



**UDC2800 Universal Digital Controller**  
**Release 200.0**

**Product Manual**

51-52-25-157  
Revision 8.0  
September 2023

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# 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	Added maximum digits for PV and SP display
3.0	March 2021	51-52-25-157	Implemented Modbus function
4.0	March 2021	51-52-25-157	Added TPSC, PP and Slidewire
5.0	June 2022	51-52-25-157	Added firmware upgrade via BLE app and PIE tool configuration
6.0	September 2023	51-52-25-157	<ul style="list-style-type: none"> <li>TC1 and TC2 fail and warning limits are updated.</li> <li>Input fail/burnout limit is updated for TC/RTD.</li> <li>Improved firmware upgrade speed.</li> </ul>
7.0	February 2023	51-52-25-157	Added configurable background theme. (Default theme: White background)
8.0	August 2023	51-52-25-157	Added 2 Loop Function.

## Special Terms

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

Symbol	Definition
PID	Proportion Integration Differentiation
PIE	Process Instrument Explorer
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
TPSC	Three Position Step Control
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

# 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.
- 1/4 DIN Size
- Jumper free configuration
- 1 or 2 Loops of Control

## 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  $\pm 0.15\%$  of full-scale input and a typical resolution of 16 bits. Both analog inputs are sampled ten times per second (every 100 ms).

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

The optional second input is isolated and accepts the same actuators as input one, or it provides the Slidewire input for Position Proportional control.

All actuators 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<sup>1</sup> 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
- To Purge
- Low Fire
- Purge AUX
- To Latching Manual Mode
- PV Hold
- Loop Display
- Output 2 tracks Input 2
- To Output 2

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 four 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

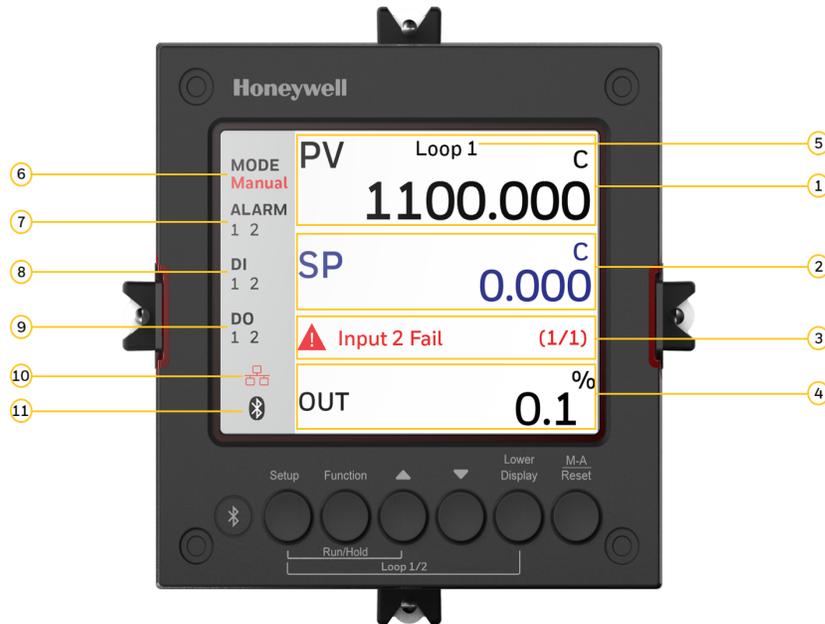


Table 2-1: Function of Displays

Item	Description
1	Upper display shows Process Variable value (maximum 10 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 10 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
3	Diagnostics display shows diagnostic messages. See Diagnostic Messages for

Item	Description
	more information.
4	<p>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.</p> <p>See Viewing the operating parameters for more information.</p>
5	<p>Indicates loop display.</p> <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b> To Switch between Loop 1 and Loop 2.</p> </div>
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	<p>Modbus, or Ethernet communication status annunciation.</p> <p>Modbus: </p> <p>Ethernet: </p> <p>Grey: The function is disabled.</p> <p>White: The function is enabled, but the connection is not established.</p> <p>Blinking: The function is enabled, and the connection is established.</p> <p>Red: The function has errors.</p> <p>No icon: No communication board inserted, or the inserted board does not have communication feature.</p>
11	<p>Bluetooth communication status annunciation.</p> <p>Grey: The function is disabled.</p> <p>White: The function is enabled, but the connection is not established.</p> <p>Blue: The function is enabled, and the connection is established.</p> <p>Blinking: The function is enabled, and the connection is established, and the controller is communicating with a mobile device.</p>

Item	Description
	Red: The function has errors.

## Function of Keys

Figure 2-2: Function of Keys

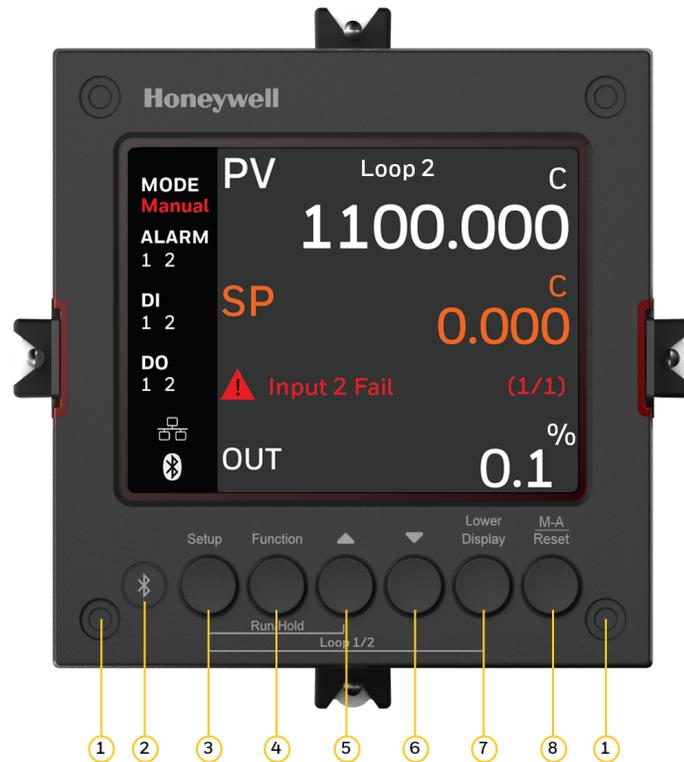


Table 2-2: Function of Keys

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

Item	Description
	<ul style="list-style-type: none"> <li>• When in the main screen, press it to enter in the setup screen.</li> <li>• When in the setup screen, it is used to scrolls through the configuration set up groups.</li> </ul>
4	<p>Function key</p> <p>Selects functions within each configuration group.</p> <ul style="list-style-type: none"> <li>• When in the main screen, press it to select next setpoint source from LP1, LP2, LP3, LP4 and RSP.</li> <li>• 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.</li> <li>• 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.</li> </ul>
5	<p>Increment key</p> <p>Increases setpoint or output value. Increases the configuration values or changes functions in Configuration mode groups.</p>
6	<p>Decrement key</p> <p>Decreases setpoint or output value. Decreases the configuration values or changes functions in Configuration mode groups.</p>
7	<p>Lower Display key</p> <p>Returns Controller to normal display from the setup screen. Toggles various operating parameters for display.</p> <ul style="list-style-type: none"> <li>• 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.</li> <li>• When in the setup screen, press it to leave the setup screen and return back to the main screen.</li> </ul>
8	<p>M-A/Reset Key</p> <p>Selects Manual or Auto mode.</p>

Item	Description
	<ul style="list-style-type: none"> <li>• When in the main screen, press it to toggle between Manual and Auto control mode.</li> <li>• 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 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.</li> </ul>
3+4	When in the main screen, press this combination will enter the display and keypad self-testing mode.
3+5	<p>Enables Run/Hold of the SP Ramp or Program plus Timer start.</p> <p>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.</p>
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.
3+7	<p>Loop Display Key - When in the main display screen, press this key combination to switch between Loop 1 and Loop 2.</p> <p>This key combination is applied when PID Loop is configured to Two loops or cascade.</p>

**NOTE:** The default password for the UDC device is 1234. It is recommended to change the password after the first login. New password should not be same as default password.

## 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 for more information.
- RS485 (Optional / Software)

See Standard Modbus Read, Write and Override Parameters for more information.

- Ethernet (Optional / Software)

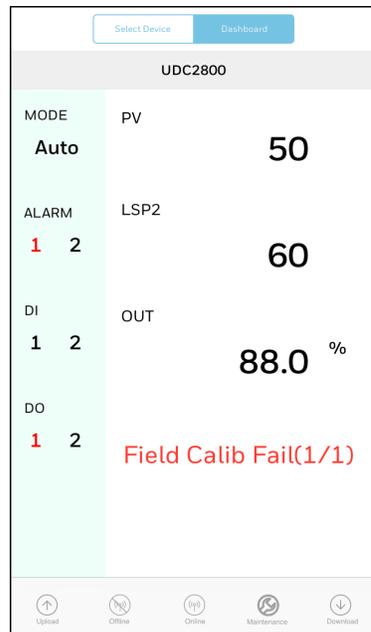
See Standard Modbus Read, Write and Override Parameters for more information.

## 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 Android 9 or higher operating system. See Configuration via Honeywell EasySet 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.

**NOTE:** The UDC device's **Bluetooth ID** appears in the communications group on the controller screen.

## 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 60664-1)

**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.

# INSTALLATION

## What's in this section?

The following topics are covered in this section.

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In this section:

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<i>Control and Alarm Relay Contact Information</i> .....	47
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# 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)	<p><b>Accuracy:</b></p> <ul style="list-style-type: none"> <li>• <math>\pm 0.15\%</math> of full scale typical (<math>\pm 1</math> digit for display)</li> <li>• Can be field calibrated to <math>\pm 0.05\%</math> of full scale typical</li> <li>• 16-bit resolution typical</li> </ul> <p><b>Sampling Rate:</b> Both inputs are sampled ten times per second</p> <p><b>Temperature Stability:</b> <math>\pm 0.01\%</math> of Full Scale span / <math>^{\circ}\text{C}</math> change-typical</p> <p><b>Input Impedance:</b></p> <ul style="list-style-type: none"> <li>• 0-20 / 4-20 Milliampere Input: 250 ohms</li> <li>• All Others: 10 megohms</li> </ul> <p><b>Maximum Lead Wire Resistance:</b></p> <ul style="list-style-type: none"> <li>• Thermocouples: 50 ohms/leg</li> <li>• 100 ohm, 200 ohm and 500 ohm RTD: 100 ohms/leg</li> <li>• 100 ohm Low RTD: 10 ohms/leg</li> </ul> <p><b>Slidewire Inputs for Position Proportional Control:</b> 100 ohms minimum to 1000 ohms maximum</p>
Analog Input Signal Failure Operation	<p><b>Burnout Selections:</b> Upscale, Downscale, No Failsafe or None</p> <p><b>Thermocouple Health:</b> Good, Failing, Failure Imminent or Failed</p> <p><b>Failsafe Output Level:</b> Configurable 0-100% of Output range</p>
Analog Input Filter	<p><b>Software:</b> Single pole lowpass section with selectable time constants, off to 120 seconds, available on both analog inputs.</p>
Stray Rejection	<p><b>Common Mode:</b> AC (50 or 60 Hz): 120 dB (with maximum source impedance of</p>

Specifications	
	<p>100 ohms) or <math>\pm 1</math> LSB (least significant bit) whichever is greater with line voltage applied.</p> <p>DC: 120 dB (with maximum source impedance of 100 ohms) or a <math>\pm 1</math> LSB whichever is greater with 120 Vdc applied.</p> <p>DC (to 1 KHz): 80 dB (with maximum source of impedance of 100 ohms) or <math>\pm 1</math> LSB whichever is greater with 50 Vac applied.</p> <p><b>Normal Mode:</b></p> <p>AC (50 or 60 Hz): 60 dB (with 100 % span peak-to-peak maximum)</p>
Digital Inputs (Two) (Optional)	<p>+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.</p> <p>On contact closure the controller will respond according to how each digital input is configured. Opening the contact causes a return to previous state.</p> <p>The second Digital Input is mutually exclusive with the Second Current Output.</p>
Controller Output Types	<p><b>Electromechanical Relays (One or Two)</b></p> <p>Single-Pole Double-Throw (SPDT) contacts. Both Normally Open and Normally Closed contacts are brought out to the rear terminals. Internally socketed</p> <ul style="list-style-type: none"> <li>• Resistive Load: 5 amps @ 125 Vac, 250 Vac or 30 Vdc</li> <li>• General use: 5 amps @ 125 Vac, 250 Vac (certified by UL)</li> <li>• Inductive Load (<math>\cos\phi = 0.4</math>): 3 amps @ 130 Vac or 250 Vac</li> <li>• Motor: 1/6 H.P 125 Vac, 250 Vac.</li> </ul> <p><b>Dual Electromechanical Relays</b></p> <p>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 or Three Position Step Control or Position Proportional Control applications. Instruments with this option can have a total of 4 relays plus one</p>

## Specifications

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 ( $\cos\phi = 0.4$ ): 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.

- 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

Specifications	
Alarm Outputs (Optional)	<p>One SPDT Electromechanical relay. A second alarm is available if the second control relay is not used for control purposes.</p> <p>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.</p> <p><b>Alarm Relay Contacts Rating:</b></p> <p>Resistive Load: 5 amps at 125 Vac or 250 Vac or 30 Vdc</p>
RS485 Modbus RTU Communications Interface (Optional)	<p><b>Baud Rate:</b> 4800, 9600,19,200 or 38,400 baud selectable</p> <p><b>Data Format:</b> Floating point or integer</p> <p><b>Length of Link:</b></p> <ul style="list-style-type: none"> <li>• 2000 ft (600 m) max. with Belden 9271 Twinax Cable and 120 ohm termination resistors</li> <li>• 4000 ft. (1200 m) max. with Belden 8227 Twinax Cable and 100 ohm termination resistors</li> </ul> <p><b>Link Characteristics:</b> Two-wire (half-duplex), multi-drop Modbus RTU protocol, 15 drops maximum or up to 31 drops for shorter link length.</p>
Ethernet TCP/IP Communications Interface (Optional)	<p><b>Type:</b> 10/100M Base-T</p> <p><b>Length of Link:</b> 330 ft. (100 m) maximum. Use Shielded twisted-pair, Category 5e (STP CAT5e) Ethernet cable.</p> <p><b>Link Characteristics:</b> Four-wire plus shield, single drop, five hops maximum</p> <p><b>IP Address:</b> IP Address is 10.0.0.2 as shipped from the Factory</p> <p><b>Configuration:</b> Ethernet parameters are configured via the Front Panel.</p>
RS485 and Ethernet Transaction rates	<p>Host computer must allow a minimum of 20 milliseconds between Read transactions and a minimum of 200 milliseconds between Write transactions.</p>
Bluetooth	<p><b>Type:</b> Bluetooth</p>

Specifications	
Communications (Standard)	<p><b>Length of Link:</b> 10 ft. (3 m) maximum for mobile devices</p> <p><b>Protocol:</b> BLE 4.2</p>
Controller Output Algorithms	<p><b>On-off or Time Proportional:</b></p> <p>One relay or open collector output. Control action can be set for direct or reverse.</p> <p>Time Proportional Relay Resolution: 3 msec</p> <p><b>On-off Duplex, Three Position Step Control, or Time Proportional Duplex:</b></p> <p>Two relays or open collector outputs. Control action can be set for direct or reverse.</p> <p>Time Proportional Relay Resolution: 3 msec</p> <p><b>Current Proportional:</b> A single 4-20 mA current output signal that can be configured for direct or reverse action.</p> <p><b>Current Proportional Duplex:</b> 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.</p> <p><b>Position Proportional:</b> Two SPDT electromechanical operate any motor having a 100-ohm to 1000-ohm feedback slidewire.</p> <p><b>Current/Time Duplex:</b> 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.</p>
Digital Displays	<p><b>TFT LCD:</b> 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.</p>
Indicators	Alarm Relay Status (Alarm 1 or 2)

Specifications	
	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 for more information.
Mounting	Panel-mounted, 4.5-inch (114 mm) depth
Wiring Connections	Screw terminals on the rear of the case. See Wiring Diagrams 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.
	<p><b>CAUTION:</b> 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.</p>
Weight	3 lbs. (1.3 kg)
Isolation (Functional)	<p><b>AC Power(100~240VAC):</b> 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.</p> <p><b>DC Power(24VDC/AC):</b> 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.</p>

Specifications	
	<p><b>Analog Inputs and Outputs, Digital Inputs and Outputs:</b> Electrically isolated from all other circuits to withstand a HIPOT potential of 1500 Vac for 60 seconds.</p> <p><b>Relay Contacts:</b> 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.</p>
Surge Withstand Capability (SWC)	Immunity: ANSI/IEEE C37.90.1, Surge Withstand Capability (SWC) (Formerly IEEE 472). Mains power input and relay contact output: 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	0 to 55 °C	0 to 55 °C	-40 to 66 °C
	77 ± 5 °F	32 to 131 °F	32 to 131 °F	-40 to 151 °F
Relative Humidity	10 to 55*	5 to 90*	5 to 90*	5 to 95*
Vibration:				
Frequency (Hz)	0	1	5	20
Acceleration (g)	0	30	30	30
Mechanical Shock:				
Acceleration (g)	0	1	5	20
Duration (ms)	0	30	30	30
Line Voltage (Vdc)	+24 ± 1	24	21.6 to 26.4	--
Line Voltage (Vac)				
	100 to 240 Vac	120 ± 1 240 ± 2	100 to 240	90 to 264 --

Environmental and Operating Conditions				
24 Vac	24 ± 1	24	21.6 to 26.4	--
Frequency (Hz)	50 ± 0.2	50	50 ± 2	--
(For Vac)	60 ± 0.2	60	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 or Laptop
- PC Based Configuration Tools
- 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	↓

<b>Table I - Specify Control Output and/or Alarms</b>				
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	•	•

<b>Table II - Communications and Software</b>				
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	Limit Controller	_ L _	•	•
	Standard Software	_ S _	•	•
	Dual Loop and Internal Cascade Control	_ D _	•	•
	Standard S/W and Setpoint Programming	_ F _	•	•
Future options	None	_ _ 0	•	•

<b>Table III - Input 1 and Input 2</b>				
Input 1 (See Note 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	•	•
	Slidewire Input for Position Proportional (Requires 2 Relay Outputs)	_ 40	a	a
	Carbon, Oxygen or Dewpoint (Provides 2 Inputs)	_ 60	b	b
<b>Note 1:</b> Input 1 can be changed in the field using external resistors.				

