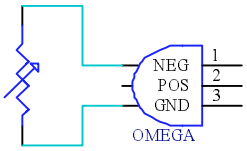
Quick Start Guide

Use this Quick Start Guide to get your Temperature Controller up and going fast!

1. Initial Checklist

Things needed for getting the Controller up and going fast include:

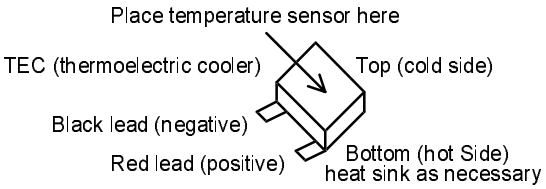
- ☑ Thermoelectric Cooler Controller and power cord.
- ☑ Sensor Mating Connector.
- ☑ Temperature Sensor.



Wire the temperature sensor to the Sensor Mating Connector as shown (thermistor shown here as an example).

See Instruction Manual page 8.11 for wiring of other type sensors.

- ☑ Thermoelectric Cooler (TEC).



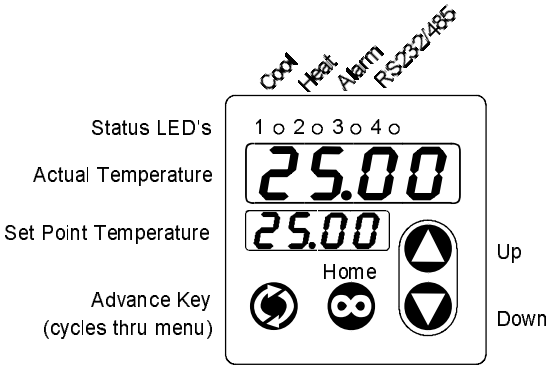
2. Powering Up Checklist

- ☑ Power rating on the TEC **must** be rated to handle the maximum power from the Temperature Controller[1] [2] [3]
- ☑ Sensor Mating Connector is wired correctly and plugged into the rear of the Temperature Controller.[4]
- ☑ If the Temperature Controller is rated for greater than 60 Watts, make sure it is properly set for the correct AC voltage (115 or 230V). Refer to page 2.4 in the Instruction Manual for details on changing the AC operating voltage setting.

3. Operation

Turn on the Temperature Controller and check the following:

- ☑ Make sure the front panel displays light up.



- ☑ Change the set point temperature by using the up and down arrows.
- ☑ Pressing the Advance Key repeatedly will rotate through the custom menu defaults. The parameters in this menu are preprogrammed at the factory and are the only parameters necessary for complete operation.[5]
- ☑ LED 1 or LED 2 should be on or blinking.

Refer to the Troubleshooting section on the back of this Quick Start Guide if any problems should arise.

Note: When using a Thermistor, there are two possible ranges to choose from. Thermistor ranges 100K and 1M refer to the maximum reading on that range and NOT the room temperature reading of the thermistor sensor. Therefore if using a 100K thermistor, it is recommended that the 0 to 1M range be used to allow the temperature to go below room temperature which is greater than 100K.

See Auto-tuning and Troubleshooting on back.

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[1] If the TEC is not rated to handle 100% output power from the Temperature Controller, please refer to the section titled "Auto-tuning" on the back of this Quick Start Guide.
[2] Check the bottom of the controller for the wattage listed in the part number.
[3] Adequate heat sinking may be necessary on the "Hot Side" of the TEC.
[4] For applications involving an RTD temperature sensor, make sure that the Sensor Mating Connector is wired according to the Instruction Manual on page 2.2.
[5] Changing the sensor input type might require other parameters to be changed. Please refer to Chapter 8 in the Instruction Manual for changing to another sensor input type and the associated parameters.

Auto-tuning

This section details certain important factors concerning the Auto-tuning process.

WARNING

THE AUTO-TUNING PROCESS REQUIRES THAT THE TEMPERATURE CONTROLLER CYCLE THE OUTPUT FROM 100% COOLING POWER TO 100% HEATING POWER TO MONITOR THE RESPONSE OF THE TEC (LOAD). DO NOT AUTO-TUNE A TEC OR LOAD THAT CANNOT HANDLE THE FULL 100% OUTPUT POWER OF THE TEMPERATURE CONTROLLER. READ BELOW FOR INFORMATION ON **AUTO-TUNING WITH AN UNDER RATED TEC.**

You can choose to Auto-tune (Manual page 5.3) at any time from the Custom Menu (Manual page 3.2) by pressing the Advance Key until [Aut] shows up in the bottom display.

Auto-tuning is a procedure that allows the temperature controller to temporarily adjust the output and measure the response of the system. While Auto-tuning, the display will blink [tunE]. When the temperature controller is finished Auto-tuning, it will automatically change the appropriate PID parameters to give the best control possible. **Note**: The Power Limits will not limit the power during an Auto-tune! Please refer to the troubleshooting section below.

Auto-tuning an Under Rated TEC

There are three ways to protect against over driving a TEC with your temperature controller. Here are some suggestions for Auto-tuning with less than 100% power output to avoid damaging the TEC.

I. Drop the extra power across a resistor in series with the TEC.

II. Change both the [out 1] and [out2] parameters from [0-10] to [0- 5] This drops the maximum output power by 50%. (i.e. If your temperature controller was 120 Watts, it now is only 60 Watts).

III. Add another TEC in series or parallel as needed. This can be permanent or temporary while Auto-tuning only.

Troubleshooting

Listed below are some conditions that may occur when using the temperature controller and also the most common explanations and possible solutions.

CONDITION	EXPLANATION	POSSIBLE SOLUTION(S)
[Err 1], [Err2], [Err3], OR [Err4] SHOWS ON DISPLAY	THESE ERROR MESSAGES ALL INDICATE THAT THEIR IS SOMETHING WRONG WITH THE TEMPERATURE SENSOR INPUT.	1. Check sensor wiring for reverse wires, open circuits, or shorted circuits. 2. Check the sensor programming and configuration page in Chapter 8 of the Instruction Manual for your particular temperature sensor. 3. Ambient temperature may be too hot or too cold. 4. Calibration offset parameter is set too high or too low.
POINTS OF CLARIFICATION		
WHAT ARE POWER LIMITS? OR [PLSP] DOESN'T WORK! OR WHAT IS [PLSP], [PL A], AND [PL b] ANYWAY!	CONFUSION BETWEEN SET POINT AND POWER LIMIT SET POINT AND POWER LIMITS ABOVE AND BELOW. DURING NORMAL OPERATION, THESE ARE USED TO LIMIT THE MAXIMUM OUTPUT OF THE TEC CONTROLLER.	[PLSP] = POWER LIMIT SET POINT = TEMPERATURE THAT THE [PL A] AND [PL b] PARAMETERS WORK WITH. [PL A] = POWER LIMIT ABOVE IN % = % POWER LIMIT THAT WILL BE APPLIED TO THE TEC WHEN THE PROCESS TEMPERATURE GOES ABOVE THE [PLSP]. [PL b] = POWER LIMIT BELOW IN % = % POWER LIMIT THAT WILL BE APPLIED TO THE TEC WHEN THE PROCESS TEMPERATURE GOES BELOW THE [PLSP].

- Setting a Proportional Band to zero causes the temperature controller's output to act as an ON/OFF controller. See Control Methods on page 5.10 of the Instruction Manual for more details.
- Remember that LED 1 (% Cooling Power) and LED 2 (% Heating Power) will always indicate the status of the temperature controllers Cooling and Heating outputs. These LED's will blink at the duty cycle that represents the % Power being applied for that output. For instance, if LED 1 is blinking at about a 50% duty cycle (½ on and ½ off), then the temperature controller is COOLING the TEC at about 50% output power. Likewise, if LED 2 should be OFF, then no Heating power is being applied.

SERIES MTCA

THERMOELECTRIC COOLER CONTROLLER

INSTRUCTION MANUAL

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Revision 5.121900

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Overview

Warranty i
Warnings ii
RF Disclaimer ii
Ventilation ii

Warranty

Melcor warrants the products delivered to be free from defects in material and workmanship at the time of delivery to the Fob point specified in the purchase order, its liability under this warranty being limited to repairing or replacing, at Melcor's option, items which are returned to it prepaid within two (2) years from the date of shipment and found to Seller's satisfaction to have been so defective. In no event shall Melcor be liable for consequential damages.

NO PRODUCT IS WARRANTED AS BEING FIT FOR A PARTICULAR PURPOSE AND THERE IS NO WARRANTY OF MERCHANTABILITY.

This warranty applies only if:

i) The items are used solely under the operating conditions and manner recommended in this manual, specifications, or other literature;

ii) The items have not been misused or abused in any manner or repairs attempted thereon;

iii) Written notice of the failure within the warranty period is forwarded to Melcor and, the directions received for properly identifying items returned under warranty are followed;

iv) The return notice authorizes Melcor to examine and disassemble returned products to the extent the Company deems necessary to ascertain the cause of failure.

The warranties stated herein are exclusive. THERE ARE NO OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED, BEYOND THOSE SET FORTH HEREIN, and Melcor does not assume any other obligation or liability in connection with the sale or use of said products.

Disclaimer of Warranty

Melcor makes no representation or warranties, either expressed or implied, by or with respect to anything in this manual, including, but not limited to, implied warranties of merchantability or fitness for a particular purpose. In no event will Melcor be liable for any damages, whether direct or indirect, special, consequential, or incidental arising from the use of this manual. Some states in the USA do not allow the exclusion of incidental or consequential damages. Melcor also reserves the right to make any changes to improve the performance of its products at any time and without notice.

Warnings

Explanation of graphic symbols:

DO NOT TOUCH!

THIS SYMBOL IS INTENDED TO ALERT THE USER TO THE PRESENCE OF IMPORTANT OPERATING AND MAINTENANCE INSTRUCTIONS.

To avoid the risk of fire or electrical shock, do not expose the outside surfaces of the Series MTCA Thermoelectric Cooler Controller to rain or water spray.

WHEN POWERED, THE PRESENCE OF NON-INSULATED DANGEROUS VOLTAGES WITHIN THE INSTRUMENT MAY BE OF SUFFICIENT MAGNITUDE TO CONSTITUTE A RISK OF ELECTRICAL SHOCK RESULTING IN INJURY OR DEATH. LEAVE ALL SERVICING TO QUALIFIED PERSONNEL. **REMOVE ALL POWER SOURCES WHEN INSTALLING OR REMOVING SENSOR CONNECTIONS AND WHEN CHANGING THE SENSOR SETUP.**

RF Disclaimer

This instrument generates and uses small amounts of radio frequency energy, and there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, try to correct the interference by one of more of the following steps:

1. Reorient the receiving antenna.
2. Relocate the instrument with respect to the receiver.
3. Change the AC outlet of the instrument so the instrument and receiver are on different branch circuits.

Ventilation

<u>DO NOT</u> BLOCK THE AIR VENTS LOCATED ON THE TOP, SIDES, AND REAR OF THE Series MTCA Thermoelectric Cooler Controller. WHEN MAXIMUM POWER IS BEING DISSIPATED INSIDE THE CONTROLLER, THESE VENTS ARE CRITICAL FOR HELPING TO KEEP THE COMPONENTS WITHIN THEIR OPERATING TEMPERATURE RANGE. SEVERE DAMAGE TO THE INSTRUMENT MAY TAKE PLACE IF AIR FLOW IS IMPEDED.

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Series MTCA Thermoelectric Cooler Controller
Table of Contents

Warranty i
Warnings ii
RF Disclaimer ii
Air Flow iii
Chapter 1: Introduction 1.1
General Description 1.1
General Specifications 1.2
Chapter 2: Installation Procedures 2.1
Unpacking the Instrument 2.1
Determining Configuration 2.1
Wiring the Sensor 2.2
Wiring the TEC 2.3
Wiring the Communications Port 2.3
Chapter 3: Operation 3.1
Preparation for Operation 3.1
TEC Fuse 3.1
Initial Setup 3.1
Custom Menu Defaults 3.1
Chapter 4: Navigation and Software 4.1
Keys and Displays 4.2
Navigation 4.3
Software Map 4.4
Example Setup Tasks 4.6
Chapter 5: Features 5.1
System 5.1
Custom Menu 5.2
Auto-Tune 5.3
Power Limit 5.4
Input 5.5
Calibration Offset 5.5
Filter Time Constant 5.6
Sensor Selection 5.7
Range Low and Range High 5.7
Control Methods 5.10
Proportional 5.11
PI Control 5.12
PID 5.13
Dual PID 5.14
Alarms 5.18
Alarm Set Points 5.18
Alarm Hysteresis 5.18
Process or Deviation Alarms 5.19
Alarm Latching 5.19
Alarm Silencing 5.20
Errors 5.21
Open Loop Detect 5.21
Bumpless Transfer 5.22
Chapter 6: Parameters 6.1
Chapter 7: Options 7.1
Temperature Sensor Configurations . . . 7.1
Optional Inputs (Input 2) 7.4
Optional Outputs (Output 3 & Output 4) 7.5
Special Configurations 7.7
TECView Software 7.11
Chapter 8:
Sensor Configuration & Programming 8.1
0 to 100K Thermistor 8.1
0 to 1M Thermistor 8.2
AD590 . . . . . 8.3
LM35 . . . . . 8.4
100 Ohm 3 Wire RTD 8.5
Voltage 8.7
Current 8.8
Thermocouples (All Types) 8.9
Hardware Reference Table 8.11
Chapter 9: Ramping 9.1
Program Menu Prompts 9.1
How to Navigate with the
Ramping Menus 9.4
Pre-run and Run Menus 9.5
Running a Series 800 Profile 9.5
Resume a Profile 9.5
Jump Loops 9.6
The Wait-for Functions
of the Soak Step 9.6
Event Input Functions 9.6
Series 800 Ramping Modbus
Register Numbers 9.7
Appendix: Modbus™ RTU A.4

1

Chapter One
Introduction

General Description 1.1
Sensors and Ranges 1.1
Mechanical Configuration 1.1
Options 1.2
RS-232C 1.2
RS-485 . . . . . 1.2
Sensor Options 1.2
General Specifications 1.3

General Description

The Series MTCA Thermoelectric Cooler Controller is a high precision instrument that utilizes advanced control technology, in combination with auto-tuning capabilities, to provide extraordinary temperature control. One of the subsystems used in the Series MTCA Thermoelectric Cooler Controller is the Series 96 Controller manufactured by Watlow. Portions of this manual reference features associated with the Series 96 as a stand alone device. Because the Series 96 is an integral part of the Series MTCA Thermoelectric Cooler Controller, the features associated with the Series 96 are part of the overall performance characteristics of the Series MTCA Thermoelectric Cooler Controller.

Sensors and Ranges

The Series MTCA Thermoelectric Cooler Controller accepts a variety of temperature sensors. With a standard configuration the Series MTCA Thermoelectric Cooler Controller will interface to the following sensors:

Standard Configuration

1. Thermistor (Full Scale of 100 Kohms or 1 Megohm)
2. Analog Devices AD590
3. LM35
4. 100 ohm, 3 wire RTD
5. Voltage or Current input (provides the ability to interface with most sensors)

Thermocouple Configuration

Types E, J, K, N, and T

Mechanical Configuration

Shown below are drawings of the front and rear panels of the Series MTCA Thermoelectric Cooler Controller (Figures 1 and 2 respectively). Please refer to the rear panel drawing when wiring the inputs and outputs.

Front Panel

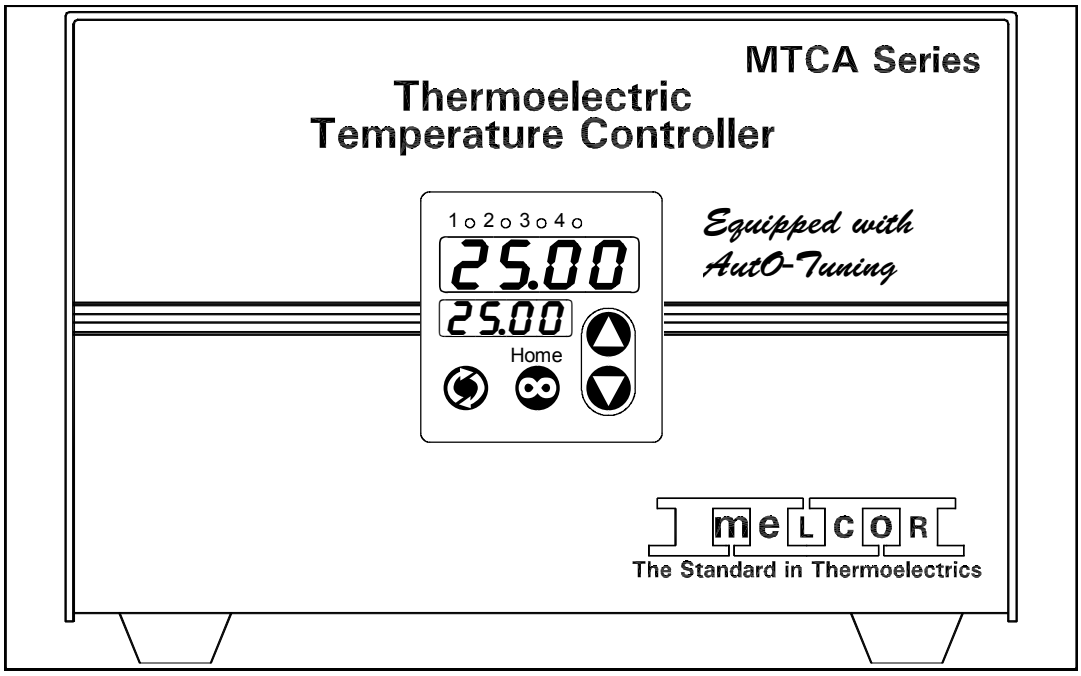


Figure 1.1

Rear Panel

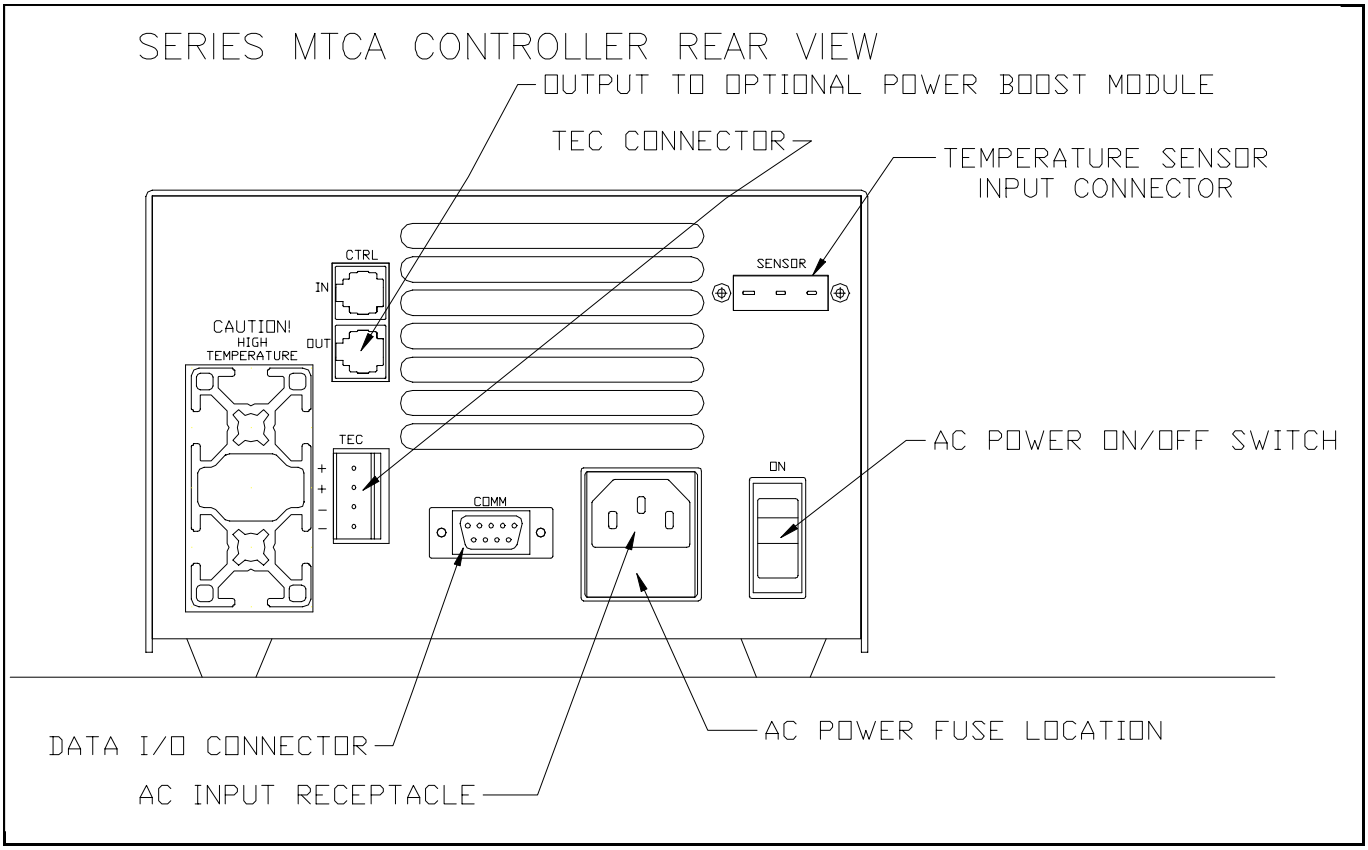


Figure 1.2

Options

The Series MTCA Thermoelectric Cooler Controller incorporates standard features that make it suitable for many applications. However, for certain requirements, the user may desire to augment the capabilities of the instrument by equipping it with one or more options.

RS-232C (P/N 8-R232)

The RS-232C option is installed at the factory and is designed for applications where enhanced serial communications is required between the Series MTCA Thermoelectric Cooler Controller and a host system. The maximum distance between the Series MTCA Thermoelectric Cooler Controller and the host computer is 50 feet.

RS-485 Option (P/N 8-R485)

The RS-485 option is installed at the factory and is designed for applications where enhanced serial communications is required between two or more Series MTCA Thermoelectric Cooler Controllers and a host system over the same communications channel. The RS-485 format allows both sending and receiving of signals over greater distances than possible with RS-232C, making it ideal for installations where the controller(s) are located at distances greater than 50 feet from the host. The maximum distance recommended between devices is 4,000 feet.

Series MTCA Power Boost Modules

For applications where the power to the TEC(s) extends beyond the limit of the Series MTCA Thermoelectric Cooler Controller, supplemental power can be obtained through the use of one or more Power Boost Modules. Each Power Boost Module (PBM) can be purchased in 60, 90, and 120 watt capacities. Any power rating can be purchased and used with an existing Series MTCA Thermoelectric Cooler Controller. For example, if an application requires 600 watts of power (15 V @ 40 A), use of the 120 watt Series MTCA Thermoelectric Cooler Controller along with four more 120 watt PBM's will provide sufficient power for the requirement (5 x 120W = 600W).

☺ **A unique feature of the Series MTCA Thermoelectric Cooler Controller is the ability to add power as needed in the form of PBM's. There is no need to purchase more power than needed.**

For example, let's say you purchase a 60 watt Series MTCA Thermoelectric Cooler Controller. Later on you have an application that calls for 200 watts of power. All you need to do is "add" the amount of power lacking (140 watts) to what you already have (60 watts) in the form of a PBM. 200 watts minus the 60 watts we already own would mean that we need at least 140 watts extra to fulfill the need. The nearest standard power rating for a PBM would be 150 watts. Add this to the 60 watt Series MTCA Thermoelectric Cooler Controller for a total of 210 watts.

☺ **Adding more power couldn't be easier! No matter what power rating your original Series MTCA Temperature Controller might have been, the PBM can be purchased at any of the standard wattage outputs. The *Master* Series MTCA Thermoelectric Cooler Controller will drive another *Slave* PBM at any of the standard output capacities. Otherwise, you would have to buy FOUR 60 watt PBM's in the example above!**

☺ **You can add as many PBM's as needed to achieve the desired power necessary. Just drive the next PBM from the last PBM in the chain. The outputs can drive separate loads or run in parallel with an existing Series MTCA Temperature Controller.**

Over Temperature Alarm Relay

When it is important that the temperature of the item being controlled does not exceed specific limits, the Series MTCA Thermoelectric Cooler Controller can be equippped with an optional temperature alarm relay. This relay can be set by the user as a high alarm, low alarm, or both a high and low alarm.

☞ Note: This option is fully explained in Chapter 7 "Options".

General Specifications

Control Loop	Unipolar or Bipolar, constant current, PID with Autotuning. User can select to use P, or P&I control only.
Maximum Output Current	1 to 8 Amperes.
Maximum Output Power	120W / unit (this includes the Power Booster Modules)
Temperature Sensor Types	Negative and Positive Temperature Coefficient devices including: 100Ω RTD, Types J, K, T, E, and N thermocouples, thermistors, AD590, and LM35.
Range of Sensors	Thermistor: 0 to 100KΩ OR 0 to 1 MΩ. AD590 and LM35: -50°C to +150°C. RTD & Thermocouple: Please refer to Specifications in the Appendix**.**
Temperature Display	TEC temperature and Setpoint temperature in °C or °F (user selectable) with an RTD, thermocouple, AD590, and LM35. For thermistors, the display is in Kohms.
Display Resolution	Thermistor: 0.01 KΩ on 100KΩ range and 0.1KΩ on 1 M Ω range. For RTD's, thermocouples, AD590, and LM35 the resolution is 0.1°C.
I/O Connections	TEC, Temperature Sensor, AC Power, optional digital interface, and Over Temperature Alarm Relay. See Chapter 7 for details on the different options available.
Optional Digital Interfaces	RS-232C, RS-485, Digital Event Input, and Relay Contact output (see below).
Optional Analog Interfaces	Remote Analog Setpoint and user defined Analog Output (typically actual temperature output for use with computer control).[1]
Optional Over/Under Temperature Alarm Relay	1 SPDT Form C contact rated 2A @ 250 VAC and 2A @ 30 VDC. Can be set for fail-safe mode as well as latching and non-latching operation.
AC Input Power	115/230 VAC, 50-60Hz (internally selectable)
Operating Temperature	0° to 50°C (32° to 122°F)
Dimensions of the Enclosure	4.5" H x 6.2" W x 10.3" L.
Weight	Approximately 11 pounds (150 Watt unit).

Melcor reserves the right to change or modify its product specifications without notice.

[1] All control interface options are wired to the 9 pin "D" connector on the rear of the Series MTCA Thermoelectric Cooler Controller. Please see the details in Chapter 7 (Options) concerning the possible inputs and outputs available.

2

Chapter Two
Installation Procedures

Unpacking the Instrument 2.1
Determining System Configuration 2.1
Wiring the Sensor 2.2
Wiring the TEC 2.3
Wiring the Communications Port 2.4
115 VAC and 230 VAC Operation 2.4

Unpacking the Instrument

Upon opening the shipping container, carefully unpack the instrument to check if the outer surfaces have been damaged. If so, report the findings immediately to Melcor who will then provide further instructions.

NOTE: IF DAMAGE HAS BEEN FOUND, DO NOT PROCEED FURTHER, BUT INSTEAD, CONTACT THE FACTORY.

If there is no apparent damage, check the contents to ensure all items were shipped. In some cases, items may be backordered. **All damage and shortage claims must be made known to Melcor within 10 days after receipt of shipment.**

Determining System Configuration

When looking at the rear of the instrument you will notice a 3 pin connector at the top left of the rear panel. This is the Sensor Input Connector. The color of this connector will tell you what type of temperature sensor the Series MTCA Thermoelectric Cooler Controller is configured for. Please refer to Table 2.1 below for details on the sensor types associated with the different colored Sensor Input connectors.

Sensor Type	Omega Mating Part #	Color	Front Panel Units
Thermistor	MTP-U-M	White	Kohms[1]
LM35	MTP-U-M	White	°C
AD590	MTP-U-M	White	°C
3 Wire RTD	MTP-U-M	White	°F or °C
Thermocouples	Only Thermocouples require different connectors:		
J	MTP-J-M	Black	°F or °C
K	MTP-K-M	Yellow	°F or °C
T	MTP-T-M	Blue	°F or °C
E	MTP-E-M	Purple	°F or °C
N	MTP-N-M	Orange	°F or °C

Table 2.1

Note: The mating connector is supplied according to the sensor specified at the time of order.

Mating Connectors

Mating Connectors are supplied by Melcor. The following connectors are provided:

1. Six foot modular AC power cord.
2. 4 pin TEC connector
3. Sensor Interface Connector

[1] Other units are available via RS232 (optional) using the optional TECView software (see Chapter 7). Note: Thermistors will always display Kohms on the front panel, however the software allows for °C or °F using the Steinhart Hart equation.

Wiring the Sensor

The following drawing illustrate how to connect each sensor type to the rear of the Series MTCA Thermoelectric Cooler Controller. Note: All sensors should interface with the Series MTCA Thermoelectric Cooler Controller through a 3 pin male connector as show below.

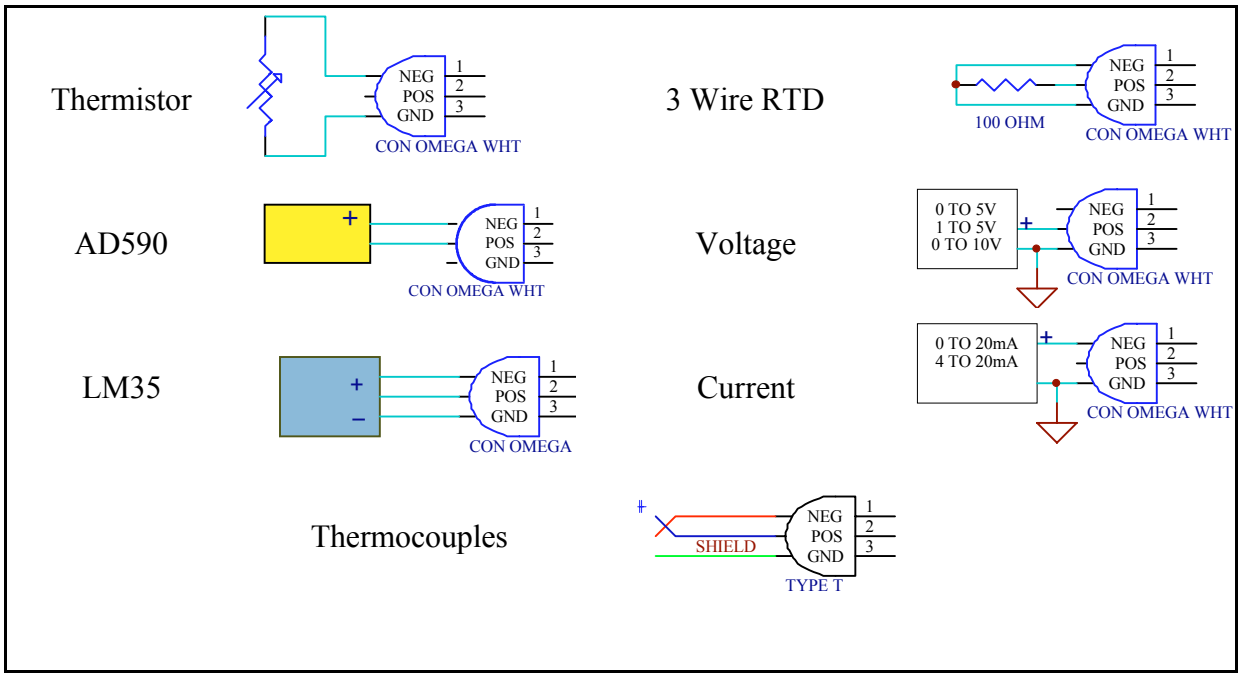


Figure 2.1

Note: Changing sensor types in the field can be done quite easily by the user. The exception to this is for thermocouples. If the need arises to change the temperature sensor from a thermocouple to a standard type or from a standard type to a thermocouple, this should only be done at Melcor or by a factory trained technician.

