Honeywell

UDC2800 Universal Digital Controller

Product Manual

51-52-25-157
Revision 2.0
December 2020

DISCLAIMER

This document contains Honeywell proprietary information. Information contained herein is to be used solely for the purpose submitted, and no part of this document or its contents shall be reproduced, published, or disclosed to a third party without the express permission of Honeywell International Sàrl.

While this information is presented in good faith and believed to be accurate, Honeywell disclaims the implied warranties of merchantability and fitness for a purpose and makes no express warranties except as may be stated in its written agreement with and for its customer.

In no event is Honeywell liable to anyone for any direct, special, or consequential damages. The information and specifications in this document are subject to change without notice.

Copyright 2020 – Honeywell International Sàrl

CONTENTS

Contents 3

Chapter 1 - About this guide 11

Chapter 2 - Introduction 13

- Overview 13
- Operator Interface 20
  - Function of Displays 20
  - Function of Keys 22
- PC Software and Mobile Device App 24
  - Configuration Tool via Bluetooth 25
- CE Conformity (Europe) 26
- North America 27
- FCC 28

Chapter 3 - Installation 31

- Overview 32
- Condensed Specifications 32
- Model Number Interpretation 40
- Control and Alarm Relay Contact Information 45
- Mounting 46
  - Physical Considerations 46
  - Overall Dimensions 47
  - Mounting Method 48
  - Mounting Procedure 49
- Wiring 50
  - Electrical Considerations 50
- Wiring Diagrams 52

Identify Your Wiring Requirements 52
Universal Output Functionality and Restrictions 52
Wiring the Controller 55
Chapter 4 - Configuration 67
Overview 68
Configuration Prompt Hierarchy 68
Configuration Procedure 72
Security Set Up Group 74
Tuning Set Up Group 76
SP Ramp/Program Set Up Group 81
SP PROG2 ~ PROG 8 Set Up Group 88
Accutune Set Up Group 90
Algorithm Set Up Group 93
Output Set Up Group 107
Input 1 Set Up Group 111
Input 2 Set Up Group 117
Control Set Up Group 122
Options Set Up Group 131
Communications Group 139
Alarms Set Up Group 143
Display Set Up Group 151
Input1 Calib Set Up Group 153
Input2 Calib Set Up Group 154
Current Calib Set Up Group 155
Auxiliary Calib Set Up Group 155
Configuration Record Sheet 156
Chapter 5 - Monitoring and Operating the Controller 163

Overview 164
Operator Interface 164
Entering a Security Code 165
Lockout Feature 166
Monitoring Your Controller 168
- Annunciators 168
- Viewing the operating parameters 168
- Diagnostic Messages 171

Start Up Procedure for Operation 172
Control Modes 173
- Mode Definitions 173
- What happens when you change modes 174

Setpoints 175
Timer 177
Accutune III 178
- Tune for Simplex Outputs 180
- Tune for Duplex (Heat/Cool) 181
- Using AUTOMATIC TUNE at start-up for Duplex (Heat/Cool) 182
- Using BLENDED TUNE at start-up for Duplex (Heat/Cool) 183
- Using MANUAL TUNE at start-up for Duplex (Heat/Cool) 184
- Error Codes 185

Fuzzy Overshoot Suppression 187
Using Four Sets of Tuning Constants 188
Auto/Manual Station 191
Alarm Setpoints 197
Setting a Failsafe Output Value for Restart After a Power Loss 199
Setting Failsafe Mode 200
Setpoint Rate/Ramp/Program 201

Setpoint Rate 201
Setpoint Ramp 202
Setpoint Ramp/Soak Programming 204
Chapter 6 - Input Calibration 215
Overview 216
Minimum and Maximum Range Values 217
Preliminary Information 219
Input 1 or 2 Set Up Wiring 220
Thermocouple Inputs using a Millivolt Source 220
RTD Inputs 221
Millivolts, Volts or Thermocouple Differential Inputs 222
Milliamperes 222
Input 1 or 2 Calibration Procedure 223
Restore Input Factory Calibration 226
Chapter 7 - Output Calibration 229
Overview 230
Current Output Calibration 230
Auxiliary Output Calibration 233
Restore Output Factory Calibration 235
Chapter 8 - Troubleshooting/Service 239
Overview 240
Troubleshooting Aids 241
Power-up Tests 242
Status Tests 243
Background Tests and Diagnostic 244
Controller Failure Symptoms 249
Troubleshooting Procedures 250
Procedure #1 251

Procedure #2 251
Procedure #3 252
Procedure #4 253
Procedure #5 254
Procedure #6 255
Procedure #7 255
Procedure #8 256
Procedure #9 257
Restoring Factory Configuration 258
Chapter 9 - Parts List 261
Exploded View 261
Removing the chassis 266
Chapter 10 - Configuration via Honeywell EasySet 267
Communications Setup 268
Upload 270
Offline Configuration 270
Download 271
Online Configuration 271
Maintenance Data 272
Chapter 11 - Modbus Read, Write and Override Parameters plus Exception Codes 273
Overview 274
Reading Digital Output 274
Reading Digital Input 275
Reading Analog Input 275
Reading Analog Output 276
Reading Diagnostic Messages 276

Reading/Writing Shed Mode 279
Reading Alarm Status 279
Reading Control Parameters 280
Reading SP Ramp Process Parameters 281
Reading SP Program Process Parameters 282
Configuration Parameters 283
- Security 283
- Tuning 284
- SP Ramp/Rate/Program 286
- SP Program 2 288
- SP Program 3 290
- SP Program 4 291
- SP Program 5 293
- SP Program 6 294
- SP Program 7 296
- SP Program 8 298
- Accutune 299
- Algorithms 300
- Output 303
- Input 1 305
- Input 2 308
- Control 312
- Options 315
- Communications 318
- Alarms 321
- Display 324
- Input1 Calibration 325
- Input2 Calibration 326
- Current Output Calibration 326

Auxiliary Output Calibration 327
Status 327
Modbus RTU Exception Codes 328
Chapter 12 - Ethernet TCP/IP 331
Notices 333

CHAPTER

1 ABOUT THIS GUIDE

Abstract

This document provides descriptions and procedures for the Installation, Configuration, Operation, and Troubleshooting of your controller.

Revision history

Revision	Date	Document ID	Description
1.0	November 2020	51-52-25-157	Initial release of this document
2.0	December 2020	51-52-25-157	Add maximum digits for PV and SP display

Special Terms

The following table lists those symbols used in this document to denote certain conditions.

Symbol	Definition
PID	Proportion Integration Differentiation
PV	Process Variable
RTD	Resistance Temperature Detector
SP	Setpoint
SPDT	Single-Pole Double-Throw
SPDT	Single-Pole Single-Throw
TC	Thermocouple
TFT	Thin Film Transistor
UDC	Universal Digital Controller

References

The following list identifies all documents that may be sources of reference for material discussed in this publication.

- How to Apply Digital Instrumentation in Severe Electrical Noise Environments: 51-52-05-01

CHAPTER

2 INTRODUCTION

Overview

Function

UDC2800 is a microprocessor-based stand-alone controller. It a high degree of functionality and operating simplicity in a 1/4 DIN size controller. This instrument is an ideal controller for regulating temperature and other process variables in numerous heating and cooling applications.

UDC2800 monitors and controls temperatures and other variables in applications for industrial process control.

Features

- 2 Universal Analog Inputs
- 0.15% Accuracy
- Fast scanning rate (100ms)
- Up to 4 Output Types
- 2 Digital Inputs
- Math Functions
- Ethernet and Modbus communication
- Bluetooth configuration on mobile device
- NEMA4X and IP66 front face protection
  NEMA and IP are certified by CSA.
- ¼ DIN Size
- Jumper free configuration

Easy to read displays

Bright display with prompts in English make the operator interface easy to read, understand, and operate. Simple keystrokes let you set operating parameters that meet your process control needs.

Analog Inputs

UDC2800 has two analog inputs with a typical accuracy of ±0.15% of full-scale input and a typical resolution of 16 bits. Both analog inputs are sampled six times per second (every 100 ms).

The first, or Process Variable input, can be one of the various thermocouple, RTD or linear actuations. Linear actuations have thermocouple and RTD transmitter characterization capability as a standard feature. Linear actuations also have square root capability.

The optional second input is isolated and accepts the same actuations as input one.

All actuations and characterizations are keyboard configurable. Cold junction compensation is provided for thermocouple type inputs. Upscale, downscale or failsafe sensor break protection is keyboard configurable. A configurable digital filter of 0 to 120 seconds provides input signal damping.

Thermocouple Health - In addition to the standard configurable upscale, downscale or failsafe output burnout selections, the condition of the thermocouple can be monitored to determine if it is good, failing or in danger of imminent failure.

Math Function

Algorithm—A pre-configured algorithm is available for easy implementation. This includes the capability of using a Ratio and Bias with any input. You can select from the following menu:

- Feedforward Summer—Uses either input, followed by a Ratio/Bias calculation, summed directly with the computed PID output value to provide a resultant output to the final control element (standard feature).
- Weighted Average —Computes the weighted average of a PV or SP for the control algorithm from two inputs (standard feature).
- Feedforward Multiplier—Uses any input, multiplied by the calculated PID output to provide a resultant output which is sent to the final control element (standard feature).
- Summer/Subtractor—Will add or subtract inputs with the result used as the derived PV.
- Multiplier/Divider—Uses the analog inputs to calculate a derived PV. Available with or without Square Root.
- Input High/Low Select—Specifies the PV input as the higher or lower of the two inputs.

Digital Inputs

Two[1] isolated digital inputs are provided for remote dry contact closure to select one of the following actions.

Note 1: The second Current Output and the second Digital Input are mutually exclusive. Selection is made via a keyboard entry.

- Manual control mode
- Local setpoint 1, 2, 3, 4
- Direct controller action
- Hold SP Ramp/Program
- Select PID set 2, 3
- PV = Input2
- ReRun - SP Ramp/Program
- Run - SP Ramp/Program
- External program reset

- Disable PID integral action
- Manual mode, failsafe output
- Disable keyboard
- Output 1 = Fixed value
- Start Timer
- Auto/Manual Station
- Initiate Tuning
- Initiate PV Hot Start
- Output 1 tracks Input 2
- To Remote Setpoint
- PID reset feedback via Input 2
- Purge
- Low Fire
- To Latching Manual Mode
- PV Hold

Also, the digital inputs can allow one of the following selections to be combined with one of the above selections.

- Select PID set 2
- Direct controller action
- Local setpoint 1, 2, 3, 4
- Disable Accutune
- To Run - SP Ramp/Program

Outputs

Output Types - UDC2800 may have up to five outputs made up of the following output types:

- Current Outputs (4-20 or 0-20 mA)
- Electromechanical Relays (5 amps)
- Dual Electromechanical Relays (2 amps)
- Open Collector Outputs (Transmitter Power)

Alarms

One or two electromechanical alarm relays are available to activate external equipment when preset alarm setpoints are reached. Each of the two alarms can be set to monitor two independent setpoints. Each alarm setpoint can be either high or low alarm. The alarm type can be selected to be either of the inputs, the Process Variable, Deviation, Output, Shed from communications, PV rate of change, or to alarm on manual mode activation or a Current Output Open failure. It can also be used as an On or Off event at the beginning or end of a Ramp/Soak segment. The alarm hysteresis is configurable from 0 to 100% of range.

- Alarms can be configured as latching or non-latching.
- Alarm blocking is also available which allows start-up without alarm energized until after it first reaches the operating region.
- PV rate of change alarm.
- Loop break alarm.
- Timer output reset.
- Diagnostic Alarm

Communications

A communications link is provided between UDC2800 and a host computer or PLC via the RS485 Modbus® RTU (optional) or Ethernet TCP/IP (optional) communications option. A Bluetooth communication link is also available allowing a non-intrusive configuration of the instrument.

Miscellaneous Features

Auxiliary Output*(optional): Either or both of the two current outputs can function as an Auxiliary Output which can be scaled from 0-20 mA or 4-20 mA for 0 to 100% for any range. It can be configured to represent Input 1, Input 2, PV, active Setpoint, Local SP1, Deviation, or the Control Output.

Transmitter Power: This output provides up to 28 volts DC to power a 2-wire transmitter (it requires the use of Open Collector Output (Transmitter Power Output) selection or the Auxiliary Output).

Four Local and one Remote Setpoints: Can be configured to provide four Local and one Remote Setpoints, which are selectable either via the keyboard or by Digital Input.

Universal Switching Power: Operates on any line voltage from 90 to 264 Vac 50/60 Hz without jumpers. 24 Vac/dc instrument power, powered by a power supply which provides double/reinforce insulation or Safety Extra-low Voltage Circuit (SELV) Input, is available as an option.

Timer: This standard feature provides a configurable time period of 0 to 99 hours, 59 minutes or units of minutes and seconds. It can be started via the keyboard, alarm 2, or by a digital input. The timer output is Alarm 1, which energizes at the end of the Timer Period. Alarm 1 can be automatically reset. The Timer Period can be changed between each batch. Status is shown on the lower display.

Moisture Protection: The NEMA4X and IP66 rated front face permits use in applications where it may be subjected to moisture, dust, or hose-down conditions.

Setpoint Ramp/Soak Programming (Optional): Enables you to use 8 programs and store 4 Ramp and 4 Soak segments per program. Program can be linked up to 64 segments. Run or Hold of program is keyboard or remote digital switch selectable.

Setpoint Rate: Lets you define a ramp rate to be applied to any local setpoint change. A separate upscale or downscale rate is configurable. A single setpoint ramp is also available as an alternative.

CE Mark: Conformity with Radio Equipment Directive 2014/53/EU.

Radio Compliance information:

Federal Communications Commission (FCC) contains FCC ID: 2AVFQ-MCUDISP;

Industry Canada (IC) contains IC: 25762-MCUDISP.

Approval Body Options:

CE, FCC, IC (Standard);

UL Listed (Optional): UL61010-1, 3rd Edition. UL61010-2-201, 2nd Edition;

CSA Certified (Optional): CAN/CSA-C22.2 No. 61010-1-12+AMD1

Four Sets of Tuning Constants - Four sets of PID parameters can be configured for each loop and automatically or keyboard selected.

Data Security: Five levels of keyboard security protect tuning, configuration, and calibration data, accessed by a configurable 4-digit code. Nonvolatile EEPROM memory assures data integrity during loss of power.

Diagnostic/Failsafe Outputs: Continuous diagnostic routines detect failure modes, trigger a failsafe output value and identify the failure to minimize troubleshooting time.

High Noise Immunity: The controller is designed to provide reliable, error-free performance in industrial environments that often affect highly noise-sensitive digital equipment.

Accutune III™: This standard feature provides a truly plug and play tuning algorithm, which will, at the touch of a button or through a digital input, accurately identify and tune any process including those with deadtime and integrating processes. This speeds up and simplifies start-up plus allows retuning at any setpoint. The algorithm used is an improved version of the Accutune IITM algorithm found on earlier controllers. Two possibilities are now offered when tuning your process: Fast Tune and Slow Tune.

Fast Tune: will tune the process in such a way that the temp is reached faster, a slight overshoot will be allowed.

Slow Tune: will minimize overshoot, but it will take more time for the process temperature to reach the target setpoint.

Heat/Cool (Duplex Tune): will automatically tune both the heating and cooling sides of the process.

Fuzzy Logic: This standard feature uses fuzzy logic to suppress process variable overshoot due to SP changes or externally induced process disturbances. It operates independently from Accutune III tuning. It does not change the PID constants, but temporarily modifies the internal controller response to suppress overshoot. This allows more aggressive tuning to co-exist with smooth PV response. It can be enabled or disabled depending on the application or the control criteria.

Operator Interface

Function of Displays

Figure 2-1: Function of Displays

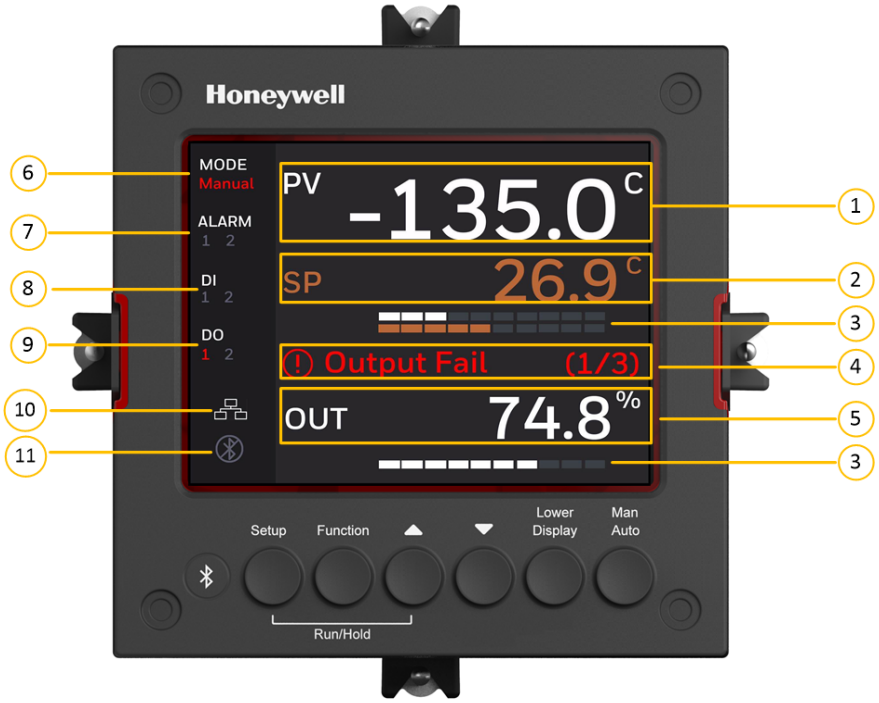


Table 2-1: Function of Displays

Item	Description
1	Upper display shows Process Variable value (maximum 6 digits including decimal point, eg. -XXXX.X). Its unit can be F, C or none.
2	Middle display shows working Setpoint and its value (maximum 6 digits including decimal point, eg. -XXXX.X). SP = Local Setpoint 1 2SP = Local Setpoint 2 3SP = Local Setpoint 3 4SP = Local Setpoint 4 RSP = Remote Setpoint

Item	Description
3	Bar display shows Process Variable, Setpoint and Output from top to bottom in percent of bar chart.
4	Diagnostics display shows diagnostic messages. See "Diagnostic Messages" on page 171 for more information.
5	Lower display shows key-selected operating parameters such as Output, Setpoints, Inputs, Deviation, active Tuning Parameter Set, Timer status, or minutes remaining in a setpoint ramp. See "Viewing the operating parameters" on page 168 for more information.
6	Indicates control mode either Manual or Auto.
7	Alarm 1 and/or Alarm 2 annunciations.
8	Digital Input 1 and/or 2 annunciations.
9	Control Relay 1 and/or 2 annunciations.
10	Modbus, or Ethernet communication status annunciation. Modbus: Ethernet: Grey: The function is disabled. White: The function is enabled, but the connection is not established. Blinking: The function is enabled, and the connection is established. Red: The function has errors. No icon: No communication board inserted, or the inserted board does not have communication feature.
11	Bluetooth communication status annunciation. Grey: The function is disabled. White: The function is enabled, but the connection is not established. Blue: The function is enabled, and the connection is established. Blinking: The function is enabled, and the connection is established, and the controller is communicating with a mobile device. Red: The function has errors.

Function of Keys

Figure 2-2: Function of Keys

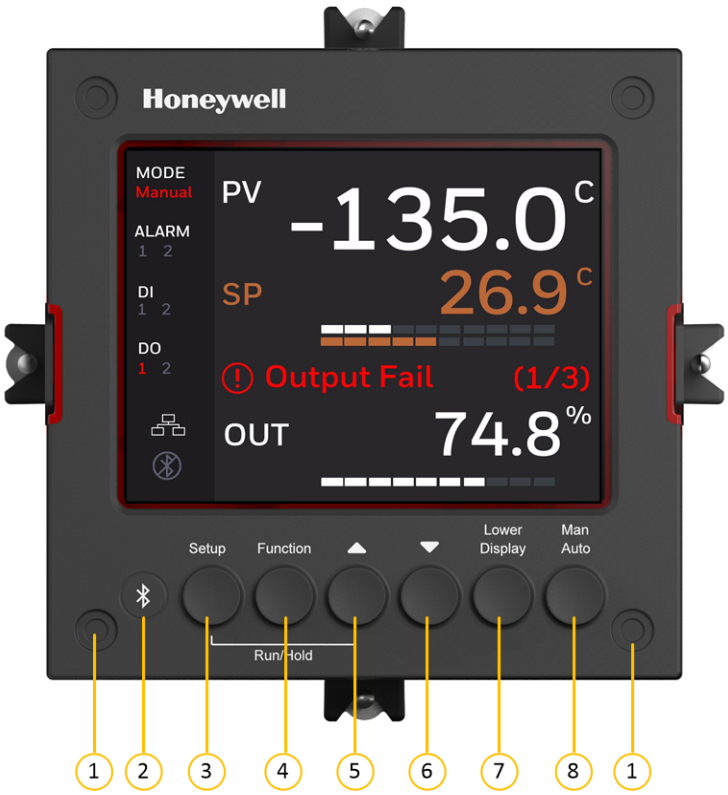


Table 2-2: Function of Keys

Item	Description
1	NEMA4X and IP66 screw attachment (each corner).
2	Bluetooth transmitter Enables to configure and operate controllers from mobility devices (mobile phones and tablet PCs), and download/upload the complete device configuration.
3	Setup key • When in the main screen, press it to enter in the setup screen. • When in the setup screen, it is used to scrolls through the configuration set up groups.

Item	Description
4	Function key Selects functions within each configuration group. • When in the main screen, press it to select next setpoint source from LP1, LP2, LP3, LP4 and RSP. • When in the setup screen. The first press will set the focus to the Function Group, and the subsequent presses used to navigate between Function Group and Option Group. • When in the setup screen and the focus in on the Option Group, press it to leave the focus from the Option Group, and also immediately save the changes user made on the Option Group.
5	Increment key Increases setpoint or output value. Increases the configuration values or changes functions in Configuration mode groups.
6	Decrement key Decreases setpoint or output value. Decreases the configuration values or changes functions in Configuration mode groups.
7	Lower Display key Returns Controller to normal display from the setup screen. Toggles various operating parameters for display. • When in the main screen, the first press of Lower Display key will set the focus to the Lower Display area of the main screen. The subsequent presses will select the next item from the Lower Display choices list. • When in the setup screen, press it to leave the setup screen and return back to the main screen.
8	Man Auto key Selects Manual or Auto mode. • When in the main screen, press it to toggle between Manual and Auto control mode. • When the controller is in the Slave mode (controller is controlled from communication and the Shed Timer in non-zero), press it to put the controller

Item	Description
	into Emergency mode in which local user can take over the output value from the front panel. Press the key again will leave the Emergency mode.
3+4	When in the main screen, press this combination will enter the display and keypad self-testing mode.
3+5	Enables Run/Hold of the SP Ramp or Program plus Timer start. When Setpoint Ramp/Program is enabled, press Setup and Increment keys at the same time to toggle the Run/Hold state of current running ramp or program.
5+6	When editing numerical values in main or setup screen, holding both Increment and Decrement keys will cause the current editable digit move one step left.

PC Software and Mobile Device App

The controller can be configured via a Honeywell EasySet or PC software. Honeywell EasySet is running on a Mobile Device, and PC software is running on a Desktop or a laptop computer.

The following communication types are available on UDC2800.

- Bluetooth (Standard / App)

  See "Configuration Tool via Bluetooth" on the facing page for more information.

- RS485 (Optional / Software)

  See "Modbus Read, Write and Override Parameters plus Exception Codes" on page 273 for more information.

- Ethernet (Optional / Software)

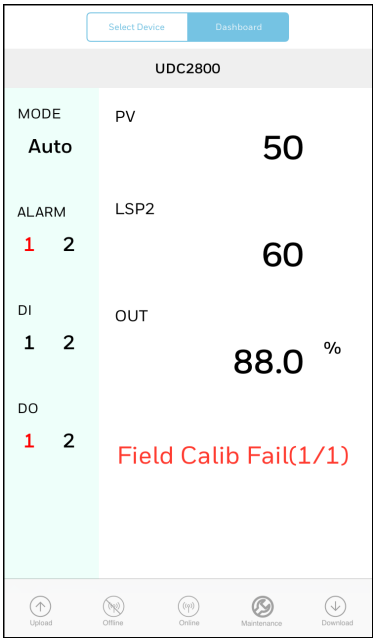
  See "Modbus Read, Write and Override Parameters plus Exception Codes" on page 273 for more information.

Configuration Tool via Bluetooth

Overview

This configuration tool (Honeywell EasySet) lets you configure your instrument on a Mobile Device via Bluetooth. It is available to detect and connect controllers within 3 meters. This app can be installed on IOS 12.0 or higher operating system. See "Configuration via Honeywell EasySet" on page 267 for more information.

Figure 2-3: Screen capture of Honeywell EasySet running on a Mobile Device



Features

- Create configurations with the application (Honeywell EasySet) running on a Mobile Device.
- Create / edit configurations online or offline, and download to controller later.
- This software is available in English.

Bluetooth communications

The Bluetooth connection provides a non-intrusive wireless connection with the instrument and maintains NEMA4X and IP66 integrity.

No need to get access to the back of the controller to communicate with the instrument, no need to take your screwdriver to wire the communication cable, no wiring mistake possible. You can now duplicate an instrument's configuration, upload or download a new configuration in a matter of seconds, just by connecting your mobile device to instrument through Bluetooth.

Connect & Upload: It takes less than 2 seconds to upload configuration from an instrument. You can then save the configuration file onto your mobile device for review, modification or archiving.

Furthermore, the software and app also give you important maintenance information on the controller: instantly, get information on the current operating parameters, digital inputs and alarm status, identify internal or analog input problems.

Questions: What if I have several controllers on the same panel? How can I be sure I am communicating with the correct one?

Answer: The Bluetooth is normally "off". You activate the Bluetooth on a particular controller by pressing any key. Once activated, you can pair with the controller. If a controller has been connected, the Bluetooth status mark will show on the screen. Each controller may also be assigned a different Bluetooth ID.

CE Conformity (Europe)

This product is in conformity with Radio Equipment Directive 2014/53/EU. Conformity of this product with any other “CE Mark” Directive(s) shall not be assumed.

Product Classification: Class I: Permanently connected, panel-mounted Industrial Control Equipment with protective earthing (grounding) (EN61010-1).

Enclosure Rating: This controller must be panel-mounted with the rear terminals enclosed within the panel. The front panel of the controller is rated at NEMA4X and IP66 when properly installed.

Installation Category (Overvoltage Category) : Category II (EN61010-1) Energy-consuming equipment supplied from the fixed Installation. Local level appliances, and Industrial Control Equipment

Pollution Degree: Pollution Degree 2. Normally non-conductive pollution with occasional conductivity caused by condensation. (Ref. IEC 664-1)

EMC Classification: Group 1, Class A, ISM Equipment (EN61326-1, emissions), Industrial Equipment (EN61326-1, immunity)

Method of EMC Assessment: Technical File (TF)

Deviation from the installation conditions specified in this manual, and the special conditions for CE conformity in Subsection 2.1, may invalidate this product's conformity with the Low Voltage and EMC Directives.

ATTENTION: The emission limits of EN61326 are designed to provide reasonable protection against harmful interference when this equipment is operated in an industrial environment. Operation of this equipment in a residential area may cause harmful interference. This equipment generates, uses, and can radiate radio frequency energy and may cause interference to radio and television reception when the equipment is used closer than 30 meters (98 feet) to the antenna(e). In special cases, when highly susceptible apparatus is used in close proximity, the user may have to employ additional mitigating measures to further reduce the electromagnetic emissions of this equipment.

WARNING: If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

North America

Installation Category (Overvoltage Category): Category II (EN61010-1)
Pollution Degree: Pollution Degree 2: Normally non-conductive pollution with occasional conductivity caused by condensation. (Ref. IEC 664-1)

WARNING: If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

FCC

Radio Compliance information: Federal Communications Commission (FCC) contains FCC ID: 2AVFQ-MCUDISP Industry Canada(IC) contains IC: 25762-MCUDISP.

This device complies with Part 15 of the FCC Rules / Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L'appareil ne doit pas produire de brouillage.
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé 2 pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

CHAPTER

3 INSTALLATION

What's in this section?

The following topics are covered in this section.

In this section:

Overview *32*
Condensed Specifications *32*
Model Number Interpretation *40*
Control and Alarm Relay Contact Information *45*
Mounting *46*
Wiring *50*
Wiring Diagrams *52*

Overview

Introduction

UDC2800 installation consists of mounting and wiring the controller according to the instructions given in this section. Read the pre-installation information, check the model number interpretation, and become familiar with your model selections, then proceed with installation.

> **NOTE:** Trained service personnel is required to install the product.

Pre-installation information

If the controller has not been removed from its shipping carton, inspect the carton for damage then remove the controller.

- Inspect the unit for any obvious shipping damage and report any damage due to transit to the carrier.
- Make sure a bag containing mounting hardware is included in the carton with the controller.
- Check that the model number shown on the inside of the case agrees with what you have ordered.

Condensed Specifications

Honeywell recommends that you review and adhere to the operating limits listed in the table below when you install your controller.

Table 3-1: Condensed Specifications

Specifications	
Analog Inputs (One or Two)	**Accuracy**: • ± 0.15% of full scale typical (± 1 digit for display) • Can be field calibrated to ± 0.05% of full scale typical • 16-bit resolution typical **Sampling Rate**: Both inputs are sampled ten times per second

Specifications	
	Temperature Stability: ± 0.01% of Full Scale span / ˚C change-typical **Input Impedance**: • 0-20 / 4-20 Milliampere Input: 250 ohms • All Others: 10 megohms **Maximum Lead Wire Resistance**: • Thermocouples: 50 ohms/leg • 100 ohm, 200 ohm and 500 ohm RTD: 100 ohms/leg • 100 ohm Low RTD: 10 ohms/leg
Analog Input Signal Failure Operation	**Burnout Selections**: Upscale, Downscale, Failsafe or None **Thermocouple Health**: Good, Failing, Failure Imminent or Failed **Failsafe Output Level**: Configurable 0-100% of Output range
Analog Input Filter	**Software**: Single pole lowpass section with selectable time constants, off to 120 seconds, available on both analog inputs.
Stray Rejection	**Common Mode**: AC (50 or 60 Hz): 120 dB (with maximum source impedance of 100 ohms) or ± 1 LSB (least significant bit) whichever is greater with line voltage applied. DC: 120 dB (with maximum source impedance of 100 ohms) or a ±1 LSB whichever is greater with 120 Vdc applied. DC (to 1 KHz): 80 dB (with maximum source of impedance of 100 ohms) or ±1 LSB whichever is greater with 50 Vac applied. **Normal Mode**: AC (50 or 60 Hz): 60 dB (with 100 % span peak-to-peak maximum)
Digital Inputs (Two) (Optional)	+30 Vdc source for external dry contacts or isolated solid state contacts. Digital Inputs are isolated from line power, earth ground, analog inputs and all outputs except for the Second Current Output.

Specifications	
	On contact closure the controller will respond according to how each digital input is configured. Opening the contact causes a return to previous state. The second Digital Input is mutually exclusive with the Second Current Output.
Controller Output Types	**Electromechanical Relays (One or Two)** Single-Pole Double-Throw (SPDT) contacts. Both Normally Open and Normally Closed contacts are brought out to the rear terminals. Internally socketed • Resistive Load: 5 amps @ 125 Vac, 250 Vac or 30 Vdc • General use: 5 amps @ 125 Vac, 250 Vac (certified by UL) • Inductive Load (cosφ = 0.4): 3 amps @ 130 Vac or 250 Vac • Motor: 1/6 H.P 125 Vac, 250 Vac. **Dual Electromechanical Relays** Two Single-Pole Single-Throw (SPST) relays. One Normally Closed contact for each relay is brought out to the rear terminals. This option takes the place of one of the above electromechanical relays, and is especially useful for Time Duplex applications. Instruments with this option can have a total of 4 relays plus one current output. Internally socketed • Resistive Load: 2 amps @ 125 Vac, 250 Vac or 30 Vdc • General use: 5 amps @ 125 Vac, 250 Vac (certified by UL) • Inductive Load (cosφ = 0.4): 1 amps @ 130 Vac or 250 Vac **Open Collector Outputs (One or Two)** Socketed assembly replacing a relay. Two types of load are supported, resistive load and pilot duty load. Opto-isolated from all other circuits except current output and not from each other. Internally powered @ 28 Vdc (0 mA) ~ 24 Vdc (20 mA). **NOTE:** Applying an external power supply to this output will damage the instrument.

Specifications	
	• Maximum Source Current: 20 mA • Overload Protection: 25 mA **Current Outputs (One or Two)** These outputs provide a 21 mA dc maximum into a negative or positive grounded load or into a non-grounded load. Current outputs are isolated from each other, line power, earth ground and all inputs. Outputs can be easily configured via the keyboard for either direct or reverse action and for either 0 to 20 mA or 4 to 20 mA without field calibration. Either or both current outputs can be used in an Auxiliary Output mode. This Auxiliary Output can be configured to represent Input, PV, Setpoint, Deviation, or Control output. The range of an Auxiliary Output can be scaled per the range of the selected variable and can be set anywhere between 0 to 21 mA. The Second Current Output is mutually exclusive with the second Digital Input. • Resolution: 16 bits over 0 to 21 mA • Accuracy: 0.05% of full scale • Temperature Stability: 0.01% F.S./°C • Load Resistance: 0 to 1000 ohms
Alarm Outputs (Optional)	One SPDT Electromechanical relay. A second alarm is available if the second control relay is not used for control purposes. Up to four setpoints are independently set as high or low alarm, two for each relay. Setpoint can be on any Input, Process Variable, Deviation, Manual Mode, Failsafe, PV Rate, RSP Mode, Communication Shed, or Output. A single adjustable hysteresis of 0.0 to 100.0% is provided. The alarm can also be set as an ON or OFF event at the beginning of a Setpoint ramp/soak segment. **Alarm Relay Contacts Rating**: Resistive Load: 5 amps at 125 Vac or 250 Vac or 30 Vdc
RS485 Modbus RTU Communications	**Baud Rate**: 4800, 9600,19,200 or 38,400 baud selectable **Data Format**: Floating point or integer

Specifications	
Interface (Optional)	**Length of Link**: • 2000 ft (600 m) max. with Belden 9271 Twinax Cable and 120 ohm termination resistors • 4000 ft. (1200 m) max. with Belden 8227 Twinax Cable and 100 ohm termination resistors **Link Characteristics**: Two-wire (half-duplex), multi-drop Modbus RTU protocol, 15 drops maximum or up to 31 drops for shorter link length.
Ethernet TCP/IP Communications Interface (Optional)	**Type**: 10/100M Base-T **Length of Link**: 330 ft. (100 m) maximum. Use Shielded twisted-pair, Category 5e (STP CAT5e) Ethernet cable. **Link Characteristics**: Four-wire plus shield, single drop, five hops maximum **IP Address**: IP Address is 10.0.0.2 as shipped from the Factory **Configuration**: Ethernet parameters are configured via the Front Panel.
RS485 and Ethernet Transaction rates	Host computer must allow a minimum of 20 milliseconds between Read transactions and a minimum of 200 milliseconds between Write transactions.
Bluetooth Communications (Standard)	**Type**: Bluetooth **Length of Link**: 10 ft. (3 m) maximum for mobile devices **Protocol**: BLE 4.2
Controller Output Algorithms	**On-off or Time Proportional**: One relay or open collector output. Control action can be set for direct or reverse. Time Proportional Relay Resolution: 3 msec **On-off Duplex, or Time Proportional Duplex**: Two relays or open collector outputs. Control action can be set for direct or reverse. Time Proportional Relay Resolution: 3 msec

Specifications	
	Current Proportional: A single 4-20 mA current output signal that can be configured for direct or reverse action. **Current Proportional Duplex**: This can be a single current output can provide both heat and cool signals (4-12 mA cool, 12-20 mA heat) or a combination of both current outputs with the First Current Output providing the Heat output (Heat = 50 to 100% of range) and Second Current Output providing the Cool output (Cool = 0 to 50% of range). Both are 4-20 mA signals that can be set for direct or reverse action. **Current/Time Duplex**: Variation of time proportional duplex for Heat/Cool applications. Time proportional output (heat or cool) is a relay. Current proportional output (Heat or Cool) is a 4-20 mA signal that can be fed into a negative or positive grounded load of 0 to 1000 ohms and is operational over 50% of range or the entire range.
Digital Displays	**TFT LCD**: A Thin Film Transistor (TFT) LCD screen is dedicated to display process variable, setpoint, and output. Key selected operating parameters can be shown in the lower area of the screen. Alternate information displayed during configuration mode.
Indicators	Alarm Relay Status (Alarm 1 or 2) Control Mode (Auto or Manual) Temperature Units (F or C) Active Set Point (■) Control Relay Status (DO 1 or 2) Digital Input Status (DI 1 and 2) Communication Status (Bluetooth, Ethernet and Modbus)
Mode of Operation	Manual Automatic with Local Setpoint Automatic with Remote Setpoint
Dimensions	See "Overall Dimensions" on page 47 for more information.
Mounting	Panel-mounted, 4.5-inch (114 mm) depth
Wiring	Screw terminals on the rear of the case.

Specifications	
Connections	See "Wiring Diagrams" on page 52 for more information.
Power Consumption	16 VA maximum (100 to 240 Vac) 12 VA maximum (24 Vac/dc)
Power Inrush Current	1.84 A maximum for 5.25 ms (under operating conditions), reducing to a maximum of 200 mA (100 to 240 Vac operation) or 312 mA (24 Vac/dc operation) after 8.42 ms. **CAUTION:** When applying power to more than one instrument, make sure that sufficient power is supplied. Otherwise, the instruments may not start up normally due to voltage drop from the inrush current.
Weight	3 lbs. (1.3 kg)
Isolation (Functional)	**AC Power(100~240VAC)**: Electrically isolated from all other inputs and outputs to withstand a HIPOT potential of 3000 Vac for 60 seconds, from earth ground to withstand a HIPOT potential of 1500 Vac for 60 seconds per EN61010-1. **DC Power(24VDC/AC)**: Electrically isolated from all other inputs and outputs and earth ground to withstand a HIPOT potential of 840 Vac for 60 seconds per EN61010-1. **Analog Inputs and Outputs**, **Digital Inputs and Outputs**: Electrically isolated from all other circuits to withstand a HIPOT potential of 1500 Vac for 60 seconds. **Relay Contacts**: With a working voltage of 125/250 Vac, these are electrically isolated from all other circuits to withstand a HIPOT potential of 3000 Vac for 60 seconds per EN61010-1.
Surge Withstand Capability (SWC)	Immunity: ANSI/IEEE C37.90.1, Surge Withstand Capability (SWC) (Formerly IEEE 472). Mains power input and relay contact outpus: 2.5 kV, Common Mode and Differential Mode. All other circuits: 1.0 kV, Common Mode and Differential Mode. The instrument is capable of meeting these test levels with no component failures, no reset, and no incorrect outputs.
Radio Frequency Interference (RFI)	Immunity: No effect on performance from a 5 W walkie-talkie operated at 151 or 450 MHz, one meter from the controller.

Environmental and Operating Conditions				
Parameter	Recommended	Rated	Operative Limits	Transportation and Storage
Ambient Temperature	25 ± 3 °C 77 ± 5 °F	0 to 55 °C 32 to 131 °F	0 to 55 °C 32 to 131 °F	–40 to 66 °C –40 to 151 °F
Relative Humidity	10 to 55*	5 to 90*	5 to 90*	5 to 95*
Vibration: Frequency (Hz) Acceleration (g)	 0 0	 1 30	 5 30	 20 30
Mechanical Shock: Acceleration (g) Duration (ms)	 0 0	 1 30	 5 30	 20 30
Line Voltage (Vdc)	+24 ± 1	24	21.6 to 26.4	- -
Line Voltage (Vac) 100 to 240 Vac 24 Vac	 120 ± 1 240 ± 2 24 ± 1	 100 to 240 24	 90 to 264 21.6 to 26.4	 - - - - - -
Frequency (Hz) (For Vac)	50 ± 0.2 60 ± 0.2	50 60	50 ± 2 60 ± 2	- - - -
Altitude	2000 meters			
* The maximum moisture rating only applies up to 40 °C (104 °F). For higher temperatures, the RH specification is derated to maintain constant moisture content.				

Model Number Interpretation

Introduction

Write your controller's model number in the spaces provided below and circle the corresponding items in each table. This information will also be useful when you wire your controller.

UDC2800 Universal Digital Controller Model Selection Guide

The UDC2800 controller packs new powerful features while retaining all the simplicity and flexibility of the industry standard UDC2500 controller including:

- Enhanced Display
- Bluetooth for configuring with Honeywell EasySet
- Ethernet Communications
- Two Analog Inputs
- Accutune III, Fast/Slow, Heat/Cool
- Thermocouple Health Monitoring

Instructions

Select the desired key number. The arrow to the right marks the selection available.

Make the desired selections from Tables I through VI using the column below the proper arrow. A dot (•) donates availability.

Key Number	I	II	III	IV	V	VI
_ _ _ _ _ _	_ _	_ _ _	_ _ _	_ _ _	_ _	_

Key Number – UDC2800 Single Loop Controller			
Description	**Selection**	**Availability**	
Digital Controller for use with 100 to 240 Vac Power	DC2800	↓	
Digital Controller for use with 24 Vac/dc power	DC2900		↓

Table I – Specify Control Output and/or Alarms				
Output #1	Current Output (4 to 20 ma, 0 to 20 ma)	C _	•	•
	Electro Mechanical Relay (5 Amp Form C)	E _	•	•
	Open Collector transistor output	T _	•	•
	Dual 2 Amp Relays (Both are Form A) (Heat/Cool Applications)	R _	•	•
Output #2 and Alarm #1 or Alarms 1 and 2	No Additional Outputs or Alarms	_ 0	•	•
	One Alarm Relay Only	_ B	•	•
	E-M Relay (5 Amp Form C) Plus Alarm 1 (5 Amp Form C Relay)	_ E	•	•
	Open Collector Plus Alarm 1 (5 Amp Form C Relay)	_ T	•	•

Table II – Communications and Software				
Communications	None	0 _ _	•	•
	Auxiliary Output/Digital Inputs (1 Aux and 1 DI or 2 DI)	1 _ _	•	•
	RS-485 Modbus Plus Auxiliary Output/Digital Inputs	2 _ _	•	•
	10/100M Base-T Ethernet (Modbus RTU) Plus Auxiliary Output/Digital Inputs	3 _ _	•	•
Software	Standard Software	_ S_	•	•
	Standard S/W and Setpoint Program	_ F_	•	•
Future options	None	_ _ O	•	•

Table III - Input 1 can be changed in the field using external resistors				
Input 1	TC, RTD, mV, 0-5V, 1-5V, 0-10V	1 _ _	•	•
	TC, RTD, mV, 0-5V, 1-5V, 0-10V, 0-20mA, 4-20mA	2 _ _	•	•
Input 2	None	_ 00	•	•
	TC, RTD, mV, 0-5V, 1-5V, 0-10V	_ 10	•	•
	TC, RTD, mV, 0-5V, 1-5V, 0-10V, 0-20mA, 4-20mA	_ 20	•	•
	Carbon, Oxygen or Dewpoint (Provides 2 Inputs)	_ 60	b	b

Table IV - Options				
Approvals	CE (Standard)	0 _ _	•	•
	CE, UL and CSA	1 _ _	•	•
Tags	None	_ 0 _	•	•
	Stainless Steel Customer ID Tag - 3 lines w/22 characters/line	_ T _	•	•
Future Options	None	_ _ 0	•	•

Table V - Documentation				
Documents	Quick Start Guide - English	0 _	•	•
Certificate	None	_ 0	•	•
	Certificate of Conformance (F3391)	_ C	•	•

Table VI - Extended Warranty				
Extended Warranty	None	0	•	•
	Extended Warranty Additional 1 year	1	•	•
	Extended Warranty Additional 2 years	2	•	•

ORDERING INSTRUCTIONS: These are provided as guidance for ordering such as those listed.

1. Part numbers are provided to facilitate Distributor Stock.
2. Orders may be placed either by model selection or by part number.
3. Part numbers are shown within the model selection tables to assist with compatibility information.
4. Orders placed by model selection are systematically protected against incompatibility.
5. Compatibility assessment is the responsibility of the purchaser for orders placed by part number.
6. Items labeled as N/A are not available via the stocking program and must be ordered by model selection.

RESTRICTIONS

Restriction Letters	Available Only With		Not Available With	
	Table	Selection	Table	Selection
b	III	1 _ _		

UDC2800 Universal Digital Controller Supplemental Accessories & Kits

Description	Part Number
Front panel assembly, UDC 2800/2900	50159507-501
TFT-LCD module for UDC2800, CTM320240N01	50152823-501
Power/Output PWA without E-M Relays (90-264 Vac Operation)	51308438-528
Power/Output PWA with E-M Relays (90-264 Vac Operation)	51308438-529
Power/Output PWA with E-M Relays (24 Vac/dc Operation)	51308440-526
Auxiliary Output/Digital Input PWA	51308448-526
Auxiliary Output/Digital Input/RS-422/485 Communications PWA	51308448-527
Auxiliary Output/Digital Input/Ethernet Communications PWA	51308448-528
Analog Input/Control Output (1ch Ai), PWA	51308452-526

Description		Part Number
Analog Input/Control Output (2ch Ai), PWA		51308452-527
MCU/Display PWA		51308456-526
Dual Electromechanical Relay PWA		51308458-526
Current Output PWA		51308460-526
Open Collector Output PWA		51308462-526
Ethernet Adaptor Board Kit		50009071-501
Electro-Mechanical Relay		51508015-505
4-20 mA Input Resistor Assembly (250 ohm)		30731996-506
CHASSIS ASSEMBLY, UDC		50150597-501
Case Assembly (including Mounting Kit with four brackets)		51452759-501
Mounting Kits (12 Brackets)		51452763-501
DIN Adaptor Kit		30755223-003
Panel Bracket Kit		50004821-501
Quick Start Guide	English	51-52-25-158
Product Manual	English	51-52-25-157

ATTENTION: It is recommended to use Honeywell provided accessories and kits. Otherwise, using non-Honeywell provided components would take risks.

Control and Alarm Relay Contact Information

Control Relays

> **ATTENTION:** Control relays operate in the standard control mode (that is, energized when output state is on).

Table 3-2: Control Relay Contact Information

Unit Power	Control Relay Wiring	Control Relay Contact	Output #1 or #2 Indicator Status
Off	N.O.	Open	Off
	N.C.	Closed	
On	N.O.	Open	Off
		Closed	On
	N.C.	Closed	Off
		Open	On

Alarm Relays

> **ATTENTION:** Alarm relays are designed to operate in a failsafe mode (that is, de-energized during alarm sate). This results in alarm actuation when power is OFF or when initially applied, until the unit completes self-diagnostics. If power is lost to the unit, the alarms will de-energize and thus the alarm contacts will close.

Table 3-3: Alarm Relay Contact Information

Unit power	Alarm relay Wiring	Variable NOT in Alarm State		Variable in Alarm State	
		Relay Contact	Indicators	Relay COntact	Indicators
Off	N.O.	Open	Off	Open	Off
	N.C.	Closed		Closed	
On	N.O.	Closed	Off	Open	On
	N.C.	Open		Closed	

Mounting

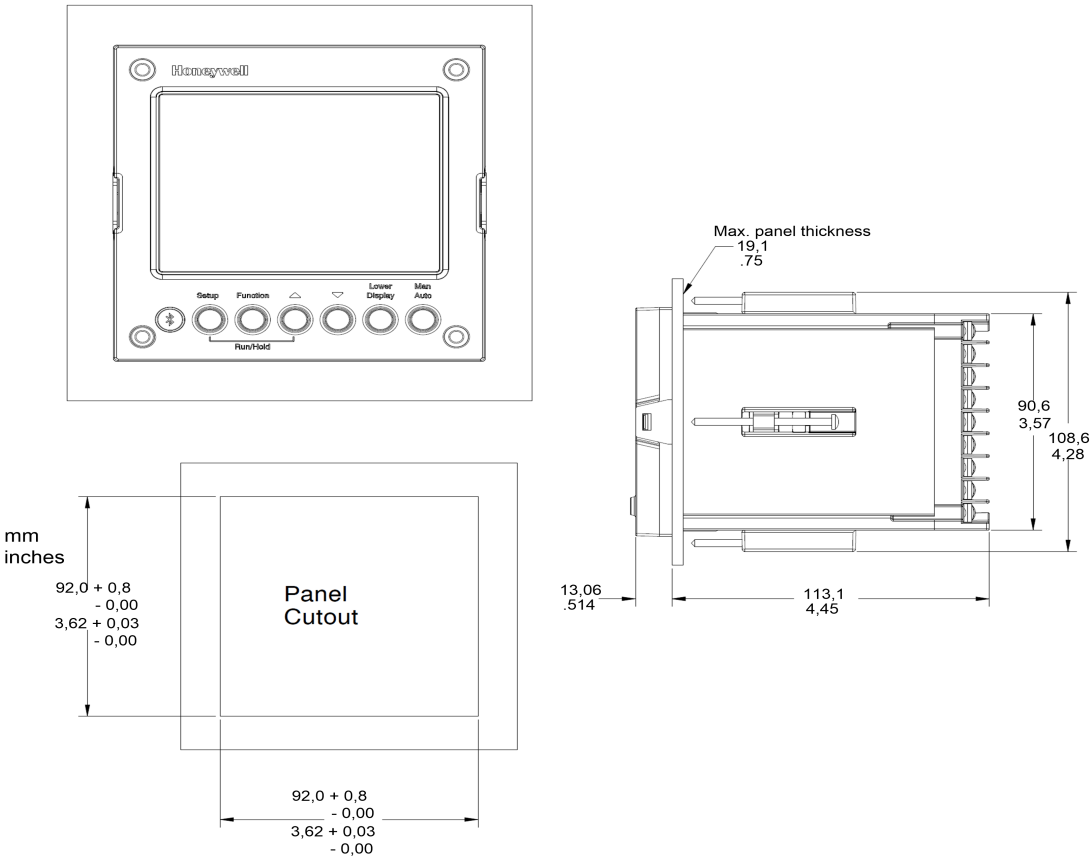
Physical Considerations

The controller can be mounted on either a vertical or tilted panel using the mounting kit supplied. Adequate access space must be available at the back of the panel for installation and servicing activities.

- The controller must be installed indoors.
- It must be panel mounted with the wiring terminals enclosed within the panel.
- The instrument is environmentally hardened and, when suitably enclosed, can be mounted anywhere in plant or factory, on the wall, or even on the process machine itself.
- The front panel is moisture rated NEMA3R and IP54 rated and can be easily upgraded to NEMA4X and IP66 for the most severe hose-down applications. See Mounting Method and Mounting Procedure for more information.
- It withstands ambient temperatures 0 ~ 55 C (32 ~ 131 F) and resists the effects of vibration and shock.
- Overall dimensions and panel cutout requirements for mounting the controller are shown in figure below. See "Overall Dimensions" on the facing page for more information.
- The controller's mounting enclosure must be grounded according to CSA standard C22.2 No. 0.4 or Factory Mutual Class No. 3820 paragraph 6.1.5.

Overall Dimensions

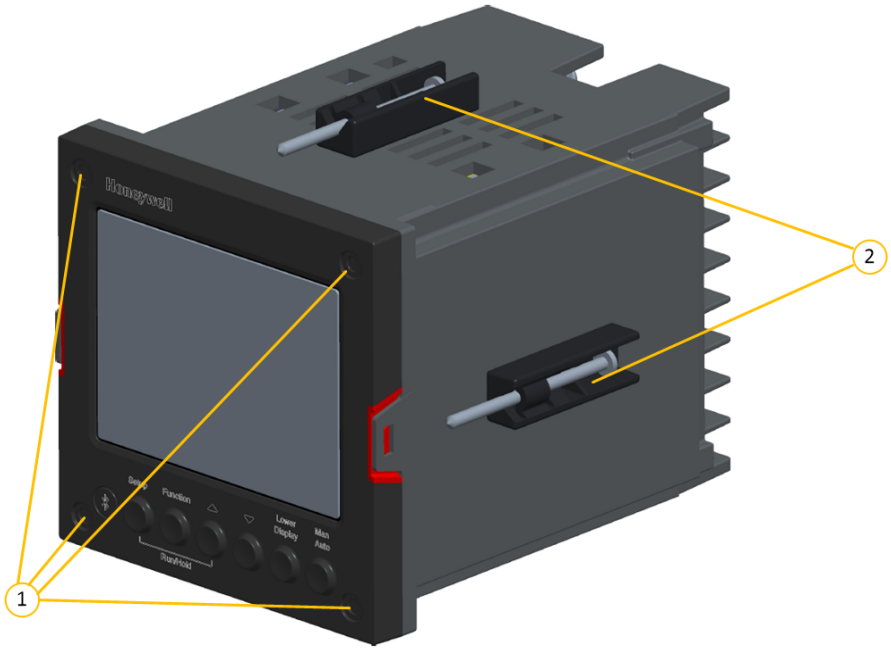
Figure 3-1: Mounting Dimensions (not to scale)



Mounting Method

Before mounting the controller, refer to the nameplate on the outside of the case and make a note of the model number. It will help later when selecting the proper wiring configuration.

Figure 3-2: Mounting Methods



Item	Description
1	Attach screws and washers here for water protection
2	Mounting clips

Mounting Procedure

Table 3-4: Mounting Procedure

Step	Action
1	Mark and cut out the controller hole in the panel according to the dimension information. See "Overall Dimensions" on page 47 for more information.
2	Orient the case properly and slide it through the panel hole from the front.
3	Remove the mounting kit from the shipping container and install the kit as follows: • For normal (NEMA3/IP55) installation two mounting clips are required. Insert the prongs of the clips into the two holes in the top and bottom center of the case • For water-protected (NEMA4X/IP66) installation four mounting clips are required. There are two options of where to install the mounting clips: 1) Insert the prongs of the clips into the two holes on the left and right side of the top and bottom of the case or 2) on the center on each of the four sides. • Tighten screws to 2 lb-inch (22 N•cm) to secure the case against the panel. CAUTION: **CAUTION:** Over tightening will cause distortion and the unit may not seal properly.
4	For water-protected installation, install four screws with washers into the four recessed areas in the corners of the front bezel. Push the point of the screw through the center piercing the elastomeric material and then tighten screws to 5 lb-in (56 N•cm).

Wiring

Electrical Considerations

Line voltage wiring

This controller is considered “rack and panel mounted equipment” per EN61010-1, Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements. Conformity with 72/23/EEC, the Low Voltage Directive requires the user to provide adequate protection against a shock hazard. The user shall install this controller in an enclosure that limits OPERATOR access to the rear terminals.

Mains Power Supply

This equipment is suitable for connection to 100 to 240 Vac 50/60 Hz, power supply mains. It is the user’s responsibility to provide a switch and non-time delay (North America), quick-acting, high breaking capacity, Type F (Europe), 1/2 A, 250V UL listed fuse(s), or 1 A UL listed circuit-breaker for 100-240 Vac applications, as part of the installation. The switch or circuit-breaker shall be located in close proximity to the controller, within easy reach of the OPERATOR. The switch or circuit-breaker shall be marked as the disconnecting device for the controller.

CAUTION: Applying 100-240 Vac to an instrument rated for 24 Vac/dc will severely damage the instrument and is a fire and smoke hazard.

NOTE: Tested with UL listed (DIVQ breaker - not current limiting), voltage rating 277 Vac, current rating 1 A.

When applying power to multiple instruments, make certain that sufficient current is supplied. Otherwise, the instruments may not start up normally due to the voltage drop caused by the in-rush current.

Controller Grounding

PROTECTIVE BONDING (grounding) of this controller and the enclosure in which it is installed shall be in accordance with National and Local electrical codes. To minimize electrical noise and transients that may adversely affect the system, supplementary bonding of the controller enclosure to a local ground, using a 14AWG ~ 20AWG copper conductor, is recommended.

Control/Alarm Circuit Wiring

The insulation of wires connected to the Control/Alarm terminals shall be rated for the highest voltage involved. Extra Low Voltage (ELV) wiring (input, current output, and low voltage Control/Alarm circuits) shall be separated from HAZARDOUS LIVE (>30 Vac, 42.4 Vpeak, or 60 Vdc) wiring per Permissible Wiring Bundling. See the table Permissible Wiring Bundling for more information.

Electrical Noise Precautions

Electrical noise is composed of unabated electrical signals which produce undesirable effects in measurements and control circuits. Digital equipment is especially sensitive to the effects of electrical noise. Your controller has built-in circuits to reduce the effect of electrical noise from various sources. If there is a need to further reduce these effects:

- Separate External Wiring—Separate connecting wires into bundles (See the table Permissible Wiring Bundling) and route the individual bundles through separate conduit metal trays.
- Use Suppression Devices —For additional noise protection, you may want to add suppression devices at the external source. Appropriate suppression devices are commercially available.

ATTENTION: For additional noise information, refer to document number 51-52-05-01, How to Apply Digital Instrumentation in Severe Electrical Noise Environments.

Permissible Wiring Bundling

Table 3-5: Permissible Wiring Bundling

Bundle No.	Wire Functions
1	• Line power wiring • Earth ground wiring • Line voltage control relay output wiring • Line voltage alarm wiring
2	Analog signal wire, such as: • Input signal wire (thermocouple, 4 to 20 mA, etc.) • 4-20 mA output signal wiring.
3	Digital input signals • Low voltage alarm relay output wiring • Low voltage wiring to solid state type control circuits • Low voltage wiring to open collector type control circuits

Wiring Diagrams

Identify Your Wiring Requirements

To determine the appropriate diagrams for wiring your controller, refer to the model number interpretation in this section. The model number of the controller is on the outside of the case.

Universal Output Functionality and Restrictions

Instruments with multiple outputs can be configured to perform a variety of output types and alarms. For example, an instrument with a current output and two relays can be configured to perform any of the following:

1. Current Simplex with two alarm relays;
2. Current Duplex 100% with two alarm relays;

3. Time Simplex with one alarm relay;
4. Time Duplex with no alarm relay(s)

Table below shows what control types and alarms are available based upon the installed outputs. In this table, when Duplex Control and Reverse Action are configured, “Output 1” is HEAT while “Output 2” is COOL. The Output 1/2 option “Single Relay” can be any of the following selections: Electro-Mechanical Relay or Open Collector Output.

Table 3-6: Universal Output Functionality and Restrictions

Output Algorithm Type	Output 1/2 Option	Function of Output 1/2	Function of Other Outputs		
			Output #3	Output #4	Auxiliary Output
Time Simplex	Single Relay	Output 1	Alarm 2	Alarm 1	Not Needed
	Current Output	INU	Output 1	Alarm 1	Not Needed
	Dual Relay	Output 1	Alarm 2	Alarm 1	Not Needed
Time Duplex	Single Relay	Output 1	Output 2	Alarm 1	Not Needed
	Current Output	INU	Output 2	Output 1	Not Needed
	Dual Relay	Outputs 1 and 2	Alarm 2	Alarm 1	Not Needed
Current Simplex	Single Relay	INU	Alarm 2	Alarm 1	Output 1
	Current Output	Output 1	Alarm 2	Alarm 1	Not Needed
	Dual Relay	INU	Alarm 2	Alarm 1	Output 1
Current Dup. 100% Current = COOL and HEAT	Single Relay	INU	Alarm 2	Alarm 1	Outputs 1 and 2
	Current Output	Outputs 1 and 2	Alarm 2	Alarm 1	Not Needed
	Dual Relay	INU	Alarm 2	Alarm 1	Outputs 1

Output Algorithm Type	Output 1/2 Option	Function of Output 1/2	Function of Other Outputs		
			Output #3	Output #4	Auxiliary Output
					and 2
Current Duplex 50% Current = HEAT Aux Out = COOL	Single Relay	N/A	N/A	N/A	N/A
	Current Output	Output 1	Alarm 2	Alarm 1	Output 2
	Dual Relay	N/A	N/A	N/A	N/A
Current/Time Current = COOL Time = HEAT	Single Relay [1]	Output 1	Output 2	Alarm 1	Output 2
	Single Relay	Output 1	Alarm 2	Alarm 1	Output 2
	Current Output	Output 2	Output 1	Alarm 1	Not Needed
	Dual Relay [1]	Outputs 1 & 2	Alarm 2	Alarm 1	Output 2
	Dual Relay	Outputs 1	Alarm 2	Alarm 1	Output 2
Time/Current Time = COOL Current = HEAT	Single Relay [1]	Output 1	Output 2	Alarm 1	Output 1
	Single Relay	Output 2	Alarm 2	Alarm 1	Output 1
	Current Output	Output 1	Output 2	Alarm 1	Not Needed
	Dual Relay [1]	Outputs 1 & 2	Alarm 2	Alarm 1	Output 1
	Dual Relay	Outputs 2	Alarm 2	Alarm 1	Output 1

N/A = Not A vailable – This output algorithm type cannot be performed with this Output 1/2 option.

INU = Installed, Not Used – The installed Output 1/2 option is not used for the configured output algorithm type.

Not Needed = Auxiliary Output is Not Needed to provide the desired output algorithm and can be used for another purpose. With the proper configuration, Auxiliary Output could also be used as a substitute for the Current Output.

Output Algorithm Type	Output 1/2 Option	Function of Output 1/2	Function of Other Outputs		
			Output #3	Output #4	Auxiliary Output
Note 1: To obtain this output algorithm type with these Output 1/2 Options: 1) Configure the Out Algorithms selection as “Time Duplex”; 2) Configure Auxiliary Output for “Output” and; 3) Scale the Auxiliary Output as necessary for the desired output algorithm type. For these selections, the Output 1 (HEAT) and Output 2 (COOL) signals will be present both on the Auxiliary Output and on the two relays normally used for Time Duplex.					

Wiring the Controller

Using the information contained in the model number, select the appropriate wiring diagrams from the composite wiring diagram below. Refer to the individual diagrams listed to wire the controller according to your requirements.

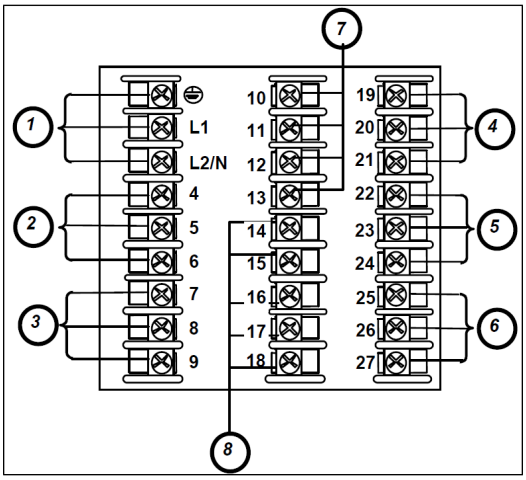
NOTE: Torque screw assembly to 10 lb-inch (1.13 N•m) 27 places.

CAUTION: ⚠ Use Copper Conductors Only for field-wiring terminals.

ATTENTION: The wire gauge of terminal blocks is AWG 14~28.

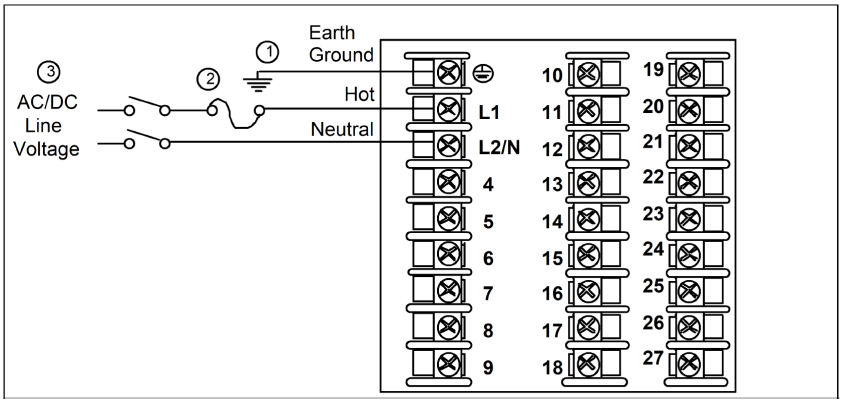
CAUTION: ⚠ Minimum temperature rating of the cable to be connected to the field wiring terminals is 68 °C.

Figure 3-3: Composite Wiring Diagram



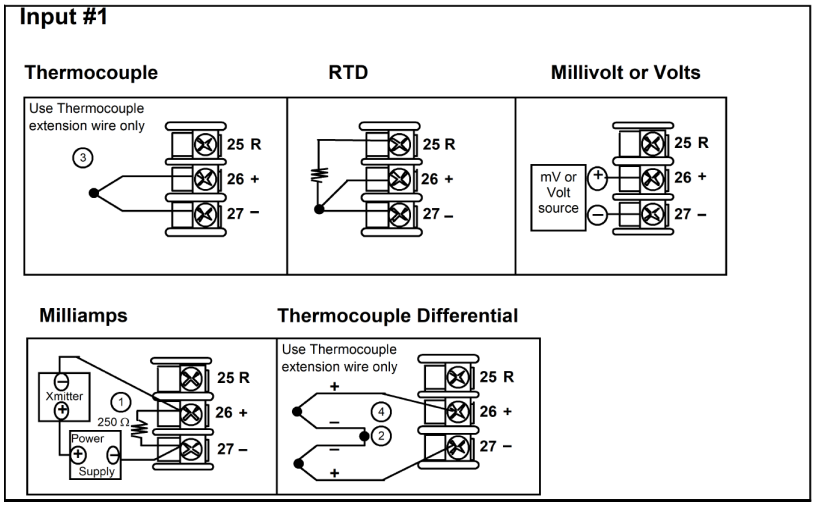
Item	Description
1	AC/DC Line Voltage Terminals.
2	Output 3 Terminals (Output #2 or Alarm #2 in the Table I of UDC2800 Universal Digital Controller Model Selection Guide). **ATTENTION:** If they are used as Relay Outputs, the wire gauge should be AWG 14~22.
3	Output 4 Terminals (Alarm #1 in the Table I of UDC2800 Universal Digital Controller Model Selection Guide). **ATTENTION:** If they are used as Relay Outputs, the wire gauge should be AWG 14~22.
4	Outputs 1 and 2 Terminals (Output #1 in the Table I of UDC2800 Universal Digital Controller Model Selection Guide). **ATTENTION:** If they are used as Relay Outputs, the wire gauge should be AWG 14~22.
5	Input #2 Terminals.
6	Input #1 Terminals.
7	Aux. Output and Digital Inputs Terminals.
8	Communications Terminals.

Figure 3-4: Mains Power Supply



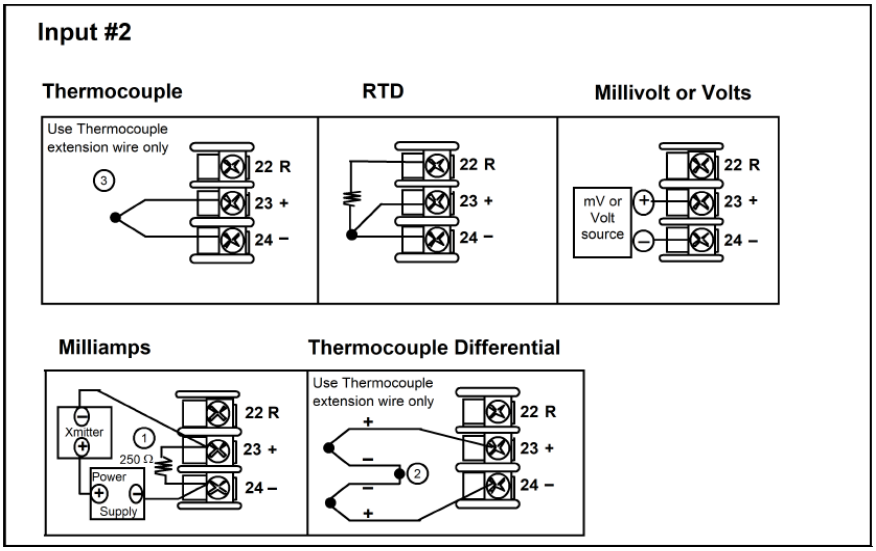
Item	Description
1	PROTECTIVE BONDING (grounding) of this controller and the enclosure in which it is installed, shall be in accordance with National and local electrical codes. To minimize electrical noise and transients that may adversely affect the system, supplementary bonding of the controller enclosure to local ground using a 14AWG ~ 20AWG copper conductor is recommended. The wire gauge of power supply is AWG 14 (2.0 mm²) ~20 (0.5 mm²).
2	**NOTE:** It is only required for 90~264 Vac applications. It is the user's responsibility to provide a switch and non-time delay (North America), quick-acting, high breaking capacity, Type F (Europe), 1/2 A, 250 V UL listed fuse(s), or 1 A UL listed circuit-breaker for 90-264 Vac applications, as part of the installation. **ATTENTION:** The nominal current of the switch must be larger than fuse's related current.
3	The wire area of power supply is AWG 14 (2.0 mm²) ~20 (0.5 mm²). **CAUTION:** Applying 90-264 Vac to an instrument rated for 24 Vac/dc will severely damage the instrument and is a fire and smoke hazard.

Figure 3-5: Input 1 Connections



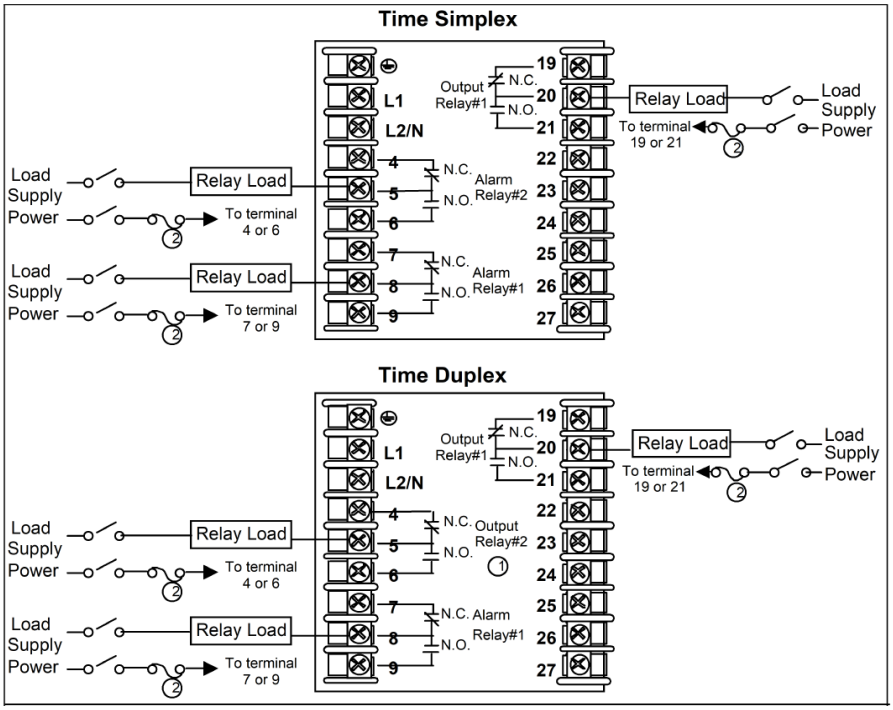
Item	Description
1	The 250 ohm resistor for milliamp inputs is supplied with the controller when those inputs are specified. These items must be installed prior to start up when the controller is wired. For 0-20 mA applications, the resistor should be located at the transmitter terminals if Burnout detection is desired.
2	Splice and tape this junction between the two thermocouples. This junction may be located anywhere between the thermocouples and the instrument terminals, it does not need to be close to the other thermocouple junctions. Both thermocouples must be of the same type. For best accuracy, the two thermocouples should be matched or, preferably, made from the same batch of wire.
3	This controller does not produce a steady current for burnout detection. For that reason, when a thermocouple is used in parallel with another instrument, it may be desirable to configure the burnout selection for this controller to "NOFS" and use the burnout current from the other instrument to also drive this controller.
4	The millivolt values for the Thermocouple Differential Input are for a pair of J thermocouples at an ambient temperature mean of 450°F/ 232°C.

Figure 3-6: Input 2 Connections



Item	Description
1	The 250 ohm resistor for milliamp inputs is supplied with the controller when those inputs are specified. These items must be installed prior to start up when the controller is wired. For 0-20 mA applications, the resistor should be located at the transmitter terminals if Burnout detection is desired.
2	Splice and tape this junction between the two thermocouples. This junction may be located anywhere between the thermocouples and the instrument terminals, it does not need to be close to the other thermocouple junctions. Both thermocouples must be of the same type. For best accuracy, the two thermocouples should be matched or, preferably, made from the same batch of wire.
3	This controller does not produce a steady current for burnout detection. For that reason, when a thermocouple is used in parallel with another instrument, it may be desirable to configure the burnout selection for this controller to "NOFS" and use the burnout current from the other instrument to also drive this controller.

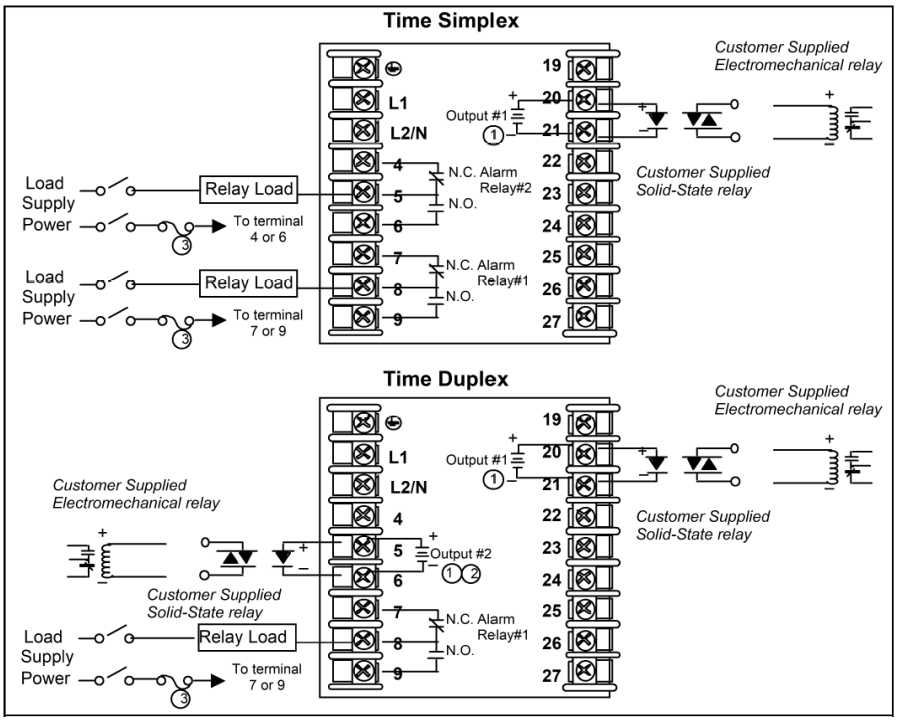
Figure 3-7: Electromechanical Relay Output



Item	Description
1	Alarm #2 is not available with Time Proportional Duplex unless the Dual Relay Option is used.
2	Electromechanical relays are rated at 5 Amps @ 125 Vac or 250 Vac or 30 Vdc. Users should size fuses accordingly. Use Fast Blow fuses only.

See the table Universal Output Functionality and Restrictions for relay terminal connections for other Output Algorithm Types.

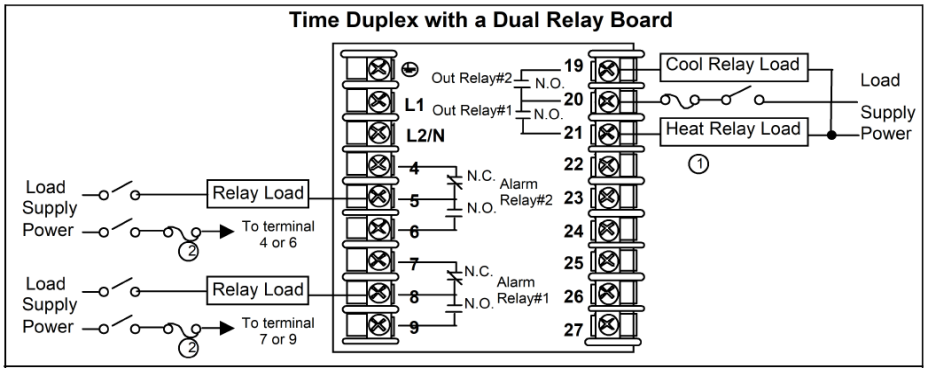
Figure 3-8: Open Collector Output



Item	Description
1	**CAUTION:** Open collector outputs are internally powered at 28 Vdc (0 mA) ~ 24 Vdc (20 mA). Connecting and external power supply will damage the controller.
2	Alarm #2 is not available with Time Proportional Duplex unless the Dual Relay option is used.
3	Electromechanical relays are rated at 5 Amps @ 125 Vac or 250 Vac or 30 Vdc. Users should size fuses accordingly. Use Fast Blow fuses only.

See the table Universal Output Functionality and Restrictions for relay terminal connections for other Output Algorithm Types.

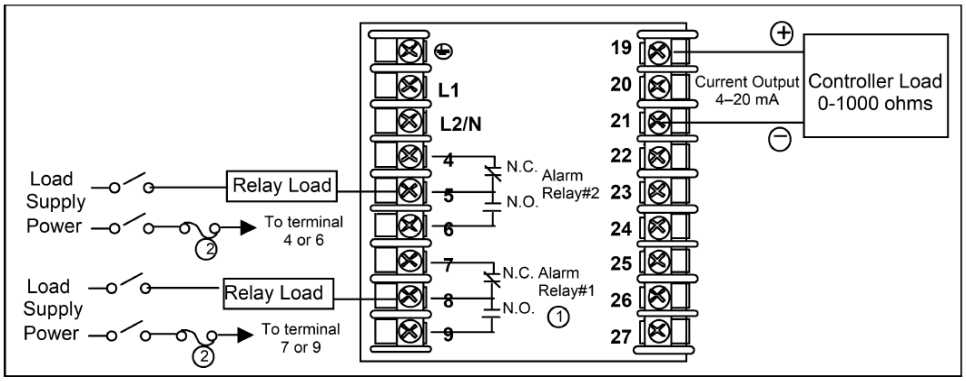
Figure 3-9: Dual Electromechanical Relay Option Output



Item	Description
1	Dual Electromechanical relays are rated at 2 Amps @125 Vac or 250 Vac or 30 Vdc. Customer should size fuses accordingly. Use Fast Blow fuses only.
2	Electromechanical relays are rated at 5 Amps @ 125 Vac or 250 Vac or 30 Vdc. Users should size fuses accordingly. Use Fast Blow fuses only.

See the table Universal Output Functionality and Restrictions for relay terminal connections for other Output Algorithm Types.

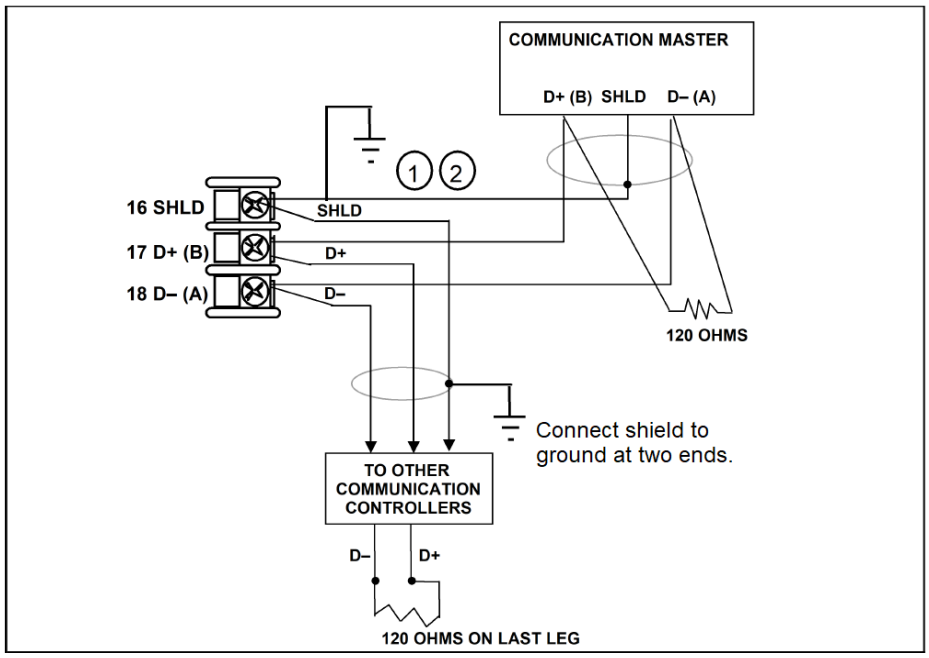
Figure 3-10: Current Output



Item	Description
1	When the instrument has the Current Output as shown, no Alarms are available when using the Time Proportional Duplex, as these outputs require both available relays.
2	Electromechanical relays are rated at 5 Amps @ 125 Vac or 250 Vac or 30 Vdc. Users should size fuses accordingly. Use Fast Blow fuses only.

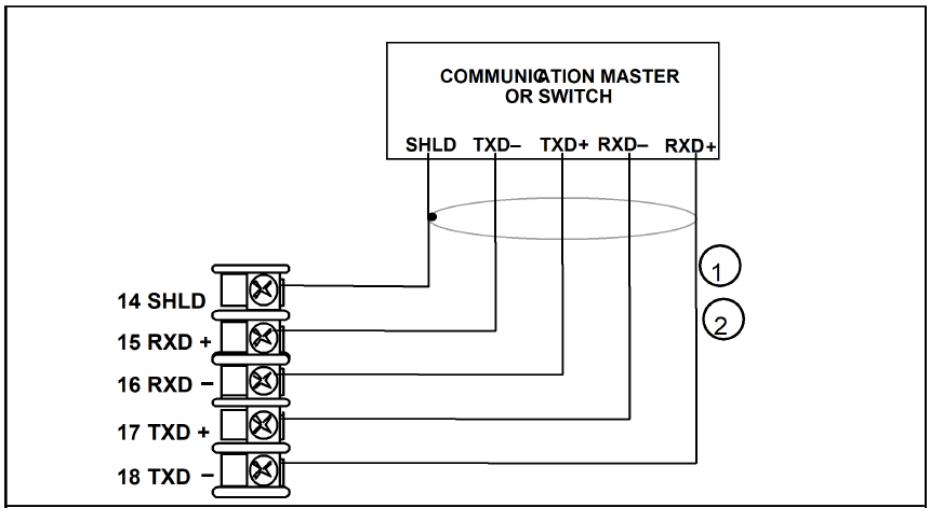
See the table Universal Output Functionality and Restrictions for relay terminal connections for other Output Algorithm Types.

Figure 3-11: RS485 Communications Option Connections



Item	Description
1	Do not run the communications lines in the same conduit as AC power.
2	Use shielded twisted pair cables (Belden 9271 Twinax or equivalent).

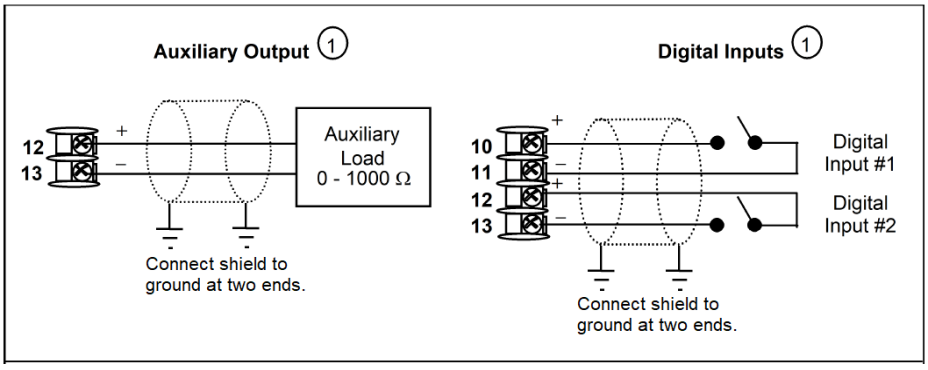
Figure 3-12: Ethernet Communications Option Connections



Item	Description
1	Do not run the communications lines in the same conduit as AC power. Correct connections may require the use of an Ethernet cross-over cable.
2	Use shielded twisted pair, Category 5e (STP CAT5e) Ethernet cable.

For Ethernet cable with RJ45 connector, an Ethernet Adapter Kit is required to install on the terminals.

Figure 3-13: Auxiliary Output and Digital Inputs Option Connections



Item	Description
1	Auxiliary Output and Digital Input 2 are mutually exclusive.

Figure 3-14: Transmitter Power for 4-20 mA — 2 wire Transmitter Using Open Collector Alarm 2 Output

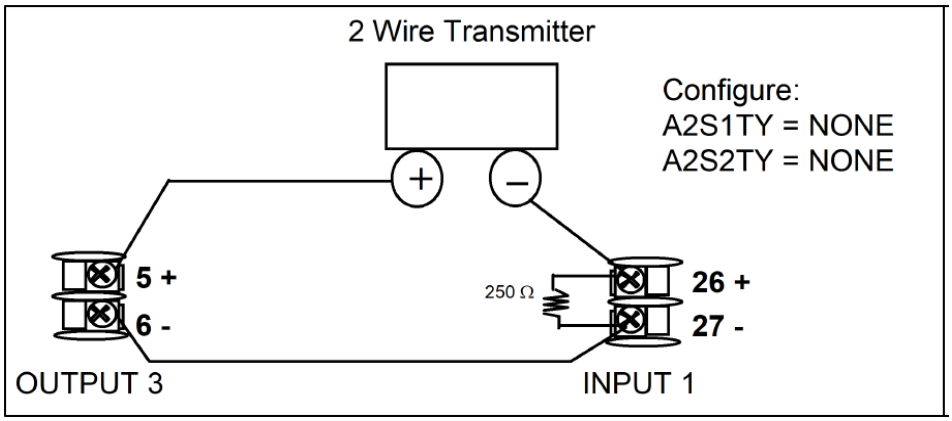
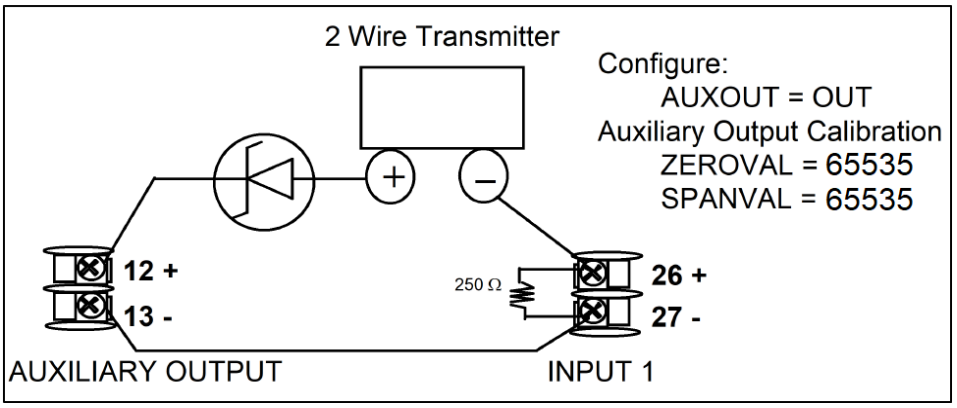


Figure 3-15: Transmitter Power for 4-20 mA — 2 Wire Transmitter Using Auxiliary Output



CHAPTER

4 CONFIGURATION

In this section:

Overview *68*

Configuration Prompt Hierarchy *68*

Configuration Procedure *72*

Security Set Up Group *74*

Tuning Set Up Group *76*

SP Ramp/Program Set Up Group *81*

SP PROG2 ~ PROG 8 Set Up Group *88*

Accutune Set Up Group *90*

Algorithm Set Up Group *93*

Output Set Up Group *107*

Input 1 Set Up Group *111*

Input 2 Set Up Group *117*

Control Set Up Group *122*

Options Set Up Group *131*

Communications Group *139*

Alarms Set Up Group *143*

Display Set Up Group *151*

Input1 Calib Set Up Group *153*

Input2 Calib Set Up Group *154*

Current Calib Set Up Group *155*

Auxiliary Calib Set Up Group *155*

Configuration Record Sheet *156*

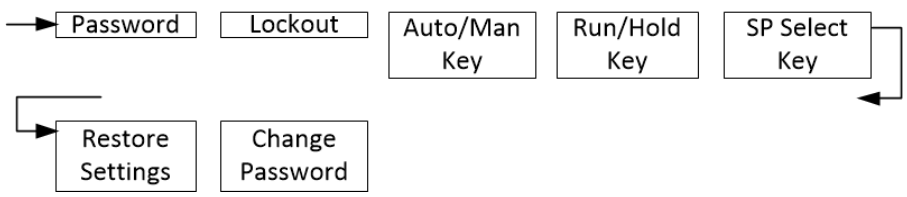
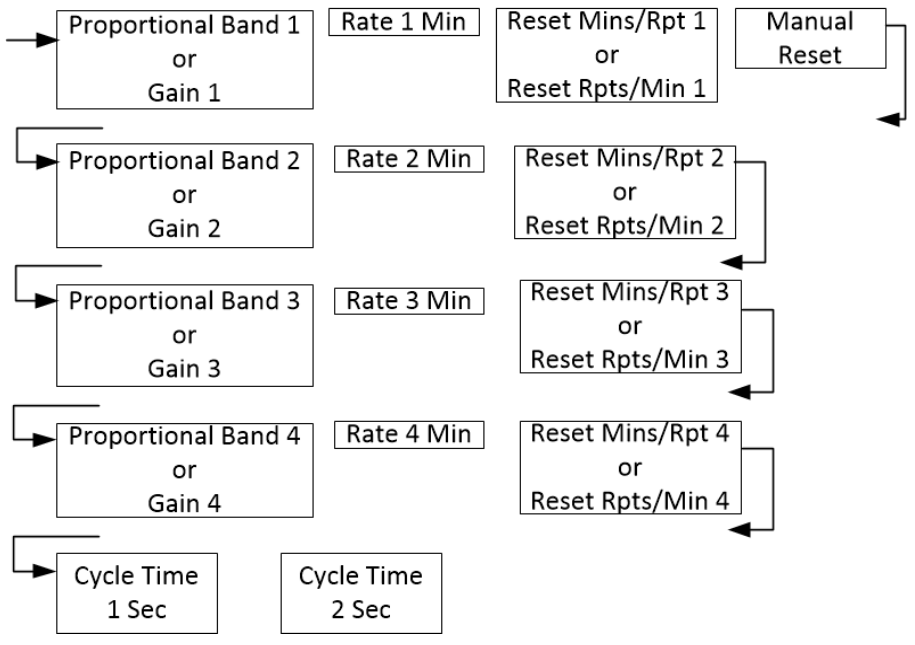
Overview

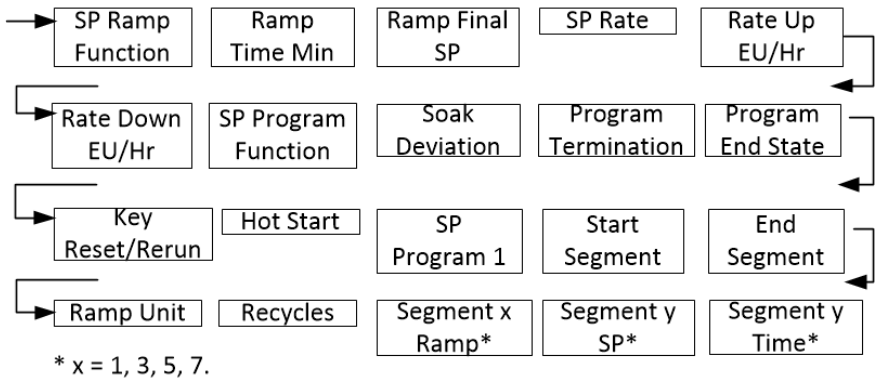
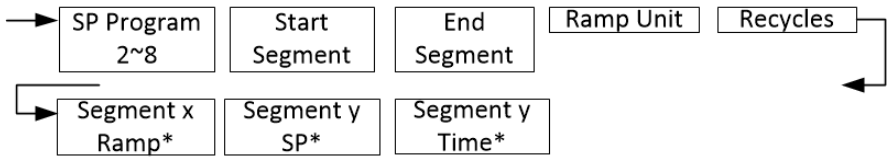
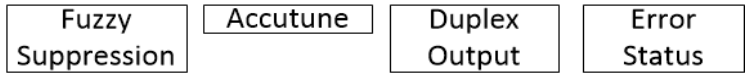
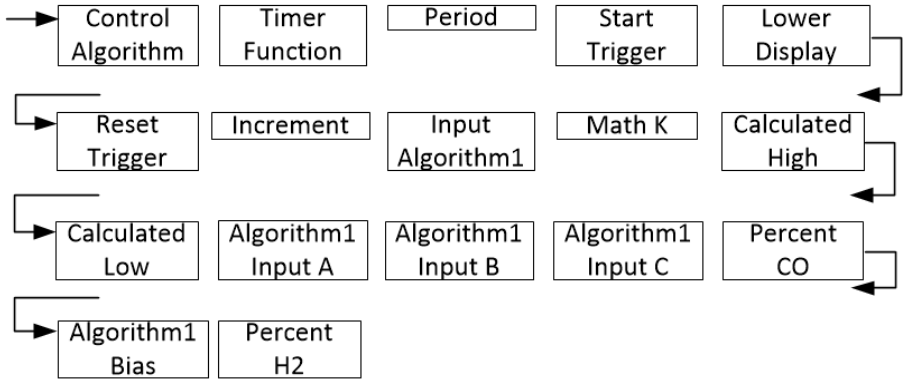
Configuration is a dedicated operation where you use straightforward keystroke sequences to select and establish (configure) pertinent control data best suited for your application.

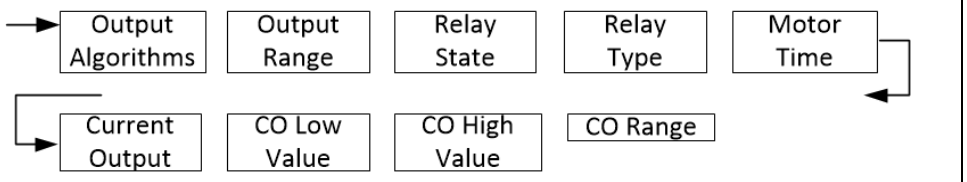
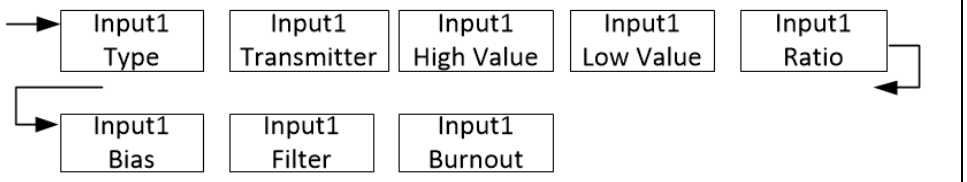
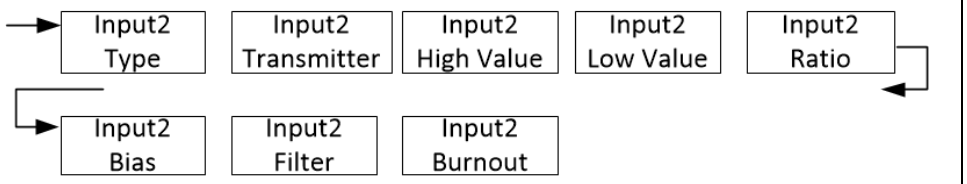
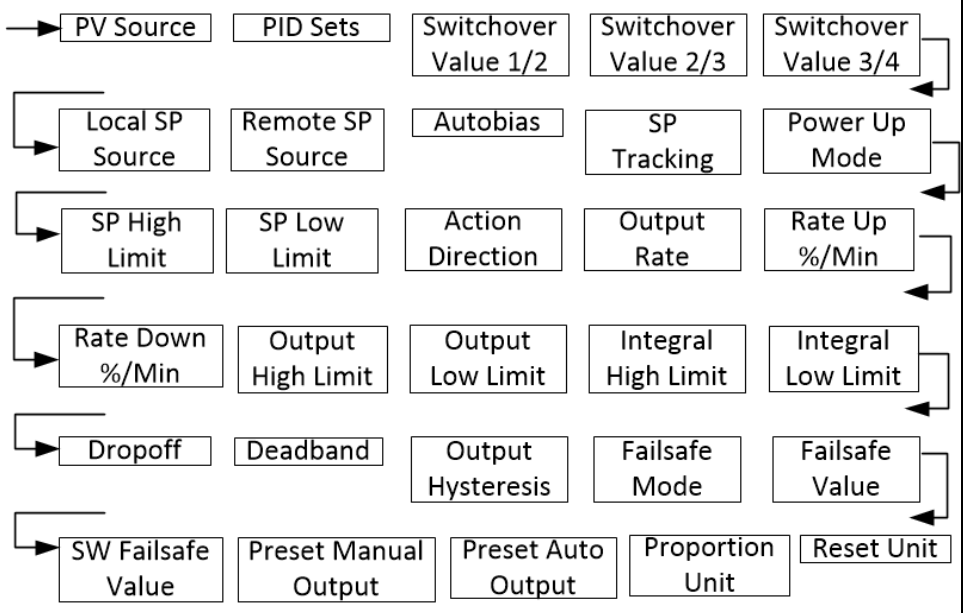
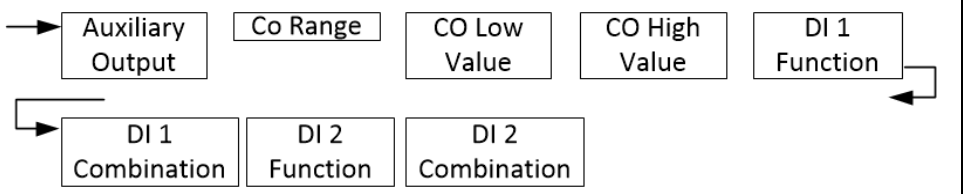
To assist you in the configuration process, there are prompts that appear in the upper, middle and lower displays. These prompts let you know what group of configuration data (Setup prompts) you are working with and also, the specific parameters (Function prompts) associated with each group.

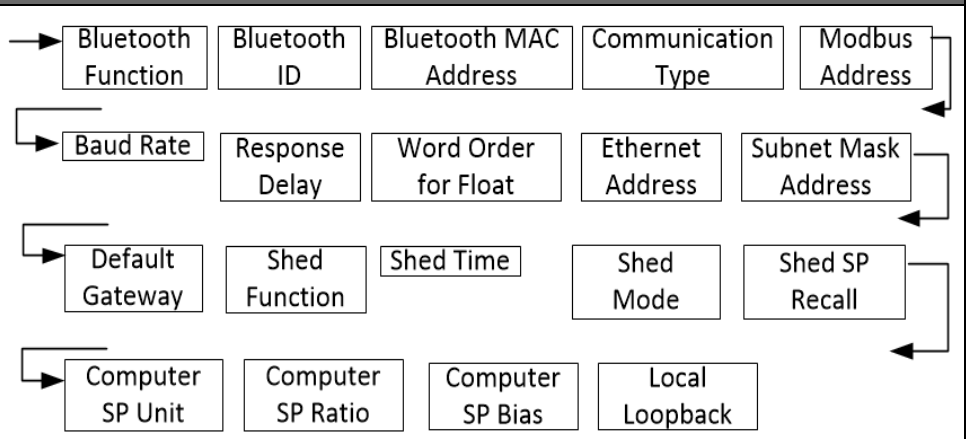
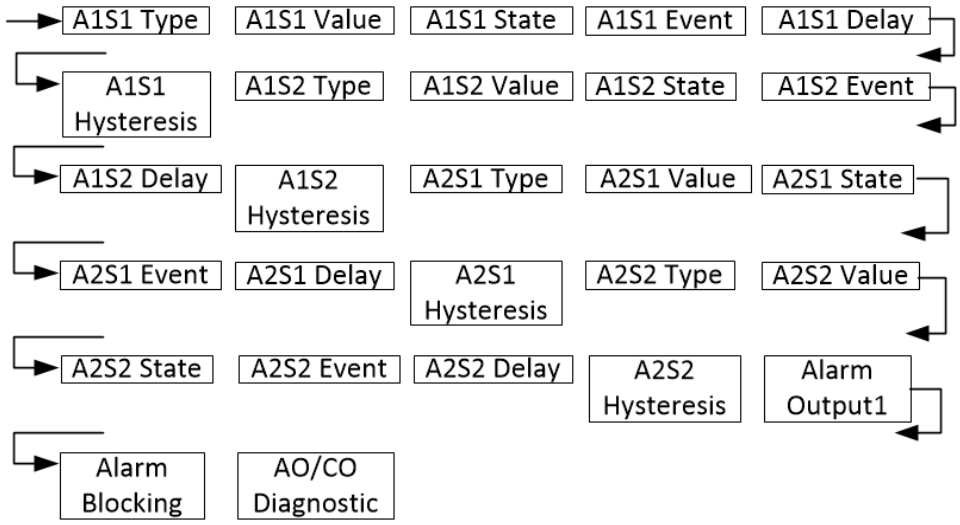
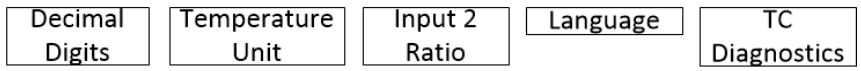
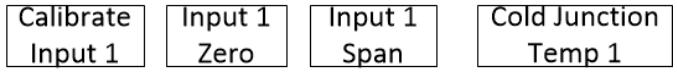
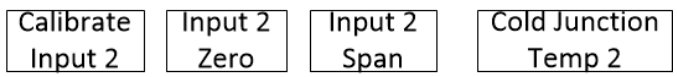
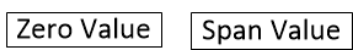
Configuration Prompt Hierarchy

Table 4-1: Configuration Prompt Hierarchy

Setup Group	Function Prompts
Security	
Tuning	

Setup Group	Function Prompts
SP Ramp/Program	 * x = 1, 3, 5, 7. y = 2, 4, 6, 8. Program concludes after segment 8.
SP Program 2~8	 * x = 1, 3, 5, 7. y = 2, 4, 6, 8. Program concludes after segment 8.
Accutune	
Algorithms	

Setup Group	Function Prompts
Output	
Input 1	
Input 2	
Control	
Options	

Setup Group	Function Prompts
Communication	
Alarms	
Display	
Input1 Calib (Calibration)	
Input2 Calib (Calibration)	
Current Calib (Calibration)	
Auxiliary Calib (Calibration)	

Setup Group	Function Prompts
Status	Software Version | Failsafe Status | Self Tests

Configuration Procedure

Introduction

Each of the Set Up groups and their functions are pre-configured at the factory.

The factory settings are shown in Table Security Group Function Prompts through Table Display Group Function Prompts.

If you want to change any of these selections or values, follow the procedure in Table Configuration Procedure. This procedure tells you the keys to press to get to any Set Up group and any associated Function parameter prompt.

Procedure

See Operator Interface for more information of keys.

> **ATTENTION:** The prompting scrolls at a rate of 2/3 seconds when the Setup or Function key is held in. Also, Increment key or Decrement key will move group prompts forward or backward at a rate twice as fast.

Table 4-2: Configuration Procedure

Step	Operation	Press	Result
1	Enter Set Up Mode	Setup key	Enter in the first set up group, Security.
2	Select any Set Up Group	Setup key or Increment key or Decrement key	Sequentially displays the other set up groups shown in the prompt hierarchy. See "Configuration Prompt Hierarchy" on page 68 for more information. You can also use the Increment key or Decrement keys to scan the set up groups in both directions. Stop at the

Step	Operation	Press	Result
			set up group title that describes the group of parameters you want to configure. Then proceed to the next step.
3	Select a Function Parameter	Function key	Enter in the first function prompt of the selected set up group.
		Increment key or Decrement key	Press Increment key or Decrement keys to display the other function prompts of the selected set up group. Stop at the function prompt that you want to change.
4	Change the Value or Selection	Function key	Enter in the value or selection of the selected function prompt.
		Increment key or Decrement key	Increment or decrement the value or selection that appears for the selected function prompt. You can press the Increment and Decrement keys at the same time to move the current editable digit one step left.
5	Enter the Value or Selection	Function key	Enter value or selection made into memory.
6	Exit Configuration	Lower Display key	Exit the set up mode, and returns to the main screen.

Security Set Up Group

Introduction

Security enables you to configure lockout, password, restore the product, and we recommend that you configure this group last, after all other configuration data has been loaded.

> **ATTENTION:** It is recommended to change the password after each use.

Function Prompts

Table 4-3: Security Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Password	0000 to 9999	The level of keyboard lockout may be changed in the Set Up mode. Knowledge of a password may be required to change from one level to another. This configuration should be copied and kept in a secure location. **NOTE:** The password is for keyboard entry only and is not available via communications. **ATTENTION:** If the password is not correct, the following prompts cannot be displayed except **Restore Settings**.
Lockout		Lockout applies to one of the functional groups: Configuration, Calibration, Tuning, Accutune. **ATTENTION:** Do not configure it until all configuration is complete.
	None	No lockout; all groups are read/write.

Function Prompt	Selections or Range of Setting	Parameter Definition
	Calibration	All groups are available for read/write except for the Calibration and Keyboard Lockout groups.
	+ Configuration	Tuning, SP Ramp, and Accutune groups are read/write. All other groups are read only. Calibration and Keyboard Lockout groups are not available.
	+ View	Tuning and Setpoint Ramp parameters are read/write. No other parameters are viewable.
	Max	Tuning and Setpoint Ramp parameters are available for read only. No other parameters are viewable.
Auto/Man Key		Allows you to disable the Auto/Manual Key
	Disable	Disable the Auto/Manual Key
	Enable	Enable the Auto/Manual Key **ATTENTION:** Can only be viewed if **Lockout** is configured for **None**.
Run/Hold Key		Allows you to disable the Run/Hold key, for either SP Ramp or SP Program. The Run/Hold key is never disabled when used to acknowledge a latched alarm 1.
	Disable	Disable the Run/Hold Key
	Enable	Enable the Run/Hold Key **ATTENTION:** Can only be viewed if **Lockout** is configured for **None**.
SP Select Key		Setpoint Select Key Lockout allows you to disable the Setpoint Select function
	Disable	Disable the Setpoint Select function
	Enable	Enable the Setpoint Select function **ATTENTION:** Can only be viewed if **Lockout** is configured for **None**.

Function Prompt	Selections or Range of Setting	Parameter Definition
Restore Settings		Allows you to reset the controller
	Disable	Disable
	Enable	Enable
Change Password	0 to 9999	Allows you to change the password. **NOTE:** The password is for keyboard entry only and is not available via communications. **ATTENTION:** Can only be viewed when the password you entered is correct.

Tuning Set Up Group

Introduction

Tuning consists of establishing the appropriate values for the tuning constants you are using so that your controller responds correctly to changes in process variable and setpoint. You can start with predetermined values but you will have to watch the system to see how to modify them. The Accutune feature automatically selects Gain, Rate, and Reset on demand.

ATTENTION: Because this group contains functions that have to do with security and lockout, we recommend that you configure this group last, after all other configuration data has been loaded.

Function Prompts

Table 4-4: TUNING Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Proportional Band 1 or Gain 1	0.1 to 9999 % or 0.001 to 1000	**NOTE:** The selection of **Proportional Band** or **Gain** is made in the **Control** set up under the prompt **Proportion Unit**. **Proportional Band 1** (simplex) is the percent of the range of the measured variable for which a proportional controller will produce a 100 % change in its output. **Gain 1** is the ratio of output change (%) over the measured variable change (%) that caused it. G = 100% / PB% where PB is the proportional band (in %) If the PB is 20 %, then the Gain is 5. And, at those settings, a 3 % change in the error signal (SP-PV) will result in a 15 % change in the controller's output due to proportional action. If the Gain is 2, then the PB is 50 %. Also defined as "HEAT" Gain on Duplex models for variations of Heat/Cool applications.
Rate 1 Min	0.00 to 10.00 minutes	Rate action, in minutes, affects the controller's output whenever the deviation is changing; and affects it more when the deviation is changing faster. Also defined as "HEAT" Rate on Duplex models for variations of Heat/Cool applications.
Reset Mins/Rpt 1 or Reset Rpts/Min 1	0.02 to 50.00	**Reset Mins/Rpt 1** = Reset in Minutes per Repeat **Reset Rpts/Min 1** = Reset in Repeats per Minute **Reset** (or **Integral Time**) adjusts the controller's output in accordance with both the size of the deviation (SP–PV) and the time that it lasts. The amount of the corrective action depends on the value of Gain. The Reset adjustment is measured as how many times proportional

Function Prompt	Selections or Range of Setting	Parameter Definition
		action is repeated per minute or how many minutes before one repeat of the proportional action occurs. Used with control algorithm PID A or PID B. Also defined as "HEAT" Reset on Duplex models for variations of Heat/Cool applications. **NOTE:** The selection of whether **Minutes per Repeat** or **Repeats per Minute** is used is made in the **Control** set up group under the prompt **Reset Unit**.
Manual Reset	–100 to +100 (in % output)	It is only applicable if you use control algorithm PD with Manual Reset in the Algorithm set up group. Because a proportional controller will not necessarily line out at setpoint, there will be a deviation (offset) from setpoint. This eliminates the offset and lets the PV line out at setpoint. **ATTENTION:** Bias is shown on the lower display.
Proportional Band 2 or GAIN 2	0.1 to 9999 % or 0.001 to 1000	**Proportional Band 2** or **GAIN 2** , **Rate 2 Min** , and **Reset 2** parameters are the same as previously described for “Heat” except that they refer to the cool zone tuning constants on duplex models or the second set of PID constants, whichever is pertinent. These parameters appear when the following settings are configured: 1. **Control Algorithm** of the **Algorithms** set up group is configured as **PID A**, **PID B**, **PD+Manual Reset**. 2. **PID Sets** of the **Control** set up group is configured as **2 Sets Keyboard**, **2 Sets PV Switchcover**, **2 Sets SP Switchover**, **4 Sets Keyboard**, **4 Sets PV Switchcover** or **4 Sets SP Switchover**. 3. **Proportion Unit** of the **Control** set up group is configured as **Proportional Band** or **Gain**.

Function Prompt	Selections or Range of Setting	Parameter Definition
Rate 2 Min	0.00 to 10.00 minutes	This is the same as above except that it applies to Duplex models for the "COOL" zone of Heat/Cool applications or for the second set of PID constants.
Reset Mins/Rpt 2 Reset Rpts/Min 2	0.02 to 50.00	These are the same as above except that they apply to Duplex models for the "COOL" zone of Heat/Cool applications or for the second set of PID constants.
Proportional Band 3 or GAIN 3	0.1 to 9999 % or 0.001 to 1000	**Proportional Band 3** or **Gain 3** , **Rate 3 Min** , and **Reset 3** parameters are the same as previously described for “Heat” except that they refer to the cool zone tuning constants on duplex models or the second set of PID constants, whichever is pertinent. These parameters appear when the following settings are configured: 1. **Control Algorithm** of the **Algorithms** set up group is configured as **PID A**, **PID B**, **PD+Manual Reset**. 2. **PID Sets** of the **Control** set up group is configured as **4 Sets Keyboard**, **4 Sets PV Swithcover** or **4 Sets SP Switchover**. 3. **Proportion Unit** of the **Control** set up group is configured as **Proportional Band** or **Gain**.
Rate 3 Min	0.00 to 10.00 minutes	This is the same as above except that it applies to Duplex models for the "COOL" zone of Heat/Cool applications or for the second set of PID constants.
Reset Mins/Rpt 3 Reset Rpts/Min 3	0.02 to 50.00	These are the same as above except that they apply to Duplex models for the "COOL" zone of Heat/Cool applications or for the second set of PID constants.
Proportional Band 4 or	0.1 to 9999 % or	**Proportional Band 4** or **Gain 4** , **Rate 4 Min**, and **Reset 4** parameters are the same as previously described for “Heat” except that they refer to the cool zone tuning constants on duplex models or the second set of PID

Function Prompt	Selections or Range of Setting	Parameter Definition
GAIN 4	0.001 to 1000	constants, whichever is pertinent. These parameters appear when the following settings are configured: 1. **Control Algorithm** of the **Algorithms** set up group is configured as **PID A**, **PID B**, **PD+Manual Reset**. 2. **PID Sets** of the **Control** set up group is configured as **4 Sets Keyboard**, **4 Sets PV Swithcover** or **4 Sets SP Switchover**. 3. **Proportion Unit** of the **Control** set up group is configured as **Proportional Band** or **Gain**.
Rate 4 Min	0.00 to 10.00 minutes	This is the same as above except that it applies to Duplex models for the "COOL" zone of Heat/Cool applications or for the second set of PID constants.
Reset Mins/Rpt 4 Reset Rpts/Min 4	0.02 to 50.00	These are the same as above except that they apply to Duplex models for the "COOL" zone of Heat/Cool applications or for the second set of PID constants.
Cycle Time 1 Sec	1 to 120 seconds	**Cycle Time 1 (Heat)** determines the length of one time proportional output relay cycle. Defined as "HEAT" cycle time for Heat/Cool applications. **NOTE:** It only appears when **Output Algorithms** is configured as **Time Simplex**, **Time Duplex** or **Current Time** in the **Output** set up group. **Cycle Time 1 Sec** —Electromechanical relays **ATTENTION:** Cycle times are in either second or 1/3-second increments depending upon the configuration of RLY TYPE in the Output Algorithm Set Up group.
Cycle Time 2 Sec	1 to 120 seconds	**Cycle Time 2 (COOL)** is the same as above except it applies to Duplex models as the cycle time in the "COOL"

Function Prompt	Selections or Range of Setting	Parameter Definition
		zone of Heat/Cool applications or for the second set of PID constants. **NOTE:** It only appears when **Output Algorithms** is configured as **Time Duplex** or **Time Current** in the **Output** set up group. **Cycle Time 2 Sec** —Electromechanical relays **ATTENTION:** Cycle times are in either second or 1/3-second increments depending upon the configuration of RLY TYPE in the Output Algorithm Set Up group.

SP Ramp/Program Set Up Group

Introduction

Set Point Ramp, Set Point Rates and Set Point Programs can be configured in this group.

- A single Setpoint Ramp (**SP Ramp**) can be configured to occur between the current local setpoint and a final local setpoint over a time interval of from 1 to 255 minutes.

  NOTE: SP Ramp only appears when **SP Program** is disabled.

- A Set Point Rate (**SP Rate**) lets you configure a specific rate of change for any local setpoint change.

  NOTE: SP Rate only works in Auto mode.

  NOTE: SP Rate operates only when both SP Ramp and SP Programing are in Hold mode or when both SP Ramp and SP Programming are disabled.

- Up to 8 Set Point Programs (**SP Program**) can be configured. Each SP Program has 8 segments.

  > **NOTE: SP Program** only appears when **SP Ramp** is disabled.

  You can configure SP Program 1 in this group, and configure other 7 SP programs in the corresponding set up groups. See SP Program 2 Set Up Group ~ SP Program 8 Set Up Group for more information.

You can start and stop the ramp / program using the **RUN/HOLD** key (Setup and Increment keys).

> **NOTE:** When SP ramp / program is running or held but not terminated, the configuration of Ramp / Program is unchangeable.

A ramp segment in SP ramp / program completes when either of the following two condition is satisfied:

- The current setpoint reaches the final setpoint.
- The ramp timer is timeout, i.e., the ramp time is expired.

when a ramp completes, despite whatever value the current setpoint was at that moment, it will be set to the final setpoint immediately.

PV Hot Start is a configurable feature and means that, at initialization, the setpoint is set to the current PV value and the Ramp or Rate or Program then starts from this value.

For how to configure Set Point Ramp, Rate and Program, See "Setpoint Rate/Ramp/Program" on page 201 for more information.

Function Prompts

Table 4-5: SP Ramp/Program Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
SP Ramp Function		**Single Setpoint Ramp** —Make a selection to enable or disable the setpoint ramp function. Make sure you configure a ramp time and a final setpoint value. **NOTE:** SP Program must be disabled for SP Ramp prompts to appear.
	Disable	Disables the setpoint ramp option.
	Enable	Allows the single setpoint ramp prompts to be shown.
Ramp Time Min	0 to 255 minutes	**Setpoint Ramp Time** —Enter the number of minutes desired to reach the final setpoint. A ramp time of “0” implies an immediate change of setpoint.
Ramp Final SP	Within setpoint limits	**Setpoint Ramp Final Setpoint** —Enter the value desired for the final setpoint . The controller will operate at the setpoint set here when ramp is ended. **ATTENTION:** If the ramp is on HOLD, the held setpoint can be changed by the Increment key and Decrement key. However, the ramp time remaining and original ramp rate is not changed. Therefore, when returning to RUN mode, the setpoint will ramp at the same rate as previous to the local setpoint change and will stop if the final setpoint is reached before the time expires. If the time expires before the final setpoint is reached, it will jump to the final setpoint.

Function Prompt	Selections or Range of Setting	Parameter Definition
		ATTENTION: SP Ramp and SP Rate will cause the SP portion of Accutune to abort. PV Tune will continue to function normally. Ramp is placed into HOLD while tuning (TUNE configuration).
SP Rate Function		**Setpoint Rate** —Lets you configure a specific rate of change for any local setpoint change. **NOTE:** SP Rate only works in Auto mode. **NOTE:** SP Rate operates only when both SP Ramp and SP Program are in Hold mode or when both SP Ramp and SP Programming are disabled.
	Disable	Disables the setpoint rate option.
	Enable	Allows the SP rate feature.
Rate Up EU/HR	0 to 9999 in engineering units per hour	Rate up value. When making a setpoint change, this is the rate at which the controller will change from the original setpoint up to the new one. The ramping (current) setpoint can be viewed as SPn in the lower display. Entering a 0 will imply an immediate step change in Setpoint (i.e., no rate applies).
Rate Down EU/HR	0 to 9999 in engineering units per hour	Rate down value . When making a setpoint change, this is the rate at which the controller will change from the original setpoint down to the new one. The ramping (current) setpoint can be viewed as SPn in the lower display. Entering a 0 will imply an immediate step change in Setpoint (i.e., no rate applies).
SP Program Function (optional feature)		**Setpoint Ramp/Soak Program** —Available only with controllers that contain this option.

Function Prompt	Selections or Range of Setting	Parameter Definition
		ATTENTION: SP Ramp must be disabled for SP Program prompts to appear. If SP Rate is enabled, it does not operate while an SP Program is running .
	Disable	Disables setpoint programming.
	Enable	Enables setpoint programming. **NOTE:** For more configurable parameters of SP Program, see the table SP Program configurable parameters.
Soak Deviation	0 to 99.999	Guaranteed Soak Deviation Value The number selected will be the PV value (in engineering units) above or below the setpoint outside of which the timer of soak segment halts. 0 means the soak deviation function is disabled.
Program Termination		Program Termination State
	Last SP	Hold at last setpoint in the program
	Failsafe	Manual mode/Failsafe output
Program End State	Disable Hold	It determines the program state after completion. Disable: SP Program Function is disabled. Hold: SP Program Function is not disabled.
Key Reset/Rerun		Reset/Rerun SP Program. After configuration, press the Lower Display key under the main screen, until you see To Begin or Rerun. Then press the Increment key or Decrement key, To Begin or Rerun will go into effect.
	Disable	Disable the function.

Function Prompt	Selections or Range of Setting	Parameter Definition
	To Begin	It allows the setpoint program to be reset to the beginning of the first segment in the program.
	Rerun	It allows the setpoint program to rerun from the current segment.
Hot Start	Disable Enable	Disable: LSP1 is used as the initial ramp setpoint. Enable: Current PV value is used as the initial ramp setpoint.

The following list is only for reference. See "Setpoint Ramp/Soak Programming" on page 204 for more information.

Figure 4-1: SP Program configurable parameters

Function Prompt	Selections or Range of Setting	Parameter Definition
Start Segment	1 to 8	Start Segment Number
End Segment	2 to 8 even numbers Always end in a soak segment (2, 4, 6 and 8)	End Segment Number
Ramp Unit		Engineering Units for Ramp Segments
	Time Hrs:Mins	Time in hours: minutes
	Rate EU/Min	Rate in Engineering units per minute 0~999 EU/Min
	Rate EU/Hr	Rate in Engineering units per hour 0~999 EU/Hr
Recycles	0 to 99 recycles	Number of Program Recycles
Segment 1 Ramp	00:00 ~ 99:59 (0-99 hours:0-59 minutes) or	Segment #1 Ramp Time/Rate **NOTE:** This parameter is affected by the **Ramp Unit** configuration. Select **Time**

Function Prompt	Selections or Range of Setting	Parameter Definition
	0 ~ 999 EU/Min or 0 ~ 999 EU/Hr	**Hrs:Mins** , **Rate EU/Mins**, or **Rate EU/Hrs** at prompt **Ramp Unit**. All ramps in this SP Program will use the same selection. **NOTE:** Press Increment Key and Decrement Key at the same time to move the current editable digit one step left if required.
Segment 2 SP	Within the Setpoint limits	Segment #2 Soak Setpoint Value
Segment 2 Time	00:00 ~ 99:59 (0-99 hours:0-59 minutes	Segment #2 Soak Duration
Segment 3 Ramp Segment 4 SP & Segment 4 Time Segment 5 Ramp Segment 6 SP & Segment 6 Time Segment 7 Ramp Segment 8 SP & Segment 8 Time	Selections are same as above.	Same as above

SP PROG2 ~ PROG 8 Set Up Group

Introduction

Setpoint Program 2 ~8 have same parameters, and they can be configured in the corresponding groups.

SP Program 2~8 only appear when **SP Program** is enabled in the **SP Ramp** set up group.

Function Prompts

Table 4-6: SP Program 2~8 Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Start Segment	1 to 8	Start Segment Number
End Segment	2 to 8 even numbers Always end in a soak segment (2, 4, 6 and 8)	End Segment Number
Ramp Unit		Engineering Units for Ramp Segments
	Time Hrs:Mins	Time in hours: minutes
	Rate EU/Mins	Rate in Engineering units per minute
	Rate EU/Hrs	Rate in Engineering units per hour
Recycles	0 to 99 recycles	Number of Program Recycles
Segment 1 Ramp	00:00 ~ 99:59 (0-99 hours:0-59 minutes) or 0 ~ 999 EU/Min or 0 ~ 999 EU/Hr	Segment #1 Ramp Time/Rate **NOTE:** This parameter is affected by the **Ramp Unit** configuration. Select **Time Hrs:Mins** , **Rate EU/Mins**, or **Rate**

Function Prompt	Selections or Range of Setting	Parameter Definition
		EU/Hrs at prompt **Ramp Unit**. All ramps in this SP Program will use the same selection.
Segment 2 SP	Within the Setpoint limits	Segment #2 Soak Setpoint Value
Segment 2 Time	00:00 ~ 99:59 (0-99 hours:0-59 minutes	Segment #2 Soak Duration
Segment 3 Ramp Segment 4 SP & Segment 4 Time Segment 5 Ramp Segment 6 SP & Segment 6 Time Segment 7 Ramp Segment 8 SP & Segment 8 Time	Selections are same as above.	Same as above

Accutune Set Up Group

Introduction

Accutune III automatically calculates GAIN, RATE, and RESET TIME (PID) tuning constants for your control loop. When initiated on demand, the Accutune algorithm measures a process step response and automatically generates the PID tuning constants needed for no overshoot on your process.

Fuzzy , Fuzzy Overshoot Suppression: When enabled, this configuration will suppress or eliminate any overshoot that may occur as a result of the existing tuning parameters, as the PV approaches the setpoint.

Tune, Demand Tuning: The tuning process is initiated through the operator interface keys or via a digital input (if configured). The algorithm then calculates new tuning parameters and enters them in the tuning group. Tune will operate with PIDA, PIDB, PD+MR algorithms.

SP, SP Tuning: SP tuning continuously adjusts the PID parameters in response to setpoint changes. You can select tuning on minimum setpoint changes of 5 % up to 15 % span. Perform SP tuning after you have configured the controller.

Simplex Tuning is used when a Simplex Control Algorithm is configured and uses the current SP value and alters the output over the Output Limit Range.

Duplex Tuning is used when a Duplex Control Algorithm is configured. To perform a Duplex Tune, Two Local Setpoints must be configured. See "Control Set Up Group" on page 122 for more information.

Function Prompts

Table 4-7: Accutune Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Fuzzy Suppression		**Fuzzy Overshoot Suppression** —Can be enabled or disabled independently of whether Demand Tuning or SP Tuning is enabled or disabled.
	Disable	Disables Fuzzy Overshoot Suppression.
	Enable	The instrument uses Fuzzy Logic to suppress or minimize any overshoot that may occur when PV approaches SP. It will not recalculate any new tuning parameters.
Accutune		**Accutune III**
	Disable	Disables the Accutune function.
	TUNE	Demand Tuning —If TUNE is selected, and tuning is initiated through the operator interface or digital input (if configured), the algorithm calculates new tuning parameters and enters them into the tuning group. This tuning requires no process knowledge and does not require line out for initialization.
Duplex Output		**Duplex Accutuning III** **NOTE:** These prompts only appear when a duplex output type has been configured.
	Manual	Tune manually using LSP 1 and LSP 2 values. LSP 1 is used to derive tuning parameters associated with HEAT (output > 50 %). LSP 2 is used to derive tuning parameters associated with COOL (output < 50 %).
	Auto	Tuning is performed automatically on both HEAT and COOL sequentially. LSP 1 is used for HEAT tuning and LSP 2 is used for COOL tuning. To initiate tuning, either LSP 1 or LSP 2 must be in use.
	Disable	The current SetPoint is used to derive a single set of blended tuning parameters. This tuning is performed

Function Prompt	Selections or Range of Setting	Parameter Definition
		over the range of the output limits similar to Simplex Tuning. The Tuning Parameters derived are placed into both the HEAT and COOL tune sets (PID 1 and PID 2).
Error Status (Read Only)		**Accutune Error Status** —When an error is detected in the Accutune process, an error prompt will appear.
	None	No errors occurred during last Accutune procedure.
	Running	An Accutune process is still active checking process gain, even though "T" is not lit. It does not affect keyboard operation.
	Abort	Current Accutune Process Aborted —Caused by one of the following conditions: • changing to manual mode • digital input detected • in heat region of output but a cool output was calculated, or vice versa.
	SP Error	LSP2 not configured or a Setpoint other than LSP1 or LSP2 is in use.

Algorithm Set Up Group

Introduction

This data deals with various algorithms in the controller and Timer functions.

The Timer section allows you to configure a time-out period and to select the timer start by either the keyboard (RUN/HOLD key) or Alarm 2. An optional digital input can also be configured to the start the timer. The timer display is selectable as either “Time Remaining” or “Elapsed Time”.

Alarm 1 is activated at the end of the time-out period. When the timer is enabled, it has exclusive control of the alarm 1 relay—any previous alarm 1 configuration is ignored. At time-out, the timer is ready to be activated again by whatever action has been configured.

Function Prompts

Table 4-8: Algorithm Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Control Algorithm		The Control Algorithm lets you select the type of control that is best for your process.
	Disable	**Disable**- Disables Algorithm
	On-Off	**ON/OFF** is the simplest control type. The output can be either ON (100 %) or OFF (0 %). The Process Variable (PV) is compared with the setpoint (SP) to determine the sign of the error (ERROR = PV–SP). The ON/OFF algorithm operates on the sign of the error signal. In Direct Acting Control, when the error signal is positive, the output is 100 %; and when the error signal is negative, the output is 0

Function Prompt	Selections or Range of Setting	Parameter Definition
		%. If the control action is reverse, the opposite is true. An adjustable overlap (Hysteresis Band) is provided between the on and off states. **ATTENTION:** Other prompts affected: OUT Hysteresis **DUPLEX ON/OFF** is an extension of this algorithm when the output is configured for a Duplex control algorithm. It allows the operation of a second ON/OFF output. There is a deadband between the operating ranges of the two inputs and an adjustable overlap (hysteresis) of the on and off states of each output. Both Deadband and Hysteresis are separately adjustable. With no relay action the controller will read 50 %. **ATTENTION:** Other prompts affected: OUT Hysteresis and Deadband
	PID A	**PID A** is normally used for three-mode control. This means that the output can be adjusted somewhere between 100 % and 0 %. It applies all three control actions—Proportional (P), Integral (I), and Derivative (D)—to the error signal. **ATTENTION:** PID A should not be used for Proportional only action; i.e., no integral

Function Prompt	Selections or Range of Setting	Parameter Definition
		(reset) action. Instead, use PD+ Manual Reset with rate set to 0. **Proportional (Gain)** —Regulates the controller's output in proportion to the error signal (the difference between Process Variable and Setpoint). **Integral (Reset)** —Regulates the controller's output to the size of the error and the time the error has existed. (The amount of corrective action depends on the value of proportional Gain.) **Derivative (Rate)** —Regulates the controller's output in proportion to the rate of change of the error. (The amount of corrective action depends on the value of proportional Gain.)
	PID B	**PID B** —Unlike the PID A equation, the controller gives only an integral response to a setpoint change, with no effect on the output due to the gain or rate action, and it gives full response to PV changes. Otherwise controller action is as described for the PID A equation. See note on PID A.
	PD+Manual Reset	**PD with Manual Reset** is used whenever integral action is not wanted for automatic control. The equation is computed with no integral contribution. The MANUAL RESET, which is operator adjustable, is then added to the present output to form the

Function Prompt	Selections or Range of Setting	Parameter Definition
		controller output. Switching between manual and automatic mode will be bumpless. If you select PD with Manual Reset you can also configure the following variations: • **PD (Two Mode) control,** • **P (Single Mode) control.** Set Rate (D) to 0. **ATTENTION:** Other prompts affected: MAN RSET in the Tuning Set Up group
Timer Function	Disable Enable	It allows you to enable or disable the timer option. The timer option allows you to configure a timeout period and to select timer start by either the keyboard (RUN/HOLD key) or Alarm 2. A digital input can also be configured to start the timer. When the timer is enabled, it has exclusive control of the alarm 1 relay; any previous alarm configuration is ignored. At timeout, the timer is ready to be re-activated by whatever action has been configured. Alarm 1 is activated at the end of the timeout period.
Period	0:00 to 99:59	The length of timeout period (either from 0 to 99 hours: 59 minutes or from 0 to 99 minutes: 59 seconds depending upon Increment configuration).

Function Prompt	Selections or Range of Setting	Parameter Definition
Start Trigger	Keyboard Alarm 2	It allows you to select whether the timer starts with the keyboard (Run/Hold key) or Alarm 2.
Lower Display	Time Remaining Elapsed Time	It allows you to select whether time remaining (TI REM) or elapsed time (E TIME) is displayed for the timer option. The time is shown on the lower display in HH:MM format along with a rotating “clock” character. • **If the “clock” rotation is clockwise, elapsed time is indicated.** • **If the “clock” rotation is counterclockwise, time remaining is indicated.**
Reset Trigger	Keyboard Alarm 1	**Reset Trigger** allows you to reset the timer with the keyboard (Run/Hold key) or Alarm 1.
Increment	Minutes Seconds	**Increment** allows you to increment the timer in either minutes or seconds.

Input Math Algorithms —Controllers with two inputs are provided with one input algorithm. Unless otherwise noted, these selections are provided only as part of the Math Options package. Each algorithm can be configured to provide a derived (calculated) PV or a derived Remote Setpoint. Up to three inputs may be applied to the calculation. See Inputs A, B, and C for definitions per equation.

All algorithms operate in engineering units except Feedforward (F FWRD) which operates in percent of output units.

ATTENTION: When the Input C configuration is set to NONE, the value of Input C used in the functions is automatically set to 1.0, except for the Summer algorithm, where it is set to 0.0.

Function Prompt	Selections or Range of Setting	Parameter Definition
Input Algorithm 1		Input Algorithm 1 has the following selections from which to choose:
	None	No algorithm configured
	Weighted Average (See Note 2) (Standard feature on controllers with two analog inputs)	When you configure for Weighted Average, the controller will compute a PV or SP for the control algorithm from the following equation: Alg1 = [(Input A x Ratio A + Bias A) + (K x Input B x Ratio B + Bias B)] / (1 + K)] + Alg1Bias
	Feedforward Summer (Standard feature on controllers with two analog inputs)	Feedforward Summer — Feedforward uses Input A, following a Ratio and Bias calculation as a value summed directly with the PID computed output value and sent, as an output value, to the final control element. This algorithm will only function in automatic mode. The following formula applies: Controller Output = PID Output + (Input A x Ratio A + Bias A) x (100 / Input A Range)
	Feedforward Mult (Standard feature on controllers with two analog inputs)	Feedforward Multiplier — Feedforward uses Input A, following a Ratio and Bias calculation as a value multiplied directly with the PID computed output value and sent, as an output value, to the final control element. This algorithm will only function in automatic mode.

Function Prompt	Selections or Range of Setting	Parameter Definition
		The following formula applies: Controller Output = PID Output x (Input A x Ratio A + Bias A) / Input A Range
	Summer (See Note 2)	Summer with Ratio and Bias —The following formula applies: Alg1 = (Input A x Ratio A + Bias A) + (Input B x Ratio B + Bias B) + (Input C x Ratio C + Bias C) + Alg1Bias
	High Select (See Note 2)	Input High Select with Ratio and Bias —This selection specifies the PV or SP as the higher of Input 1 or Input 2. The following formula applies: Alg1 = higher of (Input A x Ratio A + Bias A) or (Input B x Ratio B + Bias B)
	Low Select (See Note 2)	Input Low Select with Ratio and Bias — This selection specifies the PV or SP as the lower of Input 1 or Input 2. The following formula applies: Alg1 = lower of (Input A x Ratio A + Bias A) or (Input B x Ratio B + Bias B)
	Multi Div + Sqrt (See Note 1)	Multiplier Divider with Square Root —The following formula applies: Alg1 = K * Sq.Rt. {(Input A x Ratio A + Bias A) x (Input C x Ratio C + Bias C) / (Input B * Ratio B + Bias B)} x (Calc Hi – Calc Lo) + Alg1Bias See the figure at the end of this section for an example of Mass Flow Compensation using the Multiplier/Divider Algorithm.

Function Prompt	Selections or Range of Setting	Parameter Definition
	Multiplier + Sqrt (See Note 1)	Multiplier with Square Root —The following formula applies: Alg1 =K x Sq.Rt.{(Input A x Ratio A + Bias A) x (Input B x Ratio B + Bias B) x (Input C x Ratio C + Bias C)} x (Calc Hi – Calc Lo) + Alg1Bias
	Multiplier Divider (See Note 1)	Multiplier Divider — The following formula applies: Alg1 = K x [{(Input A x Ratio A + Bias A) x (Input C x Ratio C + Bias C)} / (Input B x Ratio B + Bias B)] x (Calc Hi – Calc Lo) + Alg1Bias
	Multiplier (See Note 1)	Multiplier —The following formula applies: Alg1 = K x [(Input A x Ratio A + Bias A) x (Input C x Ratio C + Bias C) x (Input B x Ratio B + Bias B)] x (Calc Hi – Calc Lo) + Alg1Bias
	Carbon A	Carbon Potential A —Make this selection if you have a Cambridge or Marathon monitor type Zirconium Oxide sensor. See Note 3.
	Carbon B	Carbon Potential B —Make this selection if you have a Corning type Zirconium Oxide sensor. This algorithm requires a temperature range within the region of 1380 to 2000°F. See Note 3.
	Carbon C	Carbon Potential C —Make this selection if you have an A.A.C.C. type Zirconium Oxide sensor. This algorithm requires a temperature range within the region of 1380 °F to 2000 °F. See Note 3.
	Carbon D	Carbon Potential D —Make this

Function Prompt	Selections or Range of Setting	Parameter Definition
		selection if you have a Barber Coleman, MacDhui, or Bricesco type Zirconium Oxide sensor. This algorithm requires a temperature range within the region of 1380 to 2000°F. See Note 3.
	Carbon FCC	Carbon Potential FCC —Make this selection if you have a Furnace Controls Corp Accucarb type Zirconium Oxide sensor. This algorithm requires a temperature range within the region of 1380 °F to 2000 °F. See Note 3.
	Dewpoint	Dewpoint of Carbonizing Atmosphere —Use this selection if you are using any Zirconium Oxide Carbon Probe and you want to measure the atmosphere in terms of Dewpoint. The range is –50 °F to 100 °F or –48 °C to 38 °C. This algorithm requires a temperature range within the region of 1000 °F to 2200 °F and a minimum carbon probe value of 800 millivolts.
	Oxygen	Percent Oxygen Range —Make this selection if you are using a Zirconium Oxide Oxygen Probe to measure Percent of Oxygen in a range of 0 to 40 % O_2 . This algorithm requires a temperature range within the region of 800 °F to 3000 °F.

ATTENTION: The Carbon and Dewpoint selections will automatically set the first input actuation to Carbon. The Oxygen selection will automatically set the first input actuation to Oxygen. Input 2 can be any input actuation, but it is normally a type K, R or S thermocouple input, depending upon the probe type selected. All calculations are performed by the Controller with Percent Carbon shown as

Function Prompt	Selections or Range of Setting	Parameter Definition
the PV display. The actual value of each analog input may be viewed on the lower display. For all Carbon Types, if the value of Percent Carbon falls below 0.1% - such as can happen when the Carbon Probe voltage output falls below 900 mVdc – then the Controller will continue to update the PV display, but the accuracy is unspecified. Likewise, if the measured temperature falls outside of the specified ranges as noted above for the Carbon, Oxygen and Dewpoint input types, then the Controller will continue to update the PV display, but the accuracy is unspecified. For the Dewpoint algorithm, if the Carbon Sensor voltage falls below 800 mVdc, then the Dew Point is calculated as if the sensor voltage was at 800 mVdc.		
Math K	0.001 to 1000 floating	Weighted Average Ratio or Mass Flow Orifice Constant (K) for Math Selections —Only applicable for algorithms W AVG or General Math selections Multi Div + Sqrt , Multiplier + Sqrt, Multiplier Divider, or Multiplier.
Calculated High	–999. To 9999. Floating (in engineering units)	Calculated Variable High Scaling Factor for Input Algorithm 1 — Used only when either Summer, Input Hi/Lo, or one of the General Math functions was selected as the Input Algorithm. See Note 2.
Calculated Low	–999. To 9999. Floating (in engineering units)	Calculated Variable Low Scaling Factor for Input Algorithm 1 — Used only when either Summer, Input Hi/Lo, or one of the General Math functions was selected as the Input Algorithm. See Note 2.
Algorithm 1 Input A		Algorithm 1, Input A Selection will represent one of the available selections.
	Input 1	Input 1
	Input 2	Input 2
	Output	Output

Function Prompt	Selections or Range of Setting	Parameter Definition
Algorithm 1 Input B		Algorithm 1, Input B Selection will represent one of the available selections.
	Input 1	Input 1
	Input 2	Input 2
	Output	Output
Algorithm 1 Input C		Algorithm 1, Input C Selection will represent one of the available selections.
	None	No Algorithm 1 Input C configured
	Input 1	Input 1
	Input 2	Input 2
	Output	Output
Percent CO	0.020 to 0.350 (fractional percent of CO)	Percent Carbon is only applicable when Carbon Potential is selected. Enter the value in percent carbon monoxide that is applicable for the enriching gas used in fractional form. **FOR EXAMPLE**: Natural Gas = 20.0 % CO, then setting is 0.200 Propane Gas = 23.0 % CO, setting is 0.230
Algorithm 1 Bias	-999 to 9999 floating (in engineering units)	Input Algorithm 1 Bias— Does not apply to selections: Feedforward Summer, Feedforward Mult, High Select or Low Select.
Percent H2	1.0 to 99.0 (% H2)	Hydrogen Content for Dewpoint is only applicable when Dewpoint is selected. Enter a value for the percentage of Hydrogen content that is applicable.

Function Prompt	Selections or Range of Setting	Parameter Definition
Math Algorithm Notes: 1. Calculation ranges for the Math Algorithms are set via Calculated High and Calculated Low parameters and are between –999. and 9999. The SP High and Low values (SP Range) are independent of these settings and can be any value between –999. and 9999. 2. The Calculated High and Calculated Low values determine the range limits for the SP High and Low values for the Weighted Average, Summer, Hi Select and Low Select algorithms. 3. If the Ratio for Input 2 is set to 0.0, then a constant value may be used for the Input 2 value via the Input 2 Bias setting. For this configuration, the Input 2 low range and the Sooting diagnostic messages are disabled.		

Figure 4-2: Mass Flow Example

Example - Mass Flow Compensation

A gas flow rate of 650 SCFM develops a differential pressure of 90" H_2O across an orifice plate at reference conditions of 30 psig and 140°F. Compensate this gas flow for temperature and pressure variations.

$$\text{Flow} = K\sqrt{\frac{DP_f \times P_f}{T_f} \times \frac{T_{ref}}{P_{ref}}}$$

Where:
f = flowing conditions
ref = reference conditions (in absolute units)

Apply Multiplier/Divider Algorithm:

$$PV = K\sqrt{\frac{(\text{Input A} \times \text{Ratio}_A + \text{Bias}_A) \times (\text{Input C} \times \text{Ratio}_C + \text{Bias}_C)}{(\text{Input B} \times \text{Ratio}_B + \text{Bias}_B)}} \times (\text{Calc}_{HI} - \text{Calc}_{LO})$$

Assign inputs using Engineering units:

Let:

Input A = DP_f = IN1 (in H_2O)
Input B = T_f = IN2 + Bias2 = IN2°F + 460 (°R)
Input C = P_f = IN3 + Bias3 = IN3psig + 14.7(psia)
T_{ref} = 140°F + 460 = 600°R
P_{ref} = 30 psig + 14.7 = 44.7 psia
Calc_{Hi} = 650.0
Calc_{Lo} = 0.0
> Flow in SFCM at Reference Conditions
K = to be determined next

Note: If temperature and pressure signals are already ranged in absolute units, no Bias is required for inputs B and C.

$$PV = Q_{SCFM} = K\sqrt{\frac{DP_f \times (IN3 + 14.7)}{(IN2 + 460)}} \times K^2 \times (650.0 - 0.0)$$

Note: When IN2 and IN3 are at the reference conditions of 600°R (140°F) and 44.7psia (30 psig) respectively and DP_f = 90" H_2O, the equation must calculate 650 SCFM. To accomplish this, divide the DP value by "90" to normalize the equation.

$$Q_{SCFM} = K\sqrt{\frac{DP_f}{90} \times \frac{(IN3 + 14.7)}{(IN2 + 460)} \times \frac{T_{ref}}{P_{ref}}} \times 650$$

Rearranging terms:

$$Q_{SCFM} = K\sqrt{\underbrace{DP_f \times \frac{(IN3 + 14.7)}{(IN2 + 460)}}_{\text{Variable}} \times \underbrace{\frac{1}{90} \times \frac{T_{ref}}{P_{ref}}}_{\text{Constant} = K^2}} \times 650$$

Example continued on next page

22049

Example - Mass Flow Compensation - continued

Determined value of K:

$$K^2 = \frac{1}{90} \times \frac{T_{ref}}{P_{ref}} = \frac{600}{(90)\,(44.7)} = 0.14914$$

Therefore K = 0.386

$$Q_{SCFM} = (0.386)\,(650)\sqrt{\frac{DP_f\ (\text{in } H_2O)\ (IN3 + 14.7)}{(IN2 + 460)}}$$

K

$(Calc_{HI} - Calc_{LO})$

Summary of Flow Values At Values Conditions

	Temp (T_f) (°R)	Pressure (T_f) (psia)	Flow (SFCM)	
			DP_f = 45" H_2O (50%)	DP_f = 90" H_2O (100%)
Reference Conditions	140°F + 460	30 psi + 14.7	459	650
	170° F + 460	50 psi + 14.7	539	763
	170°F + 460	20 psi + 14.7	395	559
	110°F + 460	50 psi + 14.7	567	802
	110°F + 460	20 psi + 14.7	415	587

22050

Output Set Up Group

Introduction

This group deals with various output types in the controller, the Digital Output Status and the Current Output operation.

> **ATTENTION:** The Tuning Group is automatically configured to have two PID sets when a Duplex Control Algorithm is selected.

Function Prompts

Table 4-9: OUTPUT Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Output Algorithm		The output algorithm lets you select the type of output you want. Selections are hardware dependent. For example, if the controller does not have a current output, then none of the prompts for Output Algorithms that need a current output will appear. Likewise, if the controller does not have a relay output, then none of the prompts that need a relay output will appear. **ATTENTION:** For all Duplex Output forms, PID heat parameters apply for controller output greater than 50 %; PID cool parameters apply for controller output less than 50 %.
	Time Simplex	This output algorithm uses Digital Output 1 for Time Proportional Control. The output is updated per the sampling rate selection. Time Proportional Output has a resolution of 3 msec. Cycle Time is adjustable from 1 to 120 seconds.
	Current Simplex	Type of output using one 4 mA to 20 mA signal that can be fed into a positive or negative grounded load of 0 to 1000 ohms. This signal can easily be configured for 4-20 mA or 0-20 mA operation via the CO Range

Function Prompt	Selections or Range of Setting	Parameter Definition
		configuration, below.
	Time Duplex	This output algorithm uses Digital Outputs 1 and 2 for Duplex Time Proportional Control. The outputs are updated per the Loop sampling rate selection. Time Proportional Output has a resolution of 3 msec. Cycle Time is adjustable from 1 second to 120 seconds.
	Current Duplex	It is similar to current simplex but uses a second current output. The second output is usually scaled so that zero and span correspond with 0 % and 50 % output (cool zone). When the output is 0 % to 50 %, the controller uses tuning parameter set #2, when the output is 50 % to 100 % it uses set #1. **ATTENTION:** Other prompts affected: Out Range
	Current Time	Current/Time Duplex is a variation of duplex with current active for 0 % to 50 % output (tuning set 2) and time is active 50 % to 100 % output (tuning set 1). Relay controls heat, current controls cool. **ATTENTION:** Other prompts affected: Out Range
	Time Current	Time Current Duplex is similar to Current Time except that current is active for 50 % to 100 % and time is active for 0 % to 50 %. Relay controls cool, current controls heat. **ATTENTION:** Other prompts affected: Out Range
Out Range		Current Duplex Range Algorithm — Used with Output Algorithm selections Current Duplex, Current Time, or Time Current
	50 Percent	Current Duplex Range (Split)—This setting should be used for Relay/Current and Current/Relay Duplex Outputs. It can also be used for Current Duplex when

Function Prompt	Selections or Range of Setting	Parameter Definition
		an Auxiliary Output board is present. This enables the normal control current output to provide heat control and the auxiliary current output to provide cool control. To enable this: • AUX OUT in the Options Set Up group must be selected for Output. • The Auxiliary Current Output is scaled as desired for 0-50 % controller output. • Deadband for this configuration only applies to the Current Output. The Auxiliary Output must have the Deadband scaled in. For example: If a 2 % Deadband is desired, then enter 2.0 for the Deadband selection in the Control Algorithm group. This will apply Deadband to the Current Output. In the Options group, set the Auxiliary Output LOW VAL selection to 49.0 and the HIGH VAL selection to 0.0.
	100 Percent	Current Duplex Range (FULL) enables the Current Output to provide both heat and cool functions for control over 0-100 % of the controller output. The PID heat parameters apply when the output is greater than 50 % and the PID cool parameters apply when the output is less than 50 %. The second current output is not required for this type of duplex operation.
Relay State		Digital Output Status at 0 % Output allows the following selections:
	1 Off 2 Off	1 Off 2 Off Output 1 de-energized Output 2 de-energized
	1 On 2 Off	1 On 2 Off Output 1 energized Output 2 de-energized
	1 Off 2 On	1 Off 2 On Output 1 de-energized Output 2 energized
	1 On 2 On	1 On 2 On Output 1 energized Output 2 energized
Relay Type		Relay Cycle Time Increment selection is used only for Time Simplex and Duplex output configurations. This configuration sets the increment size of the relay cycle

Function Prompt	Selections or Range of Setting	Parameter Definition
		times in the Tuning and Tuning 2 Set Up groups.
	Electromechanical	Electromechanical Relay —Cycle time in one-second increments.
Current Output		Current Output – If Current Output #1 is not used to perform one of the above output algorithms, it may be used to perform an Auxiliary Output function.
	Disable	Disable
	Input 1	Input 1
	Input 2	Input 2
	PV	Process Variable
	Deviation	Deviation
	Output	Output
	SP	Setpoint
	Local SP 1	Local Setpoint 1
	Local SP 2	Local Setpoint 2
	Local SP 3	Local Setpoint 3
	Local SP 4	Local Setpoint 4
	Remote SP	Remote Setpoint
	Input Algorithm 1	Input Algorithm 1
CO Low Value	Low Scale Value within the range of the selected variable to represent the minimun output (0 or 4 mA)	Current Output Low Scaling Factor —Used only when CUR OUT is any selection other than DISABLE. This is a value in engineering units used to represent all CUR OUT parameters except Output. For Output, this is a value in percent and can be any value between –5 % and +105 %. However, keep in mind that relay output types can only be scaled 0 % to 100 %.
CO High Value	High Scale Value within the range of the selected variable to	Current Output High Scaling Factor —Used only when CUR OUT is any selection other than DISABLE. This is a value in engineering units used to represent all CUR OUT parameters except Output.

Function Prompt	Selections or Range of Setting	Parameter Definition
	represent the maximum output (20 mA)	For Output, this is a value in percent and can be any value between –5 % and +105 %. However, keep in mind that relay output types can only be scaled 0 % to 100 %.
CO Range	4-20mA 0-20mA	Current Output Range allows the user to easily select 4-20 mA output or 0-20 mA output operation without the need for recalibration of the instrument. **ATTENTION:** Changing the Current Output Range will result in the loss of Field Calibration values and will restore Factory Calibration values.

Input 1 Set Up Group

Introduction

This data deals with various parameters required to configure Input 1.

Function Prompts

Table 4-10: INPUT 1 Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Input 1 Type		**Input 1 Actuation Type** – This selection determines what actuation you are going to use for Input 1. See "Minimum and Maximum Range Values" on page 217 for more information. **ATTENTION:** Changing the input type will result in the loss of Field Calibration values and will restore Factory Calibration values.
	Disable	Disables Input

Function Prompt	Selections or Range of Setting	Parameter Definition
	TC B	B Thermocouple
	TC E High	E Thermocouple High
	TC E Low	E Thermocouple Low
	TC J High	J Thermocouple High
	TC J Mid	J Thermocouple Med
	TC J Low	J Thermocouple Low
	TC K High	K Thermocouple High
	TC K Mid	K Thermocouple Med
	TC K Low	K Thermocouple Low
	TC M High	M Thermocouple High (Ni-Ni-Moly)
	TC M Low	M Thermocouple Low (Ni-Ni-Moly)
	TC N High	N Thermocouple High (Nicrosil-Nisil)
	TC N Low	N Thermocouple Low (Nicrosil-Nisil)
	TC R	R Thermocouple
	TC S	S Thermocouple
	TC T High	T Thermocouple High
	TC T Low	T Thermocouple Low
	TC C High	C Thermocouple High (W5W26)
	TC C Low	C Thermocouple Low (W5W26)
	TC PR40-PR20	PR40-PR20 Thermocouple
	RTD Pt100	100 Ohm RTD High
	RTD Pt100 Low	100 Ohm RTD Low
	RTD Pt200	200 Ohm RTD
	RTD Pt500	500 Ohm RTD
	0-20mA	0 to 20 Milliamperes
	4-20mA	4 to 20 Milliamperes

Function Prompt	Selections or Range of Setting	Parameter Definition
	0-10mV	0 to 10 Millivolts
	0-50mV	0 to 50 Millivolts
	0-100mV	0 to 100 Millivolts
	0-5 V	0 to 5 Volts
	1-5 V	1 to 5 Volts
	0-10 V	0 to 10 Volts
	TC Differential	Thermocouple Differential
	Carbon	Carbon Probe Input
	Oxygen	Oxygen Probe Input
Input 1 Transmitter	TC B TC E High TC E Low TC J High TC J Mid TC J Low TC K High TC K Mid TC K Low TC M High TC M Low TC N High TC N Low TC R TC S TC T High	**Transmitter Characterization** —This selection lets you instruct the controller to characterize a linear input to represent a non-linear one. If characterization is performed by the transmitter itself, then select Linear. **ATTENTION:** Prompt only appears when a linear actuation is selected at prompt Input 1 Type. FOR EXAMPLE: If input 1 is a 4 to 20 mA signal, but the signal represents a type K H thermocouple, then configure K TC H and the controller will characterize the 4 to 20 mA signal so that it is treated as a type K thermocouple input (high range). Parameter definitions are the same as in Input 1 Type.

Function Prompt	Selections or Range of Setting	Parameter Definition
	TC T Low TC W High TC W Low TC PR40-PR20 RTD Pt100 RTD Pt100 Low RTD Pt200 RTD Pt500 Linear Square Root	
Input 1 High Value	–999. To 9999. Floating (in engineering units)	Input 1 High Range Value in engineering units is displayed for all inputs but can only be configured for linear or square root transmitter characterization. Scale the #1 input signal to the display value you want for 100 %. FOR EXAMPLE: Process Variable = Flow Range of Flow = 0 to 250 Liters/Minute Actuation (Input 1) = 4 to 20 mA Characterization (XMITTER) = LINEAR Set IN1 HI display value to 250 Set IN1 LO display value to 0 Then 20 mA = 250 Liters/Minute and 4 mA = 0 Liters/Minute **ATTENTION:** The control setpoint will be limited by the range of units selected here.
Input 1 Low Value	–999. To 9999. Floating (in engineering units)	Input 1 Low Range Value in engineering units is displayed for all inputs but can only be configured for linear or square root transmitter characterization. Scale the #1 input signal to

Function Prompt	Selections or Range of Setting	Parameter Definition
		the display value you want for 0 %. See example above. **ATTENTION:** The control setpoint will be limited by the range of units selected here.
Input 1 Ratio	–20.00 to 20.00 Floats to 3 decimal places	Ratio on Input 1 —Select the Ratio value you want on Input 1.
Input 1 Bias	–999. to 9999. (in engineering units)	Bias on Input 1 — Bias is used to compensate the input for drift of an input value due to deterioration of a sensor, or some other cause. Select the bias value you want on Input 1.
Input 1 Filter	0 to 120 seconds No filter = 0	Filter for Input 1 —A software digital filter is provided for Input 1 to smooth the input signal. You can configure the first order lag time constant from 1 to 120 seconds. If you do not want filtering, enter 0.
Input 1 Burnout		**Burnout Protection (Sensor Break)** provides most input types with upscale or downscale protection if the input fails.
	NO Burnout	Pre-configured Failsafe output (selected in the CONTROL Set up Group) applied if failed input is detected (does not apply for an input out of range). Diagnostic message IN1 FAIL is intermittently flashed on the lower display.
	Upscale Burnout	It will force the Input 1 signal to the full scale value when the sensor fails. Diagnostic message IN1 FAIL intermittently flashed on the lower display. The controller remains in Automatic control mode and adjusts the controller output signal in response to the full scale Input 1 signal developed by the Burnout circuitry.
	Downscale Burnout	It will force the Input 1 signal to the lower range value when the sensor fails. Diagnostic message

Function Prompt	Selections or Range of Setting	Parameter Definition
		IN1 FAIL intermittently flashed on the lower display. The controller remains in Automatic control mode and adjusts the controller output signal in response to the lower range Input 1 signal developed by the Burnout circuitry.
	No Failsafe	This selection does not provide input failure detection and should only be used when a thermocouple input is connected to another instrument which supplies the Burnout current. (For this selection, no burnout signal is sent to the sensor.) **ATTENTION:** For Burnout to function properly on a 0-20 mA input type (or a 0-5V type that uses a dropping resistor), the dropping resistor must be remotely located (across the transmitter terminals). Otherwise, the input at the instrument terminals will always be 0 mA (i.e., within the normal operating range) when the 0-20 mA line is opened. **ATTENTION:** The Thermocouple Health feature is disabled when No Failsafe is configured.

Input 2 Set Up Group

Introduction

This data deals with various parameters required to configure Input 2.

Function Prompts

Table 4-11: Input 2 Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Input 2 Type		**Input 2 Actuation Type** – This selection determines what actuation you are going to use for Input 2. **ATTENTION:** Changing the input type will result in the loss of Field Calibration values and will restore Factory Calibration values.
	Disable	Disables Input
	TC B	B Thermocouple
	TC E High	E Thermocouple High
	TC E Low	E Thermocouple Low
	TC J High	J Thermocouple High
	TC J Mid	J Thermocouple Med
	TC J Low	J Thermocouple Low
	TC K High	K Thermocouple High
	TC K Mid	K Thermocouple Med
	TC K Low	K Thermocouple Low
	TC M High	M Thermocouple High (Ni-Ni-Moly)
	TC M Low	M Thermocouple Low (Ni-Ni-Moly)
	TC N High	N Thermocouple High (Nicrosil-Nisil)

Function Prompt	Selections or Range of Setting	Parameter Definition
	TC N Low	N Thermocouple Low (Nicrosil-Nisil)
	TC R	R Thermocouple
	TC S	S Thermocouple
	TC T High	T Thermocouple High
	TC T Low	T Thermocouple Low
	TC W High	W5W26 Thermocouple High
	TC W Low	W5W26 Thermocouple Low
	TC PR40-PR20	PR40-PR20 Thermocouple
	RTD Pt100	100 Ohm RTD High
	RTD Pt100 Low	100 Ohm RTD Low
	RTD Pt200	200 Ohm RTD
	RTD Pt500	500 Ohm RTD
	0-20mA	0 to 20 Milliamperes
	4-20mA	4 to 20 Milliamperes
	0-10mV	0 to 10 Millivolts
	0-50mV	0 to 50 Millivolts
	0-100mV	0 to 100 Millivolts
	0-5 V	0 to 5 Volts
	1-5 V	1 to 5 Volts
	0-10 V	0 to 10 Volts
	TC Differential	Thermocouple Differential
Input 2 Transmitter	TC B TC E High TC E Low TC J High TC J Mid	**Transmitter Characterization** —This selection lets you instruct the controller to characterize a linear input to represent a non-linear one. If characterization is performed by the transmitter itself, then select Linear. **ATTENTION:** Prompt only appears when a linear actuation is selected at prompt Input 2 Type.

Function Prompt	Selections or Range of Setting	Parameter Definition
	TC J Low TC K High TC K Mid TC K Low TC M High TC M Low TC N High TC N Low TC R TC S TC T High TC T Low TC W High TC W Low TC PR40-PR20 RTD Pt100 RTD Pt100 Low RTD Pt200 RTD Pt500 Linear Square Root	FOR EXAMPLE: If input 2 is a 4 to 20 mA signal, but the signal represents a type K H thermocouple, then configure K TC H and the controller will characterize the 4 to 20 mA signal so that it is treated as a type K thermocouple input (high range). Parameter definitions are the same as in Input 2 Type.
Input 2 High Value	–999. To 9999. Floating (in engineering units)	**Input 2 High Range Value** in engineering units is displayed for all inputs but can only be configured for linear or square root transmitter characterization. See the example in Input 1 High.

Function Prompt	Selections or Range of Setting	Parameter Definition
Input 2 Low Value	–999. To 9999. Floating (in engineering units)	**Input 2 Low Range Value** in engineering units is displayed for all inputs but can only be configured for linear or square root transmitter characterization. See the example in Input 1 High.
Input 2 Ratio	–20.00 to 20.00 Floats to 3 decimal places	**Ratio on Input 2** —Select the Ratio value you want on Input 2.
Input 2 Bias	–999. to 9999. (in engineering units)	**Bias on Input 2** — Bias is used to compensate the input for drift of an input value due to deterioration of a sensor, or some other cause. Select the bias value you want on Input 2.
Input 2 Filter	0 to 120 seconds No filter = 0	**Filter for Input 2** —A software digital filter is provided for Input 1 to smooth the input signal. You can configure the first order lag time constant from 1 to 120 seconds. If you do not want filtering, enter 0.
Input 2 Burnout		**Burnout Protection (Sensor Break)** provides most input types with upscale or downscale protection if the input fails.
	No Burnout	If Input 2 is being used in the Control Algorithm (such as the PV or RSP input parameter), then the pre-configured Failsafe output (selected in the Control set up group) is applied when a failed input is detected (does not apply for an input out of range). Diagnostic message IN2 FAIL is intermittently flashed on the lower display.
	Upscale Burnout	It will force the Input 2 signal to the full scale value when the sensor fails. Diagnostic message IN2 FAIL intermittently flashed on the lower display. The controller remains in Automatic control mode and adjusts the controller output signal in response to the full scale Input 2 signal developed by the Burnout circuitry.
	Downscale Burnout	It will force the Input 2 signal to the lower range value when the sensor fails. Diagnostic message IN2 FAIL intermittently flashed on the lower display.

Function Prompt	Selections or Range of Setting	Parameter Definition
		The controller remains in Automatic control mode and adjusts the controller output signal in response to the lower range Input 2 signal developed by the Burnout circuitry.
	No Failsafe	This selection does not provide input failure detection and should only be used when a thermocouple input is connected to another instrument which supplies the Burnout current. (For this selection, no burnout signal is sent to the sensor.) **ATTENTION:** For Burnout to function properly on a 0-20 mA input type (or a 0-5V type that uses a dropping resistor), the dropping resistor must be remotely located (across the transmitter terminals). Otherwise, the input at the instrument terminals will always be 0 mA (i.e., within the normal operating range) when the 0-20 mA line is opened. **ATTENTION:** The Thermocouple Health feature is disabled when NO FS is configured.

Control Set Up Group

Introduction

The functions listed in this group deal with how the controller will control the process including: Number of Tuning Parameter Sets, Setpoint Source, Tracking, Power-up Recall, Setpoint Limits, Output Direction and Limits, Deadband, and Hysteresis.

Function Prompts

Table 4-12: CONTROL Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
PV Source		**Process Variable Source** - Selects the source of the Process Variable.
	Input 1	Input 1
	Input 2	Input 2
	Input Algorithm 1	Input Algorithm 1
PID Sets		**Number of Tuning Parameter Sets**- This selection lets you choose one or two sets of tuning constants (gain, rate, and reset). **NOTE:** The Tuning Group is automatically configured to have two PID sets when a Duplex Control Algorithm is configured.
	1 Set	**One Set Only**- Only one set of tuning parameters is available. Configure the values for: Gain 1 or Proportional Band 1, Rate 1 Min, Reset Mins/Rpt 1 or Reset Rpts/Min 1
	2 Sets Keyboard	**Two Sets Keyboard Selectable**- Two sets of tuning parameters can be configured and can be selected at the operator interface or by using the Digital Inputs.

Function Prompt	Selections or Range of Setting	Parameter Definition
		Press the Lower Display key until you see PID Set1 or PID Set2, then press Increment key or Decrement key to switch between sets. Configure the values for: Gain 1 or Proportional Band 1, Rate 1 Min, Reset Mins/Rpt 1 or Reset Rpts/Min 1 Gain 2 or Proportional Band 2, Rate 2 Min, Reset Mins/Rpt 2 or Reset Rpts/Min 2
	2 Sets PV Switchover	**Two Sets PV Automatic Switchover** - When the process variable is **LESS** than the value set at prompt Switchover Value, the controller will use Gain 1 or Proportional Band 1, Rate 1 Min, and Reset Mins/Rpt 1 or Reset Rpts/Min 1. The active PID Set can be read in the lower display. When the process variable is **GREATER** than the value set at prompt Switchover Value, the controller will use Gain 2 or Proportional Band 2, Rate 2 Min, and Reset Mins/Rpt 2 or Reset Rpts/Min 2. The active PID SET can be read in the lower display. **ATTENTION:** Other prompts affected: Switchover Value 1/2
	2 Sets SP Switchover	**Two Sets SP Automatic Switchover**- When the setpoint is **LESS** than the value set at prompt Switchover Value, the controller will use Gain 1 or Proportional Band 1, Rate 1 Min, and Reset Mins/Rpt 1 or Reset Rpts/Min 1. When the setpoint is **GREATER** than the value set at prompt Switchover Value, the controller will use Gain 2 or Proportional Band 2, Rate 2 Min, and Reset Mins/Rpt 2 or Reset Rpts/Min 2. **ATTENTION:** Other prompts affected: Switchover Value 1/2
	4 Sets Keyboard	**Four Sets Keyboard Selectable**- Two sets of tuning

Function Prompt	Selections or Range of Setting	Parameter Definition
		parameters can be configured and can be selected at the operator interface or by using the Digital Inputs. Press the Lower Display key until you see PID Set1 or PID Set2 or PID Set3 or PID Set4, then press Increment key or Decrement key to switch between sets. Configure the values for: Gain 1 or Proportional Band 1, Rate 1 Min, Reset Mins/Rpt 1 or Reset Rpts/Min 1 Gain 2 or Proportional Band 2, Rate 2 Min, Reset Mins/Rpt 2 or Reset Rpts/Min 2 Gain 3 or Proportional Band 3, Rate 3 Min, Reset Mins/Rpt 3 or Reset Rpts/Min 3 Gain 4 or Proportional Band 4, Rate 4 Min, Reset Mins/Rpt 4 or Reset Rpts/Min 4
	4 Sets PV Switchover	**Four Sets PV Automatic Switchover**- When the process variable is **LESS** than the value set at prompt Switchover Value, the controller will use Gain 1 or Proportional Band 1, Rate 1 Min, and Reset Mins/Rpt 1 or Reset Rpts/Min 1. The active PID Set can be read in the lower display. When the process variable is **GREATER** than the value set at prompt Switchover Value, the controller will use Gain 2 or Proportional Band 2, Rate 2 Min, and Reset Mins/Rpt 2 or Reset Rpts/Min 2. The active PID SET can be read in the lower display. Similarly, the controller switches between the other PID sets based upon the values configured for Switchover Value 2/3 and Switchover Value 3/4. **ATTENTION:** Other prompts affected: Switchover Value 1/2, Switchover Value 2/3 and Switchover Value 3/4.
	4 Sets SP Switchover	**Four Sets SP Automatic Switchover**- When the setpoint is **LESS** than the value set at prompt Switchover Value, the controller will use Gain 1 or Proportional Band 1, Rate 1 Min, and Reset Mins/Rpt 1 or Reset

Function Prompt	Selections or Range of Setting	Parameter Definition
		Rpts/Min 1. When the setpoint is **GREATER** than the value set at prompt SW VALUE, the controller will use Gain 2 or Proportional Band 2, Rate 2 Min, and Reset Mins/Rpt 2 or Reset Rpts/Min 2. Similarly, the controller switches between the other PID sets based upon the values configured for Switchover Value 2/3 and Switchover Value 3/4. **ATTENTION:** Other prompts affected: Switchover Value 1/2, Switchover Value 2/3 and Switchover Value 3/4.
Switchover Value 1/2	Value in engineering units within PV or SP range limits	**Automatic Switchover Value**- This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #1 to Set #2. **ATTENTION:** Only appears when PID Sets is configured for 2 Sets PV Switchover, 2 Sets SP Switchover, 4 Sets PV Switchover, or 4 Sets SP Switchover.
Switchover Value 2/3	Value in engineering units within PV or SP range limits	**Automatic Switchover Value**- This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #2 to Set #3. **ATTENTION:** Only appears when PID Sets is configured for 4 Sets PV Switchover, or 4 Sets SP Switchover.
Switchover Value 3/4	Value in engineering units within PV or SP range limits	**Automatic Switchover Value**- This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #3 to Set #4. **ATTENTION:** Only appears when PID Sets is configured for 4 Sets PV Switchover, or 4 Sets SP Switchover.

Function Prompt	Selections or Range of Setting	Parameter Definition
Local SP Source		**Local Setpoint Source**- This selection determines how many local setpoints are enabled.
	1 Local SP	The setpoint entered from the keyboard.
	2 Local SP	This selection lets you switch between two local setpoints using the Function key under the main screen.
	3 Local SP	This selection lets you switch between three local setpoints using the Function key under the main screen.
	4 Local SP	This selection lets you switch between four local setpoints using the Function key under the main screen.
Remote SP Source		**Remote Setpoint Source**—This selection determines what your remote setpoint source will be when toggled by the SP Select key or Digital Input.
	NONE	No remote setpoint.
	Input 2	Remote Setpoint is Input 2.
	Input Algorithm 1	Remote Setpoint using Input 1 algorithm. **ATTENTION:** To cycle through the available local setpoints and remote setpoint, press and hold in the Function key. When the key is released, the setpoint selection currently displayed will be the new setpoint selection.
Autobias		**Autobias** is used for bumpless transfer when transferring from local setpoint to remote setpoint. Auto Bias calculates and adds a bias to remote setpoint input each time a transfer is made. Only available if no tracking is selected.
	Disable	Disables auto bias.
	Enable	Enables auto bias.
SP Tracking		**Setpoint Tracking**- The local setpoint can be configured to track either PV or RSP as listed below.

Function Prompt	Selections or Range of Setting	Parameter Definition
		Not configurable when Auto Bias is set. **ATTENTION:** For selections other than NONE, LSP is stored in nonvolatile memory only when there is a mode change; i.e., when switching from RSP to LSP or from Manual to Automatic. If power is lost, then the current LSP value is also lost.
	None	**No Tracking**- If local setpoint tracking is not configured, the LSP will not be altered when transfer from RSP to LSP is made.
	PV	Local setpoint tracks the PV when in manual.
	Remote SP	Local setpoint tracks remote setpoint when in automatic. When the controller transfers out of remote setpoint, the last value of the remote setpoint (RSP) is inserted into the local setpoint.
Power Up Mode		**Power Up Controller Mode Recall**- This selection determines which mode and setpoint the controller will use when the controller restarts after a power loss.
	Manual/Local SP	**Manual, Local Setpoint**- At power-up, the controller will use manual mode with the local setpoint displayed.
	Auto/Local SP	**Automatic Mode, Last Local Setpoint**- At power-up, the controller will use automatic mode with the last local setpoint used before power down displayed.
	Auto/Remote SP	**Automatic Mode, Last Remote Setpoint**- At power-up, the controller will use automatic mode with the last remote setpoint used before power down displayed.
	Last Mode/Last SP	**Last Mode/Last Setpoint**- At power-up, the controller will use the last mode with the last setpoint used before power down displayed.
	Last Mode/Local SP	**Last Mode/Last Local Setpoint**- At power-up, the controller will use the last mode with the last local setpoint used before power down displayed.

Function Prompt	Selections or Range of Setting	Parameter Definition
SP High Limit (Note 1)	0 to 100 % of PV span in engineering units	**Setpoint High Limit**- This selection prevents the local and remote setpoints from going above the value selected here. The setting must be equal or less than the upper range of the PV.
SP Low Limit (Note 1)	0 to 100 % of PV span in engineering units	**Setpoint Low Limit**- This selection prevents the local and remote setpoints from going below the value selected here. The setting must be equal or greater than the lower range of the PV.
Action Direction		**Control Output Direction**- Select direct or reverse output action.
	Direct	**Direct Acting Control**- The controller's output increases as the process variable increases.
	Reverse	**Reverse Acting Control**- The controller's output decreases as the process variable increases.
Output Rate		**Output Change Rate**- Enables or disables the Output Change Rate. The maximum rate is set at prompt PCT/M UP or PCT/M DN. Only available for PID-A, PID-B, PD+MR control algorithms.
	Enable	Allows output rate.
	Disable	Disables output rate.
Rate Up % Min	0 to 9999 % per minute	**Output Rate Up Value**- This selection limits the rate at which the output can change upward. Enter a value in percent per minute. Appears only if OUT RATE is enabled. "0" means no output rate applied.
Rate Down % Min	0 to 9999 % per minute	**Output Rate Down Value**- This selection limits the rate at which the output can change downward. Enter a value in percent per minute. Appears only if OUT RATE is enabled. "0" means no output rate.
Output High Limit		**High Output Limit**- This is the highest value of output beyond which you do not want the controller automatic output to exceed.
	0 % to 100 %	For relay output types.
	–5 % to 105 %	For current output types.
Output Low		**Low Output Limit**- This is the lowest value of output

Function Prompt	Selections or Range of Setting	Parameter Definition
Limit		below which you do not want the controller automatic output to exceed.
	0 % to 100 %	For relay output types.
	–5 % to 105 %	For current output types.
Integral High Limit	Within the range of the output limits	**High Reset Limit**- This is the highest value of output beyond which you do not want reset action to occur
Integral Low Limit	Within the range of the output limits	**Low Reset Limit**- This is the lowest value of output beyond which you do not want reset action to occur.
Dropoff	–5 to 105 % of output	**Controller Dropoff Value**- Output value below which the controller output will drop off to the low output limit value set in prompt Output Low Limit.
Deadband		**Deadband** is an adjustable gap between the operating ranges of output 1 and output 2 in which neither output operates (positive value) or both outputs operate (negative value).
	–5.0 to 25.0 %	Time Duplex, Current Duplex, Current Time or Time Current
Output Hysteresis	0.0 to 100.0 % of PV span	**Hysteresis (Output Relay)** is an adjustable overlap of the ON/OFF states of each control output. This is the difference between the value of the process variable at which the control outputs energize and the value at which they de-energize. Only applicable for ON/OFF control.
Failsafe Mode		**Failsafe Mode**
	Non Latching	Controller stays in last mode that was being used (automatic or manual); If unit was in Automatic mode, then the output goes to the failsafe value. (Note 2)
	Latching	Controller goes to manual mode; If unit was in Automatic mode, then the output goes to the failsafe value. (Note 2)
Failsafe Value	0 to 100 %	**Failsafe Output Value**- The value used here will also be

Function Prompt	Selections or Range of Setting	Parameter Definition
		the output level when you have Communications SHED set to failsafe or when No Burnout is configured and Input 1 fails.
Preset Manual Output	0 to 100 %	**Power-up Preset Manual Output**- At power-up, the controller will go to manual and the output to the value set here.
Preset Auto Output	0 to 100 %	**Power-up Preset Automatic Output**- At power-up, the controller will begin its automatic control at the output value set here.
Proportion Unit		**Proportional Band Units**- Select one of the following for the Proportional (P) term of the PID algorithm.
	Proportional Band	It selects units of percent proportional band for the P term of the PID algorithm. Where: PB % =100 % FS / GAIN
	GAIN	It selects the unitless term of gain for the P term of the PID algorithm. Where: GAIN =100 % FS / PB%
Reset Unit		**Reset Units**—Selects units of minutes per repeat or repeats per minute for the I term of the PID algorithm. 20 Repeats per Minute = 0.05 Minutes per Repeat.
	Repeats/Minute	**Repeats per Minute**- The number of times per minute that the proportional action is repeated by reset.
	Minutes/Repeat	**Minutes per Repeat**- The time between each repeat of the proportional action by reset.

NOTE 1: The local setpoint will automatically adjust itself to be within the setpoint limit range. For example, if SP = 1500 and the SP HiLIM is changed to 1200, the new local setpoint will be 1200.

If PV source is one of the Analog Inputs, then the SP High Limit and SP Low Limit values must be between the Input High and Input Low values for the input type configured. If the PV source is an Input Algorithm configured for:

- Carbon Potential; then the SP High Limit and SP Low Limit values must be between 0.000 and 2.000.

Function Prompt	Selections or Range of Setting	Parameter Definition
• Dewpoint; then the SP High Limit and SP Low Limit values must be between -50 and +100. • Oxygen; then the SP High Limit and SP Low Limit values must be between 0 and 40.00. • Weighted Average, Summer, Subtractor, High or Low; then the SP High Limit and SP Low Limit values must be between then configured CALC High and CALC Low values. CALC High and CALC Low can be set anywhere between -999 and 9999. • Math A, Math B, Match C or Match D; then the SP High Limit and SP Low Limit values can be set anywhere between -999 and 9999 and are not limited to the CALC High and CALC Low values. **NOTE 2**: If controller is in Manual mode when a failure occurs, then the output will maintain its value.		

Options Set Up Group

Introduction

The Options group lets you configure the remote mode switch (Digital Inputs) to a specific contact closure response, or configure the Auxiliary Output to be a specific selection with desired scaling.

Function Prompts

Table 4-13: Options Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Auxiliary Output		**ATTENTION:** Prompts for the Auxiliary Output selection appear only if one of the Auxiliary Output boards is installed. This selection provides an mA output representing one of several control parameters. The display for

Function Prompt	Selections or Range of Setting	Parameter Definition
		auxiliary output viewing will be in engineering units for all but output. Output will be displayed in percent. **ATTENTION:** Other prompts affected by these selections: 4mA VAL and 20mA VAL.
	Disable	No Auxiliary Output
	Input 1	Input 1 represents the configured range of input 1. **FOR EXAMPLE**: Type J Thermocouple (0 °F to 1600 °F) 0 °F display = 0 % output 1600 °F display = 100 % output
	Input 2	Input 2 represents the value of the configured range of input 2.
	PV	It represents the value of the Process Variable. PV = Input XxRatioX + BiasX
	Deviation	Deviation (Process Variable Minus Setpoint) represents –100 % to +100 % of the selected PV span in engineering units. Zero deviation will produce a center scale (12 mA or 50 %) output. A negative deviation equal in magnitude to the Auxiliary Output High Scaling Factor will produce a low end output (4 mA or 0 %) output. A positive deviation equal in magnitude to the Auxiliary Output Low Scaling Factor will produce a high end output (20 mA or 100 %). **FOR EXAMPLE**: Input 1 = Type T High Thermocouple PV range = –300 °F to +700 °F PV span = 1000 °F Deviation Range = –1000 °F to +1000 °F Auxiliary Output Low Scale Value = 0.0 Auxiliary Output High Scale Value = 1000

Function Prompt	Selections or Range of Setting	Parameter Definition
		If PV = 500 °F and SP = 650 °F then Deviation Display = –150 °F, which is –7.5% of the Deviation Range , so Auxiliary Output = 50% – 7.5% = 42.5%
	Output	Output represents the displayed controller output in percent (%).
	SP	Setpoint represents the value of the setpoint currently in use (LSP1, LSP2, LSP3, LSP4, RSP or CSP) and is shown in the same units as those used by the PV.
	Local SP 1	Local Setpoint one —Auxiliary output represents Local Setpoint 1 regardless of active setpoint.
	Local SP 2	Local Setpoint two —Auxiliary output represents Local Setpoint 2 regardless of active setpoint.
	Local SP 3	Local Setpoint three —Auxiliary output represents Local Setpoint 3 regardless of active setpoint.
	Local SP 4	Local Setpoint four —Auxiliary output represents Local Setpoint 4 regardless of active setpoint.
	Remote SP	Remote Setpoint represents the configured RSP regardless of the active SetPoint.
	Input Algorithm 1	Input Algorithm 1 Output represents the output from input algorithm 1.
CO Range	4-20mA 0-20mA	Auxiliary Current Output Range — Allows the user to easily select 4-20mA output or 0-20mA output operation without the need for recalibration of the instrument. **ATTENTION:** Changing the Auxiliary Current Output Range will result in the loss of Field Calibration values and will restore Factory Calibration values.
CO Low Value	Low Scale Value within the range	Auxiliary Output Low Scaling Factor — This is a value in engineering units used to represent all Auxiliary Output parameters except Output.

Function Prompt	Selections or Range of Setting	Parameter Definition
	of the selected variable to represent the minimum output (0 or 4 mA)	For Output, this is a value in percent and can be any value between –5 % and +105 %. However, keep in mind that relay output types can only be scaled 0 % to 100 %.
CO High Value	High Scale Value within the range of the selected variable to represent the maximum output (20 mA)	Auxiliary Output High Scaling Factor — This is a value in engineering units used to represent all Auxiliary Output parameters except Output. For Output, this is a value in percent and can be any value between –5 % and +105 %. However, keep in mind that relay output types can only be scaled 0 % to 100 %.
DI 1 Function		Digital Input 1 Selections —All selections are available for Input 1. The controller returns to its original state when contact opens, except when overruled by the keyboard.
	None	No Digital Input Selections
	To Manual	To Manual —Contact closure puts the affected loop into manual mode. Contact open returns controller to former mode.
	To Local SP 1	To Local Setpoint —When a remote setpoint is configured, contact closure puts the controller into local setpoint 1. When contact opens, the controller returns to former operation—local or remote setpoint—unless SP Select key is pressed while digital input is active. If this happens, the controller will stay in the local setpoint mode when contact opens.
	To Local SP 2	To Local Setpoint two —Contact closure puts the controller into local setpoint 2.
	To Local SP 3	To Local Setpoint three —Contact closure puts the controller into local setpoint 3.
	To Local SP 4	To Local Setpoint four —Contact closure puts the controller into local setpoint 4.

Function Prompt	Selections or Range of Setting	Parameter Definition
	To Direct Action	To Direct Action —Contact closure selects direct controller action.
	To Hold	To Hold —Contact closure suspends Setpoint Program or Setpoint Ramp. When contact reopens, the controller starts from the Hold point of the Ramp/Program unless the Ramp/Program was not previously started via the Run/Hold (Setup key and Increment key). This selection applies to either loop.
	To PID Set 2	To PID2 —Contact closure selects PID Set 2.
	To PID Set 3	To PID2 —Contact closure selects PID Set 3.
	To PID Set 4	To PID2 —Contact closure selects PID Set 4.
	PV Source Input 2	PV=INPUT 2 —Contact closure selects PV = Input 2.
	Rerun	Rerun allows the Setpoint Programmer to be reset to the initial segment of its current cycle, unit stays in previous mode.
	To Run	Run —Contact closure starts a stopped SP Ramp or Program. Upper left character blinks “Run”. Reopening the contact puts controller in HOLD mode. This selection applies to either loop.
	To Begin	External SP Program Reset —Contact closure resets SP Program back to the beginning of the first segment in the program and places the program in the HOLD mode. Program cycle number is not affected. Reopening switch has no effect. This selection applies to either loop. **ATTENTION:** Once the last segment of the setpoint program has timed out, the controller enters the mode of action specified in the configuration data and the program cannot be reset to the beginning of the first segment by digital input closure.

Function Prompt	Selections or Range of Setting	Parameter Definition
	Inhibit Integral	Inhibit Integral (Reset) —Contact closure disables PID Integral (Reset) action.
	Manual Failsafe	Manual Failsafe Output —Controller goes to Manual mode, output goes to the Failsafe value. **ATTENTION:** This will cause a bump in the output when switching from Automatic to Manual. The switch back from Manual to Automatic is bumpless. When the switch is closed, the output can be adjusted from the keyboard.
	Keyboard Lockout	Keyboard Lockout —Contact closure disables all keys. Lower display shows LOCKED if a key is pressed.
	To Preset Auto Output	Automatic Output —Contact closure sends output to the value set at Control prompt AUTO OUT when the controller is in the Automatic mode. Reopening the contact returns the controller to the normal output.
	Start Timer	Start Timer —Contact closure starts timer, if enabled. Reopening the switch has no effect.
	To Auto/Man Station	To Auto/Manual Station —Contact closure causes the control loop to perform as follows: PV = Input 2 Action = Direct Control algorithm = PD+MR PID SET = 2 SP = LSP 2
	To Tune	Initiate Limit Cycle Tuning —Contact closure starts the tuning process. The lower display shows TUNE ON . Opening the contact has no effect.
	SP Initialization	Setpoint Initialization —Contact closure forces the setpoint to the current PV value. Opening the contact has no effect.

Function Prompt	Selections or Range of Setting	Parameter Definition
	Output Track Input 2	Output Track Input 2 —Contact closure allows Output to track Input 2. While the switch is open, the output is in accordance with its pre-defined functionality. When the switch is closed, the output value (in percent) will track the Input 2 percent of range value. When the switch is reopened, the output will start at this last output value and normal PID action will then take over control. The transfer is bumpless.
	To Remote SP	To Remote Setpoint —Contact closure selects the Remote setpoint.
	Reset Feedback	External Reset Feedback —Contact closure allows Input 2 to override the internal reset value.
	To Purge	To Purge —Contact closure forces the loop to Manual mode with the output set to the Output High Limit configuration. MAN lights and the Output value is shown on the lower display. Opening the switch has no effect.
	Low Fire	Low Fire —Contact closure forces the loop to Manual mode with the output set to the Output Low Limit configuration. MAN lights and the Output value is shown on the lower display. Opening the switch has no effect.
	Manual Latching	Manual Latching —Contact closure transition forces the loop to Manual mode. Opening the switch has no effect. If the MAN/AUTO key is pressed while the switch is closed, the loop will return to Automatic mode.
	PV Hold	Process Variable Hold —when the switch is closed, PV is frozen at last value. When switch opens, PV resumes.
DI 1 Combination		Digital Input 1 Combination Selection —Allows the specified function to occur in addition to the one chosen for DIG IN 1.
	Disable	Disables combination function.

Function Prompt	Selections or Range of Setting	Parameter Definition
	+PID Sets 2	Plus PID2 —Contact closure selects PID Set 2.
	+To Direct Action	Plus Direct Action —Contact closure selects direct controller action.
	+To Local SP 2	Plus Setpoint 2 —Contact closure puts the controller into setpoint 2.
	+Disable Tune	Plus Disable Adaptive Tune —Contact closure disables Accutune process.
	+To Local SP 1	Plus Setpoint 1 —Contact closure puts the controller into setpoint 1.
	+To Run	Plus Run Setpoint Program/Ramp —Contact closure starts SP Program/Ramp if enabled.
	+To Local SP 3	Plus Setpoint 3 —Contact closure puts the controller into setpoint 3.
	+To Local SP 4	Plus Setpoint 4 —Contact closure puts the controller into setpoint 4.
DI 2 Function	Same selections as for Digital Input 1	Digital Input 2 Selections
DI 2 Combination	Same selections as Digital Input 1 Combinations	Digital Input 2 Combinations

Communications Group

Introduction

The Communications group lets you configure the controller to be connected to a host computer via Modbus® or Ethernet TCP/IP protocol.

A controller with a communications option looks for messages from the host computer. If these messages are not received within the configured shed time, the controller will SHED from the communications link and return to stand-alone operation. You can also set the SHED output mode and setpoint recall, and communication units.

Up to 99 addresses can be configured over this link. The number of units that can be configured depends on the link length, with 31 being the maximum for short link lengths and 15 drops being the maximum at the maximum link length.

Function Prompts

Table 4-14: Communications Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Bluetooth Function	Disable Enable	Disables/enables the Bluetooth function.
Bluetooth ID	UXXXXXXXX	Read only. It is an ID that is assigned to a controller that is to be used with the communications option.
Bluetooth Mac Address	XX:XX:XX:XX:XX:XX	Read only.
Communication Type		Communication type selection - enables the RS485 or Ethernet communication port.
	Disable	Disable —Disables communications option.
	Modbus	Modbus —Enables RS485 Modbus RTU communication port.

<table>
<tr><th>Function Prompt</th><th>Selections or Range of Setting</th><th>Parameter Definition</th></tr>
<tr><td></td><td>Ethernet</td><td>Ethernet —Enables Ethernet communication port.</td></tr>
<tr><td>Modbus Address</td><td>1 to 99</td><td>Communications station address —This is a number that is assigned to a controller that is to be used with the communications option. This number will be its address.</td></tr>
<tr><td rowspan="5">Baud Rate</td><td></td><td>Baud Rate is the transmission speed in bits per second. This value is used for RS-485.</td></tr>
<tr><td>4800</td><td>4800 BAUD</td></tr>
<tr><td>9600</td><td>9600 BAUD</td></tr>
<tr><td>19200</td><td>19200 BAUD</td></tr>
<tr><td>38400</td><td>38400 BAUD</td></tr>
<tr><td>Response Delay</td><td>1 to 500 milliseconds</td><td>Response Delay —Configurable response-delay timer allows you to force the instrument to delay its response for a time period of from 1 to 500 milliseconds compatible with the host system hardware/software.</td></tr>
<tr><td rowspan="5">Word Order for Float</td><td rowspan="2"></td><td>Defines word/byte order of floating point data for communications. Byte values:
<table><tr><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>seeeeeee</td><td>emmmmmmm</td><td>mmmmmmmm</td><td>mmmmmmmm</td></tr></table>Where:
s = sign, e = exponent, m = mantissa bit</td></tr>
<tr><td>FP_B</td><td><table><tr><td>0</td><td>1</td><td>2</td><td>3</td></tr></table></td></tr>
<tr><td>FP_BB</td><td><table><tr><td>1</td><td>0</td><td>3</td><td>2</td></tr></table></td></tr>
<tr><td>FP_L</td><td><table><tr><td>3</td><td>2</td><td>1</td><td>0</td></tr></table></td></tr>
<tr><td>FP_LB</td><td><table><tr><td>2</td><td>3</td><td>0</td><td>1</td></tr></table></td></tr>
<tr><td>Ethernet Address</td><td>0.0.0.0 to 255.255.255.255</td><td>Ethernet address, ranging from 0.0.0.0 to 255.255.255.255. It only applies to Ethernet communication port.</td></tr>
</table>

Function Prompt	Selections or Range of Setting	Parameter Definition
		The default value is 10.0.0.2.
Subnet Mask Address	0.0.0.0 to 255.255.255.255	Subnet Mask address, ranging from 0.0.0.0 to 255.255.255.255. It only applies to Ethernet communication port. The default value is 255.255.255.255.
Default Gateway	0.0.0.0 to 255.255.255.255	Default Gateway, ranging from 0.0.0.0 to 255.255.255.255. It only applies to Ethernet communication port. The default value is 0.0.0.0.
Shed Function	Disable Enable	Disables/enables shed functionality.
Shed Time	0 to 255	Shed Time —The number that represents how many sample periods there will be before the controller sheds from communications. Each period equals 1/3 seconds; 0 equals No shed. **NOTE:** Shed Time is not configurable if Communication Type is set to Modbus, and Shed Function is set to Disable.
Shed Mode		Shed Controller Mode and Output Level — Determines the mode of local control you want when the controller is shed from the communications link.
	Last Mode	Same Mode and Output—The controller will return to the same mode (manual or automatic) at the same output level that it had before shed.
	To Manual	Manual Mode, same Output—The controller will return to manual mode at the same output level that it had before shed.
	Failsafe	Manual Mode, Failsafe Output—The controller will return to manual mode at the output value selected at Control prompt Failsafe.
	To Auto	Automatic Mode, Last SP—The controller will return

Function Prompt	Selections or Range of Setting	Parameter Definition
		to the automatic mode and the last setpoint used before shed.
Shed SP Recall		Shed Setpoint Recall **NOTE:** It is not configurable if Shed Function is set as Disable.
	To Local SP	Controller will use last local or remote setpoint used.
	To Computer SP	When in “slave” mode, the controller will store the last host computer setpoint and use it at the Local setpoint. When in “monitor” mode, the controller will shed to the last instrument Local or Remote setpoint used, and the LSP is unchanged.
Computer SP Unit		Computer Setpoint Units
	Engineering Unit	Engineering units
	Percent	Percent of PV range
Computer SP Ratio	–20.0 to 20.0	Computer setpoint ratio.
Computer SP Bias	–999. to 9999. (engineering units)	Computer setpoint bias in Engineering Units.
Local Loopback		Local Loopback tests the RS-485 communications port. It is not used for any other communications port.
	Disable	Disables the Loopback test.
	Enable	Allows loopback test. The instrument goes into Loopback mode in which it sends and receives its own message. The instrument displays PASS or FAIL status in the upper display and LOOPBACK in the lower display while the test is running. The instrument will go into manual mode when LOOPBACK is enabled with the output at the Failsafe value. The test will run until the operator disables it

Function Prompt	Selections or Range of Setting	Parameter Definition
		here, or until power is turned off and on. **ATTENTION:** The instrument does not have to be connected to the external communications link in order to perform this test. If it is connected, only one instrument should run the loopback test at a time. The host computer should not be transmitting on the link while the loopback test is active.

Alarms Set Up Group

Introduction

An alarm is an indication that an event that you have configured (for example—Process Variable) has exceeded one or more alarm limits. There are two alarms available. Each alarm has two setpoints. You can configure each of these two setpoints to alarm on various controller parameters.

There are two alarm output selections, High and Low. You can configure each setpoint to alarm either High or Low. These are called single alarms.

You can also configure the two setpoints to alarm on the same event and to alarm both high and low. A single adjustable Hysteresis of 0 % to 100 % is configurable for the alarm setpoint.

See the table Alarm Relay Contact Information for Alarm relay contact information.

The prompts for the Alarm Outputs appear whether or not the alarm relays are physically present. This allows the Alarm status to be shown on the display and/or sent via communications to a host computer.

Function Prompts

Table 4-15: ALARMS Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
A1S1 Type		Alarm 1 Setpoint 1 Type —Select what you want Setpoint 1 of Alarm 1 to represent. It can represent the Process Variable, Deviation, Input 1, Input 2, Output, and if you have a model with communications, you can configure the controller to alarm on SHED. If you have setpoint programming, you can alarm when a segment goes ON or OFF.
	• None • Input 1 • Input 2 • PV • Deviation • Output • SHED • Event On • Event Off • Manual • Remote SP • Failsafe • PV Rate of Change • DI 1 Actuated • DI 2 Actuated • Loop Break • TC Warning • TC Failed • PV Hold	• No Alarm • Input 1 • Input 2 • Process Variable • Deviation (NOTE 1) • Output • Shed from Communications • Event On (SP Programming) (NOTE 7) • Event Off (SP Programming) (NOTE 7) • Alarm On Manual Mode (NOTE 2) • Remote Setpoint (NOTE 6) • Failsafe • PV Rate of Change • Digital Input 1 Actuated • Digital Input 2 Actuated • Loop Break (NOTE 3) • Thermocouple Warning (NOTE 4) • Thermocouple Fail (NOTE 5) • PV Hold

Function Prompt	Selections or Range of Setting	Parameter Definition
Note 1: This Deviation Alarm is based upon deviation from whichever SP is active. **Note 2**: Alarm 1 is not available if the Timer is enabled because Alarm 1 is dedicated to Timer output. **Note 3**: Loop Break monitors the control loop to determine if it is working. When enabled, the control output is checked against the minimum and maximum output limit settings. When the output reaches one of these limits, a timer begins. If the timer expires and the output has not caused the PV to move by a pre-determined amount, then the alarm activates, thus signalling that the loop is broken. The loop break timer value must be configured by the operator as the AxSx VAL entry. This value is in seconds with a range of 0 to 3600 seconds. A setting of 0 is equivalent to an instantaneous loop break when the output reaches one of its limit values. The amount of PV Movement required is determined by the “UNITS” setting in the Display Setup Group. For the Degrees F configuration, the PV must move by 3 º in the desired direction in the time allowed. For the Degrees C configuration, the PV must move by 2 º in the desired direction in the time allowed. For the “NONE” selection, the PV must move 1% of the PV range in the time allowed. Loop Break alarms do not have a HIGH/LOW State configuration, they are always assumed to be a HIGH state alarm. **Note 4**: Thermocouple Warning means that the instrument has detected that the Thermocouple Input is starting to fail. Not valid for other input types. **Note 5**: Thermocouple Failing means that the instrument has detected that the Thermocouple Input is in imminent danger of failing. Not valid for other input types. **Note 6**: Alarm is triggered when the current SP is remote setpoint. **Note 7**: **Event On**: Alarm is set to on when the alarm (event) condition is met. **Event Off**: Alarm is set as off when the alarm (event) condition is met. **NOTE:** The alarm will not be reset after the event is finished.		
A1S1 Value	Value in engineering units	Alarm 1 Setpoint 1 Value —This is the value at which you want the alarm type chosen in prompt A1S1 Type to actuate. The value depends on what the setpoint has been configured to represent. No setpoint is

Function Prompt	Selections or Range of Setting	Parameter Definition
		required for alarms configured for Communications SHED. For SP Programming the value is displayed as PxSy for which the event applies. PxSy = Program x, Segment y. This prompt does not appear for “Alarm on Manual” type alarm. For example: A1S1 Type = Manual.
A1S1 State		If Setpoint Programming is disabled or if the Alarm Type is not configured for Event On/Off: Alarm 1 Setpoint 1 State —Select whether you want the alarm type chosen in prompt A1S1 Type to alarm High or Low.
	High Alarm	High Alarm
	Low Alarm	Low Alarm
A1S1 Event		If Setpoint Programming is enabled and if the Alarm Type is configured for Event On/Off: Alarm 1 Segment Event 1 —Select whether you want the alarm type chosen in prompt A1S1 Type to alarm the beginning or end of a segment in setpoint Ramp/Soak programming.
	Begin of Segment	Begin of Segment
	End of Segment	End of Segment **ATTENTION:** Alarms configured for events will not operate on Setpoint Program segments of zero length.
A1S1 Delay	0~30	Configurable alarm trigger delay time allows you to force the trigger time of an alarm to delay for a time period of from 0 to 30 seconds in an alarm condition.

Function Prompt	Selections or Range of Setting	Parameter Definition
A1S1 Hysteresis	0.0 to 100.0 % of span or full output as appropriate	Alarm Hysteresis for Alarm 1—An adjustable hysteresis is provided such that when Alarm 1 is OFF it activates at exactly the alarm setpoint; when Alarm 1 is ON, it will not deactivate until the variable is 0.0 % to 100 % away from the alarm setpoint. Configure the hysteresis of the alarms based on Input signals as a % of input range span. Configure the hysteresis of the alarm based on Output signals as a % of the full scale output range.
A1S2 Type	Same as A1S1 Type	Alarm 1 Setpoint 2 Type —Select what you want Setpoint 2 of Alarm 1 to represent. The selections are the same as A1S1 Type.
A1S2 Value	Value in engineering units	Alarm 1 Setpoint 2 Value —This is the value at which you want the alarm type chosen in prompt A1S2 Type to actuate. The details are the same as A1S1 Value.
A1S2 State	High Alarm Low Alarm	Alarm 1 Setpoint 2 State —Same as A1S1 State.
A1S2 Event	Begin of Segment End of Segment	Alarm 1 Segment Event 2 —Same as A1S1 Event.
A1S2 Delay	0~30	Configurable alarm trigger delay time allows you to force the trigger time of an alarm to delay for a time period of from 0 to 30 seconds in an alarm condition.
A1S2 Hysteresis	0.0 to 100.0 % of span or full output as appropriate	Alarm Hysteresis for Alarm 1—An adjustable hysteresis is provided such that when Alarm 1 is OFF it activates at exactly the alarm setpoint; when Alarm 1 is ON, it will not deactivate until the variable is 0.0 % to 100 % away from the alarm setpoint. Configure the hysteresis of the alarms based

Function Prompt	Selections or Range of Setting	Parameter Definition
		on Input signals as a % of input range span. Configure the hysteresis of the alarm based on Output signals as a % of the full scale output range.
A2S1 Type	Same as A1S1 Type	Alarm 2 Setpoint 1 Type —Select what you want Setpoint 1 of Alarm 2 to represent. The selections are the same as A1S1 Type. **ATTENTION:** Not available with Relay Duplex output type unless using Dual Relay PWA.
A2S1 Value	Value in engineering units	Alarm 2 Setpoint 1 Value —This is the value at which you want the alarm type chosen in prompt A2S1 Type to actuate. The details are the same as A1S1 Value.
A2S1 State	High Alarm Low Alarm	Alarm 2 Setpoint 1 State —Same as A1S1 State.
A2S1 Event	Begin of Segment End of Segment	Alarm 2 Segment Event 1 —Same as A1S1 Event.
A2S1 Delay	0~30	Configurable alarm trigger delay time allows you to force the trigger time of an alarm to delay for a time period of from 0 to 30 seconds in an alarm condition.
A2S1 Hysteresis	0.0 to 100.0 % of span or full output as appropriate	Alarm Hysteresis for Alarm 1—An adjustable hysteresis is provided such that when Alarm 1 is OFF it activates at exactly the alarm setpoint; when Alarm 1 is ON, it will not deactivate until the variable is 0.0 % to 100 % away from the alarm setpoint. Configure the hysteresis of the alarms based on Input signals as a % of input range span.

Function Prompt	Selections or Range of Setting	Parameter Definition
		Configure the hysteresis of the alarm based on Output signals as a % of the full scale output range.
A2S2 Type	Same as A1S1 Type	Alarm 2 Setpoint 2 Type —Select what you want Setpoint 2 of Alarm 2 to represent. The selections are the same as A1S1 Type. **ATTENTION:** Not applicable with Relay Duplex output type unless using Dual Relay PWA.
A2S2 Value	Value in engineering units	Alarm 2 Setpoint 2 Value —This is the value at which you want the alarm type chosen in prompt A2S2 Type to actuate. The details are the same as A1S1 Value.
A2S2 State	High Alarm Low Alarm	Alarm 2 Setpoint 2 State —Same as A1S1 State.
A2S2 Event	Begin of Segment End of Segment	Alarm 2 Segment Event 2 —Same as A1S1 Event.
A2S2 Delay	0~30	Configurable alarm trigger delay time allows you to force the trigger time of an alarm to delay for a time period of from 0 to 30 seconds in an alarm condition.
A2S2 Hysteresis	0.0 to 100.0 % of span or full output as appropriate	Alarm Hysteresis —A single adjustable hysteresis is provided on alarms such that when the alarm is OFF it activates at exactly the alarm setpoint; when the alarm is ON, it will not deactivate until the variable is 0.0 % to 100 % away from the alarm setpoint. Configure the hysteresis of the alarms based on INPUT signals as a % of input range span. Configure the hysteresis of the alarm based on OUTPUT signals as a % of the full scale output range.

Function Prompt	Selections or Range of Setting	Parameter Definition
Alarm Output 1		Latching Alarm Output 1 —Alarm output 1 can be configured to be Latching or Non-latching.
	Non Latching	Non-latching
	Latching	Latching **ATTENTION:** When configured for latching, the alarm will stay active after the alarm condition ends until the RUN/HOLD key is pressed.
Alarm Blocking		Alarm Blocking —Prevents nuisance alarms when the controller is first powered up. The alarm is suppressed until the parameter gets to the non-alarm limit or band. Alarm blocking affects both alarm setpoints.
	Disable	Disables blocking
	Alarm 1	Blocks alarm 1 only
	Alarm 2	Blocks alarm 2 only
	Alarm 1 & 2	Blocks both alarms **ATTENTION:** When enabled on power up or initial enabling via configuration, the alarm will not activate unless the parameter being monitored has not been in an alarm condition for a minimum of one control cycle.
AO/CO Diagnostic		Diagnostic —Monitors the Current Output and/or Auxiliary Output for an open circuit condition. If either of these two outputs falls below about 3.5 mA, then an Alarm is activated. This configuration is in addition to whatever was selected for AxSxTYPE.
	Disable	Disables Diagnostic Alarm
	Alarm 1	Alarm 1 is diagnostic alarm

Function Prompt	Selections or Range of Setting	Parameter Definition
	Alarm 2	Alarm 2 is diagnostic alarm
	Disable Warning	Disable Output Fail messages on the middle display

Display Set Up Group

Introduction

This group includes selections for Decimal place, Units of temperature, and Language.

Function Prompts

Table 4-16: Display Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Decimal Digits		Decimal Point Location —This selection determines where the decimal point appears in the main screen display.
	None	No Decimal Place—fixed, no auto-ranging
	One Digit	One Place
	Two Digits	Two Places
	Three Digits	Three Places **ATTENTION:** Auto-ranging will occur for selections of one, two or three decimal places. For example, should the instrument be configured for two decimal places and the PV exceeds 99.99, then the display will change to a single decimal place so that values of 100.0 and above can be shown.

Function Prompt	Selections or Range of Setting	Parameter Definition
Temperature Unit		This selection will affect the indication and operation.
	Deg Fahrenheit	Degrees Fahrenheit – Degrees F Annunciator lighted
	Deg Centigrade	Degrees Centigrade – Degrees C Annunciator lighted
	None	No temperature annunciators lighted. Upper and Lower Displays will show temperature in Degrees Fahrenheit when inputs are configured for Thermocouple or RTD types.
Input 2 Ratio		Input 2 Ratio —This enables the Ratio for Input 2 to be set from the lower display. Input 2 must be installed and enabled for this configuration to operate.
	Disable	Disables setting Ratio 2 from front panel.
	Enable	Allows the Ratio for Input 2 to be set through the keyboard.
Language	English	This selection designates the prompt language, English.
TC Diagnostics		Thermocouple Diagnostics — Enable or disable Thermocouple diagnostic messages on the Lower Display.
	Enable	Enable Diagnostic Messages
	Disable	Disable Diagnostic Messages

Input1 Calib Set Up Group

Introduction

This group appears when **Input 1 Type** of **Input 1** set up group is NOT configured as **Disabled**. See "Input 1 Set Up Group" on page 111 for more information.

Function Prompts

Table 4-17: Input1 Calib Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Calibrate Input 1	Disable	Disable the calibration.
	Begin	To begin the calibration. The following function prompts appear except Cold Junction Temp 1.
Input 1 Zero	It depends on the input type.	Adjust your calibration device to an output signal equal to the 0 % range value for your particular input sensor. See the table Voltage, Milliamp and Resistance Equivalents for Input Range Values for Voltage, Degrees, or Resistance equivalents for 0 % range values.
Input 1 Span	It depends on the input type.	Adjust your calibration device to an output signal equal to the 100 % range value for your particular input sensor. See the table Voltage, Milliamp and Resistance Equivalents for Input Range Values for Voltage, Degrees, or Resistance equivalents for 100 % range values.
Cold Junction Temp 1	The value is in tenths of a degree.	It only appears when the Input 1 Type is configured as TC. It is the current reading of the temperature as measured at the thermocouple terminals and recognized by the controller. You can change this value, if it is in error, using the Increment key or Decrement key.

Input2 Calib Set Up Group

Introduction

This group appears when **Input 2 Type** of **Input 2** set up group is NOT configured as **Disabled** or **Slidewire**. See "Input 2 Set Up Group" on page 117 for more information.

Function Prompts

Table 4-18: Input2 Calib Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Calibrate Input 2	Disable	Disable the calibration.
	Begin	To begin the calibration. The following function prompts appear except Cold Junction Temp 2.
Input 2 Zero	It depends on the input type.	Adjust your calibration device to an output signal equal to the 0 % range value for your particular input sensor. See the table Voltage, Milliamp and Resistance Equivalents for Input Range Values for Voltage, Degrees, or Resistance equivalents for 0 % range values.
Input 2 Span	It depends on the input type.	Adjust your calibration device to an output signal equal to the 100 % range value for your particular input sensor. See the table Voltage, Milliamp and Resistance Equivalents for Input Range Values for Voltage, Degrees, or Resistance equivalents for 100 % range values.
Cold Junction Temp 2	The value is in tenths of a degree.	It only appears when the Input 2 Type is configured as TC. It is the current reading of the temperature as measured at the thermocouple terminals and recognized by the controller. You can change this value, if it is in error, using the Increment key or Decrement key.

Current Calib Set Up Group

Introduction

This group appears when **Output Algorithms** of **Output** set up group is configured as **Current Simplex**, **Current Duplex**, **Current Time**, or **Time Current**. See "Output Set Up Group" on page 107 for more information.

Function Prompts

Table 4-19: Current Calib Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Zero Value	It ranges from 0 to 65535.	The desired 0 % output is read on the milliammeter, use the values shown below depending on the action of your controller. Normally, this will be the setting that produces 4 mA.
Span Value	It ranges from 0 to 65535.	The desired 100 % output is read on the milliammeter, use the values shown below depending on the action of your controller. Normally, this will be the setting that produces 20 mA.

Auxiliary Calib Set Up Group

Introduction

This group appears when **Auxiliary Output** of **Options** set up group is NOT configured as **Disable**. See "Options Set Up Group" on page 131 for more information.

Function Prompts

Table 4-20: Auxiliary Calib Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Zero Value	It ranges from 0 to 65535.	The desired 0 % output is read on the milliammeter. Normally, this will be the setting that produces 4 mA.
Span Value	It ranges from 0 to 65535.	The desired 100 % output is read on the milliammeter. Normally, this will be the setting that produces 20 mA.

Configuration Record Sheet

Enter the value or selection for each prompt on this sheet so you will have a record of how your controller was configured.

Group Prompt	Function Prompt	Value or Selection	Factory Setting
Security	Password Lockout Auto/Man Key Run/Hold Key SP Select Key Restore Settings Change Password	_____ _____ _____ _____ _____ _____ _____	0 Calibration Enable Enable Enable Disable - -
Tuning	Proportional Band 1 or Gain 1 or Rate Min Reset Mins/Rpt 1 or Reset Rpts/Min 1 Manual Reset Proportional Band 2 or Gain 2 Rate 2 Min	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____	- - 1.000 0.00 1.00 - - 0 - - 1.000 0.00

Group Prompt	Function Prompt	Value or Selection	Factory Setting
	Reset Mins/Rpt 2		1.00
	or	_____	
	Reset Rpts/Min 2	_____	- -
	Proportional Band 3		- -
	or	_____	
	Gain 3	_____	1.000
	Rate 3 Min	_____	0.00
	Reset Mins/Rpt 3		1.00
	or	_____	
	Reset Rpts/Min 3	_____	- -
	Proportional Band 4		- -
	or	_____	
	Gain 4	_____	1.000
	Rate 4 Min	_____	0.00
	Reset Mins/Rpt 4		1.00
	or	_____	
	Reset Rpts/Min 4	_____	- -
	Cycle Time 1 Sec	_____	20
	Cycle Time 2 Sec		20
SR Ramp/Program	SP Ramp Function	_____	Disable
	Ramp Time Min	_____	3
	Ramp Final SP	_____	1000
	SP Rate Function	_____	Disable
	Rate Up EU/HRr	_____	0
	Rate Down EU/Hr	_____	0
	SP Program Function	_____	Disable
	Soak Deviation	_____	0
	Program Termination	_____	Last SP
	Program End State	_____	Disable
	Key Reset/Rerun	_____	Disable
	Hot Start	_____	Disable
Accutune	Fuzzy Suppression	_____	Disable
	Accutune	_____	Disable
	Duplex Output	_____	Manual
	Error Status	Read only	None
Algorithms	Control Algorithm	_____	PID A
	Timer Function	_____	Disable
	Period Hrs:Mins	_____	0.01

Group Prompt	Function Prompt	Value or Selection	Factory Setting
	Start Trigger	_____	Keyboard
	Low Display	_____	Timer Remaining
	Reset Trigger	_____	Keyboard
	Increment	_____	Minutes
	Input Algorithm 1	_____	None
	Math K	_____	1.0
	Calculated High	_____	1000
	Calculated Low	_____	0
	Algorithm 1 Input A	_____	Input 1
	Algorithm 1 Input B	_____	Input 2
	Algorithm 1 Input C	_____	None
	Percent CO	_____	0.200
	Algorithm 1 Bias	_____	0.000
	Percent H2	_____	1.000
Output	Output Algorithms	_____	NOTE 1
	Output Range	_____	100 Percent
	Relay State	_____	1 Off 2 On
	Relay Type	_____	Electromechanical
	Motor Time	_____	30
	Current Output	_____	Disalbe
	CO Low Value	_____	0.0
	CO High Value	_____	100.0
	CO Range	_____	4-20mA
Input 1	Input 1 Type	_____	0-10 mV
	Input 1 Transmitter	_____	Linear
	Input 1 High Value	_____	1000
	Input 1 Low Value	_____	0
	Input 1 Ratio	_____	1.00
	Input 1 Bias	_____	0
	Input 1 Filter	_____	1
	Input 1 Burnout	_____	No Burnout
Input 2	Input 2 Type	_____	0-10 mV
	Input 2 Transmitter	_____	Linear
	Input 2 High Value	_____	1000
	Input 2 Low Value	_____	0
	Input 2 Ratio	_____	1.00
	Input 2 Bias	_____	0
	Input 2 Filter	_____	1
	Input 2 Burnout	_____	No Burnout

Group Prompt	Function Prompt	Value or Selection	Factory Setting
Note 1: Model Number dependent.			
Control	PV Source	_____	Input 1
	PID Sets	_____	1 Set
	Switchover Value 1/2	_____	0.00
	Switchover Value 2/3	_____	0.00
	Switchover Value 3/4	_____	0.00
	Local SP Source	_____	1 Local SP
	Remote SP Source	_____	None
	Autobias	_____	Disable
	SP Tracking	_____	None
	Power Up Mode	_____	Manual/Local SP
	SP High Limit	_____	1000
	SP Low Limit	_____	0
	Action Direction	_____	Reverse
	Output Rate	_____	Disable
	Rate Up % Min	_____	0
	Rate Down % Min	_____	0
	Output High Limit	_____	100
	Output Low Limit	_____	0
	Integral High Limit	_____	100
	Integral Low Limit	_____	0
	Dropoff	_____	0
	Deadband	_____	1.0
	Output Hysteresis	_____	0.5
	Failsafe Mode	_____	Non Latching
	Failsafe Value	_____	0
	SW Failsafe Value	_____	--
	Preset Manual Output	_____	0
	Preset Auto Output	_____	0
	Proportion Unit	_____	Gain
	Reset Unit	_____	Minutes/Repeat
Options	Auxiliary Output	_____	Disable
	CO Range	_____	4-20 mA
	CO Low Value	_____	0.0
	CO High Value	_____	100.0
	DI 1 Function	_____	None
	DI 1 Combination	_____	Disable
	DI 2 Function	_____	None
	DI 2 Combination	_____	Disable

Group Prompt	Function Prompt	Value or Selection	Factory Setting
Communication	Bluetooth Function	_____	Disable
	Bluetooth ID	Read only	UXXXXXXXX
	Bluetooth MAC Address	Read only	XX:XX:XX:XX:XX:XX
	Communication Type	_____	Disable
	Modbus Address	_____	3
	Baud Rate	_____	19200
	Response Delay	_____	1
	Word Order for Float	_____	FP B 0123
	Ethernet Address	_____	10.0.0.2
	Subnet Mask Address	_____	255.255.255.0
	Default Gateway	_____	0.0.0.0
	Shed Function	_____	Disable
	Shed Time	_____	30
	Shed Mode	_____	Last Mode
	Shed SP Recall	_____	To Local SP
	Computer SP Unit	_____	Engineering Unit
	Computer SP Ratio	_____	1.00
	Computer SP Bias	_____	0
	Local Loopback	_____	Disable
Alarms	A1S1 Type	_____	None
	A1S1 Value	_____	90
	A1S1 State	_____	High Alarm
	A1S1 Event	_____	End of Segment
	A1S1 Delay	_____	0
	A1S1 Hysteresis	_____	0.1
	A1S2 Type	_____	None
	A1S2 Value	_____	10
	A1S2 State	_____	Low Alarm
	A1S2 Event	_____	Begin of Segment
	A1S2 Delay	_____	0
	A1S2 Hysteresis	_____	0.1
	A2S1 Type	_____	None
	A2S1 Value	_____	95
	A2S1 State	_____	High Alarm
	A2S1 Event	_____	End of Segment
	A2S1 Delay	_____	0
	A2S1 Hysteresis	_____	0.1
	A2S2 Type	_____	None
	A2S2 Value	_____	5
	A2S2 State	_____	Low Alarm
	A2S2 Event	_____	Begin of Segment

Group Prompt	Function Prompt	Value or Selection	Factory Setting
	A2S2 Delay	_____	0
	A2S2 Hysteresis	_____	0.1
	Alarm Output 1	_____	Non Latching
	Alarm Blocking	_____	Disable
	AO/CO Diagnostic	_____	Disable
Display	Decimal Digits	_____	None
	Temperature Unit	_____	None
	Input 2 Ratio	_____	Disable
	Language	_____	English
	TC Diagnostics	_____	Enable
Communication with RS485 board (Accessible via Communication set up group or Honeywell EasySet)	Bluetooth Function	_____	Disable
	Bluetooth ID	Read only	UXXXXXXXX
	Bluetooth MAC Address	Read only	XX:XX:XX:XX:XX:XX
	Communication Type	_____	Disable
	Modbus Address	_____	3
	Baud Rate	_____	19200
	Response Delay	_____	1
	Word Order for Float	_____	FP B 0123
	Shed Function	_____	Disable
	Shed Time	_____	30
	Shed Mode	_____	Last Mode
	Shed SP Recall	_____	To Local SP
	Computer SP Unit	_____	Engineering Unit
	Computer SP Ratio	_____	1.00
	Computer SP Bias	_____	0
	Local Loopback	_____	Disable
Communication with Ethernet board (Accessible via Communication set up group or Honeywell EasySet)	Bluetooth Function	_____	Disable
	Bluetooth ID	Read only	UXXXXXXXX
	Bluetooth MAC Address	Read only	XX:XX:XX:XX:XX:XX
	Communication Type	_____	Disable
	Modbus Address	_____	3
	Baud Rate	_____	19200
	Response Delay	_____	1
	Word Order for Float	_____	FP B 0123
	Ethernet Address	_____	10.0.0.2
	Subnet Mask Address	_____	255.255.255.0
	Default Gateway	_____	0.0.0.0
	Shed Function	_____	Disable
	Shed Time	_____	30

Group Prompt	Function Prompt	Value or Selection	Factory Setting
	Shed Mode Shed SP Recall Computer SP Unit Computer SP Ratio Computer SP Bias	_____ _____ _____ _____ _____	Last Mode To Local SP Engineering Unit 1.00 0
Status	Software Version Failsafe Status Self Tests	Read only Read only Read only	- - - - - -

CHAPTER

5 MONITORING AND OPERATING THE CONTROLLER

What's in this section?

The following topics are covered in this section.

In this section:

Overview *164*

Operator Interface *164*

Entering a Security Code *165*

Lockout Feature *166*

Monitoring Your Controller *168*

Start Up Procedure for Operation *172*

Control Modes *173*

Setpoints *175*

Timer *177*

Accutune III *178*

Fuzzy Overshoot Suppression *187*

Using Four Sets of Tuning Constants *188*

Auto/Manual Station *191*

Alarm Setpoints *197*

Setting a Failsafe Output Value for Restart After a Power Loss *199*

Setting Failsafe Mode *200*

Setpoint Rate/Ramp/Program *201*

Overview

Introduction

This section gives you all the information necessary to help you monitor and operate your controller including an Operator Interface overview, how to lockout changes to the controller, entering a security code, and monitoring the displays.

Operator Interface

Figure 5-1: Operator Interface

Entering a Security Code

Introduction

The level of keyboard lockout may be changed in the Setup mode. However, knowledge of a security code number (0 to 9999) may be required to change from one level of lockout to another. When a controller leaves the factory, it has a security code of 1234 which should be entered and changed after the first power up or after restoring to factory default settings.

Procedure

If you require the use of a security code, select a number from 0001 to 9999 and enter it when the lockout level is configured as None. Thereafter, that selected number must be used to change the lockout level from something other than None.

> **ATTENTION:** Write the number on the Configuration Record Sheet in the configuration section so you will have a permanent record.

Step	Operation	Press	Result
1	Enter Setup Mode	Setup key	The first set up group is Security.
2	Select the function prompt Password	Function key	Enter into the first function prompt Password of the Security set up group. Press the Function key again to enter in the configuration prompt of Password.
3	Enter Security Code	Increment key or Decrement key	To enter a four digit number (0001 to 9999) This will be your security code.

Lockout Feature

Introduction

The lockout feature is used to inhibit changes (via keyboard) of certain functions or parameters by unauthorized personnel.

See "Security Set Up Group" on page 74 for more information.

Lockout levels

There are different levels of Lockout depending on the level of security required. These levels are:

- None: No Lockout. All groups Read/Write.
- Calibration: Calibration prompts are deleted from the Setup List.
- +Configuration: Timer, Tuning, SP Ramp, and Accutune are Read/Write. All other Setup are Read only. Calibration Group is not available.
- +View : Timer, Tuning, and SP Ramp are Read/Write. No other parameters are available.
- Max: Timer, Tuning, and SP Ramp are Read only. No other parameters are viewable.

Function lockout

In the **Security** set up group, there are three functions that can be disabled to prevent unauthorized changes to the parameters associated with the corresponding keys. First set the **Lockout** to **None**. These functions are:

- Disable **Run/Hold Key** for Setpoint Programming, you cannot run or hold programming by pressing Setup key and Increment key.
- Disable **Auto/Manual Key**, you cannot switch to Auto or Manual mode by pressing the Man Auto key.
- Disable **SP Select Key**, you cannot select setpoint by pressing the Function key when under the main screen.

Key error

When a key is pressed and the prompt “Key Error” appears in the Diagnostics display, it will be for one of the following reasons:

- Parameter not available or locked out
- Not in setup mode, press Setup key first
- Function locked out

Monitoring Your Controller

Annunciators

For annunciators provided to help monitor the controller, see Function of displays for more information.

Viewing the operating parameters

Under the main screen, press the Lower Display key to scroll through the operating parameters listed in table below. The lower display will show only those parameters and their values that apply to your specific model.

Table 5-1: Lower Display Key Parameter Prompts

Lower Display	Description
OUT XXX.X	Output value is shown in percent with one decimal point.
COUT XXX.X	Appears when Shed function is Enabled, and Output Override register is successful override by Modbus (In Slave Mode) .
EOUT XXX.X	Appears when Shed function is Enabled, and the controller is in Slave Mode, push A/M key to enter Emergency Mode.
SP XXXX.XXX	Local Setpoint #1, appears when Control Algorithm is configured as ANY algorithm except Disable in the Algorithms set up group. It also appears for current setpoint when using SP Ramp.
2SP XXXX.XXX	Local Setpoint #2, appears when the following two conditions are satisfied: • In the **Algorithms** set up group, configure **Control Algorithm** as ANY algorithm except Disable. • In the **Control** set up group, configure **Local SP Source** as 2/3/4 Local SPs.
3SP XXXX.XXX	Local Setpoint #3, appears when the following two conditions are satisfied: • In the **Algorithms** set up group, configure **Control Algorithm** as ANY algorithm except Disable. • In the **Control** set up group, configure **Local SP Source** as 3/4

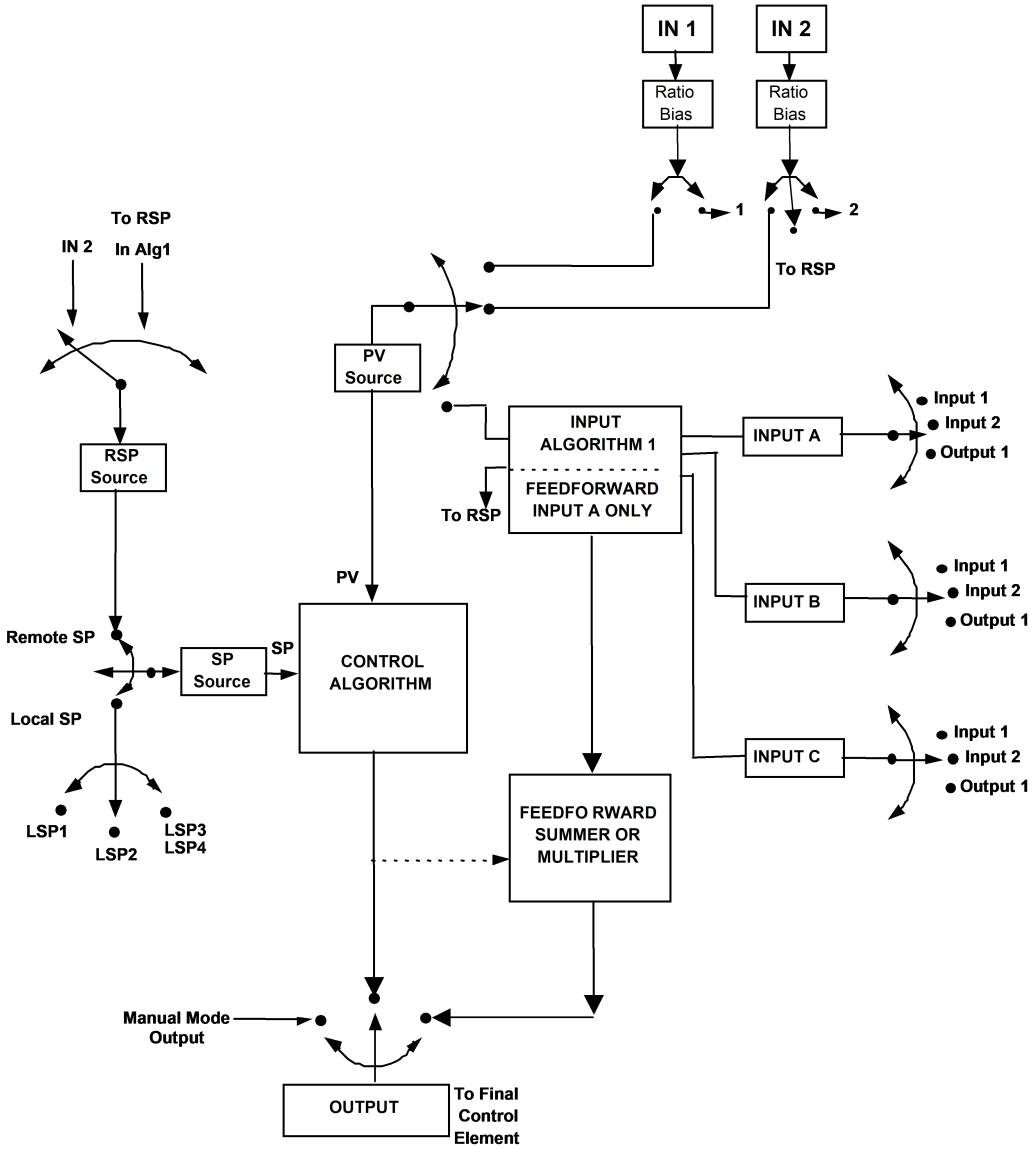
Lower Display	Description
	Local SPs.
4SP XXXX.XXX	Local Setpoint #4, appears when the following two conditions are satisfied: • In the **Algorithms** set up group, configure **Control Algorithm** as ANY algorithm except Disable. • In the **Control** set up group, configure **Local SP Source** as 4 Local SPs.
RSP XXXX.XXX	Remote Setpoint, appears when the following two conditions are satisfied: • In the **Algorithms** set up group, configure **Control Algorithm** as ANY algorithm except Disable. • In the **Control** set up group, configure **Remote SP Source** as ANY selection except Disable.
CSP XXXX.XXX	Computer Setpoint—When SP is in override. • In the **Algorithms** set up group, configure **Control Algorithm** as ANY algorithm except Disable. • In the **Communication** set up group, enable **Shed Function**. And CSP is successfully override by SP override through Modbus.
SPN XXXX.XXX	Setpoint Now—Current Setpoint when SP Rate is enabled. The SP XXXX.XXX display shows the “target” or final setpoint value. SPN is not equal with the target SP.
DEV XXX.X	Deviation
1IN XXXX.XXX	Input 1—Used only with combinational input algorithms.
2IN XXXX.XXX	Input 2
PID Set X	Tuning Parameter —where X is either 1, 2, 3 or 4.
BIAS XXXX	BIAS—Displays the manual reset value for algorithm PD+MR.
AUX XXX.X	Auxiliary Output—Displayed only when output algorithm is not Current Duplex.
TEL O XXH: XXM	Elapsed Time—Time that has elapsed on the Timer in

Lower Display	Description
or, TEL O XXM: XXS	Hours.Minutes, or Minutes:Seconds. The "O‘ is a clockwise running clock.
TRE O XXH: XXM or, TRE O XXM: XXS	Time Remaining—Time remaining on the Timer in Hours.Minutes, or Minutes:Seconds. The "O" is a counter-clockwise running clock.
RAMP XXXM: XXS	Setpoint Ramp Time—Time remaining in the Setpoint Ramp in minutes.
PXSX RA XXH:XXM:XXS PXSX RA XXX/M (0~999) PXSX RA XXX/H (0~999)	Program X(1-8) Segment X(1-8) Ramp XXH:XXM:XXS remaining X and XX is current program or segment or time remaining Initial hold states Ramp time should be remaining time
PXSX SK XXH:XXM:XXS	Program X(1-8) Segment(1-8) Soak XXH:XXM:XXS remaining X and XX is current program or segment or time remaining Initial hold states Soak time should be remaining time
Recycle XX	Number of SP Program Recycles Remaining
To Begin	Reset SP Program to Start of First Segment
Rerun	Reset SP Program to Start of Current Segment
ACTU TUNE OFF	Limit Cycle Tuning not Running, appears when Accutune is enabled but not operating.
ACTU DO SLOW	Limit Cycle Tuning with the objective of producing damped or Dahlin tuning parameters, depending upon the detected process deadtime. The tuning parameters calculated by this selection are aimed at reducing PV overshoot of the SP setting.
ACTU DO FAST	Limit Cycle Tuning with the objective of producing quarter-damped tuning parameters. This tuning may result in PV overshoot of the SP setting.

Diagnostic Messages

The instrument performs background tests to verify data and memory integrity. If there is a malfunction, a diagnostic message will be shown on the diagnostics display. In the case of more than one simultaneous malfunction, the diagnostic messages will be shown in sequence, with the highest priority message being shown first. See the section Backgroud Tests and Diagnostic Messages for a list of the Diagnostic Messages and how to correct the problems that they indicate.

Figure 5-2: Functional Overview Block Diagram of the controller



Start Up Procedure for Operation

It is required to enter the initial password and a new password when start up the controller for the first time. The initial password is 1234.

For more information of interface displays, see the section Function of displays.

Table 5-2: Procedure for Starting Up the Controller

Step	Operation	Press	Result
1	Select Manual Mode	Man Auto key	Until "Manual" is displayed under MODE. The controller is in manual mode.
2	Adjust the Output	Increment or Decrement key	Lower Display = OUT and the output value in % To adjust the output value and ensure that the final control element is functioning correctly.
3	Enter the Local Setpoint	Lower Display key	Until the required "SP" and the Local Setpoint Value are displayed.
		Increment or Decrement key	To adjust the local setpoint to the value at which you want the process variable maintained. **ATTENTION:** The local setpoint 1 cannot be changed if the Setpoint Ramp function is running.
4	Select Automatic Mode	Man Auto key	Until “Auto” is displayed under MODE. The controller is in Automatic mode. The controller will automatically adjust the output to maintain the process variable at setpoint.
5	Tune the Controller	Setup key	Make sure the controller has been configured properly and all the values and selections have been recorded on the Configuration Record Sheet. Refer to Tuning Set Up group to ensure that the selections for Proportional Band or

Step	Operation	Press	Result
			Gain, Rate Min, and Reset Mins/Rpt, or Reset Rpts/Min have been entered. Use Accutune to tune the controller. See "Accutune III" on page 178 for more information.

Control Modes

ATTENTION: After changing a Local Setpoint value, if no other key is pressed, it then takes a minimum of thirty (30) seconds elapsed time before the new value is stored in non-volatile memory. If controller power is removed before this time, the new setpoint value is lost and the previous setpoint value is used at power-up. If, after changing the LSP value, another key is pressed, then the value is stored immediately.

Mode Definitions

Table 5-3: Control Mode Definitions

Control Mode	Definitions
AUTOMATIC with LOCAL SETPOINT	In automatic local mode, the controller operates from the local setpoints and automatically adjusts the output to maintain the PV at the desired value. In this mode you can adjust the setpoint. See "Setpoints" on page 175 for more information.
AUTOMATIC with REMOTE SETPOINT (optional)	In automatic remote mode, the controller operates from the setpoint measured at the remote setpoint input. Adjustments are available to ratio this input and add a constant bias before it is applied to the control equation . See "Input 1 Set Up Group" on page 111 for more information. See "Input 2 Set Up Group" on page 117 for more information.
MANUAL (optional)	In the manual mode, the operator directly controls the controller output level. The process variable and the percent output are displayed. The

Control Mode	Definitions
	configured High and Low Output Limits are disregarded and the operator can change the output value, using the increment and decrement keys, to the limits allowed by the output type (0 % to 100 % for a time proportioning output or –5 % to 105 % for a current output).

What happens when you change modes

Table 5-4: Changing Control Modes

Control Mode	Definition
Manual to Automatic Local Setpoint	The Local Setpoint is usually the value previously stored as the Local Setpoint. > PV tracking is a configurable feature which modifies this. For this configuration, when the controller is in manual mode, the local setpoint value tracks the process variable value continuously.
Manual or Auto Local to Automatic Remote SP	The Remote Setpoint uses the stored ratio and bias to calculate the control setpoint. Auto bias is a configurable feature which modifies this. When it is selected the transfer from automatic local to automatic remote or from manual remote to automatic remote adjusts the bias based on the local setpoint such that Bias = LSP – (RSP Input x R).
Automatic Remote Setpoint to Manual or Auto Local Setpoint	If configured for local setpoint tracking, RSP, when the controller transfers out of remote setpoint the last value of the remote setpoint is inserted into the local setpoint. If LSP tracking is not configured, the local setpoint will not be altered when the transfer is made.

Setpoints

Introduction

You can configure the following setpoints for the UDC2800 controller.

- A Single Local Setpoint
- 2 Local Setpoints
- 3 Local Setpoints
- 4 Local Setpoints
- Up to 4 Local Setpoints and one Remote Setpoint

See "Control Set Up Group" on page 122 for more information.

Change the Setpoint value

Table 5-5: Procedure for Changing the Local Setpoints

Step	Operation	Press	Result
1	Select the Setpoint	Lower Display key	Until you see: Lower Display = SP or 2SP or 3SP, or 4SP (Value)
2	Change the Value	Increment key or Decrement key	To change the Local Setpoint to the value at which you want the process maintained. The display “blinks” if you attempt to enter setpoint values beyond the high and low limits. The configured setpoint will be stored immediately.

Switching between setpoints

You can switch Local and Remote setpoints or between two Local setpoints when configured.

> **ATTENTION:** The Remote Setpoint value cannot be changed at the keyboard.

Table 5-6: Procedure for Switching Between Setpoints

Step	Operation	Press	Result
1	Select the Setpoint	Function key	To switch between the four Local Setpoints and/or the Remote Setpoint. **ATTENTION:** "KEY ERROR" will appear if: • the remote setpoint or additional local setpoints are not configured as a setpoint source. • you attempt to change the setpoint while a setpoint ramp/program is running. • you attempt to change the setpoint with the setpoint select function key disabled. • while a setpoint ramp/program is not terminated.

Timer

Introduction

The Timer provides a configurable Time-out period of from 0 to 99 hours:59 minutes or 0 to 99 minutes:59 seconds.

Timer “Start Trigger” is selectable as either the "RUN/HOLD“ key or Alarm 2.

The Timer Lower Display can be either "Time Remaining" or "Elapsed Time".

Configuration check

Make sure:

- Timer Function is enabled.
- A timeout Period is selected (in hours and minutes or minutes and seconds).
- A timer Start Trigger is selected (Keyboard or Alarm 2).
- A timer Lower Display is selected (Time Remaining or Elapsed Time).
- A timer Increment is selected (Minutes or Seconds).
- A timer Reset Trigger is selected (Keyboard or Alarm 1).

See "Algorithm Set Up Group" on page 93 for more information.

Viewing Time

The time is viewed on the lower display as follows:

Time Remaining will show as a decreasing Hrs:Min value (HH:MM) or Min:Sec value (MM:SS) plus a counterclockwise rotating clock face.

Elapsed Time will show as an increasing Hrs:Min value(HH:MM) or Min:Sec value (MM:SS) plus a clockwise rotating clock face.

Operation

When the Timer Function is enabled ("RUN/HOLD" key or ALARM 2), it has exclusive control of Alarm 1 relay.

At “Time-out":

- Alarm 1 is active
- The clock character has stopped moving
- The Time display shows either 00:00 or the time-out period depending on the configuration selection
- The Timer is ready to be reset

At “Reset”:

- Alarm 1 relay is inactive
- The time display shows the time-out period
- The time-out period can be changed at this time using the or keys.
- The Timer is ready to be activated

Accutune III

Introduction

Accutune III (TUNE) may be used for self-regulating and single integrating processes. This autotuning method is initiated on-demand, typically at initial start-up.

There are no other requirements necessary, such as prior knowledge to the process dynamics or initial or post tune process line-out to setpoint or manual output.

Also, the setpoint value is not required to change in order to initiate the tuning process, but the controller must be in the Automatic mode to start tuning. The process need not be in a static (lined out) state and may be dynamic (changing with a steady output).

Configuration check

Make sure:

- Accutune is slected as TUNE. See "Accutune Set Up Group" on page 90 for more information.

Tuning indicators

A “T” will show under SP in the middle display until tuning is completed.

Operation

The Accutune III algorithm provides user-friendly, on-demand tuning in this controller. No knowledge of the process is required at start-up. The operator simply initiates the tuning while in the automatic mode.

Once Accutune III has been enabled in the TUNE setup group, either “SLOW” or “FAST” tuning may be used. Which one is used is selected via the lower display during normal operation.

For the SLOW selection, the controller calculates conservative tuning constants with the objective of minimizing overshoot. If the controller determines that the process has appreciable dead time, it will automatically default to use Dahlin Tuning, which produces very conservative tuning constants. This selection is also recommended for applications that have significant deadtimes.

For the FAST selection, the controller calculates aggressive tuning constants with the objective of producing quarter damped response. Depending upon the process, this selection will usually result in some overshoot. For this reason, it may be desireable to enable the FUZZY tune selection. See "Fuzzy Overshoot Suppression" on page 187 for more information. When Fuzzy tune is enabled, it will work to suppress or eliminate any overshoot that may occur as a result of the calculated tuning parameters as the PV approaches the setpoint. This selection is best suited for processes with a single lag or for those that do not have any appreciable deadtime. FUZZY tuning does not work well for processes that have appreciable deadtime.

The Accutune III tuning process will cycle the controller’s output two full cycles between the low and high output limits while allowing only a very small Process Variable change above and below the SP during each cycle. A “T” shows in the upper display until tuning is completed.

At the end of the tuning process, the controller immediately calculates the tuning constants and enters them into the Tuning group, and begins PID control with the correct tuning parameters. This works with any process, including integrating type processes, and allows retuning at a fixed setpoint.

Tune for Simplex Outputs

After “TUNE” is enabled, you can start Accutune as shown in table below.

Table 5-7: Procedure for Starting “TUNE”

Step	Operation	Press	Result
1	Configure LSP1	Lower Display key	Until **SP** (Local Setpoint 1) shows in the lower display.
2	Adjust LSP1 value	Increment key or Decrement key	Until LSP1 is to the desired value.
3	Switch to “Automatic” Mode	Man Auto key	Until “Auto” appears (on controllers with Manual option).
4	Show Tuning Prompt	Lower Display key	Until “TUNE OFF” is shown in the lower display.
5	Tuning in operation	Increment key or Decrement key	Select “SLOW” or “FAST” in the lower display. A “T” appears under SP in the middle display as long as ACCUTUNE process is operating. When process completes, tuning parameters are calculated and the "T" will disappear and lower display will show “TUNE OFF” prompt.

ATTENTION: The Accutune process may be aborted at any time by changing the lower display back to “TUNE OFF” or by switching the controller into Manual Mode.

Tune for Duplex (Heat/Cool)

Accutune for applications using Duplex (Heat/Cool) control.

The controller must be configured to have two local setpoints unless Blended Tuning is desired (see below). See "Control Set Up Group" on page 122 for more information. During tuning, the Accutune III process assumes that Local Setpoint 1 will cause a Heating demand (output above 50%), and the tuning parameters calculated for that setpoint are automatically entered as PID SET 1. Likewise, Accutune III assumes that Local Setpoint 2 will cause a Cooling demand (output less than 50%), and the tuning parameters calculated for that setpoint are automatically entered as PID SET 2.

Configuration Check for Duplex

See "Accutune Set Up Group" on page 90 for more information.

Make sure:

- Accutune is selected as Tune.
- Duplex has been configured to Manual, Automatic or Disabled.

Using AUTOMATIC TUNE at start-up for Duplex (Heat/Cool)

Used when DUPLEX has been configured for AUTOMATIC. This is the preferred selection for most Heat/Cool applications when tuning a new chamber. This selection will sequentially perform both Heat and Cool tuning without further operator intervention.

Table 5-8: Procedure for Using AUTOMATIC TUNE at Start-up for Duplex Control

Step	Operation	Press	Result
1	Configure LSP1	Lower Display key	Until **SP** (Local Setpoint 1) shows in the lower display.
2	Adjust LSP1 value	Increment key or Decrement key	Until LSP1 is a value within the Heat Zone (output above 50%).
3	Configure LSP2	Lower Display key	Until **2SP** (Local Setpoint 2) shows in the lower display.
4	Adjust LSP2 value	Increment key or Decrement key	Until LSP2 is a value within the Cool Zone (output below 50%).
5	Switch to “Automatic” Mode	Man Auto key	Until “Auto” appears (on controllers with Manual option).
6	Show Tuning Prompt	Lower Display key	Until “TUNE OFF” is shown in the lower display.
7	Tuning in operation	Increment key or Decrement key	Select “SLOW” or “FAST” in the lower display. A “T” appears under SP in the middle display as long as ACCUTUNE process is operating. When process completes, tuning parameters are calculated and the "T" will disappear and lower display will show “TUNE OFF” prompt.

Using BLENDED TUNE at start-up for Duplex (Heat/Cool)

When DUPLEX has been configured for DISABLE. This is the preferred selection for Heat/Cool applications which use a highly insulated chamber (a chamber which will lose heat very slowly unless a cooling device is applied). Only one local setpoint (LSP 1) is needed for this selection.

This selection results in performance tuning over the full range utilizing both Heat and Cool outputs to acquire blended tune values that are then applied to both Heat and Cool tuning parameters. Both PID sets are set to the same values.

Table 5-9: Procedure for Using BLENDED TUNE at Start-up for Duplex Control

Step	Operation	Press	Result
1	Configure LSP1	Lower Display key	Until **SP** (Local Setpoint 1) shows in the lower display.
2	Adjust LSP1 value	Increment key or Decrement key	Until the Setpoint is to the desired value.
3	Switch to “Automatic” Mode	Man Auto key	Until “Auto” appears (on controllers with Manual option).
4	Show Tuning Prompt	Lower Display key	Until “TUNE OFF” is shown in the lower display.
5	Tuning in operation	Increment key or Decrement key	Select “SLOW” or “FAST” in the lower display. A “T” appears under SP in the middle display as long as ACCUTUNE process is operating. When process completes, tuning parameters are calculated and the "T" will disappear and lower display will show “TUNE OFF” prompt.

Using MANUAL TUNE at start-up for Duplex (Heat/Cool)

When DUPLEX has been configured for MANUAL. This selection should be used when tuning is needed only for the HEAT zone or only for the COOL zone but not both. If Local Setpoint 1 is used, then the controller will perform a HEAT zone tune. If Local Setpoint 2 is used, then the controller will perform a COOL zone tune.

Table 5-10: Procedure for Using MANUAL TUNE for Heat side of Duplex Control

Step	Operation	Press	Result
1	Configure LSP1	Lower Display key	Until **SP** (Local Setpoint 1) shows in the lower display.
2	Adjust LSP1 value	Increment key or Decrement key	Until LSP1 is a value within the Heat Zone (output above 50%).
3	Switch to “Automatic” Mode	Man Auto key	Until “Auto” appears (on controllers with Manual option).
4	Show Tuning Prompt	Lower Display key	Until “TUNE OFF” is shown in the lower display.
5	Tuning in operation	Increment key or Decrement key	Select “SLOW” or “FAST” in the lower display. A “T” appears under SP in the middle display as long as ACCUTUNE process is operating. When process completes, tuning parameters are calculated and the "T" will disappear and lower display will show “TUNE OFF” prompt.

Table 5-11: Procedure for Using MANUAL TUNE for Cool side of Duplex Control

Step	Operation	Press	Result
1	Configure LSP2	Lower Display key	Until **2SP** (Local Setpoint 2) shows in the lower display.
2	Adjust LSP2 value	Increment key or Decrement key	Until LSP2 is a value within the Cool Zone (output below 50%).
3	Switch to "Automatic" Mode	Man Auto key	Until "Auto" appears (on controllers with Manual option).
4	Show Tuning Prompt	Lower Display key	Until "TUNE OFF" is shown in the lower display.
5	Tuning in operation	Increment key or Decrement key	Select "SLOW" or "FAST" in the lower display. A "T" appears under SP in the middle display as long as ACCUTUNE process is operating. When process completes, tuning parameters are calculated and the "T" will disappear and lower display will show "TUNE OFF" prompt.

Error Codes

Table 5-12: Procedure for Accessing Accutune Error Codes

Step	Operation	Press	Result
1	Select Accutune Set Up Group	Setup key	Enter in Accutune Set Up Group
2	Go to Error Status Prompt	Function key, and Increment or Decrement key	Enter in Error Status prompt
2	Go to Error Code Prompt	Function key, and Increment or Decrement key	Enter in Error Code prompt. Table below lists all the error codes, definitions, and fixes.

Table 5-13: Accutune Error Codes

Error Code	Definition	Fix
NONE	No errors occurred during last accutune procedure	None
Running	Accutune running	The Accutune process is still active (Read Only)
Abort	Current Accutune Process Aborted caused by the following conditions: a. Operator changed to Manual mode b. Digital Input detected c. In Heat region of output and a Cool output calculated or vice versa.	Try Accutune again
SP Error	LSP2 not enabled or LSP1 or LSP2 not in use (only applies to Duplex Tuning)	Enable LSP2 and configure the desired LSP1 and LSP2 setpoints. See "Accutune III" on page 178 for more information.

Aborting Accutune

To abort Accutune and return to the last previous operation (SP or output level), press Man Auto key to abort the Accutune process or increment from the “SLOW” or “FAST” prompt to the “TUNE OFF” prompt.

Completing Accutune

When Accutune is complete, the calculated tuning parameters are stored in their proper memory location and can be viewed in the Tunning Set up Group, and the controller will control at the local setpoint using these newly calculated tuning constants.

Fuzzy Overshoot Suppression

Introduction

Fuzzy Overshoot Suppression minimizes Process Variable overshoot following a setpoint change or a process disturbance. This is especially useful in processes which experience load changes or where even a small overshoot beyond the setpoint may result in damage or lost product.

How it works

The Fuzzy Logic in the controller observes the speed and direction of the PV signal as it approaches the setpoint and temporarily modifies the internal controller response action as necessary to avoid an overshoot. There is no change to the PID algorithm, and the fuzzy logic does not alter the PID tuning parameters. This feature can be independently Enabled or Disabled as required by the application to work with the Accutune algorithm. Fuzzy Tune should not be enabled for processes that have an appreciable amount of deadtime.

Configuration

To configure this item, refer to Accutune Set Up Group:

Go to Function Prompt **Fuzzy Suppression**

Select **Enable** or **Disable** using Increment key or Decrement key.

Using Four Sets of Tuning Constants

Introduction

You can use four sets of tuning constants for single output types and choose the way they are to be switched. (this does not apply for Duplex control, which always uses two PID sets).

The sets can be:

- keyboard selected,
- automatically switched when a predetermined process variable value is reached,
- automatically switched when a predetermined setpoint value is reached.

Set up Procedure

The following procedure to:

- select four sets,
- set the switch-over value,
- set tuning constant value for each set.

Table 5-14: Set Up Procedure

Step	Operation	Press	Result
1	Select Control set up group	Setup key	Until you see **Control** set up group
2	Select PID Sets	Function key	Enter in the first function prompt of the Control set up group.
		Increment key or Decrement key	Until you see **PID Sets**

Step	Operation	Press	Result
3	Select PID Sets Function	Function key	Enter in the first selection of PID Sets.
		Increment key or Decrement key	To select the type of function. Available selections are: 1 Set — 1 set of constants 2 Sets Keyboard —2 sets, keyboard selectable 2 Sets PV Switchover —2 sets, auto switch at PV value 2 Sets SP Switchover —2 sets, auto switch at SP value 4 Sets Keyboard —4 sets, keyboard selectable 4 Sets PV Switchover —4 sets, auto switch at PV value 4 Sets SP Switchover —4 sets, auto switch at SP value
4	Set Tuning Values for Each Set		Set the following tuning parameters. See "Tuning Set Up Group" on page 76 for more information. Proportional Band 1 or Gain 1 Rate 1 Min Reset Mins/Rpt 1 or Reset Rpts/Min 1 or Manual Reset Proportional Band 2 or Gain 2 Rate 2 Min Reset Mins/Rpt 2 or Reset Rpts/Min 2 Proportional Band 3 or Gain 3 Rate 3 Min Reset Mins/Rpt 3 or Reset Rpts/Min 3 Proportional Band 4 or Gain 4 Rate 4 Min Reset Mins/Rpt 4 or Reset Rpts/Min 4 Cycle Time 1 Sec or Cycle Time 2 Sec

Step	Operation	Press	Result
			When the process variable or setpoint value is **LESS** than the value set at prompt Switchover Value, the controller will use Gain 1 or Proportional Band 1, Rate 1 Min, and Reset Mins/Rpt 1 or Reset Rpts/Min 1. The active PID Set can be read in the lower display. When the process variable or setpoint value is **GREATER** than the value set at prompt Switchover Value, the controller will use Gain 2 or Proportional Band 2, Rate 2 Min, and Reset Mins/Rpt 2 or Reset Rpts/Min 2. The active PID SET can be read in the lower display. Similarly, the controller switches between the other PID sets based upon the values configured for Switchover Value 2/3 and Switchover Value 3/4.
5	Set Switchover Value for **2 Sets PV Switchover**, **2 Sets SP Switchover**, **4 Sets PV Switchover**, or **4 Sets SP Switchover** selection	Function key	Enter in the configuration prompt of Switchover Value.
		Increment key or Decrement key	Enter the switchover value. Press the Function key after enter the desired value. It is highly recommended to configure Switchover Value as follows: **Switchover Value 1/2** < **Switchover Value 2/3** < **Switchover Value 3/4**

Switch between four sets via keyboard (without automatic switch-over)

Table 5-15: Procedure for Switching PID Sets from the Keyboard

Step	Operation	Press	Result
1	Select Control set up group	Lower Display key	Until you see PID Set X (X= 1, 2, 3 or 4)
2		Increment key or Decrement key	To switch between PID Set 1, PID Set 2, PID Set 3 and PID Set 4. You can use Accutune on each set.

Auto/Manual Station

Introduction

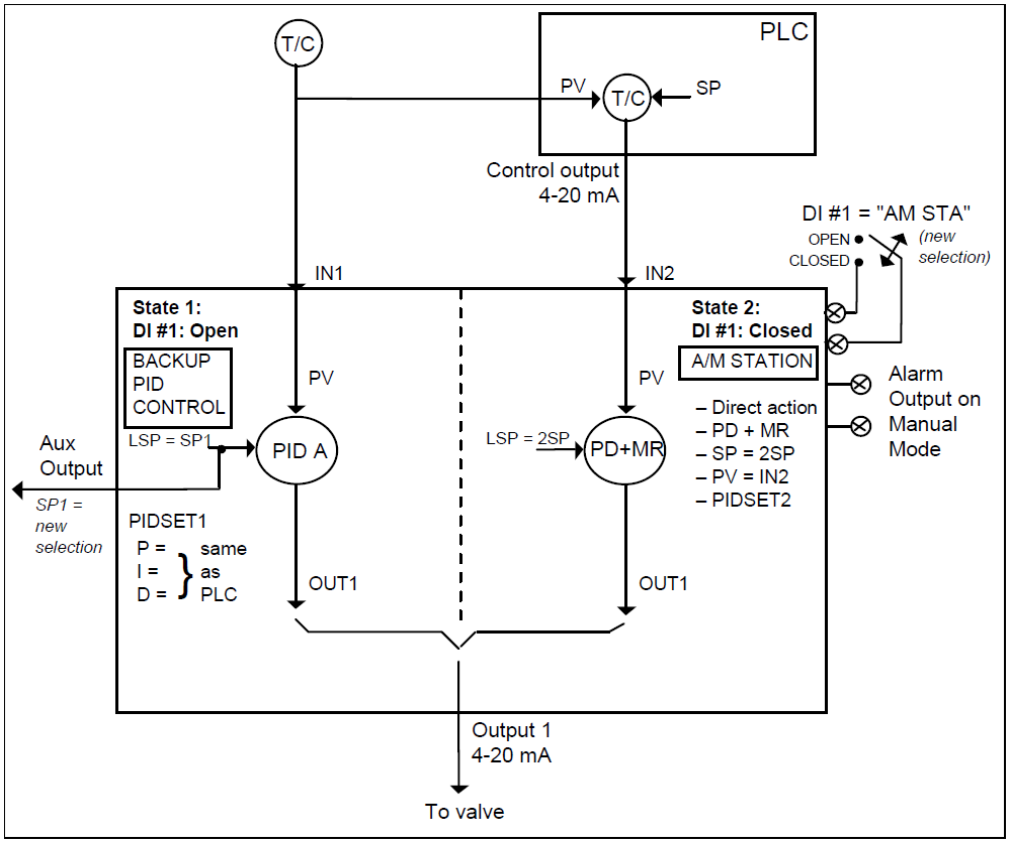
When you select "To Auto/Man Station" for one of the Digital Inputs, contact closure on the selected Digital Input causes the controller to switch to Auto/Manual Station mode. See "Options Set Up Group" on page 131 for more information.

Function

As shown in the following figure, State 2 is the "Auto/Manual Station mode" where the programmable logic controller (PLC) output is sent through the Auto/Manual Station. You can switch to manual and change the output at the controller. (It uses PID set 2.)

State 1 is the "Backup PID mode" which is triggered by opening the digital input. (It uses PID set 1.)

Figure 5-3: Auto/Manual Station



Description

The "To Auto/Man Station" selection of digital input creates a repeater station when the digital input is closed. This is accomplished by a multi-selection from the digital input menu.

- "Action" is forced as "Direct".
- "Control Algorithm" is forced as "PD+Manual Reset".
- Active setpoint is forced to 2SP.
- "PV Source" is switched to "Input 2".
- The tuning parameter used are the second set of parameters.

When the switch is open, the unit becomes a normal controller with "Control Algorithm" of "PID A", using tuning parameters set 1, SP, PV Source as Input 1 and "Direct" or "Reverse" as selected by customer configuration.

Input 1 is typically the PV of some upper controller and Input 2 is typically that controller's output. If the upper control fails, the upper device or some watchdog opens the digital input switch and UDC2800 back-up PID A control is active.

When the upper control reactivates, the digital input switch is closed and the Auto/Manual Station becomes a repeater station and allows the upper control output signal to pass through.

Configuration

There are some things to consider when configuring the controller.

The PV range stays as the Input 1 range, even while Input 2 is the PV when the switch is closed; therefore:

- The Input 2 High Value must be less than or equal to the Input 1 High Value.

  (Suggest: Input 2 High Value = 100.0)
- The Input 2 Low Value must be greater than or equal to the Input 1 Low Value.

  (Suggest: Input 2 Low Value = 0.0)
- The Tuning Gain 2 must be equal to (Input 1 High Value - Input 1 Low Value) / (Input 2 High Value - Input 2 Low Value).

See the following table for the configuration procedure.

Table 5-16: Auto/Manual Station Mode Configuration Procedure

Step	Operation	Press	Result
1	Select Algorithms set up group	Setup key	Until you see **Algorithms** set up group.
2	Select Control Algorithm	Function key	Enter in the first function prompt of the Algorithms set up group: Control Algorithm. Press the Function key again to enter in the first configuration prompt of Control Algorithm.
3	Select PD+Manual Reset function	Increment key or Decrement key	Until you see the selection **PD+Manual Reset**.

Step	Operation	Press	Result
		Function key	Select the selection **PD+Manual Reset**.
4	Select Control set up group	Setup key	Until you see **Control** set up group.
5	Select PID Sets	Function key	Enter in the first function prompt of the Control set up group: PV Source.
		Increment key or Decrement key	Until you see **PID Sets**. Press the Function key again to enter in the first configuration prompt of PID Sets.
6	Select PID Sets function	Increment key or Decrement key	Until you see the selection **2 Sets Keyboard**.
		Function key	Select the selection **PD+Manual Reset**.
7	Select Local SP Source	Increment key or Decrement key	Until you see **Local SP Source**.
		Function key	Enter in the first configuration prompt of Local SP Source.
8	Select Local SP Source Function	Increment key or Decrement key	Until you see the selection **2 Local SPs**.
		Function key	Select the selection **2 Local SPs**.
9	Select SP Tracking	Increment key or Decrement key	Until you see **SP Tracking**
		Function key	Enter in the first configuration prompt of SP Tracking.
10	Select SP Tracking function	Increment key or Decrement key	Until you see the selection **None**
		Function key	Select the selection **None**.
11	Select Tuning set up group	Setup key	Until you see **Tuning** set up group.
12	Select Manual Reset Value	Function key	Enter in the first function prompt of the Tuning set up group.

Step	Operation	Press	Result
		Increment key or Decrement key	Until you see **Manual Reset**. Press the Function key to enter in the configuration prompt of **Manual Reset**.
13	Configure Manual Reset Value	Increment key or Decrement key	Configure 0 for **Manual Reset**. A Manual Reset of 0 is for no output bias and requires that LSP2 = 0% of the Setpoint Range. If bias is required, set the Manual Reset value to equal the desired output bias value.
		Function key	Configure the value 0 for Manual Reset.
14	Select Algorithms set up group	Setup key	Until you see **Algorithms** set up group.
15	Select Control Algorithm	Function key	Enter in the first function prompt of the Algorithms set up group: Control Algorithm Press the Function key again to enter in the first configuration prompt of Control Algorithm.
16	Select PID A	Increment key or Decrement key	Until you see the selection **PID A**.
		Function key	Select the selection **PID A**. This is defining the back-up control algorithm.
17	Select Tuning set up group	Setup key	Until you see **Tuning** set up group.
18	Configure PID Set 1 Value	Function key	Enter in the first function prompt of the Tuning set up group.
		Increment key or Decrement key	Until you see **Gain 2**. Press the Function key again to enter in the first configuration prompt of Gain 2.
19	Select Gain 2 Value	Increment key or Decrement key	Set the Gain 2 equal to: $\frac{\text{Input 1 Span}}{\text{Input 2 Span}}$

Step	Operation	Press	Result
			If "PB" is selected under the Control set up group function prompt "Gain" or "Proportional Band", then set the Proportional Band 2 to: $100 \times \frac{\text{Input 2 Span}}{\text{Input 1 Span}}$
		Function key	Configure the Gain 2 value.
20	Select Rate 2 Min Value	Increment key or Decrement key	Until you see **Rate 2 Min**.
		Function key	Enter in the first configuration prompt of **Rate 2 Min**.
		Increment key or Decrement key	Configure Rate 2 Min value as 0.00. Press the Function key again to configure the value.
21	Select Options set up group	Setup key	Until you see **Options** set up group.
22	Select a Digital Input	Function key	Enter in the first function prompt of the Options set up group.
		Increment key or Decrement key	Until you see **DI 1 Function** or **DI 2 Function**. This selection determines which Digital Input will be used for Auto/Manual Station operation.
23	Select Auto/Manual Station function	Function key	Enter in the first configuration prompt of **DI 1 Function** or **DI 2 Function**.
		Increment key or Decrement key	Until you see **To Auto/Man Station**.
		Function key	Select the selection **To Auto/Man Station**.

DO NOT SELECT:

- In the Control set up list, do not select SP Tracking as PV or Remote SP.
- In the SP Ramp set up list, do not select SP Rate as Enable.

- In the Algorithms set up list, do not select Control Algorithm as PID B, On-Off.
- In the Display menu, when PID Set # is displayed, DO NOT change the selection.

Operation

Operate the Auto/Manual Station as follows:

Set the Local Setpoint 2 to 0% of the Input 2 range.

There features work with the Auto/Manual Station.

- In the SP Ramp set up list, SP Program (acts on SP1 for backup operation).
- In the SP Ramp set up list, SP Ramp (acts on SP1 for backup operation).
- In the Control set up list, Action Direction as Direct or Reverse for the backup PID A operation).
- The PD+Manual Reset action is forced to be Direct as required for the pass through of the output signal.

Alarm Setpoints

Introduction

An alarm consists of a relay contact and an operator interface indication. The alarm relay is de-energized if setpoint 1 or setpoint 2 is exceeded.

The alarm relay is energized when the monitored value goes into the allowed region by more than the hysteresis.

The relay contacts can be wired for normally open (NO) energized or normally closed (NC) de-energized using internal jumper placement.

There are four alarm setpoints, two for each alarm. The type and state (High or Low) is selected during configuration.

Alarm Setpoints Display

Table 5-17: Procedure for Displaying Alarm Setpoints

Step	Operation	Press	Result
1	Select Alarms Set-up Group	Setup key or Increment key or Decrement key	Until you see Alarms set up group
2	Select the Alarm Setpoint Values	Function key	Enter in the first function prompt A1S1 Type.
		Increment key or Decrement key	Until you see the required Alarm setpoint. A1S1 Value = Alarm 1, Setpoint 1 Value A1S2 Value = Alarm 1, Setpoint 2 Value A2S1 Value = Alarm 2, Setpoint 1 Value A2S2 Value = Alarm 2, Setpoint 2 Value To successively display the alarm setpoints and their values. Their order of appearance is shown below. Lower Display = (the alarm setpoint value) Range values are within the range of the selected parameters except: Deviation value = PV Span Events (Event On/Event Off) value = Event Segment Number PV Rate of Change = The amount of PV change in one minute in engineering units. Loop Break Alarms (Loop Break)= The timer value may be changed only for controllers configured for ON/OFF control. **NOTE:** Manual, Remote Setpoint, and Failsafe selections do not have setpoint values.
3	Change a value	Function key	Enter in the first selection of the selected Alarm Setpoint
		Increment key or Decrement key	Change any alarm setpoint value.

Step	Operation	Press	Result
4	Enter the value	Function key	Enter the value made into memory.
5	Return to Normal Display	Lower Display key	Exit the set up mode, and returns to the main screen.

Setting a Failsafe Output Value for Restart After a Power Loss

Introduction

If the power to the controller fails and power is reapplied, the controller goes through the power up tests, then goes to a user configured FAILSAFE OUTPUT VALUE.

Set a Failsafe Value

Table 5-18: Procedure for Setting a Failsafe Value

Step	Operation	Press	Result
1	Select Control Set-up Group	Setup key or Increment key or Decrement key	Until you see Control set up group.
2	Select Failsafe Function Prompt	Function key	Enter in the first function prompt of Control set up group.
		Increment key or Decrement key	Until you see Failsafe Value
3	Select a value	Function key	Enter in the value of Failsafe Value.
		Increment key or Decrement key	To select a failsafe output value, ranging from 0 to 100.
4	Enter the value	Function key	Enter the value made into memory.
5	Return to Normal Display	Lower Display key	At power up, the output will go to the value set.

Setting Failsafe Mode

Introduction

You can set the Failsafe Mode to be Latching or Non-Latching.

Set Failsafe Mode

Table 5-19: Procedure for Setting a Failsafe Mode

Step	Operation	Press	Result
1	Select Control Set-up Group	Setup key or Increment key or Decrement key	Until you see Control set up group.
2	Select Failsafe Function Prompt	Function key	Enter in the first function prompt of Control set up group.
		Increment key or Decrement key	Until you see Failsafe Mode
3	Select a value	Function key	Enter in the first selection of Failsafe Mode
		Increment key or Decrement key	To select a failsafe mode: **Latching**: Controller goes to manual and output goes to failsafe value **No Latching** :Controller mode does not change and output goes to failsafe value
4	Enter the value	Function key	Enter the value made into memory.
5	Return to Normal Display	Lower Display key	At power up, the output will go to the value set.

Setpoint Rate/Ramp/Program

Introduction

The Setpoint Ramp configuration group lets you enable and configure any of the following:

- SP Rate – a specific rate of change for any local setpoint change. (See "Setpoint Rate" below for more information.)
- SP Ramp – a single setpoint ramp that occurs between the current local setpoint and a final local setpoint over a time interval of 1 to 255 minutes. (See "Setpoint Ramp" on the next page for more information.)
- SP Program – a ramp/soak profile in a 12-segment program. (See "Setpoint Ramp/Soak Programming" on page 204 for more information.)

This section explains the operation of each selection and configuration reference where necessary.

Start/Hold Ramp or Program

You can start or hold the Ramp or Program by pressing the Setup key and the Increment key at the same time.

Setpoint Rate

Introduction

When you have configured a Setpoint Rate, it will apply immediately to local setpoint change.

Configuration check

Make sure:

- SP Rate Function is enabled.
- A Rate Up EU/Hr or Rate Down EU/Hr value has been configured in Engineering units per hour.

ATTENTION: A value of 0 will imply an immediate change in setpoint, that is, NO Rate applies. See "SP Ramp/Program Set Up Group" on page 81 for more information.

Operation

When a change to local setpoint is made, this controller will ramp from the original setpoint to the “target” setpoint at the rate specified.

The current setpoint value is shown as SPN XXXX on the lower display while the “target” setpoint is shown as SP XXXX on the lower display.

Setpoint Ramp

Introduction

When you have configured a Setpoint Ramp, the ramp will occur between the current local setpoint and a final local setpoint over a time interval of from 1 to 255 minutes. You can RUN or HOLD the ramp at any time.

Configuration Check

Make sure

- SP Program Function is disabled.
- SP Ramp Function is enabled.
- A Ramp Time Min in minutes has been configured
- A final setpoint value (Ramp Final SP) has been configured. See "SP Ramp/Program Set Up Group" on page 81 for more information.

Operation

Running a Setpoint Ramp includes starting, holding, viewing the ramp, ending the ramp and disabling it. See table below.

Table 5-20: Running A Setpoint Ramp

Step	Operation	Press	Result
1	Select Automatic Mode	Man Auto key	“Auto” is displayed under Mode.
2	Set Start Setpoint	Lower Display key	If Hot Start is enabled, Current PV value is used as the initial ramp setpoint. If Hot Start is disabled, LSP1 is used as the initial ramp setpoint. Press Lower Display key, until SP value is displayed in the lower display. Lower Display = SP and start SP value
		Increment key or Decrement key	To set the start setpoint
3	Start the Ramp	Run/Hold (Setup key and Increment key)	"Run" is displayed besides SP in the middle display. Middle Display = SP and a changing SP value increasing or decreasing toward the final SP value
4	Hold/Run the Ramp	Run/Hold (Setup key and Increment key)	This holds the ramp at the current setpoint value. Press again to continue. When the ramp is hold, “Run” changes to “Hold” besides SP in the middle display. You can change LSP1 in the hold mode, but the ramp rate will not be changed. SP ramp will stop when: • time is up, and LSP1 will be changed to the final SP. or • the final sp is reached, and the timer will be reset.
5	View the remaining ramp time	Lower Display key	Until you see Lower Display = RAMP XXM XXS (time remaining in minutes:seconds)
6	End the Ramp		When the final setpoint is reached, “Run” disappears in the middle display and the controller operates at the new final setpoint.

Step	Operation	Press	Result
			NOTE: Before the final setpoint is reached, you can disable SP Ramp Function to end the SP Ramp.

Power Outage

If power is lost during a ramp, upon power-up the controller will be in HOLD and the setpoint value will be the setpoint value prior to the beginning of the setpoint ramp.

The ramp is placed in hold at the beginning.

Configure the mode at “Control” Set Up Group, function prompt “Power Up Mode”. See "Control Set Up Group" on page 122 for more information.

Setpoint Ramp/Soak Programming

Introduction

The term “programming” is used here to identify the process for selecting and entering the individual ramp and soak segment data needed to generate the required setpoint versus time profile (also called a program). There are 8 programs, and each program has 8 segments including 4 ramp segments and 4 soak segments.

A segment is a ramp or soak function which together make up a setpoint program. Setpoint Ramp/Soak Programming lets you configure 4 ramp and 4 soak segments to be stored for use as one program or several small programs. You designate the beginning and end segments to determine where the program is to start and stop.

Review program data and configuration

While the procedure for programming is straightforward, and aided by prompts, we suggest you read the table Program Contents below lists the program contents and an explanation of each to aid you in configuration. Then refer to SP Ramp/Program Set Up Group to do the setpoint program. See "SP Ramp/Program Set Up Group" on page 81 for more information.

Make sure **SP Ramp Function** is disabled.

Fill out the worksheet

Refer to the example below (Ramp/Soak Profile Example) and draw a Ramp/Soak Profile on the worksheet provided below (Program record sheet) and fill in the information for each segment. This will give you a record of how the program was developed.

Operation

See Run/Monitor the program for more information.

Program Contents

It lists all the program contents and a description of each.

Table 5-21: Program Contents

Associated Prompts	Contents	Definition
Start Segment	Start segment number	The start segment number designates the number of the first segment. Range = 1 to 8
End Segment	End segment number	The end segment number designates the number of the last segment, it must be a soak segment (even number). Range = 2 to 8
Recycles	Recycle number	The recycle number allows the program to recycle a specified number of times from beginning to end. Range = 0 to 99
Program End State	Program state	The program state selection determines the program state after completion. The selections are: • Disable: SP Program Function is disabled (so program value changed to Disable). • Hold: SP Program Function is not disabled.
Program	Program	The program termination state function determines

Associated Prompts	Contents	Definition
Termination	termination state	the status of the controller upon completion of the program. The selections are: • Last SP: controls to last setpoint • Failsafe: manual mode and failsafe output.
Key Reset/Rerun	To Begin	Reset Program to Beginning. Press the Lower Display key under the main screen, until you see To Begin, then press the Increment key or Decrement key, To Begin will go into effect. When enabled, this selection allows you to reset the program via the keyboard to the beginning of the program.
	Rerun	Rerun the current segment. Press the Lower Display key under the main screen, until you see Rerun, then press the Increment key or Decrement key, Rerun will go into effect. When enabled, this selection allows you to reset the program via the keyboard to the beginning of the current segment.
Hot Start	Hot Start	This function determines whether LSP1 or PV is used as the setpoint when the program is initially changed from HOLD to RUN. The selections are: Disable = When the program is initially changed from HOLD to RUN the present LSP1 value is captured as the default setpoint. If the program is terminated or the power cycled before the program has completed, the LSP1 is used as the control setpoint. The beginning segment uses this value as the initial ramp setpoint. Enable = When the program is initially changed from HOLD to RUN the present PV value is captured and used as the beginning setpoint value for the ramp segment. If the program is terminated

Associated Prompts	Contents	Definition
		before completion, the setpoint value will revert back to the initial LSP1 value captured at the initial HOLD to RUN transition. If the power is cycled before program completion, upon power-up the setpoint is set to the initial LSP1 value at power-up and when the program is restarted that PV value is used initially.
Ramp Unit Segment x Ramp or Segment x Rate	Ramp time or rate segments	A ramp segment is the time it will take to change the setpoint to the next setpoint value in the program. Ramps are odd number segments (1, 3, 5, 7). Segment #1 will be the initial ramp time. Ramp time is determined in either: TIME* - Hours.Minutes, Range = 0-99 hr.59 min. or RATE* - EU/MIN or EU/HR, Range = 0 to 999 * This selection of time or rate is made at prompt "Ramp Unit". Set this prompt before entering any Ramp values. **ATTENTION:** Entering "0" implies an immediate step change in setpoint to the next soak.
Segment x SP Segment x Time	Soak segments	A soak segment is a combination of soak setpoint (value) and a soak duration (time). • Soaks are even number segments (2, 4, 6, 8). • Segment 2 will be the initial soak value and soak time. • The soak setpoint range value must be within the setpoint high and low range limits in engineering units.

Associated Prompts	Contents	Definition
		• Soak time is the duration of the soak and is determined in: TIME - Hours:Minutes, Range = 0-99 hr:59 min.
Soak Deviation	Guaranteed soak	All soak segments can have a deviation value of from 0 to ± 99 (specified by SOK DEV) which guarantees the deviation value for that segment. Guaranteed soak deviation values greater than zero guarantee that the soak segment's process variable is within the ± deviation value for the configured soak time. Whenever the ± deviation value is exceeded, the soak timer stops until the process variable gets within the ± deviation value. There are no guaranteed soaks whenever the deviation value is configured to 0, (that is, soak segments start timing soak duration as soon as the soak setpoint is first reached, regardless of where the process variable remains relative to the soak segment). The soak deviation value is the number in engineering units, above or below the setpoint, outside of which the timer halts. The range is 0 to ± 99.XX. The decimal location here corresponds decimal configuration chosen in the Display Set up group.

Ramp/soak profile example

Before you perform the actual configuration, we recommend that you draw a Ramp/Soak profile in the space provided on the “Program Record Sheet” (Program record sheet) and fill in the associated information. An example of a Ramp-Soak Profile is shown in figure below. Start setpoint is at 200 degrees F.

Figure 5-4: Ramp/Soak Profile Example

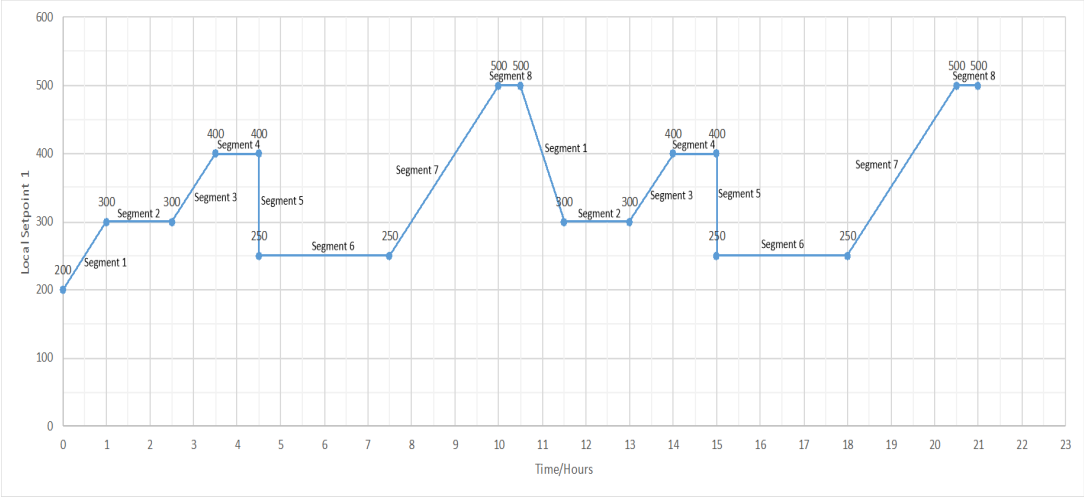


Table 5-22: Ramp/Soak Profile Example

Prompt	Function	Segment	Value
Soak Deviation	Deviation Value		0
Program Termination	Controller Status		Last SP
Program End State	Controller State at end		Hold
Key Reset/Rerun	Reset SP Program		Disable
Hot Start	PV Hot Start Program Initialization or power up in SPP		Disable
Start Segment	Start Seg.		1
End Segment	End Seg.		8

Prompt	Function	Segment	Value
Ramp Unit	Engr. Unit for Ramp		Time
Recycles	Number of Recycles		1
Segment 1 Ramp	Ramp Time	1	1 hr.
Segment 2 SP	Soak SP	2	300
Segment 2 Time	Soak Time	2	1 hr:30 min.
Segment 3 Ramp	Ramp Time	3	1 hr.
Segment 4 SP	Soak SP	4	400
Segment 4 Time	Soak Time	4	1 hr.
Segment 5 Ramp	Ramp Time	5	0 hr:0 min
Segment 6 SP	Soak SP	6	250
Segment 6 Time	Soak Time	6	3 hr:0 min.
Segment 7 Ramp	Ramp Time	7	2 hr:30 min.
Segment 8 SP	Soak SP	8	500
Segment 8 Time	Soak Time	8	0 hr:30 min.

Program record sheet

Draw your ramp/soak profile on the record sheet shown in table below and fill in the associated information in the blocks provided. This will give you a permanent record of your program and will assist you when entering the Setpoint data.

Table 5-23: Program record sheet

Prompt	Function	Segment	Value
Start Segment	Start Seg.		
End Segment	End Seg.		
Ramp Unit	Engr. Unit for Ramp		
Recycles	Number of Recycles		

Prompt	Function	Segment	Value
Soak Deviation	Deviation Value		
Program Termination	Controller Status		
Program End State	Controller State at end		
Key Reset/Rerun	Reset SP Program		
Hot Start	PV Hot Start Program Initialization or power up in SPP		
Segment 1 Ramp	Ramp Time	1	
Segment 2 SP	Soak SP	2	
Segment 2 Time	Soak Time	2	
Segment 3 Ramp	Ramp Time	3	
Segment 4 SP	Soak SP	4	
Segment 4 Time	Soak Time	4	
Segment 5 Ramp	Ramp Time	5	
Segment 6 SP	Soak SP	6	
Segment 6 Time	Soak Time	6	
Segment 7 Ramp	Ramp Time	7	
Segment 8 SP	Soak SP	8	
Segment 8 Time	Soak Time	8	

Run/Monitor the program

Prior to running the program, make sure all the “SP Program Function” prompts under the Set Up group “SP Ramp/Program” have been configured with the required data.

“Hold” appears in the Middle Display indicating that the program is in the HOLD state.

> **ATTENTION:** SP Program parameter can only be changed before the program is started (run or hold), or after the program is terminated, except for SP Program Function and Key Reset/Rerun.

Run/Monitor functions

The following table lists all the functions required to run and monitor the program.

Table 5-24: Run/Monitor Functions

Function	Press	Result
Set the Local Setpoint	Lower Display key	Until you see " SP" appears in the Lower Display.
	Increment key or Decrement key	To set the Local Setpoint value to where you want the program to start out.
Run State	Run/Hold (Setup key and Increment key)	Initiates the setpoint program. “ Run ” appears in the Middle Display indicating that the program is running.
Hold State	Run/Hold (Setup key and Increment key)	Holds the setpoint program. “ Hold ” appears in the Middle Display indicating that the program is in the HOLD state. The setpoint holds at the current setpoint.
External Hold		If one of the Digital Inputs is programmed for the HOLD function, then contact closure places the controller in the HOLD state, if the setpoint program is running. The middle display will show “Hold ” while the switch is closed. **ATTENTION:** The keyboard takes priority over the external switch for the Run/Hold function.

Function	Press	Result
		Reopening the HOLD switch runs the program.
Viewing the present ramp or soak segment number and time	Lower Display key	In the Lower Display, until you see: PXSX RA XXH:XXM:XXS for Ramps: Program X(1-8) Segment X(1, 3, 5, 7) Ramp XXH:XXM:XXS remaining or, PXSX SK XXH:XXM:XXS for Soaks: Program X(1-8) Segment X(2, 4, 6, 8) Soak XXH:XXM:XXS remaining X and XX is current program or segment or time remaining
Viewing the number of cycles left in the program	Lower Display key	Until you see Recycle XX in the Lower Display. Number of cycles remaining in the setpoint program. XX = 0 to 99
End Program		When the final segment is completed, the " Run " in the Middle Display either changes to " Hold " (if Program End State is configured for Hold state), or disappears (if configured for disable of setpoint programming). The controller then either operates at the last setpoint in the program or goes into manual mode/failsafe output, depending upon the "Program Termination" configuration.
Disable Program		See "SP Ramp/Program Set Up Group" on page 81 for more information.

Power outage

ATTENTION: If power is lost during a program, upon power-up the controller will be in hold and the setpoint value will be the setpoint value prior to the beginning of the setpoint program. The program is placed in hold at the beginning. The mode will be as configured under "Power Up Mode" in the "Control" set up group.

Digital input (remote switch) operation

Program can be placed in Run, Hold, Rerun, or To Begin state through a remote dry contact connected to optional digital input terminals, as follows:

Run —contact closure places Program in RUN state, OR

Hold —contact closure places Program in HOLD state

Rerun —contact closure allows the Setpoint Programmer to be reset to the initial segment of its current cycle, unit stays in previous mode.

Opening the contact will cause the Controller to revert to its original state.

To Begin — Contact closure resets SP Program back to the beginning of the first segment in the program and places the program in the HOLD mode. Program cycle number is not affected. Reopening switch has no effect.

Opening the contact will cause the Controller to revert to its original state.

CHAPTER

6 INPUT CALIBRATION

WARNING: INPUT CALIBRATION MAY REQUIRE ACCESS TO HAZARDOUS LIVE CIRCUITS, AND SHOULD ONLY BE PERFORMED BY QUALIFIED SERVICE PERSONNEL. MORE THAN ONE SWITCH MAY BE REQUIRED TO DE-ENERGIZE UNIT BEFORE CALIBRATION.

What's in this section?

The following topics are covered in this section.

In this section:

Overview *216*

Minimum and Maximum Range Values *217*

Preliminary Information *219*

Input 1 or 2 Set Up Wiring *220*

Input 1 or 2 Calibration Procedure *223*

Restore Input Factory Calibration *226*

Overview

Introduction

This section describes the field calibration procedures for Input 1 and Input 2.

- All input actuations in every UDC2800 controller are fully factory-calibrated and are ready for configuration by the user.
- Field Calibration can improve the accuracy of the Controller if necessary for a particular application.

CAUTION: The field calibration will be lost if a change in input type configuration is implemented at a later time. The original factory calibration data remains available for later use after a field calibration is done. See "Restore Input Factory Calibration" on page 226 for more information.

Calibration Steps

Use the following steps when calibrating an input.

Step	Action
1	Find the minimum and maximum range values for your PV input range from the table Voltage, Milliamp and Resistance Equivalents for Input Range Values.
2	Disconnect the field wiring and find out what equipment you will need to calibrate.
3	Wire the calibrating device to your controller according to the set up wiring instructions for your particular input (See "Input 1 or 2 Set Up Wiring " on page 220 for more information.).
4	Follow the calibration procedure given for Input #1 or Input #2 (See "Input 1 or 2 Calibration Procedure " on page 223 for more information.).

Minimum and Maximum Range Values

Select the Range Values

Calibrate the controller for the minimum (0 %) and maximum (100 %) range values of your particular input type. Two input controllers will need to have each input calibrated separately.

Select the Voltage, Current or Resistance equivalents for 0 % and 100 % range values from table below. Use these values when calibrating your controller.

Table 6-1: Voltage, Milliamp and Resistance Equivalents for Input Range Values

Sensor Type	PV Input Range		Range Values	
	°F	°C	0%	100%
Thermocouples (per ITS-90)				
TC B	0 to 3300	–18 to 1816	–0.100 mV	13.769 mV
TC E High	–454 to 1832	–270 to 1000	–9.835 mV	76.373 mV
TC E Low	-200 to 1100	-129 to 593	–6.472 mV	44.455 mV
TC J High	0 to 1600	–18 to 871	–0.886 mV	50.060 mV
TC J Mid	20 to 900	–7 to 482	– 0.334 mV	26.400 mV
TC J Low	20 to 550	–7 to 288	–0.334 mV	15.650 mV
TC K High	0 to 2400	–18 to 1316	–0.692 mV	52.952 mV
TC K Mid	–20 to 1200	–29 to 649	–1.114 mV	26.978 mV
TC K Low	–20 to 750	–29 to 399	–1.114 mV	16.350 mV
TC M High (Ni-Ni-Moly)	32 to 2500	0 to 1371	0.000 mV	71.773 mV

Sensor Type	PV Input Range		Range Values	
	°F	°C	0%	100%
TC M Low (Ni-Ni-Moly)	32 to 1260	0 to 682	0.000 mV	31.825 mV
TC N High (Nicrosil-Nisil)	0 to 2372	–18 to 1300	–0.461 mV	47.513 mV
TC N Low (Nicrosil-Nisil)	0 to 1472	–18 to 800	-0.461 mV	28.455 mV
TC R	0 to 3100	–18 to 1704	–0.090 mV	20.281 mV
TC S	0 to 3100	–18 to 1704	–0.092 mV	17.998 mV
TC T High	-300 to 700	–184 to 371	–5.341 mV	19.097 mV
TC T Low	-200 to 500	–129 to 260	–4.149 mV	12.574 mV
TC C High	0 to 4200	–18 to 2315	–0.234 mV	37.075 mV
TC C Low	0 to 2240	–18 to 1227	–0.234 mV	22.283 mV
Thermocouple Differential *	–50 to 150	–27.78 to 83.33	–1.54 mV	4.62 mV
RTD Alpha = 0.00385 per IEC-60751 (1995)				
RTD Pt100	–300 to 1200	–184 to 649	25.202 ohms	329.289 ohms
RTD Pt100 Low	–300 to 300	–184 to 149	25.202 ohms	156.910 ohms
RTD Pt200	–300 to 1200	–184 to 649	50.404 ohms	658.578 ohms
RTD Pt500	–300 to 1200	–184 to 649	126.012 ohms	1646.445 ohms
TC PR40-PR20	32 to 3416	0 to 1880	0.000 mV	4.933 mV

Sensor Type	PV Input Range		Range Values	
	°F	°C	0%	100%
Linear				
Milliamps	4 to 20 mA 0 to 20 mA		4.00 mA 0.00 mA	20.00 mA 20.00 mA
Millivolts	0 to 10 mV 0 to 50 mV 0 to 100 mV		0.00 mV 0.00 mV 0.00 mV	10.00 mV 50.00 mV 100.00 mV
Volts	1 to 5 Volts 0 to 5 Volts 0 to 10 Volts		1.00 Volts 0.00 Volts 0.00 Volts	5.00 Volts 5.00 Volts 10.00 Volts
Carbon Oxygen	0 to 1250 mV -30 to 510 mV		0.00 mV -30.00 mV	1250.00 mV 510.00 mV

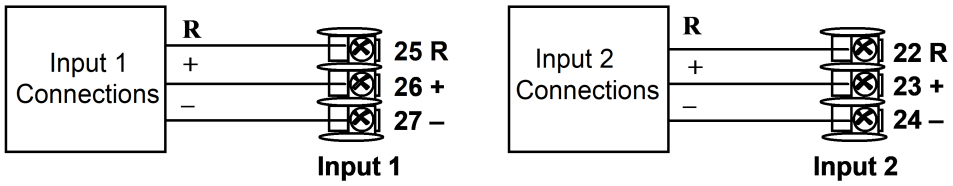
*The Factory Calibrated millivolt values for the Thermocouple Differential Input are for a pair of J thermocouples at an ambient temperature mean of 450° F / 232 ° C. Other thermocouple types and ambient temperature means may be accomplished via Field Calibration of the input, with the range value limits being –4 mV to +16 mV for the zero and span values.

Preliminary Information

Disconnect the Field Wiring

Tag and disconnect any field wiring connected to the input (#1 or #2) terminals on the rear of the controller.

Figure 6-1: Input 1 and Input 2 Wiring Terminals



Equipment Needed

Table below lists the equipment you will need to calibrate the specific types of inputs that are listed in the table. You will need a screwdriver to connect these devices to your controller.

Table 6-2: Equipment Needed

Type of Input	Equipment Needed
Thermocouple Inputs (Millivolt Source)	• A calibrating device with at least ± 0.02 % accuracy for use as a signal source such as a millivolt source. • Two insulated copper leads for connecting the thermocouple inputs to the millivolt source.
RTD (Resistance Thermometer Device)	• A decade box, with at least ± 0.02 % accuracy, capable of providing stepped resistance values over a minimum range of 0 to 1650 ohms with a resolution of 0.001 ohm. • Three insulated copper leads of equal length for connecting the decade box to the controller.
Milliampere, Millivolt and Volts	• A calibrating device with at least ± 0.02 % accuracy for use as a signal source. • Two insulated copper leads for connecting the calibrator to the controller. • Place current source at zero before switching ON. • Do not switch current sources OFF/ON while connected to the UDC2800 input.

Input 1 or 2 Set Up Wiring

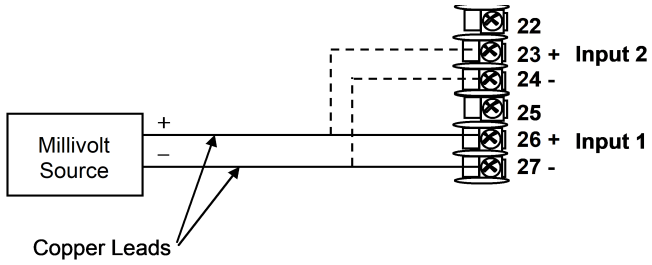
Thermocouple Inputs using a Millivolt Source

Refer to Figure "Wiring Connections for Thermocouple Inputs using a Millivolt Source" and wire the controller according to the procedure given in Table "Set Up Wiring Procedure for Thermocouple Inputs using a Millivolt Source".

Table 6-3: Set Up Wiring Procedure for Thermocouple Inputs using a Millivolt Source

Step	Action
1	Connect the copper leads to the terminals for Input #1 as shown in the following figure "Wiring Connections for Thermocouple Inputs using a Millivolt Source".

Figure 6-2: Wiring Connections for Thermocouple Inputs using a Millivolt Source



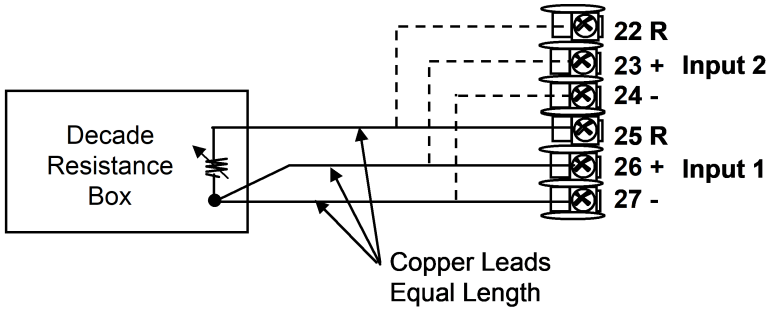
RTD Inputs

Refer to Figure "Wiring Connections for RTD (Resistance Thermometer Device)" and wire the controller according to the procedure given in Table "Set Up Wiring Procedure for RTD Inputs".

Table 6-4: Set Up Wiring Procedure for RTD Inputs

Step	Action
1	Connect the copper leads from the calibrator to the Input #1 terminals as shown in Figure "Wiring Connections for RTD (Resistance Thermometer Device)".

Figure 6-3: Wiring Connections for RTD (Resistance Thermometer Device)



Millivolts, Volts or Thermocouple Differential Inputs

Refer to the following figure and wire the controller according to the procedure given in the following table.

Figure 6-4: Wiring Connections for Thermocouple Differential, Millivolts or Volts

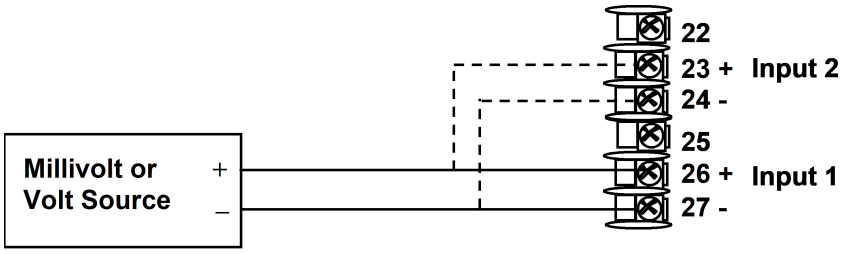


Table 6-5: Set Up Wiring Procedure for Millivolts, Volts or Thermocouple Differential Inputs

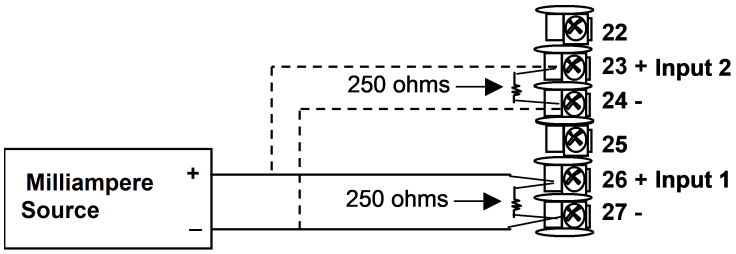
Step	Action
1	Connect the copper leads from the calibrator to the Input #1 terminals as shown in Figure "Wiring Connections for Thermocouple Differential, Millivolts or Volts".
2	Place current/voltage source at zero before switching on.
3	Do not switch current/voltage source ON/OFF while connected to the instrument.

Milliamperes

Table 6-6: Set Up Wiring Procedure for Milliampere Inputs

Step	Action
1	Connect the copper leads from the calibrator to the Input #1 terminals as shown in Figure "Wiring Connections for 0 to 20 mA or 4 to 20 mA Inputs".
2	Place current source at zero before switching on.
3	Do not switch current source ON/OFF while connected to the instrument.

Figure 6-5: Wiring Connections for 0 to 20 mA or 4 to 20 mA Inputs



Input 1 or 2 Calibration Procedure

Preliminary Steps

- Apply power and allow the controller to warm up for 30 minutes before you calibrate.
- Before beginning the procedure, See "Input 1 or 2 Set Up Wiring " on page 220 for more information.
- Make sure you have set Lock to NONE in the Security set up group. See "Security Set Up Group" on page 74 for more information.
- See the table Voltage, Milliamp and Resistance Equivalents for Input Range Values for Voltage vs. Resistance equivalents or 0 % and 100 % range values.

CAUTION: For linear inputs, avoid step changes in inputs. Vary smoothly from initial value to final 100 % value.

Procedure

The calibration procedure for Input #1 or 2 is listed in table below.

Table 6-7: Input 1 or 2 Calibration Procedure

Step	Operation	Press	Result
1	Enter Calibration Mode	Setup key	Enter into the setup mode.
		Increment key or Decrement key	Until you see "InputN Calib" (N=1 or 2)
2	Enable Calibration function	Function key	Enter into the first function prompt "Calibrate Input N" of the InputN Calib set up group. Press the Function key again to enter into the first configuration prompt of Calibrate Input N.
		Increment key or Decrement key	Until you see Begin.
		Function key	Enable the Calibration function At the completion of the sequence, the selection automatically reverts to disable.
3	Calibrate 0 %	Increment key or Decrement key	You will see Input N Zero (N=1 or 2) • Adjust your calibration device to an output signal equal to the 0 % range value for your particular input sensor. See the table Voltage, Milliamp and Resistance Equivalents for Input Range Values for Voltage, Degrees, or Resistance equivalents for 0 % range values. • Wait 15 seconds, then go to the next step.
4	Calibrate 100 %	Increment key or Decrement key	You will see Input N Span (N=1 or 2) • Adjust your calibration device to an output signal equal to the 100 % range value for your particular input sensor. See the table Voltage, Milliamp and Resistance Equivalents for Input Range Values for Voltage, Degrees, or

Step	Operation	Press	Result

			Resistance equivalents for 100 % range values.
			• Wait 15 seconds, and if
			  • you are calibrating a Thermocouple input, go to step 5.
			  • you are calibrating other than a Thermocouple input, go to step 6.

5	Check the Cold Junction Temperature	Increment key or Decrement key	The calculations for zero and span are now stored and you will see Cold Junction Temp N (N=1 or 2): The value is in tenths of a degree. It is the current reading of the temperature as measured at the thermocouple terminals and recognized by the controller. You can change this value, if it is in error, using the Increment key or Decrement key. **CAUTION:** The accuracy of the controller is directly affected by the accuracy of this value. It is recommended that this value not be changed under normal circumstances.
6	Exit the Calibration Mode	Function key	The controller stores the calibration constants
		Lower Display key	Exit the calibration mode.

Restore Input Factory Calibration

Introduction

The factory calibration constants for all the input actuation types that can be used with the controller are stored in its non-volatile memory. Thus, you can quickly restore the “Factory Calibration” for a given input actuation type by simply changing the actuation type to another type and then changing it back to the original type.

> **ATTENTION:** A restored factory calibration overwrites any previous field calibration done for the input and may change the High and Low Range Limits.
> Protect your field calibration from accidental overwrites by configuring the appropriate Lockout selection after calibration.
> See "Configuration" on page 67 for more information.

Table 6-8: Restore Factory Calibration

Step	Operation	Press	Result
1	Set Lockout to None	Setup key	Until you see Security.
		Function key	Enter into the first function prompt Password of the Security set up group. Press the Function key again to enter the correct password.
		Function key	You can see Lockout appears. Press the Function key again to enter into the configuration prompt of the Lockout.
		Increment key or Decrement key	Until you see None.
		Function key	Set Lockout to None.

Step	Operation	Press	Result
2	Enter Input set up group	Setup key	Until you see Input N (N=1 or 2).
		Function key	Enter into the first function prompt Input N Type of the Input set up group. N=1 or 2. Press the Function key again to enter into the configuration prompt of Input N Type.
		Increment key or Decrement key	To change the current selection to another selection.
3	Scroll through Functions	Function key	until the lower display rolls through the rest of the functions and returns to Input N Type (N = 1 or 2)
		Increment key or Decrement key	until you change the input selection back to the proper selection.
4	Return to Normal Operation	Lower Display key	return to Normal operating mode. The factory calibration will be restored. If the problem is not corrected, contact your Honeywell representative.

CHAPTER

7 OUTPUT CALIBRATION

What's in this section?

The following topics are covered in this section.

In this section:

Overview *230*

Current Output Calibration *230*

Auxiliary Output Calibration *233*

Restore Output Factory Calibration *235*

Overview

Introduction

This section describes the field calibration procedures for the following types of outputs:

- Current Output
- Auxiliary Output

> **WARNING:** OUTPUT CALIBRATION MAY REQUIRE ACCESS TO HAZARDOUS LIVE CIRCUITS, AND SHOULD ONLY BE PERFORMED BY QUALIFIED SERVICE PERSONNEL. MORE THAN ONE SWITCH MAY BE REQUIRED TO DE-ENERGIZE UNIT BEFORE CALIBRATION.

Current Output Calibration

Introduction

Calibrate the controller so that the output provides the proper amount of current over the desired range. The controller can provide an output current range of from 0 to 21 milliamperes and is usually calibrated at 4 mA for 0 % of output and 20 mA for 100 % of output, or any other values between 0 mA and 21 mA. It is not necessary to re-calibrate the controller in order to change from 4 to 20 mA operation over to 0 to 20 mA operation, a simple configuration change is all that is required. See "Output Set Up Group" on page 107 for more information.

Equipment Needed

You will need a standard shop type milliammeter, with whatever accuracy is required, capable of measuring 0 to 20 milliamps.

Calibrator Connections

Refer to figure below and wire the controller according to the procedure given in the table.

Figure 7-1: Wiring Connections for Calibrating Current Proportional Output

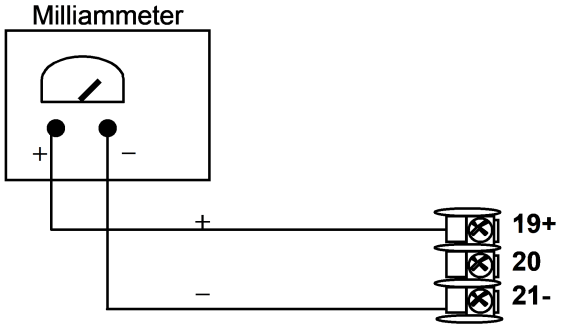


Table 7-1: Set Up Wiring Procedure for Current Output

Step	Action
1	Apply power and allow the controller to warm up 30 minutes before you calibrate.
2	Set Lockout in the Security set up group to None.
3	Tag and disconnect the field wiring, at the rear of the controller, from terminals 21 (–) and 19 (+). See figure below.
4	Connect a milliammeter across these terminals.

Procedure

The procedure for calibrating the Current Output is listed in table below.

Make sure Lockout in the Security set up group is set to None. See "Security Set Up Group" on page 74 for more information.

Table 7-2: Current Output Calibration Procedure

Step	Operation	Press	Result
1	Enter Calibration Mode	Setup key	Enter into the Setup mode.
		Setup key or Increment key or Decrement key	Until you see Current Calib.
2	Calibrate 0 %	Function key	Enter into the first function prompt Zero Value of the Current Calib set up group. Press the Function key again to enter the configuration prompt of Zero Value.
		Increment key or Decrement key	Until the desired 0 % output is read on the milliammeter, use the values shown below depending on the action of your controller. Normally, this will be the setting that produces 4 mA. If tuning Zero Value of 0-20 mA output type, the output should be tuned to non-zero value first, and then tuned back to the edge. The edge means that the output will be greater than 0 mA when the Increment key is pressed, and the output will still be 0 mA when the Decrement key is pressed.
3	Calibrate 100 %	Function key	This stores the 0 % value.
		Increment key or Decrement key	Until you see Span Value.
		Function key	Enter into the configuration prompt of Span Value.
		Increment key or Decrement key	Until the desired 100 % output is read on the milliammeter, use the values shown below depending on the action of your controller. Normally, this will be the setting that produces 20 mA.
4	Exit the Calibration Mode	Function key	The controller stores the span value.
		Lower Display key	To exit the calibration mode.

Auxiliary Output Calibration

Introduction

Calibrate the controller so that the auxiliary output provides the proper amount of current over the desired range. The controller can provide an auxiliary current output range of from 0 mA to 21 mA and and is usually calibrated at 4 mA for 0 % of output and 20 mA for 100 % of output or any other values between 0 mA and 21 mA. It is not necessary to re-calibrate the controller in order to change from 4 to 20 mA operation over to 0 to 20 mA operation, a simple configuration change is all that is required. See "Options Set Up Group" on page 131 for more information.

Equipment Needed

You will need a calibrating device with whatever accuracy is required, capable of measuring 0 to 20 mA.

Calibrator Connections

Refer to Figure "Wiring Connections for Calibrating Auxiliary Output" below and wire the controller according to the procedure given in the table "Set Up Wiring Procedure for Auxiliary Output".

Figure 7-2: Wiring Connections for Calibrating Auxiliary Output

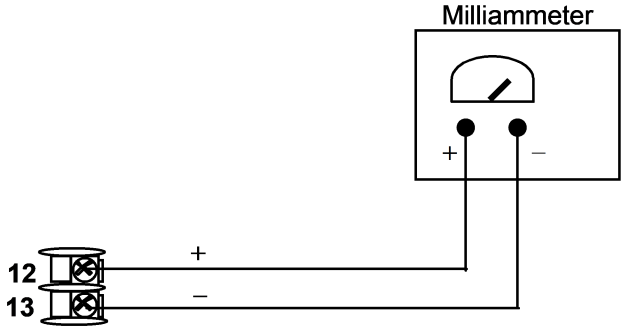


Table 7-3: Set Up Wiring Procedure for Auxiliary Output

Step	Action
1	Apply power and allow the controller to warm up 30 minutes before you calibrate.
2	Set Lockout in the Security set up group to None.
3	Tag and disconnect the field wiring, at the rear of the controller, from terminals 12 (+) and 13 (–). See figure below.
4	Connect a milliammeter across these terminals.

Procedure

The procedure for calibrating the auxiliary output is listed in table below.

Make sure Lockout in the Security set up group is set to None. See "Security Set Up Group" on page 74 for more information.

Table 7-4: Auxiliary Output Calibration Procedure

Step	Operation	Press	Result
1	Enter Calibration Mode	Setup key	Enter into the Setup mode.
		Setup key or Increment key or Decrement key	Until you see Auxiliary Calib.
2	Calibrate 0 %	Function key	Enter into the first function prompt Zero Value of the Auxiliary Calib set up group. Press the Function key again to enter the configuration prompt of Zero Value.
		Increment key or Decrement key	Until the desired 0 % output is read on the milliammeter. Normally, this will be the setting that produces 4 mA. If tuning Zero Value of 0-20 mA output type, the output should be tuned to non-zero value first, and then tuned back to the edge. The edge means that the output will be greater than 0 mA

Step	Operation	Press	Result
			when the Increment key is pressed, and the output will still be 0 mA when the Decrement key is pressed.
3	Calibrate 100 %	Function key	To store the 0 % value.
		Increment key or Decrement key	Until you see Span Value.
		Function key	Enter into the configuration prompt of Span Value.
		Increment key or Decrement key	Until the desired 100 % output is read on the milliammeter. Normally, this will be the setting that produces 20 mA.
4	Exit the Calibration Mode	Function key	The controller stores the span value.
		Lower Display key	To exit the calibration mode.

Restore Output Factory Calibration

Introduction

The factory calibration constants for the Current and Auxiliary Outputs are stored in its non-volatile memory. Thus, you can quickly restore the “Factory Calibration” for those outputs by simply changing the CO Range setting for that output to the other setting and then changing it back to the original type.

Refer to table below for procedure.

ATTENTION: A restored factory calibration overwrites any previous field calibration done for the output. Protect your field calibration from accidental overwrites by configuring the appropriate LOCKOUT selection after calibration. See "Configuration" on page 67 for more information.

Table 7-5: Restore Factory Calibration

Step	Operation	Press	Result
1	Select Lockout to None	Setup key	Until you see Security.
		Function key	Enter into the first function prompt Password of the Security set up group. Press the Function key again to enter the correct password.
		Function key	You can see Lockout appears. Press the Function key again to enter into the configuration prompt of the Lockout.
		Increment key or Decrement key	Until you see None.
		Function key	Set Lockout to None.
2	Enter Output or Options set up Group	Setup key	Until you see Output or Options. Output is for the Current Output, and Options is for the Auxiliary Output.
		Function key	Enter into the first function prompt of the Output or Options set up group.
		Increment key or Decrement key	Until you see CO Range.
		Function key	Enter into the first configuration prompt of the Output or Options set up group.
		Increment key or Decrement key	To change the range configuration to the other selection
3	Scroll through Functions	Function key	Until the lower display rolls through the rest of the functions and returns to Co Range.
		Increment key or Decrement key	To change the range selection in the upper display back to the proper selection.

Step	Operation	Press	Result
4	Return to Normal Operation	Lower Display key	Return to Normal operating mode. The factory calibration will be restored. If the problem is not corrected, contact your Honeywell representative.

CHAPTER

8 TROUBLESHOOTING/SERVICE

What's in this section?

The following topics are covered in this section.

In this section:

Overview *240*

Troubleshooting Aids *241*

Power-up Tests *242*

Status Tests *243*

Background Tests and Diagnostic *244*

Controller Failure Symptoms *249*

Troubleshooting Procedures *250*

Restoring Factory Configuration *258*

Overview

Introduction

Instrument performance can be adversely affected by installation and application problems as well as by hardware problems. We recommend that you investigate the problems in the following order:

- installation related problems
- application related problems
- hardware and software related problems

and use the information presented in this section to solve them.

Installation related problems

Read the Installation section in this manual to make sure the UDC2800 has been properly installed. The installation section provides information on protection against electrical noise, connecting external equipment to the controller, and shielding and routing external wiring.

> **ATTENTION:** System noise induced into the controller will result in diagnostic error messages recurring. If the diagnostic error messages can be cleared, it indicates a “soft” failure and is probably noise related.

If system noise is suspected, completely isolate the controller from all field wiring. Use calibration sources to simulate PV and check all controller functions; i.e. Gain, Rate, Reset, Output, Alarms, etc.

Application related problems

Review the application of the controller; then, if necessary, direct your questions to the local sales office.

Hardware and software related problems

Use the troubleshooting error message prompts and controller failure symptoms to identify typical failures which may occur in the controller. Follow the troubleshooting procedures to correct them.

Troubleshooting Aids

Overall error messages

An error message can occur:

- At power-up. See "Power-up Tests" on the next page for more information.
- When the Status Tests are requested. See "Status Tests" on page 243 for more information.
- During continuous background tests while in normal operation. See "Background Tests and Diagnostic " on page 244 for more information.

Controller failure symptoms

Other failures may occur that deal with the Power, Output, or Alarms. Refer to the controller failure symptom in Table Controller Failure Symptoms to determine what is wrong and the troubleshooting procedures to use to correct the problem.

Check installation

If a set of symptoms still persists, ensure proper installation and proper use of the controller in the system. See "Installation" on page 31 for more information.

Customer support

If you cannot solve the problem using the troubleshooting procedures listed in this section, you can get technical assistance by dialing 1-800-423-9883 USA and Canada.

An engineer will discuss your problem with you. Please have your complete model number, serial number, and Software version available. The model and serial numbers can be found on the chassis nameplate. The software version can be viewed under Setup Group “Status.” See Table Procedure for Identifying the Software Version.

If it is determined that a hardware problem exists, a replacement controller or part will be shipped with instructions for returning the defective unit.

Do not return your controller without authorization from Honeywell's Technical Assistance Center or until the replacement has been received.

Check out Honeywell's web site at http://www.honeywell.com/imc.

Determining the software version

Table below lists the procedure for identifying the software version number.

Table 8-1: Procedure for Identifying the Software Version

Step	Operation	Press	Result
1	Select Status set up group	Setup key	Until you see Status.
2	Read the software version	Function key	Enter into the first function prompt Software Version of the Status set up group. You can see the software version then. Please give this number to the Customer Support person. It will indicate which version of UDC2800 you have and help them determine a solution to your problem.

Power-up Tests

What happens at power-up

When power is applied, the controller will run several diagnostic tests, including RAM test and EEPROM test. After these tests are completed, "Success" is displayed.

Failsafe Failures

If one or more of these tests fail, the controller will go to the Failsafe Manual Mode, and FailSafe will flash in the diagnostics display and a message indicating which test failed will appear in the dianostics display.

Status Tests

Introduction

When required, the results of these tests can be checked to determine the reason the controller has gone to Failsafe.

How to check the status tests

The procedure in table below tells you how to display the results of the status tests.

Table 8-2: Procedure for Displaying the Status Test Results

Step	Operation	Press	Result
1	Select Status set up group	Setup key	Until you see Status.
2	Read the test results	Function key	Enter into the first function prompt Software Version of the Status set up group.
		Increment key or Decrement key	Until you see Failsafe Status. You can see the Failsafe status, No or Yes. Yes indicates a failure.
		Increment key or Decrement key	Until you see Self Tests. You can see the status of Self Tests, Pass or Fail.

Background Tests and Diagnostic

Introduction

This instrument performs ongoing background tests to verify data and memory integrity. If there is a malfunction, a diagnostic message will be displayed (blinking) in the diagnostics display.

In the case of simultaneous malfunctions, the messages will appear in sequence in the diagnostics display. Table below lists these background tests, the reason for their failure, and how to correct the problem.

Table 8-3: Background Tests

Lower Display	Reason for Failure	How to Correct the Problem
RAM Error	RAM test failed at start up.	1. Run through STATUS check to determine the reason for the failure. 2. Run through the STATUS check a second time to see if the error cleared. 3. Power cycle the instrument. If the message reappears, replace the instrument.
EEPROM Error	Unable to write to non-volatile memory. Anytime you change a parameter and it is not accepted, you will see EEPROM Error.	1. Check the accuracy of the parameter and re-enter. 2. Try to change something else in configuration. 3. Run through Read STATUS tests to re-write to EEPROM. 4. Run through the STATUS check a second time to see if the error cleared. If error did not clear, then power cycle the instrument. If the message reappears, replace the instrument.

Lower Display	Reason for Failure	How to Correct the Problem
Calibration Test Error	Calibration test failed at start up.	1. Run through STATUS check to determine the reason for the failure. 2. Restore factory settings. See "Restoring Factory Configuration" on page 258 for more information. 3. Power cycle the instrument. If the message reappears, replace the instrument.
Configuration Error	It appears when one of the following conditions is happened: • PV low limit is > PV high limit • SP low limit is > SP high limit • Output low limit > Output high limit	Check the configuration for each item and reconfigure if necessary.
Config Test Error	Calculated checksum is mismatched with the checksum in EEPROM.	Restore the instrument.
Failsafe	This error message shows whenever the controller goes into a failsafe mode of operation. This will happen if: • RAM test failed • Configuration test failed • Calibration test failed • Burnout is configured for none and the input failed.	1. Run through STATUS check to determine the reason for the failure. 2. Press the Setup and Increment key until Status appears. 3. Press the Function key to see whether the tests pass or fail, then run through the Status codes a second time to see if the error cleared.

Lower Display	Reason for Failure	How to Correct the Problem
Input 1 Range	Input 1 out of range. The process input is outside the range limits.	1. Make sure the range and actuation are configured properly. 2. Check the input source. 3. Restore the factory calibration. (See "Restore Input Factory Calibration" on page 226 for more information.) 4. Field calibrate. See "Input Calibration" on page 215 for more information.
Input 1 Fail	Two consecutive failures of input 1 integration; i.e., cannot make analog to digital conversion. This will happen if: • Upscale or Downscale burnout is selected and the input is open • Input not configured correctly for the sensor being used • Calibration test failed • Input source is grossly out of range.	1. Make sure the actuation is configured correctly. See "Configuration" on page 67 for more information. 2. Make sure the input is correct and that it has not burned-out (opened). 3. Check for gross over-ranging with a multimeter 4. Restore factory calibration. See "Restore Input Factory Calibration" on page 226 for more information.
Input 2 Range	Input 2 out of range. The remote input is outside the range limits.	Same as Input 1 Range above.
Input 2 Fail	Two consecutive failures of input 2 integration. i.e., cannot make analog to digital conversion.	Same as Input 1 Fail above.
PV Limit	PV in engineering unit (with ratio and bias) is out of limit.	1. Make sure the input signal is correct.

Lower Display	Reason for Failure	How to Correct the Problem
	PV limit is same as burnout high/low limit, Linear ±10%, TC/RTD ±1%, Input Algorithm 0%. PV = Input 1 x Ratio 1 + Input 1 BIAS	2. Make sure the Ratio and Bias settings are correct. 3. Recheck the calibration. Use Bias of 0.0.
Remote SP Limit	RSP in engineering unit (with ratio and bias) is out of limit. RSP limit is same as burnout high/low limit, Linear ±10%, TC/RTD ±1%, Input Algorithm 0%. RSP limit shall not triggered when RSP Source choose None. RV = Input 2 x Ratio + BIAS	1. Make sure the input signal is correct. 2. Make sure the Ratio2 and Bias2 settings are correct. 3. Recheck the calibration. Use a Ratio2 of 1.0 and a Bias2 of 0.0.
Segment Error	Setpoint Program start segment number is less than ending segment number. Segment Error shall not triggered when Setpoint Program is disabled.	Check SP Program configuration. See "SP Ramp/Program Set Up Group" on page 81 for more information.
Sooting	Percent Carbon falls outside sooting boundary	Check process for correct operation.
TC 1 Warning	Thermocouple on Input 1 is starting to burn out.	This diagnostic message means that the controller has detected that the thermocouple is starting to burn out. This error message may also be created if the resistance of the wires used to connect the thermocouple to the instrument is above 100 ohms.
TC 2 Warning	Thermocouple on Input 2 is starting to burn out.	This diagnostic message means that the controller has detected that the thermocouple is starting to burn out. This error message may also be

Lower Display	Reason for Failure	How to Correct the Problem
		created if the resistance of the wires used to connect the thermocouple to the instrument is above 100 ohms.
TC 1 Fail	Thermocouple on Input 1 is in imminent danger of burning out.	This diagnostic message means that the controller has detected that the thermocouple will soon fail. User should consider replacing the thermocouple as soon as possible. This message will also be generated if the resistance of the wires used to connect the thermocouple to the instrument is above 180 ohms.
TC 2 Fail	Thermocouple on Input 2 is in imminent danger of burning out.	This diagnostic message means that the controller has detected that the thermocouple will soon fail. User should consider replacing the thermocouple as soon as possible. This message will also be generated if the resistance of the wires used to connect the thermocouple to the instrument is above 180 ohms.
Output 1 Fail	Current Output is configured as 4-20mA, and Current Output is less than 3.5 mA	The current output is open circuit. Check the field wiring. See Procedure #2.
Output 2 Fail	Auxiliary Output is configured as 4-20mA, and Auxiliary Output is less than 3.5 mA.	The auxiliary output is open circuit. Check the field wiring. See Procedure #9.

Controller Failure Symptoms

Introduction

In addition to the error message prompts, there are failure symptoms that can be identified by noting how the controller displays and indicators are reacting.

Symptoms

Compare your symptoms with those shown in table below.

Table 8-4: Controller Failure Symptoms

Upper Display	Lower Display	Indicators	Controller Output	Probable Cause	Troubleshooting Procedure
Blank	Blank	Off	None	Power Failure	1
OK	Displayed Output disagrees with Controller Output	OK	Controller Output disagrees with Displayed Output	Current Proportional Output	2
OK		OK		Time Proportional Output	3
OK		OK		Current / Time Proportional Output	4
OK	OK	OK	External Alarm function does not operate properly	Malfunction in alarm output	5
Display does not change when a key is pressed				Keyboard Malfunction	7
Controller fails to go into “Slave” operation during communications				Communications Failure	8
OK	Displayed Output	OK	Controller Auxiliary	Auxiliary Output	9

Upper Display	Lower Display	Indicators	Controller Output	Probable Cause	Troubleshooting Procedure
	disagrees with Auxiliary Output		Output disagrees with Displayed Auxiliary Output		

Other symptoms

If a set of symptoms or prompts other than the one you started with appears while troubleshooting, re-evaluate the symptoms. This may lead to a different troubleshooting procedure.

If the symptom still persists, refer to the installation section in this manual to ensure proper installation and proper use of the controller in your system.

Troubleshooting Procedures

Introduction

The troubleshooting procedures are listed in numerical order as they appear in Table "Controller Failure Symptoms". Each procedure lists what to do if you have that particular failure and how to do it or where to find the data needed to accomplish the task.

> **WARNING:** TROUBLESHOOTING MAY REQUIRE ACCESS TO HAZARDOUS LIVE CIRCUITS, AND SHOULD ONLY BE PERFORMED BY QUALIFIED SERVICE PERSONNEL. MORE THAN ONE SWITCH MAY BE REQUIRED TO DEENERGIZE UNIT BEFORE SERVICING.

Equipment needed

You will need the following equipment in order to troubleshoot the symptoms listed in the tables that follow:

- Multimeter – Capable of measuring millivolts, milliamps and resistance.

- Calibration sources – T/C, mV, Volt, etc.

Procedure #1

This table explains how to troubleshoot power failure symptoms.

Table 8-5: Troubleshooting Power Failure Symptoms

Step	What to do	How to do it
1	Check the AC line voltage.	Use a voltmeter to measure the AC voltage across terminals L1 and L2 on the rear terminal panel of the controller. Check the earth ground connection.
2	Make sure the chassis plugs into the rear of the case properly.	Withdraw the chassis and visually inspect the controller board and the inside of the case.
3	Check the system for Brown-outs, heavy load switching, etc., and conformance to installation instructions.	Refer to Section - Installation.
4	Change Power board.	Installation instructions supplied with new board.

Procedure #2

This table explains how to troubleshoot Current Output failure symptoms.

Table 8-6: Troubleshooting Current Output Failure

Step	What to do	How to do it
1	Make sure the controller is configured for Current output and the proper range (4 to 20 or 0 to 20) is configured.	Make Output set up group function prompt Output Algorithms = Current. Make the Output set up group function prompt CO Range = 4–20 or 0–20 per your application. See "Output Set Up Group" on page 107 for more information.
2	Check the field wiring.	Output impedance must be less than or equal to

Step	What to do	How to do it
		1000 ohms.
3	Check the output.	Put the controller into Manual mode and change the output from 0 % to 100 % (4-20 mA). Use a DC milliammeter at the rear terminals to verify the output.
4	Recalibrate the Current Proportional output.	See "Output Calibration" on page 229 for more information.
5	Change Current Output board.	Installation instructions provided with new board.
6	Change Controller	

Procedure #3

This table explains how to troubleshoot Time Proportional Output failure.

Table 8-7: Troubleshooting Time Proportional Output Failure

Step	What to do	How to do it
1	Make sure the controller is configured for Time Proportional output.	Make Output set up group function prompt Output Algorithm = Time Simplex or Time Duplex. See "Configuration" on page 67 for more information.
2	Check the field wiring.	Make sure the NO or NC contact wiring is correct. See "Installation" on page 31 for more information.
3	Check the output.	Put the controller into Manual mode. Vary the output above and below the present value. Observe OUT1 indicator on the operator interface. Contact should change state. 0 % open, 100 % closed. Listen for a click from the relay when the OUT1 indicator changes state.
4	Check relay.	Change relay.
5	Change MCU board.	Installation instructions supplied with the new board.

Procedure #4

This table explains how to troubleshoot Current/Time or Time/Current Proportional Output failure.

Table 8-8: Troubleshooting Current/Time or Time/Current Proportional Output Failure

Step	What to do	How to do it
1	Make sure the controller is configured for Time/Current or Current/Time Proportional output.	Make Output Set Up group function prompt Output Algorithms = Time Current or Current Time. See "Output Set Up Group" on page 107 for more information.
2	Check the field wiring.	Make sure the NO or NC contact wiring selection is correct. See "Installation" on page 31 for more information.
3	Check the relay output.	Put the controller into Manual mode. Vary the output above and below the present value. Observe OUT1 indicator on the operator interface. Listen for a click from the relay when the OUT1 indicator changes state.
4	Check the Current Proportional Output.	Put the controller into Manual mode and change the output from 0 % to 100 % (4-20 mA). Use a DC milliammeter at the rear terminals to verify the output.
5	Recalibrate the controller.	See "Output Calibration" on page 229 for more information.
6	Change MCU and/or Current Output boards.	Installation instructions supplied with new board.

Procedure #5

This table explains how to troubleshoot Alarm Relay Output failure.

Table 8-9: Troubleshooting Alarm Relay Output Failure

Step	What to do	How to do it
1	Check the alarm configuration data. If it is correct, check the field wiring.	Reconfigure if necessary. See "Configuration" on page 67 for more information.
2	Check that the applicable alarm relay actuates properly depending on what you have set at prompt AxSxTYPE. If it does, check the field wiring.	If the alarm type is set for PV, place the controller in manual mode. Vary the input to raise and lower the PV around the setpoint. Listen for a click from the relay as the PV moves in either direction and note that the proper ALM1 or ALM2 is lit. EXAMPLE: If the alarm is set for MAN, put the controller into manual mode. The alarm light is ON. Put the controller into automatic mode and the alarm light is OFF.
3	Check the contacts.	Make sure the NO or NC contact wiring is correct. See "Installation" on page 31 for more information.
4	Change the relay and/or the current output board.	Installation instructions supplied with the new relay or board.
5	Change MCU board.	Installation instructions supplied with the new board.

Procedure #6

This table explains how to troubleshoot a Keyboard failure.

Table 8-10: Troubleshooting a Keyboard Failure

Step	What to do	How to do it
1	Make sure the keyboard is connected properly to the MCU/output and power/input boards.	Withdraw the chassis from the case and visually inspect the connection.
2	Controller Keyboard or specific keys may be LOCKED OUT via the security code.	Use your four-digit security code number to change the lockout level. See "Configuration" on page 67 for more information.
3	Run the keyboard test.	Press the Setup key and hold in, then press the Function key at the same time. The controller will run a display test. Then you will see Try keys in the Lower Display. Press each key. If it works, the key name will appear in the Lower Display.
4	Replace the display/keyboard if any keys do not function.	Refer to “Parts Replacement Procedures” in this section.

Procedure #7

This table explains how to troubleshoot a RS 485 Communications failure.

Table 8-11: Troubleshooting a RS-485 Communications Failure

Step	What to do	How to do it
1	Check the Address Number, ComState and Baud Rate settings.	See "Communications Group" on page 139 for more information.
2	Check the field wiring and termination resistor.	Using an ohm meter, check the resistance across the communications rear terminals. See Section for wiring diagrams.

Step	What to do	How to do it
3	Make sure the Communications Printed Wiring Board is installed properly in the controller.	Withdraw the chassis from the case and inspect the board. See the exploded view for location of the board. Return the chassis to the case.
4	Determine if the Communications board is faulty by running a Local Loopback Test. If the test fails, replace the board. If the test passes, the problem is most likely elsewhere in the communications network.	Disconnect the communications cable from the rear terminals. Run the Local Loopback Test. Press the Setup key until you see Communication. Press the Function key to enter in the first function prompt of the Communication set up group. Press Increment key or Decrement key until you see Local Loopback. Press the Function key to enter in the configuration prompt of Local Loopback. Press Increment key or Decrement key until you see Enable. The test will run until the operator disables it here.

Procedure #8

This table explains how to troubleshoot an Ethernet Communications failure.

Table 8-12: Troubleshooting an Ethernet Communications Failure

Step	What to do	How to do it
1	Check the IP address, Subnet Mask address and Gateway address settings.	See Communication set up group and Honeywell EasySet.
2	Check if the Ethernet Connection is	Looking into the instrument, there should be steady green LED. If this is not present, then the instrument is not seeing a valid Ethernet connection. See Section for wiring

Step	What to do	How to do it
	active.	diagrams. A second green LED will blink during actual Ethernet transactions.
3	Change Ethernet Communications board.	Installation instructions provided with new board.
4	Change Controller	

Procedure #9

This table explains how to troubleshoot Auxiliary Proportional Output failure symptoms.

Table 8-13: Troubleshooting Auxiliary Output Failure

Step	What to do	How to do it
1	Make sure the controller is configured for Auxiliary Output and the proper range (4 to 20 or 0 to 20) is configured.	Make Options set up group function prompt Auxiliary Output any selection other than Disable. If this prompt does not show up, check if DIG IN 2 is enabled. If so, then as Auxiliary Ouptut and Digital Input 2 are mutually exclusive, you must chose which one of these features you wish to use. Make the Options Set UP group function prompt CO Range = 4–20 or 0–20 per your application. See "Configuration" on page 67 for more information.
2	Check the field wiring.	Output impedance must be less than or equal to 1000 ohms.
3	Check the output.	Change the Auxiliary Output selection to Output. Put the controller into Manual mode and change the output from 0 % to 100 % (4-20 mA). Use a DC milliammeter at the rear terminals to verify the output.
4	Recalibrate the Auxiliary output.	See "Output Calibration" on page 229 for more information.
5	Change Auxiliary Output board.	Installation instructions provided with new board.
6	Change Controller	

Restoring Factory Configuration

Introduction

This procedure restores the configuration of the instrument back to the Factory Settings.See "Configuration Record Sheet" on page 156 for more information.

> **ATTENTION:** Restoring the factory configuration overwrites all user-entered configuration changes. This procedure cannot be undone, it is a one-way process.

Table 8-14: Restoring Factory Configuration

Step	Operation	Press	Result
1	Enter Security set up group	Setup key	Enter into the Setup mode.
		Setup key or Increment key or Decrement key	Until you see Security.
2	Enter Security Code	Function key	Enter into the first function prompt Password of Security set up group. Press the Function key again to the password configuration.
		Increment key or Decrement key	Enter the correct password.

Step	Operation	Press	Result
3	Enter Restoring Settings	Function key	The Lockout function prompt appears.
		Increment key or Decrement key	Until you see Restoring Settings.
		Function key	Enter into the configuration prompt of Restoring Settings.
		Increment key or Decrement key	Until you see Enable.
		Function key	A dialog appears asking you are sure to restore the settings. Configuration will be restored in 5 seconds. You can press the Lower Display key to cancel the restore within 5 seconds. When the instrument finishes the restore operation, it automatically resets itself and restarts. It is required to change the password. See "Start Up Procedure for Operation" on page 172 for more information. The instrument configuration is now the same as it was when it left the factory, and all user-entered configurations since that time have been overwritten.

CHAPTER

9 PARTS LIST

Exploded View

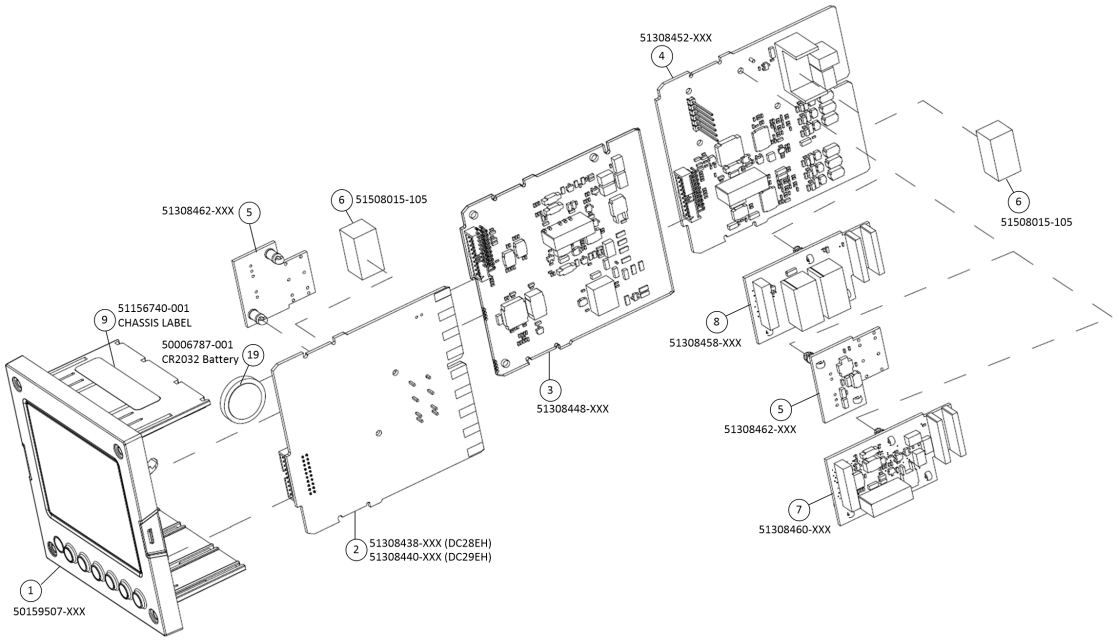
Introduction

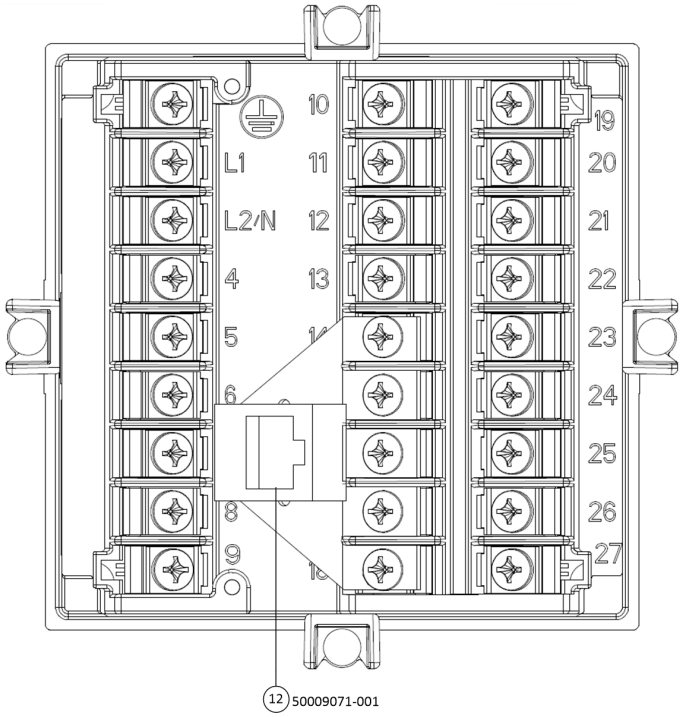
This figure shows an exploded view of the UDC2800 Controller. Each part is labeled with a key number. The part numbers are listed by key number in table Parts Identification.

NOTE: Not all parts are standard.

ATTENTION: Internal parts of the product must be replaced and maintained by Honeywell representative.

Figure 9-1: UDC2800 Exploded View




L1
L2/N
4
5
6
8
9
10
11
12
13
19
20
21
22
23
24
25
26
27
12 50009071-001

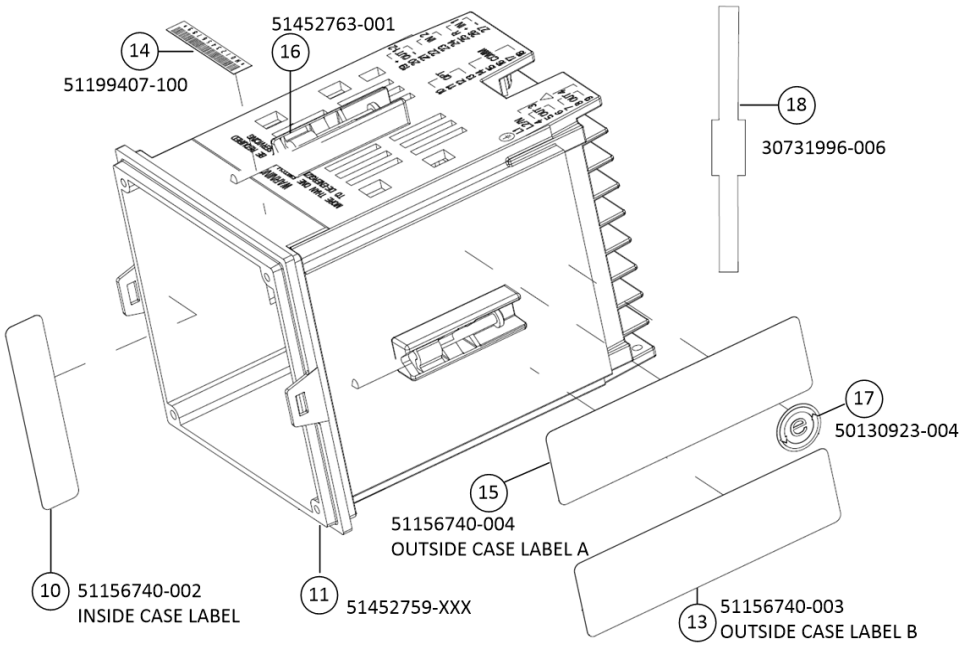
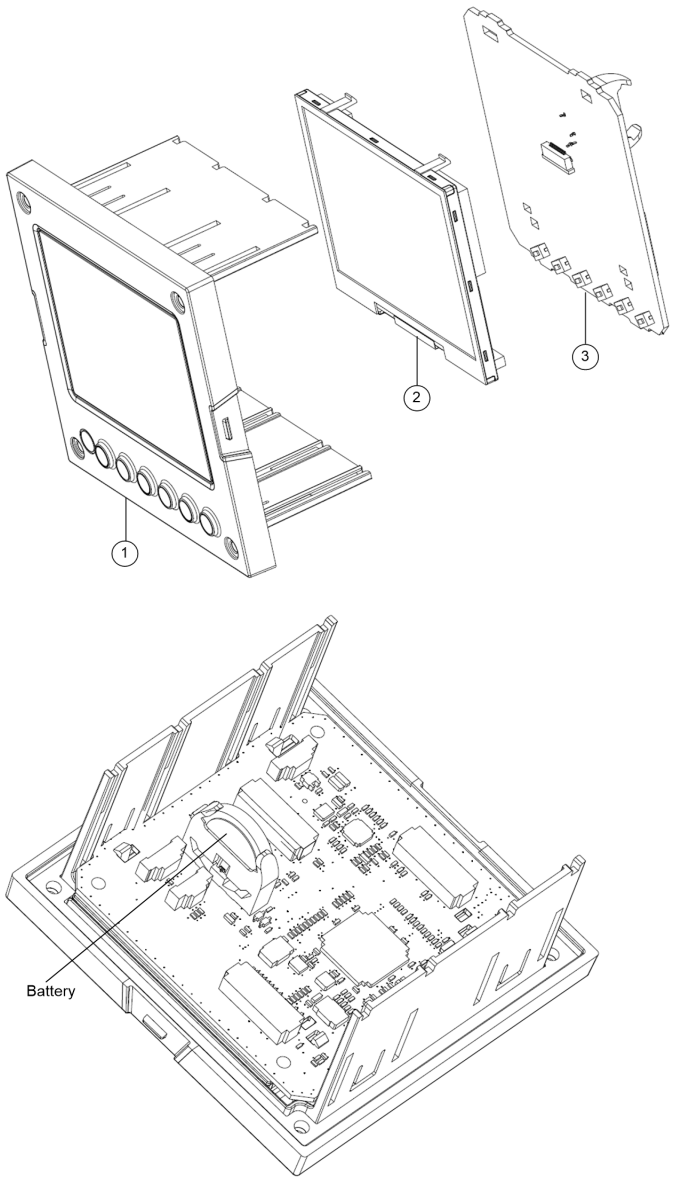

14
51199407-100
51452763-001
16
18
30731996-006
17
50130923-004
15
51156740-004
OUTSIDE CASE LABEL A
10 51156740-002
INSIDE CASE LABEL
11 51452759-XXX
13 51156740-003
OUTSIDE CASE LABEL B

Table 9-1: Parts Identification

Key Number	Part Number	Description
1	50159507-501	Front panel assembly, UDC 2800/2900
2	51308438-528	Power/Output PWA without E-M Relays (90-264 Vac Operation)
	51308438-529	Power/Output PWA with E-M Relays (90-264 Vac Operation)
	51308440-526	Power/Output PWA with E-M Relays (24 Vac/dc Operation)
3	51308448-526	Auxiliary Output/Digital Input PWA
	51308448-527	Auxiliary Output/Digital Input/RS-422/485 Communications PWA
	51308448-528	Auxiliary Output/Digital Input/Ethernet Communications PWA
4	51308452-526	Analog Input/Control Output (1ch AI), PWA
	51308452-527	Analog Input/Control Output (2ch AI), PWA
5	51308462-526	Open Collector Output (TPS) PWA
6	51508015-505	Electro-Mechanical Relay
7	51308460-526	Current Output PWA
8	51308458-526	Dual Electromechanical Relay PWA
9	51156740-001	Chassis Label
10	51156740-002	Inside Case Label
11	51452759-501	Case Assembly (including Mounting Kit with four brackets)
12	50009071-501	Ethernet Adaptor Board Kit PWA
13	51156740-003	Outside Case Label B
14	51199407-100	Label, Module Barcode
15	51156740-004	Outside Case Label A
16	51452763-501	Mounting Kits (12 brackets & screws)

Key Number	Part Number	Description
17	50130923-004	China RoHS 2 Label, Compliant
18	30731996-506	4-20 mA Input Resistor Assembly (250 ohm)
19	50006787-001	CR2032 Battery. Battery is installed in MCU display. For more information, see the following figures. **NOTE:** Battery is not used for the current release.

Figure 9-2: 50159507 Exploded View



Key Number	Part Number	Description
1	50150597-501	CHASSIS ASSEMBLY, UDC
2	50152823-501	TFT-LCD module for UDC2800, CTM320240N01
3	51308456-526	MCU/Display PWA

Removing the chassis

Using a thin screwdriver, gently twist the screwdriver to pry the side tabs from the front face. Pry just enough to release it, otherwise you'll bend or break the tab . If you break or bend the tab and can't reattach the front snugly, you'll need to reattach the front using the 4 NEMA4 screws provided. See "Mounting" on page 46 for more information.

WARNING: Do not put your fingers inside the case to touch rail terminals to avoid electric shock.

CHAPTER

10 CONFIGURATION VIA HONEYWELL EASYSET

Honeywell EasySet lets you configure your instrument on a Mobile Device via Bluetooth. It is available to detect and connect controllers within 3 meters.

This app can be installed on IOS 12.0 or higher operating system.

The configurations are accessed using icons introduced below.

Figure 10-1: Honeywell EasySet interface

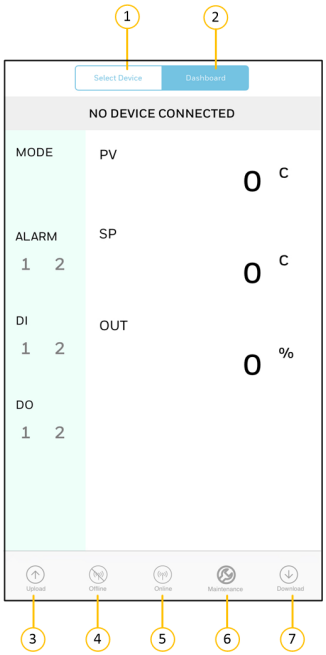


Table 10-1: Description of icons

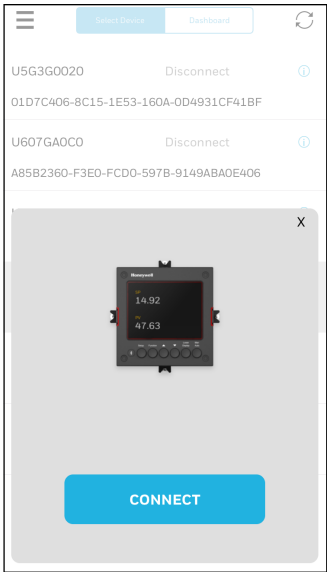
Item	Description
1	It is used to set up communications before uploading or downloading instrument configurations. See "Communications Setup" on the next page for more information.
2	It is used to configure and operate controllers and download/upload the complete configuration.
3	It is used to upload instrument configuration to Mobile Device. See "Upload" on

Item	Description
	page 270 for more information.
4	It is used to edit an instrument configuration for later downloading. See "Offline Configuration" on page 270 for more information.
5	It is used to edit and downloads one instrument setting at a time. See "Online Configuration" on page 271 for more information.
6	Displays key operating parameters and status parameters of the instrument without switching between the instrument screens. Some of the information presented here is not visible through the instrument display panel. Used primarily for diagnostics. See "Maintenance Data" on page 272 for more information.
7	It is used to download an instrument configuration to an instrument. See "Download" on page 271 for more information.

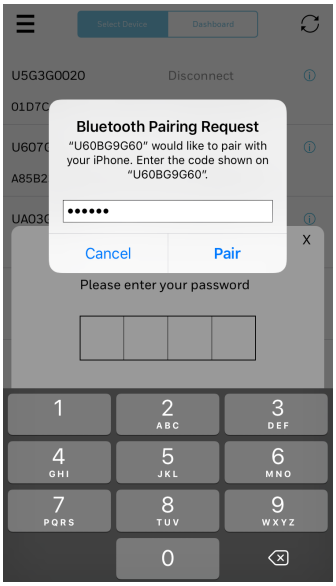
Communications Setup

Before transferring data between Honeywell EasySet and instrument, you must set up your mobile device communication parameters using this procedure.

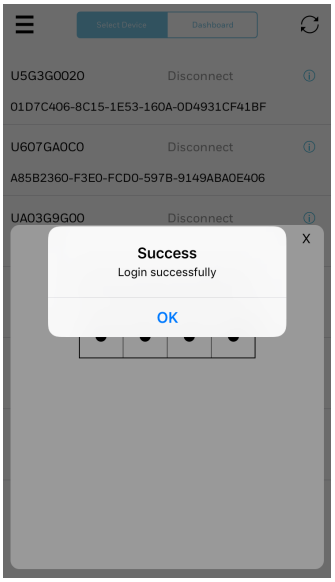
1. Click **Select Device**, all available controllers are detected and displayed with Bluetooth IDs.
2. Select the controller you want to connect, the connect dialog appears.



3. Click **CONNECT**, the controller will receive a code. Record it.
4. Enter the code, and click **Pair**.



5. Enter the controller password. A dialog appears indicating that the connection is successful.



6. Click **OK**. The controller is connected.

Upload

Upload copies your instrument's configuration into Honeywell EasySet where it can be saved, edited, and downloaded back to the instrument or other instruments.

1. Click **Dashboard**, and click **Upload**. The **Upload Configuration** dialog appears.
2. Click **Start** to begin upload. Status of upload (% complete) is shown.

   To terminate upload, select **Abort**. If upload is successful, you can save the configuration.
3. Click **Save**, and enter **File Name** and **Description**.
4. Click **Save**. The configuration is saved in the mobile device.

   If you do not want to save the configuration, click **Cancel**.

Offline Configuration

Offline Configuration lets you edit an instrument's configuration file for later downloading to an instrument. This operation is mostly used during initial configuration where the configuration from one instrument is copied, duplicated, or modified and then downloaded to other instruments.

1. Click **Dashboard**, and click **Offline**. The **Offline Configuration** dialog appears.
2. Select **Device Type** and **File List**.

Item	Description
Device Type	Select the device type whose configuration you want to edit, e.g. UDC2800.
File List	Previously saved configuration files are shown.

3. Click **Open File**, the offline configuration dialog appears.
4. Select a group and edit configurations. The prompts are organized exactly as on the instrument itself.

If an analog configuration is highlighted with red text or a digital configuration is shown blank, it means that the stored value is now out of range, either because of previous changes to the instrument's configuration or because of incompatibilities with the configuration set. Change the configuration to an in-range setting to correct the error.

5. After finishing the configuration, click **Save**. A dialog appears indicating that configurations are saved successfully.
6. Click **OK**.

Download

Download sends your instrument configuration in Honeywell EasySet to the instrument.

1. Click **Dashboard**, and click **Download**. The **Download Configuration** dialog appears.
2. Select **Device Type** and **File List**.

Item	Description
Device Type	Select the device type whose configuration you want to download, e.g. UDC2800.
File List	Previously saved configuration files are shown.

3. Click **Download**, and a dialog appears indicating that the configuration is downloaded successfully.
4. Click **OK**.

Online Configuration

Online Configuration lets you upload an instrument configuration and write one change at a time back to the instrument. This is useful for tuning your instrument and is faster than downloading the entire configuration. However, it is recommended to do offline configuration for multiple changes.

1. Click **Dashboard**, and click **Online Configuration**. The **Online Configuration** dialog appears.
2. Click **Start**to begin upload. Status of upload (% complete) is shown.

To terminate upload, select **Abort**. If upload is successful, configurable groups appear.

3. Select a group and edit configurations. The prompts are organized exactly as on the instrument itself.

   If an analog configuration is highlighted with red text or a digital configuration is shown blank, it means that the value read up from the instrument is now out of range, either because of previous changes to the instrument's configuration or because of incompatibilities with a downloaded configuration set. Change the configuration to an in-range setting to correct the error.

4. After finishing the configuration, click **Save**. A dialog appears indicating that configurations are saved successfully.
5. Click the arrow at the top left corner to return to the configurable groups page.
6. Click the arrow at the top left corner again, a dialog appears to ask you to save the changed configuration for later use in the mobile device.
7. Enter **File Name** and **Description**, and click **Save**.

   If you do not want to save the configuration, click **Cancel**.

Maintenance Data

Maintenance Data displays key operating parameters and status parameters of the instrument without switching between the instrument screens. Some of the information presented here is not visible through the instrument display panel. Used primarily for diagnostics.

Click **Dashboard**, and click **Maintenance**. The **Maintenance Data** dialog appears with **Loop Data**, **Communication Status** and **Status Data**.

CHAPTER

11

MODBUS READ, WRITE AND OVERRIDE PARAMETERS PLUS EXCEPTION CODES

What's in this section?

The following topics are covered in this section.

In this section:

Overview 274
Reading Digital Output 274
Reading Digital Input 275
Reading Analog Input 275
Reading Analog Output 276
Reading Diagnostic Messages 276
Reading/Writing Shed Mode 279
Reading Alarm Status 279
Reading Control Parameters 280
Reading SP Ramp Process Parameters 281
Reading SP Program Process Parameters 282
Configuration Parameters 283
Modbus RTU Exception Codes 328

Overview

This section contains information concerning Reading, Writing and Overriding parameters in UDC2800.

General Information

Supported Function Codes:

RS485 and Ethernet ports 1, 3, 6, 16

Reading Digital Output

Use the identifying codes listed in the following table to read the specific items.

A Write request for these codes will result in an Error message.

Table 11-1: Digital Output Parameters

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
Output 1	0x0046	70	Float	R	0: No output 1: Hardware channel Output 1
Output 2	0x0676	1654	INT16	R	0: No output 1: Hardware channel Output 2
Alarm Relay 2 / Output 2	0x0024	36	Coil	R	0: No output 1: Hardware channel Output 3
Alarm Relay 1	0x0025	37	Coil	R	0: No output 1: Hardware channel Output 4

Reading Digital Input

Use the identifying codes listed in the following table to read the specific items.

A Write request for these codes will result in an Error message.

Table 11-2: Digital Input Parameters

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
Digital Input 1	0x0022	34	Coil	R	0: No input 1: Digital Input 1
Digital Input 2	0x0023	35	Coil	R	0: No input 1: Digital Input 2

Reading Analog Input

Use the identifying codes listed in the following table to read the specific items.

A Write request for these codes will result in an Error message.

Table 11-3: Digital Input Parameters

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
Analog Input 1	0x012C	300	INT16	R	0: No input 1: Analog Input 1
Analog Input 2	0x012D	301	INT16	R	0: No input 1: Analog Input 2

Reading Analog Output

Use the identifying codes listed in the following table to read the specific items.

A Write request for these codes will result in an Error message.

Table 11-4: Analog Output Parameters

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
Current Output	0x0046	70	Float	R	0: No output 1: Current Output
Auxiliary Output	0x05CD	1485	Float	R	0: No output 1: Auxiliary Output

Reading Diagnostic Messages

Use the identifying codes listed in the following table to read the specific items.

For how to correct errors, see Background Tests and Diagnostic Messages.

Table 11-5: Diagnostic Messages

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
Failsafe	0x002A	42	Coil	R	0: No error 1: This error message shows whenever the controller goes into a failsafe mode of operation.
Config Test Error	0x002B	43	Coil	R	0: No error 1: Calculated checksum is mismatched with the checksum in EEPROM.

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
Output2 Fail	0x002C	44	Coil	R	0: No error 1: Auxiliary Output is configured as 4-20mA, and it is less than 3.5 mA.
Output1 Fail	0x002D	45	Coil	R	0: No error 1: Current Output is configured as 4-20mA, and it is less than 3.5 mA.
TC2 Fail	0x002E	46	Coil	R	0: No error 1: Thermocouple on Input 2 is in imminent danger of burning out.
TC1 Fail	0x002F	47	Coil	R	0: No error 1: Thermocouple on Input 1 is in imminent danger of burning out.
TC2 Warning	0x0030	48	Coil	R	0: No error 1: Thermocouple on Input 1 is starting to burn out.
TC2 Warning	0x0031	49	Coil	R	0: No error 1: Thermocouple on Input 2 is starting to burn out.
Soothing	0x0032	50	Coil	R	0: No error 1: Percent Carbon falls outside sooting boundary
Segment Error	0x0035	53	Coil	R	0: No error 1: Setpoint Program start segment number is less than ending segment number.
Remote SP Limit	0x0036	54	Coil	R	0: No error 1: RSP in engineering unit (with ratio and bias) is out of limit.
PV Limit	0x0037	55	Coil	R	0: No error

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
					1: PV in engineering unit (with ratio and bias) is out of limit.
Input2 Fail	0x0038	56	Coil	R	0: No error 1: Two consecutive failures of input 2 integration. i.e., cannot make analog to digital conversion.
Input2 Range	0x0039	57	Coil	R	0: No error 1: Input 2 out of range. The remote input is outside the range limits.
Input1 Fail	0x003A	58	Coil	R	0: No error 1: Two consecutive failures of input 1 integration; i.e., cannot make analog to digital conversion.
Input1 Range	0x003B	59	Coil	R	0: No error 1: Input 1 out of range. The process input is outside the range limits.
Config Error	0x003C	60	Coil	R	0: No error 1: PV low limit is > PV high limit, or SP low limit is > SP high limit or Output low limit > Output high limit
Calibration Error	0x003D	61	Coil	R	0: No error 1: Configuration data is in error.
EEPROM Error	0x003E	62	Coil	R	0: No error 1: Unable to write to non-volatile memory. Anytime you change a parameter and it is not accepted, you will see EEPROM Error.
RAM Error	0x003F	63	Coil	R	0: No error 1: RAM test failed at start up

Reading/Writing Shed Mode

Use the identifying codes listed in the following table to read/write the specific items.

Table 11-6: Shed Mode Parameters

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
CPV Override Value	0x0617	1559	Float	R/W	PV Override Value, Writable when shed function is enabled.
CSP Override Value	0x0619	1561	Float	R/W	SP Override Value, Writable when shed function is enabled.
COutput Override Value	0x061B	1563	Float	R/W	Output Override Value, Writable when shed function is enabled.

Reading Alarm Status

Use the identifying codes listed in the following table to read the specific items.

Table 11-7: Alarm Status

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
Alarm 1 Status	0x066C	1644	INT16	R	0: No Alarm 1: Alarm 1
Alarm 2 Status	0x066D	1645	INT16	R	0: No Alarm 1: Alarm 2

Reading Control Parameters

Use the identifying codes listed in the following table to read the specific items.

Table 11-8: Control Parameters

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
Control Mode	0x0190	400	INT16	R/W	0: Auto 1: Manual
Working SP Switch	0x018A	394	INT16	R/W	0: LSP1 1: LSP2 2: LSP3 3: LSP4 4: RSP **ATTENTION:** Before selecting a local setpoint or remote setpoint, you must enable the setpoint.
Working SP Value	0x006A	106	Float	R/W	Current in use SP value
Control PV	0x0040	64	Float	R	Control PV
PV High Limit	0x0666	1638	Float	R	PV High Limit
PV Low Limit	0x0664	1636	Float	R	PV Low Limit
LSP1	0x006A	1646	Float	R/W	LSP1
LSP2	0x006C	108	Float	R/W	LSP2
LSP3	0x009C	388	Float	R/W	LSP3
LSP4	0x009E	390	Float	R/W	LSP4

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
RSP	0x0188	392	Float	R	RSP
Control Output	0x0046	70	Float	R	Control Output
Deviation	0x066A	1642	Float	R	Deviation
PID sets selection	0x0663	1635	INT16	R/W	PID set 1, PID set 2, PID set 3, PID set 4, only available when Control - PID sets have selected properly. (same as select PID sets on front panel, in compliance with the same dependency)

Reading SP Ramp Process Parameters

Use the identifying codes listed in the following table to read the specific items.

Table 11-9: SP Ramp Process Parameters

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
SP Ramp Output	0x066E	1646	Float	R	Setpoint Ramp output value (engineering unit)
SP Ramp Time Remaining	0x0670	1648	INT32	R	Unit: second
Run/Hold	0x0669	1641	INT16	W	0: Run 1: Hold

Reading SP Program Process Parameters

Use the identifying codes listed in the following table to read the specific items.

Table 11-10: SP Program Process Parameters

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
SP Program Output	0x066E	1646	Float	R	Setpoint Program output value (engineering unit)
SP Program Status	0x0672	1650	INT16	R	0: Run 1: Hold
Current Program #	0x0673	1651	INT16	R	The current program (1~8)
Current Segment #	0x0674	1652	INT16	R	The current segment (1~8)
Segment Time Remaining	0x0670	1648	INT32	R	Unit: second
Remaining Recycle	0x0675	1653	INT16	R	Recycle times (an integer which >=0)
Run/Hold	0x0669	1641	INT16	W	0: Run 1: Hold

Configuration Parameters

Overview

Listed on the next pages are the identifying codes for the parameters in the various Set-up Groups in the UDC2800 Process Controller. Most of the parameters are configurable through the hosts. Some are Read Only and are indicated as such and cannot be changed.

Reading or Writing

Do a Read or Write, depending on your requirements, using the identifying code and format code listed in the tables. The range or selection available for each range is listed in the tables.

Security

Table below lists all the register addresses and ranges or selections for the function parameters in the Set-up Group Security.

Table 11-11: Set-up Group – Security

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Restore Settings	0x019A	410	INT16	R	0 = Disable 1 = Enable
Lockout (keyboard only) Changes to data are always possible via communications regardless of this configuration.	0x0601	1537	INT16	R	0 = No Lockout 1 = Calibration Locked out 2 = +Configuration – Timer, Tuning, SP Ramp, Accutune are read/write 3 = +View – Tuning and SP Ramp are read/write, no other parameters are

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					available 4 = Maximum Lockout
Man/Auto Key Lockout	0x0602	1538	INT16	R	0 = Disable 1 = Enable
Run/Hold Key Lockout	0x0603	1539	INT16	R	0 = Disable 1 = Enable
Setpoint Key Lockout	0x0604	1540	INT16	R	0 = Disable 1 = Enable

Tuning

Table below lists all the register addresses and ranges or selections for the function parameters in the Set-up Group Tuning.

Table 11-12: Set-up Group – Tuning

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Gain 1 or Proportional Band 1 See Note 1	0x004C	76	FP	R/W	0.01 to 1000 Gain 0.1 to 1000 Proportional Band
Rate 1 Min See Note 1	0x0052	82	FP	R/W	0.00 to 10.00
Reset Mins/Rpt 1, or Rest Rpts/Min 1 See Note 1	0x0050	80	FP	R/W	0.02 to 50.00
Manual Reset	0x01AA	426	FP	R/W	-100 to +100

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Gain 2 or Proportional Band 2 See Note 1	0x0060	96	FP	R/W	0.01 to 1000 Gain 0.1 to 1000 Proportional Band
Rate 2 Min See Note 1	0x0066	102	FP	R/W	0.00 to 10.00
Reset Mins/Rpt 2, or Rest Rpts/Min 2 See Note 1	0x0064	100	FP	R/W	0.02 to 50.00
Gain 3 or Proportional Band 3 See Note 1	0x0090	144	FP	R/W	0.01 to 1000 Gain 0.1 to 1000 Proportional Band
Rate 3 Min See Note 1	0x0094	148	FP	R/W	0.00 to 10.00
Reset Mins/Rpt 3, or Rest Rpts/Min 3 See Note 1	0x0092	146	FP	R/W	0.02 to 50.00
Gain 4 or Proportional Band 4 See Note 1	0x0096	150	FP	R/W	0.01 to 1000 Gain 0.1 to 1000 Proportional Band
Rate 4 Min See Note 1	0x009A	154	FP	R/W	0.00 to 10.00
Reset Mins/Rpt 4, or Rest Rpts/Min 4 See Note 1	0x0098	152	FP	R/W	0.02 to 50.00

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Cycle Time 1 Sec	0x0054	84	INT16	R/W	1 to 120 seconds
Cycle Time 2 Sec	0x0068	104	INT16	R/W	1 to 120 seconds
Note 1: Writes to these locations are not available when Accutune is enabled.					

SP Ramp/Rate/Program

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group SP Ramp/Program.

Table 11-13: Set-up Group – Setpoint Ramp/Program

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Ramp Function	0x01E9	489	INT16	R	0 = Disabled 1 = Enabled
Ramp Time Min	0x01EF	495	FP	R	0 to 255 (minutes)
Ramp Final SP	0x01F1	497	FP	R	SP High/Low limit in Control setup group.
SP Rate Function	0x01EB	491	INT16	R	0 = Disabled 1 = Enabled
Rate Up EU/Hr	0x01F5	501	FP	R	0 to 9999
Rate Down EU/Hr	0x01F7	503	FP	R	0 to 9999
SP Program Function	0x01ED	493	INT16	R	0 = Disabled 1 = Enabled
Soak Deviation	0x0201	513	FP	R	0 to 99.9 0 = disable soak deviation function
Program Termination	0x0203	515	INT16	R	0 = Last Setpoint and Mode 1 = Manual, Failsafe Output

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Program End State	0x0205	517	INT16	R	0 = Disable SP Program 1 = Hold at Program End
Key Reset/Rerun	0x0207	519	INT16	R	0 = Disable 1 = To Begin 2 = Rerun
Hot Start	0x01F3	499	INT16	R	0 = Disabled 1 = Enabled
SP Program 1	0x02C9	713	INT16	R	0 = Disabled 1 = Enabled
Start Segment	0x02CA	714	INT16	R	Ramp segment 1 to 8
End Segment	0x02CB	715	INT16	R	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	0x02CC	716	INT16	R	0 = Time Hrs:Mins 1 = Rate EU/Min 2 = Rate EU/Hr
Recycles	0x02CD	717	INT16	R	0 to 100
Segment 1 Ramp	0x0209	521	FP	R	00:00 ~ 99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (EU/Min) or 0 to 999 (EU/Hr)
Segment 2 SP	0x020B	523	FP	R	Within Setpoint Limits
Segment 2 Time	0x020D	525	FP	R	00:00 ~ 99.59 (0-99 Hrs:0 -59 Mins)
Segment 3 Ramp	0x020F	527	FP	R	00:00 ~ 99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (EU/Min) or 0 to 999 (EU/Hr)

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Segment 4 SP	0x0211	529	FP	R	Within Setpoint Limits
Segment 4 Time	0x0213	531	FP	R	00:00 ~ 99.59 (0-99 Hrs:0 -59 Mins)
Segment 5 Ramp	0x0215	533	FP	R	00:00 ~ 99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (EU/Min) or 0 to 999 (EU/Hr)
Segment 6 SP	0x0217	535	FP	R	Within Setpoint Limits
Segment 6 Time	0x0219	537	FP	R	00:00 ~ 99.59 (0-99 Hrs:0 -59 Mins)
Segment 7 Ramp	0x021B	539	FP	R	00:00 ~ 99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (EU/Min) or 0 to 999 (EU/Hr)
Segment 8 SP	0x021D	541	FP	R	Within Setpoint Limits
Segment 8 Time	0x021F	543	FP	R	00:00 ~ 99.59 (0-99 Hrs:0 -59 Mins)

SP Program 2

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group SP Program 2.

Table 11-14: Set-up Group – Setpoint Program 2

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 2	0x02CE	718	INT16	R	0 = Disabled 1 = Enabled
Start Segment	0x02CF	719	INT16	R	Ramp segment 1 to 8

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
End Segment	0x02D0	720	INT16	R	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	0x02D1	721	INT16	R	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	0x02D2	722	INT16	R	0 to 100
Segment 1 Ramp	0x0221	545	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	0x0223	547	FP	R	Within Setpoint Limits
Segment 2 Time	0x0225	549	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 3 Ramp	0x0227	551	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	0x0229	553	FP	R	Within Setpoint Limits
Segment 4 Time	0x022B	555	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 5 Ramp	0x022D	557	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	0x022F	559	FP	R	Within Setpoint Limits
Segment 6 Time	0x0231	561	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	0x0233	563	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	0x0235	565	FP	R	Within Setpoint Limits
Segment 8 Time	0x0237	567	FP	R	99.59 (0-99 Hrs:0 -59 Min)

SP Program 3

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group SP Program 33.

Table 11-15: Set-up Group – Setpoint Program 3

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 3	0x02D3	723	INT16	R	0 = Disabled 1 = Enabled
Start Segment	0x02D4	724	INT16	R	Ramp segment 1 to 8
End Segment	0x02D5	725	INT16	R	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	0x02D6	726	INT16	R	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	0x02D7	727	INT16	R	0 to 100
Segment 1 Ramp	0x0239	569	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	0x023B	571	FP	R	Within Setpoint Limits
Segment 2 Time	0x023D	573	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 3 Ramp	0x023F	575	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	0x0241	577	FP	R	Within Setpoint Limits
Segment 4 Time	0x0243	579	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 5 Ramp	0x0245	581	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Segment 6 SP	0x0247	583	FP	R	Within Setpoint Limits
Segment 6 Time	0x0249	585	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	0x024B	587	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	0x024D	589	FP	R	Within Setpoint Limits
Segment 8 Time	0x024F	591	FP	R	99.59 (0-99 Hrs:0 -59 Min)

SP Program 4

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group SP Program 4.

Table 11-16: Set-up Group – Setpoint Program 4

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 4	0x02D8	728	INT16	R	0 = Disabled 1 = Enabled
Start Segment	0x02D9	729	INT16	R	Ramp segment 1 to 8
End Segment	0x02DA	730	INT16	R	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	0x02DB	731	INT16	R	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	0x02DC	732	INT16	R	0 to 100
Segment 1 Ramp	0x0251	593	FP	R	99.59 (0-99 Hrs:0 -59 Min) or

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					0 to 999 (Degrees/Minute)
Segment 2 SP	0x0253	595	FP	R	Within Setpoint Limits
Segment 2 Time	0x0255	597	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 3 Ramp	0x0257	599	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	0x0259	601	FP	R	Within Setpoint Limits
Segment 4 Time	0x025B	603	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 5 Ramp	0x025D	605	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	0x025F	607	FP	R	Within Setpoint Limits
Segment 6 Time	0x0261	609	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	0x0263	611	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	0x0265	613	FP	R	Within Setpoint Limits
Segment 8 Time	0x0267	615	FP	R	99.59 (0-99 Hrs:0 -59 Min)

SP Program 5

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group SP Program 5.

Table 11-17: Set-up Group – Setpoint Program 5

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 5	0x02DD	733	INT16	R	0 = Disabled 1 = Enabled
Start Segment	0x02DE	734	INT16	R	Ramp segment 1 to 8
End Segment	0x02DF	735	INT16	R	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	0x02E0	736	INT16	R	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	0x02E1	737	INT16	R	0 to 100
Segment 1 Ramp	0x0269	617	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	0x026B	619	FP	R	Within Setpoint Limits
Segment 2 Time	0x026D	621	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 3 Ramp	0x026F	623	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	0x0271	625	FP	R	Within Setpoint Limits

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Segment 4 Time	0x0273	627	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 5 Ramp	0x0275	629	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	0x0277	631	FP	R	Within Setpoint Limits
Segment 6 Time	0x0279	633	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	0x027B	635	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	0x027D	637	FP	R	Within Setpoint Limits
Segment 8 Time	0x027F	639	FP	R	99.59 (0-99 Hrs:0 -59 Min)

SP Program 6

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group SP Program 6.

Table 11-18: Set-up Group – Setpoint Program 6

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 6	0x02E2	738	INT16	R	0 = Disabled 1 = Enabled
Start Segment	0x02E3	739	INT16	R	Ramp segment 1 to 8

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
End Segment	0x02E4	740	INT16	R	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	0x02E5	741	INT16	R	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	0x02E6	742	INT16	R	0 to 100
Segment 1 Ramp	0x0281	641	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	0x0283	643	FP	R	Within Setpoint Limits
Segment 2 Time	0x0285	645	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 3 Ramp	0x0287	647	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	0x0289	649	FP	R	Within Setpoint Limits
Segment 4 Time	0x028B	651	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 5 Ramp	0x028D	653	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	0x028F	655	FP	R	Within Setpoint Limits
Segment 6 Time	0x0291	657	FP	R	99.59 (0-99 Hrs:0 -59 Min)

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Segment 7 Ramp	0x0293	659	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	0x0295	661	FP	R	Within Setpoint Limits
Segment 8 Time	0x0297	663	FP	R	99.59 (0-99 Hrs:0 -59 Min)

SP Program 7

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group SP Program 7.

Table 11-19: Set-up Group – Setpoint Program 7

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 7	0x02E7	743	INT16	R	0 = Disabled 1 = Enabled
Start Segment	0x02E8	744	INT16	R	Ramp segment 1 to 8
End Segment	0x02E9	745	INT16	R	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	0x02EA	746	INT16	R	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	0x02EB	747	INT16	R	0 to 100

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Segment 1 Ramp	0x0299	665	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	0x029B	667	FP	R	Within Setpoint Limits
Segment 2 Time	0x029D	669	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 3 Ramp	0x029F	671	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	0x02A1	673	FP	R	Within Setpoint Limits
Segment 4 Time	0x02A3	675	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 5 Ramp	0x02A5	677	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	0x02A7	679	FP	R	Within Setpoint Limits
Segment 6 Time	0x02A9	681	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	0x02AB	683	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	0x02AD	685	FP	R	Within Setpoint Limits
Segment 8 Time	0x02AF	687	FP	R	99.59 (0-99 Hrs:0 -59 Min)

SP Program 8

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group SP Program 8.

Table 11-20: Set-up Group – Setpoint Program 8

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 8	0x02EC	748	INT16	R	0 = Disabled 1 = Enabled
Start Segment	0x02ED	749	INT16	R	Ramp segment 1 to 8
End Segment	0x02EE	750	INT16	R	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	0x02EF	751	INT16	R	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	0x02F0	752	INT16	R	0 to 100
Segment 1 Ramp	0x02B1	689	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	0x02B3	691	FP	R	Within Setpoint Limits
Segment 2 Time	0x02B5	693	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 3 Ramp	0x02B7	695	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	0x02B9	697	FP	R	Within Setpoint Limits

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Segment 4 Time	0x02BB	699	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 5 Ramp	0x02BD	701	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	0x02BF	703	FP	R	Within Setpoint Limits
Segment 6 Time	0x02C1	705	FP	R	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	0x02C3	707	FP	R	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	0x02C5	709	FP	R	Within Setpoint Limits
Segment 8 Time	0x02C7	711	FP	R	99.59 (0-99 Hrs:0 -59 Min)

Accutune

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Accutune.

Table 11-21: Set-up Group – Accutune

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Fuzzy Overshoot Suppression	0x0577	1399	INT16	R/W	0 = Disabled 1 = Enabled
Accutune Enable	0x05C8	1480	INT16	R	0 = Accutune Disabled 1 = Tune

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Accutune Duplex selection	0x01A9	425	INT16	R	0 = Manual 1 = Auto 2 = Disable (blend)
Accutune Error Status (Read only)	0x061D	1565	INT16	R	0 = None 1 = Running 1 = Abort 3 = SP Error

Algorithms

The following table lists all the register addresses and ranges or selections for the function parameters in Set-up Group Algorithm.

Table 11-22: Set-up Group – Algorithm

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Control Algorithm Selection (Selection here will affect ID code 39 in Output Algorithms.)	0x0175	373	INT16	R	0 = Disable 1 = On-Off 2 = PID A 3 = PID B 4 = PD-A with Manual Reset
Timer Function	0x01CE	462	INT16	R	0 = Disable 1 = Enable
Period Hrs:Mins	0x01D0	464	FP	R	00.00 TO 99.59
Start Trigger	0x01D2	466	INT16	R	0 = Keyboard (Run/Hold by pressing Setup and Increment keys) 1 = Alarm 2

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Lower Display	0x01D4	468	INT16	R	0 = Time Remaining 1 = Elapsed Time
Reset Trigger	0x01D6	470	INT16	R	0 = Keyboard (Run/Hold Key) 1 = Alarm1 (Alarm 1 or Key)
Timer increment	0x01D8	472	INT16	R	0 = Minutes (Counts hr/minute) 1 = Seconds (Counts min/second)
Input Algorithm 1 Input source selected via ID 417, 418, 419.	0x0146	326	INT16	R	0 = None 1 = Weighted Average (LSP) 2 = Feedforward Summer 3 = Feedforward Multiplier 4 = Summer (with ratio and bias) 5 = Input High Select (with ratio and bias) 6 = Input low Select (with ratio and bias) 7 = General Math A (Mult Div + Sqrt) 8 = General Math B (Multiplier + Sqrt) 9 = General Math C

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					(Multiplier Divider) 10 = General Math D (Multiplier) 11 = Carbon A 12 = Carbon B 13 = Carbon C 14 = Carbon D 15 = Carbon FCC 16 = Dewpoint 17 = Oxygen
Math K	0x019B	411	FP	R	0.001 to 1000
Calculated High	0x019D	413	FP	R	–999.0 to +9999 in Engineering Units
Calculated Low	0x019F	415	FP	R	–999.0 to +9999 in Engineering Units
Input Algorithm 1 Input A Selection (used with ID 326 math calculations)	0x01A1	417	INT16	R	0 = Input 1 1 = Input 2 2 = Output
Input Algorithm 1 Input B Selection (used with ID 326 math calculations)	0x01A2	418	INT16	R	0 = Input 1 1 = Input 2 2 = Output
Input Algorithm 1 Input C Selection (used with ID 326 math calculations)	0x01A3	419	INT16	R	0 = Input 1 1 = Input 2 2 = Output 3 = None
Algorithm 1 Bias	0x01A4	420	FP	R	-999.0 to 9999 in Engineering Units

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Percent Carbon Value	0x0147	327	FP	R	0.02 to 0.350
Percent Hydrogen	0x0149	329	FP	R	1 to 99 (% H2)

Output

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Output.

Table 11-23: Set-up Group – Output

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Output Algorithms	0x0027	39	INT16	R	0 = Time Simplex 1 = Current Simplex 3 = Time Duplex 4 = Current Duplex 5 = Current Time Duplex 6 = Time Current Duplex
Output Range	0x0028	40	INT16	R	0 = Split (50%) 1 = Full (100%)
Relay State	0x061E	1566	INT16	R	0 = 1 Off 2 Off 1 = 1 On 2 Off 2 = 1 Off 2 On 3 = 1 On 2 On
Relay Type	0x061F	1567	INT16	R	Electromechanical
Motor Time for Positional Proportional	0x0620	1568	INT16	R	5 to 1800 seconds

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Current Output (Auxiliary Output Mode)	0x0621	1569	INT16	R	0 = Disable 1 = Input 1 2 = Input 2 3 = PV 4 = Deviation 5 = Output 6 = SP 7 = Local SP 1 8 = Local SP 2 9 = Local SP 3 10 = Local SP 4 11 = Remote SP 12 = Input Algorithm 1
CO Low Value	0x01C5	453	FP	R	Within the range of the selected variable in ID 242
CO High Value	0x01C7	455	FP	R	Within the range of the selected variable in ID 242
CO Range	0x0029	41	INT16	R	0 = 4-20 mA 1 = 0-20 mA

Input 1

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Input 1.

Table 11-24: Set-up Group – Input 1

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input 1 Type	0x012C	300	INT16	R	0 = Disable 1 = TC B 2 = TC E High 3 = TC E Low 4 = TC J High 5 = TC J Mid 6 = TC J Low 7 = TC K High 8 = TC K Mid 9 = TC K Low 10 = TC M High 11 = TC M Low 12 = TC N High 13 = TC N Low 14 = TC R 15 = TC S 16 = TC T High 17 = TC T Low 18 = TC C High 19 = TC C Low

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					20 = TC PR40-PR20 21 = Thermocouple Differential 22 = RTD Pt100 23 = RTD Pt100 Low 24 = RTD Pt200 25 = RTD Pt500 26 = 0-20 mA 27 = 4-20 mA 28 = 0-10 mV 29 = 0-50 mV 30 = 0-100 mV 31 = 1-5 Vdc 32 = 0-5 Vdc 33 = 0-10 Vdc 34 = Carbon 35 = Oxygen
	ATTENTION: Changing the Input Type will result in the loss of Field Calibration values and will restore the Factory Calibration values.				
Input 1 Transmitter Characterization	0x0160	352	INT16	R	0 = TC B 1 = TC E High 2 = TC E Low 3 = TC J High 4 = TC J Mid

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					5 = TC J Low 6 = TC K High 7 = TC K Mid 8 = TC K Low 9 = TC M High 10 = TC M Low 11 = TC N High 12 = TC N Low 13 = TC R 14 = TC S 15 = TC T High 16 = TC T Low 17 = TC C High 18 = TC C Low 19 = TC PR40-PR20 20 = RTD Pt100 21 = RTD Pt100 Low 22 = RTD Pt200 23 = RTD Pt500 24 = Linear 25 = Square Root
Input 1 High Value	0x0162	354	FP	R	–999. to 9999. Engineering Units (Linear types only)

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input 1 Low Value	0x0164	356	FP	R	–999 to 9999. Engineering Units (Linear types only)
Input 1 Ratio	0x00A8	168	FP	R/W	–20.00 to 20.00
Input 1 Bias	0x00AA	170	FP	R/W	–999 to 9999. Engineering Units
Input 1 Filter	0x0141	321	FP	R	0 to 120 seconds
Input 1 Burnout (Open Circuit Detection)	0x0145	325	INT16	R	0 = No Burnout 1 = Upscale Burnout 2 = Downscale Burnout 3 = No Failsafe

Input 2

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Input 2.

Table 11-25: Set-up Group – Input 2

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input 2 Type	0x012D	301	INT16	R	0 = Disable 1 = TC B 2 = TC E High 3 = TC E Low 4 = TC J High 5 = TC J Mid 6 = TC J Low 7 = TC K High

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					8 = TC K Mid 9 = TC K Low 10 = TC M High 11 = TC M Low 12 = TC N High 13 = TC N Low 14 = TC R 15 = TC S 16 = TC T High 17 = TC T Low 18 = TC C High 19 = TC C Low 20 = TC PR40-PR20 21 = Thermocouple Differential 22 = RTD Pt100 23 = RTD Pt100 Low 24 = RTD Pt200 25 = RTD Pt500 26 = 0-20 mA 27 = 4-20 mA 28 = 0-10 mV 29 = 0-50 mV 30 = 0-100 mV 31 = 1-5 Vdc

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					32 = 0-5 Vdc 33 = 0-10 Vdc
	ATTENTION: Changing the Input Type will result in the loss of Field Calibration values and will restore the Factory Calibration values.				
Input 2 Transmitter Characterization	0x0161	353	INT16	R	0 = TC B 1 = TC E High 2 = TC E Low 3 = TC J High 4 = TC J Mid 5 = TC J Low 6 = TC K High 7 = TC K Mid 8 = TC K Low 9 = TC M High 10 = TC M Low 11 = TC N High 12 = TC N Low 13 = TC R 14 = TC S 15 = TC T High 16 = TC T Low 17 = TC C High 18 = TC C Low 19 = TC PR40-PR20

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					20 = RTD Pt100 21 = RTD Pt100 Low 22 = RTD Pt200 23 = RTD Pt500 24 = Linear 25 = Square Root
Input 2 High Value	0x0166	358	FP	R	–999. to 9999. Engineering Units
Input 2 Low Value	0x0168	360	FP	R	–999 to 9999. Engineering Units
Input 2 Ratio	0x00AC	172	FP	R/W	–20.00 to 20.00
Input 2 Bias	0x00AE	174	FP	R/W	–999 to 9999. Engineering Units
Input 2 Filter	0x0143	323	FP	R	0 to 120 seconds
Input 2 Burnout	0x0115	277	INT16	R	0 = No Burnout 1 = Upscale Burnout 2 = Downscale Burnout 3 = No Failsafe

Control

Table below lists all the register addresses and ranges or selections for the function prompts in Set-up Group Control.

Table 11-26: Set-up Group – Control

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
PV Source	0x0174	372	INT	R	0 = Input 1 1 = Input 2 2 = Input Algorithm 1
PID Sets	0x01CD	461	INT16	R	0 = One set only 1 = 2 sets keyboard selected 2 = 2 sets with PV automatic switchover 3 = 2 sets with SP automatic switchover 4 = 4 sets keyboard selected 5 = 4 sets with PV automatic switchover 6 = 4 sets with SP automatic switchover
Automatic Switchover Value 1/2 (used with 461 selection 2 or 3	0x05B8	1464	FP	R	Within the PV Range in engineering units
Automatic Switchover Value 2/3 (used with 461 selection 5 or 6	0x05BA	1466	FP	R	Within the PV Range in engineering units

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Automatic Switchover Value 3/4 (used with 461 selection 5 or 6	0x05BC	1468	FP	R	Within the PV Range in engineering units
Local Setpoint Source (Number of LSPs)	0x05B6	1462	INT	R	0 = One Local Setpoint 1 = Two Local Setpoints 2 = Three Local Setpoints 3 = Four Local Setpoints
Power Up Mode	0x018B	395	INT16	R	0 = Manual/Local SP 1 = Auto/Local SP 2 = Auto/Remote SP 3 = Last Mode/Last SP 4 = Last Mode/Local SP
RSP Source	0x01CF	463	INT16	R	0 = None 1 = Input 2 1 = Input Algorithm 1
Setpoint Tracking	0x0623	1571	INT16	R	0 = None 1 = LSP = PV (when in Manual) 2 = LSP = RSP (when switched)
Autobias	0x0622	1570	INT16	R	0 = Disable 1 = Enable
Control Setpoint High Limit	0x05BE	1470	FP	R/W	0 to 100% of PV (engineering units)

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Control Setpoint Low Limit	0x05C0	1472	FP	R/W	0 to 100% of PV (engineering units)
Control Action Direction	0x004E	78	INT16	R	0 = Direct 1 = Reverse
Output Rate Enable	0x0624	1572	INT16	R	0 = Disable 1 = Enable
Output Rate Up	0x0625	1573	FP	R	0.00 to 9999% per minute
Output Rate Down	0x0627	1575	FP	R	0.00 to 9999% per minute
High Output Limit	0x01DA	474	FP	R/W	–5 to 105% of output
Low Output Limit	0x01DC	476	FP	R/W	–5 to 105% of output
High Integral Limit	0x01DE	478	FP	R	-5 to 105%
Low Integral Limit	0x01E0	480	FP	R	-5 to 105%
Output Deadband for Time Duplex	0x0176	374	FP	R/W	–5 to +25.0%
Output Drop Off Limit	0x0172	370	FP	R	-5 to 105%
Output Hysteresis	0x0178	376	FP	R	0.0 to 100.0% of PV
Failsafe Mode	0x0191	401	INT	R	0 = Latching 1 = Non latching
Failsafe Output Level	0x0195	405	FP	R	0 to 100%
Preset Manual Output	0x018C	396	FP	R	0.0 to 100.0% of Output

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Preset Auto Output	0x018E	398	FP	R	0.0 to 100.0% of Output
Proportion Unit	0x01C2	450	INT16	R	0 = Proportional Band 1 = Gain
Reset Unit	0x01C3	451	INT16	R	0 = Repeats/Minute 1 = Minutes/Repeat

Options

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Options.

Table 11-27: Set-up Group – Options

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Auxiliary Output *	0x05CD	1485	INT16	R	0 = Disable 1 = Input 1 2 = Input 2 3 = PV 4 = Deviation 5 = Output 6 = SP 7 = Local SP 1 8 = Local SP 2 9 = Local SP 3 10 = Local SP 4 11 = Remote SP

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					12 = Input Algorithm 1
CO Low Value	0x05CE	1486	FP	R	Within the range of the selected variable in ID 134
CO High Value	0x05D0	1488	FP	R	Within the range of the selected variable in ID 134
CO Range	0x059E	1438	INT16	R	0 = 4-20 mA 1 = 0-20 mA
Digital Input 1 Function	0x05C9	1481	INT16	R	0 = None 1 = To Manual 2 = To Local Setpoint 1 3 = To Local Setpoint 2 4 = To Local Setpoint 3 5 = To Local Setpoint 4 6 = To Direct Action 7 = To Hold Ramp 8 = To PID Set 2 9 = To PID Set 3 10 = To PID Set 4 11 = PV Source Input 2 12 = Rerun SPP Cycle 13 = To Run Ramp 14 = To Begin (Reset SP Program) 15 = Inhibit Integral 16 = Manual Failsafe Output

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					17 = Disable Keyboard 18 = To Preset Auto Output 19 = To Start Timer 20 = To Auto/Man Station 21 = Initiate Limit Cycle Tuning (To Tune) 22 = Setpoint Initialization (SP=PV) 23 = Output Track Input 2 24 = To Remote SP 25 = External Reset Feedback 26 = To Purge 27 = To Low Fire 28 = Manual Latching 29 = PV Hold
Digital Input 1 Combinations	0x05CA	1482	INT16	R	0 = Disable 1 = + PID Sets 2 2 = + To Direct Action 3 = + To Local SP 2 4 = + Disable Tune 5 = + Local SP 1 6 = + To Run 7 = + To Local SP 3 8 = + To Local SP 4

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Digital Input 2 Function *	0x05CB	1483	INT16	R	Same as Digital Input 1 Function
Digital Input 2 Combinations	0x05CC	1484	INT16	R	0 = Disable 1 = + PID Sets 2 2 = + To Direct Action 3 = + To Local SP 2 4 = + Disable Tune 5 = +To Local SP 1 6 = + To Run 7 = + To Local SP 3 8 = + To Local SP 4
* Auxiliary Output and Digital Input #2 are mutually exclusive.					

Communications

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Communications.

Table 11-28: Set-up Group – Communications

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Bluetooth Function	0x0629	1577	INT16	R	0 = Disable 1 = Enable
Communications Type	0x060D	1549	INT	R	0 = Disable 1 = RS-485 Modbus 2 = Ethernet

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Modbus Address	0x060E	1550	FP	R	1 - 99
Baud Rate	0x0610	1552	INT16	R	0 = 4800 1 = 9600 2 = 19200 3 = 38400
Response Delay	0x062B	1579	FP	R	Response Delay in ms (1 to 500) + 6ms
Word Oder for Float	0x017E	382	INT16	R	0 = FP B 0123 1 = FP BB 1032 2 = FP L 3210 3 = FP LB 2301
Ethernet Address 1	0x0605	1541	INT16	R	Ethernet Address = Add1.Add2.Add3.Add4 Ranges: 0~255
Ethernet Address 2	0x0606	1542	INT16	R	
Ethernet Address 3	0x0607	1543	INT16	R	
Ethernet Address 4	0x0608	1544	INT16	R	
Subnet Mask Address 1	0x0609	1545	INT16	R	Subnet Mask Address = Add1.Add2.Add3.Add4 Ranges: 0~255
Subnet Mask Address 2	0x060A	1546	INT16	R	
Subnet Mask Address 3	0x060B	1547	INT16	R	
Subnet Mask Address 4	0x060C	1548	INT16	R	

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Default Gateway 1	0x0651	1617	INT16	R	Default Gateway = Gateway1.Gateway2.Gateway3.Gateway4 Ranges: 0~255
Default Gateway 2	0x0652	1618	INT16	R	
Default Gateway 3	0x0653	1619	INT16	R	
Default Gateway 4	0x0654	1620	INT16	R	
Shed Function	0x0611	1553	INT16	R/W	0 = Enable 1 = Disable
Shed Time	0x0612	1554	INT16	R/W	0~255 Unit: 1/3 second
Shed Mode	0x0614	1556	INT16	R	0 = Last Mode 1 = Manual Mode 2 = Failsafe 3 = Auto Mode
Shed Setpoint Recall	0x0615	1557	INT16	R	0 = To Last Local Setpoint used 1 = To Computer SP
Computer Setpoint Units	0x0616	1558	INT16	R	0 = Engineering Units 1 = Percent
Computer Setpoint Ratio	0x062D	1581	FP	R/W	–20.00 to 20.00
Computer Setpoint Bias	0x062F	1583	FP	R/W	–999 to 9999.
Local Loopback	0x0631	1585	INT16	R	0 = Disable 1 = Enable

Alarms

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Alarms.

Table 11-29: Set-up Group – Alarms

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Alarm 1 Setpoint 1 Type	0x05D2	1490	INT16	R	0 = None 1 = Input 1 2 = Input 2 3 = PV 4 = Deviation 5 = Output 6 = Alarm on Shed 7 = SP Event On 8 = SP Event Off 9 = Manual 10 = Remote Setpoint 11 = Failsafe 12 = PV Rate of Change 13 = Alarm on Digital Input 1 14 = Alarm on Digital Input 2 15 = Loop Break 16 = T/C Warning 17 = T/C Fail 18 = PV Hot Start

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Alarm 1 Setpoint 1 Value	0x05D3	1491	FP	R	Within the range of selected parameter or PV span for deviation alarm
Alarm 1 Setpoint 1 State	0x05D5	1493	INT16	R	0 = High Alarm 1 = Low Alarm
Alarm 1 Setpoint 1 Event	0x05D6	01494	INT16	R	0 = Begin of Segment 1 = End of Segment
Alarm 1 Setpoint 1 Delay	0x05D7	1495	FP	R	0~30 seconds
Alarm 1 Setpoint 1 Hysteresis	0x05D9	1497	FP	R	0.0 to 100% of output or span
Alarm 1 Setpoint 2 Type	0x05DB	1499	INT16	R	Same as 1490
Alarm 1 Setpoint 2 Value	0x0655	1621	FP	R	Within the range of selected parameter or PV span for deviation alarm
Alarm 1 Setpoint 2 State	0x0657	1623	INT16	R	0 = High Alarm 1 = Low Alarm
Alarm 1 Setpoint 2 Event	0x0658	1624	INT16	R	0 = Begin of Segment 1 = End of Segment
Alarm 1 Setpoint 2 Delay	0x0659	1625	FP	R	0~30 seconds
Alarm 1 Setpoint 2 Hysteresis	0x05E2	1506	FP	R	0.0 to 100% of output or span
Alarm 2 Setpoint 1 Type	0x05E4	1508	INT16	R	Same as 1490
Alarm 2 Setpoint 1 Value	0x05E5	1509	FP	R	Within the range of selected parameter or PV span for deviation alarm

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Alarm 2 Setpoint 1 State	0x05E7	1511	INT16	R	0 = High Alarm 1 = Low Alarm
Alarm 2 Setpoint 1 Event	0x05E8	1512	INT16	R	0 = Begin of Segment 1 = End of Segment
Alarm 2 Setpoint 1 Delay	0x05E9	1513	FP	R	0~30 seconds
Alarm 2 Setpoint 1 Hysteresis	0x05EB	1515	FP	R	0.0 to 100% of output or span
Alarm 2 Setpoint 2 Type	0x05ED	1517	INT16	R	Same as 1490
Alarm 2 Setpoint 2 Value	0x05EE	1518	FP	R	Within the range of selected parameter or PV span for deviation alarm
Alarm 2 Setpoint 2 State	0x05F0	1520	INT16	R	0 = High Alarm 1 = Low Alarm
Alarm 2 Setpoint 2 Event	0x05F1	1521	INT16	R	0 = Begin of Segment 1 = End of Segment
Alarm 2 Setpoint 2 Delay	0x05F2	1522	FP	R	0~30 seconds
Alarm 2 Setpoint 2 Hysteresis	0x05F4	1524	FP	R	0.0 to 100% of output or span
Alarm Latching for Output 1	0x05F6	1526	INT16	R	0 = Non Latching 1 = Latching
Alarm Blocking	0x05F7	1527	INT16	R	0 = Disable 1 = Alarm 1 2 = Alarm 2 3 = Alarm 1&2

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
AO/CO Diagnostic Alarm	0x05F8	1528	INT16	R	0 = Disable 1 = Alarm 1 2 = Alarm 2 3 = Disable Warning

Display

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Display.

Table 11-30: Set-up Group – Display

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Decimal Point Location	0x05C2	1474	INT16	R	0 = None – Fixed 1 = One Digit– Floating decimal point to one 2 = Two Digits– Floating decimal point to two 3 = Three Digits– Floating decimal point to three
Temperature Units	0x012E	302	INT16	R	0 = °F 1 = °C 2 = None
Language	0x0633	1587	INT16	R	0 = English
Input 2 Ratio	0x0632	1586	INT16	R	0 = Disable 1 = Enable
TC Diagnostics	0x0634	1588	INT16	R	0 = Enable 1 = Disable

Input1 Calibration

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Input1 Calib.

Table 11-31: Set-up Group – Input1 Calib

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Calibrate Input 1	0x0635	1589	INT16	R	0 = Disable 1 = Begin
Input 1 Zero	0x0636	1590	FP	R	Depends on the type. See the table Voltage, Milliamp and Resistance Equivalents for Input Range Values for Voltage, Degrees, or Resistance equivalents for 0 % range values.
Input 1 Span	0x0638	1592	FP	R	Depends on the type. See the table Voltage, Milliamp and Resistance Equivalents for Input Range Values for Voltage, Degrees, or Resistance equivalents for 0 % range values.
Cold Junction Temp 1	0x063A	1594	FP	R	0 ~140 °F/°C

Input2 Calibration

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Input2 Calib.

Table 11-32: Set-up Group – Input2 Calib

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Calibrate Input 2	0x063C	1596	INT16	R	0 = Disable 1 = Begin
Input 2 Zero	0x063D	1597	FP	R	Depends on the type. See the table Voltage, Milliamp and Resistance Equivalents for Input Range Values for Voltage, Degrees, or Resistance equivalents for 0 % range values.
Input 2 Span	0x063F	1599	FP	R	Depends on the type. See the table Voltage, Milliamp and Resistance Equivalents for Input Range Values for Voltage, Degrees, or Resistance equivalents for 0 % range values.
Cold Junction Temp 2	0x0641	1601	FP	R	0 ~140 °F/°C

Current Output Calibration

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Current Calib.

Table 11-33: Set-up Group – Current Calib

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Zero Value	0x01B3	435	FP	R	0~65535
Span Value	0x01B5	437	FP	R	0~65535

Auxiliary Output Calibration

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Auxiliary Calib.

Table 11-34: Set-up Group – Auxiliary Calib

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Zero Value	0x01BB	443	FP	R	0~65535
Span Value	0x01BD	445	FP	R	0~65535

Status

Table below lists all the register addresses and ranges or selections for the function parameters in Set-up Group Staus.

Table 11-35: Set-up Group – Status

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Software Version	0x0643	1603	FP	R	Software version
Failsafe Status	0x0199	409	INT16	R	0 = Yes 1 = No
Self Tests	0x0645	1605	INT16	R	0 = Pass 1 = Fail

Modbus RTU Exception Codes

Introduction

When a master device sends a query to a responder device it expects a normal response. One of four possible events can occur from the master's query:

- Responder device receives the query without a communication error and can handle the query normally.
  It returns a normal response.
- Responder does not receive the query due to a communication error No response is returned. The master program will eventually process a time-out condition for the query.
- Responder receives the query but detects a communication error (parity, LRC or CRC).
  No response is returned. The master program will eventually process a time-out condition for the query.
- Responder receives the query without a communication error but cannot handle it (i.e., request is to a non-existent coil or register). The responder will return with an exception response informing the master of the nature of the error (Illegal Data Address.)

The exception response message has two fields that differentiate it from a normal response:

Function Code Field:

In a normal response, the responder echoes the function code of the original query in the function code field of the response. All function codes have a most-significant bit (MSB) of 0 (their values are below 80 hex). In an exception response, the responder sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 80 hex higher than the value would be for a normal response.

With the function code's MSB set, the master's application program can recognize the exception response and can examine the data field for the exception code.

Data Field:

In a normal response, the responder may return data or statistics in the data field. In an exception response, the responder returns an exception code in the data field. This defines the responder condition that caused the exception.

Query

Example: Internal responder error reading 2 registers starting at address 1820h from responder at responder address 02.

02 03 18 20 00 02 CRC CRC

Response

Example: Return MSB in Function Code byte set with responder Device Failure (04) in the data field.

02 83 04 CRC CRC

Table 11-36: Modbus RTU Data Layer Status Exception Codes

Exception Code	Definition	Description
01	Illegal Function	The message received is not an allowable action for the addressed device.
02	Illegal Data Address	The address referenced in the function-dependent data section of the message is not valid in the addressed device.
03	Illegal Data Value	The value referenced at the addressed device location is no within range.

CHAPTER

12 ETHERNET TCP/IP

Overview

Ethernet parameters can only be configured via the Communication set up group, or Honeywell EasySet.

Ethernet IP Address is 10.0.0.2 as shipped from the Factory.

The MAC address is printed on the case label of each instrument.

Widely used by manufacturers, the Ethernet connection, which uses Modbus TCP/IP, allows the controller to connect to other Ethernet networks and exchange data with computers or devices on that network for monitoring or managing your process from almost any location.

When constructing a network, it is recommended that a Switch be used to connect UDCs to a LAN rather than using a Hub. This is because a Switch passes only those messages for IP addresses that are connected to the Switch while a Hub passes all message traffic. Using a Switch thus improves the overall throughput of the traffic to and from the UDCs.

To secure the network communication, it is recommended to use IP security (IPSec) to set up a Virtual Private Network (VPN).

Figure 12-1: Private network

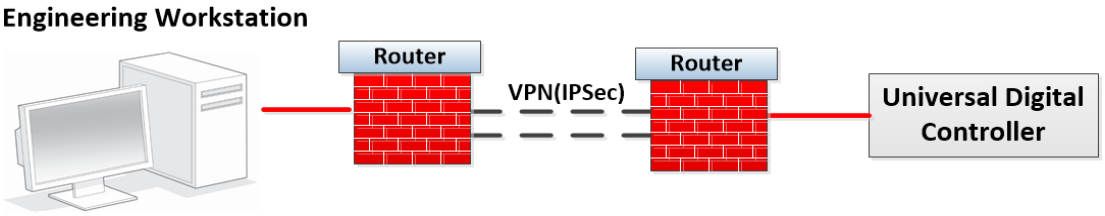
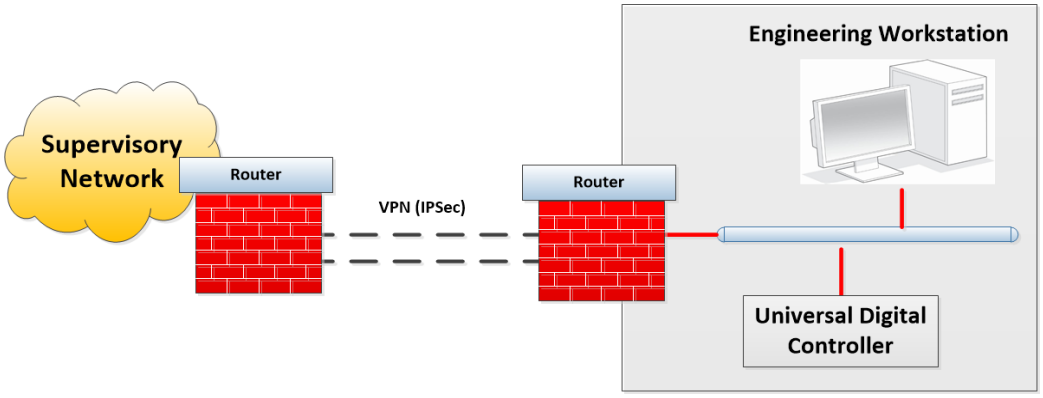


Figure 12-2: Public network



NOTICES

Honeywell®, Experion®, PlantScape®, SafeBrowse®, and TotalPlant® are registered trademarks of Honeywell International, Inc.

Other brand or product names are trademarks of their respective owners.

Other trademarks

Microsoft and SQL Server are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

Trademarks that appear in this document are used only to the benefit of the trademark owner, with no intention of trademark infringement.

Third-party licenses

This product may contain or be derived from materials, including software, of third parties. The third party materials may be subject to licenses, notices, restrictions and obligations imposed by the licensor. The licenses, notices, restrictions and obligations, if any, may be found in the materials accompanying the product, in the documents or files accompanying such third party materials, in a file named third_party_licenses on the media containing the product, or at http://www.honeywell.com/en-us/privacy-statement.

Documentation feedback

You can find the most up-to-date documents on the Honeywell Process Solutions Support website at:
http://www.honeywellprocess.com/support

If you have comments about Honeywell Process Solutions documentation, send your feedback to: hpsdocs@honeywell.com

Use this email address to provide feedback, or to report errors and omissions in the documentation. For immediate help with a technical problem, contact HPS Technical Support through your local Customer Contact Center, or by raising a support request on the Honeywell Process Solutions Support website.

How to report a security vulnerability

For the purpose of submission, a security vulnerability is defined as a software defect or weakness that can be exploited to reduce the operational or security capabilities of the software.

Honeywell investigates all reports of security vulnerabilities affecting Honeywell products and services.

To report a potential security vulnerability against any Honeywell product, please follow the instructions at:

https://www.honeywell.com/en-us/product-security.

Support

For support, contact your local Honeywell Process Solutions Customer Contact Center (CCC). To find your local CCC visit the website, https://www.honeywellprocess.com/en-US/contact-us/customer-support-contacts/Pages/default.aspx.

Training classes

Honeywell holds technical training classes that are taught by process control systems experts. For more information about these classes, contact your Honeywell representative, or see http://www.automationcollege.com.

Factory information

Company Name: HONEYWELL System Sensor de Mexico, S. de R.L. de C.V.

Company Address: Avenida Miguel De La Madrid, #8102 Colonia Lote Bravo Ciudad Juarez, Chihuahua, C.P. 32695, México