wear-leveling of the data storage**. If, however, the device remains without power for a longer period of time and you connect the power bank at the start of the cycle, you can deactivate the automatic functions using the middle button and then reactivate them with the same button.

In this way, you can **eliminate any power outages** and start the plant lighting cycle with the originally set value. The lighting period statistics are not reset.

TIP: *Connecting the power bank at the start of the cycle ▸ switch it off using the middle button and then switch it back on.*



ASSEMBLING THE KIT

PREPARING THE ELECTRONICS

The basic electronics consist of four parts that are necessary for the elementary functions of the AlbiLAB:

- the mainboard
- the power modules for the LED
- the LED ring(s)
- the display

BEFORE ASSEMBLY

- Detach all 3 LED modules from the main electronics. Be careful not to damage the electronics and not to injure yourself on any sharp parts.
- **You can optionally** remove the LED ring, **but it is not necessary to do so** if you want to use side illumination without a subsequent connection *(see page 22)*.

ASSEMBLY

1) Connect the display to the top 8-pin connector.

2) Insert the three power modules into the appropriate slots (WHITE, BLUE, RED). Each module is marked with a dot on the opposite side. Each module is inserted into the two and four-pin connectors.

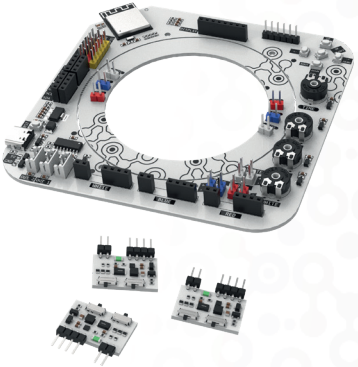
3) You can optionally connect additional LED rings using the two-pin connectors, each with the same colour (white, blue or red) and while + - maintaining their polarity.

If you have not detached the LED ring from the main electronics, it is not necessary to connect it to the electronics. The other LED rings need connecting.

4) Connect the power source to the USB-C connector.

7 The mainboard

Do not remove the LED ring from the mainboard if you want to use illumination from the side without the need for a subsequent connection.

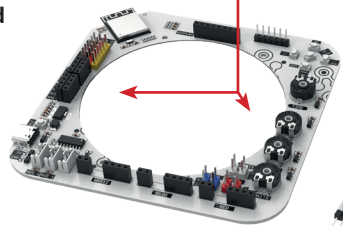


8 The LED ring

THE MAINBOARD

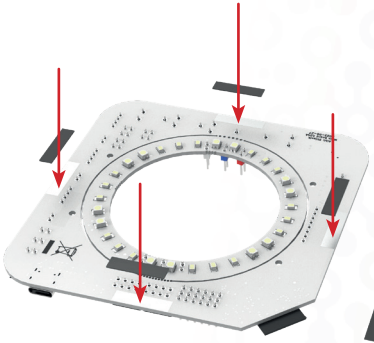
2 *Sand the breaks using the sandpaper*

7 **Mainboard**

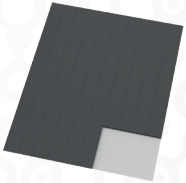


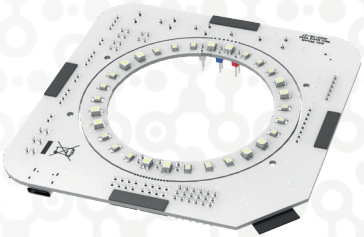
14 Sandpaper

3 *Adhering the metallic tapes*

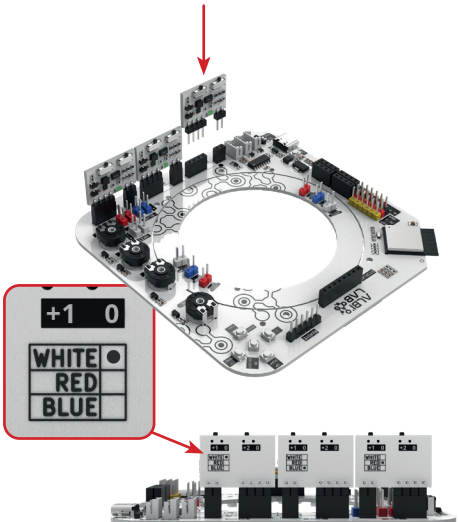


13 Metallic self-adhesive tapes

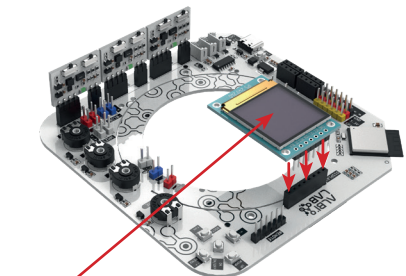




4 *Connecting the LED power modules*

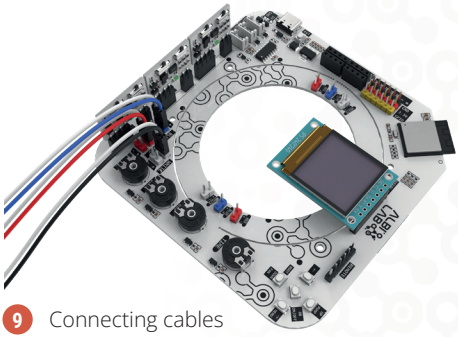


5 *Attaching the display*



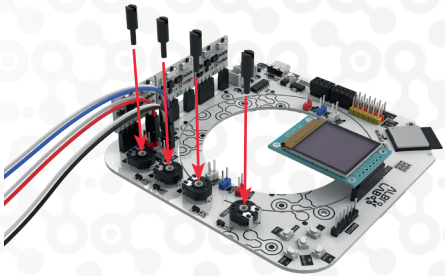
2 The colour TFT LCD display

6 *Connecting the cables to the motherboard: red, blue, black => (+) white => (-)*



9 Connecting cables

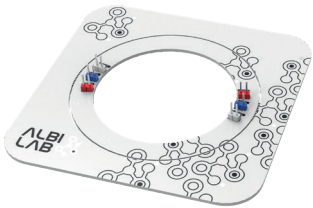
7 *Connect the trimmer's shafts*

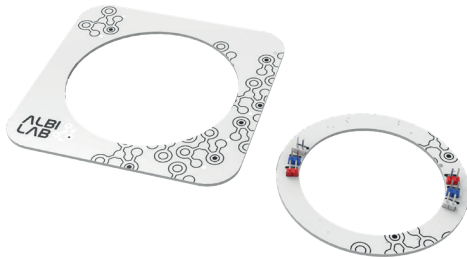


16 Trimmer shafts

THE LED RING

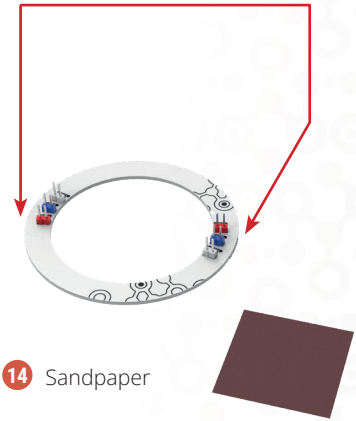
1 *Detaching the ring (optional)*





8 The LED ring

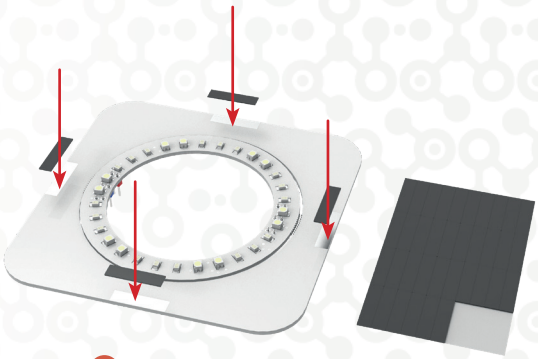
2 *Sanding with sandpaper*



14 Sandpaper

Sand the small parts of the LED ring progressively so that it perfectly fits into the upper opening in the cube.

