

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

**Artisan Technology Group**
(217) 352-9330 | sales@artisantg.com | artisantg.com

**Full-service, independent repair center**
with experienced engineers and technicians on staff.

**We buy your excess, underutilized, and idle equipment**
along with credit for buybacks and trade-ins.

**Custom engineering**
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

**Expert team | Trust guarantee | 100% satisfaction**

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

**Visit our website - *Click HERE***

# Series 96

# User's Manual




## 1/16 DIN Temperature Controller

### with Custom Toolbar (patented)

**User Levels:**


• New User ..... go to page 1.1
• Experienced User ..... go to page 2.1
• Expert User ..... go to page 2.1


**Installers:**


• Installation ..... go to page 2.1
• Wiring .....go to page 3.1


CE

TOTAL CUSTOMER SATISFACTION
3 Year Warranty

ISO 9001
Registered Company
Winona, Minnesota USA

WATLOW

**U.S. English**


1241 Bundy Blvd., P.O. Box 5580, Winona, Minnesota USA 55987-5580
Phone: (507) 454-5300, Fax: (507) 452-4507 http://www.watlow.com



**0600-0002-0002 Rev G**
**July 2005**
Supersedes: 0600-0002-0002 Rev F

**Made in the U.S.A.**
**$15.00**

**NOTE:**

**Details of a "Note" appear in the narrow margin on the outside or on the bottom of each page.**

**CAUTION:**

**Details of a "Caution" appear here in the narrow margin on the outside of each page.**

**WARNING:**

**Details of a "Warning" appear here in the narrow margin on the outside of each page.**

# 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.

# Technical Assistance

If you encounter a problem with your Watlow controller, see the Troubleshooting Table in the Appendix and review all of your configuration information to verify that your selections are consistent with your application: inputs; outputs; alarms; limits; etc. If the problem persists after checking the above, you can get technical assistance from your local Watlow representative, or by dialing (507) 454-5300.

An applications engineer will discuss your application with you.

**Please have the following information available when calling:**

- Complete model number
- All configuration information
- User's Manual
- Diagnostic Menu readings

# Your Feedback

Your comments or suggestions on this manual are welcome. Please send them to: Technical Writer, Watlow Winona, 1241 Bundy Blvd., P.O. Box 5580, Winona, MN 55987-5580; phone: (507) 454-5300; fax: (507) 452-4507. *The Series 96 User's Manual* is copyrighted by Watlow Winona, Inc., © July 2005, with all rights reserved. (2198)

# Series 96
# Table of Contents


Chapter 1: Overview . . . . . .1.1

Chapter 2: Installation . . . . . .2.1

Chapter 3: Wiring . . . . . .3.1
- Input to Output Isolation . . . . . .3.1
- Power Wiring . . . . . .3.1
- Sensor Installation Guidelines . . . . .3.1
- Input 1 . . . . . .3.2
- Input 2 . . . . . .3.3
- Output 1 . . . . . .3.4
- Output 2 . . . . . .3.5
- Output 3 . . . . . .3.6
- Output 4 . . . . . .3.7
- Wiring Example . . . . . .3.9

Chapter 4: Navigation and Software. . . . 4.1
- Keys and Displays . . . . . .4.1
- Navigation . . . . . .4.2
- Software Map . . . . . 4.3
- Basic Navigation for New Users. . . . 4.4

Chapter 5: Features. . . . . 5.1
- The System. . . . . 5.1
- Input . . . . . 5.3
- Control Methods . . . . . 5.5
- Alarms. . . . . 5.9
- Errors . . . . . 5.10
- Communications . . . . . 5.11

Chapter 6: Parameters . . . . . 6.1
- Home Page. . . . . 6.1
- Operations Page . . . . . 6.2
- Setup Page . . . . . 6.8
- Factory Page. . . . . 6.18

Chapter 7: Ramping . . . . . 7.1

Appendix. . . . . A.1
- Troubleshooting Alarms and Errors . A.1
- Modbus™ Register Numbers . . . . . A.3
- Declaration of Conformity . . . . . A.4
- Product Specifications. . . . . A.5
- Ordering Information . . . . . A.7
- Index . . . . . A.8
- Prompt Index . . . . . A.10
- Required Parameter Setup Order . . . . . .inside back cover
- Software Map . . . . . .inside back cover
- Calibration Information .inside back cover
- Warranty and Returns Policy. . back cover

# 1

# Chapter One
# **Overview**

## Introduction

With one universal input, a second auxiliary input and four outputs, the Series 96 can be programmed to perform temperature measurement, input event switching, remote set point input, heating, boost heating, cooling, alarms, digital communications, ramp and soak, and retransmit. These features make this controller ideally suited for applications involving plastics, packaging, semiconductor, food processing and lab equipment.

Set point ramping operations include two files with eight steps in each file. The files may be linked to create a single 16-step profile for varying ramp and soak needs.

With fast 10hz sampling, burst firing outputs, NEMA 4x front panel, and 0.1 percent accuracy, the Series 96 can easily handle some of the toughest application needs. The Series 96 is manufactured by ISO 9001-registered Watlow Winona with reliability backed by a three-year warranty.

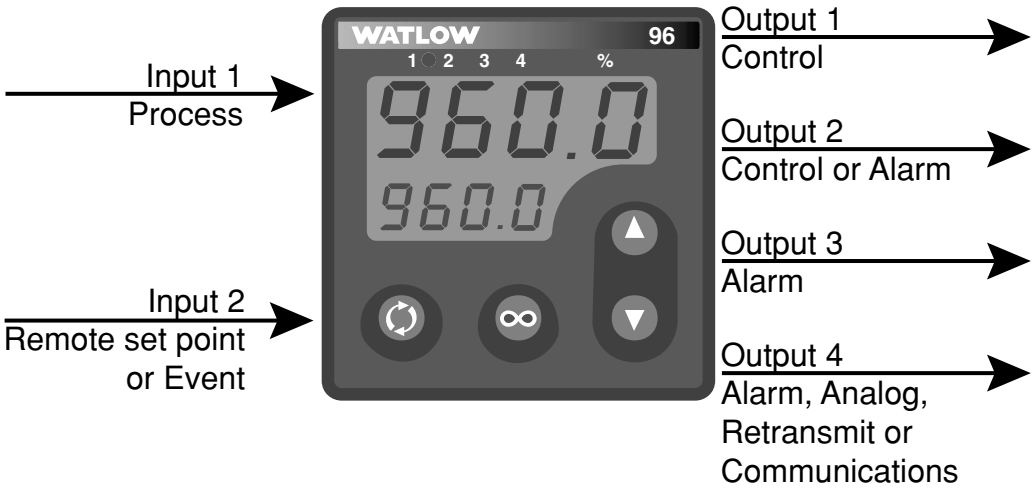



**Figure 1.1 – Series 96 inputs and outputs.**

# 2

# Chapter Two
# **Installation**

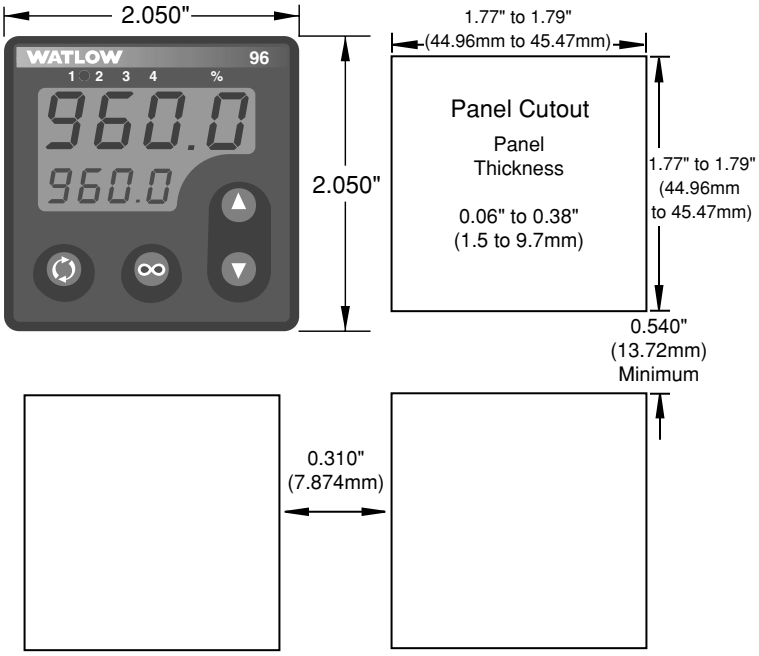



**Figure 2.1 – Series 96 multiple panel cutout dimensions.**

**NOTE: Measurements between panel cutouts are the minimum recommended.**

**For rapid mounting, use Greenlee 1/16 DIN punch, die, draw stud, part number 60287, available from Grainger.**

# Installing the Series 96 Controller

Installing and mounting requires access to the back of the panel.

1. Make the panel cutout using the mounting template dimensions found in this chapter.
2. Check to see that the gasket is properly seated into the gasket channel on the front bezel and that it is not twisted. Make sure that the rounded surface of the gasket is the surface that is exposed from the gasket channel, as this is the surface that will mate to the panel surface. Insert the controller into the panel cutout.
3. With the controller inserted into the panel cutout, take the retention collar and slide it over the controller, making certain that the two locating holes in the retention collar are visible from the rear of the controller, with one hole pointing up and one pointing down. Then, take the mounting collar and slide it over the controller, making certain that one cantilever is pointing up and one is pointing down also. With one hand holding the controller and the other hand using a #2 Phillips screwdriver, tighten the two screws in the mounting collar until the gap between the bezel and panel surface is .025" maximum.

See the figure below. Make sure that you cannot move the controller back and forth in the cutout. If you can, you do not have a proper seal.

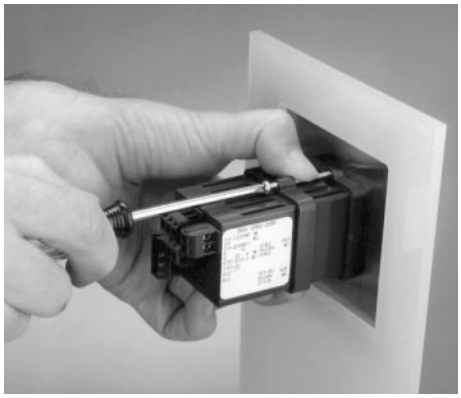


**Figure 2.2a – Installing the controller.**

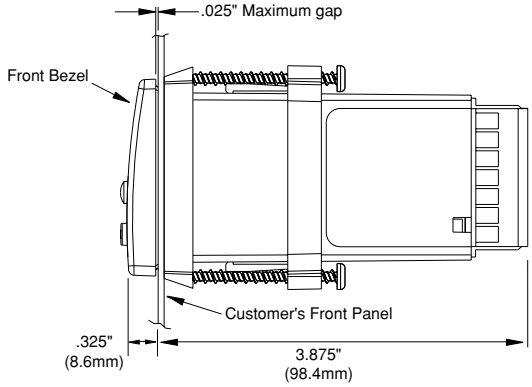



**Figure 2.2b – Series 96 gap dimensions.**

**CAUTION: Follow the installation procedure exactly to guarantee a proper NEMA 4X seal. Make sure the gasket between the panel and the rim of the case is not twisted and is seated properly. Failure to do so could result in damage to equipment.**

**NOTE: Be careful not to over-tighten the screws. This may cause the mounting cover to fail. Over-tightening occurs when the front bezel is touching the customer's front panel.**

# Removing the Series 96 Controller

1. Hold the controller with one hand while using the other hand to loosen the screws with a #2 Phillips screwdriver until the end of the screw is flush or past the end of the cantilevers; see the figure below.
2. After the screws have been loosened, hold the controller with one hand while squeezing the two screws together with the other hand. Then simply slide the mounting collar off the controller.

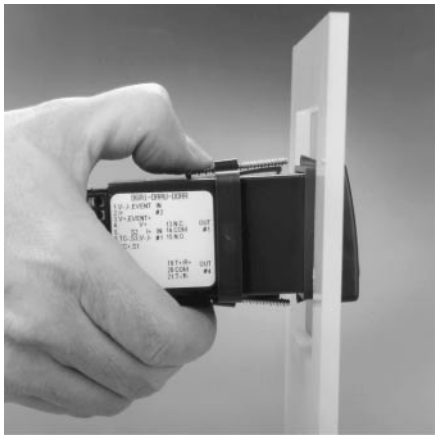


**Figure 2.2c Removing the controller.**

# 3

# Chapter Three
# Wiring

**NOTE:**
**It is advisable to check Output 1-4 hardware. These outputs may differ from those listed for the model number on the controller and described in this manual, indicating a customized hardware setup.**

**CAUTION:**
**If high voltage is applied to a low-voltage unit, irreversible damage will occur.**

**WARNING:**
**To avoid damage to property and equipment, and/or injury of loss of life, use National Electric Code (NEC) standard wiring practices to install and operate the Series 96. Failure to do so could result in injury or death.**

**CAUTION:**
**Maintain isolation between input 1 and input 2 to prevent a ground loop. A ground loop may cause incorrect readings, dashes across the upper display or the display of error codes. Failure to follow this guideline could result in damage to equipment and product.**

## Input-to-Output Isolation

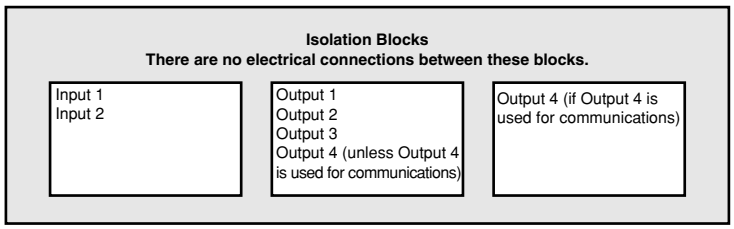



**Figure 3.1a Isolation blocks.**

## Power Wiring

100 to 240V~ (ac), nominal (85 to 264 actual) 96 A _ - _ _ _ _ - _ _ _ _

24 to 28V≂ (ac/dc), nominal (21 to 30 actual) 96 B _ - _ _ _ _ - _ _ _ _

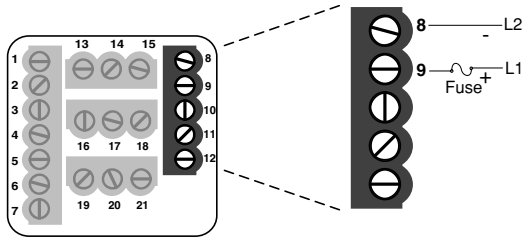



**Figure 3.1b Power wiring.**

## Sensor Installation Guidelines

**Thermocouple inputs:** Extension wire for thermocouples must be of the same alloy as the thermocouple to limit errors.

When using a process signal (4-20mA, 0-5V⎓ [dc], etc.) for the remote set point or a voltage input for the digital input 2, use an ungrounded or isolated thermocouple. If a grounded thermocouple is required, the signal to input 2 must be isolated to prevent possible ground loops.

**RTD input:** Each 1Ω of lead wire resistance can cause a +2°F error when using a two-wire RTD. A three-wire RTD sensor overcomes this problem. All three wires must have the same electrical resistance (i.e., same gauge, same length, multi-stranded or solid, same metal).

**Process input:** Isolation must be maintained between input 1 and input 2. If both input 1 and input 2 are process signals, a separate power supply and transmitter must be used for each input. These inputs must be electrically isolated from one another to prevent ground loops.

# Input 1 Wiring

**NOTE:**

**Successful installation requires five steps:**

- **Choose the controller's hardware configuration and model number (Appendix);**
- **Choose a sensor (Chapters Three and Six, and Appendix);**
- **Install the controller (Chapter Two);**
- **Wire the controller (Chapter Three) and**
- **Configure the controller (Chapters Four, Five and Six).**

**WARNING:**

**To avoid potential electric shock and damage to property and equipment, use National Electric Code (NEC) safety practices when wiring and connecting this unit to a power source and to electrical sensors or peripheral devices. Failure to do so could result in injury or death.**

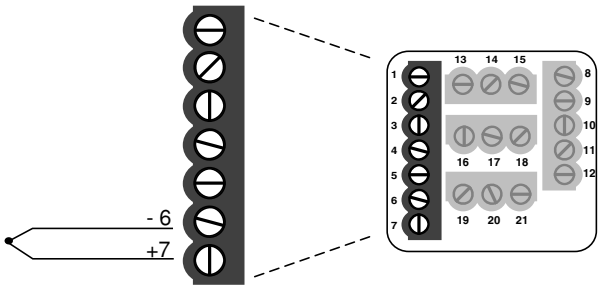
**CAUTION:**

**Maintain isolation between input 1 and input 2 to prevent a ground loop. A ground loop may cause incorrect readings, dashes across the upper display or the display of error codes. Failure to follow this guideline could result in damage to equipment and product.**

## Figure 3.2a – **Thermocouple**

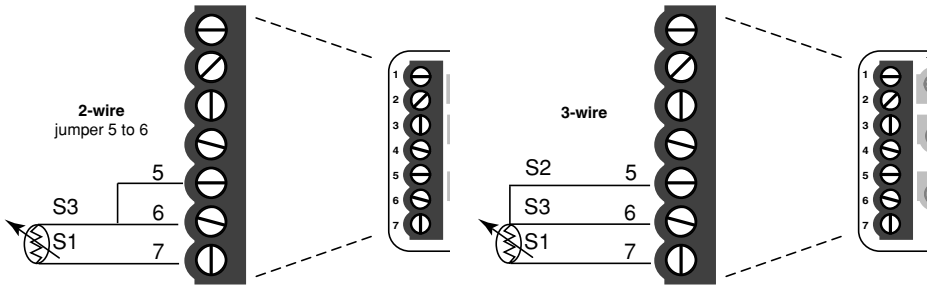
Available on all units

Impedance: 20MΩ




## Figure 3.2b – **RTD (2- or 3-Wire) 100Ω Platinum**

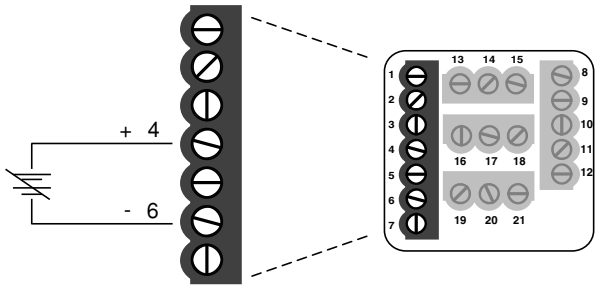
Available on all units




## Figure 3.2c – **0-5V⎓, 1-5V⎓ or 0-10V⎓ (dc) Process

Available on all units

Input impedance: 20kΩ



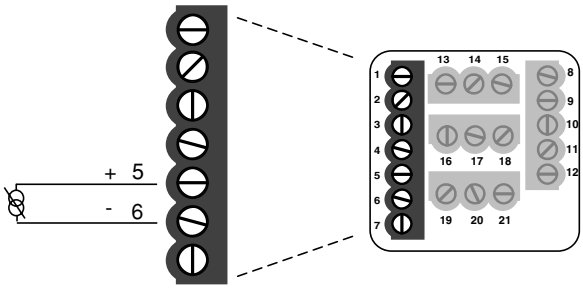

## Figure 3.2d – **0-20mA or 4-20mA Process

Available on all units

Input impedance: 100Ω

**CAUTION:

**Process input does not have sensor break protection. Outputs can remain full on.**



# Input 2 Wiring

**WARNING:**

**To avoid damage to property and equipment, and/or injury of loss of life, use National Electric Code (NEC) standard wiring practices to install and operate the Series 96. Failure to do so could result in injury or death.**

**CAUTION:**

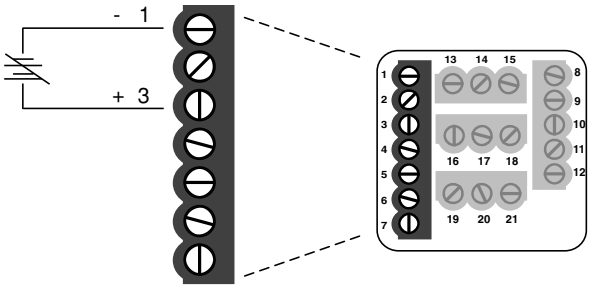
**Maintain isolation between input 1 and input 2 to prevent a ground loop. A ground loop may cause incorrect readings, dashes across the upper display or the display of error codes. Failure to follow this guideline could result in damage to equipment and product.**

****CAUTION:**

**Process input does not have sensor break protection. Outputs can remain full on.**

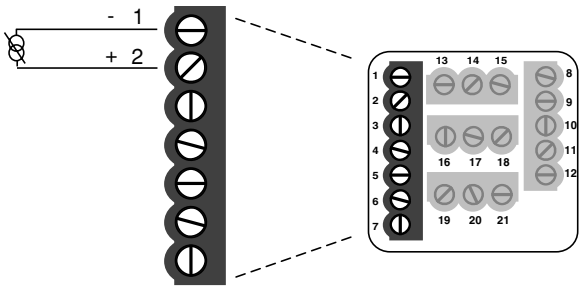
## Figure 3.3a – **0-5V⎓, 1-5V⎓ or 0-10V⎓ (dc) Process

Universal signal conditioner
96 _ 1 - _ _ _ _ - _ _ _ _
Input impedance: 20kΩ




## Figure 3.3b – **0-20mA or 4-20mA Process

Universal signal conditioner
96 _ 1 - _ _ _ _ - _ _ _ _
Input impedance: 100Ω




## Figure 3.3c – Digital Event

96 _ 1 - _ _ _ _ - _ _ _ _

**Voltage input**

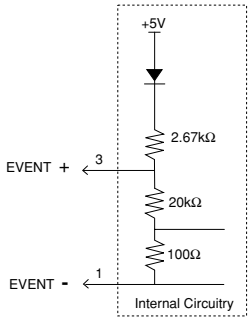
3-36V⎓ (dc) Event Input High State

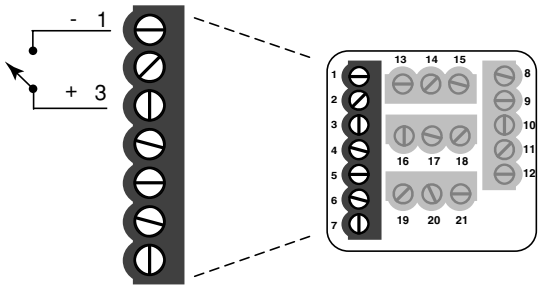
0-2V⎓ (dc) Event Input Low State

**Contact closure**

0-2kΩ Event Input Low State

> 23kΩ Event Input High State



# Output 1 Wiring

**NOTE:**

**Successful installation requires five steps:**

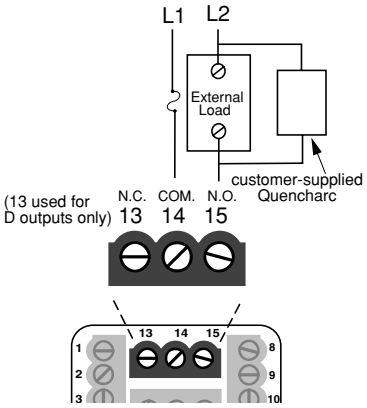
- **Choose the controller's hardware configuration and model number (Appendix);**
- **Choose a sensor (Chapters Three and Six, and Appendix);**
- **Install the controller (Chapter Two);**
- **Wire the controller (Chapter Three) and**
- **Configure the controller (Chapters Four, Five and Six).**

**NOTE:**

**Switching inductive loads (relay coils, solenoids, etc.) with the mechanical relay, switched dc or solid-state relay output options requires use of an R.C. suppressor.**

**Watlow carries the R.C. suppressor Quencharc brand name, which is a trademark of ITW Paktron. Watlow Part No. 0804-0147-0000.**

## Figure 3.4a – **AC Outputs**




•Electromechanical relay without contact suppression

96 _ _ - D _ _ _ - _ _ _ _

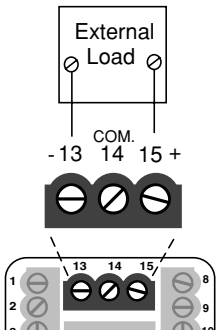
Form C, 2 amps, off-state impedance: 31MΩ

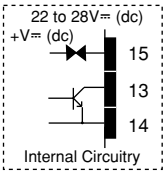
•Solid-state relay without contact suppression

96 _ _ - K _ _ _ - _ _ _ _

0.5 amps, off-state impedance: 31MΩ

## Figure 3.4b – **Switched DC, Open Collector**




96 _ _ - C _ _ _ - _ _ _ _

•Switched dc configuration

Supply current limited to 30mA

•Open collector configuration

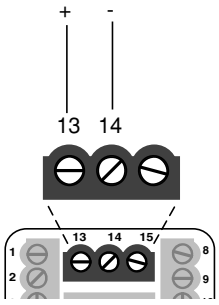
Maximum voltage 42V⎓ (dc)