<b>Table IV - Options</b>				
Approvals	CE (Standard)	0 _ _	•	•
	CE, UL and CSA	1 _ _	•	•
	CE, UL and CSA, FM (Limit control)	2 _ _		
Tags	None	_ 0 _	•	•
	Stainless Steel Customer ID Tag - 3 lines w/22 characters/line	_ T _	•	•
Future Options	None	_ _ 0	•	•

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

<b>Table VI - Extended Warranty</b>				
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
a	I	EE, R_		
b	III	1 _ _		
c	II	_S _D_		
d	II	_L_		
e	III	_ 00	I	C_, R_

### 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

Description		Part Number
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
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 state). 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

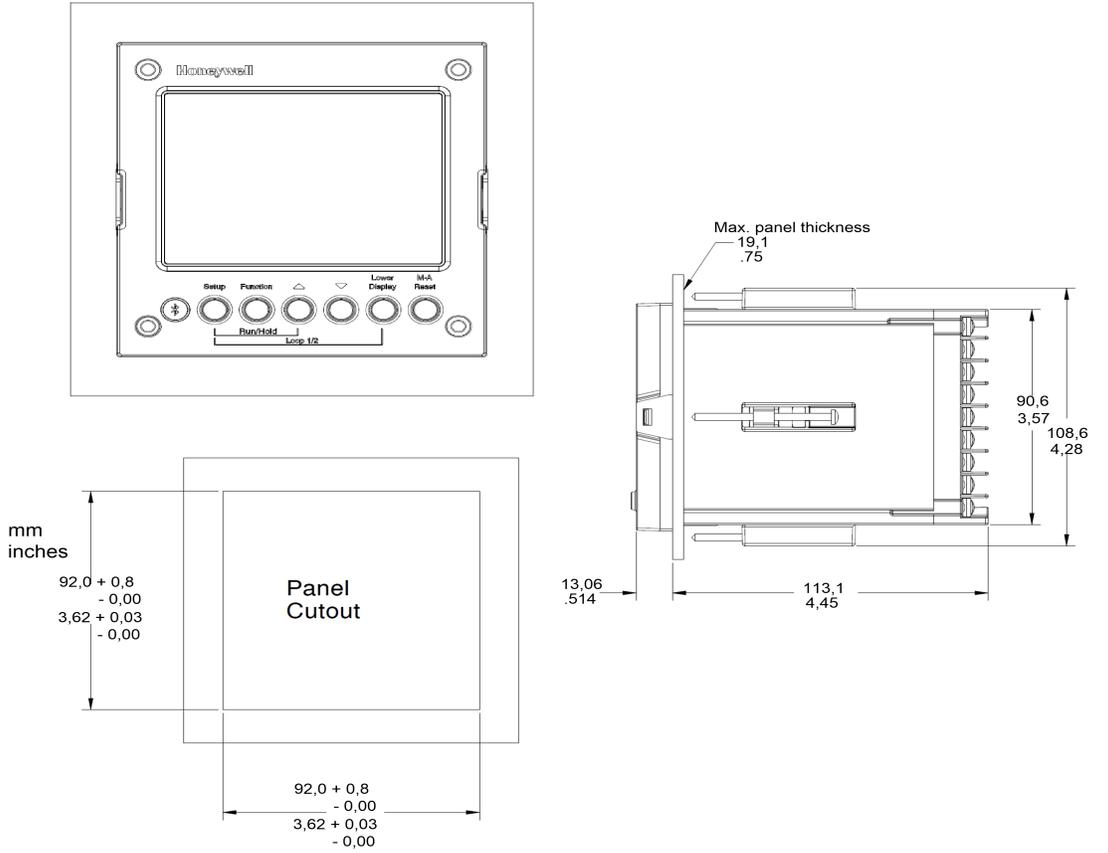
The controller can be mounted on either a vertical or tilted panel using the mounting kit supplied. Adequate access space must be available at the back of the panel for installation and servicing activities.

- 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 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

### Dimensions and Mounting

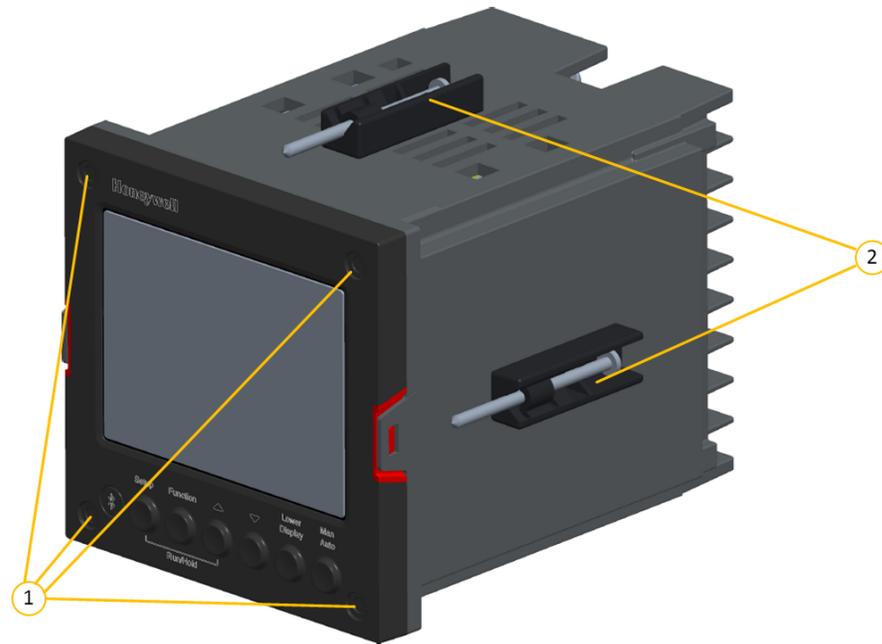
Figure 3-1: Mounting Dimensions (not to scale)



## 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 for more information.
2	Orient the case properly and slide it through the panel hole from the front.
3	<p>Remove the mounting kit from the shipping container and install the kit as follows:</p> <ul style="list-style-type: none"> <li>• 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</li> <li>• 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.</li> <li>• Tighten screws to 2 lb-inch (22 N•cm) to secure the case against the panel. CAUTION:</li> </ul> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>CAUTION:</b> Over tightening will cause distortion and the unit may not seal properly.</p> </div>
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 2014/35/EU, 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.

**ATTENTION:** It is recommended to set up an uninterrupted power supply to avoid fluctuations on the device power line, as such fluctuations may cause device availability issues.

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	<ul style="list-style-type: none"> <li>• Line power wiring</li> <li>• Earth ground wiring</li> <li>• Line voltage control relay output wiring</li> <li>• Line voltage alarm wiring</li> </ul>
2	Analog signal wire, such as: <ul style="list-style-type: none"> <li>• Input signal wire (thermocouple, 4 to 20 mA, etc.)</li> <li>• 4-20 mA output signal wiring.</li> </ul>
3	Digital input signals <ul style="list-style-type: none"> <li>• Low voltage alarm relay output wiring</li> <li>• Low voltage wiring to solid state type control circuits</li> <li>• Low voltage wiring to open collector type control circuits</li> </ul>

## 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);

5. Three Position Step Control with no alarm relays.

These selections may all be made via the keyboard and by wiring to the appropriate output terminals; there are no internal jumpers or switches to change. This flexibility allows a customer to stock a single instrument which is able to handle a variety of applications.

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. When Three Position Step Control is configured, “Output 1” is OPEN while “Output 2” is CLOSE. The Output 1/2 option “Single Relay” can be any of the following selections: Electro-Mechanical Relay or Open Collector Output.

*Table 3-6: Single or Cascade Loop Controller – Loop 1 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 or TPSC or Position Proportional	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%	Single Relay	INU	Alarm 2	Alarm 1	Outputs 1 and 2

Output Algorithm Type	Output 1/2 Option	Function of Output 1/2	Function of Other Outputs		
			Output #3	Output #4	Auxiliary Output
Current = COOL and HEAT	Current Output	Outputs 1 and 2	Alarm 2	Alarm 1	Not Needed
	Dual Relay	INU	Alarm 2	Alarm 1	Outputs 1 and 2
Current Duplex 50%	Single Relay	N/A	N/A	N/A	N/A
Current = HEAT Aux Out = COOL	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 <sup>1</sup>	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 <sup>1</sup>	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 <sup>1</sup>	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 <sup>1</sup>	Outputs 1 & 2	Alarm 2	Alarm 1	Output 1
	Dual Relay	Outputs 2	Alarm 2	Alarm 1	Output 1
TPSC = Three Position Step Control					
N/A = Not A available – This output algorithm type cannot be performed with this Output 1/2 option.					

Output Algorithm Type	Output 1/2 Option	Function of Output 1/2	Function of Other Outputs		
			Output #3	Output #4	Auxiliary Output
<p>INU = Installed, Not Used – The installed Output 1/2 option is not used for the configured output algorithm type.</p> <p>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.</p>					
<p><b>Note 1:</b> To obtain this output algorithm type with these Output 1/2 Options:</p> <ol style="list-style-type: none"> <li>1) Configure the Out Algorithms selection as “Time Duplex”;</li> <li>2) Configure Auxiliary Output for “Output” and;</li> <li>3) Scale the Auxiliary Output as necessary for the desired output algorithm type.</li> </ol> <p>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.</p>					

Table below shows what control types and alarms are available for loop 2 based upon the installed outputs. In this table, when Duplex Control and Reverse Action are configured, “Loop 2 Output 1” is HEAT while “Loop 2 Output 2” is COOL.

**ATTENTION:** Loop 2 output algorithms have priority over Alarm relays.

**ATTENTION:**

1. The selection for Loop 1 Output takes precedence over the selection for Loop 2 Output.  
For Example: If user selects the Loop 1 Output Algorithm as current Duplex 50%, then user cannot have current Duplex 50% as the output Algorithm for Loop 2.
2. TPSC and Position Proportional are available only on Loop 1.

**ATTENTION:** If user is trying to use the relays or current outputs that are already used by loop 2, then the user will get a Pop up message on Controller as "Outputs are already in use for loop 2".

*Table 3-7: Dual Loop Controller – Loop 2 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	NUL 2	Alarm 3	Loop 2 Output 1	Not Needed
	Current Output	INU	NUL 2	Loop 2 Output 1	Not Needed
	Dual Relay	NUL 2	Alarm 3	Loop 2 Output 1	Not Needed
Time Duplex	Single Relay	NUL 2	Loop 2 Output 2	Loop 2 Output 1	Not Needed
	Current Output	INU	Loop 2 Output 2	Loop 2 Output 1	Not Needed
	Dual Relay	NUL 2	Loop 2 Output 2	Loop 2 Output 1	Not Needed
Current Simplex	Single Relay	NUL 2	Alarm 2	Alarm 1	Loop 2 Output 1
	Current Output	Loop 2 Output 1*	Alarm 2	Alarm 1	Loop 2 Output 1
	Dual Relay	NUL 2	Alarm 2	Alarm 1	Loop 2 Output 1
Current Duplex 100% Current = COOL and HEAT	Single Relay	NUL 2	Alarm 2	Alarm 1	Loop 2 Outputs 1 & 2
	Current Output	Loop 2 Outputs 1&2	Alarm 2	Alarm 1	Not Needed
	Dual Relay	NUL 2	Alarm 2	Alarm 1	Loop 2 Outputs 1 & 2
Current Duplex 50% Current = HEAT	Single Relay	N/A 2	N/A 2	N/A 2	N/A 2

Output Algorithm Type	Output 1/2 Option	Function of Output 1/2	Function of Other Outputs		
			Output #3	Output #4	Auxiliary Output
Aux Out = COOL	Current Output	Loop 2 Output 1	Alarm 2	Alarm 1	Loop 2 Output 2
	Dual Relay	N/A 2	N/A 2	N/A 2	N/A 2
Current/Time Current = COOL Time = HEAT	Single Relay	NUL 2	Alarm 2	Loop 2 Output 1	Loop 2 Output 2
	Current Output	Loop 2 Output 2*	Alarm 2	Loop 2 Output 1	Loop 2 Output 2
	Dual Relay	NUL 2	Alarm 2	Loop 2 Output 1	Loop 2 Output 2
Time/Current Time = COOL Current = HEAT	Single Relay	NUL 2	Alarm 2	Loop 2 Output 2	Loop 2 Output 1
	Current Output	Loop 2 Output 1*	Alarm 2	Loop 2 Output 2	Loop 2 Output 1
	Dual Relay	NUL 2	Alarm 2	Loop 2 Output 2	Loop 2 Output 1
<p>NUL 2 = Not Used on Loop 2 – This particular output is not used for the selected Second Loop Output type, but it may be used for the First Loop Output type. Refer to the selection made in Table 3-6.</p> <p>N/A 2 = If the current output is not available or if it's already in use for Loop 1, then the Current Duplex 50% is not available for Loop 2.</p> <p>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.</p> <p>"*" indicates the current output can be used for the algorithm if auxiliary output is not available</p>					

Table 3-8: Output Algorithms supported for Loop 2 based on MSG

MSG	Output Algorithm Loop 1	Output Algorithms Supported for Loop 2
EO_0	Time Simplex	None
EO_1	Time Simplex	Current Simplex
EB_0	Time Simplex	Time Simplex
	Time Duplex	None
EB_1	Time Simplex	Time Simplex Current Simplex Time Current Current Time
	Time Duplex	Current Simplex
EE_0	Time Simplex	Time Simplex Time Duplex
	Time Duplex/PP	Time Simplex
EE_1	Time Simplex	Time Simplex Current Simplex Time Current Current Time Time Duplex
	Time Duplex/PP	Time Simplex Current Simplex Time Current Current Time
ET_0	Time Simplex	Time Simplex Time Duplex
	Time Duplex	Time Simplex
ET_1	Time Simplex	Time Simplex Current Simplex Time Current Current Time Time Duplex
	Time Duplex	Time Simplex Current Simplex Time Current

MSG	Output Algorithm Loop 1	Output Algorithms Supported for Loop 2
		Current Time
CO_0	Current Simplex	None
CO_1	Current Simplex	Current Simplex
CB_0	Time Simplex	Current Simplex
	Current Simplex	Time Simplex
	Time Current	None
	Current Time	None
CB_1	Time Simplex	Current Simplex
		Current Duplex
	Current Simplex	Time Simplex
		Current Simplex
		Time Current
		Current Time
	Time Current	Current Simplex
	Current Time	Current Simplex
Current Duplex	Time Simplex	
CE_0	Time Simplex	Time Simplex Current Simplex Time Current Current Time
		Current Simplex
		Time Current
		Current Time
CE_1	Time Simplex	Time Simplex Current Simplex Time Current Current Time Current Duplex
		Current Simplex

MSG	Output Algorithm Loop 1	Output Algorithms Supported for Loop 2
		Current Simplex Time Current Current Time Time Duplex
	Time Current	Time Simplex
		Current Simplex
		Time Current
	Current Time	Current Time
		Time Simplex
		Current Simplex
		Time Current
		Current Time
	Current Duplex	Time Simplex
	Time Duplex	
CT_0	Time Simplex	Time Simplex Current Simplex Time Current Current Time
	Current Simplex	Time Simplex Time Duplex
	Time Current	Time Simplex
	Current Time	Time Simplex
CT_1	Time Simplex	Time Simplex Current Simplex Time Current Current Time Current Duplex
	Current Simplex	Time Simplex Current Simplex Time Current Current Time Time Duplex

MSG	Output Algorithm Loop 1	Output Algorithms Supported for Loop 2
	Time Current	Time Simplex Current Simplex Time Current Current Time
	Current Time	Time Simplex Current Simplex Time Current Current Time
	Current Duplex	Time Simplex Time Duplex
RO_0	Time Simplex	None
	Time Duplex	None
RO_1	Time Simplex	Current Simplex
	Time Duplex	Current Simplex
RB_0	Time Simplex	Time Simplex
	Time Duplex/PP	Time Simplex
RB_1	Time Simplex	Time Simplex Current Simplex Time Current Current Time
	Time Duplex/PP	Time Simplex Current Simplex Time Current Current Time
RE_0	Time Simplex	Time Simplex Time Duplex
	Time Duplex/PP	Time Simplex Time Duplex
RE_1	Time Simplex	Time Simplex Current Simplex Time Current Current Time Time Duplex

MSG	Output Algorithm Loop 1	Output Algorithms Supported for Loop 2
	Time Duplex/PP	Time Simplex Current Simplex Time Current Current Time Time Duplex
RT_0	Time Simplex	Time Simplex Time Duplex
	Time Duplex/PP	Time Simplex Time Duplex
RT_1	Time Simplex	Time Simplex Current Simplex Time Current Current Time Time Duplex
	Time Duplex/PP	Time Simplex Current Simplex Time Current Current Time Time Duplex
TO_0	Time Simplex	None
TO_0	Time Simplex	Current Simplex
TB_0	Time Simplex	Time Simplex
	Time Duplex	None
TB_1	Time Simplex	Time Simplex Current Simplex Time Current Current Time
	Time Duplex	Current Simplex
TE_0	Time Simplex	Time Simplex Time Duplex
	Time Duplex/PP	Time Simplex
TE_1	Time Simplex	Time Simplex Current Simplex

MSG	Output Algorithm Loop 1	Output Algorithms Supported for Loop 2
		Time Current Current Time Time Duplex
	Time Duplex/PP	Time Simplex Current Simplex Time Current Current Time
TT_0	Time Simplex	Time Simplex Time Duplex
	Time Duplex	Time Simplex
TT_1	Time Simplex	Time Simplex Current Simplex Time Current Current Time Time Duplex
	Time Duplex	Time Simplex Current Simplex Time Current Current Time

### 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.

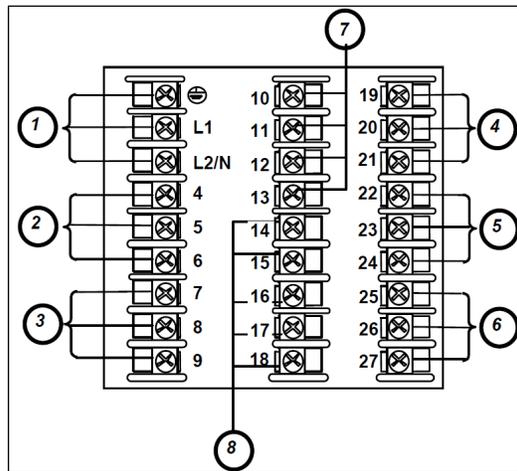
**NOTE:** Torque screw assembly to 10 lb-inch (1.13 N•m) 27 places.