Wiring the Thermoelectric Device

Please familiarize yourself with Figure 2.2 before connecting a thermoelectric cooler to the Series MTCA Thermoelectric Cooler Controller.

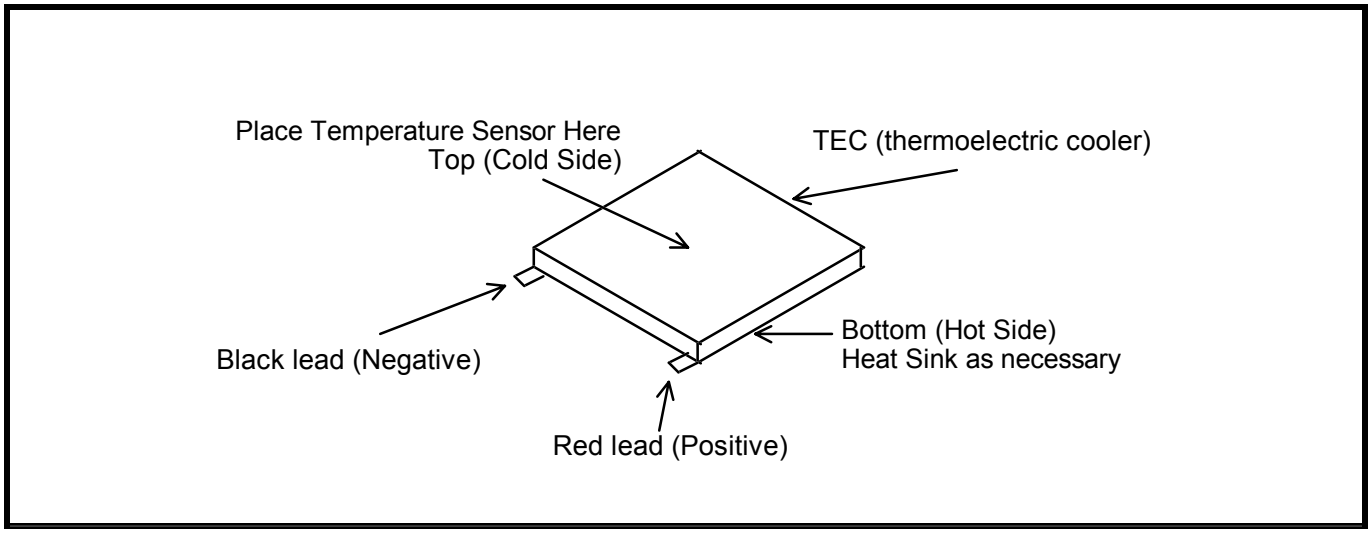


Figure 2.2

- **Please note that the positive lead connections to the Series MTCA Thermoelectric Cooler Controller are located on the top of the TEC Connector (see rear panel drawing .**

- ***<u>Never</u> connect either of the thermoelectric cooler leads to ground!***
  This results in excessive current to flow causing possible damage to the cooler. Note: a slightly overrated fuse has been installed in the Series MTCA Thermoelectric Cooler Controller that should protect the TEC against most faults. However, <u>there is no guarantee</u>. See Chapter 3 for details on the fuse.

- **Never put a direct short across the thermoelectric cooler leads when power is applied. This will cause excessive currents to flow and could generate a significant spark.**

- **Always set the output Power Limit of the Series MTCA Thermoelectric Cooler Controller to 10% <u>less</u> than that specified by the manufacturer of the thermoelectric cooler.**

- **If a thermoelectric cooler melts down due to excess current in all likelihood it will become a direct short. *Note: Current to the thermoelectric cooler can be adjusted by using the Power Limit settings: PL A, PL b and PLSP. See Chapter 5 under "Power Limit" for details*.**

Wiring the Optional Communications Port

Connect the Series MTCA Thermoelectric Cooler Controller to a terminal or computer as follows:

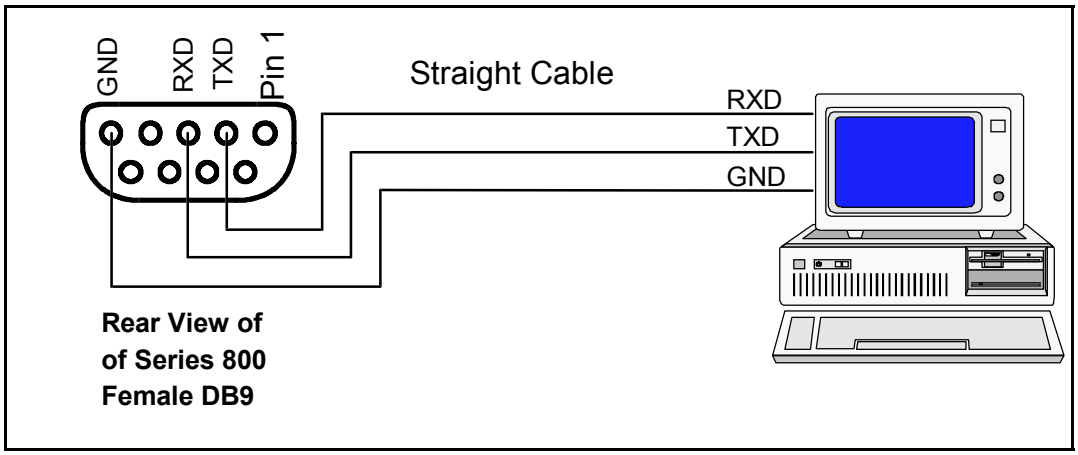


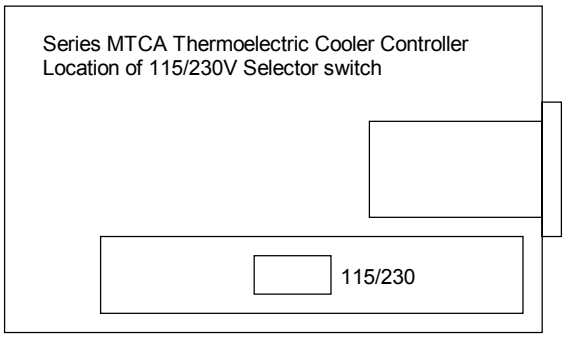
Figure 2.3

Note: If the Series MTCA Thermoelectric Cooler Controller is equipped with the Optional Communications Port, and there is difficulty communicating with the instrument, try tipping over the input and output lines. Some RS-485 connections are called T+ / T- or A / B. With RS-232, try tipping over the TxD and RxD connections. The communications link will not work unless these are correct.

115 VAC to 230 VAC Operation

The Series MTCA Thermoelectric Cooler Controller is shipped for use with the AC voltage level specified in the customer's purchase order. The default configuration is 115 VAC., 60 Hz. If it becomes necessary to change the AC input voltage in the field, the following instructions should be followed:

1. Disconnect the modular AC input cable from the instrument.
2. Remove the top cover of the instrument by removing the four screws that hold the cover to the sides.
3. Locate the 115/230 selector switch (see diagram below) located on the side of the power supply. (Note: Some Series MTCA Thermoelectric Cooler Controllers have universal inputs. If so, no switch will be available.
4. Slide the switch to the required AC voltage. *Note the desired voltage is indicated in the switch*.
5. Replace the cover to the instrument in reverse manner as it was removed.
6. Replace the AC power input modular cord.



3

Chapter Three
Operation

Preparation for Operation 3.1
TEC Fuse 3.1
Initial Setup 3.1
Custom Menu Defaults 3.2
Temperature Limit Shutdown 3.2

Preparation for Operation

1. Ensure that power to the Series MTCA Thermoelectric Cooler Controller is OFF.
2. Check to be sure that the selected temperature sensor is wired correctly to the mating connector of the Series MTCA Thermoelectric Cooler Controller (See Chapter 2, Figure 2.1 under "Wiring the Sensor").
3. Locate the positive and negative leads from the thermoelectric cooler and be sure they are ready to plug into the TEC output of the Series MTCA Thermoelectric Cooler Controller.

TEC Fuse

The fuse holder for the Series MTCA Thermoelectric Cooler Controller is located inside the instrument towards the top rear section. The fuse installed will limit the current in case of an accidental short to ground or a failure of the thermoelectric cooler. The rating for this fuse should be no greater than 15 amps. It is also possible to use this fuse as protection for the thermoelectric cooler(s) if they are rated for operation for less current than the maximum of the Series MTCA Thermoelectric Cooler Controller in use. For instance, if the thermoelectric cooler in use is rated for 2 amps and the Series MTCA Thermoelectric Cooler Controller is rated at 10 amps, the factory suggests installing a 2 Ampere fast acting fuse in the fuse holder. This precaution, along with limiting the power via the front panel [Pcnt] parameter (Refer to Chapter Four, Navigation and Software), will offer protection against failure due to incorrect setup of hardware and/or software.

Initial Setup

The Series MTCA Thermoelectric Cooler Controller is shipped ready to operate with the sensor type specified at the time of order. Please refer to Table 2.1 on Page 2.1.

To verify proper operation of the temperature sensor, wire the sensor to the mating Sensor Interface Connector (See Figure 2.1) and plug it into the rear of the Series MTCA Thermoelectric Cooler Controller at the Sensor Interface input. **Without any connection to the TEC output terminals**, turn power on to the Series MTCA Thermoelectric Cooler Controller and check that the temperature is properly displayed in the units particular to the specific temperature sensor i.e. Kohms, °C, °F, etc. (Refer to Table 2.1 for units associated with specific sensors).

☺ **The optional TECView Software allows you to easily set all parameters for a specific sensor and helps to minimize errors.**

Note: The Series MTCA Thermoelectric Cooler Controller is designed so that Channel 1 output is always cooling power. This means that positive voltage will appear at the positive output of the Series MTCA Thermoelectric Cooler Controller when cooling. To avoid any misunderstanding or problems, the following terms have been defined (please refer to Figure 2.2):

☞ Cooling — Positive voltage is applied to the positive terminal of the thermoelectric cooler (TEC) originating from the positive output terminals of the Series MTCA Thermoelectric Cooler Controller.

☞ Heating — Positive voltage is applied to the negative terminal of the (TEC) originating from the negative output terminals of the Series MTCA Thermoelectric Cooler Controller.

☞ Cold Side — The side of the TEC that is opposite the side where the leads are attached to the ceramic plate. This is the controlled side where the temperature sensor should be located.

☞ Hot Side — The side of the TEC where the leads are attached to the ceramic plate. This is the side which should be mounted to a heat sink (consult the manufacturer of the thermoelectric cooler if selection of a heat sink is required).

Custom Menu Defaults[1]

The Series MTCA Thermoelectric Cooler Controller is shipped from the factory with a preprogrammed Custom Menu (See Chapter Five under “Custom Menu”). This menu places certain commonly used parameters in the “Main Menu” of the controller. These defaults are recommended and are as follows:

1. Percent Power Max. Pcnt
2. Proportional Term 1 Pb 1
3. Integral Term 1 It 1
4. Derivative Term 1 dE 1
5. Proportional Term 2 Pb 2
6. Integral Term 2 It 2
7. Derivative Term 2 dE 2
8. Auto Tune Aut

To access the Main Menu,

☞ Pressing the button.

Will bring you to the Main Screen showing the Actual temperature on the top display and the Set Point temperature on the bottom display.

☞ Pressing the button.

Will cycle through all parameters programmed into the Custom Menu described above.

☞ Pressing the or buttons.

Will modify the parameters.

➢ **EXAMPLE (assumes Custom Menu programmed as described above)**

Performing an Auto Tune allows the controller to turn the power fully ON (Heat and/or Cool) and OFF to measure the response time of the load and therefore, automatically set the P, I, and D[2] terms associated with the control loop.

To perform an Auto Tune[3] you would perform the following steps:

1. Press then press eight times in a row. You should see Aut in the bottom display.
2. Press the or buttons until tunE is shown in the top display. This option will perform an auto tune on both channels (i.e. Heat and Cool outputs) when selected. You can also optionally choose to tune only the P id1 or P id2 parameters. This will tune only the Cool or Heat outputs respectively.
3. Press the or the button to return to the Main Screen. This will start the Auto Tune process.

Please read Chapter Four and Five for more information about programming the Custom Menu and it’s description.

---

[1] The Custom Menu is not available with the Ramp ‘N’ Soak firmware option. Use Chapter 6 “Parameters” as a reference for changing the individual parameters.

[2] Proportional Term, Integral Time Constant, and Derivative Term respectively.

[3] Please read Chapter Five under “Auto Tune”.

4

Chapter Four
Navigation and Software

Keys and Displays 4.2
Navigation 4.3
Software Map 4.4
Example Setup Tasks 4.6

Keys and Displays

This chapter explains keys, displays and navigation skills, and presents charts showing how to accomplish basic and advanced tasks, including setting up the Custom Menu, which is unique to the Series 96. You'll also find a complete software map.

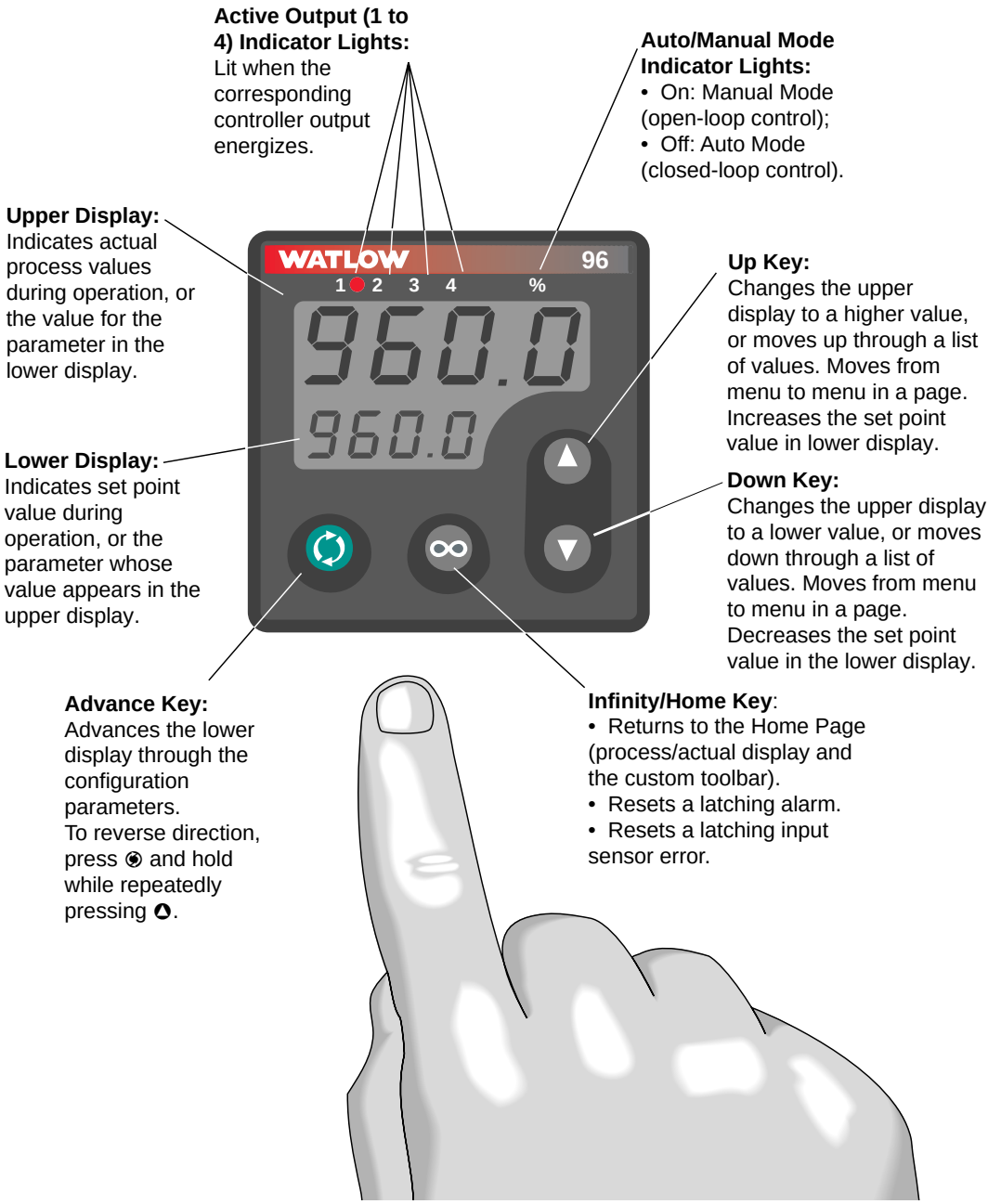


Figure 4.2 – Series 96 keys and displays.

Navigating the Series 96

Choose a page (Operation, Setup or Factory) and press its key sequence. The page appears in the lower display.

- **Operation Page:** Press ▼ and ▲ keys together for 3 seconds.
- **Setup Page:** Press ▼ and ▲ keys together for 6 seconds.
- **Factory Page:** Press ⊙ and ∞ keys together for 6 seconds.
- **Home Page:** From anywhere, press the ∞ key.

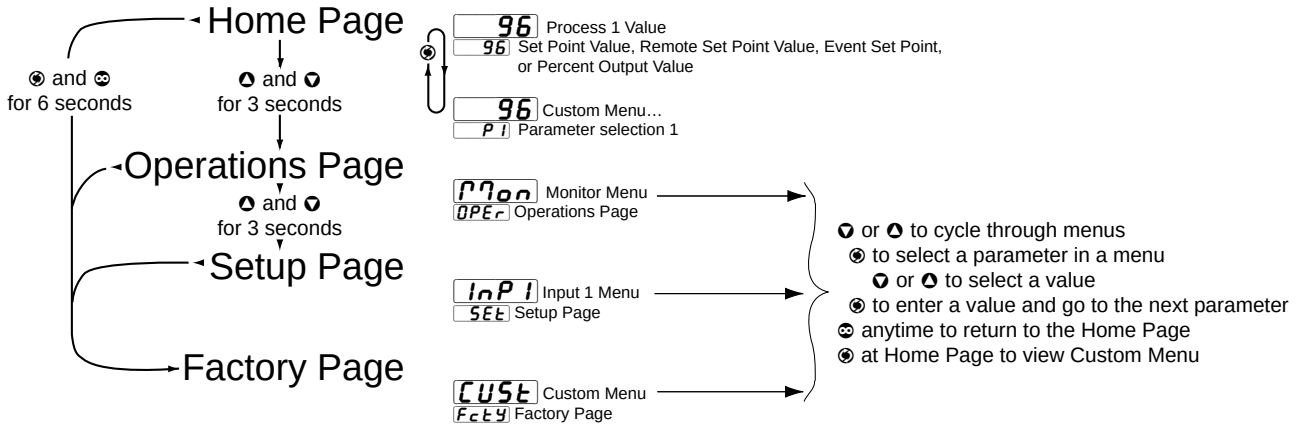
Press ▼ or ▲ to find a specific menu in a page. The menu appears in the upper display and the page remains in the lower display.

Press ⊙ to enter the list of paramenters in the menu displayed. The menu's parameters appear in the lower display and the values in the upper. To go backward through the parameter list press ⊙ and ▲ together.

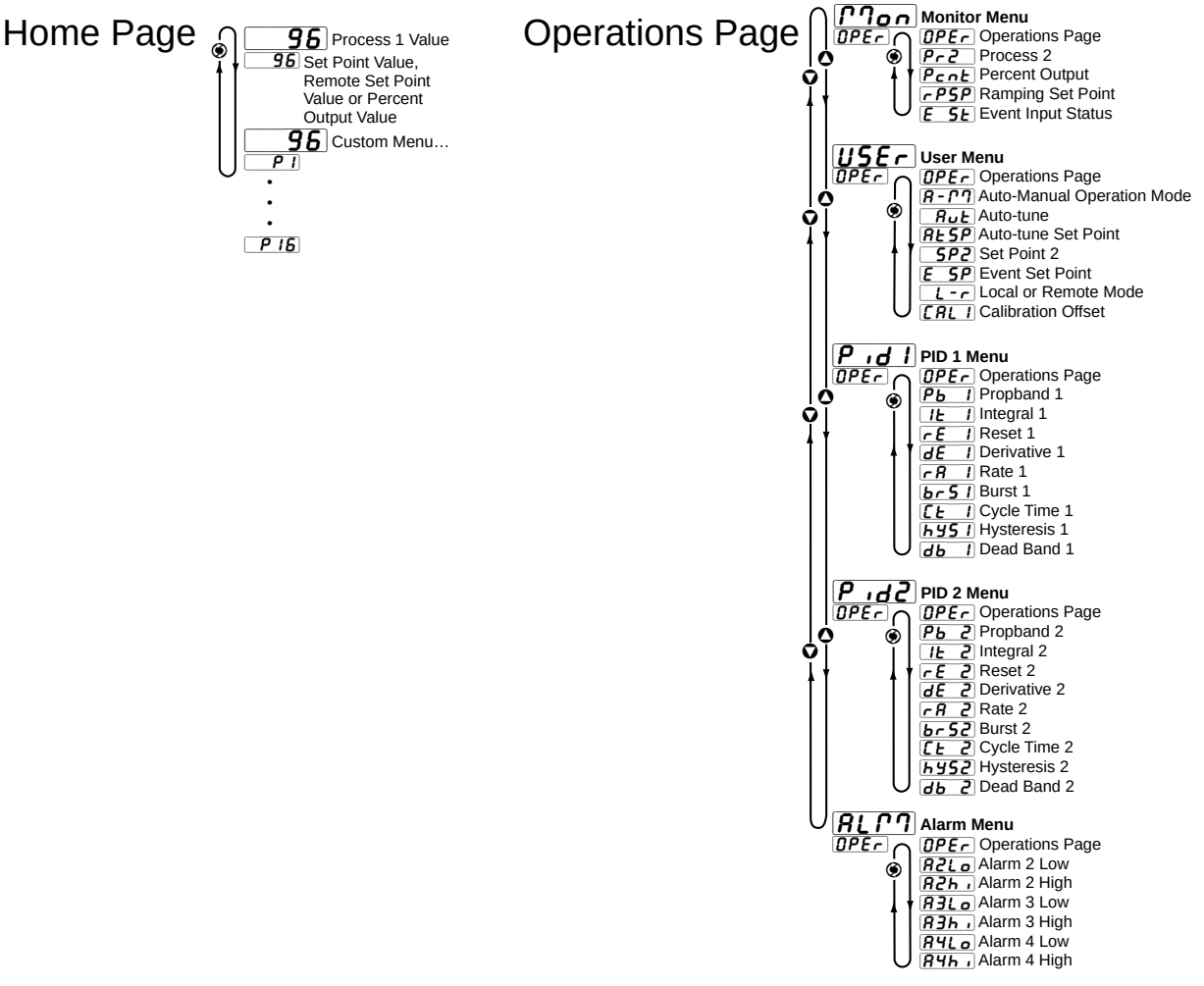
Press ▼ or ▲ to select a value, either alpha or numeric.

Press ⊙ to set the value and go to the next parameter.

Navigation



Software Map



Note: What you see depends on the options and settings included in your controller.

Note: For easy reference to prompts on the Operations and Setup pages, unfold the inside back cover flap while you read through the parameters in Chapter Six.

Setup Page

Input 1 Menu
- SEt Setup Page
- SEn 1 Sensor Type
- In 1 Input Type 1
- rL 1 Range Low 1
- rh 1 Range High 1
- dEC 1 Decimal 1
- Ftr 1 Input Software Filter 1

Input 2 Menu
- SEt Setup Page
- In 2 Input 2
- rL 2 Range Low 2
- rh 2 Range High 2
- CAL2 Calibration Offset 2
- E Fn Event Function
- E cn Event Condition

Output 1 Menu
- SEt Setup Page
- Ot 1 Output 1
- Prc 1 Process Type 1

Output 2 Menu
- SEt Setup Page
- Ot 2 Output 2
- Prc2 Process Type 2
- AtY2 Alarm Type 2
- AhY2 Alarm Hysteresis 2
- LAt2 Latching 2
- S IL2 Silencing 2
- S id2 Alarm Active Sides 2
- L9c2 Alarm Logic 2
- Anu2 Alarm Annunciation 2

Output 3 Menu
- SEt Setup Page
- Ot 3 Output 3
- AtY3 Alarm Type 3
- AhY3 Alarm Hysteresis 3
- LAt3 Latching 3
- S IL3 Silencing 3
- S id3 Alarm Active Sides 3
- L9c3 Alarm Logic 3
- Anu3 Alarm Annunciation 3

Output 4 Menu
- SEt Setup Page
- Ot 4 Output 4
- AtY4 Alarm Type 4
- AhY4 Alarm Hysteresis 4
- LAt4 Latching 4
- S IL4 Silencing 4
- S id4 Alarm Active Sides 4
- L9c4 Alarm Logic 4
- Anu4 Alarm Annunciation 4
- Aout Analog Output 4
- Prc4 Process Type 4
- A hi Analog Output High
- A Lo Analog Output Low
- ACAL Analog Output Offset
- bAUd Baud Rate
- Addr Address

Global Menu
- SEt Setup Page
- Unit Units Type
- C-F C or F
- Err Input Error Latching
- FAIL Failure Mode
- MAn Manual Default Power
- PLSP Power Limit Set Point
- PL A High Power Limit Above
- PL b High Power Limit Below
- rP Ramping Mode
- rP S Ramp Scale
- rAtE Ramp Rate
- OPLP Open Loop Detect

Factory Page*

Custom Menu
- FctY Factory Page
- P 1
- •
- •
- •
- P 16

Lockout Menu
- FctY Factory Page
- SP Set Point Lock
- CUSt Custom Menu Lock
- OPEr Operations Page Lock
- SEt Setup Page Lock
- CAL Calibration Menu Lock

Diagnostics Menu
- FctY Factory Page
- Mdl Model Number
- dAtE Date of Manufacture
- Sn 1 Serial Number 1
- Sn2 Serial Number 2
- SoFt Software ID Number
- rEv Software Revision
- It Y2 Input 2 Hardware Enabled
- OtY 1 Output 1 Hardware
- OtY2 Output 2 Hardware
- OtY3 Output 3 Hardware
- OtY4 Output 4 Hardware
- tout Test Output
- dISP Test Displays
- hrES High Resolution
- Amb Ambient Temperature
- Acnt Ambient A-D Counts
- cnt 1 Channel 1 A-D Counts
- cnt2 Channel 2 A-D Counts
- tSHt Troubleshooting/ Communication Test
- LinE Line Frequency

***The Factory Page also includes calibration parameters that are not necessary for everyday use of the controller. Calibration parameters and procedures are explained in the Appendix.**

Note: What you see depends on the options and settings included in your controller.

Basic navigation for new users

Use this example task to learn how to use the keys and displays. For more information about the control features available in the Series 96, see Chapter Five. For a table of all parameters and values, see Chapter Six.

Configure the controller

To configure the controller to suit your application, go to the Setup Page, enter the menus and set the parameters for the system, its inputs and outputs.

	Do this	Press these keys	You'll see*	
1	Go to the Setup Page from the Home Page.	Up-arrow and Down-arrow keys for 6 seconds.	After 3 seconds the Operations Page appears in the lower display; after 6 seconds the Setup Page appears in the lower display. A menu is in the upper display.	InP 1 SEt
2	Choose a menu to enter.	Up-arrow key.	The Setup Page remains in the lower display while menu names appear in the upper display.	InP2 SEt
3	Go to a parameter.	Advance key.	The menu's parameters appear in the lower display and the values appear in the upper display. (Note: When you enter a menu, the display changes. Instead of the Setup Page and menu, you see parameter and value.)	OFF In 2
4	Choose a value.	Up-arrow key, until you reach the desired value.	Values appear in the upper display when the parameter is in the lower display.	E In In 2
5	Set a value and go on to the next parameter.	Advance key (when the chosen value is displayed).	You will see the chosen value in the upper display. After pressing the Advance key, the next parameter appears in the lower display, with one of its values in the upper display. Values auto-enter after 5 seconds.	nonE E Fn

Summary

To make a selection or choice:	Press Up-arrow key or Down-arrow key.
To move or change location in a page or menu:	Press Advance key or Home/Infinity key.

***What you see depends on the options included in your controller.**

Tip: Use the foldout software map on the inside back cover for easy reference.

Program and view the Custom Menu (patent pending)

The Custom Menu allows you a shortcut way to monitor, tune or change the values you use most often.

For more information about this and other features, see Chapter Five.

For a table of parameters and values, see Chapter Six.

	Do this	Press these keys	You'll see	
1	Go to the Factory Page.	Advance and Home/Infinity keys together for 6 seconds.	Factory Page appears in the lower display, and Custom Menu appears in the upper display.	CUSt / FctY
2	Go to a place number on the Custom Menu.	Advance key.	A place number (1 to 16) appears in the lower display, while the available parameters appear in the upper display.	Pr2 / P1
3	Choose a parameter.	Up-arrow key.	Available parameters appear in the upper display.	Pb 1 / P1
4	Select a parameter for view on the Home Page.	Leave it on the display and move to the next place number by pressing the Advance key.	The next place number appears in the lower display, while the available parameters appear in the upper display.	rE 1 / P2
5	Return to the Home Page.	Home/Infinity key.	The actual temperature appears in the upper display, and the set point appears in the lower display.	96 / 96
6	View the Custom Menu from the Home Page.	Advance key.	The first parameter in the Custom Menu appears in the lower display, and its value appears in the upper display.	25 / Pb 1

Note: Setting up the Custom Menu is an advanced user task.

Tip: Use the foldout software map on the inside back cover for easy reference.

Tasks for experienced users

Use this as a model of how to think about setting up other features in the Series 96. All of them require users to navigate to different pages, menus and parameters and select values that will define the way the controller operates.

For more explanation of Remote Set Point and other features, see Chapter Five. For a table of all parameters and values, see Chapter Six.

NOTE: Users should be familiar with the Series 96 navigation and displays before attempting to set up features such as remote set point.