Maximum current 200mA

## Figure 3.4c – **0-20mA and 4-20mA Process**

96 _ _ - F _ _ _ - _ _ _ _

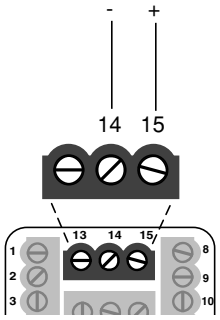
Maximum load impedance: 800Ω




## Figure 3.4d – **0-5V⎓, 1-5V⎓ and 0-10V⎓ (dc) Process**

96-_ _ -F_ _ _ - _ _ _ _

Minimum load impedance: 1kΩ



# Output 2 Wiring

**NOTE:**

**Switching inductive loads (relay coils, solenoids, etc.) with the mechanical relay, switched dc or solid-state relay output options requires use of an R.C. suppressor.**

**Watlow carries the R.C. suppressor Quencharc brand name, which is a trademark of ITW Paktron. Watlow Part No. 0804-0147-0000.**

**WARNING:**

**To avoid damage to property and equipment, and/or injury of loss of life, use National Electric Code (NEC) standard wiring practices to install and operate the Series 96. Failure to do so could result in injury or death.**

## Figure 3.5a – **AC Outputs**

•Electromechanical relay without contact suppression

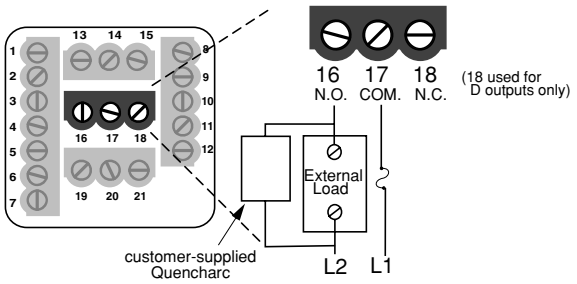
96 _ _ - _ D _ _ _ - _ _ _ _

Form C, 2 amps, off-state impedance: 31MΩ

•Solid-state relay without contact suppression

96 _ _ - _ K _ _ - _ _ _ _

0.5 amps, off-state impedance: 31MΩ




## Figure 3.5b – **Switched DC, Open Collector**

96 _ _ - _ C _ _ - _ _ _ _

**Open Collector**

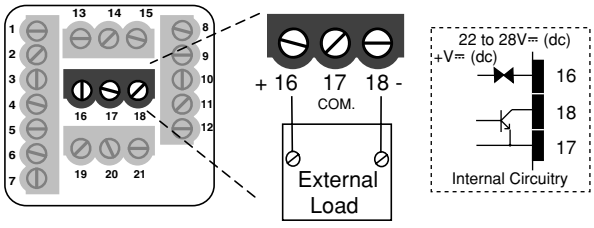
Max. voltage: 42V⎓ (dc)

Max. current: 200mA

**Switched DC**

Max. dc supply current: 30mA

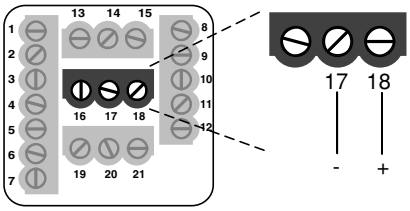
Supply voltage: 22 to 28V⎓ (dc)




## Figure 3.5c – **0-20mA and 4-20mA Process**

96 _ _ - _ F _ _ - _ _ _ _

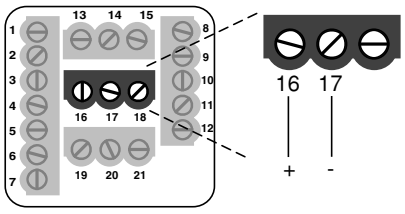
Maximum load impedance: 800Ω




## Figure 3.5d – **0-5V⎓, 1-5V⎓ and 0-10V⎓ (dc) Process**

96 _ _ - _ F _ _ - _ _ _ _

Minimum load impedance: 1kΩ



# Output 3 Wiring

**NOTE:**

**Successful installation requires five steps:**

- **Choose the controller's hardware configuration and model number (Appendix);**
- **Choose a sensor (Chapters Three and Six, and Appendix);**
- **Install the controller (Chapter Two);**
- **Wire the controller (Chapter Three) and**
- **Configure the controller (Chapters Four, Five and Six).**

**NOTE:**

**Switching inductive loads (relay coils, solenoids, etc.) with the mechanical relay, switched dc or solid-state relay output options requires use of an R.C. suppressor.**

**Watlow carries the R.C. suppressor Quencharc brand name, which is a trademark of ITW Paktron. Watlow Part No. 0804-0147-0000.**

**WARNING:**

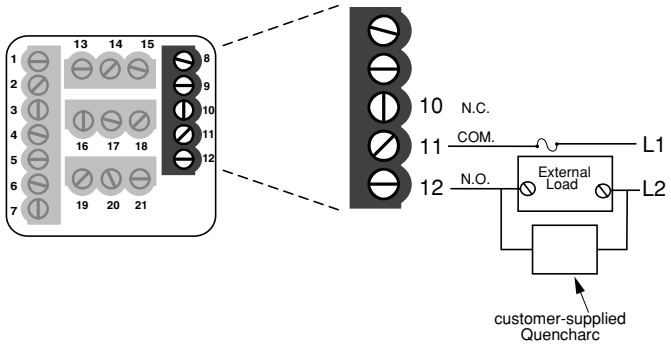
**To avoid damage to property and equipment, and/or injury of loss of life, use National Electric Code (NEC) standard wiring practices to install and operate the Series 96. Failure to do so could result in injury or death.**

Figure 3.6 – **AC Outputs**

Electromechanical relay without contact suppression

96 _ _ - _ _ D_ - _ _ _ _

Form C, 2 amps, off-state impedance: 31MΩ



# Output 4 Wiring

**NOTE:**

**Switching inductive loads (relay coils, solenoids, etc.) with the mechanical relay, switched dc or solid-state relay output options requires use of an R.C. suppressor.**

**Watlow carries the R.C. suppressor Quencharc brand name, which is a trademark of ITW Paktron. Watlow Part No. 0804-0147-0000.**

**WARNING:**

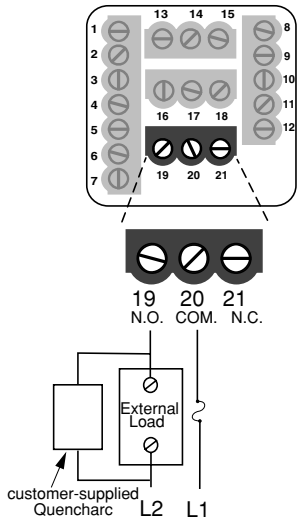
**To avoid damage to property and equipment, and/or injury of loss of life, use National Electric Code (NEC) standard wiring practices to install and operate the Series 96. Failure to do so could result in injury or death.**

## Figure 3.7a – **AC Outputs**

Electromechanical relay without contact suppression

96 _ _ - _ _ _ D - _ _ _ _

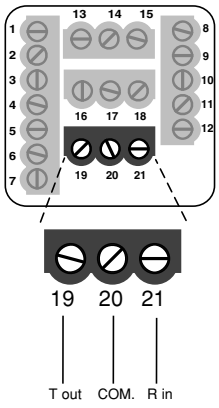
Form C, 2 amps, off-state impedance: 31MΩ




## Figure 3.7b – **Communications and Retransmit Option**

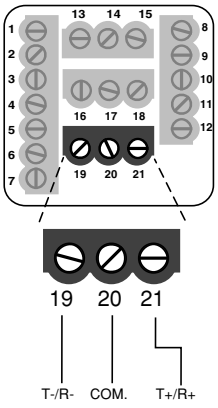
**EIA/TIA-232**

96 _ _ - _ _ _ R - _ _ _ _



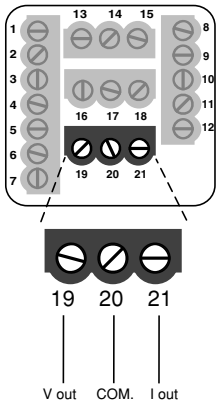

**EIA/TIA-485**

96 _ _ - _ _ _ U - _ _ _ _

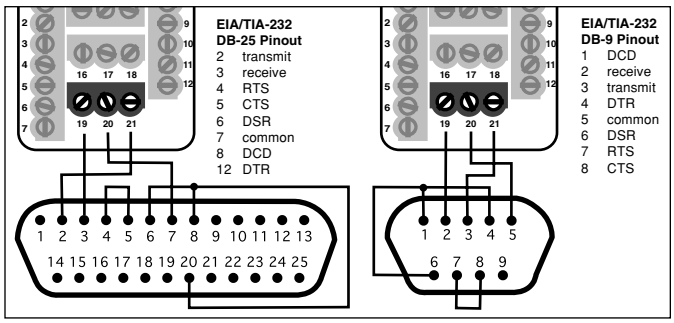



**Retransmit Option**

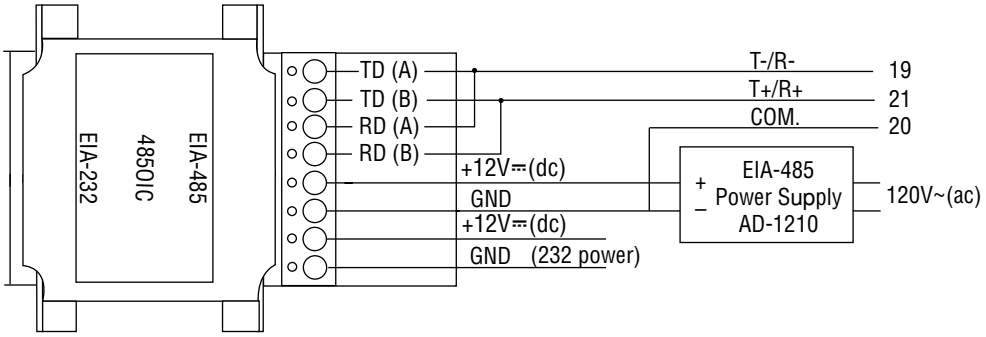
96_ _ - _ _ _ M - _ _ _ _



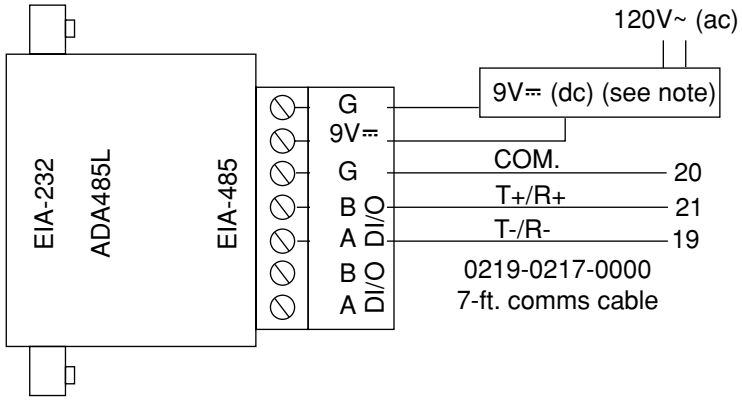

V out: 1,000Ω minimum load impedance.
I out: 800Ω maximum load impedance.



## Figure 3.8a – **EIA-232 to EIA-485 Conversion**




B&B Converter (B&B Electronics Manufacturing Company, [815] 433-5100).




CMC Converter (CMC Connecticut Micro-Computer, Inc., 800-426-2872).

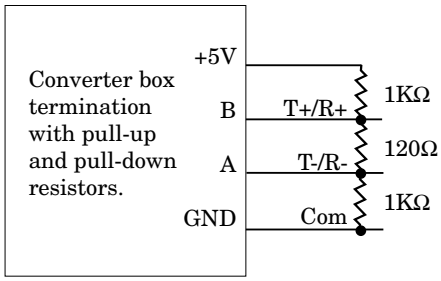
**NOTE:**

**The CMC converter requires an external power supply when used with a laptop computer.**

**WARNING:**

**To avoid damage to property and equipment, and/or injury of loss of life, use National Electric Code (NEC) standard wiring practices to install and operate the Series 96. Failure to do so could result in injury or death.**

## Figure 3.8b – **Termination for EIA-232 to EIA-485 Converter**




If the system does not work properly, it may need termination resistors at each end of the network. A typical installation would require a 120-ohm resistor across the transmit/receive terminals (19 and 21) of the last controller in the network and the converter box or serial card. Pull-up and pull-down resistors may be needed to maintain the correct voltage during the idle state.

**NOTE: For more information about communicating with Watlow controllers, go to www.watlow.com and download the Data Communications Reference: Electronic User's Manual. It is located under Literature, User's Manuals, English and search on *data communications reference*.**

# Wiring Example

**WARNING:**

**To avoid potential electric shock and damage to property and equipment, use National Electric Code (NEC) safety practices when wiring and connecting this unit to a power source and to electrical sensors or peripheral devices. Failure to do so could result in injury or death.**

**WARNING:**

**Install high- or low-temperature-limit control protection in systems where an over-temperature fault condition could present a fire hazard or other hazard. Failure to install temperature-limit control protection where a potential hazard exists could result in damage to equipment and property.**

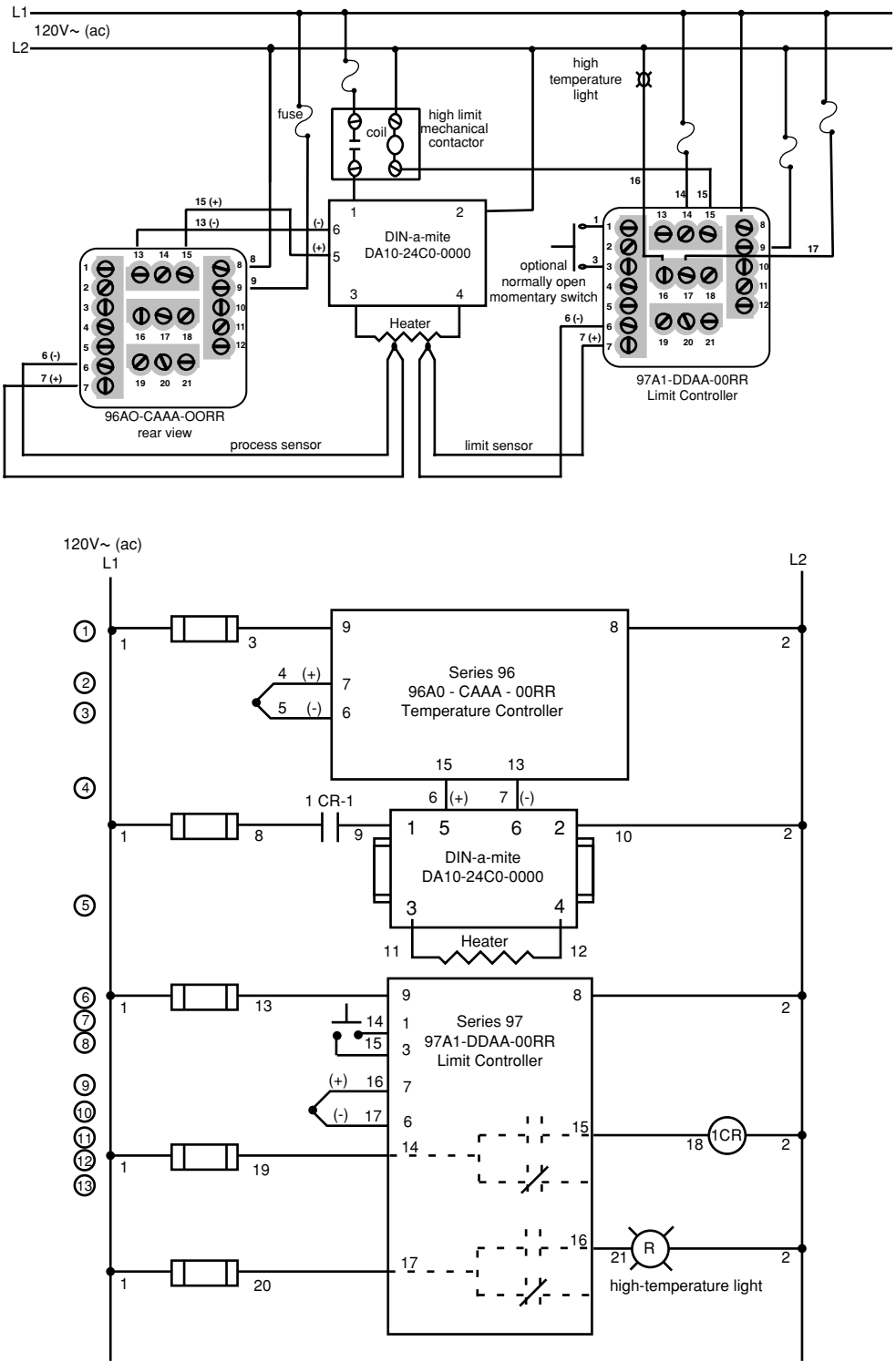



**Figure 3.9 – System wiring example.**

# 4

# Chapter Four
# Navigation and Software

## Keys and Displays

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

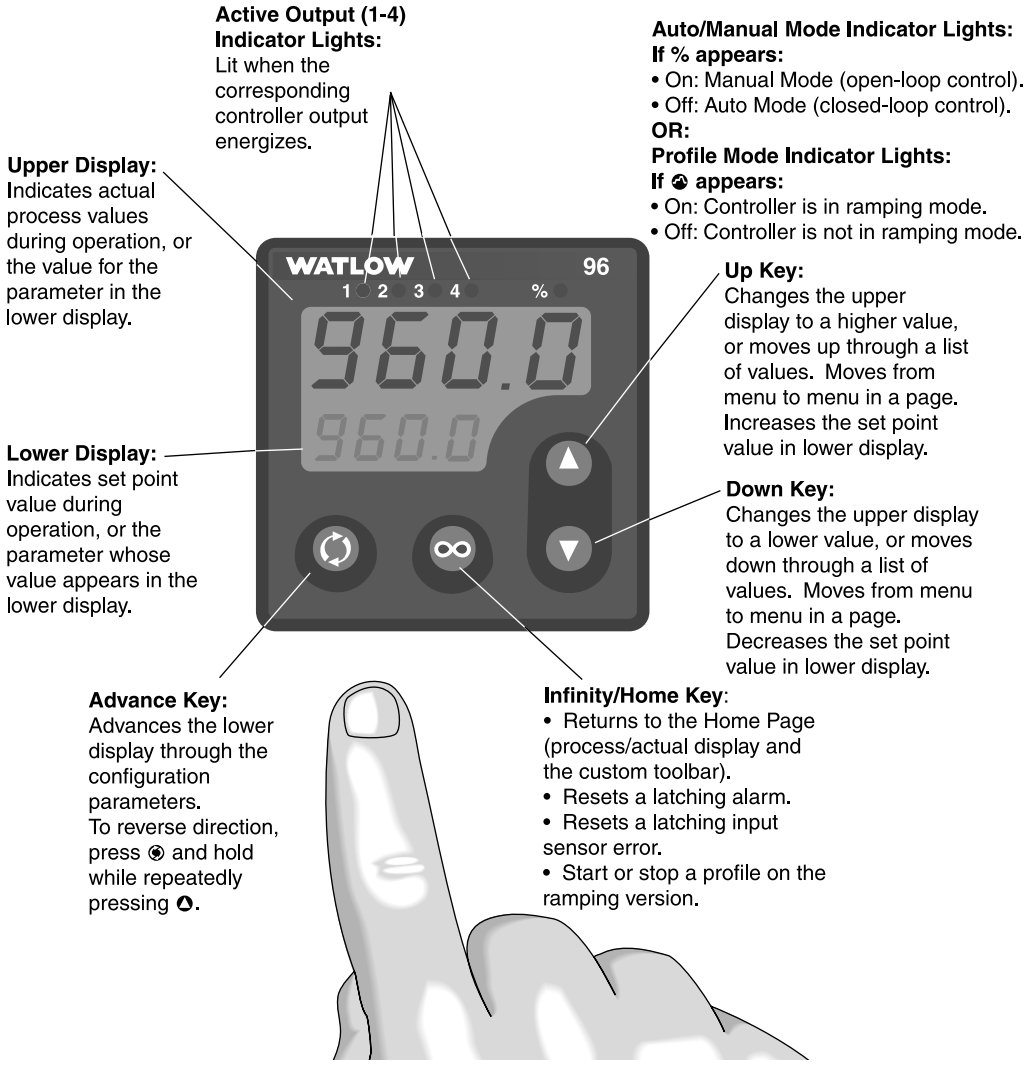
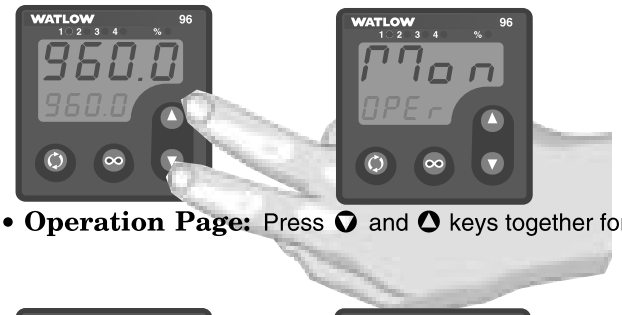



**Figure 4.1 – Series 96 keys and displays.**

# Navigating the Series 96

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




- **Operation Page:** Press ▼ and ▲ keys together for 3 seconds.




- **Setup Page:** Press ▼ and ▲ keys together for 6 seconds.




- **Factory Page:** Press ◉ and ∞ keys together for 6 seconds.




- **Home Page:** From anywhere, press the ∞ key.

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

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

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

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

# Series 96 Software Map

## Home Page

96 Process 1 Value
96 Set Point Value, Remote Set Point Value or Percent Output Value
96 Custom Menu**…
PI

## Program Menu*

(see pg. 7.1)

## Operations Page

**Monitor Menu**
OPEr Operations Page
Pr2 Process 2**
Pcnt Percent Output
rPSP Ramping Set Point**
E St Event Input Status

**User Menu**
OPEr Operations Page
A-M Auto-Manual Operations Mode**
Aut Auto-tune
AtSP Auto-tune Set Point
SP2 Set Point 2**
E SP Event Set Point**
L-r Local or Remote Mode**
CAL I Calibration Offset

**PID 1 Menu**
OPEr Operations Page
Pb 1 Propband 1
It 1 Integral 1
rE 1 Reset 1
dE 1 Derivative 1
rA 1 Rate 1
brS 1 Burst 1
Ct 1 Cycle Time 1
hYS 1 Hysteresis 1
db 1 Dead Band 1

**PID 2 Menu**
OPEr Operations Page
Pb 2 Propband 2
It 2 Integral 2
rE 2 Reset 2
dE 2 Derivative 2
rA 2 Rate 2
brS2 Burst 2
Ct 2 Cycle Time 2
hYS2 Hysteresis 2
db 2 Dead Band 2

**Alarm Menu**
OPEr Operations Page
A2Lo Alarm 2 Low
A2h i Alarm 2 High
A3Lo Alarm 3 Low
A3h i Alarm 3 High
A4Lo Alarm 4 Low
A4h i Alarm 4 High

***Added if ramping version of controller is selected (96__-____-AA__).**
****Removed if ramping version of controller is selected (96__-____-AA__).**

## Setup Page

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

**Input 2 Menu**
SEt Setup Page
In 2 Input 2**
rL 2 Range Low 2**
rh 2 Range High 2**
CAL2 Calibration Offset 2**
E Fn Event Function
E cn Event Condition
AbSP Abort Set Point*

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

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

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

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

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

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

## Factory Page

**Custom Menu****
FctY Factory Page
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
P16

**Lockout Menu**
FctY Factory Page
SP Set Point Lock
Prog Program Menu Lock*
CuSt Custom Menu Lock**
OPEr Operations Page Mode
SEt Setup Page Lock
CAL Calibration Menu Lock

**Diagnostics Menu**
FctY Factory Page
MMdL Model Number
dAtE Date of Manufacture
Sn 1 Serial Number 1
Sn2 Serial Number 2
SoFt Software ID Number
ItY2 Input Type 2 _
rEv Software Revision
OtY1 Output 1 Hardware
OtY2 Output 2 Hardware
OtY3 Output 3 Hardware
OtY4 Output 4 Hardware
tout Test Output
diSP Test Displays
hrES High Resolution
AMb Ambient Temperature
Acnt Ambient A-D Counts
cnt 1 Channel 1 A-D Counts
cnt2 Channel 2 A-D Counts
tSht Communications Test/ Troubleshooting
LinE Line Frequency

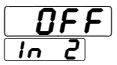
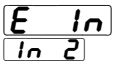
**The Factory Page includes calibration parameters that are not necessary for everyday use of the controller.**

# Basic navigation for new users

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

## Configure the controller

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

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

**Summary**

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

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

# 5

# Chapter Five **Features**

## The System

### Custom Menu (patented)

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

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

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

To change the list of parameters in the Custom Menu, press both the ⊛ and ⊙ keys for 6 seconds. This will take you to the Factory Page. The Custom Menu [CUSt] is the first menu on the Factory page. Press the ⊛ key once to go to the first selection in the menu. The parameter choices will appear in the top display and the selection number will appear in the bottom display. Use the ▲ or the ▼ key to change the selected parameter in the top display. If you do not want a parameter to appear for that location, select [nonE]. To change the other 15 selections, press ⊛ to select a place in the menu, [ P1] to [ P16], in the bottom display and use the ▲ or the ▼ key to change the parameter selected in the top display.