**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.

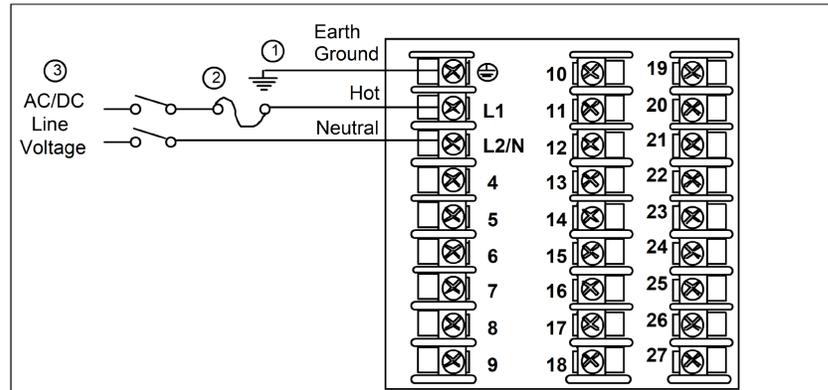
Figure 3-3: Composite Wiring Diagram



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).

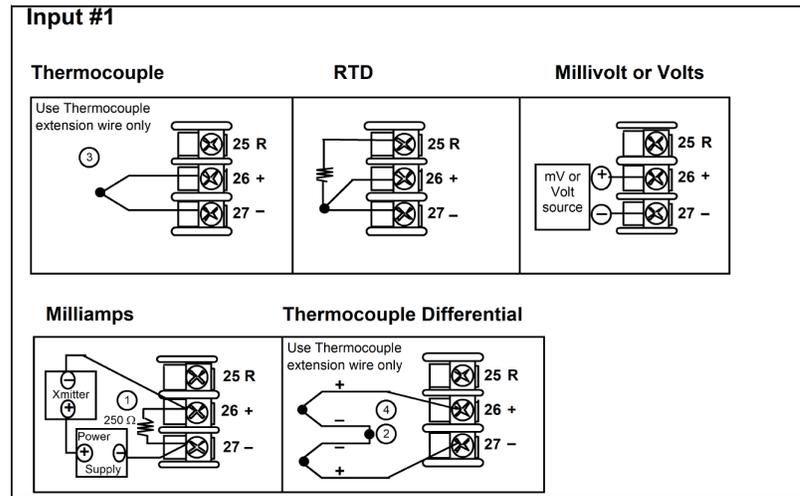
Item	Description
	<p><b>ATTENTION:</b> If they are used as Relay Outputs, the wire gauge should be AWG 14~22.</p> <p><b>ATTENTION:</b> It Can be used as Output #3 in the table of Dual Loop Controller – <a href="#">Loop 2 Universal Output Functionality and Restrictions</a>.</p>
3	<p>Output 4 Terminals (Alarm #1 in the Table I of UDC2800 Universal Digital Controller Model Selection Guide).</p> <p><b>ATTENTION:</b> If they are used as Relay Outputs, the wire gauge should be AWG 14~22.</p> <p><b>ATTENTION:</b> It Can be used as Output #4 in the table of Dual Loop Controller – <a href="#">Loop 2 Universal Output Functionality and Restrictions</a>.</p>
4	<p>Outputs 1 and 2 Terminals (Output #1 in the Table I of UDC2800 Universal Digital Controller Model Selection Guide).</p> <p><b>ATTENTION:</b> If they are used as Relay Outputs, the wire gauge should be AWG 14~22.</p>
5	Input #2 Terminals.
6	Input #1 Terminals.
7	Aux. Output and Digital Inputs Terminals.
8	Communications Terminals.

Figure 3-4: Mains Power Supply



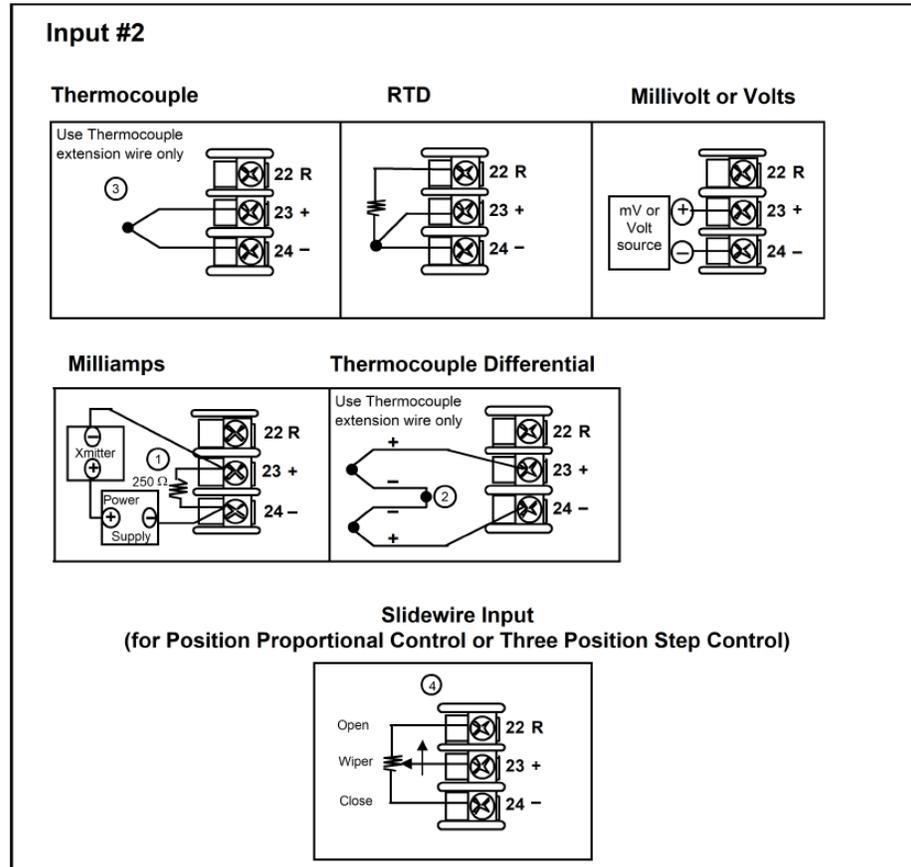
Item	Description
1	<p>PROTECTIVE BONDING (grounding) of this controller and the enclosure in which it is installed, shall be in accordance with National and local electrical codes. To minimize electrical noise and transients that may adversely affect the system, supplementary bonding of the controller enclosure to local ground using a 14AWG ~ 20AWG copper conductor is recommended.</p> <p>The wire gauge of power supply is AWG 14 (2.0 mm<sup>2</sup>) ~20 (0.5 mm<sup>2</sup>).</p>
2	<p><b>NOTE:</b> It is only required for 90~264 Vac applications.</p> <p>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.</p> <p><b>ATTENTION:</b> The nominal current of the switch must be larger than fuse's related current.</p>
3	<p>The wire area of power supply is AWG 14 (2.0 mm<sup>2</sup>) ~20 (0.5 mm<sup>2</sup>).</p> <p><b>CAUTION:</b> Applying 90-264 Vac to an instrument rated for 24 Vac/dc will severely damage the instrument and is a fire and smoke hazard.</p>

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.

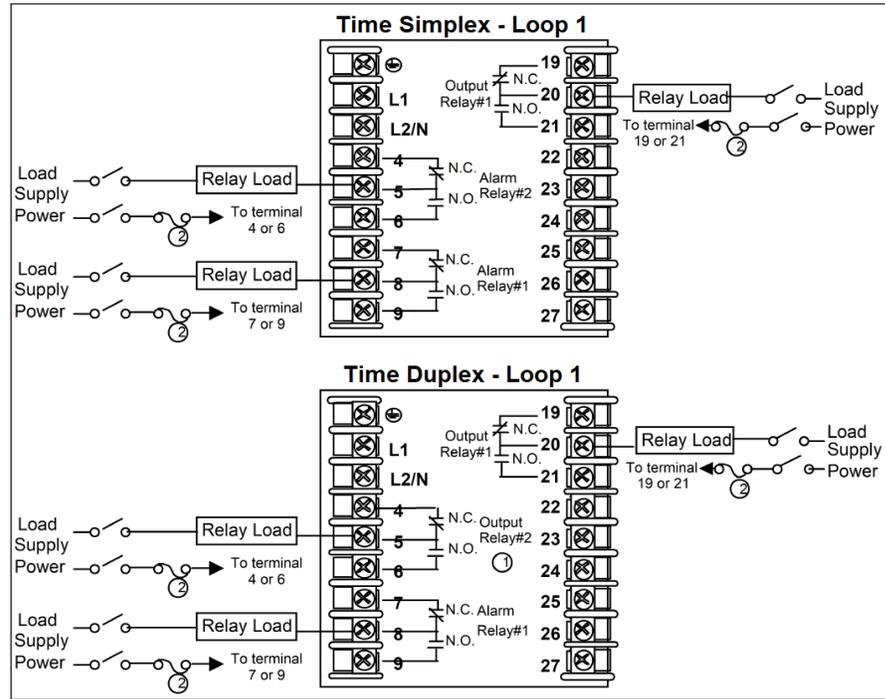
Figure 3-6: Input 2 Connections



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.

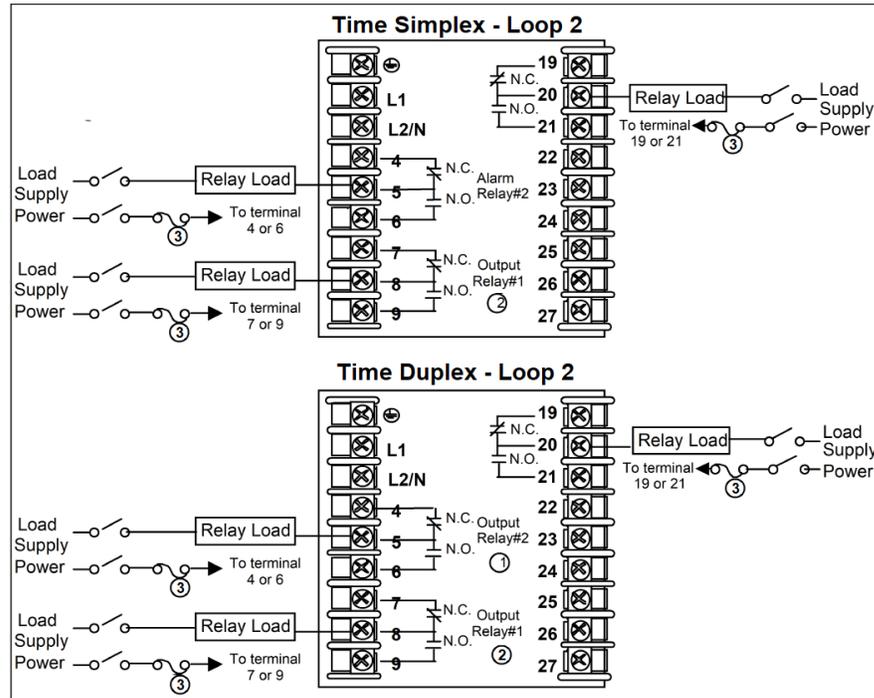
Item	Description
4	Input 2 is used to measure the Slidewire Input for Position Proportional Control.

Figure 3-7: Electromechanical Relay Output



Item	Description
1	Alarm #2 is not available with Time Proportional Duplex or Three Position Step Control 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.

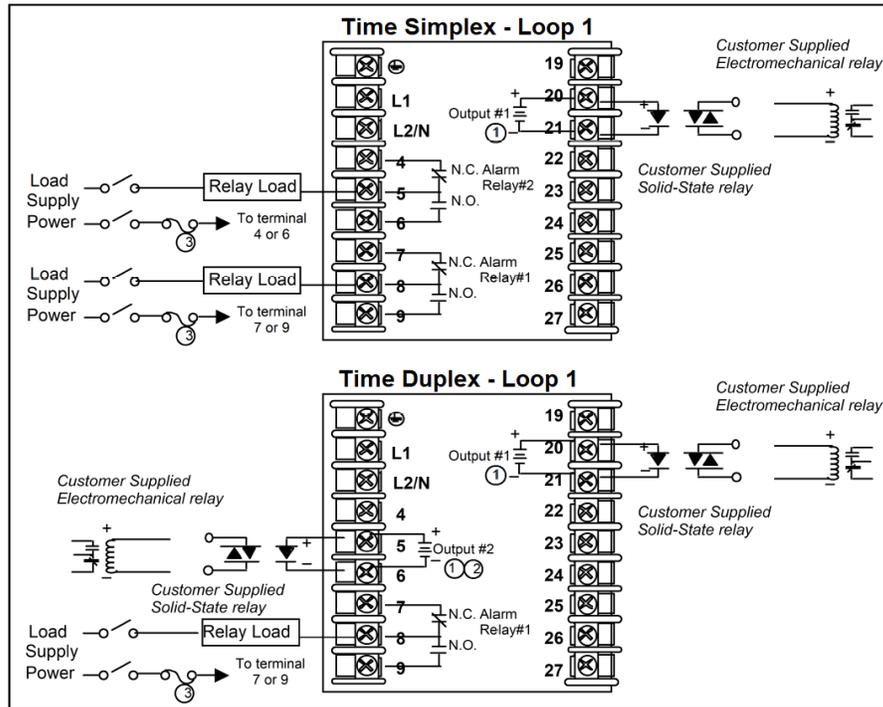
See the table [Loop 1 Universal Output Functionality and Restrictions](#) for relay terminal connections for other Output Algorithm Types.



Item	Description
1	Alarm #2 is not available with Time Proportional Duplex.
2	Alarm #1 is not available with Time Proportional Simplex and Time Proportional Duplex.
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.

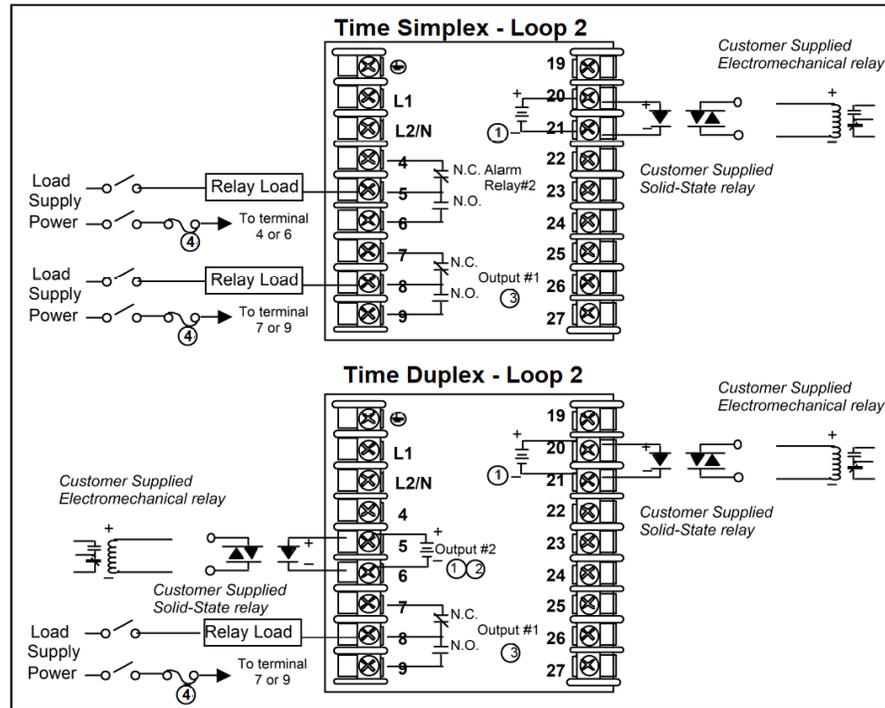
See the table [Loop 2 Universal Output Functionality and Restrictions](#) for relay terminal connections for other Output Algorithm Types.

Figure 3-8: Open Collector Output



Item	Description
1	<b>CAUTION:</b> 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 or Three Position Step Control 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.

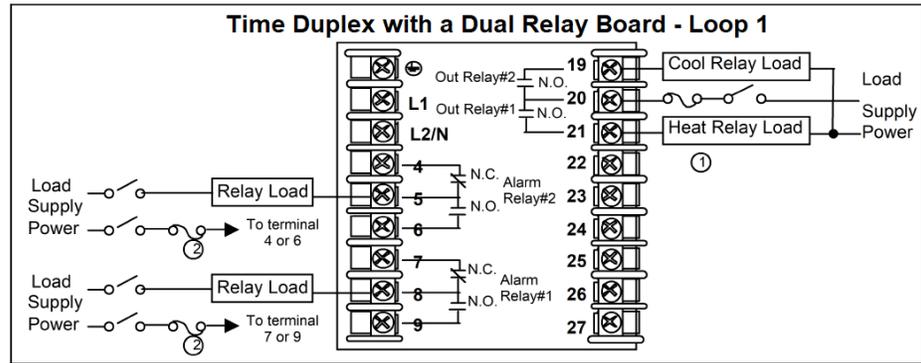
See the table [Loop 1 Universal Output Functionality and Restrictions](#) for relay terminal connections for other Output Algorithm Types.



Item	Description
1	<b>CAUTION:</b> 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.
3	Alarm #1 is not available with Time Proportional Simplex and Time Proportional Duplex.
4	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.

