Life Imaging Services

THE CUBE 2
TEMPERATURE CONTROLLER

OPERATOR'S MANUAL

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1 WARNING SYMBOLS

The lightning flash with arrowhead within an equilateral triangle is intended to alert the operator to the presence of dangerous voltage within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons and to indicate possible risk of equipment damage.

The exclamation point within an equilateral triangle is intended to alert the operator to potential dangers not arising directly from electrical hazards. It is also used to emphasize the presence of important operating and maintenance instructions in the documentation accompanying the temperature controller.

Warning: To prevent fire or electric shock do not expose this appliance to rain or moisture.

Caution: To reduce the risk of electric shock do not remove cover. No user-serviceable parts inside. Refer servicing to LIFE IMAGING SERVICES.

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3 A NOTE ON INSTALLATION AND SAFETY

THE CUBE 2 Temperature Controller should be installed on any stable heat-resistant surface. It is recommended to place it on a different surface than the microscope stand to avoid transmission of unwanted vibrations. It should be installed close enough to the microscope to allow connection of the air circulation hoses.

THE CUBE 2 generates heat and thus requires some ventilation. Do not place it on a soft surface that it could sink into. Allow enough space between THE CUBE 2 and other equipment or the wall. The metal enclosure may reach the set temperature during operation. In case of obstruction of the air flow the unit may reach 70° C before it is turned off by the built-in protection circuit. Therefore, no heat-sensitive material should be placed close to or onto the unit. The enclosure does not constitute a burning hazard when touched with bare hands under normal operating conditions.

THE CUBE 2 should be operated only with the air circulation hoses attached. Operation without the air circulation hoses can cause aspiration and subsequent ejection of small objects. Shut off the power and unplug the AC power cord before removing the hoses. Do not reach into the connection ports to avoid touching hot parts and high voltage. Obstruction of the hoses may lead to excessive heat-up of THE CUBE 2. When the temperature inside the enclosure reaches 70°C the built-in protection circuit engages and shuts off the main power automatically. After automatic shutdown operation becomes possible only after unplugging the AC power cord and a cooling period of about 10 minutes. Inspect the hoses for clear air circulation and remove obstructions before operating again. If THE CUBE 2 does not operate after an automatic shutdown call LIFE IMAGING SERVICES for inspection.

THE CUBE 2 is specified to work only as a temperature controller together with THE BOX microscope enclosure. It is not designed for other uses like drying or ventilation of any other equipment manufactured by a company other than LIFE IMAGING SERVICES. Any other use voids the warranty. Any collateral damages caused to other equipment or persons as a consequence or accidental by the misuse of THE CUBE 2 are solely the responsibility of the purchaser.

Caution: To prevent fire or shock hazard, do not permit THE CUBE 2 to get wet. If liquid is accidentally spilled on it, immediately shut off its power and unplug the AC power cord. Allow sufficient time for complete evaporation to occur before operating THE CUBE 2 again. If the liquid is anything else than water (e.g. physiological saline or organic solvents) THE CUBE 2 should be examined by a qualified technician before power is applied. Do not remove the cover, or attempt to modify or repair THE CUBE 2 yourself. Refer all service to LIFE IMAGING SERVICES.

4 FIRST INSTALLATION

The first installation is normally performed by LIFE IMAGING SERVICES or by an authorized dealer designated by LIFE IMAGING SERVICES. If the operator performs the first installation or the system is dismantled and re-installed on another location the instructions below should be read and followed carefully.

4.1 PREPARATION FOR CORRECT LINE VOLTAGE

THE CUBE 2 is shipped with the fuses removed. Before operation it has to be set for the correct power line voltage. To set THE CUBE 2 for correct voltage operation follow these steps:

1. Unplug the power cord!

2. Slide the fuse drawer open (located under the mains socket on the rear panel) using a small screwdriver. Do not apply force.

3. Select the appropriate fuses for the specified voltage. Insert the 2 equal fuses and close the drawer.

230VAC: 2 x F 230VAC / 3.15 A **115VAC: 2 x F 230VAC / 6.3 A**

4. Turn the voltage selector gently to the **<230>** or **<115>** position, respectively.

4.2 CONNECTING THE AIR CIRCULATION HOSES

After secure placing of THE CUBE 2 the air circulation hoses should be attached to the corresponding ports on THE BOX. The side ports of THE CUBE 2 (heated air outflow) connect to the top ports of THE BOX (heated air inflow) above the filters. The top ports of THE CUBE 2 connect to the bottom ports of THE BOX. Do not operate THE CUBE 2 without air circulation hoses. When removing the hoses shut off THE CUBE 2 and unplug the AC power cord.

4.3 INSTALLING AND POSITIONING OF THE TEMPERATURE SENSOR

Plug in the cable of the temperature sensor into the socket on the front panel of THE CUBE 2. Lead the temperature sensor through the cable notch on the rear part of THE BOX. Attach the self-adhesive holder onto the lamp arm and position the tip of the temperature sensor as close to the microscope stage as possible. The tip of the sensor should not touch any surface and should be kept clean for accurate temperature measurement.