Set up Remote Set Point

Remote Set Point uses an external signal to establish the controller's set point. This feature allows the output from one controller to control the set point of other controllers for ramping or multi-zone applications.

What to do	How to do it
1 **Learn to navigate.**	See page 4.6.
2 **Choose the signal.** Tell the controller what kind of signal will be received on Input 2.	Go to the Setup Page, Input 2 Menu, to the first in a list of parameters: In 2. Select the signal from among the values listed: 4-20mA, 0-20mA, 0-5V⎓, 1-5V⎓ or 1-10V⎓ (dc).
3 **Scale the signal.** Tell the controller how to interpret the signal. Input 2 will read rL 2 when the sensor is at its low value. Input 2 will read rh 2 when the sensor is at its high value.	Go to the Setup Page, Input 2 Menu, rL 2 parameter, and establish the set point in degrees for the low end of the Input 2 signal. Then go to the rh 2 parameter and establish the set point in degrees for the high end of the Input 2 signal.
4 **Activate remote set point.** Tell the controller to look for a remote set point instead of the front panel set point.	Go to the Operations Page, User Menu, L-r (Local-Remote) parameter, and select R (remote). When you change from L to R, the controller will look at Input 2 for its set point. The set point cannot be adjusted using the front panel if Remote is selected.

For example:

If you have a 0-5V signal and you want it to be a remote set point signal representing 100 to 250 degrees, you must tell the controller how to scale the signal — 0V should be interpreted as 100 degrees and 5V will represent 250 degrees. This establishes the scaling of that remote set point. The remote set point is limited to the sensor range of Input 1.

5

Chapter Five
Features

The System
- Custom Menu 5.2
- Auto-tune 5.3
- Power Limit 5.4

Input
- Calibration Offset 5.5
- Filter Time Constant 5.6
- Sensor Selection 5.7
- Range Low and Range High 5.7
- Event Input 5.8
- Retransmitting a Remote Set Point 5.9

Control Methods
- On/Off 5.10
- Proportional Control 5.11
- PI Control 5.12
- PID 5.13
- Dual PID 5.14
- Dead Band 5.15
- Burst Fire 5.16
- Ramp to Set Point 5.17

Alarms
- Alarm Set Points 5.18
- Alarm Hysteresis 5.18
- Process or Deviation Alarms 5.19
- Alarm Latching 5.19
- Alarm Silencing 5.20

Errors
- Open Loop Detect 5.21
- System Errors. 5.21
- Input Errors. 5.21
- Bumpless Transfer 5.22

The System

Custom Menu (patent pending)

The Custom Menu provides you with a shortcut to monitor, tune or change the parameter values that you use most often. You can go directly to the Custom Menu in the Home Page by pressing ⊛. This provides a fast and convenient way to monitor and change settings.

You can create your own Custom Menu with as many as 16 of the active parameters from the list below. When a parameter is placed in the Custom Menu it is accessible through both the Custom Menu and its original menu. If you change a parameter in the Custom Menu it is automatically changed in its original menu. If you change a parameter in its original menu it is automatically changed in the Custom Menu.

If you do not assemble a Custom Menu, four default parameters will automatically appear in the Custom Menu.

To change the list of parameters in the Custom Menu, press both the ⊛ and ⊙ keys for 6 seconds. This will take you to the Factory Page. The Custom Menu CUSt is the first menu on the Factory page. Press the ⊛ key once to go to the first selection in the menu. The parameter choices will appear in the top display and the selection number will appear in the bottom display. Use the ▲ or the ▼ key to change the selected parameter in the top display. If you do not want a parameter to appear for that location, select nonE. To change the other 15 selections, press ⊛ to select a place in the menu, P 1 to P 16, in the bottom display and use the ▲ or the ▼ key to change the parameter selected in the top display.

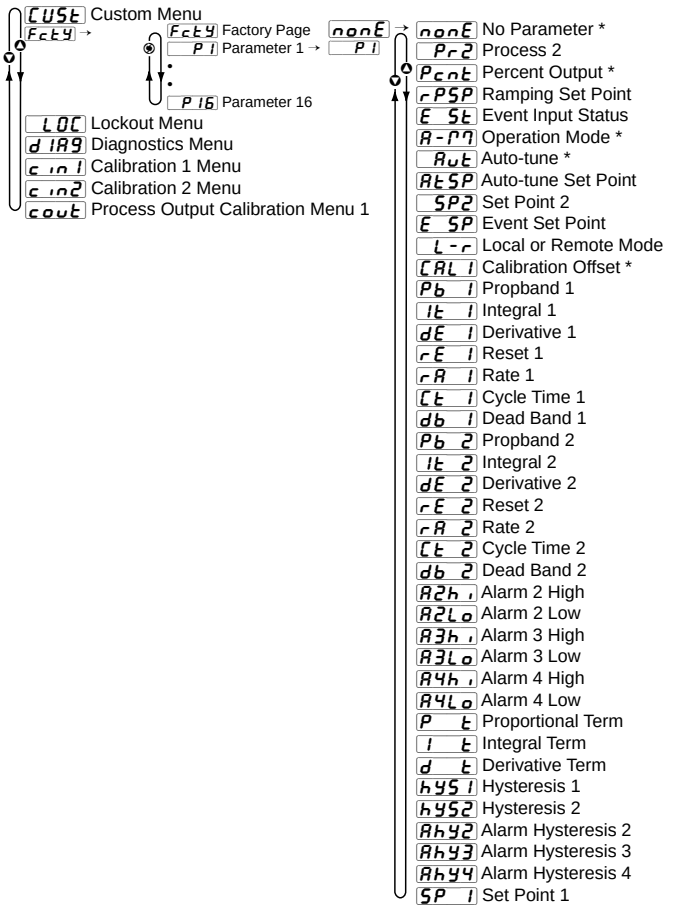


Figure 5.2 – Parameters available for the Custom Menu (*default selections).
Note: Refer to page 4.7 to program the custom menu.

Auto-tune

Auto-tuning allows the controller to explore the responsiveness of the system to determine an effective set of parameters for PID control. To do this it crosses an auto-tune set point several times, then controls at the normal set point using the new parameters.

Use Auto-tune Set Point [AtSP] (User Menu) to select the temporary set point, as a percentage of the normal set point, that the controller will tune to. Initiate or cancel the auto-tune process with Initiate Auto-tune [Aut] (User Menu).

In heat-only or cool-only modes the only option is [tunE].

In heat/cool or cool/heat modes there are three tuning options:

- [tunE] tunes both heat and cool at the same time. This is appropriate if the system typically operates with both heat and cool contributing, such as in an environmental chamber.
- [Pid1] tunes just PID set 1. This is appropriate for tuning the heat of an extruder application in the endothermic mode.
- [Pid2] tunes just PID set 2. This is appropriate for tuning the cool set of an extruder application in the exothermic mode.

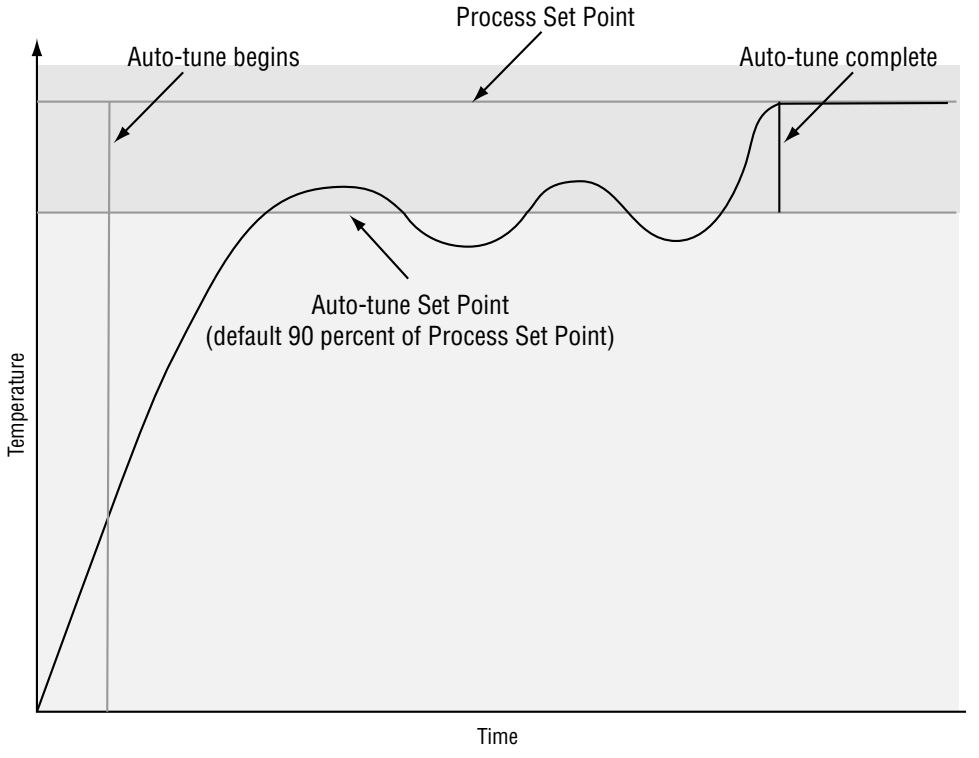


Figure 5.3 – Auto-tuning.

CAUTION: Choose an auto-tune set point value that will protect your product from possible damage from overshoot or undershoot during the auto-tuning oscillations. If the product is sensitive, carefully select the auto-tune set point to prevent product damage.

Power Limit

A high side power limit and low side power limit set the maximum output power within two ranges.

A low side power limit limits the output to a percentage of the maximum output power while the process temperature or value is below the power limit set point.

The high side power limit limits the output to a percentage of the maximum output power while the process temperature or value is above the power limit set point.

The power limits work the same way in a cooling applications, but the negative values are converted to absolute (positive) values for determining whether the range is below or above the power limit set point.

The low side power limit can be viewed or changed with High Power Limit Below PL b (Global Menu).

The high side power limit can be viewed or changed with High Power Limit Above PL A (Global Menu).

The power limit set point can be viewed or changed with Power Limit Set Point PLSP (Global Menu).

The actual output power can be viewed with Percent Output Pcnt (Monitor Menu).

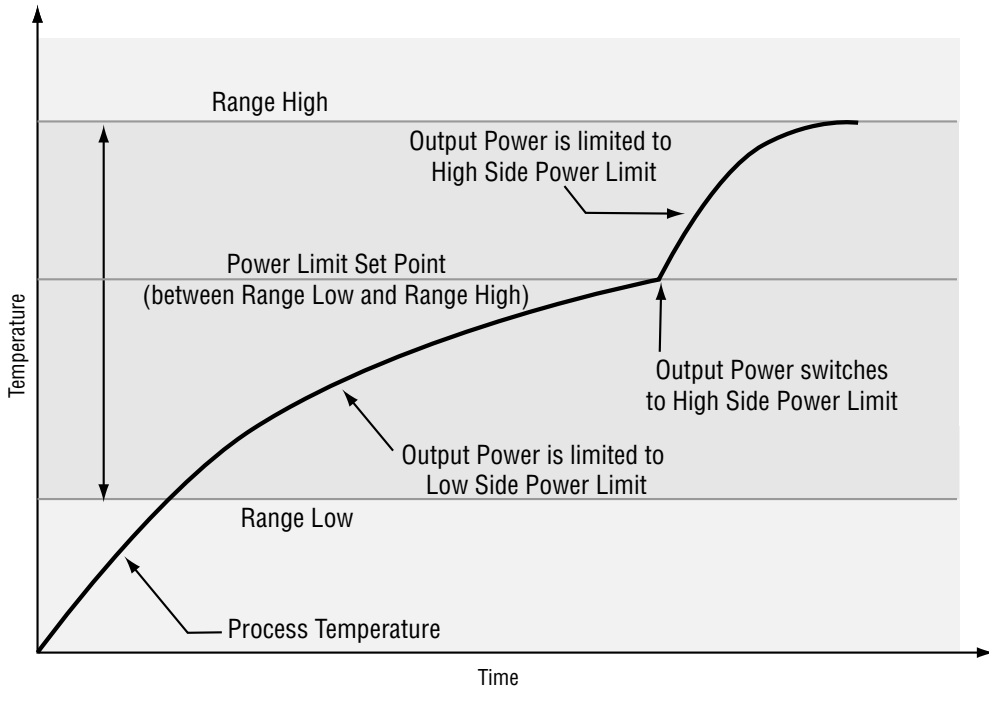


Figure 5.4 – Power limits.

Input

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 1 offset value can be viewed or changed with Calibration Offset 1 [CAL 1] (User Menu).

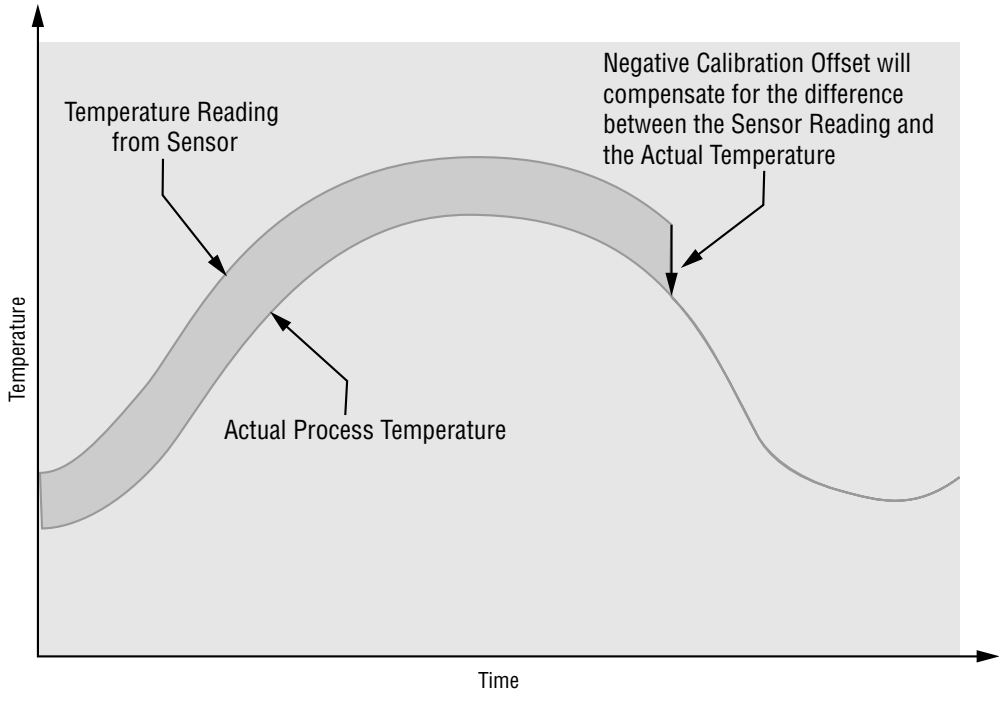


Figure 5.5 – Calibration offset.

Filter Time Constant

A time filter smooths an input signal by applying a first-order filter time constant to the signal. Either the displayed value or both the displayed and control values can be filtered. Filtering the displayed value makes it easier to monitor. Filtering the signal may improve the performance of PID control in a noisy or very dynamic system.

View or change the Input 1 time filter with Filter Time Constant 1 [Ftr 1] (Input 1 Menu). A positive value affects only the viewed values. A negative value affects both the viewed and control values.

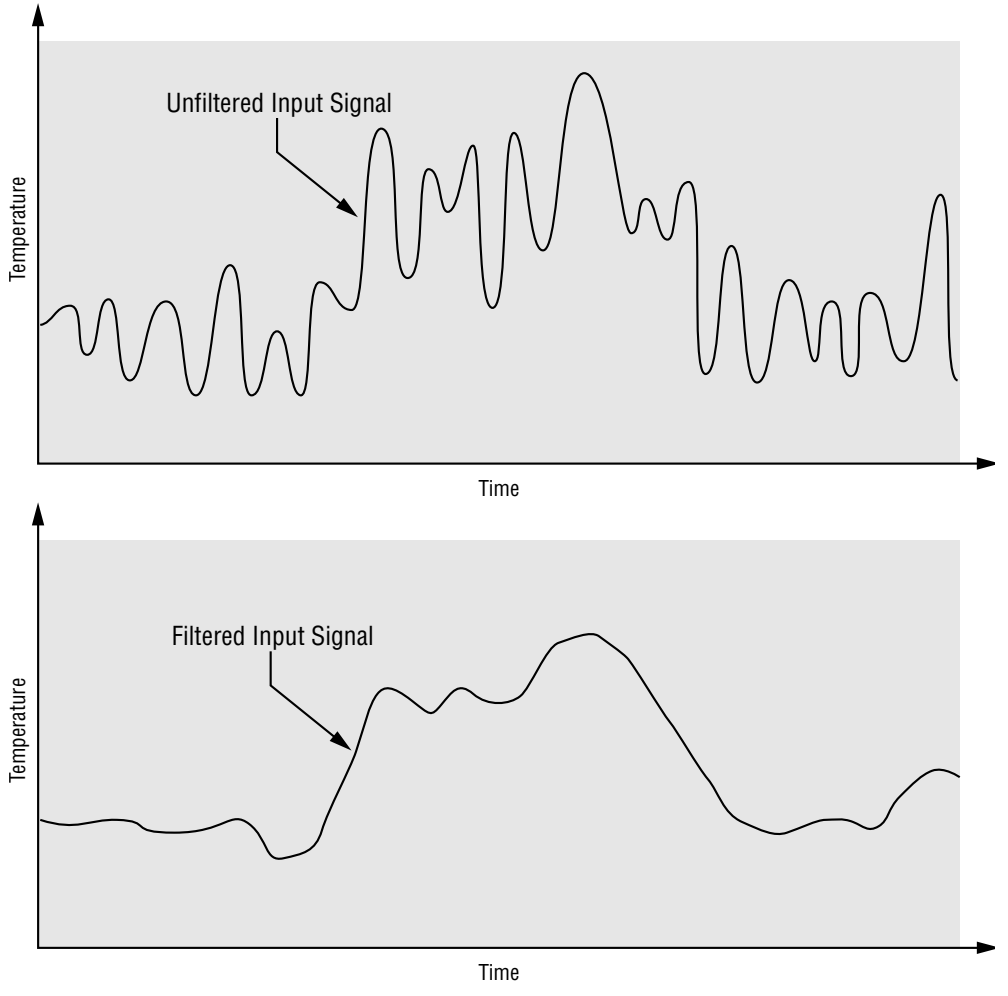


Figure 5.6 – Filtered and unfiltered input signals.

Sensor Selection

You need to configure a controller to match the input device, which is normally a thermocouple, RTD or process transmitter. When you select an input device, the controller automatically sets the input linearization to match the sensor. It also sets high and low limits, which in turn limit the range-high and range-low values.

Use Sensor Type 1 [SEn1] and Input 1 [In1] (Input 1 Menu) to select the appropriate sensor for Input 1.

Range Low and Range High

The controller constrains the set point to a value between range high and range low. Range high cannot be set higher than the sensor high limit or lower than range low. Range low cannot be set lower than the sensor low limit or higher than range high.

Use Set Point 1 [SP1] (Home Page), Range Low 1 [rL1] and Range High 1 [rh1] (Input 1 Menu) to select or view values for the corresponding Input 1 parameters.

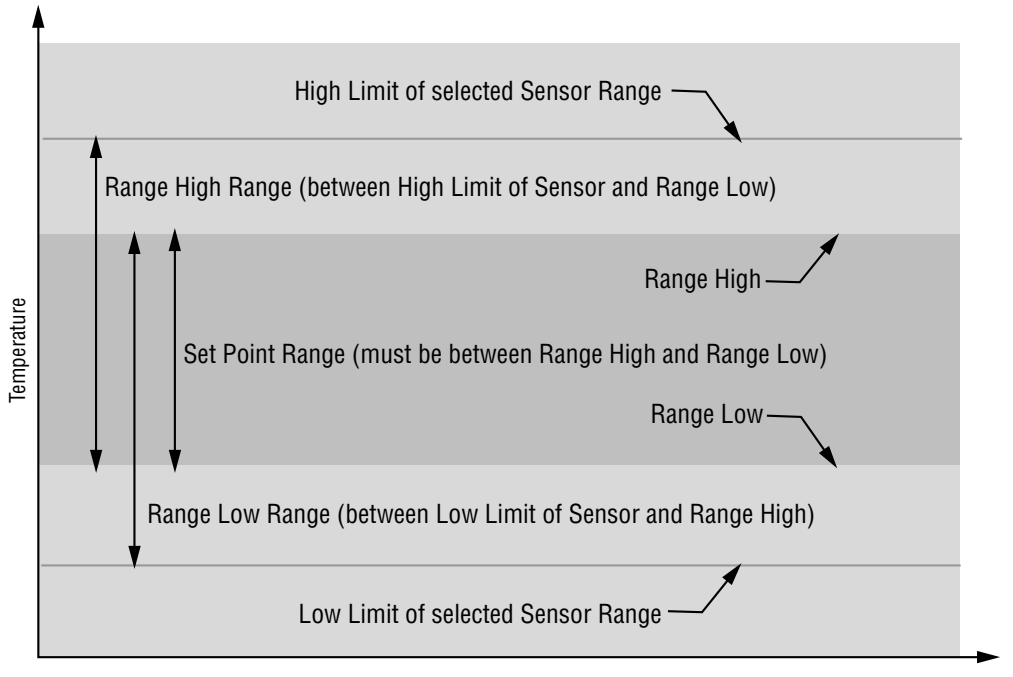


Figure 5.7 – Sensor ranges.

Event Input

With an event input an operator can perform certain operations on a system by opening or closing a switch or applying a dc logic signal to the controller. This feature can add convenience, safety or security to a system.

Use Event Input Status [E St] (Monitor Menu) to read the state of the event input parameter.

Use Event Function [E Fn] (Input 2 Menu) to select how an event will affect the system.

- [nonE] Events will not affect the system.
- [SP] Switch to the event set point.
- [AOFF] Turn off control outputs and disable alarms.
- [COFF] Turn off control outputs.
- [LOC] Lock out key board.
- [A-M] Switch to manual mode.
- [tunE] Initiate an auto-tune.
- [AL] Clear an alarm.

Use Event Condition [E cn] (Input 2 Menu) to select what condition will trigger an event.

- [Lo] Low generates an event while the voltage is low (switch closed).
- [hi] High generates an event while the voltage is high (switch open).
- [riSE] Rise changes the event state when the voltage changes from low to high.
- [FALL] Fall changes the event state when the voltage changes from high to low.

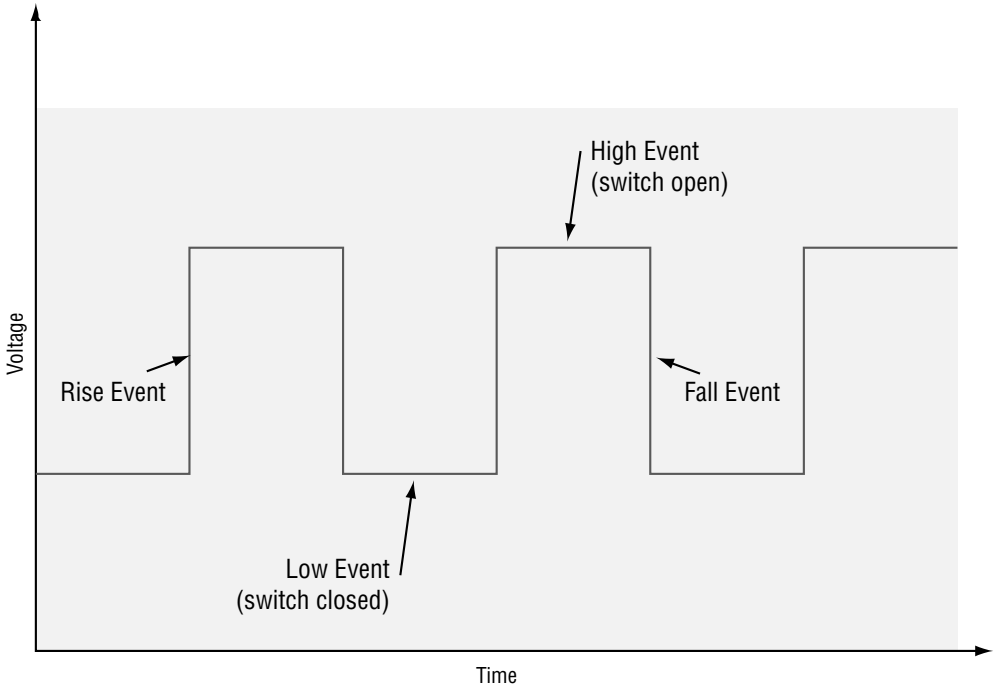


Figure 5.8 – Event inputs.

Retransmitting a Remote Set Point

The retransmit feature allows an output to retransmit an analog signal that can serve as an input variable for another device. The signal may serve as a remote set point for another controller or it could be used as input for a chart recorder to document system performance over time.

With the remote set point feature a set point can be received from another device or controller. This flexibility allows the output from one controller to control the set point of other controllers for chaining or multi-zone applications.

To use a remote set point a Series 96 must be equipped with Input 2 hardware (96_ 1 - _ _ _ _ - _ _ _ _).

Zone 1

To use the retransmit feature, a Series 96 must come equipped with a Universal Retransmit board installed in output 4 (96_ _ - _ _ _ M - _ _ _ _). Select the output scaling with Analog Output Range Low [A Lo] and Analog Output Range High [A hi] (Output 4 Menu). Set an offset for the output range with Analog Output Offset [ACAL] (Output 4 Menu). For example: If you want to retransmit set point 50° to 250°F and set [A Lo] to 50°, [A hi] to 250°.

Select the value that will be represented by Output 4 with Analog Output Selection [Aout] (Output 4 Menu).

- [OFF] retransmit not active.
- [Proc] retransmits the process value.
- [SP] retransmits the set point.
- [Pcnt] retransmits the percent power output.

Zones 2 and 3

To scale the remote set point input signal, set the set point value for the lowest Input 2 signal with [rL2] (Input 2 Menu) and the value for the highest Input 2 signal with [rH2] (Input 2 Menu). For example, if you want 4-20mA to represent a 50° to 250° set point, set [rL2] to 50 and [rH2] to 250. As the Input 2 signal varies between 4 and 20mA, the remote set point value will vary between 50° and 250°.

Use the Local-Remote parameter [L-r] (User Menu) to switch between the local [L] and remote [r] set point.

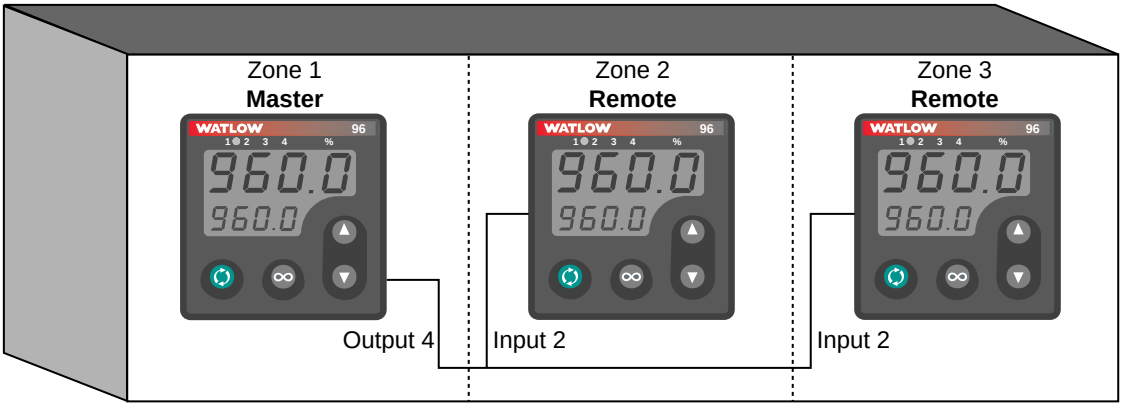


Figure 5.9 – Retransmitting a remote set point.

Control Methods

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 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, causing “chattering.”

Set Proportional Band 1 [Pb 1] (PID 1 Menu) to 0 to set the controller to on/off control mode. Set the Output 1 hysteresis with Hysteresis 1 [hYS 1] (PID 1 Menu).

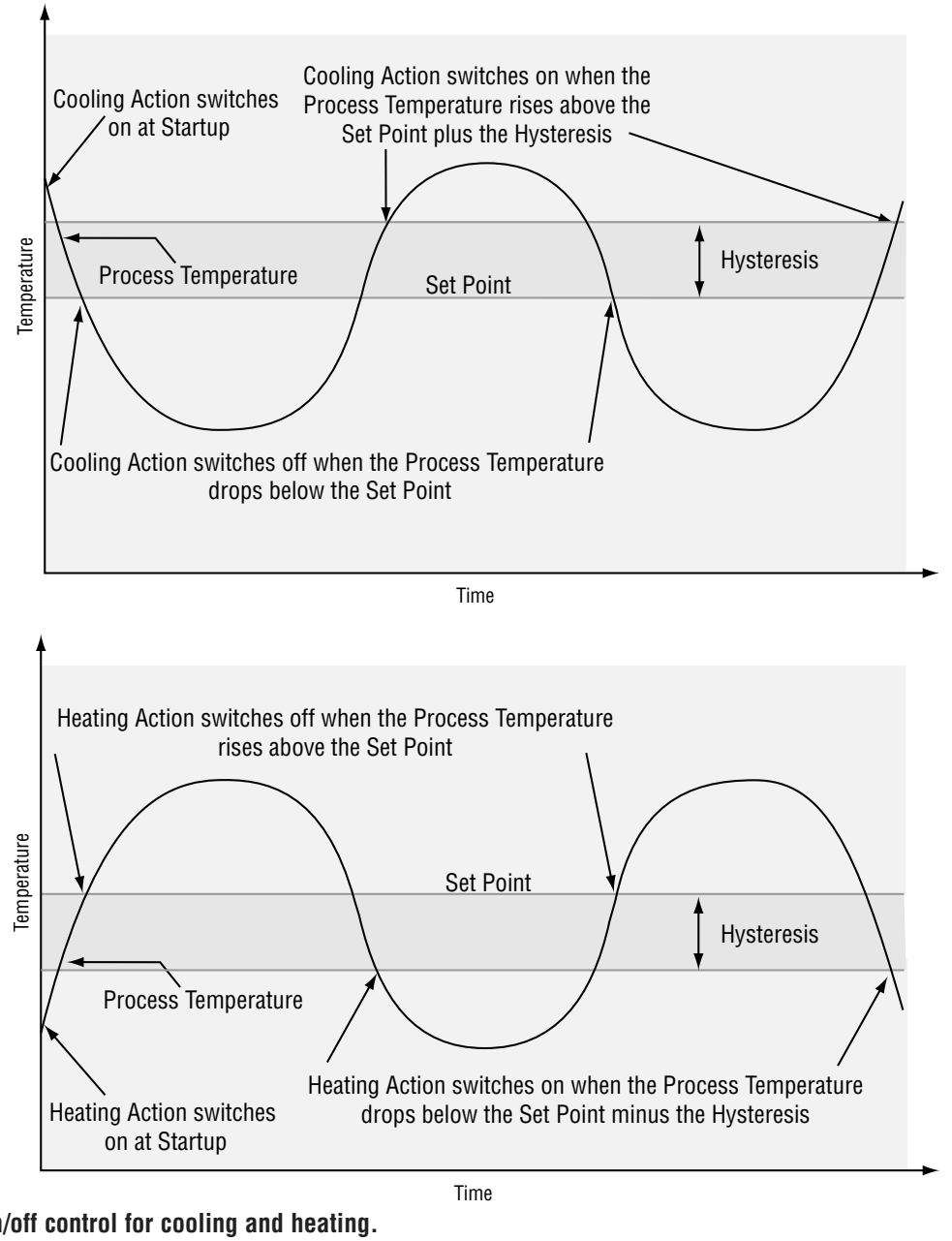


Figure 5.10 – On/off control for cooling and heating.

