THORLABS

LK220
Thermoelectric
Liquid Chiller

User Guide

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Chapter 1 Safety

The device comes with a switching power supply compatible with voltages from 100 to 240 VAC. There is no need to change the fuse when selecting your regional voltage. If the user needs to change the fuse located below the AC plug on the back of the unit, see section 6.1.

SHOCK WARNING

High voltage inside. To avoid electrical shock, before powering unit, make sure that the protective conductor of the 3-conductor power cord is correctly connected to the protective earth contact of the socket outlet. Improper grounding can cause electric shock resulting in severe injury or even death. Do not operate without cover installed.

WARNING

This unit must not be operated in explosive environments.

WARNING

Always power off the unit before opening the housing.

CAUTION

Never disassemble the chiller as irreparable damage may occur.

CAUTION

Do not operate the chiller in ambient temperatures of 40 ºC or higher.

CAUTION

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

CAUTION

Do not store the chiller over 60 °C.

CAUTION

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

CAUTION

Do not ship the chiller with coolant inside the unit as freezing temperatures may be encountered which would damage the unit. Always pump all coolant out of the chiller prior to shipping.

Chapter 2 Overview

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 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 using the front panel controls or the software GUI when the unit is connected to a PC via the included USB cable.

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.

Chapter 3 Getting Started

3.1. Shipping List

The package contains the following items:

- 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 Flash Drive Containing the Operation Software and Manual

3.2. Front & Back Panels

Figure 1 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 Confirmination / 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

Chapter 4 Operation

4.1. Starting the Device

Connect the hose to the female quick-connection fittings provided in the package. Then, connect the hose to the coolant in/out port on the back panel of the chiller. Connect the other side of the hoses to the thermal load.

Figure 2 Ferruleless Compression Fitting for Easy Connection with Tubing

Figure 3 Connecting Hoses to the LK220

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 4 Removing the Plastic Cap (Top) and Filling the Reservoir (Bottom)

Toggle the rocker switch (B1 in Figure 1) on the back panel to “I” to power on the device. Press the secondary power switch (F1 in Figure 1) on the front panel to enable the system.

Leave the reservoir open and set the target temperature to room temperature (see section 4.2 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.

Figure 5 Set Target to Room Temperature and Run LK220

Once the hoses, heat load, and the reservoir are filled, put the cap back on the reservoir, close the hatch, and start regular operation.

4.2. 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 4.2.4).

4.2.1. 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.

