



Instruction Manual

Temperature Controller



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Safety Considerations

To ensure operation safety, the ibidi Temperature Controller must be operated correctly and maintained according to a regular schedule. Carefully read this manual to fully understand all safety precautions before operating the instrument. Please take a moment to understand what the signal words **WARNING!**, **CAUTION** and **NOTE** mean in this manual.

Safety Symbols

WARNING!

A **WARNING!** indicates a potentially hazardous situation that, if not avoided, could result in serious injury or even death.

CAUTION

A **CAUTION** indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against damaging the equipment or the instrument.

Do not proceed beyond a **WARNING!** or **CAUTION** notice until you understand the hazardous conditions and have taken the appropriate steps.

NOTE

A **NOTE** provides additional information to help the operator achieve optimal instrument and assay performance.



READ MANUAL label. This label indicates that you have to read the manual before using the instrument.



This symbol indicates important notes.



IDENTIFICATION label. This label is positioned at the backside / rear panel of the temperature controller.

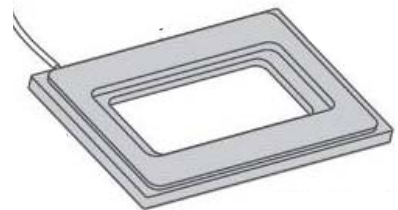
Nomenclature



**TEMPERATURE
CONTROLLER**



HEATED LID



HEATED PLATE

WARNING! Only operate the ibidi Temperature Controller with the delivered cables and plugs. Using other cables, etc. poses a risk electric shock and fire.

WARNING! Do not operate the ibidi Temperature Controller with substances, or under conditions, that can cause a risk of explosion, implosion or the release of gases. Only operate the ibidi Temperature Controller with aqueous solutions.

CAUTION Ensure that the power plug is well accessible. The ibidi Temperature Controller must be installed in a way that does not hinder the access to the power plug.

CAUTION Operate the ibidi Temperature Controller only in a power socket with a protective conductor to ground the housing of the temperature controller.

CAUTION The weight of the ibidi Temperature Controller is approx. 3.4 kg. Provide a secure stand for the controller, where it cannot be accidentally dropped. Moving the temperature controller poses a risk of personal injury or damage to the instrument.

CAUTION The manual opening of the temperature controller is not allowed. Manual opening poses a risk of personal injury or damage to the controller. Contact ibidi service personnel if you need to open the controller.

CAUTION Only use recommended replacement fuses. The correct values of the replacement fuses are indicated on the backside of the temperature controller. Using the wrong replacement fuses can lead to the overheating of the temperature controller which can cause fires.

CAUTION Only ibidi staff is allowed to service and open the temperature controller. Turn off the power switch and unplug the power cord before servicing the system, unless otherwise noted. Connect the temperature controller only to the supplied power plug. Do not use extension cords. Have an electrician immediately replace any damaged cords, plugs, or cables. Not doing so poses a risk of personal injury or damage to the system.

CAUTION Only use the temperature controller in dry rooms, and do not use the temperature controller in the cold room.

CAUTION Turn off the power switch on the back of the controller, when the ibidi Temperature Controller is not in use.

CAUTION Do not use ethanol or other types of organic solvents to clean the controller, as they may remove the paint.

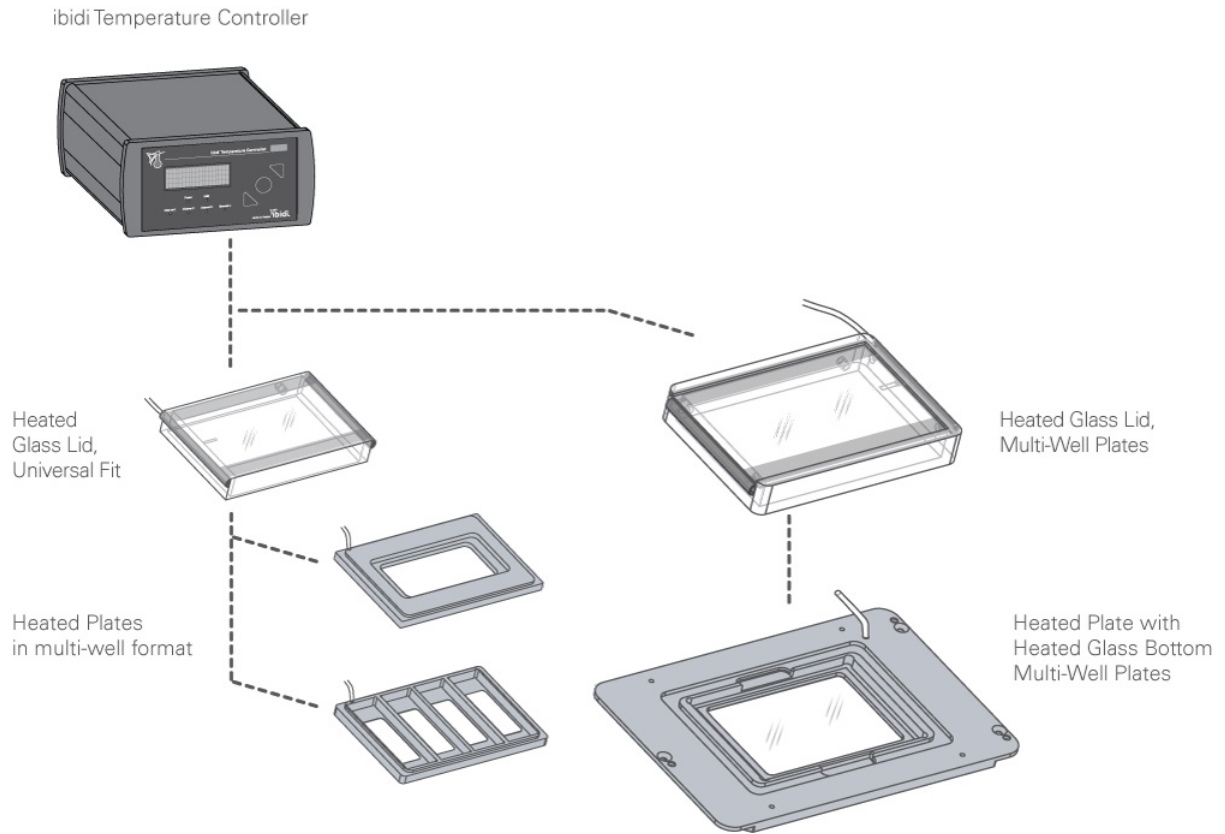
CAUTION Use the instrument only for cell experiments with aqueous solutions.

CAUTION Do not use the instrument with hazardous substances or substances/materials that pose a risk of infections.

Specifications

| | |
|----------------------------------|---|
| Power Consumption | |
| Supply Voltage | 230 V / 50 Hz - 115 V / 60 Hz |
| Output Voltage | 10 – 30 V |
| Max. Power Input | 160 VA |
| Max. Power Output | 160 VA |
| Surrounding Conditions | |
| Storage Temperature | -5 – 50°C |
| Operating Temperature | 15 - 40°C (Indoor use only) |
| Humidity | 80 % relative humidity up to 31°C, 30 % relative humidity up to 40°C |
| Operating Altitude | max. 2000 m |
| Temperature Control Range | |
| Ambient temperature to +45°C | |
| Net Dimensions (h×w×d) | |
| Controller | 90 x 170 x 230 mm ³ |
| Weight | |
| Controller | 3.4 kg |
| Fuses | |
| 230 V / 50 Hz | 1 A (T) |
| 115 V / 60 Hz | 2 A (T) |

Compatibility



Preface

This manual is your guide for using the ibidi Temperature Controller for cell culture experiments on an optical microscope. It instructs first-time users on how to use the instrument, and serves as a reference for experienced users.