Proportional Control

Some processes need to maintain a temperature or process value closer to the set point than an on/off control can provide. Proportional control provides closer control by adjusting the output when the temperature or process value is within a proportional band. When the value is in the band, the controller adjusts the output based on how close the process value is to the set point: the closer to set point the lower the output. This is similar to backing off on the gas pedal of a car as you approach a stop sign. It keeps the temperature or process value from swinging as widely as it would with a simple on/off control. However, when a system settles down, the temperature or process value tends to “droop” short of the set point.

With proportional control the output power level equals (set point minus process value) divided by propband.

The PID 1 proportional band can be viewed or changed with Propband 1 [Pb1] (PID 1 Menu).

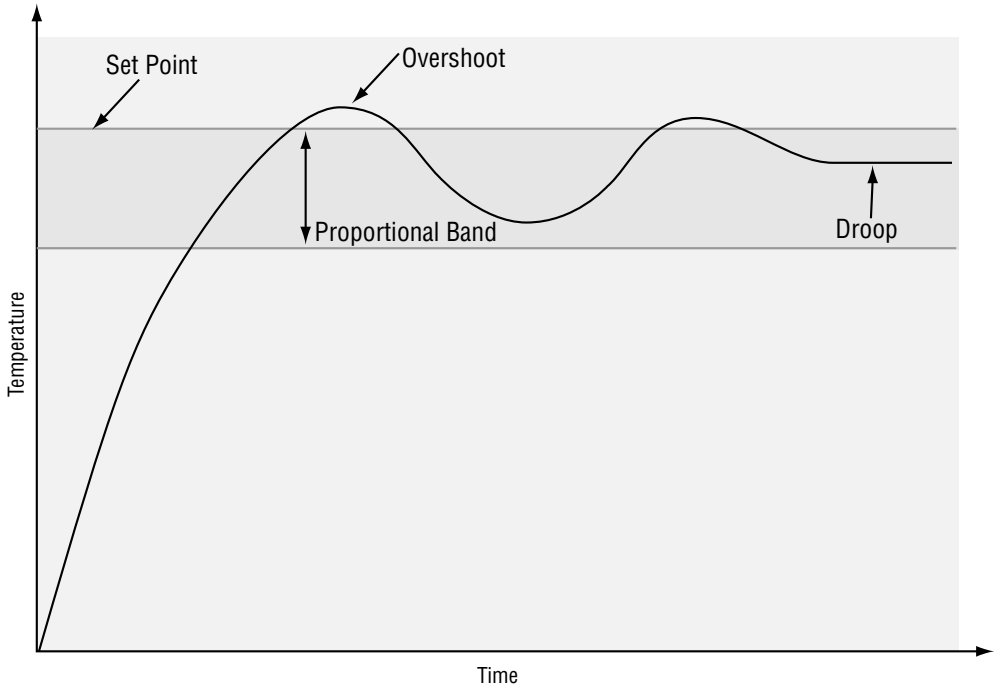


Figure 5.11 – Proportional control.

Proportional plus Integral (PI) Control

The droop caused by proportional control can be corrected by adding integral (reset) control to the system. When the system has settled down the integral (reset) value is tuned to bring the temperature or process value closer to the set point. Integral (reset) determines the speed of the correction. However, this may increase the overshoot that occurs at startup or when the set point is changed. Too much integral (reset) action will make the system unstable.

Integral (reset) is cleared when the process value is outside of the proportional band.

Reset is measured in repeats per minute. A low reset value causes a slow integrating action.

Integral is measured in minutes per repeat (the inverse of reset). A low integral value causes a fast integrating action.

View or change the Output 1 integral or reset value with Integral 1 [It 1] or Reset 1 [rE 1] (PID 1 Menu). Integral appears if Units Type [Unit] (Global Menu) is set to [SI]. Reset appears if [Unit] is set to [US].

Integral Value	Equivalent Reset Value
1 minute	1 repeat per minute
2 minutes	0.5 repeats per minute
3 minutes	0.33 repeats per minute
4 minutes	0.25 repeats per minute

Table 5.12 – Converting between integral and reset values.

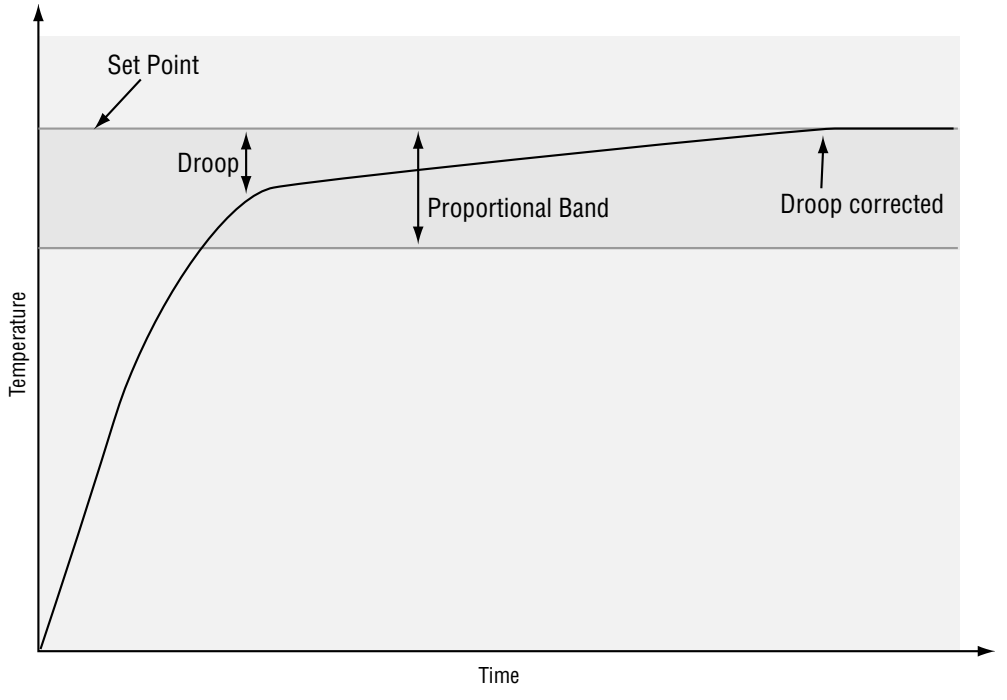


Figure 5.12 – Proportional plus integral control.

Proportional plus Integral plus 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.

Rate action is active only when the process value is within twice the proportional value from the set point.

View or change the Output 1 derivative or rate with Derivative 1 [dE1] or Rate 1 [rA1] (PID 1 Menu). Derivative appears if Units Type [Unit] (Global Menu) is set to [SI]. Rate appears if [Unit] is set to [US].

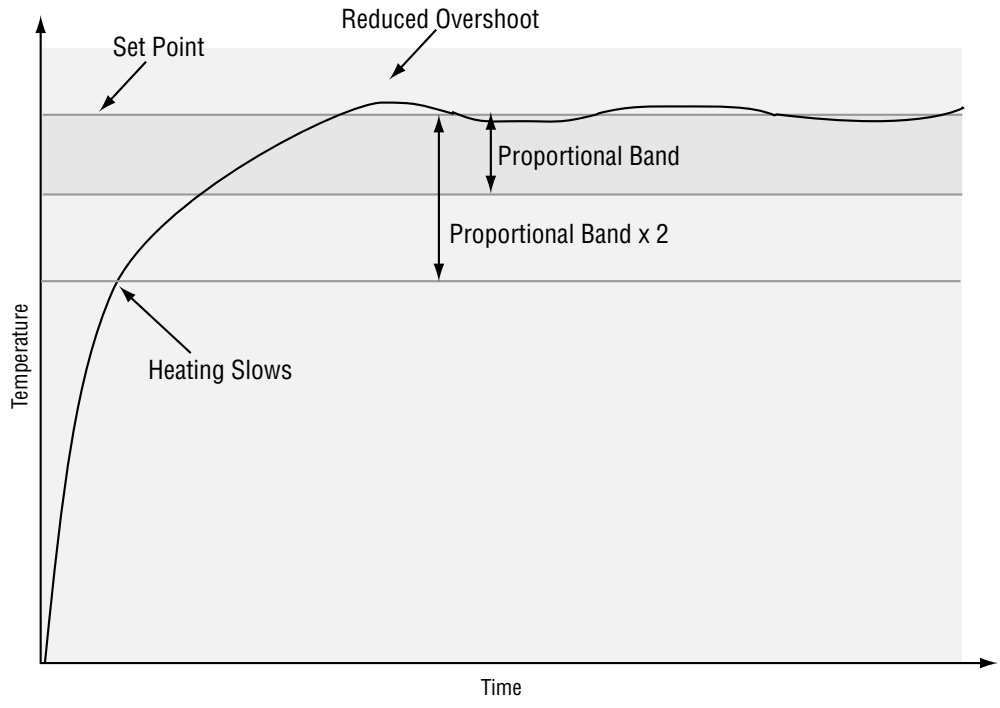


Figure 5.13 – PID control.

Dual PID

In an application with one output assigned to heating and another assigned to cooling, each will have a separate set of PID parameters and separate dead bands. The heating parameters take effect when the process temperature is lower than the set point and the cooling parameters take effect when the process temperature is higher than the set point.

PID 1 parameters apply to Output 1; PID 2 parameters apply to Output 2. View or change PID 1 and PID 2 parameters in the PID 1 and PID 2 menus (Operations Page).

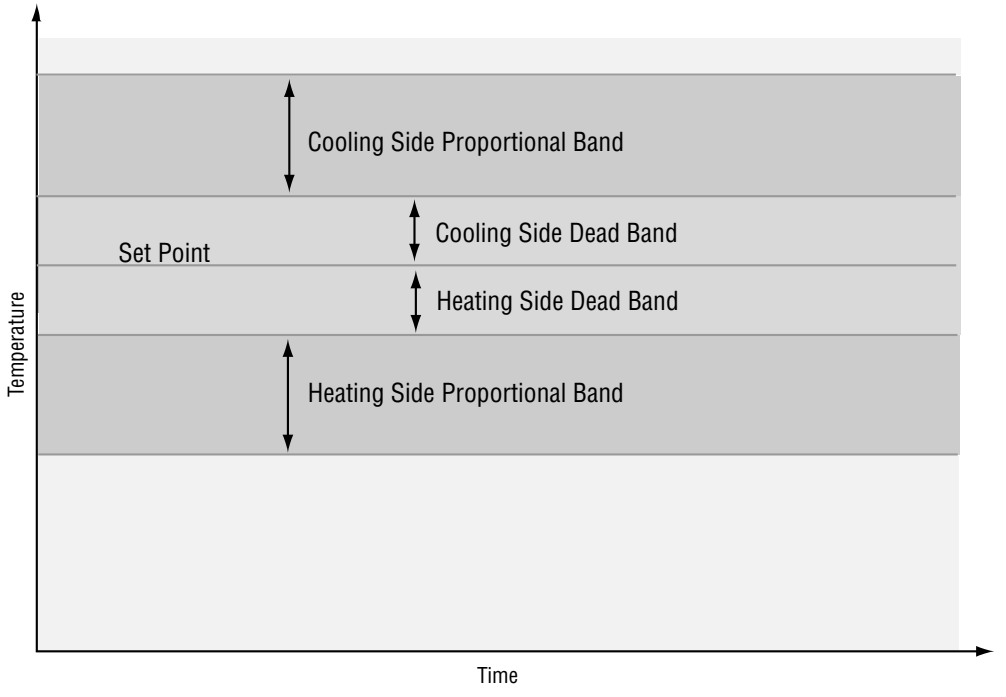


Figure 5.14 – Dual PID.

Dead Band

In a dual PID application the dead bands above and below the set point can be used to save energy and wear on an application by maintaining a process temperature within an acceptable range. Shifting the effective cooling set point and heating set point keeps the two systems from fighting each other.

Proportional action ceases when the process value is within the dead band. Integral action continues to bring the process temperature to the set point. When the value of the dead band is zero, the heating element becomes active when the temperature drops below the set point, and the cooling element switches on when the temperature exceeds the set point.

The dead band for Output 1 can be viewed or changed with Dead Band 1 db 1 (PID 1 Menu). The dead band for Output 2 can be viewed or changed with Dead Band 2 db 2 (PID 2 Menu).

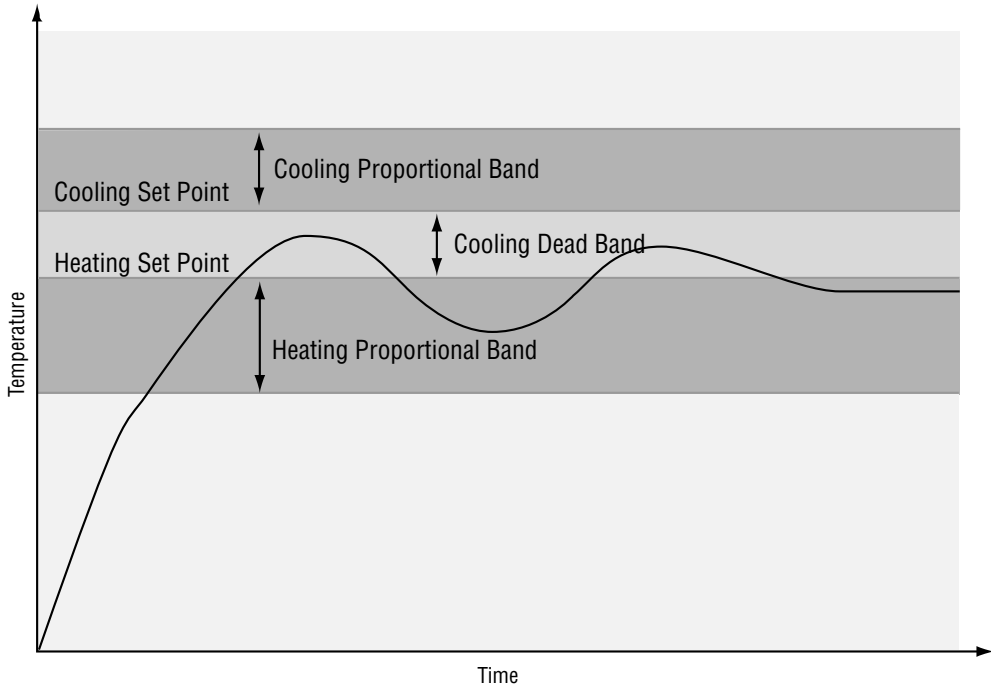


Figure 5.15 – Cooling dead band.

Burst Fire

Burst firing provides even output power with the lowest level of noise generation (RFI). Burst fire is the preferred method for controlling a resistive load, providing a very short time base for longer heater life.

The controller determines when the ac sine wave will cross the 0-volts point, then switches the load on or off only at this point, minimizing RFI.

The burst fire feature for Output 1 can be turned on or off with Burst Fire 1 brS1 (PID 1 Menu). The burst fire feature for Output 1 requires either switched dc (96_ _-C _ _ _ -_ _ _ _) or solid-state relay (96_ _-K _ _ _ -_ _ _ _).

The burst fire feature for Output 2 can be turned on or off with Burst Fire 2 brS2 (PID 2 Menu). The burst fire feature for Output 2 requires either switched dc (96_ _-_ C _ _ -_ _ _ _) or solid-state relay (96_ _- _ K _ _ -_ _ _ _).

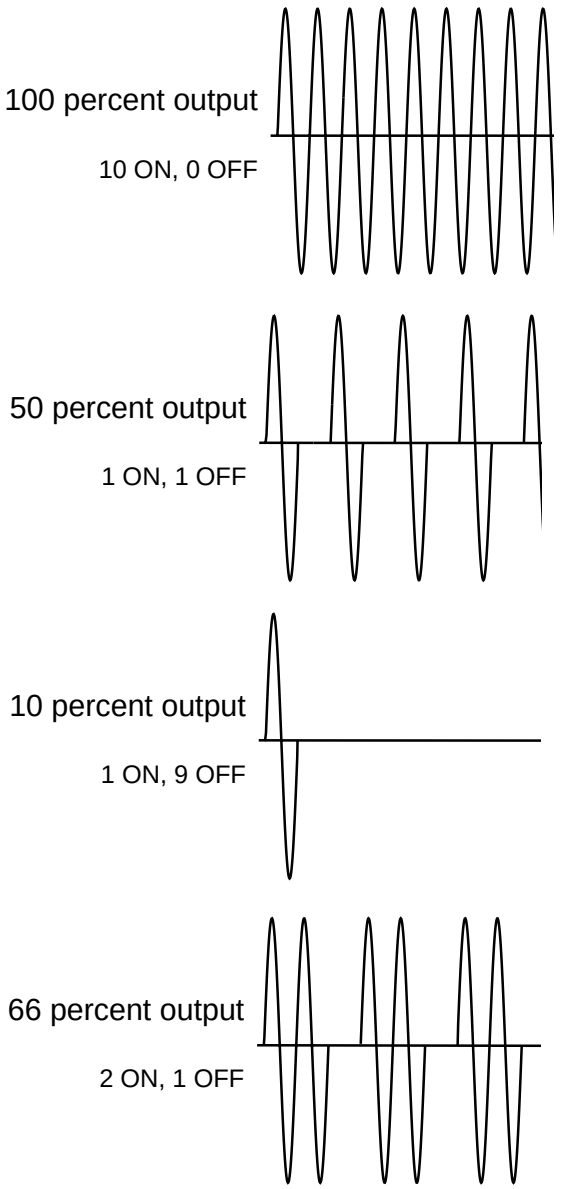


Figure 5.16 – Burst fire.

Ramp to Set Point

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.

Select when ramping is active with Ramping Mode [rP] (Global Menu).

- [OFF] ramping not active.
- [Strt] ramp at startup.
- [StPt] ramp at startup or when the set point changes.

Select whether the rate is in degrees per minute or hour with Ramp Scale [rP S] (Global Menu). Set the ramping rate with Ramp Rate [rAtE] (Global Menu).

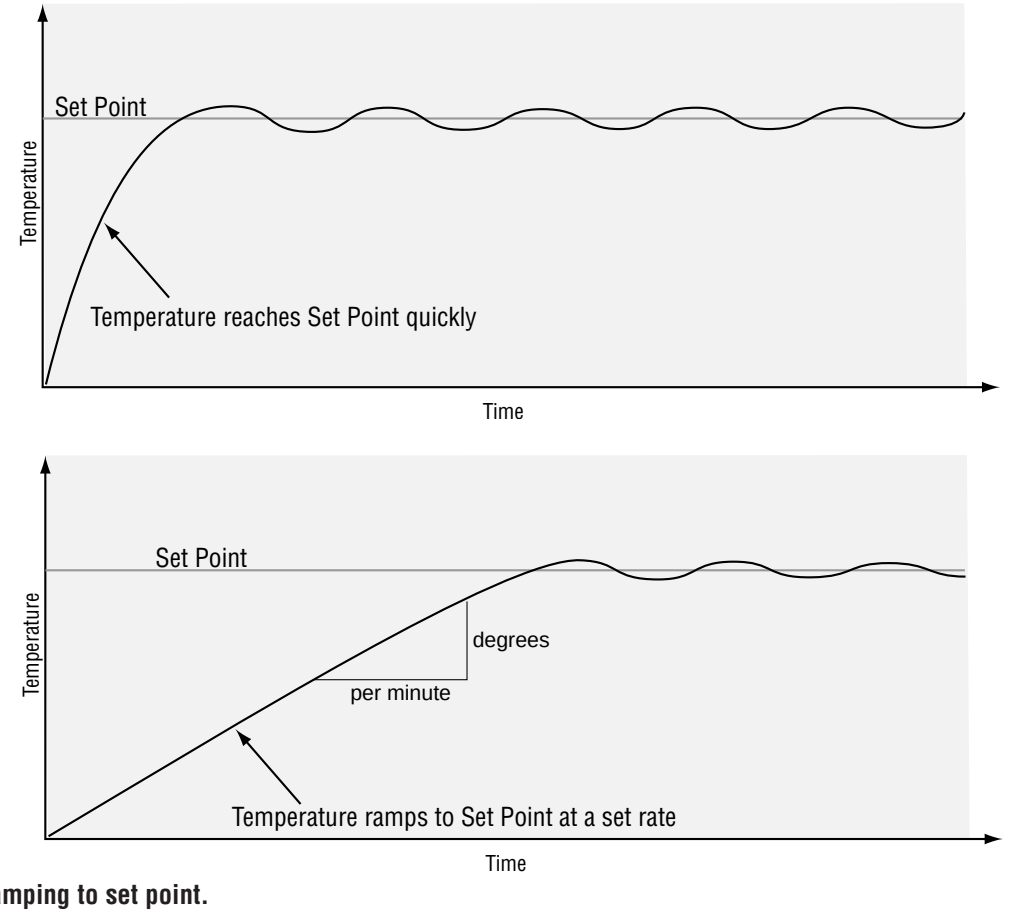


Figure 5.17 – Ramping to set point.

Alarms

An alarm takes some action, usually notifying an operator, when the process temperature leaves a defined range. A user can configure how and when an alarm is triggered and whether it turns off automatically when the alarm condition is over.

Alarm Set Points

The alarm high set point defines the temperature that will trigger a high side alarm. The alarm high set point must be higher than the alarm low set point and lower than the high limit of the sensor range.

The alarm low set point defines the temperature that will trigger a low side alarm. The alarm low set point must be lower than the alarm high set point and higher than the low limit of the sensor range.

Process or deviation alarm set points for Output 2 can be viewed or changed with Alarm 2 High [A2hi] and Alarm 2 Low [A2Lo] (Alarm Menu).

Alarm Hysteresis

Alarm hysteresis is a zone inside each alarm set point. This zone is defined by adding the hysteresis value to the alarm low set point or subtracting the hysteresis value from the alarm high set point.

An alarm state is triggered when the process value reaches the alarm high or alarm low set point. Alarm hysteresis defines how far the process must return into the normal operating range before the alarm can be cleared.

The alarm hysteresis value for Output 2 can be viewed or changed with Hysteresis 2 [hYS2] (Output 2 Menu).

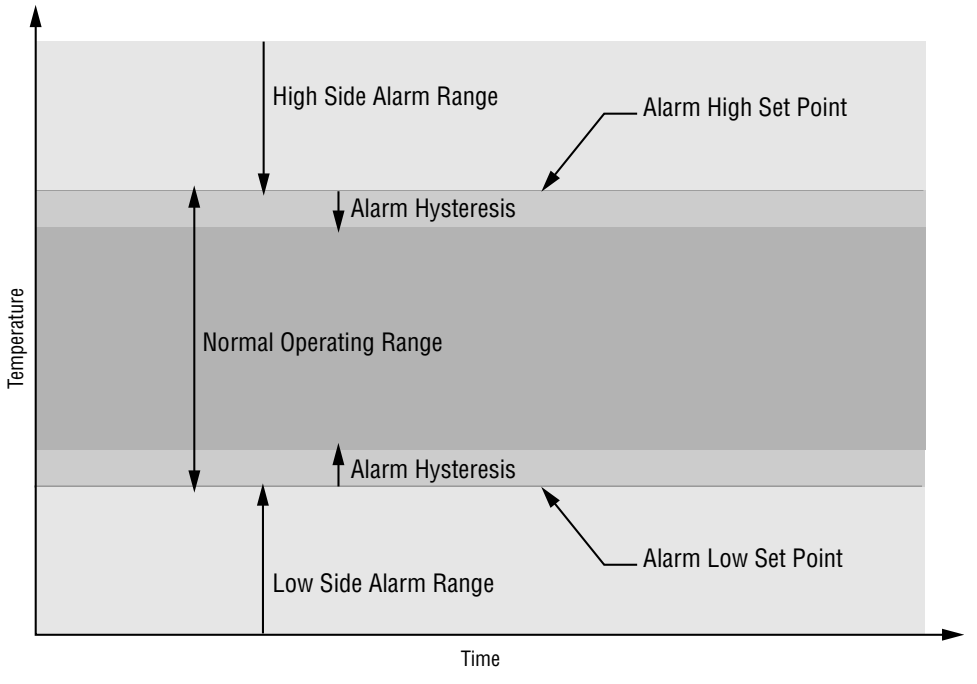


Figure 5.18 – Alarm settings.

Process or 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 control set point. High and low alarm set points are calculated by adding and/or subtracting offset values from the control set point. If the set point changes, the window defined by the alarm set points automatically change with it.

Alarm 2 Type [AtY2] (Output 2 Menu) allows you to view or change whether the Output 2 alarm will function as a process or deviation alarm.

The alarm deviation value of Output 2 can be viewed or changed with Alarm 2 High [A2hi] and Alarm 2 Low [A2Lo] (Alarm Menu).

Alarm Latching

A latched alarm will remain active after the alarm condition has passed. It can only be deactivated by the user. An alarm that is not latched will deactivate automatically when the alarm condition has passed.

Alarm 2 Latching [LAt2] (Output 2 Menu) allows you to view or change whether the Output 2 alarm will latch.

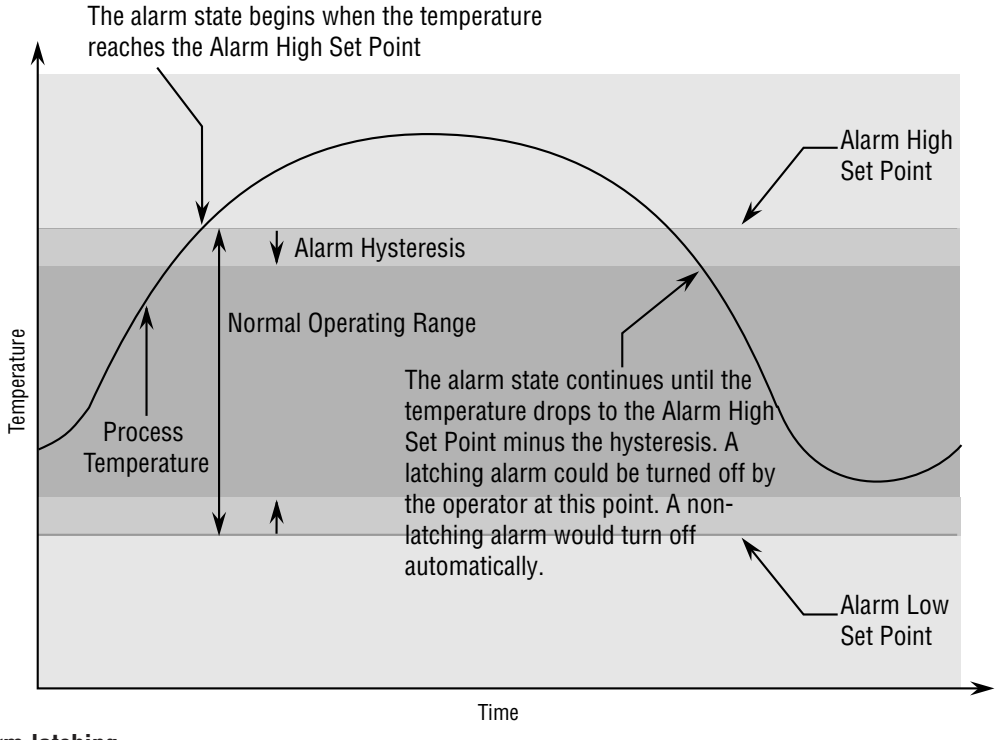


Figure 5.19 – Alarm latching.

Alarm Silencing

Alarm silencing has two uses:

1. It is often used to allow a system to warm up after it has been started up. With alarm silencing on, an alarm is not triggered when the process temperature is initially lower that the alarm low set point. The process temperature has to enter the normal operating range beyond the hysteresis zone to activate the alarm function.
2. Alarm silencing also allows the operator to disable the alarm output while the controller is in an alarm state. The process temperature has to enter the normal operating range beyond the hysteresis zone to activate the alarm output function.

If a Series 96 output is functioning as a deviation alarm, the alarm is silenced when the set point is changed, until the process value re-enters the normal operating range.

Alarm Silencing 2 [SIL2] (Output 2 Menu) allows you to view or change whether alarm silencing is on. If Alarm Annunciation 2 [Anu2] (Output 2 Menu) is set to [YES], the Output 2 indicator light will remain on and an alarm message will appear in the display, even though the alarm output is silenced.

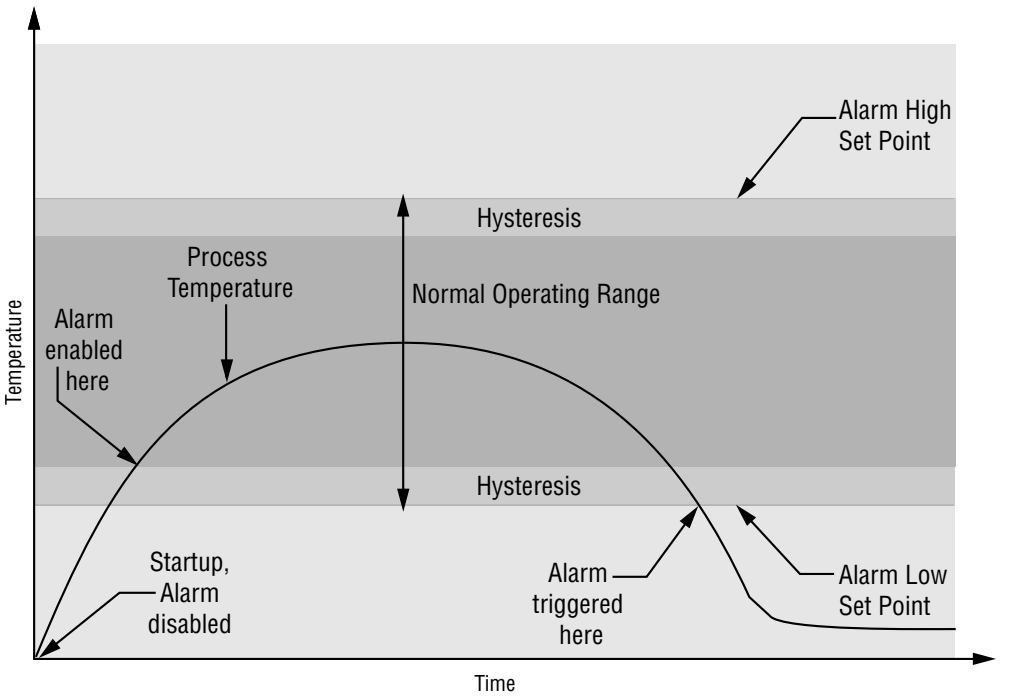


Figure 5.20 – Alarm silencing.

