

Bento Lab User Manual

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This is the user manual for Bento Lab, containing a summary and links to all other chapters of the manual.

Overview and Summary



Bento Lab is a portable mobile genomics setup. The compact laboratory is equipped with thermal cycler **(1)** a microcentrifuge **(2)**, a blue LED transilluminator **(3)** and a gel electrophoresis power supply used with an external gel electrophoresis container **(4)**.

The system is operated using an intuitive on-board graphical interface **(5)**, and comes with a convenient tube rack **(6)**.

Bento Lab is a professional laboratory device, and although it is also used in educational settings, it is not a toy. Read this manual carefully, in particular sections on safety, before using the device.

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Centrifuge

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Safety

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Physical Description, Unpacking and Servicing

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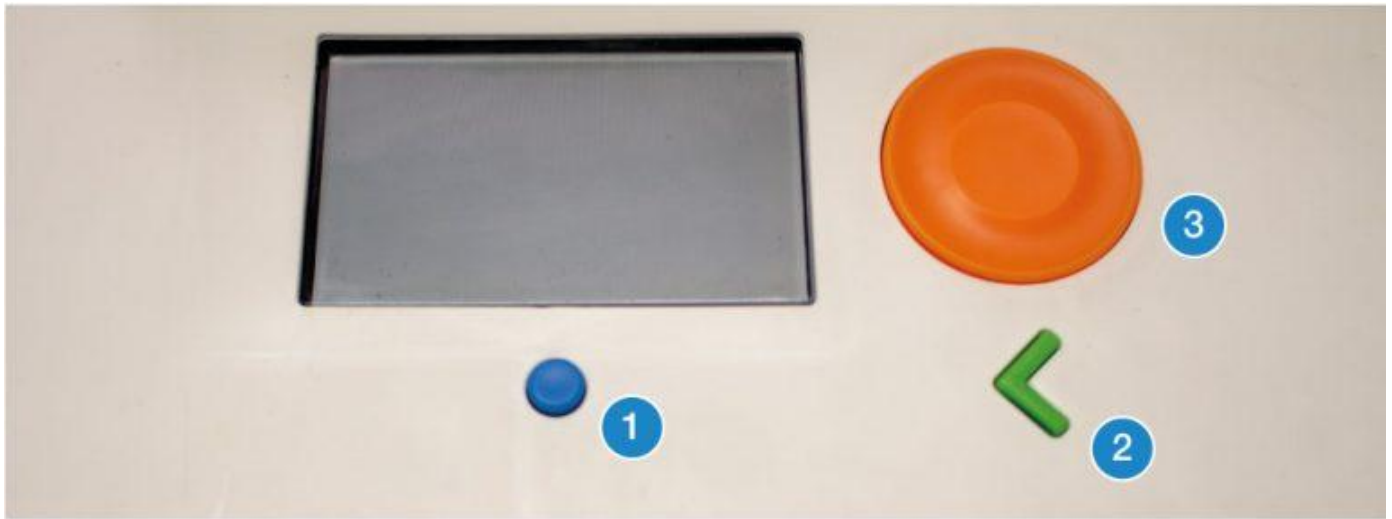
This chapter of the Bento Lab user manual describes the main physical characteristics of Bento Lab, and notes on installation.



Bento Lab contains a thermocycler module **(1)** a microcentrifuge **(2)**, a blue LED transilluminator **(3)** and a gel electrophoresis power supply used with an external gel electrophoresis container **(4)**.

The system is operated using an intuitive on-board graphical interface **(5)**, and comes with a convenient tube rack **(6)**.

Interface Area



Bento Lab has three physical buttons. The blue round button **(1)** under the screen is the HOME button and always takes the user back to the overview screen from where all the different modules can be selected. The green button shaped like an arrow **(2)** is the BACK button and depending on the context takes the user back one step or undoes an action. In addition, there is an orange click-dial **(3)** which is used to select elements on the screen and change values.

Physical Description – Sides

At the back, Bento Lab has a 4-pin power connector **(1)** and a physical power switch **(2)**.



On the right side, Bento Lab has vents for the active fan cooling of the thermal cycler's heat sink.

On the left side, Bento Lab has red and black connectors for the gel electrophoresis power supply.

*All parts of the Bento Lab gel electrophoresis
box*

*The gel box is plugged into the side of Bento
Lab. An indicator light is on when current is*

flowing.

