Operation Manual

Instruction Notes for 3622566, 3622567, 3622568, 3622569

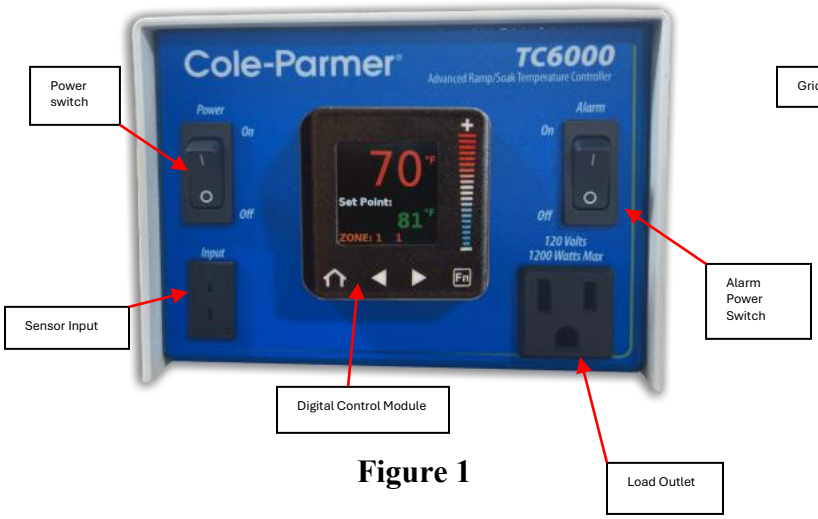


Figure 1

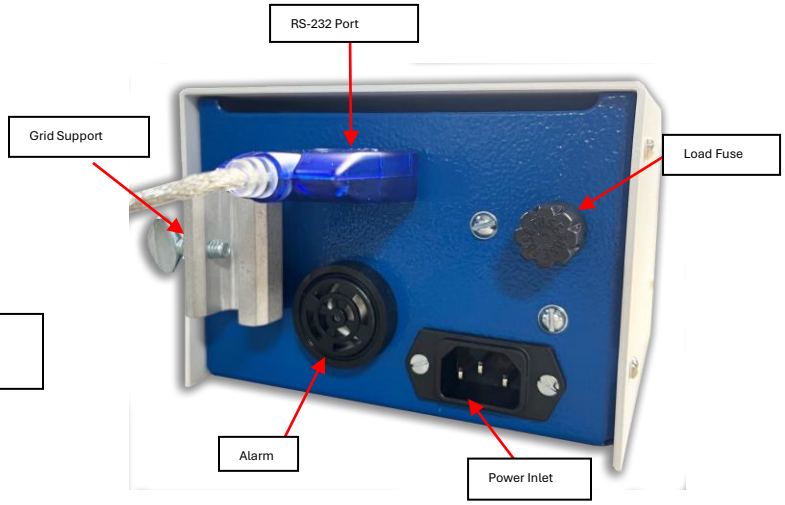


Figure 2

General Description

If your heating process requires several steps, this is the control for you. The Ramp/Soak feature of this control allows up to a 40-step profile, which can be configured from the provided software. You can profile Temperature, Time, Hold, Soak and End steps to create the ideal profile for your process. The built-in adaptive control technology provides even tighter control for these demanding applications. Several input types are available. This unit comes with 6' detachable power cord, communication port, audible alarm function and grid support bracket, which is ideal for fume hood mounting to maximize bench space.

This control is a microprocessor-based, digital indicating, automatic temperature control with a single input and a single output. It features an auto-tuning function that allows automatic setting of control parameters with a minimum of user input required. This family of control accepts a type "J", "K", "T" thermocouples or RTD input depending on the model ordered.

The control automatically sets the PID parameters through a "learning" sequence in the auto-tuning mode. PID parameters include proportional band, reset/integral and rate/derivative. User-friendly features include an intuitive interface with a smooth touch keypad and full LCD display for easy programming and readability. This control automatically stores all information in a non-volatile memory.

Control Features

1. On/Off power switch.
2. On/Off alarm switch.
3. 12-amp output.
4. Control **PID with Auto-tune algorithm, solid state relay**
5. Circuit protection (fuse)
6. Low profile housing.

Key & Display Description

Touch Keys

A-Up/Down Increment Key: Scroll up or down lists using the + or - keys.

B-Numeric Slider: Increase or decrease numeric parameters with the slider.

C-Forward Select Arrow: Return to the previous selection with the Forward arrow.

D-Back Select Arrow: Select items or move to lists using the Back arrow.

E-Home: Return to the home screen from any screen with the Home Key.

F-Function Keys: Function Keys can be programmed for various tasks.

Quick Setup Guide:

SET UP THE SENSOR INPUT

Sensor Types
- thermocouple
- millivolts
- volts
- milliamp
- 100Ω RTD
- 1000Ω RTD
- potentiometer
- analog input off

1. From **Home**, tap the *forward arrow* to go to **Operations**.
2. Scroll to **Setup** using the *+/- keys* then press *forward arrow* to select it.
3. Scroll to and select **Analog Input**.
4. Scroll to and select **Sensor Type**.
5. Scroll to and select your sensor type.
6. If you select ***Thermocouple***, a TC Linearization list opens. Use the *+/- keys* to find the correct type: J, K, N, R, S, or T.
7. If you select ***100Ω*** or ***1000Ω RTD***, press *back arrow* to return to **Sensor Type**, scroll to and select **RTD Leads**, then select **2** or **3**, as needed for your sensor.

CONTROL LOOP MODE, SET POINT, AUTOTUNE

NOTES: By default the control loop Heat algorithim is enabled for PID control and the Cool algorithim is OFF. To enable, go to Control Loop.

CAUTION: Autotune turns on the loop's heat output until the process value exceeds 90% of the set point, then turns the output off and repeats this. When finished the loop controls at the set point. Before starting Autotune, consider if it is safe to do so.

The system must be operational for autotuning to select PID settings.

Control Mode

1. From **Home**, tap the ***forward arrow*** to go to **Operations**.
2. Scroll to and select **Setup**.
3. Scroll to and select **Control Loop.**
4. Scroll to and select **Control Mode**.
5. Select **Off, Auto,** or **Manual**.
   Auto: loop adjusts output so process matches set point.
   Manual: user sets control loop output in percent power.
   Off: no control loop output

Control Loop Set Point

1. Press the **Home** button to return to the Home screen.
2. Use the *numeric slider* or the *+/-keys* to choose the set point.

