TC300B
Heater and TEC Temperature Controller

User Guide



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Chapter 1 Introduction

1.1 Intended Use

This product is a benchtop controller intended for use with resistive heating or TEC elements rated up to 48 W. User-programmable maximum temperature and current/voltage limits protect the connected heating element from being overheated or over driven. Other safety features include an Open Sensor Alarm that will shut down the driver if the temperature sensing element is missing or becomes disconnected.

Capable of standalone operation from a simple keypad interface, this controller can be interfaced with a PC using a standard USB Type B connector using our TC300B Application Program, LabVIEW drivers, LabWindows drivers, or using a simple command-line interface from any terminal window.

Please make sure the TC300B is used in a 0 to 40 °C environment and the ventilation slots on the bottom and on the back panel of the device are not blocked.

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 TC300B Heater Temperature Controller is a dual channel controller intended for use with resistive heating elements. It is equipped with two channels, each with a driving capability up to 48 W, capable of either independent or synchronized operation. This general-purpose instrument can drive various types of heaters, including foil and resistor types. It accepts feedback from various type of temperature sensors including resistive temperature sensor and thermal couples (AD590). Each channel has programmable P, I, and D gains as well as an auto-tune function. A user-programmable maximum temperature limit provides protection to the device being overheated, and a user-programmable current/voltage limit protects the heating element from being over driven.

Capable of stand-alone operation from a simple keypad interface, the TC300B can also be controlled with a PC using a standard USB Type B connector and our TC300B Application Program. Additionally, interfacing with a PC can be achieved with a simple command-line interface from any terminal window.

1.4 Technical Data

1.4.1 Specifications

TC300B	Value
Max Output Power Per Channel	48 W
Max Output Current Per Channel	2 A
Max Output Voltage Per Channel	24 V
Temperature Setting Range	Sensor Dependent, -200 to 400 °C
Set Point Resolution	0.1 °C / 0.001 °C[a]
Temperature Stability	±0.1 °C
Sensor Types	Thermistor, AD590, Thermocouple, 2-Wire and 4-Wire Platinum 100 Ω, 2-Wire and 4-Wire Platinum 1000 Ω
Output Connector Type	Hirose HR10A-7R-6S(73)
USB Interface	USB 2.0 Type-B
Power Supply	100 - 240 VAC, 50 - 60 Hz, 165 VA Max
Ambient Operating Temperature	0 - 40 °C
Storage Temperature	-15 - 65 °C
Dimensions (H x W x D)	86.6 mm x 154.3 mm x 327.8 mm (3.41" x 6.07" x 12.91")
Weight	1.7 kg

a. 0.001 °C Resolution Only In High Resolution Mode; Requires NTC Thermistor

1.4.2 Mechanical Drawings

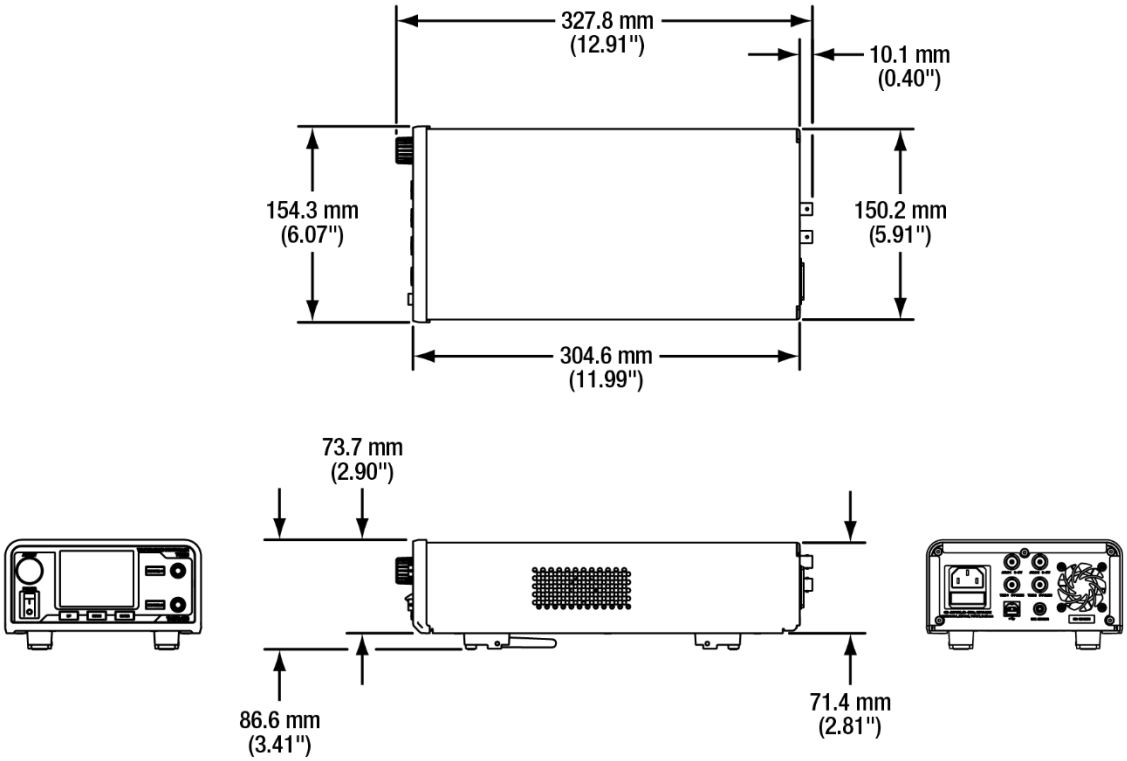


Figure 1 TC300B Mechanical Drawing

1.5 Pin Diagram

On the front panel of the TC300B controller there are two 6-pin Hirose connectors. Each corresponds to an operational channel of the TC300B controller. The two connectors allow users to wire the heaters and sensors to the TC300B controller for temperature control operation. The detailed pin assignment is shown below.



Pin Number	Definition
Pin 1	Heater/TEC Output Positive
Pin 2	Heater/TEC Output Negative
Pin 3	Sensor Input Positive (4-Wire PT100/PT1000 Only)
Pin 4	Sensor Input Positive
Pin 5	Sensor Input Negative
Pin 6	Sensor Input Negative (4-Wire PT100/PT1000 Only)

NOTICE

Never wire the heater output to any of the sensor input pins. Maximum voltage and current of sensor inputs (Pins 3 - 6) are 7 V and 30 mA respectively. Sending signal exceeding these levels into the sensor input pins will cause permanent damage to the TC300B controller.

1.6 Components

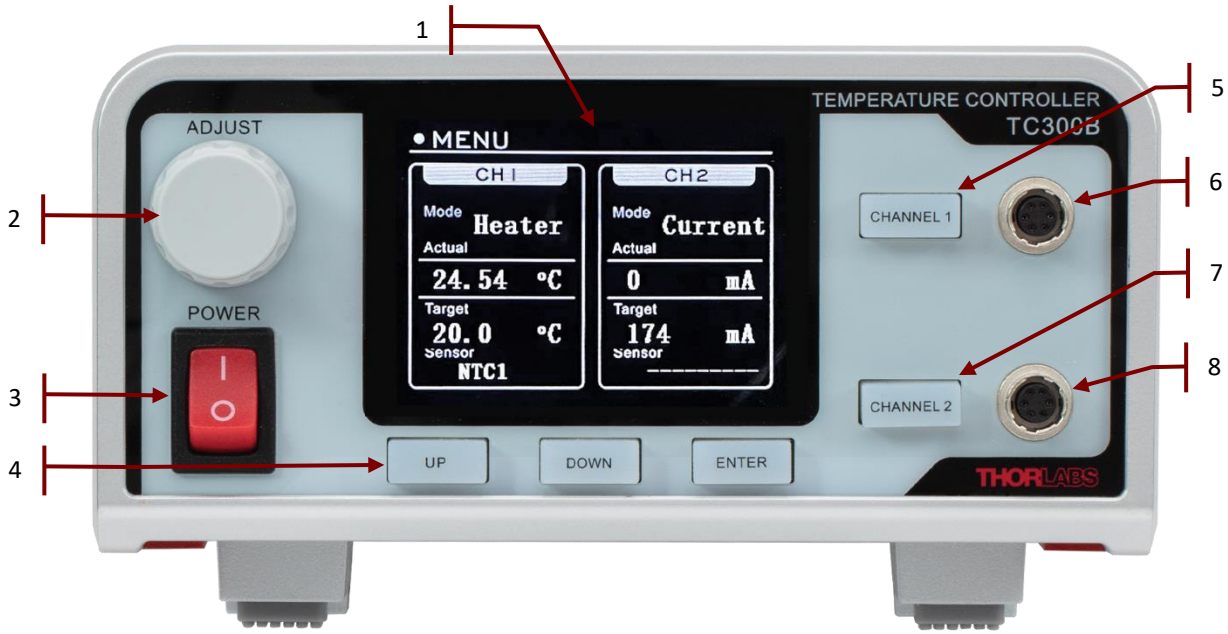


Figure 2 TC300B Front Panel

Front Panel	
Callout	**Description**
1	LCD Screen – When the device is switched on, the main user interface is displayed on the LCD
2	Adjustment Knob – The knob can be used to navigate the user interface and change values
3	Power Switch – Turns the unit on and off
4	Keypads – Used to navigate the user interface
5	Enable/Disable Button for Channel 1 - This button enables/disables Channel 1. The button is equipped with a built-in LED indicator which lights on when Channel 1 is enabled and off when Channel 1 is disabled
6	6-pin Hirose Connector for Channel 1 - For detailed pin assignment see Section 1.5.
7	Enable/Disable Button for Channel 2 - This button enables/disables Channel 2. The button is equipped with a built-in LED indicator which lights on when Channel 2 is enabled and off when Channel 2 is disabled
8	6-pin Hirose Connector for Channel 2 - For detailed pin assignment see Section 1.5.

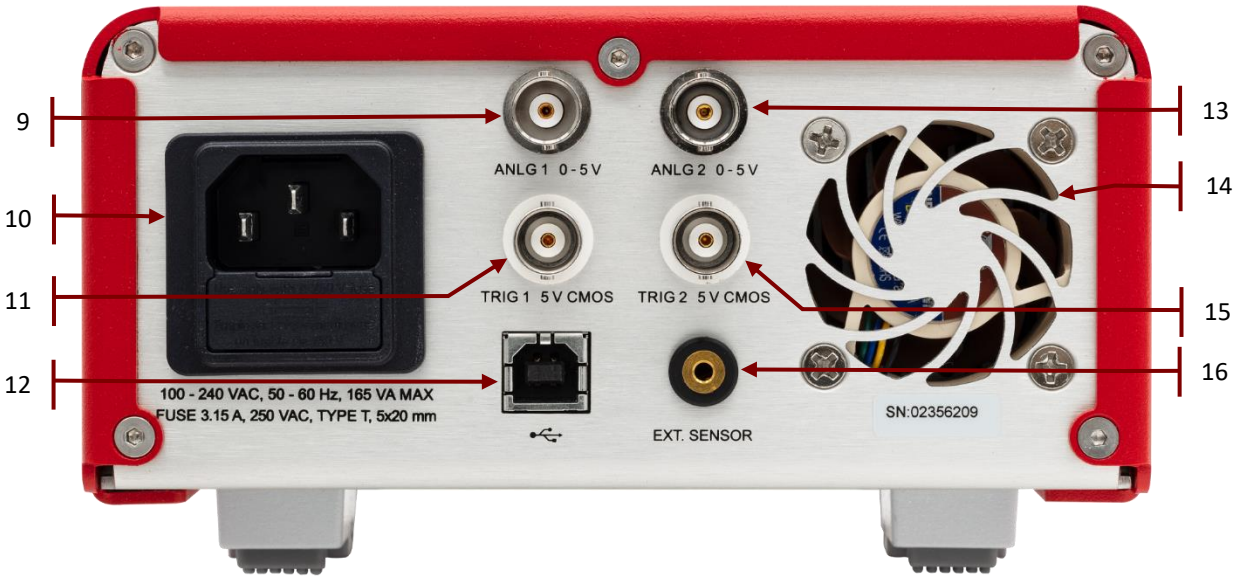


Figure 3 TC300B Back Panel

Back Panel	
Callout	**Description**
9	Analog Output of Channel 1 (ANLG1) - 0 to + 5 V output proportional to the actual temperature of Channel 1; 0 V corresponds to the minimum temperature setting and + 5 V corresponds to the maximum temperature setting of Channel 1.
10	AC Input Connector
11	Trigger of Channel 1 (TRIG1) - When set to input: high level (+5 V) input will enable Channel 1, and low level (0 V) input will disable it. When set to output: outputs high level (+5 V) when Channel 1 is enabled and outputs low level (0 V) when Channel 1 is disabled.
12	USB Type B Connector – For software and command line operation. For more details, see Chapter 7 and Chapter 8.
13	Analog Output of Channel 2 (ANLG2): 0 to + 5 V output proportional to the actual temperature of Channel 2; 0 V corresponds to the minimum temperature setting and + 5 V corresponds to the maximum temperature setting of Channel 2.
14	Cooling Fan
15	Trigger of Channel 2 (TRIG) - When set to input: high level (+5 V) input will enable Channel 2, and low level (0 V) input will disable it. When set to output: outputs high level (+5 V) when Channel 2 is enabled and outputs low level (0 V) when Channel 2 is disabled.
16	Mono Jack Socket for External Sensor

1.7 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=14852

1.8 FCC Designation

Class A FCC Designation - User Manual Text
For a Class A digital device or peripheral, the instructions furnished in the user manual shall include the following or similar statement, placed in a prominent location in the text of the manual:

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.

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 TC300B is shipped with the following components:

- TC300B Controller
- Regional Power Cord
- USB Type-B Cable, 2 m (79”) Long
- Quick Start Guide

Chapter 4 Operation

4.1 Initial Setup

Set the device on a benchtop. Make sure the device is switched off and the power cord is disconnected. All wiring should be done when the unit is powered OFF.

NOTICE Do NOT perform any wiring when the unit is powered on as it may cause permanent damage to the TC300B controller.

4.2 Heater connection

Most resistive heaters do not have a polarity, so simply wire the heater to pin 1 (output heater positive) and pin 2 (output heater negative) of the Hirose connector on the front panel, as shown in Figure 4. The TC300B is compatible with most resistive heaters but achieves maximum efficiency when paired with heaters with 12 Ω resistance.

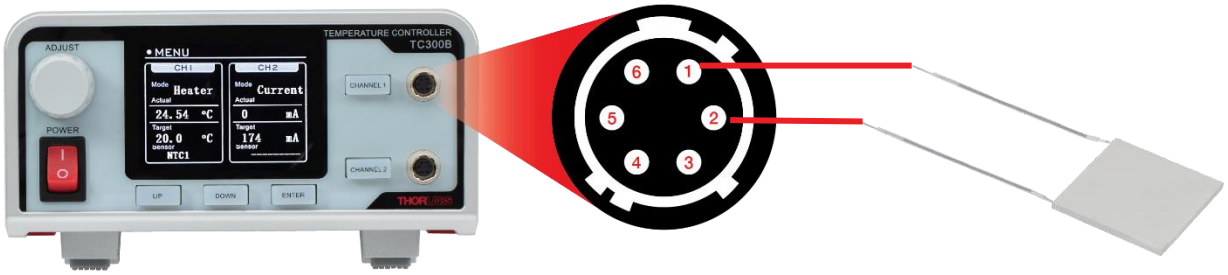


Figure 4 Heater Connection

4.3 Thermal Sensor Connection

The TC300B is compatible with a variety of different types of temperature sensors including:

- Thermistors
- Platinum Resistance Temperature Sensors
- Thermocouples
- AD590

Each sensor type requires a slightly different wiring and set up.

NOTICE Never wire the heater output to any of the sensor input pins. Maximum voltage and current of sensor inputs (pins 3 - 6) are 7 V and 30 mA respectively. Sending signals exceeding these levels into the sensor input pins will cause permanent damage to the TC300B controller.

4.3.1 Thermistors

The TC300B controller is compatible with thermistors with resistance of up to 999 kΩ. Most thermistors do not have polarity. To connect a thermistor to the TC300B, simply wire the thermistor to pin 4 (sensor positive) and pin 5 (sensor negative) of the Hirose connector as shown in Figure 5.

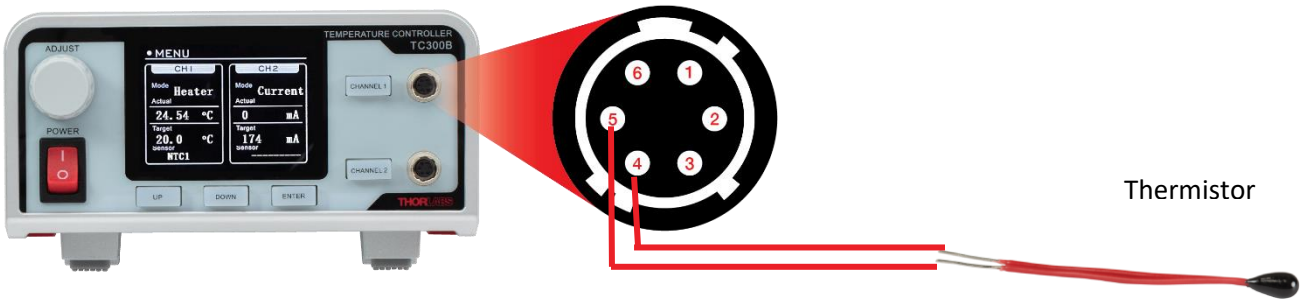


Figure 5 Thermistor Connection

4.3.2 Platinum Resistance Temperature Sensors

The TC300B controller is compatible with both 100 Ω (PT100) and 1000 Ω (PT1000) platinum resistance temperature sensors. Both 2-wire and 4-wire connections are supported.

A 2-wire platinum resistance temperature sensor usually does not have polarity. To connect a 2-wire sensor, simply wire the sensor to pin 4 (sensor positive) and pin 5 (sensor negative) of the Hirose connector, as shown in Figure 6.

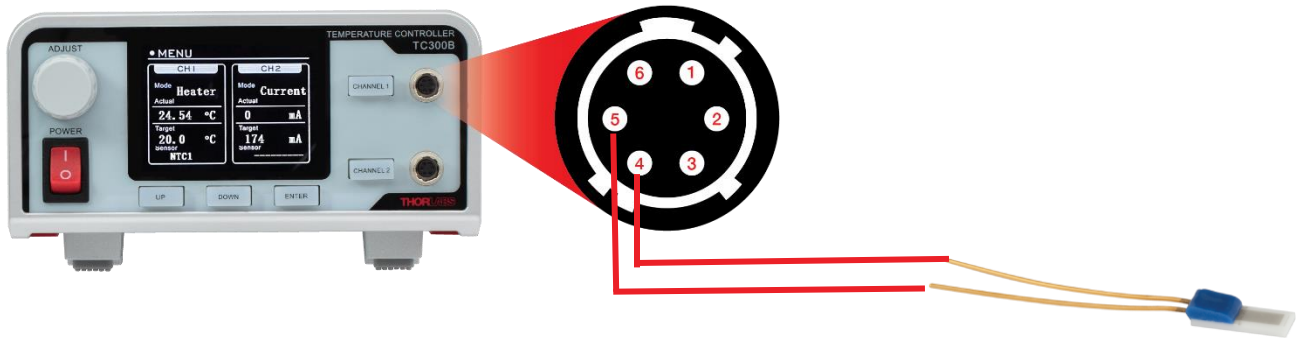


Figure 6 2-Wire Platinum Sensor Connection

However, as the resistance of platinum sensors is relatively low, we recommend using sensors that support 4-wire connection which can help to alleviate problems due to extension wire length and resistance imbalance between the leads, providing a much more accurate measurement.