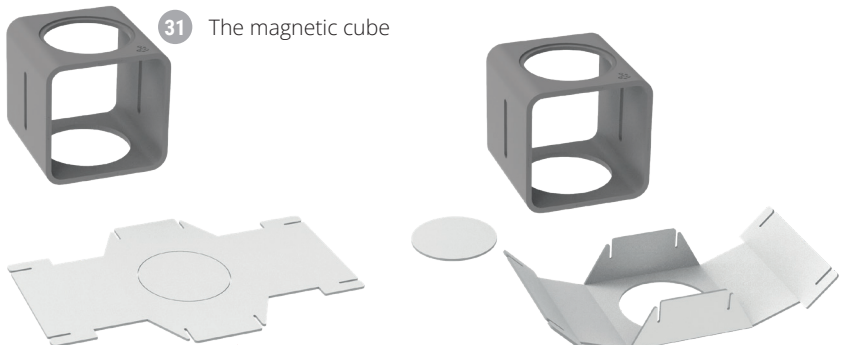
3 *Adhering the metallic tapes (only if you have not detached the LED ring)*



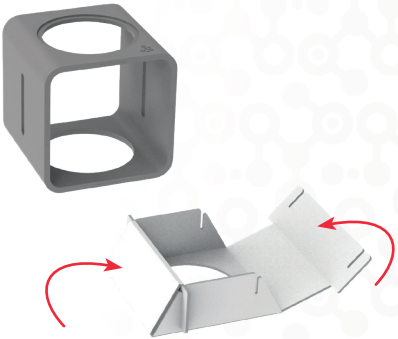
13 Metallic self-adhesive tapes

THE BASIC KIT

1 *The composition of the kit for the petri dish*

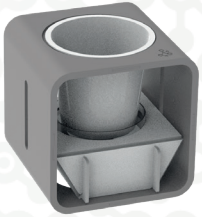


Remove the petri dish holder from the internal part of the box.

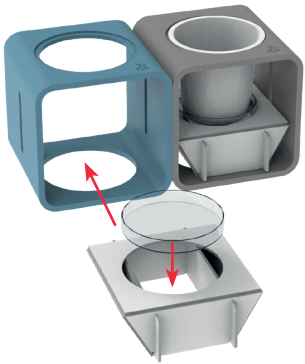


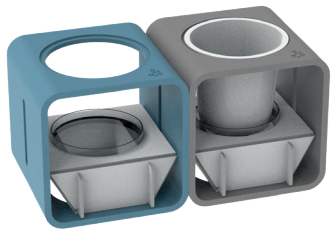
24 The petri dish

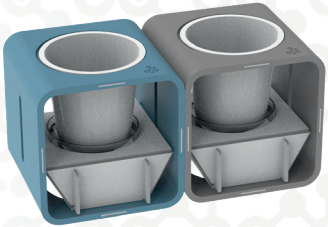
33 The cultivation container



2 *Connecting another cube*

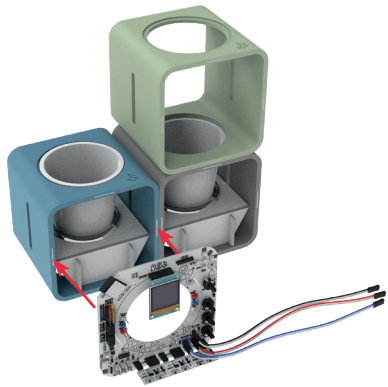




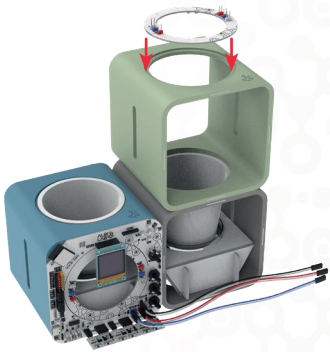


3 *Connecting a third cube*

4 *Adding the mainboard*

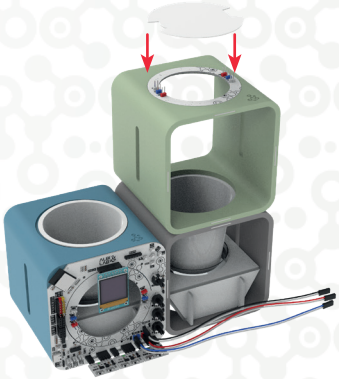


5 *Installing the LED ring*

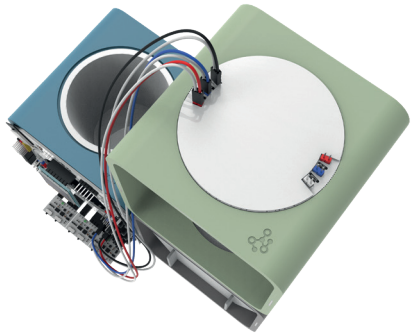


6 *Installing the LED cover*

17 The LED cover



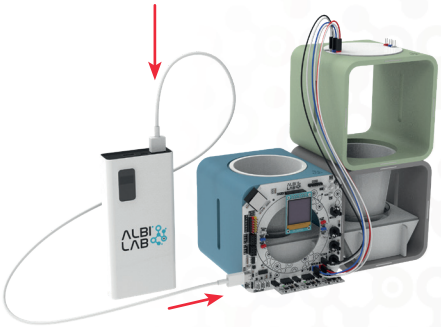
7 *Connecting the cables*



8 *Connecting the power bank*

(optionally to a PC)

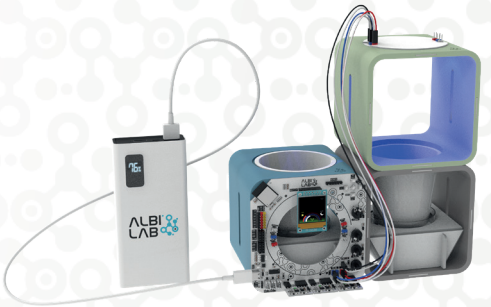
NEVER CONNECT THE KIT DIRECTLY TO THE POWER GRID.



18 The 20,000 mAh power bank

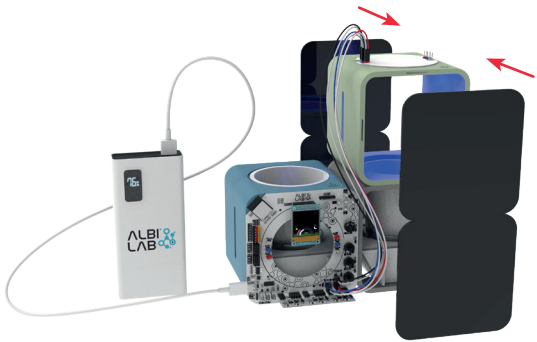
9 *Activation*

It is necessary to set the light intensity.