Bento Lab comes with an external gel electrophoresis container with two rubber dams to create buffer zones during casting, a 9 well comb and a 12 well comb. The current for gel electrophoresis is run through the lid which connects to the Bento Lab gel electrophoresis power supply. The lid also doubles as an orange filter for the blue light transilluminator.

An external power supply for Bento Lab is provided.

Unpacking and Inspection

Carefully unpack the unit and ensure Bento Lab, including tube rack and gel box, and power supply are present. If the equipment appears damaged in any way, contact us at hello@bento.bio.

Please retain packaging to return equipment for servicing.

Three orange ribbons are attached to the base of Bento Lab to secure the tube rack and the gel box when transporting. They can be stored by securing them around the foot opposite.

Easily store the orange ribbons by pulling them over the opposite foot as shown.

Ensure that Bento Lab is placed on a solid, level surface, which is able to support its weight.

Servicing

Bento Lab contains no user-serviceable parts. Refer all repairs to qualified service personnel. Opening the product voids the warranty. For servicing contact us at hello@bento.bio.

Troubleshooting

If you identify a fault with your lab, please contact us at hello@bento.bio.

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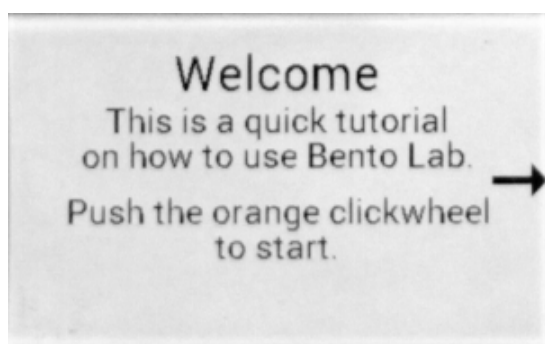
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Interface

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Overview of the Bento Lab User Interface. Explains the function of each button, and common elements on the graphical user interface used to operate the device.



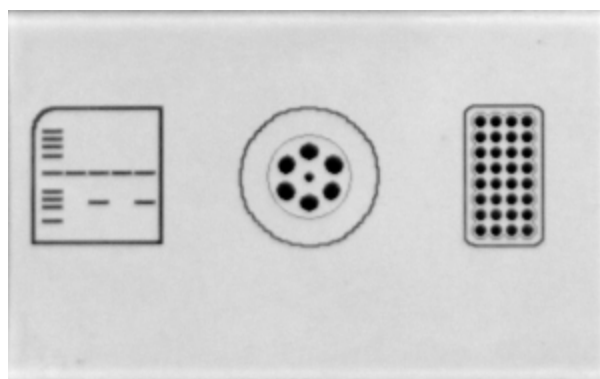
Welcome To Bento Lab Tutorial



Tutorial Button on Settings Menu

The first time Bento Lab is activated it displays a welcome tutorial showing off the basics of the interface, such as how to change values on the screen. The tutorial can be run again by opening SETTINGS (by holding down the blue HOME button for longer than 2 seconds) and selecting the tutorial button on the right side with the orange click dial.

When Bento Lab has been switched on, an overview screen displays the status of each module.



Status Screen

By turning the orange click-dial left or right, different elements on the screen can be selected.

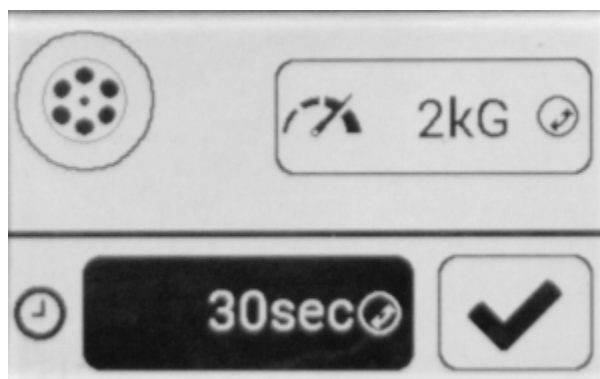
Pushing the orange click-dial when the centrifuge is selected will activate the centrifuge module. The user can always return to the overview screen by pressing the blue home button.

