EZ-ZONE® PM

User’s Manual

PID Controller Models

1241 Bundy Boulevard, Winona, Minnesota USA 55987
Phone: +1 (507) 454-5300, Fax: +1 (507) 452-4507 http://www.watlow.com

Made in the U.S.A.

0600-0058-0000 Rev. C

March 2008

$15.00
Safety Information

We use note, caution and warning symbols throughout this book to draw your attention to important operational and safety information.

A “NOTE” marks a short message to alert you to an important detail.

A “CAUTION” safety alert appears with information that is important for protecting your equipment and performance. Be especially careful to read and follow all cautions that apply to your application.

A “WARNING” safety alert appears with information that is important for protecting you, others and equipment from damage. Pay very close attention to all warnings that apply to your application.

The safety alert symbol, ▼ (an exclamation point in a triangle) precedes a general CAUTION or WARNING statement.

The electrical hazard symbol, □ (a lightning bolt in a triangle) precedes an electric shock hazard CAUTION or WARNING safety statement.

CAUTION or WARNING

Electrical Shock Hazard
CAUTION or WARNING

Warranty

The EZ-ZONE® PM is manufactured by ISO 9001-registered processes and is backed by a three-year warranty to the first purchaser for use, providing that the units have not been misapplied. Since Watlow has no control over their use, and sometimes misuse, we cannot guarantee against failure. Watlow’s obligations hereunder, at Watlow’s option, are limited to replacement, repair or refund of purchase price, and parts which upon examination prove to be defective within the warranty period specified. This warranty does not apply to damage resulting from transportation, alteration, misuse or abuse. The purchaser must use Watlow parts to maintain all listed ratings.

Technical Assistance

If you encounter a problem with your Watlow controller, review your configuration information to verify that your selections are consistent with your application: inputs, outputs, alarms, limits, etc. If the problem persists, you can get technical assistance from your local Watlow representative (see back cover), by e-mailing your questions to wintechsupport@watlow.com or by dialing +1 (507) 494-5656 between 7 a.m. and 5 p.m., Central Standard Time (CST). Ask for a Watlow Applications Engineer. Please have the following information available when calling:

• Complete model number
• All configuration information
• User’s Manual
• Factory Page

Return Material Authorization (RMA)

1. Call Watlow Customer Service, (507) 454-5300, for a Return Material Authorization (RMA) number before returning any item for repair. If you do not know why the product failed, contact an Application Engineer or Product Manager. All RMA’s require:

• Ship-to address
• Bill-to address
• Contact name
• Phone number
• Method of return shipment
• Your P.O. number
• Detailed description of the problem
• Any special instructions
• Name and phone number of person returning the product.

2. Prior approval and an RMA number from the Customer Service Department is required when returning any product for credit, repair or evaluation. Make sure the RMA number is on the outside of the carton and on all paperwork returned. Ship on a Freight Prepaid basis.

3. After we receive your return, we will examine it and try to verify the reason for returning it.

4. In cases of manufacturing defect, we will enter a repair order, replacement order or issue credit for material returned. In cases of customer mis-use, we will provide repair costs and request a purchase order to proceed with the repair work.

5. To return products that are not defective, goods must be in new condition, in the original boxes and they must be returned within 120 days of receipt. A 20 percent restocking charge is applied for all returned stock controls and accessories.

6. If the unit is unrepairable, you will receive a letter of explanation and be given the option to have the unit returned to you at your expense or to have us scrap the unit.

7. Watlow reserves the right to charge for no trouble found (NTF) returns.

The EZ-ZONE® PM PID Controller User’s Manual is copyrighted by Watlow Winona, Inc., © July 2007 with all rights reserved.

EZ-ZONE® PM is covered by U.S. Patent No. 6,005,577 and Patents Pending
<table>
<thead>
<tr>
<th>Chapter 1: Overview</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard Features and Benefits</td>
<td>2</td>
</tr>
<tr>
<td>Chapter 2: Install and Wire.</td>
<td>5</td>
</tr>
<tr>
<td>Chapter 3: Keys and Displays</td>
<td>17</td>
</tr>
<tr>
<td>Chapter 4: Home Page</td>
<td>20</td>
</tr>
<tr>
<td>Attention Codes</td>
<td>20</td>
</tr>
<tr>
<td>Chapter 5: Operations Page</td>
<td>22</td>
</tr>
<tr>
<td>Chapter 6: Setup Page</td>
<td>27</td>
</tr>
<tr>
<td>Chapter 7: Profiling Page</td>
<td>37</td>
</tr>
<tr>
<td>Chapter 8: Factory Page</td>
<td>41</td>
</tr>
<tr>
<td>Chapter 9: Features</td>
<td>45</td>
</tr>
<tr>
<td>Chapter 10: Appendix</td>
<td>58</td>
</tr>
<tr>
<td>Troubleshooting Alarms, Errors and Control Issues</td>
<td>58</td>
</tr>
<tr>
<td>Specifications</td>
<td>61</td>
</tr>
<tr>
<td>Ordering Information for PID Controller Models</td>
<td>63</td>
</tr>
<tr>
<td>Index</td>
<td>64</td>
</tr>
<tr>
<td>Declaration of Conformity</td>
<td>68</td>
</tr>
</tbody>
</table>
Chapter 1: Overview

The EZ-ZONE® PM takes the pain out of solving your thermal loop requirements.

Watlow’s EZ-ZONE® PM controllers offer options to reduce system complexity and the cost of control-loop ownership. You can order the EZ-ZONE® PM as a PID controller or an over-under limit controller, or you can combine both functions in the PM Integrated Limit Controller. You now have the option to integrate a high-amperage power controller output, an over-under limit controller and a high-performance PID controller all in space-saving, panel-mount packages. You can also select from a number of serial communications options to help you manage system performance.

It just got a whole lot easier to solve the thermal requirements of your system. Because the EZ-ZONE® PM controllers are highly scalable, you only pay for what you need. So if you are looking for a PID controller, an over-under limit controller or an integrated controller, the EZ-ZONE® PM is the answer.

Standard Features and Benefits

**Advanced PID Control Algorithm**
- TRU-TUNE+® Adaptive tune provides tighter control for demanding applications.
- Auto Tune for fast, efficient start ups

**High-amperage Power Control Output**
- Drives 15 amp resistive loads directly
- Reduces component count
- Saves panel space and simplifies wiring
- Reduces the cost of ownership

**EZ-ZONE® configuration communications and software**
- Saves time and improves the reliability of controller set up

**Parameter Save & Restore Memory**
- Reduces service calls and down time

**Agency approvals:** UL Listed, CSA, CE, RoHS, W.E.E.E. FM
- Assures prompt product acceptance
- Reduces end product documentation costs
- Semi F47-0200

**P3T Armor Sealing System**
- NEMA 4X and IP66 offers water and dust resistance, can be cleaned and washed down
- Backed up by UL 50 independent certification to NEMA 4X specification

**Three-year warranty**
- Demonstrates Watlow’s reliability and product support

**Touch-safe Package**
- IP2X increased safety for installers and operators

**Removable cage clamp wiring connectors**
- Reliable wiring, reduced service calls
- Simplified installation

**EZ-Key**
- Programmable EZ-Key enables simple one-touch operation of repetitive user activities

**Programmable Menu System**
- Reduces set up time and increases operator efficiency

**Full-featured Alarms**
- Improves operator recognition of system faults
- Control of auxiliary devices

**Heat-Cool Operation**
- Provides application flexibility with accurate temperature and process control

**Profile Capability**
- Preprogrammed process control
- Ramp and soak programming with four files and 40 total steps
A Conceptual View of the PM

The flexibility of the PM’s software and hardware allows a large range of configurations. Acquiring a better understanding of the controller’s overall functionality and capabilities while at the same time planning out how the controller can be used will deliver maximum effectiveness in your application.

It is useful to think of the controller in three parts: inputs; procedures; and outputs. Information flows from an input to a procedure to an output when the controller is properly configured. A single PM controller can carry out several procedures at the same time, for instance closed-loop control, monitoring for several different alarm situations and operating switched devices, such as lights and motors. Each process needs to be thought out carefully and the controller’s inputs, procedures and outputs set up properly.

Inputs

The inputs provide the information that any given programmed procedure can act upon. In a simple form, this information may come from an operator pushing a button or as part of a more complex procedure it may represent a remote set point being received from another controller.

Each analog input typically uses a thermocouple or RTD to read the temperature of something. It can also read volts, current or resistance, allowing it to use various devices to read humidity, air pressure, operator inputs and others values. The settings in the Analog Input Menu (Setup Page) for each analog input must be configured to match the device connected to that input.

Each digital input reads whether a device is active or inactive. A PM with digital input-output hardware includes two sets of terminals each of which can be used as either an input or an output. Each pair of terminals must be configured to function as either an input or output with the Direction parameter in the Digital Input/Output Menu (Setup Page).

The Function or EZ Key on the front panel of the PM also operates as a digital input by toggling the function assigned to it in the Digital Input Function parameter in the Function Key Menu (Setup Page).

Functions

Functions use input signals to calculate a value. A function may be as simple as reading a digital input to set a state to true or false, or reading a temperature to set an alarm state to on or off. Or, it could compare the temperature of a process to the set point and calculate the optimal power for a heater.

To set up a function, it’s important to tell it what source, or instance, to use. For example, an alarm may be set to respond to either analog input 1 or 2 (instance 1 or 2, respectively).

Outputs

Outputs can perform various functions or actions in response to information provided by a function, such as operating a heater; turning a light on or off; unlocking a door; or turning on a buzzer.

Assign an output to a Function in the Output Menu or Digital Input/Output Menu. Then select which instance of that function will drive the selected output. For example, you might assign an output to respond to alarm 4 (instance 4) or to retransmit the value of analog input 2 (instance 2).

You can assign more than one output to respond to a single instance of a function. For example, alarm 2 could be used to trigger a light connected to output 1 and a siren connected to digital output 5.

Input Events and Output Events

Input events are internal states that are set by the digital inputs. Digital input 5 provides the state of input event 1, and digital input 6 provides the state of input event 2. Wait for Event steps in profiles are triggered by these events. The setting of Digital Input Function (Setup Page, Digital Input/Output Menu) does not change the relationship between the input and the event, so take care not to configure the function in a way that would conflict with a profile that uses and input event. An input will still control the input event state, even if Digital Input Function is set to None.

Output events are internal states that can only be set by profile steps. Outputs 1 through 4 can be configured to respond to output events.
EZ-ZONE® PM PID Model 1/16 & 1/32 DIN – Input/Output
(no communications options 2 to 6)
Universal Sensor Input, Configuration Communications,
Red/Green 7-Segment Display

Input Functions

Analog Input 1 thermocouple, RTD, process (V, mV, mA, 1k potentiometer)

Digital Input (or Output) 5 (optional) none, switch, volts dc

Digital Input (or Output) 6 (optional) none, switch, volts dc

EZ Key (1/16 DIN only) programmable event

EIA 485 Communications Standard Bus, Modbus RTU (optional)

Output Functions

Output 1 none, switched dc/open collector, form C mechanical (5 A) relay, form A solid-state (0.5 A) relay, process (V, mA)

Output 2 none, switched dc, no-arc power control (15 A), form A mechanical (5 A) or solid-state (0.5 A) relay

Output 1 none, switched dc/open collector, form C mechanical (5 A) relay, form A solid-state (0.5 A) relay, process (V, mA)

Output 2 none, switched dc, no-arc power control (15 A), form A mechanical (5 A) or solid-state (0.5 A) relay

PID Controller Board Slot A ramp-soak with 4 files (optional)

Supervisory & Power Board Slot C

Digital Output (or Input) 5 (optional) none, switched dc

Digital Output (or Input) 6 (optional) none, switched dc

Network remote user interface, personal computer, programmable logic controller, human-machine interface

Input Functions

Output Functions
Chapter 2: Install and Wire

Dimensions 1/32 DIN

---

**Side**
- 15.9 mm (0.63 in)
- 101.6 mm (4.00 in)

**Front**
- 53.3 mm (2.10 in)
- 31.2 mm (1.23 in)
- 30.9 mm (1.22 in)

**Top**
- 21.6 mm (0.85 in)
- 45.2 mm (1.78 in)

**Back**
- Output 1
- Output 2
- Input 1

---

Recommended panel spacing:
- Panel thickness 1.53 to 9.52 mm (0.060 to 0.375)
- 22.4 mm (0.88 in)
- 21.6 mm (0.85 in)

---

Watlow EZ-ZONE® PM PID Controller

Chapter 2 Install and Wire
Dimensions 1/16 DIN

Side

Front

Top

Back

Recommended panel spacing

panel thickness 1.53 to 9.52 mm (0.060 to 0.375)

21.6 mm (0.85 in)

21.6 mm (0.85 in)

51.2 mm (2.02 in)

53.3 mm (2.10 in)

45.2 mm (1.78 in)

45.2 mm (1.78 in)

15.8 mm (0.62 in)

101.6 mm (4.00 in)

53.3 mm (2.10 in)
Installation

1. Make the panel cutout using the mounting template dimensions in this chapter. Insert the case assembly into the panel cutout.

2. While pressing the case assembly firmly against the panel, slide the mounting collar over the back of the controller.

   If the installation does not require a NEMA 4X seal, slide the mounting collar up to the back of the panel tight enough to eliminate the spacing between the gasket and the panel.

3. For a NEMA 4X seal, place the blade of a screwdriver in the notch of the mounting collar assembly and push toward the panel while applying pressure to the face of the controller. Don’t be afraid to apply enough pressure to properly install the controller. The seal system is compressed more by mating the mounting collar tighter to the front panel (see picture). If you can move the case assembly back and forth in the cutout, you do not have a proper seal.

   The tabs on each side of the mounting collar have teeth that latch into the ridges on the sides of the controller. Each tooth is staggered at a different depth from the front so that only one of the tabs, on each side, is locked onto the ridges at a time.

   Note: There is a graduated measurement difference between the upper and lower half of the display to the panel. In order to meet the seal requirements mentioned above, ensure that the distance from the front of the top half of the display to the panel is 16 mm (0.630 in.) or less, and the distance from the front of the bottom half and the panel is 13.3 mm (0.525 in.) or less.

Removing the Mounted Controller from Its Case

1. From the controller’s face, pull out the tab on each side until you hear it click.

2. Once the sides are released, grab the unit above and below the face with two hands and pull the unit out.

   If it is difficult to pull the unit out, remove the connectors from the back of the controller. This should make it easier to remove.

   Warning:

   All electrical power to the controller and controlled circuits must be disconnected before removing the controller from the front panel or disconnecting other wiring.

   Failure to follow these instructions may cause an electrical shock and/or sparks that could cause an explosion in class 1, div. 2 hazardous locations.
Returning the Controller to its Case

1. Ensure that the orientation of the controller is correct and slide it back into the housing.

   Note: The controller is keyed so if it feels that it will not slide back in do not force it. Check the orientation again and reinsert after correcting.

2. Using your thumbs push on either side of the controller until both latches click.

Chemical Compatibility

This product is compatible with acids, weak alkalis, alcohols, gamma radiation and ultraviolet radiation. This product is not compatible with strong alkalis, organic solvents, fuels, aromatic hydrocarbons, chlorinated hydrocarbons, esters and keytones.
### Slot A

<table>
<thead>
<tr>
<th>Output</th>
<th>Terminal Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X1 common (Any switched dc output can use this common.) dc- (open collector) dc+</td>
<td>Switched dc/open collector output 1: PM _ _ _ C _- AAAA _</td>
</tr>
<tr>
<td>2</td>
<td>W2 dc- Y2 dc+</td>
<td>Switched dc output 2: PM _ _ _ C _- AAAA _</td>
</tr>
<tr>
<td></td>
<td>F1 voltage or current - voltage + current +</td>
<td>Universal Process output 1: PM _ _ _ F _- AAAA _</td>
</tr>
<tr>
<td></td>
<td>L1 normally open common normally closed</td>
<td>Mechanical Relay 5 A, Form C output 1: PM _ _ _ E _- AAAA _</td>
</tr>
<tr>
<td></td>
<td>L2 normally open common</td>
<td>No-arc 15 A, Form A (1/16 DIN only) output 2: PM 6 _ _ H _- AAAA _</td>
</tr>
<tr>
<td></td>
<td>L2 normally open common</td>
<td>Mechanical Relay 5 A, Form A output 2: PM _ _ _ J _- AAAA _</td>
</tr>
<tr>
<td></td>
<td>L1 L2 normally open common</td>
<td>Solid-state Relay 0.5 A, Form A output 1: PM _ _ _ K _- AAAA _ output 2: PM _ _ _ K _- AAAA _</td>
</tr>
</tbody>
</table>

#### Inputs

<table>
<thead>
<tr>
<th></th>
<th>T1 S2 (RTD) or current +, potentiometer wiper</th>
<th>Universal Sensor input 1: all configurations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S1 S3 (RTD), thermocouple -, current - or volts - S1 (RTD), thermocouple + or volts +</td>
<td>Universal Sensor input 1: all configurations</td>
</tr>
</tbody>
</table>

### Terminal Definitions for Slots A.

<table>
<thead>
<tr>
<th>Slot C</th>
<th>Terminal Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>98</td>
<td>power input: ac or dc+ power input: ac or dc-</td>
<td>all</td>
</tr>
<tr>
<td>99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CC</td>
<td>Standard Bus or Modbus RTU EIA-485 common</td>
<td>Standard Bus or Modbus PM _ _ _ _ _ 1 AAAA _</td>
</tr>
<tr>
<td>CA</td>
<td>Standard Bus or Modbus RTU EIA-485 T-/R-</td>
<td>PM _ _ _ _ _ 1 AAAA _</td>
</tr>
<tr>
<td>CB</td>
<td>Standard Bus or Modbus RTU EIA-485 T+/R+</td>
<td>PM _ _ _ _ _ 1 AAAA _</td>
</tr>
<tr>
<td>CF</td>
<td>Standard Bus EIA-485 common</td>
<td>Standard Bus or Modbus</td>
</tr>
<tr>
<td>CD</td>
<td>Standard Bus EIA-485 T-/R-</td>
<td>PM _ _ _ _ _ 1 AAAA _</td>
</tr>
<tr>
<td>CE</td>
<td>Standard Bus EIA-485 T+/R+</td>
<td>PM _ _ _ _ _ 1 AAAA _</td>
</tr>
<tr>
<td>B5</td>
<td>digital input-output common</td>
<td>PM _ _ _ _ _ AAAA _</td>
</tr>
<tr>
<td>D6</td>
<td>digital input or output 6</td>
<td>PM _ _ _ _ _ AAAA _</td>
</tr>
<tr>
<td>D5</td>
<td>digital input or output 5</td>
<td>PM _ _ _ _ _ AAAA _</td>
</tr>
</tbody>
</table>

### Terminal Definitions for Slot C.

---

**Watlow EZ-ZONE® PM PID Controller**

Chapter 2 Install and Wire
Controller Power Supply
12 to 40V~ (dc)
24 to 28V~ (ac)
85 to 264V~ (ac)

Low voltage power bus and internal bus

Safety Isolation

No Isolation

Switched DC, Open Collector, Process Outputs

Analog Input 1

Mechanical Relay, Solid-state Relay & No-arc Relay Outputs

EIA-485 Communications Port

Low-voltage Isolation: 42V peak
Safety Isolation: 1,528V~ (ac)

EZ-ZONE® PM isolation blocks.
Warning: Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or loss of life.

Note: Maximum wire size termination and torque rating:
- 0.0507 to 3.30 mm² (30 to 12 AWG) single-wire termination or two 1.31 mm² (16 AWG)
- 0.8 Nm (7.0 lb.-in.) torque

Note: Adjacent terminals may be labeled differently, depending on the model number.

Note: To prevent damage to the controller, do not connect wires to unused terminals.

Note: Maintain electrical isolation between analog input 1, digital input-outputs, switched dc/open collector outputs and process outputs to prevent ground loops.

Note: The control output common terminal and the digital common terminal are referenced to different voltages and must remain isolated.

---

**Low Power**

<table>
<thead>
<tr>
<th>Slot C</th>
<th>98</th>
<th>99</th>
<th>0F</th>
<th>CD</th>
<th>CE</th>
<th>BS</th>
<th>D6</th>
<th>D5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power fuse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 12 to 40V (dc)
- 20 to 28V (ac)
- 20 to 28V (ac) Semi Sig F47
- 47 to 63 Hz
- 10VA maximum power consumption

**High Power**

<table>
<thead>
<tr>
<th>Slot C</th>
<th>98</th>
<th>99</th>
<th>0F</th>
<th>CD</th>
<th>CE</th>
<th>BS</th>
<th>D6</th>
<th>D5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power fuse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 85 to 264V (ac)
- 100 to 240V (ac) Semi Sig F47
- 47 to 63 Hz
- 10VA maximum power consumption

**Digital Input or Output 5**

<table>
<thead>
<tr>
<th>Slot C</th>
<th>98</th>
<th>99</th>
<th>0F</th>
<th>CD</th>
<th>CE</th>
<th>BS</th>
<th>D6</th>
<th>D5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power fuse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Digital Input**
- update rate 10 Hz
- dry contact or dc voltage

**DC voltage**
- maximum input 36V at 3 mA
- minimum high state 3V @ 0.25 mA
- maximum low state 2V

**Dry contact**
- minimum open resistance 500 Ω
- maximum closed resistance 100 Ω
- maximum short circuit 15 mA

**Digital Output**
- update rate 10 Hz
- output voltage 24V
- current limit, Output 5, 24 mA maximum
- capable of driving a 3-pole DIN-A-MITE
- open-circuit voltage 22 to 32V (dc)

**Digital Input or Output 6**

<table>
<thead>
<tr>
<th>Slot C</th>
<th>98</th>
<th>99</th>
<th>0F</th>
<th>CD</th>
<th>CE</th>
<th>BS</th>
<th>D6</th>
<th>D5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power fuse</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Digital Input**
- update rate 10 Hz
- dry contact or dc voltage

**DC voltage**
- maximum input 36V at 3 mA
- minimum high state 3V @ 0.25 mA
- maximum low state 2V

**Dry contact**
- minimum open resistance 500 Ω
- maximum closed resistance 100 Ω
- maximum short circuit 13 mA

**Digital Output**
- update rate 10 Hz
- output voltage 24V
- current limit, Output 6, 10 mA maximum
- capable of driving a single-pole DIN-A-MITE
- open-circuit voltage 22 to 32V (dc)
Warning:
Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or loss of life.