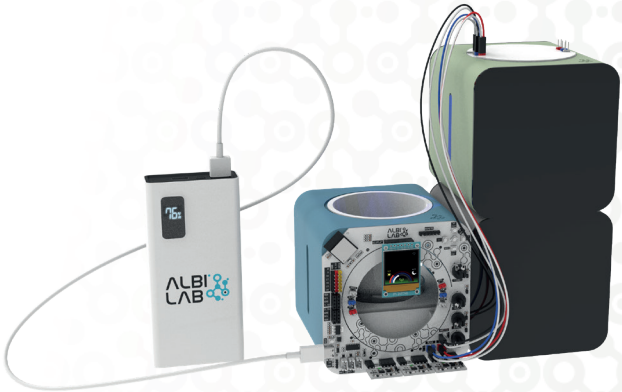
19 The USB – USB-C cable

10 *Connecting the black covers to create an artificial environment*



11 The front black cover

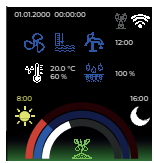
You can find a summary of the connection variants at the end of the brochure.


ALBI LAB

GETTING STARTED

Make sure that you have connected everything correctly according to the previous instructions and that the device has been successfully activated. You will first see the AlbiLAB logo followed by the home screen.

The default language in the initial activation is English; if you want to change the menu to other language, go to **Menu ▸ Settings ▸ Language**. It will then be necessary to restart the device using the RST button, after which the language will be changed.



When the device is first activated, the information bar appears at the top of the main screen with the WiFi connection icon (top right) and two icons of the sun and the moon at the sides. The sun icon indicates the illumination time (8:00 am) and the moon indicates the downtime/deactivation of the LEDs (4:00 pm). If you have adjusted the setting with using the TIME trimmer, the display will depict a different value, specifically between 8:00 am and 4:00 pm for the illumination period and the remaining time up to 24 hours for the dark period.

The area under the status bar is reserved for icons that indicate the temperature, the soil or air moisture, the water level in the tank or the functioning of the pump or fan. These icons will appear as soon as you connect the given devices/periphery.
See the following illustration:

The lower section shows the LED intensity indicator setting for red, blue and white light with the growth phase icon

below it. This also corresponds to the settings or to the manual control mode.

The following illustration depicts a visual summary of these statuses:


This depicts the manual mode where the LED intensity and illumination time is set using the trimmers directly on the board.


The germination phase


The plant's vegetative phase


The flowering phase


The ripening phase

THE INITIAL SETTINGS

When first activated, the device is in its default setting where no periphery has been initialised and the AlbiLAB functions is fully in manual mode.

It is necessary to set the intensity of the individual LED colours using the appropriate trimmers (the default value is 0%) and the time (the default value is 8:16) in this phase. You can find out more about the colour spectrum and its influence on plants on page 12 of the Scientific Journal.

TIP: *If you do not set the lighting values manually, you can choose one of the pre-set lighting profiles – see page 56.*

If you also own other accessories, it is possible to set up the soil moisture, temperature and air humidity sensors and the actuators (the water pump and the fan). These components are also available for sale, but do not come with the basic kit.

THE LED RINGS

It is possible to connect up to 4 LED rings to the mainboard (the control board), which is especially advantageous for taller plants: it enables you to secure equal illumination for the plant.

If you have not detached the ring from the mainboard, it is only possible to add three more rings. This also needs to be taken into account when setting up the switches.

Every LED driver includes two switches, whereby the left-hand one adds power to the next ring and the right-hand one does the same for the next two rings (designated as +1 or +2 in the figure on the right side). If it remains in position 0, this will be taken to mean that no other LED ring has been connected.

bílá:

WHITE	●
RED	
BLUE	

modrá:

WHITE	
RED	
BLUE	●

červená:

WHITE	
RED	●
BLUE	

+1 0	+2 0	NUMBER OF RINGS
		
		
		
		

If you forget to change the switch to the +1 or +2 position and you have 2, 3 or 4 rings (the first ring is usually incorporated into the mainboard), the overall output power will be distributed among all the connected rings.

If you forget to change the switch back to the 0 position, the LED ring will not be damaged, because the output is limited to the maximum voltage.

Nevertheless, we do not recommend operating the device for long in this mode, because this will **significantly reduce the service life of the LED due to more current passing through the circuit!**

THE SENSORS

When adjusting the sensors, go to **Menu ▸ Sensors** and choose the sensor that you want to configure. You have the option of choosing from three types of sensors in all: a temperature sensor combined with a humidity sensor, a soil moisture sensor or a water level sensor to indicate sufficient levels of water in the tank for the automatic watering of the plant.

It is necessary to select the type and choose the method of connection to the board for each sensor. Most analogue or simple sensors are connected to one of the six GPIO pins (to the left of the black-yellow-red connector). However, sensors that communicate with the I2C interface are connected to one of the four black connectors. In both cases, it is important to carefully adhere to the correct connection orientation, i.e. to not mix up the outlets, **because this may lead to a short circuit and to the damage of the sensor or the board!**

You can find a detailed description of the set-up in the **Menu ▸ Settings** section. **The successful sensor set-up is shown by the depiction of the appropriate icon and the measured value on the main display.**

THE ACTUATORS

The actuators can be set up via **Menu ▸ Actuators**, where you have the option of choosing between adjusting the water pump and the fan. Both are only connected to one of the two controlled connectors in the lower section of the electronics labelled OUT1 or OUT2. **The pump and fan can be manually controlled** by pressing the UP button to activate/deactivate the water pump or the DOWN button to activate/deactivate the fan. Their current activity is depicted by an animation on the main screen: water will drip in the case of the water pump and the fan will rotate. **The pump can also be set up in the automatic mode.**

AUTOMATION

It is possible to activate some of the available functions in **Menu ▸ Automation** as part of the autonomous control of the greenhouse. It is currently possible to activate automated irrigation, which is only available once the water pump has been set up. You can define the time that the pump is active and the switching period. Otherwise, it is also possible to activate the pump when the soil moisture drops below a certain level, which enables the optimisation of the irrigation according to the needs of the plants. The inspection is also undertaken after a given period.

WIFI AND THE SMART ALBILAB

You can use the display found directly on the device to monitor the basic information and acquire a quick overview, but, given that AlbiLAB is a smart greenhouse, it is also possible to monitor the data on your telephone or computer using WiFi.

AlbiLAB offers two connection options: as an Access Point or using a connection to a domestic WiFi network using the **"Connect to WiFi"** option.

Activate the WiFi using **Menu ▸ Settings ▸ WiFi**. During the initial set-up, select the Access Point mode, connect to the AlbiLAB using a smart phone or a PC and enter the address **"AlbiLAB.local"** into the web browser's search bar. You can then set the SSID and password for your home WiFi network (see page 65).

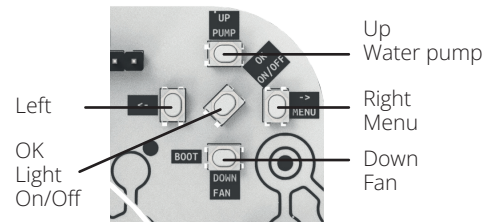
You can acquire status information and update the firmware in the WiFi network connection mode without being directly connected to the device.