Before using the ibidi Temperature Controller, please read this instruction manual carefully, and make sure that the contents are fully understood. This manual should be easily accessible to the operator at all times during instrument operation. When not using the instrument, keep this manual in a safe place. If this manual gets lost, order a replacement from ibidi GmbH.

Notices

1. ibidi shall not be held liable, either directly or indirectly, for any consequential damage incurred as a result of product use.
2. Prohibitions on the use of ibidi software:
 - Copying software other than for backup
 - Transfer or licensing of the right to use software to a third party
 - Disclosure of confidential information regarding software
 - Modification of software
 - Use of software on multiple workstations, network terminals, or by other methods
3. The contents of this manual are subject to change without notice for product improvement.
4. This manual is considered complete and accurate at the time of publication.
5. This manual does not guarantee the validity of any patent rights or other rights.
6. If an ibidi software program has failed causing an error or improper operation, it may be due to a conflict from another program operating on the notebook (PC). In this case, take corrective action by uninstalling the conflicting product(s).
7. ibidi is a registered trademark of ibidi GmbH in Germany and other countries.

Limited Warranty

Products sold by ibidi, unless otherwise specified, are under warranty for a period of one year from the date of shipment, and should be delivered free of defects in materials and workmanship. If any defects in the product are found during this warranty period, ibidi will repair or replace the defective part(s) or product free of charge.

THIS WARRANTY DOES NOT APPLY TO DEFECTS RESULTING FROM THE FOLLOWING:

1. IMPROPER OR INADEQUATE INSTALLATION.
2. IMPROPER OR INADEQUATE OPERATION, MAINTENANCE, ADJUSTMENT, OR CALIBRATION.
3. UNAUTHORIZED MODIFICATION OR MISUSE.
4. USE OF UNAUTHORIZED CELL CULTURE WARE.
5. USE OF CONSUMABLES, DISPOSABLES, AND PARTS NOT SUPPLIED BY AN AUTHORIZED IBIDI DISTRIBUTOR.
6. CORROSION DUE TO THE USE OF IMPROPER SOLVENTS, SAMPLES, OR DUE TO SURROUNDING GASES.
7. ACCIDENTS BEYOND IBIDI'S CONTROL, INCLUDING NATURAL DISASTERS.

This warranty does not cover consumables like cell culture dishes, reagents, and the like.

The warranty for all parts supplied and repairs provided under this warranty expires on the warranty expiration date of the original product. For inquiries concerning repair service, contact ibidi after confirming the model name and serial number of your ibidi system.

Installation Requirements

To ensure operation safety, observe the following conditions:

1. Only operate the ibidi Temperature Controller with the supplied power cable.
2. Only connect the power cable of the ibidi Temperature Controller to an electrical socket containing a protective conductor terminal.
3. Ensure that the power plug of the power supply is well accessible. The ibidi Temperature Controller must be installed in a way that does not hinder the access to the external power supply and its power plug.
4. Operate the temperature controller in a temperature range of 15 – 40°C.
5. Operate the temperature controller in a humidity range of 0 – 80% RH up to 31°C and 30% RH up to 40 °C.
6. Operate the temperature controller in an atmospheric pressure range of 800 – 1060 hPa.
7. Do not operate the temperature controller under conditions that pose a risk of explosion, implosion or the risk of any gas release.
8. Avoid strong magnetic fields and sources of high frequency. The temperature controller may not function properly when operating near a strong magnetic field or high frequency source.
9. Avoid vibrations from vacuum pumps, centrifuges, electric motors, processing equipment and machine tools.
10. Avoid dust and corrosive gas. Do not install the temperature controller where it may be exposed to dust, especially in locations exposed to outside air or ventilation outlets.
11. Only use ultrapure water for cleaning the temperature controller, only use ultrapure water.
12. Do not install the temperature controller in a location where it may be exposed to direct sunlight.
13. Install the temperature controller in a horizontal and stable position. This includes a table, bench or desk upon which the instrument is installed.
14. Ensure that no air conditioner blows air directly onto the temperature controller. This may prevent stable conditions.
15. Install the temperature controller in a location that allows easy access for maintenance.

NOTE: The above conditions do not guarantee optimal performance of this temperature controller.

Installation and Connecting Cables

Connecting the ibidi Temperature Controller to the power supply

Confirm that the power switch of the temperature controller is off (power switch is at the right, rear side of the temperature controller).

WARNING! Only operate the ibidi Temperature Controller with the supplied cables and plugs, because not doing so may put you at risk of electrical shock and fire.

CAUTION Ensure that the power plug of the external power supply is well accessible. The temperature controller must be installed in a way that it does not hinder the access to its power plug.

Connect the temperature controller to the Notebook by using the supplied network cable. (Only necessary when using a PC to control the Heating System.)

Switch on the temperature controller and the Notebook.

Maintenance and Operation

Pay close attention to the temperature controller-operating environment and always keep it clean so that the instrument can be used in a stabilized condition over a long period of time. Do not place anything heavy on top of the temperature controller.

Operating the ibidi Temperature Controller

Use the instrument only in the intended application that is described in this manual.

CAUTION Unintended use, which is not in compliance with this manual, can lead to a failure of the instrument's protective systems. This failure may cause personal injury or damage.

Cleaning the ibidi Temperature Controller

Switch off the temperature controller and remove the power plug from the electrical socket. Only use a dry cloth or a cloth dampened with water (ultrapure) to clean the instrument.

CAUTION Do not use ethanol or other types of organic solvents to clean the instrument, as they may remove the instrument paint.

Transporting the ibidi Temperature Controller

Switch off the temperature controller and remove the power plug from the electrical socket. Carry the instrument carefully and avoid mechanical shocks.

CAUTION The weight of the temperature controller is approx. 3.4 kg. Dropping the instrument while moving it may cause personal injury or damage.

Functional Disorder

In the case of a functional disorder, switch off the temperature controller and wait for five minutes, then switch on the instrument again. If there is still a functional disorder, switch off the device, unplug the power cable, and contact the ibidi service.

Repairing the ibidi Temperature Controller

Do not try to repair the instrument by yourself. Contact the ibidi service to repair the instrument.

CAUTION The manual opening of the controller is not allowed. Manual opening poses a risk of personal injury or damage to the instrument. Contact ibidi service personnel if you need to open the controller.

Waste Treatment

Waste treatment is your own responsibility. You must dispose of the waste using a company that specializes in waste recovery. Do not dispose the ibidi Temperature Controller in a trash bin or at a public waste disposable site. For detailed information, please contact the ibidi service.

1 Overview

A brief overview is provided in this section, which includes the nomenclature for later descriptions in this document.