The lab will display tips for best practice, such as warning the user to balance tubes. Once you have read and understood the tips, you can disable them either for one session (right check mark), in which case they will be displayed again when the lab is next turned on, or disable the tip forever (left check mark).



Popup displaying best practice

Some buttons contain values that can be manipulated. This is indicated by the circular icon on the right of the button showing arrows pointing up and left. To change the value on this button, select the button, press and hold down the click-dial whilst turning it. This will adjust the value up (turning right) or down (turning left). When releasing the click-dial, the new value will be set.



Menu to change centrifuge speed and duration

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Centrifuge

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User manual chapter for the Bento Lab centrifuge module, including a physical specification, operation guide, information on safety and balancing.



Components and Physical Layout



The centrifuge module is visibly located in the middle of the Bento Lab system. To ensure safety, it comes with an automatically locking lid **(1)**. The removable rotor of the microcentrifuge **(2)** is visible through a lid window.

Centrifuge Specifications

Rotor Capacity	6 x 1.5mL tubes
Min Centrifugal Force	500 x g
Max Centrifugal Force	8,000 x g
Modes	Burst Spin Time Spin of up to 60 minutes

Before Use: Balancing

Before starting the centrifuge, make sure that your samples are placed opposite each other on the rotor.

Also check that your samples are the same weight.

Using the Centrifuge

To operate the centrifuge, select the module from the status screen.

Centrifuge selected on the Status Screen

There are two modes of usage; the **Burst Spin** and the **Time Spin**. The Burst Spin is used for short spins with no pre-defined time. This mode is usually used when you need to run the centrifuge for a number of seconds, such as when collecting samples at the bottom of the tube. The Time Spin is used for spins at user-defined speeds for a pre-defined time.

The lid has to be closed to select either Burst Spin or Time Spin options.

The centrifuge lid needs to be closed to start centrifuge action.

Centrifuge time spin (selected) or burst (left button).

To use the Burst Spin option, select the circular arrow button using the orange click-dial. Hold down the orange click-dial and the centrifuge will start spinning. A counter will record how many seconds the centrifuge has been active. Once the user lets go of the orange button, the centrifuge will slow down and come to a halt. The lid automatically unlocks once the motor has stopped and it is safe to open. Wait until you hear a click from the lid. To use the Time Spin option, select the clock symbol using the orange click-dial. Set the duration of the spin and the G force required.

Setting centrifuge speed and timer

Please note that some tubes, even though they physically fit into the centrifuge rotor, will bend too far at high speeds and can damage the centrifuge. These include some skirted tubes.

Safety Advice

Intention of use

The centrifuge is intended for the separation of suspensions and solutions held in the appropriate 1.5ml.

- Only operate the centrifuge after you have read and understood the manual.
- It is the responsibility of the Bento Lab owner to ensure that all persons using the centrifuge have been trained and that full records of training are maintained.

- Wear the necessary protective equipment and follow good lab practices, including for the storage and disposal of samples and tubes.
- Irrespective of the organism, chemical or reagent which you are using, always ensure you are handling, storing and disposing of the material as per supplier instructions and as per local and national regulations.
- Do not use the Bento Lab if there are exposed wires, signs of severe mechanical damage or corrosions.

Warnings to avoid personal injury, exposing others to risk, damage to centrifuge and rotor

Risk of flying debris and/or fire from mechanical failure of rotor

- Prior to use, inspect the centrifuge visually and ensure that power cables, lid and seals are clean and in good condition and that no wires are exposed.
- Stop the centrifuge immediately if an unusual condition (noise or vibration) begins.

Risk of skin irritation from opening the centrifuge and touching the rotor during operation

- Do not open the cover when the rotor is still spinning.
- Do not attempt to slow down the spinning rotor by hand.

Risk of cuts and infection from broken sample tubes

- Only use sample tubes of size 1.5ml or 0.2ml (with appropriate converter)
- Wear suitable protective gloves.
- Disinfect the centrifuge if there are any spills. If necessary, clean the surrounding area.
- Decontaminate and dispose of the broken sample tubes as necessary.
- If you cut yourself, seek first-aid.

Risk of contamination from use of hazardous samples

- Only use pathogenic, toxic or radioactive substances if safety precautions listed on the product of interest are observed.
- Handle and dispose of the samples as per good laboratory practice procedures.

Risk of rotor damage from imbalance of samples in centrifuge during operation

- Load the samples in the centrifuge evenly.
- Ensure they have the same mass.
- Ensure the centrifuge is placed on a level surface.