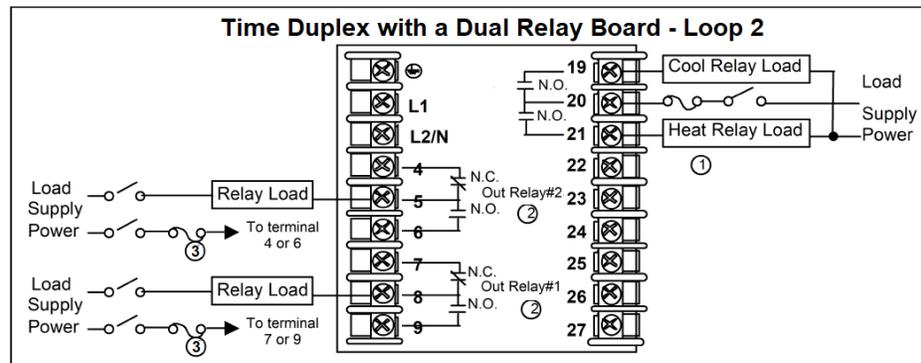
See the table [Loop 2 Universal Output Functionality and Restrictions](#) for relay terminal connections for other Output Algorithm Types.

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.

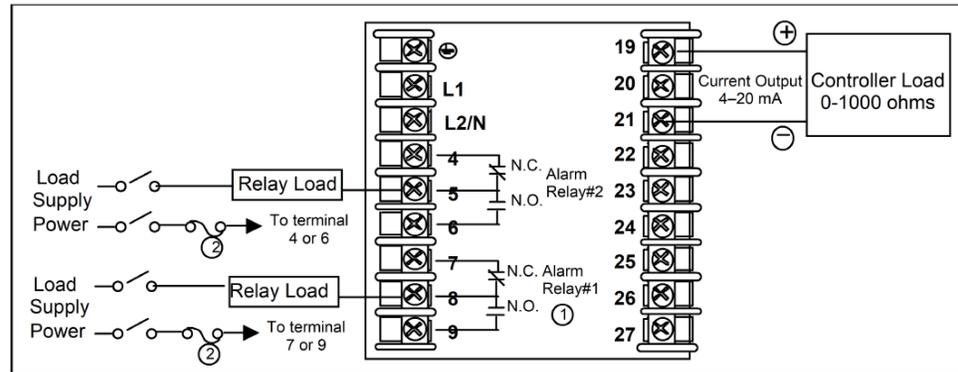
See the table [Loop 1 Universal Output Functionality and Restrictions](#) for relay terminal connections for other Output Algorithm Types.



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	Alarm #1 and Alarm #2 are not available with Time Proportional Duplex.
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 [Loop 2 Universal Output Functionality and Restrictions](#) for relay terminal connections for other Output Algorithm Types.

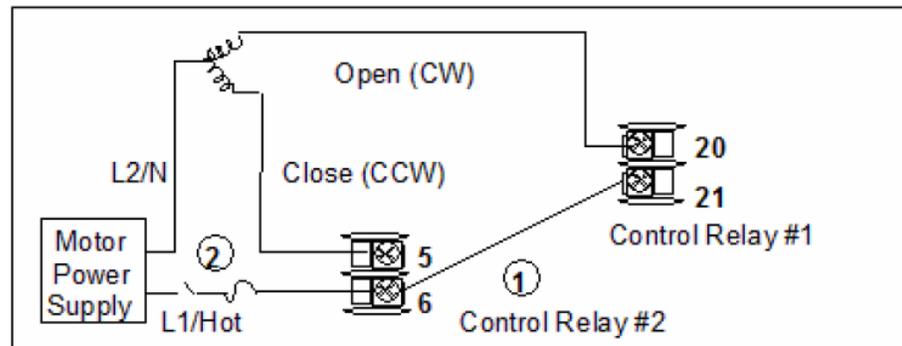
Figure 3-10: Current Output



Item	Description
1	When the instrument has the Current Output as shown, no Alarms are available when <b>loop 1</b> is using the Time Proportional Duplex or Three Position Step Control Output Algorithms or <b>loop 2</b> is using 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.

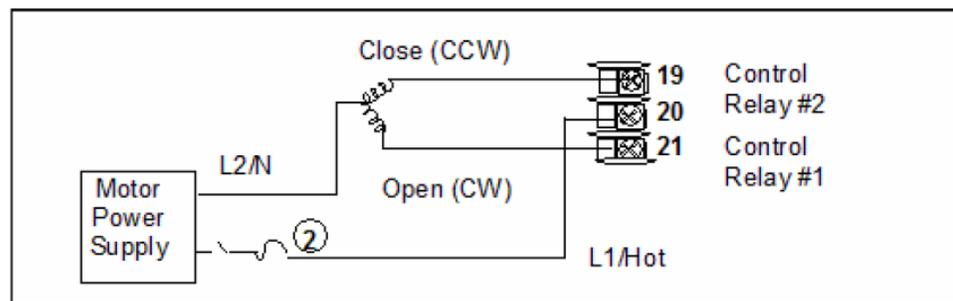
See the table [Loop 1 Universal Output Functionality and Restrictions](#) and [Loop 2 Universal Output Functionality and Restrictions](#) for relay terminal connections for other Output Algorithm Types.

Figure 3-11: Position Proportional or Three Position Step Control Connections, model DC2800-EE or DC2900-EE



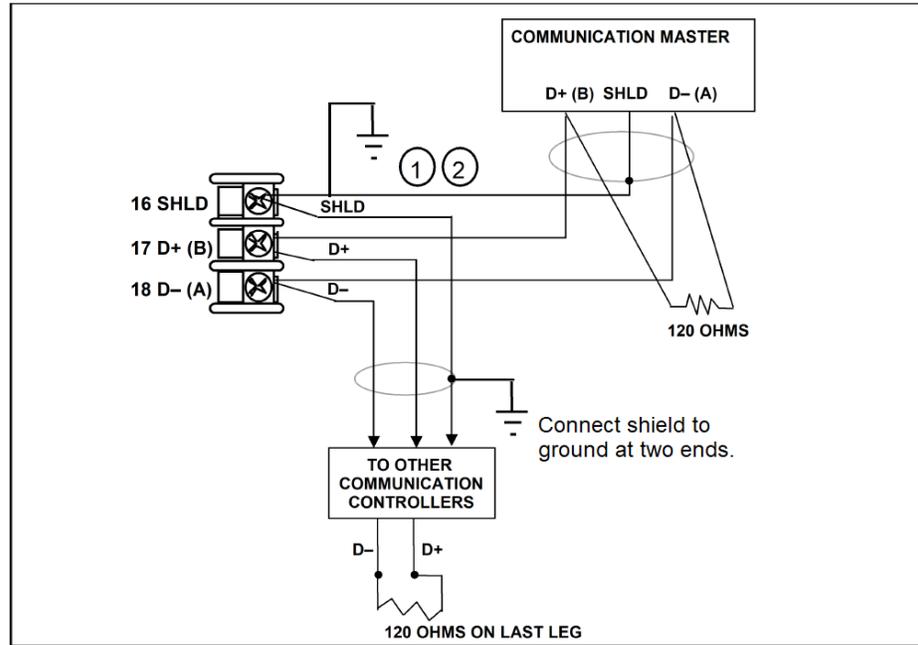
Item	Description
1	Alarm #2 is not available with this configuration.
2	DC2800-EE or DC2900-EE Electromechanical Relays are rated at 5 Amps at 120 Vac or 240 Vac or 24 Vdc.  Users should size fuses accordingly. Use Fast Blow fuses only.
3	See Input 2 Wiring Diagram for Slidewire Connections.

Figure 3-12: Position Proportional or Three Position Step Control Connections, model DC2800-R\_ or DC2900-R\_



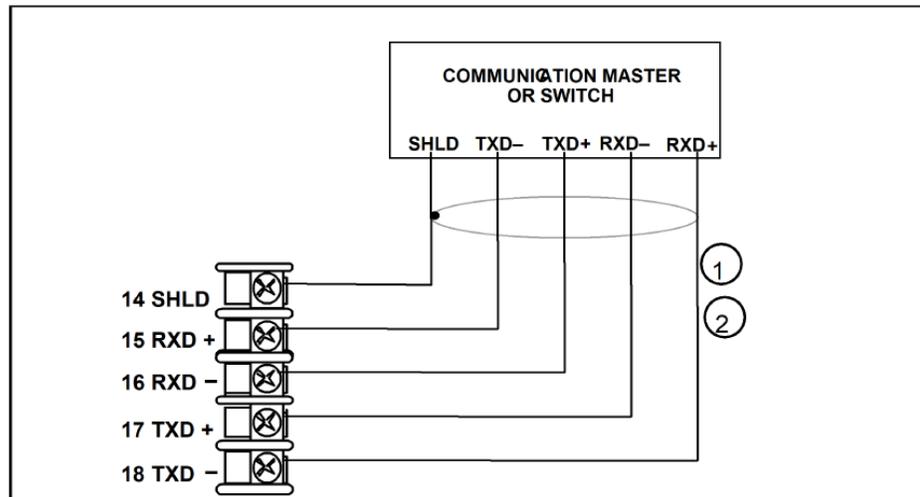
Item	Description
1	Alarm #2 is not available with this configuration.
2	DC2800-R_ or DC2900-R_ Dual Electromechanical Relays are rated at 2 Amps at 120 Vac or 240 Vac or 30 Vdc.  Users should size fuses accordingly. Use Fast Blow fuses only.
3	See Input 2 Wiring Diagram for Slidewire Connections.

Figure 3-13: 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).

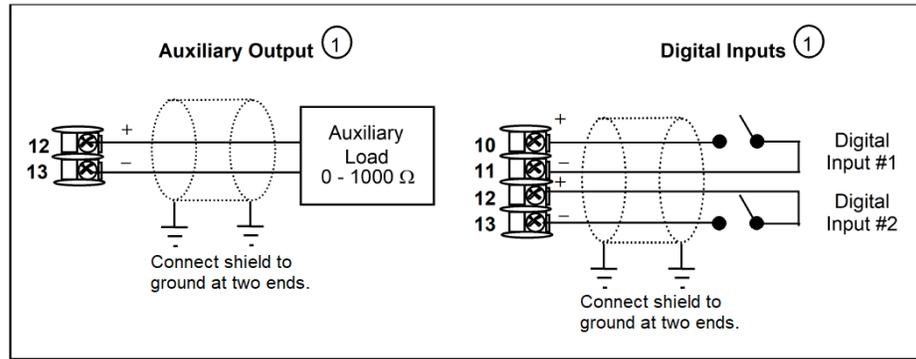
Figure 3-14: Ethernet Communications Option Connections



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 3-15: Auxiliary Output and Digital Inputs Option Connections



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

**ATTENTION:** Auxiliary Output can be used for Current Simplex, Current Time, and Time Current Output algorithms for loop 2.

Figure 3-16: Transmitter Power for 4-20 mA – 2 wire Transmitter Using Open Collector Alarm 2 A2S1TY Deviation Output

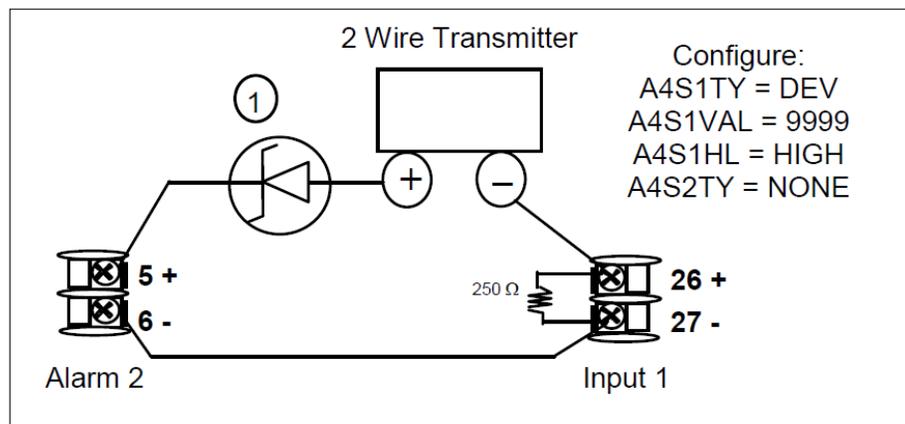
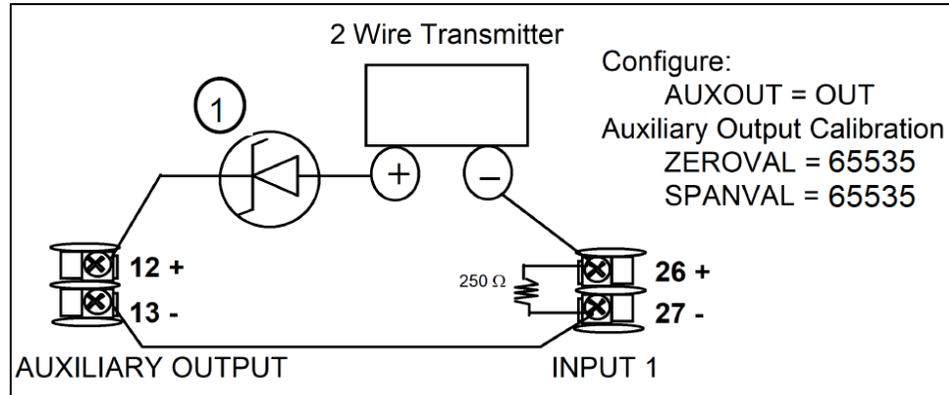


Figure 3-17: Transmitter Power for 4-20 mA – 2 Wire Transmitter Using Auxiliary Output



- ① If necessary, install a zener diode here to reduce voltage at the transmitter. A 1N4733 will reduce the voltage at the transmitter to approximately 25 Vdc.

**CONFIGURATION**

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## 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	<p>The Security group contains the following prompts: Password, Lockout, Auto/Man Key, Run/Hold Key, SP Select Key, Restore Settings, and Change Password. Arrows indicate a flow from Password to Lockout, Auto/Man Key, Run/Hold Key, and SP Select Key. From SP Select Key, an arrow points to Restore Settings and Change Password. From Restore Settings, an arrow points back to Password.</p>
Tuning	<p>The Tuning group contains the following prompts: Proportional Band 1 or Gain 1, Rate 1 Min, Reset Mins/Rpt 1 or Reset Rpts/Min 1, 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, and Cycle Time 2 Sec. Arrows indicate a flow from Proportional Band 1 to Rate 1 Min, Reset Mins/Rpt 1, and Manual Reset. From Manual Reset, an arrow points to Proportional Band 2. This pattern repeats for bands 2, 3, and 4. From Cycle Time 1 Sec, an arrow points to Cycle Time 2 Sec.</p>
Tuning 2	<p>The Tuning 2 group contains the following prompts: PROP BD5 or GAIN5, RATE5MIN, RSET5MIN or RSET5RPM, MAN RSET, PROPBD6 or GAIN 6, RATE6MIN, RSET6MIN or RSET6RPM, PROPB7 or GAIN 7, RATE7MIN, RSET7MIN or RSET7RPM, PROPBD8 or GAIN 8, RATE8MIN, RSET8MIN or RSET8RPM, CYC5 SEC or CYC5 SX3, and CYC6 SEC or CYC6 SX3. Arrows indicate a flow from PROP BD5 to RATE5MIN, RSET5MIN, MAN RSET, PROPBD6, RATE6MIN, RSET6MIN, and PROPB7. From PROPB7, an arrow points to RATE7MIN. This pattern repeats for bands 6, 7, and 8. From RATE7MIN, an arrow points to RATE8MIN. From RATE8MIN, an arrow points to CYC5 SEC and CYC6 SEC.</p>

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

Setup Group	Function Prompts
Input 2	
Control	
Control 2	
Options	

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

Setup Group	Function Prompts
Status	<input type="text" value="Software Version"/> <input type="text" value="Failsafe Status"/> <input type="text" value="Failsafe Status Loop 2"/> <input type="text" value="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.

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	<p>Sequentially displays the other set up groups shown in the prompt hierarchy. See Configuration Prompt Hierarchy for more information.</p> <p>You can also use the Increment key or Decrement keys to scan the set up groups in both directions. Stop at the set up group title that describes the group of parameters you want to configure. Then proceed to the next step.</p>
3	Select a Function Parameter	Function key	Enter in the first function prompt of the selected set up group.

Step	Operation	Press	Result
		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	<p>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.</p> <div style="border: 1px solid blue; padding: 5px; margin-bottom: 5px;"> <p><b>NOTE:</b> The default password for the UDC device is 1234. It is recommended to change the password after the first login.</p> </div> <div style="border: 1px solid blue; padding: 5px; margin-bottom: 5px;"> <p><b>NOTE:</b> The password is for keyboard entry only and is not available via communications.</p> </div> <div style="border: 1px solid blue; padding: 5px; margin-bottom: 5px;"> <p><b>NOTE:</b> Holding both the Increment and Decrement keys while editing numerical values in the main or setup screen allows the current editable digit to move one step left.</p> </div> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> If the password is not correct, the following prompts cannot be displayed except</p> </div>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<div style="border: 1px solid orange; padding: 5px;"> <p><b>Restore Settings.</b></p> </div>
Lockout		<p>Lockout applies to one of the functional groups: Configuration, Calibration, Tuning, Accutune.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Do not configure it until all configuration is complete.</p> </div> <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b> In the Honeywell EasySet app, lockout options appears under the security group only after entering the password.</p> </div>
	None	No lockout; all groups are read/write.
	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	<p>Tuning and Setpoint Ramp parameters are available for read only. No other parameters are viewable.</p> <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b> In the Honeywell EasySet app for security group lockout parameter max all group parameter options are available for read only.</p> </div>

Function Prompt	Selections or Range of Setting	Parameter Definition
Auto/Man Key		Allows you to disable the Auto/Manual Key
	Disable	Disable the Auto/Manual Key
	Enable	Enable the Auto/Manual Key  <b>ATTENTION:</b> Can only be viewed if <b>Lockout</b> is configured for <b>None</b> .
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  <b>ATTENTION:</b> Can only be viewed if <b>Lockout</b> is configured for <b>None</b> .
	Reset	Reset the latched alarm using the Run/Hold key combination after the alarm condition is complete.
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  <b>ATTENTION:</b> Can only be viewed if <b>Lockout</b> is configured for <b>None</b> .
Restore Settings		Allows you to reset the controller
	Disable	Disable
	Enable	Enable
Restore*		It allows you to reset the controller to factory settings while preserving configuration.