Figure 1: Schematic Setup

2 Components

| | |
|------------------------------|--|
| ibidi Temperature Controller |  |
| Power Cable |  |
| USB Cable |  |

3 ibidi Temperature Controller

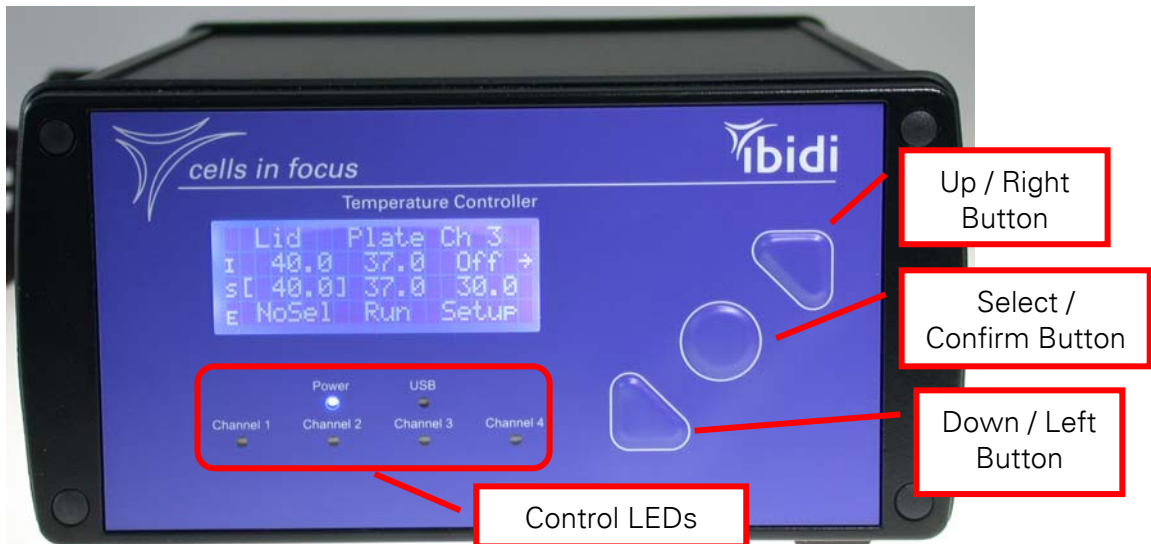


Figure 2: Front Panel of the ibidi Temperature Controller

The ibidi Temperature Controller is designed to precisely control the different ibidi heating devices. To achieve this, the controller has four control channels on the rear panel. When required, the controller can be customized for two, or up to 64 channels. In addition, this controller can be run as either a stand-alone system or be PC-controlled.

The measured ('I' = is) and set ('S' = set) temperatures of all the channels are displayed. You can navigate through the menu by using the control buttons on the right. The LEDs, located below the display, indicate the status of the channels and feedback, the power, and the USB connection.

Control LEDs:

| | |
|--------------------------|------------------|
| LED off | Channel inactive |
| LED on / blinking slowly | Channel active |
| LED blinking fast | Channel error |

3.1 Connecting the Temperature Controller



Figure 3: Rear Panel of the ibidi Temperature Controller

All plugs for the electrical connections are integrated into the rear of the ibidi Temperature Controller, as shown in Figure 3. There are ports for external temperature sensors (four-terminal sensing of Pt100 resistors and thermocouple sensors).

The standard connectors are:

- power cable
- USB cable
- 4 control channels
- 2 external temperature sensors

Optional features:

- analog output for extreme noise reduction

To setup a computer communication to the ibidi Temperature Controller, the USB cable must be connected.

To calibrate the system for the sample temperature, you can use the external temperature sensor of the controller or the control software TempControl. For more details, please refer to the instruction manual of the heating devices.

3.2 Menu Navigation

Most control parameters can be manually set on the controller using the buttons and the display on the front panel. The functions of the button are:

- up / right
- down / left
- select / confirm

The cursor position is indicated with square brackets ('[xxx]'). You can move the cursor using the 'Left' and 'Right' buttons. If you want to select a parameter or a function, you need to press the 'Select' button. When you select a parameter, the square brackets will change to angle brackets ('<xxx>'). Now you are able to change the value up or down. To confirm the changed value, you must press the 'Confirm' button once more. When selecting a function, you will see the individual function view, which is where you can change the parameters or access further functions.

You can find a detailed description of the menu navigation, including all functions, in Appendix A.

3.3 Supply Voltage Adjustments

The temperature controller should only be used in dry rooms.

The temperature controller must be adjusted to the corresponding voltage (230 V or 115 V). The actual voltage setting may be read and adjusted at the integrated fuse box of the power cable connector, located on the rear panel. In order to change these settings, it is necessary to pull out the fuse holder from the casing. Replace the fuses to match the input voltage (1 A (T) for 230V / 50Hz or 2 A (T) for 115 V / 60 Hz). Rotate the grey fuse holder, and then reinsert it so that the correct voltage is shown in the window. Snap the fuse box back into the housing.

The 'On/Off' switch is at the rear side of the controller. After selecting 'On', the controller will automatically start a self-test, and then the measured values will be shown.

3.4 Setting into Operation

Here is the procedure to start the operation of the controller.

For the first power up, we recommend disconnecting the heating devices (e.g., the heated lid and the heated plate). By doing this, you ensure that you do not start heating with the wrong temperature settings. It is now possible to set the temperatures for the individual channels. Afterwards, you can reconnect the heating devices.

Since the controller is preconfigured, we recommend connecting the heating devices as described in the instruction manual of the corresponding heating devices.



Please let the temperature of the system equilibrate for a minimum of 30 minutes before you start your experiments.



4 TempControl Software

The ibidi Temperature Controller has an USB interface for computer control. The TempControl software is the tool that was developed for this remote control, and comes with the controller.

Download from:

http://ibidi.com/fileadmin/products/software/temp_control/ibidi_TempControl_v_1_0_2.zip

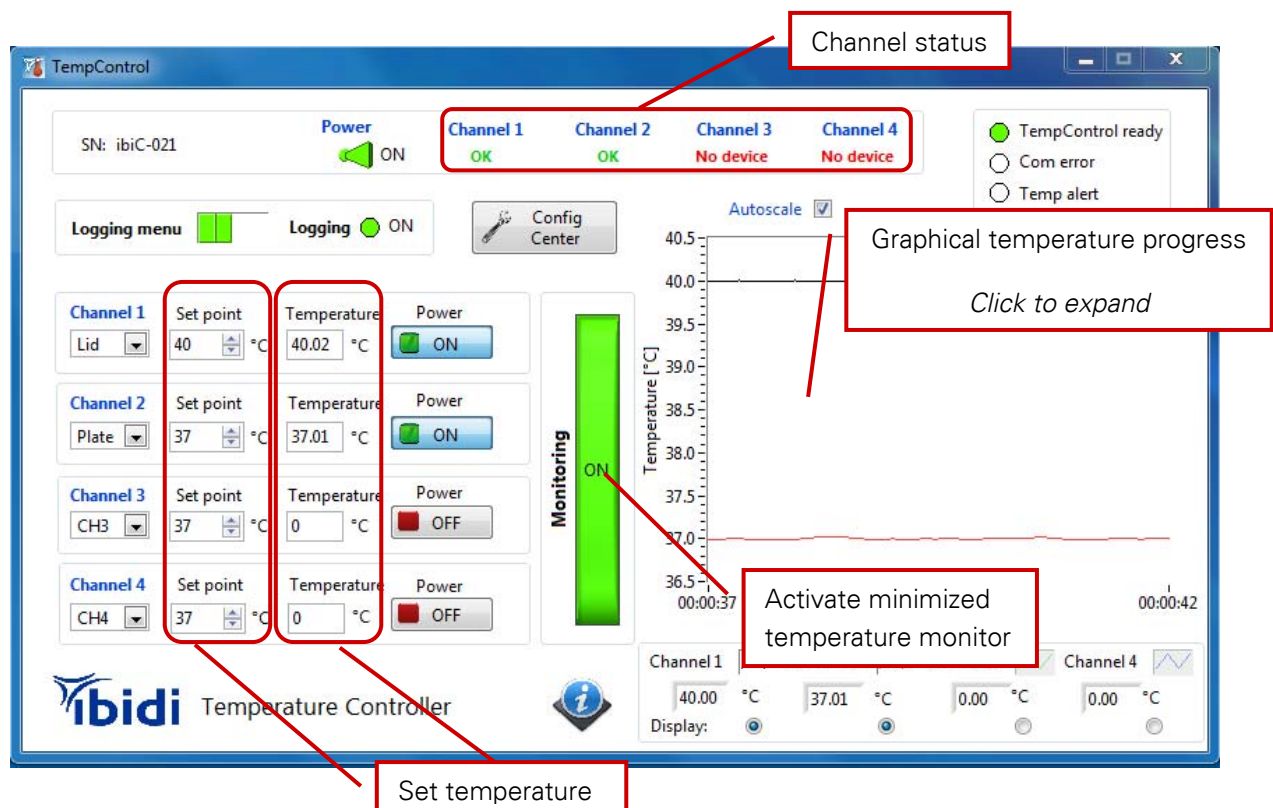


Figure 4: Main View of TempControl Window

Measured temperature

4.1 Software Overview

In the main view window of the TempControl software, you can set the temperature for each individual channel, plus you can view the measured temperature, and also the temperature course. Additionally, you can find indicators for the channel status and the communication between the controller and the computer.