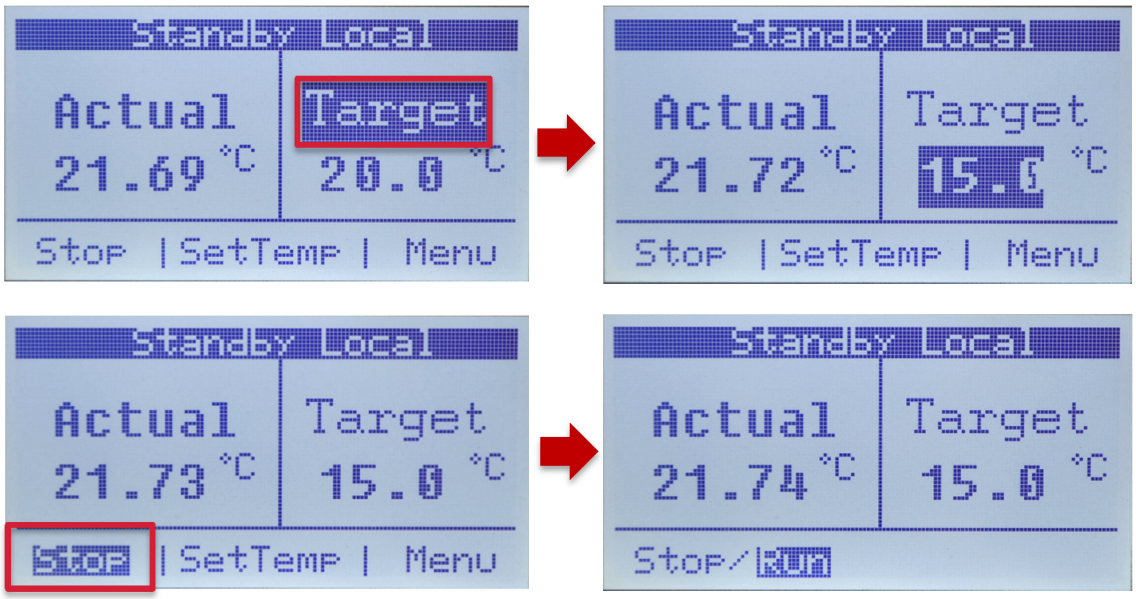


Figure 6 Quick Operation to Run LK220 by Panel Control

4.2.2. 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.

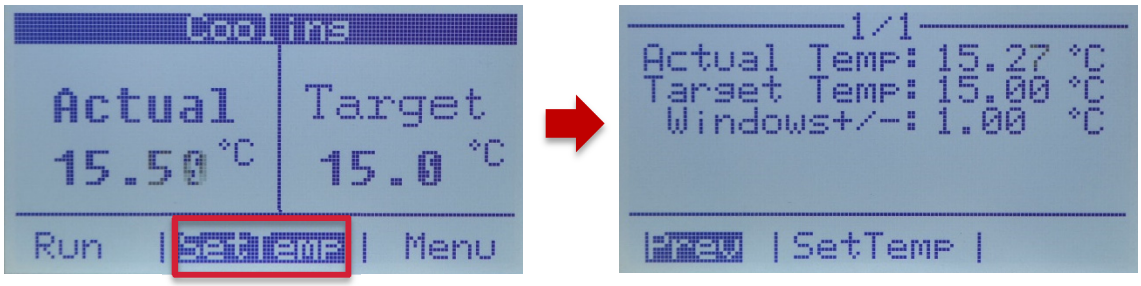


Figure 7 SetTemp Menu Accessed with Panel Control

4.2.3. Menu

Select Menu to enter the menu screen.

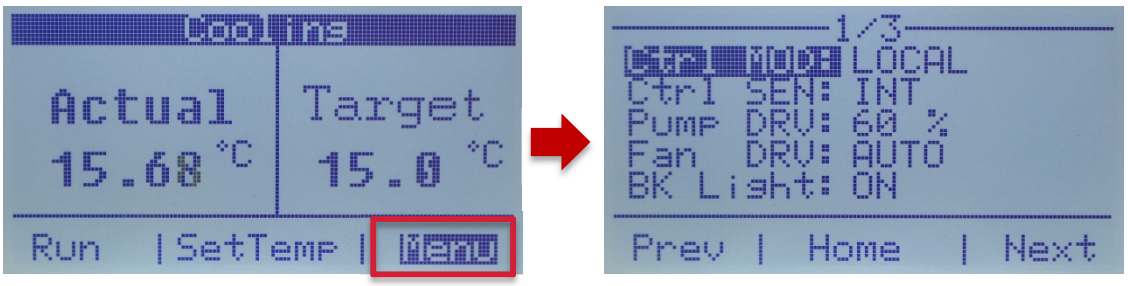


Figure 8 Select Menu to Enter Menu Screens

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.