Note:
Maximum wire size termination and torque rating:
- 0.0507 to 3.30 mm² (30 to 12 AWG) single-wire termination or two 1.31 mm² (16 AWG)
- 0.8 Nm (7.0 lb.-in.) torque

Note:
Adjacent terminals may be labeled differently, depending on the model number.

Note:
To prevent damage to the controller, do not connect wires to unused terminals.

Note:
Maintain electrical isolation between analog input 1, digital input-outputs, switched dc/open collector outputs and process outputs to prevent ground loops.

Note:
The control output common terminal and the digital common terminal are referenced to different voltages and must remain isolated.

Input 1 Thermocouple

- 20 Ω maximum source resistance
- >20 MΩ input impedance
- 3 microampere open-sensor detection
- Thermocouples are polarity sensitive. The negative lead (usually red) must be connected to S1.
- To reduce errors, the extension wire for thermocouples must be of the same alloy as the thermocouple.

PM_ _ _ _ _-_ AAAA _ _ (all)

Input 1 RTD

- platinum, 100 and 1,000 Ω @ 0°C
- calibration to DIN curve (0.00385 Ω/Ω/°C)
- 20 Ω total lead resistance
- RTD excitation current of 0.09 mA typical. Each ohm of lead resistance may affect the reading by 0.03°C.
- For 3-wire RTDs, the S1 lead (usually white) must be connected to R1.
- For best accuracy use a 3-wire RTD to compensate for lead-length resistance. All three lead wires must have the same resistance.

PM_ _ _ _ _-_ AAAA _ _ (all)

Input 1 Process

- 0 to 20 mA @ 100 Ω input impedance
- 0 to 10V= (dc) @ 20 kΩ input impedance
- 0 to 50 mV= (dc) @ 20 kΩ input impedance
- scalable

PM_ _ _ _ _-_ AAAA _ _ (all)

Input 1 Potentiometer

- Use a 1 kΩ potentiometer.

PM_ _ _ _ _-_ AAAA _ _ (all)
Warning: Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or loss of life.

Note: Maximum wire size termination and torque rating:
- 0.0507 to 3.30 mm² (30 to 12 AWG) single-wire termination or two 1.31 mm² (16 AWG)
- 0.8 Nm (7.0 lb.-in.) torque

Note: Adjacent terminals may be labeled differently, depending on the model number.

Note: To prevent damage to the controller, do not connect wires to unused terminals.

Note: Maintain electrical isolation between analog input 1, digital input-outputs, switched dc/open collector outputs and process outputs to prevent ground loops.

Note: The control output common terminal and the digital common terminal are referenced to different voltages and must remain isolated.

Quencharc Note: Switching pilot duty inductive loads (relay coils, solenoids, etc.) with the mechanical relay, solid state relay or open collector output options requires use of an R.C. suppressor.

Output 1 Switched DC/Open Collector

Switched DC
- 30 mA dc maximum supply current
- short circuit limited to <50 mA
- 22 to 32V (dc) open circuit voltage
- Use dc- and dc+ to drive external solid-state relay.
- DIN-A-MITE compatible
- single-pole: up to 4 in parallel or 4 in series
- 2-pole: up to 2 in parallel or 2 in series
- 3-pole: up to 2 in series

Open Collector
- 100 mA maximum output current sink
- 30V (dc) maximum supply voltage
- Any switched dc output can use the common terminal.
- Use an external power supply to control a dc load, with the load positive to the positive of the power supply, the load negative to the open collector and common to the power supply negative.

See Quencharc note.

PM _ _ _ C _ _ AAAA _ _

Output 1 Mechanical Relay, Form C

- 5 A at 240V~ (ac) or 30V (dc) maximum resistive load
- 20 mA at 24V minimum load
- 125 VA pilot duty at 120/240V~ (ac), 25 VA at 24V~ (ac)
- 100,000 cycles at rated load
- Output does not supply power.
- for use with ac or dc

See Quencharc note.

PM _ _ _ E _ _ AAAA _ _

Output 1 Universal Process

- 0 to 20 mA into 800 Ω maximum load
- 0 to 10V (dc) into voltage 1 kΩ minimum load
- scalable
- output supplies power
- cannot use voltage and current outputs at same time
- Output may be used as re-transmit or control.

PM _ _ _ F _ _ AAAA _ _

Note: If output 1 is a universal process output, output 2 cannot function as a variable-time-base output.
- This note does not apply to EZ-ZONE® PM controls with firmware versions of 4 or higher.
**Warning:** Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or loss of life.

**Note:**
Maximum wire size termination and torque rating:
- 0.0507 to 3.30 mm² (30 to 12 AWG) single-wire termination or two 1.31 mm² (16 AWG)
- 0.8 Nm (7.0 lb.-in.) torque

**Note:** Adjacent terminals may be labeled differently, depending on the model number.

**Note:**
To prevent damage to the controller, do not connect wires to unused terminals.

**Note:**
Maintain electrical isolation between analog input 1, digital input-outputs, switched dc/open collector outputs and process outputs to prevent ground loops.

**Note:**
The control output common terminal and the digital common terminal are referenced to different voltages and must remain isolated.

**Quencharc Note:**
Switching pilot duty inductive loads (relay coils, solenoids, etc.) with the mechanical relay, solid state relay or open collector output options requires use of an R.C. suppressor.

### Output 1 Solid-state Relay, Form A

<table>
<thead>
<tr>
<th>Slot A</th>
<th>L1</th>
<th>K1</th>
<th>L2</th>
<th>K2</th>
</tr>
</thead>
<tbody>
<tr>
<td>normally open</td>
<td>common</td>
<td>normally open</td>
<td>common</td>
<td></td>
</tr>
</tbody>
</table>

- 0.5 A at 20 to 264V~ (ac) maximum resistive load
- 20 VA 120/240V~ (ac) pilot duty
- opto-isolated, without contact suppression
- maximum off state leakage of 105 microamperes
- output does not supply power
- Do not use on dc loads.
- See Quencharc note.

PM _ _ _ K _ _ AAAAA _

### Output 2 Switched DC

<table>
<thead>
<tr>
<th>Slot A</th>
<th>L1</th>
<th>K1</th>
<th>J1</th>
<th>W2</th>
<th>Y2</th>
</tr>
</thead>
<tbody>
<tr>
<td>dc</td>
<td>dc</td>
<td>dc</td>
<td>dc</td>
<td>dc</td>
<td>dc</td>
</tr>
</tbody>
</table>

- 10 mA dc maximum supply current
- short circuit limited to <50 mA
- 22 to 32V~ (dc) open circuit voltage
- use dc- and dc+ to drive external solid-state relay
- DIN-A-MITE compatible
- single-pole: up to 2 in series, none in parallel

PM _ _ _ C _ _ AAAAA _

### Output 2 No-arc Relay, Form A

<table>
<thead>
<tr>
<th>Slot A</th>
<th>L1</th>
<th>K1</th>
<th>J1</th>
<th>L2</th>
<th>K2</th>
</tr>
</thead>
<tbody>
<tr>
<td>normally open</td>
<td>common</td>
<td>normally open</td>
<td>common</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 15 A at 85 to 264V~ (ac) resistive load only
- 1/16 DIN models only
- 2,000,000 cycle rating for no-arc circuit
- 100 mA minimum load
- 2 mA maximum off state leakage
- Do not use on dc loads.
- Output does not supply power.

PM 6 _ _ H _ _ AAAAA _

### Output 2 Mechanical Relay, Form A

<table>
<thead>
<tr>
<th>Slot A</th>
<th>L1</th>
<th>K1</th>
<th>J1</th>
<th>L2</th>
<th>K2</th>
</tr>
</thead>
<tbody>
<tr>
<td>normally open</td>
<td>common</td>
<td>normally open</td>
<td>common</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 5 A at 240V~ (ac) or 30V~ (dc) maximum resistive load
- 20 mA at 24V minimum load
- 125 VA pilot duty @ 120/240V~ (ac), 25 VA at 24V~ (ac)
- 100,000 cycles at rated load
- Output does not supply power.
- for use with ac or dc

See Quencharc note.
PM _ _ _ J _ _ AAAAA _
Output 2 Solid-state Relay, Form A

- 0.5 A at 20 to 264V- (ac) maximum resistive load
- 20 VA 120/240V- (ac) pilot duty
- opto-isolated, without contact suppression
- maximum off state leakage of 105 microamperes
- Output does not supply power.
- Do not use on dc loads.

See Quencharc note.

Standard Bus EIA-485 Communications

- Wire T-/R- to the A terminal of the EIA-485 port.
- Wire T+/R+ to the B terminal of the EIA-485 port.
- Wire common to the common terminal of the EIA-485 port.
- Do not route network wires with power wires. Connect network wires in daisy-chain fashion when connecting multiple devices in a network.
- Do not connect more than 16 EZ-ZONE® PM controllers on a network.
- maximum network length: 1,200 meters (4,000 feet)
- 1/8th unit load on EIA-485 bus

Modbus RTU or Standard Bus EIA-485 Communications

- Wire T-/R- to the A terminal of the EIA-485 port.
- Wire T+/R+ to the B terminal of the EIA-485 port.
- Wire common to the common terminal of the EIA-485 port.
- Do not route network wires with power wires. Connect network wires in daisy-chain fashion when connecting multiple devices in a network.
- A termination resistor may be required. Place a 120 Ω resistor across T+/R+ and T-/R- of last controller on network.
- Only one protocol per port is available at a time: either Modbus RTU or Standard Bus.
- Do not connect more than 16 EZ-ZONE® PM controllers on a Standard Bus network.
- Do not connect more than 247 EZ-ZONE® PM controllers on a Modbus RTU network.
- maximum network length: 1,200 meters (4,000 feet)
- 1/8th unit load on Modbus RTU bus
Warning: Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or loss of life.

Note: Maximum wire size termination and torque rating:
- 0.0507 to 3.30 mm² (30 to 12 AWG) single-wire termination or two 1.31 mm² (16 AWG)
- 0.8 Nm (7.0 lb.-in.) torque

Note: Adjacent terminals may be labeled differently, depending on the model number.

Note: To prevent damage to the controller, do not connect wires to unused terminals.

Note: Maintain electrical isolation between analog input 1, digital input-outputs, switched dc/open collector outputs and process outputs to prevent ground loops.

Note: The control output common terminal and the digital common terminal are referenced to different voltages and must remain isolated.

Note: Avoid continuous writes within loops. Excessive writes to EEPROM will cause premature EEPROM failure. The EEPROM is rated for 1,000,000 writes.

Wiring a Serial EIA-485 Network
Do not route network wires with power wires. Connect network wires in daisy-chain fashion when connecting multiple devices in a network.
A termination resistor may be required. Place a 120 Ω resistor across T+/R+ and T-/R- of the last controller on a network.

Only one protocol per port is available at a time: either Modbus RTU or Standard Bus.

A network using Watlow’s Standard Bus and an RUI/Gateway

A network using Modbus RTU.
Chapter 3: Keys and Displays

Upper Display:
In the Home Page, displays the process value, otherwise displays the value of the parameter in the lower display.

Zone Display:
Indicates the controller zone that the remote user interface (RUI) is currently communicating with.

1 to 9 = zones 1 to 9
A = zone 10
C = zone 12
b = zone 11
F = zone 15
c = zone 13

Lower Display:
Indicates the set point or output power value during operation, or the parameter whose value appears in the upper display.

EZ Key:
This key can be programmed to do various tasks, such as starting a profile.

Temperature Units Indicator Lights:
Indicates whether the temperature is displayed in Fahrenheit or Celsius.

Output Activity:
Number lights indicate activity of outputs 1 through 5. A flashing light indicates retransmit activity.

Percent Units Indicator:
Lights when the controller is displaying values as a percentage or when the open-loop set point is displayed.

Profile Activity:
Lights when a profile is running. Flashes when a profile is paused.

Communications Activity:
Flashes when another device is communicating with this controller.

Up and Down Keys
In the Home Page, adjusts the set point in the lower display. In other pages, changes the upper display to a higher or lower value, or changes a parameter selection.

Responding to a Displayed Message
An active message will cause the display to toggle between the normal settings and the active message in the upper display and [Attention] in the lower display.

Your response will depend on the message and the controller settings. Some messages, such as Ramping and Tuning, indicate that a process is underway. If the message was generated by a latched alarm or limit condition, the message can be cleared when the condition no longer exists. If an alarm has silencing enabled, it can be silenced.

Push the Advance Key to display [Ignr] in the upper display and the message source (such as [Li;h1]) in the lower display.

Use the Up and Down keys to scroll through possible responses, such as Clear [CLr] or Silence [Sil]. Then push the Advance or Infinity key to execute the action.

- [AL;L1] Alarm Low 1 to 4
- [AL;L2] Alarm Low 2 to 4
- [AL;L3] Alarm Low 3 to 4
- [AL;L4] Alarm Low 4 to 4
- [AL;H1] Alarm High 1 to 4
- [AL;H2] Alarm High 2 to 4
- [AL;H3] Alarm High 3 to 4
- [AL;H4] Alarm High 4 to 4
- [AL;E1] Alarm Error 1 to 4
- [AL;E2] Alarm Error 2 to 4
- [AL;E3] Alarm Error 3 to 4
- [AL;E4] Alarm Error 4 to 4
- [Er;i1] Error Input 1
- [Er;i2] Error Input 2
- [Er;i3] Error Input 3
- [Er;i4] Error Input 4
- [rP1] Ramping
- [LP;o1] Loop Open Error
- [LP;r1] Loop Reversed Error
- [hEr] Heater Error

3/16 DIN
1/32 DIN

Left (Upper) Display:
In the Home Page, displays the process value, otherwise displays the value of the parameter in the lower display.

Right (Lower) Display:
Indicates the set point or output power value during operation, or the parameter whose value appears in the upper display.

Advance Key
Advances through parameter prompts.

Infinity Key
Press to back up one level, or press and hold for two seconds to return to the Home Page.

Up and Down Keys
In the Home Page, adjusts the set point in the lower display. In other pages, changes the upper display to a higher or lower value, or changes a parameter selection.

Output Activity:
Number lights indicate activity of outputs 1, 2, 5 and 6. A flashing light indicates retransmit activity.

Percent Units Indicator
Lights when the controller is displaying values as a percentage or when the open-loop set point is displayed.

Profile Activity:
Lights when a profile is running. Flashes when a profile is paused.

Responding to a Displayed Message
An active message will cause the display to toggle between the normal settings and the active message in the upper display and [Attn] in the lower display.

Your response will depend on the message and the controller settings. Some messages, such as Ramping and Tuning, indicate that a process is underway. If the message was generated by a latched alarm or limit condition, the message can be cleared when the condition no longer exists. If an alarm has silencing enabled, it can be silenced.

Push the Advance Key to display [ignr] in the upper display and the message source (such as [Li;h1]) in the lower display.

Use the Up [ ] and Down [ ] keys to scroll through possible responses, such as Clear [CLr] or Silence [SIL]. Then push the Advance [ ] or Infinity [ ] key to execute the action.

- [ALL1] Alarm Low 1 to 4
- [ALL2] Alarm High 1 to 4
- [ALL3] Alarm Error 1 to 4
- [ALL4] Error Input 1
- [rP1] Tuning
- [LPo1] Ramping
- [LPo1] Loop Open Error
- [LPo1] Loop Reversed Error
- [hFe] Heater Error
Navigating the EZ-ZONE® PM PID Controller

1/16 DIN

Home Page from anywhere: Press the Infinity Key ◎ for two seconds to return to the Home Page.

Operations Page from Home Page: Press both the Up ◁ and Down ◁ keys for three seconds.

Setup Page from Home Page: Press both the Up ◁ and Down ◁ keys for six seconds.

Profiling Page from Home Page: Press the Advance Key ◊ for three seconds.

Factory Page from Home Page: Press both the Advance ◊ and Infinity ◎ keys for six seconds.
Chapter 4: Home Page

Default Home Page Parameters

The Home Page is a customized list of as many as 20 parameters that can be configured and changed in the Custom Menu (Factory Page). The default list of nine parameters below includes the Active Process Value (value in upper display) and Active Set Point (value in lower display). The Attention parameter only appears if there is an active message. An active message could be a reported error, for example, \[C;Er1\] (Current Error), or it could be for information only, for example, \[EUN\] (Autotuning).

Use the Advance Key to step through the other parameters. The parameter prompt will appear in the lower display, and the parameter value will appear in the upper display. You can use the Up and Down keys to change the value of read-write parameters, just as you would in any other menu.

If Control Mode is set to Auto, the process value is in the upper display and the Closed Loop Set Point (read-write) is in the lower display.

If a profile is running, the process value is in the upper display and the Target Set Point (read only) is in the lower display.

If Control Mode is set to Manual, the process value is in the upper display and the output power level (read-write) is in the lower display.

If Control Mode is set to Off, the process value is in the upper display and \[oFF\] (read only) is in the lower display.

If a sensor failure has occurred, \[- - - -\] is in the upper display and the output power level (read-write) is in the lower display.

Changing the Set Point

You can change the set point by using the Up and Down keys, when a profile is not running.

If the set point is displayed and the % indicator is lit, the controller is in open-loop (manual) mode.

Note: Avoid continuous writes within loops. Excessive writes to EEPROM will cause premature EEPROM failure. The EEPROM is rated for 1,000,000 writes.

<table>
<thead>
<tr>
<th>Custom Menu Number</th>
<th>Home Page Display (defaults)</th>
<th>Parameter Name</th>
<th>Settings</th>
<th>Custom Menu Display (defaults)</th>
<th>Parameter Page and Menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Upper Display</td>
<td>(value only)</td>
<td>Active Process Value</td>
<td>[PcPu]</td>
<td>Operations Page, Analog Input Menu</td>
<td></td>
</tr>
<tr>
<td>2 Lower Display</td>
<td>(value only)</td>
<td>Active Set Point</td>
<td>[PCSp]</td>
<td>Operations Page, Profile Status Menu</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>[CM]</td>
<td>Control Mode</td>
<td>[CM]</td>
<td>Operations Page, Loop Menu</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>[hPr]</td>
<td>Heat Power</td>
<td>[hPr]</td>
<td>Operations Page, Monitor Menu</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>[CP]</td>
<td>Cool Power</td>
<td>[CP]</td>
<td>Operations Page, Monitor Menu</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>[A]</td>
<td>Autotune</td>
<td>[A]</td>
<td>Operations Page, Loop Menu</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>[idS]</td>
<td>Idle Set Point</td>
<td>[idLE]</td>
<td>Operations Page, Loop Menu</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>[PrSt]</td>
<td>Profile Start</td>
<td>[PrSt]</td>
<td>Home Page only (See Profile Page Chapter.)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>[PrAc]</td>
<td>Profile Action Request</td>
<td>[PrAc]</td>
<td>Home Page only (See Profile Page Chapter.)</td>
<td></td>
</tr>
<tr>
<td>10 to 20</td>
<td>(skipped)</td>
<td>None</td>
<td>[non]</td>
<td>(Add parameters to the Home Page in the Custom Menu, Factory Page.)</td>
<td></td>
</tr>
</tbody>
</table>

Default Home Page and Attention Codes
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name</th>
<th>Description</th>
<th>Setting</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attn</td>
<td>Attention</td>
<td>An active message will cause the display to toggle between the normal settings and the active message in the upper display and <code>Attn</code> in the lower display. Your response will depend on the message and the controller settings. Some messages, such as Ramping and Tuning, indicate that a process is underway. If the message was generated by a latched alarm or limit condition, the message can be cleared when the condition no longer exists. If an alarm has silencing enabled, it can be silenced. Push the Advance Key to display <code>ignr</code> in the upper display and the message source (such as <code>Li;h1</code>) in the lower display. Use the Up <code>¿</code> and Down <code>¯</code> keys to scroll through possible responses, such as Clear <code>CLr</code> or Silence <code>SiL</code>. Then push the Advance † or Infinity ˆ key to execute the action.</td>
<td><code>ALL1</code></td>
<td>ALlL1 to ALlL4</td>
<td>ALlL1</td>
<td>0 to 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>ALh1</code></td>
<td>ALhL1 to ALhL4</td>
<td>ALhL1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>ALE1</code></td>
<td>ALEL1 to ALEL4</td>
<td>ALEL1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>Li;h1</code></td>
<td>Error Input 1</td>
<td><code>Li;h1</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>TUn1</code></td>
<td>Tuning</td>
<td><code>TUn1</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>rP1</code></td>
<td>Ramping</td>
<td><code>rP1</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>LPo1</code></td>
<td>Loop Open Error</td>
<td><code>LPo1</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>LPr1</code></td>
<td>Loop Reversed Error</td>
<td><code>LPr1</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>heCR</code></td>
<td>Heater Error</td>
<td><code>heCR</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Profile Start</td>
<td>Select a profile or step number that will be affected by Profile Action.</td>
<td>0 to 40</td>
<td>0</td>
<td>None</td>
<td>the controller includes profiling (PM _R _ _ _ _ AAAA _ _).</td>
</tr>
<tr>
<td></td>
<td>Profile Action Request</td>
<td>Select the action to apply to the profile (1 to 4) or step selected in Profile Start.</td>
<td><code>nonE</code></td>
<td>No Action</td>
<td><code>nonE</code></td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>prene</code></td>
<td>Start a Profile</td>
<td><code>prene</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>SeEp</code></td>
<td>Start a Step</td>
<td><code>SeEp</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>Prus</code></td>
<td>Pause</td>
<td><code>Prus</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>rE5u</code></td>
<td>Resume</td>
<td><code>rE5u</code></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><code>EnD</code></td>
<td>End</td>
<td><code>EnD</code></td>
<td></td>
</tr>
</tbody>
</table>

Parameters that appear only in the Home Page
Chapter 5: Operations Page

To go to the Operations Page from the Home Page, press both the Up \( \uparrow \) and Down \( \downarrow \) keys for three seconds. \[ R \] will appear in the upper display and \[ OPER \] will appear in the lower display.