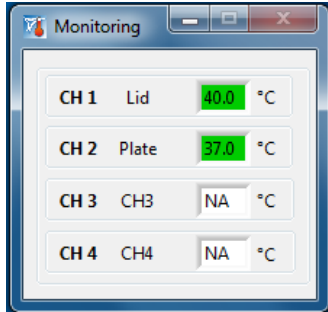


Figure 5: Minimized View of the Temperature Monitoring Window

From this view, you can access further sub-menus. By activating the 'Monitoring' button, you get a minimized view of the measured temperatures for each channel, as shown in Figure 5. You can use this feature when your desktop space is limited.

By clicking inside the temperature graph, you can expand the graphical presentation of the temperature course, as seen in Figure 6.

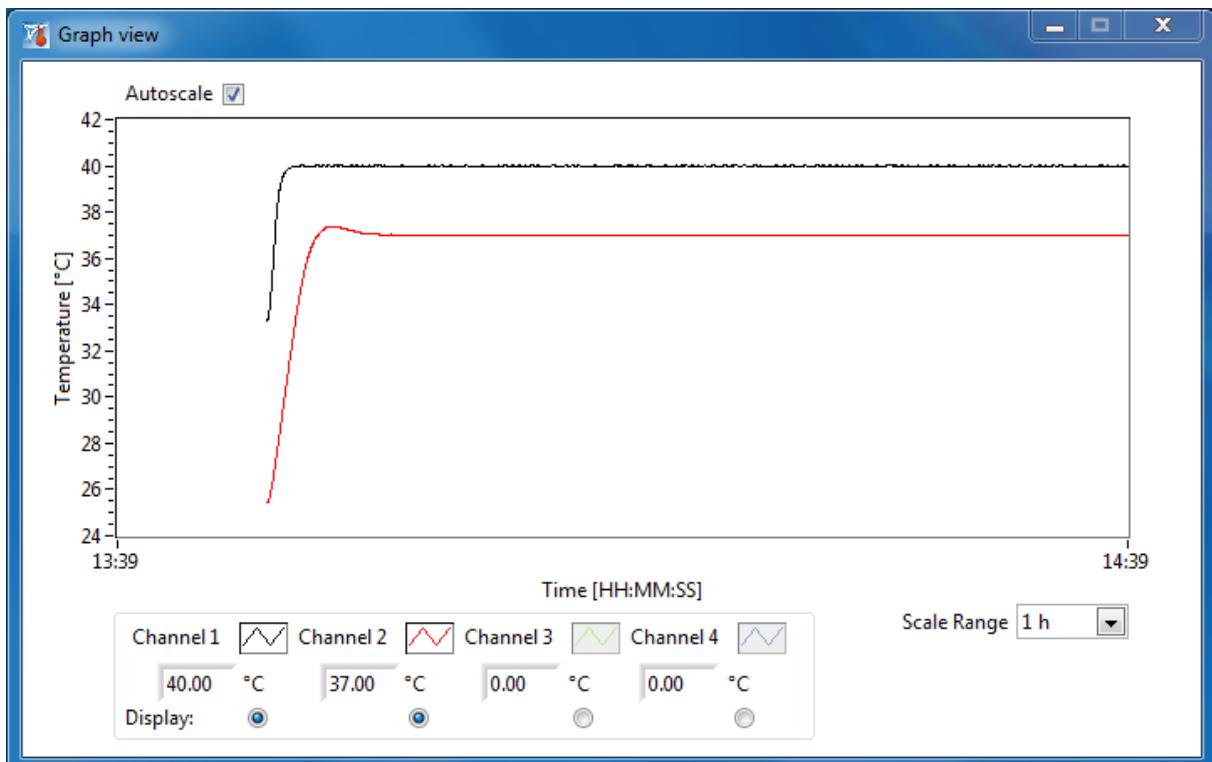


Figure 6: Graphical Presentation of the Temperature Course

The 'Logging Menu' button brings you to a menu where you can start logging the temperature course. The 'Advanced' button leads you to a menu where the channel parameters can be viewed and modified.

4.2 Logging Menu

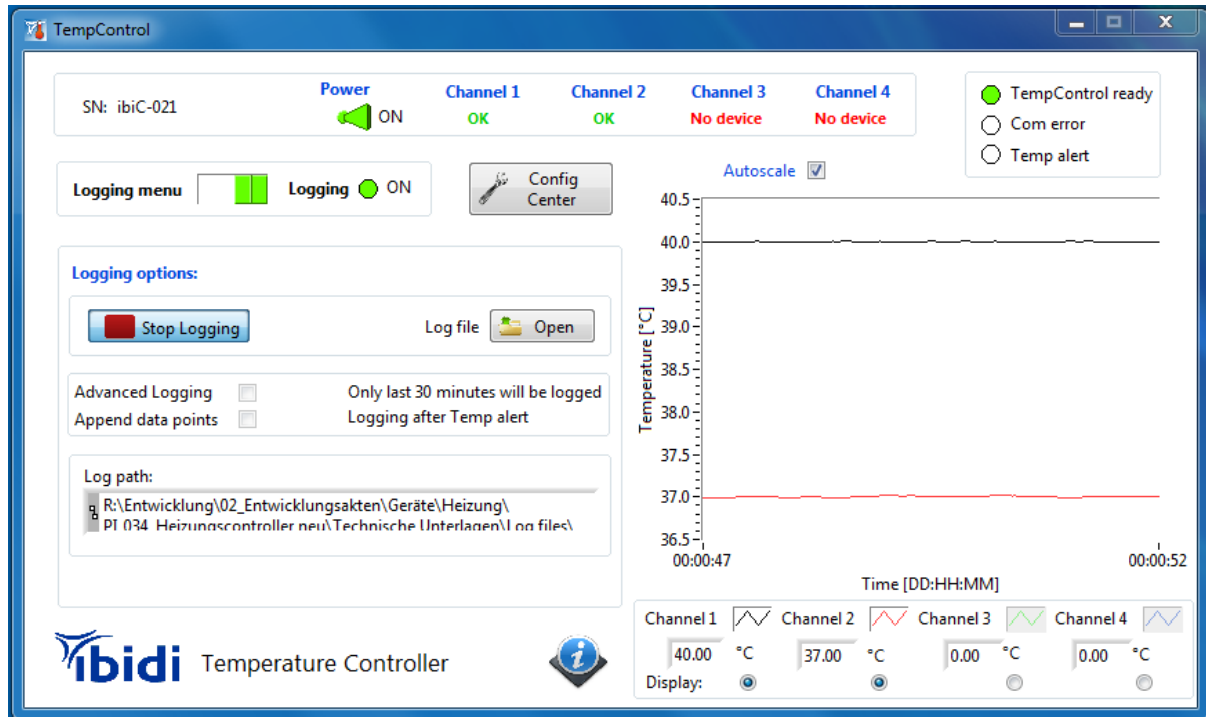


Figure 7: Logging Menu

If you choose 'Start Logging', you have to select a file name under which the data should be stored. This data can be viewed in a normal text viewer or it can be loaded using the 'Open' button.