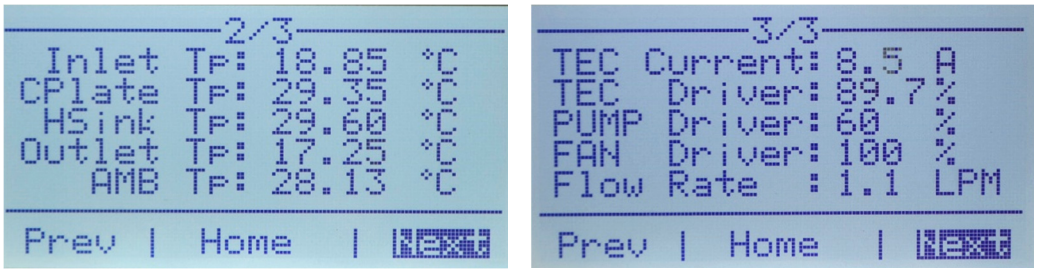


Figure 9 Second and Third Pages of the Menu Screen

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

4.2.4. 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

4.3. 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

4.4. LED Indicator

The LED indicator (F5 in Figure 1) 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. When an error occurs, it may be due to one of the following reasons:
    a) The device is working properly but the temperature has not reached the target.
    a) Low Flow: the Flow Measured by the Flow Meter is <0.1 Litre per Minute (LPM)
4. Red: There are errors in the device and operation has stopped. When an error occurs, it may be due to one of the following reasons:
    b) High Temperature Error: Any of the Internal Temperature Sensors are > 65 °C (TBD)
    c) Low Temperature Error: Any of the Internal Temperature Sensors are < -10 °C
    d) Low Level Error: Coolant Level is <25% of the Maximum Coolant Capacity
    e) No Flow Error: the Flow Measured by the Flow Meter is <0.1 Litre per Minute (LPM) for more than 30 seconds
    f) Pump Failure Error: Pump Open Circuit and Short Circuit
    g) TEC Failure Error: TEC Open Circuit and Short Circuit
    h) Fan Failure Error: Fan Open Circuit and Short Circuit.
    i) EXT Sensor Error: the Sensor is Set to External but no Temperature Sensor is Connected
    j) Connection Error: the Control Mode is Set to Remote but no Trig or Analog Cable is Connected

4.5. Connecting an External Sensor

On the front panel of the LK220, there is a 2.5 mm Stereo Jack (F2 in Figure 1). 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.

4.6. 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.

4.7. 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.

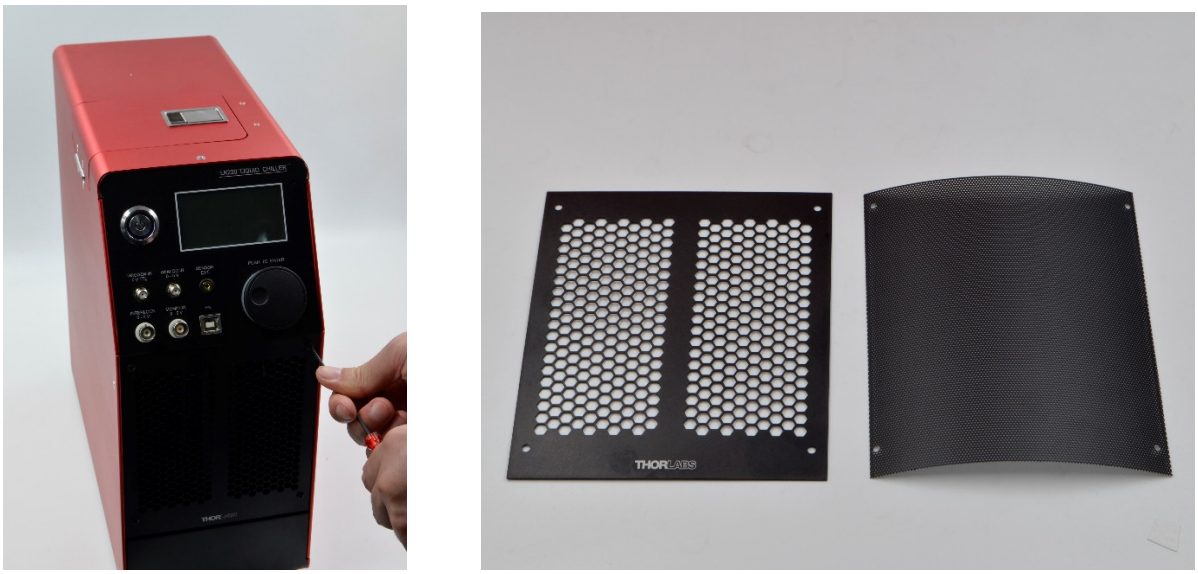


Figure 10 Unscrewing the Front Panel (Left) and Removing the Dust Filter (Right)

Chapter 5 Command Line Operation

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.