Autotune

1. From **Setup**, scroll to and select **Control Loop.**
2. Scroll to and select **AutoTune**.
3. Select **Yes**.

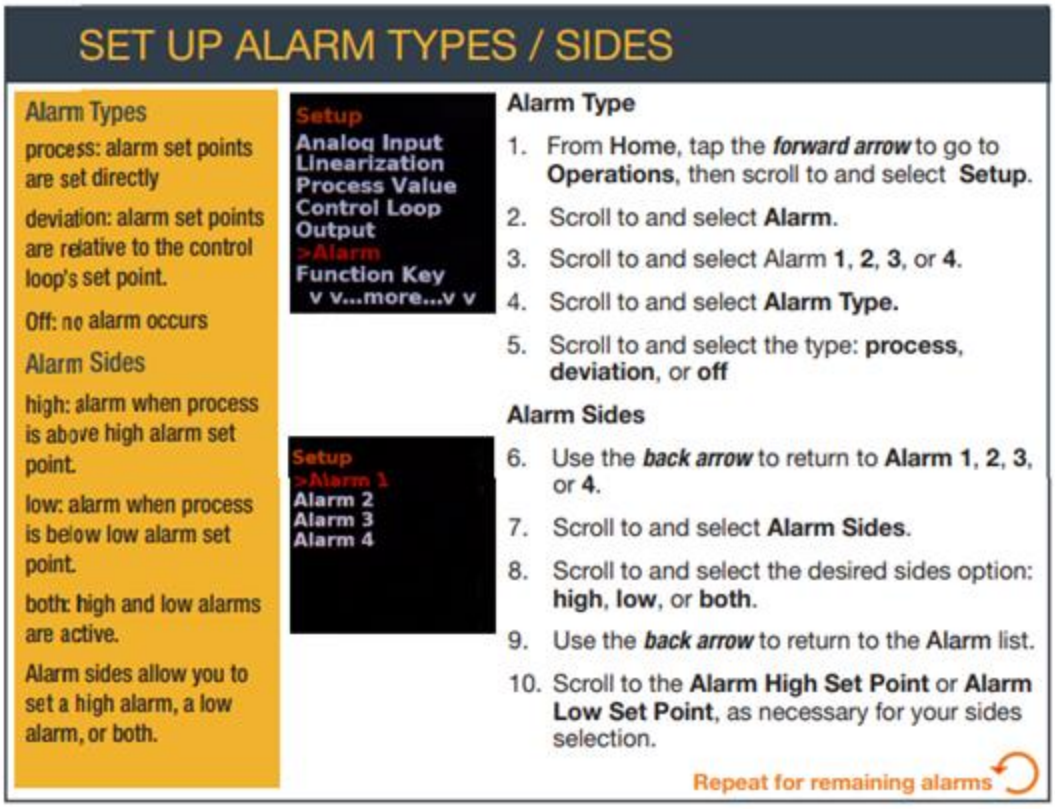
SET UP OUTPUTS

Repeat for all outputs

Output Functions
- heat control
- cool control
- event a
- event b
- alarm
- output off

1. From **Home**, tap the ***forward arrow*** to go to **Operations**.
2. Scroll to and select **Setup**.
3. Scroll to and select the **Output** list.
4. Scroll to **Output 1** and press *forward arrow* to select it.
5. Scroll and select **Output Function**.
6. Scroll up or down the list to select the output function, then use the back arrow to return to the **Output** list and select the settings for that Output function:

- For alarm outputs, select **Output Function Instance**, then select **Alarm Instance 1 - 4**.
- For heat or cool outputs, set the Time Base.
  - For a **Fixed Time Base,** select **Output Time Base** and use the *numeric slider* to set the time base cycle.
  - If you have a Switched DC or Open Collector and prefer a **Variable Time Base**, select **Output Low Power Scale** and set it with the *numeric slider*. Use the *back arrow* to return to **Output**, select **Output High Power Scale,** and set it with the *numeric slider*.



Specifications

Control Mode
- Microprocessor-based, single input, single output.
  - Control loops
    - Control Loop 1 User Defined Modes
      - ON/OFF
      - PID
      - Manual

- PID parameters

Proportional band: 1 to 999° F
Reset: 0.00 to 99.99 repeats per minute.
Integral: 0.00 to 99.99 minutes per repeat.
Rate or Derivative: 0.00 to 9.99 minutes.

Input
- Type J, K, T thermocouple or (RTD): input grounded or ungrounded.
- Automatic cold junction compensation and break protection for sensors.
- Degrees F or degrees C display; user selectable (preset for degrees C)

Range Type J:	**-200°C to 1200°C**
Range Type K:	**-200°C to 1370°C**
Range Type T:	**-200°C to 400°C**
Range Type RTD:	**-200°C to 800°C**

Primary Output (Heating or Cooling)
- 12 Amp, 120 Volts.

Accuracy
- Calibration accuracy: 0.1% of span.
- Temperature stability: 0.2 °F / °F rise in ambient maximum.
- Voltage stability: 0.01% of span / % of rated line voltage.

Power
- 50/60 Hz 5%
- Data retention upon power failure via nonvolatile memory

Operating Environment
- 32 to 149 °F / 0 to 65 °C; 0 to 90% RH, non-condensing.

General Operation Instructions

Prior to turning on control connect control loop #1 thermocouple to the input connection located on the back of the control chassis. Control loop output heating device shouldn't be connected to the control until control settings are verified on the initial power up of the system. Control settings can be verified by accessing the operations and setup pages.

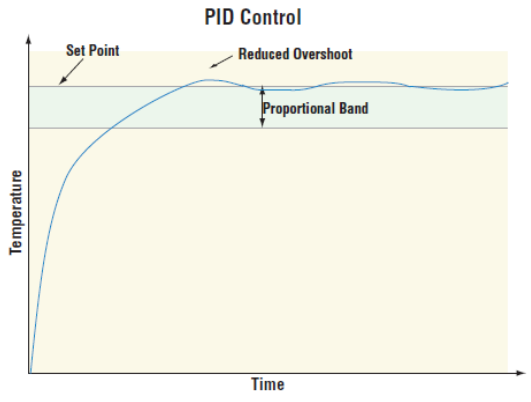
Control Loop Sensor

Proper placement of the sensor can eliminate many problems in the total system. The probe should be placed so that it can detect any temperature change with little thermal lag. In a process that requires fairly constant heat output, the probe should be close to the heating source. In processes where heat demand is variable, the probe should be close to the work area. Experimenting with probe location should be done to provide optimum results.

Proportional, Integral, and Derivative (PID) Control Mode

Proportional, Integral and Derivative (PID) Control

Use derivative (rate) control to minimize the overshoot in a PI-controlled system. Derivative (rate) adjusts the output based on the rate of change in the temperature or process value. Too much derivative (rate) will make the system sluggish. Adjust the derivative with Time Derivative (Operations Page, Loop Menu).