There are two further options for the data logging. If you select 'Advanced Logging', you can save disk space, because only the last 30 minutes will be stored. If you select the 'Append Values' box, then, in addition to the last 30 minutes, all data after an incident is recorded, as in the case of a temperature alert.

4.3 Advanced Menu

The 'Advanced' menu allows you to configure the individual channel parameters, starting from the PID algorithm coefficients over the input limits, to the alarm settings. There, you can also label the channels according to the heating device.

An interesting option for many users is the possibility of defining a temperature offset. This is a simple way to calibrate the controller.

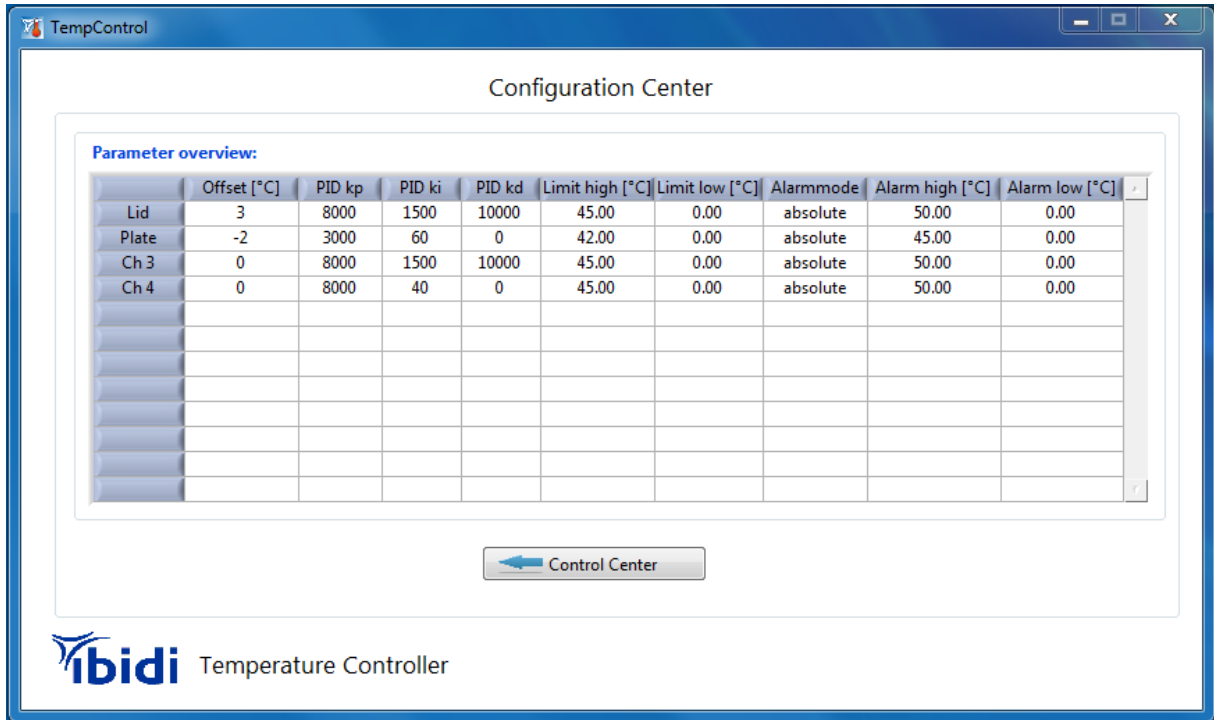


Figure 8: Advanced Menu for Control Channel Configuration



Unless otherwise noted or advised by ibidi personnel, please do not change the values in the Configuration Center. Wrong values can lead to failure of the functionality of the instrument or even cause damage to the instrument and the user.



4.3.1 Calibration Routine Using TempControl

Using the external temperature sensor, measure the temperature at the cell position, as is shown in Section A4.4. Calculate the difference between the temperature measured by the integrated sensor of the heating device and that of the external sensor. Use this value as the offset. If, after changing the offset the temperature still deviates, repeat this step.

5 Troubleshooting

5.1 Focus Not Stable

Focus drift is a disturbing effect, especially during time-lapse experiments. Focus stability is mainly influenced by mechanical changes and temperature variations. Follow these recommendations to keep your cells in focus:

- Switch on all components (e.g., heating, gas incubation, computer, and other equipment) at least 60 minutes before starting the experiment.
- After you put the sample onto the microscope, wait 20 minutes before starting a time-lapse experiment to achieve temperature and immersion oil equilibration. (*)
- Keep the room temperature as stable as possible. Air conditioning should either be working continuously or switched off.
- Do not change the temperature during the experiments. Avoid door/window openings, as this could rapidly change the temperature.
- Eliminate all sources of mechanical vibrations. Use a damped table for your microscope.

(*) In case the experiment needs to be started immediately, either after placing the sample on the microscope or after closing the lid, we recommend controlling the focus for 20 minutes. In the first minutes after starting the experiment, temperature equilibration might influence the focus/z-position of the cells.

Please contact us at info@ibidi.com for further troubleshooting help.

6 WEEE/RoHS Compliance Statement

EU Directives WEEE and RoHS

To Our Valued Customers:

ibidi GmbH is committed to being a good corporate citizen. As part of that commitment, we strive to maintain an environmentally conscious manufacturing operation. The European Union (EU) has enacted two directives, the first on product recycling (Waste Electrical and Electronic Equipment, WEEE) and the second on limiting the use of certain substances (Restriction on the use of Hazardous Substances, RoHS).

Two Categories of products covered by the WEEE Directive are currently exempt from the RoHS Directive – Category 8, medical devices (with the exception of implanted or infected products) and Category 9, monitoring and control instruments.

All of our products fall into either Category 8 or 9, and are currently exempt from the RoHS Directive. We will, however, continue to monitor the application of the RoHS Directive in relation to our products and will comply with any changes, as they apply.

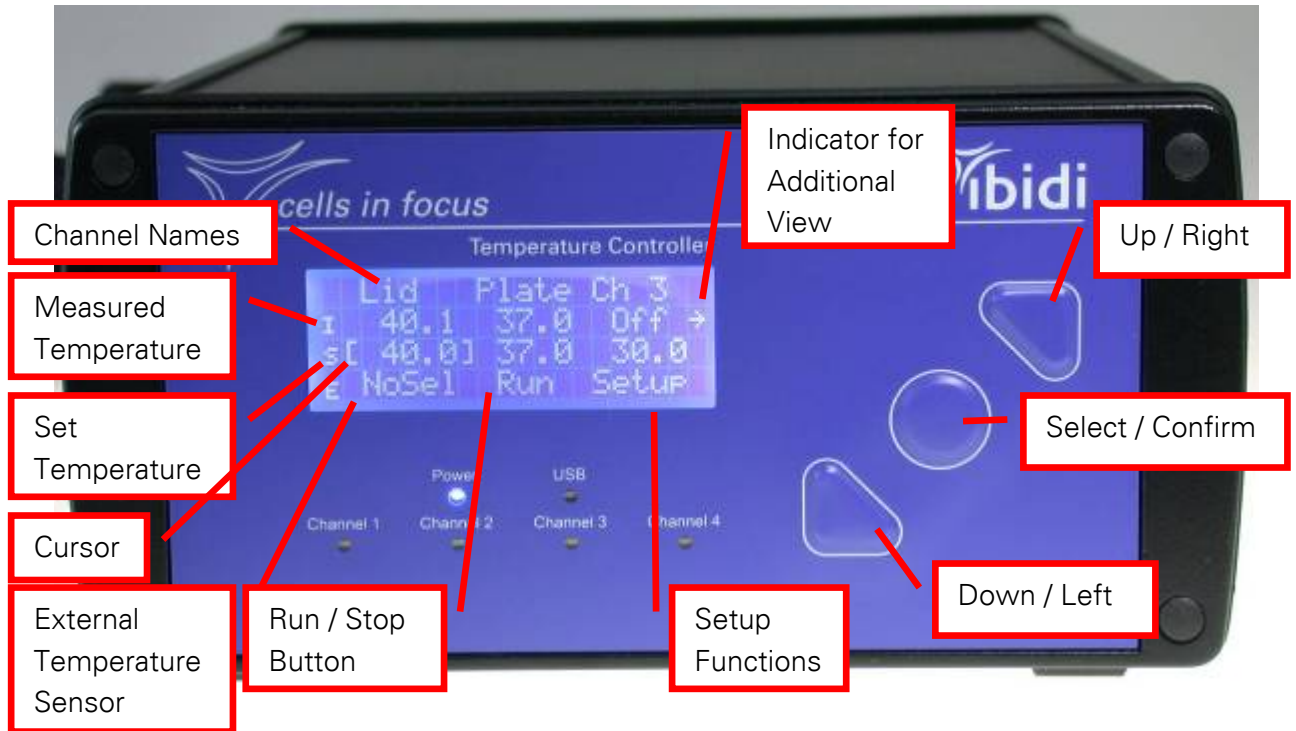
Recycling is offered for our products that fall within the scope of the WEEE Directive. These specific products, available for sale after August 13, 2005, will be identified with a “wheelie bin” symbol.