Command	Syntax	Description
Get Commands	COMMAND?	List the available commands
Get ID	IDN?	Return the device hardware and firmware versions
Get Device State	ST?	Return device state
Disable/Enable the Chiller	EN=0,1	0=Disable chiller,1=Enable chiller
Get Target Temperature	TSET?	Get the target temperature (range: -5.0 - 45.0 °C)
Set Target Temperature	TSET=n	Set the target temperature(n = -50 - 450, representing -5.0 - 45.0 °C)
Get Actual Temperature	TACT?	Get the actual temperature (range: -10.00 - 60.00 °C, resolution = 0.01°C)
Set Temperature Window	WINDOW=n	Set temperature window (n = 1 - 50, representing ±0.1 - ±5 °C)
Get Temperature Window	WINDOW?	Get temperature window ((range 0.1 - 5, representing ±0.1 - ±5 °C)
Set Control Mode	MOD=n	Set control mode (n = 0 Local; 1 Local-Analog; 2 Trig; 3 Trig-Analog)
Get Control Mode	MOD?	Return the control mode (n = 0 Local; 1 Local-Analog; 2 Trig; 3 Trig-Analog)
Set Control Sensor Mode	SENS=n	Set control sensor (0 = internal sensor; 1 = external sensor)
Get Control Sensor Mode	SENS?	Return control sensor state (0 = internal sensor; 1 = external sensor)
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
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
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
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
Set Pump Driver	PUMP=n	Set driving power of the coolant pump in LK220 (n = 10 - 100, representing 10 - 100%)
Get Pump Driver	PUMP?	Return the driving power of the coolant pump in LK220 (range 10 - 100%)
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%)
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%)
Get Tec Current	TEC?	Return “n”, n from 0 to 10.0, representing 0 - 10.0A
Get Liquid Flow Rate	FLOW?	Return the coolant flow rate: “n”, n from 0 to 5.0, representing 0 - 5.0 LPM
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.
Get Knob State	KNOB?	Get the knob state (0=Unlock 1=Locked)
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).
Get P Parameter	KP?	Return the gain value of the P share in the temperature PID control loop (range: 0 - 9.99)
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).
Get I Parameter	TI?	Return the gain value of the I share in the temperature PID control loop (range: 0 - 9.99).
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)
Get D Parameter	TD?	Return the gain value of the D share in the temperature PID control loop (range: 0 - 9.99)
Set Period Parameter	PERIOD=n	Set the integrating period of the PID servo loop (n = 500 - 5000, representing 500 - 5000ms).

Command	Syntax	Description
Get Period Parameter	PERIOD?	Return the integrating period of the PID servo loop “n” (n = 500 ~ 5000, representing 500 ~ 5000ms).
Get Error Message	ERR?	Return the error message value
Get Warning Message	WARN?	Return the warning message value
Get Monitor Message	MONITOR?	Return all monitor status
Load Factory Parameter	LOADFACT!	Restore the device factory parameters

5.1. Description of Commands

- **COMMAND? – Get Device Commands**

  Return: All of the command list in the Table1.

- **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.

- **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

- **EN=n – Disable/Enable the Chiller**

  n=0, Disable chiller;

  n=1, Enable chiller.

- **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.

- **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.

- **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.

- **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

- **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.

- **MOD=n – Set Control Mode**

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

- **MOD? – Get Control Mode**

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

- **SENS=n – Set Control Sensor**

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

- **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.

- **EXT=n – Set the EXT Sensor Type**

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

- **EXT? – Get the EXT Sensor Type**

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

- **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 10k ohm thermistor), n from 0 to 9999.

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

- **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 10k ohm thermistor), n from 0 to 9999.

- **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.

- **PUMP? – Get PUMP Driver**

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

- **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%.

- **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%)

- **TEC? – Get the TEC Current**

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

- **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).

- **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.

- **KNOB? – Get Knob State**

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

- **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.

- **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.

- **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.

- **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.

- **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

- **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.

- **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.

- **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.

- **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.

- **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.

- **LOADFACT! – Load Factory Parameter**

  Return: “>”, Restore the device to factory settings.

Chapter 6 Maintenance

6.1. Fuse Replacement

The fuse is located in the fuse drawer below the power inlet (B1 in Figure 1). 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. 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 11 Draining the Reservoir

Chapter 7 Specifications

Item #	LK220
Temperature Control Specifications	
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
Pumping Specifications	
Pump Type	Brushless DC Magnetic Drive
Static Pressure[d]	1.2 Bar (Typical)
Tubing Specifications	
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, .17" ID (6.4 mm OD, 4.3 mm ID)
General Specifications	
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

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

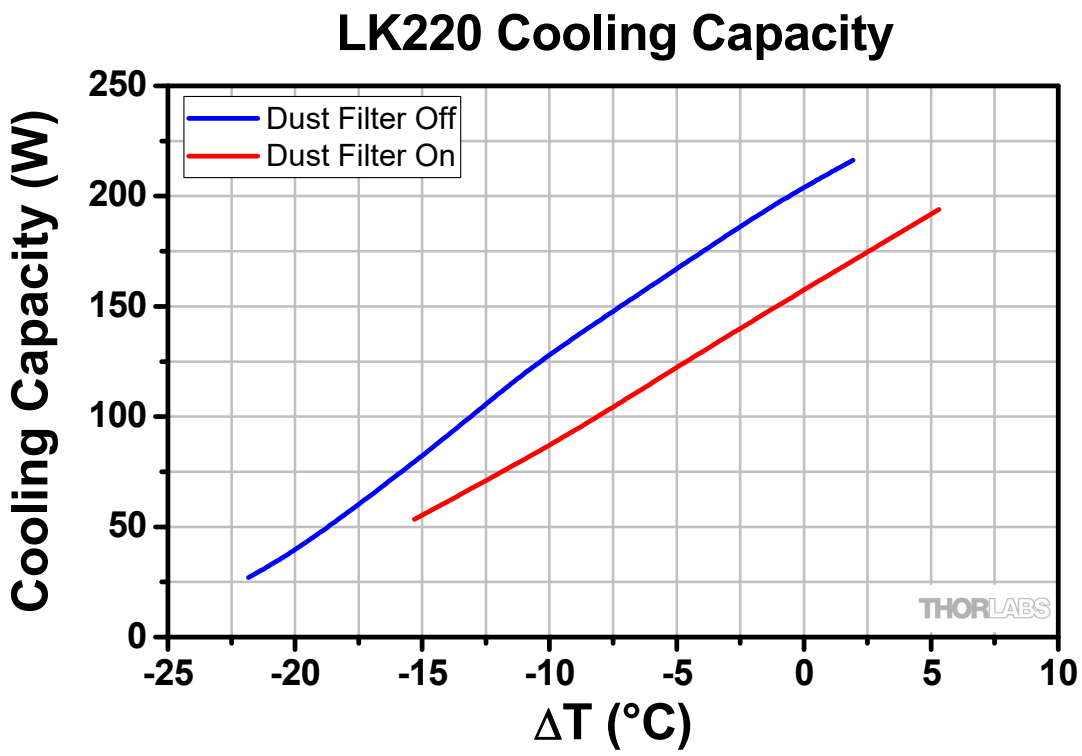


Figure 12 This graph shows the maximum heat load that the unit can dissipate. Alternatively, given a known heat load, this graph shows the minimum temperature that the unit can achieve and stabilize at. This data was measured with CDTX Coolflow DTX Refrigerant Antifreeze. The measurement with the dust filter off was taken at a 25 °C ambient temperature, while the ambient temperature was 20 °C for the dust filter on.

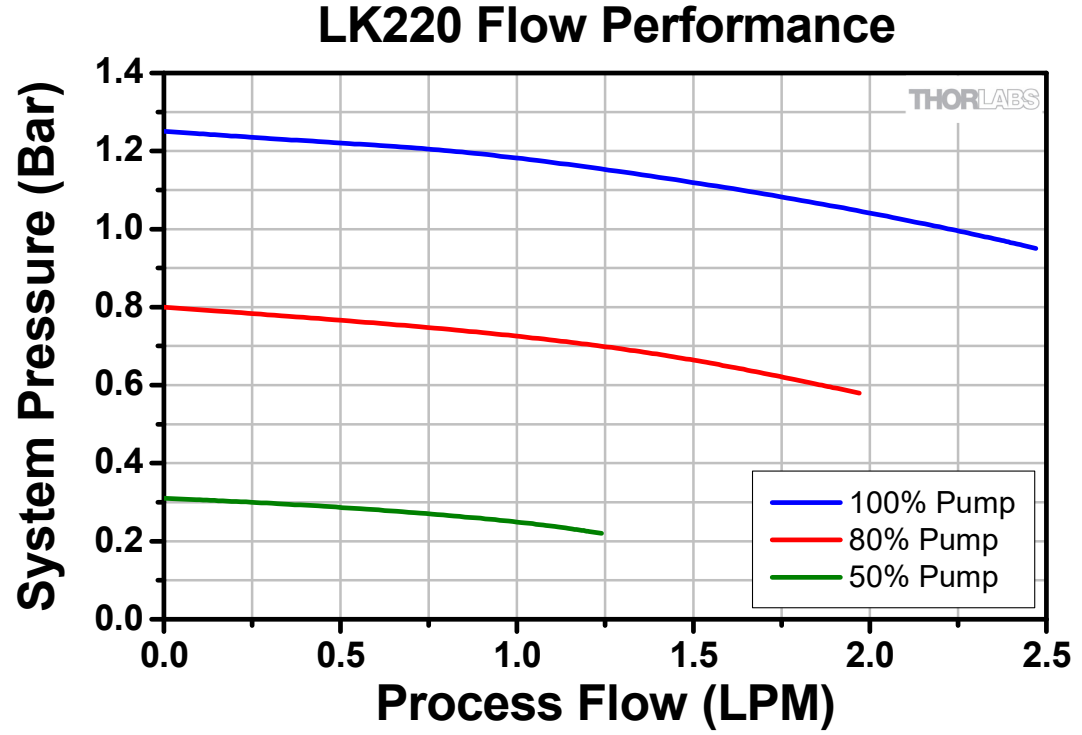


Figure 13 The Pumping Capability of LK220 at a 25 °C ambient temperature and with water used as coolant. Note that the kinematic viscosity of CDTX Coolflow DTX is approximately twice that of water and will result in less than half the flow performance.

Chapter 8 Mechanical Drawings

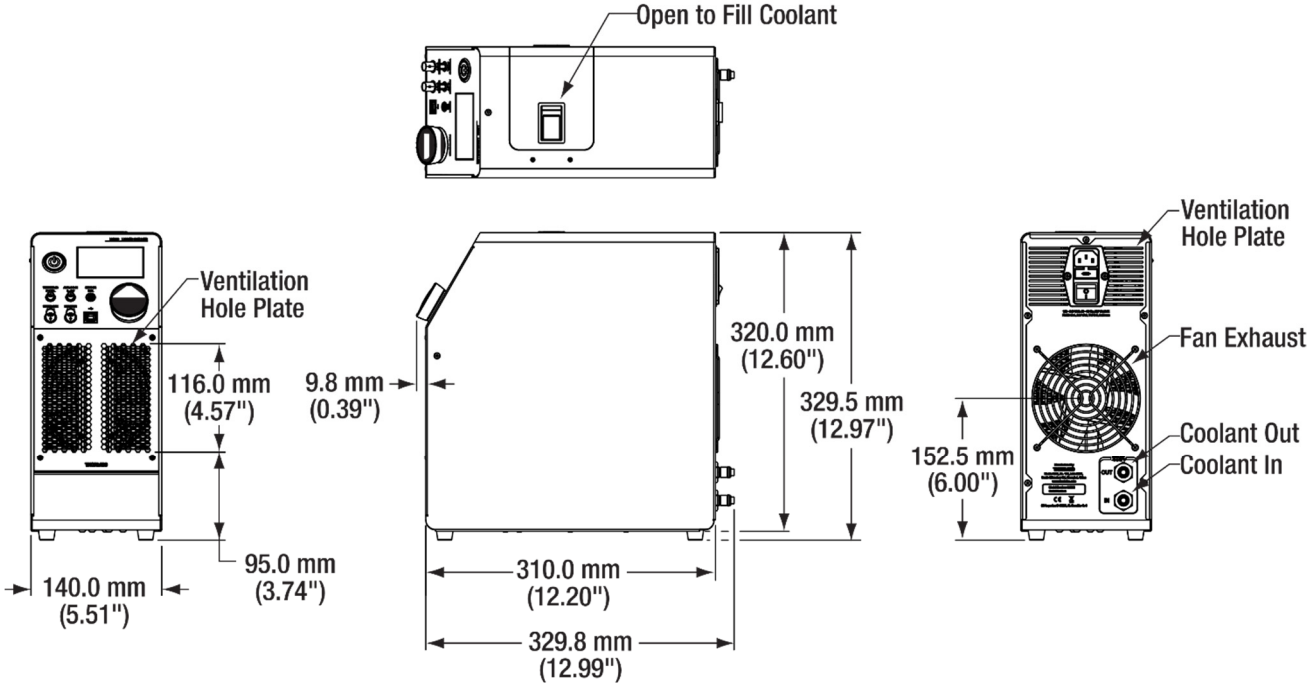


Figure 14 LK220 Diagram

Chapter 9 Certification and Compliance

CE

Declaration of Conformity

We: Thorlabs Optical Electronic Technology (Shanghai) Co., Ltd
of: Room A101, No.100, Lane 2891, South Qilianshan Rd, Shanghai

In accordance with the following Directive(s):

2014/35/EU	Low Voltage Directive (LVD)
2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2011/65/EU	Restriction of Use of Certain Hazardous Substances (RoHS)

hereby declare that:

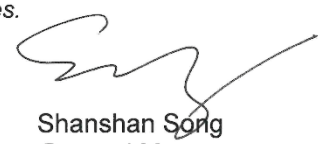
Model: ***LK220***
Equipment: ***Thermoelectric Liquid Chiller***

Is in conformity with the applicable requirements of the following documents:

EN 61010-1: 2010 (Third Edition)
EN 61326-1: 2013
EN 61326-2-1: 2013
EN 61326-2-2: 2013
EN 55011: 2009 + A1: 2010 (Class B)
EN 61000-3-2: 2014
EN 61000-3-3: 2013
IEC 61000-4-2: 2008
IEC 61000-4-3: 2006 + A1: 2007 + A2: 2010
IEC 61000-4-4: 2012
IEC 61000-4-5: 2014 + A1: 2017
IEC 61000-4-6: 2013
IEC 61000-4-8: 2009
IEC 61000-4-11: 2004 + A1: 2017

and which, issued under the sole responsibility of Thorlabs, is in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8th June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, for the reason stated below:
does not contain substances in excess of the maximum concentration values tolerated by weight in homogenous materials as listed in Annex II of the Directive.

I hereby declare that the equipment named has been designed to comply with the relevant section of the above referenced specifications, and complies with all applicable Essential Requirements of the Directives.

Signed:  on: 20. Nov 2019

Name: Shanshan Song
Position: General Manager

Declaration of Conformity

Thorlabs Optical Electronic Technology (Shanghai) Co., Ltd
Room A101, No.100, Lane 2891, South Qilianshan Rd., Shanghai

declares under it's own responsibility, that the product:

Thermoelectric Liquid Chiller

Model No.: **LK220**

fulfills the requirements of the standard

CISPR PUB. 22, FCC Part 15 Subpart B Class B

and therefore corresponds to the regulations of the directive.

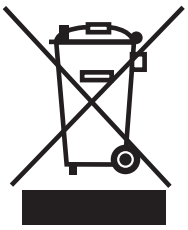
Signed:  on: 20. Nov 2019

Name: Shanshan Song
Position: General Manager

Chapter 10 Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated



Wheelie Bin Logo

As the WEEE directive applies to self-contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB’s, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

Waste Treatment is Your Own Responsibility

If you do not return an “end of life” unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.

Chapter 11 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.

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