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p><b>ATTENTION:</b> The device will restart if enabled.</p>
	Disable	Disable
	Enable	Enable
Change Password	0 to 9999	<p>Allows you to change the password.</p> <p><b>NOTE:</b> The password is for keyboard entry only and is not available via communications.</p> <p><b>ATTENTION:</b> Can only be viewed when the password you entered is correct.</p>

# 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	<div style="border: 1px solid blue; padding: 5px; margin-bottom: 10px;"> <p><b>NOTE:</b> The selection of <b>Proportional Band</b> or <b>Gain</b> is made in the <b>Control</b> set up under the prompt <b>Proportion Unit</b>.</p> </div> <p><b>Proportional Band 1</b> (simplex) is the percent of the range of the measured variable for which a proportional controller will produce a 100 % change in its output.</p> <p><b>Gain 1</b> is the ratio of output change (%) over the measured variable change (%) that caused it.</p> $G = 100\% / PB\%$ <p>where PB is the proportional band (in %)</p> <p>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</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		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	<p><b>Reset Mins/Rpt 1</b> = Reset in Minutes per Repeat</p> <p><b>Reset Rpts/Min 1</b> = Reset in Repeats per Minute</p> <p><b>Reset</b> (or <b>Integral Time</b>) 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 action is repeated per minute or how many minutes before one repeat of the proportional action occurs.</p> <p>Used with control algorithm PID A or PID B.</p> <p>Also defined as "HEAT" Reset on Duplex models for variations of Heat/Cool applications.</p> <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b> The selection of whether <b>Minutes per Repeat</b> or <b>Repeats per Minute</b> is used is made in the <b>Control 2</b> set up group under the prompt <b>Reset Unit</b>.</p> </div>
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.

Function Prompt	Selections or Range of Setting	Parameter Definition
		<div style="border: 2px solid orange; padding: 5px; display: inline-block;"> <b>ATTENTION:</b> Bias is shown on the lower display.                 </div>
Proportional Band 2 or GAIN 2	0.1 to 9999 % or 0.001 to 1000	<p><b>Proportional Band 2</b> or <b>GAIN 2</b> , <b>Rate 2 Min</b> , and <b>Reset 2</b> 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.</p> <p>These parameters appear when the following settings are configured:</p> <ol style="list-style-type: none"> <li>1. <b>Control Algorithm</b> of the <b>Algorithms</b> set up group is configured as <b>PID A</b>, <b>PID B</b>, <b>PD+Manual Reset</b> or <b>Three Position Step</b>.</li> <li>2. <b>PID Sets</b> of the <b>Control</b> set up group is configured as <b>2 Sets Keyboard</b>, <b>2 Sets PV Swithcover</b>, <b>2 Sets SP Swithcover</b>, <b>4 Sets Keyboard</b>, <b>4 Sets PV Swithcover</b> or <b>4 Sets SP Swithcover</b>.</li> <li>3. <b>Proportion Unit</b> of the <b>Control</b> set up group is configured as <b>Proportional Band</b> or <b>Gain</b>.</li> </ol>
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	<p><b>Proportional Band 3</b> or <b>Gain 3</b> , <b>Rate 3 Min</b> , and <b>Reset 3</b> 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.</p> <p>These parameters appear when the following settings are configured:</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<ol style="list-style-type: none"> <li>1. <b>Control Algorithm</b> of the <b>Algorithms</b> set up group is configured as <b>PID A, PID B, PD+Manual Reset</b> or <b>Three Position Step</b>.</li> <li>2. <b>PID Sets</b> of the <b>Control</b> set up group is configured as <b>4 Sets Keyboard, 4 Sets PV Swithcover</b> or <b>4 Sets SP Swithcover</b>.</li> <li>3. <b>Proportion Unit</b> of the <b>Control</b> set up group is configured as <b>Proportional Band</b> or <b>Gain</b>.</li> </ol>
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 GAIN 4	0.1 to 9999 % or 0.001 to 1000	<p><b>Proportional Band 4</b> or <b>Gain 4</b> , <b>Rate 4 Min</b>, and <b>Reset 4</b> 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.</p> <p>These parameters appear when the following settings are configured:</p> <ol style="list-style-type: none"> <li>1. <b>Control Algorithm</b> of the <b>Algorithms</b> set up group is configured as <b>PID A, PID B, PD+Manual Reset</b> or <b>Three Position Step</b>.</li> <li>2. <b>PID Sets</b> of the <b>Control</b> set up group is configured as <b>4 Sets Keyboard, 4 Sets PV Swithcover</b> or <b>4 Sets SP Swithcover</b>.</li> <li>3. <b>Proportion Unit</b> of the <b>Control</b> set up group is configured as <b>Proportional Band</b> or <b>Gain</b>.</li> </ol>
Rate 4 Min	0.00 to	This is the same as above except that it applies to

Function Prompt	Selections or Range of Setting	Parameter Definition
	10.00 minutes	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	<p><b>Cycle Time 1 (Heat)</b> determines the length of one time proportional output relay cycle. Defined as "HEAT" cycle time for Heat/Cool applications.</p> <div style="border: 1px solid blue; padding: 5px;"> <p><b>NOTE:</b> It only appears when <b>Output Algorithms</b> is configured as <b>Time Simplex</b>, <b>Time Duplex</b> or <b>Current Time</b> in the <b>Output</b> set up group.</p> </div> <p><b>Cycle Time 1 Sec</b> —Electromechanical relays</p>
Cycle Time 2 Sec	1 to 120 seconds	<p><b>Cycle Time 2 (COOL)</b> is the same as above except it applies to Duplex models as the cycle time in the "COOL" zone of Heat/Cool applications or for the second set of PID constants.</p> <div style="border: 1px solid blue; padding: 5px;"> <p><b>NOTE:</b> It only appears when <b>Output Algorithms</b> is configured as <b>Time Duplex</b> or <b>Time Current</b> in the <b>Output</b> set up group.</p> </div> <p><b>Cycle Time 2 Sec</b> —Electromechanical relays</p>

# Loop 2 Tuning Set Up Group

## Introduction

Tuning consist of establishing the appropriate values for the tuning constants you are using so that your controller responds correctly to change 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.

There can be as many as four PID sets available for Loop 2.

## Function Prompts

Table 4-5: Loop 2 TUNING Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Proportional Band 5 or Gain 5	0.1 to 9999 % or 0.001 to 1000	<p><b>Proportional Band 5</b> (simplex) is the percent of the range of the measured variable for which a proportional controller will produce a 100 % change in its output.</p> <p><b>Gain 5</b> is the ratio of output change (%) over the measured variable change (%) that caused it.</p> $G = 100\% / PB\%$ <p>where PB is the proportional band (in %)</p> <p>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 %.</p> <p>Also defined as "HEAT" Gain on Duplex models for variations of Heat/Cool applications.</p>
Rate 5 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.

Function Prompt	Selections or Range of Setting	Parameter Definition
Reset Mins/Rpt 5 or Reset Rpts/Min 5	0.02 to 50.00	<p>Also defined as "HEAT" Rate on Duplex models for variations of Heat/Cool applications.</p> <p><b>Reset Mins/Rpt 5</b> = Reset in Minutes per Repeat  <b>Reset Rpts/Min 5</b> = Reset in Repeats per Minute</p> <p><b>Reset</b> (or <b>Integral Time</b>) 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 action is repeated per minute or how many minutes before one repeat of the proportional action occurs.</p> <p>Used with control algorithm PID A or PID B.</p> <p>Also defined as "HEAT" Reset on Duplex models for variations of Heat/Cool applications.</p> <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b> The selection of whether <b>Minutes per Repeat</b> or <b>Repeats per Minute</b> is used is made in the <b>Control</b> set up group under the prompt <b>MIN</b> or <b>RPM</b>.</p> </div>
Manual 5 Reset	–100 to +100 (in % output)	<p>It is only applicable if you use control algorithm PD with Manual Reset for Loop 2 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.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Bias is shown on the lower display.</p> </div>
Proportional Band 6 or GAIN 6	0.1 to 9999 % or 0.001 to 1000	<p><b>Proportional Band 6</b> or <b>GAIN 6</b>, <b>Rate 6</b>, and <b>Reset 6</b> 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.</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
Rate 6 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 6 Reset Rpts/Min 6	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 7 or GAIN 7	0.1 to 9999 % or 0.001 to 1000	<b>Proportional Band 7</b> or <b>Gain 7</b> parameters are the same as previously described. This prompt appears only when four PID sets are enabled.
Rate 7 Min	0.00 to 10.00 minutes	<b>Rate 7 Minutes</b> parameter is the same as previously described. This prompt appears only when four PID sets are enabled.
Reset Mins/Rpt 7 Reset Rpts/Min 7	0.02 to 50.00	<b>Reset 7 Minutes</b> or <b>Reset 7 Repeats Per Minute</b> parameters are the same as previously described. This prompt appears only when four PID sets are enabled.
Proportional Band 8 or GAIN 4	0.1 to 9999 % or 0.001 to 1000	<b>Proportional Band 8</b> or <b>Gain 8</b> , <b>Rate 8</b> , and <b>Reset 8</b> parameters are the same as previously described. This prompt appears only when four PID sets are enabled.
Rate 8 Min	0.00 to 10.00 minutes	Rate 8 Minutes parameters is the same as previously described. This prompt appears only when four PID sets are enabled.
Reset Mins/Rpt 8 Reset Rpts/Min 8	0.02 to 50.00	Reset 8 Minutes or Reset 8 Repeats Per Minute parameters are the same as previously described. This prompt appears only when four PID sets are enabled.

Function Prompt	Selections or Range of Setting	Parameter Definition
<p>Cycle Time 5 Sec or <b>CYC5 SX3</b></p>	<p>1 to 120 seconds</p>	<p><b>Cycle Time 1 (Heat)</b> determines the length of one time proportional output relay cycle. Defined as "HEAT" cycle time for Heat/Cool applications.</p> <p><b>Cycle Time 5 Sec</b> —Electromechanical relays <b>CYC5 SX3</b> —Solid state relays</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> 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.</p> </div>
<p>Cycle Time 6 Sec or <b>CYC6 SX3</b></p>	<p>1 to 120 seconds</p>	<p><b>Cycle Time 2 (COOL)</b> is the same as above except it applies to Duplex models as the cycle time in the "COOL" zone of Heat/Cool applications or for the second set of PID constants.</p> <p><b>Cycle Time 6 Sec</b> —Electromechanical relays <b>CYC2 SX3</b> —Solid state relays</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> 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.</p> </div>

# 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 Programming 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 Program then starts from this value.

**NOTE: PV Hot Start** is only applicable to **SP Ramp** and **SP Program**

For how to configure Set Point Ramp, Rate and Program, see Setpoint Rate/Ramp/Program for more information.

## Function Prompts

Table 4-6: SP Ramp/Program Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
SP Ramp Function		<p><b>Single Setpoint Ramp</b> –Make a selection to enable or disable the setpoint ramp function. Make sure you configure a ramp time and a final setpoint value.</p> <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b> SP Program must be disabled for SP Ramp prompts to appear.</p> </div>
	Disable	Disables the setpoint ramp option.
	Enable	Allows the single setpoint ramp prompts to be shown.
	Enable 2	Allows the single setpoint ramp prompts for Loop 2.
	Enable 1&2	Allows the single setpoint ramp prompts for Loop 1 & 2.
Ramp Time Min	0 to 255 minutes	<b>Setpoint Ramp Time</b> –Enter the number of minutes desired to reach the final setpoint. A ramp time of “0” implies an immediate change of setpoint.

Function Prompt	Selections or Range of Setting	Parameter Definition
Ramp Final SP	Within setpoint limits	<p><b>Setpoint Ramp Final Setpoint</b> –Enter the value desired for the final setpoint . The controller will operate at the setpoint set here when ramp is ended.</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> 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.</p> </div> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> 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).</p> </div>
SP Rate Function		<p><b>Setpoint Rate</b> –Lets you configure a specific rate of change for any local setpoint change.</p> <div style="border: 1px solid blue; padding: 5px;"> <p><b>NOTE:</b> SP Rate only works in Auto mode.</p> </div> <div style="border: 1px solid blue; padding: 5px;"> <p><b>NOTE:</b> 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.</p> </div>
	Disable	Disables the setpoint rate option.
	Enable	Allows the SP rate feature.
	Enable 2	Allows the SP rate feature for Loop 2.

Function Prompt	Selections or Range of Setting	Parameter Definition
	Enable 1 & 2	Allows the SP rate feature for Loop 1 & 2.
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).
Rate Up EU/HR Loop 2	0 to 9999 in engineering units per hour	Rate up value for loop 2, 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 Loop 2	0 to 9999 in engineering units per hour	Rate down value for loop 2, 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)		<b>Setpoint Ramp/Soak Program</b> –Available only with controllers that contain this option.  <b>ATTENTION:</b> SP Ramp must be

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>disabled for SP Program prompts to appear. If SP Rate is enabled, it does not operate while an SP Program is running</p>
	Disable	Disables setpoint programming.
	Enable	<p>Enables setpoint programming.</p> <p><b>NOTE:</b> For more configurable parameters of SP Program, see the table <a href="#">SP Program configurable parameters</a>.</p>
Soak Deviation	0 to 99.999	<p>Guaranteed Soak Deviation Value</p> <p>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.</p> <p>0 means the soak deviation function is disabled.</p>
Program Termination		Program Termination State
	Last SP	Hold at last setpoint in the program
	Failsafe	Manual mode/Failsafe output
Program End State	<p>Disable</p> <p>Hold</p>	<p>It determines the program state after completion.</p> <p>Disable: SP Program Function is disabled.</p> <p>Hold: SP Program Function is not disabled.</p>
Key Reset/Rerun		<p>Reset/Rerun SP Program.</p> <p>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.</p>

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

Users can run a single set point program at a time and jump various segments in the program as per the requirements. If the user configured more than one set point program, then the set point program will run one after another. For example, SPP1-SPP2-SPP3-...SPP8.

The following list is only for reference. See Setpoint Ramp/Soak Programming 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

Function Prompt	Selections or Range of Setting	Parameter Definition
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  <div style="border: 1px solid blue; padding: 5px;"> <p><b>NOTE:</b> In recycles program, if user select <b>To Begin</b>; The recycles also begin from first segment and first program. It also reset recycles to all programs</p> </div> <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b> In recycles program, if user select <b>Rerun</b>; the setpoint program to rerun from the first segment in the current program and it is do not effects recycle program.</p> </div>
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  <div style="border: 1px solid blue; padding: 5px;"> <p><b>NOTE:</b> This parameter is affected by the <b>Ramp Unit</b> configuration. Select <b>Time Hrs:Mins</b> , <b>Rate EU/Mins</b>, or <b>Rate EU/Hrs</b> at prompt <b>Ramp Unit</b>. All ramps in this SP Program will use the same selection.</p> </div> <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b> Press Increment Key and Decrement Key at the same time to move the current editable digit one step left if required.</p> </div>
Segment 2 SP	Within the Setpoint limits	Segment #2 Soak Setpoint Value

Function Prompt	Selections or Range of Setting	Parameter Definition
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 Tim	Selections are same as above.	Same as above

**NOTE:** The SPP program initiates in the incremental order from 1 to 8. For example SP program 1, SP program 2 and so on.

# 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 4-7: 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  <b>NOTE:</b> This parameter is affected by the <b>Ramp Unit</b> configuration. Select <b>Time Hrs:Mins</b> , <b>Rate</b>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<div style="border: 1px solid blue; padding: 5px;"> <p><b>EU/Mins, or Rate EU/Hrs</b> at prompt <b>Ramp Unit.</b> All ramps in this SP Program will use the same selection.</p> </div>
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 and Three Position Step Control algorithms.

**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 for more information.

## Function Prompts

Table 4-8: Accutune Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Fuzzy Suppression		<b>Fuzzy Overshoot Suppression</b> –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

Function Prompt	Selections or Range of Setting	Parameter Definition
		tuning parameters.
	Enable 2	<b>Enable on Loop 2 only</b> - Fuzzy Tune used only on Loop 2.
	Enable 1&2	<b>Enable on Both Loops</b> - Fuzzy Tune used on both loops.
Accutune		<b>Accutune III</b>
	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		<b>Duplex Accutuning III</b>  <div style="border: 1px solid blue; padding: 5px;"><b>NOTE:</b> These prompts only appear when a duplex output type has been configured.</div>
	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 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).

Function Prompt	Selections or Range of Setting	Parameter Definition
Accutune 2	Same selection as for Loop 1	<b>Accutune III for Loop 2</b> - Available only when the instrument is configured for cascade or two Loop operation.  Same selection as for Loop 1.
Duplex 2	Same selection as for Loop 1	<b>Duplex Accutuning III for Loop 2</b> - These prompts only appears when a duplex output type has been configured for Loop 2 and TUNE has been selected.  Same selections as for Loop 1.
Error Status (Read Only)		<b>Accutune Error Status</b> —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: <ul style="list-style-type: none"> <li>• <b>changing to manual mode</b></li> <li>• <b>digital input detected</b></li> <li>• <b>in heat region of output but a cool output was calculated, or vice versa.</b></li> </ul>
	SP Error	LSP2 not configured or a Setpoint other than LSP1 or LSP2 is in use.
Error Status 2 (Read Only)	Same as Loop 1	Accutune Error Status for Loop 2.