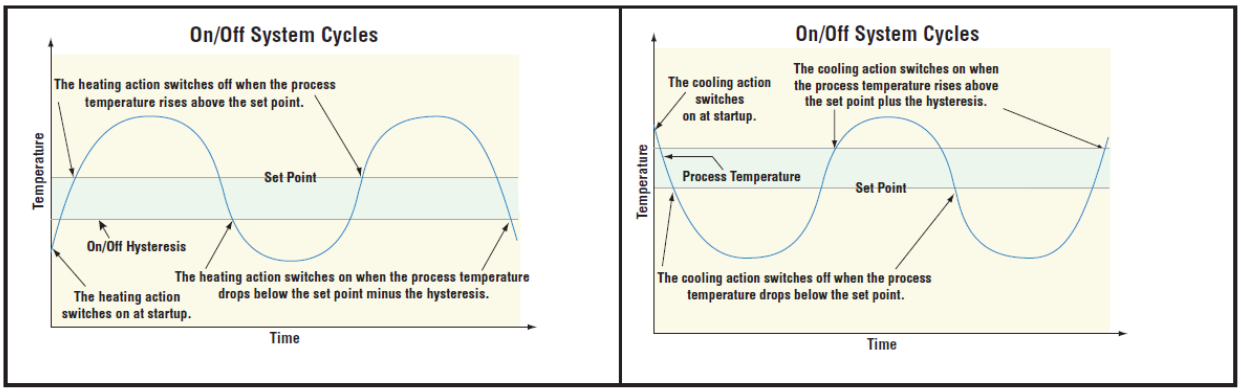
On-Off Control Mode

On-Off Control

On-off control switches the output either full on or full off, depending on the input, set point and hysteresis values.

The hysteresis value indicates the amount the process value must deviate from the set point to turn on the output. Increasing the value decreases the number of times the output will cycle. Decreasing hysteresis improves controllability. With hysteresis set to 0, the process value would stay closer to the set point, but the output would switch on and off more frequently, and may result in the output "chattering."

On-off control can be selected with Heat Algorithm (**Operations — Setup - Control Loop - Heat Algorithm**) or Cool Algorithm (**Operations — Setup - Control Loop - Cool Algorithm**). Then, On/Off hysteresis can be set at **Operations — Setup - Control Loop - On/Off Heat Hyster.** or **Operations — Setup - Control Loop - On/Off Cool Hyster.**.



Dead Band

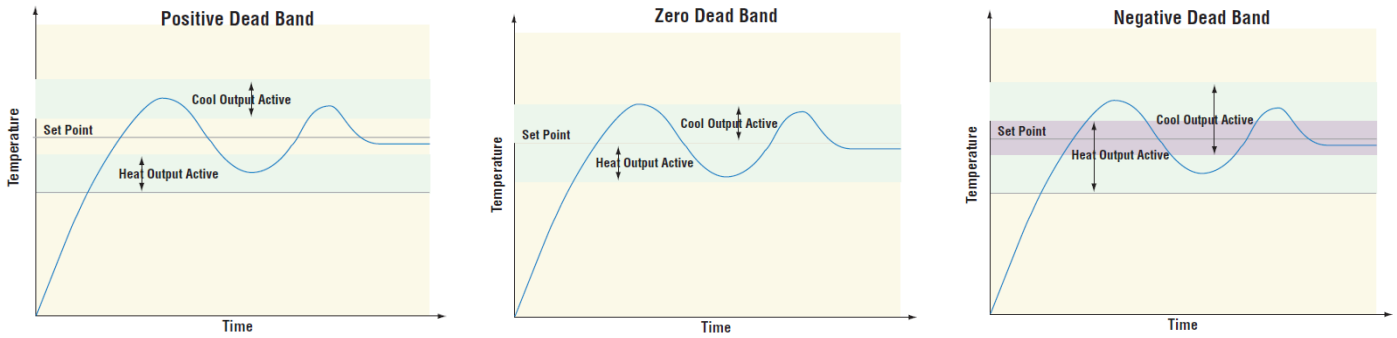
In a PID application the dead bands above and below the set point can save an application's energy and wear by maintaining process temperature within acceptable ranges.

Proportional action ceases when the process value is within the dead band. Integral action continues to bring the process temperature to the set point. Using a **positive dead band value** keeps the heating and cooling from fighting each other.

When the dead band value is zero, the heating output activates when the temperature drops below the set point, and the cooling output switches on when the temperature exceeds the set point.

When the dead band value is a negative value, both heating and cooling outputs are active when the temperature is near the set point.

Go to **Operations — Setup — Control Loop — Deadband** to adjust.



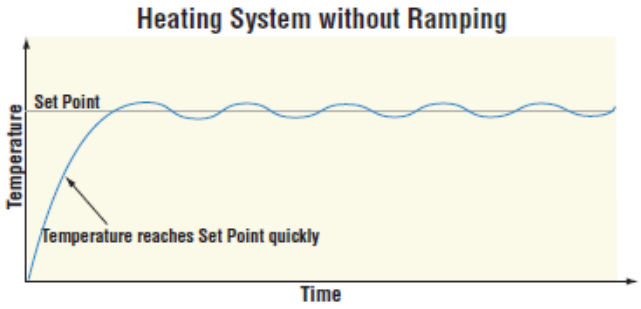
Single Set Point Ramping

Ramping protects materials and systems that cannot tolerate rapid temperature changes. The value of the ramp rate is the maximum degrees per minute or hour that the system temperature can change.

Note - Single Set Point Ramping should be set to Off, when running a Profile.

Select Ramp Action (**Operations — Setup - Control Loop - Ramp Action**):

Off ramping not active.
Start ramp at startup.
Set Point ramp at a set point change.
both ramp at startup or when the set point changes.



Once the Ramp Action is selected, you can go back to the Control Loop List and select whether the rate is in degrees per minute or degrees per hour at **Operations — Setup - Control Loop - Ramp Scale** and then set the ramping rate at **Operations — Setup - Control Loop - Ramp Rate**

Alarms

Alarms are activated when the output level, process value or temperature leaves a defined range. A user can configure how and when an alarm is triggered, what action it takes and whether it turns off automatically when the alarm condition is over. Configure alarm outputs in the Setup Page before setting alarm set points. Alarms do not have to be assigned to an output. Alarms can be monitored and controlled through the front panel or using software.

Process and Deviation Alarms

A process alarm uses one or two absolute set points to define an alarm condition. A deviation alarm uses one or two set points that are defined relative to the set point used by the control loop. Deviation high and low alarm set points are calculated by adding or subtracting offset values from the set point used by the control loop. If the set point changes, the window defined by the deviation alarm set points automatically moves with it. Select the type with Type (Setup Page, Alarm Menu).

Set Points

The high set point defines the process value or temperature that will trigger a high side alarm. The low set point defines the temperature that will trigger a low side alarm. For deviation alarms, a negative set point represents a value below set point used by the control loop. A positive set point represents a value above the set point used by the control loop. View or change alarm set points with Low Set Point and High Set Point (Operations Page, Alarm Menu).

Silencing Alarms

If silencing is on you can disable the alarm output while the controller is in an alarm state. The process value or temperature has to enter the normal operating range beyond the hysteresis zone to activate the alarm output function again. An active message, such as an alarm message, will cause the display to toggle between the normal settings and the active message on the Home screen display.