Risk of fire, combustion from operation of centrifuge in vicinity of flammable or combustible vapours which can ignite inside the centrifuge

- Work in a well-ventilated space

Risk of fire, contamination or corrosion from sample leaks

- Check tubes for cracks and deformities before use.
- Do not fill tubes above the maximum recommended by manufacturer.
- Material loaded into sample tubes must be compatible with the sample tube material
- Clean spillages immediately. Spills of hazardous material must be adequately decontaminated. The remainder of the liquid will flow through. The centrifuge is insulated from the remainder of the equipment and so should not cause any shortages.
- Do not centrifuge samples which can develop flammable or explosive vapours.

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Gel Electrophoresis and Transilluminator

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User manual chapter for the Bento Lab gel electrophoresis and transilluminator module. Includes a physical specification, information on casting gels and connecting the gel box, and operation guide for the interface.



Gel Electrophoresis

Transilluminator

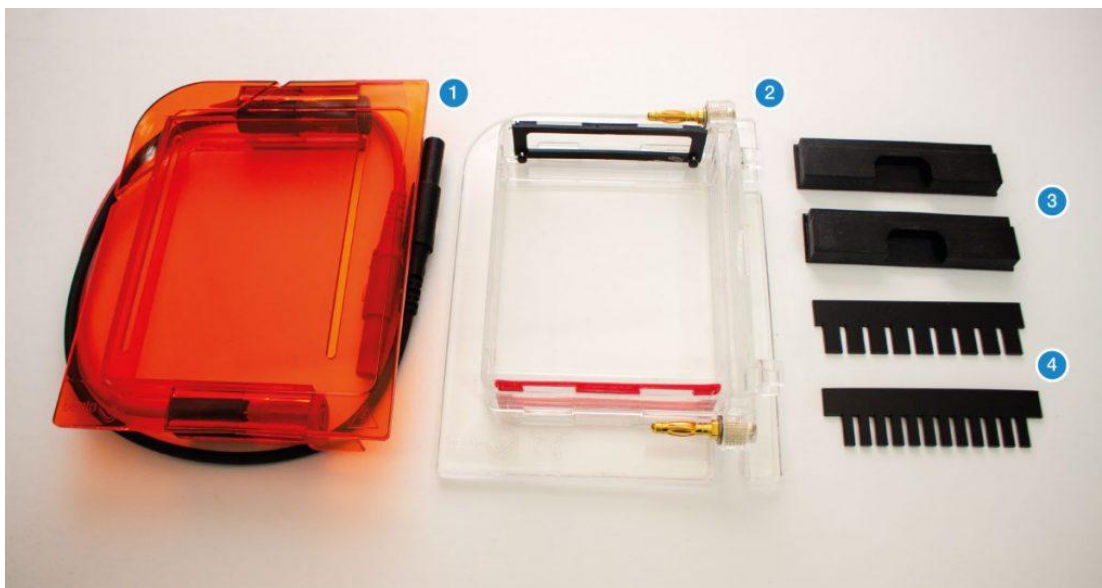
Components and Physical Layout



The gel electrophoresis and transilluminator module is on the left side of the Bento Lab system.

The gel box is made up of two parts. The base **(1)** is made of clear acrylic. It is used to cast gels and as a gel tank during electrophoresis. It also stores casting shutters and combs. The lid **(2)** is made of orange acrylic that functions as a filter for the blue light transilluminator. On the left side

of the Bento Lab system **(3)**, a red and black socket provide current for gel electrophoresis. The blue LED transilluminator **(4)** is located on the left side of the device.



The gel box contains several parts, including the orange lid **(1)** and the base **(2)**, two dams used to create buffer zones during gel casting **(3)**, and combs for 11 and 15 well gels **(4)**.

Specifications

Voltage	50V – 120V
Box Dimensions	91mm x 78mm
Visualisation	470nm blue light and diffuser
Viewing Window	As box dimensions
Filter	Amber acrylic

Casting a gel

1. Measure out agarose. For a 1% gel, use 0.5 g with 50 mL of buffer.
2. Mix the agarose powder with 50 mL of 0.5x TBE buffer in a microwavable flask.
3. Once the agarose has dissolved, heat the solution in a microwave at full power for short bursts of 20-30 seconds. Swirl the solution in between bursts to mix, until the agarose is completely dissolved. Avoid overboiling the mixture, as the buffer will evaporate and you will end up with a higher concentration of agarose.