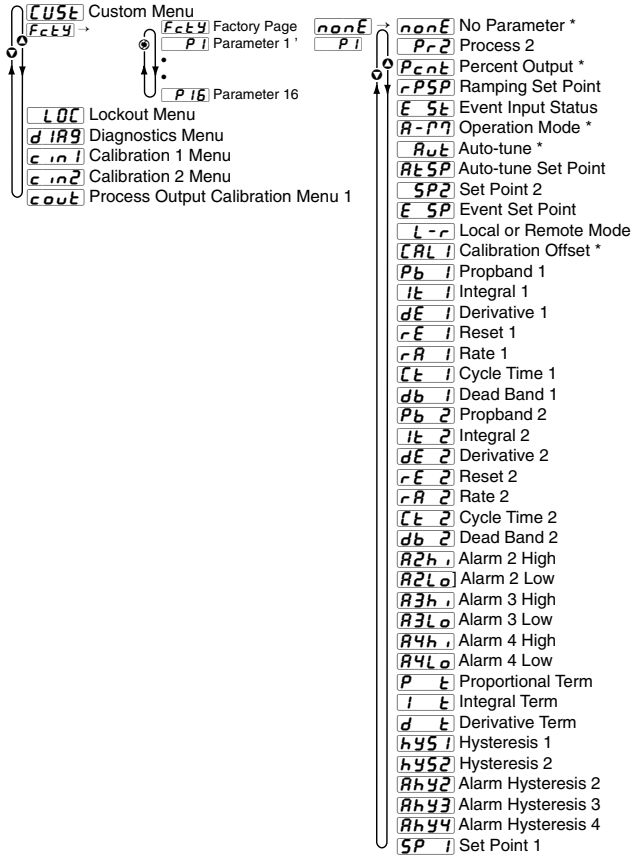



**Figure 5.1 – Parameters available for the Custom Menu (*default selections).**

**Note: The Custom Menu will not appear if the ramping software option has been ordered (96XX-XXXX-AAXX).**

## Auto-tune

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

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

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

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

[tunE] tunes both heat and cool at the same time. This is appropriate if the system typically operates with both heat and cool contributing, such as in an environmental chamber.

[P id1] tunes just PID set 1. This is appropriate for tuning the heat of an extruder application in the endothermic mode.

[P id2] tunes just PID set 2. This is appropriate for tuning the cool set of an extruder application in the exothermic mode.

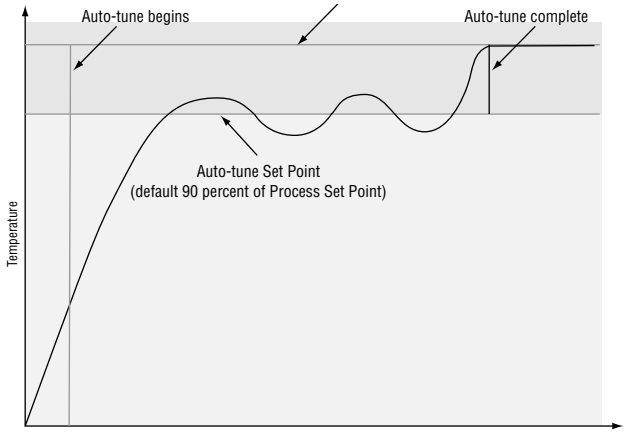



**Figure 5.2a Auto-tuning.**

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

## Power Limit

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

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

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

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

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

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

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

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

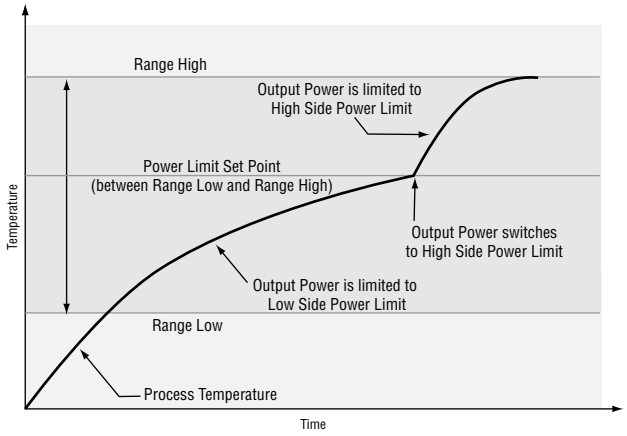



**Figure 5.2b Power limits.**

# Input

## Calibration Offset

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

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

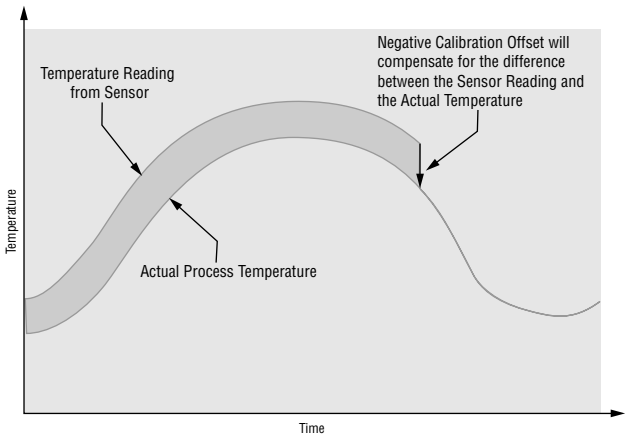



**Figure 5.3a Calibration offset**

## Filter Time Constant

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

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

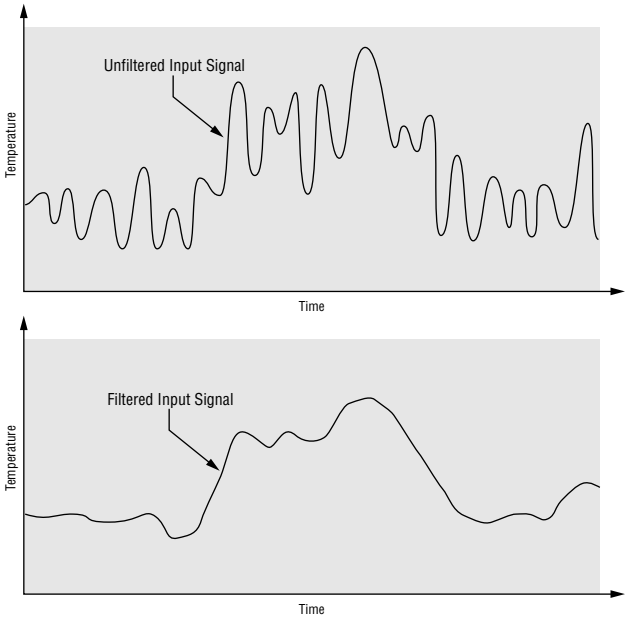



**Figure 5.3b Filtered and unfiltered input signals.**

## Sensor Selection

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

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

## Range Low and Range High

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

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

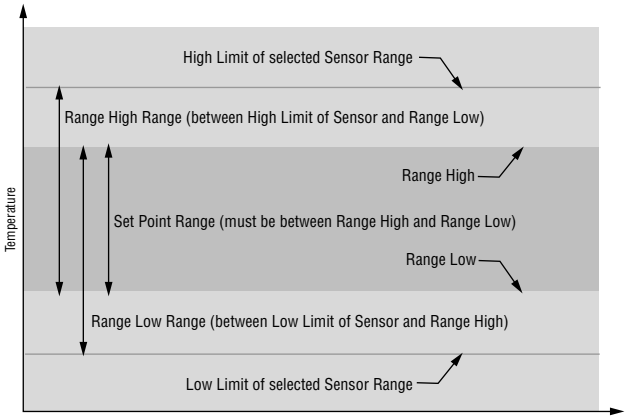



**Figure 5.4a Sensor ranges.**

## Event Input

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

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

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

- [nonE] Events will not affect the system.
- [SP] Switch to the event set point.
- [AOFF] Turn off control outputs and disable alarms.
- [COFF] Turn off control outputs.
- [LOC] Lock out key board.
- [A-M] Switch to manual mode.**
- [tunE] Initiate an auto-tune.
- [AL] Clear an alarm.
- [SLOC] Lock out everything except primary set point (auto or manual). If selected and if a profile is not running (non-ramping mode) will lock the user out of all parameters except set point and event outputs.
- [WJE] Wait-for event input*
- [PAuS] Pause*
- [F 1L 1] Profile 1*
- [F 1L2] Profile 2*
- [hold] Hold*
- [AbSP] abort set point*

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

- [Lo] Low generates an event while the voltage is low (switch closed).
- [hi] High generates an event while the voltage is high (switch open).
- [r 1SE] Rise changes the event state when the voltage changes from low to high.
- [FALL] Fall changes the event state when the voltage changes from high to low.

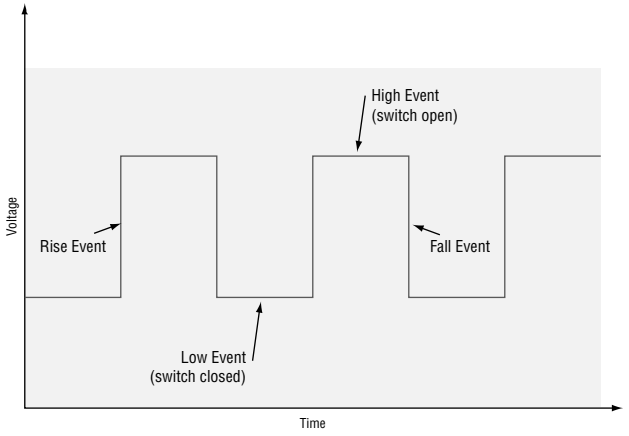



**Figure 5.4b Event inputs.**

***These parameters are added if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

****These parameters are removed if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

## Retransmitting a Remote Set Point

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

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

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

### Zone 1

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

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

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

### Zones 2 and 3

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

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

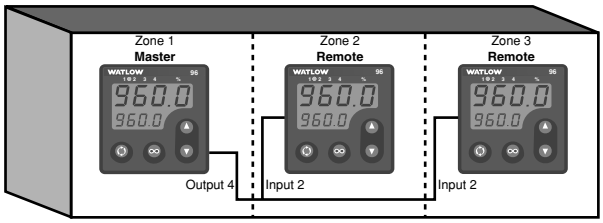



**Figure 5.5a Retransmitting a remote set point.**

**Note: Remote set point input option is not available if the ramping option has been ordered (96XX-XXXX-AAXX).**

# Control Methods

## On/Off Control

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

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

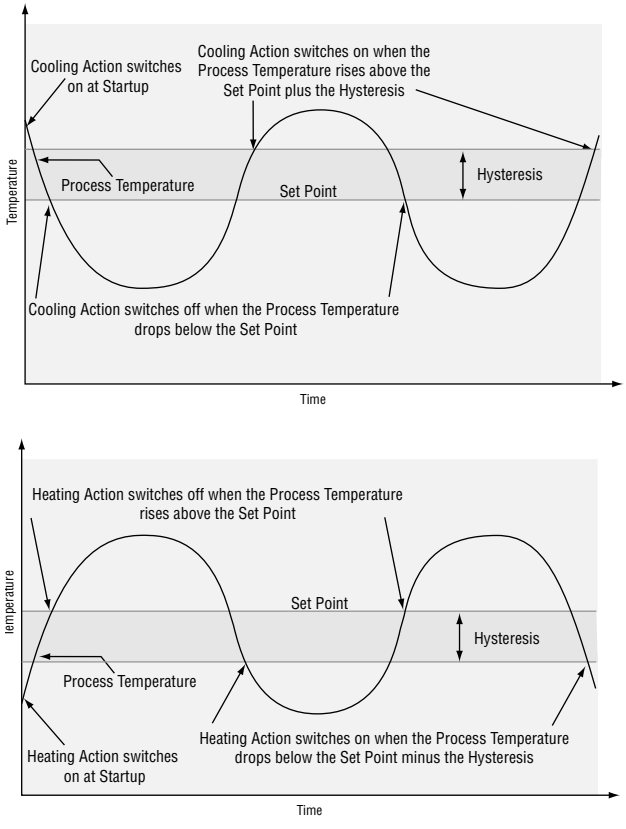



**Figure 5.5b On/off control for cooling and heating.**

## Proportional Control

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

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

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

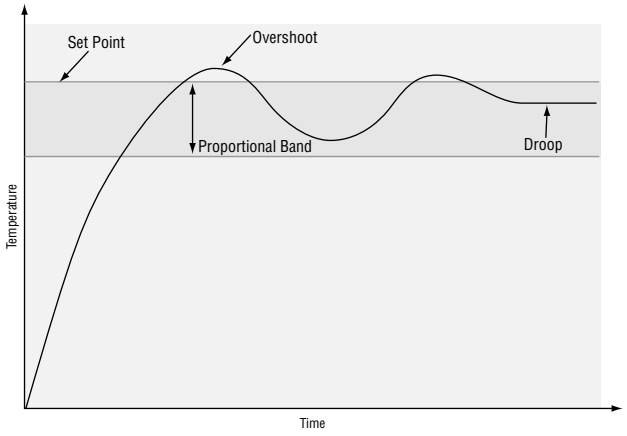



**Figure 5.6a Proportional control.**

## Proportional plus Integral (PI) Control

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

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

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

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

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

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

**Table 5.6 – Converting between integral and reset values.**

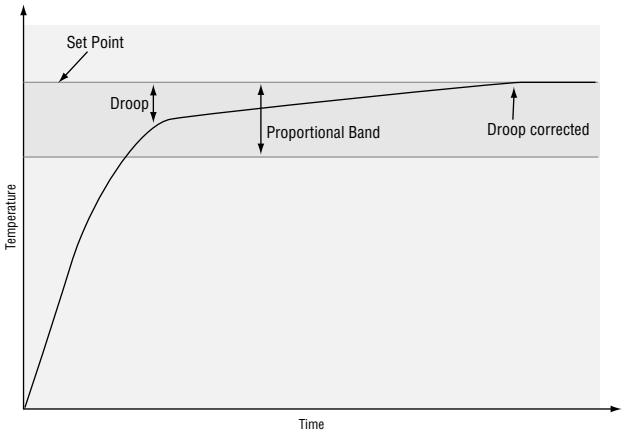



**Figure 5.6b Proportional plus integral control.**

## Proportional plus Integral plus Derivative (PID) Control

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

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

View or change the Output 1 derivative or rate with Derivative 1 [dE 1] or Rate 1 [rA 1] (PID 1 Menu). Derivative appears if Units Type [Un it] (Global Menu) is set to [ S I]. Rate appears if [Un it] is set to [ US].

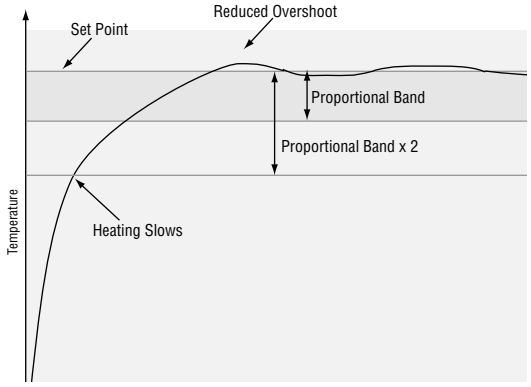



**Figure 5.7a PID control.**

## Dual PID

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

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

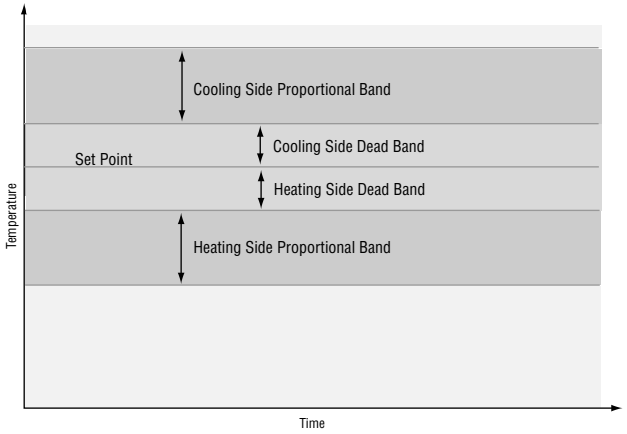



**Figure 5.7b Dual PID.**

## Dead Band

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

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

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

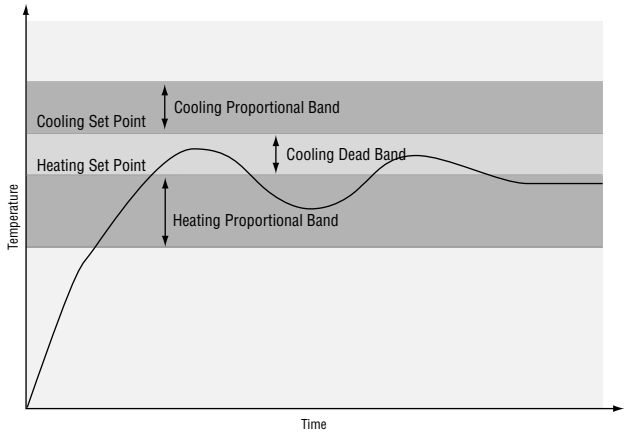



**Figure 5.7c Cooling dead band.**

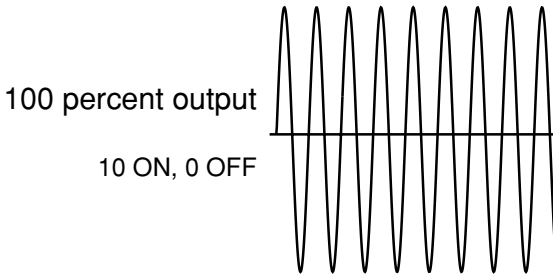
## Burst Fire

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

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

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

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



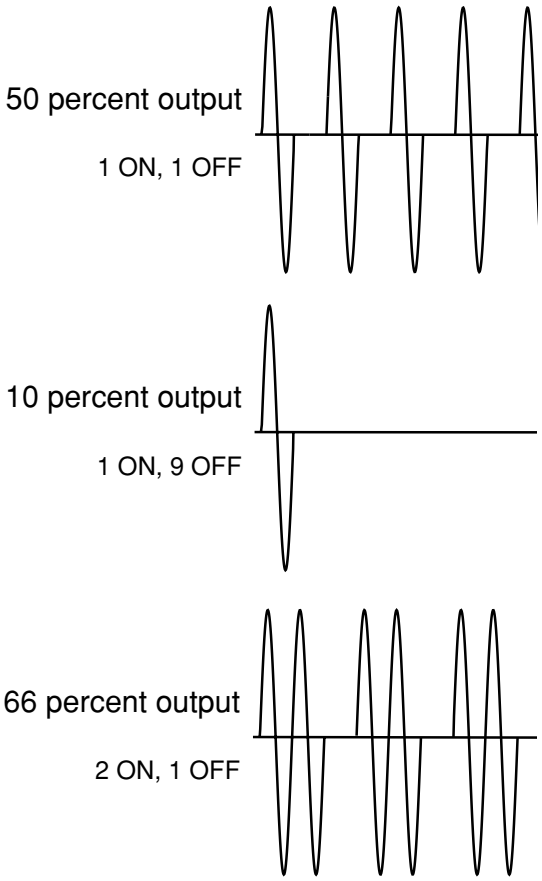




**Figure 5.8a Burst fire.**

## Ramp to Set Point

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

Select when ramping is active with Ramping Mode [ rP] (Global Menu).
[ OFF] ramping not active.
[Strt] ramp at startup.
[StPt] ramp at startup or when the set point changes.

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

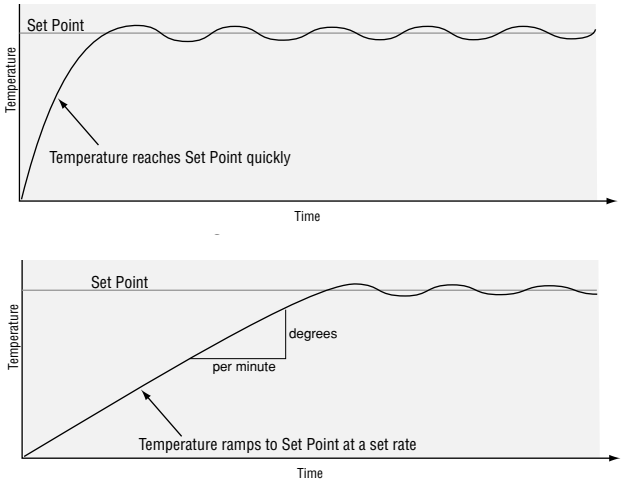



**Figure 5.8b Ramping to set point.**

**Note: The Ramping Mode will not appear if the ramping software option has been ordered (96XX-XXXX-AAXX).**

# Alarms

An alarm takes some action, usually notifying an operator, when the process temperature leaves a defined range. A user can configure how and when an alarm is triggered and whether it turns off automatically when the alarm condition is over. The alarm examples below are for Output 2.

## Alarm Set Points

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

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

Process or deviation alarm set points for Output 2 can be viewed or changed with Alarm 2 High [A2h,] and Alarm 2 Low [A2Lo] (Alarm Menu).

## Alarm Hysteresis

Modbus Register #720 r/w; values: (1-9999).

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

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

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

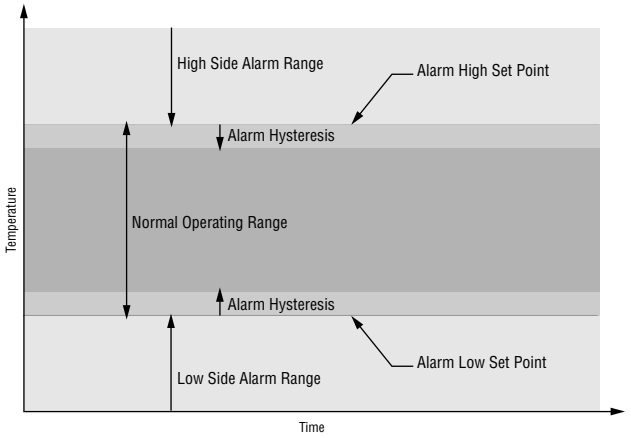



**Figure 5.9a Alarm settings.**

## Process or Deviation Alarms

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

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

Alarm 2 Type [At Y2] (Output 2 Menu) allows you to view or change whether the Output 2 alarm will function as a process or deviation alarm.

The alarm deviation value of Output 2 can be viewed or changed with Alarm 2 High [A2h,] and Alarm 2 Low [A2Lo] (Alarm Menu).

## Alarm Latching

Modbus Register #721 r/w; values: No (0), Yes (1).

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

Alarm 2 Latching [LAt2] (Output 2 Menu) allows you to view or change whether the Output 2 alarm will latch. A latched alarm condition that has been corrected can be reset by pressing the ∞ infinity key.

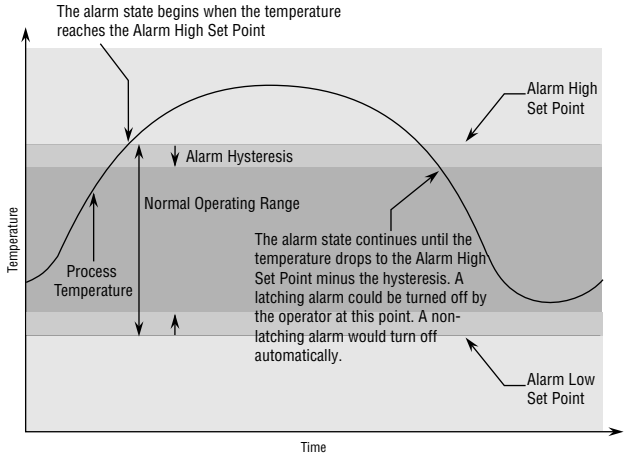



**Figure 5.9bÍ Alarm latching.**

## Alarm Silencing

Modbus Register #722 r/w; values: No (0), Yes (1).

Alarm silencing has two uses:

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

2. Alarm silencing also allows the operator to disable the alarm output while the controller is in an alarm state. The process temperature has to enter the normal operating range beyond the hysteresis zone to activate the alarm output function.

If a Series 96 output is functioning as a deviation alarm, the alarm is silenced when the set point is changed, until the process value re-enters the normal operating range. Alarm Silencing 2 [SIL2] (Output 2 Menu) allows you to view or change whether alarm silencing is on.

If Alarm Annunciation 2 [Anu2] (Output 2 Menu) is set to [YES], the Output 2 indicator light will remain on and an alarm message will appear in the display, even though the alarm output is silenced.