To enable alarm silencing, go to **Operations — Setup — Alarm — Alarm [1,2,3,4] — Silencing — [Off,On]**,

> NOTE: If silence is on, and you silence with Home Key, the message is cleared, but the warning symbol remains.

Blocking Alarms

Blocking allows a system to warm up after it has been started up. With blocking on, an alarm is not triggered when the process temperature is initially lower than the low set point or higher than the high set point. The process temperature has to enter the normal operating range beyond the hysteresis zone to activate the alarm function. If the PM PLUS has an output that is functioning as a deviation alarm, the alarm is blocked when the set point is changed, until the process value re-enters the normal operating range.

To enable alarm silencing, go to **Operations — Setup — Alarm — Alarm [1,2,3,4] — Blocking —** and then select the desired blocking option: **[Off,Startup,Set Point,Both]**.

Calibration Offset

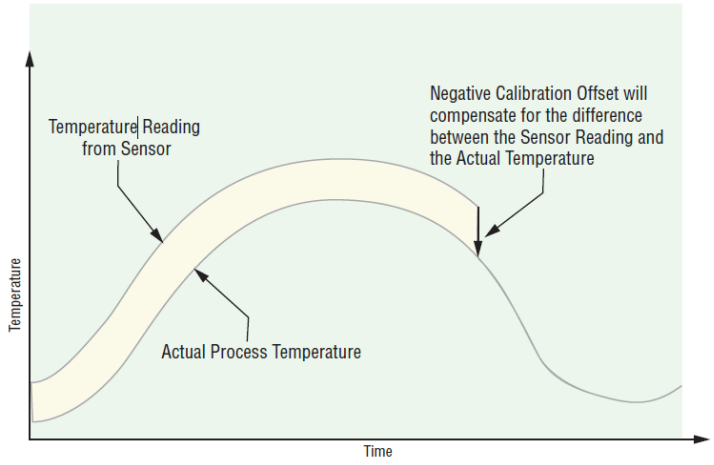
Calibration offset allows a device to compensate for an inaccurate sensor, lead resistance or other factors that affect the input value. A positive offset increases the input value, and a negative offset decreases the input value. The input offset value can be viewed or changed with Calibration Offset (**Operations — Setup - Analog Input**).

Before performing any calibration procedure, verify that the displayed readings are not within published specifications by inputting a known value from a precision source to the analog input. Next, subtract the displayed value with the known value and compare this difference to the published accuracy range specification for that type of input.

Use Calibration Offset

Use of the Calibration Offset parameter shifts the readings across the entire displayed range by the offset value. Use this parameter to compensate for sensor error or sensor placement error. Typically this value is set to zero.

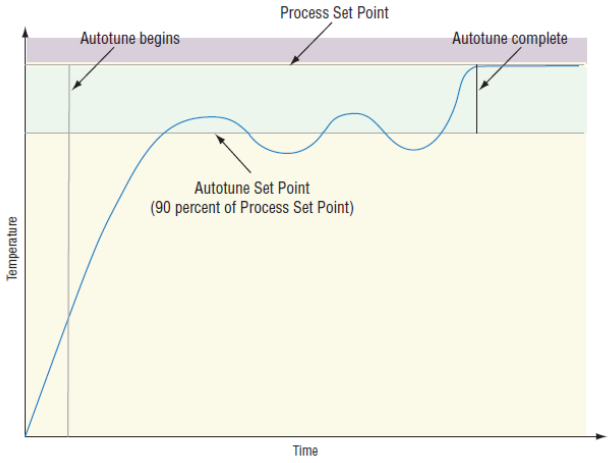
1. Navigate to **Operations — Setup - Analog Input - Calibration Offset**
2. Set the offset to the desired value.



Autotune

When an autotune is performed on the PM PLUS™ the set point and the autotune set point are used to calculate the tuning set point. For example, if the active set point is 200° and Autotune Set Point is 90 percent, the autotune function uses 180° for tuning.

Autotuning calculates the optimum heating and/or cooling PID parameter settings based on the system's response. The PID settings generated by the autotune will be used until the autotune feature is rerun, the PID values are manually adjusted or TRU-TUNE+ is enabled.



Start Autotune

1. Use the slider or +/- keys to set the set point for the tune.
2. Navigate to: **Operations - Autotune 1, (or Autotune 2 if autotuning loop 2).**
3. Scroll to select **Yes**.
4. Press the Home icon to return to the Home Screen.

WARNING! ⚠

During autotuning, the controller sets the output to 100 percent and attempts to drive the Process Value toward the set point. Enter a set point and heat and cool power limits that are within the safe operating limits of your system.

Temperature overshoot

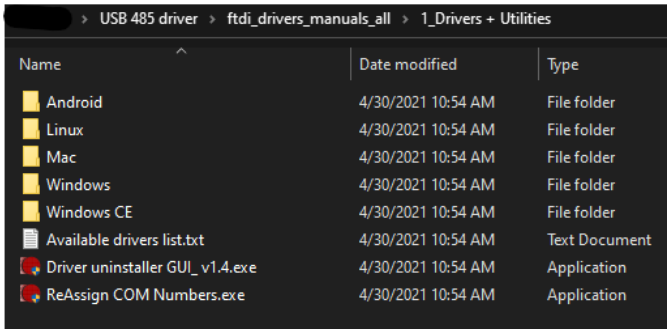
In most cases this is due to a small sample size being heated with a high wattage heater. The control is set at the factory with the Power Scale High Output 1 with a value of 100. This value can be adjusted in the setup menu, reference page 5 and 6 for instructions on how to change value. The Power Scale Output 1 is located in the output menu of the setup menu. If excessive temperature overshoot is occurring, adjust the value to 50 and start the heating process from ambient room temperature. If excessive temperature overshoot is still occurring, decrease to a lower value and repeat heating process from ambient room temperature. If the process temperature never makes it to the set point temperature value, increase the power scale high output 1 value. This process can take several value changes to obtain proper temperature control with your particular application setup. It is recommended to initiate the Auto-Tune process again after the proper power scale high output 1 value has been determined for your application.

Error Code Definitions and Actions:

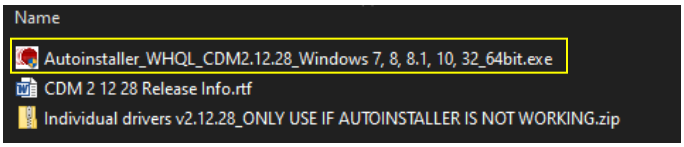
Er.In - An open or reversed polarity sensor is the most likely cause. Check the sensor; if the connection is good and functions properly, call the factory. Make sure the input parameter [SEn] is set to the correct type thermocouple.
Er.Ab – Ambient temperature may be too hot or too cold. Make sure that the temperature surrounding the control is –18 to 65C.
Er.CS – Checksum Error. Settings may have changed unexpectedly. Press the **Infinity** key to clear the error. Verify settings. If error message persists, contact the factory.
To clear an corrected error, cycle power to the control.