Errors

Open Loop Detect

Open loop detect can alert the user of trouble on the input or output side of the control loop. It only works when the controller is operating with PID control. An open loop error is triggered when 100 percent power is applied at the control output for a period of time equal to the setting of integral (or the inverse of the reset value) without the input registering a 5° (ºF or ºC) change.

The open loop detect feature can be turned on or off with Open Loop Detect OPLP (Global Menu).

If an open loop error occurs, the controller outputs will shut off and OPLP will flash in the upper display of the controller. Shut down the system, check the input and control output wiring and check the input and output devices.

System Errors (error number in top display, error message in bottom display)

Er 4 Error 4 indicates there is a RAM malfunction.
rAM

Er 5 Error 5 indicates nonvolatile memory checksum error.
EEcS

Er 6 Error 6 indicates a ROM malfunction.
roM

Er 7 Error 7 indicates a hardware failure.
hArd

Er 8 Error 8 indicates a module error.
PLuG

Er 9 Error 9 indicates a configuration error.
cnFG

Er 10 Error 10 indicates a module has been changed.
chnG

Er 11 Error 11 indicates new software has been installed.
SoFt

Er 12 Error 12 indicates that calibration data is corrupted.
CAL

Er 13 Error 13 indicates an analog-to-digital timeout.
Atod

Er 14 Error 14 indicates a serial EEPROM timeout.
EEhd

Er 15 Error 15 indicates a new unit.
nEuJ

Er 16 Error 16 indicates an EEPROM invalid address.
Addr

Input Errors (error number in top display, percent output in bottom display)

Err 1 Error 1 indicates the input is too low to measure.

Err2 Error 2 indicates the input is under the sensor range.

Err3 Error 3 indicates the input is over the sensor range.

Err4 Error 4 indicates the input is too large to measure.

Bumpless Transfer

When the sensor opens (fails), the controller switches from automatic to manual operation. If bumpless transfer is active when the sensor fails, the control output (or outputs) will remain stable — a bumpless, or smooth, transition.

If the Failure Mode FAIL (Global Menu) is set to bumpless bPLS and the process has stabilized at a ± 5 percent output power level for 2 minutes prior to the sensor break, and that power level is less than 75 percent, the controller switches to manual operation at the last automatic power level. If these conditions are not met, the output goes to 0 percent power (output disabled).

If Failure Mode is set to manual MAn, the Series 96 switches to manual operation at the percent power value of Manual Default Power MAn (Global Menu). Manual operation provides open-loop control of the outputs from a range of -100 percent to 100 percent output. The Series 96 allows a negative output value only when Output 1 or 2 is set to cool.

When the controller returns to closed-loop control, it uses the previous set point value.

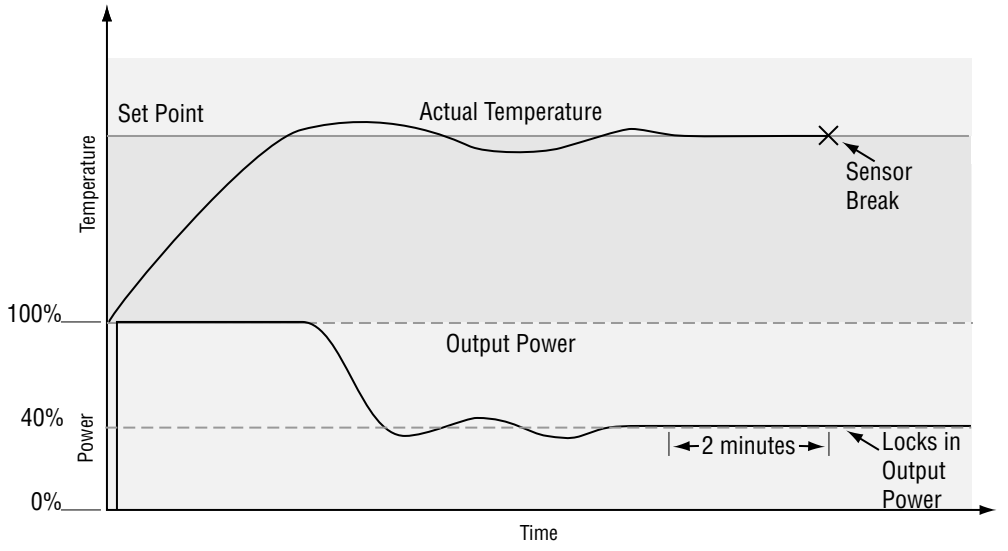


Figure 5.22 – Bumpless transfer.

6

Chapter Six
Parameters

Parameter Setup Order 6.2

Home Page 6.3

Operations Page 6.4
- Monitor Menu 6.4
- User Menu 6.4
- PID 1 Menu 6.5
- PID 2 Menu 6.7
- Alarm Menu 6.8

Setup Page 6.10
- Input 1 Menu 6.10
- Input 2 Menu 6.11
- Output 1 Menu 6.13
- Output 2 Menu 6.13
- Output 3 Menu 6.15
- Output 4 Menu 6.16
- Global Menu 6.18

Factory Page 6.20
- Custom Menu 6.20
- Lockout Menu 6.21
- Diagnostics Menu 6.22
- Calibration 1 Menu 6.24
- Calibration 2 Menu 6.26
- Process Output Calibration Menu 6.26

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Table 6.2 – Set up parameters in this order.

Key:
D = Changing will change the default
C = Changing will convert the temperature scale
O = Other effect

Changing this affects this ↓ / →	Units Type Un.t	°C or °F C-F	Output 1 Ot 1	Output 2 Ot 2	Sensor Type SEn 1	Input 1 In 1	Range High 1 rh 1	Range Low rL 1	Decimal 1 dEC 1	HPL Above PL A	HPL Below PL b	Input 2 In 2	Alarm Type 2, 3, 4
Units Type Un.t													
°C or °F C-F													
Failure Mode FA.L													
Output 1 Ot 1													
Output 2 Ot 2													
Output 3 Ot 3													
Output 4 Ot 4													
Manual Default Power MAn			O	O						O	O		
Sensor Type SEn 1													
Input 1 In 1					O								
Range High 1 rh 1		C			D	D			C				
Range Low rL 1		C			D	D			C				
Decimal 1 dEC 1					D	D							
Calibration Offset 1 CAL 1		C			D	D			C				
Input Software Filter 1 Ftr 1					D	D			O				
Power Limit Set Point PLSP		C			D	D	O	O	C				
High Power Limit Above PL A			O	O									
High Power Limit Below PL b			O	O									
Input 2 In 2													
Event Function E Fn												O	
Event Condition E cn												O	
Range High 2 rh2		C							C			D	
Range Low 2 rL2	C							C			D		
Calibration Offset 2 CAL2		C							C			D	
Analog Output 4 Aout					D	D							
Analog Output High A hi		C			D	D			C				
Analog Output Low A Lo		C			D	D			C				
Analog Output Offset ACAL		C			D	D			C				
Ramping Mode rP													
Ramp Scale rP S													
Ramp Rate rAtE													
Alarm Type 2, 3, 4 AtY2 3 4													
Alarm Hysteresis 2, 3, 4 AhY2 3 4		C			D	D			C				
Latching 2, 3, 4 LAt2 3 4													
Alarm Silencing 2, 3, 4 S.L2 3 4													
Alarm Active Sides 2, 3, 4 S.d2 3 4													
Alarm Logic 2, 3, 4 L9c2 3 4													
Alarm 2, 3, 4 High A2h. 3 4		C			D	D			C				O
Alarm 2, 3, 4 Low A2Lo 3 4		C			D	D			C				O
Propband 1, 2 Pb 1 2		C			D	D			C				
Integral 1, 2 It 1 2	C												
Reset 1, 2 rE 1 2	C												
Derivative 1, 2 dE 1 2													
Rate 1, 2 rA 1 2													
Burst 1, 2 brS 1 2													
Cycle Time 1, 2 Ct 1 2													
Dead Band 1, 2 db 1 2		C			D	D			C				
Hysteresis 1, 2 HYS 1 2		C			D	D			C				
Auto-Manual Operations Mode A-M													
Event Set Point E SP		C			D	D	O	O	C				
Set Point 2 SP2		C			D	D	O	O	C				
Set Point Lock SP		C			D	D	O	O	C				
Manual Set Point			O	O						O	O		

Parameter Setup Order

Home Page

The resting-state display shows one of the following sets of data, depending on controller setup. The first prompt appears in the top display, the second in the bottom.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
96 100	Process 1 Set Point 1 Monitor the Process 1 value and change the Set Point values.	Range Low 1 to Range High 1		100 r 300 r/w	Active if the event set point is not active and Local or Remote Mode (User Menu) is set to L (local) or Auto-Manual Operation Mode (User Menu) is set to Auto (automatic).
96 200	Process 1 Remote Set Point Monitor the Process 1 value and Remote Set Point values.	Range Low 1 to Range High 1		100 r 202 r	Active if the remote set point is active and Local or Remote Mode L-r (User Menu) is set to r (remote) and Auto-Manual Operation Mode (User Menu) is set to Auto (automatic).
96 50.0	Process 1 Event Set Point Monitor the Process 1 value and Event Set Point values.	Range Low 1 to Range High 1		100 r 202 r	Active if Event Function E Fn (Input 2 Menu) is set to SP (event set point), an event condition exists and Auto-Manual Operation Mode (User Menu) is set to Auto (automatic).
96 50.0	Process 1 Manual Set Point Monitor the Process 1 value and change manual set point value.	heat modes: 0.0 to 100.0 cool modes: -100.0 to 0.0 heat/cool modes: -100.0 to 100.0		100 r 310 r/w	Active if Auto-Manual Operation Mode (User Menu) is set to MAn (manual), or if there is an error.
The parameters selected in the Custom Menu (Factory Page) will appear here.					

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Operations Page

The Operations Page contains five menus:

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
OPEr	**Operations Page Select** Go to an operations menu.	Mon Monitor USEr User Pid1 PID 1 Pid2 PID 2 (if ouput 2 is Active) ALM Alarm (if any alarms are active)			Active if Operations Page Mode Lock (Lockout Menu/Factory Page) is not set to hidE.
Mon OPEr	***Monitor Menu Operations Page***	Mon Monitor: comms value (0)			
Pr2	**Process 2** Monitor the process 2 value.			105 r	Active if Input 2 (Input 2 Menu) is not set to OFF or E In and Operations Page Lock (Lockout Menu) is not set to hidE.
Pcnt	**Percent Output** Monitor the control output power level.			103 r	Active if Operations Page Lock (Lockout Menu) is not set to hidE.
rPSP	**Ramping Set Point** Monitor the ramping set point.			203 r	Active if Ramping Mode (Global Menu) is not set to OFF and Operations Page Lock (Lockout Menu) is not set to hidE.
E St	**Event Input Status** Monitor the event input status.	truE true (1)* FALS false (0)*		201 r	Active if Input 2 (Input 2 Menu) is set to E In (event input) and Operations Page Lock (Lockout Menu) is not set to hidE.
USEr OPEr	***User Menu Operations Page***				
A-M	**Auto-Manual Operation Mode** Select whether the controller is under auto or manual control.	Auto Auto mode (0) MAn Manual mode (1)	Auto	301 r	Active if Operations Page Lock (Lockout Menu) is not set to hidE.

***Numbers in parentheses are the ordinals/enumerators for use in Modbus communications.**

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
Aut	**Auto-tune** Initiate or cancel an auto-tune.	OFF off or cancel an auto-tune in progress (0) tunE initiate an auto-tune (1) Pid1 Set 1 only (2) Pid2 Set 2 only (3)	OFF (0)	305 r/w	Active if Auto-Manual Operation Mode (User Menu) is set to Auto (automatic) and Operations Page Lock (Lockout Menu) is not set to hidE.
AtSP	**Auto-tune Set Point** Set the auto-tune set point as a percent of the currently active set point.	50 to 150	90	304 r/w	Active if Operations Page Lock (Lockout Menu) is not set to hidE.
SP2	**Set Point 2** Set the boost set point.	Range Low 1 to Range High 1	75°F, 24°C	319 r/w	Active if output 2 is present (not 96 _ _-_ A _ _-_ _ _ _), both Output 1 (Output 1 Menu) and Output 2 (Output 2 Menu) are set to either heAt or COOL and Operations Page Lock (Lockout Menu) is not set to hidE.
E SP	**Event Set Point** Set the set point when the event input is active as defined by Event Condition.	Range Low 1 to Range High 1	75°F, 24°C	306 r/w	Active if Input 2 (Input 2 Menu) is set to E In (event input), E Fn is set to SP, and Operations Page Lock (Lockout Menu) is not set to hidE.
L-r	**Local or Remote Mode** Set the mode to local or remote set point.	L local (0) r remote (1)	L (0)	316 r/w	Active if Input 2 (Input 2 Menu) is not set to OFF, Input 2 is not set to E In (event input) and Operations Page Lock (Lockout Menu) is not set to hidE.
CAL1	**Calibration Offset** Set the input 1 calibration offset.	-1999 to 9999	0	605 r/w	Active if Operations Page (Lockout Menu) is not set to hidE.
Pid1 OPEr	***PID 1 Menu*** ***Operations Page***				
Pb 1	**Propband 1** Set the proportional band for PID control.	0º to 9999º If Pb 1 is set to 0 operates in on/off mode.	25ºF, 17ºC	500 r/w	Active if Operations Page Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
It 1	**Integral 1** Set the integral time in minutes for output 1.	0.00 to 99.99 minutes per repeat	0.00	501 r/w	Active if Propband 1(PID 1 Menu) is not set to 0, Units Type (Global Menu) is set to S1 and Operations Page Lock (Lockout Menu) is not set to hidE.
rE 1	**Reset 1** Set the reset time in repeats/minute for output 1.	0.00 to 99.99 repeats per minute	0.00 (0)	502 r/w	Active if Propband 1(PID 1 Menu) is not set to 0, Units Type (Global Menu) is set to US and Operations Page Lock (Lockout Menu) is not set to hidE.
dE 1	**Derivative 1** Set the derivative time in minutes for output 1.	0.00 to 9.99 minutes	0.00 (0)	503 r/w	Active if Propband 1(PID 1 Menu) is not set to 0, Units Type (Global Menu) is set to S1 and Operations Page Lock (Lockout Menu) is not set to hidE.
rA 1	**Rate 1** Set the rate time in minutes for output 1.	0.00 to 9.99 minutes	0.00 (0)	504 r/w	Active if Propband 1(PID 1 Menu) is not set to 0, Units Type (Global Menu) is set to US and Operations Page Lock (Lockout Menu) is not set to hidE.
brS1	**Burst 1** Select burst fire mode for output 1.	no no (0) YES yes (1)	no (0)	509 r/w	Active if Propband 1 (PID 1 Menu) is not set to 0, and Operations Page Lock (Lockout Menu) is not set to hidE, and if output 1 is equipped for a solid-state relay (96A _-K _ _ _-_ _ _ _) or switched dc (96A _-C _ _ _-_ _ _ _) or high voltage power supply (96A _-_ _ _ _-_ _ _ _.)
Ct 1	**Cycle Time 1** Set the cycle time in seconds for output 1.	Relay: 5.0 to 60.0 Solid State: 0.1 to 60.0	Determined by output type.	506 r/w	Active if Propband 1 (PID 1 Menu) is not set to 0, Burst 1 (PID 1 Menu) is set to no, output 1 is not a process type (not 96 _ _-F _ _ _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hidE.
hyS1	**Hysteresis 1** Sets the switching hysteresis for output 1.	1 to 9999	3°F, 2°C	507 r/w	Active if output 1 is not a process type (not 96 _ _-F _ _ _-_ _ _ _), Propband 1 (PID 1 Menu) is set to 0 and Operations Page Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
db 1	**Dead Band 1** Set point shift for output 1 control.	0 to 9999	0	505 r/w	Active if output 2 is present (not 96 _ _-_ A _ _-_ _ _ _), one output is set to hEAt, another is set to COOL and Operations Page Lock (Lockout Menu) is not set to hidE.
P id2	***PID 2 Menu***				
OPEr	***Operations Page***				
Pb 2	**Propband 2** Set the proportional band for output 2.	0° to 9999° If Pb 2 is set to 0 operates in on/off mode.	25°F, 17°C	510 r/w	Active if one output is set to heat and the other to cool and Operations Page Lock (Lockout Menu) is not set to hidE and Heat-Cool Mode.
It 2	**Integral 2** Set the integral time in minutes for output 2.	0.00 to 99.99 minutes per repeat	0.00 (0)	511 r/w	Active if Propband 2 (PID 2 Menu) is not set to 0, Units Type (Global Menu) is set to SI and Operations Page Lock (Lockout Menu) is not set to hidE.
rE 2	**Reset 2** Set the reset time in repeats/minutes for output 2.	0.00 to 99.99 repeats per minute	0.00 (0)	512 r/w	Active if Propband 2 (PID 2 Menu) is not set to 0, Units Type (Global Menu) is set to US and Operations Page Lock (Lockout Menu) is not set to hidE.
dE 2	**Derivative 2** Set the derivative time in minutes for output 2.	0.00 to 9.99 minutes	0.00 (0)	513 r/w	Active if Propband 2 (PID 2 Menu) is not set to 0, Units Type (Global Menu) is set to SI and Operations Page Lock (Lockout Menu) is not set to hidE.
rA 2	**Rate 2** Set the rate time in minutes for output 2.	0.00 to 9.99 minutes	0.00 (0)	514 r/w	Active if Propband 2 (PID 2 Menu) is not set to 0, Units Type (Global Menu) is set to US and Operations Page Lock (Lockout Menu) is not set to hidE.
brS2	**Burst 2** Select burst fire mode for output 2.	no no (0) YES yes (1)	no (0)	519 r/w	Active if Propband 2 (PID 2 Menu) is not set to 0, and Operations Page Lock (Lockout Menu) is not set to hidE, and if Output 2 is equipped for a solid-state relay (96A _-K _ _ _-_ _ _ _) or switched dc (96A _-C _ _ _-_ _ _ _) or voltage power supply option (96A _-_ _ _ _-_ _ _ _.)

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
Ct 2	**Cycle Time 2** Set the cycle time in seconds for output 2.	Relay: 5.0 to 60.0 Solid-state: 0.1 to 60.0	Relay: 10.0 (100) Solid-state: 1.0 1(0)	516 r/w	Active if Propband 2 (PID 2 Menu) is not set to 0, Burst 2 (PID 2 Menu) is set to no, output 2 is not a process (not 96 _ _ - _ F _ _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hidE.
hYS2	**Hysteresis 2** Sets the switching hysteresis for output 2.	1 to 9999	3°F, 2°C	517 r/w	Active if Output 2 is present, but output 2 is not a process type (not 96 _ _-_ A _ _-_ _ _ _ or 96 _ _-_ F_ _-_ _ _ _), or Output 2 (Output 2 Menu) is set to heAt or COOL (opposite of Output 1 heAt or COOL selection); and Propband 2 (PID 2 Menu) is set to 0 and Setup Page Lock (Lockout Menu) is not set to hidE.
db 2	**Dead Band 2** Set point shift for output 2 control.	0 to 9999	0	515 r/w	Active if output 2 is present (not 96 _ _-_ A _ _-_ _ _ _), one output is set to heAt, another is set to COOL and Operations Page Lock (Lockout Menu) is not set to hidE.
ALM OPEr	***Alarm Menu*** ***Operations Page***				
A2Lo	**Alarm 2 Low** Set the low alarm set point for output 2.	Process: low limit of selected sensor range to Alarm 2 High-1 Deviation: -1999 to 0	Process: low limit of selected sensor range Deviation: -999	321 r/w	Active if Output 2 (Output 2 Menu) is set to AL (Alarm), Alarm Active Sides 2 (Output 2 Menu) is not set to hi, output 2 is present, but is not a process output (not 96 _ _-_ A _ _-_ _ _ _ or 96 _ _-_ F_ _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hidE.
A2hi	**Alarm 2 High** Set the high alarm set point for output 2.	Process: Alarm 2 Low+1 to high limit of selected sensor range Deviation: 0 to 9999	Process: high limit of selected sensor range Deviation: 999	322 r/w	Active if Output 2 (Output 2 Menu) is set to AL (Alarm), Alarm Active Sides 2 (Output 2 Menu) is not set to Lo, output 2 is present, but is not a process (not 96 _ _-_ A _ _-_ _ _ _ or 96 _ _-_ F_ _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
A3Lo	**Alarm 3 Low** Set the low alarm set point for output 3.	Process: low limit of selected sensor range to Alarm 3 High-1 Deviation: -1999 to 0	Process: low limit of selected sensor range Deviation: -999	340 r/w	Active if Output 3 (Output 3 Menu) is AL (Alarm), Alarm Sides 3 (Output 3 Menu) is not hi, output 3 is present (96 _ _-_ _ D _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hidE.
A3hi	**Alarm 3 High** Set the high alarm set point for output 3.	Process: Alarm 3 Low+1 to high limit of selected sensor range Deviation: 0 to 9999	Process: high limit of selected sensor range Deviation: 999	341 r/w	Active if Output 3 (Output 3 Menu) is set to AL (Alarm), Alarm Sides 3 (Output 3 Menu) is set to Lo, output 3 is present (96 _ _-_ _ D _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hidE.
A4Lo	**Alarm 4 Low** Set the low alarm set point for output 4.	Process: low limit of selected sensor range to Alarm 4 High-1 Deviation: -1999 to 0	Process: low limit of selected sensor range Deviation: -999	none*	Active if Output 4 (Output Menu 4) is set to AL (Alarm), Alarm Sides 4 (Output Menu 4) is not hi, output 4 is a relay (96 _ _-_ _ _ D-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hidE.
A4hi	**Alarm 4 High** Set the high alarm set point for output 4.	Process: Alarm 4 Low+1 to high limit of selected sensor range Deviation: 0 to 9999	Process: high limit of selected sensor range Deviation: 999	none*	Active if Output 4 (Output Menu 4) is set to AL (Alarm), Alarm Sides 4 (Output Menu 4) is not set to Lo, output 4 is a relay (96 _ _-_ _ _ D-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hidE.

*Output 4 parameters cannot be changed with the Modbus interface.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Setup Page

The setup page contains seven menus.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
SEt	**Setup Page** Go to a setup menu.	InP1 Input 1 InP2 Input 2 Out1 Output 1 (if present) Out2 Output 2 (if present) Out3 Output 3 (if present) Out4 Output 4 (if present) GLbL Global	InP1		Active if Setup Page Lock (Lock-out Menu) is not set to hidE.
InP1	***Input 1 Menu***				
SEt	***Setup Page***				
SEn1	**Sensor Type 1** Sets the input hard-ware type of input 1.	tc Thermocouple (0) rtd RTD (1)* Proc Process (2)	tc (0)*	600 r/w	Active if Setup Page Lock (Lock-out Menu) is not set to hidE.
In1	**Input 1** Sets the input lin-earization parameter of input.	If Sensor Type is set to thermocouple: J J (0) H K (1) t T (2) E E (3) n N (4) C C (5) d D (6) Pt2 PT2 (7) r R (8) S S (9) b B (10) If Sensor Type is set to RTD: din RTD_DIN (11) JIS RTD_JIS (12) If Sensor Type is set to process: 4-20 4-20mA (13) 0-20 0-20mA (14) 0- 5 0-5V⎓ (dc) (15) 1- 5 1-5V⎓ (dc) (16) 0-10 0-10V⎓ (dc) (17)	If Sensor Type (Input 1 Menu) is changed to thermocou-ple: J (0) If Sensor Type is changed to RTD: din (11) If Sensor Type is set to process: 4-20 (13)	601 r/w	Active if Setup Page Lock (Lock-out Menu) is not set to hidE.

***Numbers in parentheses are the ordinals/enumerators for use in Modbus communications.**

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
rL 1	**Range Low 1** Set the input range low. This setting is the lowest value that the set point can have.	See Specifications in the Appendix for sensor ranges and defaults.	See Specifications in the Appendix for sensor ranges and defaults.	602 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.
rh 1	**Range High 1** Set the input range high. This setting is the highest value that the set point can have.	See Specifications in the Appendix for sensor ranges and defaults.	See Specifications in the Appendix for sensor ranges and defaults.	603 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.
dEC 1	**Decimal 1** Sets the position of the decimal point for input readings.	If Set Sensor Type is RTD, thermocouple or process (excluding R, S or B thermocouple): 0 0 (0) 0.0 0.0 (1) If Set Sensor Type is a process: 0 0 (2) 0.0 0.0 (3) 0.00 0.00 (4) 0.000 0.000 (5)	0	606 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.
Ftr 1	**Input Software Filter 1** Set the filter time for the input, in seconds. This smooths out a rapidly changing input signal. Positive values affect the monitor readings only. Negative values affect both the monitor readings and the control values.	-60.0 to 60.0	0 (1.0 if dEC 1 is set to 0.0).	604 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.
InP2 SEt	***Input 2 Menu*** ***Setup Page***				
In 2	**Input 2** Sets the input type parameter of input 2.	OFF off: (0) E In event input: (1) 4-20 4-20mA (2) 0-20 0-20mA (3) 0-5 0-5V⎓ (dc) (4) 1-5 1-5V⎓ (dc) (5) 0-10 0-10V⎓ (dc) (6)	OFF (0)	611 r/w	Active if input 2 hardware is present (96 _1 _-_ _ _ _ -_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
rL 2	**Range Low 2** Set the input range low. This setting is the value Pr 2 will read when Input 2 is at its low range.	-1999 to rh2 Range High 2	rL1	612 r/w	Active if input 2 hardware is present (96 _1 _-_ _ _ _ -_ _ _ _) and In 2 is not set to E In or OFF and Setup Page Lock (Lockout Menu) is not set to hidE.
rh 2	**Range High 2** Set the input range high. This setting is the value Pr 2 will read when Input 2 is at its high range.	rL2 Range Low 2 to 9999	rh1	613 r/w	Active if input 2 hardware is present (96 _1 _-_ _ _ _ -_ _ _ _), and In 2 is not set to E In or OFF and Setup Page Lock (Lockout Menu) is not set to hidE.
CAL2	**Calibration Offset 2** Set the input calibration offset. This allows you to compensate for lead resistance, sensor errors and other factors.	-1999 to 9999	0	615 r/w	Active if input 2 hardware is present (96 _1 _-_ _ _ _ -_ _ _ _), and In 2 is not set to E In or OFF and Setup Page Lock (Lockout Menu) is not set to hidE.
E Fn	**Event Function** Select the event function.	nonE no function (0) SP switch to event set point (1) AOFF turn off control outputs and disable alarms (2) COFF turn off control outputs (3) LOC lock out key board (4) A-M switch to manual mode (5) tunE initiate an auto-tune (6) AL clear alarm (7) SLOC lock out everything except primary set point (auto or manual) (8)	nonE (0)	1060 r/w	Active if input 2 hardware is present (96 _1 _-_ _ _ _ -_ _ _ _) and Input 2 (Input 2 Menu) is set to E In (Event Input) and Setup Page Lock (Lockout Menu) is not set to hidE.
E cn	**Event Condition** Select the condition to trigger an event.	LO low (0): hi high (1) rISE rise (2) FALL fall (3)	LO (0)	1061 r	Active if input 2 hardware is present (96 _1 _-_ _ _ _ -_ _ _ _), Input 2 (Input 2 Menu) is set to E In (Event Input), Event Function (Input 2 Menu) is not set to nonE and Setup Page Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
Out 1 SEt	***Output 1 Menu Setup Page***				
Ot 1	**Output 1** Select whether the control output will control for heating or cooling.	heAt heat (0) COOL cool (1)	heAt (0)	700 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.
Prc 1	**Process 1 Type** Sets process 1 output type.	4-20 4-20mA (0) 0-20 0-20mA (1) 0-5 0-5V⎓ (dc) (2) 1-5 1-5V⎓ (dc) (3) 0-10 0-10V⎓ (dc) (4)	4-20 (0)	701 r/w	Active if output 1 is equipped for a process (96 _ _-F _ _ _-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hidE.
Out2 SEt	***Output 2 Menu Setup Page***				
Ot 2	**Output 2** Select output 2 function.	OFF off (0) heAt heat (1) COOL cool (2) AL alarm (3)	OFF (0)	717 r/w	Active if output 2 is present (not 96 _ _-_ A _ _-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hidE.
Prc2	**Process 2 Type** Sets output 2 process type.	4-20 4-20mA (0) 0-20 0-20mA (1) 0-10 0-10V⎓ (dc) (2) 0-5 0-5V⎓ (dc) (3) 1-5 1-5V⎓ (dc) (4)	4-20 (0)	718 r/w	Active if output 2 is equipped for a process (96 _ _-_ F_ _-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hidE.
AtY2	**Alarm 2 Type** Select alarm type. A process alarm responds when the temperature leaves a fixed range. A deviation alarm responds when the temperature deviates from the set point by a set number of degrees.	Proc process alarm (0) dE deviation alarm (1)	Proc (0)	719 r/w	Active if output 2 is present, but is not process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
AhY2	**Alarm Hysteresis 2** Sets the switching hysteresis for the alarm output. This defines a band on the inside of the alarm set point. When the process temperature is in this band, the alarm state will not change.	1 to 9999	3°F, 2°C	720 r/w	Active if output 2 is present, but is not process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
LAt2	**Latching 2** Enable Alarm 2 Latching.	no no action (0) YES latching enabled (1)	no (0)	721 r/w	Active if output 2 is present, but is not a process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
SIL2	**Silencing 2** Enable Silence 2.	no no action (0) YES silence alarm (1)	no (0)	722 r/w	Active if output 2 is present, but is not a process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
Sid2	**Alarm Active Sides 2** Select which side or sides the alarm setpoints can be programmed for.	both both (0) hi high (1): high side only Lo low (2): low side only	both (0)	723 r/w	Active if output 2 is present, but is not a process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
Lgc2	**Alarm Logic 2** Select alarm 2 output condition in the alarm state.	AL 0 alarm condition de-energizes output (fail-safe operation) (0) AL C alarm condition energizes output (1)	AL 0 (0)	724 r/w	Active if output 2 is present, but is not a process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
Anu2	**Alarm Annunciation 2** Select alarm 2 annunciation option.	no no (0) YES yes (1)	YES (0)	725 r/w	Active if output 2 is present, but is not a process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
Out3 SEt	***Output 3 Menu Setup Page***				
Ot 3	**Output 3** Select type of output 3.	OFF off (0) AL alarm (1)	OFF (0)	734 r/w	Active if output 3 present (96 _ _-_ _ D _-_ _ _ _), Output 3 (Output 3 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
AtY3	**Alarm 3 Type** Select alarm 3 type.	Proc process alarm (0) dE deviation alarm (1)	Proc (0)	736 r/w	Active if output 3 present (96 _ _-_ _ D _-_ _ _ __), Output 3 (Output 3 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
AhY3	**Alarm Hysteresis 3** Set the switching hysteresis for the alarm output. This defines a band on the inside of the alarm set point. When the process temperature is in this band, the alarm state will not change.	1 to 9999	3°F, 2°C	737 r/w	Active if output 3 is present (96 _ _-_ _ D _-_ _ _ __), Output 3 (Output 3 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
LAt3	**Latching 3** Enable Alarm 3 Latching.	no no action (0) YES latching enabled (1)	no (0)	738 r/w	Active if output 3 is present (96 _ _-_ _ D _-_ _ _ _), Output 3 (Output 3 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
SIL3	**Silencing 3** Enable Silence 3.	no no action (0) YES silence 3 enabled (1)	no (0)	739 r/w	Active if output 3 is present (96 _ _-_ _ D _-_ _ _ _), Output 3 (Output 3 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
Sid3	**Alarm Active Sides 3** Select alarm 3 side option.	both both (0) hi high (1) Lo low (2)	both (0)	740 r/w	Active if output 3 is present (96 _ _-_ _ D _-_ _ _ _), Output 3 (Output 3 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
LGc3	**Alarm Logic 3** Select alarm 3 output condition in the alarm state.	AL 0 alarm condition de-energizes output (fail-safe operation) (0) AL C alarm condition energizes output (1)	AL 0 (0)	741 r/w	Active if output 3 is present (96 _ _-_ _ D _-_ _ _ _), Output 3 (Output 3 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
Anu3	**Alarm Annunciation 3** Select alarm 3 annunciation option.	no no (0) YES yes (1)	YES (1)	742 r/w	Active if output 3 is present (96 _ _-_ _ D _-_ _ _ _), Output 3 (Output 3 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
Out4 SEt	***Output 4 Menu Setup Page***				
Ot 4	**Output 4** Select output 4 type.	OFF off AL alarm	OFF	none*	Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hidE.
AtY4	**Alarm 4 Type** Select alarm 4 type.	Proc process alarm dE deviation alarm	Proc	none*	Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
AhY4	**Alarm Hysteresis 4** Sets the switching hysteresis for the alarm output. This defines a band on the inside of the alarm set point. When the process temperature is in this band, the alarm state will not change.	1 to 9999	3°F, 2°C	none*	Active if output 4 is equipped for a relay (96 _ _-_ _ _ D -_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.
LAt4	**Latching 4** Enable alarm 4 latching.	no no action YES latching en-abled	no	none*	Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hidE.