A 4-wire platinum sensor has 4 wires divided into two color coded groups. Connect the two wires from one group to pin 3 (sensor positive, 4 Wire PT100/PT1000 only) and pin 4 (sensor positive) and connect the other two wires from the other group to pin 5 (sensor negative) and pin 6 (sensor negative, 4 Wire PT100/PT1000 only), as shown in Figure 7.

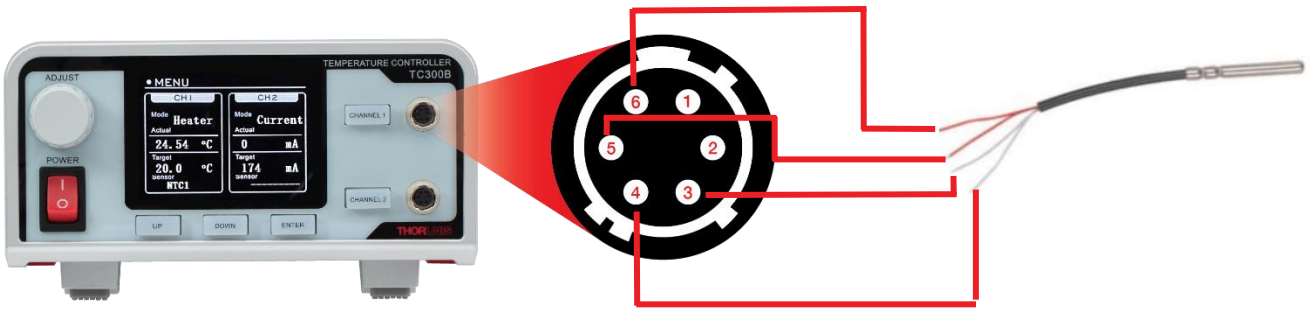


Figure 7 4-Wire Platinum Sensor Connection

3-wire platinum sensors are not supported by the TC300B controller.

4.3.3 Thermocouples

Thermocouples are usually polarized. To connect a thermocouple to the TC300B, wire the positive lead to pin 4 (sensor positive), and the negative lead to pin 5 (sensor negative), as seen in Figure 8.

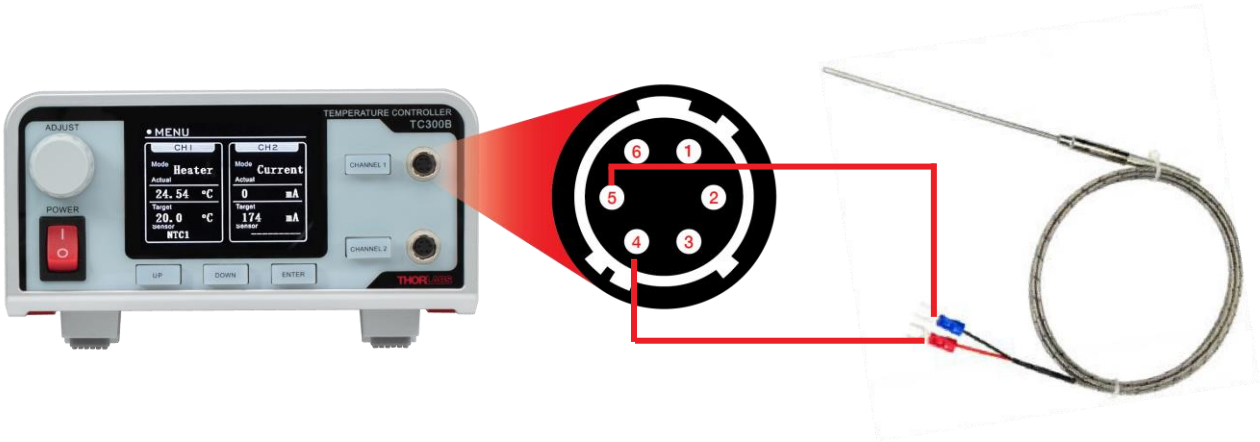


Figure 8 Thermocouple Connection

4.3.4 AD590

The TC300B controller also supports the AD590 temperature transducer. To connect an AD590 to the TC300B controller, wire the positive lead (anode) to pin 4 (sensor positive), and the negative lead (cathode) to pin 5 (sensor negative), as seen in Figure 9.

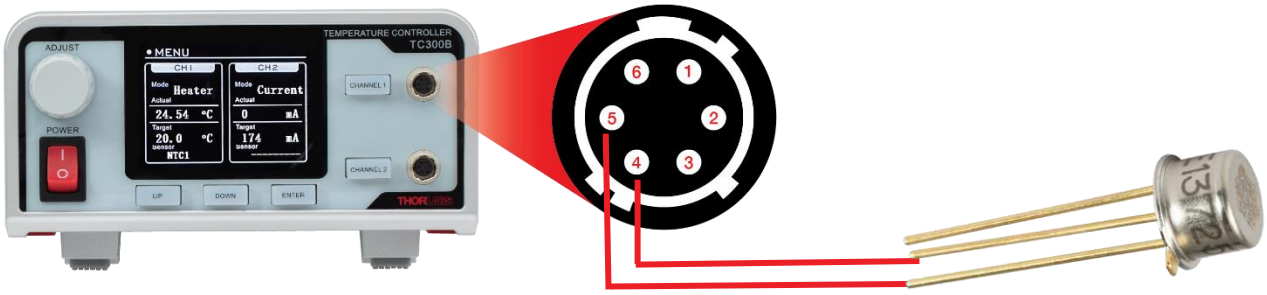


Figure 9 AD590 Connection

4.3.5 External Sensor Port

The TC300B controller allows the user to connect a thermistor via the “EXT. SENSOR” port on the back panel. The EXT.SENSOR port accepts a 2.5 mm stereo earphone jack. It is directly compatible with the Thorlabs TSP-TH temperature probe sensor.

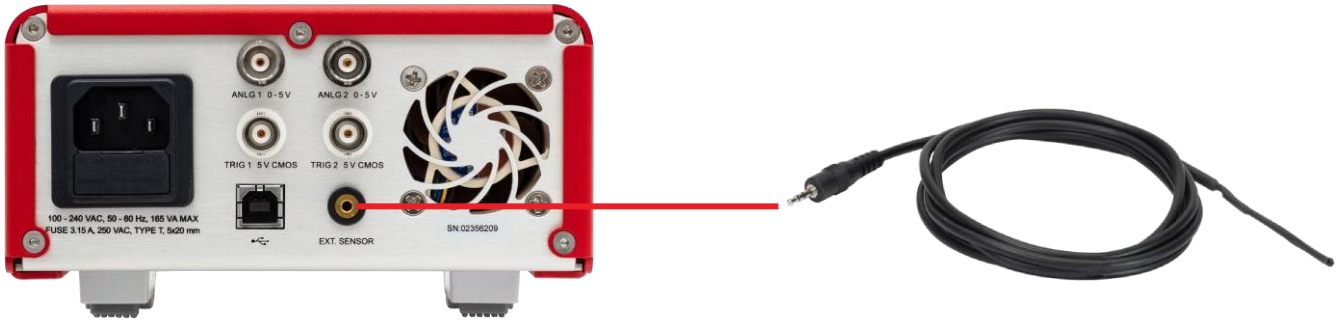


Figure 10 External Sensor Connection

It is also possible for users to utilize the EXT. SENSOR port with third-party thermistors. Users would need to have a cable with a 2.5 mm stereo jack on one end and an open lead at the other. Wire the thermistor in between the two leads corresponding to the TH+ and TH- contact of the 2.5 mm stereo jack (as shown in Figure 11). The TC300B supports thermistors with resistance up to 999 kΩ.

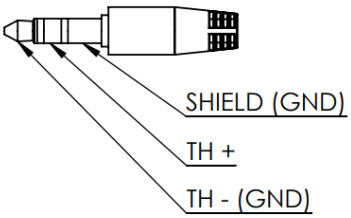


Figure 11 External Sensor Connector (2.5 mm Stereo Jack)

4.4 Turning the TC300B Controller On

Once both the heater and the thermistor are correctly connected, the unit is ready to be powered on. Connect the power line to the AC inlet on the back panel with the included power cord and press the rocker switch on the front panel to turn on the device.

The device will take a few seconds to initialize and then it will enter the HOME screen.

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

4.5 Font Panel Operation

Use the three buttons beneath the LCD to interact with the TC300B controller. Press the “UP” and “DOWN” buttons to move the cursor on the screen. Press the “ENTER” button to confirm or cancel selection. When a value is selected, the color of the text will become yellow. Pressing the “UP” button will then increase the value and pressing the “DOWN” button will decrease the value. Once the change to a value is done, press “ENTER” again to validate the change.

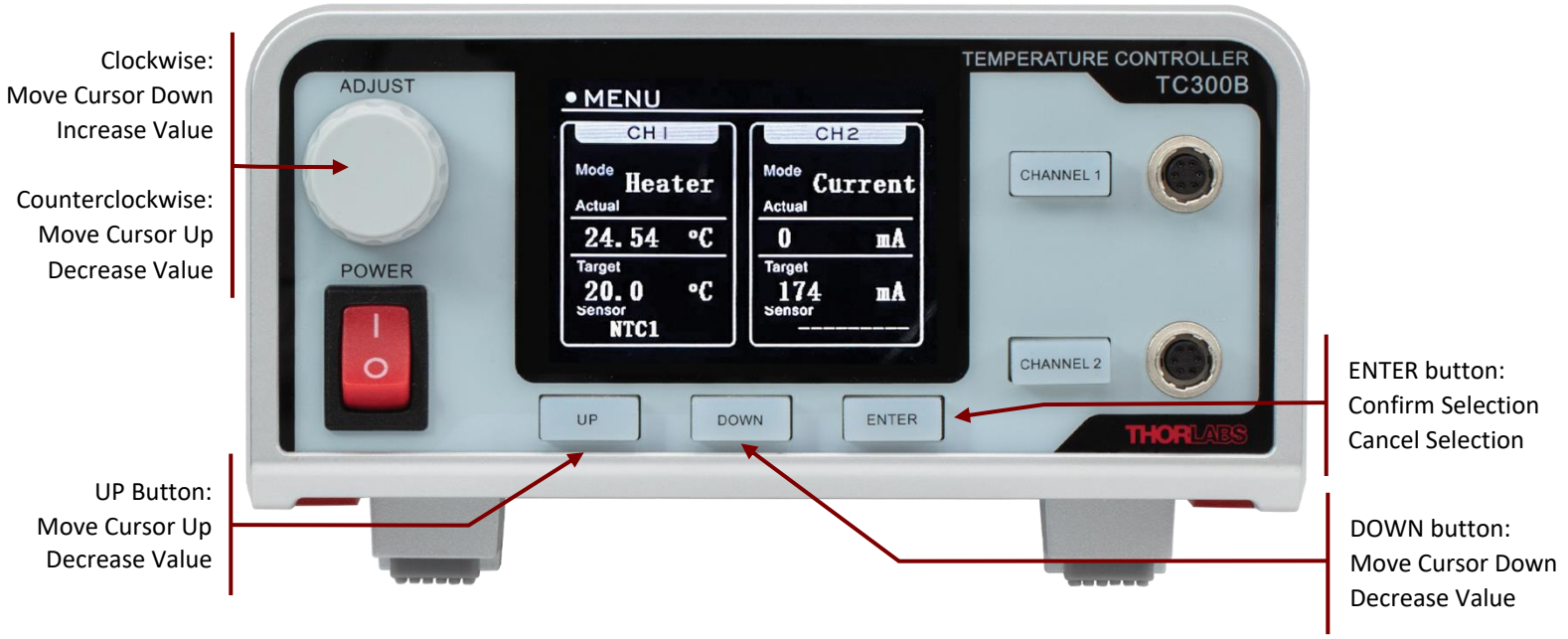


Figure 12 Front Panel

Alternatively, the knob above the power switch can be used to navigate the user interface and make changes to values. Turning the knob clockwise will move the cursor on the screen downwards and turning the knob counterclockwise will move the cursor upwards. When a value is selected by pressing the “ENTER” button, turn the knob clockwise to increase and counterclockwise to decrease the value.

When in the HOME screen, move the cursor to the “MENU” icon on top of the main screen and press “ENTER” to access the menu screen.

In the menu screen, moving the cursor to the icon and pressing the “ENTER” button will enter the next menu screen. Move the cursor to the icon and press the “ENTER” button to go back to the previous menu screen. Move the cursor to icon and press “ENTER” to go back to the HOME screen.

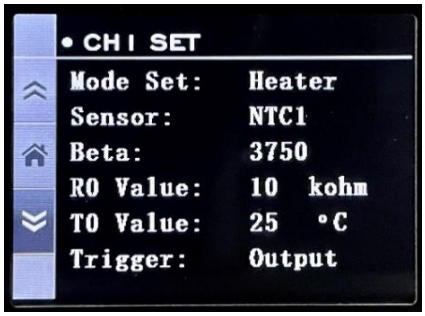


Figure 13 Menu Screen

4.6 Menu Structure

The TC300B controller is set to single channel operation by default. When in single channel operation, only the parameters of Channel 1 will be displayed on the HOME screen and only the settings of Channel 1 will be visible in the menus. In the menus, there are three screens for setting the parameters of Channel 1 and one screen for general options settings of the device.



Figure 14 Menu Structure in Single Channel Operation

When in dual channel operation, the parameters of both Channel 1 and Channel 2 will be displayed on the HOME screen. Settings of both channels will be visible in the menus. For each channel, there are 3 screens for setting parameters. There is one screen for general options settings of the device.

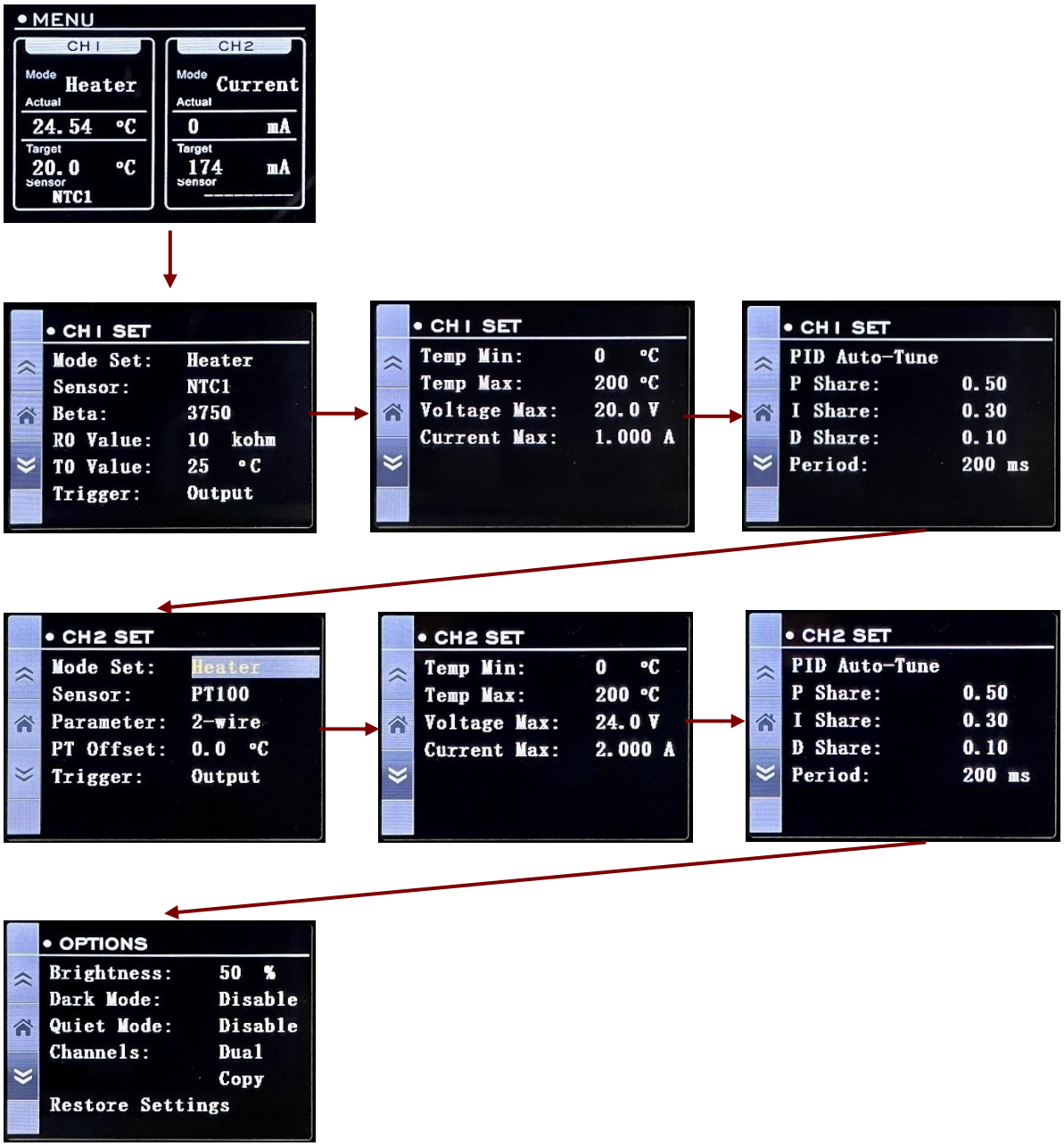


Figure 15 Menu Structure in Dual Channel Operation

4.7 Compatible Thorlabs Devices

The Thorlabs devices listed are compatible with TC300B. Since they are all equipped with the corresponding 6-pin Hirose connector, they support plug-and-play operation with the TC300B with no extra wiring required.

- GCH25-75, Heater Assembly for Ø9, Ø19, or Ø25 mm x 75 mm Glass Cells
- TLK-H, Flexible Polyimide Foil Heater with 10 k? Thermistor and 6 Pin Hirose Connector

- SM1L10HR, Temperature-Controlled SM1 Lens Tube
- LCC1xxxT, Temperature-Stabilized Full-Wave and Half-Wave LC Retarders
- Flexible Resistive Foil Heaters (HT10K);
- Resistive Cartridge Heaters (HT15W);
- Metal Ceramic Heaters (HT10KR1/HT19K);
- Temperature-Controlled Mounts for TO-Can Laser Diodes
- TEC elements (≤2.0A);

4.8 Operation Mode

The TC300B controller supports three different operation modes: heater mode, TEC mode, and constant current mode.

In heater or TEC mode, the TC300B controller works in a closed loop, taking temperature measurements from the temperature sensor and adjusting the current applied to the heater automatically based on a PID algorithm to reach and maintain a set target temperature. Thus a temperature sensor is necessary when working in heater mode or TEC mode.

In heater or TEC mode, the sensor type, the actual temperature, and the target temperature will be shown on the main screen. To change the target temperature, move the cursor on to the target temperature number, press "ENTER" button to confirm selection, and then turn the knob or press the "UP" or "DOWN" buttons to change value. Press "ENTER" again to validate the value change.

NOTICE Heaters and TEC elements are driven by current, if the output voltage is set too high then the power consumption of the controller can become too high which can cause a HSINK over temperature alarm, disabling the outputs entirely.

In current mode, the TC300B works as a current source in an open loop. It outputs a constant current according to a user inputted current value. A temperature sensor is not needed when working in current mode.

In current mode, only the target current and actual current reading will be shown on the main screen. To change the target current, move the cursor on to the target current number, press the "ENTER" button to confirm selection, and then turn the knob or press "UP" or "DOWN" button to change value. Press "ENTER" again to validate the value change.