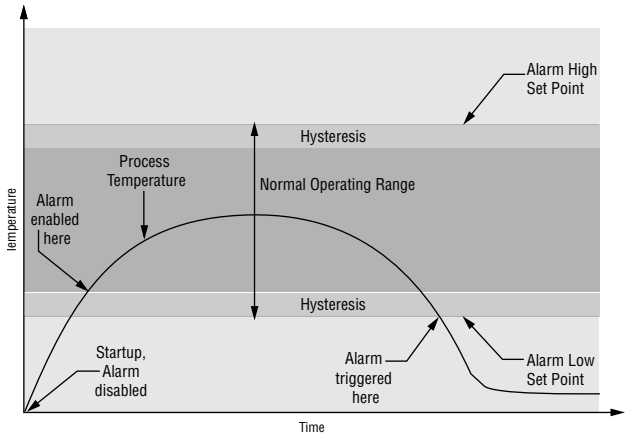



**Figure 5.10 – Alarm silencing.**

# Errors

## Open Loop Detect

Modbus Register #210 r; values: Clear (0), Error (1).

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

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

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

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

Modbus Register #209 r; (values in parenthesis below).

**Refer to appendix, page A.2, in back of manual for troubleshooting tips about error codes.**

[Er 4] [rAM] (4) Error 4 indicates there is a RAM malfunction.

[Er 5] [EEcS] (5) Error 5 indicates nonvolatile memory checksum error.

[Er 6] [roM] (6) Error 6 indicates a ROM malfunction.

[Er 7] [hArd] (7) Error 7 indicates a hardware failure.

[Er 8] [PLug] (8) Error 8 indicates a module error.

[Er 9] [conF] (9) Error 9 indicates a configuration error.

[Er 10] [chng] (10) Error 10 indicates a module has been changed.

[Er 11] [SoFt] (11) Error 11 indicates new software has been installed.

[Er 12] [CAL] (12) Error 12 indicates that calibration data is corrupted.

[Er 13] [Atod] (13) Error 13 indicates an analog-to-digital timeout.

[Er 14] [EEhd] (14) Error 14 indicates a serial EEPROM time-out.

[Er 15] [nEuU] (15) Error 15 indicates a new unit.

[Er 16] [Addr] (16) Error 16 indicates an EEPROM invalid address.

**Errors continued on next page.**

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

Modbus Register #101 r; (values in parenthesis below).
Err 1 (1) Error 1 indicates the input is too low to measure.
Err 2 (2) Error 2 indicates the input is under the sensor range.
Err 3 (3) Error 3 indicates the input is over the sensor range.
Err 4 (4) Error 4 indicates the input is too large to measure.
No error = (0)

## Bumpless Transfer

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

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

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

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

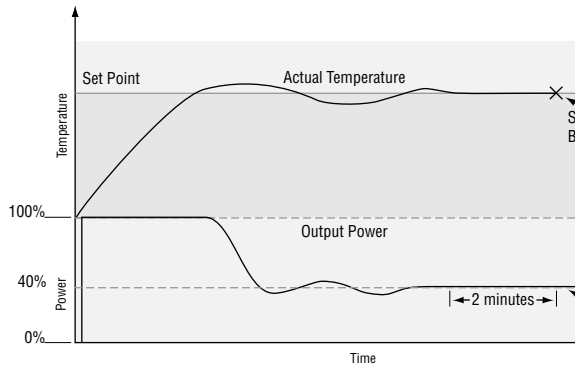



**Figure 5.11 – Bumpless transfer.**
**Note: The bumpless transfer feature will not appear if the ramping software option has been ordered (96XX-XXXX-AAXX).**

## Communications

A Series 96 controller can also be programmed and monitored by connecting it with a personal computer or programmable logic controller (PLC) via serial communications. To use this communications option, a Series 96 must be equipped with a EIA/TIA 485 (96_ _ - _ _ _U - _ _ _ _) or EIA/TIA 232 (96_ _ - _ _ _R - _ _ _ _) communications board installed for Output 4.

Use of the EIA/TIA 485 requires that your PC or PLC use the EIA/TIA 485 interface in half duplex. Purchase an interface converter which communicates in half duplex when using a PC or PLC with an EIA/TIA 232 communications port. You must use the EIA/TIA 485 option to communicate with more than one control. This option directly supports up to 32 devices on a network.

To view or change controller settings with a personal computer, you need to run software that uses the Modbus RTU protocol to read or write to registers in the controller. See Chapter Six for the Modbus registers. These registers contain the parameter values that determine how the controller will function and the values that reflect the current input and output values of the system.

Decimal points are not sent or received in Modbus. To determine decimal point locations, read the decimal parameter dEC 1. For example, 127.5 degrees is read or written as 1275 degrees with the decimal parameter set to 0.0.

Parameters relating to communications appear in the Output 4 Menu (Setup Page). Match the Baud Rate bAUd to that of the computer and select an Address Addr for the Series 96.

**NOTE: For more information about communicating with Watlow controllers, go to www.watlow.com and download the Data Communications Reference: Electronic User's Manual. It is located under Literature, User's Manuals, English and search on *data communications reference*.**

# 6

# Chapter Six
# **Parameters**

## Home Page

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| 96<br>100 | **Process 1**<br>**Set Point 1**<br>Monitor the Process 1 value and change the Set Point values. | Range Low 1 to Range High 1<br>OFF Off | | 100 r<br>300 r/w | Active: Always<br>Active if the event set point is not active and Local or Remote Mode (User Menu) is set to L (local) or Auto-Manual Operation Mode (User Menu) is set to Auto (automatic).<br>OFF will appear when slewing below the rL 1 value. |
| 96<br>200 | **Process 1**<br>**Remote Set Point****<br>Monitor the Process 1 value and Remote Set Point values. | Range Low 1 to Range High 1 | | 100 r<br>202 r | Active: Always<br>Active if the remote set point is active and Local or Remote Mode L-r (User Menu) is set to r (remote) and Auto-Manual Operation Mode (User Menu) is set to Auto (automatic). |
| 96<br>50.0 | **Process 1**<br>**Event Set Point****<br>Monitor the Process 1 value and Event Set Point values. | Range Low 1 to Range High 1 | | 100 r<br>202 r | Active: Always<br>Active if Event Function E Fn (Input 2 Menu) is set to SP (event set point), an event condition exists and Auto-Manual Operation Mode (User Menu) is set to Auto (automatic). |
| 96<br>50.0 | **Process 1**<br>**Manual Set Point****<br>Monitor the Process 1 value and change manual set point value. | Range Low 1 to Range High 1<br>heat modes: 0.0 to 100.0<br>cool modes: -100.0 to 0.0<br>heat/cool modes: -100.0 to 100.0 | | 100 r<br>310 r/w | Active: Always<br>Active if Auto-Manual Operation Mode (User Menu) is set to MAn (manual), or if there is an error. |

The parameters selected in the Custom Menu (Factory Page) will appear here.

***These parameters are added if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

****These parameters are removed if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

**NOTE: Refer to Chapter 7 of this manual for information on parameters for creating ramp and soak profiles in Ramping versions of the Series 96.**

**NOTE: To see how all the pages, menus and parameters are grouped, refer to the inside back cover of this manual.**

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

# Operations Page

The Operations Page contains five menus:

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| OPEr | **Operations Page Select**<br>Go to an operations menu. | MOn Monitor<br>USEr User<br>P id 1 PID 1<br>P id2 PID 2 (if output 2 is Active)<br>ALM Alarm (if any alarms are active) | | | Active if Operations Page Mode Lock (Lockout Menu/Factory Page) is not set to hidE. |
| MOn | ***Monitor Menu*** | MOn Monitor: comms value (0) | | | |
| OPEr | ***Operations Page*** | | | | |
| Pr2 | **Process 2****<br>Monitor the process 2 value. | | | 105 r | Active if Input 2 (Input 2 Menu) is not set to OFF or E In and Operations Page Lock (Lockout Menu) is not set to hidE. |
| Pcnt | **Percent Output**<br>Monitor the control output power level. | | | 103 r | Active if Operations Page Lock (Lockout Menu) is not set to hidE. |
| rPSP | **Ramping Set Point****<br>Monitor the ramping set point. | | | 203 r | Active if Ramping Mode (Global Menu) is not set to OFF and Operations Page Lock (Lockout Menu) is not set to hidE. |
| E St | **Event Input Status**<br>Monitor the event input status. | trUE true (1)***<br>FALS false (0)*** | | 201 r | Active if E Fn (Input 2 Menu) is not set to nonE and Operations Page Lock (Lockout Menu) is not set to hidE. |
| USEr | ***User Menu*** | | | | |
| OPEr | ***Operations Page*** | | | | |
| A-M | **Auto-Manual** Operation Mode**<br>Select whether the controller is under auto or manual control. | Auto Auto mode (0)<br>MAn Manual mode (1) | Auto (0) | 301 r/w | Active if Operations Page Lock (Lockout Menu) is not set to hidE. |
| Aut | **Auto-tune**<br>Initiate or cancel an auto-tune. | OFF off or cancel an auto-tune in progress (0)<br>tunE initiate an auto-tune (1)<br>P id 1 Set 1 only (2)<br>P id2 Set 2 only (3) | OFF (0) | 305 r/w | Active if Auto-Manual Operation Mode (User Menu) is set to Auto (automatic) and Operations Page Lock (Lockout Menu) is not set to hidE. |

***These parameters are added if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

****These parameters are removed if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| AtSP | **Auto-tune Set Point**<br>Set the auto-tune set point as a percent of the currently active set point. | 50 to 150 | 90 | 304 r/w | Active if Operations Page Lock (Lockout Menu) is not set to hidE. |
| E SP | **Event Set Point2****<br>Set the set point when the event input is active as defined by Event Condition. | Range Low 1 to Range High 1 | 75°F, 24°C | 306 r/w | Active if Input 2 (Input 2 Menu) is set to E In (event input), E Fn is set to SP, and Operations Page Lock (Lockout Menu) is not set to hidE. |
| SP2 | **Set Point 2****<br>Set the boost set point. | Range Low 1 to Range High 1 | 75°F, 24°C | 319 r/w | Active if output 2 is present (not 96 _ _-_ A _ _-_ _ _ _), both Output 1 (Output 1 Menu) and Output 2 (Output 2 Menu) are set to either HEAt or COOL and Operations Page Lock (Lockout Menu) is not set to hidE. |
| L-r | **Local or Remote Mode****<br>Set the mode to local or remote set point. | L local (0)<br>r remote (1) | L (0) | 316 r/w | Active if Input 2 (Input 2 Menu) is not set to OFF, Input 2 is not set to E In (event input) and Operations Page Lock (Lockout Menu) is not set to hidE. |
| CAL I | **Calibration Offset**<br>Set the input 1 calibration offset. | -1999 to 9999 | 0 | 605 r/w | Active if Operations Page (Lockout Menu) is not set to hidE. |
| PId1 | ***PID 1 Menu*** | | | | |
| OPEr | ***Operations Page*** | | | | |
| Pb 1 | **Propband 1**<br>Set the proportional band for PID control. | 0° to 9999°<br>If Pb 1 is set to 0 operates in on/off mode. | 25°F, 14°C | 500 r/w | Active if Operations Page Lock (Lockout Menu) is not set to hidE. |
| It 1 | **Integral 1**<br>Set the integral time in minutes for output 1. | 0.00 to 99.99 minutes per repeat | 0.00 (0) | 501 r/w | Active if Propband 1(PID 1 Menu) is not set to 0, Units Type (Global Menu) is set to S I and Operations Page Lock (Lockout Menu) is not set to hidE. |
| rE 1 | **Reset 1**<br>Set the reset time in repeats/minute for output 1. | 0.00 to 99.99 repeats per minute | 0.00 (0) | 502 r/w | Active if Propband 1(PID 1 Menu) is not set to 0, Units Type (Global Menu) is set to US and Operations Page Lock (Lockout Menu) is not set to hidE. |

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| dE 1 | **Derivative 1**<br>Set the derivative time in minutes for output 1. | 0.00 to 9.99 minutes | 0.00 (0) | 503 r/w | Active if Propband 1(PID 1 Menu) is not set to 0, Units Type (Global Menu) is set to SI and Operations Page Lock (Lockout Menu) is not set to hIdE. |
| rA 1 | **Rate 1**<br>Set the rate time in minutes for output 1. | 0.00 to 9.99 minutes | 0.00 (0) | 504 r/w | Active if Propband 1(PID 1 Menu) is not set to 0, Units Type (Global Menu) is set to US and Operations Page Lock (Lockout Menu) is not set to hIdE. |
| brS 1 | **Burst 1**<br>Select burst fire mode for output 1. | no no (0)<br>YES yes (1) | no (0) | 509 r/w | Active if Propband 1 (PID 1 Menu) is not set to 0, and Operations Page Lock (Lockout Menu) is not set to hIdE, and if output 1 is equipped for a solid-state relay (96A _-K _ _ _-_ _ _ _) or switched dc (96A _-C _ _ _-_ _ _ _) and high voltage power supply (96A _-_ _ _ _-_ _ _ _.) |
| Ct 1 | **Cycle Time 1**<br>Set the cycle time in seconds for output 1. | Relay: 5.0 to 60.0 (50 to 600)<br>Solid State: 0.1 to 60.0 (1 to 600) | Determined by output type. | 506 r/w | Active if Propband 1 (PID 1 Menu) is not set to 0, Burst 1 (PID 1 Menu) is set to no, output 1 is not a process type (not 96 _ _-F _ _ _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hIdE. |
| hYS 1 | **Hysteresis 1**<br>Sets the switching hysteresis for output 1. | 1 to 9999 | 3°F, 2°C | 507 r/w | Active if output 1 is not a process type (not 96 _ _-F _ _ _-_ _ _ _), Propband 1 (PID 1 Menu) is set to 0 and Operations Page Lock (Lockout Menu) is not set to hIdE. |
| db 1 | **Dead Band 1**<br>Set point shift for output 1 control. | 0 to 9999 | 0 | 505 r/w | Active if output 2 is present (not 96 _ _-_ A _ _-_ _ _ _), one output is set to HEAt, another is set to COOL and Operations Page Lock (Lockout Menu) is not set to hIdE. |

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| PId2 | ***PID 2 Menu*** | | | | |
| OPEr | ***Operations Page*** | | | | |
| Pb 2 | **Propband 2**<br>Set the proportional band for output 2. | 0° to 9999°<br>If Pb 2 is set to 0 operates in on/off mode. | 25°F, 14°C | 510 r/w | Active if one output is set to heat and the other to cool and Operations Page Lock (Lockout Menu) is not set to hidE and Heat-Cool Mode. |
| It 2 | **Integral 2**<br>Set the integral time in minutes for output 2. | 0.00 to 99.99 minutes per repeat (0 to 9999) | 0.00 (0) | 511 r/w | Active if Propband 2 (PID 2 Menu) is not set to 0, Units Type (Global Menu) is set to SI and Operations Page Lock (Lockout Menu) is not set to hidE. |
| rE 2 | **Reset 2**<br>Set the reset time in repeats/minutes for output 2. | 0.00 to 99.99 repeats per minute (0 to 999) | 0.00 (0) | 512 r/w | Active if Propband 2 (PID 2 Menu) is not set to 0, Units Type (Global Menu) is set to US and Operations Page Lock (Lockout Menu) is not set to hidE. |
| dE 2 | **Derivative 2**<br>Set the derivative time in minutes for output 2. | 0.00 to 9.99 minutes (0 to 999) | 0.00 (0) | 513 r/w | Active if Propband 2 (PID 2 Menu) is not set to 0, Units Type (Global Menu) is set to SI and Operations Page Lock (Lockout Menu) is not set to hidE. |
| rA 2 | **Rate 2**<br>Set the rate time in minutes for output 2. | 0.00 to 9.99 minutes (0 to 999) | 0.00 (0) | 514 r/w | Active if Propband 2 (PID 2 Menu) is not set to 0, Units Type (Global Menu) is set to US and Operations Page Lock (Lockout Menu) is not set to hidE. |
| brS2 | **Burst 2**<br>Select burst fire mode for output 2. | no no (0)<br>YES yes (1) | no (0) | 519 r/w | Active if Propband 2 (PID 2 Menu) is not set to 0, and Operations Page Lock (Lockout Menu) is not set to hidE, and if Output 2 is equipped for a solid-state relay (96A _-K _ _ _-_ _ _ _) or switched dc (96A _-C _ _ _-_ _ _ _) or voltage power supply option (96A _-_ _ _ _-_ _ _ _.) |
| Ct 2 | **Cycle Time 2**<br>Set the cycle time in seconds for output 2. | Relay: 5.0 to 60.0 (50 to 600)<br>Solid-state: 0.1 to 60.0 (1 to 600) | Relay: 10.0 (100)<br>Solid-state: 1.0 (10) | 516 r/w | Active if Propband 2 (PID 2 Menu) is not set to 0, Burst 2 (PID 2 Menu) is set to no, output 2 is not a process (not 96 _ _ - _ F _ _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hidE. |

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| hYS2 | **Hysteresis 2**<br>Sets the switching hysteresis for output 2. | 1 to 9999 | 3°F, 2°C | 517 r/w | Active if Output 2 is present, but output 2 is not a process type (not 96 _ _-_ A _ _-_ _ _ _ or 96 _ _-_ F_ _-_ _ _ _), or Output 2 (Output 2 Menu) is set to hEAt or COOL (opposite of Output 1 hEAt or COOL selection); and Propband 2 (PID 2 Menu) is set to 0 and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| db 2 | **Dead Band 2**<br>Set point shift for output 2 control. | 0 to 9999 | 0 (0) | 515 r/w | Active if output 2 is present (not 96 _ _-_ A _ _-_ _ _ _), one output is set to hEAt, another is set to COOL and Operations Page Lock (Lockout Menu) is not set to hIdE. |
| ALM | ***Alarm Menu*** | | | | |
| OPEr | ***Operations Page*** | | | | |
| A2Lo | **Alarm 2 Low**<br>Set the low alarm set point for output 2. | Process: low limit of selected sensor range to Alarm 2 High-1<br>Deviation: -1999 to 0 | Process: low limit of selected sensor range<br>Deviation: -999 | 321 r/w | Active if Output 2 (Output 2 Menu) is set to AL (Alarm), Alarm Active Sides 2 (Output 2 Menu) is not set to hi, output 2 is present, but is not a process output (not 96 _ _-_ A _ _-_ _ _ _ or 96 _ _-_ F_ _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hIdE. |
| A2hi | **Alarm 2 High**<br>Set the high alarm set point for output 2. | Process: Alarm 2 Low+1 to high limit of selected sensor range<br>Deviation: 0 to 9999 | Process: high limit of selected sensor range<br>Deviation: 999 | 322 r/w | Active if Output 2 (Output 2 Menu) is set to AL (Alarm), Alarm Active Sides 2 (Output 2 Menu) is not set to Lo, output 2 is present, but is not a process (not 96 _ _-_ A _ _-_ _ _ _ or 96 _ _-_ F_ _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hIdE. |
| A3Lo | **Alarm 3 Low**<br>Set the low alarm set point for output 3. | Process: low limit of selected sensor range to Alarm 3 High-1<br>Deviation: -1999 to 0 | Process: low limit of selected sensor range<br>Deviation: -999 | 340 r/w | Active if Output 3 (Output 3 Menu) is AL (Alarm), Alarm Sides 3 (Output 3 Menu) is not hi, output 3 is present (96 _ _-_ _ D _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hIdE. |

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| A3h1 | **Alarm 3 High**<br>Set the high alarm set point for output 3. | Process: Alarm 3 Low+1 to high limit of selected sensor range<br>Deviation: 0 to 9999 | Process: high limit of selected sensor range<br>Deviation: 999 | 341 r/w | Active if Output 3 (Output 3 Menu) is set to AL (Alarm), Alarm Sides 3 (Output 3 Menu) is set to Lo, output 3 is present (96 _ _-_ _ D _-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hIdE. |
| A4Lo | **Alarm 4 Low**<br>Set the low alarm set point for output 4. | Process: low limit of selected sensor range to Alarm 4 High-1<br>Deviation: -1999 to 0 | Process: low limit of selected sensor range<br>Deviation: -999 | none**** | Active if Output 4 (Output Menu 4) is set to AL (Alarm), Alarm Sides 4 (Output Menu 4) is not Hi, output 4 is a relay (96 _ _-_ _ _ D-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hIdE. |
| A4h1 | **Alarm 4 High**<br>Set the high alarm set point for output 4. | Process: Alarm 4 Low+1 to high limit of selected sensor range<br>Deviation: 0 to 9999 | Process: high limit of selected sensor range<br>Deviation: 999 | none**** | Active if Output 4 (Output Menu 4) is set to AL (Alarm), Alarm Sides 4 (Output Menu 4) is not set to Lo, output 4 is a relay (96 _ _-_ _ _ D-_ _ _ _) and Operations Page Lock (Lockout Menu) is not set to hIdE. |

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



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

# Setup Page

The setup page contains seven menus.

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| SEt | **Setup Page**<br>Go to a setup menu. | InP 1 Input 1<br>InP2 Input 2<br>Out 1 Output 1 (if present)<br>Out2 Output 2 (if present)<br>Out3 Output 3 (if present)<br>Out4 Output 4 (if present)<br>GLbL Global | InP 1 | | Active if Setup Page Lock (Lockout Menu) is not set to hidE. |
| InP 1 | ***Input 1 Menu*** | | | | |
| SEt | ***Setup Page*** | | | | |
| SEn 1 | **Sensor Type 1**<br>Sets the input hardware type of input 1. | tc Thermocouple (0)<br>rtd RTD (1)***<br>Proc Process (2) | tc (0)*** | 600 r/w | Active if Setup Page Lock (Lockout Menu) is not set to hidE. |
| In 1 | **Input 1**<br>Sets the input linearization parameter of input. | If Sensor Type is set to thermocouple:<br>J J (0)<br>H K (1)<br>t T (2)<br>E E (3)<br>n N (4)<br>C C (5)<br>d D (6)<br>Pt2 PT2 (7)<br>r R (8)<br>S S (9)<br>b B (10)<br>If Sensor Type is set to RTD:<br>din RTD_DIN (11)<br>JIS RTD_JIS (12)<br>If Sensor Type is set to process:<br>4-20 4-20mA (13)<br>0-20 0-20mA (14)<br>0- 5 0-5V⎓ (dc) (15)<br>1- 5 1-5V⎓ (dc) (16)<br>0-10 0-10V⎓ (dc) (17) | If Sensor Type (Input 1 Menu) is changed to thermocouple: J (0)<br>If Sensor Type is changed to RTD: din (11)<br>If Sensor Type is set to process: 4-20 (13) | 601 r/w | Active if Setup Page Lock (Lockout Menu) is not set to hidE. |

***These parameters are added if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

****These parameters are removed if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

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

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| rL 1 | **Range Low 1**<br>Set the input range low. This setting is the lowest value that the set point can have. | See Specifications in the Appendix for sensor ranges and defaults. | See Specifications in the Appendix for sensor ranges and defaults. | 602 r/w | Active if Setup Page Lock (Lockout Menu) is not set to hIdE. |
| rH 1 | **Range High 1**<br>Set the input range high. This setting is the highest value that the set point can have. | See Specifications in the Appendix for sensor ranges and defaults. | See Specifications in the Appendix for sensor ranges and defaults. | 603 r/w | Active if Setup Page Lock (Lockout Menu) is not set to hIdE. |
| dEC 1 | **Decimal 1**<br>Sets the position of the decimal point for input readings. | If Set Sensor Type is RTD or thermocouple (excluding R, S or B thermocouple):<br>0 0 (0)<br>0.0 0.0 (1)<br>If Set Sensor Type is a process:<br>0 0 (0)<br>0.0 0.0 (1)<br>0.00 0.00 (2)<br>0.000 0.000 (3) | 0 | 606 r/w | Active if Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Ftr 1 | **Input Software Filter 1**<br>Set the filter time for the input, in seconds. This smoothes out a rapidly changing input signal. Positive values affect the monitor readings only. Negative values affect both the monitor readings and the control values. | -60.0 to 60.0 (-600 to 600) | 0 (0) [1.0 (10) if dEC 1 is set to 0.0]. | 604 r/w | Active if Setup Page Lock (Lockout Menu) is not set to hIdE. |
| InP2 | ***Input 2 Menu*** | | | | |
| SEt | ***Setup Page*** | | | | |
| In 2 | **Input 2**<br>Sets the input type parameter of input 2. | OFF off: (0)<br>E In event input: (1)<br>4-20 4-20mA (2)**<br>0-20 0-20mA (3)**<br>0-5 0-5V⎓ (dc) (4)**<br>1-5 1-5V⎓ (dc)(5)**<br>0-10 0-10V⎓ (dc) (6)** | OFF (0) | 611 r/w | Active if input 2 hardware is present (96 _1 _-_ _ _ _ -_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hIdE. |

