

# LTE3

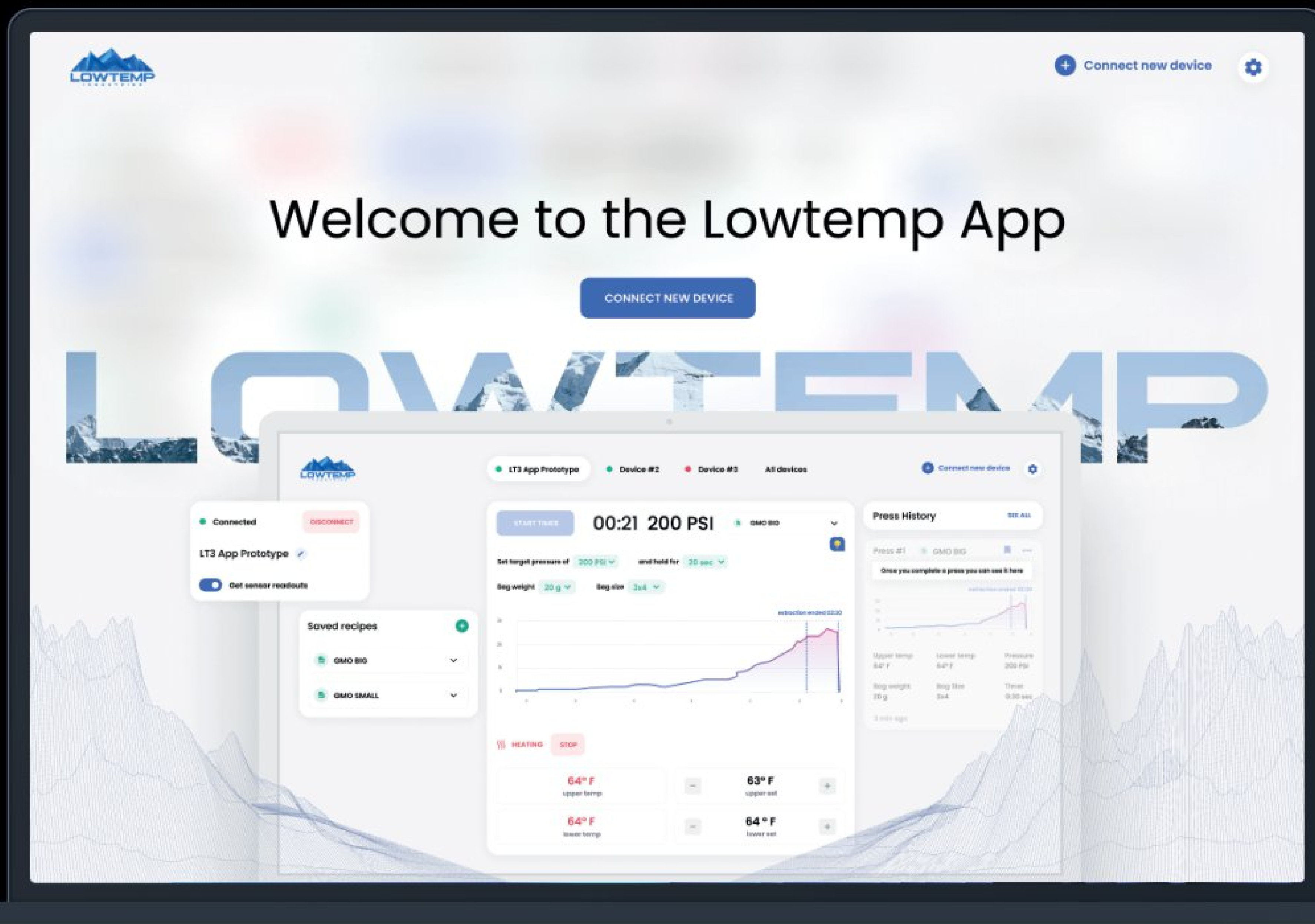


**HEAT CONTROLLER**

**BY HASHMAKERS, FOR HASHMAKERS**

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LT3 SOFTWARE

[LOWTEMP-PLATES.COM/LT3](http://LOWTEMP-PLATES.COM/LT3)



## MANUFACTURER INFORMATION

**Manufacturer:** Lowtemp Industries, LLC  
6395 W 56th Ave.  
Arvada, CO 80002

**Product Support:** (316) 308-7441

### Product Information:

Model: LT3  
Power: 120-240V AC, 50-60Hz, 7A max

This device is a multi-zone PID heat controller, designed for use with Lowtemp Industries (brand) heating elements only. Make sure that the heating elements match the voltage and power requirements for the region in which the device is being used. While the heat controller is compatible with both 120V and 230V (50-60Hz) systems, different heating elements are necessary depending on the voltage and frequency of the region.