*Output 4 parameters cannot be changed with the Modbus interface.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
SIL4	**Silencing 4** Enable Silence 4.	no no action YES silence 4 enabled	no	none*	Active if output 4 is equipped for a relay (96 _ _-_ _ _ D -_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE.
Sid4	**Alarm Active Sides 4** Select alarm 4 side option.	both both hi high Lo low	both	none*	Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE.
LGc4	**Alarm Logic 4** Select alarm 4 output condition in alarm state.	AL 0 alarm condition de-energizes output AL C alarm condition energizes output	AL 0	none*	Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE.
Anu4	**Alarm Annunciation 4** Select alarm 4 annunciation option.	no no YES yes	YES	none*	Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _), Output 4 is Set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE.
Aout	**Analog Output 4** Select Output 4 retransmit signal.	OFF not active Proc process SP set point Pcnt percent power	OFF	none*	Active if output 4 is equipped for retransmit (96 _ _-_ _ _ M-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hIdE.
Prc4	**Process 4 Type** Set process 4 output type.	4-20 4-20 mA 0-20 0-20 mA 0- 5 0-5V⎓ (dc) 1- 5 1-5V⎓ (dc) 0-10 0-10V⎓ (dc)	4-20	none*	Active if output 4 is equipped for retransmit (96 _ _-_ _ _ M - _ _ _ _) and Aout (Analog Output 4) is not set to OFF and Setup Page Lock (Lockout Menu) is not set to hIdE.
A Lo	**Analog Output Low** Set analog output range low scaling.	-1999 to A hi Analog Output High	Sensor type rL1	none*	Active if output 4 is equipped for retransmit (96 _ _-_ _ _ M-_ _ _ _), Analog Output 4 (Output 4 Menu) is set to OFF and Setup Page Lock (Lockout Menu) is not set to hIdE.
A hi	**Analog Output High** Set analog output range high scaling.	A Lo Analog Output Low to 9999	Sensor type rh1	none*	Active if output 4 is equipped for retransmit (96 _ _-_ _ _ M-_ _ _ _), Analog Output 4 (Output 4 Menu) is set to OFF and Setup Page Lock (Lockout Menu) is not set to hIdE.

*Output 4 parameters cannot be changed with the Modbus interface.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
ACAL	**Analog Output Offset** Set analog output offset.	-1999 to 9999	0	none*	Active if output 4 is equipped for retransmit (96 _ _-_ _ _ M-_ _ _ _), Aout (Analog Output 4) is not set to OFF and Setup Page Lock (Lockout Menu) is not set to hidE.
bAUd	**Baud Rate** Set communications baud rate.	1200 1200 2400 2400 4800 4800 9600 9600 19.20 19.2K	9600	none*	Active if output 4 is equipped for communications (96 _ _-_ _ _ R-_ _ _ _ or 96 _ _-_ _ _ U-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hidE.
Addr	**Address** Set communications address.	1 to 247	1	none*	Active if output 4 is equipped for communications (96 _ _-_ _ _ R-_ _ _ _ or 96 _ _-_ _ _ U-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hidE.
GLbL SEt	***Global Menu*** ***Setup Page***				
Unit	**Units Type** Select US or SI units of measurement.	US propbands in degrees, reset and rate (1) SI propbands in degrees, integral and derivative (2)	US (1)	900 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.
C-F	**°C or °F** Select the temperature scale for the input. Converts all temperature parameters.	°C °Celsius (1) °F °Fahrenheit (0)	°F (0)	901 r/w	Active if Sensor Type 1 (Input 1 Menu) is set to RTD or thermocouple and Setup Page Lock (Lockout Menu) is not set to hidE.
Err	**Input Error Latching** Select input error latching mode.	LAt latching (0) nLAt no latching (1)	nLAt (1)	607 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.
FAIL	**Failure Mode** Select failure mode after errors.	bPLS bumpless (0) MAn manual (1) OFF off (2)	bPLS (0)	902 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.

*Output 4 parameters cannot be changed with the Modbus interface.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
mAn	**Manual Default Power** Select output power for manual mode.	heat: 0.0 to 100.0 cool: -100.0 to 0.0 heat/cool: -100.0 to 100.0	0.0 (0)	903 r/w	Active if Failure Mode (Global Menu) is set to mAn (manual) and Setup Page Lock (Lockout Menu) is not set to hidE.
PLSP	**Power Limit Set Point** Set point for power limits, PL A above this point, PL b below.	rl I Sensor Range Low rh I Sensor Range High	rh I (1)	713 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.
PL A	**High Power Limit Above** Set high power limit above the power limit set point.	0.0 to 100.0	100.0 (1000)	714 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.
PL b	**High Power Limit Below** Set high power limit below the power limit set point.	0.0 to 100.0	100.0 (1000)	715 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.
rP	**Ramping Mode** Set the single step ramp to setpoint mode.	OFF off (0) Strt startup only (1) StPt startup or set point change (2)	OFF (0)	1100 r/w	Active if Local or Remote Mode (User Menu) is not r (remote setpoint is not active) and Setup Page Lock (Lockout Menu) is not set to hidE.
rP S	**Ramp Scale** Set the single step ramp scaling in degrees per hour or minute.	min minute (0) hour hour (1)	min (0)	1102 r/w	Active if Local or Remote Mode (User Menu) is not set to r, Ramping Mode (Global Menu) is not set to OFF and Setup Page Lock (Lockout Menu) is not set to hidE.
rAtE	**Ramp Rate** Set the units or degrees set point ramp rate.	0.1 to 99.9	10.0 (1)	1101 r/w	Active if Local or Remote Mode (User Menu) is not set to r , Ramping Mode is not set to OFF and Setup Page Lock (Lockout Menu) is not set to hidE.
OPLP	**Open Loop Detect** Turn the open loop detect feature on or off.	on on (0) OFF off (1)	OFF (1)	904 r/w	Active if Setup Page Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Factory Page

The factory page contains six menus:

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
Fcty	**Factory Page Selection** Choose factory menu to enter.	CUSt Custom Menu LOC Lockout Menu diAg Diagnostics Menu cin1 Calibration 1 Menu cin2 Calibration 2 Menu cout Calibration Menu	CUSt		Active: Always
CUSt Fcty	***Custom Menu*** ***Factory Page***				
P1 to P16	**Custom Prompt number** (1 to 16) Choose an operations prompt to be in custom prompt slot.	nonE none (0)* Pr2 Process 2 (1) Pcnt Percent Output (2) rPSP Ramping Set Point (3) E St Event Input Status (4) A-M Operation Mode (5) Aut Auto-tune (6) AtSP Auto-tune Set Point (7) SP2 Set Point 2 (8) E SP Event Set Point (9) L-r Local or Remote Mode (10) CAL1 Calibration Offset (11) Pb 1 Propband 1 (12) It 1 Integral 1 (13) dE 1 Derivative 1 (14) rE 1 Reset 1 (15) rA 1 Rate 1 (16) Ct 1 Cycle Time 1 (17) db 1 Dead Band 1 (18) Pb 2 Propband 2 (19) It 2 Integral 2 (20) dE 2 Derivative 2 (21) (Continued Next Page)	P1:A-M (Operation Mode) P2:Aut (Auto-tune) P3:Pcnt (Percent Power) P4:CAL1 (Calibration Offset) P5 to P16: nonE	1400-1415 r/w	Active: Always

***Numbers in parentheses are the ordinals/enumerators for use in Modbus communications.**

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
		rE 2 Reset 2 (22) rA 2 Rate 2 (23) Ct 2 Cycle Time 2 (24) db 2 Dead Band 2 (25) A2hi Alarm 2 High (26) A2Lo Alarm 2 Low (27) A3hi Alarm 3 High (28) A3Lo Alarm 3 Low (29) A4hi Alarm 4 High (30) A4Lo Alarm 4 Low (31) P t Proportional Term (32) I t Integral Term (33) d t Derivative Term (34) hyS1 Hysteresis 1 (35) hyS2 Hysteresis 2 (36) Ahy2 Alarm Hysteresis 2 (37) Ahy3 Alarm Hysteresis 3 (38) Ahy4 Alarm Hysteresis 4 (39) SP 1 Set Point 1 (40)			
LOC FcEY	***Lockout Menu*** ***Factory Page***				
SP	**Set Point Lock** Set the set point lockout level.	rEAd read only (0) chng change (1)	chng (1)	1300 r/w	Active: Always
CUSt	**Custom Menu Lock** Set the Custom Menu lockout level.	hidE hide (0) chng change (1) rEAd read only (2)	chng (1)	1304 r/w	Active: Always
OPEr	**Operations Page Mode Lock** Set the Operations Page lockout level.	hidE hide (0) chng change (1) rEAd read only (2)	chng (1)	1301 r/w	Active: Always

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
SEt	**Setup Page Lock** Set the Setup Page lockout level.	hidE hide (0) chng change (1) rEAd read only (2)	chng (1)	1302 r/w	Active: Always
CAL	**Calibration Menu Lock** Set the calibration menus lockout level.	hidE hide (0) chng change (1) rEAd read only (2)	chng (1)	1305 r/w	Active: Always
diAg	***Diagnostics Menu***				
FctY	***Factory Page***				
mdL	**Model Number** Read the model number of the controller.	96	96	0 r	Active: Always
dAtE	**Date of Manufacture** Displays date as WEEK:YEAR (WWYY).	0196 to 9999	none	5 r	Active: Always
Sn1	**Serial Number 1** Read the first four digits of the serial number.	0 to 9999	none	1 r	Active: Always
Sn2	**Serial Number 2** Read the last four digits of the serial number.	0 to 9999	none	2 r	Active: Always
SoFt	**Software ID Number** Read the software ID number.	0 to 9999	none	3 r	Active: Always
rEv	**Software Revision** Read software revision number.	0.00 to 99.99	none	4 r	Active: Always
ItY2	**Input 2 Hardware Enabled** Read the input 2 hardware type.	nonE none (0) PrEt process event (5)	(0)	9 r	Active: Always

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
Oty1	**Output 1 Hardware** Read the output 1 hardware type.	none (0) rely relay (1) SSr solid-state relay (2) dc dc (3) Proc process (4)	(0)	16 r	Active: Always
Oty2	**Output 2 Hardware** Read the output 2 hardware type.	none (0) rely relay (1) SSr solid-state relay (2) dc dc (3) Proc process (4)	(0)	17 r	Active: Always
Oty3	**Output 3 Hardware** Read the output 3 hardware type.	none (0) rely relay (1)	(0)	18 r	Active: Always
Oty4	**Output 4 Hardware** Read the output 4 hardware type.	none (0) rely relay (1) Proc process (4) 485 (6) 232 (7)	(0)	19 r	Active: Always
tout	**Test Output** Turns on specific output.	none (0) out1 output 1 (1) out2 output 2 (2) out3 output 3 (3) out4 output 4 (4) All all outputs (5)	none (0)	1514 r/w	Active: Always
disP	**Test Display** Test the indicator lights on the front panel.	OFF turn off the cyclic display test (0) on turn on the cyclic display test (1)	OFF (0)	1513 r/w	Active: Always
hrES	**High Resolution** Displays high resolution input value.	0.0 to 99.9 (0 to 999)	none	1707 r	Active: Always
Amb	**Ambient Temperature** Read the ambient temperature in 0.1 degrees Fahrenheit.		none	1500 r	Active: Always
Acnt	**Ambient A-D Counts** Displays the raw ambient channel A-D counts.		none	1501 r	Active: Always

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
cnt1	**Channel 1 A-D Counts** Displays the raw channel 1 A-D counts.		none	1504 r	Active: Always
cnt2	**Channel 2 A-D Counts** Displays the raw channel 2 A-D counts.		none	1505 r	Active: Always
tSht	**Troubleshooting** Helps solve problems with the controller.	no (0) Pid (1) enables PID terms in custom menu CoM sends modbus packet every 1 second (2)	no		
LinE	**Line Frequency** Displays the AC line frequency in Hz.		none	1515 r	Active: Always
cin1	***Calibration 1 Menu***				
Fcty	***Factory Page***				
rSt	**Restore Factory Calibration** Restore factory calibration. Does not affect operations and setup parameters.	no no (0) yES yes (1)	no (0)	1601 w	Active if Calibration Lock (Lockout Menu) is not set to hidE.
dFLt	**Default Settings** Restore default settings.	no no (0) yES yes (800)	no (0)	1602 w	Active if Calibration Lock (Lockout Menu) is not set to hidE.
tc50	**Thermocouple Calibration, 50mV** Store 50.000mV calibration for input 1 thermocouple.	no no (0) yES yes (2)	no (0)	1603 w	Active if Calibration Lock (Lockout Menu) is not set to hidE.
tc00	**Thermocouple Calibration, 0mV** Store 0.000mV calibration for input 1 thermocouple.	no no (0) yES yes (1)	no (0)	1603 w	Active if Calibration Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
tc32	**Thermocouple Calibration, 32º** Store 32º F type J calibration.	no (0) yes (3)	no (0)	1603 w	Active if Calibration Lock (Lockout Menu) is not set to hide.
gnd	**Set Ground** Store calibration for ground.	no (0) yes (4)	no (0)	1603 w	Active if Calibration Lock (Lockout Menu) is not set to hide.
LEAd	**Lead Resistance Calibration** Store calibration for lead resistance.	no (0) yes (5)	no (0)	1603 w	Active if Calibration Lock (Lockout Menu) is not set to hide.
r 15	**RTD Calibration, 15Ω** Store 15.00Ω calibration for input 1 RTD.	no (0) yes (6)	no (0)	1603 w	Active if Calibration Lock (Lockout Menu) is not set to hide.
r380	**RTD Calibration, 380Ω** Store 380.00Ω calibration for input 1 RTD.	no (0) yes (7)	no (0)	1603 w	Active if Calibration Lock (Lockout Menu) is not set to hide.
A 0v	**Process Calibration 1, 0V** Store 0.000V calibration for input 1 process.	no (0) yes (8)	no (0)	1603 w	Active if Calibration Lock (Lockout Menu) is not set to hide.
A 10v	**Process Calibration 1, 10V** Store 10.000V calibration for input 1 process.	no (0) yes (9)	no (0)	1603 w	Active if Calibration Lock (Lockout Menu) is not set to hide.
A 4A	**Process Calibration 1, 4mA** Store 4.000mA calibration for input 1 process.	no (0) yes (10)	no (0)	1603 w	Active if Calibration Lock (Lockout Menu) is not set to hide.
A20A	**Process Calibration 1, 20mA** Store 20.000mA calibration for input 1 process.	no (0) yes (11)	no (0)	1603 w	Active if Calibration Lock (Lockout Menu) is not set to hide.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
c in2	***Calibration 2 Menu***				
FctY	***Factory Page***				
b 0u	**Process Calibration 2, 0V** Store 0.000V calibration for input 2 process.	no no (0) YES yes (1)	no (0)	1608 w	Active if input 2 is present (96 _1 _-_ _ _ _ -_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
b 10u	**Process Calibration 2, 10V** Store 10.000V calibration for input 2 process.	no no (0) YES yes (2)	no (0)	1608 w	Active if input 2 is present (96 _1 _-_ _ _ _ -_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
b 4A	**Process Calibration 2, 4mA** Store 4.000mA calibration for input 2 process.	no no (0) YES yes (3)	no (0)	1608 w	Active if input 2 is present (96 _1 _-_ _ _ _ -_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
b20A	**Process Calibration 2, 20mA** Store 20.000mA calibration for input 2 process.	no no (0) YES yes (4)	no (0)	1608 w	Active if input 2 is present (96 _1 _-_ _ _ _ -_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
cout	***Process Output Calibration Menu***				
FctY	***Factory Page***				
1 4	**Output Calibration 1, 4mA** Enter the output value in milliamps as measured.	0.00 to 99.99	4.00 (400)	1604 w	Active if output 1 is process (96 _ _-F _ _ _-_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
1 20	**Output Calibration 1, 20mA** Enter the output value in milliamps as measured.	0.00 to 99.99	20.00 (2000)	1605 w	Active if output 1 is process (96 _ _-F _ _ _-_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
1 1	**Output Calibration 1, 1V** Enter the output value in volts as measured.	0.00 to 99.99	1.00 (100)	1606 w	Active if output 1 is process (96 _ _-F _ _ _-_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Display	Parameter	Range	Default	Modbus Address Read/Write	Conditions for Parameters to Appear
1 10	**Output Calibration 1, 10V** Enter the output value in volts as measured.	0.00 to 99.99	10.00 (1000)	1607 w	Active if output 1 is process (96 _ _-F _ _ _-_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
2 4	**Output Calibration 2, 4mA** Enter the output value in milliamps as measured.	0.00 to 99.99	4.00 (400)	1609 w	Active if output 2 is process (96 _ _ - _ F _ _-_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
2 20	**Output Calibration 2, 20mA** Enter the output value in milliamps as measured.	0.00 to 99.99	20.00 (2000)	1610 w	Active if output 2 is process (96 _ _ - _ F _ _-_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
2 1	**Output Calibration 2, 1V** Enter the output value in volts as measured.	0.00 to 99.99	1.00 (100)	1611 w	Active if output 2 is process (96 _ _ - _ F _ _-_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
2 10	**Output Calibration 2, 10V** Enter the output value in volts as measured.	0.00 to 99.99	10.00 (1000)	1612 w	Active if output 2 is process (96 _ _ - _ F _ _-_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
4 4	**Output Calibration 4, 4mA** Enter the output value in milliamps as measured.	0.00 to 99.99	4.00 (400)	1619 w	Active if output 4 is process (96 _ _- _ _ _ M -_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
4 20	**Output Calibration 4, 20mA** Enter the output value in milliamps as measured.	0.00 to 99.99	20.00 (2000)	1620 w	Active if output 4 is process (96 _ _- _ _ _ M -_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
4 1	**Output Calibration 4, 1V** Enter the output value in volts as measured.	0.00 to 99.99	1.00 (100)	1621 w	Active if output 4 is process (96 _ _- _ _ _ M -_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.
4 10	**Output Calibration 4, 10V** Enter the output value in volts as measured.	0.00 to 99.99	10.00 (000)	1622 w	Active if output 4 is process (96 _ _- _ _ _ M -_ _ _ _) and Calibration Lock (Lockout Menu) is not set to hidE.

NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.

Notes

NOTES

7

Chapter Seven Options

Temperature Sensor Configurations 7.1
Standard Configuration 7.1
Thermocouple Configuration 7.2
Jumper Settings 7.3
Optional Inputs (Input 2) 7.4
Event 7.4
Remote Analog Set point 7.4
Optional Outputs (Output 3 and Output 4)
Temperature Limit Alarm 7.5
Analog Retransmit 7.6
Digital Communications (RS232/485) . . 7.6
Special Configurations
Temperature Limit Shutdown 7.7
Other Configurations 7.10
TECView Software 7.11

Temperature Sensor Configurations

The Series MTCA Thermoelectric Cooler Controller was designed to allow the user to select from a wide range of temperature sensors. Should it become necessary to change the sensor interface to a different input other than the one that was shipped from the factory, then follow the steps below.

NOTE: If changing to / from a standard configuration to / from a thermocouple configuration, please contact the factory.

Standard Configuration

This configuration allows the most flexibility to interface to all temperature sensors <u>except</u> thermocouples (see thermocouple configuration below). By simply changing jumpers internally on the printed circuit board, the Series MTCA Thermoelectric Cooler Controller can accommodate a wide range of sensors. (See Jumper Settings on next page)

The drawing below shows the Standard Configuration for the Series MTCA Thermoelectric Cooler Controller. This configuration will allow ALL sensors EXCEPT Thermocouples to be used via the rear panel connector.

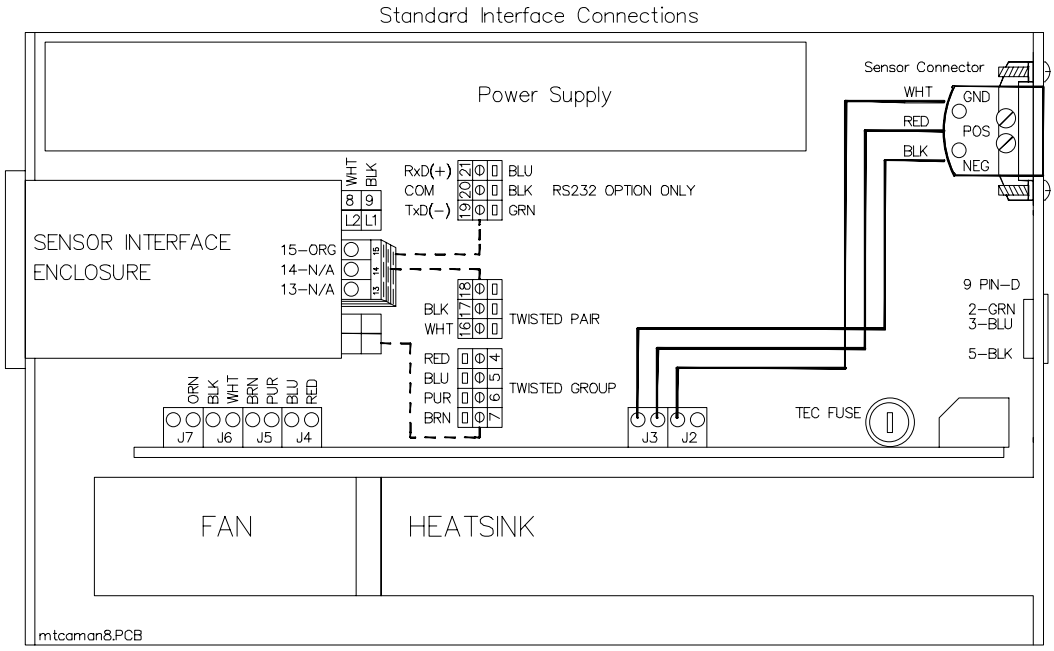


Figure 7.1

Thermocouple Configuration

The drawing below shows the thermocouple configuration for the Series MTCA Thermoelectric Cooler Controller. In this configuration only the thermocouple Type specified at time of order can be used. To use any other type sensor, contact the factory.

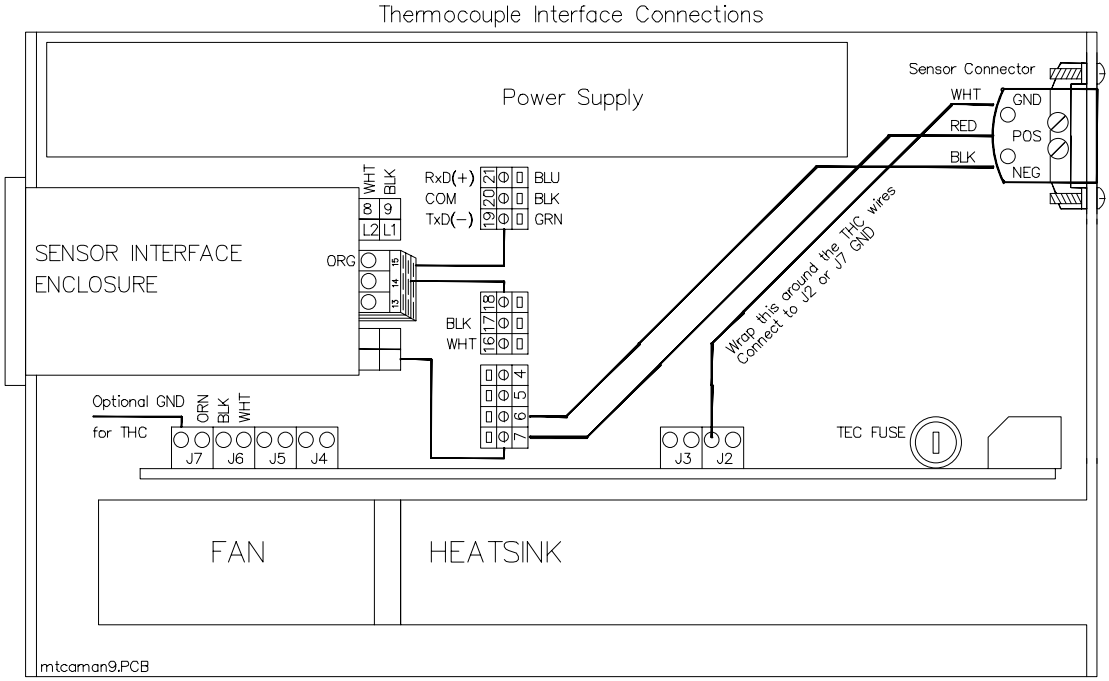


Figure 7.2

Jumper Settings

The following table shows the sensor type and the appropriate jumper settings that should be changed internally to the Series MTCA Thermoelectric Cooler Controller. Also shown is the mating connector that should be used with the corresponding Sensor Interface.

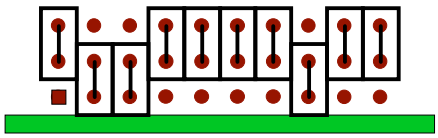
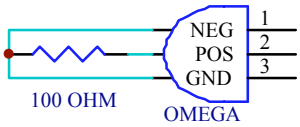
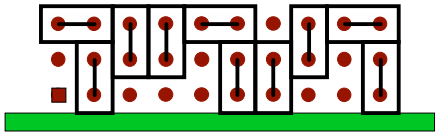
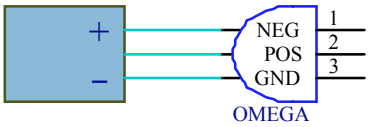
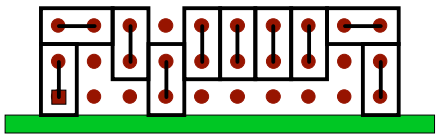
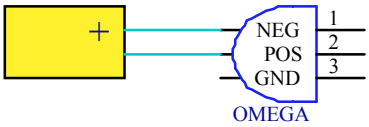
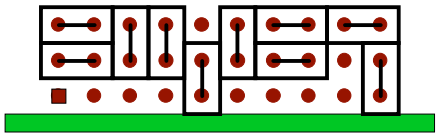
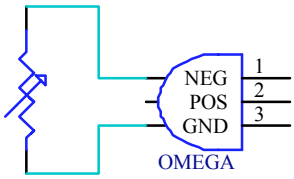
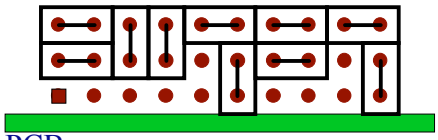
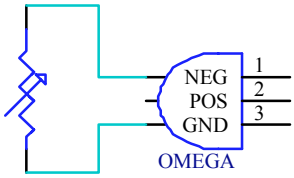
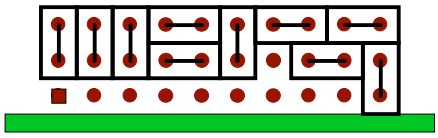
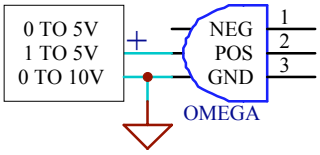
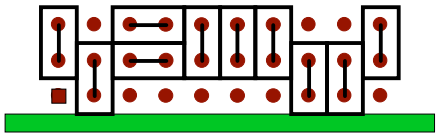
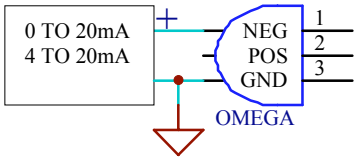
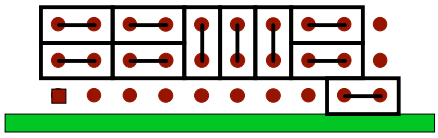
Sensor Type	Jumper Settings	Rear Panel Connections
3 Wire RTD		
LM35		
AD590		
Thermistor 100K		
Thermistor 1 Meg		
Voltage		
Current		
Thermocouple		DO NOT change these jumpers if Thermocouples are being used. Changing to all other sensors requires hardware modifications. Contact the factory for information.

Table 7.1

Optional Inputs

Event/Remote Analog Set point (Input 2)

The Series MTCA Thermoelectric Cooler Controller provides a great deal of flexibility for the customer by allowing the customer to control it via Optional Input 2. Along with the Sensor Input, the Series MTCA Thermoelectric Cooler Controller can be equipped with an additional input (Input 2), which can perform a variety of functions. See pages 5.8 and 6.11 for details on setting the Input 2 parameters. Below are descriptions of the individual Input 2 functions.

Event

Setting the Optional Input 2 to respond to an event will allow for the customer to control the output of the Series MTCA Thermoelectric Cooler Controller. See page 5.8 for details.

Remote Analog Set point

The Remote Set point option is available via the rear panel on the 9 pin “D” connector. This allows the user to control the temperature set point by applying an analog input. The Series MTCA Thermoelectric Cooler Controller will accept a voltage or a current input.

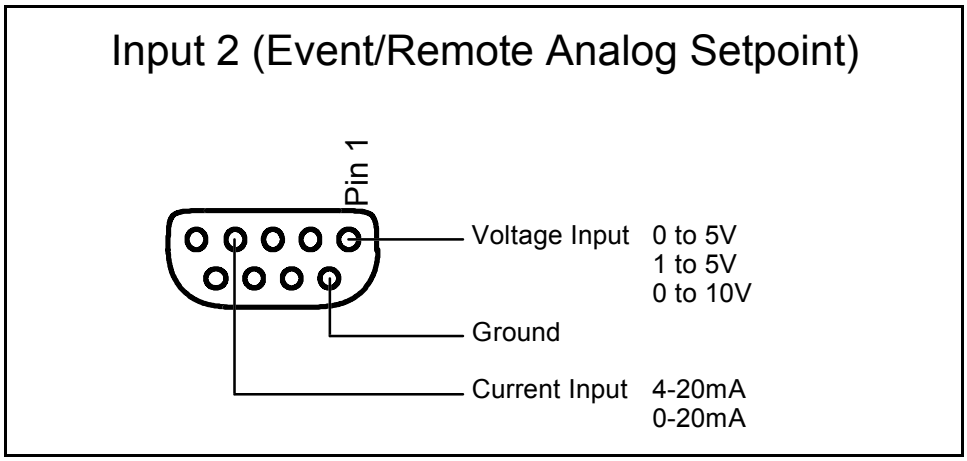


Figure 7.3

Optional Outputs

The Series MTCA Thermoelectric Cooler Controller can be optionally equipped with up to two additional outputs. Output 3 is a user configurable high or low Temperature Limit Alarm. Output 4 can be ordered as either an Analog Retransmit Output or a digital communications channel capable of RS232 or RS485.

Temperature Limit Alarm / Soft Start (Output 3)

Temperature Limit Alarm

The Temperature Limit Alarm option allows the Series MTCA Thermoelectric Cooler Controller to "alarm" the user of preset high or low Temperature Limits that are controlled via the front panel of the Series MTCA Thermoelectric Cooler Controller. This alarm is present at the rear panel in the form of a single pole double throw relay contact. As shown below, all three contacts are available to the user. The output can also be configured for Fail safe operation as well.

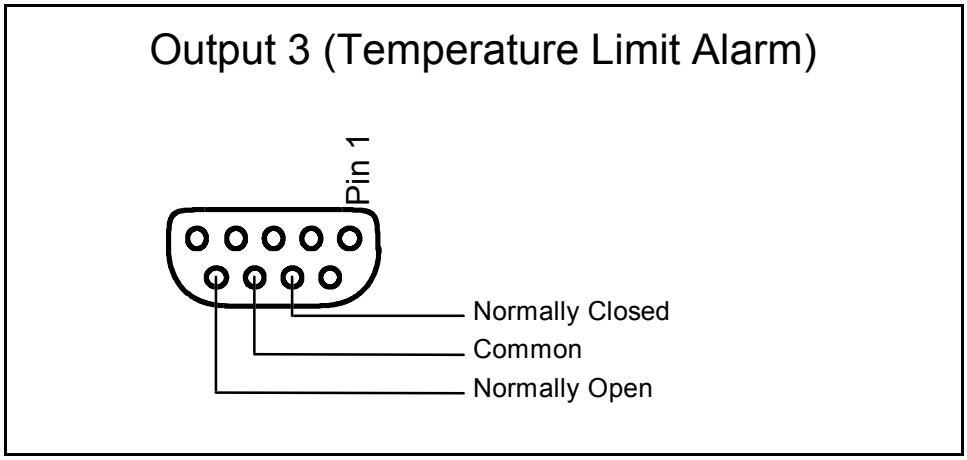


Figure 7.4

This allows the Series MTCA Thermoelectric Cooler Controller to signal the user when responding to a Temperature Alarm Set point. When either of the Temperature Limit Set points are exceeded the Series MTCA Thermoelectric Cooler Controller will change the output status of the relay.

In conjunction with the Temperature Limit Shutdown input, the controller can be setup to automatically shut off the output power to the TEC as soon as an alarm threshold has been crossed. See "Automatic Temperature Shutdown" under "Special Configurations" on the following pages.

Optional Outputs (continued)

Analog Retransmit or Digital Communications (Output 4)

Output 4 can be ordered as either an analog output (Analog Retransmit) or a digital output (RS232 or RS485). The two options are described below in more detail.

Analog Retransmit

With this option installed, the Series MTCA Thermoelectric Cooler Controller will output an analog voltage corresponding to the user selectable parameter via the front panel. See Chapter Five under "Retransmitting a Remote Set Point" for details.

☺ **When using multiple controllers to control multiple points to the same temperature, you can simply connect the analog output of one controller to the analog input of the next. This allows you to communicate to all other controllers from the first controller in the series of controllers.**

Digital Communications

The Digital Communications option can be ordered as either RS232 or RS485. This allows for communication between a PC and the Series MTCA Thermoelectric Cooler Controller. This also makes it possible to configure and log data using the optional TECView® software described later in this section.

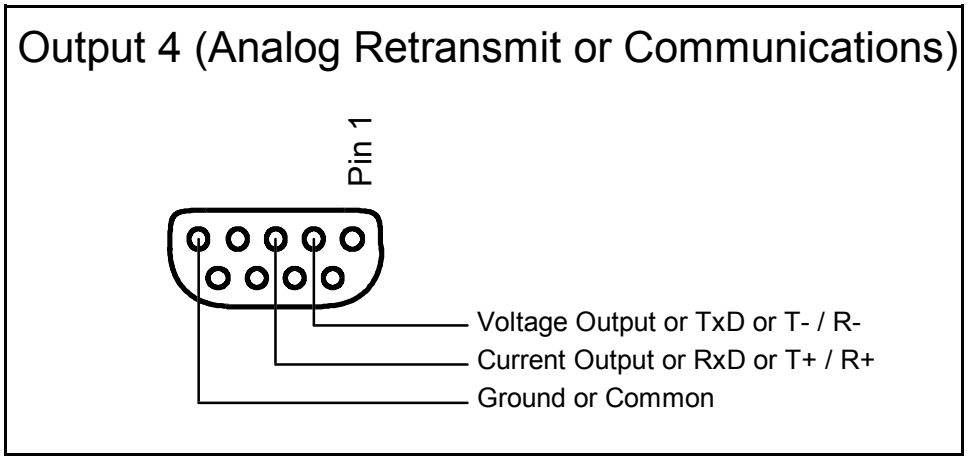


Figure 7.5

Special Configurations

The Series MTCA Thermoelectric Cooler Controller offers great user flexibility. The following sections describe how to set up special configurations that provide greater control using the optional components described previously.

The functionality of the Series MTCA Thermoelectric Cooler Controller can be seen in the following table. Please note that Output 4 must be specified as either Retransmit OR one of the communications protocols (RS232 or RS485).

Functionality Matrix

Options	Event & Remote Set Point	Alarm	Analog Retransmit	RS232 or RS485
Input 2 (Event/Remote Analog Set Point)	Optionally Turn Output OFF			
Output 3 (Temperature Limit Alarm)		Optionally Turn Output OFF		
Output 4 (Analog Retransmit or RS232/RS485)		Contact the factory for custom requirements		Optionally Turn Output OFF

Temperature Limit Shutdown

☞ Note: Optional Output 3 is required to automatically shut down the Series 800 Thermoelectric Cooler Controller outputs when the process temperature exceeds user specified limits.

Output 3 (Temperature Limit Alarm)[1]

With the Temperature Limit Alarm option (Output 3) installed, the Series MTCA Thermoelectric Cooler Controller can be configured to automatically shut down the outputs if either of the high or low temperature alarms are exceeded. This is accomplished through the use of a Series MTCA Interface Module supplied by Melcor (See Figure 7.6).

When shipped in this configuration, the user will have the ability to set up Alarms for Output 3 using the [Out3] menu under the Setup Page. Also, you can change the temperature limits via the [ALM] menu under the Operations Page (See Chapter Four and Chapter Five under “Alarms” for more information).

Series MTCA Interface Module

There are four (4) connectors on the Series MTCA Interface Module as follows:

1. 6 pin modular phone jack closest to 9 pin "D" Female connector (Automatic Temperature Limit Shutdown)
2. 6 pin modular phone jack closest to 9 pin "D" Male connector (Optional I/O interface)
3. 9 pin "D" Male connector
4. 9 pin "D" Female connector

The 9 pin "D" Male connector is used to attach to the rear of the Series MTCA Thermoelectric Cooler Controller. This allows the Series MTCA Interface Module to separate out the individual signals to the user (Refer to Figure 7.6 next page).

---

[1] Optional “Temperature Limit Alarm” is the same thing as “Soft Start” only wired externally. This gives the user maximum flexibility using the Series 800 Interface Module to “break out” the RS232/485 signals and any other optional signals. “Soft Start” gives the same Temperature Shutdown capabilities but does not give the user access to the relay contacts.

Series MTCA Interface Module (continued)

The 6 pin modular phone jack (located closest to the 9 pin "D" Female connector) is used for configuring the Series MTCA Thermoelectric Cooler Controller for Automatic Temperature Limit Shutdown. This "phone jack" should be used to connect directly to the Series MTCA Thermoelectric Cooler Controller at the CTRL-IN input (Refer to Figure 1.2). Using this method, in conjunction with the optional Output 3 (Temperature Limit Alarm), allows the user to "shutdown" the Series MTCA Thermoelectric Cooler Controller's outputs when either a high or low temperature alarm is crossed without wasting the optional Input 2. This frees up Input 2 to be used for other functions such as monitoring the temperature of a heat sink.[1]

The 6 pin modular phone jack (located closest to the 9 pin "D" Male connector) is used for Optional Input 2 (Event/Remote Analog Set Point) and/or Optional Output 3 (Temperature Limit Alarm) interfaces. The pin out is listed below:

Optional Input 2 (Event/Remote Analog Set Point)
Optional Output 3 (Temperature Limit Alarm)

Event/Remote Analog Set Point	Temperature Limit Alarm
1.	1. Relay (Normally Open)
2.	2. Relay (Common)
3.	3. Relay (Normally Closed)
4. Current Input (+)	4.
5. Return for Voltage or Current Input	5.
6. Voltage Input (+)	6.

Automatic Temperature Shutdown is easily accomplished by plugging the Series MTCA Interface Module into the Series MTCA Thermoelectric Cooler Controller and attaching the supplied phone cord directly into the Series MTCA Interface Module and to the Series MTCA Thermoelectric Cooler Controller (as shown in Figure 7.6).

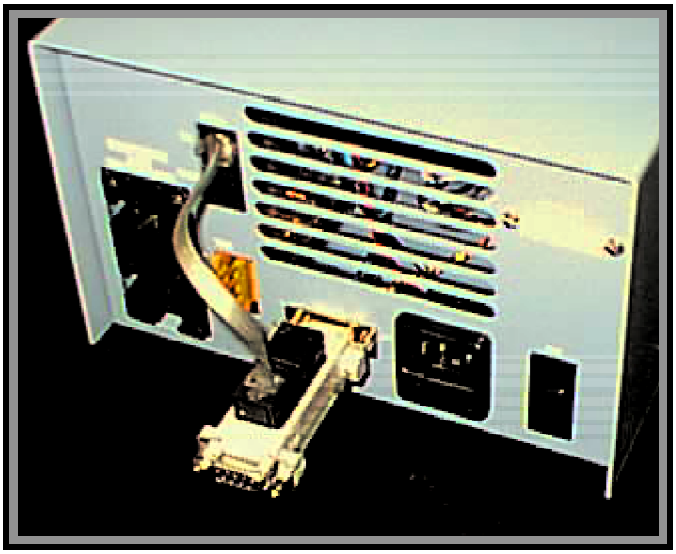


Figure 7.6

[1] This can be factory installed internal to the instrument as the “Soft Start” option.

Series MTCA Interface Module (continued)

The 9 pin “D” Female connector is used for interfacing with the Optional Output 4. The pinouts will vary depending on the option ordered for this output. Shown below are the names associated with each pin in their respective configurations.

Optional Output 4 (Analog Retransmit or RS232 or RS485)

RS232	RS485	Analog Retransmit
1.	1.	1.
2. TxD	2. T-/R-	2. Voltage Output (+)
3. RxD	3. T+/R+	3. Current Output (+)
4.	4.	4.
5. Ground	5. Common	5. Return (Ground)
6.	6.	6.
7.	7.	7.
8.	8.	8.
9.	9.	9.

Special Configurations

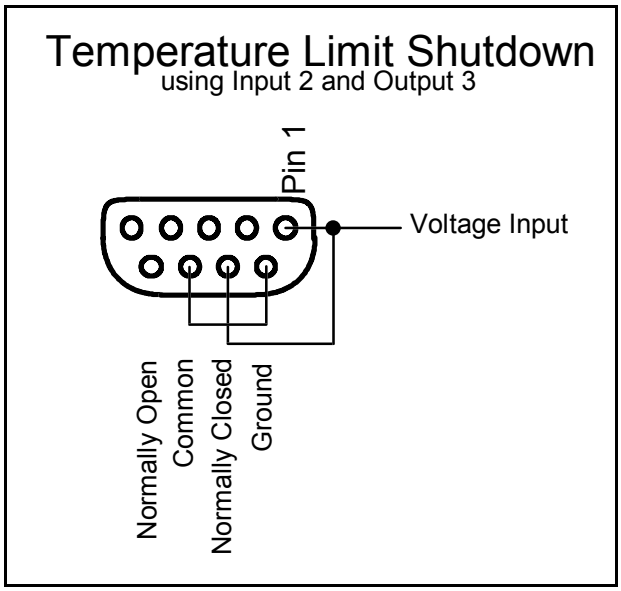
Temperature Limit Shutdown (continued)

Input 2 (as Event) and Output 3 (Temperature Limit Alarm) Installed

☞ Note: The Series MTCA Interface Module is NOT necessary in the following configuration.

With the Temperature Limit Alarm (Output 3) option AND the Event (Input 2) option installed, the Series MTCA Thermoelectric Cooler Controller can be configured to automatically shut down the outputs if either of the high or low temperature alarms are exceeded. These alarms are can be set via the front panel.

Simply connect the output of the Temperature Limit Alarm Output to the Event Input as shown below.



Picture of the Rear Panel 9 Pin "D" Connector

Now by setting an alarm for either under or over temperature, the Series MTCA Thermoelectric Cooler Controller can be shut down via the optional Event Input (Input 2). See Chapter Six under "Setup Page" and InP2 for more information.

Other Configurations

☺ **It is possible to have Remote Analog Setpoint AND Automatic Temperature Limit Shutdown at the same time. However, this requires that the Series MTCA Interface Module be used. The Series MTCA Interface Module will free up the optional Input 2 for Remote Analog Setpoint by utilizing the CTRL Input connector.**

☞ Note: Ordering both the optional Input 2 and the optional Output 3 features gives the most flexibility as it gives the user access to all possible configurations.

☺ **Remote Analog Setpoint in conjunction with Analog Retransmit allows the Series MTCA to interface directly with a PC that utilizes a Digital to Analog Converter (DAC) and an Analog to Digital Converter board (ADC).**

Other Configurations (continued)

Soft Start (with Temperature Limit Shutdown)[1]

The Soft Start option is a factory installed Output 3 option that is internally wired to accomplish both a Soft Start condition and allow for setting Temperature Limit Alarms that automatically shutdown the output when an alarm condition is met. A “Soft Start” of the Series MTCA Thermoelectric Cooler Controller is accomplished by keeping the analog circuitry OFF while booting up. This is done by setting up the Output 3 Alarm so that the NC (normally closed) contacts of the Output 3 relay short out the CTRL-IN input pins 1 and 6. This will keep the output of the Series MTCA Thermoelectric Cooler OFF until the Alarm is sensed as being OFF or “o.k.”. At this time the relay will turn ON (opening the NC contacts) and allow normal operation. At any time there is an alarm condition the output will be “shutdown”.

☞ Note: Wiring Output 3 option internally eliminates having the relay contacts wired to the rear panel. Unless access to the relay contacts is necessary, the “Soft Start” option should be ordered in favor of the “Temperature Limit Alarm” only option.

☞ Note: Soft Start can be configured to work properly when wired externally also. The user must insure that the NC (normally closed) contacts are across the CTRL-IN input pins 1 and 6[2].

TECView Software

The Series MTCA Thermoelectric Cooler Controller can optionally be operated via the digital output option (Output 4) by means of special software. This software is called TECView and can be very helpful in setting up the controller and logging data using a personal computer.

The following is a list of some of the features of the TECView software:

1. Easily configure the Series MTCA Thermoelectric Cooler Controller for standard sensors. No front panel programming required. Simply choose the desired sensor and press “Update” and “Save”.
2. Easily scale the temperature ranges.
3. Use of the Steinhart Hart equation to give °C or °F readings using a thermistor input.
4. Easily set the power limits and the PID parameters right on the Main Screen.
5. Easily view and adjust the temperature stability via the Main Screen by use of the graphical output of Actual Temperature and Set Point Temperature versus Time.
6. Easily log data to a file and load it into a spreadsheet program for viewing and/or graphing at a later date.

☞ **Note: TECView is not compatible with Ramp ‘N’ Soak firmware!**

---

[1] Ordering Soft Start eliminates the need for the user to wire the optional Output 3 externally. Also, no Series MTCA Interface Module is necessary to “break out” the RS232/485 signals. The only exception to this is if all three options are ordered (i.e. Event / Remote Analog Set point, Soft Start and Analog Retransmit/Digital Communication).

[2] Make sure that the Alarm Logic [LGc3] is set to “OPEN” [AL 0] otherwise the output of the Series MTCA Thermoelectric Cooler Controller will remain at 0.0 Volts unless there is an alarm condition!

8

Chapter Eight Sensor Configuration & Programming

0 to 100K Thermistor 8.1
0 to 1M Thermistor 8.2
AD590 . . . . . 8.3
LM35 . . . . . 8.4
100 ohm 3 Wire RTD 8.5
Voltage 8.7
Current 8.8
Thermocouples (All Types) 8.9
Hardware Reference Table 8.11

Sensor Programming & Configuration

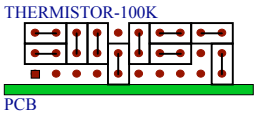
0 to 100K Thermistor

This procedure will show how to configure the Series MTCA Thermoelectric Cooler Controller for use with a 0 to 100K Thermistor.

Setup the hardware for Thermistor (0 to 100 Kohm) Operation:

⚠ Before programming the Series MTCA Thermoelectric Cooler Controller, remove ALL connections (including the AC power) from the rear of the instrument and remove the cover by unscrewing the four screws on the bottom of the sides.

☞ Set the Jumpers as follows:



⚠ Replace the cover of the Series MTCA Thermoelectric Cooler Controller by sliding it back over the top of the controller and replace the screws that were removed.

Front Panel Programming

Pressing ▲▼ simultaneously for about 6 seconds will get you to the SEt Menu in the bottom display. Cycle through using ▲ or ▼ until you reach inP 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. SEn 1 = Proc — Remember the parameter to change is in the lower display.
2. In 1 = 0-10 — The variable to change is in the upper display
3. dEC 1 = 0.00 — Change dEC 1 first before rL 1 & rh 1 since changing the decimal point will automatically load defaults into rL 1 & rh 1.
4. rL 1 = 0.00 — Range Low in Kohms.[1]
5. rh 1 = 99.99 — Range High in Kohms. (See footnote)
6. Ftr 1 = 1.0 — Filter, this is optional. See Chapter Five under “Filter Time Constant” for more information.

Using the ⊛ button, cycle through until you reach inP 1 in the top display, then press the ▲ or ▼ arrows until you reach Out 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 1 = hEAt
2. Prc 1 = 0-10

Using the ⊛ button, cycle through until you reach Out 1 in the top display, then press the ▲ or ▼ arrows until you reach Out2 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 2 = COOL
2. Prc2 = 0-10

☞ Press the infinity button ∞ to exit.

---

[1] Thermistors have a fixed output based on the current flowing through them (i.e. 100uA). Therefore, the only way to read out °C ,°F or °K is to use the optional RS232 interface in conjunction with either Melcor's own TECView® software or a 3rd party program to convert the temperatures.

Sensor Programming & Configuration

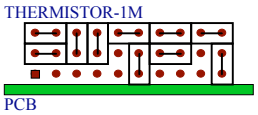
0 to 1M Thermistor

This procedure will show how to configure the Series MTCA Thermoelectric Cooler Controller for use with a 0 to 1M Thermistor.

Setup the hardware for Thermistor (0 to 1 Megohm) Operation:

⚠ Before programming the Series MTCA Thermoelectric Cooler Controller, remove ALL connections (including the AC power) from the rear of the instrument and remove the cover by unscrewing the four screws on the bottom of the sides.

☞ Set the Jumpers as follows:



⚠ Replace the cover of the Series MTCA Thermoelectric Cooler Controller by sliding it back over the top of the controller and replace the screws that were removed.

Front Panel Programming

Pressing ▲▼ simultaneously for about 6 seconds will get you to the SEt Menu in the bottom display. Cycle through using ▲ or ▼ until you reach inP 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. SEn 1 = Proc — Remember the parameter to change is in the lower display.
2. In 1 = 0-10 — The variable to change is in the upper display.
3. dEC 1 = 0.0 — Change dEC 1 first before rL 1 & rh 1 since changing the decimal point will automatically load defaults into rL 1 & rh 1.
4. rL 1 = 0.0 — Range Low in Kohms.[1]
5. rh 1 = 999.9 — Range High in Kohms. (See footnote)
6. Ftr 1 = 1.0 — Filter, this is optional. See Chapter Five under “Filter Time Constant” for more information.

Using the ⊛ button, cycle through until you reach inP 1 in the top display, then press the ▲ or ▼ arrows until you reach Out 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 1 = hEAt
2. Prc 1 = 0-10

Using the ⊛ button, cycle through until you reach Out 1 in the top display, then press the ▲ or ▼ arrows until you reach Out2 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 2 = COOL
2. Prc2 = 0-10

☞ Press the infinity button ∞ to exit.

---

[1] Thermistors have a fixed output based on the current flowing through them (i.e. 10uA). Therefore, the only way to read out °C ,°F or °K is to use the optional RS232 interface in conjunction with either Melcor's own TECView® software or a 3rd party program to convert the temperatures.

Sensor Programming & Configuration

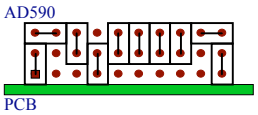
AD590

This procedure will show how to configure the Series MTCA Thermoelectric Cooler Controller for use with an AD590.

Setup the hardware for AD590 Operation:

⚠ Before programming the Series MTCA Thermoelectric Cooler Controller, remove ALL connections (including the AC power) from the rear of the instrument and remove the cover by unscrewing the four screws on the bottom of the sides.

☞ Set the Jumpers as follows:



⚠ Replace the cover of the Series MTCA Thermoelectric Cooler Controller by sliding it back over the top of the controller and replace the screws that were removed.

Front Panel Programming

Pressing ▲▼ simultaneously for about 6 seconds will get you to the SEt Menu in the bottom display. Cycle through using ▲ or ▼ until you reach inP 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. SEn 1 = Proc — Remember the parameter to change is in the lower display.
2. In 1 = 0-10 — The variable to change is in the upper display
3. dEC 1 = 0.0 — Change dEC 1 first before rL 1 & rh 1 since changing the decimal point will automatically load defaults into rL 1 & rh 1.
4. rL 1 = -50.0 — Range Low in °C[1]
5. rh 1 = 150.0 — Range High in °C (See footnote)
6. Ftr 1 = 1.0 — Filter, this is optional. See Chapter Five under “Filter Time Constant” for more information.

Using the ⊛ button, cycle through until you reach inP 1 in the top display, then press the ▲ or ▼ arrows until you reach Out 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 1 = COOL
2. Prc 1 = 0-10

Using the ⊛ button, cycle through until you reach Out 1 in the top display, then press the ▲ or ▼ arrows until you reach Out2 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 2 = HEAt
2. Prc2 = 0-10

☞ Press the infinity button ∞ to exit.

---

[1] You can also optionally scale the output to °F by entering -58.0 in rL 1 and 302.0 in rh 1.

Sensor Programming & Configuration

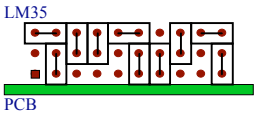
LM35

This procedure will show how to configure the Series MTCA Thermoelectric Cooler Controller for use with an LM35.

Setup the hardware for LM35 Operation:

⚠ Before programming the Series MTCA Thermoelectric Cooler Controller, remove ALL connections (including the AC power) from the rear of the instrument and remove the cover by unscrewing the four screws on the bottom of the sides.

☞ Set the Jumpers as follows:



⚠ Replace the cover of the Series MTCA Thermoelectric Cooler Controller by sliding it back over the top of the controller and replace the screws that were removed.

Front Panel Programming

Pressing ▲▼ simultaneously for about 6 seconds will get you to the SEt Menu in the bottom display. Cycle through using ▲ or ▼ until you reach inP 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. SEn 1 = Proc — Remember the parameter to change is in the lower display.
2. In 1 = 0-10 — The variable to change is in the upper display
3. dEC 1 = 0.0 — Change dEC 1 first before rL 1 & rh 1 since changing the decimal point will automatically load defaults into rL 1 & rh 1.
4. rL 1 = -50.0 — Range Low in °C[1]
5. rh 1 = 150.0 — Range High in °C (See footnote)
6. Ftr 1 = 1.0 — Filter, this is optional. See Chapter Five under “Filter Time Constant” for more information.

Using the ⊛ button, cycle through until you reach inP 1 in the top display, then press the ▲ or ▼ arrows until you reach Out 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 1 = COOL
2. Prc 1 = 0-10

Using the ⊛ button, cycle through until you reach Out 1 in the top display, then press the ▲ or ▼ arrows until you reach Out2 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 2 = HEAt
2. Prc2 = 0-10

☞ Press the infinity button ∞ to exit.

---

[1] You can also optionally scale the output to °F by entering -58.0 in rL 1 and 302.0 in rh 1.

Sensor Programming & Configuration

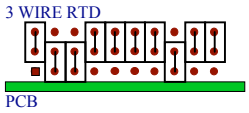
100 Ohm 3 Wire RTD

This procedure will show how to configure the Series MTCA Thermoelectric Cooler Controller for use with an 100 Ohm 3 Wire RTD.

Setup the hardware for 100 Ohm 3 Wire RTD Operation:

⚠ Before programming the Series MTCA Thermoelectric Cooler Controller, remove ALL connections (including the AC power) from the rear of the instrument and remove the cover by unscrewing the four screws on the bottom of the sides.

☞ Set the Jumpers as follows:



⚠ Replace the cover of the Series MTCA Thermoelectric Cooler Controller by sliding it back over the top of the controller and replace the screws that were removed.

Front Panel Programming

Pressing ▲▼ simultaneously for about 6 seconds will get you to the SEt Menu in the bottom display. Cycle through using ▲ or ▼ until you reach inP1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. SEn1 = rtd — Remember the parameter to change is in the lower display. The variable to change is in the upper display.

Cycle through using ⊛ until you see inP1 again in the top display. Then press ▲ or ▼ until you see glbL in the top display. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Unit = S1 — This affects the PID parameters.
2. C-F = °C — You have a choice between °C and °F only.

Cycle through using ⊛ until you see glbL again in the top display. Then press ▲ or ▼ until you see inP1 in the top display. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. dEC1 = 0.0 — You have two choices here. One decimal point or no decimal point. Change dEC1 first before rL1 & rh1 since changing the decimal point will automatically load defaults into rL1 & rh1.
2. rL1 = -99.9 — Range Low in units previously selected. Set this to the lowest temperature you will want to set. You can leave it at it's default or limit the range to make it easier and faster to get to a desired temperature.
3. rh1 = 190.0 — Range High in units previously selected.
4. Ftr1 = 1.0 — Filter, this is optional. See Chapter Five under "Filter Time Constant" for more information.

Continued next page.

100 Ohm 3 Wire RTD (continued)

Using the button, cycle through until you reach inP 1 in the top display, then press the or arrows until you reach Out 1 in the top display, then press . Cycle through using to select the parameters to change in the bottom display. Change the parameters by using the or arrows.

1. Ot 1 = COOL
2. Prc 1 = 0-10

Using the button, cycle through until you reach Out 1 in the top display, then press the or arrows until you reach Out2 in the top display, then press . Cycle through using to select the parameters to change in the bottom display. Change the parameters by using the or arrows.

1. Ot 2 = HEAt
2. Prc2 = 0-10

☞ Press the infinity button to exit.

Sensor Programming & Configuration

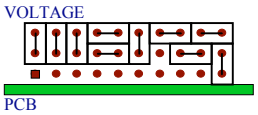
Voltage

This procedure will show how to configure the Series MTCA Thermoelectric Cooler Controller for use with a Voltage input in the range of 0 to 10V.

Setup the hardware for Voltage Operation:

⚠ Before programming the Series MTCA Thermoelectric Cooler Controller, remove ALL connections (including the AC power) from the rear of the instrument and remove the cover by unscrewing the four screws on the bottom of the sides.

☞ Set the Jumpers as follows:



⚠ Replace the cover of the Series MTCA Thermoelectric Cooler Controller by sliding it back over the top of the controller and replace the screws that were removed.

Front Panel Programming

Pressing ▲▼ simultaneously for about 6 seconds will get you to the SEt Menu in the bottom display. Cycle through using ▲ or ▼ until you reach inP 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. SEn 1 = Proc — Remember the parameter to change is in the lower display.
2. In 1 = 0-10 — Choose any one of the voltage ranges available.
3. dEC 1 = 0.000 — Change dEC 1 first before rL 1 & rh 1 since changing the decimal point will automatically load defaults into rL 1 & rh 1.
4. rL 1 = 0.000 — Range Low in Volts.[1]
5. rh 1 = 9.999 — Range High in Volts. (See footnote)
6. Ftr 1 = 1.0 — Filter, this is optional. See Chapter Five under “Filter Time Constant” for more information.