# 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 4-9: 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	<b>Disable-</b> Disables Algorithm <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Tuning, SP program, and Accutune groups depend on the control algorithm. If the control algorithm is disabled, all three groups can not display on the main menu.</p> </div>
	On-Off	<b>ON/OFF</b> 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

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>of the error (ERROR = PV-SP). The ON/OFF algorithm operates on the sign of the error signal.</p> <p>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 %. If the control action is reverse, the opposite is true. An adjustable overlap (Hysteresis Band) is provided between the on and off states.</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Other prompts affected: OUT Hysteresis</p> </div> <p>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 %.</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Other prompts affected: OUT Hysteresis and Deadband</p> </div>
	PID A	<p><b>PID A</b> 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</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>Derivative (D)—to the error signal.</p> <div style="border: 1px solid orange; padding: 5px; margin: 10px 0;"> <p><b>ATTENTION:</b> PID A should not be used for Proportional only action; i.e., no integral (reset) action. Instead, use PD+ Manual Reset with rate set to 0.</p> </div> <p><b>Proportional (Gain)</b> —Regulates the controller’s output in proportion to the error signal (the difference between Process Variable and Setpoint).</p> <p><b>Integral (Reset)</b> —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.)</p> <p><b>Derivative (Rate)</b> —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.)</p>
	PID B	<p><b>PID B</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.</p>
	PD+Manual Reset	<p><b>PD with Manual Reset</b> is used whenever integral action is not wanted for automatic control. The equation is computed with no</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>integral contribution. The MANUAL RESET, which is operator adjustable, is then added to the present output to form the controller output.</p> <p>Switching between manual and automatic mode will be bumpless.</p> <p>If you select PD with Manual Reset you can also configure the following variations:</p> <ul style="list-style-type: none"> <li>• PD (Two Mode) control,</li> <li>• P (Single Mode) control.</li> </ul> <p>Set Rate (D) to 0.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Other prompts affected: MAN RSET in the Tuning Set Up group</p> </div>
	<p>Three Position Step</p>	<p><b>Three Position Step</b> –The Three Position Step Control algorithm allows the control of a valve (or other actuator) with an electric motor driven by two controller relay outputs; one to move the motor upscale, the other downscale without a feedback slidewire linked to the motor shaft. The deadband is adjustable in the same manner as the duplex output algorithm.</p> <p>The Three Position Step Control algorithm provides an output display (OUT) which is an estimated motor position, since the motor is not using any slidewire feedback. Although this output indication is only an approximation, it is</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>“corrected” each time the controller drives the motor to one of its stops (0 % or 100 %). It avoids all the control problems associated with the feedback slidewire (wear, dirt, noise). When operating in this algorithm, the estimated OUT display is shown to the nearest percent (i.e., no decimal). This selection forces the Output Algorithm selection to “POSITON”. Output Set Up Group.</p> <p>Refer to the Operation section for motor position displays.</p> <p>As a customer configurable option, when a second input board is installed, the motor slidewire can be connected to the controller. The actual slidewire position is then shown on the lower display as POS. This value is used for display only. It is NOT used in the Three Position Step algorithm. To configure this option, set Input 2 actuation to SLIDEW and then calibrate Input 2. Position Proportional and Three Position Step Output Calibration</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Other prompts affected: Deadband</p> </div> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Before switching to the Three Position Step Algorithm, the relay state must be set to 1 OFF 2 ON.</p> </div>
PID Loops		<p><b>PID Loops</b> - Number of PID Loops to be used.</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
	1 Loop	<b>1 Loop</b> - Select one loop of control.
	2 Loops	<b>2 Loops</b> - Select two independent loops of control, each with its own PID tuning sets and control parameters.
	Cascade	<b>Cascade</b> - Select Cascade Control in a Cascade control system, the output of the primary loop (loop 2) is used to adjust the remote setpoint of the secondary loop (loop 1), the output of the secondary loop is used to control the final control element.
Control Algorithm 2		<b>Control Algorithm for Loop 2</b> - This prompt only appears if two loop or cascade control has been selected. 3P Step and On-Off control are not available on the second control loop.
	PID A	<b>PID A</b> - Same as Loop 1.
	PID B	<b>PID B</b> - Same as Loop 1.
	PD+MR	<b>PD with manual Reset</b> - Same as Loop 1.
Output Override		<p><b>Output Override Select</b> - This selection lets you select high or low output override. Only available if the controller is configured for two loop operation. Not applicable for three position step application.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Loop 1 must be in automatic mode for this selection to work, while the output is being overridden, a blinking "OVERRIDE" appears</p> </div>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<div style="border: 1px solid orange; padding: 2px;">on the display.</div>
	Disable	<b>Disable</b> - Disables the override function.
	High Select	<b>High Select</b> - The controller will select the higher of output 1 or output 2 and direct it to the rear terminal for output 1.
	Low Select	<b>Low Select</b> - The controller will select the lower of output 1 or output 2 and direct it to the rear terminal for output 1.
Timer Function	Disable Enable	<p>It allows you to enable or disable the timer option.</p> <p>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.</p> <p>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.</p>
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).
Start Trigger	Keyboard Alarm 2	It allows you to select whether the timer starts with the keyboard (Run/Hold key) or Alarm 2.

Function Prompt	Selections or Range of Setting	Parameter Definition
Lower Display	Time Remaining Elapsed Time	<p>It allows you to select whether time remaining (TI REM) or elapsed time (E TIME) is displayed for the timer option.</p> <p>The time is shown on the lower display in HH:MM format along with a rotating “clock” character.</p> <ul style="list-style-type: none"> <li>• If the “clock” rotation is clockwise, elapsed time is indicated.</li> <li>• If the “clock” rotation is counterclockwise, time remaining is indicated.</li> </ul>
Reset Trigger	Keyboard Alarm 1	<p><b>Reset Trigger</b> allows you to reset the timer with the keyboard (Run/Hold key) or Alarm 1.</p>
Increment	Minutes Seconds	<p><b>Increment</b> allows you to increment the timer in either minutes or seconds.</p>
<p>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.</p> <p>All algorithms operate in engineering units except Feedforward (F FWRD) which operates in percent of output units.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> 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.</p> </div>		
Input Algorithm 1		Input Algorithm 1 has the following selections from which to choose:
	None	No algorithm configured
	Weighted Average	When you configure for Weighted

Function Prompt	Selections or Range of Setting	Parameter Definition
	<p>(See Note 2)</p> <p>(Standard feature on controllers with two analog inputs)</p>	<p>Average, the controller will compute a PV or SP for the control algorithm from the following equation:</p> $\text{Alg1} = [(\text{Input A} \times \text{Ratio A} + \text{Bias A}) + (\text{K} \times \text{Input B} \times \text{Ratio B} + \text{Bias B})] / (1 + \text{K}) + \text{Alg1Bias}$
	<p>Feedforward Summer</p> <p>(Standard feature on controllers with two analog inputs)</p>	<p>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.</p> <p>This algorithm will only function in automatic mode and is not used for Three Position Step Control applications.</p> <p>The following formula applies:</p> $\text{Controller Output} = \text{PID Output} + (\text{Input A} \times \text{Ratio A} + \text{Bias A}) \times (100 / \text{Input A Range})$
	<p>Feedforward Mult</p> <p>(Standard feature on controllers with two analog inputs)</p>	<p>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.</p> <p>This algorithm will only function in automatic mode and is not used for Three Position Step Control applications.</p> <p>The following formula applies:</p> $\text{Controller Output} = \text{PID Output} \times (\text{Input A} \times \text{Ratio A} + \text{Bias A}) / \text{Input A Range}$

Function Prompt	Selections or Range of Setting	Parameter Definition
	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.
	Multiplier + Sqrt (See Note 1)	Multiplier with Square Root –The following formula applies:  Alg1 =K x Sq.Rt.{(Input A x Ratio A +

Function Prompt	Selections or Range of Setting	Parameter Definition
		$\text{Bias A) x (Input B x Ratio B + Bias B) x (Input C x Ratio C + Bias C)} \times (\text{Calc Hi} - \text{Calc Lo}) + \text{Alg1Bias}$
	Multiplier Divider (See Note 1)	Multiplier Divider – The following formula applies:  $\text{Alg1} = K \times \{[(\text{Input A} \times \text{Ratio A} + \text{Bias A}) \times (\text{Input C} \times \text{Ratio C} + \text{Bias C})] / (\text{Input B} \times \text{Ratio B} + \text{Bias B})\} \times (\text{Calc Hi} - \text{Calc Lo}) + \text{Alg1Bias}$
	Multiplier (See Note 1)	Multiplier –The following formula applies:  $\text{Alg1} = K \times [(\text{Input A} \times \text{Ratio A} + \text{Bias A}) \times (\text{Input C} \times \text{Ratio C} + \text{Bias C}) \times (\text{Input B} \times \text{Ratio B} + \text{Bias B})] \times (\text{Calc Hi} - \text{Calc Lo}) + \text{Alg1Bias}$
	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 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

Function Prompt	Selections or Range of Setting	Parameter Definition
		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 <sub>2</sub> . This algorithm requires a temperature range within the region of 800 °F to 3000 °F.
	A-B	The A-B algorithm subtracts input B with Ratio/Bias from input A with Ratio/Bias.  PV or SP = K*(A-B)*(Cals Hi - Cals Lo).

**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

Function Prompt	Selections or Range of Setting	Parameter Definition
<p>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 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.</p>		
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

Function Prompt	Selections or Range of Setting	Parameter Definition
	Output	Output – Should not be used for Three Position Step Control applications.
	Output 2	Output 2 – Should not be used for Three Position Step Control applications.
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 – Should not be used for Three Position Step Control applications.
	Output 2	Output 2 – Should not be used for Three Position Step Control applications.
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 – Should not be used for Three Position Step Control applications.
	Output 2	Output – Should not be used for Three Position Step Control applications.
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

Function Prompt	Selections or Range of Setting	Parameter Definition
		monoxide that is applicable for the enriching gas used in fractional form.  <b>FOR EXAMPLE:</b> 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.
<p>Math Algorithm Notes:</p> <ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.</li> </ol>		

# 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 4-10: OUTPUT Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Output Algorithm		<p>The output algorithm lets you select the type of output you want. Not applicable with Control algorithm prompt Three Position Step.</p> <p>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.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> 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 %.</p> </div>
	Time Simplex	This output algorithm uses Digital

Function Prompt	Selections or Range of Setting	Parameter Definition
		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 configuration, below.
	Position Proportion	<p>Type of output using two relays and a motor that has a 100 to 1000 ohms feedback slidewire.</p> <p>This output algorithm selection forces Input 2 to the SLIDEW selection when the Control Algorithm is any selection other than Three Position Step.</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Other prompts affected: Deadband, Input2 Type</p> </div>
	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

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>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.</p> <p><b>ATTENTION:</b> Other prompts affected: Out Range 2.</p>
	Current Time	<p>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.</p> <p><b>ATTENTION:</b> Other prompts affected: Out Range 2.</p> <p><b>ATTENTION:</b> Current/Time Duplex uses Second Current Output (Auxiliary Output) if it is available, else the Primary Current Output will be used.</p>
	Time Current	<p>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.</p> <p><b>ATTENTION:</b> Other prompts affected: Out Range 2.</p> <p><b>ATTENTION:</b> Time/Current Duplex uses Second Current Output (Auxiliary Output) if it</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<div style="border: 1px solid orange; padding: 5px;">                     is available, else the Primary Current Output will be used.                 </div>
Out Range		Current Duplex Range Algorithm – Used with Output Algorithm selections Current Duplex, Current Time, or Time Current
	50 Percent	<p>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 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:</p> <ul style="list-style-type: none"> <li>• AUX OUT in the Options Set Up group must be selected for Output.</li> <li>• The Auxiliary Current Output is scaled as desired for 0-50 % controller output.</li> <li>• Deadband for this configuration only applies to the Current Output. The Auxiliary Output must have the Deadband scaled in.</li> </ul> <p>For example:</p> <p>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.</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
	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 times in the Tuning and Tuning 2 Set Up groups.
	Electromechanical	Electromechanical Relay –Cycle time in one-second increments.
Motor Time	5 to 1800 seconds	Motor Time – Appears only when “POSITON” is selected as the Output algorithm. This is the time it takes the motor to travel from 0 to 100% (fully closed to fully open). This time can usually be found on the nameplate of the motor.

Function Prompt	Selections or Range of Setting	Parameter Definition
Output Algorithm 2		<p><b>Output Algorithm</b> - Selects the type of output desired for the second control loop.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Some of these configurations may not be available on loop 2 if loop 1 uses the available outputs.</p> </div>
	None	None
	Time Simplex	<p>This output algorithm uses Output #4 (Alarm 1) for Time Proportional Control the output is updated as per the sampling rate selection. Time Proportional Output has a resolution of 3 msec and the cycle Time is adjustable from 1 to 120 seconds.</p>
	Current Simplex	<p>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 configuration.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Current Simplex uses Second Current Output (Auxiliary Output) if it is available, else the Primary Current Output will be used.</p> </div>
	Time Duplex	<p>This output algorithm uses Output #4 (Alarm 1) and Output #3 (Alarm 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 and the cycle</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		time is adjustable from 1 second to 120 seconds.
	Current Duplex	<p>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.</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Other prompts affected: Output Range 2.</p> </div>
	Current/Time Duplex	<p>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.</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Other prompts affected: Output Range 2.</p> </div>
	Time/Current Duplex	<p>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.</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Other prompts affected: Output Range 2.</p> </div>
Output Range 2		<p><b>Current Duplex Range Algorithm</b> — Used with Output Algorithm selections Current Duplex, Current Time, or Time Current.</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
	50 Percent	<p><b>Current Duplex Range (Split) for Loop 2</b></p> <p>This setting should be used for Relay/Current and Current/Relay Duplex Outputs. It can also be used for Current Duplex when 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.</p> <p>To enable this:</p> <ul style="list-style-type: none"> <li>• AUX OUT in the Options Set Up group must be selected for Output 2.</li> <li>• The Auxiliary Current Output is scaled as desired for 0-50 % controller output.</li> <li>• Deadband for this configuration only applies to the Current Output. The Auxiliary Output must have the Deadband scaled in.</li> </ul> <p><b>For example:</b></p> <p>If a 2 % Deadband is desired, then:</p> <p>Enter 2.0 for the Deadband selection in the Control 2 Algorithm group.</p> <p>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.</p>
	100 Percent	<p><b>Current Duplex Range (FULL)</b> -Enables the Current Output to provide both heat and cool functions for control over 0-100 % of the controller output. The PID heat parameters</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		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 2		<b>Digital Output Status at 0 % Output for Loop 2</b> 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.
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

Function Prompt	Selections or Range of Setting	Parameter Definition
	Local SP 3	Local Setpoint 3
	Local SP 4	Local Setpoint 4
	Remote SP	Remote Setpoint
	Input Algorithm 1	Input Algorithm 1
	PV 2	<b>Process Variable for Loop 2</b>
	Deviation 2	<b>Deviation for Loop 2</b>
	Output 2	<b>Output for Loop 2</b>
	SP Loop2	<b>Setpoint for Loop 2</b>
	LSP1 Loop2	<b>Local Setpoint One for Loop 2</b>
	LSP2 Loop2	<b>Local Setpoint Two for Loop 2</b>
	LSP3 Loop 2	<b>Local Setpoint Three for Loop 2</b>
	LSP4 Loop 2	<b>Local Setpoint Four for Loop 2</b>
	RSP Loop2	<b>Remote Setpoint for Loop2</b>
CO Low Value	Low Scale Value within the range of the selected variable to represent the minimum output (0 or 4 mA)	<p>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.</p> <p>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 %.</p>
CO High Value	High Scale Value within the range of the selected variable to represent the maximum output (20 mA)	<p>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.</p> <p>For Output, this is a value in percent</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		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	<p>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.</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Changing the Current Output Range will result in the loss of Field Calibration values and will restore Factory Calibration values.</p> </div>

# Input 1 Set Up Group

## Introduction

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

## Function Prompts

Table 4-11: INPUT 1 Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Input 1 Type		<b>Input 1 Actuation Type</b> – This selection determines what actuation you are going to use for Input 1. See Minimum and Maximum Range Values for more information.

Function Prompt	Selections or Range of Setting	Parameter Definition
		<div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Changing the input type will result in the loss of Field Calibration values and will restore Factory Calibration values.</p> </div>
	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

Function Prompt	Selections or Range of Setting	Parameter Definition
	TC K Low	CK 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 Milliampere
	4-20mA	4 to 20 Milliampere
	0-10mV	0 to 10 Millivolts
	0-50mV	0 to 50 Millivolts

Function Prompt	Selections or Range of Setting	Parameter Definition
	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 TC T Low TC C High	<p><b>Transmitter Characterization</b> –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.</p> <div style="border: 1px solid orange; padding: 5px; margin: 10px 0;"> <p><b>ATTENTION:</b> Prompt only appears when a linear actuation is selected at prompt Input 1 Type.</p> </div> <p>FOR EXAMPLE:</p> <p>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).</p> <p>Parameter definitions are the same as in Input 1 Type.</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
	TC C 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)	<p>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.</p> <p>Scale the #1 input signal to the display value you want for 100 %.</p> <p>FOR EXAMPLE:</p> <p>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</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> The control setpoint will be limited by the range of units selected here.</p> </div>
Input 1 Low Value	-999. To 9999. Floating (in engineering units)	<p>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 the display value you want for 0 %. See example</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		above. <div style="border: 1px solid yellow; padding: 5px; margin-top: 10px;"> <b>ATTENTION:</b> The control setpoint will be limited by the range of units selected here.                     </div>
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		<b>Burnout Protection (Sensor Break)</b> 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 IN1 FAIL intermittently flashed on the lower

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>display.</p> <p>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.</p>
	No Failsafe	<p>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.)</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> 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.</p> </div> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> The Thermocouple Health feature is disabled when No Failsafe is configured.</p> </div>

# Input 2 Set Up Group

## Introduction

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

## Function Prompts

Table 4-12: Input 2 Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Input 2 Type		<p><b>Input 2 Actuation Type</b> – This selection determines what actuation you are going to use for Input 2</p> <div style="border: 1px solid orange; padding: 5px; margin: 10px 0;"> <p><b>ATTENTION:</b> Changing the input type will result in the loss of Field Calibration values and will restore Factory Calibration values</p> </div> <p>Selecting Position Proportional Control in the Output Setup Group forces Input 2 to the Slidewire Selection.</p>
	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

Function Prompt	Selections or Range of Setting	Parameter Definition
	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	W5W26 Thermocouple High
	TC C 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

Function Prompt	Selections or Range of Setting	Parameter Definition
Input 2 Type	TC Differential	Thermocouple Differential
	Slidewire	100-1K ohm Slidewire (For Position Proportional Applications)
Input 2 Transmitter	TC B	<p><b>Transmitter Characterization</b> –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.</p> <div style="border: 1px solid orange; padding: 5px; margin: 10px 0;"> <p><b>ATTENTION:</b> Prompt only appears when a linear actuation is selected at prompt Input 2 Type.</p> </div> <p>FOR EXAMPLE:</p> <p>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).</p> <p>Parameter definitions are the same as in Input 2 Type.</p>
	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	
	TC T Low	
	TC C High	
	TC C Low	
TC PR40-PR20		
RTD Pt100		

Function Prompt	Selections or Range of Setting	Parameter Definition
	RTD Pt100 Low RTD Pt200 RTD Pt500 Linear Square Root	
Input 2 High Value	–999. To 9999. Floating (in engineering units)	<b>Input 2 High Range Value</b> 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 Low Value	–999. To 9999. Floating (in engineering units)	<b>Input 2 Low Range Value</b> 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	<b>Ratio on Input 2</b> –Select the Ratio value you want on Input 2.
Input 2 Bias	–999. to 9999. (in engineering units)	<b>Bias on Input 2</b> – 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	<b>Filter for Input 2</b> –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		<b>Burnout Protection (Sensor Break)</b> provides most input types with upscale or downscale protection if the input fails.