- Press the Up \( \uparrow \) or Down \( \downarrow \) key to move through the menus.
- Press the Advance Key \( \ast \) to move to a submenu.
- Press the Up \( \uparrow \) or Down \( \downarrow \) key to move through the submenus.
- Press the Advance Key \( \ast \) to move through the parameters of the menu or submenu.

- Press the Infinity Key \( \hat{\rightarrow} \) to move backwards through the levels: parameter to submenu; submenu to menu; menu to Home Page.
- Press and hold the Infinity Key \( \hat{\rightarrow} \) for two seconds to return to the Home Page.

Note:
Avoid continuous writes within loops. Excessive writes to EEPROM will cause premature EEPROM failure. The EEPROM is rated for 1,000,000 writes.

Navigating the Operations Page

Note:
Some of these menus and parameters may not appear, depending on the controller's options. See model number information in the Appendix for more information.

If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter name</th>
<th>Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Analog Input Menu</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Analog Input 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>![Ain]</td>
<td><strong>Process Value</strong></td>
<td>View the process value.</td>
<td></td>
<td>-1,999.000 to 9,999.000°F or units</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>![i.Er]</td>
<td><strong>Error Status</strong></td>
<td>View the cause of the most recent error. If the message is [Err.1] or [Err.2], this parameter will display the cause of the input error.</td>
<td></td>
<td>None</td>
<td>None</td>
<td>always</td>
</tr>
<tr>
<td>![i.CA]</td>
<td><strong>Calibration Offset</strong></td>
<td>Offset the input reading to compensate for lead wire resistance or other factors that cause the input reading to vary from the actual process value.</td>
<td></td>
<td>-1,999.000 to 9,999.000°F or units</td>
<td>0.0</td>
<td>always</td>
</tr>
<tr>
<td>![d.o]</td>
<td><strong>Digital Input/Output Menu</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>![d.5]</td>
<td><strong>Digital Input (5 or 6)</strong></td>
<td><strong>Output State</strong></td>
<td>View the state of this output.</td>
<td>On</td>
<td>Off</td>
<td>always</td>
</tr>
<tr>
<td>![E.5]</td>
<td><strong>Digital Input (5 or 6)</strong></td>
<td><strong>Event Input Status</strong></td>
<td>View this event input state.</td>
<td>Inactive</td>
<td>Active</td>
<td>always</td>
</tr>
<tr>
<td></td>
<td><strong>Monitor Menu</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>![C.MA]</td>
<td><strong>Control Mode Active</strong></td>
<td>View the current control mode.</td>
<td>Off</td>
<td>Auto</td>
<td>Manual</td>
<td>always</td>
</tr>
<tr>
<td>![h.Pr]</td>
<td><strong>Heat Power</strong></td>
<td>View the current heat output level.</td>
<td>0.0 to 100.0%</td>
<td>0.0</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>![C.Pr]</td>
<td><strong>Cool Power</strong></td>
<td>View the current cool output level.</td>
<td>-100.0 to 0.0%</td>
<td>0.0</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>![C.SP]</td>
<td><strong>Closed Loop Working Set Point</strong></td>
<td>View the set point currently in effect.</td>
<td>-1,999.000 to 9,999.000°F or units</td>
<td>75°F or units 24°C</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>![P.v.A]</td>
<td><strong>Process Value Active</strong></td>
<td>View the current filtered process value using the control input.</td>
<td>-1,999.000 to 9,999.000°F or units</td>
<td>-1,128.000 to 5,537.000°C</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Loop Menu</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>![L.o]</td>
<td><strong>Control Mode</strong></td>
<td>Select the method that the controller will use to control.</td>
<td>Off</td>
<td>Auto (closed loop)</td>
<td>Manual (open loop)</td>
<td>always</td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.

If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter name</th>
<th>Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>[A.tSP]</td>
<td>Loop Autotune Set Point</td>
<td>Set the set point that the autotune will use, as a percentage of the current set point.</td>
<td>50.0 to 200.0%</td>
<td>90.0</td>
<td>Heat Algorithm or Cool Algorithm (Setup Page) is set to PID.</td>
<td></td>
</tr>
<tr>
<td>[A.aut]</td>
<td>Loop Autotune Request</td>
<td>Start an autotune. While autotune is active, the Home Page will display [k^\text{Un}\text{t}k^\text{Un}\text{t}]. When the autotune is complete, the message will clear automatically.</td>
<td></td>
<td></td>
<td>Heat Algorithm or Cool Algorithm (Setup Page) is set to PID.</td>
<td></td>
</tr>
<tr>
<td>[C.SP]</td>
<td>Loop Closed Loop Set Point</td>
<td>Set the set point that the controller will automatically control to.</td>
<td>Low Set Point to High Set Point (Setup Page)</td>
<td>75°F or units 24°C</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>[id.S]</td>
<td>Loop Idle Set Point</td>
<td>Set a closed loop set point that can be triggered by an event state.</td>
<td>Low Set Point to High Set Point (Setup Page)</td>
<td>75°F or units 24°C</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>[h.Pb]</td>
<td>Loop Heat Proportional Band</td>
<td>Set the PID proportional band for the heat outputs.</td>
<td>0 to 9,999.000°F or units 0 to 5,555.000°C</td>
<td>25.0°F or units 14.0°C</td>
<td>Heat Algorithm (Setup Page) is set to PID.</td>
<td></td>
</tr>
<tr>
<td>[h.hy]</td>
<td>Loop Heat Hysteresis</td>
<td>Set the control switching hysteresis for on-off control. This determines how far into the “on” region the process value needs to move before the output turns on.</td>
<td>0 to 9,999.000°F or units 0 to 5,555.000°C</td>
<td>3.0°F or units 2.0°C</td>
<td>Heat Algorithm (Setup Page) is set to On-Off.</td>
<td></td>
</tr>
<tr>
<td>[C.Pb]</td>
<td>Loop Cool Proportional Band</td>
<td>Set the PID proportional band for the cool outputs.</td>
<td>0 to 9,999.000°F or units 0 to 5,555.000°C</td>
<td>25.0°F or units 14.0°C</td>
<td>Cool Algorithm (Setup Page) is set to PID.</td>
<td></td>
</tr>
<tr>
<td>[C.hy]</td>
<td>Loop Cool Hysteresis</td>
<td>Set the control switching hysteresis for on-off control. This determines how far into the “on” region the process value needs to move before the output turns on.</td>
<td>0 to 9,999.000°F or units 0 to 5,555.000°C</td>
<td>3.0°F or units 2.0°C</td>
<td>Cool Algorithm (Setup Page) is set to On-Off.</td>
<td></td>
</tr>
<tr>
<td>[ti]</td>
<td>Loop Time Integral</td>
<td>Set the PID integral for the outputs.</td>
<td>0 to 9,999 seconds per repeat</td>
<td>180.0 seconds per repeat</td>
<td>Heat Algorithm or Cool Algorithm (Setup Page) is set to PID.</td>
<td></td>
</tr>
<tr>
<td>[td]</td>
<td>Loop Time Derivative</td>
<td>Set the PID derivative time for the outputs.</td>
<td>0 to 9,999 seconds</td>
<td>0.0 seconds</td>
<td>Heat Algorithm or Cool Algorithm (Setup Page) is set to PID.</td>
<td></td>
</tr>
<tr>
<td>[db]</td>
<td>Loop Dead Band</td>
<td>Set the offset to the proportional band. With a negative value, both heating and cooling outputs are active when the process value is near the set point. A positive value keeps heating and cooling outputs from fighting each other.</td>
<td>-1,000.0 to 1,000.0°F or units -5,555.000 to 5,555,000°C</td>
<td>0.0</td>
<td>Heat Algorithm and Cool Algorithm (Setup Page) are set to PID or On-Off.</td>
<td></td>
</tr>
<tr>
<td>[o.SP]</td>
<td>Loop Open Loop Set Point</td>
<td>Set a fixed level of output power when in manual (open-loop) mode.</td>
<td>-100 to 100% (heat and cool) 0 to 100% (heat only) -100 to 0% (cool only)</td>
<td>0.0</td>
<td>always</td>
<td></td>
</tr>
</tbody>
</table>

### Alarm Menu

<table>
<thead>
<tr>
<th>Alarm Menu</th>
<th>Alarm 1</th>
<th>Alarm 2</th>
<th>Alarm 3</th>
<th>Alarm 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm Menu</td>
<td>Alarm 1</td>
<td>Alarm 2</td>
<td>Alarm 3</td>
<td>Alarm 4</td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.

If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter name</th>
<th>Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>![RL](a. Lo)</td>
<td>low Alarm (1 to 4)</td>
<td>Low Set Point</td>
<td>-1,999.000 to 9,999.000°F or units -1,128.000 to 5,537.000°C</td>
<td>-1,128.000 to 5,537.000°C</td>
<td>32.0°F or units 0.0°C</td>
<td>Alarm Sides (Setup Page) is not set to High.</td>
</tr>
<tr>
<td>![RH](a. hi)</td>
<td>High Set Point</td>
<td>-1,999.000 to 9,999.000°F or units -1,128.000 to 5,537.000°C</td>
<td>300.0°F or units 150.0°C</td>
<td>Alarm Sides (Setup Page) is not set to Low.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Profile Status Menu (menu appears if PM _ R _ _ _ AAAA _ _)

* Some parameters in the Profile Status Menu can be changed for the currently running profile, but should only be changed by knowledgeable personnel and with caution. Changing parameters via the Profile Status Menu will not change the stored profile but will have an immediate impact on the profile that is running.

Changes made to profile parameters in the Profiling Pages will be saved and will also have an immediate impact on the running profile.

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter name</th>
<th>Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="PStr" alt="PsKr" /></td>
<td>Profile Start</td>
<td>Select a step or profile to load.</td>
<td>1 to 40</td>
<td>0 (none)</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td><img src="PACr" alt="PACr" /></td>
<td>Profile Action Request</td>
<td>Select what action to apply to the currently loaded profile.</td>
<td>None</td>
<td>None</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td><img src="S.typ" alt="StP" /></td>
<td>Active Step</td>
<td>View the currently running step.</td>
<td>0 to 40</td>
<td>0 (none)</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td><img src="S.typ" alt="StP" /></td>
<td>Active Step Type</td>
<td>View the currently running step type.</td>
<td>Unused Step</td>
<td>Unused Step</td>
<td>a profile is active.</td>
<td></td>
</tr>
<tr>
<td><img src="tg.SP" alt="tg.SP" /></td>
<td>Active Target Set Point</td>
<td>View or change the target set point of the current step.</td>
<td>-1,999.000 to 9,999.000°F or units -1,128.000 to 5,537.000°C</td>
<td>0.0°F or units -18.0°C</td>
<td>a profile is active.</td>
<td></td>
</tr>
<tr>
<td><img src="AC.SP" alt="AC.SP" /></td>
<td>Active Set Point</td>
<td>Display the current set point, even if the profile is ramping.</td>
<td>-1,999.000 to 9,999.000°F or units -1,128.000 to 5,537.000°C</td>
<td>0.0°F or units -18.0°C</td>
<td>always</td>
<td></td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.

If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter name Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{SE}_{i}$</td>
<td>Profile Status</td>
<td><em>Step Time Remaining</em></td>
<td>View or change the time remaining for the current step. Step is displayed in seconds. If the time exceeds 9,999 seconds, the display will show 9,999 and remain there while the control continues to decrement internally. Once the remaining time is equal to or less than 9,999 the display will represent the actual seconds remaining. As an example, if a three-hour soak time is currently being monitored, the first value displayed will be 9,999, and the display will remain at 9,999 until the remaining time is approximately equal to 2 hours and 46 minutes. At this point the display will track the actual seconds remaining.</td>
<td>0 to 9,999.000 seconds</td>
<td>0.0</td>
</tr>
<tr>
<td>$\text{SE}_{k}$</td>
<td>Profile Status</td>
<td><em>Active Event Output (1 or 2)</em></td>
<td>View or change the event output states of the current step.</td>
<td>$\text{off}$ Off</td>
<td>Off</td>
</tr>
<tr>
<td>$\text{SE}_{n}$</td>
<td>Profile Status</td>
<td>Jump Count Remaining</td>
<td>View the jump counts remaining for the current loop. In a profile with nested loops, this may not indicate the actual jump counts remaining.</td>
<td>0 to 9,999</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.

If there is only one instance of a menu, no submenus will appear.
### Chapter 6: Setup Page

#### Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Type</td>
<td>Linearization</td>
</tr>
<tr>
<td>In/Out</td>
<td>Function</td>
</tr>
<tr>
<td>Output Control</td>
<td>Base</td>
</tr>
<tr>
<td>Output Time</td>
<td>Source</td>
</tr>
<tr>
<td>Output Low Power</td>
<td>Scale Low</td>
</tr>
<tr>
<td>Output High Power</td>
<td>Scale High</td>
</tr>
<tr>
<td>Output Function</td>
<td>Scale Low</td>
</tr>
<tr>
<td>Digital Input Level</td>
<td>Scale High</td>
</tr>
<tr>
<td>Digital Input Function</td>
<td>Scale Low</td>
</tr>
<tr>
<td>Digital Input Function Instance</td>
<td>Scale High</td>
</tr>
</tbody>
</table>

#### Navigating the Setup Page

**Note:**
Some of these menus and parameters may not appear, depending on the controller's options. See model number information in the Appendix for more information.

If there is only one instance of a menu, no submenus will appear.
To go to the Setup Page from the Home Page, press both the Up ☆ and Down ☇ keys for six seconds. [ Ai ] will appear in the upper display and [ Set ] will appear in the lower display.

- Press the Up ☆ or Down ☇ key to move through the menus.
- Press the Advance Key ☇ to move to a submenu.
- Press the Up ☆ or Down ☇ key to move through the submenus.
- Press the Advance Key ☇ to move through the parameters of the menu or submenu.
- Press and hold the Infinity Key ☇ for two seconds to return to the Home Page.

**Note:** Avoid continuous writes within loops. Excessive writes to EEPROM will cause premature EEPROM failure. The EEPROM is rated for 1,000,000 writes.

### Analog Input Menu

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ Ai ]</td>
<td>[ Set ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Input 1**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Settings</th>
<th>Description</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Type</td>
<td>Off</td>
<td>Thermocouple</td>
<td>-</td>
<td></td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>Thermocouple</td>
<td>-</td>
<td></td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>Thermocouple</td>
<td>-</td>
<td></td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>Thermocouple</td>
<td>-</td>
<td></td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>Thermocouple</td>
<td>-</td>
<td></td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>Thermocouple</td>
<td>-</td>
<td></td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>Thermocouple</td>
<td>-</td>
<td></td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>R</td>
<td>Thermocouple</td>
<td>-</td>
<td></td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>Thermocouple</td>
<td>-</td>
<td></td>
<td>Always</td>
</tr>
<tr>
<td></td>
<td>T</td>
<td>Thermocouple</td>
<td>-</td>
<td></td>
<td>Always</td>
</tr>
</tbody>
</table>

**Linearization**

- Set the linearization to match the thermocouple type wired to this input.

**Input 1**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Settings</th>
<th>Description</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTD Leads</td>
<td>2</td>
<td>RTD 100 Ω</td>
<td>-1,999.000 to 9,999.000</td>
<td>0.0</td>
<td>Sensor Type is set to Millivolts, Volts, Milliamps or Potentiometer 1 kΩ</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>RTD 1,000 Ω</td>
<td>-1,999.000 to 9,999.000°C</td>
<td>9,999.0</td>
<td>Sensor Type is set to Millivolts, Volts, Milliamps or Potentiometer 1 kΩ</td>
</tr>
<tr>
<td>Scale Low</td>
<td>0.0</td>
<td>Low</td>
<td>0.0</td>
<td>20.0</td>
<td>Sensor Type is set to Millivolts, Volts, Milliamps or Potentiometer 1 kΩ</td>
</tr>
<tr>
<td>Scale High</td>
<td>19999.000</td>
<td>High</td>
<td>0.0</td>
<td>9999.0</td>
<td>Sensor Type is set to Millivolts, Volts, Milliamps or Potentiometer 1 kΩ</td>
</tr>
<tr>
<td>Process Error Enable</td>
<td>Off</td>
<td>Low</td>
<td>0.0</td>
<td>9999.0</td>
<td>Sensor Type is set to Millivolts, Volts, Milliamps or Potentiometer 1 kΩ</td>
</tr>
</tbody>
</table>

**Note:** Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>PEL</code></td>
<td>Input 1 Process Error Low If the process value drops below this value, it will trigger an input error.</td>
<td>-100.0 to 1,000.0</td>
<td>0.0</td>
<td>Sensor Type is set to Millivolts, Volts, Milliamps or Potentiometer 1 kΩ, and Error Enable is set to Low.</td>
<td></td>
</tr>
<tr>
<td><code>FL</code></td>
<td>Input 1 Filter Time Filtering smooths out the process signal to both the display and the input. Increase the time to increase filtering.</td>
<td>0.0 to 60.0 seconds</td>
<td>0.5</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td><code>iEr</code></td>
<td>Input 1 Error Latching Turn input error latching on or off. If latching is on errors must be manually cleared.</td>
<td>Off</td>
<td>Off</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td><code>dEC</code></td>
<td>Input 1 Decimal Set the precision of the displayed value.</td>
<td>Whole</td>
<td>Whole</td>
<td>always</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SEL</th>
<th>Digital Input or Output Menu</th>
<th>Digital Input or Output 5</th>
<th>Digital Input or Output 6</th>
<th>(menu appears if PM _ _ [2 or 4] _ _- AAAA _)</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>dir</code></td>
<td>Direction Set the function to an input or output.</td>
<td>Output Voltage Output Dry Contact</td>
<td>Output</td>
<td>always</td>
</tr>
<tr>
<td><code>Fn</code></td>
<td>Function Select what function will drive this output.</td>
<td>Off Cool Heat Alarm Event</td>
<td>Off</td>
<td>Direction is set to Output.</td>
</tr>
<tr>
<td><code>o.Ct</code></td>
<td>Control Set the output control type. This parameter is only used with PID control, but can be set anytime.</td>
<td>Fixed Time Base Variable Time Base</td>
<td>Fixed Time Base</td>
<td>Direction is set to Output.</td>
</tr>
<tr>
<td><code>o.tb</code></td>
<td>Time Base Set the time base for fixed-time-base control.</td>
<td>0.1 to 60.0 seconds (solid-state relay or switched dc) 5.0 to 60.0 seconds (mechanical relay or no-arc power control)</td>
<td>0.1 sec. [SSR &amp; sw dc] 20.0 sec. [mech, relay, no-arc]</td>
<td>Control is set to Fixed Time Base.</td>
</tr>
<tr>
<td><code>o.Lo</code></td>
<td>Low Power Scale The power output will never be less than the value specified and will represent the value at which output scaling begins.</td>
<td>0.0 to 100.0%</td>
<td>0.0%</td>
<td>Direction is set to Output and Source is set to Heat or Cool.</td>
</tr>
<tr>
<td><code>o.hi</code></td>
<td>High Power Scale The power output will never be greater than the value specified and will represent the value at which output scaling stops.</td>
<td>0.0 to 100.0%</td>
<td>100.0%</td>
<td>Direction is set to Output and Source is set to Heat or Cool.</td>
</tr>
<tr>
<td><code>Fi</code></td>
<td>Function Instance Select which source instance will drive the output.</td>
<td>1 to 4</td>
<td>1 (output 5) 2 (output 6)</td>
<td>Direction is set to Output, and there is more than one instance of the Function selection.</td>
</tr>
<tr>
<td><code>Leu</code></td>
<td>Digital Input (5 or 6) Level Select what action will be interpreted as a true state.</td>
<td>High Low</td>
<td>High Low</td>
<td>Direction is set to Input Voltage or Input Dry Contact.</td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.