Using the ⊛ button, cycle through until you reach inP 1 in the top display, then press the ▲ or ▼ arrows until you reach Out 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 1 = COOL
2. Prc 1 = 0-10

Using the ⊛ button, cycle through until you reach Out 1 in the top display, then press the ▲ or ▼ arrows until you reach Out2 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 2 = HEAt
2. Prc2 = 0-10

☞ Press the infinity button ∞ to exit.

---

[1] The rL 1 & rh 1 parameters can be scaled to engineering units if desired. For instance if 0 to 10V equals 0 to 50°C then enter 00.00 in dEC 1, 00.00 in rL 1, and 50.00 in rh 1. This will yield a setpoint of 0 to 50.00°C for a corresponding input of 0 to 10V.

Sensor Programming & Configuration

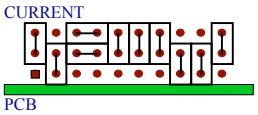
Current

This procedure will show how to configure the Series MTCA Thermoelectric Cooler Controller for use with a Current input in the range of 0 to 20mA.

Setup the hardware for Current Operation:

⚠ Before programming the Series MTCA Thermoelectric Cooler Controller, remove ALL connections (including the AC power) from the rear of the instrument and remove the cover by unscrewing the four screws on the bottom of the sides.

☞ Set the Jumpers as follows:



⚠ Replace the cover of the Series MTCA Thermoelectric Cooler Controller by sliding it back over the top of the controller and replace the screws that were removed.

Front Panel Programming

Pressing ▲▼ simultaneously for about 6 seconds will get you to the SEt Menu in the bottom display. Cycle through using ▲ or ▼ until you reach inP 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. SEn 1 = Proc — Remember the parameter to change is in the lower display.
2. In 1 = 4-20 — Choose any one of the current ranges available.
3. dEC 1 = 00.00 — Change dEC 1 first before rL 1 & rh 1 since changing the decimal point will automatically load defaults into rL 1 & rh 1.
4. rL 1 = 4.00 — Range Low in mA.[1]
5. rh 1 = 20.00 — Range High in mA. (See footnote)
6. Ftr 1 = 1.0 — Filter, this is optional. See Chapter Five under “Filter Time Constant” for more information.

Using the ⊛ button, cycle through until you reach inP 1 in the top display, then press the ▲ or ▼ arrows until you reach Out 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 1 = COOL
2. Prc 1 = 0-10

Using the ⊛ button, cycle through until you reach Out 1 in the top display, then press the ▲ or ▼ arrows until you reach Out2 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Ot 2 = HEAt
2. Prc2 = 0-10

☞ Press the infinity button ∞ to exit.

---

[1] The rL 1 & rh 1 parameters can be scaled to engineering units if desired. For instance if 4 to 20mA equals 0 to 50°C then enter 00.00 in dEC 1, 00.00 in rL 1, and 50.00 in rh 1. This will yield a setpoint of 0 to 50.00°C for a corresponding input of 4 to 20mA.

Sensor Programming & Configuration

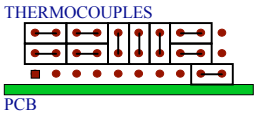
Thermocouples (All Types)

This procedure will show how to configure the Series MTCA Thermoelectric Cooler Controller for use with a Thermocouple (Any Type)

Setup the hardware for Thermocouples (All Types) :

⚠ Before programming the Series MTCA Thermoelectric Cooler Controller, remove ALL connections (including the AC power) from the rear of the instrument and remove the cover by unscrewing the four screws on the bottom of the sides.

☞ Set the Jumpers as follows:



⚠ Replace the cover of the Series MTCA Thermoelectric Cooler Controller by sliding it back over the top of the controller and replace the screws that were removed.

Front Panel Programming

Pressing ▲▼ simultaneously for about 6 seconds will get you to the SEt Menu in the bottom display. Cycle through using ▲ or ▼ until you reach inP 1 in the top display, then press ⊛. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. SEn 1 = tc — Remember the parameter to change is in the lower display. The variable to change is in the upper display.
2. In 1 = t — Choose the desired "type" thermocouple. This MUST match the sensor input connector!

Cycle through using ⊛ until you see inP 1 again in the top display. Then press ▲ or ▼ until you see GLbL in the top display. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. Unit = S I — This affects the PID parameters.
2. C-F = °C — You have a choice between °C and °F only.

Cycle through using ⊛ until you see GLbL again in the top display. Then press ▲ or ▼ until you see inP 1 in the top display. Cycle through using ⊛ to select the parameters to change in the bottom display. Change the parameters by using the ▲ or ▼ arrows.

1. dEC 1 = 0.0 — You have two choices here. One decimal point or no decimal point. Change dEC 1 first before rL 1 & rh 1 since changing the decimal point will automatically load defaults into rL 1 & rh 1.
2. rL 1 = -99.9 — Range Low in units previously selected. Set this to the lowest temperature you will want to set. You can leave it at it's default or limit the range to make it easier and faster to get to a desired temperature.
3. rh 1 = 190.0 — Range High in units previously selected.
4. Ftr 1 = 1.0 — Filter, this is optional. See Chapter Five under "Filter Time Constant" for more information.

Continued next page.

Thermocouples (All Types) (continued)

Using the button, cycle through until you reach inP 1 in the top display, then press the or arrows until you reach Out 1 in the top display, then press . Cycle through using to select the parameters to change in the bottom display. Change the parameters by using the or arrows.

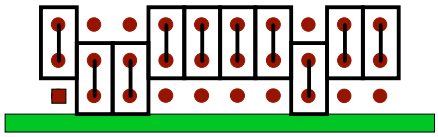
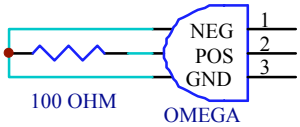
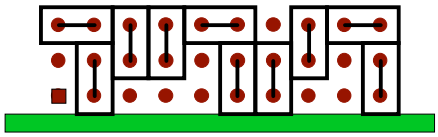
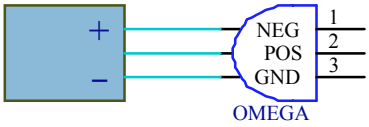
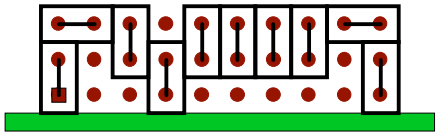
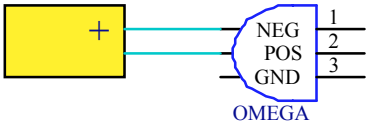
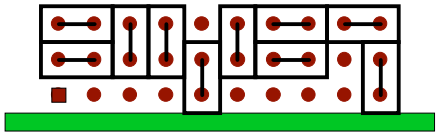
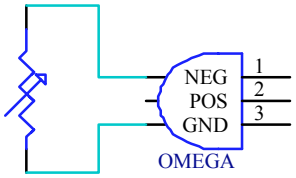
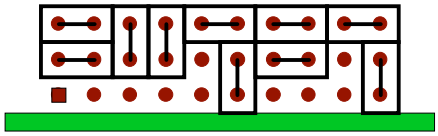
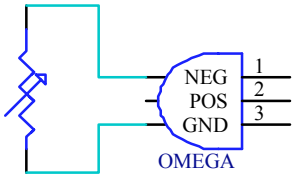
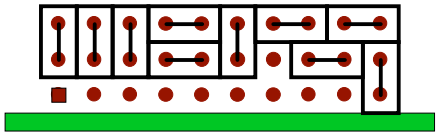
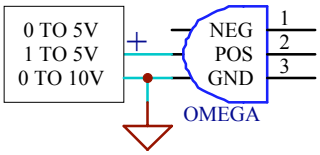
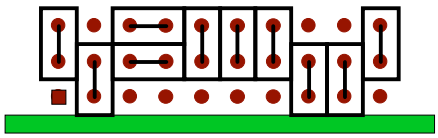
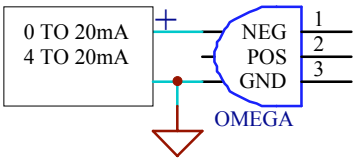
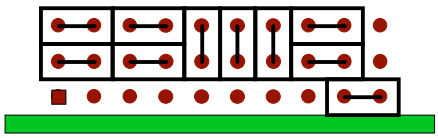
1. Ot 1 = COOL
2. Prc 1 = 0-10

Using the button, cycle through until you reach Out 1 in the top display, then press the or arrows until you reach Out2 in the top display, then press . Cycle through using to select the parameters to change in the bottom display. Change the parameters by using the or arrows.

1. Ot 2 = HEAt
2. Prc2 = 0-10

☞ Press the infinity button to exit.

Hardware Reference Table

Sensor Type	Jumper Settings	Rear Panel Connections
3 Wire RTD	 PCB	
LM35	 PCB	
AD590	 PCB	
Thermistor 100K	 PCB	
Thermistor 1 Meg	 PCB	
Voltage	 PCB	
Current	 PCB	
Thermocouple	 PCB	DO NOT change these jumpers if Thermocouples are being used. Changing to all other sensors requires hardware modifications. Contact the factory for information.

9

Chapter Nine
Special Notes

Thermoelectric Cooler Controllers
with
Ramp ‘N’ Soak Firmware
and a
Positive Temperature Coefficient Sensor

☞ **Note:** **If the Thermoelectric Cooler Controller is set up for an NTC (negative temperature coefficient) sensor (i.e. Thermistor), there is no need to change anything. These special notes can be ignored. Please turn to Chapter 9 "Ramping".**

Introduction

Thank you for purchasing your new Thermoelectric Cooler Controller. We hope that the Ramp 'N' Soak firmware is helpful to you and performs to your satisfaction. This document has been written to bring to the user's attention certain hardware changes that have been made at the factory in order for a standard Thermoelectric Cooler Controller to operate with the Ramp 'N' Soak firmware.

Due to the nature of the programming internal to the Thermoelectric Cooler Controller, certain features that are included in the basic firmware must be removed in order to allow the space needed to do multiple Ramp 'N' Soak cycles and also to program these cycles via the front panel. These changes affect how the user will interface with the Thermoelectric Cooler Controller in some cases. Please read the rest of this document to make sure that the Thermoelectric Cooler Controller operates as you would expect.

Factory Swapped Output 1 and Output 2

When the Thermoelectric Cooler Controller is ordered with a PTC (positive temperature coefficient) temperature sensor such as an RTD or an Analog Devices AD590 along with the Ramp 'N' Soak firmware, it is necessary to swap the internal control outputs to satisfy the Output 1 = Heat and Output 2 = Cool requirements of the Ramp 'N' Soak firmware option. The reason for this is that normally, Output 1 is always the Cooling output in a standard configuration (i.e. Without Ramp 'N' Soak). Likewise, Output 2 is always the Heating output in a standard configuration.

The firmware for the Ramp 'N' Soak is limited to Output 1 always being Heat and Output 2 always being Cool. This works fine for a NTC (negative temperature coefficient) thermistor sensor, however all PTC sensors must have their outputs swapped. Due to the limitation in the software, the factory physically swaps the Heat and Cool outputs INTERNALLY to make up for the software limitations. This essentially keeps the polarity of the Thermoelectric Cooler Controllers output the same on the rear panel TEC output connector.

Output LED indicators

In a standard configuration (i.e. Without Ramp 'N' Soak), the Thermoelectric Cooler Controller will indicate it's output via the front panel in the form of two LED's (light emitting diodes). Output 1 is labeled '1' and Output 2 is labeled '2'. In this configuration, these LED's would indicate the following:

Output 1	LED '1'	Cooling
Output 2	LED '2'	Heating

☞ Note: This is true no matter what sensor type the controller was set up for. You may have even noticed that a thermistor appears to be backwards by setting the Out 1 parameter to Heat instead of Cool. This in fact is correct as it corrects for the Negative Temperature Coefficient (NTC) properties of a thermistor sensor.

In the case where the Ramp ‘N’ Soak firmware is used with a PTC sensor the Output LED’s will be “swapped”. This is in direct relationship to the internal factory output swap. Therefore, the LED’s would indicate the following if using the Ramp ‘N’ Soak firmware with a PTC sensor.

Output 1	LED ‘1’	Heating
Output 2	LED ‘2’	Cooling

☞ Note: This must be taken into effect if trying to change sensor types according to the manual. Every time you read “HEAT”, you must change it to “COOL” and likewise every time you read “COOL”, you must change it to “HEAT”.

☞ Note: For Thermocouples it should not be necessary to change any parameters since the Thermoelectric Cooler Controller setting is fixed for a specific type of thermocouple (i.e. ‘J’, ‘K’, ‘T’, etc.). Changing the sensor “type” at any time in the future will require a factory modification.

A

Appendix

Troubleshooting Alarms and Errors A.2

Modbus™ RTU A.4

Troubleshooting Alarms and Errors

Indication	Probable Cause(s)
Power	
• No power.	• Power to unit may be off.
	• Fuse may be blown.
	• Breaker may be tripped.
	• Safety interlock door switch etc. may be activated.
	• Separate system limit control may be latched.
	• Wiring may be open.
	• Input Power may be incorrect.
Communications	
• Unit will not communicate.	• Address parameter may be incorrectly set.
	• Baud rate parameter may be incorrectly set.
	• Unit-to-unit daisy chain may be disconnected.
	• Communications wiring may be reversed, short or open.
	• EIA-485 converter box may be incorrectly wired.
	• Computer COM port may be incorrectly set up.
	• Communications software setup or address may be incorrect.
	• Protocol or parity may be wrong, should be 8, n, 1.
	• Application software not working properly.
	• May need termination and pull-up and pull-down resistors.
Input Error (error number in top display, % LED lit, percent power in bottom)	
• Input is in error condition.	• The sensor may be improperly wired.
Err 1 Underflow	• Sensor wiring may be reversed, shorted or open.
Err2 Under Sensor Range	• Input type setting may be for the wrong sensor/may not be calibrated.
Err3 Over Sensor Range	• Input type setting may be for the wrong sensor/may not be calibrated.
Err4 Overflow	• Ambient temperature may be too hot or too cold.
	• The open loop detect shows a broken sensor.
	• The calibration offset parameter is set much too high or low.
Alarms	
• Alarm won't occur.	• Alarm output may be off.
	• Alarm set points may be incorrect.
	• Alarm may be silenced.
	• Alarm sides may be incorrect.
	• Controller may be in diagnostics mode.
• Alarm won't clear.	• Alarm may be latched.
	• Alarm set points may be incorrect.
	• Alarm hysteresis may be incorrect.
	• Input may be in error condition.
Unit Errors (error number in top display, error message in bottom display)	
• Er 4 rAM	• There is a RAM malfunction.
• Er 5 EEcS	• The EEPROM data is corrupted.
• Er 6 roM	• There is a PROM malfunction.
• Er 7 HArd	• There is a logic hardware problem.
• Er 8 PLuG	• Module error.
• Er 9 conF	• Configuration error. Module in invalid position.
• Er 10 chnG	• Module changed.
• Er 11 SoFt	• New firmware is installed.
• Er 12 cAL	• Calibration data is corrupted.
• Er 13 Atod	• There is an analog-to-digital hardware failure.
• Er 14 EEhd	• There is an EEPROM hardware problem.
• Er 15 nEuu	• It is the new unit's first power up.
• Er 16 Addr	• There is an EEPROM hardware problem.

Corrective Action
• Check switches, fuses, breakers, interlocks, limits, connectors, etc. for energized condition and proper connection.
• Measure power upstream for required level. Check part number for input power required.
• Check wire size.
• Check for bad connections.
• Check comms setup menu and set to correct address.
• Check comms setup menu and set to correct baud rate.
• Look for a break in the daisy chain.
• Verify correct connections and test wiring paths.
• Check converter box wiring and its documentation.
• Reconfigure computer's COM port setup and verify communications ok.
• Check the communication card documentation for setable variables and operational testing.
• Restart COMS software and check for settings agreement. Verify the COM bus is active.
• Verify operation with Watlow comms tool.
• Add termination resistors per EIA-485 standards if using this option.
• Check sensor connections.
• Check sensor connections and sensor wiring.
• Change the Sensor Type parameter to match the sensor hardware.
• Change the Sensor Type parameter to match the sensor hardware. Try Restore Factory Calibration (Cal. 1 Menu).
• Verify that the temperature surrounding the controller is 32 to 149°F (0 to 65°C).
• Check sensor function. The Open Loop Detect parameter indicates it may be broken.
• Check the Calibration Offset parameter value; set it to a lower level.
• Configure output as an alarm.
• Check alarm set points.
• To clear the alarm, correct the alarm condition; check to see if the alarm is latched.
• Check the alarm sides setting.
• Check the alarm type setting.
• Check the alarm logic for compatibility with system peripherals and annunciators.
• Check the power limit setting.
• Check the operation mode.
• Check the alarm output function.
• Check the °C or°F setting.
• Check the calibration offset value; set it to a lower level.
• Cycle power to unit. If problem persists, return unit to factory.
• Cycle power to unit.
• Cycle power to unit. If problem persists, return unit to factory.
• Cycle power to unit. If problem persists, return unit to factory.
• Module defective, replace or verify module configuration.
• Return unit to factory.
• Cycle power to unit.
• Cycle power to unit.
• Recalibrate unit.
• Cycle power to unit. If problem persists, return unit to factory.
• Cycle power to unit. If problem persists, return unit to factory.
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• Cycle power to unit. If problem persists, return unit to factory.

Modbus Remote Terminal Unit (RTU)

Modbus RTU enables a computer or PLC to read and write directly to registers containing the controller's parameters. With it you could read all 141 of the controller's parameters with five read commands.

Because of the wide array of choices available for setting up a Series 96 controller, only a subset of the prompts contain parameters in a given situation. This manual explains the interrelations between prompts. A Modbus read command response of -32000 indicates that a register is not implemented; -32001, register not active; or -32002, not read-accessible. A write command will return an exception response of 01 to indicate an illegal function; 02, illegal register; or 03, illegal data. If you try to write to an inactive prompt the controller will return an illegal data address message (02).

If you already have a software application that uses Modbus, you can simply skip to the Temperature/process Controller Prompt Table or the Modbus RTU Address Table in this chapter for the address information your program will need. The rest of this section on the Modbus provides information for writing a software application that uses Modbus.

Special Modbus Functions

The following are modbus registers with special functions: Disable Non-volatile (system) Memory (24); Alarm Status Output 2 (106); Alarm Status Output 3 (110); Alarm Status Output 4 (114); Auto-Manual Operation Mode (200); Clear Input Errors (311); Clear Alarms (331); Silence Alarms (332).

A "0" indicates an inactive state. Send "1" to the register to activate the function. It will automatically reset to "0" when the function is complete.

Writing a Modbus Application

You need to code messages in eight-bit bytes, with no parity bit, one stop bit (8, n, 1). Negative parameter values must be written in twos complement format. Decimal places are assumed and are not sent or received in modbus packets. For example, 127.5 degrees is sent and read as 1275 degrees. You must look at the decimal parameter to determine where to place the decimal point. Parameters are stored in two-byte registers accessed with read and write commands to a relative address.

Messages are sent in packets that are delimited by a pause at least as long as the time it takes to send 30 bits. To determine this time in seconds, divide 30 by your baud rate.

Because changing some parameters automatically changes or defaults other parameters, use the Complete Parameter Download Sequence table in this chapter to order write commands.

Using a controller address of 0x00 for a write command broadcasts that command to all the controllers in the network. This is a powerful feature if all the controllers on a network use all or most of the same parameters.

Packet Syntax

Each message packet begins with a one-byte controller address, from 0x01 to 0xF7. The second byte in the message packet identifies the message command: read (0x03 or 0x04); write (0x06 or 0x10); or loop back (0x08).

The next n bytes of the message packet contain register addresses and/or data.

The last two bytes in the message packet contain a two-byte Cyclical Redundancy Checksum (CRC) for error detection.

Packet format:

nn	nn	nn nn...	nn nn

address
command
registers and/or data
CRC

Read Multiple Registers Command (0x03 or 0x04)

This command returns from 1 to 32 registers.

Packet sent to controller:

nn	03	nn nn	00 nn	nn nn

controller address (one byte)
read command (0x03 or 0x04)
starting register high byte
starting register low byte
number of registers high byte (0x00)
number of registers low byte
CRC low byte
CRC high byte

Packet returned by controller:

nn	03	nn	nn nn... nn nn	nn nn

controller address (one byte)
read command (0x03 or 0x04)
number of bytes (one byte)
first register data high byte
first register data low byte

register n data high byte
register n data low byte
CRC low byte
CRC high byte

Example: Read register 0 (model number) of the controller at address 1.

Sent:	01 03 00 00 00 01 84 0A
Received:	01 03 02 00 60 B8 6C
Message:	96 (0x0060).

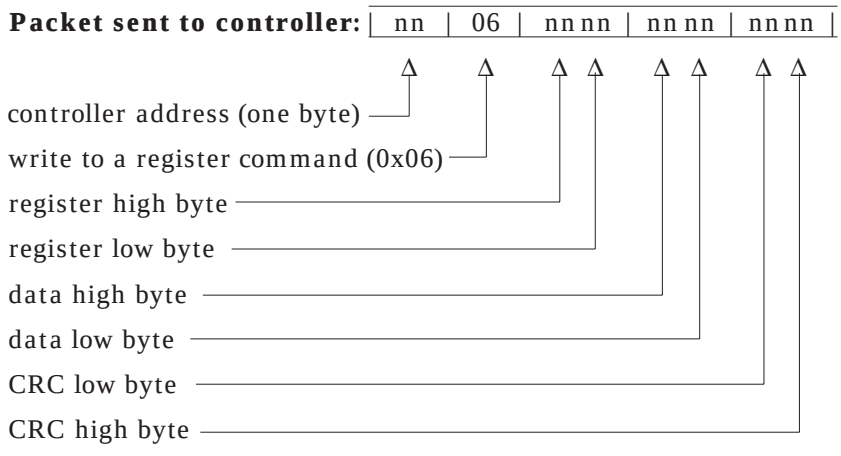
Example: Read register 1 and 2 (Serial number 1 and Serial number 2) of controller at address 5.

Sent:	05 03 00 01 00 02 94 4F
Received:	05 03 04 00 64 00 C8 FF BA
Message:	(0x0064) and (0x00C8).

Write to a Single Register Command (0x06)

This command writes a parameter to a single register. The controller will echo back the command. An attempt to write to a read-only parameter returns an illegal data address error (0x02).

Packet sent to controller:



Example: Set register 300 (set point 1) to 200 (0x00C8) on controller at address 9.

Sent:	09 06 01 2C 00 C8 49 21
Received:	09 06 01 2C 00 C8 49 21

Write to Multiple Registers Command (0x10)

This command actually writes a parameter to only a single register. An attempt to write to a read-only parameter returns an illegal data address error (0x02).

Packet sent to controller:

nn	10	nn nn	00 01	02	nn nn	nn nn

controller address (one byte)
write to multiple registers command (0x10)
starting register high byte
starting register low byte
number of registers to write high byte (0x00)
number of registers to write low byte (must be 0x01)
number of data bytes (must be 0x02)
data high byte
data low byte
CRC low byte
CRC high byte

Packet returned by controller:

nn	10	nn nn	00 01	nn nn

controller address (one byte)
write to multiple registers command (0x10)
starting register high byte
starting register low byte
number of registers to write high byte (0x00)
number of registers to write low byte (must be 0x01)
CRC low byte
CRC high byte

Loop Back Command (0x08)

This command simply echoes the message. This serves as a quick way to check your wiring.

Packet sent to controller:

nn	08	nn nn	nn nn

controller address (one byte)
loop back command (0x08)
data high byte
data low byte
CRC low byte
CRC high byte

Example: Run loop back test on controller at address 40 (0x28).

Sent: 28 08 55 66 77 88 31 B7

Received: 28 08 55 66 77 88 31 B7

Exception Responses

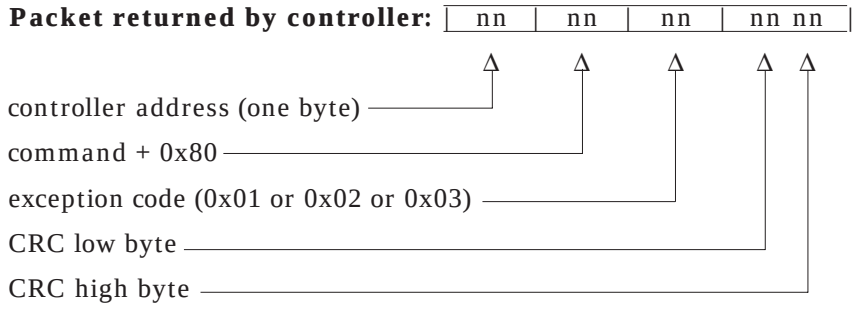
When a controller cannot process a command it returns an exception response and sets the high bit (0x80) of the command.

0x01 illegal command

0x02 illegal data address

0x03 illegal data value

Packet returned by controller:



Messages with the wrong format, timing or CRC are ignored. A read command sent to an inactive parameter returns 0x0000.

Example: Exception 01 - Command 02 is not supported.

Sent: 01 02 00 01 00 02 A8 0B

Received: 01 82 01 81 60

Example: Exception 02 - The parameter at register 45 (0x002D) is inactive.

Sent: 01 06 00 2D 00 01 D8 C3

Received: 01 86 02 C3 A1

Example: Exception 03 - Cannot write 12,000 (0x2EE0) to register 7, out of range, illegal data value.

Sent: 01 06 02 59 2E E0 44 49

Received: 01 86 03 81 82

Cyclical Redundancy Checksum (CRC) Algorithm

This C routine, calc_crc(), calculates the cyclical redundancy checksum, CRC, for a string of characters. The CRC is the result of dividing the string by 0xA001. Modbus applications calculate the packet's CRC, then append it to the packet.

```
#define POLYNOMIAL 0xA001;

unsigned int calc_crc(unsigned char *start_of_packet, unsigned char
*end_of_packet)
{
        unsigned int crc;
        unsigned char bit_count;
        unsigned char *char_ptr;

/* Start at the beginning of the packet */

        char_ptr = start_of_packet;

/* Initialize CRC */

        crc = 0xffff;

/* Loop through the entire packet */

        do{

/* Exclusive-OR the byte with the CRC */

            crc ^= (unsigned int)*char_ptr;

/* Loop through all 8 data bits */

            bit_count = 0;
            do{

/* If the LSB is 1, shift the CRC and XOR the polynomial mask with the CRC */

                if(crc & 0x0001){
                    crc >>= 1;
                    crc ^= POLYNOMIAL;
                }

/* If the LSB is 0, shift the CRC only */

                else{
                    crc >>= 1;
                }
            } while(bit_count++ < 7);
        } while(char_ptr++ < end_of_packet);

return(crc);

}
```

Modbus Register Numbers

Absolute	Relative	Parameters
40001	0	Model Number
40002	1	Serial Number 1
40003	2	Serial Number 2
40004	3	Software ID Number
40005	4	Software Revision
40006	5	Date of Manufacture
40010	9	Input 2 Hardware Enabled
40017	16	Output 1 Hardware
40018	17	Output 2 Hardware
40019	18	Output 3 Hardware
40020	19	Output 4 Hardware
40025	24	Disable Nonvolatile Memory (System)
40101	100	Process 1
40102	101	Error 1
40104	103	Percent Output
40105	104	Actual 2
40106	105	Process 2
40107	106	Alarm 2 Status
40111	110	Alarm 3 Status
40115	114	Alarm 4 Status
40201	200	Operation Mode
40202	201	Event Input Status
40203	202	Remote Set Point
40204	203	Ramping Set Point
40205	204	PID Power 1
40206	205	Prop Term 1
40207	206	Integral Term 1
40208	207	Derivative Term 1
40210	209	System Error
40211	210	Open Loop Error
40301	300	Set Point 1
40302	301	Auto-Manual Operation Mode
40305	304	Auto-tune Set Point 1
40306	305	Auto-tune Start 1
40307	306	Event Set Point 1
40310	309	Boost Set Point 1
40311	310	Manual Set Point
40312	311	Clear Input Errors
40317	316	Local-Remote (L-r) 1
40320	319	Set Point 2
40322	321	Alarm 2 Low
40323	322	Alarm 2 High
40332	331	Clear Alarms
40333	332	Silence Alarms
40341	340	Alarm 3 Low
40342	341	Alarm 3 High
40501	500	Propband 1
40502	501	Integral 1
40503	502	Reset 1
40504	503	Derivative 1
40505	504	Rate 1
40506	505	Dead Band 1
40507	506	Cycle Time 1
40508	507	Hysteresis 1
40601	600	Sensor Type 1
40602	601	Input 1
40603	602	Range Low 1
40604	603	Range High 1
40605	604	Input Software Filter 1
40606	605	Calibration Offset 1

Absolute	Relative	Parameters
40607	606	Decimal 1
40608	607	Input Error Latching
40612	611	Input 2
40613	612	Range Low 2
40614	613	Range High 2
40616	615	Calibration Offset
40701	700	Output 1
40702	701	Process 1 Type
40703	702	High Limit Set Point
40714	713	Power Limit Set Point
40715	714	High Power Limit Above
40716	715	High Power Limit Below
40718	717	Output 2
40719	718	Process 2 Type
40720	719	Alarm 2 Type
40721	720	Alarm Hysteresis 2
40722	721	Latching 2
40723	722	Silencing 2
40724	723	Alarm Active Sides 2
40725	724	Alarm Logic 2
40726	725	Alarm Annunciation 2
40735	734	Output 3
40737	736	Alarm 3 Type
40738	737	Alarm Hysteresis 3
40739	738	Latching 3
40740	739	Silencing 3
40741	740	Alarm Active Sides 3
40742	741	Alarm Logic 3
40743	742	Alarm Annunciation 3
40901	900	Units Type
40902	901	C or F
40903	902	Failure Mode
40904	903	Fixed Manual 1
40905	904	Open Loop Detect
41061	1060	Event Function
41062	1061	Event Condition
41101	1100	Ramping Mode
41102	1101	Ramp Rate
41103	1102	Ramp Scale
41301	1300	Set Point Menu Lock
41302	1301	Operations Page Mode Lock
41303	1302	Setup Page Lock
41305	1304	Custom Menu Lock
41306	1305	Calibration Menu Lock
41401-41416	1400-1415	Custom Prompt Number (1-16)
41501	1500	Ambient Temperature
41502	1501	Ambient A-D Counts
41505	1504	Channel 1 A-D Counts
41506	1505	Channel 2 A-D Counts
41514	1513	Test Display
41515	1514	Test Output
41516	1515	Line Frequency
41602	1601	Restore Factory Calibration
41603	1602	Default Settings
41604 (1)	1603 (1)	Thermocouple Calibration, 0mV
41604 (2)	1603 (2)	Thermocouple Calibration, 50mV
41604 (3)	1603 (3)	Thermocouple Calibration, 32°
41604 (4)	1603 (4)	Set Ground
41604 (5)	1603 (5)	Lead Resistance Calibration
41604 (6)	1603 (6)	RTD Calibration 15Ω
41604 (7)	1603 (7)	RTD Calibration 380Ω