This device is designed for commercial use in a laboratory setting, and for use with Lowtemp Industries (brand) heat presses only. Heating elements are designed for use in 6061 aluminum plates mounted in a Lowtemp Industries pressing apparatus only. Do not leave the device unattended while in use, and carefully monitor the system for faults during operation.

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.

## SAFETY AND PRECAUTIONS

- Read entire manual
- Remove all packaging materials
- Do not leave controller unattended. Ensure heating element set screw is engaged onto the heating element to secure it into the platen. **Failure to do so could result in severe injury, death, or fire.**
- Do not use near walls, curtains, wood cabinets, etc.
- Inspect for damage before each use. Do not attempt to use a controller if any part, including the wires, is damaged.
- Make sure the power cable used is the one provided with the device, or a sufficient 16AWG or thicker cable with three prongs, including the ground terminal. Before using any power cable, double check the rating and make sure it is adequately rated for the device.
- Ensure ground straps are screwed into the plate between the thermocouple and the plate while the device is in operation.
- Do not touch any part of the plate or heating element assemblies while heating.
- Do not position the device such that the power switch is difficult to access. Monitor the device and if unsafe conditions arise, turn off the power switch or unplug the device immediately.
- Lowtemp Industries, LLC is not responsible for damage or injuries sustained if the device is not used in the manner outlined in this manual, or if any precautions are overlooked by the operator.

## USER GUIDE



Video overview and exclusive  
how-to's visit

[lowtemp-plates.com/lt3/instructions](http://lowtemp-plates.com/lt3/instructions)

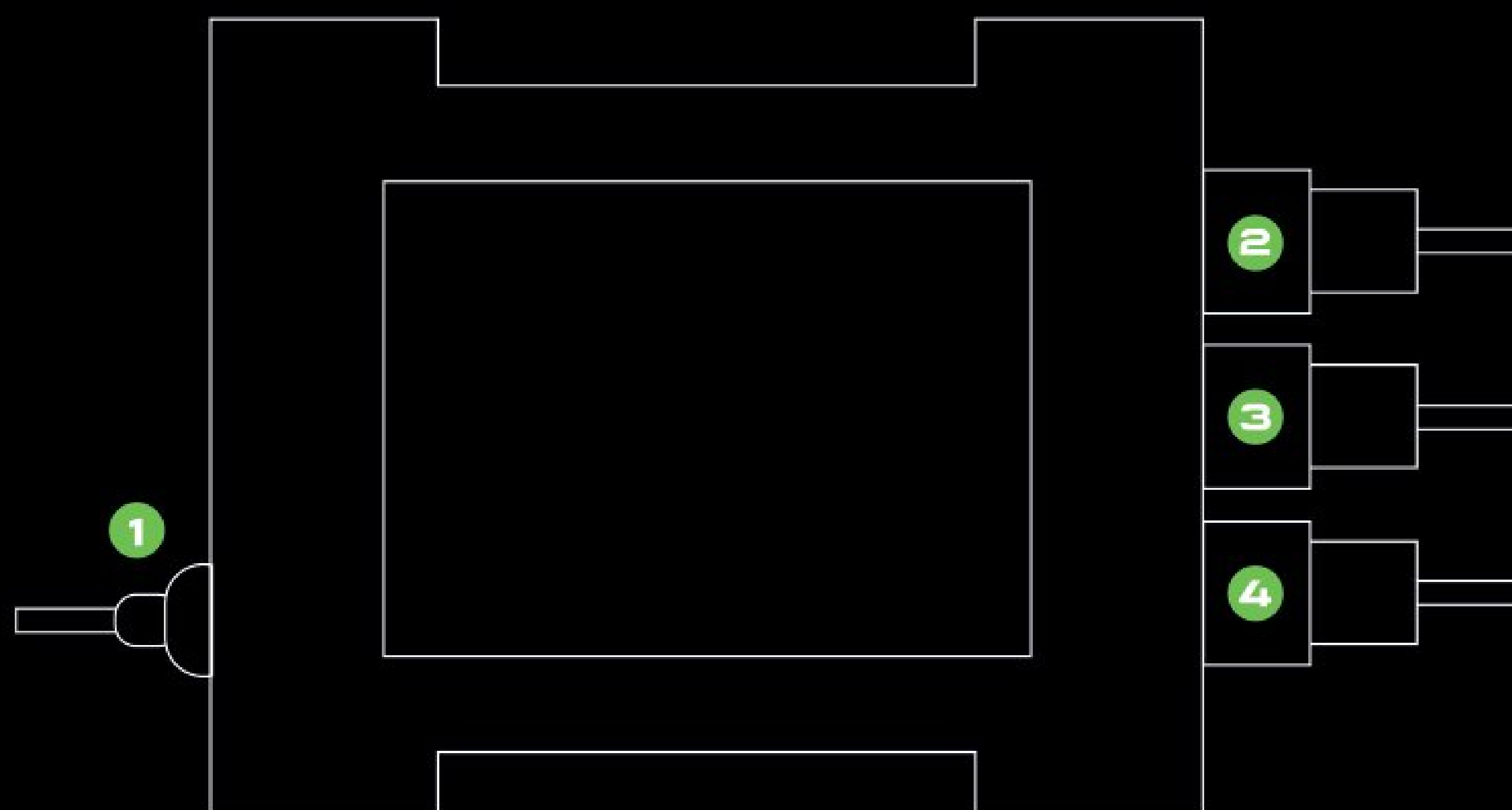
## GETTING STARTED

To set up your LT3 control box, install the thermocouple with the ring grounding strap into the platens first, hand tighten. DO NOT USE A WRENCH, OR TOOL TO TIGHTEN THE THERMOCOUPLE. It will thread in by hand. Ensure proper alignment. If you cannot get the thermocouple to thread in, contact Lowtemp Industries. Next, install the heating elements into your platens, and secure them with the heating element set screw. EXTREMELY IMPORTANT. FAILURE TO DO SO MAY RESULT IN INJURY, FIRE, OR DEATH. Now, connect the heating elements to your LT3 Controller via the quick connects, knowing that the top zone corresponds with the left zone on the screen, and the bottom with the right side of the screen. Optionally, a pressure transducer can be connected to the third port on the device to monitor hydraulic cylinder pressure during operation. Plug the power cord is plugged into the wall and the power switch is turned to the “on” position. To get started, set the desired temperatures on each zone, and press the “HEAT” button to begin.

## INPUTS AND OUTPUTS

1. Power supply (standard IEC-C13 plug. Use provided cable or appropriate 16AWG (or thicker) cable with three prongs (including ground terminal))
2. Upper heating zone. Connect provided heat assembly here.
3. Lower heating zone. Connect provided heat assembly here.
4. Pressure transducer connection. Use the provided pressure transducer with appropriate 20-ton hydraulic cylinder.

BLE (Bluetooth Low-Energy) is also available on the device and can be activated in settings. Use the provided app to communicate with the controller.



### Limitations

Maximum settable temperature: 350 F  
Minimum settable temperature: 110 F  
Maximum gauge PSI: 10,000 PSI  
Number of allowable recipes: 15 recipes



## THE HOME SCREEN

### “HEAT” button

The “HEAT” button enables device heating, using independent PID control for each zone to match the zone temperature to the setpoint. Once at the setpoint, the zone will remain there and continually adjust to maintain the correct temperature. When the device is in heating mode, it will also monitor for several safety faults and stop the heating process if a fault is detected. If the device firmware should freeze during the heating cycle, the device has a built-in hardware watchdog that will automatically power down the heaters.

### Temperature Selection

Each zone has an independently selectable temperature, with the ‘upper’ zone being on the left and the ‘lower’ zone being on the right. Each zone displays the actual calibrated (see calibration) temperature in the selected units (see units) of the plate on top, and the zone setpoint temperature on the bottom. Clicking either of these will allow you to enter a new setpoint for the zone using the keypad.

If the displayed temperature of the zone does not match the actual temperature as measured by an external device (like an IR temperature gun or external thermocouple), the calibrated temperature can be adjusted through settings. However, be cognizant that IR guns’ signal can be heavily scrambled by reflectivity, and thorough thermocouple contact is the most reliable method of temperature measurement.

### Timer

The timer allows the user to measure time using the device, based on input from either the user or the pressure sensor. The user can also select whether the timer counts up or down, selectable in settings.