4. Check you are working on a level surface to cast a gel with uniform thickness.
5. Gently slide off the orange lid off the gel tank.
6. Place the dams in the tank to cover the buffer zones around the electrodes.
7. Select a comb and insert the comb into the holder.
8. Once the agarose has cooled to about 55°C, it should feel hot, but not too hot to touch – add your DNA stain, and pour the melted gel into the gel tank.
9. Allow the gel to cool down and solidify. This takes about 30 min at room temperature, or 15 min in a cool room or a fridge.
10. Gently remove the comb from the gel, and get ready to run the gel.

Buffers for Electrophoresis

What buffer should I use?

Bento Lab contains a mini gel electrophoresis system, therefore a higher voltage gradient than larger gel systems. Electrophoresis buffers contain ions that transmit charge to separate the DNA fragments. Higher concentration buffers transmit more charge, which is useful for large gel systems. For a mini gel system, lower concentration buffer allow better resolution of bands. For best results, we recommend running gels at 50V with 0.5x TBE.

TBE Buffer Recipe

TBE buffer is usually made as a 5X concentrated stock solution. A working solution of 0.5x TBE buffer is 45 mM Tris-borate, and 1 mM EDTA.

To prepare a 5X stock solution, add the following to 1 L of H₂O:

- 54 g of Tris base
- 27.5 g of Boric acid
- 20 mL of 0.5 M EDTA (pH 8)

Agarose percentage

What percentage of agarose should I use?

DNA can be resolved by size using agarose gels of various concentrations. The greater the percentage of agarose, the smaller the fragment of DNA that can be resolved. The appropriate percent agarose gel depends on the size of DNA fragment that you will be running on the gel. You will obtain good resolution of larger DNA fragments (5-7kb) with a 1% agarose gel, whereas for good resolution of small PCR products, you will need a higher percent gel.

DNA Size Resolution	Percent Agarose Gel	Weight Agarose
1-30 kb	0.5%	0.5g per 100mL
800 bp – 12 kb	0.7%	0.7g per 100mL
500 bp – 10 kb	1.0%	1g per 100mL
400 bp – 7 kb	1.2%	0.6g per 50mL
200 bp – 3 kb	1.5%	0.75g per 50mL
50 bp – 2 kb	2.0%	1g per 50mL

Running a gel

Bento Lab contains a mini gel electrophoresis system, therefore a higher voltage gradient than larger gel systems, as the distance used to determine voltage gradients is the distance between the electrodes, not the gel length. If the voltage is too high, you may observe band streaking. For best results, we recommend running gels at 50V with 0.5x TBE.

1. Prepare the running buffer or use pre-prepared buffer
2. Pour the buffer solution into the electrophoresis tank over your prepared gel until the liquid cover your gel, and the level is about 2-3 mm above your gel.
3. Carefully load a molecular weight ladder into the first lane of the gel.
4. Load your samples into the remaining wells of the gel.
5. Gently slid the orange lid onto the gel tank until it clicks shut.
6. Set the voltage to the desired electrophoresis voltage for your protocol. To make changes to the voltage, select the voltage value button. Push down the orange click-wheel and hold down whilst rotating to change the value. Dial clockwise to increase the voltage, and counter-clockwise to decrease. Release the orange click-wheel once you have reached the desired voltage.
7. Set the desired time by selecting the time value, pushing down and rotating the orange click-wheel.
8. Confirm your settings by clicking on the tick on the right, and set the gel to run.
9. Run the gel until the dye line has travelled down about 75% the length of the gel. A typical run time with Bento Lab is about 30-45 minutes, depending on the gel concentration and voltage.
10. Wait until the run has finished, or cancel the run. Disconnect the electrodes from the power source, and then carefully remove the gel from the gel box.

11. Place your gel on the transilluminator, and select the transilluminator button to turn the blue light on to visualise your bands.

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PCR Thermocycler / Heating Block

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This user guide contains all the information needed to make the most out of Bento Lab's thermocycler and heatblock module, including creating and storing new protocols.