The web interface is described in more detail on page 72.

THE CONTROLS

THE 5-WAY CONTROLLER

The 5 buttons located in the upper right-hand area of the electronics are used to move through the menu and control the AlbiLAB. They have the following functions:



- **The central button** is used to activate the operations of the AlbiLAB, if you are in the home screen with the data. Otherwise, it is used as the confirmation button that enables the selected option to be confirmed or the chosen action to be performed.

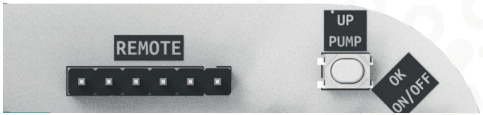
- **The Right button** is used to enter the menu from the home screen with the data. Once in the menu, it is used to move to the right or to add to the set value.

- **The Left button** is used to move to the left in the menu or to reduce the set value.

- **The Up button** is used to move upwards in the menu or to control the water pump.

- **The Down button** is used to move downwards in the menu or to control the fan.

TIP: *It is also possible to connect a remote control to the main electronics. This will perform the same functions as the 5 buttons on the main electronics. Once the remote control has been connected, you can control the AlbiLAB in both ways. The connection of the buttons to the microcontroller is stated in the table on page 77 and the button is active when the value on the given pin is at logical 0.*



SETTING THE TRIMMERS

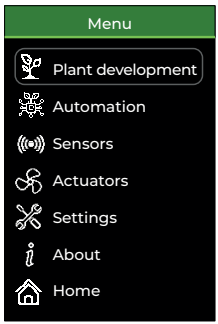
The main electronics include 4 rotary trimmers. The upper one is used to set the time and the lower three are used to set the intensity of the LED lights (red, blue and white). These trimmers are only active in the manual mode (**Menu ▸ Plant development phase ▸ Manual setting**).

The trimmer for setting the time enables the illumination time to be set within an interval of 8 to 16 hours. The downtime (darkness) is then the remaining period up to 24 hours. This setting is used to simulate day and night.

The LED intensity trimmers enable the intensity ratio between the individual colours (red, blue, white) to be set, which is suitable for the various phases of plant development.
You can read more about the influence of the light spectrum on plants and the ways they can be set on page 10 of the Scientific Journal.

THE MENU AND SETTING UP THE ALBILAB

The menu is critical for setting up the individual peripheries and the behaviour of the entire AlbiLAB. The main menu is divided into the following sections:

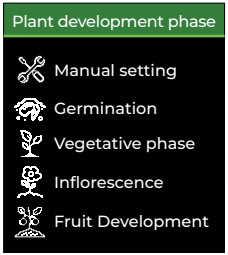


- **Plant development:** the selection of the plant's growth phase and the appropriate illumination period or the choice of the manual mode where the values are set using the trimmers.
- **Automation:** If external sensors are connected, this can be used to set the automation for the entire greenhouse, especially the irrigation.
- **Sensors:** The set-up of the individual sensors if they have been connected to the electronics.
- **Actuators:** The setting of the actuators: the water pump or the fan.
- **Settings:** Setting the device's other functions: the display backlighting, language, WiFi and also the option of configuring the Plant development phase.
- **About:** Information about the device and the list of used licences.
- **Home:** Return to the home screen with the status information.

PLANT DEVELOPMENT

This menu contains pre-set profiles for the plant's individual vegetative periods. These settings are only recommended for the initial experiments and it is possible to change them using the **Menu ▸ Settings ▸ Plant development**.
The selected phases are subsequently depicted as an icon at the bottom of the home screen and they also set the lighting values and the period.

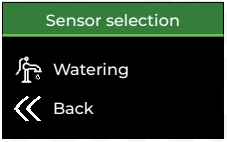
TIP: *No matter whether you are moving in the menu with the lights on or off, the settings are applied when you return to "Home". The only exception involves the configuration of the individual phases in* ***Menu ▸ Settings ▸ Plant development*** *(see page 64)*



- **Manual setting:** manual control of the LED lighting and times using the trimmers.
- **Germination:** predefined settings for germination.
- **Vegetative phase:** predefined settings for the vegetative phase.
- **Inflorescence:** predefined settings for inflorescence.
- **Fruit Development:** predefined settings for fruit formation.

AUTOMATION

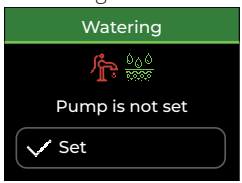
The menu with the automation settings for the AlbiLAB device.



- **Watering:** the set-up for the automated watering of the plant.
- **Back:** return to the main menu.

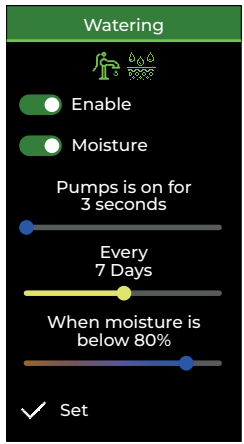
IRRIGATION

It is necessary to first assign the water pump under **Menu ▸ Actuators ▸ Pump** to enable the automated watering of the plant. The option of setting the automated irrigation will then appear.



If you do not set this up, the device will inform you that it is first necessary to activate the water pump.

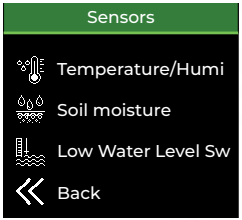
- **Icons:** the sensors and actuators that are connected to the AlbiLAB are depicted in green, while those that are not are depicted in red. Further options are depicted on the basis of the connected periphery.
- **Enable:** this permits automated irrigation.
- **Moisture:** the irrigation is activated whenever the soil moisture falls below the set level.
- **1st slider:** sets the length of the pump's operation ranging from 1 second to 3 minutes.
- **2nd slider:** sets the irrigation period and moisture inspection. The time can be set within the range of 8 hours to 30 days.



- **3rd slider:** if the soil moisture sensor is connected and automation has been enabled using the Moisture switch, it is possible to set the soil moisture level, at which the plant should be automatically watered. Watering will only take place when the humidity level falls below the set threshold, according to the time set by the second slider.
  The moisture level can set in a range from 20% to 90%.
- **Set:** confirmation of the setting.

SENSORS

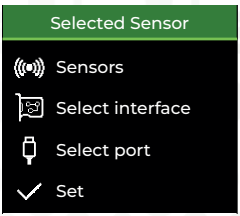
The possible sensors that can be connected to the device. At present, it is possible to connect three sensors, namely an air temperature and humidity sensor, a soil moisture sensor or a low water level sensor.



- **Temperature/ Humidity:** sets the temperature or air humidity sensor.
- **Soil moisture:** the soil moisture sensor.
- **Low Water Level Switch:** the low water level sensor in the water tank.
- **Back:** return to the main menu.

JOINT SETTINGS FOR THE SENSORS

Once the sensor has been selected, the menu with the current setting appears.

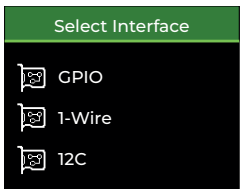


- **Sensors:** the type of connected sensor.
- **Select interface:** the type of connection interface (GPIO/1-Wire/I2C).
- **Select port:** the physical connection to the pin or the device's I2C address.
- **Calibration:** sensor calibration, provided this option is enabled.
- **Set:** Conformation of the setting.