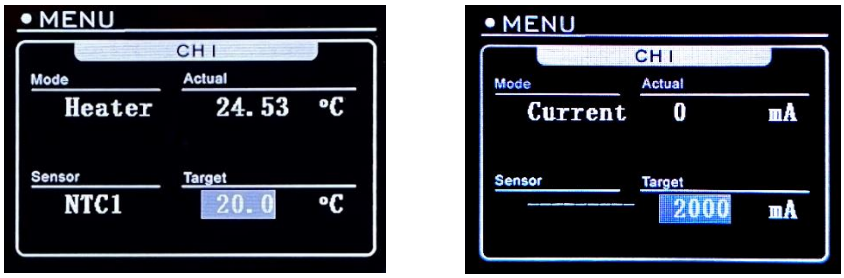


Figure 16 Main Screens for Heater and Current Mode

⚠WARNING

Hot Surface

In current mode, the TC300B does not monitor the temperature of any attached sensor. The temperature of the heating element can rise to a level that could cause harm to the heater and become a hazard to personnel.

To set the operation mode of the TC300B controller, go to the first setting screen of each channel, move the cursor on “Mode Set”, and press “ENTER” to confirm selection. Then use the knob or the “UP”/“DOWN” buttons to toggle between “Heater” and “Current”. Press “ENTER” again to confirm selection. When current mode is selected, the settings of the temperature sensor will not be shown on screen.



Figure 17 Toggling Between Heater and Current Mode

4.9 Sensor Configuration

In the first setting screen of each channel, move the cursor on “Sensor” and press “ENTER” to confirm selection, then use the knob or “UP”/ “DOWN” buttons to select the correct type of sensor. Press “ENTER” again to confirm selection.

The sensor types below are available to be selected in the setting screen. Each sensor type has a few different variable parameters that will be displayed on the screen beneath the sensor type accordingly.

- NTC1: Thermistor whose resistance is defined by the “Beta” formula
- NTC2: Thermistor whose resistance is defined by the Steinhart-Hart equation
- PT100: 100 Ω Platinum Resistance Temperature Detector
- PT1000: 1000 Ω Platinum Resistance Temperature Detector
- THERMO C.: Thermocouple
- AD590: Temperature Transducer AD590
- EXT1: Thermistor whose resistance is defined by the “Beta” formula, connected to EXT.SENSOR port
- EXT2: Thermistor whose resistance is defined by the Steinhart-Hart equation, connected to EXT.SENSOR port

NOTICE

The TC300B controller can only determine shorted or open sensor connections; it cannot determine if the installed sensor does not match the programmed sensor selection. Care must be taken to ensure that the settings match the actual sensor used, or damage will occur to the heating system.

4.9.1 Thermistors (NTC1 and NTC2)

When the sensor type is set to NTC1, the TC300B measures the resistance value of the thermistors wired to the Hirose connectors on front panel and calculates the temperature based on the "Beta" formulas defined below.

$$R(T) = R_0 * e^{\beta\left(\frac{1}{T} - \frac{1}{T_0}\right)}$$

$$\text{Thus} \qquad T(R) = \frac{\beta * T_0}{T_0 * ln\left(\frac{R}{R_0}\right) + \beta}$$

T - Temperature in K (Kelvin)
R - Thermistor resistance at temperature
β - Thermistor constant (sensitivity index, B value, Beta)
R_0 - Thermistor nominal resistance at temperature T0
T_0 - Nominal temperature (usually 298.15 K = 25° C)

The TC300B allows users to set the values of β (Beta), R_0, and T_0. For different thermistors, the actual value of these parameters can vary and can usually be found on their datasheets.



Figure 18 Sensor Settings for Thermistors

The TC300B controller also supports the Steinhart-Hart method for approximating the relation between temperature and thermistor resistance when the sensor type is set to NTC2.

The Steinhart-Hart method can be described by the formula

$$1/T = A + B * \ln(R) + C * (\ln(R))^3$$

with T being the temperature in K (Kelvin) and A, B, and C being the Steinhart-Hart parameters. The TC300B allows user input of the A, B, and C parameters. For thermistors that support the Steinhart-Hart method, the actual value of A, B, and C can usually be found on their datasheets.

There is a high-resolution display mode for NTC sensors. In the high resolution mode the measured temperature resolution is 0.0001℃ and the target temperature resolution is 0.001℃. To set the resolution mode, please refer to Section 4.12.

4.9.2 Platinum Resistance Temperature Detector (PT100 and PT1000)

The TC300B controller is compatible with both 100 Ω (PT100) and 1000 Ω (PT1000) platinum resistance temperature detectors. When working with platinum sensors, set the sensor type to PT100 or PT1000 according to the sensor wired to the Hirose connector on front panel.

The TC300B controller measures the resistance and calculates the temperature for PT100 and PT1000 platinum resistance temperature detectors using the following formula:

$$R = R_0(1 + A * T + B * T^2)$$

A = 3.9083 x 10^{-3} °C^{-1}
B = -5.775 x 10^{-7} °C^{-2}
T - Temperature in K (Kelvin)
R - Thermistor resistance in Ω at temperature T
R_0 - 100 Ω for the PT100; 1000 Ω for the PT1000

The TC300B supports 2-wire and 4-wire connection for both PT100 and PT1000. When the sensor type is set to PT100 or PT1000, select the "Parameter" option to toggle between the 2-wire and 4-wire connection setting.

As the resistance of platinum sensors is relatively low so we recommend using sensors that support 4-wire connection which can help to alleviate problems due to extension wire length and resistance imbalance between the leads, providing a much more accurate measurement result.

When the sensor type is set to PT100 or PT1000, the TC300B controller also offers the option of a user input offset to allow the device to compensate for a known deviation in temperature measurement.

To determine the offset value, a reference temperature measurement needs to be made with an additional instrument. Use the platinum sensor connected to the TC300B controller and the reference instrument to measure the temperature of the same item at the same spot. The PT Offset value will then be:

$$PT\ Offset = T_{reference} - T_{TC300}$$

$T_{reference}$: Temperature reading of the third-party reference instrument
T_{TC300B}: Temperature reading of the TC300B controller with platinum sensor



Figure 19 Sensor Settings for Platinum Sensors

3-wire platinum temperature detectors are not compatible with the TC300B controller.

4.9.3 Thermocouple (THERMO C.)

When using thermocouples as temperature sensors, set the sensor type to THERMO C.

The TC300B supports both J type and K type thermocouples. Set the Parameter according to the type of sensor wired to the Hirose connector on the front panel.

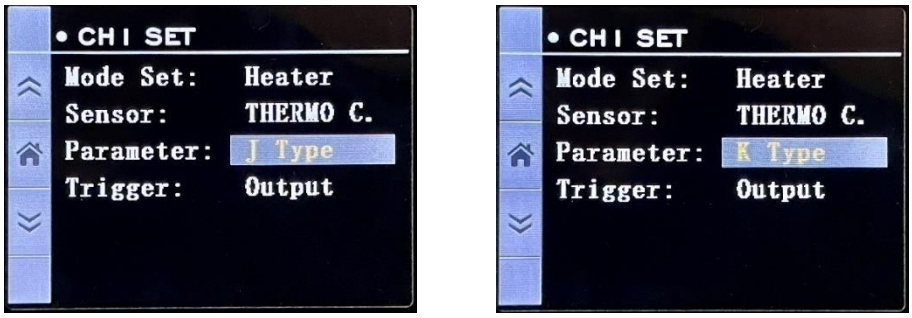


Figure 20 Sensor Settings for Thermocouples

4.9.4 AD590

When using an AD590 temperature transducer, set the sensor type to AD590. There are no variable parameters for AD590 sensors.

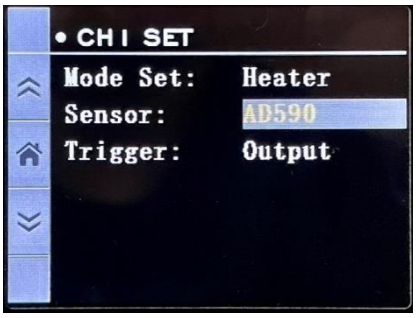


Figure 21 Sensor Settings for AD590

4.9.5 External Sensor

When a temperature sensor is connected to the "EXT. SENSOR" port on the back panel, setting the sensor type to EXT1 or EXT2 will allow the TC300B to take the temperature reading from the external sensor. Currently only thermistor-type temperature sensors are supported by the "EXT. SENSOR" port.

When the sensor type is set to EXT1, the TC300B measures the resistance value of the thermistors wired to the "EXT. SENSOR" port and calculates the temperature based on the "Beta" formulas:

$$R(T) = R_0 * e^{\beta\left(\frac{1}{T} - \frac{1}{T_0}\right)}$$

$$\text{thus} \quad T(R) = \frac{\beta * T_0}{T_0 * ln\left(\frac{R}{R_0}\right) + \beta}$$

T - Temperature in K (Kelvin)
R – Thermistor resistance at temperature T
β - Thermistor constant (sensitivity index, B value, Beta)
R_0 - Thermistor nominal resistance at temperature T0
T_0 - Nominal temperature (usually 298.15 K = 25 °C)

The TC300B controller allows users to set the values of β (Beta), R_0, and T_0. The default value is set to match the parameters of Thorlabs' TSP-TH temperature sensor. For different thermistors, the actual value of these parameters can vary and can usually be found on their datasheets.

When the sensor type is set to EXT2, the temperature is calculated based on the Steinhart-Hart method:

$$1/T = A + B * \ln(R) + C * (\ln(R))^3$$

with T being the temperature in K (Kelvin) and A, B, and C being the Steinhart-Hart parameters. The TC300B controller allows user input of the A, B, and C parameters. For thermistors that support the Steinhart-Hart method, the actual value of A, B, and C can usually be found on their datasheets.

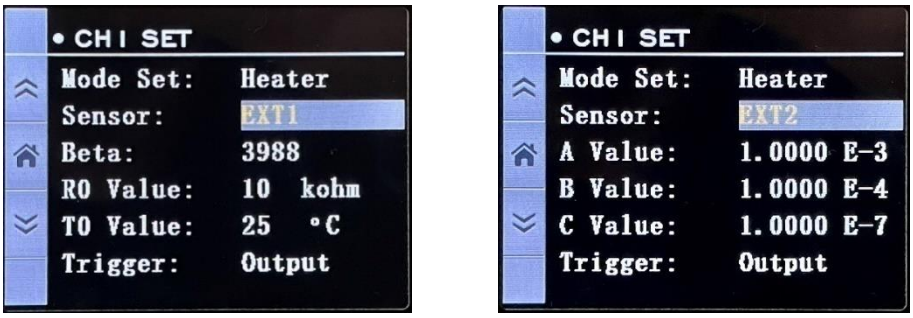


Figure 22 Sensor Settings for External Sensor

4.10 Voltage/Current Limit

The maximum output voltage and current applied to the heater can be set on the second setting screen of each channel. The TC300B controller will limit its output so that it will not exceed either of the max levels. These settings are valid for all heating modes.

We suggest setting the current limit first. Determine this limit based on the maximum operating current of the heater or TEC element. Then, set the voltage limit to 1 V to 2 V above the product of the heater's or TEC's resistance and the current limit.

NOTICE

Heaters and TEC element may have different operational currents and voltages. Carefully set the voltage and current limits according to the heater datasheet to make sure the device always operates with the maximum allowed current and voltage ranges. Otherwise damage to the heater or the TC300B itself may occur.

To set the output limit of voltage, select "Voltage Max" and change the value by turning the knob or by pressing the "UP" and "DOWN" buttons. The value can be changed from 1.0 to 24 V.

To set the output limit of current, select "Current Max" and change the value by turning the knob or by pressing the "UP" and "DOWN" buttons. The value can be changed from 0 to 2 A.

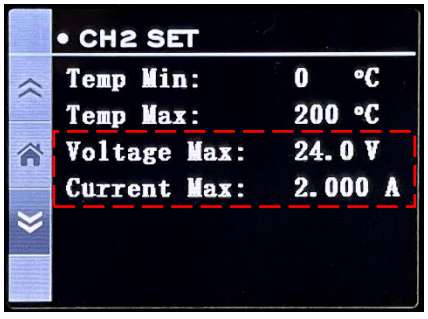


Figure 23 Setting the Maximum Output Level

4.11 Temperature Range

The operation temperature range can be set on the second setting screen of each channel. The upper and lower limit defines the range when working in heater mode.

To change the upper limit of the temperature range, select “Temp Max” and change the value by turning the knob or by pressing the “UP” and “DOWN” buttons.

To change the lower limit of the temperature range, select “Temp Min” and change the value by turning the knob or by pressing the “UP” and “DOWN” buttons.

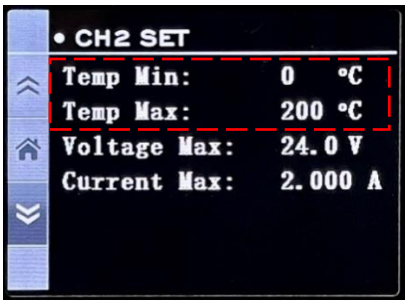


Figure 24 Setting the Operation Temperature Range

4.12 Temperature Resolution

The temperature resolution can be set on the second setting screen of each channel. When an NTC sensor is chosen, the temperature resolution can be set as either NORMAL or HIGH RES. For HIGH RES, the temperature resolution is 0.0001 °C and the target temperature resolution is 0.001 °C. For the NORMAL resolution mode, the temperature resolution is 0.01 °C and the target temperature resolution is 0.1 °C.



Figure 25 Setting the Temperature resolution

NOTICE

Different heaters and sensors may have different operating temperature ranges. Since the TC300B controller does not have the capability of getting such information from the heater or sensor, please make sure that the temperature range is always set within the range of the heater and the sensor. Otherwise, it may lead to damage to the heater, the sensor, or the TC300B itself.

4.13 Enabling/Disabling Output

Press “CHANNEL 1” on the front panel to enable and disable Channel 1. Press “CHANNEL 2” on the front panel to enable and disable Channel 2.

There is a two second delay between pressing of the buttons and actual enabling of the channel output. There is no delay when disabling the channel.

4.14 Standard Digital PID Algorithm

This section describes the digital control systems utilizing the **Positional (Absolute) PID Algorithm** where the control law is defined by:

- Proportional Gain (K_p), **P Share** parameter in TC300B
- Integral Time (T_i), **I Share** parameter in TC300B
- Derivative Time (T_d), **D Share** parameter in TC300B
- Sampling Period (T_s): The fixed time interval at which the controller reads inputs and calculates outputs. **Period** parameter in TC300B.

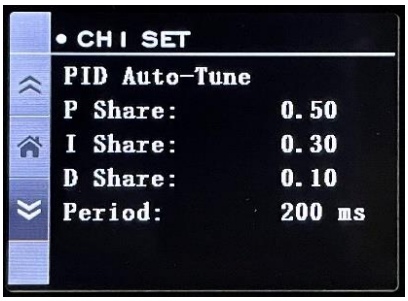


Figure 26 PID Parameters in TC300B

The Standard Digital PID (Time Constant Form) calculates an **absolute output** ($u(k)$) based on the error (e), scaled by a fixed **Sampling Period** (T_s). This algorithm is standard for industrial process control where precise time-based tuning is required.

The controller executes the following discrete equation at every sampling interval T_s :

$$u(k) = K_p \left[e(k) + \frac{T_s}{T_i} \sum_{j=0}^{k} e\,(j) + \frac{T_d}{T_s} (e(k) - e(k-1)) \right]$$

Parameter Definitions and Effects:

- Sampling Period (T_s): The fixed calculation cycle time. It acts as the base reference for scaling integral and derivative terms. It should be set to 1/10–1/20 of the process dominant time constant (**if you don’t know this parameter, set Period to minimum**). Crucial: Changing T_s requires retuning T_i and T_d to maintain performance.
- Proportional Gain (K_p): Determines response strength to the current error. It is independent of T_s . Increasing K_p speeds up response and reduces offset but risks oscillation; decreasing it improves stability but leaves a steady-state error.
- Integral Time (T_i): Eliminates steady-state error by accumulating past errors. Its action strength is inversely proportional to T_i (Small T_i = Strong Action). The term scales directly with

T_s (T_s/T_i). Decreasing T_i removes error faster but risks windup and oscillation; increasing it slows correction but improves stability.

- Derivative Time (T_d): Dampens overshoot by predicting future error trends. Its action strength is directly proportional to T_d (Large T_d = Strong Action). The term scales inversely with T_s (T_d/T_s). Increasing T_d reduces overshoot; however, a high T_d combined with a low T_s causes severe noise jitter.

4.15 PID Manual Tuning

Preparation and Sequential Procedure:

1. Setup: Fix the Sampling Period (T_s) based on process dynamics (**if you don't know this parameter, set Period to minimum**) and do not change it during tuning. Set the controller to Manual Mode. Initialize parameters: K_p = Low, T_i = Maximum (Off), T_d = 0.
2. Proportional Tuning (K_p): Switch to Automatic Mode. Introduce a small step change. Gradually increase K_p until the process variable exhibits slight, sustained oscillation, then reduce K_p to 60% of that value.
3. Integral Tuning (T_i): Gradually decrease T_i to introduce integral action. Stop when the steady-state error is eliminated within an acceptable time without causing large overshoot or low-frequency "hunting." If oscillation occurs, increase T_i .
4. Derivative Tuning (T_d): (Optional) Only if overshoot persists, gradually increase T_d . Stop immediately if the control output shows high-frequency jitter or noise, and reduce T_d or set it to 0.

NOTE: Adjust only one parameter at a time. Allow the system to stabilize and observe at least two full response cycles between adjustments.

4.16 PID Auto-Tune

The TC300B controller also has an Auto-Tune function to help users to calculate and set the gain values for the PID control loop.

To perform a PID auto-tune, please make sure both heater and the sensor are all correctly connected and configured with the voltage and current limits set. You can then go to the third setting screen for the channel you wish to auto-tune.

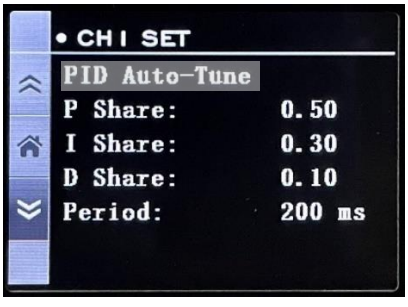


Figure 27 Select PID Auto-Tune

Select PID Auto-tune and press enter. After the prompt appears select "YES" to start the PID Auto-Tune process or select "NO" to cancel.



Figure 28 Select Yes to Start PID Auto-Tune

Wait for the process to finish. To abort the PID auto-tune, press the "ENTER" button on the front panel while this screen is showing.

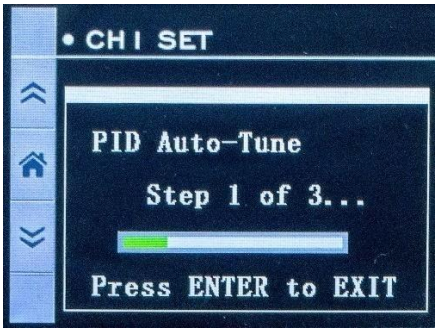


Figure 29 PID Auto-Tune in Progress

Once PID auto-tune is complete, select "APPLY SETTINGS" to apply the resulting PID gain values or select "CANCEL" to exit.



Figure 30 PID Auto-Tune Complete

If PID auto-tune fails to find suitable gain values, the below window will appear. Pressing the "ENTER" button on the front panel will exit the PID auto-tune process.

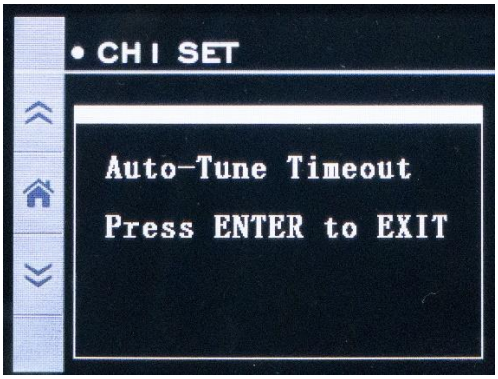


Figure 31 PID Auto-Tune Failed

If PID auto-tune repeatedly fails to find the suitable PID gain values, it may be because the system does not have enough heating power to reach the target temperature or the sensor and the heater are placed too far apart, resulting in the system failing to reach a thermal equilibrium before the timeout is reached. Increasing the current and voltage limit or moving the sensor closer to the heater may help the PID auto-tune process yield a better result.

The PID period can be adjusted for better control accuracy with a minimum period time of 20 ms.

4.17 Single/Dual Channel Operation

The TC300B temperature controller is set to single channel operation by default. To enable dual channel operation, go to the option menu, move the cursor to “Channels”, press the “ENTER” button to confirm selection and then turn the knob or press “UP” and “DOWN” to toggle between single and dual channel operation. Press “ENTER” again to confirm the setting.



Figure 32 Toggling Between Single Channel and Dual Channel Operation

When dual channel operation is enabled, users can copy all configurations of CH1 to CH2 by moving the cursor to “Copy CH1 to CH2” and pressing the “ENTER” button. The operation will copy every setting of CH1 including operation mode, sensor type, and parameters, current/voltage limit, temperature range and PID gains. The enabling and disabling of channels remains independent.



Figure 33 Copy all CH1 Configurations to CH1

4.18 Sync Mode

When set to dual channel operation, the TC300B offers an extra "sync" mode on Channel 2. In sync mode, Channel 2 completely mirrors Channel 1; the two channels will be enabled and disabled together by pressing the "CHANNEL 1" button. Once enabled, Channel 2 will output the same current as Channel 1.

To enable the sync mode, go to the first setting screen of Channel 2 and toggle the mode to "Sync".

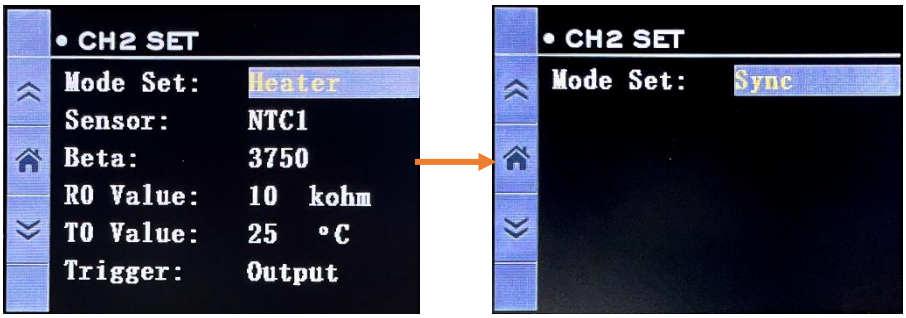


Figure 34 Set Channel to into Sync Mode

Sync mode works both in current mode and in heater mode. In current mode, Channel 2 will output the same current set as the target current of Channel 1. In heater mode, Channel 2 will output the same current as Channel 1 does while the output of both channels will be controlled by the PID settings of Channel 1 according to the temperature readings on Channel 1.

We recommend enabling sync mode when using the TC300B controller to control the GCH25-75 heater assembly for glass cells.

4.19 Trigger Mode

On the bottom of the first setting screen of each channel, the user can program the trigger mode to either output or input. This setting defines the functions of the TRIG1 and TRIG2 BNC ports on the back panel.

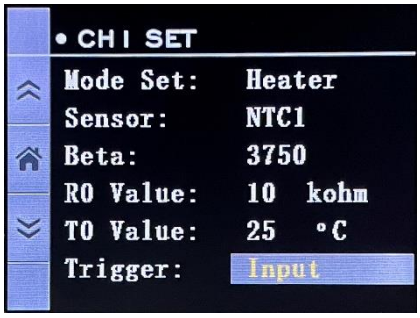




Figure 35 Toggling Trigger Input and Output

Trigger of Channel 1 (TRIG1) - When set to input: high level (+5 V) input will enable Channel 1, and low level (0 V) input will disable it. When set to output: outputs high level (+5 V) when Channel 1 is enabled and outputs low level (0 V) when Channel 1 is disabled.

Trigger of Channel 2 (TRIG2) - When set to input: high level (+5 V) input will enable Channel 2, and low level (0 V) input will disable it. When set to output: outputs high level (+5 V) when Channel 2 is enabled and outputs low level (0 V) when Channel 2 is disabled.

Port Name	Connector	Channel	Signal Type	Signal Definition
TRIG1	BNC female	CH1	5 V CMOS	High: 3.5 to 5 V Low: 0 to 1.5 V
TRIG2		CH2		

4.20 Analog Output

On the back panel, there are two analog output channels that provide analog signals that represent the temperature readings of Channel 1 and Channel 2.

Analog Output of Channel 1 (ANLG1) - 0 to + 5 V output proportional to the actual temperature of Channel 1 with 0 V corresponding to the lower limit of the temperature range of Channel 1 and + 5 V corresponding to the upper limit of the temperature range of Channel 1.

Analog Output of Channel 2 (ANLG2) - 0 to + 5 V output proportional to the actual temperature of Channel 2 with 0 V corresponding to the lower limit of the temperature range of Channel 2 and + 5 V corresponding to the upper limit of the temperature range of Channel 2.

Port Name	Connector	Channel	Signal Type	Signal Definition
ANLG1	BNC female	CH1	0 to 5 V 20 kΩ Impedance	Proportional to temperature reading
ANLG2	BNC female	CH2		

4.21 Cycle Mode

In CYCLE mode, the user can program one to one hundred distinct temperature levels. A “ramp” time (in 0.1 minutes) can be programmed for each step to determine how long it will take to get from the starting temperature to the stopping temperature. A “hold” time (also in 0.1 minutes) can be programmed to determine how long the system will stay at the stopping temperature before moving on to the next step. During the course of any step, CYCLE Mode can be paused, stopping the ramp or hold timers at their present count. Removing the paused function will resume the cycle at the same point at which it was paused.

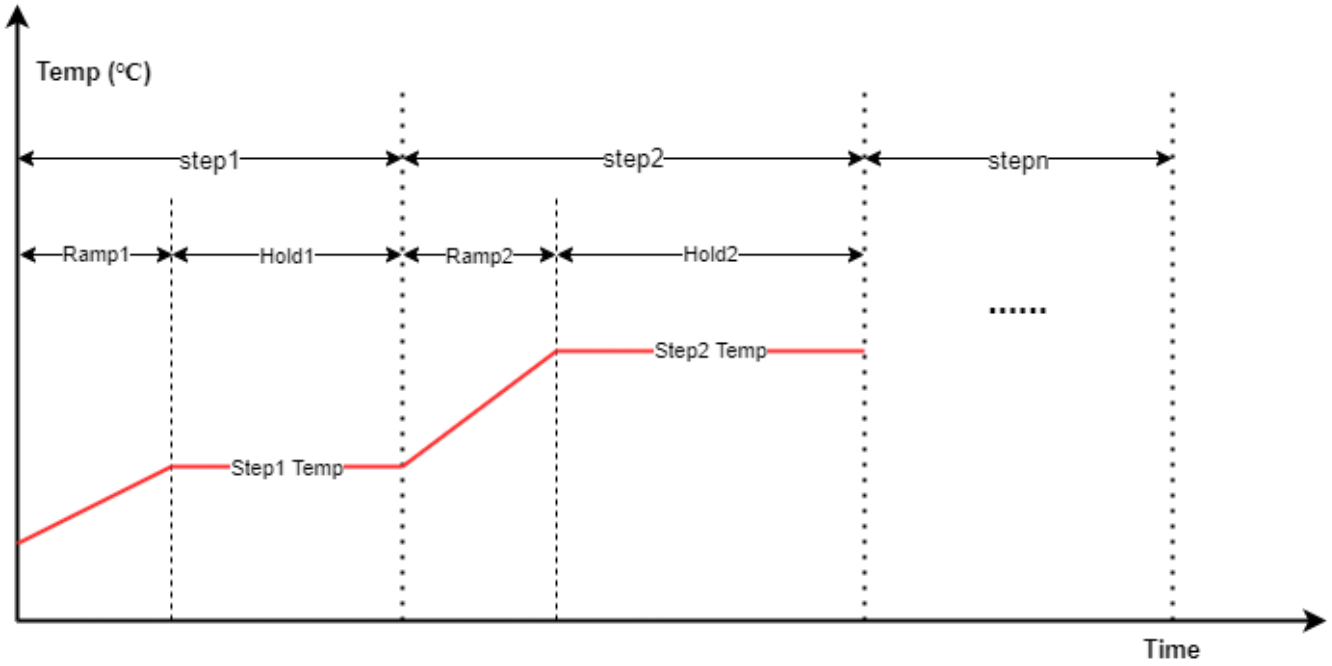


Figure 36 Cycle mode process

There are six parameters that should be set up. Pressing the "ENTER" button will accept the changes and advance you to the next step's parameter screen.

Cycle Num: cycle repeat number;

Step Num: Step number in one cycle;

Step Sel: Which step is setup for now;

Ramp n: Ramp time for the selected step;

Hold n: Hold time for the selected step;

Temp n: hold temperature for the selected step;

The Cycle Parameters can only be adjusted if the heater is disabled. After setting the cycle parameters, select the "Cycle Start" to enable the cycle mode. The controller will update information on the screen as shown below:

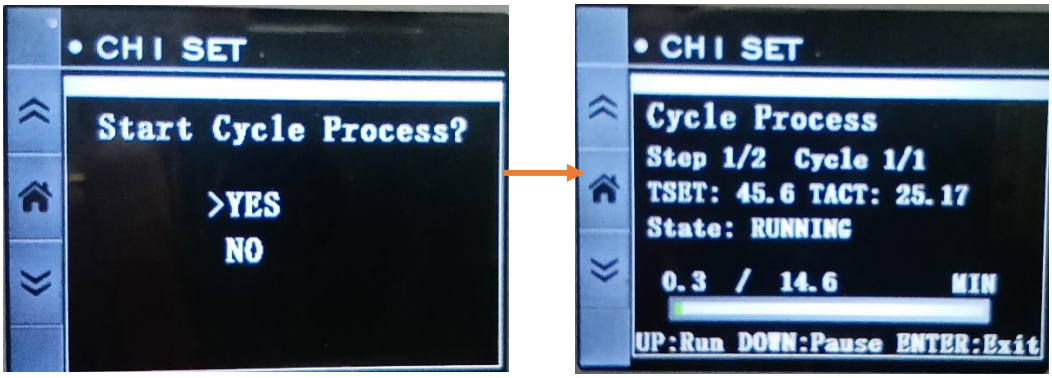


Figure 37 Cycle Mode Running

While in the Cycle Process, pressing the "DOWN" button at any time will cause the scan to pause. Once paused, the cycle will hold at the current ramp or hold time count and remain there with the heater still enabled.

Pressing the “UP” button will cause the scan to resume at the current channel. Pressing the “ENTER” button will edit the cycle Process and return to normal mode.

4.22 General Settings in Options Menu

In the options menu, aside from the switch between single and dual channel operation, there are four other settings:

Brightness: Set the brightness of the backlight of the LCD screen.

Dark Mode: Completely shuts off all lights on the device, including the LCD screen and the LED indicators in the two enable/disable buttons. Software and command line operation via a PC are the only ways to interface with the device in dark mode. Power cycling the device will disable dark mode. Software or command line operation via a PC are required to exit the dark mode without powering off the controller.

Quiet Mode: Switches off the button sounds.

Restore Factory Settings: Restore all settings to default factory values.

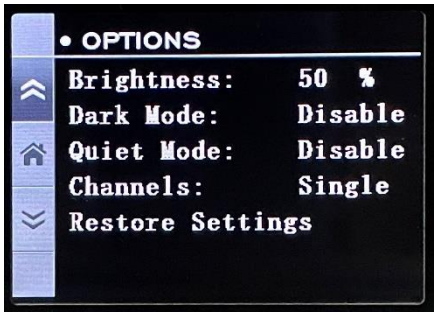


Figure 38 Settings in the Options Menu

4.23 Error Handling

There are two types of alarm messages for the TC300B controller: Warnings and Errors. A warning indicates a state in which enabled channels of the TC300B controller will continue to work but there are some parameters that are out of range; thus, optimum performance cannot be guaranteed. An error is a state in which a critical failure occurred and all channels of the TC300B controller are disabled. The error and warning messages will be shown on the top right corner of the main screen. It is possible to have multiple warnings and errors occurring simultaneously.

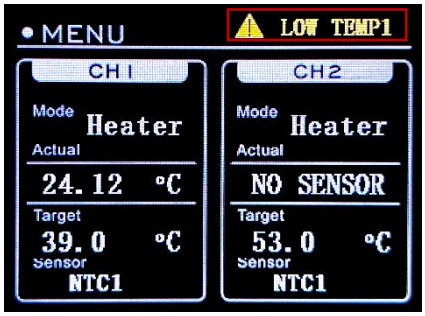


Figure 39 Warning/Error Message Appearing on Top Right Corner

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

Type	Message	Cause of Warning or Error	Suggested Action
Warning	HIGH AMBTEMP	Environment temperature is too high	Make sure the controller is in a 0 to 40 °C environment
Warning	LOW AMBTEMP	Environment temperature is too low	
Warning	HIGH TEMP1	The measured temperature on CH1 is higher than the user defined maximum temperature.	Make sure both sensor and heater are correctly connected to the TC300B and configured according to datasheets.
Warning	LOW TEMP1	The measured temperature on CH1 is lower than the user defined minimum temperature.	
Warning	HIGH TEMP2	The measured temperature on CH2 is higher than the user defined maximum temperature.	
Warning	LOW TEMP2	The measured temperature on CH2 is lower than the user defined minimum temperature.	
Warning	TRIG IN CH1	User trying to enable CH1 when the trigger of CH1 is set to input	Set the trigger to output or use an external signal source to enable/disable the channels of the TC300B
Warning	TRIG IN CH2	User trying to enable CH2 when the trigger of CH2 is set to input	
Warning	E2PROM ERR	Failed to read data from the E2PROM inside the TC300B	Power cycle the device. If warning continues to occur, contact tech support.
Warning	OVER VOLT1	The voltage on CH1 is too high or open circuit occurred	Make sure both sensor and heater are correctly connected to the TC300B and configured according to datasheets. Contact tech support if the error continues to occur.
Warning	OVER VOLT2	The voltage on CH2 is too high or open circuit occurred	
Error	NO LOAD1	No heater is connected to CH1	Make sure both sensor and heater are correctly connected to the TC300B and configured according to datasheets.
Error	CH1 SENSOR ERR	No sensor is connected to CH1, or the sensor type does not match the settings on the TC300B	
Error	NO LOAD2	No heater is connected to CH2	
Error	CH2 SENSOR ERR	No sensor is connected to CH2, or the sensor type does not match the settings on the TC300B	
Error	OVER CURR1	The current on CH1 is too high or short circuit occurred	Make sure both sensor and heater are correctly connected to the TC300B and configured according to datasheets. Contact tech support if the error continues to occur.
Error	OVER CURR2	The current on CH2 is too high or short circuit occurred	

Type	Message	Cause of Warning or Error	Suggested Action
Error	HIGH HSINK	The heatsink inside the TC300B is too hot	Make sure the TC300B is put in a 0 to 40 °C environment and the ventilation slots on the bottom and on the back panel of the device are not blocked. Check the voltage limit setting, which should be set to 1 V to 2 V above the product of the heater's or TEC's resistance and the current limit. Contact tech support if the error continues to occur.

Chapter 5 Software

Thorlabs provides a software package for the TC300B controller which allows access to all functionality of the controller from a PC interface. This software is available for download from the Thorlabs website. After installing the software package and connecting the host PC to the TC300B controller via USB, the PC can control the TC300B controller using either the software GUI or through a command-line interface, as discussed in Chapter 6.

The GUI's controls duplicate all front panel functions and additionally allow for data logging and trigger settings to be configured.

The software GUI and front panel controls are enabled simultaneously (i.e. any adjustments made to the TC300B controller using the front panel are used to update the status of the GUI).

TC300B GUI: Hardware Requirements

- Processor (CPU): ≥1 GHz
- Memory (RAM): 2 GB
- Hard Drive: Min. 100 MB of Available Disk Space
- Interface: Free USB 2.0 Port

The software is compatible with the following operating systems:

- Windows® 10 64-bit
- Windows® 11 64-bit

In the main interface of the software, the user can enable or disable output channels, select the operation mode, start a PID autotune, set the target temperature, and begin data logging.

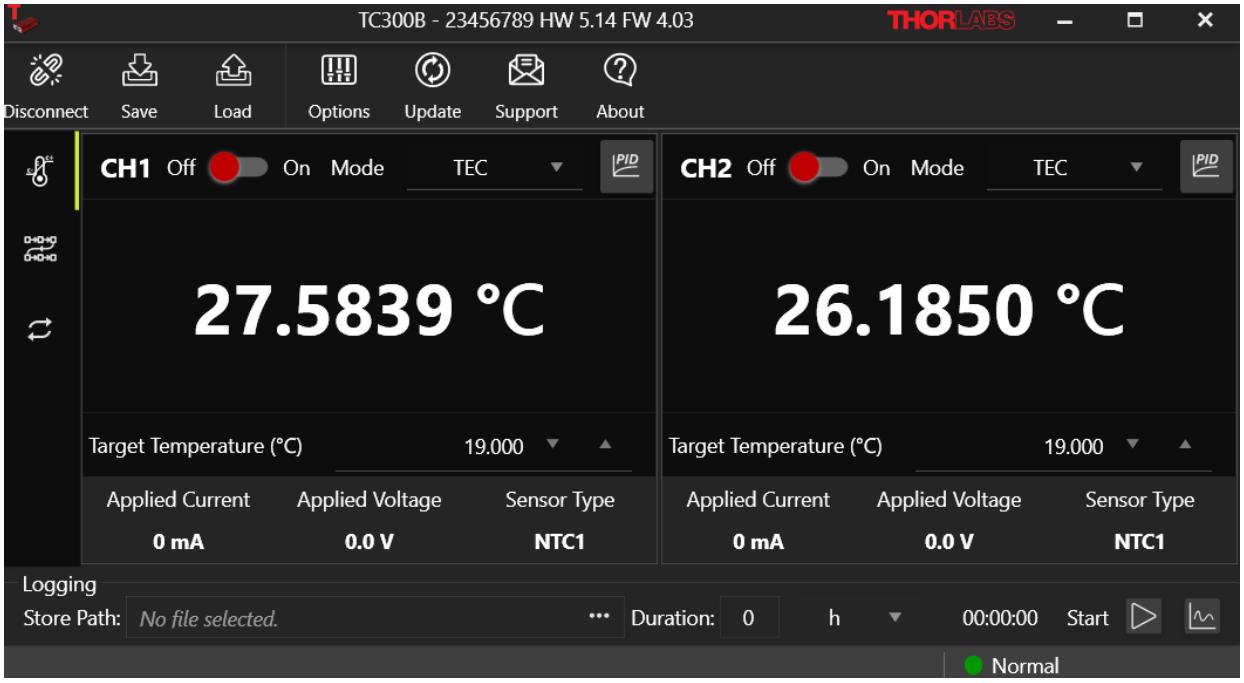


Figure 40 Main Interface of the Software GUI

In the options view, a user can set the output maximum current and voltage, the type of sensor, the range of allowed target temperatures, the trigger mode of the channel, and the temperature resolution. Additionally the controller can be put in dark mode and the sounds can be disabled.

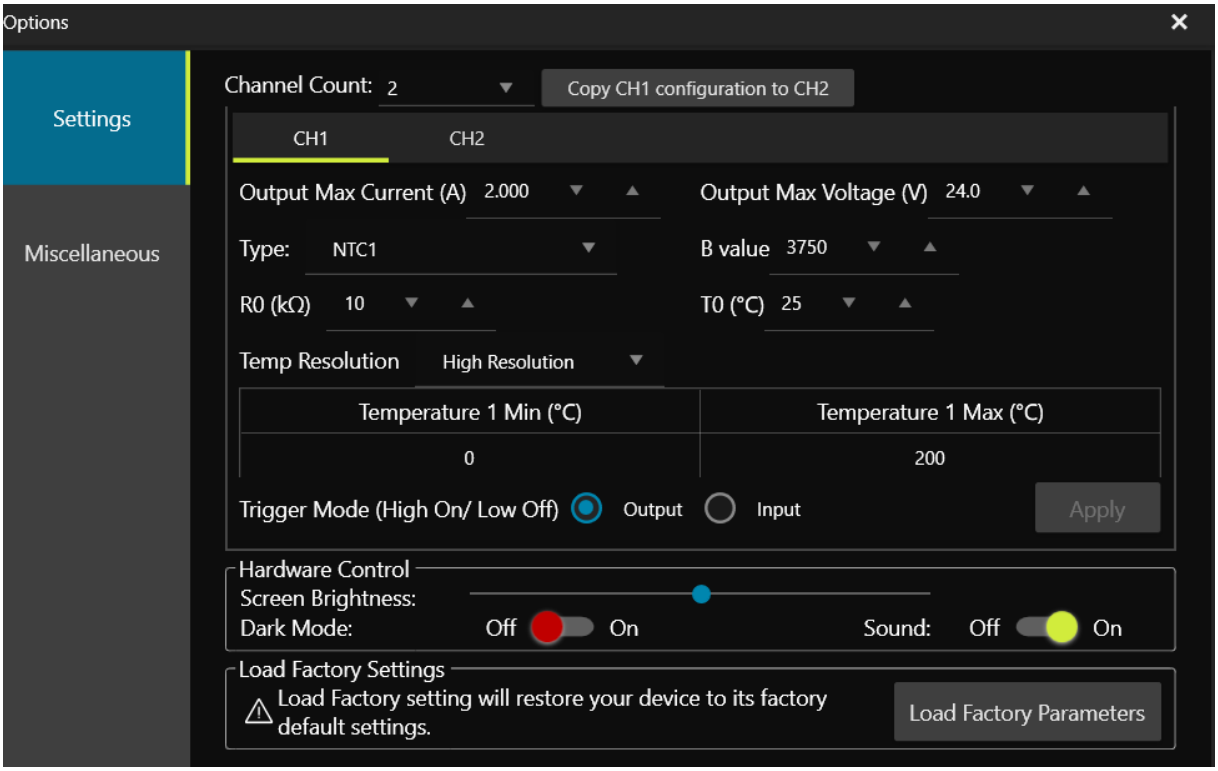


Figure 41 The Options Page of the Software GUI

To enable data logging, select the file storage path and choose a duration such as 1 hour, then chick “Start”. The software will log the temperature, output current, and output voltage of the channel to a .csv file.

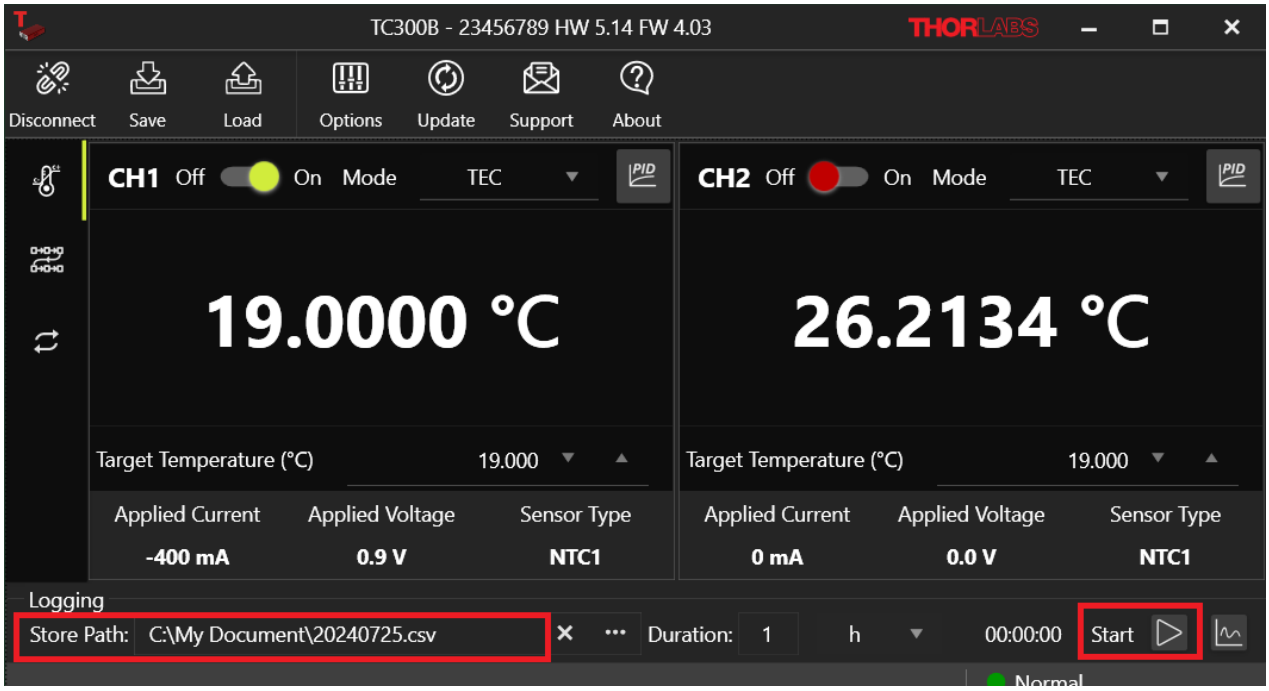


Figure 42 The data logging path and start button are shown in the red boxes.

The software can display the same information that is written to a .csv file with the data logging function: temperature, voltage, and current.

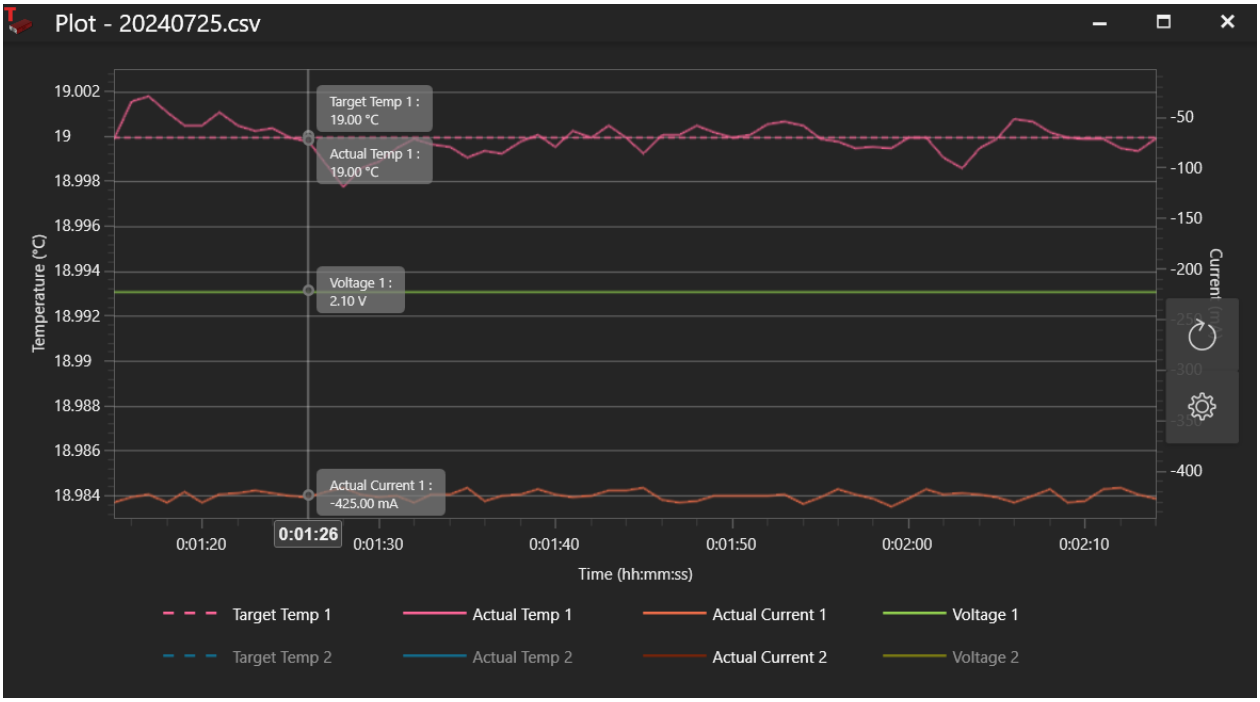


Figure 43 A plot of the temperature, voltage, and current can be written to a .csv file using the data logging function.

Click the sequence icon on the left sidebar to enter the sequence mode settings.

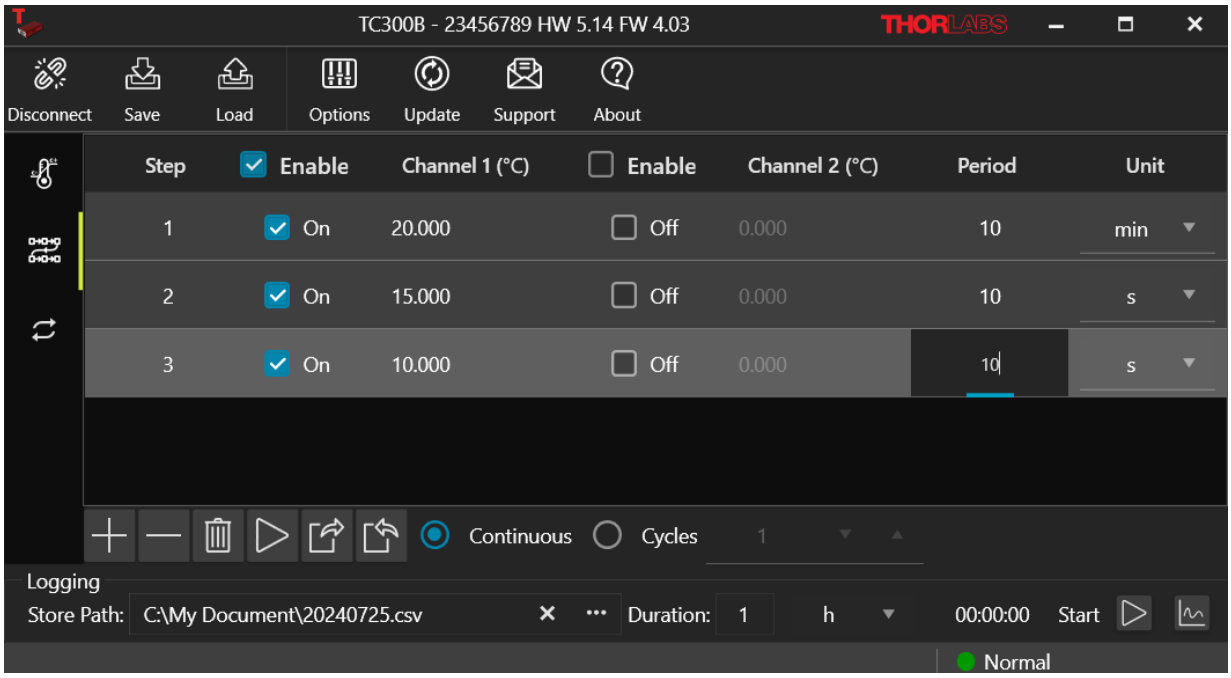


Figure 44 Sequence Mode Settings

Click the cycle icon on the left sidebar to enter the cycle mode settings.

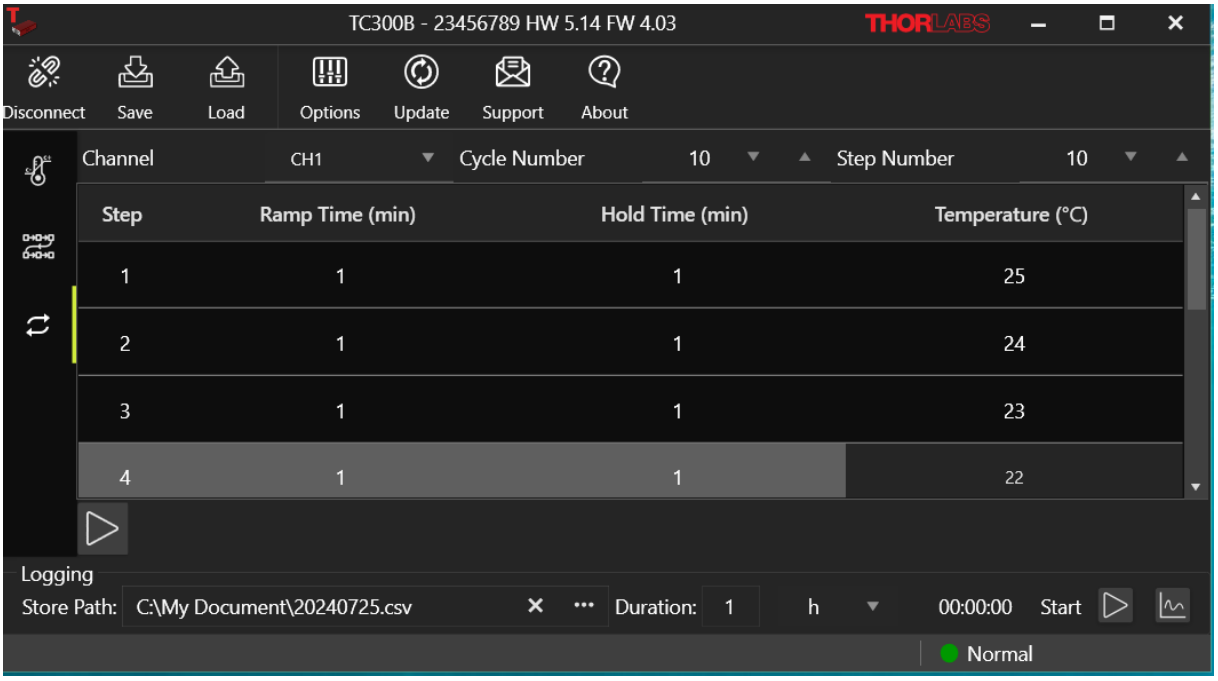


Figure 45 Cycle Mode Settings

Thorlabs also provides C/C++ and LabVIEW® software development kits (SDKs) for controlling the TC300B through the USB port on the controller. Sample C++ code and LabVIEW programs help to illustrate how the C commands and LabVIEW VIs can be utilized. Full documentation on the available commands is provided in the SDK manual. The software development interface can be found by clicking “About” in software menu.

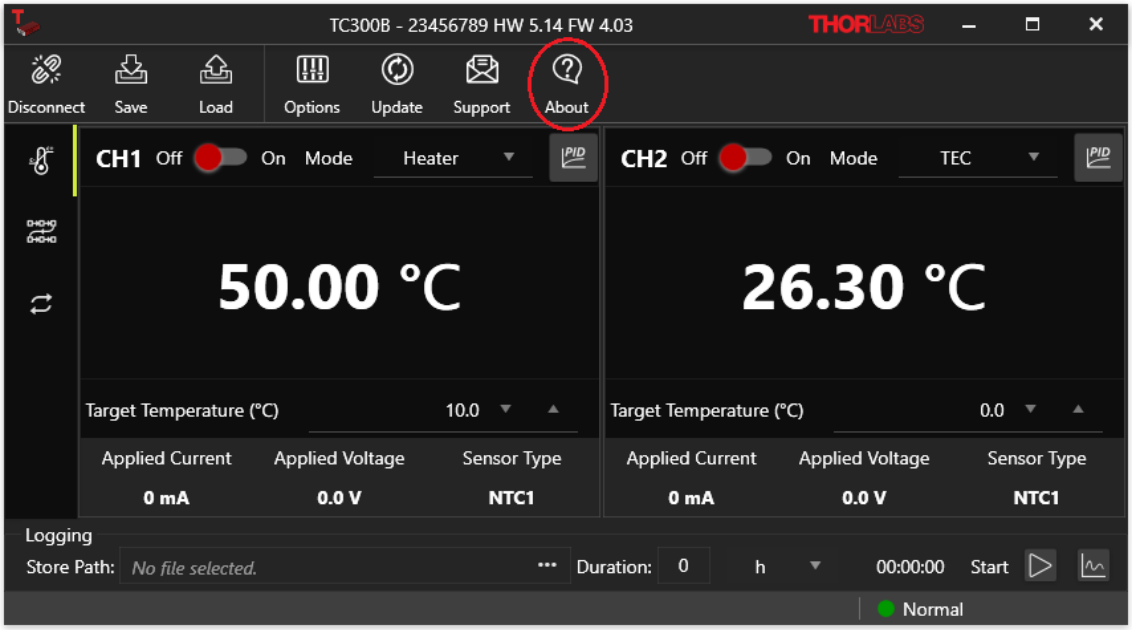


Figure 46 The “About” menu contains the software development kits (SDKs) and the SDK manual.

Chapter 6 Command Line Operation

6.1 Command Line Overview

The TC300B controller can be controlled by command line through the USB or RS232 ports as a virtual COM device. This is to enable operation through a terminal interface or for those who wish to write their own program to control the unit. The command-line 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 TC300B controller 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

The basic structure of the interface is a keyword followed by either an equal 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).

The command structure is as follows:

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

where “keyword” defines the function and “argument” is a numerical value followed by a carriage return (CR). Notice 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. The following table lists the commands and queries

available with this device as well as unique shortcut keys. The prompt symbol (>) appears after each command is accepted by the controller indicating it is ready to receive the next command.

If the command is incorrect, the controller returns `CMD_NOT_DEFINED`; if the setting value is out of range, it returns `Data Out-Of-Range!`.

6.2 Command Line Summary

No.	Command	Syntax	Description
1	**Get ID**	IDN?	Returns the model number, hardware and firmware versions.
2	**Get Device Status**	ST?	Returns device status (see Section 6.3.2 for details).
3	**Disable/Enable the Channel 1**	EN1=n	Set Channel 1 status (0 = disabled; 1 = enabled).
4	**Disable/Enable the Channel 2**	EN2=n	Set Channel 2 status (0 = disabled; 1 = enabled).
5	**Get CH1 Target Temperature**	TSET1?	Get the CH1 target temperature in °C (range: TMIN1 to TMAX1, with a resolution of 0.1 °C).
6	**Set CH1 Target Temperature**	TSET1=n	Set the CH1 target temperature to n/10 °C, (n range: TMIN1*10 to TMAX1*10, with a resolution of 1).
7	**Get CH1 Actual Temperature**	TACT1?	Get the CH1 actual temperature in °C (range: - 200.00 to 400.00 °C, with a resolution of 0.01 °C).
8	**Get CH2 Target Temperature**	TSET2?	Get the CH2 target temperature in °C (range: TMIN2 to TMAX2, with a resolution of 0.1 °C).
9	**Set CH2 Target Temperature**	TSET2=n	Set the CH2 target temperature to n/10 °C, (n range: TMIN2*10 to TMAX2*10, with a resolution of 1).
10	**Get CH2 Actual Temperature**	TACT2?	Get the CH2 actual temperature in °C (range: - 200.00 to 400.00 °C, with a resolution of 0.01 °C).
11	**Get CH1 Max Temperature**	TMAX1?	Get the CH1 target temperature max value in °C (range: TMIN1 to 400 °C, with a resolution of 1 °C).
12	**Set CH1 Max Temperature**	TMAX1=n	Set the CH1 target temperature max value in °C (range: TMIN1 to 400 °C, with a resolution of 1 °C).
13	**Get CH2 Max Temperature**	TMAX2?	Get the CH2 target temperature max value in °C (range: TMIN2 to 400 °C, with a resolution of 1 °C).

No.	Command	Syntax	Description
14	**Set CH2 Max Temperature**	TMAX2=n	Set the CH2 target temperature max value in °C (range: TMIN2 to 400 °C, with a resolution of 1 °C).
15	**Get CH1 Min Temperature**	TMIN1?	Get the CH1 target temperature min value in °C (range: -200 to TMAX1 °C, with a resolution of 1 °C).
16	**Set CH1 Min Temperature**	TMIN1=n	Set the CH1 target temperature min value in °C (range: -200 to TMAX1 °C, with a resolution of 1 °C).
17	**Get CH2 Min Temperature**	TMIN2?	Get the CH2 target temperature min value in °C (range: -200 to TMAX2 °C, with a resolution of 1 °C).
18	**Set CH2 Min Temperature**	TMIN2=n	Set the CH2 target temperature min value in °C (range: -200 to TMAX2 °C, with a resolution of 1 °C).
19	**Get CH1 Output Volt**	VOLT1?	Get the CH1 output voltage value (range: 0.1 to 24.0 V, with a resolution of 0.1 V).
20	**Get CH2 Output Volt**	VOLT2?	Get the CH2 output voltage value (range: 0.1 to 24.0 V, with a resolution of 0.1 V).
21	**Get CH1 Output Current**	CURR1?	Get the CH1 actual output current value in mA (range: - 2000 to 2000 mA, with a resolution of 1 mA).
22	**Get CH2 Output Current**	CURR2?	Get the CH2 actual output current value in mA (range: - 2000 to 2000 mA, with a resolution of 1 mA).
23	**Get CH1 Max Current**	CMAX1?	Get the CH1 output current max value in A (range: 0.010 to 2.000 A, with a resolution of 0.001 A).
24	**Set CH1 Max Current**	CMAX1=n	Set the CH1 output current max value in mA (range: 10 to 2000 mA, with a resolution of 1 mA).
25	**Get CH2 Max Current**	CMAX2?	Get the CH2 output current max value in A (range: 0.010 to 2.000 A, with a resolution of 0.001 A).
26	**Set CH2 Max Current**	CMAX2=n	Set the CH2 output current max value in mA (range: 10 to 2000 mA, with a resolution of 1 mA).
27	**Get CH1 Max Volt**	VMAX1?	Get the CH1 output voltage max value in V (range: 0.1 to 24.0 V, with a resolution of 0.1 V).
28	**Set CH1 Max Volt**	VMAX1=n	Set the CH1 output voltage max value to n/10 V (n range: 1 to 240, with a resolution of 1).
29	**Get CH2 Max Volt**	VMAX2?	Get the CH2 output voltage max value in V (range: 0.1 to 24.0 V, with a resolution of 0.1 V).

No.	Command	Syntax	Description
30	**Set CH2 Max Volt**	VMAX2=n	Set the CH2 output voltage max value to n/10 V (n range: 1 to 240, with a resolution of 1).
31	**Set CH1 Output Current**	CURR1=n	Set the CH1 output current in mA, when MOD1 = 2, (range: -CMAX1 to CMAX1 mA, with a resolution of 1 mA).
32	**Set CH2 Output Current**	CURR2=n	Set the CH2 output current in mA, when MOD2 = 2, (range: -CMAX2 to CMAX2 mA, with a resolution of 1 mA).
33	**Get CH1 Set Output Current Value**	CSET1?	Get the CH1 output current set value in mA, (range: - CMAX1 to CMAX1 mA, with a resolution of 1 mA).
34	**Get CH2 Set Output Current Value**	CSET2?	Get the CH2 output current set value in mA, (range: - CMAX2 to CMAX2 mA, with a resolution of 1 mA).
35	**Get CH1 mode**	MOD1?	Return the CH1 mode (0 = Heater; 1 TEC 2 = Current).
36	**Set CH1 mode**	MOD1=n	Set the CH1 mode (0 = Heater; 1 TEC 2 = Current).
37	**Get CH2 mode**	MOD2?	Return the CH1 mode (0 = Heater;1=TEC; 2 = Current; 3 = Synchronize with CH1).
38	**Set CH2 mode**	MOD2=n	Set the CH1 mode (0 = Heater;1=TEC; 2 = Current; 3 = Synchronize with CH1).
39	**Get CH1 Sensor Offset**	OFFSET1?	Return the CH1 Sensor offset value in °C (range: - 100 to 100 °C, with a resolution of 0.1 °C).
40	**Set CH1 Sensor Offset**	OFFSET1=n	Set the CH1 Sensor offset value to n/10 °C (n range: - 1000 to 1000, with a resolution of 1).
41	**Get CH2 Sensor Offset**	OFFSET2?	Return the CH2 Sensor offset value in °C (range: - 100 to 100 °C, with a resolution of 0.1 °C).
42	**Set CH2 Sensor Offset**	OFFSET2=n	Set the CH2 Sensor offset value to n/10 °C (n range: - 1000 to 1000, with a resolution of 1).
43	**Get CH1 Sensor Type**	TYPE1?	Return CH1 sensor type (0 = PT100; 1 = PT1000; 2 = NTC1; 3 = NTC2; 4 = Thermo C.; 5 = AD590; 6 = EXT1; 7 = EXT2).
44	**Set CH1 Sensor Type**	TYPE1=n	Set CH1 sensor type (0 = PT100; 1 = PT1000; 2 = NTC1; 3 = NTC2; 4 = Thermo C.; 5 = AD590; 6 = EXT1; 7 = EXT2).
45	**Get CH2 Sensor Type**	TYPE2?	Return CH2 sensor type (0 = PT100; 1 = PT1000; 2 = NTC1; 3 = NTC2; 4 = Thermo C.; 5 = AD590; 6 = EXT1; 7 = EXT2).

No.	Command	Syntax	Description
46	**Set CH2 Sensor Type**	TYPE2=n	Set CH2 sensor type (0 = PT100; 1 = PT1000; 2 = NTC1; 3 = NTC2; 4 = Thermo C.; 5 = AD590; 6 = EXT1; 7 = EXT2).
47	**Get CH1 ThemoC Type**	TCTYPE1?	Return CH1 thermocouple type (0 = J-Type; 1 = K-Type).
48	**Set CH1 ThemoC Type**	TCTYPE1=n	Set CH1 thermocouple type (0 = J-Type; 1 = K-Type).
49	**Get CH2 ThemoC Type**	TCTYPE2?	Return CH2 thermocouple type (0 = J-Type; 1 = K-Type).
50	**Set CH2 ThemoC Type**	TCTYPE2=n	Set CH2 thermocouple type (0 = J-Type; 1 = K-Type).
51	**Get CH1 PTWire Type**	WIRE1?	Return CH1 wire number if using a PT sensor (0 = 2-wire; 1= 4-wire).
52	**Set CH1 PTWire Type**	WIRE1=n	Set CH1 wire number if using a PT sensor (0 = 2-wire; 1= 4-wire).
53	**Get CH2 PTWire Type**	WIRE2?	Return CH2 wire number if using a PT sensor (0 = 2-wire; 1= 4-wire).
54	**Set CH2 PTWire Type**	WIRE2=n	Set CH2 wire number if using a PT sensor (0 = 2-wire; 1= 4-wire).
55	**Get CH1 NTC Beta value**	BETA1?	Return CH1 NTC1 sensor β value (range: 0 to 9999, with a resolution of 1).
56	**Set CH1 NTC Beta value**	BETA1=n	Set CH1 NTC1 sensor β value (range: 0 to 9999, with a resolution of 1).
57	**Get CH2 NTC Beta value**	BETA2?	Return CH1 NTC1 sensor β value (range: 0 to 9999, with a resolution of 1).
58	**Set CH2 NTC Beta value**	BETA2=n	Set CH2 NTC1 sensor β value (range: 0 to 9999, with a resolution of 1).
59	**Get CH1 EXT Beta value**	EXTBETA1?	Return CH2 EXT1 sensor β value (range: 0 to 9999, with a resolution of 1).
60	**Set CH1 EXT Beta value**	EXTBETA1=n	Set CH1 EXT1 sensor β value (range: 0 to 9999, with a resolution of 1).
61	**Get CH2 EXT Beta value**	EXTBETA2?	Return CH2 EXT1 sensor β value (range: 0 to 9999, with a resolution of 1).
62	**Set CH2 EXT Beta value**	EXTBETA2=n	Set CH2 EXT1 sensor β value (range: 0 to 9999, with a resolution of 1).
63	**Get CH1 T0 constant**	T0CH1?	Return CH1 NTC/EXT sensor T0 value (range: 0 to 999, with a resolution of 1).
64	**Set CH1 T0 constant**	T0CH1=n	Set CH1 NTC/EXT sensor T0 value (range: 0 to 999, with a resolution of 1).

No.	Command	Syntax	Description
65	**Get CH2 T0 constant**	T0CH2?	Return CH2 NTC/EXT sensor T0 value (range: 0 to 999, with a resolution of 1).
66	**Set CH2 T0 constant**	T0CH2=n	Set CH2 NTC/EXT sensor T0 value (range: 1 to 999, with a resolution of 1).
67	**Get CH1 R0 constant**	R0CH1?	Return CH1 NTC/EXT sensor R0 value (range: 1 to 999, with a resolution of 1).
68	**Set CH1 R0 constant**	R0CH1=n	Set CH1 NTC/EXT sensor R0 value (range: 0 to 999, with a resolution of 1).
69	**Get CH2 R0 constant**	R0Ch2?	Return CH2 NTC/EXT sensor R0 value (range: 1 to 999, with a resolution of 1).
70	**Set CH2 R0 constant**	R0CH2=n	Set CH2 NTC/EXT sensor R0 value (range: 1 to 999, with a resolution of 1).
71	**Get CH1 Steinhart-Hart A constant**	HARTA1?	Return CH1 NTC/EXT sensor Steinhart-Hart A value (range: -9.9999 to 9.9999, with a resolution of 0.0001).
72	**Set CH1 Steinhart-Hart A constant**	HARTA1=n	Set CH1 NTC/EXT sensor Steinhart-Hart A value to n/10000 (range: -99999 to 99999, with a resolution of 1).
73	**Get CH2 Steinhart-Hart A constant**	HARTA2?	Return CH2 NTC/EXT sensor Steinhart-Hart A value (range: -9.9999 to 9.9999, with a resolution of 0.0001).
74	**Set CH2 Steinhart-Hart A constant**	HARTA2=n	Set CH2 NTC/EXT sensor Steinhart-Hart A value to n/10000 (range: -99999 to 99999, with a resolution of 1).
75	**Get CH1 Steinhart-Hart B constant**	HARTB1?	Return CH1 NTC/EXT sensor Steinhart-Hart B value (range: -9.9999 to 9.9999, with a resolution of 0.0001).
76	**Set CH1 Steinhart-Hart B constant**	HARTB1=n	Set CH1 NTC/EXT sensor Steinhart-Hart B value to n/10000 (range: -99999 to 99999, with a resolution of 1).
77	**Get CH2 Steinhart-Hart B constant**	HARTB2?	Return CH2 NTC/EXT sensor Steinhart-Hart B value (range: -9.9999 to 9.9999, with a resolution of 0.0001).
78	**Set CH2 Steinhart-Hart B constant**	HARTB2=n	Set CH2 NTC/EXT sensor Steinhart-Hart B value to n/10000 (range: -99999 to 99999, with a resolution of 1).
79	**Get Ch1 Steinhart-Hart C constant**	HARTC1?	Return CH1 NTC/EXT sensor Steinhart-Hart C value (range: -9.9999 to 9.9999, with a resolution of 0.0001).

No.	Command	Syntax	Description
80	**Set CH1 Steinhart-Hart C constant**	HARTC1=n	Set CH1 NTC/EXT sensor Steinhart-Hart C value to n/10000 (range: -99999 to 99999, with a resolution of 1).
81	**Get CH2 Steinhart-Hart C constant**	HARTC2?	Return CH2 NTC/EXT sensor Steinhart-Hart C value (range: -9.9999 to 9.9999, with a resolution of 0.0001).
82	**Set CH2 Steinhart-Hart C constant**	HARTC2=n	Set CH2 NTC/EXT sensor Steinhart-Hart C value to n/10000 (range: -99999 to 99999, with a resolution of 1).
83	**Get CH1 Trigger status**	TRIG1?	Return CH1 trigger mode (0 = output; 1 = input).
84	**Set CH1 Trigger mode**	TRIG1=n	Set CH1 trigger mode (0 = output; 1 = input).
85	**Get CH2 Trigger status**	TRIG2?	Return CH2 trigger mode (0 = output; 1 = input).
86	**Set CH2 Trigger mode**	TGIG2=n	Set CH2 trigger mode (0 = output; 1 = input).
87	**Get Brightness**	BRIGHT?	Get the LCD brightness in % (range: 10% to 100%, with a resolution of 1%).
88	**Set Brightness**	BRIGHT=n	Set LCD brightness in % (range: 10% to 100% , with a resolution of 1%).
89	**Get Dark Mode status**	DARK?	Return the dark mode status (0 = disabled; 1 = enabled).
90	**Set Dark Mode**	DARK=n	Set the dark mode status (0 = disabled; 1 = enabled).
91	**Set Knob State**	KB=n	Set the knob and button state (0 = unlocked; 1 = locked).
92	**Get Knob State**	KB?	Get the knob and button state (0 = unlocked; 1 = locked).
93	**Get CH1 PID Parameters**	PID1?	Return CH1 P, I, D, and period values.
94	**Get CH1 PID Mode**	PIDM1?	Return CH1 PID Mode (0 = manual; 1 = auto).
95	**Set CH1 PID Mode**	PIDM1=n	Set CH1 PID Mode (0 = manual; 1 = auto).
96	**Set CH1 P Share**	KP1=n	Set CH1 P share to n/100, (n range: 0 to 99999, with a resolution of 1).
97	**Get CH1 P Share**	KP1?	Return CH1 P share set value (range: 0 to 999.99, with a resolution of 0.01).
98	**Set CH1 I Share**	TI1=n	Set CH1 I share to n/100, (n range: 0 to 99999, with a resolution of 1).
99	**Get CH1 I Share**	TI1?	Return CH1 I share set value (range: 0 to 999.99, with a resolution of 0.01).
100	**Set CH1 D Share**	TD1=n	Set CH1 D share to n/100, (n range: 0 to 99999, with a resolution of 1).
101	**Get CH1 D Share**	TD1?	Return CH1 D share set value (range: 0 to 999.99, with a resolution of 0.01).

No.	Command	Syntax	Description
102	**Get CH1 Period**	PERIOD1?	Get CH1 PID period in ms (range: 20 to 100000 ms, with a resolution of 1 ms).
103	**Set CH1 Period**	PERIOD1=n	Set CH1 PID period in ms (range: 20 to 100000 ms, with a resolution of 1 ms).
104	**Load CH1 Default PID Parameters**	PID1DEF!	Load CH1 default PID shares.
105	**Get CH2 PID Parameters**	PID2?	Return CH2 P, I, D, and period values.
106	**Get CH2 PID Mode**	PIDM2?	Return CH2 PID Mode (0 = manual; 1 = auto).
107	**Set CH2 PID Mode**	PIDM2=n	Set CH2 PID Mode (0 = manual; 1 = auto).
108	**Set CH2 P Share**	KP2=n	Set CH2 P share to n/100, (n range: 0 to 99999, with a resolution of 1).
109	**Get CH2 P Share**	KP2?	Return CH2 P share set value (range: 0 to 999.99, with a resolution of 0.01).
110	**Set CH2 I Share**	TI2=n	Set CH2 I share to n/100, (n range: 0 to 99999, with a resolution of 1).
111	**Get CH2 I Share**	TI2?	Return CH2 I share set value (range: 0 to 999.99, with a resolution of 0.01).
112	**Set CH2 D Share**	TD2=n	Set CH2 D share to n/100, (n range: 0 to 99999, with a resolution of 1).
113	**Get CH2 D Share**	TD2?	Return CH2 D share set value (range: 0 to 999.99, with a resolution of 0.01).
114	**Get CH2 Period**	PERIOD2?	Get CH2 PID period in ms (range: 20 to 100000 ms, with a resolution of 1 ms).
115	**Set CH2 Period**	PERIOD2=n	Set CH2 PID period in ms (range: 20 to 100000 ms, with a resolution of 1 ms).
116	**Load CH2 Default PID Parameters**	PID2DEF!	Load CH2 default PID shares.
117	**Get Quiet Mode Status**	QUIET?	Return the quiet mode status (0 = disabled; 1 = enabled).
118	**Set Quiet Mode Status**	QUIET=n	Set the quiet mode status (0 = disabled; 1 = enabled).
119	**Get Channel Number**	CHANNELS?	Return the channel number (0 = single; 1 = dual).
120	**Set Channel Number**	CHANNELS=n	Set the channel number (0 = single; 1 = dual).
121	**CH2 Parameters Sync to CH1 When Dual Channels are Working**	COPYPARA	Copy all parameters of CH1 to CH2, when both are being used.
122	**Get Heatsink Temperature**	TSINK?	Get the heatsink temperature in °C (range: 0 to 200.0 °C, with a resolution of 0.1 °C).
123	**Get Ambient Temperature**	TAMB?	Get the ambient temperature in °C (range: 0 to 100.0 °C, with a resolution of 0.1 °C).
124	**Get Serial Number**	SN?	Return the serial number of the device.
125	**Get Monitor Message**	MONITOR?	Return the monitor messages (see Section 6.3.40 for details).

No.	Command	Syntax	Description
126	**Get Error Message**	ERR?	Return the error messages (see Section 6.3.41 for details).
127	**Get Warning Message**	WARN?	Return the warning messages (see Section 6.3.42 for details).
128	**Load Factory Settings**	LOADFACT!	Restore the device to factory settings.
129	**Get CH1 AutoPID Result**	APID1PAR?	Return CH1 P, I, D, and period values from the AutoPID process.
130	**Apply CH1 AutoPID Result**	APID1APP=n	1: Apply CH1 PID auto tune result; 0: discard CH1 PID auto tune result.
131	**Get CH1 AutoPID State**	APID1ST?	Get CH1 PID auto tune state (0 = IDLE; 1 = autotune step 1; 2 = autotune step 2; 3 = autotune step 3; 4 = finished; 5 = confirm to apply; 6 = autotune error; 7 = autotune timeout).
132	**CH1 AutoPID ctrl**	APID1EN=n	0: Disable CH1 PID auto tune; 1: start CH1 PID auto tune.
133	**CH1 AutoPID progress**	APID1PGS?	Get Ch1 PID auto tune progress (range: 0 to 100%).
134	**Get CH2 AutoPID Result**	APID2PAR?	Return CH2 P, I, D, and period values from the AutoPID process.
135	**Apply CH2 AutoPID Result**	APID2APP=n	1: Apply CH2 PID auto tune result; 0: discard CH2 PID auto tune result.
136	**Get CH2 AutoPID State**	APID2ST?	Get CH2 PID auto tune state (0 = IDLE; 1 = autotune step 1; 2 = autotune step 2; 3 = autotune step 3; 4 = finished; 5 = confirm to apply; 6 = autotune error; 7 = autotune timeout).
137	**CH2 AutoPID ctrl**	APID2EN=n	0: Disable CH2 PID auto tune; 1: start CH2 PID auto tune.
138	**CH2 AutoPID progress**	APID2PGS?	Get Ch2 PID auto tune progress (range: 0 to 100%).
139	**Disable/Enable Ch1 NTC High Accuracy**	HAEN1=n	0: Disable 1: Enable valid when sensor is NTC1 NTC2 EXT1 EXT2
140	**Get Ch1 NTC High Accuracy state**	HAEN1?	0: Disable 1: Enable
141	**Disable/Enable Ch2 NTC High Accuracy**	HAEN2=n	0: Disable 1: Enable valid when sensor is NTC1 NTC2 EXT1 EXT2
142	**Get Ch2 NTC High Accuracy state**	HAEN2?	0: Disable 1: Enable
143	**Set Ch1 step number**	STEP1=n	Set the Ch1 step number, n equals value 1~100, Resolution as 1, invalid when cycle is running
144	**Get Ch1 step number**	STEP1?	Get the Ch1 step number

No.	Command	Syntax	Description
145	**Set Ch1 cycle number**	CYCLE1=n	Set the Ch1 cycle number, n equals value 1~100, Resolution as 1, invalid when cycle is running
146	**Get Ch1 cycle number**	CYCLE1?	Get the Ch1 cycle number
147	**Set Ch1 cycle paused state**	PAUSE1=n	0: Run 1: Paused valid when cycle is running
148	**get Ch1 cycle paused state**	PAUSE1?	0: Run 1: Paused
149	**Set Ch1 current step**	STSEL1=n	Active the step to setup the parameter, n equals value 1~STEP1, Resolution as 1, invalid when cycle is running
150	**Get Ch1 current step**	STSEL1?	Get current active step
151	**Set Ch1 Ramp Time**	RAMP1=n	Set Ch1 Ramp time, n equals value 0~60000, Resolution as 0.1. Invalid when cycle is running
152	**Get Ch1 Ramp Time**	RAMP1?	Get Ch1 Ramp time, 0~6000.0 min
153	**Set Ch1 Hold Time**	HOLD1=n	Set Ch1 Hold time, n equals value 0~60000, Resolution as 0.1, invalid when cycle is running
154	**Get Ch1 Hold Time**	HOLD1?	Get Ch1 Hold time, 0~6000.0 min
155	**Set Ch1 Hold Temperature**	TEMP1=n	Set Ch1 hold temperature, n equals value TMIN~TMAX, Resolution as 0.1, invalid when cycle is running
156	**Get Ch1 Hold Temperature**	TEMP1?	Get Ch1 hold temperature, n equals value TMIN~TMAX, Resolution as 0.1
157	**Disable/Enable Ch1 Cycle state**	CYCEN1=n	Set Ch1 cycle enable 0: Disable 1: Enable
158	**Get Ch1 Cycle state**	CYCEN1?	0: Disable 1: Enable
159	**Get Cycle info**	CYCINF1?	state: 0: IDEL,1: running, 2: exit_confirm, 3: Pause, 4:Error total time: float, Resolution as 0.1 passed time: float, Resolution as 0.1 stepnum: int current step: int cyclenum: int current cycle: int TSET: float, Resolution as 0.1 TACT: float, Resolution as 0.01
160	**Set Ch2 step number**	STEP2=n	Set the Ch2 step number, n equals value 1~100, Resolution as 1, invalid when cycle is running
161	**Get Ch2 step number**	STEP2?	Get the Ch2 step number

No.	Command	Syntax	Description
162	**Set Ch2 cycle number**	CYCLE2=n	Set the Ch2 cycle number, n equals value 1~100, Resolution as 1, invalid when cycle is running
163	**Get Ch2 cycle number**	CYCLE2?	Get the Ch2 cycle number
164	**Set Ch2 cycle paused state**	PAUSE2=n	0: Run 1: Paused, valid when cycle is running
165	**get Ch2 cycle paused state**	PAUSE2?	Get the Ch2 pause status, 0: Run 1: Paused
166	**Set Ch2 current step**	STSEL2=n	Active the step to setup the parameter, n equals value 1~STEP1, Resolution as 1, invalid when cycle is running
167	**Get Ch2 current step**	STSEL2?	Get current active step
168	**Set Ch2 Ramp Time**	RAMP2=n	Set Ch2 Ramp time, n equals value 0~60000, Unit is 0.1 Minute Resolution as 0.1, invalid when cycle is running
169	**Get Ch2 Ramp Time**	RAMP2?	Get Ch2 Ramp time, 0~6000.0 min
170	**Set Ch2 Hold Time**	HOLD2=n	Set Ch2 Hold time, n equals value 0~60000, Resolution as 0.1, invalid when cycle is running
171	**Get Ch2 Hold Time**	HOLD2?	Get Ch2 Hold time, 0~6000.0 min
172	**Set Ch2 Hold Temperature**	TEMP2=n	Set Ch2 hold temperature, n equals value TMIN~TMAX, Resolution as 0.1, invalid when cycle is running
173	**Get Ch2 Hold Temperature**	TEMP2?	Get Ch2 hold temperature, n equals value TMIN~TMAX, Resolution as 0.1
174	**Disable/Enable Ch2 Cycle**	CYCEN2=n	Set Ch2 cycle enable 0: Disable 1: Enable
175	**Get Ch2 Cycle state**	CYCEN2?	0: Disable 1: Enable
176	**Get Cycle info**	CYCINF2?	state: 0: IDEL, 1: running, 2: paused, 3:error total time: float, Resolution as 0.1 passed time: float, Resolution as 0.1 stepnum: int current step: int cyclenum: int current cycle: int TSET: float, Resolution as 0.1 TACT: float, Resolution as 0.01
177	**Set Ch1 Current direction**	CURRP1=n	0: positive 1: negative valid only when mode is TEC
178	**Get Ch1 Current direction**	CURRP1?	0: positive 1: negative

No.	Command	Syntax	Description
179	**Set Ch2 Current direction**	CURRP2=n	0: positive 1: negative valid only when mode is TEC
180	**Get Ch2 Current direction**	CURRP2?	0: positive 1: negative

6.3 Description of Commands

6.3.1 IDN? – Model Number, Hardware and Firmware Version of TC300B

Query model number, hardware, and firmware versions of the TC300B device.

Return:

THORLABS TC300B HV x.xx FV x.xx

where THORLABS TC300B is the model number, HV x.xx is hardware version, and FV x.xx is firmware version for every device.

6.3.2 ST? – Device Status of TC300B

Query device status of the TC300B device. An 8-bit binary digit will be returned. Each bit corresponds to the following definitions.

Bit Number	Definition
bit0	0: CH1 disabled 1: CH1 enabled
bit1	0: CH2 disabled 1: CH2 enabled
bit2	0: Error or Warning 1: Normal operation
bit3	0: No warning 1: Warning
bit4	0: No error 1: Error
bit5	Reserved
bit6	Reserved
bit7	Reserved

6.3.3 EN1=n ; EN2=n – Channel status of TC300B

EN command is used to enable channels of TC300B device.

EN1=n

Enable Channel 1 of TC300B device when n=1, disable when n=0

EN2=n

Enable Channel 2 of TC300B device when n=1, disable when n=0

6.3.4 TSET1=n; TSET1?; TSET2=n; TSET2=? – Target Temperature of TC300B

TSET command is used to set and query the target temperature of the TC300B device, the range is from TMIN to TMAX.

TSET1=n

Normal: Set target temperature of Channel 1 to n/10 °C, the setting range is defined by TMIN1 and TMAX1, setting resolution of n is 1.

High-Resolution: Set target temperature of Channel 1 to n/1000 °C, the setting range is defined by TMIN1 and TMAX1, setting resolution of n is 1.

TSET1?

Normal:

Query target temperature of Channel 1 in °C, with a resolution of 0.1°C

Return: `n/10`

High-Resolution:

Query target temperature of Channel 1 in °C, with a resolution of 0.001°C

Return: `n/1000`

TSET2=n

Normal: Set target temperature of Channel 2 to n/10 °C, the setting range is defined by TMIN2 and TMAX2, setting resolution of n is 1.

High-Resolution:

Set target temperature of Channel 2 to n/1000 °C, the setting range is defined by TMIN2 and TMAX2, setting resolution of n is 1.

TSET2?

Normal:

Query target temperature of Channel 2 in °C, with a resolution of 0.1°C

Return: `n/10`

High-Resolution:

Query target temperature of Channel 2 in °C, with a resolution of 0.001°C

Return: `n/1000`

6.3.5 TACT1?; TACT2? – Actual Temperature of TC300B

TACT command is used to query the actual temperature of the TC300B device, the range is from -200.00 to 400.00°C.

TACT1?

Get the CH1 actual temperature, returned value is the actual temperature in °C.

TACT2?

Get the CH2 actual temperature, returned value is the actual temperature in °C.

6.3.6 TMAX1=n; TMAX1?; TMAX2=n; TMAX2? – Target Temperature Max value of TC300B

TMAX command is used to set and query the target temperature max value of the TC300B device, the range is from TMIN to +400.0 °C.

TMAX1=n

Set target temperature max value of Channel 1, in unit of 1°C.

TMAX1?

Query target temperature max value of Channel 1, in unit of 1°C.

Return:

`n`

TMAX2=n

Set target temperature max value of Channel 2, in unit of 1°C.

TMAX2?

Query target temperature max value of Channel 2, in unit of 1°C.

Return:

`n`

6.3.7 TMIN1=n; TMIN1?; TMIN2=n; TMIN2? – Target Temperature Min value of TC300B

TMIN command is used to set and query the target temperature min value of the TC300B device, the range is from -200.0 °C to TMAX.

TMIN1=n

Set target temperature min value of Channel 1, in unit of 1°C.

TMIN1?

Query target temperature min value of Channel 1, in unit of 1°C.

Return:

n

TMIN2=n

Set target temperature min value of Channel 2, in unit of 1°C.

TMIN2?

Query target temperature min value of Channel 2, in unit of 1°C.

Return:

n

6.3.8 VOLT1?; VOLT2? – Actual Output Voltage of TC300B

VOLT command is used to query the actual output voltage of the TC300B device, the range is from 0.1 to 24.0 V.

VOLT1?

Query actual output voltage of Channel 1, in unit of V, resolution is 0.1V

VOLT2?

Query actual output voltage of Channel 1, in unit of V, resolution is 0.1V

6.3.9 CURR1=n; CURR1?; CURR2?; CURR2=n – Output Current of TC300B

CURR command is used to set and query the output current of the TC300B device, the range is from -2000 to +2000 mA.

CURR1=n

Set output current of Channel 1, in unit of 1 mA.

CURR1?

Query output current of Channel 1, in unit of 1 mA.

Return:

```
n
```

CURR2=n

Set output current of Channel 2, in unit of 1 mA.

CURR2?

Query output current of Channel 2, in unit of 1 mA.

Return:

```
n
```

6.3.10 CMAX1=n; CMAX1?; CMAX2=n; CMAX2? – Output Current Max Value of TC300B

CMAX command is used to set and query the output current max value of the TC300B device, the range is from 0.010 to 2.000 A.

CMAX1=n

Set the CH1 output current max value, n ranges from 10 to 2000 mA, resolution is 1 mA.

CMAX1?

Get the CH1 output current max value in the unit of A (range:0.010 to 2.000 A, resolution is 0.001 A).

Return:

```
n/1000
```

CMAX2=n

Set the CH2 output current max value, n ranges from 10 to 2000 mA, resolution is 1 mA.

CMAX2?

Get the CH2 output current max value in the unit of A (range:0.010 to 2.000 A, resolution is 0.001 A).

Return:

```
n/1000
```

6.3.11 VMAX1=n; VMAX1?; VMAX2=n; VMAX2? – Output Voltage Max value of TC300B

VMAX command is used to set and query the output voltage max value of the TC300B device, the range is from 0.1 to 24.0 V.

VMAX1=n

Set the maximum allowed voltage of Channel 1 to n/10 V, n ranges from 1 to 240, corresponding to 0.1 to 24.0 V.

VMAX1?

Query the maximum allowed voltage of Channel 1, in unit of V, resolution is 0.1 V.

Return:

```
n/10
```

VMAX2=n

Set the maximum allowed voltage of Channel 2 to n/10 V, n ranges from 1 to 240, corresponding to 0.1 to 24.0 V.

VMAX2?

Query the maximum allowed voltage of Channel 2, in unit of V, resolution is 0.1 V.

Return:

```
n/10
```

6.3.12 CSET1?; CSET2? – Output Current Set Value of TC300B

CSET command is used to query the output current set value of the TC300B device, the range is from -2000 to +2000 mA.

CSET1?

Query output current set value of Channel 1, in unit of 1 mA.

CSET2?

Query output current set value of Channel 2, in unit of 1 mA.

6.3.13 MOD 1 =n; MOD 1?; MOD =n; MOD 2? – Test Mode of TC300B

MOD command is used to set and query the test mode of TC300B device.

MOD1=n

Set test mode of Channel 1

n=0: Heater

n=1: TEC

n=1: Constant Current

MOD1?

Query test mode of Channel 1

Return:

n

MOD2=n

Set test mode of Channel 2

n=0: Heater

n=1: TEC

n=2: Constant Current

N=3: Sync mode

MOD2?

Query test mode of Channel 2

Return:

n

6.3.14 OFFSET1=n; OFFSET1?; OFFSET2=n; OFFSET2? – Sensor Offset Value of TC300B

OFFSET command is used to set and query the sensor offset value of the TC300B device, the range is from -100.0 to +100.0 °C.

OFFSET1=n

Set the sensor offset value of Channel 1 to n/10V, n ranges from -1000 to +1000, corresponding to -100 to +100 °C

OFFSET1?

Query the sensor offset value of Channel 1 in °C.

Return:

```
n/10
```

OFFSET2=n

Set the sensor offset value of Channel 2 to n/10 V, n ranges from -1000 to +1000, corresponding to -100 to +100 °C ***OFFSET2?***

Query the sensor offset value of Channel 2 in °C.

Return:

```
n/10
```

6.3.15 TYPE1=n; TYPE1?; TYPE2=n; TYPE2? – Sensor Type of TC300B

TYPE command is used to set and query the sensor type of the TC300B device. Channel 1 and Channel 2 share the External sensor.. Channel 2 cannnot select EXT1/EXT2 when it is configured for Channel 1 or vice versa.

TYPE1=n

Set sensor type of Channel 1

n=0: PT100

n=1: PT1000

n=2: NTC1

n=3: NTC2

n=4: Thermo C.

n=5: AD590

n=6: EXT1

n=7: EXT2

TYPE1?

Query sensor type of Channel 1

Return:

```
n
```

TYPE2=n

Set sensor type of Channel 2

n=0: PT100

n=1: PT1000

n=2: NTC1

n=3: NTC2

n=4: Thermo C.

n=5: AD590

n=6: EXT1

n=7: EXT2

TYPE2?

Query sensor type of Channel 2

Return:

```
n
```

6.3.16 TCTYPE1=n; TCTYPE1?; TCTYPE2=n; TCTYPE2? – Thermocouple Type

TCTYPE command is used to set and query the thermocouple type of the TC300B device.

TCTYPE1=n

Set thermocouple type of Channel 1

n=0: J Type

n=1: K Type

TCTYPE1?

Query thermocouple type of Channel 1

Return:

```
n
```

TCTYPE2=n

Set thermocouple type of Channel 2

n=0: J Type

n=1: K Type

TCTYPE2?

Query thermocouple type of Channel 2

Return:

```
n
```

6.3.17 WIRE1=n; WIRE1?; WIRE2=n; WIRE2? – PT Sensor Wire Number of TC300B

WIRE command is used to set and query the wire number of the PT100 and PT1000 sensor.

WIRE1=n

Set wire number of Channel 1

n=0: 2-wire

n=1: 4-wire

WIRE1?

Query wire number of Channel 1

Return:

```
n
```

WIRE2=n

Set wire number of Channel 2

n=0: 2-wire

n=1: 4-wire

WIRE2?

Query wire number of Channel 2

Return:

n

6.3.18 BETA 1=n; BETA 1?; BETA 2=n; BETA 2? – NTC Beta Value of TC300B

BETA command is used to set and query NTC beta value of the TC300B device, the range is from 0 to 9999. NTC sensor beta value is only available for NTC1 sensor type.

BETA1=n

Set NTC beta value of Channel 1

BETA1?

Query NTC beta value of Channel 1

Return:

n

BETA2=n

Set NTC beta value of Channel 2

BETA2?

Query NTC beta value of Channel 2

Return:

n

6.3.19 EXTBETA1=n; EXTBETA 1?; EXTBETA 2=n; EXTBETA 2? – External Beta Value of TC300B

EXTBETA command is used to set and query external beta value of the TC300B device, the range is from 0 to 9999. External sensor beta value is only available for EXT1 sensor type.

EXTBETA1=n

Set external beta value of Channel 1

EXTBETA1?

Query external beta value of Channel 1

Return:

n

EXTBETA2=n

Set external beta value of Channel 2

EXTBETA2?

Query external beta value of Channel 2

Return:

n

6.3.20 T0CH1=n; T0CH1?; T0CH 2=n; T0CH2? – Thermistor T0 value of TC300B

T0CH command is used to set and query thermistor T0 value of the TC300B device, the range is from 0 to 999 °C. Thermistor T0 value is only available for NTC1 or EXT1 sensor type.

T0CH1=n

Set NTC thermistor T0 value of Channel 1 in °C

T0CH1?

Query thermistor T0 value of Channel 1 in °C

Return:

n

T0CH2=n

Set thermistor T0 value of Channel 2 in °C

T0CH2?

Query thermistor T0 value of Channel 2 in °C

Return:

n

6.3.21 R0CH1=n; R0CH1?; R0CH2=n; R0CH2? – Thermistor R0 value of TC300B

R0CH command is used to set and query thermistor R0 value of the TC300B device, the range is from 0 to 999 kΩ. Thermistor R0 value is only available for NTC1 or EXT1 sensor type.

R0CH1=n

Set NTC thermistor R0 value of Channel 1 in kΩ

R0CH1?

Query thermistor R0 value of Channel 1 in kΩ

Return:

n

R0CH2=n

Set thermistor R0 value of Channel 2 in kΩ

R0CH2?

Query thermistor R0 value of Channel 2 in kΩ

Return:

```
n
```

6.3.22 HARTA1=n; HARTA1?; HARTB1=n; HARTB1? HARTC1=n; HARTC1? HARTA2=n; HARTA2?; HARTB2=n; HARTB2? HARTC2=n; HARTC 2? –Thermistor Steinhart-Hart Coefficient

HART command is used to set and query thermistor Steinhart-Hart coefficient of the TC300B device. These thermistor Steinhart-Hart coefficients are only available for NTC2 or EXT2 sensor type.

HARTA1=n

Set Steinhart-Hart A coefficient of Channel 1 to n/10000, the range of n is -99999 to 99999 with a resolution of 1.

HARTA1?

Query Steinhart-Hart A coefficient of Channel 1, Range: -9.9999 to 9.9999, Resolution: 0.0001.

Return:

```
n/10000
```

HARTB1=n

Set Steinhart-Hart B coefficient of Channel 1 to n/10000, the range of n is -99999 to 99999 with a resolution of 1.

HARTB1?

Query Steinhart-Hart B coefficient of Channel 1, Range: -9.9999 to 9.9999, Resolution: 0.0001.

Return:

```
n/10000
```

HARTC1=n

Set Steinhart-Hart C coefficient of Channel 1 to n/10000, the range of n is -99999 to 99999 with a resolution of 1.

HARTC1?

Query Steinhart-Hart C coefficient of Channel 1, Range: -9.9999 to 9.9999, Resolution: 0.0001.

Return:

```
n/10000
```

HARTA2=n

Set Steinhart-Hart A coefficient of Channel 2 to n/10000, the range of n is -99999 to 99999 with a resolution of 1.

HARTA2?

Query Steinhart-Hart A coefficient of Channel 2, Range: -9.9999 to 9.9999, Resolution: 0.0001.

Return:

```
n/10000
```

HARTB2=n

Set Steinhart-Hart B coefficient of Channel 2 to n/10000, the range of n is -99999 to 99999 with a resolution of 1.

HARTB2?

Query Steinhart-Hart B coefficient of Channel 2, Range: -9.9999 to 9.9999, Resolution: 0.0001Return:

```
n/10000
```

HARTC2=n

Set Steinhart-Hart C coefficient of Channel 2 to n/10000, the range of n is -99999 to 99999 with a resolution of 1.

HARTC2?

Query Steinhart-Hart C coefficient of Channel 2, Range: -9.9999 to 9.9999, Resolution: 0.0001.

Return:

```
n/10000
```

6.3.23 TRIG1=n ; TRIG1? TRIG2=n ; TRIG2?– Trigger Mode of 300

TRIG command is used to set and query trigger mode of the TC300B device.

TRIG1=n

Set trigger mode of Channel 1, when n=1, Output, when n=0, Input

TRIG1?

Query trigger mode of Channel 1, when n=1, Output, when n=0, Input

Return:

```
n
```

TRIG2=n

Enable trigger mode of Channel 2, when n=1, Output, when n=0, Input

TRIG2?

Query trigger mode of Channel 2, when n=1, Output, when n=0, Input

Return:

n

6.3.24 BRIGHT=n; BRIGHT? – Brightness of TC300B

BRIGHT command is used to set and query brightness of TC300B Display, the range is from 10 to 100%.

BRIGHT=n

Set brightness of TC300B Display in %. The range is from 10 to 100%. Resolution is 1 %.

BRIGHT?

Get brightness of TC300B Display in %.

Return:

n

6.3.25 DARK=n; DARK? – Darkness Status of TC300B

DARK command is used to set and query darkness status of the TC300B Display,

DARK=n

Set darkness status of TC300B Display, when n=1, Enable, when n=0, Disable

DARK?

Query darkness status of TC300B Display, when n=1, Enable, when n=0, Disable

Return:

n

6.3.26 PIDM1=n; PIDM1?; PIDM2=n PIDM2? – Set PID tuning mode

These commands are used to set PID tuning mode of TC300B.

PIDM1=n

Set PID tuning mode of Channel 1

n = 0: manual

n = 1: auto

PIDM1?

Query PID tuning mode for Channel 1.

Return:

n

PIDM2=n

Set PID tuning mode of Channel 2

n = 0: manual

n = 1: auto ***PIDM2?***

Query PID tuning mode for Channel 2.

Return:

n

6.3.27 KB=n; KB? – Lock Status of TC300B

KB command is used to set and query lock status of the TC300B knob and buttons. When lock is enabled, the TC300B will not be responding to any operation input from the knob or buttons on the front panel.

KB=n

Set lock status of TC300B, when n=1, Enable, when n=0, Disable.

KB?

Query lock status of TC300B, when n=1, Enable, when n=0, Disable.

Return:

n

6.3.28 KP1=n; KP1?; KP2=n; KP2? – KP Value of PID

KP command is used to set and query the P share (Gain of P) value of PID.

KP1=n

Set P share (Gain of P) value of PID for Channel 1 to n/100. The range of n is 0 to 99999 with a resolution of 1.

KP1?

Query P share (Gain of P) value of PID for Channel 1, range: 0 to 999.99, resolution: 0.01.

Return:

```
n/100
```

KP2=n

Set P share (Gain of P) value of PID for Channel 2 to n/100. The range of n is 0 to 99999 with a resolution of 1.

KP2?

Query P share (Gain of P) value of PID for Channel 2, range: 0 to 999.99, resolution: 0.01.

Return:

```
n/100
```

6.3.29 TI1=n; TI1?; TI2=n; TI2? – TI Value of PID

TI command is used to set and query the I share (Gain of I) value of PID.

TI1=n

Set I share (Gain of I) value of PID for Channel 1 to n/100. The range of n is 0 to 99999 with a resolution of 1.

TI1?

Query I share (Gain of I) value of PID for Channel 1, range: 0 to 999.99, resolution: 0.01.

Return:

```
n/100
```

TI2=n

Set I share (Gain of I) value of PID for Channel 2 to n/100. The range of n is 0 to 99999 with a resolution of 1.

TI2?

Query I share (Gain of I) value of PID for Channel 2, range: 0 to 999.99, resolution: 0.01.

Return:

```
n/100
```

6.3.30 TD 1=n; TD 1?; TD 2=n; TD 2? – TD Value of PID

TD command is used to set and query the D share (Gain of D) value of PID.

TD1=n

Set D share (Gain of D) value of PID for Channel 1 to n/100. The range of n is 0 to 99999 with a resolution of 1.

TD1?

Query D share (Gain of D) value of PID for Channel 1, range: 0 to 999.99, resolution: 0.01.

Return:

n

TD2=n

Set D share (Gain of D) value of PID for Channel 2 to n/100. The range of n is 0 to 99999 with a resolution of 1.

TD2?

Query D share (Gain of D) value of PID for Channel 1, range: 0 to 999.99, resolution: 0.01.

Return:

n

6.3.31 PERIOD1=n; PERIOD1?; PERIOD2=n; PERIOD2? – PERIOD Value of PID

PERIOD command is used to set and query the PERIOD value of PID, the range is from 100 to 100000 ms.

PERIOD1=n

Set PERIOD value of PID for Channel 1, range:20 to 100000 ms, resolution: 1 ms

PERIOD1?

Query PERIOD value of PID for Channel 1

Return:

n

PERIOD2=n

Set PERIOD value of PID for Channel 2, range:20 to 100000 ms, resolution: 1 ms

PERIOD2?

Query PERIOD value of PID for Channel 2

Return:

n

6.3.32 PID1?; PID2? – Return PID Parameters

These commands are used to Query PID parameters of TC300B.

PID1?

Query PID parameters for Channel 1.

Return:

P, I, D, Period values

PID2?

Query PID parameters for Channel 2.

Return:

P, I, D, Period values

6.3.33 PID1DEF!; PID2DEF! – Load Default PID Parameters

These commands are used to load default PID parameters of TC300B.

PID1DEF!

Load default PID parameters for Channel 1.

PID2DEF!

Load default PID parameters for Channel 2.

6.3.34 QUIET=n; QUIET? – BEEP Quiet Status of TC300B

QUIET command is used to set and query BEEP quiet status of the TC300B.

QUIET =n

Set BEEP quiet status of TC300B, when n=1, Enable, when n=0, Disable.

QUIET?

Query BEEP quiet status of TC300B, when n=1, Enable, when n=0, Disable.

Return:

n

6.3.35 CHANNELS=n; CHANNELS? – Channel Count of TC300B

CHANNELS command is used to switch between single channel and dual channel operation on the TC300B.

CHANNELS =n

Set channel count of TC300B, when n=1, Dual, when n=0, Single.

CHANNELS?

Query channel count of TC300B, when n=1, Dual, when n=0, Single.

Return:

```
n
```

6.3.36 COPYPARA – Copy CH1 Parameters to CH2

COPYPARA

Copy Channel 1 parameters to Channel 2 when two channels in dual channel mode.

6.3.37 TSINK? – Heatsink Temperature of TC300B

TSINK?

Query the heatsink temperature of the TC300B in °C. The heatsink is the main heat dissipation element in the TC300B.

Return:

Temperature reading on the heatsink, in unit of °C.

6.3.38 TAMB? – Ambient Temperature of TC300B

TAMB?

Query the ambient temperature of TC300B.

Return:

Temperature reading on the air inlet of TC300B, in unit of °C.

6.3.39 SN? – Serial Number of TC300B

SN command is used to query the serial number of TC300B.

Return:

```
xxxxxxxx
```

where the result is 8 digits.

6.3.40 MONITOR? – Monitor Messages of TC300B

MONITOR command is used to query the main operational status parameters of the TC300B. The return of the MONITOR command is a one-dimensional array, where the value on each position of the array is a return of a Query command as described in below table.

Pos 1	Return of Query Command	Description
1	TSET1?	Target Temperature of CH1
2	TACT1?	Actual Temperature of CH1
3	CSET1?	Target Output Current of CH1
4	CURR1?	Actual Output Current of CH1
5	TMIN1?	Minimum Temperature of CH1
6	TMAX1?	Maximum Temperature of CH1
7	CMAX1?	Maximum Output Current of CH1
8	VOLT1?	Actual Output Voltage of CH1
9	MOD1?	Operation Mode of CH1
10	TRIG1?	Trigger State of CH1
11	TYPE1?	Sensor Type of CH1
12	TSET2?	Target Temperature of CH2
13	TACT2?	Actual Temperature of CH2
14	CSET2?	Target Output Current of CH2
15	CURR2?	Actual Output Current of CH2
16	TMIN2?	Minimum Temperature of CH2
17	TMAX2?	Maximum Temperature of CH2
18	CMAX2?	Maximum Output Current of CH2
19	VOLT2?	Actual Output Voltage of CH2
20	MOD2?	Operation Mode of CH2
21	TRIG2?	Trigger State of CH2
22	TYPE2?	Sensor Type of CH2

6.3.41 ERR? – Error Status of TC300B

ERR command is used to query the error status of the TC300B. A 16-bits binary digit will be returned, with each bit corresponding to the following definitions.

Bit Number	Error Message	Description
bit0=1	NO LOAD1	No heater is connected to CH1
bit1=1	NO SENSOR1	No sensor is connected to CH1
bit2=1	NO LOAD2	No heater is connected to CH2
bit3=1	NO SENSOR2	No sensor is connected to CH2
bit4=1	OVER CURR1	Over current on CH1
bit5=1	OVER CURR2	Over current on CH2
bit6=1	HIGH HSINK	Temperature on heatsink is too high
bit7	Reserved	Reserved
bit8	Reserved	Reserved
bit9	Reserved	Reserved
bit10	Reserved	Reserved
bit11	Reserved	Reserved
bit12	Reserved	Reserved
bit13	Reserved	Reserved

Bit Number	Error Message	Description
bit14	Reserved	Reserved
bit15	Reserved	Reserved

6.3.42 WARN? – Warning Status of TC300B

WARN command is used to query the warning status of TC300B. a 16-bits binary digit will be returned; each bit corresponds to the following definitions.

Bit Number	Error Message	Description
bit0=1	HIGH AMBTEMP	Ambient temperature Is too high
bit1=1	LOW AMBTEMP	Ambient temperature Is too low
bit2=1	CH1 HIGH TEMP	The measured temperature is higher than the set maximum temperature of CH1 (TMAX1)
bit3=1	CH1 LOW TEMP	The measured temperature is lower than the set minimum temperature of CH1 (TMIN1)
bit4=1	CH2 HIGH TEMP	The measured temperature is higher than the set maximum temperature of CH2 (TMAX2)
bit5=1	CH2 LOW TEMP	The measured temperature is lower than the set minimum temperature of CH2 (TMIN2)
bit6=1	TRIG IN CH1	The trigger port of CH1 is set to be input
bit7=1	TRIG IN CH2	The trigger port of CH2 is set to be input
bit8=1	EEPROM ERR	Read/write error for the on board E2PROM
bit9=1	CH1 OUT RANGE	The temperature of CH1 is outside the valid range
bit10=1	CH2 OUT RANGE	The temperature of CH2 is outside the valid range
bit11=1	CH1 OVER VOLT	The output voltage of CH1 is too high
bit12=1	CH2 OVER VOLT	The output voltage of CH2 is too high
bit13	Reserved	Reserved
bit14	Reserved	Reserved
bit15	Reserved	Reserved

6.3.43 LOADFACT! – Restore the Device Factory Parameters

LOADFACT! command is used to restore the device factory parameters of the TC300B.

6.3.44 APID1PAR? APID2PAR? – Result of AutoTune

APIDPAR command is used to query AutoTune result.

APID1PAR?

Return Channel 1 P, I, D, Period values, respectively.

APID2PAR?

Return Channel 2 P, I, D, Period values, respectively.

6.3.45 APID1APP=n APID2APP=n – Handle AutoTune Result

APIDAPP command is used to apply or discard AutoTune result (Only valid during AutoTune).

APID1APP=n

When n =1, apply AutoTune Result as PID parameter,when n=0, discard parameter.

APID2APP=n

When n =1, apply AutoTune Result as PID parameter,when n=0,discard parameter.

6.3.46 APID1ST? APID2ST? –AUTOTUNE STATE – Get AutoTune State

APIDST command is used to query AutoTune state.

APID1ST?

Query Channel 1 autotune state, each number corresponds to the following definitions.

APID2ST?

Query Channel 2 autotune state, each number corresponds to the following definitions.

Return Number	State Description
0	IDEL
1	AutoTuneState1
2	AutoTuneState2
3	AutoTuneState3
4	Finished
5	ApplyConfirm
6	AutoTuneError
7	AutoTuneTimeout

6.3.47 APID1EN=n APID2EN=n – AUTOTUNE ENABLE

APIDEN command is used to enable AutoTune.

APID1EN =n

Start AutoTune Progress of Channel 1, when n=1, start AutoTune, when n=0, disable AutoTune

APID2EN =n

Start AutoTune Progress of Channel 2, when n=1, start AutoTune, when n=0, disable AutoTune

6.3.48 APID1PGS? APID2PGS? –AUTOTUNE PROGRESS

APIDPGS command is used to query AutoTune progress, the range is from 0 to 100.

APID1PGS?

Query AutoTune progress of Channel 1, when n=100, AutoTune finished.

APID2PGS?

Query AutoTune progress of Channel 2, when n=100, AutoTune finished.

6.3.49 HAEN1=n HAEN1? HAEN2=n HAEN2? – HIGH Resolution

Command about high-resolution mode, in high-resolution mode, temperature resolution is 0.001℃.

HAEN1=n, HAEN2=n

n=0, high-resolution disabled, n=1, high-resolution enabled. These commands valid when sensor is NTC1 NTC2 EXT1 EXT2.

HAEN1?, HAEN2?

Query the state of high-resolution, n=0, high-resolution disabled, n=1, high-resolution enabled.

6.3.50 STEP1=n STEP1? STEP2=n STEP2? – CYCLE STEP NUMBER SETUP

STEP1=n, STEP2=n

Set the step number, n equals value 1~100, Resolution as 1, invalid when cycle is running.

STEP1?, STEP2?

Get the step number.

6.3.51 CYCLE1=n CYCLE1? CYCLE2=n CYCLE2? –CYCLE NUMBER SETUP

CYCLE1=n, CYCLE2=n

Set the cycle number, n equals value 1~100, Resolution as 1, invalid when cycle is running.

CYCLE1?, CYCLE2?

Get the cycle number.

6.3.52 PAUSE1=n PAUSE1? PAUSE2=n PAUSE2? –PAUSE STATE SETUP

PAUSE1=n, PAUSE2=n

Setup pause state, 0:Run 1:Paused, valid when cycle is running.

PAUSE1?, PAUSE2?

Get the pause status, 0:Run 1:Paused.

6.3.53 STSEL1=n STSEL1? STSEL2=n STSEL2? – SELECT WHICH STEP TO SETUP

STSEL1=n, STSEL1=n

Active the step to setup the parameter, n equals value 1~STEP1, Resolution as 1, invalid when cycle is running.

STSEL1?, STSEL1?

Get current active step.

6.3.54 RAMP1=n RAMP1? RAMP2=n RAMP2? –SETUP RAMP TIME

RAMP1=n, RAMP2=n

Set Ramp time, n equals value 0~60000, Resolution as 0.1,invalid when cycle is running.

RAMP1?, RAMP2?

Get Ramp time, 0~6000.0 min.

6.3.55 HOLD1=n HOLD1? HOLD2=n HOLD2? –SETUP HOLD TIME

HOLD1=n, HOLD2=n

Set Hold time, n equals value 0~60000, Resolution as 0.1, invalid when cycle is running.

HOLD1?, HOLD2?

Get Hold time, 0~6000.0 min

6.3.56 TEMP1=n TEMP1? TEMP2=n TEMP2? –SETUP HOLD TEMP

TEMP1=n, TEMP2=n

Set hold temperature, n equals value TMIN~TMAX, Resolution as 0.1, invalid when cycle is running.

TEMP1?, TEMP2?

Get hold temperature, n equals value TMIN~TMAX, Resolution as 0.1.

6.3.57 CYCEN1=n CYCEN1? CYCEN2=n CYCEN2? –ENABLE/DISABLE CYCLE

CYCEN1=n, CYCEN2=n

Set cycle enable, 0:Disable 1:Enable.

CYCEN1?, CYCEN2?

0:Disable 1:Enable

6.3.58 CYCINF1? CYCINF2? –GET CYCLE INFORMATION

Get current cycle state, parameters returns as follows:

state: 0: IDEL, 1: running, 2: paused, 3: error

total time: float, Resolution as 0.1

passed time: float, Resolution as 0.1

stepnum: int

current step: int

cyclenum: int

current cycle: int

target temperature: float, Resolution as 0.1

actual temperature: float, Resolution as 0.01

6.3.59 CURRP1=n CURRP1? CURRP2=n CURRP2? –SETUP TEC CURRENT DIRECTION

CURRP1=n, CURRP2=n

Setup current direction, 0:positive 1:negative, valid only when mode is TEC.

CURRP1?, CURRP2?

0: positive 1: negative

Chapter 7 Maintenance

7.1 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. Pull out the drawer and take out the used fuse. Please use 3.15 A, 250 VAC, Type "T", slow blow fuses only for replacement.



Figure 47 Fuse Replacement

7.2 Firmware Update

Thorlabs offers downloads of firmware update files for the TC300B on the website (http://www.thorlabs.com/). To update the controller firmware, connect the controller to a PC with the included USB cable. Keep holding down the “ENTER” button when powering on the controller until below screen appears on the LCD. The device has then entered the Bootloader for firmware update.



Figure 48 Bootloader Mode for Firmware Update

On the PC, start the firmware update tool, which can also be downloaded from the website (http://www.thorlabs.com/), select the correct COM port, and press “Connect”.

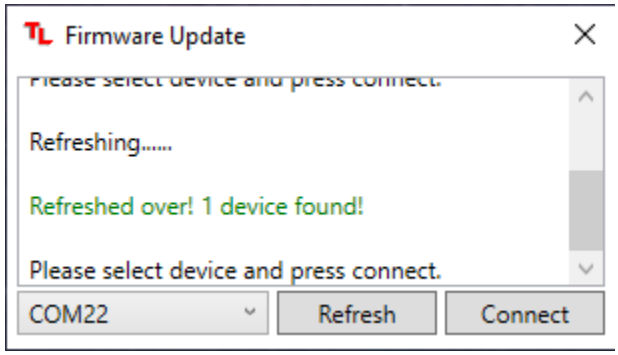


Figure 49 Select COM port on Firmware Update Tool

Click “Browse” to select the new firmware file.

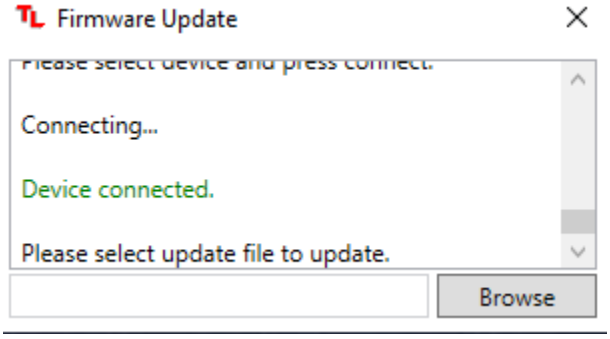


Figure 50 Select Firmware File on Firmware Update Tool

Click “Update” to start the firmware update. The device will automatically reboot after the firmware update is complete.

Chapter 8 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 9 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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