If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Fn]</td>
<td>Digital Input (5 or 6) Function</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Select the function that will be triggered by a true state. Functions respond to a level state change or an edge level change.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Fn]</td>
<td>Digital Input (5 or 6) Function Instance</td>
<td></td>
<td></td>
<td>0 All Instances (except profiles)</td>
<td>Direction is set to Input Voltage or Input Dry Contact, and the feature is available.</td>
</tr>
<tr>
<td></td>
<td>Select which instance of the Event Function will be triggered by a true state.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loop</td>
<td>Heat Algorithm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[h.Ag]</td>
<td>Set the heat control method.</td>
<td></td>
<td>Off</td>
<td>PID</td>
<td>PID always</td>
</tr>
<tr>
<td></td>
<td>PID</td>
<td>PID</td>
<td>On-Off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loop</td>
<td>Cool Algorithm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[C.Ag]</td>
<td>Set the cool control method.</td>
<td></td>
<td>Off</td>
<td>PID</td>
<td>Off always</td>
</tr>
<tr>
<td></td>
<td>PID</td>
<td>PID</td>
<td>On-Off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loop</td>
<td>Cool Output Curve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[C.Cr]</td>
<td>Select a special cool output curve to change the responsiveness of the system.</td>
<td></td>
<td>Off</td>
<td>Cool Algorithm is set to Off.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>Curve A</td>
<td>Curve B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loop</td>
<td>TRU-TUNE4® Enable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[t.tUn]</td>
<td>Enable or disable the TRU-TUNE4® adaptive tuning feature.</td>
<td></td>
<td>No</td>
<td>No</td>
<td>Cool Algorithm or Heat Algorithm is set to PID.</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loop</td>
<td>TRU-TUNE4® Band</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[t.bnd]</td>
<td>Set the range, centered on the set point, within which TRU-TUNE4® will be in effect. Use this function only if the controller is unable to adaptive tune automatically.</td>
<td></td>
<td>0 Auto</td>
<td>Cool Algorithm or Heat Algorithm is set to PID and TRU-TUNE4® Enable is set to Yes.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 to 1,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.

If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>TRU-TUNE+® Gain</td>
<td>Select the responsiveness of the TRU-TUNE+® adaptive tuning calculations. More responsiveness may increase overshoot.</td>
<td>1 to 6 Most to least responsive</td>
<td>3</td>
<td>Cool Algorithm or Heat Algorithm is set to PID and TRU-TUNE+® Enable is set to Yes.</td>
</tr>
<tr>
<td>Display</td>
<td>Autotune Aggressiveness</td>
<td>Select the aggressiveness of the autotuning calculations.</td>
<td>Under damped Critical damped Over damped</td>
<td>Critical</td>
<td>Cool Algorithm or Heat Algorithm is set to PID.</td>
</tr>
<tr>
<td>Display</td>
<td>User Failure Action</td>
<td>Select what the controller outputs will do when the user switches control to manual mode.</td>
<td>Off, sets output power to 0% Bumpless, maintains same output power, if it was less than 75% and stable, otherwise 0% Manual Fixed, sets output power to Manual Power setting User, sets output power to last open-loop set point the user entered</td>
<td>Off always</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>Manual Power</td>
<td>Set the manual output power level that will take effect if an input error failure occurs.</td>
<td>Set Point Open Loop Limit Low to Set Point Open Loop Limit High (Setup Page)</td>
<td>0.0</td>
<td>Input Error Failure is set to Manual Fixed.</td>
</tr>
<tr>
<td>Display</td>
<td>Open Loop Detect Enable</td>
<td>Turn on the open-loop detect feature to monitor a closed-loop operation for the appropriate response.</td>
<td>No Yes</td>
<td>No</td>
<td>controller is equipped with a current transformer input (PM6 _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _).</td>
</tr>
<tr>
<td>Display</td>
<td>Open Loop Detect Time</td>
<td>The Open Loop Detect Deviation value must occur for this time period to trigger an open-loop error.</td>
<td>0 to 3,600 seconds</td>
<td>240</td>
<td>Open Loop Detect Enable is set to Yes.</td>
</tr>
<tr>
<td>Display</td>
<td>Open Loop Detect Deviation</td>
<td>Set the value that the process must deviate from the set point to trigger an open-loop error.</td>
<td>-1,999,000 to 9,999,000°F or units -1,110.555 to 5,555.000°C</td>
<td>10.0°F or units -6.0°C</td>
<td>Open Loop Detect Enable is set to Yes.</td>
</tr>
<tr>
<td>Display</td>
<td>Ramp Action</td>
<td>Select when the controller’s set point will ramp to the defined end set point.</td>
<td>Off Startup Set Point Change Both</td>
<td>Off always</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>Ramp Scale</td>
<td>Select the scale of the ramp rate.</td>
<td>Hours Minutes</td>
<td>Minutes</td>
<td>Ramp Action is set to Startup, Set Point or Both.</td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.

If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name</th>
<th>Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>r.t</code></td>
<td>Loop</td>
<td>Ramp Rate</td>
<td>Set the rate for the set point ramp. Set the time units for the rate with the Ramp Scale parameter.</td>
<td>0 to 9,999°F or units 0 to 5,555.000°C</td>
<td>1.0°F or units 1.0°C</td>
<td>Ramp Action is set to Startup, Set Point or Both.</td>
</tr>
<tr>
<td><code>L.SP</code></td>
<td>Loop</td>
<td>Low Set Point</td>
<td>Set the low end of the set point range.</td>
<td>-1,999.000 to 9,999.000°F or units -1,128.000 to 5,537.000°C</td>
<td>-1,999.000°F or units -1,128.00°C</td>
<td>always</td>
</tr>
<tr>
<td><code>h.SP</code></td>
<td>Loop</td>
<td>High Set Point</td>
<td>Set the high end of the set point range.</td>
<td>-1,999.000 to 9,999.000°F or units -1,128.000 to 5,537.000°C</td>
<td>9,999.000°F or units 5,537.000°C</td>
<td>always</td>
</tr>
<tr>
<td><code>SP.Lo</code></td>
<td>Loop</td>
<td>Set Point Low Limit Open Loop</td>
<td>Set the minimum value of the open-loop set point range.</td>
<td>-100 to 100%</td>
<td>-100</td>
<td>always</td>
</tr>
<tr>
<td><code>SP.hi</code></td>
<td>Loop</td>
<td>Set Point High Limit Open Loop</td>
<td>Set the maximum value of the open-loop set point range.</td>
<td>-100 to 100%</td>
<td>100</td>
<td>always</td>
</tr>
<tr>
<td><code>otPt</code></td>
<td>Output Menu</td>
<td>Output 1</td>
<td>Output 2</td>
<td>(check model number for output information)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>ty</code></td>
<td>Output Type</td>
<td>Select whether the process output will operate in volts or milliamps.</td>
<td><code>V</code></td>
<td>Volts</td>
<td>Milliamps</td>
<td></td>
</tr>
<tr>
<td><code>ty</code></td>
<td>Output Function</td>
<td>Select what function will drive this output.</td>
<td><code>O</code></td>
<td>Off</td>
<td>Heat</td>
<td></td>
</tr>
<tr>
<td><code>ty</code></td>
<td>Retransmit Source</td>
<td>Select the value that will be retransmitted.</td>
<td><code>A</code></td>
<td>Analog Input</td>
<td>Set Point</td>
<td></td>
</tr>
<tr>
<td><code>ty</code></td>
<td>Function Instance</td>
<td>Select which source instance will drive the output.</td>
<td><code>S</code></td>
<td>1 to 4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><code>S.Lo</code></td>
<td>Output Scale Low</td>
<td>Set the minimum value of the process output range in electrical units.</td>
<td><code>S</code></td>
<td>0.00 to 20.00</td>
<td>0.00</td>
<td>a process output (PM __ _ _ F __ AAAA ___) and there is more than one instance of the Function selection.</td>
</tr>
<tr>
<td><code>S.hi</code></td>
<td>Output Scale High</td>
<td>Set the maximum value of the process output range in electrical units.</td>
<td><code>S</code></td>
<td>0.00 to 20.00</td>
<td>10.00</td>
<td>a process output (PM __ _ _ F __ AAAA ___) and Function is set to Re-transmit.</td>
</tr>
<tr>
<td><code>r.Lo</code></td>
<td>Output Range Low</td>
<td>Set the minimum value of the retransmit value range in process units. When the retransmit source is at this value, the retransmit output will be at its Scale Low value.</td>
<td><code>r</code></td>
<td>-1,999.000 to 9,999.000°F or units -1,128.000 to 5,537.000°C</td>
<td>0.0°F or units -18.0°C</td>
<td>a process output (PM __ _ _ F __ AAAA ___) and Function is set to Re-transmit.</td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.

If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>r.hi</code></td>
<td>Output 1 Range High</td>
<td>-1,999.000 to 9,999.000°F or units 9,999.0°F or units 5,537.0°C</td>
<td>a process output (PM <code>_ _ </code> _ _ F _ <em>-</em> AAAA _) and Function is set to Re-transmit.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>o.hi</code></td>
<td>Output 1 High Power Scale</td>
<td>0.0 to 100.0%</td>
<td>100.0</td>
<td>a process output (PM <code>_ _ </code> _ _ F _ <em>-</em> AAAA _) and Function is set to Heat or Cool.</td>
<td></td>
</tr>
<tr>
<td><code>o.CA</code></td>
<td>Output 1 Calibration Offset</td>
<td>-1,999.000 to 9,999.000°F or units -1,110.555 to 5,555.000°C</td>
<td>0.0</td>
<td>a process output (PM <code>_ _ </code> _ _ F _ <em>-</em> AAAA _)</td>
<td></td>
</tr>
<tr>
<td><code>Fn</code></td>
<td>Output (1or 2) Function</td>
<td>1 to 4</td>
<td>1</td>
<td>a time-proportioned output (solid-state relay, switched dc or mechanical relay) and there is more than one instance of the Function selection.</td>
<td></td>
</tr>
<tr>
<td><code>t.b</code></td>
<td>Output (1 or 2) Time Base</td>
<td>0.1 to 60.0 seconds (solid-state relay or switched dc) 5.0 to 60.0 seconds (mechanical relay &amp; no-arc power control)</td>
<td>0.1 sec. [SSR &amp; sw dc] 20.0 sec. [mech. relay &amp; no-arc]</td>
<td>a time-proportioned output (solid-state relay, switched dc or mechanical relay) and Control is set to Fixed Time Base.</td>
<td></td>
</tr>
<tr>
<td><code>o.Lo</code></td>
<td>Output 1 Low Power Scale</td>
<td>0.0 to 100.0%</td>
<td>0.0%</td>
<td>a time-proportioned output (solid-state relay, switched dc or mechanical relay) and Source is set to Heat or Cool.</td>
<td></td>
</tr>
<tr>
<td><code>o.hi</code></td>
<td>Output 1 High Power Scale</td>
<td>0.0 to 100.0%</td>
<td>100.0</td>
<td>a time-proportioned output (solid-state relay, switched dc or mechanical relay) and Source is set to Heat or Cool.</td>
<td></td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.

If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Alm]</td>
<td>Alarm Menu</td>
<td>Alarm Menu</td>
<td>Alarm 1</td>
<td>Alarm 2</td>
<td>Alarm 3</td>
</tr>
<tr>
<td>[A;ty]</td>
<td>Alarm (1 to 4) Type</td>
<td>.off</td>
<td>Off</td>
<td>Pr.AL</td>
<td>Process Alarm</td>
</tr>
<tr>
<td>[Sr;A]</td>
<td>Alarm (1 to 4) Source</td>
<td>Analог In</td>
<td>Analog Input</td>
<td>Power (process only)</td>
<td>Current (process only)</td>
</tr>
<tr>
<td>[A.hy]</td>
<td>Alarm (1 to 4) Hysteresis</td>
<td>0.001 to 9,999.000°F or units 0.001 to 5,555.000°C</td>
<td>1.0°F or units 1.0°C</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>[A.Lg]</td>
<td>Alarm (1 to 4) Logic</td>
<td>Close On Alarm</td>
<td>Close On Alarm</td>
<td>Open On Alarm</td>
<td>Close On Alarm</td>
</tr>
<tr>
<td>[A.Sd]</td>
<td>Alarm (1 to 4) Sides</td>
<td>Both</td>
<td>Both</td>
<td>high</td>
<td>High</td>
</tr>
<tr>
<td>[A.LA]</td>
<td>Alarm (1 to 4) Latching</td>
<td>Non-Latching</td>
<td>Non-Latching</td>
<td>Latching</td>
<td>Non-Latching</td>
</tr>
<tr>
<td>[A.hL]</td>
<td>Alarm (1 to 4) Blocking</td>
<td>Off</td>
<td>Off</td>
<td>Startup</td>
<td>Set Point</td>
</tr>
<tr>
<td>[A.Si]</td>
<td>Alarm (1 to 4) Silencing</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>[A.dSP]</td>
<td>Alarm (1 to 4) Display</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>[A.dL]</td>
<td>Alarm (1 to 4) Delay</td>
<td>0 to 9,999 seconds</td>
<td>0</td>
<td>always</td>
<td></td>
</tr>
</tbody>
</table>

Function Key Menu  (1/32 DIN models do not have a Function Key.)

<table>
<thead>
<tr>
<th>Function Key Menu</th>
<th>Level</th>
<th>Description</th>
<th>Settings</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>[LEw]</td>
<td></td>
<td>Function Key Level</td>
<td>High</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.

If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fn</td>
<td><strong>Function Key</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Digital Input Function</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Program the EZ Key to trigger an action. Functions respond to a level state change or an edge level change.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fn</td>
<td><strong>Function Key</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Instance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Select which instance the EZ Key will affect. If only one instance is available, any selection will affect it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gL bL</td>
<td><strong>Global Menu</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gSE</td>
<td>Display Units</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Select which units will be displayed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC LF</td>
<td>AC Line Frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Set the frequency to the applied ac line power source.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pyp</td>
<td>Profile Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Set the profile startup to be based on a set point or a process value.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gSE</td>
<td>Guaranteed Soak Enable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enables the guaranteed soak deviation function in profiles.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gSd</td>
<td>Guaranteed Soak Deviation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Set the value of the deviation band that will be used in all profile step types. The process value must enter the deviation band before the step can proceed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces. If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name</th>
<th>Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCoL</td>
<td>Communications</td>
<td>Protocol</td>
<td>[Std]</td>
<td>Modbus</td>
<td>the controller includes Modbus RTU (PM6 _ _ _ _1 AAAA _ _).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Address</td>
<td>Standard Bus</td>
<td></td>
<td>1 to 16</td>
<td>1</td>
<td>always</td>
</tr>
<tr>
<td></td>
<td>Address</td>
<td>Modbus</td>
<td></td>
<td>1 to 247</td>
<td>1</td>
<td>Protocol is set to Modbus Range depends on the model.</td>
</tr>
<tr>
<td>Ad.M</td>
<td>Baud Rate</td>
<td>Modbus</td>
<td></td>
<td>9,600</td>
<td>9,600</td>
<td>always</td>
</tr>
<tr>
<td>[bAUd]</td>
<td>Parity</td>
<td>Modbus</td>
<td>[none]</td>
<td>9,600</td>
<td></td>
<td>Range depends on the model.</td>
</tr>
<tr>
<td></td>
<td>Parity</td>
<td>Even</td>
<td>[EuEn]</td>
<td>9,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parity</td>
<td>Odd</td>
<td>[odd]</td>
<td>9,600</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with other interfaces.

If there is only one instance of a menu, no submenus will appear.
Chapter 7: Profiling Page

Navigating the Profiling Page

Note:
Some of these menus and parameters may not appear, depending on the controller's options. See model number information in the Appendix for more information.

If there is only one instance of a menu, no submenus will appear.
The Profiling Page allows you to enter your ramp and soak profile information.

To go to the Profiling Page from the Home Page, press the Advance Key for three seconds, until appears in the lower display and the profile number appears in the upper display. Press the Up or Down key to change to another profile.

- Press the Advance Key to move to the selected profile's first step.
- Press the Up or Down keys to move through the steps.
- Press the Advance Key to move through the selected step's settings.
- Press the Up or Down keys to change the step's settings.
- Press the Infinity Key at any time to return to the step number prompt.
- Press the Infinity Key again to return to the profile number prompt.
- From any point press and hold the Infinity Key for two seconds to return to the Home Page.

**Note:** Changes made to profile parameters in the Profiling Pages will be saved and will also have an immediate impact on the running profile.

Some parameters in the Profile Status Menu can be changed for the currently running profile, but should only be changed by knowledgeable personnel and with caution. Changing parameters via the Profile Status Menu will not change the stored profile but will have an immediate impact on the profile that is running.

### How to Start a Profile

After defining the profile follow the steps below to run the profile:

1. From the Home Page push the Advance Key repeatedly until Profile Start appears in the lower display.
2. Use the Up or Down key to choose the step number where you want the profile to begin running.
3. Press the Advance Key. This takes you to Profile Action where you can select the appropriate action.
   - **none** No action
   - **ProF** Begin execution from first step of the specified profile number, whether it exists or not.
   - **PAUS** Pause the currently running profile.
   - **rESU** Resume running the profile from the previously paused step.
   - **End** End the profile.
   - **STEP** Begin running the profile from the specified step number.

**Note:** Avoid continuous writes within loops. Excessive writes to EEPROM will cause premature EEPROM failure. The EEPROM is rated for 1,000,000 writes.

---

### Display Parameter name Description

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter name Description</th>
<th>Settings (Integer values for Modbus in parentheses.)</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pr.of</td>
<td>Profile</td>
<td>Select the profile to be edited or viewed.</td>
<td>P1 to P4</td>
<td>always</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>always</td>
</tr>
<tr>
<td>STyp</td>
<td>Step Type</td>
<td>Select a step type.</td>
<td>Unused</td>
<td>always</td>
</tr>
<tr>
<td>STyp</td>
<td>Target Set Point</td>
<td>Select the set point for this step.</td>
<td>-1999.000 to 9999.000°F or units -1128.000 to 5537.000°C</td>
<td>Step Type is set to Time, Rate, Wait for Process or Wait for Both</td>
</tr>
</tbody>
</table>