TIP: *For example, the soil moisture sensor is set up as follows:* ***Menu*** ▶ ***Sensors*** ▶ ***Soil moisture*** ▶ ***None*** ▶ ***Soil moisture****. The type of interface is given here (GPIO), but it is necessary to assign the correct port:* ***Select*** ▶ ***GPIOx****, where x indicates the number of the physical port, to which the soil moisture sensor is connected (9, 10, 17, 18, 19 or 20). It is also possible to optionally calibrate the sensor (this is only recommended for advanced users). Then confirm everything with* ***Set****.*

THE INTERFACE

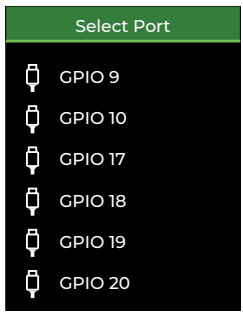
The selection of the interface, provided one is available for the given sensor. There is usually only one due to the method of communication and data transfer. The following is a description of the three possible interfaces for sensor connections.



- **GPIO (General Purpose Input/Output):** the connection of the output with one wire, usually as an analogue sensor output or digital signal with an ON/OFF mode. The sensor is connected to one of the GPIO pins on the black-red-yellow connector.
- **1-Wire (1-wire digital communication):** this interface enables the 1-wire communication of the sensor with the single-board computer and the connection is realised via the GPIO interface.
- **I2C (Inter-Integrated Circuit):** a series interface for the device's communication at short distances. An address is required for clear identification. The sensor is connected to one of the four I2C connectors.

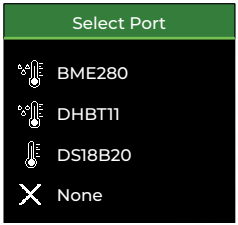
THE PORT

When selecting the port, to which the selected sensor is connected, it is necessary to take its availability into account. If a port is not present in the list, this means that it has already been allocated to another device. If you wish to use an assigned port, it is necessary to first free up the given port and then to assign it to the given sensor.



THE TEMPERATURE AND AIR HUMIDITY SENSOR

The following menu includes a list of the available temperature sensors and possibly air humidity sensors.



- **BME280:** an air temperature and humidity sensor with a connection via the I2C interface.
- **DHT11:** an air temperature and humidity sensor with a 1-WIRE interface.
- **DS18B20:** a temperature sensor with a 1-WIRE interface. *If the sensor is housed in a protective cover, it can also be used to measure soil or water temperature.*
- **None:** no temperature and humidity sensor has been connected.

The icon for the given sensor expresses information as to whether the sensor includes humidity measurements.

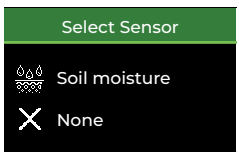
A temperature and air humidity sensor

Only a temperature sensor

• **TIP:** *For example, the sensor is set up as follows:* ***Menu*** ▸ ***Sensors*** ▸ ***Temperature/Humidity*** ▸ ***None*** ▸ ***DS18B20****. The type of interface in this case is given as 1-Wire, but it is also necessary to assign the correct port:* ***Selection*** ▸ ***GPIOx****, where x indicates the number of the physical port to which the sensor is connected (9, 10, 17, 18, 19 or 20). Then confirm everything with the* ***Set*** *option.*

THE SOIL MOISTURE SENSOR

Only one sensor of this type is available, namely with a connection to a GPIO pin. We recommend using a sensor that functions on a capacitance basis. When using a sensor based on the measurement of water conductivity, there is the risk of the gradual loss of the electrodes due to electrolysis from the natural voltage and the soil's moisture content. If no sensor is required, select **None**.

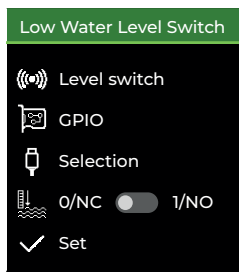


THE LOW WATER LEVEL SWITCH

The low water level switch in the automatic irrigation tank checks whether it is possible to activate the pump. If the water level falls beneath a certain level, the sensor switches the status on the main screen and a red icon will appear indicating the low water level. A picture of the water pump with a flashing water drop will also appear to signal insufficient water. If, however, if the water level is sufficient, the sensor will switch the status to blue indicating sufficient water using the appropriate pictograms.

High water level

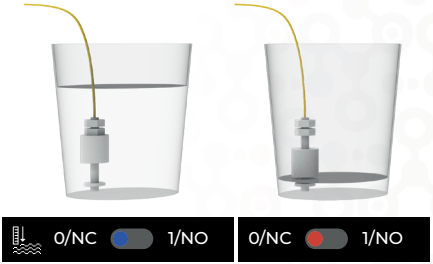
Low water level



It is necessary to define the low water level detection logic in order to ensure the correct setting of the sensor. This can be adjusted in the sensor settings in the 4th line.

The colour on the switch indicates whether there is sufficient (blue) or insufficient (red) water.

The selection of the 0/NC or 1/NO switch determines the sensor logic. To ensure the simplicity of the setting, it is necessary for the colour on the switch to correspond to the status of the water level, see the illustration.

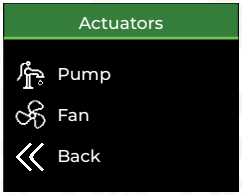


0/NC: if there is sufficient water, logical 0 must be at the input.

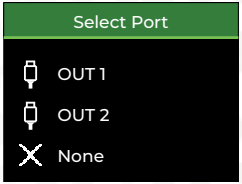
1/NO: if there is sufficient water, logical 1 must be at the input.

THE ACTUATORS

There are two actuators available for AlbiLAB: the **pump** for automatic irrigation and the **fan** to maintain a uniform air humidity. After selecting a specific actuator, it is essential to set the port to which the given actuator is connected.



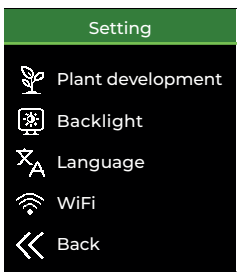
- **Pump:** a water pump.
- **Fan:** a fan.
- **Back:** return to the main menu.



- **OUT 1:** connector for OUT 1 connection
- **OUT 2:** connector for OUT 2 connection.
- **None:** no actuator is connected.

SETTINGS

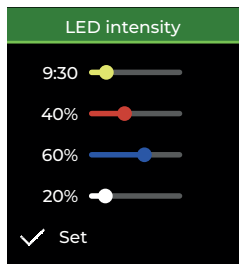
It is possible to configure the device's basic parameters, such as the language selection and the setting of the display's backlighting intensity, in the Settings section. In addition, you can also adjust the lighting values for the predefined plant growth phase profiles. This function enables the lighting to be adapted according to the specific needs of the plants at various phases of their development.



- **Plant development:** sets the predefined values for the plant phases.
- **Backlight:** sets the intensity of the display backlighting.
- **Language:** the selection of the device language. It is necessary to restart the device after choosing a new language.
- **WiFi:** sets the wireless transfer of data by WiFi.
- **Back:** return to the main menu.

SETTING THE PLANT DEVELOPMENT

This setting gives you the option of defining the intensity of the LED lights and the period of illumination for each individual growth phase. When the given phase is selected, the LED shines at the pre-set intensity, which enables an immediate visual inspection of the current light intensity.



- **Yellow:** sets the LED illumination period in the format hh:mm.
- **Red:** sets the illumination intensity of the red LED.
- **Blue:** sets the illumination intensity of the blue LED.
- **White:** sets the illumination intensity of the white LED.
- **Set:** confirmation of the setting.

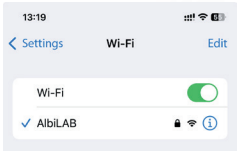
WIFI

Activate the WiFi to monitor information on a smart phone or PC in one of two modes.
In the first mode, so-called **Access Point (AP)**, the device creates its own WiFi (with the default name SSID AlbiLAB and the password AlbiLAB_AP).

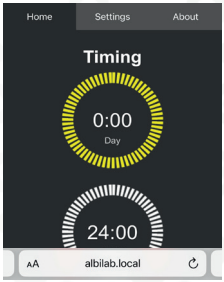
- **Access point:** shows the current WiFi setting in the Access point mode and also selects this method.
- **Connect to WiFi:** shows the password and SSID for connecting the device to the home Wi-Fi network.
- **Disable:** disables the use of WiFi: this requires a restart of the device.
- **Set:** confirms the settings.

Connecting in the Access point mode (AP):

1. Select **Menu** ▸ **Settings** ▸ **WiFi** ▸ **Access point** ▸ **Set** on the AlbiLAB display.



2. Find the WiFi connection menu in your smart phone or PC and select the AlbiLAB network, enter the password (the default is AlbiLAB_AP).



3. Open the web browser and enter **http://AlbiLAB.local** into the address line. The current setting of the greenhouse will be displayed in the Home tab.

Connecting to a home network (the second mode):

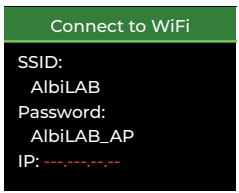
4. Switch to the Settings tab in the web browser (while still in the AP mode).

5. Change the SSID (your home network's name) and the password for the network and confirm the selection with the Change WiFi and AP Settings button.

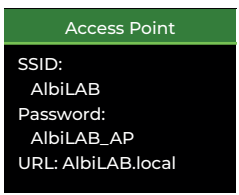
6. Select **Menu ▸ Settings ▸ WiFi ▸ Connect to WiFi ▸ Set** on the AlbiLAB display.

7. Set up the WiFi connection on your smart phone or PC (this time in your home network).

8. Open the web browser with the address: http://AlbiLAB.local.



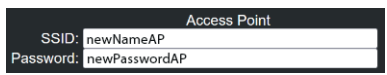
If the device fails to find the address: http://AlbiLAB.local, it is necessary to add the IP address, which you can find by selecting **"Connect to WiFi"** on the AlbiLAB display



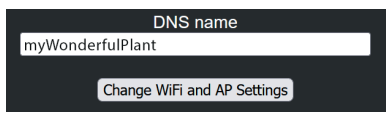
TIP: *you can find the password to the Access Point just as simply, namely in Menu ▸ Settings ▸ WiFi ▸ Access Point*

If you have several AlbiLAB kits, it may not be clear which one you are connecting to. You can therefore change their names in order to differentiate the individual kits. The procedure is as follows:

1. (Only valid in the Access point mode). Change the SSID name for the Access Point mode, including the password, if necessary. The original name for the AlbiLAB has been changed to newNameAP and the password has been changed from AlbiLAB_AP to newPasswordAP in the figure below.
The name and password must be 6 to 32 characters long without any diacritics and spaces. You can find more information about the connections in the Access Point mode on the previous page.



2. Change the device's default name, which you will then use to connect (AlbiLAB) to the new one (6 to 32 characters).



In the example, AlbiLAB has been changed to: myWonderfulPlant.
3. Confirm with the **Change WiFi and AP Settings** button.

4. Restart the device with the **RST** button.

5. Connect to the WiFi with the new name (only after the application of point 1) and then write the new device name in the address bar of your browser. In the example: myWonderfulPlant.local (originally AlbiLAB.local).

ABOUT

This section provides device statistics and information about information about libraries and resource usage.

- **Lighting Stats:** statistics of light duration in each mode and their total time.
- **Acknowledgement:** information about libraries, resource usage, etc.
- **Back:** return to main menu.

SOIL MOISTURE SENSOR

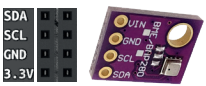
One of a number of sensors can be used to measure the soil moisture. The effects of water on the electronics and the passage of the current through the circuit can lead to electrolysis, meaning that the use of capacitive sensors is preferable to those that measure the soil conductivity.

The moisture sensor is inserted in the soil up to the maximum depth marked by a line under the electronics. Never insert the sensor any deeper, as this may lead to it being damaged or destroyed. The sensor is connected to the electronics using 3 wires, two of which are the power source (red +, black -) and the third is the signal wire (yellow). The sensor output is an analogue voltage that corresponds to the measured capacity of the capacitor. This voltage can then be converted to the soil moisture value, in this case given as a percentage.

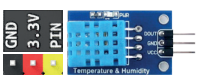
The capacity sensor is sensitive to disturbance and the values may change, for example during the operations of the pump. It is important to keep this sensitivity in mind when interpreting the measured values.

THE TEMPERATURE SENSOR

There are many types of temperature sensors. At present, it is possible to connect one of three sensors to the AlbiLAB, which may also be combined with an air humidity sensor. This involves the following specific sensors:



BME280: A temperature and humidity sensor connected a I2C interface. It offers the option of measuring the temperature accurate to 1°C and a resolution of 0.01°C and of measuring the relative humidity accurate to 3% and a resolution of 0.008%.



DHT11: A temperature and humidity sensor with a 1-WIRE interface. It offers the option of temperature measurement accurate to 2°C and relative humidity accurate to 5%.

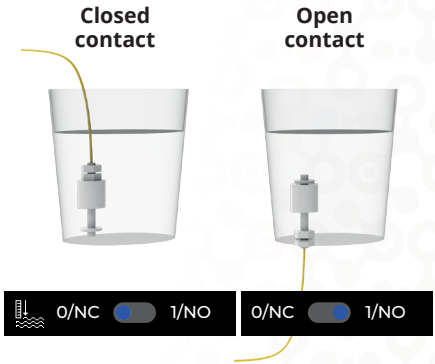
DS18B20: A temperature sensor with a 1-WIRE interface. It offers the option of measuring the temperature accurate to 0.5 °C. If the sensor is in a protective case, it can also be used to measure soil and water temperature

THE LOW WATER LEVEL SWITCH

It is possible to effectively use magnetic switches with a float connected via a GPIO interface to detect the low water level.

The float is set up so that, whenever the water falls beneath a certain level, the switch signals a change either by closing or opening. The logic of this detection depends on the orientation of the switch and the float and their specifications, see the illustrations.

The same switch can also have the opposite logic: it is closed in the first illustration (NC), but the contact is open in the second one (NO). The reason is the different position of the magnetic switch in the water – it is rotated by 180°.

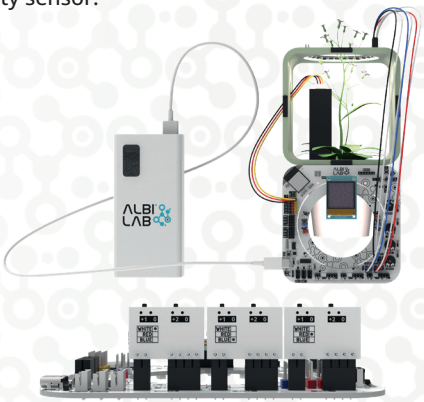


Test out the function in the **Sensors ▸ Low water level switch** menu and check the low water level detection logic. It is possible to use various types of sensors with a mechanical switch, an electronic output of the open collector type or logical levels with a 3.3V logic for this application.

It is possible to use any suitable sensor with a mechanical switch, an electronic output of the open collector type or logical levels with a 3.3V logic.

EXAMPLES OF ALBILAB CONNECTIONS

The basic variant with LED rings and a humidity sensor.

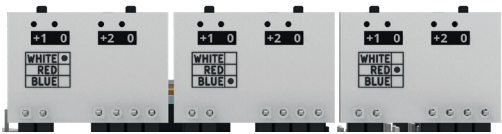


1. Put the soil and seeds in the container.

2. Connect an LED ring to the electronics using the connecting cables. Connect the rings so that cables from a colour on the LED ring are connec-

ted to the corresponding colour on the electronics, while always ensuring the correct polarity at both ends of the cable. + − Always connect the coloured cables to + and the white ones to -.

3. Set the switch on the power modules to position +1. Do not activate position +2



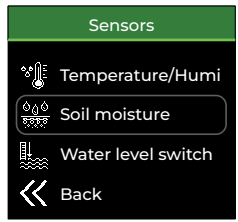
4. Then insert the moisture sensor into the soil in the container so that the soil level is below the line marked on the sensor. Connect the sensor to one of the six connectors on the top left of the electronics, while the sensor connection must correspond to the colours on the appropriate connectors on the electronics (yellow – yellow, black– black, red – red).

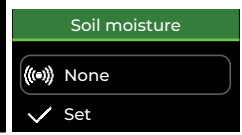
5. Set up the soil moisture sensor (Menu ▸ Sensors ▸ Soil moisture).

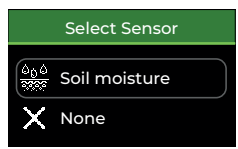
6. Choose one of the 5 growing modes (Menu ▸ Plant development). If you select the manual mode, set the length and intensity of the illumination using the trimmers.

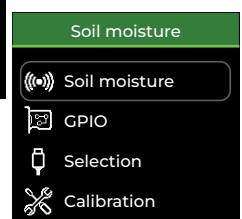
7. Return to the home screen and activate the device by pressing the OK – ON/OFF button.

8. Water the plant when the moisture level drops below 80%.

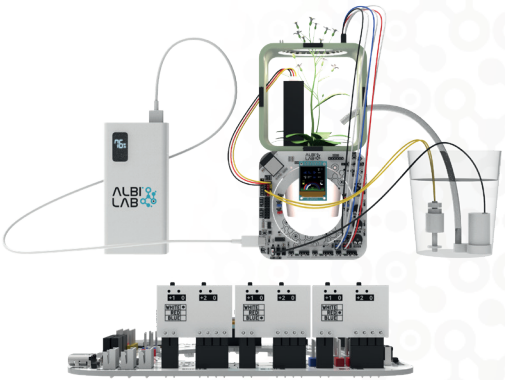








An advanced variant for automatic irrigation (with the connection of a pump, a water level sensor, a moisture sensor and LED rings).

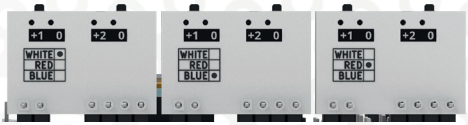


Note: *Skip the appropriate points (5 and 8) if you don't have a water level switch.*

1. Fill the container with soil and seeds.

2. Connect the LED rings to the electronics using the cables. Connect the rings so that the cables connect the same colour on the LED ring to the corresponding colour on the electronics, while ensuring the + - correct polarity at both ends of the cables. Always connect the coloured wire to + and the white wire to -.

3. Set the switch on the power modules to position +1. Do not activate position +2.



4. Then insert the moisture sensor into the soil in the container so that the soil level is below the line marked on the sensor. Connect the sensor to one of the six connectors on the top left of the electronics, while the sensor connection must correspond to the colours on the appropriate connectors on the electronics (yellow – yellow, black– black, red – red).

5. Connect the low water level sensor to one of the free GPIO pins as in the previous point.

6. Prepare the water container and insert the pump and low water level switch into it *(if you have one available)*.

7. Set up the moisture sensor (**Menu ▸ Sensors ▸ Soil moisture**).

8. Set up the low water level switch (**Menu ▸ Sensors ▸ Low water level switch**).

9. Set up the water pump (**Menu ▸ Actuators ▸ Water Pump**).

10. Set up the automatic irrigation mode (**Menu ▸ Automation ▸ Watering**).

11. Choose one of the 5 growing modes (**Menu ▸ Plant development**). If you select the manual mode, set the length and intensity of the illumination using the trimmers.

12. Return to the home screen and activate the device by pressing the **OK – ON/OFF** button.

THE WEB INTERFACE

It is possible to use the web interface that runs directly on the device to control the AlbiLAB. It is first necessary to *activate the WiFi* interface using the menu (**Menu ▸ Settings ▸ WiFi**) and to select one of the two available modes.

The connection to the AlbiLAB can be realised in two ways: either using the URL address **http://AlbiLAB.local**, provided the name has not been altered by the user, or using the assigned IP address.

The following text will refer to the URL address **http://AlbiLAB.local**; if you have changed the name or are using an IP address, modify the URL address accordingly.

In the basic mode, you can *monitor the current information* in the **Home** tab, *update the Firmware* in the **Settings** tab or find out about the authors in the **About** tab.

OPERATION INFORMATION

After successfully logging on to the AlbiLAB using the URL **http://AlbiLAB.local** or via an assigned IP address, you will be able to acquire access to information on the set length of the day/night interval, the plant's current growth phase and the status of the self-watering mode. The screen is divided into three columns:

- **The left-hand column:** provides information on the selected mode and the status of the automatic watering. Green indicates that the given mode has been selected or that automatic watering has been activated.
- **The central column:** contains important settings such as the length of illumination, the time remaining until the next automatic watering and the intensity of the LED light.
- **The right-hand column:** shows information about the sensors and the actuators. If a sensor or actuator is shown in blue, it is active and is either measuring values or performing a task.

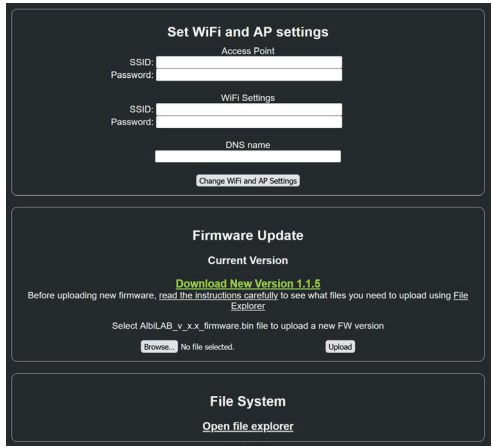
UPDATING THE FIRMWARE

Programs are constantly improving and we endeavour to provide you with the best possible equipment. Given that new sensors are constantly being developed, we also regularly expand the spectrum of options pertaining to AlbiLAB. As such, *the firmware* needs to be regularly updated.