Ramp/Soak Operation / USB Driver Installation

USB Driver Install:
Windows OS should automatically install the correct driver when the user connects the USB cable from the controller to their computer. If this doesn't occur then download the following file: https://www.usconverters.com/downloads/drivers/ftdi_drivers_manuals_all.zip. Extract the zip file into a local directory on your computer. Open the folder "1_Drivers + Utilities" and open your computer operating system folder. →



Next select version of OS and execute the *.exe file → (Example Windows 10 OS)

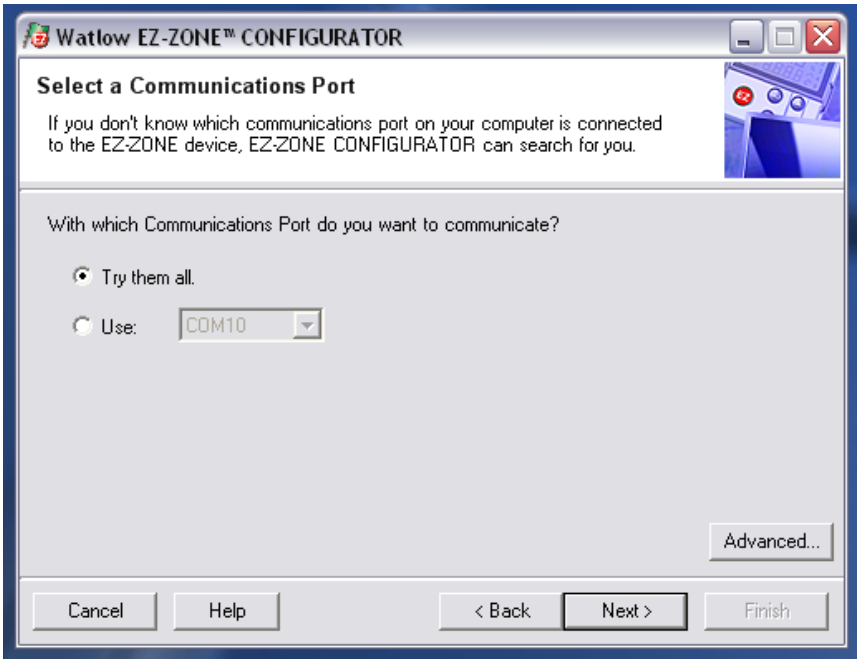


Follow the instructions to complete the installation of the driver.

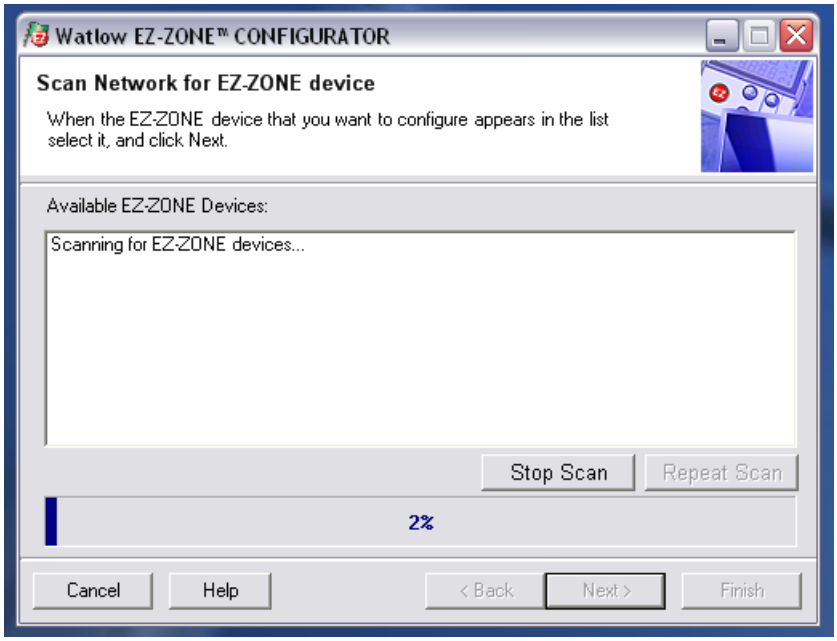
Once this is accomplished it is recommended to go to the Watlow web site, https://www.watlow.com/resources-and-support/Technical-Library/Software-and-Demos, and download/install the EZ-Zone configuration software. This software will allow you to easily set any parameter in the control and allow simple profile setup.

Once the software has been installed you can now attach the control to a pc and open the EZ-Zone configuration software.