**Note:** Some values will be rounded off to fit in the four-character display. Full values can be read with another interface.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter name Description</th>
<th>Settings</th>
<th>Range (Integer values for Modbus in parentheses.)</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours</td>
<td>Step Type Parameters</td>
<td>0 to 99</td>
<td>0</td>
<td>Step Type is set to Time or Soak.</td>
<td></td>
</tr>
<tr>
<td>Minutes</td>
<td>Step Type Parameters</td>
<td>0 to 59</td>
<td>0</td>
<td>Step Type is set to Time or Soak.</td>
<td></td>
</tr>
<tr>
<td>Seconds</td>
<td>Step Type Parameters</td>
<td>0 to 59</td>
<td>0</td>
<td>Step Type is set to Time or Soak.</td>
<td></td>
</tr>
<tr>
<td>Rate</td>
<td>Step Type Parameters</td>
<td>0 to 9,999.000°F or units per minute</td>
<td>0.0°F or units</td>
<td>Step Type is set to Rate.</td>
<td></td>
</tr>
<tr>
<td>Wait For Process Instance</td>
<td>Step Type Parameters</td>
<td>1 or 2</td>
<td>1</td>
<td>Step Type is set to Wait For Process.</td>
<td></td>
</tr>
<tr>
<td>Wait For Process Value</td>
<td>Step Type Parameters</td>
<td>-1,999.000 to 9,999.000°F or units</td>
<td>0.0°F or units</td>
<td>Step Type is set to Wait For Process.</td>
<td></td>
</tr>
<tr>
<td>Event State (1 and 2)</td>
<td>Step Type Parameters</td>
<td>Off, On, None</td>
<td>Off</td>
<td>Step Type is set to Wait Event or Wait for Both.</td>
<td></td>
</tr>
<tr>
<td>Jump Step</td>
<td>Step Type Parameters</td>
<td>1 to 40</td>
<td>0</td>
<td>Step Type is set to Jump Loop.</td>
<td></td>
</tr>
<tr>
<td>Jump Count</td>
<td>Step Type Parameters</td>
<td>0 to 9,999</td>
<td>0</td>
<td>Step Type is set to Jump Loop.</td>
<td></td>
</tr>
<tr>
<td>End Type</td>
<td>Step Type Parameters</td>
<td>Off, Control Mode set to Off, Hold last closed-loop set point in the profile, User, reverts to previous set point</td>
<td>User</td>
<td>Step Type is set to End.</td>
<td></td>
</tr>
<tr>
<td>Event Output (1 and 2)</td>
<td>Step Type Parameters</td>
<td>Off, On</td>
<td>Off</td>
<td>Step Type is set to Time, Rate, Soak, Wait Event, Wait for Process, Wait for Both or Jump Loop.</td>
<td></td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with another interface.
<table>
<thead>
<tr>
<th>Display</th>
<th>Step Type</th>
<th>Description</th>
<th>Parameters in Step Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Step Types</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Time</strong></td>
<td>A Time Step controls at the Target Set Point and maintains two event output states for the designated time.</td>
<td><strong>kgSP</strong> Target Set Point, <strong>hUr</strong> Hours, <strong>mIn</strong> Minutes, <strong>sec</strong> Seconds, <strong>Ent1</strong> Event Output 1, <strong>Ent2</strong> Event Output 2</td>
</tr>
<tr>
<td></td>
<td><strong>Rate</strong></td>
<td>A Rate Step ramps the process value to the Target Set Point in degrees per minute while maintaining two event output states.</td>
<td><strong>kgSP</strong> Target Set Point, <strong>ReE</strong> Rate, <strong>Ent1</strong> Event Output 1, <strong>Ent2</strong> Event Output 2</td>
</tr>
<tr>
<td></td>
<td><strong>Soak</strong></td>
<td>A Soak Step maintains the last Target Set Point and two event output states for the designated time.</td>
<td><strong>hUr</strong> Hours, <strong>mIn</strong> Minutes, <strong>sec</strong> Seconds, <strong>Ent1</strong> Event Output 1, <strong>Ent2</strong> Event Output 2</td>
</tr>
<tr>
<td></td>
<td><strong>Wait For Event</strong></td>
<td>A Wait Event Step will wait for the event input states to match the two Wait Event settings.</td>
<td><strong>wE1</strong> Wait Event 1 (digital input 5), <strong>wE2</strong> Wait Event 2 (digital input 6), <strong>Ent1</strong> Event Output 1, <strong>Ent2</strong> Event Output 2</td>
</tr>
<tr>
<td></td>
<td><strong>Wait For Process</strong></td>
<td>A Wait For Process Step will wait for the process value to match the Wait For Process value.</td>
<td><strong>wPr1</strong> Wait For Process Instance, <strong>wPr2</strong> Wait For Process Value, <strong>Ent1</strong> Event Output 1, <strong>Ent2</strong> Event Output 2</td>
</tr>
<tr>
<td></td>
<td><strong>Wait For Both</strong></td>
<td>A Wait For Both Step will wait for the process value to match the Target Set Point and for the event states to match the two event output settings</td>
<td><strong>kgSP</strong> Target Set Point, <strong>wE1</strong> Wait Event 1 (digital input 5), <strong>wE2</strong> Wait Event 2 (digital input 6), <strong>Ent1</strong> Event Output 1, <strong>Ent2</strong> Event Output 2</td>
</tr>
<tr>
<td></td>
<td><strong>Jump Loop</strong></td>
<td>A Jump Loop step will jump to the Jump Step the number of times designated in Jump Count. Loops can be nested up to four deep.</td>
<td><strong>JS</strong> Jump Step, <strong>JC</strong> Jump Count, <strong>Ent1</strong> Event Output 1, <strong>Ent2</strong> Event Output 2</td>
</tr>
<tr>
<td></td>
<td><strong>End</strong></td>
<td>An End Step will end the profile. If a profile doesn’t include an End Step, control will move to the next step. If no End Step is confronted, after step 40 control will default to the set point in effect before the profile started.</td>
<td><strong>End</strong> End Type</td>
</tr>
<tr>
<td></td>
<td><strong>Unused Step</strong></td>
<td>This is an empty step that can be used to, in effect, erase a step in a profile.</td>
<td></td>
</tr>
</tbody>
</table>
To go to the Factory Page from the Home Page, press and hold both the Advance and Infinity keys for six seconds.

- Press the Advance Key to move through the parameter prompts.
- Press the Up or Down keys to change the parameter value.
- Press the Infinity Key to return to the Home Page.

Note: Avoid continuous writes within loops. Excessive writes to EEPROM will cause premature EEPROM failure. The EEPROM is rated for 1,000,000 writes.

Navigating the Factory Page

<table>
<thead>
<tr>
<th>Home Page</th>
<th>Factory Page</th>
<th>Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press and hold both keys for 6 seconds.</td>
<td>Hold both keys for 6 seconds.</td>
<td>Custom</td>
</tr>
<tr>
<td>Custom Menu</td>
<td>Custom 1 Submenu</td>
<td>Custom 1 Parameter</td>
</tr>
<tr>
<td>Lockout Menu</td>
<td>Custom 2 to 20 Submenus</td>
<td>Custom 2 Same as above.</td>
</tr>
<tr>
<td>Diagnostic Menu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration Menu</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
Some of these menus and parameters may not appear, depending on the controller's options. See model number information in the Appendix for more information.
If there is only one instance of a menu, no submenus will appear.
### Display Parameter Name Description

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Name</th>
<th>Description</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom Menu</td>
<td>Custom Menu</td>
<td>Custom Menu</td>
<td>Custom 1</td>
<td>Custom 20</td>
<td></td>
</tr>
</tbody>
</table>

#### Parameter 1 to 20
Select the parameters that will appear in the Home Page.

The Parameter 1 value will appear in the upper display of the Home Page. It cannot be changed with the arrow keys in the Home Page.

The Parameter 2 value will appear in the lower display in the Home Page. It can be changed with the arrow keys in the Home Page if it is a writeable paragraph.

Scroll through the other Home Page parameters with the Advance Key.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Parameter Name</th>
<th>Description</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td>Process</td>
<td>Process</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Active Process Value</td>
<td>Active Process Value</td>
<td>Active Process Value</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Active Set Point</td>
<td>Active Set Point</td>
<td>Active Set Point</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Open Loop Set Point</td>
<td>Open Loop Set Point</td>
<td>Open Loop Set Point</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Input Calibration Offset</td>
<td>Input Calibration Offset</td>
<td>Input Calibration Offset</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Display Units</td>
<td>Display Units</td>
<td>Display Units</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Alarm Low Set Point</td>
<td>Alarm Low Set Point</td>
<td>Alarm Low Set Point</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Alarm High Set Point</td>
<td>Alarm High Set Point</td>
<td>Alarm High Set Point</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Alarm Hysteresis</td>
<td>Alarm Hysteresis</td>
<td>Alarm Hysteresis</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Autotune</td>
<td>Autotune</td>
<td>Autotune</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>User Control Mode</td>
<td>User Control Mode</td>
<td>User Control Mode</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Heat Power</td>
<td>Heat Power</td>
<td>Heat Power</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Cool Power</td>
<td>Cool Power</td>
<td>Cool Power</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Time Integral</td>
<td>Time Integral</td>
<td>Time Integral</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Time Derivative</td>
<td>Time Derivative</td>
<td>Time Derivative</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Dead Band</td>
<td>Dead Band</td>
<td>Dead Band</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Heat Proportional Band</td>
<td>Heat Proportional Band</td>
<td>Heat Proportional Band</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Heat Hysteresis</td>
<td>Heat Hysteresis</td>
<td>Heat Hysteresis</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Cool Proportional Band</td>
<td>Cool Proportional Band</td>
<td>Cool Proportional Band</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Cool Hysteresis</td>
<td>Cool Hysteresis</td>
<td>Cool Hysteresis</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Ramp Rate</td>
<td>Ramp Rate</td>
<td>Ramp Rate</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>TRU-TUNE+® Enable</td>
<td>TRU-TUNE+® Enable</td>
<td>TRU-TUNE+® Enable</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Idle Set Point</td>
<td>Idle Set Point</td>
<td>Idle Set Point</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Custom Menu</td>
<td>Custom Menu</td>
<td>Custom Menu</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Profile Start</td>
<td>Profile Start</td>
<td>Profile Start</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Profile Action Request</td>
<td>Profile Action Request</td>
<td>Profile Action Request</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Guaranteed Soak Deviation Value</td>
<td>Guaranteed Soak Deviation Value</td>
<td>Guaranteed Soak Deviation Value</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Home Page</td>
<td>Home Page</td>
<td>Home Page</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Profiling Page*</td>
<td>Profiling Page*</td>
<td>Profiling Page*</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Setup Page and Diagnostics Menu</td>
<td>Setup Page and Diagnostics Menu</td>
<td>Setup Page and Diagnostics Menu</td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>Lock, Calibration and Custom menus</td>
<td>Lock, Calibration and Custom menus</td>
<td>Lock, Calibration and Custom menus</td>
<td></td>
<td></td>
<td>always</td>
</tr>
</tbody>
</table>

#### Note

Some values will be rounded off to fit in the four-character display. Full values can be read with another interface.

If there is only one instance of a menu, no submenus will appear.

---

Watlow EZ-ZONE® PM PID Controller  •  42  •  Chapter 8 Factory Page
### Lockout Menu

**Parameter Name**
Set Lockout Security

**Description**
Set the write security clearance level. The user can access the selected level and all lower levels. If the Set Lockout Security level is higher than the Read Lockout Security, the Read Lockout Security level takes priority.

**Parameter Settings**
- 0 to 5
- 0: No changes allowed, except to the Lockout Menu
- 1: Home Page
- 2: Operations Page*
- 3: Profiling Page*
- 4: Setup Page and Diagnostics Menu
- 5: Lock, Calibration and Custom menus
  *You can change the security level of the Operations and Profiling pages with Lock Operations Page and Lock Profiling Page.

**Default**
5

### Diagnostics Menu

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name</th>
<th>Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>[SLoC]</td>
<td>Lockout Menu</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td></td>
<td>Set Lockout Security</td>
<td>Set the write security clearance level. The user can access the selected level and all lower levels. If the Set Lockout Security level is higher than the Read Lockout Security, the Read Lockout Security level takes priority.</td>
<td></td>
<td></td>
<td></td>
<td>always</td>
</tr>
<tr>
<td>[Pn]</td>
<td>Diagnostics Menu</td>
<td>Part Number</td>
<td>Display this controller's part number.</td>
<td>0 to 2,147,483,647</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>[rEv]</td>
<td>Diagnostics Menu</td>
<td>Software Revision</td>
<td>Display this controller's firmware revision number.</td>
<td>always</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[S.bLd]</td>
<td>Diagnostics Menu</td>
<td>Software Build</td>
<td>Display the firmware build number.</td>
<td>0 to 2,147,483,647</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>[Sn]</td>
<td>Diagnostics Menu</td>
<td>Serial Number</td>
<td>Display the serial number.</td>
<td>0 to 2,147,483,647</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>[dAtE]</td>
<td>Diagnostics Menu</td>
<td>Date of Manufacture</td>
<td>Display the date code.</td>
<td>0 to 2,147,483,647</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>[U5Sr.r]</td>
<td>Diagnostics Menu</td>
<td>User Restore Set</td>
<td>Replace all of the controller's settings with another set.</td>
<td>None</td>
<td>None</td>
<td>always</td>
</tr>
<tr>
<td>[U5Sr.S]</td>
<td>Diagnostics Menu</td>
<td>User Save Set</td>
<td>Save all of the controller's settings to the selected set.</td>
<td>None</td>
<td>None</td>
<td>always</td>
</tr>
<tr>
<td>[C.LEd]</td>
<td>Diagnostics Menu</td>
<td>Communications Indicator Light</td>
<td>Select which channel the Communications Activity indicator will monitor.</td>
<td>off: Off</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Calibration Menu

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name</th>
<th>Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Mv]</td>
<td>Calibration Menu</td>
<td>Electrical Measurement</td>
<td>Read the raw electrical value for this input in the units corresponding to the Sensor Type (Setup Page, Analog Input Menu) setting.</td>
<td>-1,999.000 to 9,999.000</td>
<td>always</td>
<td></td>
</tr>
<tr>
<td>[E Li.o]</td>
<td>Calibration Menu</td>
<td>Electrical Input Offset</td>
<td>Change this value to calibrate the low end of the input range.</td>
<td>-1,999.000 to 9,999.000</td>
<td>0.0</td>
<td>always</td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with another interface.

If there is only one instance of a menu, no submenus will appear.
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter Name</th>
<th>Description</th>
<th>Settings</th>
<th>Range</th>
<th>Default</th>
<th>Appears If</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELi,S</td>
<td>Calibration Menu</td>
<td>Electrical Input Slope</td>
<td>Adjust this value to calibrate the slope of the input value.</td>
<td>-1.999.000 to 9,999.000</td>
<td>1.0</td>
<td>always</td>
</tr>
<tr>
<td>Lao,0</td>
<td>Calibration Menu</td>
<td>Electrical Output Offset</td>
<td>Change this value to calibrate the low end of the output range.</td>
<td>-1.999.000 to 9,999.000</td>
<td>0.0</td>
<td>the controller has a process output (PM _ _ _ F _ _ AAAAA _ _).</td>
</tr>
<tr>
<td>Lao,S</td>
<td>Calibration Menu</td>
<td>Electrical Output Slope</td>
<td>Adjust this value to calibrate the slope of the output value.</td>
<td>-1.999.000 to 9,999.000</td>
<td>1.0</td>
<td>the controller has a process output (PM _ _ _ F _ _ AAAAA _ _).</td>
</tr>
</tbody>
</table>

Note: Some values will be rounded off to fit in the four-character display. Full values can be read with another interface.
If there is only one instance of a menu, no submenus will appear.
Chapter 9: Features

Saving and Restoring User Settings ........................................... 46
Programming the Home Page ................................................... 46
Tuning the PID Parameters ....................................................... 46
  Manual Tuning ...................................................................... 47
  Autotuning with TRU-TUNE+® ............................................. 47
Inputs .................................................................................... 48
  Calibration Offset .................................................................. 48
  Calibration ........................................................................... 48
  Filter Time Constant ............................................................ 49
  Sensor Selection ................................................................. 49
  Set Point Low Limit and High Limit ..................................... 49
  Scale High and Scale Low .................................................... 49
  Range High and Range Low .................................................. 49
Outputs .................................................................................. 49
  Duplex ................................................................................. 49
  No-arc Relay ........................................................................ 50
  Retransmitting a Process Value or Set Point ......................... 50
  Cool Output Curve .............................................................. 50
Control Methods ................................................................ 51
  Output Configuration ........................................................... 51
  Auto (closed loop) and Manual (open loop) Control .............. 51
  On-Off Control ................................................................... 52
  Proportional Control ............................................................ 52
  Proportional plus Integral (PI) Control ................................. 52
  Proportional plus Integral plus Derivative (PID) Control .......... 53
  Dead Band .......................................................................... 53
  Variable Time Base ............................................................. 53
  Single Set Point Ramping ..................................................... 54
Alarms .................................................................................... 54
  Process and Deviation Alarms .............................................. 54
  Alarm Set Points .................................................................. 54
  Alarm Hysteresis ................................................................. 55
  Alarm Latching .................................................................... 55
  Alarm Silencing ................................................................... 55
  Alarm Blocking .................................................................... 55
Programming the EZ Key ....................................................... 56
Using Lockout to Secure Settings ........................................... 56
Saving and Restoring User Settings

Recording setup and operations parameter settings for future reference is very important. If you unintentionally change these, you will need to program the correct settings back into the controller to return the equipment to operational condition.

After you program the controller and verify proper operation, use User Save Set [USR;S] (Factory Page, Diagnostics Menu) to save the settings into either of two files in a special section of memory. If the settings in the controller are altered and you want to return the controller to the saved values, use User Restore Set [USR;r] (Factory Page, Diagnostics Menu) to recall one of the saved settings.

A digital input or the Function Key can also be configured to restore parameters.

Note: Only perform the above procedure when you are sure that all the correct settings are programmed into the controller. Saving the settings overwrites any previously saved collection of settings. Be sure to document all the controller settings.

Programming the Home Page

Watlow’s patented user-defined menu system improves operational efficiency. The user-defined Home Page provides you with a shortcut to monitor or change the parameter values that you use most often.

You can create your own Home Page with as many as 20 of the active parameters. When a parameter normally located in the Setup Page or Operations Page is placed in the Home Page, it is accessible through both. If you change a parameter in the Home Page, it is automatically changed in its original page. If you change a parameter in its original page it is automatically changed in the Home Page.

The default parameters will automatically appear in the Home Page.

Change the list of parameters in the Home Page from the Custom Menu [CUSE] (Factory Page).

Tuning the PID Parameters

Autotuning

When an autotune is performed on the EZ-ZONE® PM, the set point is used to calculate the tuning set point.

For example, if the active set point is 200° and Autotune Set Point [ATSP] (Operations Page, Loop Menu) is set to 90 percent, the autotune function utilizes 180° for tuning. This is also how autotuning works in previous Watlow Winona controllers. In addition, changing the active set point in previous controllers causes the autotune function to restart; while with the EZ-ZONE® PM changing the set point after an autotune has been started has no effect.

A new feature in EZ-ZONE® PM products will allow set point changes while the control is autotuning, this includes while running a profile or ramping. When the autotune is initially started it will use the current set point and will disregard all set point changes until the tuning process is complete. Once complete, the controller will then use the new set point.

This is why it is a good idea to enter the active set point before initiating an autotune.

Autotuning calculates the optimum heating and/or cooling PID parameter settings based on the system’s response. Autotuning can be enabled whether or not TUNE-TUNE+® is enabled. The PID settings generated by the autotune will be used until the autotune feature is rerun, the PID values are manually adjusted or TRU-TUNE+® is enabled.

To initiate an autotune, set Autotune Request [AUT] (Operations Page, Loop Menu) to [YES]. You should not autotune while a profile is running. If the autotune cannot be completed in 60 minutes, the autotune will time-out and the original settings will take effect.

The lower display will flash between [tUnE] and the set point while the autotuning is underway. The temperature must cross the Autotune Set Point five times to complete the autotuning process. Once complete, the controller controls at the normal set point, using the new parameters.

Select a set point for the tune with Autotune Set Point. The Autotune Set Point is expressed as a percent of the Closed Loop Set Point.

If you need to adjust the tuning procedure’s aggressiveness, use Autotune Aggressiveness [T Agr] (Setup Page, Loop Menu). Select under damped [Un-dr] to bring the process value to the set point quickly. Select over damped [ouer] to bring the process value to the set point with minimal overshoot. Select critical damped [Crit] to balance a rapid response with minimal overshoot.
Manual Tuning

In some applications, the autotune process may not provide PID parameters for the process characteristics you desire. If that is the case, you may want to tune the controller manually.

1. Apply power to the controller and establish a set point typically used in your process.
2. Go to the Operations Page, Loop Menu, and set Heat Proportional Band \( h_P \) and/or Cool Proportional Band \( C_P \) to 5. Set Time Integral \( t_i \) to 0. Set Time Derivative \( t_d \) to 0.
3. When the system stabilizes, watch the process value. If it fluctuates, increase the Heat Proportional Band or Cool Proportional Band value in 3 to 5° increments until it stabilizes, allowing time for the system to settle between adjustments.
4. When the process has stabilized, watch Heat Power \( h_P \) or Cool Power \( C_P \) (Operations Page, Monitor Menu). It should be stable ±2%. At this point, the process temperature should also be stable, but it will have stabilized before reaching the set point. The difference between the set point and actual process value can be eliminated with Integral.
5. Start with an Integral value of 6,000 and allow 10 minutes for the process temperature to reach the set point. If it has not, reduce the setting by half and wait another 10 minutes. Continue reducing the setting by half every 10 minutes until the process value equals the set point. If the process becomes unstable, the Integral value is too small. Increase the value until the process stabilizes.
6. Increase Derivative to 0.1. Then increase the set point by 11° to 17°C. Monitor the system’s approach to the set point. If the process value overshoots the set point, increase Derivative to 0.2. Increase the set point by 11° to 17°C and watch the approach to the new set point. If you increase Derivative too much, the approach to the set point will be very sluggish. Repeat as necessary until the system rises to the new set point without overshoot or sluggishness.

For additional information about autotune and PID control, see related features in this chapter.

Autotuning with TRU-TUNE+®

The TRU-TUNE+® adaptive algorithm will optimize the controller’s PID values to improve control of dynamic processes. TRU-TUNE+® monitors the process variable and adjusts the control parameters automatically to keep your process at set point during set point and load changes. When the controller is in the adaptive control mode, it determines the appropriate output signal and, over time, adjusts control parameters to optimize responsiveness and stability. The TRU-TUNE+® feature does not function for on-off control.

The preferred and quickest method for tuning a loop is to establish initial control settings and continue with the adaptive mode to fine tune the settings.

Setting a controller’s control mode to tune starts this two-step tuning process. (See Autotuning in this chapter.) This predictive tune determines initial, rough settings for the PID parameters. Then the loop automatically switches to the adaptive mode which fine tunes the PID parameters.

Once the process variable has been at set point for a suitable period (about 30 minutes for a fast process to roughly two hours for a slower process) and if no further tuning of the PID parameters is desired or needed, TRU-TUNE+® may be turned off. However, keeping the controller in the adaptive mode allows it to automatically adjust to load changes and compensate for differing control characteristics at various set points for processes that are not entirely linear.

Once the PID parameters have been set by the TRU-TUNE+® adaptive algorithm, the process, if shut down for any reason, can be restarted in the adaptive control mode.

Turn TRU-TUNE+® on or off with TRU-TUNE+® Enable \( E_{Un} \) (Setup Page, Loop Menu).

Use TRU-TUNE+® Band \( b_{n/d} \) (Setup Page, Loop Menu) to set the range above and below the set point in which adaptive tuning will be active. Adjust this parameter only in the unlikely event that the controller is unable to stabilize at the set point with TRU-TUNE+® Band set to auto (0). This may occur with very fast processes. In that case, set TRU-TUNE+™ Band to a large value, such as 100.