When you see this symbol, do not dispose of this product with Municipal Waste. Special Collection/Disposal is required.

Please contact us for feedback or further information.

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Appendix

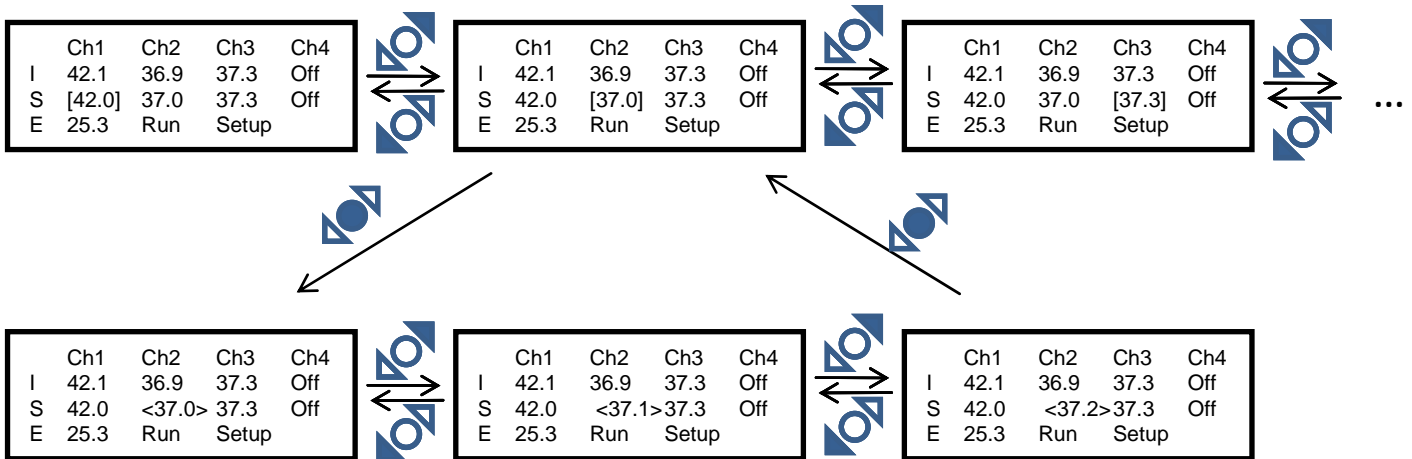
A Menu Navigation

Most of the functions and parameters of the ibidi Temperature Controller can be accessed with the control buttons on the front panel. The LC display shows the changes. However, the display is limited to 20 characters per line and four lines. Therefore, some of the fields are out of the initial view. Nevertheless, they are reachable by using the 'Up / Right' and 'Down / Left' arrow buttons. The view shifts accordingly.

By default, there are four channels displayed, but only three of them fit into the viewing frame. Therefore, to reach the last channel you need to push the 'Up / Right' arrow button once more, after you have reached the Channel 3. Then, Channel 4 is displayed and Channel 1 vanishes. By using the 'Down / Left' arrow button, you will reach Channel 1 again.

A.1 Setting the Temperature

By pressing the control buttons, the cursor on the display will change position. When you are at the parameter you want to change, you need to select the field with the round 'Select' button and change the value using the 'Up / Right' and 'Down / Left' arrow buttons. To confirm the change, you need to press the 'Select' button again.



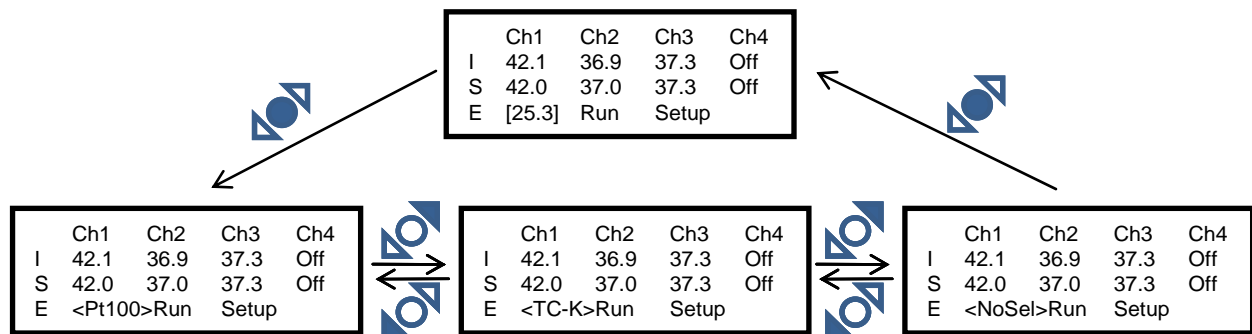
A.2 External Temperature Sensor

The ibidi Temperature Controller has plugs for two different temperature sensors:

- Type-K plug for a thermo-couple sensor
- Plug for a 4-terminal sensing of a Pt100 resistor

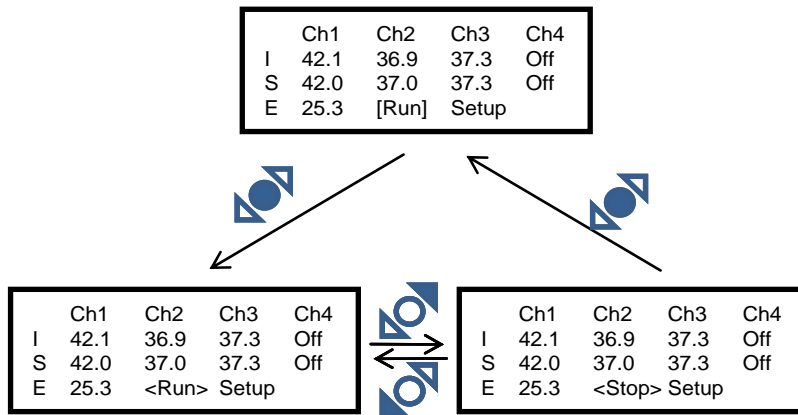
You can choose which sensor you want to have displayed and use it as the reference sensor:

- Thermo-couple: 'TC-K'
- Pt100 sensor: Pt100
- No selection: 'NoSel'