Function Prompt	Selections or Range of Setting	Parameter Definition
	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	<p>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.</p> <p>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.</p>
	Downscale Burnout	<p>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.</p> <p>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.</p>
	No Failsafe	<p>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.)</p> <div style="border: 2px solid orange; padding: 10px; margin-top: 10px;"> <p><b>ATTENTION:</b> 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.</p> </div>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<b>ATTENTION:</b> 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 4-13: CONTROL Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
PV Source		<b>Process Variable Source</b> - Selects the source of the Process Variable.
	Input 1	Input 1
	Input 2	Input 2
	Input Algorithm 1	Input Algorithm 1
PID Sets		<p><b>Number of Tuning Parameter Sets</b>- This selection lets you choose one or two sets of tuning constants (gain, rate, and reset).</p> <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b> The Tuning Group is automatically configured to have two PID sets when a Duplex Control Algorithm is configured</p> </div>

Function Prompt	Selections or Range of Setting	Parameter Definition
	1 Set	<p><b>One Set Only-</b> Only one set of tuning parameters is available.</p> <p>Configure the values for:            Gain 1 or Proportional Band 1,            Rate 1 Min,            Reset Mins/Rpt 1 or Reset Rpts/Min 1</p>
	2 Sets Keyboard	<p><b>Two Sets Keyboard Selectable-</b> Two sets of tuning parameters can be configured and can be selected at the operator interface or by using the Digital Inputs.</p> <p>Press the Lower Display key until you see PID Set1 or PID Set2, then press Increment key or Decrement key to switch between sets.</p> <p>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</p>
	2 Sets PV Switchover	<p><b>Two Sets PV Automatic Switchover -</b> When the process variable is <b>LESS</b> 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.</p> <p>When the process variable is <b>GREATER</b> 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.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Other prompts affected: Switchover Value 1/2</p> </div>
	2 Sets SP Switchover	<p><b>Two Sets SP Automatic Switchover-</b> When the setpoint is <b>LESS</b> than the value set at prompt</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>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.</p> <p>When the setpoint is <b>GREATER</b> 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.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Other prompts affected: Switchover Value 1/2.</p> </div>
	<p>4 Sets Keyboard</p>	<p><b>Four Sets Keyboard Selectable-</b> Two sets of tuning parameters can be configured and can be selected at the operator interface or by using the Digital Inputs.</p> <p>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.</p> <p>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</p>
	<p>4 Sets PV Switchover</p>	<p><b>Four Sets PV Automatic Switchover-</b> When the process variable is <b>LESS</b> 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.</p> <p>When the process variable is <b>GREATER</b> than</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>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.</p> <p>Similarly, the controller switches between the other PID sets based upon the values configured for Switchover Value 2/3 and Switchover Value 3/4.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Other prompts affected: Switchover Value 1/2, Switchover Value 2/3 and Switchover Value 3/4.</p> </div>
	<p>4 Sets SP Switchover</p>	<p><b>Four Sets SP Automatic Switchover-</b> When the setpoint is <b>LESS</b> 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.</p> <p>When the setpoint is <b>GREATER</b> 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.</p> <p>Similarly, the controller switches between the other PID sets based upon the values configured for Switchover Value 2/3 and Switchover Value 3/4.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Other prompts affected: Switchover Value 1/2, Switchover Value 2/3 and Switchover Value 3/4.</p> </div>
<p>Switchover Value 1/2</p>	<p>Value in engineering units within PV or SP range limits</p>	<p><b>Automatic Switchover Value-</b> This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #1 to Set #2.</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p><b>ATTENTION:</b> 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.</p>
Switchover Value 2/3	Value in engineering units within PV or SP range limits	<p><b>Automatic Switchover Value-</b> This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #2 to Set #3.</p> <p><b>ATTENTION:</b> Only appears when PID Sets is configured for 4 Sets PV Switchover, or 4 Sets SP Switchover.</p>
Switchover Value 3/4	Value in engineering units within PV or SP range limits	<p><b>Automatic Switchover Value-</b> This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #3 to Set #4.</p> <p><b>ATTENTION:</b> Only appears when PID Sets is configured for 4 Sets PV Switchover, or 4 Sets SP Switchover.</p>
Local SP Source		<b>Local Setpoint Source-</b> 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.	

Function Prompt	Selections or Range of Setting	Parameter Definition
Remote SP Source		<b>Remote Setpoint Source</b> —This selection determines what your remote setpoint source will be when toggled by the Function key under the main screen or Digital Input.
	NONE	No remote setpoint.
	Input 2	Remote Setpoint is Input 2.
	Input Algorithm 1	Remote Setpoint using Input 1 algorithm.  <b>ATTENTION:</b> 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		<b>Autobias</b> 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		<b>Setpoint Tracking</b> - The local setpoint can be configured to track either PV or RSP as listed below. Not configurable when Auto Bias is set.  <b>ATTENTION:</b> If SP tracking option is enabled for a long duration, it can cause EEPROM life-cycle deterioration.  <b>ATTENTION:</b> For selections other than NONE, LSP is stored in nonvolatile memory only when there is a mode change; i.e., when switching from RSP

Function Prompt	Selections or Range of Setting	Parameter Definition
		to LSP or from Manual to Automatic. If power is lost, then the current LSP value is also lost.
	None	<b>No Tracking-</b> 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		<b>Power Up Controller Mode Recall-</b> This selection determines which mode and setpoint the controller will use when the controller restarts after a power loss.
	Manual/Local SP	<b>Manual, Local Setpoint-</b> At power-up, the controller will use manual mode with the local setpoint displayed.
	Auto/Local SP	<b>Automatic Mode, Last Local Setpoint-</b> At power-up, the controller will use automatic mode with the last local setpoint used before power down displayed.
	Auto/Remote SP	<b>Automatic Mode, Last Remote Setpoint-</b> At power-up, the controller will use automatic mode with the last remote setpoint used before power down displayed.
	Last Mode/Last SP	<b>Last Mode/Last Setpoint-</b> At power-up, the controller will use the last mode with the last setpoint used before power down displayed.
	Last Mode/Local SP	<b>Last Mode/Last Local Setpoint-</b> 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
TPSC Power Up Mode		<div style="border: 1px solid blue; padding: 5px; margin-bottom: 10px;"> <p><b>NOTE:</b> For Three Position Step Control Only (Note 3)</p> </div> <p><b>Three Position Control Step Output Start-up Mode</b>—This selection determines what position the motor will be in when powered up or in the failsafe position.</p>
	Last	<b>Last Output</b> —At power-up in automatic mode, the motor position will be the last one prior to power down. When the unit goes into FAILSAFE, it will stay in automatic mode; motor will not be driven to the configured failsafe position.
	Failsafe	<b>Failsafe Output</b> —At power-up in manual mode, the motor will be driven to either the 0 % or 100 % output position, whichever is selected at prompt FAILSAFE. For Burn out/None, when the unit goes into FAILSAFE, it will go to manual mode; motor will be driven to the configured failsafe position.
SP High Limit (Note 1)	0 to 100 % of PV span in engineering units	<b>Setpoint High Limit</b> - 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	<b>Setpoint Low Limit</b> - 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		<b>Control Output Direction</b> - Select direct or reverse output action.
	Direct	<b>Direct Acting Control</b> - The controller's output increases as the process variable increases.
	Reverse	<b>Reverse Acting Control</b> - The controller's output decreases as the process variable increases.
Output Rate		<b>Output Change Rate</b> - Enables or disables the

Function Prompt	Selections or Range of Setting	Parameter Definition
		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	<b>Output Rate Up Value-</b> 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	<b>Output Rate Down Value-</b> 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		<b>High Output Limit-</b> 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 Limit		<b>Low Output Limit-</b> This is the lowest value of output 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 (Note 5)	Within the range of the output limits	<b>High Reset Limit-</b> This is the highest value of output beyond which you do not want reset action to occur
Integral Low Limit (Note 5)	Within the range of the output limits	<b>Low Reset Limit-</b> This is the lowest value of output beyond which you do not want reset action to occur.

Function Prompt	Selections or Range of Setting	Parameter Definition
Dropoff (Note 5)	-5 to 105 % of output	<b>Controller Dropoff Value</b> - Output value below which the controller output will drop off to the low output limit value set in prompt Output Low Limit.
Deadband		<b>Deadband</b> 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
	0.5 to 5.0 %	Position Proportional and Three Position Step
Output Hysteresis	0.0 to 100.0 % of PV span	<b>Hysteresis (Output Relay)</b> 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		<b>Failsafe Mode</b>
	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 4, 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 %	<b>Failsafe Output Value</b> - The value used here will also be the output level when you have Communications SHED set to failsafe or when No Burnout is configured and Input 1 fails.  <b>ATTENTION:</b> Applies for all output types except Three Position Step Control.
		<b>Three Position Step Failsafe Output</b>

Function Prompt	Selections or Range of Setting	Parameter Definition
	0 Percent 100 Percent	<b>0 Percent-</b> Motor goes to closed position. <b>100 Percent-</b> Motor goes to open position.
SW Failsafe Value		Position Proportional motor position when slidewire fails.  <b>ATTENTION: TPSC Power Up Mode must be configured for Failsafe.</b>
	0 Percent	Motor goes to closed position.
	100 Percent	Motor goes to open position.
Preset Manual Output	0 to 100 %	<b>Power-up Preset Manual Output-</b> At power-up, the controller will go to manual and the output to the value set here. (Note 4)
Preset Auto Output	0 to 100 %	<b>Power-up Preset Automatic Output-</b> At power-up, the controller will begin its automatic control at the output value set here. (Note 4)
Proportion Unit		<b>Proportional Band Units-</b> 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		<b>Reset Units</b> —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	<b>Repeats per Minute-</b> The number of times per minute that the proportional action is repeated by reset.

Function Prompt	Selections or Range of Setting	Parameter Definition
	Minutes/Repeat	<b>Minutes per Repeat</b> - The time between each repeat of the proportional action by reset.
<p><b>NOTE 1:</b> 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.</p> <p>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:</p> <ul style="list-style-type: none"> <li>• Carbon Potential; then the SP High Limit and SP Low Limit values must be between 0.000 and 2.000.</li> <li>• Dewpoint; then the SP High Limit and SP Low Limit values must be between -50 and +100.</li> <li>• Oxygen; then the SP High Limit and SP Low Limit values must be between 0 and 40.00.</li> <li>• 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.</li> <li>• Math A(Mult Div + Sqrt), Math B(Multiplier + Sqrt), Math C(Multiplier Divider) or Math D(Multiplier); 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.</li> </ul> <p><b>NOTE 2:</b> If controller is in Manual mode when a failure occurs, then the output will maintain its value.</p> <p><b>NOTE 3:</b> These selections appear when:</p> <p>A. Control Algorithm is selected for Three Position Step.</p> <p style="padding-left: 20px;">or,</p> <p>B. Control Algorithm is selected for PD+Manual Reset, and Output Algorithm is selected for Position Proportional.</p> <p><b>NOTE 4:</b> Does not apply to Three Position Step Control.</p> <p><b>NOTE 5:</b> Reset limits and Dropoff are not displayed when Three Position Step Control</p>		

Function Prompt	Selections or Range of Setting	Parameter Definition
is configured.		

## Control 2 Set Up Group

### Introduction

The functions listed in this group deal with how the controller will control the Loop 2 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 4-14: CONTROL 2 Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
PV 2 Source		<b>Process Variable Source</b> - Selects the source of the Process Variable for loop 2.
	Input 1	Input 1
	Input 2	Input 2
	Input Algorithm 1	Input Algorithm 1
Link Loops		<b>Link loops Mode and Setpoint</b> –Link together the operation of the two loops. If either loop changes mode due to a front panel change, digital input action, or failsafe action, then the other loop will track that mode and/or local setpoint.
	Disable	<b>Disable</b> —Disable. Loops operate independently.
	Link Modes	<b>Link Modes</b> —Links A/M modes on both loops.
	Link LSP1	<b>Link LSP1</b> – Links Local Setpoint 1 for both

Function Prompt	Selections or Range of Setting	Parameter Definition
	Link Modes + LSP 1	<p>loops.</p> <p><b>Link Modes and Setpoints</b> – Links both modes and Local Setpoint 1 for both loops.</p>
PID Sets		<p><b>Number of Tuning Parameter Sets</b>- This selection lets you choose one or two sets of tuning constants (gain, rate, and reset).</p>
	1 Set	<p><b>One Set Only</b>- Only one set of tuning parameters is available.</p> <p>Configure the values for:            Gain(proportional band)            Rate            Reset Time, Cycle Time (if time proportional is used)</p>
	2 Sets Keyboard	<p><b>Two Sets Keyboard Selectable</b>- Two sets of tuning parameters can be configured and can be selected at the operator interface or by using the Digital Inputs.</p> <p>Press the Lower Display key until you see PID Set1 or PID Set2, then press Increment key or Decrement key to switch between sets.</p> <p>Configure the values for:            Gain 5 or Proportional Band 5, Rate 5 Min, Reset Mins/Rpt 5 or Reset Rpts/Min 5.            Gain 6 or Proportional Band 6, Rate 6 Min, Reset Mins/Rpt 6 or Reset Rpts/Min 6.</p>
	2 Sets PV Switchover	<p><b>Two Sets PV Automatic Switchover</b> - When the process variable is <b>LESS</b> than the value set at prompt Switchover Value, the controller will use Gain 5 or Proportional Band 5, Rate 5 Min, and Reset Mins/Rpt 5 or Reset Rpts/Min 5. The active PID Set can be read in the lower display.</p> <p>When the process variable is <b>GREATER</b> than the value set at prompt Switchover Value, the controller will use Gain 6 or Proportional Band</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>6, Rate 6 Min, and Reset Mins/Rpt 6 or Reset Rpts/Min 6. The active PID SET can be read in the lower display.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Other prompts affected: Switchover Value 1/2.</p> </div>
	<p>2 Sets SP Switchover</p>	<p><b>Two Sets SP Automatic Switchover-</b> When the setpoint is <b>LESS</b> than the value set at prompt Switchover Value, the controller will use Gain 5 or Proportional Band 5, Rate 5 Min, and Reset Mins/Rpt 5 or Reset Rpts/Min 5.</p> <p>When the setpoint is <b>GREATER</b> than the value set at prompt Switchover Value, the controller will use Gain 6 or Proportional Band 6, Rate 6 Min, and Reset Mins/Rpt 6 or Reset Rpts/Min 6.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Other prompts affected: Switchover Value 1/2.</p> </div>
	<p>4 Sets Keyboard</p>	<p><b>Four Sets Keyboard Selectable-</b> Two sets of tuning parameters can be configured and can be selected at the operator interface or by using the Digital Inputs.</p> <p>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.</p> <p>Configure the values for:            Gain 5 or Proportional Band 5, Rate 5 Min, Reset Mins/Rpt 5 or Reset Rpts/Min 5            Gain 6 or Proportional Band 6, Rate 6 Min, Reset Mins/Rpt 6 or Reset Rpts/Min 6            Gain 7 or Proportional Band 7, Rate 7 Min, Reset Mins/Rpt 7 or Reset Rpts/Min 7            Gain 8 or Proportional Band 8, Rate 8 Min, Reset Mins/Rpt 8 or Reset Rpts/Min 8</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
	4 Sets PV Switchover	<p><b>Four Sets PV Automatic Switchover-</b> When the process variable is <b>LESS</b> than the value set at prompt Switchover Value, the controller will use Gain 5 or Proportional Band 5, Rate 5 Min, and Reset Mins/Rpt 5 or Reset Rpts/Min 5. The active PID Set can be read in the lower display.</p> <p>When the process variable is <b>GREATER</b> than the value set at prompt Switchover Value, the controller will use Gain 6 or Proportional Band 6, Rate 6 Min, and Reset Mins/Rpt 6 or Reset Rpts/Min 6. The active PID SET can be read in the lower display.</p> <p>Similarly, the controller switches between the other PID sets based upon the values configured for Switchover Value 2/3 and Switchover Value 3/4.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Other prompts affected: Switchover Value 1/2, Switchover Value 2/3 and Switchover Value 3/4.</p> </div>
	4 Sets SP Switchover	<p><b>Four Sets SP Automatic Switchover-</b> When the setpoint is <b>LESS</b> than the value set at prompt Switchover Value, the controller will use Gain 5 or Proportional Band 5, Rate 5 Min, and Reset Mins/Rpt 5 or Reset Rpts/Min 5.</p> <p>When the setpoint is <b>GREATER</b> than the value set at prompt SW VALUE, the controller will use Gain 6 or Proportional Band 6, Rate 6 Min, and Reset Mins/Rpt 6 or Reset Rpts/Min 6.</p> <p>Similarly, the controller switches between the other PID sets based upon the values configured for Switchover Value 2/3 and Switchover Value 3/4.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Other prompts affected:</p> </div>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>Switchover Value 1/2, Switchover Value 2/3 and Switchover Value 3/4.</p>
Switchover Value 1/2	Value in engineering units within PV or SP range limits	<p><b>Automatic Switchover Value-</b> This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #1 to Set #2.</p> <p><b>ATTENTION:</b> Only appears when PID Sets selection is configured for 2 or 4 PID sets.</p>
Switchover Value 2/3	Value in engineering units within PV or SP range limits	<p><b>Automatic Switchover Value-</b> This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #2 to Set #3.</p> <p><b>ATTENTION:</b> Only appears when PID Sets selection is configured for 4 PID Sets.</p>
Switchover Value 3/4	Value in engineering units within PV or SP range limits	<p><b>Automatic Switchover Value-</b> This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #3 to Set #4.</p> <p><b>ATTENTION:</b> Only appears when PID Sets selection is configured for 4 PID Sets</p>
Local SP Source		<b>Local Setpoint Source-</b> 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.