Use TRU-TUNE+® Gain \( g_{n} \) (Setup Page, Loop Menu) to adjust the responsiveness of the adaptive tuning calculations. Six settings range from 1, with the most aggressive response and most potential overshoot (highest gain), to 6, with the least aggressive response and least potential for overshoot (lowest gain). The default setting, 3, is recommended for loops with thermocouple feedback and moderate response and overshoot potential.

Before Tuning

Before autotuning, the controller hardware must be installed correctly, and these basic configuration parameters must be set:

- Sensor Type \( S_{E_{n}} \) (Setup Page, Analog Input Menu), and scaling, if required;
- Function \( F_{n} \) (Setup Page, Output Menu) and scaling, if required.

How to Autotune a Loop

1. Enter the desired set point or one that is in the middle of the expected range of set points that you want to tune for.
2. Enable TRU-TUNE+®.
3. Initiate an autotune. (See Autotuning in this chapter.)
When autotuning is complete, the PID parameters should provide good control. As long as the loop is in the adaptive control mode, TRU-TUNE+® continuously tunes to provide the best possible PID control for the process.

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

### Inputs

#### Calibration Offset

Calibration offset allows a device to compensate for an inaccurate sensor, lead resistance or other factors that affect the input value. A positive offset increases the input value, and a negative offset decreases the input value.

The input offset value can be viewed or changed with Calibration Offset \( \text{Cal} \) (Operations Page, Analog Input Menu).

1. Apply the low source signal to the input you are calibrating. Measure the signal to ensure it is accurate.
2. Read the value of Electrical Measurement \( \text{Mea} \) (Factory Page, Calibration Menu) for that input.
3. Calculate the offset value by subtracting this value from the low source signal.
4. Set Electrical Input Offset \( \text{ElIo} \) (Factory Page, Calibration Menu) for this input to the offset value.
5. Check the Electrical Measurement to see whether it now matches the signal. If it doesn’t match, adjust Electrical Input Offset again.
6. Apply the high source signal to the input. Measure the signal to ensure it is accurate.
7. Read the value of Electrical Measurement for that input.
8. Calculate the gain value by dividing the low source signal by this value.
9. Set Electrical Input Slope \( \text{EliS} \) (Factory Page, Calibration Menu) for this input to the calculated gain value.
10. Check the Electrical Measurement to see whether it now matches the signal. If it doesn’t match, adjust Electrical Input Slope again.

Set Electrical Input Offset to 0 and Electrical Input Slope to 1 to restore factory calibration.

#### Follow these steps for a thermocouple or process input:

1. Measure the low source resistance to ensure it is accurate. Connect the low source resistance to the input you are calibrating.
2. Read the value of Electrical Measurement \( \text{Mea} \) (Factory Page, Calibration Menu) for that input.
3. Calculate the offset value by subtracting this value from the low source resistance.
4. Set Electrical Input Offset \( \text{ElIo} \) (Factory Page, Calibration Menu) for this input to the offset value.
5. Check the Electrical Measurement to see whether it now matches the signal. If it doesn’t match, adjust Electrical Offset again.
6. Measure the high source resistance to ensure it is accurate. Connect the high source resistance to the input.
7. Read the value of Electrical Measurement for that input.
8. Calculate the gain value by dividing the low source signal by this value.
9. Set Electrical Input Slope \( \text{EliS} \) (Factory Page, Calibration Menu) for this input to the calculated gain value.
10. Check the Electrical Measurement to see whether it now matches the signal. If it doesn’t match, adjust Electrical Input Slope again.

Set Electrical Input Offset to 0 and Electrical Input Slope to 1 to restore factory calibration.

#### Follow these steps for an RTD input:

1. Measure the low source resistance to ensure it is accurate. Connect the low source resistance to the input you are calibrating.
2. Read the value of Electrical Measurement \( \text{Mea} \) (Factory Page, Calibration Menu) for that input.
3. Calculate the offset value by subtracting this value from the low source resistance.
4. Set Electrical Input Offset \( \text{ElIo} \) (Factory Page, Calibration Menu) for this input to the offset value.
5. Check the Electrical Measurement to see whether it now matches the signal. If it doesn’t match, adjust Electrical Offset again.
6. Measure the high source resistance to ensure it is accurate. Connect the high source resistance to the input.
7. Read the value of Electrical Measurement for that input.
8. Calculate the gain value by dividing the low source signal by this value.
9. Set Electrical Input Slope \( \text{EliS} \) (Factory Page, Calibration Menu) for this input to the calculated gain value.
10. Check the Electrical Measurement to see whether it now matches the signal. If it doesn’t match, adjust Electrical Input Slope again.

Set Electrical Input Offset to 0 and Electrical Input Slope to 1 to restore factory calibration.

### Calibration

To calibrate an analog input, you will need to provide two electrical signals or resistance loads near the extremes of the range that the application is likely to utilize. See recommended values below:

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Low Source</th>
<th>High Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>thermocouple</td>
<td>0.000 mV</td>
<td>50.000 mV</td>
</tr>
<tr>
<td>millivols</td>
<td>0.000 mV</td>
<td>50.000 mV</td>
</tr>
<tr>
<td>volts</td>
<td>0.000V</td>
<td>10.000V</td>
</tr>
<tr>
<td>milliamps</td>
<td>0.000 mA</td>
<td>20.000 mA</td>
</tr>
<tr>
<td>100 Ω RTD</td>
<td>50.00 Ω</td>
<td>350.00 Ω</td>
</tr>
<tr>
<td>1,000 Ω RTD</td>
<td>500.00 Ω</td>
<td>3,500.00 Ω</td>
</tr>
</tbody>
</table>
Filtering smoothes an input signal by applying a first-order filter time constant to the signal. 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.

Adjust the filter time interval with Filter Time \( F_{\text{fil}} \) (Setup Page, Analog Input Menu).

Example: With a filter value of 0.5 seconds, if the process input value instantly changes from 0 to 100 and remained at 100, the display will indicate 100 after five time constants of the filter value or 2.5 seconds.

Sensor Selection

You need to configure the controller to match the input device, which is normally a thermocouple, RTD or process transmitter.

Select the sensor type with Sensor Type \( S_{\text{en}} \) (Setup Page, Analog Input Menu).

Set Point Low Limit and High Limit

The controller constrains the set point to a value between a set point low limit and a set point high limit.

Set the set point limits with Low Set Point \( L_{\text{SP}} \) and High Set Point \( H_{\text{SP}} \) (Setup Page, Loop Menu).

There are two sets of set point low and high limits: one for a closed-loop set point, another for an open-loop set point.

Scale High and Scale Low

When an analog input is selected as process voltage or process current input, you must choose the value of voltage or current to be the low and high ends. For example, when using a 4 to 20 mA input, the scale low value would be 4.00 mA and the scale high value would be 20.00 mA. Commonly used scale ranges are: 0 to 20 mA, 4 to 20 mA, 0 to 5V, 1 to 5V and 0 to 10V.

You can create a scale range representing other units for special applications. You can reverse scales from high values to low values for analog input signals that have a reversed action. For example, if 50 psi causes a 4 mA signal and 10 psi causes a 20 mA signal.

Scale low and high low values do not have to match the bounds of the measurement range. These along with range low and high provide for process scaling and can include values not measureable by the controller. Regardless of scaling values, the measured value will be constrained by the electrical measurements of the hardware.

Select the low and high values with Scale Low \( S_{\text{lo}} \) and Scale High \( S_{\text{hi}} \) and Range Low \( r_{\text{lo}} \) and Range High \( r_{\text{hi}} \) (Setup Page, Analog Input Menu).

Range High and Range Low

With a process input, you must choose a value to represent the low and high ends of the current or voltage range. Choosing these values allows the controller’s display to be scaled into the actual working units of measurement. For example, the analog input from a humidity transmitter could represent 0 to 100 percent relative humidity as a process signal of 4 to 20 mA. Low scale would be set to 0 to represent 4 mA and high scale set to 100 to represent 20 mA. The indication on the display would then represent percent humidity and range from 0 to 100 percent with an input of 4 to 20 mA.

Select the low and high values with Range Low \( r_{\text{lo}} \) and Range High \( r_{\text{hi}} \) (Setup Page, Analog Input Menu).

Outputs

Duplex

Certain systems require that a single process output control both heating and cooling outputs. An EZ-ZONE® PM controller with a process output can function as two separate outputs.

With a 4 to 20mA output the heating output will operate from 12 to 20mA (0 to +100 percent) and the cooling output will operate from 12 to 4mA (0 to -100 percent).

In some cases this type of output is required by the device that the EZ-ZONE® PM controls, such as a three-way valve that opens one way with a 12 to 20mA signal and opens the other way with a 4 to
12mA signal. This feature reduces the overall system cost by using a single output to act as two outputs.

Outputs 1 and 3 can be ordered as process outputs. Select duplex [dup] as the Output Function [Fn] (Setup Page, Output Menu). Set the output to volts [vLt] or milliamps [mA] with Output Type [oTy]. Set the range of the process output with Scale Low [SLo] and Scale High [Sh].

No-arc Relay
A no-arc relay provides a significant improvement in the life of the output relay over conventional relays.

Conventional mechanical relays have an expected life of 100,000 cycles at the rated full-load current. The shorter life for conventional relays is due to the fact that when contacts open while current is flowing metal degradation occurs. This action produces unavoidable electrical arcing causing metal to transfer from one contact to the other. The arcing conditions continue on each subsequent contact opening until over time the resistance through the contacts increases causing the contacts to increase in temperature. Eventually, the contacts will weld together and the relay remains in the on state.

The Watlow no-arc relay is a hybrid relay. It uses a mechanical relay for the current load and a triac (solid-state switch) to carry the turn-on and turn-off currents. No-arc relays extend the life of the relay more than two million cycles at the rated full-load current.

Although a no-arc relay has significant life advantages, a few precautions must be followed for acceptable usage:

**Do not use:**
- hybrid relays for limit contactors. A limit or safety device must provide a positive mechanical break on all hot legs simultaneously;
- dc loads with hybrid relays. The triacs used for arc suppression will turn off only with ac line voltage;
- hybrid switches to drive any inductive loads, such as relay coils, transformers or solenoids;
- cycle times less than five seconds on hybrid switches;
- on loads that exceed 264V ac through relay;
- on loads that exceed 15 amperes load;
- on loads less than 100 mA;
- no-arc relays in series with other no-arc relays.

Retransmitting a Process Value or Set Point
The retransmit feature allows a process output to provide an analog signal that represents the set point or process value. The signal may serve as a remote set point for another controller or as an input for a chart recorder documenting system performance over time.

In choosing the type of retransmit signal the operator must take into account the input impedance of the device to be retransmitted to and the required signal type, either voltage or milliamps.

Typically applications might use the retransmit option to record one of the variables with a chart recorder or to generate a set point for other controls in a multi-zone application.

Output 1 can be ordered as process outputs. Select retransmit [rMt] as the Output Function [Fn] (Setup Page, Output Menu). Set the output to volts [vLt] or milliamps [mA] with Output Type [oTy]. Select the signal to retransmit with Retransmit Source [rSr].

Set the range of the process output with Scale Low [SLo] and Scale High [Sh]. Scale the retransmit source to the process output with Range Low [rLo] and Range High [rHi].

When the retransmit source is at the Range Low value, the retransmit output will be at its Scale Low value. When the retransmit source is at the Range High value, the retransmit output will be at its Scale High value.

Cool Output Curve
A nonlinear output curve may improve performance when the response of the output device is nonlinear. If a cool output uses one of the nonlinear curves a PID calculation yields a lower actual output level than a linear output would provide.

These output curves are used in plastics extruder applications: curve 1 for oil-cooled extruders and curve 2 for water-cooled extruders.
Select a nonlinear cool output curve with Cool Output Curve ▬ [C;C] (Setup Menu, Loop Menu).

**Control Methods**

**Output Configuration**

Each controller output can be configured as a heat output, a cool output, an alarm output or deactivated. No dependency limitations have been placed on the available combinations. The outputs can be configured in any combination. For instance, all three could be set to cool.

Heat and cool outputs use the set point and Operations parameters to determine the output value. All heat and cool outputs use the same set point value. Heat and cool each have their own set of control parameters. All heat outputs use the same set of heat control parameters and all cool outputs use the same set of cool output parameters.

Each alarm output has its own set of configuration parameters and set points, allowing independent operation.

**Auto (closed loop) and Manual (open loop) Control**

The controller has two basic modes of operation, auto mode and manual mode. Auto mode allows the controller to decide whether to perform closed-loop control or to follow the settings of Input Error Failure ▬ [FA;L] (Setup Page, Loop Menu). The manual mode only allows open-loop control. The EZ-ZONE® PM controller is normally used in the auto mode. The manual mode is usually only used for specialty applications or for troubleshooting.

Manual mode is open-loop control that allows the user to directly set the power level to the controller’s output load. No adjustments of the output power level occur based on temperature or set point in this mode.

In auto mode, the controller monitors the input to determine if closed-loop control is possible. The controller checks to make certain a functioning sensor is providing a valid input signal. If a valid input signal is present, the controller will perform closed-loop control. Closed-loop control uses a process sensor to determine the difference between the process value and the set point. Then the controller applies power to a control output load to reduce that difference.

If a valid input signal is not present, the controller will indicate an input error message in the upper display and ▬ [Attn] in the lower display and respond to the failure according to the setting of Input Error Failure ▬ [FA;L]. You can configure the controller to perform a “bumpless” transfer ▬ [bPLS], switch power to output a preset fixed level ▬ [MAn], or turn the output power off.

Bumpless transfer will allow the controller to transfer to the manual mode using the last power value calculated in the auto mode if the process had stabilized at a ±5 percent output power level for the time interval of Time Integral (Operations Page, Loop) prior to sensor failure, and that power level is less than 75 percent.

Input Error Latching ▬ [Er] (Setup Page, Analog Input Menu) determines the controller’s response once a valid input signal returns to the controller. If latching is on, then the controller will continue to indicate an input error until the error is cleared. To clear a latched alarm, press the Advance Key ‡ then the Up Key †. If latching is off, the controller will automatically clear the input error and return to reading the temperature. If the controller was in the auto mode when the input error occurred, it will resume closed-loop control. If the controller was in manual mode when the error occurred, the controller will remain in open-loop control.

The Manual Control Indicator Light % is on when the controller is operating in manual mode.

You can easily switch between modes if the Control Mode ▬ [CM] parameter is selected to appear in the Home Page.

To transfer to manual mode from auto mode, press the Advance Key ‡ until ▬ [CM] appears in the lower display. The upper display will display ▬ [Auto] for auto mode. Use the Up † or Down ‡ keys to select ▬ [Man]. The manual set point value will be recalled from the last manual operation.
To transfer to auto mode from manual mode, press the Advance Key until \[\text{MAn}\] appears in the lower display. The upper display will display \[\text{AUT}\] for manual mode. Use the Up \[\uparrow\] or Down \[\downarrow\] keys to select \[\text{AUto}\]. The automatic set point value will be recalled from the last automatic operation.

Changes take effect after three seconds or immediately upon pressing either the Advance Key \[\ast\] or the Infinity Key \[\hat{\nu}\].

**On-Off Control**

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

On-off control can be selected with Heat Algorithm \[\text{hAg}\] or Cool Algorithm \[\text{C Ag}\] (Setup Page, Loop Menu).

On-off hysteresis can be set with Heat Hysteresis \[\text{hHY}\] or Cool Hysteresis \[\text{C HY}\] (Operations Page, Loop Menu).

**Note:**

Input Error Failure Mode \[\text{fRtl}\] does not function in on-off control mode. The output goes off.

**Proportional Control**

Some processes need to maintain a temperature or process value closer to the set point than 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 the process value is to the set point, the lower the output power. 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 simple on-off control. However, when the 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 the proportional band value.

In an application with one output assigned to heating and another assigned to cooling, each will have a separate proportional parameter. The heating parameter takes effect when the process temperature is lower than the set point, and the cooling parameter takes effect when the process temperature is higher than the set point.

Adjust the proportional band with Heat Proportional Band \[\text{h Pb}\] or Cool Proportional Band \[\text{C Pb}\] (Operations Page, Loop Menu).

**Proportional plus Integral (PI) Control**

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

Adjust the integral with Time Integral \[\text{ti}\] (Operations Page, Loop Menu).
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.

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

Adjust the derivative with Time Derivative \( t_d \) (Operations Page, Loop Menu).

Dead Band

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

Proportional action ceases when the process value is within the dead band. Integral action continues to bring the process temperature to the set point.

Using a positive dead band value keeps the two systems from fighting each other.

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

Adjust the dead band with Dead Band \( d_b \) (Operations Page, Loop Menu).

Variable Time Base

Variable time base is the preferred method for controlling a resistive load, providing a very short time base for longer heater life. Unlike phase-angle firing, variable-time-base switching does not limit the current and voltage applied to the heater.

With variable time base outputs, the PID algorithm calculates an output between 0 and 100%, but the output is distributed in groupings of three ac line cycles. For each group of three ac line cycles, the controller decides whether the power should be on or off. There is no fixed cycle time since the decision is made for each group of cycles. When used in conjunction with a zero cross (burst fire) device, such as a solid-state power controller, switching is done only at the zero cross of the ac line, which helps reduce electrical noise (RFI).

Variable time base should be used with solid-state power controllers, such as a solid-state relay (SSR) or silicon controlled rectifier (SCR) power controller. Do not use a variable time base output for controlling electromechanical relays, mercury displacement relays, inductive loads or heaters with unusual resistance characteristics.

The combination of variable time base output and
a solid-state relay can inexpensively approach the effect of analog, phase-angle fired control.

Select the AC Line Frequency (Setup Page, Global Menu), 50 or 60 Hz.

![Diagram of solid-state relay operation]

100 percent output
10 ON, 0 OFF

50 percent output
3 ON, 3 OFF

66 percent output
6 ON, 3 OFF

**Note:**
When output 1 is a universal process output, output 2 cannot use variable time base, fixed time base only.

**Single Set Point Ramping**

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

Select Ramp Action (Setup Page, Loop Menu):
- **off** ramping not active.
- **SFP** ramp at startup.
- **SPE** ramp at a set point change.
- **both** ramp at startup or when the set point changes.

Select whether the rate is in degrees per minute or degrees per hour with Ramp Scale (Setup Page, Loop Menu).

Set the ramping rate with Ramp Rate (Setup Page, Loop Menu).

**Alarms**

Alarms are activated when the output level, process value or temperature leaves a defined range. A user can configure how and when an alarm is triggered, what action it takes and whether it turns off automatically when the alarm condition is over.

Configure alarm outputs in the Setup Page before setting alarm set points.

Alarms do not have to be assigned to an output. Alarms can be monitored and controlled through the front panel or by using software.

**Process and Deviation Alarms**

A process alarm uses one or two absolute set points to define an alarm condition.

A deviation alarm uses one or two set points that are defined relative to the control set point. High and low alarm set points are calculated by adding or subtracting offset values from the control set point. If the set point changes, the window defined by the alarm set points automatically moves with it.

Select the alarm type with Type (Setup Page, Alarm Menu).

**Alarm Set Points**

The alarm high set point defines the process value or temperature that will trigger a high side alarm. It 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. It must be lower than the alarm high set point and higher than the low limit of the sensor range.
View or change alarm set points with Low Set Point \( L_{\text{Lo}} \) and High Set Point \( L_{\text{hi}} \) (Operations Page, Alarm Menu).

### Alarm Hysteresis

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.

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.

View or change alarm hysteresis with Hysteresis \( H_{\text{hy}} \) (Setup Page, 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 active message, such as an alarm message, will cause the display to toggle between the normal settings and the active message in the upper display and \( A_{\text{Attn}} \) in the lower display.

Push the Advance Key to display \( A_{\text{ignr}} \) in the upper display and the message source in the lower display.

Use the Up \( U \) and Down \( D \) keys to scroll through possible responses, such as Clear \( C_{\text{CLr}} \) or Silence \( S_{\text{SiL}} \). Then push the Advance \( A \) or Infinity \( \infty \) key to execute the action.

See the Keys and Displays chapter and the Home Page chapter for more details.

Turn alarm latching on or off with Latching \( L_{\text{LA}} \) (Setup Page, Alarm Menu).

### Alarm Silencing

If alarm silencing is on the operator can disable the alarm output while the controller is in an alarm state. The process value or temperature has to enter the normal operating range beyond the hysteresis zone to activate the alarm output function again.

An active message, such as an alarm message, will cause the display to toggle between the normal settings and the active message in the upper display and \( A_{\text{Attn}} \) in the lower display.

Push the Advance Key to display \( A_{\text{ignr}} \) in the upper display and the message source in the lower display.

Use the Up \( U \) and Down \( D \) keys to scroll through possible responses, such as Clear \( C_{\text{CLr}} \) or Silence \( S_{\text{SiL}} \). Then push the Advance \( A \) or Infinity \( \infty \) key to execute the action.

See the Keys and Displays chapter and the Home Page chapter for more details.

Turn alarm silencing on or off with Silencing \( S_{\text{Si}} \) (Setup Page, Alarm Menu).

### Alarm Blocking

Alarm blocking allows a system to warm up after it has been started up. With alarm blocking on, an alarm is not triggered when the process temperature is initially lower than the alarm low set point or higher than the alarm high set point. The process temperature has to enter the normal operating range beyond the hysteresis zone to activate the alarm function.