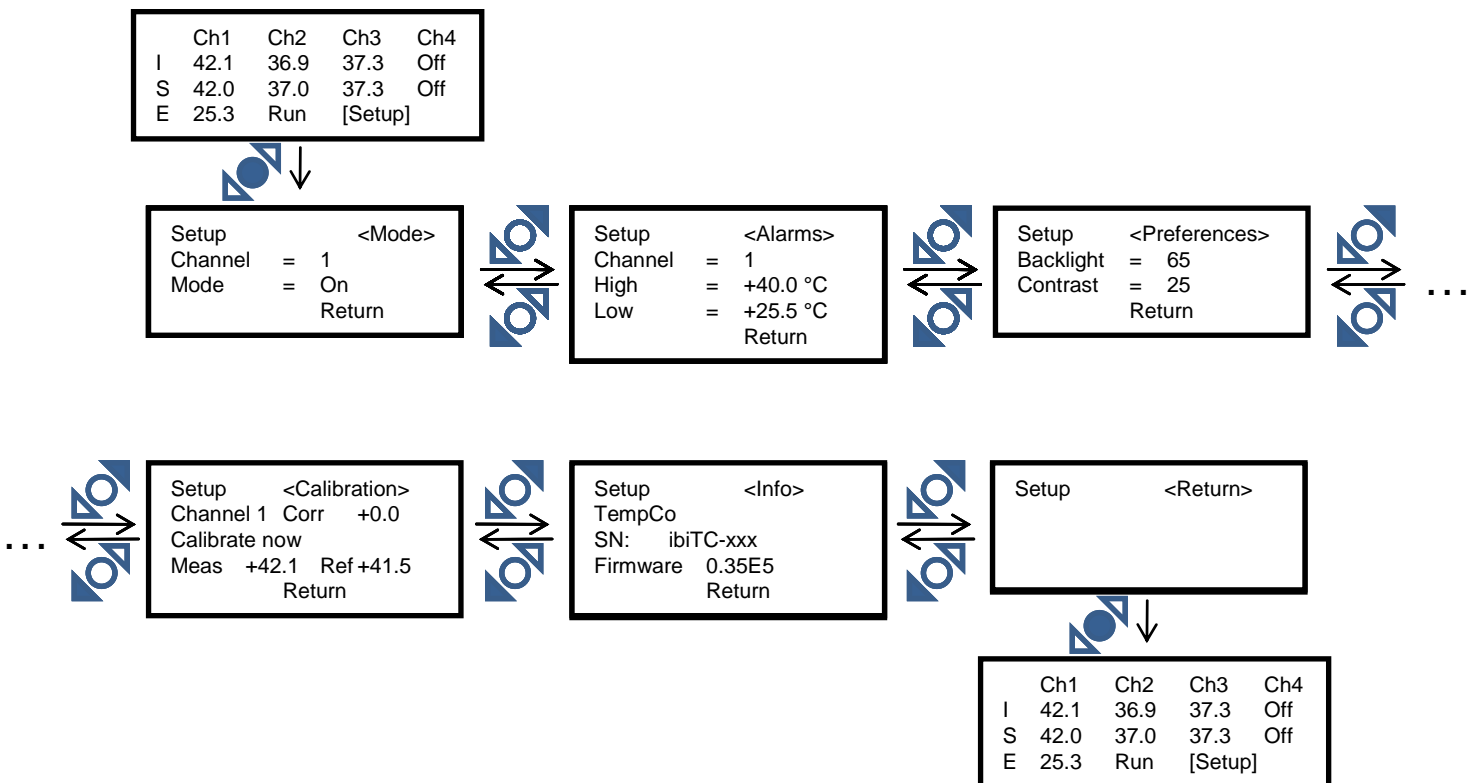
A.3 Run / Stop Button

With the 'Run / Stop' button, you can set all control channels to standby.



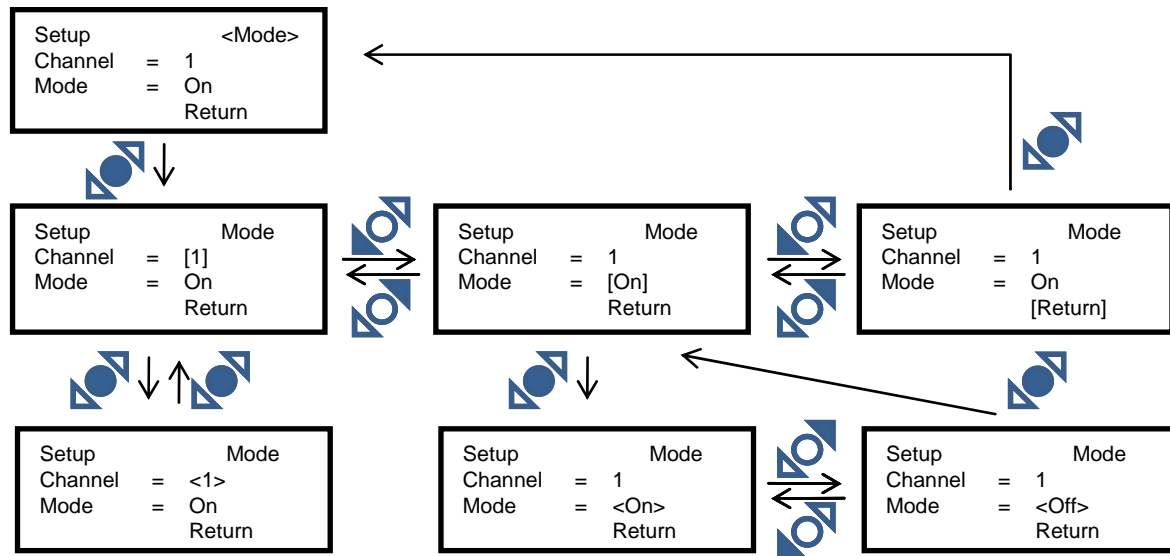
A.4 Setup Button

Using the 'Setup' button, you can reach further functions, such as the channel output 'Mode', the 'Alarm' function, the controller 'Preferences', the 'Calibration' function, and you can view the 'Info' (information) about the controller.



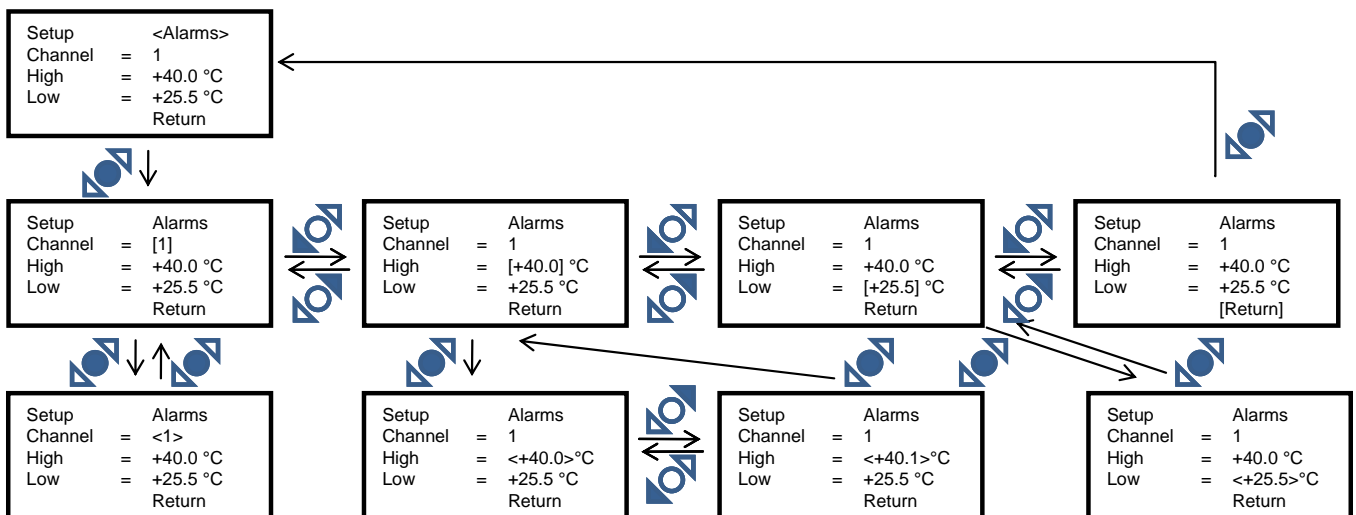
A.4.1 Mode Function

In this field, you can switch the channels individually 'On' and 'Off'. For that, you have to select the corresponding channel number and change the 'Mode' from 'On' to 'Off'.