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| rL 2 | **Range Low 2**** Set the input range low. This setting is the value Pr 2 will read when Input 2 is at its low range. | -1999 to rh2 Range High 2 | rL1 | 612 r/w | Active if input 2 hardware is present (96 _1 _-_ _ _ _-_ _ _ _) and In 2 is not set to E In or OFF and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| rh 2 | **Range High 2**** Set the input range high. This setting is the value Pr 2 will read when Input 2 is at its high range. | rL2 Range Low 2 to 9999 | rh1 | 613 r/w | Active if input 2 hardware is present (96 _1 _-_ _ _ _-_ _ _ _), and In 2 is not set to E In or OFF and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| CAL2 | **Calibration Offset 2**** Set the input calibration offset. This allows you to compensate for lead resistance, sensor errors and other factors. | -1999 to 9999 | 0 | 615 r/w | Active if input 2 hardware is present (96 _1 _-_ _ _ _-_ _ _ _), and In 2 is not set to E In or OFF and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| E Fn | **Event Function** Select the event function. | nonE no function (0)<br>SP switch to event set point (1)**<br>AOFF turn off control outputs and disable alarms (2)<br>COFF turn off control outputs (3)<br>LOC lock out key board (4)<br>A-M switch to manual mode (5)**<br>tunE initiate an auto-tune (6)<br>AL clear alarm (7)<br>SLOC lock out everything except primary set point (auto or manual). If selected and if a profile is not running (non-ramping mode) will lock the user out of all parameters except set point and event outputs. (8)<br>UJE wait-for event input (9)*<br>PAuS pause (10)*<br>F IL1 profile 1 (11) *<br>F IL2 profile 2 (12) *<br>hold hold (13)*<br>AbSP abort set point (14)* | nonE (0) | 1060 r/w | Active if input 2 hardware is present (96 _1 _-_ _ _ _-_ _ _ _) and Input 2 (Input 2 Menu) is set to E In (Event Input) and Setup Page Lock (Lockout Menu) is not set to hIdE.<br><br>* UJE, PAuS, F IL1, F IL2, hold, and AbSP are added if ramping version of the controller is selected (96__-____-AA__.)<br><br>** SP and A-M are removed if ramping version of the controller is selected (96__-____-AA__.) |

***These parameters are added if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

****These parameters are removed if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| E cn | **Event Condition**<br>Select the condition to trigger an event. | LO low (0):<br>hi high (1)<br>rISE rise (2)<br>FALL fall (3) | LO (0) | 1061 r/w | Active if input 2 hardware is present (96 _1 _-_ _ _ _ -_ _ _ _), Input 2 (Input 2 Menu) is set to E In (Event Input), Event Function (Input 2 Menu) is not set to nonE and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| AbSP | **Abort Set Point** | OFF,<br>Range Low 1 to Range High 1 (-32768) | 75°F, 24°C | 1211 r/w | Active if E Fn is set to AbSP. |
| Out 1 | ***Output 1 Menu**** | | | | |
| SEt | ***Setup Page*** | | | | |
| Ot 1 | **Output 1**<br>Select whether the control output will control for heating or cooling. | hEAt heat (0)<br>COOL cool (1) | hEAt (0) | 700 r/w | Active if Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Prc 1 | **Process 1 Type**<br>Sets process 1 output type. | 4-20 4-20mA (0)<br>0-20 0-20mA (1)<br>0-5 0-5V⎓ (dc) (2)<br>1-5 1-5V⎓ (dc) (3)<br>0-10 0-10V⎓ (dc) (4) | 4-20 (0) | 701 r/w | Active if output 1 is equipped for a process (96 _ _-F _ _ _-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Out2 | ***Output 2 Menu**** | | | | |
| SEt | ***Setup Page*** | | | | |
| Ot 2 | **Output 2**<br>Select output 2 function. | OFF off (0)<br>hEAt heat (1)<br>COOL cool (2)<br>AL alarm (3)<br>Evnt event (4)* | OFF (0) | 717 r/w | Active if output 2 is present (not 96 _ _-_ A _ _-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hIdE.<br>*Event output is added if ramping version of the controller is selected (96__-____-AA__.) |
| Prc2 | **Process 2 Type**<br>Sets output 2 process type. | 4-20 4-20mA (0)<br>0-20 0-20mA (1)<br>0-5 0-5V⎓ (dc) (2)<br>1-5 1-5V⎓ (dc) (3)<br>0-10 0-10V⎓ (dc) (4) | 4-20 (0) | 718 r/w | Active if output 2 is equipped for a process (96 _ _-_ F_ _-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| At2 | **Alarm 2 Type**<br>Select alarm type. A process alarm responds when the temperature leaves a fixed range. A deviation alarm responds when the temperature deviates from the set point by a set number of degrees. | Proc process alarm (0)<br>dE deviation alarm (1) | Proc (0) | 719 r/w | Active if output 2 is present, but is not process type ( not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE. |

******Output 1 and Output 2 menu prompts cannot have range selections set to identical control modes, e.g. Heat/Heat or Cool/Cool if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| AHY2 | **Alarm Hysteresis 2**<br>Sets the switching hysteresis for the alarm output. This defines a band on the inside of the alarm set point. When the process temperature is in this band, the alarm state will not change. | 1 to 9999 | 3°F, 2°C | 720 r/w | Active if output 2 is present, but is not process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to HIDE. |
| LAT2 | **Latching 2**<br>Enable Alarm 2 Latching. | no no action (0)<br>YES latching enabled (1) | no (0) | 721 r/w | Active if output 2 is present, but is not a process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to HIDE. |
| SIL2 | **Silencing 2**<br>Enable Silence 2. | no no action (0)<br>YES silence alarm (1) | no (0) | 722 r/w | Active if output 2 is present, but is not a process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to HIDE. |
| SID2 | **Alarm Active Sides 2**<br>Select which side or sides the alarm set points can be programmed for. | both both (0)<br>hi high (1): high side only<br>Lo low (2): low side only | both (0) | 723 r/w | Active if output 2 is present, but is not a process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to HIDE. |
| LGC2 | **Alarm Logic 2**<br>Select alarm 2 output condition in the alarm state. | AL O alarm condition de-energizes output (fail-safe operation) (0)<br>AL C alarm condition energizes output (1) | AL O (0) | 724 r/w | Active if output 2 is present, but is not a process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to HIDE. |
| ANU2 | **Alarm Annunciation 2**<br>Select alarm 2 annunciation option. | no no (0)<br>YES yes (1) | YES (1) | 725 r/w | Active if output 2 is present, but is not a process type (not 96 _ _-_ A _ _-_ _ _ __ or 96 _ _-_ F_ _-_ _ _ _), Output 2 (Output 2 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to HIDE. |

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

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

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| LGc3 | **Alarm Logic 3**<br>Select alarm 3 output condition in the alarm state. | AL 0 alarm condition de-energizes output (fail-safe operation) (0)<br>AL C alarm condition energizes output (1) | AL 0 (0) | 741 r/w | Active if output 3 is present (96 _ _-_ _ D _-_ _ _ _), Output 3 (Output 3 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Anu3 | **Alarm Annunciation 3**<br>Select alarm 3 annunciation option. | no (0)<br>YES yes (1) | YES (1) | 742 r/w | Active if output 3 is present (96 _ _-_ _ D _-_ _ _ _), Output 3 (Output 3 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Out4 | ***Output 4 Menu*** | | | | |
| SEt | ***Setup Page*** | | | | |
| Ot 4 | **Output 4**<br>Select output 4 type. | OFF off<br>AL alarm<br>Eunt event* | OFF | none**** | Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hIdE.<br>*Event output is added if ramping version of the controller is selected (96__-____-AA__.) |
| At44 | **Alarm 4 Type**<br>Select alarm 4 type. | Proc process alarm<br>dE deviation alarm | Proc | none**** | Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Ahy4 | **Alarm Hysteresis 4**<br>Sets the switching hysteresis for the alarm output. This defines a band on the inside of the alarm set point. When the process temperature is in this band, the alarm state will not change. | 1 to 9999 | 3°F, 2°C | none**** | Active if output 4 is equipped for a relay (96 _ _-_ _ _ D -_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| LAt4 | **Latching 4**<br>Enable alarm 4 latching. | no no action<br>YES latching enabled | no | none**** | Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE. |

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

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| SIL4 | **Silencing 4**<br>Enable Silence 4. | no no action<br>YES silence 4 enabled | no | none**** | Active if output 4 is equipped for a relay (96 _ _-_ _ _ D -_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Sid4 | **Alarm Active Sides 4**<br>Select alarm 4 side option. | both both<br>hi high<br>Lo low | both | none**** | Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Lgc4 | **Alarm Logic 4**<br>Select alarm 4 output condition in alarm state. | AL O alarm condition de-energizes output<br>AL C alarm condition energizes output | AL O | none**** | Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _), Output 4 (Output 4 Menu) is set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Anu4 | **Alarm Annunciation 4**<br>Select alarm 4 annunciation option. | no no<br>YES yes | YES | none**** | Active if output 4 is equipped for a relay (96 _ _-_ _ _ D-_ _ _ _), Output 4 is Set to AL (Alarm) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Aout | **Analog Output 4**<br>Select Output 4 retransmit signal. | OFF not active<br>Proc process<br>SP set point<br>Pcnt percent power | OFF | none**** | Active if output 4 is equipped for retransmit (96 _ _-_ _ _ M-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Prc4 | **Process 4 Type**<br>Set process 4 output type. | 4-20 4-20 mA<br>0-20 0-20 mA<br>0- 5 0-5V⎓ (dc)<br>1- 5 1-5V⎓ (dc)<br>0-10 0-10V⎓ (dc) | 4-20 | none**** | Active if output 4 is equipped for retransmit (96 _ _-_ _ _ M - _ _ _ _) and Aout (Analog Output 4) is not set to OFF and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| A Lo | **Analog Output Low**<br>Set analog output range low scaling. | -1999 to A hi Analog Output High | Sensor type rL1 | none**** | Active if output 4 is equipped for retransmit (96 _ _-_ _ _ M-_ _ _ _), Analog Output 4 (Output 4 Menu) is set to OFF and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| A hi | **Analog Output High**<br>Set analog output range high scaling. | A Lo Analog Output Low to 9999 | Sensor type rh1 | none**** | Active if output 4 is equipped for retransmit (96 _ _-_ _ _ M-_ _ _ _), Analog Output 4 (Output 4 Menu) is set to OFF and Setup Page Lock (Lockout Menu) is not set to hIdE. |

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| ACAL | **Analog Output Offset**<br>Set analog output offset. | -1999 to 9999 | 0 | none**** | Active if output 4 is equipped for retransmit (96 _ _-_ _ _ M-_ _ _ _), Aout (Analog Output 4) is not set to OFF and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| bAUd | **Baud Rate**<br>Set communications baud rate. | 1200 1200<br>2400 2400<br>4800 4800<br>9600 9600<br>19.20 19.2K | 9600 | none**** | Active if output 4 is equipped for communications (96 _ _-_ _ _ R-_ _ _ _ or 96 _ _-_ _ _ U-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Addr | **Address**<br>Set communications address. | 1 to 247 | 1 | none**** | Active if output 4 is equipped for communications (96 _ _-_ _ _ R-_ _ _ _ or 96 _ _-_ _ _ U-_ _ _ _) and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| ******Output 4 parameters cannot be changed with the Modbus interface.** | | | | | |
| GLbL | ***Global Menu*** | | | | |
| SEt | ***Setup Page*** | | | | |
| Unit | **Units Type**<br>Select US or SI units of measurement. | US propbands in degrees, reset and rate (1)<br>SI propbands in degrees, integral and derivative (2) | US (1) | 900 r/w | Active if Setup Page Lock (Lockout Menu) is not set to hIdE. |
| C-F | **°C or °F**<br>Select the temperature scale for the input. Converts all temperature parameters. | oF °Fahrenheit (0)<br>oC °Celsius (1) | oF (0) | 901 r/w | Active if Sensor Type 1 (Input 1 Menu) is set to RTD or thermocouple and Setup Page Lock (Lockout Menu) is not set to hIdE. |
| Err | **Input Error Latching**<br>Select input error latching mode. | LAt latching (0)<br>nLAt no latching (1) | nLAt (1) | 607 r/w | Active if Setup Page Lock (Lockout Menu) is not set to hIdE. |
| FAIL | **Failure Mode****<br>Select failure mode after errors. | bPLS bumpless (0)<br>MAn manual (1)<br>OFF off (2) | bPLS (0) | 902 r/w | Active if Setup Page Lock (Lockout Menu) is not set to hIdE. |
| MAn | **Manual Default Power****<br>Select output power for manual mode. | heat: 0.0 to 100.0 (0 to 1000)<br>cool: -100.0 to 0.0 (-1000 to 0)<br>heat/cool: -100.0 to 100.0 (-1000 to 1000) | 0.0 (0) | 903 r/w | Active if Failure Mode (Global Menu) is set to MAn (manual) and Setup Page Lock (Lockout Menu) is not set to hIdE. |

***These parameters are added if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**
****These parameters are removed if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**
**NOTE: For more information about how parameter settings affect the controller's operation, see Chapter Five, Features.**

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| PLSP | **Power Limit Set Point**<br>Set point for power limits, PL A above this point, PL b below. | rL I Sensor Range Low<br>rH I Sensor Range High | rH I (1) | 713 r/w | Active if Setup Page Lock (Lockout Menu) is not set to HIdE. |
| PL A | **High Power Limit Above**<br>Set high power limit above the power limit set point. | 0.0 to 100.0 (0 to 1000)<br>Applies to heat or cool. | 100.0 (1000) | 714 r/w | Active if Setup Page Lock (Lockout Menu) is not set to HIdE. |
| PL b | **High Power Limit Below**<br>Set high power limit below the power limit set point. | 0.0 to 100.0 (0 to 1000)<br>Applies to heat or cool. | 100.0 (1000) | 715 r/w | Active if Setup Page Lock (Lockout Menu) is not set to HIdE. |
| rP | **Ramping Mode****<br>Set the single step ramp to set point mode. | OFF off (0)<br>Strt startup only (1)<br>StPt startup or set point change (2) | OFF (0) | 1100 r/w | Active if Local or Remote Mode (User Menu) is not r (remote set point is not active) and Setup Page Lock (Lockout Menu) is not set to HIdE. |
| rP S | **Ramp Scale****<br>Set the single step ramp scaling in degrees per hour or minute. | MIn minute (0)<br>hour hour (1) | MIn (0) | 1102 r/w | Active if Local or Remote Mode (User Menu) is not set to r, Ramping Mode (Global Menu) is not set to OFF and Setup Page Lock (Lockout Menu) is not set to HIdE. |
| rAtE | **Ramp Rate****<br>Set the units or degrees set point ramp rate. | 0.1 to 99.9 (1 to 999) | 10.0 (1) | 1101 r/w | Active if Local or Remote Mode (User Menu) is not set to r , Ramping Mode is not set to OFF and Setup Page Lock (Lockout Menu) is not set to HIdE. |
| OPLP | **Open Loop Detect**<br>Turn the open loop detect feature on or off. | OFF off (0)<br>on on (1) | OFF (0) | 904 r/w | Appears if Setup Page Lock (Lockout Menu) is not set to HIdE. |
| PtYP | **Program Type***<br>Select whether the program type will be time based or rate based. | t I time based (0)<br>rAtE rate based (1) | t I (0) | 1208 r/w | Added if ramping version of the controller is selected (96__-____-AA__). |

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

# Factory Page

The factory page contains six menus:

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| FctY | **Factory Page Selection** Choose factory menu to enter. | CUSt Custom Menu**<br>LOC Lockout Menu<br>diAG Diagnostics Menu<br>cAL1 Calibration 1 Menu<br>cAL2 Calibration 2 Menu**<br>cout Calibration Menu | | | Active: Always |
| CUSt | ***Custom Menu*****<br>FctY ***Factory Page*** | | | | |
| P1 to P16 | **Custom Prompt number**** (1 to 16) Choose an operations prompt to be in custom prompt slot. | nonE none (0)<br>Pr2 Process 2 (1)<br>Pcnt Percent Output (2)<br>rPSP Ramping Set Point (3)<br>E St Event Input Status (4)<br>A-M Operation Mode (5)<br>Aut Auto-tune (6)<br>AtSP Auto-tune Set Point (7)<br>SP2 Set Point 2 (8)<br>E SP Event Set Point (9)<br>L-r Local or Remote Mode (10)<br>CAL1 Calibration Offset (11)<br>Pb 1 Propband 1 (12)<br>It 1 Integral 1 (13)<br>dE 1 Derivative 1 (14)<br>rE 1 Reset 1 (15)<br>rA 1 Rate 1 (16)<br>Ct 1 Cycle Time 1 (17)<br>db 1 Dead Band 1 (18)<br>Pb 2 Propband 2 (19)<br>It 2 Integral 2 (20)<br>dE 2 Derivative 2 (21)<br>(Continued Next Page) | P1: A-M (Operation Mode)<br>P2: Aut (Auto-tune)<br>P3: Pcnt (Percent Power)<br>P4: CAL1 (Calibration Offset)<br>P5 to P16: nonE | 1400-1415 r/w | Active: Always |

***These parameters are added if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

****These parameters are removed if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| | | rE 2 Reset 2 (22)<br>rA 2 Rate 2 (23)<br>Ct 2 Cycle Time 2 (24)<br>db 2 Dead Band 2 (25)<br>A2hi Alarm 2 High (26)<br>A2Lo Alarm 2 Low (27)<br>A3hi Alarm 3 High (28)<br>A3Lo Alarm 3 Low (29)<br>A4hi Alarm 4 High<br>A4Lo Alarm 4 Low<br>P t Proportional Term (32)<br>I t Integral Term (33)<br>d t Derivative Term (34)<br>hyS1 Hysteresis 1 (35)<br>hyS2 Hysteresis 2 (36)<br>Ahy2 Alarm Hysteresis 2 (37)<br>Ahy3 Alarm Hysteresis 3 (38)<br>Ahy4 Alarm Hysteresis 4<br>SP 1 Set Point 1 (40) | | | tSht Troubleshooting must be set to P id PID.<br>tSht Troubleshooting must be set to P id PID.<br>tSht Troubleshooting must be set to P id PID. |
| LOC *Lockout Menu*<br>Fcty *Factory Page* | | | | | |
| SP **Set Point Lock**<br>Set the set point lockout level. | | chng change (1)<br>rEAd read only (2) | chng (1) | 1300 r/w | Active: Always |
| CUSt **Custom Menu Lock****<br>Set the Custom Menu lockout level. | | hidE hide (0)<br>chng change (1)<br>rEAd read only (2) | chng (1) | 1304 r/w | Active: Always, unless ramping version of the controller is selected (96__-____-AA__). |
| OPEr **Operations Page Mode Lock**<br>Set the Operations Page lockout level. | | hidE hide (0)<br>chng change (1)<br>rEAd read only (2) | chng (1) | 1301 r/w | Active: Always |

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| SEt | **Setup Page Lock**<br>Set the Setup Page lockout level. | hidE hide (0)<br>chng change (1)<br>rEAd read only (2) | chng (1) | 1302 r/w | Active: Always |
| CAL | **Calibration Menu Lock**<br>Set the calibration menus lockout level. | hidE hide (0)<br>chng change (1)<br>rEAd read only (2) | chng (1) | 1305 r/w | Active: Always |
| Prog | **Program Menu Lock***<br>The lockout menu will allow the user to set different levels of user lockout for he program menu. | hidE hide (0)<br>chng change (1)<br>rEAd read only (2) | chng (1) | 1314 r/w | Active if ramping version of the controller is selected (96__-____-AA__). |
| diAG<br>FctY | ***Diagnostics Menu***<br>***Factory Page*** | Enter diAG mode | (1789) | 1512 w | |
| MOdL | **Model Number**<br>Read the model number of the controller. | 96 | 96 | 0 r | Active: Always |
| dAtE | **Date of Manufacture**<br>Displays date as WEEK:YEAR (WWYY). | 0196 to 9999 | none | 5 r | Active: Always |
| Sn1 | **Serial Number 1**<br>Read the first four digits of the serial number. | 0 to 9999 | none | 1 r | Active: Always |
| Sn2 | **Serial Number 2**<br>Read the last four digits of the serial number. | 0 to 9999 | none | 2 r | Active: Always |
| SoFt | **Software ID Number**<br>Read the software ID number. | 0 to 9999 | none | 3 r | Active: Always |

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| rEu | **Software Revision**<br>Read software revision number. | 0.00 to 99.99 | none | 4 r | Active: Always |
| It42 | **Input 2 Hardware Enabled**<br>Read the input 2 hardware type. | nonE none (0)<br>PrEt process event (5) | (0) | 9 r | Active: Always |
| Ot41 | **Output 1 Hardware**<br>Read the output 1 hardware type. | nonE none (0)<br>rELY relay (1)<br>SSr solid-state relay (2)<br>dc dc (3)<br>Proc process (4) | (0) | 16 r | Active: Always |
| Ot42 | **Output 2 Hardware**<br>Read the output 2 hardware type. | nonE none (0)<br>rELY relay (1)<br>SSr solid-state relay (2)<br>dc dc (3)<br>Proc process (4) | (0) | 17 r | Active: Always |
| Ot43 | **Output 3 Hardware**<br>Read the output 3 hardware type. | nonE none (0)<br>rELY relay (1) | (0) | 18 r | Active: Always |
| Ot44 | **Output 4 Hardware**<br>Read the output 4 hardware type. | nonE none (0)<br>rELY relay (1)<br>Proc process (4)<br>485 (6)<br>232 (7) | (0) | 19 r | Active: Always |
| tout | **Test Output**<br>Turns on specific output. | nonE none (0)<br>out1 output 1 (1)<br>out2 output 2 (2)<br>out3 output 3 (3)<br>out4 output 4 (4)<br>ALL all outputs (5) | nonE (0) | 1514 r/w | Active: Must be in diAG mode |
| diSP | **Test Display**<br>Test the indicator lights on the front panel. | OFF turn off the cyclic display test (0)<br>on turn on the cyclic display test (1) | OFF (0) | 1513 r/w | Active: Must be in diAG mode |
| hrES | **High Resolution**<br>Displays high resolution input value. | -199.9 to 199.9<br>(-1999 to 1999) | none | 1707 r | Active: Always |

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| AMb | **Ambient Temperature**<br>Read the ambient temperature in 0.1 degrees Fahrenheit. | | none | 1500 r | Active: Always |
| Acnt | **Ambient A-D Counts**<br>Displays the raw ambient channel A-D counts. | | none | 1501 r | Active: Always |
| cnt1 | **Channel 1 A-D Counts**<br>Displays the raw channel 1 A-D counts. | | none | 1504 r | Active: Always |
| cnt2 | **Channel 2 A-D Counts**<br>Displays the raw channel 2 A-D counts. | | none | 1505 r | Active: Always |
| tSht | **Troubleshooting**<br>Helps solve problems with the controller. | no<br>Pid enables PID terms in custom menu<br>Comm sends modbus packet every 1 second | Pid | | Proportional term 205<br>Integral term 206<br>Derivative term 207 |
| Line | **Line Frequency**<br>Displays the AC line frequency in Hz. | | none | 1515 r | Active: Always<br>(Model 96A - available only with ac input.) |
| cin1 | ***Calibration 1 Menu*** | Enter diAG mode | (1789) | 1512 w | |
| FctY | ***Factory Page*** | Enter cin1 mode | (1415) | 1600 w | |
| rSt | **Restore Factory Calibration**<br>Restore factory calibration. Does not affect operations and setup parameters. | no no (0)<br>YES yes (1) | no (0) | 1601 w | Active if Calibration Lock (Lockout Menu) is not set to hidE. |
| dFLt | **Default Settings**<br>Restore default settings. | no no (0)<br>YES yes (800) | no (0) | 1602 w | Active if Calibration Lock (Lockout Menu) is not set to hidE. |

**NOTE: Complete calibration menus and parameters are explained at Watlow's web site, http://www.watlow.com/literature/prodtechinfo. Search on *96 calibration manual.***

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

# 7

# Chapter Seven
# Ramping

## Program Menu Prompts

**Entering the Program Menu:** Press the ◉Advance key to enter the Program Menu while the program is on hold or not running.