If the EZ-ZONE® PM has an output that is functioning as a deviation alarm, the alarm is blocked when the set point is changed, until the process value re-enters the normal operating range.

Turn alarm blocking on or off with Blocking \( B_{\text{bl}} \) (Setup Page, Alarm Menu).
**Programming the EZ Key**

You can program the EZ Key either in the Setup Menu or with configuration software, such as EZ-ZONE® Configurator, using a personal computer.

The following examples show how to program the EZ Key to start and stop a profile.

**Using keys and display:**
1. To go to the Setup Page from the Home Page, press both the Up业余 and Down业余 keys for six seconds.业余会 appear in the upper display and业余会 appear in the lower display.
2. Press the Up Key业余 until业余会 appears in the upper display and业余会 will appear in the lower display.
3. Press the Advance Key业余 until Digital Input Level业余会 appears in the lower display. Use an arrow key to specify the state of the key (high or low) when the controller is powered up. Functions will toggle with each press of the EZ Key, such as Profile Start/Stop.
4. Press the Advance Key业余. The lower display will show Digital Function业余会. Press the Up业余 or Down业余 key to scroll through the functions that can be assigned to the EZ Key.
   - When Profile Start/Stop业余会 appears in the upper display and业余会 appears in the lower display, press the Advance Key业余 once to select that function and move to the Function Instance业余会 parameter.
5. Press the Up业余 or Down业余 key to scroll to the profile that you want the EZ Key to control.
6. The instance tells the controller which of the numbered functions should be acted upon. For profiles, there are 4 instances. Press the Infinity Key业余 once to return to the submenu, twice to return to the main menu or three times to return to the Home Page.

**Using the software with Standard Bus:**
1. Make the necessary physical connections between the personal computer and the EZ-ZONE® PM. Set Protocol (Setup Page, Communications Menu) to Standard Bus. Run the software and allow it to connect to the controller by directing it or allowing it to find the appropriate communications port.
2. After the software connects to the controller, look on the left side of your screen under the Parameters Menu for Function Key under Setup. Click on the plus sign to reveal the Function Key业余 submenu.
3. Click on Function Key业余, then select a Digital Input Function and a Function Instance.
   - If you want to start and stop a profile with the EZ Key, select Profile Start/Stop and the number of the profile that you want the EZ Key to control.

**Using Lockout to Secure Settings**

If unintentional changes to parameter settings might raise safety concerns or lead to downtime, you can use the lockout feature to make them more secure.

Each of the menus in the Factory Page and each of the pages, except the Factory Page, has a security level assigned to it. You can change the read and write access to these menus and pages by using the parameters in the Lockout Menu (Factory Page).

**Lockout Menu**

There are four parameters in the Lockout Menu (Factory Page):

- **Lock Operations Page业余** sets the security level for the Operations Page. (default: 2)
- **Lock Profiling Page业余** sets the security level for the Profiling Page. (default: 3)
- **Read Lockout Security业余** determines which pages can be accessed. The user can access the selected level and all lower levels. (default: 5)
- **Set Lockout Security业余** determines which parameters within accessible pages can be written to. The user can write to the selected level and all lower levels. (default: 5)

<table>
<thead>
<tr>
<th>Security Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>------</td>
</tr>
<tr>
<td>Home Page: 1</td>
</tr>
<tr>
<td>Operations Page: 1</td>
</tr>
<tr>
<td>Setup Page: 4</td>
</tr>
<tr>
<td>Profiling Page: 1</td>
</tr>
<tr>
<td>Factory Page Menus</td>
</tr>
<tr>
<td>Custom Menu: 5</td>
</tr>
<tr>
<td>Lockout Menu: 0</td>
</tr>
<tr>
<td>Diagnostic Menu: 0</td>
</tr>
<tr>
<td>Calibration Menu: 5</td>
</tr>
</tbody>
</table>

Bars indicate page and menu access by security level.
The following examples show how the Lockout Menu parameters may be used in applications:

1. You can lock out access to the Operations Page but allow an operator access to the Profile Menu, by changing the default Profile Page and Operations Page security levels. Change Lock Operations Page \[ \text{LoC}_O \] to 3 and Lock Profiling Page \[ \text{LoC}P \] to 2. If Set Lockout Security \[ \text{SLoC} \] is set to 2 or higher and the Read Lockout Security \[ \text{rLoC} \] is set to 2, the Profiling Page and Home Pages can be accessed, and all writable parameters can be written to. Pages with security levels greater than 2 will be locked out (unaccessible).

2. If Set Lockout Security \[ \text{SLoC} \] is set to 0 and Read Lockout Security \[ \text{rLoC} \] is set to 5, all pages will be accessible, however, changes will not be allowed on any pages or menus, with one exception: Set Lockout Security \[ \text{SLoC} \] can be changed to a higher level.

3. The operator wants to read all the menus and not allow any parameters to be changed.
   In the Factory Page, Lockout Menu, set Read Lockout Security \[ \text{rLoC} \] to 5 and Set Lockout Security \[ \text{SLoC} \] to 0.

4. The operator wants to read and write to the Home Page and Profiling Page, and lock all other pages and menus.
   In the Factory Page, Lockout Menu, set Read Lockout Security \[ \text{rLoC} \] to 2 and Set Lockout Security \[ \text{SLoC} \] to 2.
   In the Factory Page, Lockout Menu, set Lock Operations Page \[ \text{LoC}_O \] to 3 and Lock Profiling Page \[ \text{LoC}P \] to 2.

5. The operator wants to read the Operations Page, Setup Page, Profiling Page, Diagnostics Menu, Lock Menu, Calibration Menu and Custom Menus. The operator also wants to read and write to the Home Page.
   In the Factory Page, Lockout Menu, set Read Lockout Security \[ \text{rLoC} \] to 1 and Set Lockout Security \[ \text{SLoC} \] to 5.
   In the Factory Page, Lockout Menu, set Lock Operations Page \[ \text{LoC}_O \] to 2 and Lock Profiling Page \[ \text{LoC}P \] to 3.
<table>
<thead>
<tr>
<th>Indication</th>
<th>Description</th>
<th>Possible Cause(s)</th>
<th>Corrective Action</th>
</tr>
</thead>
</table>
| Alarm won’t clear or reset | Alarm will not clear or reset with keypad or digital input | • Alarm latching is active  
• Alarm set to incorrect output  
• Alarm is set to incorrect source  
• Sensor input is out of alarm set point range  
• Alarm set point is incorrect  
• Alarm is set to incorrect type  
• Digital input function is incorrect | • Reset alarm when process is within range or disable latching  
• Set output to correct alarm source instance  
• Set alarm source to correct input instance  
• Correct cause of sensor input out of alarm range  
• Set alarm set point to correct trip point  
• Set alarm to correct type: process, deviation or power  
• Set digital input function and source instance |
| Alarm won’t occur | Alarm will not activate output | • Alarm silencing is active  
• Alarm blocking is active  
• Alarm is set to incorrect output  
• Alarm is set to incorrect source  
• Alarm set point is incorrect  
• Alarm is set to incorrect type | • Disable alarm silencing, if required  
• Disable alarm blocking, if required  
• Set output to correct alarm source instance  
• Set alarm source to correct input instance  
• Set alarm set point to correct trip point  
• Set alarm to correct type: process, deviation or power |
| AL;E1 | Alarm Error | Alarm state cannot be determined due to lack of sensor input | • Sensor improperly wired or open  
• Incorrect setting of sensor type  
• Calibration corrupt | • Correct wiring or replace sensor  
• Match setting to sensor used  
• Check calibration of controller |
| AL;L1 | Alarm Low | Sensor input below low alarm set point | • Temperature is less than alarm set point  
• Alarm is set to latching and an alarm occurred in the past  
• Incorrect alarm set point  
• Incorrect alarm source | • Check cause of under temperature  
• Clear latched alarm  
• Establish correct alarm set point  
• Set alarm source to proper setting |
| AL;H1 | Alarm High | Sensor input above high alarm set point | • Temperature is greater than alarm set point  
• Alarm is set to latching and an alarm occurred in the past  
• Incorrect alarm set point  
• Incorrect alarm source | • Check cause of over temperature  
• Clear latched alarm  
• Establish correct alarm set point  
• Set alarm source to proper setting |
| Li;E1 | Limit Error | Sensor does not provide a valid signal to controller | • Sensor improperly wired or open  
• Incorrect setting of sensor type  
• Calibration corrupt | • Correct wiring or replace sensor  
• Match setting to sensor used  
• Check calibration of controller |
| Li;L1 | Limit Low | Limit will not clear or reset with keypad or digital input | • Sensor input is out of limit set point range  
• Limit set point is incorrect  
• Digital input function is incorrect | • Correct cause of sensor input out of limit range  
• Set limit set point to correct trip point  
• Set digital input function and source instance |
| Li;E1 | Limit Error | Limit state cannot be determined due to lack of sensor input, limit will trip | • Sensor improperly wired or open  
• Incorrect setting of sensor type  
• Calibration corrupt | • Correct wiring or replace sensor  
• Match setting to sensor used  
• Check calibration of controller |
| Li;L1 | Limit Low | Sensor input below low limit set point | • Temperature is less than limit set point  
• Limit outputs latch and require reset  
• Incorrect alarm set point | • Check cause of under temperature  
• Clear limit  
• Establish correct limit set point |
<table>
<thead>
<tr>
<th>Indication</th>
<th>Description</th>
<th>Possible Cause(s)</th>
<th>Corrective Action</th>
</tr>
</thead>
</table>
| Limit High | Sensor input above high limit set point | • Temperature is greater than limit set point  
• Limit outputs latch and require reset  
• Incorrect alarm set point | • Check cause of over temperature  
• Clear limit  
• Establish correct limit set point |
| Loop Open Error | Open Loop Detect is active and the process value did not deviate by a user-select ed value in a user specified period. | • Setting of Open Loop Detect Time incorrect  
• Setting of Open Loop Detect Deviation incorrect  
• Thermal loop is open  
• Open Loop Detect function not required but activated | • Set correct Open Loop Detect Time for application  
• Set correct Open Loop Deviation value for application  
• Determine cause of open thermal loop: misplaced sensors, load failure, loss of power to load, etc.  
• Deactivate Open Loop Detect feature |
| Loop Reversed Error | Open Loop Detect is active and the process value is headed in the wrong direction when the output is activated based on deviation value and user-selected value. | • Setting of Open Loop Detect Time incorrect  
• Setting of Open Loop Detect Deviation incorrect  
• Output programmed for incorrect function  
• Thermocouple sensor wired in reverse polarity | • Set correct Open Loop Detect Time for application  
• Set correct Open Loop Deviation value for application  
• Set output function correctly  
• Wire thermocouple correctly, (red wire is negative) |
| Ramping 1 | Controller is ramping to new set point | • Ramping feature is activated | • Disable ramping feature if not required |
| Autotuning 1 | Controller is autotuning the control loop | • User started the autotune function  
• Digital input is set to start autotune | • Wait until autotune completes or disable autotune feature  
• Set digital input to function other than autotune, if desired |
| No heat/cool action | Output does not activate load | • Output function is incorrectly set  
• Control mode is incorrectly set  
• Output is incorrectly wired  
• Load, power or fuse is open  
• Control set point is incorrect  
• Incorrect controller model for application | • Set output function correctly  
• Set control mode appropriately (Open vs Closed Loop)  
• Correct output wiring  
• Correct fault in system  
• Set control set point in appropriate control mode and check source of set point: remote, idle, profile, closed loop, open loop  
• Obtain correct controller model for application |
| No Display | No display indication or LED illumination | • Power to controller is off  
• Fuse open  
• Breaker tripped  
• Safety interlock switch open  
• Separate system limit control activated  
• Wiring error  
• Incorrect voltage to controller | • Turn on power  
• Replace fuse  
• Reset breaker  
• Close interlock switch  
• Reset limit  
• Correct wiring issue  
• Apply correct voltage, check part number |
| No Serial Communication | Cannot establish serial communications with the controller | • Address parameter incorrect  
• Incorrect protocol selected  
• Baud rate incorrect  
• Parity incorrect  
• Wiring error  
• EIA-485 converter issue  
• Incorrect computer or PLC communications port  
• Incorrect software setup  
• Termination resistor may be required | • Set unique addresses on network  
• Match protocol between devices  
• Match baud rate between devices  
• Match parity between devices  
• Correct wiring issue  
• Check settings or replace converter  
• Set correct communication port  
• Correct software setup to match controller  
• Place 120 Ω resistor across EIA-485 on last controller |
<table>
<thead>
<tr>
<th>Indication</th>
<th>Description</th>
<th>Possible Cause(s)</th>
<th>Corrective Action</th>
</tr>
</thead>
</table>
| Process doesn't control to set point     | Process is unstable or never reaches set point | • Controller not tuned correctly  
• Control mode is incorrectly set  
• Control set point is incorrect | • Perform autotune or manually tune system  
• Set control mode appropriately (Open vs Closed Loop)  
• Set control set point in appropriate control mode and check source of set point: remote, idle, profile, closed loop, open loop |
| Temperature runaway                      | Process value continues to increase or decrease past set point. | • Controller output incorrectly programmed  
• Thermocouple reverse wired  
• Controller output wired incorrectly  
• Short in heater  
• Power controller connection to controller defective  
• Controller output defective | • Verify output function is correct (heat or cool)  
• Correct sensor wiring (red wire negative)  
• Verify and correct wiring  
• Replace heater  
• Replace or repair power controller  
• Replace or repair controller |
| ![100](image) Device Error               | Controller displays internal malfunction message at power up. | • Controller defective              | • Replace or repair controller                                                   |
| ![he](image) Heater Error                | Heater Error                             | • Current through load is above current trip set point  
• Current through load is below current trip set point | • Check that the load current is proper. Correct cause of overcurrent and/or ensure current trip set point is correct.  
• Check that the load current is proper. Correct cause of undercurrent and/or ensure current trip set point is correct. |
| ![Ce](image) Current Error               | Load current incorrect.                  | • Shorted solid-state or mechanical relay  
Open solid-state or mechanical relay  
Current transformer load wire associated to wrong output  
Defective current transformer or controller  
Noisy electrical lines | • Replace relay  
• Replace relay  
• Route load wire through current transformer from correct output, and go to the ![C5](image) Source Output Instance parameter (Setup Page, Current Menu) to select the output that is driving the load.  
• Replace or repair sensor or controller  
• Route wires appropriately, check for loose connections, add line filters |
| Menus inaccessible                       | Unable to access ![SEE](image), ![OPER](image), ![KEY](image) or ![Prof](image) menus or particular prompts in Home Page | • Security set to incorrect level  
Digital input set to lockout keypad  
Custom parameters incorrect | • Check lockout setting in Factory Page  
Change state of digital input  
Change custom parameters in Factory Page |
| EZ-Key doesn't work                      | EZ-Key does not activate required function | • EZ-Key function incorrect  
EZ-Key function instance not correct  
Keypad malfunction | • Verify EZ-Key function in Setup Menu  
Check that the function instance is correct  
Replace or repair controller |
Specifications

Line Voltage/Power
- 85 to 264V~ (ac), 47 to 63 Hz
- 12 to 40V= (dc); 20 to 28V~ (ac), 47 to 63 Hz
- 10VA maximum power consumption
- Data retention upon power failure via nonvolatile memory
- Compliant with Semi F47-0200, Figure R1-1 voltage sag requirements @ 24- (ac) or higher

Environment
- -18 to 65°C (0 to 149°F) operating temperature
- -40 to 85°C (~40 to 185°F) storage temperature
- 0 to 90 percent RH, non-condensing

Accuracy
- Calibration accuracy and sensor conformity: ±0.1 percent of accuracy span, ±1°C at the calibrated ambient temperature and rated line voltage
- Types R, S, B; 0.2 percent
- Type T below -50°C (58°F); 0.2 percent
- Types R, S, B; 0.2 percent
- Temperature stability: ±0.1°C/°C (±0.1°F/°F) rise in ambient
- Accuracy span: 540°C (1,000°F) minimum
- Calibration ambient temperature @ 25°C, ±3°C (77°F, ±5°F)
- Type J: 0 to 750°C or 32 to 1,383°F (±1.75°C)
- Type K: -200 to 1,250°C or -328 to 2,282°F (±2.45°C)
- Type T: -200 to 350°C or -328 to 662°F (±1.55°C)
- Type E: -328 to 1,652°C or -58 to 3,000°F (±2.10°C)

Agency Approvals
- UL® Listed to UL 61010-1 File E185611.
- C-UL® Listed to CSA C22.2 No. 1998.2-04.
- FM Class 3545 File 3029084 temperature limit switches.
- UL Review to CSA C22.2 No. 1998.2-04.
- UL® Listed to UL 61010-1 File E185611.
- UL® Listed to CSA C22.2 No. 61010-1-04.
- UL 50 Type 4X, NEMA 4X indoor locations, IP66 front panel seal.
- FM Class 3545 File 3029084 temperature limit switches.
- ODVA – EtherNet/IP™ Compliance.

Wiring Termination, Touch-Safe Terminals
- Input, power and controller output terminals touch-safe removable 3.30 to 0.0507mm² (12 to 30 AWG)
- Wire strip length 7.6 mm (0.30 in)
- Torque 0.8 Nm (7.0 lb.- in.)

Universal Input
- Thermocouple, grounded or ungrounded sensors
  >20 MΩ input impedance
  Maximum of 2K Ω source resistance
  RTD 2- or 3-wire, platinum, 100 and 1,000 Ω @ 0°C calibration to DIN curve (0.00385 Ω/°C); lead resistance effect: 0.3°C/Ω maximum
  Process, 0 to 20 mA @ 100 Ω, or 0 to 10V= (dc) and 0 to 50 mA @ 20 kΩ input impedance; scalable
- Inverse scaling

Accuracy Range
Type J: 0 to 375°C or 0 to 707°F (±1.5°C)
Type K: -200 to 1,250°C or -328 to 2,282°F (±2.45°C)
Type T: -200 to 350°C or -328 to 662°F (±1.55°C)
Type E: -328 to 1,652°C or -58 to 3,000°F (±2.10°C)

Agency Approvals
- WARNING – EXPLOSION HAZARD. Do not disconnect equipment unless power has been switched off or the area is known to be nonhazardous.
- Isolated communications EIA-485, Standard Bus: all models; EIA-232/485, Modbus™ RTU serial communications.
- Requires a minimum load of 20 mA @ 24V
- Requires a minimum load of 20 mA @ 24V

Digital Input
- Update rate 10 Hz
- Dry contact or dc voltage

DC voltage
- Maximum input 36V at 3 mA
- Minimum high state 3V @ 0.25 mA
- Maximum low state 2V

Dry contact
- Minimum open contact 10 kΩ
- Maximum closed contact 50 Ω
- Maximum short circuit 13 mA

Digital Output
- Update rate 10 Hz
- Output voltage 24V
- Current limit, Output 5, 24 mA maximum; Output 6, 10 mA maximum
- Output voltage 24V
- Update rate 10 Hz

Output Hardware
- User selectable for heat-cool as on-off, P, PI, PD, PID, alarm action or limit.

Switched DC
- Unregulated 22 to 32V= (dc) low side @ 30 mA outputs 1 and 3, 10 mA outputs 2 and 4
- Unregulated 22 to 32V= (dc) low side @ 30 mA outputs 1 and 3, 10 mA outputs 2 and 4

Open Collector
- Output sink 100 mA @ 30V= (dc) maximum

Solid-State Relay
- 0.5 A @ 24 to 264V~ (ac) maximum, opto-isolated, without contact suppression; maximum off-state leakage current: 105 microamperes
- Electromechanical Relay, Form A
  - 5 A, 24 to 240V~ (ac) or 30V= (dc) maximum, resistive load, 100,000 cycles at rated load, 125 VA pilot duty
  - Requires a minimum load of 20 mA @ 24V
- Electromechanical Relay, Form C
  - 5 A, 24 to 240V~ (ac) or 30V= (dc) maximum, resistive load, 100,000 cycles at rated load, 125 VA pilot duty
  - Requires a minimum load of 20 mA @ 24V

No-arc Relay Form A
15 A, 85 to 264V~ (ac), no V= (dc), resistive load, 2 million cycles at rated load, maximum off-state leakage current: 2 mA

**Process**
- Universal process/Retransmit, outputs range selectable, 0 to 10 V= (dc) into minimum 1,000 Ω load, 0 to 20 mA into maximum 800 Ω load

**Operator Interface**
- Dual 4-digit, 7-segment LED displays
- Advance, infinity, up and down keys plus an EZ Key programmable function key
- Typical display update rate 1Hz
- Agency approved to IP66/NEMA 4X

**Dimensions**

<table>
<thead>
<tr>
<th>Size</th>
<th>Behind Panel (max.)</th>
<th>Width</th>
<th>Height</th>
<th>Display Height</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/16</td>
<td>101.6 mm (4.00 in)</td>
<td>53.3 mm (2.10 in)</td>
<td>53.3 mm (2.10 in)</td>
<td>up: 10.80 mm (0.425 in)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>low: 6.98 mm (0.275 in)</td>
</tr>
<tr>
<td>1/32</td>
<td>101.6 mm (4.00 in)</td>
<td>53.3 mm (2.10 in)</td>
<td>30.9 mm (1.22 in)</td>
<td>left: 7.59 mm (0.299 in)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>right: 5.90 mm (0.220 in)</td>
</tr>
</tbody>
</table>

**Weight**
- Controller: 200 g (7.1 oz.)
- User manual: 167.26 g (5.9 oz)

Modbus® is a trademark of AEG Schneider Automation Inc.
EtherNet/IP™ is a trademark of ControlNet International Ltd. used under license by Open DeviceNet Vendor Association, Inc. (ODVA).
UL® is a registered trademark of Underwriters Laboratories Inc.
DeviceNet™ is a trademark of Open DeviceNet Vendors Association.