4.4 INSTALLING THE SERIAL INTERFACE (OPTIONAL)

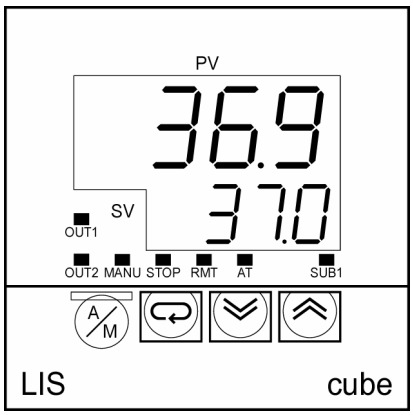
Connect the 9-pole Sub-D socket on the rear panel of THE CUBE 2 to a serial interface (RS232C) of your computer using a link cable (null modem cable).

5 OPERATION

5.1 SWITCHING ON

Plug in the power cord into a 230VAC/50Hz wall outlet (115 VAC/60 Hz in the U.S.) or into a heavy duty extension cord. Switch on operating mode by pushing the switch located on the front panel. The red glowing of the switch confirms the presence of high voltage on the mains socket. By switching on the temperature display lights up and the fan motor is audible.

The temperature is set by pressing the arrow keys below the LED display on the front panel. The up and down keys allow to scroll from 0°C to 50°C in steps of 0.1°. The current real temperature is shown in the red main display. The smaller green digits below display the set temperature. The temperature control operates in real time and there is no need to confirm the set values by pressing an enter key.



The OUT1 indicator flashes with the control period of the controller. The relative duration of the flash indicates the duty cycle of the output. The other keys and indicators are not used in normal operation mode. Their function is described below.

Since THE CUBE 2 is designed only to heat and contains no cooling device a temperature below the ambient temperature in the room cannot be achieved. The best temperature setting for feedback control is about 5° above ambient temperature. The maximal temperature setting allowed is 50° C.

THE CUBE 2 features a fast and precise PID controller. The PID parameters are continuously optimized by a fuzzy-logic algorithm. However, when starting the system from room temperature a heating phase (2 hours at least recommended) should be allowed to achieve a homogeneous equilibration of all parts inside THE BOX to the desired temperature. The CUBE 2 is designed for continuous operation. To avoid long idle times and thermal stress of the microscope's optical components it is recommended to leave THE CUBE 2 on unless it is not used for several days.

5.2 SETTING THE FAN SPEED

The CUBE 2 is equipped with a fan speed control. The control knob is located under the main switch on the front panel. With the knob turned fully counter-clockwise (min) the fan runs at about 2,000 rpm and at about 6,000 rpm in the fully clockwise position (max).

The typical setting for most imaging experiments is **<5>**. For heating up a microscope from room temperature the first time the fan can be set to maximal speed. This creates a rapid air circulation and allows reaching an even distribution of warm air in shorter time. After reaching a steady state (allow at least 3 hours to equilibrate the whole microscope) the speed should be set to **<5>** again and left so. The temperature controller will adapt its parameters to this air flow.

In some rare occasions, depending on the sensitivity of the whole microscope setup and image magnification some submicrometer vibration artifacts might be observed in the images when the fan speed is set too high. In these cases the fan speed can be set to lower values. Allow enough time for the temperature controller to adapt its parameters to the reduced air flow.

5.3 ADDITIONAL KEYS AND INDICATORS

The RMT (remote) indicator lights up when THE CUBE 2 is controlled externally through the serial port. The SUB1 indicator lights up if the temperature sensor is disconnected or not functioning

properly. The A/M key, the menu key (recycling symbol), and the OUT2, MANU, STOP and AT indicators are not used in normal operation mode.

5.4 SECURITY SETTINGS

By pressing the A/M key and the menu key for 2s, you enter the protect mode. (display SECr). The basic setting is security level 5 which enables access to the set temperature only. To block users from changing the set temperature, increase the setting to security level 6

Security levels lower than 5 must not be set unless so instructed by LIFE IMAGING SERVICES. Security levels 0 to 4 enable access to control parameters which may prevent THE CUBE 2 from operating safely if set inappropriately.

(Pressing the menu key enables access to the A/M key protection(display KEYP). Leave the protection on).

Press the A/M key and the menu key again for 2s to exit the protect mode.

Read-out of the actual temperature with the computer

If required, the actual temperature can be monitored using the serial interface. For technical details please contact your dealer.

6. MAINTENANCE & CLEANING

After prolonged use dust deposits may form on THE CUBE 2 which can be removed by wiping the enclosure with a soft cloth.

THE CUBE 2's circuitry is protected from power failures and voltage peaks by two internal fuses. If failure should occur switch off THE CUBE 2 and unplug the AC power cord. Open the fuse holder located on the rear panel underneath the AC socket. Inspect both fuses and replace with new ones with exactly the same specifications.

7. APPENDIX

7.1 CALIBRATION OF THE CONTROLLER AND THE TEMPERATURE SENSOR

Use the Pt100 platinum resistance sensor that came with THE CUBE 2. The basic accuracy is ±0.3°C at 0°C (EN 60751 class B). Repeatability and drift per year are typically <0.1°C. The controller and the sensor are calibrated by LIFE IMAGING SERVICES to ±0.1°C at 37°C. Contact LIFE IMAGING SERVICES if recalibration is required.

7.2 PROGRAMMING THE CONTROLLER

More than 50 parameters are available to adapt the controller to different situations. Programming can be performed directly (after enabling access in protect mode) or via the serial interface

Inappropriate parameters settings may prevent THE CUBE 2 from operating safely! Therefore, parameters may only be changed upon instruction by LIFE IMAGING SERVICES.