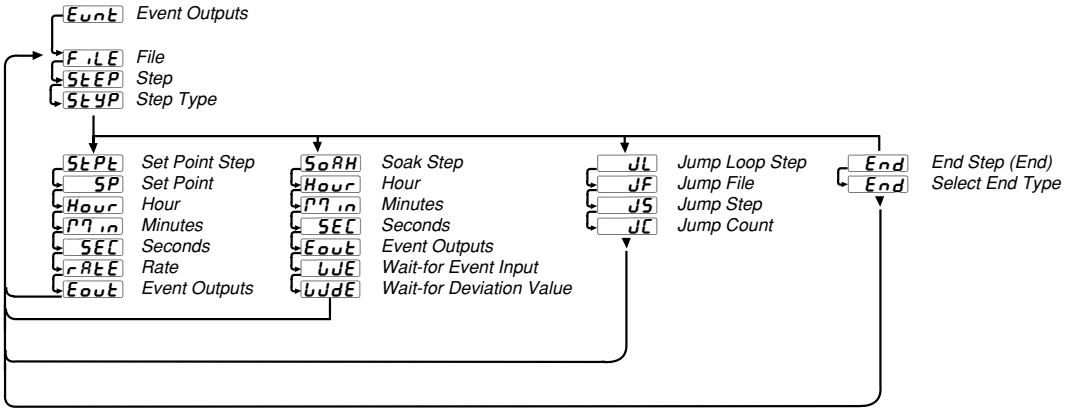



**Figure 7.1 – The Program Menu**

**Note: The Program Menu will only appear if the ramping software option has been ordered (96 _ _ - _ _ _ _ - AA _ _ ) .**

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| EunE | **Event Outputs** Manually change the event output status while the program is not running. | OFF (0)<br>2 (1)<br>3 (2)<br>2 3 (3) | OFF (0) | 1268 r/w | Active if hardware is present for Outputs 2, 3, or 4 and the parameters are set to EunE. Selecting a number to appear will turn the respective event output on. |
| FILE | **File** Represents the profile to be edited or viewed. | 1 (1 to 2)<br>2 | 1 (1) | | |
| StEP | **Step** Represents the current step of the profile to be edited or viewed. | 1 (1 to 8)<br>to<br>8 | 1 (1) | | |
| StYP | **Step Type** Select from four different step types. | StPt Set Point (0)<br>SoAH Soak (1)<br>JL Jump Loop (2)<br>End End (3) | End (3) | See p. 7.7 | |

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| StPt | ***Set Point Step*** | | | | |
| SP | **Set Point**<br>Indicates ending set point value the controller ramps to during the set point step. | OFF (-32768)<br>rL 1<br>rH 1 | 75°F/24°C or rL value if rL ≥ 75°F/24°C or if rH ≤ 75°F/24°C | See p. 7.7 | Active: Always |
| Hour | **Hour**<br>The number of hours, (plus Min and Sec parameters) equal the total step time to achieve the ending set point under the StyP step type. | 0 to 99 | 0 | See p. 7.7 | Active if the value set for PtyP is t, or time based profile. |
| Min | **Minutes**<br>The number of minutes, (plus Hour and Sec parameters) equal the total step time to achieve the ending set point under the StyP step type. | 0 to 59 | 0 | See p. 7.7 | Active if the value set for PtyP is t, or time based profile. |
| SEC | **Seconds**<br>The number of seconds, (plus Hour and Min parameters) equal the total step time to achieve the ending set point under the StyP step type. | 0 to 59 | 0 | See p. 7.7 | Active if the value set for PtyP is t, or time based profile. |
| rAtE | **Rate**<br>Indicates rate at which the set point changes in degrees per minute. | 0.0 to 3600 °F<br>0.0 to 2000 °C<br>0.0 to 3600 Units | 0.0 | See p. 7.7 | Active if the value set for PtyP is rAtE or rate based profile. |
| Eout | **Event Outputs**<br>Selects whether the event output(s) are on or off during the program step. | OFF (0)<br>2 (1)<br>3 (2)<br>2 3 (3)<br>4 ****<br>2 4 ****<br>3 4 ****<br>234 **** | OFF (0) | See p. 7.7 | Active if hardware is present for Outputs 2, 3 or 4 and the parameters are set to Eunt.<br>Selecting a number to appear will turn the respective event output on during the program step. |

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

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| SoAH | ***Soak Step*** | | | | |
| Hour | **Hour**<br>The number of hours, (plus Min and Sec parameters) equal the total soak step time at set point under the SoAH step type. | 0 to 99 | 0 | See p. 7.7 | Always displayed in this menu. |
| Min | **Minutes**<br>The number of minutes, (plus Hour and Sec parameters) equal the total soak step time at set point under the SoAH step type. | 0 to 59 | 0 | See p. 7.7 | Always displayed in this menu. |
| SEC | **Seconds**<br>The number of seconds, (plus Hour and Min parameters) equal the total soak step time at set point under the SoAH step type. | 0 to 59 | 0 | See p. 7.7 | Always displayed in this menu. |
| Eout | **Event Outputs**<br>Selects whether the event output(s) are on or off during the program step. | OFF (0)<br>2 (1)<br>3 (2)<br>2 3 (3)<br>4 ****<br>2 4 ****<br>3 4 ****<br>234 **** | OFF (0) | See p. 7.7 | Active if hardware is present for Outputs 2, 3, or 4 and the parameters are set to Eunt.<br>Selecting a number to appear will turn the respective event output on during the program step. |
| WJE | **Wait-for Event Input**<br>The program will not begin to decrement the soak time during the programmed step until the event input condition has been satisfied | OFF (0)<br>On (1) | OFF (0) | See p. 7.7 | Active if the parameter for Input 2 E Fn is set to WJE. |
| WJdE | **Wait-for Deviation Value**<br>The program will not begin to decrement the soak time during the programmed step until process value is equal to or within the wait-for deviation value setting. | OFF (-32768)<br>0 to 99 | OFF (-32768) | See p. 7.7 | Always displayed in this menu. |

| Display | Parameter | Range (Modbus Value) | Default | Modbus Register read/write | Conditions for Parameters to Appear |
|---|---|---|---|---|---|
| JL | ***Jump Loop Step*** | | | | |
| JF | **Jump file**<br>Selects the File which is to be jumped to. This is a zero-time step. | 1 to 2 | Current File | See p. 7.7 | |
| JS | **Jump Step**<br>Selects the Step which is to be jumped to. This is a zero-time step. | 1 to 8 | 1 | See p. 7.7 | |
| JC | **Jump Count**<br>Indicates the number of times the Jump is to be done. | 0 to 255 | 0 | See p. 7.7 | |
| End | ***End Step*** | | | | |
| End | **End**<br>Selects the state of the control and auxiliary outputs when a profile is ended. | Hold (0)<br>OFF (1) | Hold (0) | See p. 7.7 | When selected as Hold, the control and auxiliary outputs will be enabled to maintain the same state as in the last step in the program just completed.<br>When selected as OFF, the control and auxiliary outputs will be disabled and OFF is shown in the lower display. |

## How to Navigate with the Ramping Menus

| | Pre-run Menu | Program Menu | Run Menu |
|---|---|---|---|
| **Enter menu** | Press the ∞Infinity key. | Press the ◉Advance key. | Press the ∞Infinity key two times or one time if the profile indicator is flashing. |
| **Scroll thru menu.** | Press the ◉Advance key. | Press the ◉Advance key. | Press the ◉Advance key. |
| **Change prompt values.** | Press ▲Up and ▼Down arrow keys. | Press ▲Up and ▼Down arrow keys. | Menu is read only. |
| **Exit menu.*** | Press the ◉Advance key repeatedly. | Press the ∞Infinity key. | Press the ◉Advance key repeatedly. |

***Exit menu refers to returning back to the display of process value in the upper display and active set point value in the lower display. The ramping set point will be active while running a profile and the manual adjustable set point will be active when a profile is not running.**

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

## Pre-run and Run Menus

The Pre-run and Run menu prompts are only visible when in the Pre-Run or Run mode.

The Pre-run mode is entered by pressing the ∞Infinity key one time while at the Home Page location. The profile indicator light flashes while in the Pre-run mode. The Pre-run menu consists of the FILE, STEP, rESU and prompts. The Pre-run menu allows the user to select a profile and step number to run or to resume running a profile. The Pre-run menu contains these three prompts and does not revolve around in a continuous loop. Pressing the ◉Advance key at the rESU prompt will not advance you back to the top of the Pre-run menu. If the ◉Advance key is pressed at the rESU prompt, the user will exit out of the Pre-run menu and return to the display of process/current set point.
The Run mode is active when a program is running. The Run mode is entered by pressing the ∞Infinity key one time while in the Pre-run menu. The profile indicator light will be full on while in the Run mode. The F-St file-step prompt is visible in the Run menu and shows the current file and step number of the running profile. Other prompts in the Run menu show the target end set point, as well as status for time remaining, ramp rate, wait-for, and jump count if relevant.

**Pre-run Menu**

FILE
STEP
rESU (File number - step number)

**Run Menu**

F-St File number - step number
EnSP End set point for step
Hour Hours remaining in step
Min Minutes remaining in step
SEc Seconds remaining in step
rAtE Ramp rate in minutes for step
WAIt Wait-for event
WAdE Wait-for process deviation value selection for step
EJC Elapsed jump count for last jump step

## Running a Series 96 Profile

1. You must be at the Home Page location before you can begin running a profile. Start your profile by entering the pre-run menu. Enter the pre-run menu by pressing the infinity key.

2. The profile indicator LED begins flashing. The upper display shows the file number to be run and the bottom display shows the FILE parameter. Use the ▲Up and ▼Down arrow keys to select which profile number to run.

3. Press the ◉Advance key, the upper display shows the step number to be run and the bottom display shows the STEP parameter. Use the ▲Up and ▼ Down arrow keys to select which step number to start ramping at.

4. Press the ∞Infinity key again and the profile will start running. If not pressed within approximately one minute, the controller will automatically exit out of a pre-run mode. If the ∞Infinity key is pressed within one minute, the profile indicator LED will change from flashing to being continually lit to indicate the profile is now running. The upper display shows the process value and the lower display will show the ramping set point or soak set point value.

5. You may step through the Run menu parameters with the ◉Advance key while the profile is running. The Run menu will show the file/step number, and what the parameters are set to. At any time, you may press the ∞Infinity key to stop the profile. To resume running the profile where it was stopped, press the ∞Infinity key once; the profile indicator LED begins flashing. Now, press the ◉Advance key repeatedly until the rESU parameter appears in the lower display; once again, press the ∞Infinity key and the profile resumes running. After the profile has ended, the profile indicator LED will turn off and the lower display will read OFF or the last profile step set point depending on the End prompt setting.

## Resume a Profile

To resume a halted profile, from the Home Page, press the ∞Infinity key once to enter the Pre-run Menu. Press the ◉Advance key twice until the rESU parameter appears in the lower display. The lower display will show rESU and the upper display will show the file and step number that will be resumed (file-step). Press the ∞Infinity key again, the profile resumes, and the profile indicator LED is lit. You can only resume at the exact step you left off on. If you halt a running profile and make changes to the current step, you cannot resume the profile. The rESU parameter only appears when a running profile has been halted.

**To Run your profile...** Press the ∞Infinity key twice.

**To Stop a running profile...** Press the ∞Infinity key once.

**To Resume a halted profile...** Press the ∞Infinity key once, press the ◉Advance key repeatedly until the rESU parameter appears in the lower display, and press the ∞Infinity key.

## Jump-loops

The Series 96 can jump forward or backwards at any step. You cannot jump-loop to the step that you are on.

| | | | | | |
|---|---|---|---|---|---|
| Example: | Step 1 | StPt Set Point Step | | | |
| | Step 2 | StPt Set Point Step | | | |
| | Step 3 | SoAH Soak Step | | | |
| | Step 4 | StPt Set Point Step | | | |
| | Step 5 | JL Jump-loop | JF = 1 | JS = 2 | JC = 1 |
| | Step 6 | End End | | | |

In this example the program will execute steps 2 through 4 a total of 2 times. This includes the initial pass and the pass associated with the Jump Count of 1 JC 1. Following the second pass the End End step (Step 6) will be executed and the program will end.

Your JC Jump Count can be any number from 0 to 255. If you enter 0, this will be an infinite loop and never progresses to Step 6.

When JF Jump File is not set to the current program file, the profile may jump to any step of the other file.

## The Wait-for Functions of the Soak Step

There are two wait-for functions. The first is WJE Wait-for Event. The profile will wait-for the programmed event input condition to occur. The desired event condition is programmed by the E Cn parameter. If the WJE parameter is set to OFF the function will be ignored.

The second wait-for function is WJdE Wait-for Process Deviation Value. If a value is entered for this prompt, the profile will wait at this step until the desired process value is equal to or within the WJdE Wait-for Process Deviation Value band. Even though only one numeric number is programmed to wait-for, this absolute number represents both a positive and negative window around the desired process value.

Both wait-for functions (if enabled) must be satisfied before the time entered in the SOAH Soak step will begin to decrement. Once the wait-for condition has been satisfied, the soak step time will continue to decrement regardless of event input or process changes during the remainder of the profile step.

## Event Input Functions

In addition to being able to set the event input as a WJE Wait-for Event, the event input can also be programmed to pause a running profile, start a profile, hold a profile, or abort a profile.

If the event input is set to PAuS Pause a profile, satisfying the event input condition will toggle the profile between hold and resume.

If the event input is set to hold Hold, the profile will end when the event input condition is satisfied. The controller will return to the non-ramping mode and will continue to control the outputs by holding the last active profile step set point and event output settings.

If the event input is set to F iL 1 or F iL2, Profile 1 or Profile 2, the control will begin running the designated profile number selected when the event input condition has been satisfied if a profile is not currently running. This will begin at step 1.

If the event input is set to AbSP Abort Set Point, the profile will end when the event input condition is satisfied. The controller will return to the non-ramping mode and continue to operate by using the set point value programmed at the AbSP parameter. The event output settings will remain in the same state as the profile step settings when the profile was aborted.

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

# Series 96 Ramping Modbus Register Numbers

| Command Registers (Write Only) Send to activate | | | |
|---|---|---|---|
| 41210 | 1209 | Resume Profile | 1 |
| 41211 | 1210 | Hold Profile | 1 |
| 40001 | 4000 | Start File | 1 or 2 |
| 40002 | 4001 | Start Step | 1 - 8 |
| 40003 | 4002 | Start Profile | 5 |

| Absolute | Relative | Parameter Monitor Current Profile Registers (Read Only) |
|---|---|---|
| 45001 | 5000 | File |
| 45002 | 5001 | Step |
| 45003 | 5002 | Step Type |
| 45004 | 5003 | Wait for Event Input [4] |
| 45005 | 5004 | Wait for Deviation (process input) [4] |
| 45006 | 5005 | Event Output |
| 45007 | 5006 | Hours |
| 45008 | 5007 | Minutes |
| 45009 | 5008 | Seconds |
| 45010 | 5009 | Current Set Point |
| 45011 | 5010 | Jump Count |
| 45012 | 5011 | End Set Point |
| 45013 | 5012 | Rate |
| 45014 | 5013 | Profile State |

**Profile Definition Registers (Read and Write)**

**Note: For absolute numbers, add 40001 to each relative number.**

| Parameter | File 1 Step 1 | File 1 Step 2 | File 1 Step 3 | File 1 Step 4 | File 1 Step 5 | File 1 Step 6 | File 1 Step 7 | File 1 Step 8 | File 2 Step 1 | File 2 Step 2 | File 2 Step 3 | File 2 Step 4 | File 2 Step 5 | File 2 Step 6 | File 2 Step 7 | File 2 Step 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Step Type | 5020 | 5033 | 5046 | 5059 | 5072 | 5085 | 5098 | 5111 | 5124 | 5137 | 5050 | 5163 | 5176 | 5189 | 5202 | 5215 |
| End Set Point | 5021 | 5034 | 5047 | 5060 | 5073 | 5086 | 5099 | 5112 | 5125 | 5138 | 5151 | 5164 | 5177 | 5190 | 5203 | 5216 |
| Hours [1 or 4] | 5022 | 5035 | 5048 | 5061 | 5074 | 5087 | 5100 | 5113 | 5126 | 5139 | 5152 | 5165 | 5178 | 5191 | 5204 | 5217 |
| Minutes [1 or 4] | 5023 | 5036 | 5049 | 5062 | 5075 | 5088 | 5101 | 5114 | 5127 | 5140 | 5153 | 5166 | 5179 | 5192 | 5205 | 5218 |
| Seconds [1 or 4] | 5024 | 5037 | 5050 | 5063 | 5076 | 5089 | 5102 | 5115 | 5128 | 5141 | 5154 | 5167 | 5180 | 5193 | 5206 | 5219 |
| Rate [2 and 3] | 5025 | 5038 | 5051 | 5064 | 5077 | 5090 | 5103 | 5116 | 5129 | 5142 | 5155 | 5168 | 5181 | 5194 | 5207 | 5220 |
| Event Output [2, 3 or 4] | 5026 | 5039 | 5052 | 5065 | 5078 | 5091 | 5104 | 5117 | 5130 | 5143 | 5156 | 5169 | 5182 | 5195 | 5208 | 5221 |
| Waitfor Event Input [4] | 5027 | 5040 | 5053 | 5066 | 5079 | 5092 | 5105 | 5118 | 5131 | 5144 | 5157 | 5170 | 5183 | 5196 | 5209 | 5222 |
| Waitfor Deviation (Process Input) [4] | 5028 | 5041 | 5054 | 5067 | 5080 | 5093 | 5106 | 5119 | 5132 | 5145 | 5158 | 5171 | 5184 | 5197 | 5210 | 5223 |
| Jump File [5] | 5029 | 5042 | 5055 | 5068 | 5081 | 5094 | 5107 | 5120 | 5133 | 5146 | 5159 | 5172 | 5185 | 5198 | 5211 | 5224 |
| Jump Step [5] | 5030 | 5043 | 5056 | 5069 | 5082 | 5095 | 5108 | 5121 | 5134 | 5147 | 5160 | 5173 | 5186 | 5199 | 5212 | 5225 |
| Jump Count [5] | 5031 | 5044 | 5057 | 5070 | 5083 | 5096 | 5109 | 5122 | 5135 | 5148 | 5161 | 5174 | 5187 | 5200 | 5213 | 5226 |
| End Type [6] | 5032 | 5045 | 5058 | 5071 | 5084 | 5097 | 5110 | 5123 | 5136 | 5149 | 5162 | 5175 | 5188 | 5201 | 5214 | 5227 |

* Register is disabled or unavailable.
1 Register is only available if program type is set to Time.
2 Register is only available if program type is set to Rate.
3 Register is only available if step type is set to Set Point.
4 Register is only available if step type is set to Soak.
5 Register is only available if step type is set to Jump.
6 Register is only available if step type is set to End.

**Note: Data to be written to registers that are unavailable for a particular step type will be ignored.**

Register

Register 106 (Alarm 2 Status)
Register 110 (Alarm 3 Status)

| | |
|---|---|
| 0 | No Alarm Exists |
| 1 | Alarm High State |
| 2 | Alarm Low State |
| 3 | Alarm High Latched State |
| 4 | Alarm Low Latched State |
| 5 | Alarm High Silenced State |
| 6 | Alarm Low Silenced State |
| 7 | Alarm High Latched & Silenced State |
| 8 | Alarm Low Latched & Silenced State |
| 9 | Alarm Waiting for In Range State |
| 10 | Alarm Disabled State |
| 11 | Alarm Error State |

**NOTE: For more information about communicating with Watlow controllers, go to www.watlow.com and download the Data Communications Reference: Electronic User's Manual. It is located under Literature, User's Manuals, English and search on *data communications reference*.**

# A

# Appendix

## Troubleshooting Alarms and Errors

| Indication | Probable Cause(s) | Corrective Action |
|---|---|---|
| **Power** | | |
| • No power. | • Power to unit may be off.<br>• Fuse may be blown.<br>• Breaker may be tripped.<br>• Safety interlock door switch etc. may be activated.<br>• Separate system limit control may be latched.<br>• Wiring may be open. | • Check switches, fuses, breakers, interlocks, limits, connectors, etc. for energized condition and proper connection. |
| | • Input Power may be incorrect. | • Measure power upstream for required level. Check part number for input power required.<br>• Check wire size.<br>• Check for bad connections. |
| **Communications** | | |
| • Unit will not communicate. | • Address parameter may be incorrectly set. | • Check comms setup menu and set to correct address. |
| | • Baud rate parameter may be incorrectly set. | • Check comms setup menu and set to correct baud rate. |
| | • Unit-to-unit daisy chain may be disconnected. | • Look for a break in the daisy chain. |
| | • Communications wiring may be reversed, shorted or open. | • Verify correct connections and test wiring paths. |
| | • EIA-485 converter box may be incorrectly wired. | • Check converter box wiring and its documentation. |
| | • Computer COM port may be incorrectly set up. | • Reconfigure computer's COM port setup and verify communications ok. |
| | • Communications software setup or address may be incorrect. | • Check the communication card documentation for setable variables and operational testing. |
| | • Protocol or parity may be wrong, should be 8, n, 1. | • Restart COMS software and check for settings agreement. Verify the COM bus is active. |
| | • Application software not working properly. | • Verify operation with Watlow comms tool. |
| | • May need termination and pull-up and pull-down resistors. | • Add termination resistors per EIA-485 standards if using this option. |

| Indication | Probable Cause(s) | Corrective Action |
|---|---|---|
| **Input Error (error number in top display, % LED lit, percent power in bottom)** | | |
| • Input is in error condition.<br>Err 1 Underflow<br>Err2 Under Sensor<br>Err3 Over Sensor<br>Err4 Overflow | • The sensor may be improperly wired.<br>• Sensor wiring may be reversed, shorted or open.<br>• Input type setting may be for the wrong sensor/may not be calibrated.<br>• Input type setting may be for the wrong sensor/may not be calibrated.<br>• Ambient temperature may be too hot or too cold.<br>• The open loop detect shows a broken sensor.<br>• The calibration offset parameter is set much too high or low.<br>• Calibration may have been corrupted. | • Check sensor connections.<br>• Check sensor connections and sensor wiring.<br>• Change the Sensor Type parameter to match the sensor hardware.<br>• Change the Sensor Type parameter to match the sensor hardware. Try Restore Factory Calibration (Cal. 1 Menu).<br>• Verify that the temperature surrounding the controller is 32 to 149°F (0 to 65°C).<br>• Check sensor function. The Open Loop Detect parameter indicates it may be broken.<br>• Check the Calibration Offset parameter value; set it to the correct value.<br>• Restore factory calibration. See pg. 6.22 for selecting rSt = YES. |
| **Alarms** | | |
| • Alarm won't occur. | • Alarm output may be off.<br>• Alarm set points may be incorrect.<br>• Alarm may be silenced.<br>• Alarm sides may be incorrect.<br>• Controller may be in diagnostics mode. | • Configure output as an alarm.<br>• Check alarm set points.<br>• To clear the alarm, correct the alarm condition; check to see if the alarm is latched.<br>• Check the alarm sides setting.<br>• Check the alarm type setting. |
| • Alarm won't clear. | • Alarm may be latched.<br>• Alarm set points may be incorrect.<br>• Alarm hysteresis may be incorrect.<br>• Input may be in error condition. | • Check the alarm logic for compatibility with system peripherals and annunciators.<br>• Check the power limit setting.<br>• Check the operation mode.<br>• Check the alarm output function.<br>• Check the °C or °F setting.<br>• Check the calibration offset value; set it to a lower level. |
| **Unit Errors (error number in top display,error message in bottom display)** | | |
| • Er 4 rAM | • There is a RAM malfunction. | • Cycle power to unit. If problem persists, return unit to factory. |
| • Er 5 EEcS | • The EEPROM data is corrupted. | • Cycle power to unit. |
| • Er 6 roM | • There is a PROM malfunction. | • Cycle power to unit. If problem persists, return unit to factory. |
| • Er 7 HArd | • There is a logic hardware problem. | • Cycle power to unit. If problem persists, return unit to factory. |
| • Er 8 PLuG | • Module error. | • Module defective, replace or verify module configuration. |
| • Er 9 conF | • Configuration error. Module in invalid position. | • Return unit to factory. |
| • Er 10 chnG | • Module changed. | • Cycle power to unit. |
| • Er 11 SoFt | • New firmware is installed. | • Cycle power to unit. |
| • Er 12 cAL | • Calibration data is corrupted. | • Recalibrate unit. |
| • Er 13 AtoD | • There is an analog-to-digital hardware failure. | • Cycle power to unit. If problem persists, return unit to factory. |
| • Er 14 EEhd | • There is an EEPROM hardware problem. | • Cycle power to unit. If problem persists, return unit to factory. |
| • Er 15 nEuJ | • It is the new unit's first power up. | • Cycle power to unit. If problem persists, return unit to factory. |
| • Er 16 Addr | • There is an EEPROM hardware problem. | • Cycle power to unit. If problem persists, return unit to factory. |