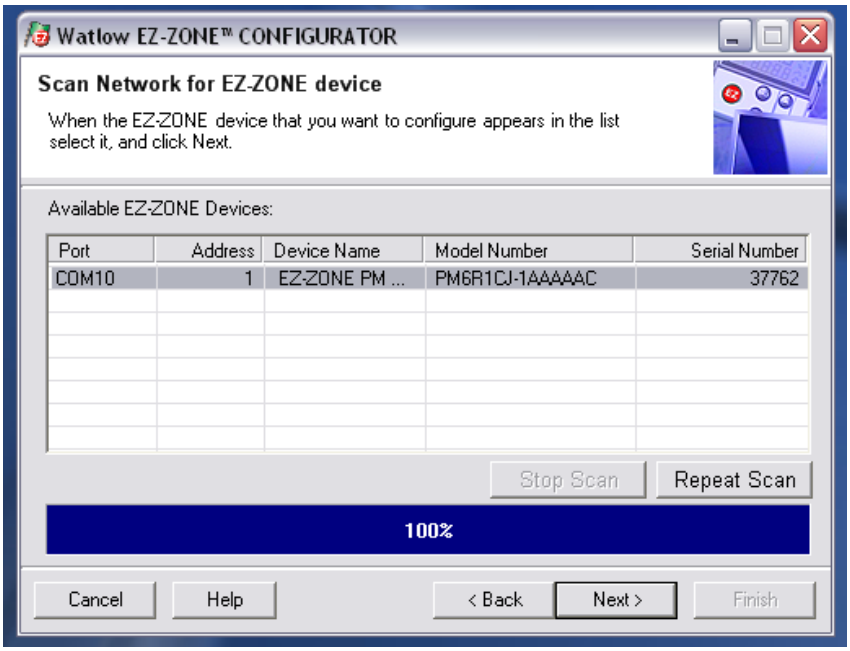
First Screen



Second Screen

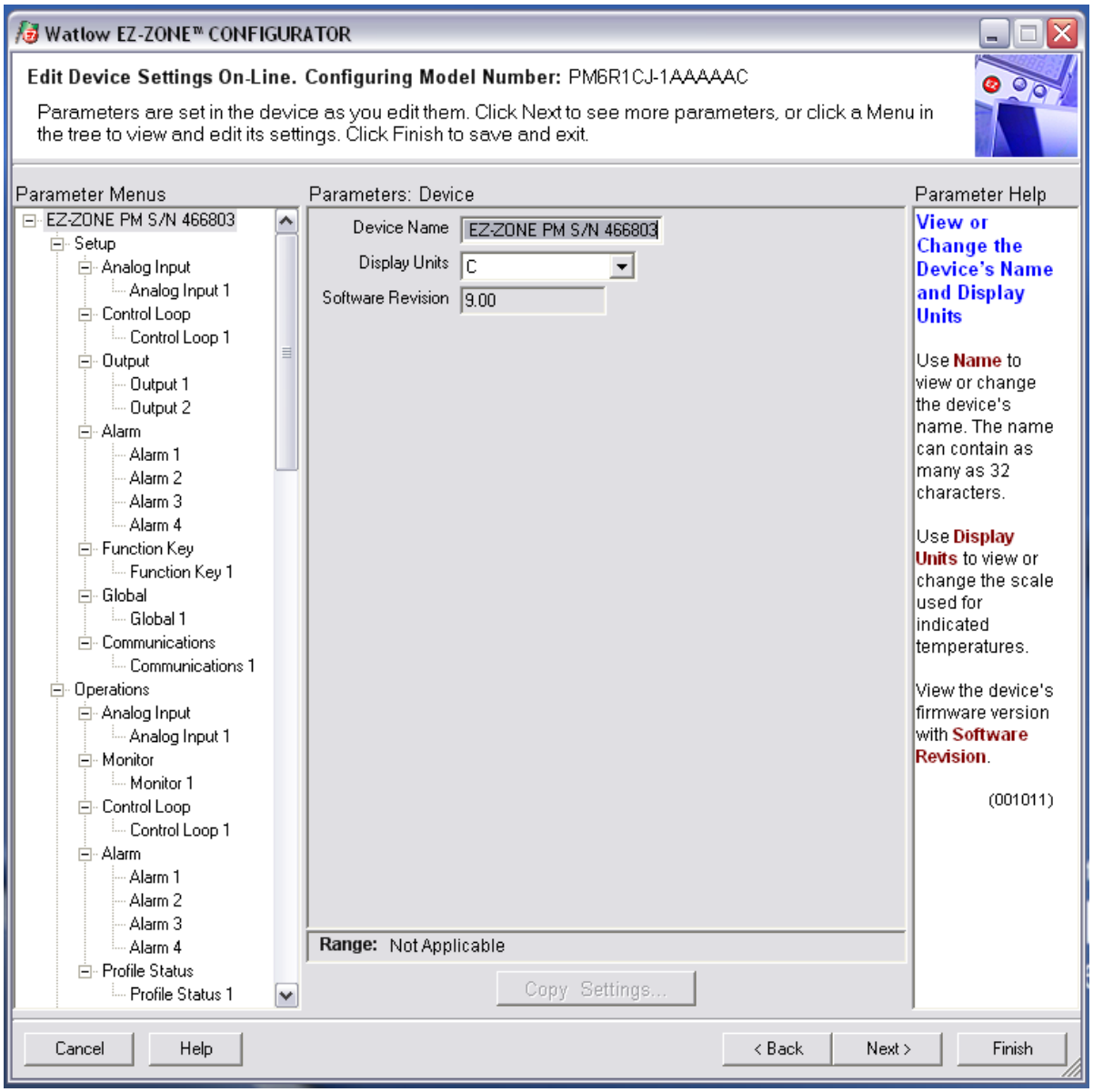


Third Screen

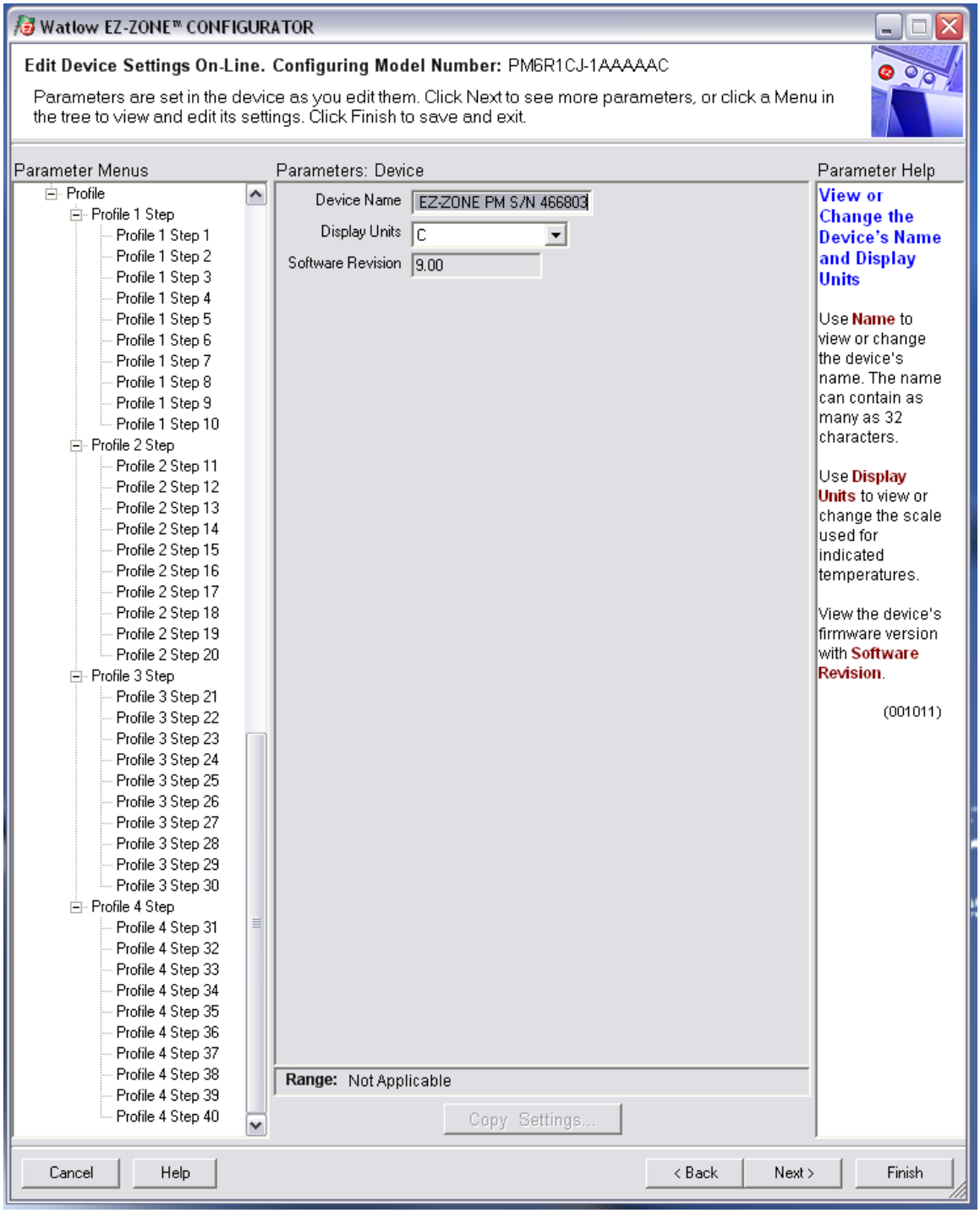


Fourth Screen

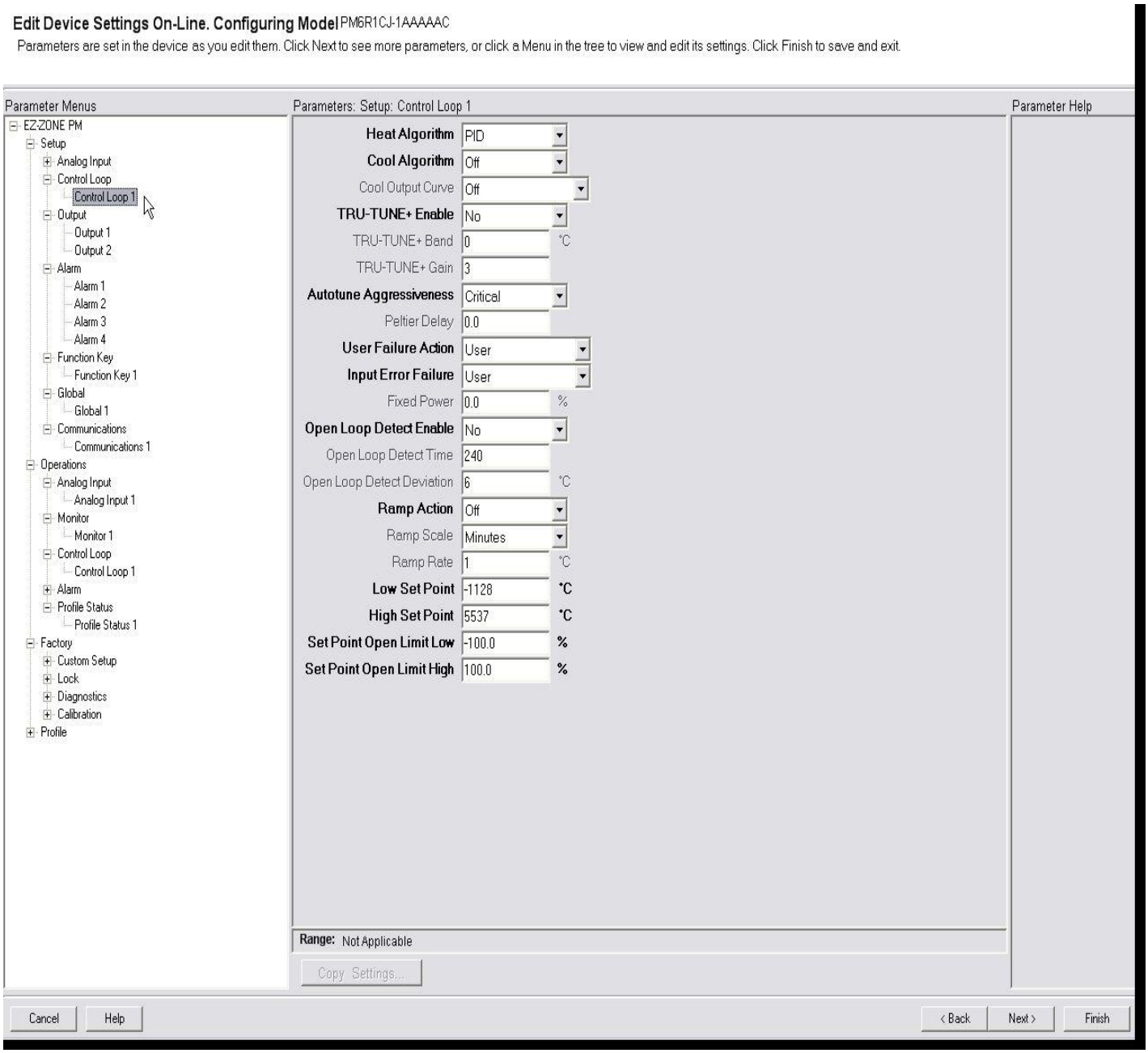
EZ-Zone Configurator software will now open and the following will appear on the screen:



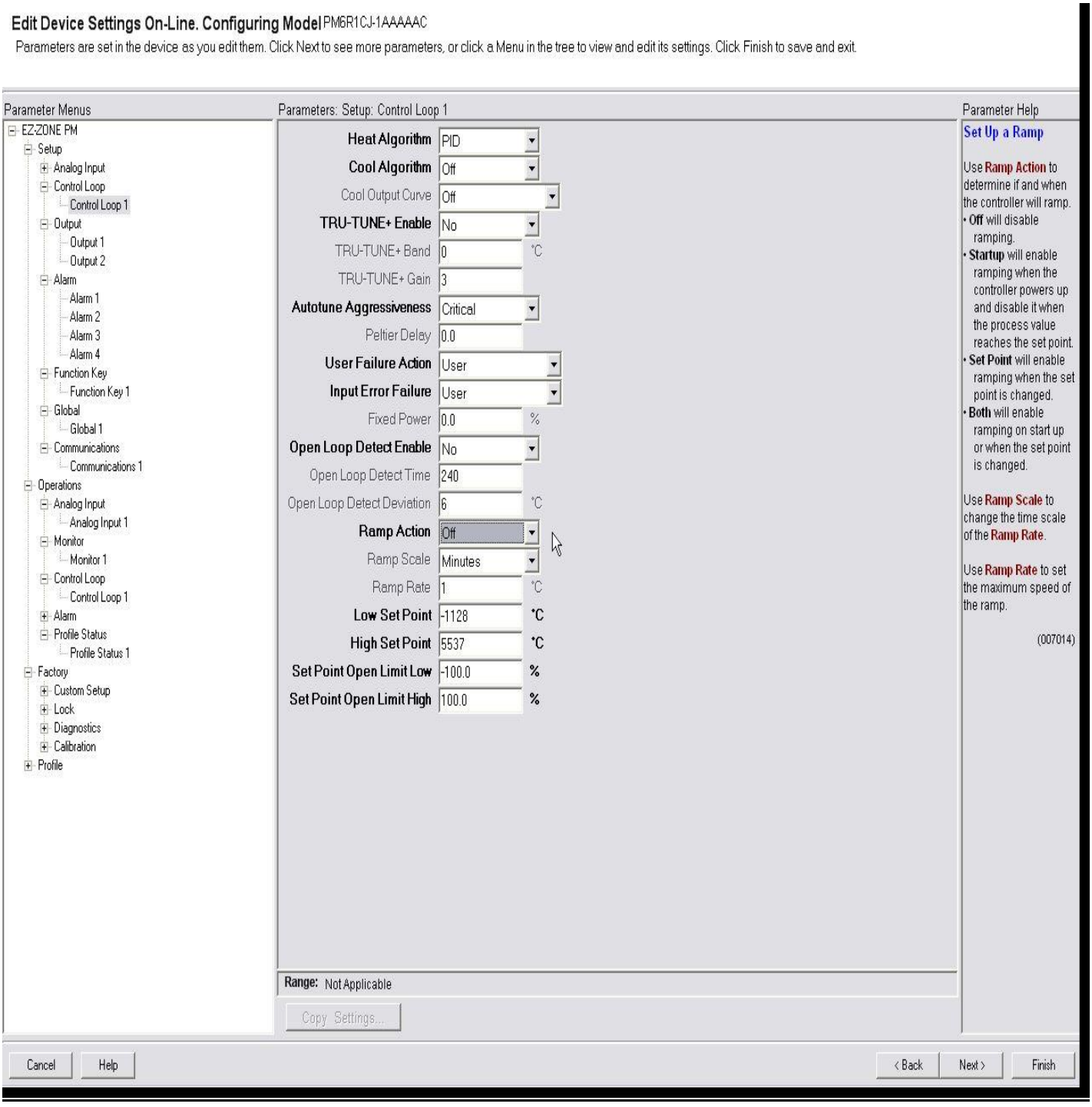
Continued:


Watlow EZ-ZONE™ CONFIGURATOR
Edit Device Settings On-Line. Configuring Model Number: PM6R1CJ-1AAAAAC
Parameters are set in the device as you edit them. Click Next to see more parameters, or click a Menu in the tree to view and edit its settings. Click Finish to save and exit.
Parameter Menus
Parameters: Device
Parameter Help
Profile
Profile 1 Step
Profile 1 Step 1
Profile 1 Step 2
Profile 1 Step 3
Profile 1 Step 4
Profile 1 Step 5
Profile 1 Step 6
Profile 1 Step 7
Profile 1 Step 8
Profile 1 Step 9
Profile 1 Step 10
Profile 2 Step
Profile 2 Step 11
Profile 2 Step 12
Profile 2 Step 13
Profile 2 Step 14
Profile 2 Step 15
Profile 2 Step 16
Profile 2 Step 17
Profile 2 Step 18
Profile 2 Step 19
Profile 2 Step 20
Profile 3 Step
Profile 3 Step 21
Profile 3 Step 22
Profile 3 Step 23
Profile 3 Step 24
Profile 3 Step 25
Profile 3 Step 26
Profile 3 Step 27
Profile 3 Step 28
Profile 3 Step 29
Profile 3 Step 30
Profile 4 Step
Profile 4 Step 31
Profile 4 Step 32
Profile 4 Step 33
Profile 4 Step 34
Profile 4 Step 35
Profile 4 Step 36
Profile 4 Step 37
Profile 4 Step 38
Profile 4 Step 39
Profile 4 Step 40
Device Name
EZ-ZONE PM S/N 466803
Display Units
C
Software Revision
9.00
Range: Not Applicable
Copy Settings...
View or Change the Device's Name and Display Units
Use Name to view or change the device's name. The name can contain as many as 32 characters.
Use Display Units to view or change the scale used for indicated temperatures.
View the device's firmware version with Software Revision.
(001011)
Cancel
Help
< Back
Next >
Finish

To activate the Ramp action, follow the below setup:



Ramp Action Continued:



GLOSSARY

Automatic prompts: Data entry points where a microprocessor-based control "prompts" or asks the operator for information input.

Auto-tune: Automatically tunes the parameters to fit the characteristics of your particular thermal system.

Cold junction compensation: Electronic means to compensate for the effect temperature at the cold junction.

Cycle time: The time necessary to complete a full On-through-Off period in a time proportioning control system.

Derivative/Rate: Anticipatory action that senses the rate of change of the process, and compensates to minimize overshoot and undershoot.

Default parameters: The parameters (programmed instructions) permanently stored in microprocessor software to provide the data base.

Droop: Difference in temperature between set point and stabilized process temperature.

Hysteresis: In On/Off control, the temperature change necessary to change the output from On to full Off.

Input (sensor): Process variable information being supplied to the instrument.

Integral/Reset: Control action that automatically eliminates offset, or "droop", between set point and actual process temperature.

Offset: Adjustment to actual input temperature and to the temperature valves the control uses for display and control.

ON/OFF control: Control of temperature about a set point by turning the output full On below set point and full Off above set point.

Output: Action in response to difference between set point and process variable.

Overshoot: Condition where temperature exceeds steeping due to initial power up or process changes.

Parameter: a physical property whose value determines the response of a electronic control to given inputs.

PID: Proportioning control with auto-reset and rate.

Process variable: Thermal system element to be regulated, such as time, temperature, relative humidity, etc.

Proportional band: Span of temperature about the set point where time proportional control action takes place.

Set point: Intended value of the process variable.

Thermal system: A regulated environment consisting of a heat source, heat transfer medium, sensing device and a process variable control.

Thermocouple: Temperature sensing device that is constructed of two dissimilar metals wherein a measurable, predicative voltage is generated corresponding to temperature.

Thermocouple break protection: Fail-safe operation that assures output shutdown upon an open thermocouple condition.

Time Proportioning Control: Action which varies the amount of ON and OFF time when "close" to the set point (within the proportional band). This variance is proportional to the difference between the set point and the actual process temperature.

Maintenance

Simple preventative maintenance steps include keeping the controller clean. Protect it from overload, excessive dirt, oil and corrosion.

Warranty

Cole-Parmer, for itself does hereby offer a warranty for products from the date of receipt by the user, under normal and proper usage, against defects in workmanship and materials for 12 months, and will repair or replace any defective part(s) without charge when same is shipped Prepaid to Cole-Parmer from which the product was originally purchased.

Should the nature of any defect require that the product, or any constituent portion thereof, be returned to Cole-Parmer, Vernon Hill, Illinois, prepaid for service, a condition precedent to any return shall be the procurement of authorization from Cole-Parmer assigning a **Return Goods Number** to the product or part requiring service.

Parts and accessories manufactured by others are warranted only to the extent of the regular warranty of the manufacturer or supplier of such materials and only insofar as Cole-Parmer is able to transfer the benefits of warranty coverage, if any, to the user. Any adequately warranted defective part or accessory manufactured or supplied by others may be exchanged through Cole-Parmer for a replacement part is shipped prepaid and received at Cole-Parmer within 30 days from the date any replacement part is obtained by the user.

This warranty supersedes and is given in lieu of all implied warranties and is void if the user causes damages from improper usage of product under normal operating conditions.

12 MONTHS LIMITED WARRANTY ON ALL PARTS AND LABOR IS GIVEN BY COLE-PARMER.

CATALOG NUMBER 3622566, 3622567, 3622568, 3622569

SERIAL NUMBER _____

DATE OF PURCHASE _____

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