**Adjusting the timer:** To adjust the timer, tap the displayed time from the home screen and enter the new desired time in MM:SS (minutes:seconds). Editing the time will stop the timer if it is in use.

**Start button:** To begin the timer manually, tap the “START” button. Once running, the timer will display a “STOP” button which will stop the timer. After the time has expired, the device will display a warning screen to indicate to the user that the timer has elapsed.

**Pressure detection:** The timer will also automatically start and stop based on the pressure displayed on the screen. It will begin when the pressure passes the user-selectable pressure threshold, and will stop when the pressure decreases to at least 300 psi beneath the pressure threshold.

## PRESSURE SOURCE

The device offers two methods of displaying pressure to the user (and calculating pressure for timer functionality). These modes can be changed by tapping on the pressure display on the home screen. Pressure will not display on the device if below 300 total psi.

**How is pressure calculated?** The device assumes you are using a 20-ton hydraulic cylinder (Cylinder size = 20t). These hydraulic systems utilize a 10,000 psi peak basis, meaning if you are using a 20 ton cylinder and the hydraulic line is at 10,000psi, you are delivering 20 total tons. It follows an even pressure line from 0-100% total force. For every 1,000 gauge psi within the hydraulic line with a 20 ton cylinder, it will deliver 2 tons or 4,000lbs of force.

$$\text{Total force (lb)} = \text{Gauge PSI} \times \frac{20 \text{ ton}}{10,000 \text{ PSI}} \times \frac{2,000 \text{ lb}}{1 \text{ ton}}$$

$$\text{Total force (lb)} = \text{Gauge PSI} \times 4$$

**Total pressure:** The “Total Pressure” mode will display the total pressure detected on the hydraulic cylinder by the pressure transducer. This is “raw” pressure being delivered to the press.

**Platen pressure:** The “Platen Pressure” mode will use the entered bag size to adjust the displayed pressure to reflect the pressure on the surface area of the bag, instead of the total force of the hydraulic cylinder. Bag width and bag length are defined in inches.

$$\text{Platen Pressure} \times = \frac{\text{Total Pressure}}{\text{Bag width} \times \text{Bag length}}$$

For example, a “Total pressure” of 1000 internal PSI on a 20-ton cylinder, generates 2 tons or 4,000 total lbs of force.

If “Bag size” is set to 3 inches by 6 inches, the platen pressure will be

$$\frac{4000 \text{ lb}}{18 \text{ in}^2} = 222 \text{ Platen PSI}$$

**Note:** If “Bag size” is not set or contains a zero, “Platen pressure” mode will not work.

### Bag Size

Bag size is a user-selectable field with options to enter the length and width of the bag in inches. To enter this information, tap on the “Bag size” field from the home screen. A keypad will open allowing you to enter both dimensions of the bag. This information is used by the “Pressure source” when the device is in “Platen pressure” mode.

### Bag Weight

Bag weight is a user-selectable field to store the weight of the bag while pressing. This information is not used for any calculations by the device, but can be handy for helping keep track of press data.

## RECIPES

The “Recipes” menu can be accessed by tapping on the folder icon on the top-left of the screen. This will open a menu where recipes can be either loaded or edited. The device has room for 15 different recipes, each with their own zone temperatures, pressure threshold, bag weight, bag size, and timer setting.

### **Saving a New Recipe**

To save a new recipe, enter the desired values on the home screen. Tapping the ribbon icon on the top right of the screen will open the “Edit Recipe” dialog with the home screen value pre-populated. The text box at the top of the screen allows the user to enter a recipe name which will appear in the “Recipes” area and will also appear on the home-screen when the recipe is loaded.

### **Editing a Recipe**

From the “Recipes” menu, each of the 15 different recipes can be edited by clicking on the pencil icon corresponding to that recipe. Clicking the pencil icon will allow you to change any particular recipe value, as well as rename the recipe if necessary.

### **Loading a Recipe**

From the “Recipes” menu, each recipe can be loaded by pressing the “Load recipe” button with the desired recipe name. Clicking the “Load recipe” button will direct the user to the home screen, where the recipe values will be loaded and the recipe name will be displayed on the top left of the screen. Editing any value once a recipe is loaded will not change the recipe, and instead the recipe will no longer be loaded and if desired, a new recipe can be saved.

## DEVICE SETTINGS

To access device settings, click the “Settings” button from the home page. This will allow you to edit global device settings, which are not specific to any particular recipe.

### **Temperature Units**

The device offers two temperature units: Fahrenheit (default), and Celsius. Changing units will adjust all units on the device, including preset temperatures and calibration differences.

### **Timer Settings**

The timer includes a “countdown” (default) and a “count-up” mode. This does not impact functionality of the timer, but will change whether the user sees the timer count up to the desired value, or count down to zero from the desired value.



## **Temperature Calibration**

The temperature feedback from your controller can be calibrated if you have agreed second and third methods of reading platen temperature outside of the included thermocouple with the device. Keep in mind that IR guns' signal will be scrambled from the reflectiveness of plates. The best way to fully calibrate your platen temperatures, put a matte masking tape on the plates and shoot with an IR gun. Then, utilize a very accurate thermocouple probe style from a different temp reading device. If those two alternative temperature reading tools agree with each other, then you can utilize the calibration tool within the device to make the adjustment.

## **Automatic Shutoff**

The device features an automatic shutoff feature which will disable heating after a user-selectable amount of time. This can be adjusted to 2, 6, or 12hours. After heating for longer than the automatic-shutoff period, the device will stop the heating process and display a warning message to the user. Simply tap on the screen to dismiss the warning message, and the device can be used like usual.

### **Allow Single Element Heating**

This mode allows the device to either allow or disallow the heating process when only one zone is connected. With “disallow” the device will alert the user and disable heating if either zone is disconnected, while “allow” will only cause this warning if both zones are disconnected.

## **PID Settings**

The device uses two independent software-driven PID controllers to regulate the temperature of each plate. The control gains for each zone are the same and typically come pre-tuned for the plates that come with the controller. The device comes with one of two preset PID settings, the 3x5 plates or 4x7 plates. Tap on the corresponding choice depending on which plates are being used. The device will come default with our most popular software programming, for the 4x7 plates.

## **PID Auto-tuner**

The PID auto-tuner can be used to automatically select P, I, and D gains for an attached heated plate. To use the auto-tuner, the plates must each be heated to at least 150 degrees Fahrenheit. Once they are pre-heated, the PID auto-tuner can be activated and will run automatically. It will step the device in either direction (hotter and cooler), and will observe how the heated plate responds.

Once finished running, a dialog will appear on the screen showing the calculated P, I, and D values for each zone. Values are calculated using the Ziegler-Nichols tuning method, and we find for quicker plate heating, it is best to reduce the D gain by a factor of 3. (divide by 3). For more accurate tuning, we recommend using the same plate style on each zone and averaging the gains given for each zone by the autotuner. These gains can be entered in the PID Settings dialog.

## **Flip Screen Orientation**

For convenience, the orientation of the screen on the device can be changed. Simply tap the “Flip Screen Orientation” button in settings and the display will be rotated.

## **Bluetooth LE**

The device contains a Bluetooth Low-Energy (BLE) module for easy communication and software-updates. To enable BLE advertising, simply turn “Bluetooth LE” on from settings. Once on, the device can be connected to via Bluetooth and can transfer data or be controlled. Turning “Bluetooth LE” off will stop advertising and disable the Bluetooth module. Every unit includes a compatible bluetooth dongle in case your computer does not have a compatible bluetooth module.

## Warnings and About

These options provide information to the user about the device model and software versions, as well as information about each warning that can appear on the device.

### Factory Reset

If there are problems with the device or it is otherwise necessary to revert to factory settings, the “Reset Device” setting can be used. Clicking this box will open a confirmation dialog, and tapping “Yes” will reset the device to factory settings. This process is slow and takes a minute, so please be patient after confirming the reset.

## SAFETY AND TROUBLESHOOTING



To maintain safe operation of the device, several warnings and hazardous condition detections are built-in, whose execution is checked by a physical watchdog circuit built into the hardware. Upon occurrence of these errors, a warning dialog will appear on the screen to advise the user of the condition.

### Disconnected device errors

This warning appears on the device when attempting to start heating when the heating zones are not plugged in. This warning depends on the Allow Single-Element Heating setting, which will determine whether the device will allow only one element to be used.