# Series 96 Modbus Register Numbers

| Relative | Parameters |
|---|---|
| 0 | Model Number |
| 1 | Serial Number 1 |
| 2 | Serial Number 2 |
| 3 | Software ID Number |
| 4 | Software Revision |
| 5 | Date of Manufacture |
| 9 | Input 2 Hardware Enabled |
| 16 | Output 1 Hardware |
| 17 | Output 2 Hardware |
| 18 | Output 3 Hardware |
| 19 | Output 4 Hardware |
| 24 | Disable Nonvolatile Memory |
| 100 | Process 1 |
| 101 | Error 1 |
| 103 | Percent Output |
| 104 | Actual 2 |
| 105 | Process 2 |
| 106 | Alarm 2 Status |
| 110 | Alarm 3 Status |
| 200 | Operation Mode |
| 201 | Event Input Status |
| 202 | Remote Set Point |
| 203 | Ramping Set Point |
| 204 | PID Power |
| 205 | Prop Term |
| 206 | Integral Term |
| 207 | Derivative Term |
| 209 | System Error |
| 210 | Open Loop Error |
| 300 | Set Point 1 |
| 301 | Auto-Manual Operation Mode |
| 304 | Auto-tune Set Point 1 |
| 305 | Auto-tune Start 1 |
| 306 | Event Set Point 1 |
| 310 | Manual Set Point |
| 311 | Clear Input Errors |
| 316 | Local-Remote (L-r) |
| 319 | Set Point 2 |
| 321 | Alarm 2 Low |
| 322 | Alarm 2 High |
| 331 | Clear Alarms |
| 332 | Silence Alarms |
| 340 | Alarm 3 Low |
| 341 | Alarm 3 High |
| 500 | Propband 1 |
| 501 | Integral 1 |
| 502 | Reset 1 |
| 503 | Derivative 1 |
| 504 | Rate 1 |
| 505 | Dead Band 1 |
| 506 | Cycle Time 1 |
| 507 | Hysteresis 1 |
| 509 | Burst 1 |
| 510 | Propband 2 |
| 511 | Integral 2 |
| 512 | Reset 2 |
| 513 | Derivative 2 |
| 514 | Rate 2 |
| 515 | Dead Band 2 |
| 517 | Hysteresis 2 |
| 519 | Burst 2 |
| 600 | Sensor Type 1 |
| 601 | Input 1 |
| 602 | Range Low 1 |
| 603 | Range High 1 |
| 604 | Input Software Filter 1 |
| 605 | Calibration Offset 1 |
| 606 | Decimal 1 |
| 607 | Input Error Latching |
| 611 | Input 2 |
| 612 | Range Low 2 |
| 613 | Range High 2 |
| 615 | Calibration Offset 2 |
| 700 | Output 1 |
| 701 | Process 1 Type |
| 713 | Power Limit Set Point |
| 714 | High Power Limit Above |
| 715 | High Power Limit Below |
| 717 | Output 2 |
| 718 | Process 2 Type |
| 719 | Alarm 2 Type |
| 720 | Alarm Hysteresis 2 |
| 721 | Latching 2 |
| 722 | Silencing 2 |
| 723 | Alarm Active Sides 2 |
| 724 | Alarm Logic 2 |
| 725 | Alarm Annunciation 2 |
| 734 | Output 3 |
| 736 | Alarm 3 Type |
| 737 | Alarm Hysteresis 3 |
| 738 | Latching 3 |
| 739 | Silencing 3 |
| 740 | Alarm Active Sides 3 |
| 741 | Alarm Logic 3 |
| 742 | Alarm Annunciation 3 |
| 900 | Units Type |
| 901 | °C or °F |
| 902 | Failure Mode |
| 903 | Manual Default Power |
| 904 | Open Loop Detect |
| 1060 | Event Function |
| 1061 | Event Condition |
| 1100 | Ramping Mode |
| 1101 | Ramp Rate |
| 1102 | Ramp Scale |
| 1208 | Program Type |
| 1211 | Abort Set Point |
| 1300 | Set Point Menu Lock |
| 1301 | Operations Page Mode Lock |
| 1302 | Setup Page Lock |
| 1304 | Custom Menu Lock |
| 1305 | Calibration Menu Lock |
| 1314 | Program Menu Lock |
| 1400-1415 | Custom Prompt Number (1-16) |
| 1500 | Ambient Temperature |
| 1501 | Ambient A-D Counts |
| 1504 | Channel 1 A-D Counts |
| 1505 | Channel 2 A-D Counts |
| 1513 | Test Display |
| 1514 | Test Output |
| 1515 | Line Frequency |
| 1601 | Restore Factory Calibration |
| 1602 | Default Settings |

## Special Modbus Functions

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

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

**Note: For Absolute Modbus numbers, add 40001 to the Relative number.**

**Note: Refer to p. 7.7 for Modbus Register Numbers for ramping parameters.**

# *Declaration of Conformity*

# *Series 96*

**WATLOW Winona, Inc.**
1241 Bundy Boulevard
Winona, Minnesota 55987 USA

CE

***English***

Declares that the following product:

| | |
|---|---|
| Designation: | Series 96 |
| Model Number(s): | 96 (A or B) (0 or 1) – (C, D, F or K) (A, C, D, F or K) (A or D) (A, D, M, R or U) – (Any four letters or numbers) |
| Classification: | Temperature control, Installation Category II, Pollution degree 2 |
| Rated Voltage: | 100 to 240 V~ (ac) or 24 to 28 V≂ (ac or dc) |
| Rated Frequency: | 50 or 60 Hz |
| Rated Power Consumption: | 7VA maximum |

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

### *89/336/EEC Electromagnetic Compatibility Directive*

**EN 61326:1997 With A1:1998 – Electrical equipment for measurement, control and laboratory use – EMC requirements (Industrial Immunity, Class A Emissions).**
EN 61000-4-2:1996 With A1, 1998 – Electrostatic Discharge Immunity
EN 61000-4-3:1997 – Radiated Field Immunity
EN 61000-4-4:1995 – Electrical Fast-Transient / Burst Immunity
EN 61000-4-5:1995 With A1, 1996 – Surge Immunity
EN 61000-4-6:1996 – Conducted Immunity
EN 61000-4-11:1994 Voltage Dips, Short Interruptions and Voltage Variations Immunity
EN 61000-3-2:1995 With A1-3:1999 – Harmonic Current Emissions
EN 61000-3-3:1995 With A1:1998 – Voltage Fluctuations and Flicker

### *73/23/EEC Low-Voltage Directive*

**EN 61010-1:1993 With A1:1995 Safety Requirements of electrical equipment for measurement, control and laboratory use. Part 1: General requirements**

***Français***

déclare que le produit suivant :

| | |
|---|---|
| Désignation : | Séries 96 |
| Numéros de modèles : | 96 (A ou B) (0 ou 1) - (C, D, F ou K) (A, C, D, F ou K) (A ou D) (A, D, M, R, ou U) (N'importe quelle combinaison de quatre lettres ou chiffres) |
| Classification : | Régulation de température, Catégorie d'installation II, Degré de pollution 2 |
| Tension nominale : | 100 à 240 V~ (c.a) ou 24 à 28 V ≂ (c.a ou c.c) |
| Fréquence nominale : | 50 ou 60 Hz |

Consommation d'alimentation nominale : 7 VA maximum

Répond aux normes essentielles des directives suivantes de l'Union européenne en utilisant les standards normalisés ci-dessous qui expliquent les normes auxquelles répondre :

### *Directive 89/336/CEE sur la compatibilité électromagnétique*

**EN 61326:1997 avec A1 :1998 – Matériel électrique destiné à l'étalonnage, au contrôle et à l'utilisation en laboratoire – Exigences CEM (Immunité industrielle, Émissions de catégorie A).**
EN 61000-4-2:1996 Avec A1, 1998 – Immunité aux décharges électrostatiques
EN 61000-4-3:1997 – Immunité aux champs de radiation
EN 61000-4-4:1995 – Immunité contre les surtensions électriques rapides/ Rafale
EN 61000-4-5:1995 avec A1, 1996 – Immunité contre les surtensions
EN 61000-4-6:1996 – Immunité conduite
EN 61000-4-11:1994 Immunité contre les écarts de tension, interruptions courtes et variations de tension
EN 61000-3-2:1995 avec A1-3 :1999 – Emissions de courant harmoniques
EN 61000-3-3:1995 avec A1 :1998 – Fluctuations et vacillements de tension

### *Directive 73/23/CEE sur les basses tensions*

**EN 61010-1:1993 avec A1 :1995 Normes de sécurité du matériel électrique pour la mesure, le contrôle et l'utilisation en laboratoire. 1ère partie : Conditions générales**

(2199)

***Deutsch***

Erklärt, dass das folgende Produkt:

| | |
|---|---|
| Bezeichnung: | Serie 96 |
| Modell-Nummern: | 96 (A oder B) (0 oder 1) - (C, D, F oder K) (A, C, D, F oder K) (A oder D) (A, D, M, R oder U) - (Beliebige vier Ziffern oder Buchstaben) |
| Klassifikation: | Temperaturregler, Installationskategorie II, Verschmutzungsgrad 2 |
| Nennspannung: | 100 bis 240 V~ (ac) oder 24 bis 28 V ≂ (AC oder DC) |
| Nennfrequenz: | 50 oder 60 Hz |
| Nennstromverbrauch: | Max. 7 VA |

Erfüllt die wichtigsten Normen der folgenden Anweisung(en) der Europäischen Union unter Verwendung des wichtigsten Abschnitts bzw. der wichtigsten Abschnitte die unten zur Befolgung aufgezeigt werden.

### *89/336/EEC Elektromagnetische Kompatibilitätsrichtlinie*

**EN 61326:1997 mit A1:1998 – Elektrisches Gerät für Messung, Kontrolle und Laborgebrauch – EMV-Anforderungen (Störfestigkeit Industriebereich, Klasse A Emissionen)**
EN 61000-4-2:1996 mit A1, 1998 – Störfestigkeit gegen elektronische Entladung
EN 61000-4-3:1997 – Störfestigkeit gegen Strahlungsfelder
EN 61000-4-4:1995 – Störfestigkeit gegen schnelle Stöße/Burst
EN 61000-4-5:1995 mit A1, 1996 – Störfestigkeit gegen Überspannung
EN 61000-4-6:1996 – Geleitete Störfestigkeit
EN 61000-4-11:1994 Störfestigkeit gegen Spannungsabfall, kurze Unterbrechungen und Spannungsschwankungen
EN 61000-3-2:1995 mit A1-3:1999 – Harmonische Stromemissionen
EN 61000-3-3:1995 mit A1:1998 – Spannungsfluktationen und Flimmern
EN 61000-3-3: 1995 Grenzen der Spannungsschwankungen und Flimmern

### *73/23/EEC Niederspannungsrichtlinie*

**EN 61010-1:1993 mit A1:1995 Sicherheitsanforderungen für elektrische Geräte für Messungen, Kontrolle und Laborgebrauch. Teil 1: Allgemeine Anforderungen**

***Español***

Declara que el producto siguiente:

| | |
|---|---|
| Designación: | Serie 96 |
| Números de modelo: | 96 (A o B) (0 ó 1) - (C, D, F o K) (A, C, D, F o K) (A o D) (A, D, U, M o R) - (Cualesquiera cuatro letras o números) |
| Clasificación: | Control de temperatura, Categoría de instalación II, Grado de contaminación 2 |
| Tensión nominal: | 100 a 240 V~ (CA) o 24 a 28 V ≂(CA o CD) |
| Frecuencia nominal: | 50 o 60 Hz |
| Consumo nominal de energía: | 7 VA máximo |

Cumple con los requisitos esenciales de las siguientes Directrices de la Unión Europea mediante el uso de las normas aplicables que se muestran a continuación para indicar su conformidad.

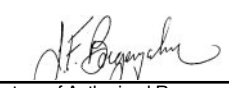
### *89/336/EEC Directriz de compatibilidad electromagnética*

**EN 61326:1997 CON A1:1998.– Equipo eléctrico para medición, control y uso en laboratorio – Requisitos EMC (Inmunidad industrial, Emisiones Clase A).**
EN 61000-4-2:1996 con A1, 1988 – Inmunidad a descarga electrostática
EN 61000-4-3:1997 – Inmunidad a campo radiado
EN 61000-4-4:1995 – Inmunidad a incremento repentino/rápidas fluctuaciones eléctricas transitorias
EN 61000-4-5:1995 con A1, 1996 – Inmunidad a picos de voltaje o corriente
EN 61000-4-6:1996 – Inmunidad por conducción
EN 61000-4-11:1994 Inmunidad a caídas de voltaje, variaciones y pequeñas interrupciones de voltaje
EN 61000-3-2:1995 con A1-3:1999 – Emisiones de corriente armónica
EN 61000-3-3:1995 con A1:1998 – Fluctuaciones de voltaje y centelleo.

### *73/23/EEC Directriz de bajo voltaje*

**EN 61010-1:1993 con A1:1995 Requisitos de seguridad de equipo eléctric para medición, control y uso en laboratorio. Parte 1: Requisitos generales**

| | |
|---|---|
| Jim Boigenzahn | Winona, Minnesota, USA |
| Name of Authorized Representative | Place of Issue |
| General Manager | September 2001 |
| Title of Authorized Representative | Date of Issue |



Signature of Authorized Representative

# Specifications

(2200)

### Controller

- Microprocessor-based, user-selectable control modes
- Heat and cool auto-tune for control outputs
- Universal input 1, auxiliary input 2, 4 outputs
- Control outputs user-selectable as on/off, P, PI, PID
- Input sample period; Single input 10Hz (100 msec), dual input 5Hz (200 msec) adjustable digital filter
- Display update; 2Hz (500 msec), adjustable digital filter
- Retransmit output update; 1 Hz (1 second)
- Output update; burst, 0.1 to 999.9 seconds
- Input/Output/Communication isolation
- Displayed in °C, °F, or process units

### Operator Interface

- Dual 4-digit LED displays: upper 0.4 in (10.2mm), lower 0.244 in (6.2mm)
- Advance, Up Arrow, Down Arrow, Infinity tactile keys

### Standard Conditions For Specifications

- Ambient temperature 77°F/25°C ±3°C, rated line voltage, 50 to 60Hz, 0 to 90% RH non-condensing, 15-minute warm-up

### *Universal Input 1*

### Thermocouple

- Type J, K, T, N, C (W5), E, PTII, D (W3), B, R, S thermocouple types
- >20MΩ input impedance
- Maximum 20Ω source resistance
- 30µA open detection bias

### RTD

- 2- or 3-wire platinum, 100Ω
- JIS and DIN curves
- Whole or tenth degree indication
- 150µA nominal RTD excitation current

### Process

- Range selectable: 0-10V⎓ (dc), 0-5V⎓ (dc), 1-5V⎓ (dc), 0-20mA, 4-20mA,
- Voltage input impedance 20kΩ
- Current input impedance 100Ω
- Minimum current source resistance 1MΩ
- Input resolution 50,000 bits (approx.) at full scale
- mV input impedance 20MΩ

### *Input 2*

### Event Input

- Contact or voltage
- 20KΩ input impedance
- Voltage input: event high state 3 to 36V⎓ (dc), event low state 0 to 2V⎓ (dc)
- Resistance/contact input: event high state > 23kΩ, event low state 0 to 2kΩ

### Remote Set Point Input: mA or DC Range Selectable

- Voltage input impedance 20kΩ
- Current input impedance 100Ω

### *Output Types*

### Open Collector/Switched DC

- Open collector configuration:
  Maximum voltage 42V⎓ (dc)
  Maximum current 200mA
  Maximum "on" resistance 1.1Ω
  Maximum offstate leakage current 100µA
- Switched dc configuration:
  Switched dc supply voltage 22 to 28V⎓ (dc)
  dc supply current limited to 30mA

### Solid-state Relay

- Optically isolated
- Zero cross switched
- Without contact suppression
- Minimum load current 0.5mA rms
- Maximum current 0.5A rms at 20 to 280V~ (ac)
- Maximum offstate leakage current 10µA rms
- For resistive loads only, must use RC suppression for inductive loads

### Electromechanical Relay

- Form C contact configuration
- Minimum load current 10mA @ 5V⎓ (dc)
- Rated resistive and inductive loads: 2A @ 250V~ (ac) or 30V⎓ (dc) maximum
- Electrical life 100,000 cycles at rated current
- For resistive loads only, must use RC suppression for inductive loads

### Process

- Range selectable: 0-20mA, 4-20mA, 0-5V⎓ (dc), 1-5V⎓ (dc), 0-10V⎓ (dc)
- Reverse or direct acting
- 0 to 10V⎓ (dc) voltage output into 1,000Ω minimum load resistance
- 0 to 20mA current output into 800Ω maximum load resistance
- Resolution:
  dc ranges = 2.5mV nominal
  mA ranges = 5µA nominal
- Calibration accuracy:
  dc ranges = ±15mV
  mA ranges = ±30µA
- Temperature stability 100ppm/°C

### Retransmit

- Range selectable: 0-20mA, 4-20mA, 0-5V⎓ (dc), 1-5V⎓ (dc), 0-10V⎓ (dc)
- 0 to 10V⎓ (dc) voltage output into a 1,000Ω minimum load resistance
- 0 to 20mA current output into an 800Ω maximum load resistance
- Resolution:
  dc ranges = 2.5mV nominal
  mA ranges = 5µA nominal
- Calibration accuracy:
  dc ranges = ±15mV
  mA ranges = ±30mA
- Temperature stability 100ppm/°C

## Communications
- EIA/TIA-485 or EIA/TIA-232
- Opto-isolated
- Modbus™ RTU protocol
- 1200, 2400, 4800, 9600, 19200 baud rates
- 32 maximum units can be connected (with additional 485 repeater hardware, up to 247 units may be connected)

## Accuracy
- Input ranges

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Type J: | 32 | to | 1382°F | or | 0 | to | 750°C |
| Type K: | -328 | to | 2282°F | or | -200 | to | 1250°C |
| Type T: | -328 | to | 662°F | or | -200 | to | 350°C |
| Type N: | 32 | to | 2282°F | or | 0 | to | 1250°C |
| Type E: | -328 | to | 1470°F | or | -200 | to | 900°C |
| Type C(W5): | 32 | to | 4200°F | or | 0 | to | 2315°C |
| Type D(W3): | 32 | to | 4200°F | or | 0 | to | 2315°C |
| Type PTII: | 32 | to | 2540°F | or | 0 | to | 1393°C |
| Type R: | 32 | to | 2642°F | or | 0 | to | 1450°C |
| Type S: | 32 | to | 2642°F | or | 0 | to | 1450°C |
| Type B: | 1598 | to | 3092°F | or | 870 | to | 1700°C |
| DIN: | -328 | to | 1472°F | or | -200 | to | 800°C |
| JIS: | -328 | to | 1166°F | or | -200 | to | 630°C |
| Process: | -1999 | to | 9999 units | | | | |

## Thermocouple Inputs
- Calibration accuracy ±0.1% of span ±1°C at standard conditions
  Exceptions:
  Type T; 0.12% of span for -200°C to -50°C,
  Types R and S; 0.15% of span for 0°C to 100°C
  Types B; 0.24% of span for 870°C to 1700°C
- Accuracy span: 1,000°F/540°C minimum
- Temperature stability: ±0.1 degree per degree change in ambient

## RTD Inputs
- Calibration accuracy ±0.1% of span ±1°C at standard conditions
- Accuracy span: 1,000°F/540°C minimum
- Temperature stability: ±0.05 degree per degree change in ambient

## Process Inputs
- Voltage input ranges
  Accuracy ±10mV ±1 LSD at standard conditions
  Temperature stability ±100ppm/°C maximum
- Milliamp input ranges
  Accuracy ±20µA ±1 LSD at standard conditions
  Temperature stability ±100ppm/°C maximum

## Agency Approvals
- UL 916 Listed file Number E185611; c-UL Approved,
- UL CCN QQXY, QQXY7 Process Control Equipment
- CE and NEMA 4X approved.

Modbus™ is a trademark of AEG Schneider Automation.
UL® is a registered trademark of the Underwriter's Laboratories, Inc.

## Terminals
- Touch safe
- 22 to 12 AWG

## Power
- 100-240V≂ (ac/dc) +10%; -15%; 50/60Hz, ±5%
- 24-28V≂ (ac/dc) +10%; -15%; 50/60Hz, ±5%
- 7.0VA maximum power consumption
- Data retention upon power failure via nonvolatile memory

## Operating Environment
- 32 to 149°F, 0 to 65°C
- 0 to 90% RH, non-condensing
- Storage temperature: -40 to 185°F, -40 to 85°C

## Dimensions
- Width 2.05 in. or 52mm
- Height 2.05 in. or 52mm
- Length 4.2 in. or 107mm
- Depth behind panel surface 3.875 in. or 98.4mm
- Approximate controller weight 0.4 lbs (0.2 kg)

## Allowable Operating Ranges

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Type J: | 1.0 | 32 | to | 1,500°F | or | 0 | to | 815°C |
| | 0.1 | 32.0 | to | 999.9°F | or | 0.0 | to | 815.0°C |
| Type K: | 1.0 | -454 | to | 2,500°F | or | -270 | to | 1,370°C |
| | 0.1 | -199.9 | to | 999.9°F | or | -199.9 | to | 999.9°C |
| Type T: | 1.0 | -454 | to | 750°F | or | -270 | to | 400°C |
| | 0.1 | -199.9 | to | 750.0°F | or | -199.9 | to | 400.0°C |
| Type N: | 1.0 | 32 | to | 2,372°F | or | 0 | to | 1,300°C |
| | 0.1 | 32.0 | to | 999.9°F | or | 0.0 | to | 999.9°C |
| Type E: | 1.0 | -454 | to | 1,470°F | or | -270 | to | 800°C |
| | 0.1 | -199.9 | to | 999.9°F | or | -199.9 | to | 800.0°C |
| Type C: | 1.0 | 32 | to | 4,200°F | or | 0 | to | 2,315°C |
| | 0.1 | 32.0 | to | 999.9°F | or | 0.0 | to | 999.9°C |
| Type D: | 1.0 | 32 | to | 4,200°F | or | 0 | to | 2,315°C |
| | 0.1 | 32.0 | to | 999.9°F | or | 0.0 | to | 999.9°C |
| Type PTII: | 1.0 | 32 | to | 2,543°F | or | 0 | to | 1,395°C |
| | 0.1 | 32.0 | to | 999.9°F | or | 0.0 | to | 999.9°C |
| Type R: | 1.0 | 32 | to | 3,200°F | or | 0 | to | 1,760°C |
| Type S: | 1.0 | 32 | to | 3,200°F | or | 0 | to | 1,760°C |
| Type B: | 1.0 | 32 | to | 3,300°F | or | 0 | to | 1,816°C |
| RTD (DIN) | 1.0 | -328 | to | 1,472°F | or | -200 | to | 800°C |
| | 0.1 | -199.9 | to | 999.9°F | or | -199.9 | to | 800.0°C |
| RTD (JIS) | 1.0 | -328 | to | 1,166°F | or | -200 | to | 630°C |
| | 0.1 | -199.9 | to | 999.9°F | or | -199.9 | to | 630.0°C |
| Process | | -1,999 | to | 9,999 units | | | | |

### Functionality Matrix

| | Universal Input | Event & Remote Set Point | Control | Alarm | Retransmit | 232/485 Comm |
|---|---|---|---|---|---|---|
| Input 1 | ■ | | | | | |
| Input 2 | | ■ | | | | |
| Output 1 | | | ■ | | | |
| Output 2 | | | ■ | ■ | | |
| Output 3 | | | | ■ | | |
| Output 4 | | | | ■ | ■ | ■ |

Note: These specifications are subject to change without prior notice.