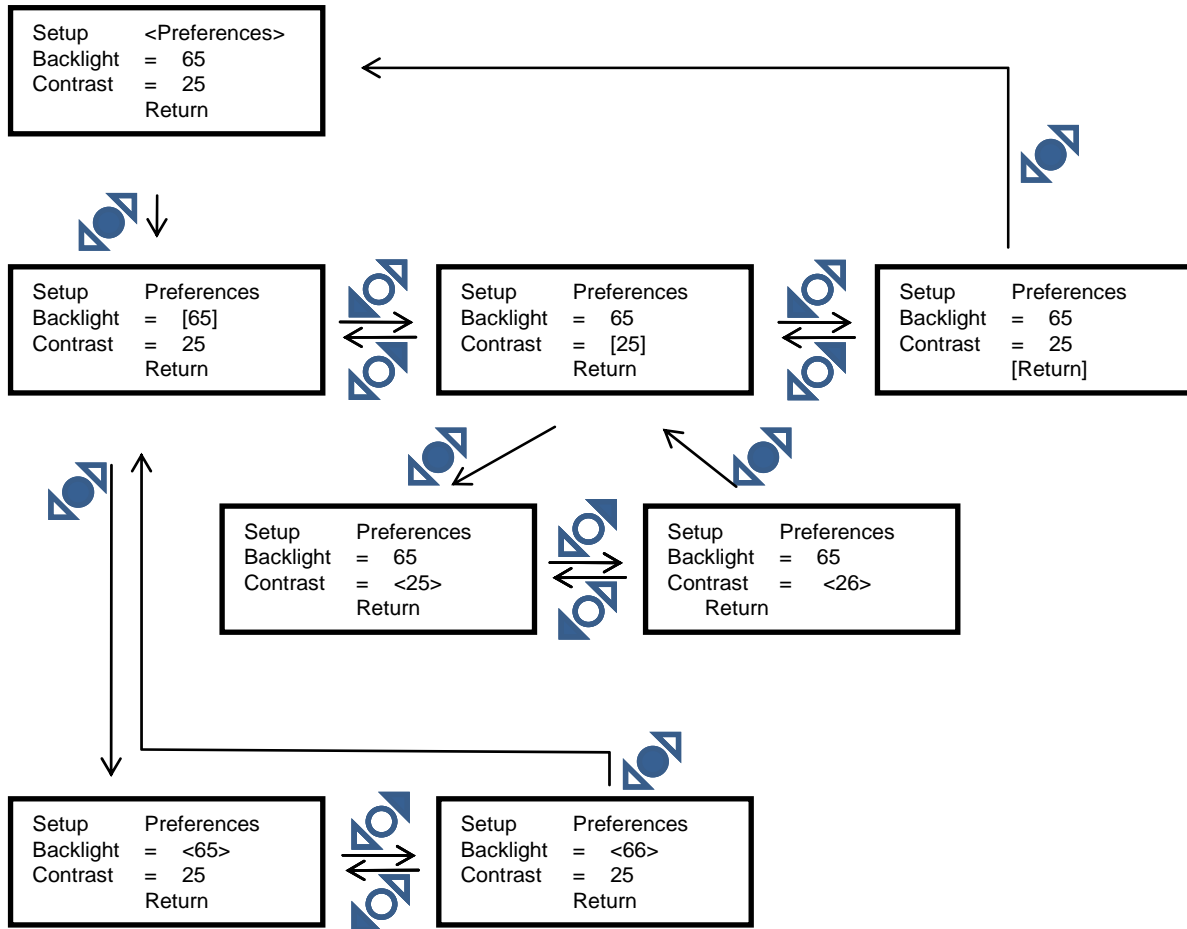


A.4.2 Alarm Function

If you activate the 'Alarm' function, you will get a visual (\rightarrow 'High' or 'Low' message on the LCD) and optionally acoustical signal (\rightarrow Beeper, please contact ibidi). The alarm goes off when the measured temperature exceeds the upper or lower thresholds of the alarm limits. The limits are individually programmable. You can set the thresholds as absolute or relative temperatures using the TempControl software.



A.4.3 Preferences

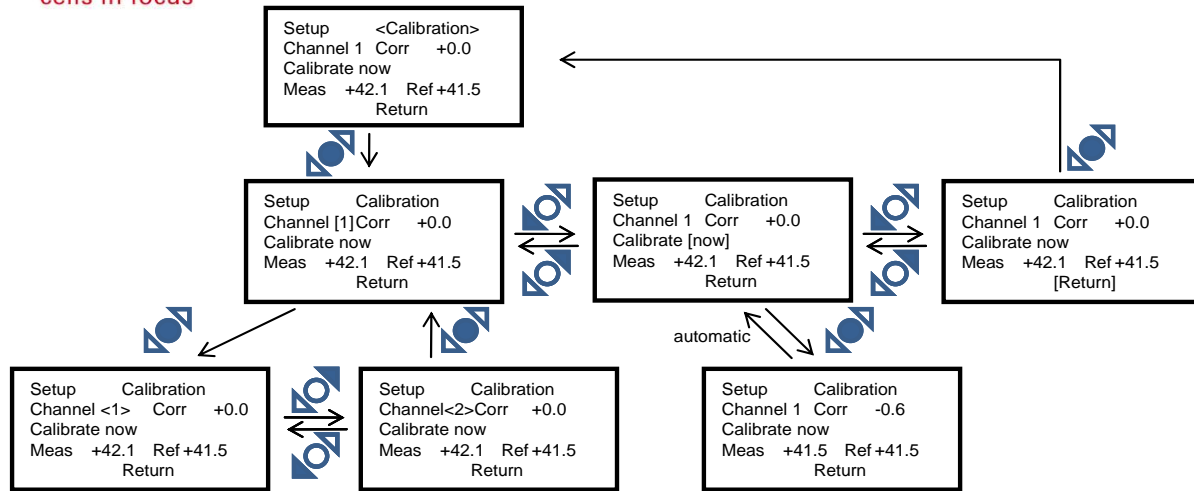


The display settings of the controller can be changed under 'Preferences'. You can modify the brightness of the display ('Backlight') and the contrast.

A.4.4 Sensor Calibration

A recalibration is generally not necessary. Before shipment, all controllers are run through an in-house calibration to ensure their accuracy. This calibration only refers to the sensors of the actively heated devices, such as the plate and the lid. Additionally, the ibidi Temperature Controller has a built-in function for calibrating the controlled channels. To do this, there are two plugs for external temperature sensors on the rear panel of the controller. In this menu, you will find the channel number, the currently measured temperature 'Meas', the sensed temperature 'Ref' of the external sensor, and the currently used temperature offset 'Corr'. You can change the reference sensor, as described in Section A.2.

For a sample temperature calibration, please follow the steps described in the instruction in the instruction manual of the heating devices.



Once you have activated the calibration 'Calibrate Now', the controller will calculate an offset from the temperature difference between the control channel and the external sensor. This offset will replace the former value of 'Corr'.

A.4.5 Info

```

Setup      <Info>
TempCo
SN:  ibiTC-xxx
Firmware  0.31E5
Return
  
```

In this menu, you can find the serial number of the device, as well as the hardware and firmware versions.