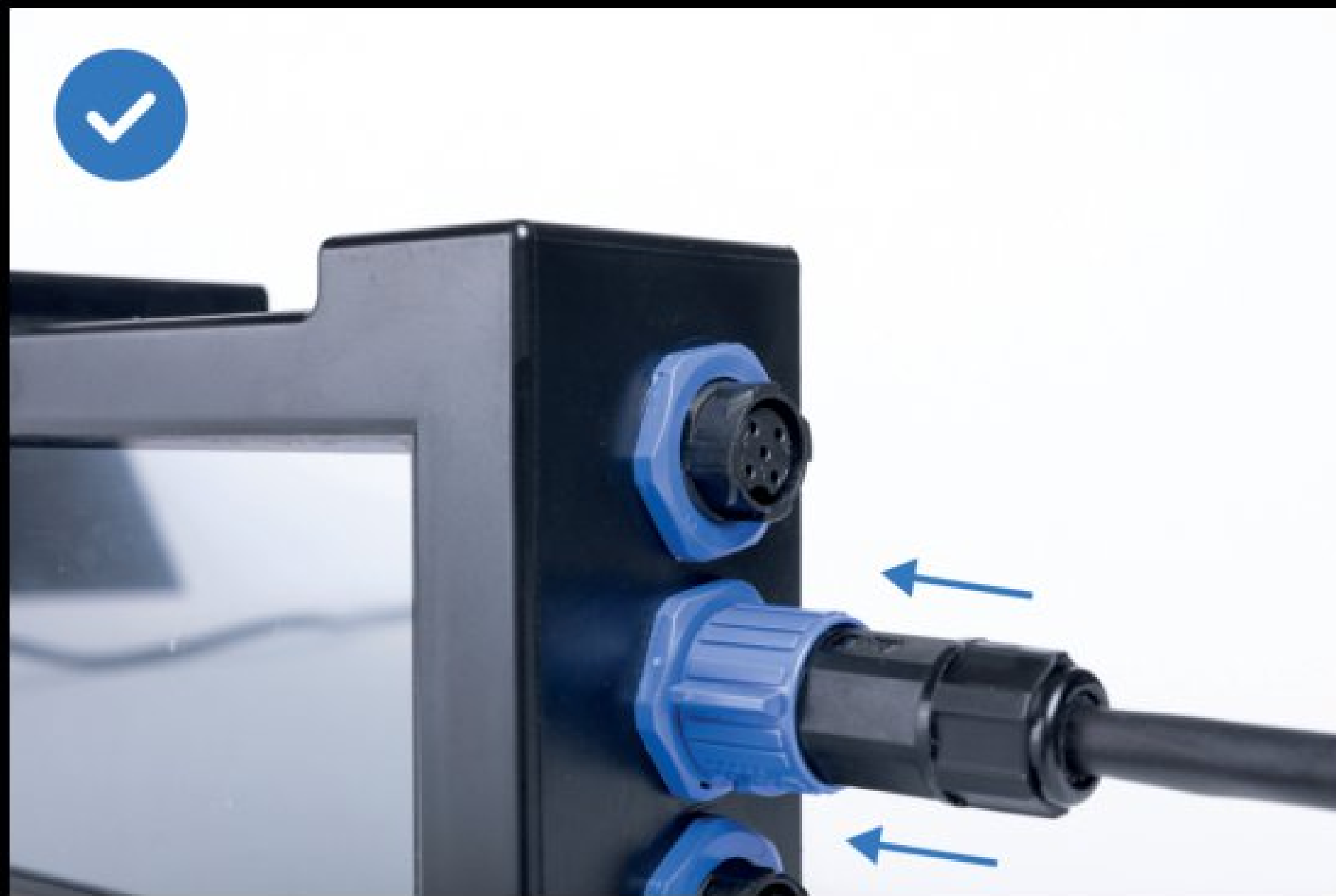
To fix this warning, ensure the required heat zone cables are plugged into the corresponding ports on the controller, and make sure a temperature is displayed for each zone. If plugging in a heat zone cable does not result in a temperature appearing on the display, you may have a faulty heating element/thermocouple assembly, please contact Lowtemp.

### Over-temperature errors

This temperature appears when any one of the heat zones exceeds the maximum allowable temperature on the device. This is factory-set to 350 degrees Fahrenheit, and is not editable by the user. This error will automatically stop power on both of the heating zones, and the device can be used again when the temperature returns to normal.

If this error appears, be very careful when handling the heated plates as they could be hotter than expected. If this error persistently occurs, stop using the device and contact Lowtemp.

**DON'T LEAVE THE CONTROLLER HEATING UNATTENDED.**



Plug straight in



Do not twist / tighten



Make sure the thermocouple and grounding strap are secured and flush



No tools



Do not put your heating element all the way in



Do not! Make sure it's all the way in