# Ordering Information

(2201)

**Series 96** **9 6** – – –

Microprocessor-based 1/16 DIN with universal input 1. Options include software, power supply, input 2, four outputs and display color

**Power Supply**

A = 100-240V≂ (ac/dc)

B = 24-28V≂ (ac/dc)

**Input 2**

0 = None

1 = Event input & 0-5V⎓ (dc)/ 4-20mA (remote set point input)

**Output 1**

C = Switched dc/open collector

D = Electromechanical relay, Form C, 2A, without RC suppression

F = Universal Process, range selectable: 0-20mA, 4-20mA, 0-5V⎓ (dc), 1-5V⎓ (dc), 0-10V⎓ (dc)

K = 0.5A solid-state relay without RC suppression

**Output 2**

A = None

C = Switched dc/open collector

D = Electromechanical relay, Form C, 2A, without RC suppression

F = Universal Process, range selectable: 0-20mA, 4-20mA, 0-5V⎓ (dc), 1-5V⎓ (dc), 0-10V⎓ (dc)

K = 0.5A solid-state relay without RC suppression

**Output 3**

A = None

D = Electromechanical relay, Form C, 2A, without RC suppression

**Output 4**

A = None

D = Electromechanical relay, Form C, 2A, without RC suppression

R = 232 Communications

U = 485 Communications

M = Universal Retransmit, range selectable: 0-20mA, 4-20mA, 0-5V⎓ (dc), 1-5V⎓ (dc), 0-10V⎓ (dc)

**Software/Preset Parameters**

00 = Standard software

AA = Ramping

XX = Custom software

XX = Preset parameters

**Standard Display/Overlay**

| | Upper Display | Lower Display |
|---|---|---|
| RR = | Red | Red |
| RG = | Red | Green |
| GR = | Green | Red |
| GG = | Green | Green |

**Ramping Display/Overlay**

| | Upper Display | Lower Display |
|---|---|---|
| BA = | Red | Red |
| BB = | Red | Green |
| BC = | Green | Red |
| BD = | Green | Green |

# Index


## A

Abort Set Point 6.11
Address 6.16
Alarm 2 High 6.6
Alarm 2 Low 6.6
Alarm 2 Type 6.11
Alarm 3 High 6.7
Alarm 3 Low 6.6
Alarm 3 Type 6.13
Alarm 4 High 6.7
Alarm 4 Low 6.7
Alarm 4 Type 6.14
Alarm
  latching 5.9, 6.12, 6.13, 6.14
  process or deviation 5.9
  silencing 5.10
Alarm Active Sides 2 6.12
Alarm Active Sides 3 6.13
Alarm Active Sides 4 6.15
Alarm Annunciation 2 6.12
Alarm Annunciation 3 6.14
Alarm Annunciation 4 6.15
Alarm Hysteresis 2 6.12
Alarm Hysteresis 3 6.13
Alarm Hysteresis 4 6.14
Alarm Hysteresis 5.9
Alarm Logic 2 6.12
Alarm Logic 3 6.14
Alarm Logic 4 6.15
Alarm Menu 6.6-6.7
Alarm Set Points 5.9
Ambient A-D Counts 6.22
Ambient Temperature 6.22
Analog Output 4 6.15
Analog Output High 6.15
Analog Output Low 6.15
Analog Output Offset 6.16
Auto-Manual Operation Mode 6.2
Auto-tune Set Point 5.2, 6.3
Auto-tune 5.2, 6.2

## B

Baud Rate 6.16
Bumpless transfer 5.11
Burst 1 6.4
Burst 2 6.5
Burst Fire 5.8

## C

Calibration 1 Menu 6.22
Calibration Menu Lock 6.20
Calibration Offset 2 6.10
Calibration Offset 5.3, 6.3
Channel 1 A-D Counts 6.22
Channel 2 A-D Counts 6.22
configure the controller 4.4
communications 5.11
  and retransmit options 3.7
°C or °F 6.16
Custom Menu 4.3, 5.1, 6.18-6.19
Custom Menu Lock 6.19
Custom Prompt number 6.18-6.19
Cycle Time 1 6.4
Cycle Time 2 6.5

## D

Date of Manufacture 6.20
Dead Band 1 6.4
Dead Band 2 6.6
Dead Band 5.7
Decimal 1 6.9
Derivative 1 6.4
Derivative 2 6.5
Diagnostics Menu 6.20-6.22
digital event
  wiring 3.3

## E

End Step Menu 7.4
End 7.4
Errors
  bumpless transfer 5.11
  open loop detect 5.10
  troubleshooting A.2-A.3
Event Condition 6.11
Event Function 6.10
Event Input 5.4, 7.6
Event Input Status 6.2
Event Outputs 7.1
Event Outputs 7.2, 7.3
Event Set Point 6.3

## F

Factory Page 4.2, 4.3, 6.18-6.22
Failure Mode 5.11, 6.16
feedback inside front cover
File 7.1
filter time constant 5.3

## G

gap dimensions 2.1
Global Menu 6.16-6.17

## H

High Power Limit Above 6.17
High Power Limit Below 6.17
High Resolution 6.21
Home Page 4.2, 4.3, 6.1
Hour 7.2, 7.3
Hysteresis 1 6.4
Hysteresis 2 6.6

## I J

Input 1 6.8
Input 2 6.9
  Hardware Enabled 6.21
Input 1 Menu 6.8-6.9
Input 2 Menu 6.9-6.11
Input Error Latching 6.16
inputs and outputs (graphic) 1.1
Input Software Filter 1 6.9
input-to-output isolation 3.1
input wiring 3.2-3.3
  digital event 3.3
  process 3.2, 3.3
  RTD 3.2
  thermocouple 3.2
installation 2.1-2.2
  sensor 3.1
Integral 1 6.3
Integral 2 6.5
Isolation blocks 3.1
Jump Count 7.4
Jump File 7.4
Jump-loops 7.6
Jump Loop Menu 7.4
Jump Step 7.4

## K

keys and displays 4.1

## L

Latching 2 6.12
Latching 3 6.13
Latching 4 6.14
Line Frequency 6.22
Local or Remote Mode 6.3
Lockout Menu 6.19-6.20

## M

Manual Default Power 6.16
Minutes 7.2, 7.3
Model Number 6.20
Monitor Menu 6.2

## N

Navigation and Software 4.1-4.4
  Raming menu 7.4

## O

On/Off control 5.5
Open Loop Detect 5.10, 6.17
Operations Page 4.2, 4.3, 6.2-6.7
Operations Page Mode lockout 6.19
Output 1 6.11
Output 2 6.11
Output 3 6.13
Output 4 6.14
Output 1 Hardware 6.21
Output 2 Hardware 6.21
Output 3 Hardware 6.21
Output 4 Hardware 6.21
Output 1 Menu 6.11
Output 2 Menu 6.11-6.13
Output 3 Menu 6.13-6.14
Output 4 Menu 6.14-6.16
output wiring 3.4-3.7
  AC 3.4-3.7
  communications and retransmit 3.7
  process 3.4, 3.5
  switched DC, open collector 3.4, 3.5

## P Q

panel cutout dimensions 2.1
Percent Output 6.2
PID 1 Menu 6.3-6.4
PID 2 Menu 6.5-6.6
Power Limit 5.2
Power Limit Set Point 6.17
power wiring 3.1
Process 2 6.2
Process 1 Type 6.11
Process 2 Type 6.11
Process 4 Type 6.15
process input
  wiring 3.2, 33
process output
  wiring 3.4, 3.5
Profiles
  Menus 7.5
  Resume 7.5
  Running 7.5
Program Lock 6.20
Program Type 6.17
Propband 1 6.3
Propband 2 6.5
Proportional Control 5.6
Proportional plus Integral (PI) Control 5.6
Proportional plus Integral plus Derivative (PID) Control 5.7
  Dual 5.7

## R

Ramping Mode 6.17
Ramping Set Point 6.2
Ramp Scale 6.17
Ramp Rate 6.17
Range Low and Range High 5.4
Range High 1 6.9
Range High 2 6.10
Range Low 1 6.9
Range Low 2 6.10
Rate 7.2
Rate 1 6.4
Rate 2 6.5
remote set point
  retransmitting 5.5
removing controller 2.2
Reset 1 6.3
Reset 2 6.5
Restore Factory Calibration 6.22
RTD input
  wiring 3.2

## S

safety information inside front cover
Seconds 7.2, 7.3
sensor
  installation 3.1
  selection 5.3
Sensor Type 1 6.8
Serial Number 1 6.20
Serial Number 2 6.20
Set Point 7.2
  Lock 6.19
  ramping to 5.8
Set Point 2 6.3, 7.3
Set Point Step 7.2
Setup Page 4.2, 4.3, 6.8-6.17
Setup Page Lock 6.20
Silencing 2 6.12
Silencing 3 6.13
Silencing 4 6.15
Soak Step 7.3
Soak Step Wait-for Functions 7.6
Software ID Number 6.20
software map 4.3
Software Revision 6.21
Step 7.1
Step Type 7.1

## T

tasks 4.4
technical assistance inside front cover
Test Display 6.21
Test Output 6.21
thermocouple inputs
  wiring 3.2
Troubleshooting 6.22
Troubleshooting Alarms and Errors A.1-A.2

## U V

Units Type 6.16
User Menu 6.2-6.3

## W X Y Z

Wait-for Deviation Value 7.3
Wait-for Event Input 7.3
warranty information back cover
wiring 3.1-3.9
  Input 1 3.2
  Input 2 3.3
  Output 1 3.4
  Output 2 3.5
  Output 3 3.6
  Output 4 3.7
wiring example 3.9

# Prompt Index


1 1 Output Calibration 1, 1V
1 4 Output Calibration 1, 4mA
1 10 Output Calibration 1, 10V
1 20 Output Calibration 1, 20mA
2 1 Output Calibration 2, 1V
2 4 Output Calibration 2, 4mA
2 10 Output Calibration 2, 10V
2 20 Output Calibration 2, 20mA
4 1 Output Calibration 4, 1V
4 4 Output Calibration 4, 4mA
4 10 Output Calibration 4, 10V
4 20 Output Calibration 4, 20mA

A

A 0u Process Calibration 1, 0V
A2h i Alarm 2 High 6.6
A2Lo Alarm 2 Low 6.6
A3h i Alarm 3 High 6.7
A3Lo Alarm 3 Low 6.6
A 4A Process Calibration 1, 4mA
A4h i Alarm 4 High 6.7
A4Lo Alarm 4 Low 6.7
A 10u Process Calibration 1, 10V
A20A Process Calibration 1, 20mA
ACAL Analog Output Offset 6.16
Acnt Ambient A-D Counts 6.22
Addr Address 6.16
A h i Analog Output High 6.15
Ahy2 Alarm Hysteresis 2 6.12
Ahy3 Alarm Hysteresis 3 6.13
Ahy4 Alarm Hysteresis 4 6.14
ALM Alarm Menu 6.6-6.7
A Lo Analog Output Low 6.15
A-M Auto-Manual Operation Mode 6.2
AMb Ambient Temperature 6.22
Anu2 Alarm Annunciation 2 6.12
Anu3 Alarm Annunciation 3 6.14
Anu4 Alarm Annunciation 4 6.15
Aout Analog Output 4 6.15
AtSP Auto-tune Set Point 6.3
Aty2 Alarm 2 Type 6.11
Aty3 Alarm 3 Type 6.13
Aty4 Alarm 4 Type 6.14
Aut Auto-tune 6.2
AbSP Abort Set Point 6.11

B

b 0u Process Calibration 2, 0V
b 4A Process Calibration 2, 4mA
b 10u Process Calibration 2, 10V
b20A Process Calibration 2, 20mA
bAUd Baud Rate 6.16
br51 Burst 1 6.4
br52 Burst 2 6.5

C

CAL Calibration Menu Lock 6.20
CAL1 Calibration Offset 6.3
CAL2 Calibration Offset 2 6.10
cin1 Calibration 1 Menu 6.22
cin2 Calibration 2 Menu
C-F °C or °F 6.16
cnt1 Channel 1 A-D Counts 6.22
cnt2 Channel 2 A-D Counts 6.22
cout Process Output Calibration Menu
Ct 1 Cycle Time 1 6.4
Ct 2 Cycle Time 2 6.5
CUSt Custom Menu 6.18-6.19
CUSt Custom Menu Lock 6.19


**NOTE: Complete information on calibration prompts are explained at Watlow's web site,http://www.watlow.com/literature/prodtechinfo. Search on *96 calibration manual*.**


D

dAtE Date of Manufacture 6.20
db 1 Dead Band 1 6.4
db 2 Dead Band 2 6.6
dE 1 Derivative 1 6.4
dE 2 Derivative 2 6.5
dEC1 Decimal 1 6.9
dFLt Default Settings 6.22
diAG Diagnostics Menu 6.20-6.22
d,SP Test Display 6.21

E

E cn Event Condition 6.11
E Fn Event Function 6.10
Err Input Error Latching 6.16
End End Step Menu 7.4
End End 7.4
E SP Event Set Point 6.3
E St Event Input Status 6.2
Eunt Event Outputs 7.1
Eout Event Outputs 7.2, 7.3

F

FAIL Failure Mode 6.16
F,LE File 7.1
FctY Factory Page menus 6.18-6.22
Ftr1 Input Software Filter 1 6.9

G

GLbL Global Menu 6.16-6.17
Gnd Set Ground

H

Hour Hour 7.2, 7.3
hrES High Resolution 6.21
hYS1 Hysteresis 1 6.4
hYS2 Hysteresis 2 6.6

I J K

In 1 Input 1 6.8
In 2 Input 2 6.9
InP1 Input 1 Menu 6.8-6.9
InP2 Input 2 Menu 6.9-6.11
It 1 Integral 1 6.3
It 2 Integral 2 6.5
ItY2 Input 2 Hardware Enabled 6.21
JC Jump Count 7.4
JF Jump File 7.4
JL Jump Loop Menu 7.4
JS Jump Step 7.4

L

Lgc2 Alarm Logic 2 6.12
Lgc3 Alarm Logic 3 6.14
Lgc4 Alarm Logic 4 6.15
LAt2 Latching 2 6.12
LAt3 Latching 3 6.13
LAt4 Latching 4 6.14
LEAd Lead Resistance Calibration
LinE Line Frequency 6.22
LOC Lockout Menu 6.19-6.20
L-r Local or Remote Mode 6.3

M N

MAn Manual Default Power 6.16
Mdl Model Number 6.20
Min Minutes 7.2, 7.3
Mon Monitor Menu 6.2

O

OPEr Operations Page menus 6.2-6.7
OPEr Operations Page Mode Lock 6.19
OPLP Open Loop Detect 6.17
Oty1 Output 1 Hardware 6.21
Oty2 Output 2 Hardware 6.21
Oty3 Output 3 Hardware 6.21
Oty4 Output 4 Hardware 6.21
Ot 1 Output 1 6.11
Ot 2 Output 2 6.11
Ot 3 Output 3 6.13
Ot 4 Output 4 6.14
Out1 Output 1 Menu 6.11
Out2 Output 2 Menu 6.11-6.12
Out3 Output 3 Menu 6.13-6.14
Out4 Output 4 Menu 6.14-6.16

P Q

P1 to P16 Custom Prompt number (1-16) 6.18-6.19
Pb 1 Propband 1 6.3
Pb 2 Propband 2 6.5
Pcnt Percent Output 6.2
Pid1 PID 1 Menu 6.3-6.4
Pid2 PID 2 Menu 6.5-6.6
PLSP Power Limit Set Point 6.17
PL A High Power Limit Above 6.17
PL b High Power Limit Below 6.17
Pr2 Process 2 6.2
Prc1 Process 1 Type 6.11
Prc2 Process 2 Type 6.11
Prc4 Process 4 Type 6.15
PtYP Program Type 6.17
Pr09 Program Lock 6.20

R

r 15 RTD Calibration, 15Ω
r380 RTD Calibration, 380Ω
rAtE Rate 7.2
rAtE Ramp Rate 6.17
rA 1 Rate 1 6.4
rA 2 Rate 2 6.5
rE 1 Reset 1 6.3
rE 2 Reset 2 6.5
rEv Software Revision 6.21
rh 1 Range High 1 6.9
rh 2 Range High 2 6.10
rL 1 Range Low 1 6.9
rL 2 Range Low 2 6.10
rP Ramping Mode 6.17
rP S Ramp Scale 6.17
rPSP Ramping Set Point 6.2
rSt Restore Factory Calibration 6.22

S

SEC Seconds 7.2, 7.3
SEn1 Sensor Type 1 6.8
SEt Setup Page menus 6.8-6.17
SEt Setup Page Lock 6.20
Sid2 Alarm Active Sides 2 6.12
Sid3 Alarm Active Sides 3 6.13
Sid4 Alarm Active Sides 4 6.15
SIL2 Silencing 2 6.12
SIL3 Silencing 3 6.13
SIL4 Silencing 4 6.15
Sn 1 Serial Number 1 6.20
Sn2 Serial Number 2 6.20
SoAH Soak Step menu 7.3
SoFt Software ID Number 6.20
SP2 Set Point 2 6.3
SP Set Point Lock 6.19
SP Set Point 7.2
StEP Step 7.1
StPt Set Point Step menu 7.2
StYP Step Type 7.1

T

tc00 Thermocouple Calibration, 0mV
tc32 Thermocouple Calibration, 32mV
tc50 Thermocouple Calibration, 50mV
tout Test Output 6.21
tSHt Troubleshooting 6.22

U V W X Y Z

Unit Units Type 6.16
USEr User Menu 6.2-6.3
WdE Wait-for Deviation Value 7.3
WE Wait-for Event Input 7.3

# Series 96 Software Map

## Home Page

96 Process 1 Value
96 Set Point Value, Remote Set Point Value or Percent Output Value
96 Custom Menu**…
P1

## Program Menu*

(see pg. 7.1)

## Operations Page

**Monitor Menu**
OPEr Operations Page
Pr2 Process 2** _____
Pcnt Percent Output _____
rPSP Ramping Set Point** _____
E St Event Input Status _____

**User Menu**
OPEr Operations Page
A-M Auto-Manual Operations Mode** __
Aut Auto-tune _____
AtSP Auto-tune Set Point _____
SP2 Set Point 2** _____
E SP Event Set Point** _____
L-r Local or Remote Mode** _____
CAL 1 Calibration Offset _____

**PID 1 Menu**
OPEr Operations Page
Pb 1 Propband 1 _____
It 1 Integral 1 _____
rE 1 Reset 1 _____
dE 1 Derivative 1 _____
rA 1 Rate 1 _____
brS 1 Burst 1 _____
Ct 1 Cycle Time 1 _____
hYS 1 Hysteresis 1 _____
db 1 Dead Band 1 _____

**PID 2 Menu**
OPEr Operations Page
Pb 2 Propband 2 _____
It 2 Integral 2 _____
rE 2 Reset 2 _____
dE 2 Derivative 2 _____
rA 2 Rate 2 _____
brS2 Burst 2 _____
Ct 2 Cycle Time 2 _____
hYS2 Hysteresis 2 _____
db 2 Dead Band 2 _____

**Alarm Menu**
OPEr Operations Page
A2Lo Alarm 2 Low _____
A2hi Alarm 2 High _____
A3Lo Alarm 3 Low _____
A3hi Alarm 3 High _____
A4Lo Alarm 4 Low _____
A4hi Alarm 4 High _____

**Enter your settings on a photocopy of this page.**

## Setup Page

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

**Input 2 Menu**
SEt Setup Page
In 2 Input 2** _____
rL 2 Range Low 2** _____
rh 2 Range High 2** _____
CAL2 Calibration Offset 2** _____
E Fn Event Function _____
E cn Event Condition _____
AbSP Abort Set Point* _____

**Output 1 Menu**
SEt Setup Page
Ot 1 Output 1 _____
Prc 1 Process Type 1 _____

**Output 2 Menu**
SEt Setup Page
Ot 2 Output 2 _____
Prc2 Process Type 2 _____
AtY2 Alarm Type 2 _____
AhY2 Alarm Hysteresis 2 _____
LAt2 Latching 2 _____
SIL2 Silencing 2 _____
Sid2 Alarm Active Sides 2 _____
Lgc2 Alarm Logic 2 _____
Anu2 Alarm Annunciation 2 _____

**Output 3 Menu**
SEt Setup Page
Ot 3 Output 3 _____
AtY3 Alarm Type 3 _____
AhY3 Alarm Hysteresis 3 _____
LAt3 Latching 3 _____
SIL3 Silencing 3 _____
Sid3 Alarm Active Sides 3 _____
Lgc3 Alarm Logic 3 _____
Anu3 Alarm Annunciation 3 _____

**Output 4 Menu**
SEt Setup Page
Ot 4 Output 4 _____
AtY4 Alarm Type 4 _____
AhY4 Alarm Hysteresis 4 _____
LAt4 Latching 4 _____
SIL4 Silencing 4 _____
Sid4 Alarm Active Sides 4 _____
Lgc4 Alarm Logic 4 _____
Anu4 Alarm Annunciation 4 _____
Aout Analog Output 4 _____
Prc4 Process Type 4 _____
A hi Analog Output High _____
A Lo Analog Output Low _____
ACAL Analog Output Offset _____
bAUd Baud Rate _____
Addr Address _____

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

## Factory Page

**Custom Menu****
FctY Factory Page
P1 _____
P2 _____
P3 _____
P4 _____
P5 _____
P6 _____
P7 _____
P8 _____
P9 _____
P10 _____
P11 _____
P12 _____
P13 _____
P14 _____
P15 _____
P16 _____

**Lockout Menu**
FctY Factory Page
SP Set Point Lock _____
Prog Program Menu Lock* _____
CuSt Custom Menu Lock** _____
OPEr Operations Page Mode _____
SEt Setup Page Lock _____
CAL Calibration Menu Lock _____

**Diagnostics Menu**
FctY Factory Page _____
MMdL Model Number _____
dAtE Date of Manufacture _____
Sn 1 Serial Number 1 _____
Sn2 Serial Number 2 _____
SoFt Software ID Number _____
ItY2 Input Type 2 _____
rEv Software Revision _____
OtY1 Output 1 Hardware _____
OtY2 Output 2 Hardware _____
OtY3 Output 3 Hardware _____
OtY4 Output 4 Hardware _____
tout Test Output _____
dISP Test Displays _____
hrES High Resolution _____
AMb Ambient Temperature _____
Acnt Ambient A-D Counts _____
cnt 1 Channel 1 A-D Counts _____
cnt2 Channel 2 A-D Counts _____
tSht Communications Test/ Troubleshooting _____
LinE Line Frequency _____

**The Factory Page also includes calibration parameters that are not necessary for everyday use of the controller. Calibration parameters and procedures are explained at Watlow's web site, http://www.watlow.com/literature/prodtechinfo. Search on *96 calibration manual*.**

***Menu added if ramping version of the controller is selected (96__-____-AA__).**
****Menu removed if ramping version of the controller is selected (96__-____-AA__).**

**Table 3.2 — Set up parameters in this order.**

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

| Changing this → / Affects this ↓ | Units Type | °C or °F | Output 1 | Output 2 | Sensor Type | Input 1 | Range High 1 | Range Low 1 | Decimal 1 | HPL Above | HPL Below | Input 2 | Alarm Type 2, 3, 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Units Type | | | | | | | | | | | | | |
| °C or °F | | | | | | | | | | | | | |
| Failure Mode | | | | | | | | | | | | | |
| Output 1 | | | | | | | | | | | | | |
| Output 2 | | | | | | | | | | | | | |
| Output 3 | | | | | | | | | | | | | |
| Output 4 | | | | | | | | | | | | | |
| Manual Default Power | | | O | O | | | | | | O | O | | |
| Sensor Type | | | | | | | | | | | | | |
| Input 1 | | | | | O | | | | | | | | |
| Range High 1 | | C | | | D | D | | | C | | | | |
| Range Low 1 | | C | | | D | D | | | C | | | | |
| Decimal 1 | | | | | D | D | | | | | | | |
| Calibration Offset 1 | | C | | | D | D | | | C | | | | |
| Input Software Filter 1 | | | | | D | D | | | O | | | | |
| Power Limit Set Point | | C | | | D | D | O | O | C | | | | |
| High Power Limit Above | | | O | O | | | | | | | | | |
| High Power Limit Below | | | O | O | | | | | | | | | |
| Input 2 | | | | | | | | | | | | | |
| Event Function | | | | | | | | | | | | O | |
| Event Condition | | | | | | | | | | | | O | |
| Range High 2 | | C | | | | | | | C | | | D | |
| Range Low 2 | | C | | | | | | | C | | | D | |
| Calibration Offset 2 | | C | | | | | | | C | | | D | |
| Analog Output 4 | | | | | D | D | | | | | | | |
| Analog Output High | | C | | | D | D | | | C | | | | |
| Analog Output Low | | C | | | D | D | | | C | | | | |
| Analog Output Offset | | C | | | D | D | | | C | | | | |
| Ramping Mode | | | | | | | | | | | | | |
| Ramp Scale | | | | | | | | | | | | | |
| Ramp Rate | | | | | | | | | | | | | |
| Alarm Type 2, 3, 4 | | | | | | | | | | | | | |
| Alarm Hysteresis 2, 3, 4 | | C | | | D | D | | | C | | | | |
| Latching 2, 3, 4 | | | | | | | | | | | | | |
| Alarm Silencing 2, 3, 4 | | | | | | | | | | | | | |
| Alarm Active Sides 2, 3, 4 | | | | | | | | | | | | | |
| Alarm Logic 2, 3, 4 | | | | | | | | | | | | | |
| Alarm 2, 3, 4 High | | C | | | D | D | | | C | | | | O |
| Alarm 2, 3, 4 Low | | C | | | D | D | | | C | | | | O |
| Propband 1, 2 | | C | | | D | D | | | C | | | | |
| Integral 1, 2 | C | | | | | | | | | | | | |
| Reset 1, 2 | C | | | | | | | | | | | | |
| Derivative 1, 2 | | | | | | | | | | | | | |
| Rate 1, 2 | | | | | | | | | | | | | |
| Burst 1, 2 | | | | | | | | | | | | | |
| Cycle Time 1, 2 | | | | | | | | | | | | | |
| Dead Band 1, 2 | | C | | | D | D | | | C | | | | |
| Hysteresis 1, 2 | | C | | | D | D | | | C | | | | |
| Auto-Manual Operations Mode | | | | | | | | | | | | | |
| Event Set Point | | C | | | D | D | O | O | C | | | | |
| Set Point 2 | | C | | | D | D | O | O | C | | | | |
| Set Point Lock | | C | | | D | D | O | O | C | | | | |
| Manual Set Point | | O | O | | | | | | O | O | | | |

# How to Reach Us

TOTAL
CUSTOMER
SATISFACTION
3 Year Warranty

### Quality and Mission Statement:

*Watlow Winona will be the world's best supplier of industrial temperature control products, services, and systems by exceeding our customers', employees', and shareholders' expectations.*

## Contact

**Your Authorized Watlow Distributor is:**

- Phone: (507) 454-5300.
- Fax: (507) 452-4507.
- For technical support, ask for an Applications Engineer.
- To place an order, ask for Customer Service.
- To discuss a custom option, ask for a Series 96 Product Manager.

## Warranty

The Watlow Series 96 is warranted to be free of defects in material and workmanship for 36 months after delivery 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.

## Returns

- Call or fax Customer Service for a Return Material Authorization (RMA) number before returning a controller.
- Put the RMA number on the shipping label, and also on a written description of the problem.
- A restocking charge of 20% of the net price is charged for all standard units returned to stock.

**Artisan Technology Group** is an independent supplier of quality pre-owned equipment

## Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

## We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

## Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP