LK220
Thermoelectric Liquid Chiller

User Guide



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Chapter 1 Introduction

1.1 Intended Use

The LK220 is an air-cooled, recirculating liquid chiller based on thermoelectric elements (TECs), designed to be used for cooling or heating applications. This liquid chiller has a maximum heat pump capability of 200 W when set to the ambient temperature and a temperature control stability of ±0.1 °C. The temperature can be set between -5 °C and 45 °C.

Capable of standalone operation from a simple keypad interface, this device can be interfaced with a PC using a standard USB Type B connector using our LK220 Application Program, LabVIEW drivers, LabWindows drivers, or using a simple command-line interface from any terminal window.

The product may only be used in accordance with the instructions described in this manual. Any other use will invalidate the warranty.

1.2 Explanation of Safety Warnings

⚠WARNING Warning indicates a hazard with a medium level of risk that, if not avoided, could result in death or serious injury.

NOTICE Indicates information considered important, but not hazard-related, such as possible damage to the product.


Hot Surface


Shock Warning


The CE/UKCA markings on the product are the manufacturer's declaration that the product complies with the essential requirements of the relevant European health, safety, and environmental protection legislation.


The wheelie bin symbol on the product, the accessories or packaging indicates that this device must not be treated as unsorted municipal waste but must be collected separately.

1.3 Description

The LK220 is an air-cooled, recirculating liquid chiller based on thermoelectric elements (TECs) that provides up to 1.2 bar of pumping capability. The bi-polar operation of the TECs allows the LK220 to be used for both cooling or heating applications.

For easy hose installation or removal, the LK220 features valved quick-connections. Two valved quick-connection fittings and 5 meters of hose with 4 mm inner diameter are included in the package.

The LK220 is designed to be used with the CDTX Coolflow DTX Refrigerant Antifreeze, which is available on the Thorlabs website. This liquid chiller is compatible with most ethylene glycol-based antifreeze or coolant. Water can also be used as an alternative coolant, however, the cooling performance is reduced. Please note that a funnel and a siphon pump are included to help transfer coolant into the chiller.

To measure the outlet coolant temperature, the LK220 is equipped with an internal thermistor sensor. The LK220 also features an external sensor port for more precise temperature control, which is compatible with Thorlabs' TSP-TH temperature probe (not included) or other third party thermistors.

1.4 Technical Data

1.4.1 Specifications

LK220	Value
Maximum Cooling Power[a, b]	200 W (Typical)
Temperature Setting Range[c]	-5 ˚C to 45 ˚C
Temperature Readout Resolution	0.01 ˚C
Temperature Stability	±0.1 ˚C Constant Load at Constant Ambient Temperature
Pump Type	Brushless DC Magnetic Drive
Static Pressure[d]	1.2 Bar (Typical)
Fitting Type	Valved Thumb Latch Quick-Disconnect Fitting
Connector Type (Chiller Side)	Coupling insert with Hose Barb CPC PLCD42004
Connector Type (Tube Side, included in package)	Valved Coupling Body with Ferruleless Polytube Fitting CPC PLCD13004
Included Hose	Polyurethane Hose, 1/4" OD, 0.17" ID (6.4 mm OD, 4.3 mm ID)
Noise (at 1 meter)	65 dBA Max
Reservoir Volume	400 mL
Power Supply	100 - 240 VAC, 50 - 60 Hz
Power Consumption	600 W Max
Operating Temperature	0 to 40 ˚C
Operating Humidity	15% to 80%
Storage Temperature	-15 to 60 ˚C
Dimensions (L x W x H)[e]	310.0 mm x 140.0 mm x 320.0 mm
Weight	8.1 kg
Weight	1.7 kg

a. This is the typical value when the LK220 chiller is used with CDTX Coolflow DTX refrigerant antifreeze, the dust filter is removed, and the target temperature is kept the same as the ambient temperature.

b. The LK220 is shipped with the dust filter installed, which decreases the cooling power by 30 - 50 W.

c. The actual achievable temperature range is related to the thermal load, ambient temperature, and the freezing point of the coolant.

d. This is the pump performance at 100% and zero flow.

e. Not Including Connectors and Feet

1.4.2 Graphs

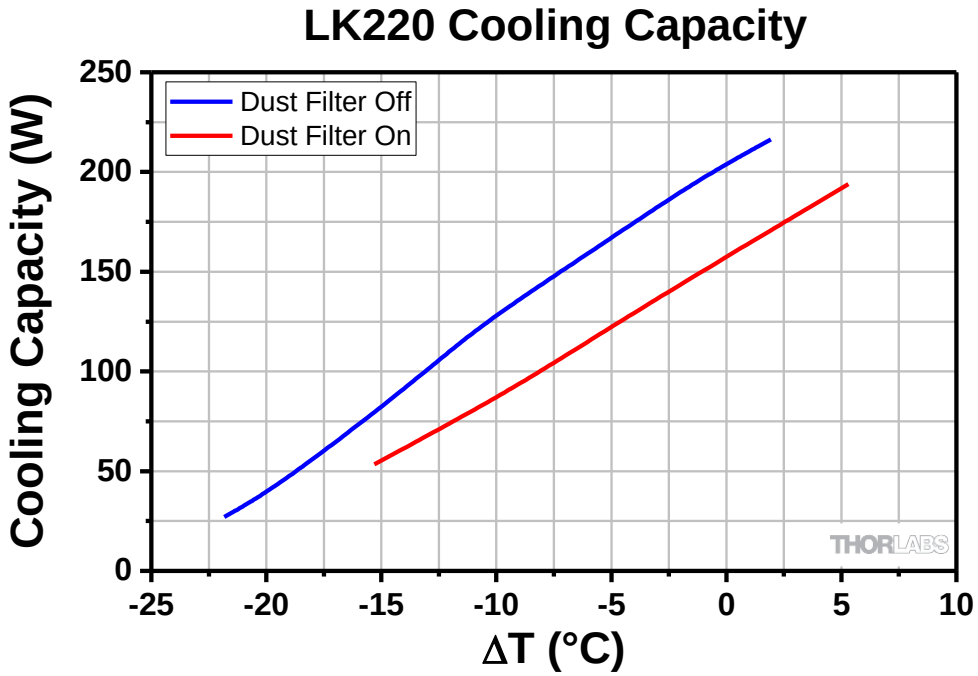


***Figure 1** This graph shows the maximum heat load that the unit can dissipate. Alternatively, given a known heat load, this graph shows the minimum temperature that the unit can achieve and stabilize at. This data was measured with CDTX Coolflow DTX Refrigerant Antifreeze. The measurement with the dust filter off was taken at a 25 °C ambient temperature, while the ambient temperature was 20 °C for the dust filter on.*

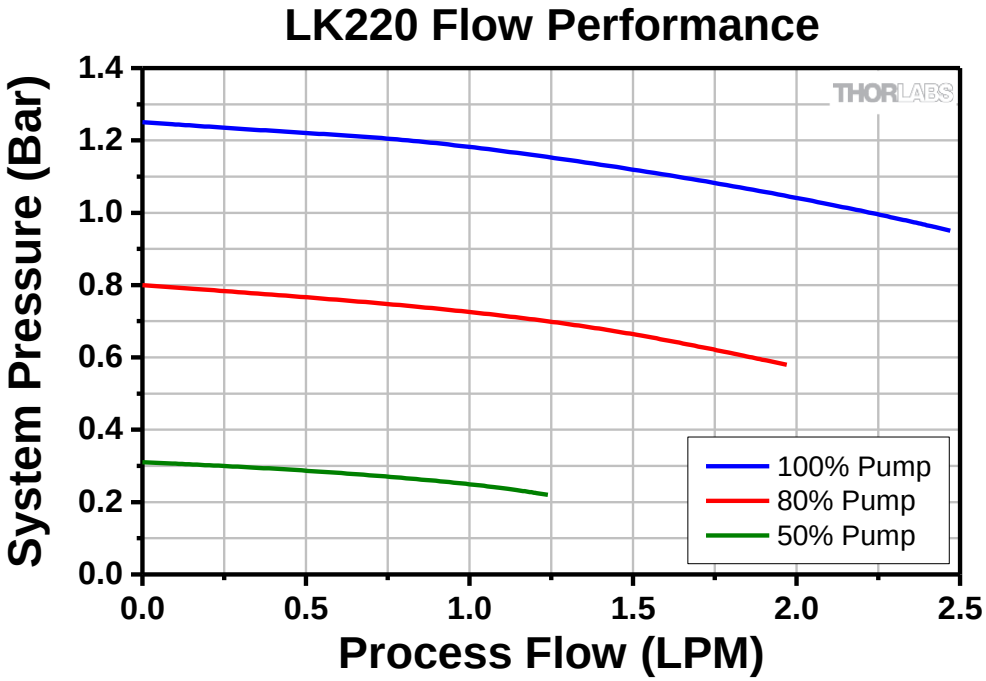


***Figure 2** The Pumping Capability of LK220 at a 25 °C ambient temperature and with water used as coolant. Note that the kinematic viscosity of CDTX Coolflow DTX is approximately twice that of water and will result in less than half the flow performance.*

1.4.3 Mechanical Drawings

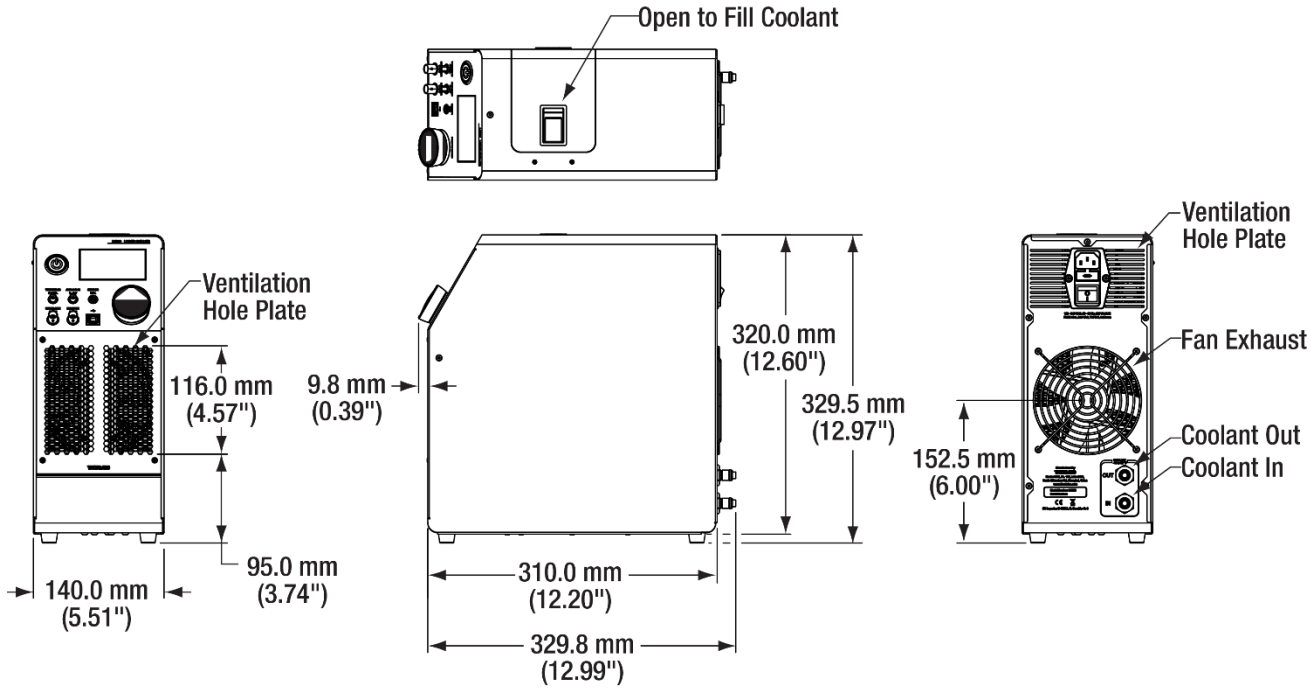


Figure 3 LK220 Mechanical Drawing

1.5 Components



Figure 4 Front and Back Panels of LK220

- F1. Secondary Power Switch
- F2. SMA Port for Analog IN: 0 V to 5 V
- F3. 2.5 mm Stereo Jack for External Thermistor
- F4. LCD Screen
- F5. Knob for Adjustment and Confirmation / LED Indicator
- F6. SMA Port for Trigger IN: 5 V CMOS
- F7. BNC Port for Interlock: 0 V to 5 V
- F8. BNC Port for Monitor: 0 V to 5 V
- F9. USB Port
- F10. Airflow Inlet
- B1. AC Power Inlet / Fuse Drawer / Main Power Switch
- B2. Airflow Output
- B3. 1/4" Hose Valved Coupling Insert for Coolant Supply
- B4. 1/4" Hose Valved Coupling Insert for Coolant Return

1.6 Simplified Declaration of Conformity

The full text of the EU declaration of conformity is available at the following internet address: https://thorlabs.com/newgrouppage9.cfm?objectgroup_id=13404

1.7 FCC Designation

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Chapter 2 Safety

⚠WARNING

Risk of Electrical Shock
HIGH VOLTAGE INSIDE
To avoid electrical shock, the power cord protective grounding conductor must be connected to ground. Do not operate without cover installed. Refer servicing to qualified personnel.

For all applications, use an IEC320 compatible power cord fitted with a plug appropriate for your particular power socket. Make sure that the line voltage rating marked on the rear panel agrees with your local power supply and that the appropriate fuses are installed. Changing the main fuse can be done by the user. Apart from this fuse, there are no user-serviceable parts in this product.

NOTICE

Do not obstruct the air ventilation slots in the housing.

This unit must not be operated in explosive environments.

Do not operate the chiller in ambient temperature of 40 °C or higher.

Do not operate the chiller within 2 °C of the coolant's freezing point.

Do not use alcohol (methanol, ethanol or isopropanol) based coolants.

Chapter 3 Installation

3.1 Warranty Information

This precision device is only serviceable if returned and properly packed into the complete original packaging including the complete shipment plus the cardboard insert that holds the enclosed devices. If necessary, ask for replacement packaging. Refer servicing to qualified personnel.

3.2 Packing List

Each LK220 is shipped with the following components:

- 1 Chiller
- 1 Power Cord
- 1 USB Cable
- 5 Meters of 4.3 mm (0.17”) Inner Diameter Hose
- 1 Siphon Pump
- 1 Funnel
- 2 CPC® Valved Quick-connection Fittings for 4.3 mm (0.17”) Inner Diameter Hose
- 1 LKF40 In-Line Filter
- 1 Flash Drive Containing the Operation Software and Manual

3.3 Initial Setup

Remove the LK220 chiller from this package and sit it upright on a clean, solid surface. The LK220 chiller is shipped with a LKF40 inline filter included in the package. We strongly recommend putting the filter on the inlet of the chiller. The filter can help to trap large particles or small foreign objects that accidentally go into the tubing system, prevent them from harming the chiller or any other devices that are connected to the tubing system.



Figure 5 Connect LKF40 Filter to the Coolant Inlet of LK220

Cut and prepare the hose. Connectorize the chiller side of the included hose with the female CPC® valved quick-connection fittings included in the package.



Figure 6 Ferruleless Compression Fitting for Easy Connection with Tubing

Then, connect one hose to the LKF40 filter that has already been connected to the coolant in port of the chiller. Another hose to the coolant out port on the back panel of the chiller. Connect the other side of the hoses to the thermal load.

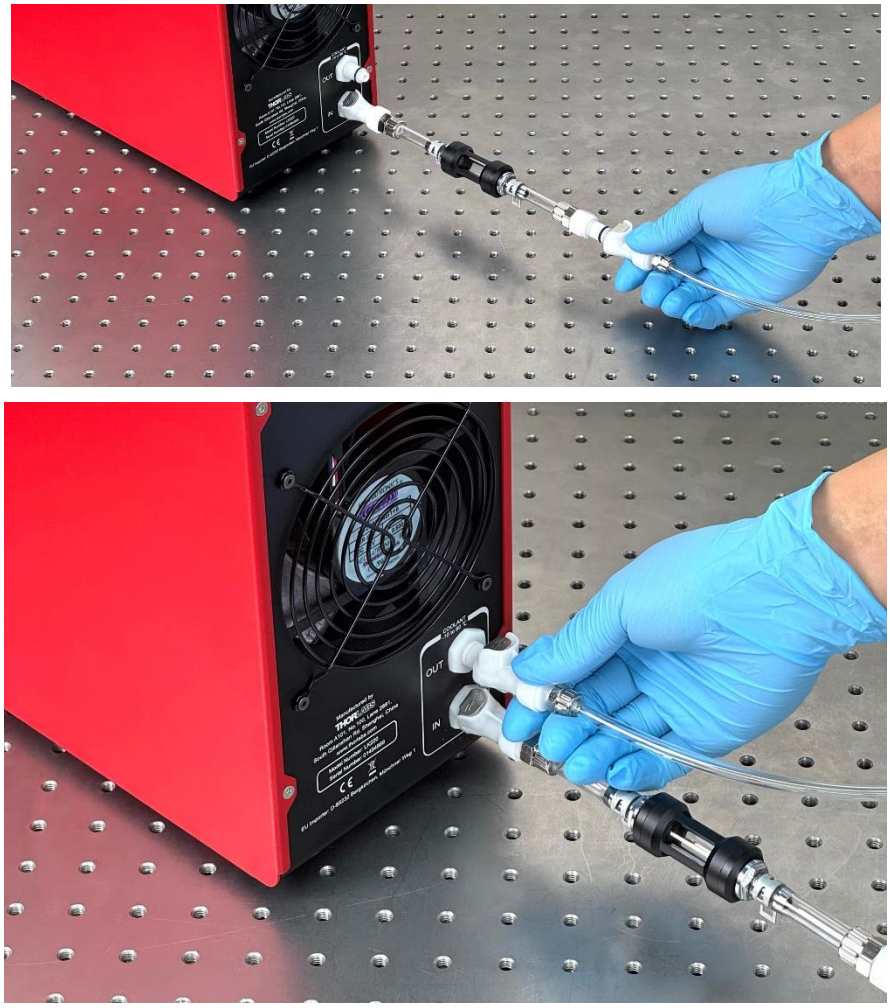


Figure 7 Connecting Hoses to the LKF40 And LK220

3.4 Filling the Chiller

Open the hatch on top of the chiller and remove the plastic cap. Fill the reservoir with coolant, using the included funnel for help if necessary. If moving coolant from a large container, we strongly recommend using the included siphon pump. Please note that this device is safe to operate even if small spills occur or the reservoir overflows.

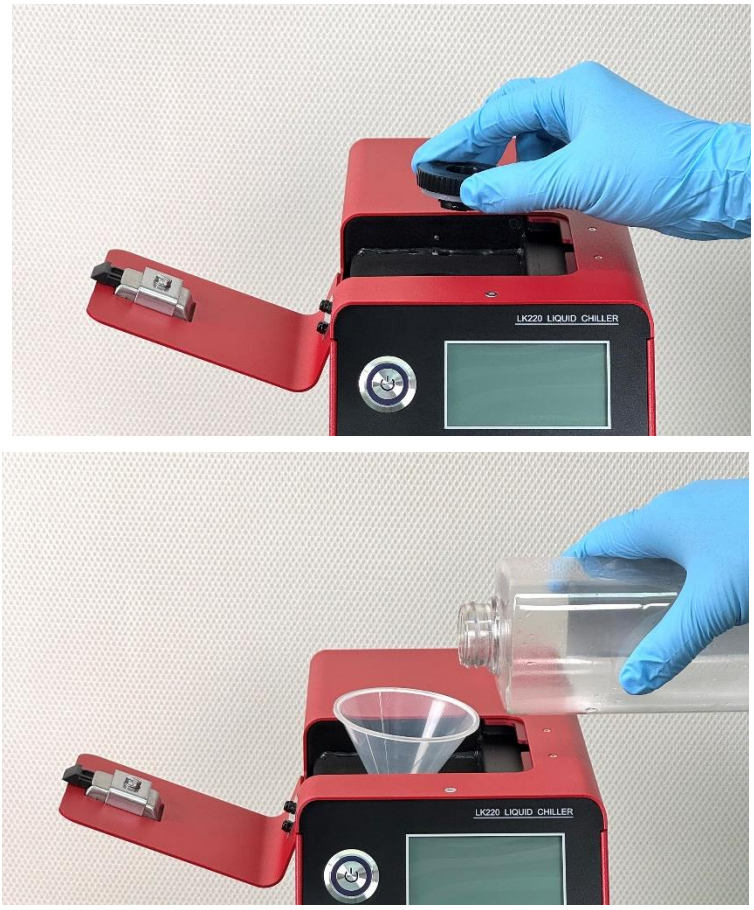


Figure 8 Removing the Plastic Cap (Top) and Filling the Reservoir (Bottom)

Toggle the rocker switch (B1 in Figure 4) on the back panel to "I" to power on the device. Press the secondary power switch (F1 in Figure 4) on the front panel to enable the system.

Leave the reservoir open and set the target temperature to room temperature (see Section 4.1 for details). Start running the chiller. The pump will start, filling the tubes and heat load with coolant, and the air remaining inside will be released to the atmosphere at the open reservoir. If the coolant level is low, an alarm will start. Fill the reservoir with more coolant and press the knob to reset the warning. Once the hoses, heat load, and the reservoir are filled, put the cap back on the reservoir, close the hatch, and start regular operation.



Figure 9 Set Target to Room Temperature and Run LK220

Chapter 4 Operation

4.1 Front Panel Operation

Turn the knob to move the cursor on the screen, and press to confirm/select. The device status is displayed on the title bar (see Section 4.1.4).

4.1.1 Quick Operation

Set the target temperature by selecting Target and turning the knob clockwise or counterclockwise to increase or decrease the temperature, respectively. Press the knob to confirm the temperature value. Select the Run/Stop option to enable the device.

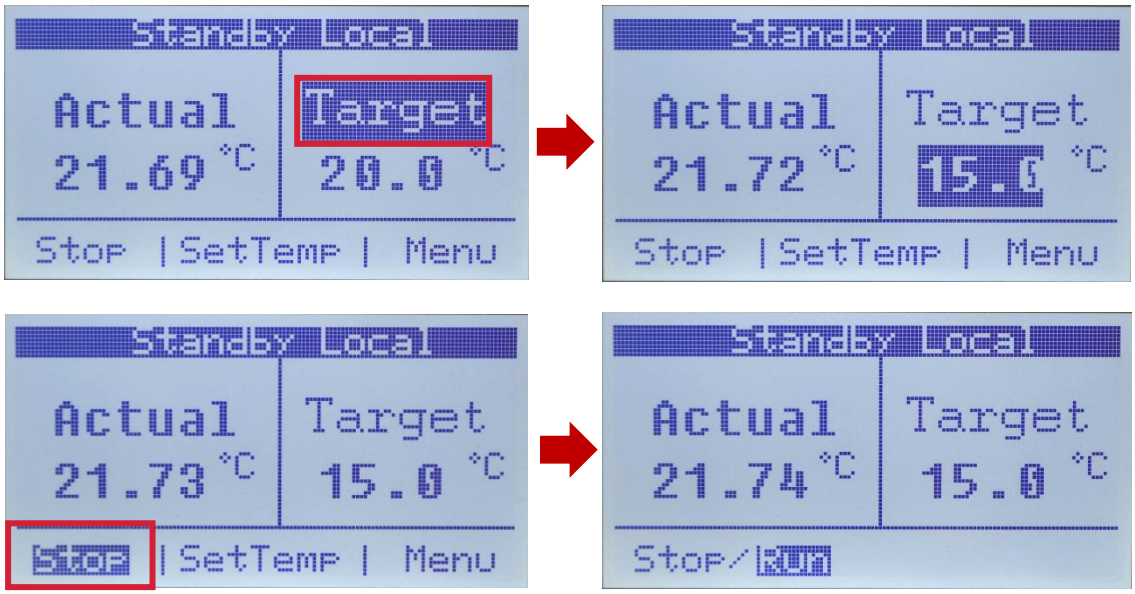


Figure 10 Quick Operation to Run LK220 by Panel Control

4.1.2 SetTemp

Select the SetTemp button to enter the set temperature screen; the target temperature and temperature window can be set here. The temperature control window defines the allowed temperature shift of the device. Please note that a warning message appears when the difference between the actual and target temperature if larger than the temperature window. However, the chiller will continue to run.

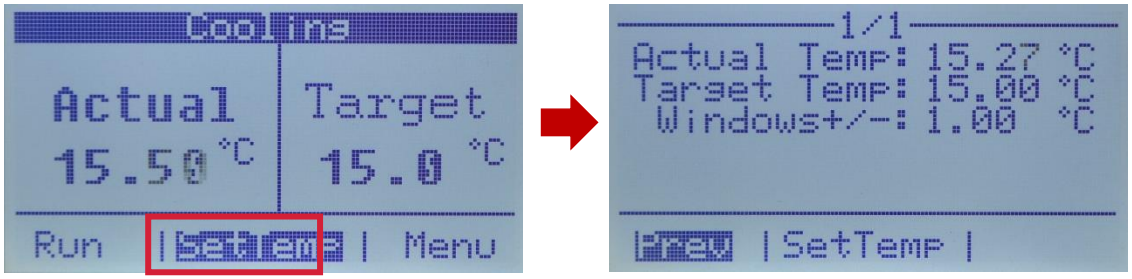


Figure 11 SetTemp Menu Accessed with Panel Control

4.1.3 Menu

Select Menu to enter the menu screen.

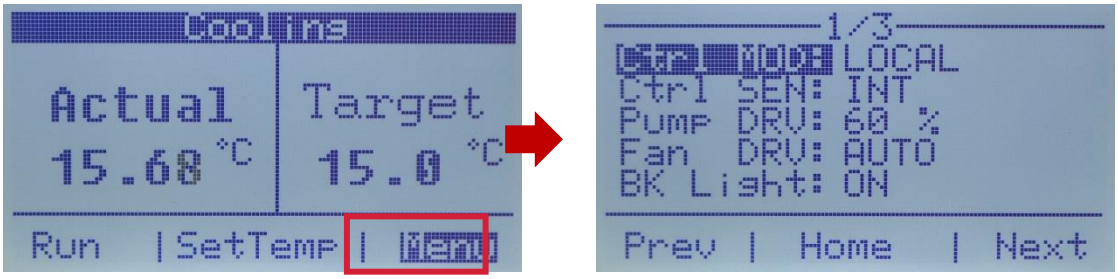


Figure 12 Select Menu to Enter Menu Screens

On the first page of the menu screen, users are able to monitor and control the control mode, the temperature sensor, pump drive, fan drive, and back light.

Ctrl MOD: There are four different control modes supported by the devices:

- LOCAL: The device responds to knob and software GUI operation.
- LOCAL-ANG: The target temperature is set by the Analog IN port, and the RUN/STOP of the chiller is controlled by the knob and GUI.
- TRIG: The target temperature is set by the knob and GUI, and the RUN/STOP of the chiller is controlled by the Trigger IN port.
- TRIG-ANG: The target temperature is set by the Analog IN port, and the RUN/STOP of the chiller is controlled by the Trigger IN port.

Ctrl SEN (Control Sensor):

- INT: The internal sensor measuring the output coolant temperature is selected to provide the actual temperature reading;
- EXT: The external TSP-TH sensor connected on the front panel is selected to provide the actual temperature reading. If this control sensor is selected while no sensor is connected, a error message will appear and a alarm will be set off. The LK220 chiller will be disabled until a TSP-TH is connected or the control sensor is switched back to INT.

Pump DRV (Pump Driving):

- This sets the pumping power, which defaults to 60%. 30 - 60% pumping power usually provides the best cooling performance.

Fan DRV (Set the Duty Cycle of the Fan)

- This sets the duty cycle of the main fan, which defaults to AUTO.

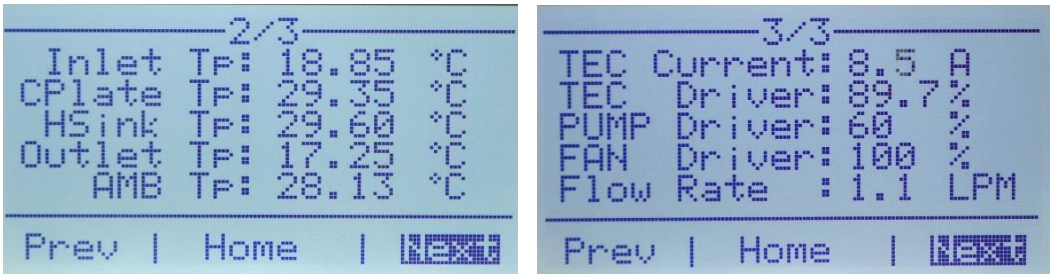


Figure 13 Second and Third Pages of the Menu Screen

On the second and third page of the menu screen, users are able to monitor the operation state of the chiller.

- Inlet T1: Temperature of Inlet Coolant
- Cold T2: Temperature of the Cold Plate Inside the Chiller
- HSink T3: Temperature of the Heat Sink Inside the Chiller
- Outlet T4: Temperature of the Outlet Coolant when the Sensor Type is Set to Internal; Temperature of the External Sensor when the Sensor Type is Set to External
- AMB T5: Temperature of the Ambient Environment
- TEC Current: TEC Driving Current
- TEC Driver: TEC Driving Duty Cycle
- PUMP Driver: Pumping Driving Duty Cycle
- FAN Driver: Fan Driving Duty Cycle
- Flow Rate: Current Coolant Flow Rate

4.1.4 Status Display

The device status is displayed on the title bar:

- Standby Local: When the Unit is in Standby and Local Operation Mode
- Standby Analog: When the Unit is in Standby and Local-ANG Operation Mode
- Standby TRIG: When the Unit is in Standby and TRIG Operation Mode
- Standby TRIG-ANG: When the Unit is in Standby and TRIG-ANG Operation Mode
- Cooling: When the Unit is Running and the Actual Temperature is Higher than the Target but within the Temperature Window
- Heating: When the Unit is Running, the Actual Temperature is Lower than the Target but within the Temperature Window
- Low ActTemp: When the Unit is Running, the Actual Temperature is Lower than the Target and Outside the Temperature Window
- High ActTemp: When the Unit is Running, the Actual Temperature is Higher than the Target and Outside the Temperature Window

4.2 I/O

There are six I/O ports on the front panel of LK220.

- Analog In: SMA Port, provides control of the target temperature from a external signal, 0 V to +5 V DC Input Corresponds to -5 °C to 45 °C Target temperature;
- Analog Out: BNC Port, provides a monitor signal of the actual temperature, 0 V to +5 V DC Output Corresponds to -5 °C to 45 °C Actual Temperature
- Trigger In: SMA Port, High Level (+ 5 V) Input to enable the temperature control function of the Chiller; Low Level (0 V) Input to Disable the Chiller (default)
- Interlock: BNC Port, High Level (+5 V) Output when Chiller Errors Occur; Low Level (0 V) Output when there are no Chiller Errors
- USB: For Connecting to a PC for Software or Command Line Operation
- TSP-TH: For use with the TSP-TH Sensor as the External Sensor

4.3 Connecting an External Sensor

On the front panel of the LK220, there is a 2.5 mm Stereo Jack (F2 in Figure 4). It is designed to accept a Thorlabs TSP-TH thermistor temperature probe as an external sensor. Other 10 kΩ thermistors (R_0 = 10 kΩ @ T_0 = 25 °C) soldered with a 2.5 mm Stereo Jack can also be used.

Connect the TSP-TH and toggle the “Ctrl SEN” in 1st Menu screen to “EXT”. Then, the LK220 will use the external thermistor as the temperature monitor for its temperature control feedback loop instead of the internal thermistor inside the return coolant hose.

When “Ctrl SEN” is set to “EXT”, the LK220 chiller is configured by default according to the parameters of TSP-TH. No additional settings need to be adjusted. To get accurate temperature readings while using other thermistors, the Beta value must be set in the LK220 software GUI.

4.4 Software Operation

Connect the device to a computer with the included USB cable. The device can be controlled by the LK220 software, included with the device. The most up-to-date software GUI is also available on www.thorlabs.com.

Within the software, users can carry out all the operations of the panel control mode, and the PID parameters can also be adjusted. Using the software GUI, users can also set temperature sequences and save all data from the device monitor.

4.5 Error Handling

The LED indicator (F5 in Figure 4) has four possible colors to indicate the current status of the device:

1. Blue: The temperature has reached the target and stabilized while the device is controlled in Local or Local-Ana mode.
2. Green: The temperature has reached the target and stabilized while the device is controlled in TRIG or TRIG-Ana mode.
3. Yellow: indicates warning conditions under which the device is still fully operation.
4. Red: There are errors in the device and operation has stopped.

The detailed warning/error messages and suggested actions are listed below:

Type	Message	Cause of Warning or Error	Suggested Action
Warning	N/A	The device is working properly but the temperature has not reached the target.	Wait for the Device to stabilize
Warning	LOW FLOW	The Flow Measured by the Flow Meter is <0.1 Litre per Minute (LPM)	• Check the coolant level and fill up the coolant reservoir if necessary. • Check the tubing system and clear any possible blockage. • Clean the LKF40 filter
Error	High Temperature	Any of the Internal Temperature Sensors are > 65 °C	• Make sure the ventilation holes on the front and back panel of the device are not blacked. Remove the dust cover if necessary • Make sure the device is operating with an ambient temperature below 40°C • Make sure the thermal load is within LK220's heat dissipation capability • Contact Thorlabs tech support if the error persists.
Error	Low Temperature	Any of the Internal Temperature Sensors are < -10 °C	• Make sure the device is operating with an ambient temperature above -10°C
Error	Low Level	Coolant Level is <25% of the Maximum Coolant Capacity	Refill the coolant reservoir. Contact Thorlabs tech support if the error persists.
Error	No Flow	the Flow Measured by the Flow Meter is <0.1 Litre per Minute (LPM) for more than 30 seconds	• Check the coolant level and fill up the coolant reservoir if necessary. • Check the tubing system and clear any possible blockage. • Clean the LKF40 filter Contact Thorlabs tech support if the error persists.
Error	Pump Failure	Pump Open Circuit and Short Circuit	Power Cycle the device Contact Thorlabs tech support if the error persists.
Error	TEC Failure	TEC Open Circuit and Short Circuit	Power Cycle the device Contact Thorlabs tech support if the error persists.
Error	Fan Failure	Fan Open Circuit and Short Circuit	Power Cycle the device Contact Thorlabs tech support if the error persists.
Error	EXT Sensor	the Sensor is Set to External but no Temperature Sensor is Connected	Check if the sensor configuration of LK220 are set correctly.
Error	Connection Error	the Control Mode is Set to Remote but no Trig or Analog Cable is Connected	Check if the I/Os of LK220 are connected correctly according to the control mode.

Chapter 5 Command Line Operation

5.1 Command Line Overview

The LK220 can be controlled by a command-line language through the USB port. Users can either use a terminal emulator or write their own program to control the unit. The command language is described below. Prior to running the command-line interface, the included drivers should be installed, the unit should be powered on, and a USB cable should be connected between the liquid chiller and the host PC.

The terminal emulator should be configured as follows:

- Baud Rate: 115.2 kbps
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

If the connection parameters are correct, you will see the following after pressing the Enter key (without any leading commands):

```
CMD_NOT_DEFINED
>
```

The above error indicates that an empty command (which is equivalent to an incorrect command) has been sent.

The basic structure of the interface is a keyword followed by either an equals sign (=) or a question mark (?). The = or ? character determines if the string is a command or a query. All strings, commands, and queries must be terminated by a carriage return (CR) or by pressing the Enter key on the computer.

The command structure is as follows:

```
Keyword=argument(CR)
```

Here, “keyword” defines the function and “argument” as a numerical value followed by a carriage return (CR). Note that some commands might have more than one argument, separated by a space character.

The query structure is as follows:

```
Keyword?(CR)
```

Where “keyword” defines the function and the question mark (?) indicates a query. The string is terminated with a carriage return (CR).

There are a few exceptions to this, which are noted below. Also noted below are unique shortcut keys. The following table lists the commands and queries available with this device. The prompt symbol (>) appears on power up and after a command is accepted by the controller, indicating it is ready to receive the next command.

If the command is incorrect, the chiller returns `CMD_NOT_DEFINED`;

If the command parameter is incorrect, the chiller returns `PARAMETER_ERR`;

The table on the next two pages lists all the available commands for the operation of LK220.

5.2 Command Line Summary

No.	Command	Syntax	Description
1	**Get ID**	IDN?	Returns the model number, hardware and firmware versions.
2	**Get Commands**	COMMAND?	List the available commands
3	**Get ID**	IDN?	Return the device hardware and firmware versions
4	**Get Device State**	ST?	Return device state
5	**Disable/Enable the Chiller**	EN=0,1	0=Disable chiller,1=Enable chiller
6	**Get Target Temperature**	TSET?	Get the target temperature (range: -5.0 - 45.0 °C)
7	**Set Target Temperature**	TSET=n	Set the target temperature(n = -50 - 450, representing -5.0 - 45.0 °C)
8	**Get Actual Temperature**	TACT?	Get the actual temperature (range: -10.00 - 60.00 °C, resolution = 0.01°C)
9	**Set Temperature Window**	WINDOW=n	Set temperature window (n = 1 - 50, representing ±0.1 - ±5 °C)
10	**Get Temperature Window**	WINDOW?	Get temperature window ((range 0.1 - 5, representing ±0.1 - ±5 °C)
11	**Set Control Mode**	MOD=n	Set control mode (n = 0 Local; 1 Local-Analog; 2 Trig; 3 Trig-Analog)
12	**Get Control Mode**	MOD?	Return the control mode (n = 0 Local; 1 Local-Analog; 2 Trig; 3 Trig-Analog)
13	**Set Control Sensor Mode**	SENS=n	Set control sensor (0 = internal sensor; 1 = external sensor)
14	**Get Control Sensor Mode**	SENS?	Return control sensor state (0 = internal sensor; 1 = external sensor)
15	**Set the EXT Sensor Type**	EXT=n	Set the external sensor type, n = 1 TSP01; 2 other TSP, reserved for future use; 8 other 10k ohm thermistor
16	**Get the EXT Sensor Type**	EXT?	Get the external sensor type, n = 1 TSP01; 2 other TSP, reserved for future use; 8 other 10k ohm thermistor
17	**Set EXT Sensor Constant**	BETA=n	Set the β value of the thermistor of external sensor when the external sensor type is set to 8 (other 10k ohm thermistor), n from 0 to 9999
18	**Get EXT Sensor Constant**	BETA?	Return the β value of the thermistor of external sensor when the external sensor type is set to 8 (other 10k ohm thermistor), n from 0 to 9999
19	**Set Pump Driver**	PUMP=n	Set driving power of the coolant pump in LK220 (n = 10 - 100, representing 10 - 100%)
20	**Get Pump Driver**	PUMP?	Return the driving power of the coolant pump in LK220 (range 10 - 100%)

No.	Command	Syntax	Description
21	**Set Fan Mode**	FAN=n	Set the duty cycle of the main cooling fan (n = 0 Auto; 1 0%, 2 25%, 3 50%, 4 75%, 5 100%)
22	**Get Fan Mode**	FAN?	Get the duty cycle of the main cooling fan (n = 0 Auto; 1 0%, 2 25%, 3 50%, 4 75%, 5 100%)
23	**Get Tec Current**	TEC?	Return “n”, n from 0 to 10.0, representing 0 - 10.0A
24	**Get Liquid Flow Rate**	FLOW?	Return the coolant flow rate: “n”, n from 0 to 5.0, representing 0 - 5.0 LPM
25	**Set Knob State**	KNOB=n	Set the knob state, n=0 Unlock; n=1 Locked. When set to locked, LK220 will not respond to any movement on the knob on the front panel.
26	**Get Knob State**	KNOB?	Get the knob state (0=Unlock 1=Locked)
27	**Set P Parameter**	KP=n	Set the gain value of the P share in the temperature PID control loop (n = 0 - 999, representing gain value of 0 ~ 9.99).
28	**Get P Parameter**	KP?	Return the gain value of the P share in the temperature PID control loop (range: 0 - 9.99)
29	**Set I Parameter**	TI=n	Set the gain value of the I share in the temperature PID control loop (n = 0 - 999, representing gain value of 0 - 9.99).
30	**Get I Parameter**	TI?	Return the gain value of the I share in the temperature PID control loop (range: 0 - 9.99).
31	**Set D Parameter**	TD=n	Set the gain value of the D share in the temperature PID control loop (n = 0 - 999, representing gain value of 0 - 9.99)
32	**Get D Parameter**	TD?	Return the gain value of the D share in the temperature PID control loop (range: 0 - 9.99)
33	**Set Period Parameter**	PERIOD=n	Set the integrating period of the PID servo loop (n = 500 - 5000, representing 500 - 5000ms).
34	**Get Period Parameter**	PERIOD?	Return the integrating period of the PID servo loop “n” (n = 500 ~ 5000, representing 500 ~ 5000ms).
35	**Get Error Message**	ERR?	Return the error message value
36	**Get Warning Message**	WARN?	Return the warning message value
37	**Get Monitor Message**	MONITOR?	Return all monitor status
38	**Load Factory Parameter**	LOADFACT!	Restore the device factory parameters

5.3 Description of Commands

5.3.1 COMMAND? – Get Device Commands

Return: All of the command list in the Table1.