Heat Block

PCR

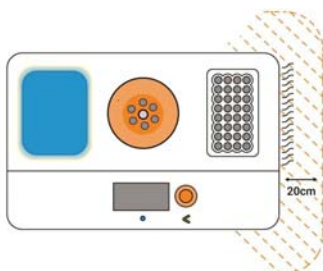
Thermocycler

Components and Physical Layout



The thermocycling module is on the right side of the Bento Lab system. The thermocycling block **(1)** fits 0.2 mL tubes with flat or round caps in a 4 x 8 arrangement. Strip tubes can be fitted. The heated lid **(2)** is sprung and adjusts automatically to fit tubes. A fan is used to move heat out of

the system through air vents **(3)** on the right side. Ensure that no objects obstruct the air flow to prevent overheating.



Safety Advice: An indicator light **(4)** shows that the system is active or still hot. Whenever the light is on, extra caution is advised when opening the lid, as elements like the heat block or the heated lid might be very hot.

Thermocycler Specifications

Capacity	32 x 0.2mL tubes
Thermal cycling system	Peltier temperature control, active cooling
Temperature Range	15°C – 99 °C
Heated Lid	120°C / ambient (off)

Getting Started

The Bento Lab Thermocycler module is ready to use out the box, without any need for extra equipment or software. Everything can be programmed and configured directly from the on-board graphical interface using Bento Lab's intuitive click-wheel button.

To get started, turn on your Bento Lab using the power switch at the back. After a moment, the Bento Lab status screens comes up, displaying the three module icons (left: Gel Electrophoresis, center: Centrifuge, right: Thermocycler). Click on the Thermocycler icon to activate the module. This brings up the Thermocycler screen.

The Thermocycler screen shows status information about the current state of the module at the top half of the screen, such as the temperature of the block and lid. When the module is running a protocol, the remaining time estimate is also displayed.

Left: PCR module is idle. Right: PCR module is currently running

When the module is idle, the bottom buttons are used to open the Thermocycler protocol editor. The first two buttons open the editor with a default PCR protocol **(1)** or a default heat block protocol **(2)**. The disk button **(3)** on the right leads to a list of all the previously saved Thermocycler protocols.

When the module is running, the bottom buttons change. The inspection button on the left **(4)** can be used to see the precise position in the currently running program. The cancel button on the right **(5)** is used to end the program and can be used either to cancel it, or to turn the module off when it is on a final holding step.

Loading Samples

Before loading samples, ensure that the heat indicator light of the module is off. This means that the lid is safe to open and that no element is hot.

1. Open the Bento Lab Thermocycler lid. The lid opens easily with little resistance.
2. Load PCR tubes (0.2mL) into the block. Up to 32 tubes can be loaded. If the protocol makes use of the heated lid, ensure that all PCR tubes have the same height, so that the heated lid applies evenly when the lid is closed.

Ensure that the Thermocycler block is clean and no dust or other elements prevent contact between the block and the tubes. Ensure that PCR tubes sit tightly in the block.

3. Close the lid and ensure it is fully engaged.

Creating, editing, storing and running protocols

Protocols for the Bento Lab Thermocycler can be created and edited directly on the Bento Lab, without the need for external devices. Protocols can be named and stored for later re-use.

Creating a new protocol

To create a new protocol, start by choosing the default PCR protocol from the Thermocycler menu. This will open the editor pre-loaded with default settings.

Alternatively, when using the Bento Lab Thermocycler as a heat block, a convenient default protocol that contains only one temperature step is available.

The screen shows a graphical representation of the protocol. At the bottom right of the screen, several buttons are visible. Initially, three options are given:

Initial protocol editor view

The left button with the *spanner* icon **(1)** unlocks the protocol for editing. The middle button with the *disk* icon **(2)** gives the option of naming and storing the protocol. The right button with the *start* icon **(3)** will activate the module and begin running the protocol.

Editing a protocol

From the default protocol view, click on the spanning icon.

The three buttons on the bottom right disappear. Instead, the first temperature stage is highlighted and the precise properties of the stage is displayed below. Using the orange click-wheel you can now scroll through each stage in the protocol. The detailed properties at the bottom of the screen change accordingly.

To return to the default protocol view in order to save your changes or run the protocol, push the green back button.