**Note:** These specifications are subject to change without prior notice.
## Ordering Information for PID Controller Models

<table>
<thead>
<tr>
<th>Controller</th>
<th>PM</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EZ-ZONE® PM PID Models</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Universal Sensor Input, configuration communications

*TRU-TUNE+® Adaptive Tune, red-green 7-segment displays

### Package Size

<table>
<thead>
<tr>
<th></th>
<th>1/32 DIN</th>
<th>1/16 DIN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>6</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Primary Function

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>R</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PID Controller</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ramp and Soak</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Custom Firmware</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Power Supply, Digital Input/Output

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>100 to 240V~ (ac)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>100 to 240V~ (ac) plus 2 digital i/o points</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>12 to 40V= (dc) and 20 to 28V~ (ac)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>12 to 40V= (dc) and 20 to 28V~ (ac), plus 2 digital i/o points</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Output 1 and 2 Hardware Options

<table>
<thead>
<tr>
<th>Output 1</th>
<th>Output 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>Switched dc/open collector</td>
</tr>
<tr>
<td>CH</td>
<td>Switched dc/open collector</td>
</tr>
<tr>
<td>CC</td>
<td>Switched dc/open collector</td>
</tr>
<tr>
<td>CJ</td>
<td>Switched dc/open collector</td>
</tr>
<tr>
<td>CK</td>
<td>Switched dc/open collector</td>
</tr>
<tr>
<td>EA</td>
<td>Mechanical relay 5 A, form C</td>
</tr>
<tr>
<td>EH</td>
<td>Mechanical relay 5 A, form C</td>
</tr>
<tr>
<td>EC</td>
<td>Mechanical relay 5 A, form C</td>
</tr>
<tr>
<td>EJ</td>
<td>Mechanical relay 5 A, form C</td>
</tr>
<tr>
<td>EK</td>
<td>Mechanical relay 5 A, form C</td>
</tr>
<tr>
<td>FA</td>
<td>Universal process</td>
</tr>
<tr>
<td>FC</td>
<td>Universal process</td>
</tr>
<tr>
<td>FJ</td>
<td>Universal process</td>
</tr>
<tr>
<td>FK</td>
<td>Universal process</td>
</tr>
<tr>
<td>AK</td>
<td>None</td>
</tr>
<tr>
<td>KH</td>
<td>Solid-state relay, form A, 0.5 A</td>
</tr>
<tr>
<td>KK</td>
<td>Solid-state relay, form A, 0.5 A</td>
</tr>
</tbody>
</table>

### Communications Options

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>None</strong></td>
<td>EIA 485 Modbus RTU®</td>
<td></td>
</tr>
</tbody>
</table>

### Additional Options

<table>
<thead>
<tr>
<th></th>
<th>AA</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard EZ-ZONE® face plate</strong></td>
<td>Class 1, div. 2 (not available with mechanical relay outputs)</td>
<td></td>
</tr>
</tbody>
</table>

Note: The model of controller that you have is one of many possible models in the EZ-ZONE® PM family of controllers. To view the others, visit our website (http://www.watlow.com/literature/pti search.cfm) and type EZ-ZONE® into the Keyword field.
Watlow EZ-ZONE® PM PID Controller

Appendix

Index

Screens

Alarm Blocking 34, 55
AC Line Frequency 35, 54
Active Set Point 25
Address Modbus 36
Address Standard Bus 36
Alarm Display 34
Alarm High Set Point 25, 55
Alarm Hysteresis 34, 55
Analog Input Menu 23, 28
Process Value 23
Alarm Latching 34, 55
Alarm Error 1 to 4 17, 18, 21
Alarm Logic 34
Alarm High 1 to 4 17, 18, 21
Alarm Low 1 to 4 17, 18, 21
Alarm Menu 24, 34
Alarm Low Set Point 25, 55
Alarm Sides 34
Alarm Silencing 34, 55
Autotune Set Point 24, 46
Attention 17, 18, 20, 21, 55
Alarm Type 34, 54
Autotune 24, 46
Autotune 20
Baud Rate 36
Calibration Menu 43
Cool Algorithm 30, 52
Cool Output Curve 30, 51
Display Units 35
Cool Hysteresis 24, 52
Communications Indicator Light 43
Clear 55
Control Mode 23, 51
Control Mode 20
Control Mode Active 23
Communications Menu 35
Cool Proportional Band 24, 47, 52
Cool Power 23, 47
Cool Power 20
Closed Loop Set Point 24
Closed Loop Working Set Point 23
Custom Menu 20, 42, 46
Date of Manufacture 43
Dead Band 24, 53
Decimal 29
Diagnostics Menu 43
Digital Input/Output Menu 23
Direction 29
Digital Output State 23
Event Status 23
Electrical Input Offset 43, 48
Electrical Input Slope 44, 48
Electrical Input Offset 44
Electrical Input Slope 44
End 40
End Type 39
Active Event Output 1 26
Event Output 1 39
Active Event Output 2 26
Event Output 2 39
Error Input 1 or 2 17, 18
Error Input 1 21
Input Error Failure 31, 51
Filter Time 29, 49
Digital Input Function Instance 30
Function Key Instance 35
Digital Output Function Instance 29
Output Function Instance 32, 33
Digital Output Function 29
Output Function 32, 33, 47, 50
Digital Input Function 30, 35
Function Menu 34
Global Menu 35
Guaranteed Soak Deviation 35
Guaranteed Soak Enable 35
Heat Algorithm 30, 52
Heater Error 17, 18, 21
Heater Hysteresis 24, 52
Hours 39
Heat Proportional Band 24, 47, 52
Heat Power 23, 47
Heat Power 20
Loop High Set Point 32
Calibration Offset 23, 48–49
Idle Set Point 24
Idle Set Point 20
Input Error Latching 29
Input Error Status 23
Instance 42
Jump Count 39
Jump Count Remaining 26
Jump Loop 40
Jump Step 39
Digital Input Level 29, 34
Open Loop Detect Deviation 31
Open Loop Detect Enable 31
Open Loop Detect Time 31
Linearization 28
Lockout Menu 42
Lock Operations Menu 42, 56
Lock Profiling Page 42, 56
Loop Menu 23, 30
Loop Open Error 17, 18, 21
Loop Reversed Error 17, 18, 21
Loop Low Set Point 32
Manual Power 31
Minutes 39
Monitor Menu 23
Electrical Measurement 43, 48
Output Calibration Offset 33
Output Control 29, 33
Output High Power Scale 29, 33
Output Low Power Scale 29, 33
Open Loop Set Point 24
Output Time Base 29, 33
Output Menu 32
Output Type 32, 50
Profile Action Request 20, 21
Profile Action Request 25
Parameter 1 to 20 42
Parity 36
Protocol 36
Process Error Enable 28
Process Error Low 29
Profile 38
Profile Start 20, 21
Profile Status Menu 25
Profile Start 25
Profile Type 35
Process Value Active 23
Rate 39, 40
Software Revision 43
Range High 28, 33, 49
Range Low 28, 32, 49
Read Lockout Security 42, 56
Ramp Action 31, 54
Ramping 17, 18, 21
Ramp Rate 32, 54
Ramp Scale 31, 54
Retransmit Source 32, 50
RTD Leads 28
A
accuracy 61
Active Event Output (1 or 2) 26
Active Process Value 20
Active Set Point 20, 25
Active Step 25
Active Step Type 25
Active Target Set Point 25
AC Line Frequency 35, 54
adaptive tuning 47
Address Modbus 36
Address Standard Bus 36
Advance Key 17, 18
agency approvals 2, 61
alarms 54
Blocking 34, 55
deviation 54
Display 34
Hysteresis 34, 55
Latching 34, 55
Logic 34
process 54
set points 54
Sides 34
Silencing 34, 55
Source 34
Type 34
alarm blocking 55
Alarm Error 1 to 4 17, 18
Alarm High 1 to 4 17, 18
Alarm Low 1 to 4 17, 18
Alarm Menu 24, 34
Operations Page 22
Setup Page 27
Alarm Type 34, 54
Analog Input Menu 23, 28
Operations Page 22
Setup Page 27
Attention 20
Autotune 20, 46
Autotune Aggressiveness 31
Autotune Request 24
Autotune Set Point 24, 46
autotuning 46–47
autotuning with TRU-TUNE+® 47
auto (closed loop) control 51
Closed Loop Set Point 24
Closed Loop Working Set Point 23
communications activity light 17
Communications Indicator Light 43
Communications Menu 35
Setup Page 27
Control 29, 33
ccontrol methods 51
Control Mode 20, 23, 51
Control Mode Active 23
Cool Algorithm 30, 52
Cool Hysteresis 24, 52
Cool Output Curve 30, 51
Cool Power 20, 23, 47
Cool Proportional Band 24, 47, 52
current sensing 55
cCustom Menu 20, 42, 46
Factory Page 41
Custom Menu display 20
D
Date of Manufacture 43
Dead Band 24, 53
dead band 53
Decimal 29
Declaration of Conformity 68
default Home Page parameters 20
deviation alarms 54
Diagnostics Menu 43
Factory Page 41
Digital Input/Output Menu 23, 29
Operations Page 22
Setup Page 27
digital inputs 3
digital Input Function 3, 35
digital input specifications 61
digital output specifications 61
dimensions 62
1/16 DIN 6
1/32 DIN 5
direction 29
display 34
displays 17
display Units 35
down Key 17, 18
E
electrical gain 48
electrical Input Offset 43, 48
electrical Input Slope 44, 48
electrical Measurement 43, 48
electrical Output Offset 44
electrical Output Slope 44
deend 40
dend Set Point Value 39
environment 61
error Input 1 or 2 17, 18
event Output (1 and 2) 39
event Status 23
Filter Time 29, 49
filter time constant 49
Function 30, 47
Function Instance 29, 32, 33
Function Key Menu 34, 56
Setup Page 27

Factory Page 41
Filter Time 29, 49
filter time constant 49
Function 30, 47
Function Instance 29, 32, 33
Function Key Menu 34, 56
Setup Page 27

Global Menu 35
Setup Page 27

Guaranteed Soak Deviation 35
Guaranteed Soak Enable 35

Heater Error 17, 18
Heat Algorithm 30, 52
Heat Hysteresis 24, 52
Heat Power 20, 23, 47
Heat Proportional Band 24, 47, 52
High Power Scale 29, 33
high range 49
high scale 49
High Set Point Alarm 25, 55
Loop 32, 49
Home Page 20, 46
Home Page display 20
Hours 39
Hysteresis 34, 55

Idle Set Point 20, 24
Infinity Key 17, 18
inputs 3
Input Error Failure 31, 51
Input Error Latching 29, 51
Input Error Status 23
input events 3
input features 48–50
calibration 48
Input Function Instance 30
Input Sensor Type 47
installation 7
Instance 35, 42

Jump Count 39
Jump Count Remaining 26
Jump Loop 40
Jump Step 39

keys and displays
1/16 DIN 17
1/32 DIN 18

Latching 34, 55
Level 29, 34
Linearization 28
line voltage/power 61
lockout 56
Lockout Menu 42, 56
Factory Page 41
Lock Operations Page 42, 56
Lock Profiling Page 42, 56
Logic 34
Loop Menu 23, 30
Operations Page 22
Setup Page 27
Loop Open Error 17, 18
Loop Reversed Error 17, 18
lower display 17, 18
Low Power Scale 29, 33
low range 49
low scale 49
Low Set Point
  Alarm 25, 55
  Loop 32, 49

manual (open loop) control 51
Manual Control Indicator Light 51
Manual Power 31
manual tuning 47
message, display 17, 18
Message Action 21
Minutes 39
Monitor Menu 23
Operations Page 22

navigating
Factory Page 41
Pages and menus 19
Profile 37
Setup Page 27
NEMA 4X seal 7
network wiring 16
no-arc relay 50

on-off control 52
Open Loop Detect Deviation 31
Open Loop Detect Enable 31
Open Loop Detect Time 31
Open Loop Set Point 24
Operations Page 22, 42
operator interface 62
outputs 3
output activity lights 17, 18
output configuration 51
output events 3
output features 49
Output Function 29, 32, 33, 50
output hardware specifications 61
Output Menu 32
Setup Page 27
output power scaling 50
Output State 23
Output Type 32, 50

P3T armor sealing system 2
Parameter 1 to 20 42
Parity 36
Part Number 43
percent units indicator light 17, 18
process alarms 54
Process Error Enable 28
Process Error Low 29
Process Value 23
Process Value Active 23
Profile 38
Profile Action Request 20, 21, 25
profile activity light 17, 18
Profile Start 20, 21, 25
Profile Status Menu 25
  Operations Page 22
Profile Type 35
Profiling Page 37, 42
programming the Home Page 46
proportional control 52
  plus integral (PI) control 52
  plus integral plus derivative (PID) control 53
Protocol 36

Q

Ramp Action 31
Ramp Rate 32, 54
Ramp Scale 31, 54
Range High 28, 33, 49
Range Low 28, 32, 49
Rate 39, 40
Read Lockout Security 42, 56
removing mounted controller 7
responding to a displayed message 17–18
restoring user settings 46
retransmit 49
Retransmit Source 32, 50
RTD Leads 28

saving user settings 46
Scale High 28, 32, 49, 50
Scale Low 28, 32, 49, 50
Seconds 39
securing settings 56
sensor selection 49
Sensor Type 28, 47, 49
serial communications 61
Serial Number 43
Setup Page 27
Set Lockout Security 43, 56
set point high limit 49
Appendix

Set Point High Limit Open Loop 32
Set point low limit 49
Set Point Low Limit Open Loop 32
Sides
  Alarm 34
Silencing 34, 55
Single set point ramping 54
Soak 40
Software Build 43
Software Revision 43
Source 34
specifications 61
Step 38
Step Time Remaining 26
Step Type 38

T
Target Set Point 38
temperature units indicator lights 17
Time 40
Time Base 29, 33
Time Derivative 24, 47, 53
Time Integral 24, 47, 52
troubleshooting 58
TRU-TUNE+® Band 30, 47
TRU-TUNE+® Enable 30, 47
TRU-TUNE+® Gain 31, 47
tuning the PID parameters 46

U
universal input 61
Unused Step 40
upper display 17, 18
Up Key 17, 18
User Failure Action 31
User Restore Set 43, 46
User Save Set 43, 46
User Tune Aggressiveness 46
using the software 56

V
variable time base 53

W
Wait Event 40
Wait Event (1 and 2) 39
Wait For Both 40
Wait For Process 40
Wait For Process Instance 39
Wait For Process Value 39
weight 62
wiring
digital input or output 5 11
digital input or output 6 11
high power 11
input 1 potentiometer 12
input 1 process 12
input 1 RTD 12
input 1 thermocouple 12
low power 11
Modbus RTU or Standard Bus EIA-485 communications 15
output 1 mechanical relay, form C 13
output 1 solid-state relay, form A 14
output 1 switched dc/open collector 13
output 1 universal process 13
output 2 mechanical relay, form A 14
output 2 no-arc relay, form A 14
output 2 solid-state relay, form A 15
output 2 switched DC/open collector 14
output 3 switched dc/open collector 15
Standard Bus EIA-485 communications 15
wiring a network 16
wiring termination, touch-safe terminals 61

X

Y

Z
zone display 17
Declaration of Conformity

Series EZ Zone PM

Watlow Winona, Inc.
1241 Bundy Blvd.
Winona, MN 55987 USA

Declares that the following product:
Designation: Series EZ Zone PM (Panel Mount)
Model Numbers: PM (3 or 6)(Any letter or number) – (1, 2, 3 or 4)(A, C, E, F or K)
(A, C, H, J or K)(Any letter or number) – (Any letter or number)
(A, C, E, F or K)(A, D, J or K)(Any two letters or numbers)
Classification: Temperature control, Installation Category II, Pollution degree 2
Rated Voltage and Frequency: 100 to 240 V~ ac 50/60 Hz or 15 to 36 V~ dc/24 V~ ac 50/60 Hz
Rated Power Consumption: 10 VA maximum.
Environmental Rating: Front Panel IP66

Meets the essential requirements of the following European Union Directives by using the relevant standards show below to indicate compliance.

EN 61000-4-2 1996 A1, A2, 2001 Electrostatic Discharge Immunity
EN 61000-4-3 2002 A1, A2, 2005 Radiated Field Immunity
EN 61000-4-4 2004 Electrical Fast-Transient / Burst Immunity
EN 61000-4-5 1995 A1, A2, 2001 Surge Immunity
EN 61000-4-6 1996 A1,A2,A3, 2005 Conducted Immunity
EN 61000-4-11 2004 Voltage Dips, Short Intermittent and Voltage Variations Immunity
EN 61000-3-2 2000 ED.2. Harmonic Current Emissions
EN 61000-3-3¹ 1995 A1, A2, 2002 Voltage Fluctuations and Flicker

¹For mechanical relay loads, cycle time may need to be extended up to 30 seconds to meet flicker requirements depending on load switched and source impedance.

73/23/EEC Low-Voltage Directive
EN 61010-1 2001 Safety Requirements of electrical equipment for measurement, control and laboratory use. Part 1: General requirements

Compliant with 2002/95/EC RoHS Directive

2002/96/EC WEEE Directive Equipment Requires Recycling

Raymond D. Feller III Winona, Minnesota, USA
Name of Authorized Representative Place of Issue

General Manager August, 2007
Title of Authorized Representative Date of Issue

Signature of Authorized Representative
How to Reach Us

Corporate Headquarters
Watlow Electric Manufacturing Company
12001 Lackland Road
St. Louis, MO 63146
Sales: 1-800-WATLOW2
Manufacturing Support: 1-800-4WATLOW
Email: info@watlow.com
Website: www.watlow.com

From outside the USA and Canada:
Tel: +1 (314) 878-4600
Fax: +1 (314) 878-6814

Latin America
Watlow de México S.A. de C.V.
Av. Fundición No. 5
Col. Parques Industriales
Querétaro, Qro. CP-76130
Mexico
Tel: +52 442 217-6235
Fax: +52 442 217-6403

Europe
Watlow France SARL
Immeuble Somag
16, Rue Ampère
95307 Cergy-Pontoise CEDEX
France
Tel: +33 (0)1 30 73 24 25
Fax: +33 (0)1 30 73 28 75
Email: info@watlow.fr
Website: www.watlow.fr

Watlow GmbH
Postfach 11 65, Lauchwasenstr. 1
D-76709 Kronau
Germany
Tel: +49 (0) 7253 9400-0
Fax: +49 (0) 7253 9400-900
Email: info@watlow.de
Website: www.watlow.de

Watlow Italy S.r.l.
Viale Italia 52/54
20094 Corsico MI
Italy
Tel: +39 024588841
Fax: +39 0245869954
Email: italyinfo@watlow.com
Website: www.watlow.it

Watlow Korea Co., Ltd.
#1406, E&C Dream Tower, 46, Yangpyeongdong-3ga
Yeongdeungpo-gu, Seoul 150-103
Republic of Korea
Tel: +82 (2) 2628-5770
Fax: +82 (2) 2628-5771
Website: www.watlow.co.kr

Watlow Malaysia Sdn Bhd
No. 14-3 Jalan 2/114
Kuchai Business Centre
Jalan Kuchai Lama
58200 Kuala Lumpur
Malaysia
Tel: +60 3 7980 7741
Fax: +60 3 7980 7739

Watlow Electric Taiwan Corporation
10F-1 No.189 Chi-Shen 2nd Road Kaohsiung 80143
Taiwan
Tel: +886-7-2885168
Fax: +886-7-2885568

Asia and Pacific
Watlow Singapore Pte Ltd.
16 Ayer Rajah Crescent,
#06-03/04,
Singapore 139965
Tel: +65 6773 9488
Fax: +65 6778 0323
Email: info@watlow.com.sg
Website:www.watlow.com.sg

Watlow Australia Pty., Ltd.
4/57 Sharps Road
Tullamarine, VIC 3043
Australia
Tel: +61 3 9335 6449
Fax: +61 3 9330 3566
Website: www.watlow.com

Watlow Electric Manufacturing (Shanghai) Company
115-22#, 572nd Lane, Bibo Road, Zhangjiang High-Tech Park,
Shanghai, PRC 201203
People’s Republic of China
Tel: +86 21 5080-0902
Fax: +86 21 5080-0906
Email: info@watlow.cn
Website: www.watlow.cn

Watlow Japan Ltd.
1-14-4 Uchikanda, Chiyoda-Ku
Tokyo 101-0047
Japan
Tel: +81-3-3518-6630
Fax: +81-3-3518-6632
Email: info@watlow.com
Website: www.watlow.co.jp

Your Authorized Watlow Distributor