5.3.2 IDN? – Get device Information

Queries the device part number, hardware and firmware versions.

Return:

THORLABS LK220 HV x.xx FV x.xx.

Where HV is the hardware version; and FV is the firmware version.

5.3.3 ST? – Get Device Information

Return: an 8-bit byte was defined as in below table:

Device state define	8bit
bit0=1	Standby
bit1=1	Heating
bit2=1	Cooling
bit3=1	Warning
bit4=1	Error
bit5=1	Reserved
bit6=1	Reserved
bit7=1	Reserved

5.3.4 EN=n – Disable/Enable the Chiller

n=0, Disable chiller;

n=1, Enable chiller.

5.3.5 TSET? – Get Target Temperature

Get the target temperature (range: -5.0 - 45.0 °C).

E.g. returned “10.0” means target temperature = 10.0 °C.

5.3.6 TSET=n – Set Target Temperature

Set the target temperature (n = -50 - 450, representing -5.0 -45.0 °C).

E.g. "TSET=100" means to set target temperature to 10.0 °C.

5.3.7 TACT? – Get Actual Temperature

Get the actual temperature (range: -10.00 - 60.00 °C, resolution = 0.01 °C).

E.g. returned “20.00” means actual temperature = 20.00 °C.

5.3.8 WINDOW=n – Set Temperature Window

Set temperature window (n = 1 - 50), representing ±0.1 to ±5 °C. When the difference between the actual temperature and the target temperature is outside the set temperature window, a warning will occur.

E.g. "WINDOW=5" means to set temperature window to ±0.5 °C

5.3.9 WINDOW? – Get Temperature Window

Get temperature window (range 0.1 - 5, representing ±0.1 - ±5 °C).

E.g. returned "0.5" means the temperature window is ±0.5 °C.

5.3.10 MOD=n – Set Control Mode

Set control mode (n = 0 Local; 1 Local-Analog; 2 Trig; 3 Trig-Analog).

5.3.11 MOD? – Get Control Mode

Return control mode “n” (n = 0 Local; 1 Local-Analog; 2 Trig; 3 Trig-Analog).

5.3.12 SENS=n – Set Control Sensor

Set which sensor will be providing the actual temperature reading, n = 0 Internal Sensor; 1 External Sensor.

5.3.13 SENS? – Get Control Sensor

Get the state on which sensor has be selected to provide the actual temperature reading, n = 0 internal sensor; 1 external sensor.

Return “n”, n = 0 internal sensor; 1 external sensor.

5.3.14 EXT=n – Set the EXT Sensor Type

Set the external sensor type, n = 1 TSP01; 2 other TSP, reserved for future use; 8 other 10 kΩ thermistor.

5.3.15 EXT? – Get the EXT Sensor Type

Return the external sensor type “n”. n = 1 TSP01; 2 other TSP; 8 other 10 kΩ thermistor.

5.3.16 BETA=n – Set EXT Sensor Constant

Set the β value of the thermistor of external sensor when the external sensor type is set to 8 (other 10 kΩ thermistor), n from 0 to 9999.

E.g. "BETA=3488" means to set the β value to 3488.

5.3.17 BETA? – Get EXT Sensor Constant

Return the β value of the thermistor of external sensor when the external sensor type is set to 8 (other 10 kΩ thermistor), n from 0 to 9999.

5.3.18 PUMP=n – Set Pump Driver

Set driving power of the coolant pump in LK220 (n = 10 - 100, representing 10 - 100%).

E.g. "PUMP=60" means to set the driving power of the pump to 60% of its maximum.

5.3.19 PUMP? – Get PUMP Driver

Return the driving power of the coolant pump in LK220 (range 10 - 100%).

5.3.20 FAN=n – Set Fan Mode

Set the duty cycle of the main cooling fan (n = 0 Auto; n = 1 0%, n = 2 25%, n = 3 50%, n = 4 75%, n = 5 100%).

E.g. "FAN=5" means to set duty cycle of the cooling fan to 100%.

5.3.21 FAN? – Get the FAN Driver

Return the duty cycle of the main cooling fan (n = 0 Auto; 1 0%, 2 25%, 3 50%, 4 75%, 5 100%)

5.3.22 TEC? – Get the TEC Current

Return the TEC current "n", n from 0 to 10.0, representing 0 - 10.0 A.

5.3.23 FLOW? – Get Liquid Flow Rate

Return the coolant flow rate: "n", n from 0 to 5.0, representing 0 - 5.0 LPM (Liter per Minute).

5.3.24 KNOB=n – Set Knob State

Set the knob state, n=0 Unlock; n=1 Locked. When set to locked, LK220 will not respond to any movement on the knob on the front panel.

5.3.25 KNOB? – Get Knob State

Return the knob state "n", n=0 Unlock; n=1 Locked.

5.3.26 KP=n – Set P Parameter

Set the gain value of the P share in the temperature PID control loop (n = 0 - 999, representing gain value of 0 - 9.99).

E.g. "KP=100" means to set the gain value of the P share to 1.00.

5.3.27 KP? – Get P Parameter

Return the gain value of the P share in the temperature PID control loop (range: 0 - 9.99).

E.g. "1.00" means the gain value of the P share is 1.00.

5.3.28 TI=n – Set I Parameter

Set the gain value of the I share in the temperature PID control loop (n = 0 - 999, representing gain value of 0 - 9.99).

E.g. "TI=200" means to set the gain value of the I share to 2.00.

5.3.29 TI? – Get I Parameter

Return the gain value of the I share in the temperature PID control loop (range: 0 - 9.99).

E.g. "2.00" means the gain value of the I share is 2.00.

5.3.30 TD=n – Set D Parameter

Set the gain value of the D share in the temperature PID control loop (n = 0 - 999, representing gain value of 0 - 9.99).

E.g. "TD=200" means to set the gain value of the D share to 2.00

5.3.31 TD? – Get D Parameter

Return the gain value of the D share in the temperature PID control loop (range: 0 - 9.99).

E.g. "1.00" means the gain value of the D share is 1.00.

5.3.32 PERIOD=n – Set Period Parameter

Set the integrating period of the PID servo loop (n = 500 - 5000, representing 500 – 5000 ms).

E.g. "PERIOD=2000", means to set the integrating period of the PID servo loop to 2000 ms.

5.3.33 PERIOD? – Get PID Period Time Value

Return the integrating period of the PID servo loop "n" (n = 500 - 5000, representing 500 – 5000 ms).

E.g. "2000", means the integrating period of the PID servo loop is 2000 ms.

5.3.34 ERR? – Get Error Message

Return: an 8-bit byte was defined in below table:

bit0=1	Coolant Level Low
bit1=1	Device Over Temperature
bit2=1	Device Low Temperature
bit3=1	TEC Error
bit4=1	Eternal Sensor Error
bit5=1	Internal Sensor Error
bit6=1	No flow
bit7=1	Reserved

Error is defined as fatal error occurs to the device. The device will be disabled and an alarm will be set off when an error occurs.

- **WARN? – Get Warning Message**

  Return: an 8-bit byte was defined In below table:

bit0=1	Ambient Temperature High
bit1=1	Ambient Temperature Low
bit2=1	Actual Temperature High
bit3=1	Actual Temperature Low
bit4=1	Low Flow

bit5=1	E2PROM Incorrect
bit6=1	Reserved
bit7=1	Reserved

When a warning occurs, the device is still operational.

5.3.35 MONITOR? – Get Monitor Messages

Return all monitor status: Target Temperature (°C), Inlet Temperature (°C), Cold Plate Temperature (°C), Heat sink Temperature (°C), Actual Temperature (°C), Ambient Temperature (°C), TEC Current (A), TEC Driving Duty Cycle (%), Flow Rate (LPM);

E.g. "10.00, 23.42, 23.44, 23.36, 23.44, 24.01, 7.7, 21.0, 0.0" means

Target Temperature = 10.00 °C, Inlet Temperature = 23.42 °C, Cold Plate Temperature = 23.44 °C, Heat sink Temperature = 23.36 °C, Actual Temperature = 23.44 °C, Ambient Temperature = 24.01 °C, TEC Current = 7.7 A, TEC Driving Duty Cycle = 21.0 %, Flow Rate = 0.0 LPM.

5.3.36 LOADFACT! – Load Factory Parameter

Return: ">", Restore the device to factory settings.

Chapter 6 Maintenance

6.1 Fuse Replacement

⚠WARNING

Risk of Electrical Shock
To avoid electrical shock, always power off the device and unplug the power cord before fuse replacement.

The fuse is located in the fuse drawer below the power inlet (B1 in Figure 4). To replace the fuse, press the two clips on the drawer and pull it out.

Take out the used fuse and put in the new one. Please use Ø5 mm x 20 mm, 10 A, 250 VAC, Type "F", fast blow fuse only.

6.2 Dust Filter

The chiller is equipped with a dust filter behind the front panel. Users can remove the dust filter to achieve the full cooling power of the chiller, which is 200 W when the actual temperature is kept the same as the ambient temperature. With the filter installed, there is a 30 W to 50 W loss of cooling power. Please note that long term operation of the chiller without a filter is only recommended for a standard photonics lab environment or a cleanroom.

Unscrew the 4 cap screws with a 2 mm (5/64") ball driver or hex key to remove the front panel. Peel off the dust filter from the back of the front panel, and then put the panel back on.

The dust filter can be cleaned using a vacuum cleaner or by flushing under tap water.

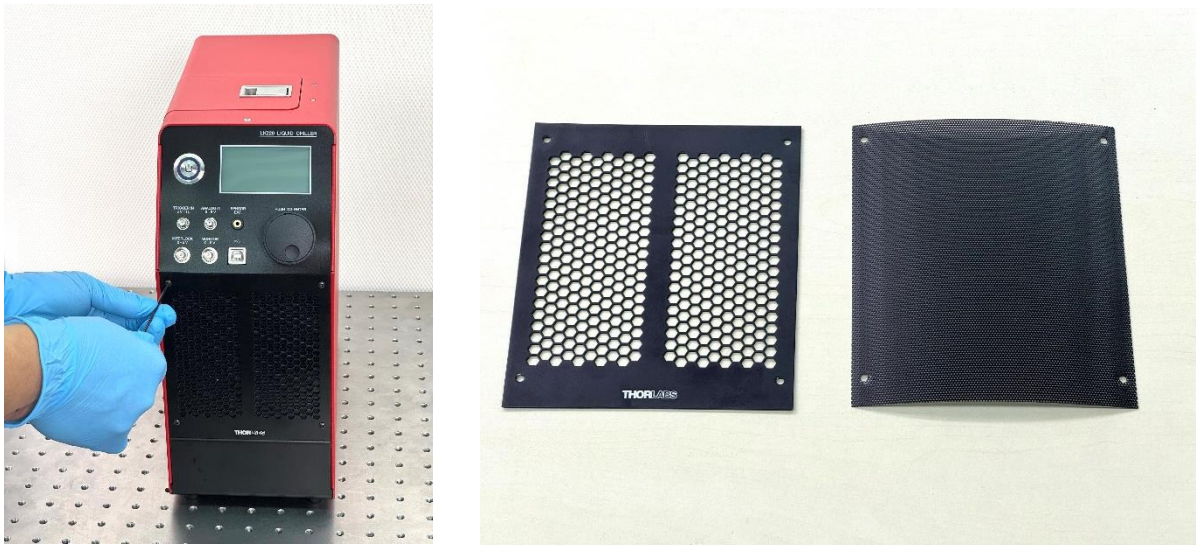


Figure 14 Unscrewing the Front Panel (Left) and Removing the Dust Filter (Right)

6.3 Draining The Reservoir

The reservoir of the LK220 needs to be drained before shipping the chiller.

Before draining, open the hatch and remove the cap on the reservoir. Connect a small length of open tube on both the “coolant In” and “coolant out”. Slightly lift the front side the chiller and wait until all coolant flows out from the open end of the tubes.



Figure 15 Draining the Reservoir

Chapter 7 Disposal



Thorlabs verifies our compliance with the WEEE (Waste Electrical and Electronic Equipment) directive of the European Community and the corresponding national laws. Accordingly, all end users in the EC may return “end of life” Annex I category electrical and electronic equipment sold after August 13, 2005 to Thorlabs, without incurring disposal charges. Eligible units are marked with the crossed out “wheelie bin” logo (see right), were sold to and are currently owned by a company or institute within the EC and are not dissembled or contaminated. Contact Thorlabs for more information. Waste treatment is your own responsibility. “End of life” units must be returned to Thorlabs or handed to a company specializing in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site. It is the user’s responsibility to delete all private data stored on the device prior to disposal.

Chapter 8 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.



Corporate Headquarters
Thorlabs, Inc.
43 Sparta Ave
Newton, New Jersey 07860
United States

sales@thorlabs.com
techsupport@thorlabs.com

Product Manufacturer
Thorlabs China
Room A101, No.100, Lane 2891,
South Qilianshan Road
Putuo District
Shanghai 200331
China

chinasales@thorlabs.com
techsupport-cn@thorlabs.com

EU Importer
Thorlabs GmbH
Münchner Weg 1
D-85232 Bergkirchen
Germany

sales.de@thorlabs.com
europe@thorlabs.com

UK Importer
Thorlabs Ltd.
204 Lancaster Way Business Park
Ely CB6 3NX
United Kingdom

sales.uk@thorlabs.com
techsupport.uk@thorlabs.com



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www.thorlabs.com