Making changes to a temperature stage

1. Highlight the temperature stage you want to change by scrolling to it with the orange click wheel.
2. Push down the orange click wheel. The temperature stage is now selected and the properties are editable.
3. To make changes to the temperature, select the temperature value button. Push down the orange click-wheel and keep holding it down whilst rotating it to change the value. Dial clockwise to increase the temperature, and counter-clockwise to decrease it. Release the orange click-wheel once you have reached the desired temperature.
4. To make changes to the duration, select the duration value button and change the value in the same manner as the temperature.
5. Once you are done, confirm your changes by clicking on the confirmation button on the right. The properties become locked again.
6. If you do not want to keep your changes, you can also use the green back button. In this case the properties also become locked again, but the changes are not kept.

Making changes to a cycle

1. Highlight the cycle you want to change by scrolling to it with the orange click wheel.
2. Push down the orange click wheel. The cycle is now selected and the properties are editable.
3. To change the number of repeats, select the cycle repeat value button at the bottom of the screen. Push down the orange click-wheel and keep holding it down whilst rotating it to

- change the value. Dial clockwise to add cycles, and counter-clockwise to reduce the number of cycles. Release the orange click-wheel once you have set the desired number of cycles.
4. To change the start and end point of the cycle, buttons with a left-right icon are shown on the left and right sides of the cycle.
 5. To change the start point of the cycle, highlight the button on the left side of the cycle. Push down the orange click-wheel and keep holding it down whilst rotating it. Dial counter-clockwise to move the starting point of the cycle to the left, or clockwise to move it to the right.
 6. The end point of the cycle can be similarly changed.
 7. If the last stage is a hold stage, it can not be included in a cycle.
 8. Once you are done, confirm your changes by clicking on the confirmation button on the right. The properties become locked again.
 9. If you do not want to keep your changes, you can also use the green back button. In this case the properties also become locked again, but the changes are not kept.

Adding and removing temperature stages

1. To add a temperature stage, select a temperature stage next to the position where the new stage should be.
2. Push down the orange click wheel.
3. A new stage can be added either to the left or to the right side of the selected stage, by clicking on the button with the plus icon on either side of the stage.
4. Once the plus has been clicked, a new stage is added on the selected side. The new stage has the same properties as its neighbour that was selected to add the stage.
5. The new stage is automatically selected to be edited.
6. To delete a stage, click on the button with the bin icon at the bottom left. If the stage is the only remaining stage in a cycle, the cycle will also be removed.

Configuring the heated lid

1. To configure the temperature of the heated lid, select the cog icon at the top right of the editor.
2. Push down the orange click wheel.
3. The temperature of the lid is now editable. It can be tuned in a similar manner to the temperature of any temperature stage in the editor.
4. In addition, the heated lid can be completely turned off and on again by pushing on the temperature value button.
5. To confirm your changes, click on the confirmation button on the right. The properties become locked again.
6. If you do not want to keep your changes, you can also use the green back button. In this case the properties also become locked again, but the changes are not kept.

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Safety and Best Practice

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Essential Safety Advice chapter of the Bento Lab User Manual. Explanation of safety symbols, notes on maintenance, technical specifications and warnings.



Safety

Safety Warnings

Always observe the following safety precautions

- Only connect to an earthed supply socket. The mains adaptor is class 1 construction and must be earthed!
- This equipment is for use in moderate climates only. Never use the equipment in damp or wet conditions.
- Avoid excessive heat, humidity, dust & vibration.
- Always use the mains lead supplied.
- Ensure that liquids don't enter through the ventilation area.

Maintenance

- Clean only with a damp cloth
- **Do not** wetten or allow moisture to penetrate the unit
- **Do not** use solvents

The products are designed to comply with IEC/EN 61010-1 and can be flash tested. The mains adaptor may be fitted with radio frequency interference suppressors. Therefore it is recommended that only a D.C. test be performed.

Technical Specification

- This equipment is for indoor use and will meet its performance figure within an ambient temperature range 10 to 35°C with maximum relative humidity of 80% and is safe for use in and an ambient temperature up to 40°C.
- Equipment is for operation at installation category II (transient voltages) and pollution degree II in accordance with IEC 664 at altitudes up to 2000 metres.
- Dimensions: 329 mm * 214 mm * 81.5 mm
- Weight: 2.5kg
- Power supply input: 100-240V~2.5A, 50/60 Hz
- Power supply output: 15VDC, 9.6A
- Only use with approved accessories

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