Updating to the newer version is easy. Open the URL **http://AlbiLAB.local** and then open the dialogue window in the **Settings** tab and select the new firmware labelled according to the model: **AlbiLAB_v_x.y_firmware.bin**

Click on the Upload button and wait until the firmware has been uploaded to the device and stored in the memory. Once this process is completed, the device will restart automatically and you can then make use of the device's updated functions.

You can also download the new firmware manually. You can find it on the website at: **AlbiLAB.cz**.



ABOUT THE AUTHORS

This tab will provide you with information about the authors and other points of interest pertaining to the creation of the AlbiLAB.

OTHER OPTIONS AND INFORMATION

It is possible to use the web interface to read the operating data directly from the address **http://AlbiLAB.local/info** and to connect it to other services such as home automation. The data is provided in the *.json* structured format.

FILE SYSTEM

Use the following address to depict the directory structure of the internal data storage:

http://AlbiLAB.local/files

It is important not to change or delete the following files if you do not know what you are doing. All of the files are important for recording files such as firmware or files in the data storage or they contain important equipment settings.

This involves the files *ajax.js, jQuery.min.js* and *config.json.*

If you want to change the files, you can do so by adding ‚?access' to the URL, i.e. the address will then be, for example:

http://AlbiLAB.local/files?access.

Then select the **Allow** option which will allow the files to be overwritten (until the device restarts) and press **Submit**.

If you select **Decline and subsequently press Submit**, the overwriting of the files will be prohibited.

Before modifying the files, we recommend that you back up the contents of the Settings folder, i.e. the *config.json, plants.json* and *statistics.json*.

If something goes wrong and it proves necessary to fully revert the firmware, it can be downloaded from: **https://albilab.cz/update/AlbiLAB_Complete.zip** Follow the enclosed instructions when downloading.

You will lose all your data if you perform a full firmware update, so we recommend that you back up the Settings folder.

THE TABLE OF INPUT AND OUTPUT CONNECTIONS

If you decide to modify the firmware or to create your own, the following table contains a description of the connections to the individual peripheries on the GPIO pins with a short explanation of their use. The module used for the single-board computer is an ESP32-S2-MINI2-N4R2 with a 4MB flash memory and a 2MB PSRAM memory.

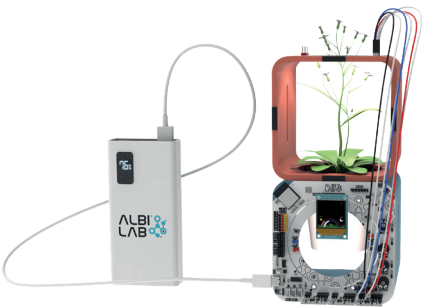
GPIO	Purpose	Use	Special function
0	Down button	Control	Boot
1	OUT1 power output, output voltage: 5 V	5 V output controlled by a transistor	5 V
2	OUT2 power output, output voltage: 5 V	5 V output controlled by a transistor	5 V
3	I2C SCL	I2C	I2C
4	I2C SDA	I2C	I2C
5	BLUE trimmer	Intensity setting	ADC
6	WHITE trimmer	Intensity setting	ADC
7	RED trimmer	Intensity setting	ADC
8	TIME trimmer	Time setting	ADC
9	GPIO9	General GPIO use	ADC
10	GPIO10	General GPIO use	ADC
11	Display CS	Display	
12	Display DC	Display	
13	Display RST	Display	
14	Display Backlight PWM	Display	
15	32 kHz Crystal	Clock	XTAL
16	32 kHz Crystal	Clock	XTAL
17	GPIO17	General GPIO use	ADC, DAC
18	GPIO18	General GPIO use	ADC, DAC
19	GPIO19	General GPIO use	ADC, USB D-
20	GPIO20	General GPIO use	ADC, USB D+
21	Display SCL/Clock	Display	
33	Display SDA/Data	Display	
34	Activating the red LED module, active in 1	LED power modules	

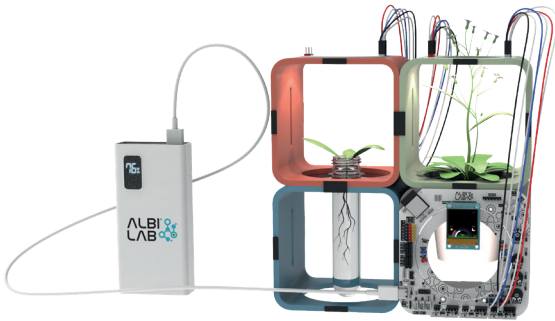
35	Red LED intensity setting via PWM	LED power modules	
36	Activating the blue LED module, active in 1	LED power modules	
37	Blue LED intensity setting via PWM	LED power modules	
38	Activating the white LED module, active in 1	LED power modules	
39	White LED intensity setting via PWM	LED power modules	
40	Left button	Control	
41	Up button	Control	
42	OK button	Control	
43	TxD	PC communication	Prog
44	RxD	PC communication	Prog
45	Right/Menu button	Control	

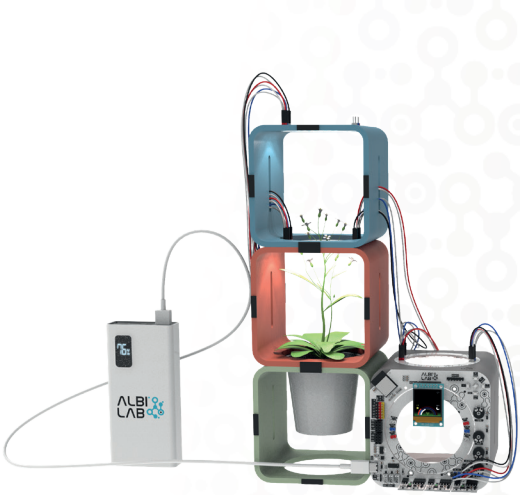
THE LIST OF TERMS

ADC: Analog to Digital Converter
DAC: Digital to Analog Converter
GPIO: General Purpose Input Output
I2C: Inter Integrated Circuit
IO: Input-Output
JTAG: Joint Test Action Group
LED: Light-Emitting Diode
NC: Normally Close
NO: Normally Open
PWM: Pulse Width Modulation
RST: Reset
SSID: Service Set IDentifier
Trimr: A part with variable resistance
URL: Uniform Resource Locator
WiFi: Wireless Fidelity
XTAL: Crystal

OTHER ASSEMBLY OPTIONS



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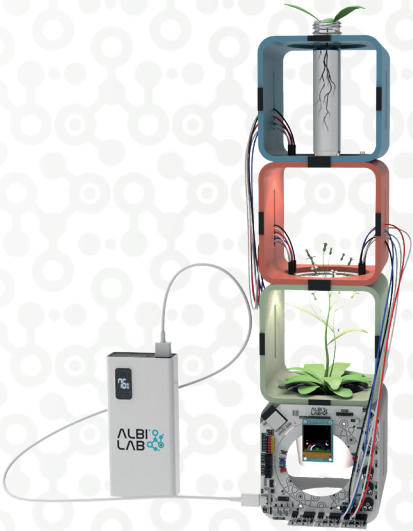
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BOTANICKÝ ÚSTAV AV ČR v.v.i.

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