Function Prompt	Selections or Range of Setting	Parameter Definition
	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		<b>Remote Setpoint Source</b> —This selection determines what your remote setpoint source will be when toggled by the function key under the main screen or Digital Input.
	NONE	No remote setpoint.
	Input 2	Remote Setpoint is Input 2.
	Input Algorithm 1	Remote Setpoint using Input 1 algorithm.
Autobias		<b>Autobias</b> 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.  Available for any analog input used as the RSP source and if no tracking is selected.
	Disable	Disables auto bias.
	Enable	Enables auto bias.
SP Tracking		<b>Setpoint Tracking</b> - The local setpoint can be configured to track either PV or RSP as listed below. Not configurable when Auto Bias is set.  <div style="border: 1px solid orange; padding: 5px; margin: 5px 0;"> <p><b>ATTENTION:</b> 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.</p> </div>
	None	<b>No Tracking</b> - If local setpoint tracking is not

Function Prompt	Selections or Range of Setting	Parameter Definition
		configured, the LSP will not be altered when transfer from RSP to LSP is made.
	PV	Local setpoint tracks the PV when in manual mode.
	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		<b>Power Up Controller Mode Recall-</b> This selection determines which mode and setpoint the controller will use when the controller restarts after a power loss.
	Manual/Local SP	<b>Manual, Local Setpoint-</b> At power-up, the controller will use manual mode with the local setpoint displayed.
	Auto/Local SP	<b>Automatic Mode, Last Local Setpoint-</b> At power-up, the controller will use automatic mode with the last local setpoint used before power down displayed.
	Auto/Remote SP	<b>Automatic Mode, Last Remote Setpoint-</b> At power-up, the controller will use automatic mode with the last remote setpoint used before power down displayed.
	Last Mode/Last SP	<b>Last Mode/Last Setpoint-</b> At power-up, the controller will use the last mode with the last setpoint used before power down displayed.
	Last Mode/Local SP	<b>Last Mode/Last Local Setpoint-</b> At power-up, the controller will use the last mode with the last local setpoint used before power down displayed.
SP High Limit (Note 1)		<b>Setpoint High Limit-</b> 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 inputs.

Function Prompt	Selections or Range of Setting	Parameter Definition
SP Low Limit (Note 1)		<b>Setpoint Low Limit-</b> 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 inputs.
<p><b>NOTE:</b> The local setpoint will automatically adjust itself to be within the setpoint limit range. For example, if SP = 1500 and SP HiLIM is changed to 1200, then the SP will be changed to 1200.</p>		
Action Direction		<b>Control Output Direction-</b> Select direct or reverse acting control.
	Direct	<b>Direct Acting Control-</b> The controller's output increases as the process variable increases.
	Reverse	<b>Reverse Acting Control-</b> The controller's output decreases as the process variable increases.
Output Rate		<b>Output Change Rate-</b> Enables or disables the Output Change Rate. The maximum rate is set at prompt PCT/M UP or PCT/M DN.
	Enable	Allows output rate.
	Disable	Disables output rate.
Rate Up % Min	0 to 9999 % per minute	<b>Output Rate Up Value-</b> 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	<b>Output Rate Down Value-</b> 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		<b>High Output Limit-</b> 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.

Function Prompt	Selections or Range of Setting	Parameter Definition
	-5 % to 105 %	For current output types.
Output Low Limit		<b>Low Output Limit</b> - This is the lowest value of output 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	<b>High Reset Limit</b> - This is the highest value of output beyond which you want no reset to occur.
Integral Low Limit	Within the range of the output limits	<b>Low Reset Limit</b> - This is the lowest value of output beyond which you want no reset to occur.
Dropoff	-5 to 105 % of output	<b>Controller Dropoff Value</b> - Output value below which the controller output will drop off to the low output limit value set in prompt Output Low Limit.
Deadband		<b>Deadband</b> 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
Failsafe Mode		<b>Failsafe Mode</b> - How the controller operates during a Failsafe condition.
	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. .
	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 %	<b>Failsafe Output Value</b> - The value used here will also be the output level when you have Communications SHED set to failsafe or when

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>No Burnout is configured and the PV source fails.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> At power -up, the loop 2 output is set to the Failsafe output 2 value.</p> </div>
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.
<p><b>NOTE 1:</b> If PV 2 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:</p>		

Function Prompt	Selections or Range of Setting	Parameter Definition
		<ul style="list-style-type: none"> <li>Carbon Potential; then the SP High Limit and SP Low Limit values must be between 0.000 and 2.000.</li> <li>Dewpoint; then the SP High Limit and SP Low Limit values must be between -50 and +100.</li> <li>Oxygen; then the SP High Limit and SP Low Limit values must be between 0 and 40.00.</li> <li>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.</li> <li>Math A, Math B, Math C or Math 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.</li> </ul> <p><b>NOTE 2:</b> If controller is in Manual mode when a failure occurs, then the output will maintain its value.</p>

## 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 4-15: Options Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
Auxiliary Output		<div style="border: 2px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Prompts for the Auxiliary Output selection appear only if</p> </div>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<div style="border: 1px solid orange; padding: 5px;"> <p>one of the Auxiliary Output boards is installed.</p> </div> <p>This selection provides an mA output representing one of several control parameters. The display for auxiliary output viewing will be in engineering units for all but output. Output will be displayed in percent.</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Other prompts affected by these selections: 4mA VAL and 20mA VAL.</p> </div> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Output cannot be configured when Three Position Step Control is used.</p> </div>
	Disable	No Auxiliary Output
	Input 1	Input 1 represents the value of the configured range of input 1.
	Input 2	Input 2 represents the value of the configured range of input 2.
	PV	<p>It represents the value of the Process Variable.</p> $PV = \text{Input } X \times \text{Ratio } X + \text{Bias } X$
	Deviation	Deviation (Process Variable Minus Setpoint) represents - 100 % to +100 % of the

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>selected PV span in engineering units.</p> <p>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 %).</p> <p><b>FOR EXAMPLE:</b>            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            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%</p>
	Output	<p>Output represents the displayed controller output in percent (%). Cannot be used with Three Position Step Control.</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
	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	Auxiliary output represents Local Setpoint 1 regardless of active setpoint.
	Local SP 2	Auxiliary output represents Local Setpoint 2 regardless of active setpoint.
	Local SP 3	Auxiliary output represents Local Setpoint 3 regardless of active setpoint.
	Local SP 4	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.
	PV2	Represents the value of the process variable for Loop 2.
	Deviation 2	<p><b>Deviation (Process Variable Minus Setpoint for Loop 2)</b></p> <p>Represents -100 % to +100 % of the selected PV span in engineering units.</p> <p>Zero deviation will produce a center scale (12 mA or 50 %) output. A negative deviation equal in magnitude to the</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>Output High Scaling Factor will produce a low end output (4 mA or 0 %) output. A positive deviation equal in magnitude to the Output High Scaling Factor will produce a high end output (20 mA or 100 %).</p> <p><b>FOR EXAMPLE:</b></p> <p>Input 1 = Type T High Thermocouple            PV range = -300 °F to +700 °F            PV span = 1000 °F            Deviation Range = -1000 to +1000 °F = 2000 °F            Auxiliary Low Scale Value = 0.0            Auxiliary High Scale Value = 1000</p> <p>If PV = 500 °F and SP = 650 °F then Deviation Display = -150 °F, which is <math>-150 / 2000 = -7.5\%</math> of the Deviation Range, so            Output = <math>50\% - 7.5\% = 42.5\%</math></p>
	Output 2	<p><b>Output For Loop 2</b>—Represents the displayed controller Loop 2 output in percent (%).</p>
	SP Loop 2	<p><b>Setpoint For Loop 2</b>—Represents the value of the setpoint currently in use by Loop 2 (LSP1, LSP2, LSP3, RSP or CSP) and is shown in the same units as those used by the PV for Loop 2.</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
	LSP1 Loop 2	<b>Local Setpoint One for Loop 2</b> — Output represents Loop 2 Local Setpoint 1 regardless of active setpoint.
	LSP2 Loop 2	<b>Local Setpoint Two for Loop 2</b> — Output represents Loop 2 Local Setpoint 2 regardless of active setpoint.
	LSP3 Loop 2	<b>Local Setpoint Three for Loop 2</b> — Output represents Loop 2 Local Setpoint 3 regardless of active setpoint.
	LSP4 Loop 2	<b>Local Setpoint Four for Loop 2</b> — Output represents Loop 2 Local Setpoint 4 regardless of active setpoint.
	RSP Loop 2	<b>Remote Setpoint for Loop 2</b> — Represents the configured Loop 2 RSP regardless of the active SetPoint for Loop 2.
CO Range	4-20mA 0-20mA	<p>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.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Changing the Auxiliary Current Output Range will result in the loss of Field Calibration values and will restore Factory Calibration values.</p> </div>

Function Prompt	Selections or Range of Setting	Parameter Definition
CO Low Value	Low Scale Value within the range of the selected variable to represent the minimum output (0 or 4 mA)	<p>Auxiliary Output Low Scaling Factor – This is a value in engineering units used to represent all Auxiliary Output parameters except Output.</p> <p>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 %.</p>
CO High Value	High Scale Value within the range of the selected variable to represent the maximum output (20 mA)	<p>Auxiliary Output High Scaling Factor – This is a value in engineering units used to represent all Auxiliary Output parameters except Output.</p> <p>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 %.</p>
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	Contact closure puts the affected loop into manual mode. Contact open returns controller to former mode.
	To Local SP 1	When a remote setpoint is configured, contact closure puts the controller into local

Function Prompt	Selections or Range of Setting	Parameter Definition
		setpoint 1. When contact opens, the controller returns to former operation—local or remote setpoint—unless function 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	Contact closure puts the controller into local setpoint 2.
	To Local SP 3	Contact closure puts the controller into local setpoint 3.
	To Local SP 4	Contact closure puts the controller into local setpoint 4.
	To Direct Action	Contact closure selects direct controller action.
	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	Contact closure selects PV =

Function Prompt	Selections or Range of Setting	Parameter Definition
		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	<p>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.</p> <p>This selection applies to either loop.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> 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.</p> </div>

Function Prompt	Selections or Range of Setting	Parameter Definition
	Inhibit Integral	Inhibit Integral (Reset) – Contact closure disables PID Integral (Reset) action.
	Manual Failsafe	<p>Manual Failsafe Output – Controller goes to Manual mode, output goes to the Failsafe value.</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> 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.</p> </div>
	Keyboard Lockout	Contact closure disables all keys. Lower display shows LOCKED if a key is pressed.
	To Preset Auto Output	<p>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.</p> <div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Does not apply to Three Position Step Control.</p> </div>
	Start Timer	Contact closure starts timer, if enabled. Reopening the switch has no effect.

Function Prompt	Selections or Range of Setting	Parameter Definition
	To Auto/Man Station	Contact closure causes the control loop to perform as follows:  PV = Input 2  Action = Direct  Control algorithm = PD+MR  PID SET = 2 and 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	Contact closure forces the setpoint to the current PV value. Opening the contact has no effect.
	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	Contact closure selects the Remote setpoint.  <div style="border: 1px solid orange; padding: 5px; display: inline-block;"> <b>ATTENTION:</b> When DI1                     </div>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>or DI2 selects "To Remote SP," the remote SP overwrites the local SP rather than considering the remote SP directly. To consider remote SP directly, set the DI1 or DI2 state to CLOSE and then OPEN.</p>
	Reset Feedback	<p>External Reset Feedback – Contact closure allows Input 2 to override the internal reset value.</p>
	To Purge	<p>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.</p> <p><b>ATTENTION:</b> Does not apply to Three Position Step Control.</p>
	Low Fire	<p>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.</p> <p><b>ATTENTION:</b> Does not apply to Three Position Step Control.</p>

Function Prompt	Selections or Range of Setting	Parameter Definition
	Manual Latching	<p>Contact closure transition forces the loop to Manual mode.</p> <p>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.</p>
	PV Hold	Process Variable Hold –when the switch is closed, PV is frozen at last value. When switch opens, PV resumes.
	Loop Display	Contact closure displays the loop not currently being displayed, opening contact returns to the original loop display.
	Output 2 Tracks Input 2	Contact closure allows Output 2 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 bump-less.
	Output 2 Overrides Output 1 (To Output 2)	Contact closure forces Output 1 to track Output 2. Opening the contact restores normal operation.

Function Prompt	Selections or Range of Setting	Parameter Definition
		<div style="border: 1px solid orange; padding: 5px;"> <p><b>ATTENTION:</b> Does not apply to three position step control.</p> </div>
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.
	+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.	

Function Prompt	Selections or Range of Setting	Parameter Definition
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
DI on Loop 2		Used when two loops or internal cascade are configured. Digital inputs are assigned to loop 2 per this configuration. All other Digital Inputs are assigned to Loop 1
	None	No Digital Input on loop 2, all on Loop 1.
	DI 2	Assign Digital Input 2 to Loop 2.

# Communications Group

## Introduction

The Communications group lets you configure the controller with Easyset, a mobile app that communicates through Bluetooth, and lets a Modbus® client/master host communicate with the controller via Ethernet TCP/IP protocol.

A controller with the Ethernet 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 4-16: 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.

Function Prompt	Selections or Range of Setting	Parameter Definition								
	Ethernet	Ethernet –Enables Ethernet communication port.								
Modbus Address	1 to 99	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.								
Baud Rate		Baud Rate is the transmission speed in bits per second. This value is used for RS-485.								
	4800	4800 BAUD								
	9600	9600 BAUD								
	19200	19200 BAUD								
	38400	38400 BAUD								
Response Delay	1 to 500 milliseconds	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.								
Word Order for Float		<p>Defines word/byte order of floating point data for communications. Byte values:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">0</td> <td style="width: 25%;">1</td> <td style="width: 25%;">2</td> <td style="width: 25%;">3</td> </tr> <tr> <td>seeeee e</td> <td>emmmmm mm</td> <td>mmmmmm mm</td> <td>mmmmmm mm</td> </tr> </table> <p>Where: s = sign, e = exponent, m = mantissa bit</p>	0	1	2	3	seeeee e	emmmmm mm	mmmmmm mm	mmmmmm mm
	0	1	2	3						
	seeeee e	emmmmm mm	mmmmmm mm	mmmmmm mm						
	FP_B	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">0</td> <td style="width: 25%;">1</td> <td style="width: 25%;">2</td> <td style="width: 25%;">3</td> </tr> </table>	0	1	2	3				
	0	1	2	3						
	FP_BB	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">1</td> <td style="width: 25%;">0</td> <td style="width: 25%;">3</td> <td style="width: 25%;">2</td> </tr> </table>	1	0	3	2				
1	0	3	2							
FP_L	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">3</td> <td style="width: 25%;">2</td> <td style="width: 25%;">1</td> <td style="width: 25%;">0</td> </tr> </table>	3	2	1	0					
3	2	1	0							
FP_LB	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">2</td> <td style="width: 25%;">3</td> <td style="width: 25%;">0</td> <td style="width: 25%;">1</td> </tr> </table>	2	3	0	1					
2	3	0	1							
Ethernet Address	0.0.0.0 to 255.255.255.2	Ethernet address, ranging from 0.0.0.0 to 255.255.255.255. It only applies to Ethernet								

Function Prompt	Selections or Range of Setting	Parameter Definition
	55	communication port. 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.  <b>NOTE:</b> 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.

Function Prompt	Selections or Range of Setting	Parameter Definition
	To Auto	Automatic Mode, Last SP—The controller will return to the automatic mode and the last setpoint used before shed.
Shed SP Recall		Shed Setpoint Recall  <b>NOTE:</b> 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.
Computer SP Ratio 2	-20.0 to 20.0	<b>Loop 2 Computer Setpoint Ratio</b> - Computer setpoint ratio for loop 2.
Computer SP Bias 2	-999. to 9999. (engineering units)	<b>Loop 2 Computer Setpoint Bias</b> - Computer setpoint bias in engineering units for loop 2.
Local Loopback		Local Loopback tests the RS-485 communications port. It is not used for any other communications port.
	Disable	Disables the Loopback test.

Function Prompt	Selections or Range of Setting	Parameter Definition
	Enable	<p>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 here, or until power is turned off and on.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> 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.</p> </div>

## 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 4-17: ALARMS Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
A1S1 Type		<p>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.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Alarms not available when loop 2 is using Time Simplex/Time Duplex/Current Time/Time Current Output algorithms.</p> </div>
	<ul style="list-style-type: none"> <li>• None</li> <li>• Input 1</li> <li>• Input 2</li> <li>• PV</li> <li>• Deviation</li> <li>• Output</li> <li>• SHED</li> <li>• Event On</li> <li>• Event Off</li> <li>• Manual</li> <li>• Remote SP</li> </ul>	<ul style="list-style-type: none"> <li>• No Alarm</li> <li>• Input 1</li> <li>• Input 2</li> <li>• Process Variable</li> <li>• Deviation (NOTE 1)</li> <li>• Output (NOTE 8)</li> <li>• Shed from Communications</li> <li>• Event On (SP Programming) (NOTE 7)</li> <li>• Event Off (SP Programming) (NOTE 7)</li> <li>• Alarm On Manual Mode (NOTE 2)</li> <li>• Remote Setpoint (NOTE 6)</li> </ul>

Function Prompt	Selections or Range of Setting	Parameter Definition
	<ul style="list-style-type: none"> <li>• Failsafe</li> <li>• PV Rate of Change</li> <li>• DI 1 Actuated</li> <li>• DI 2 Actuated</li> <li>• Loop Break</li> <li>• TC Warning</li> <li>• TC Failed</li> <li>• PV Hold</li> <li>• PV 2</li> <li>• Deviation 2</li> <li>• Output 2</li> <li>• Manual 2</li> <li>• Remote Setpoint 2</li> <li>• FailSafe 2</li> <li>• PV Rate of change 2</li> <li>• Loop Break 2</li> <li>• PV Hold 2</li> </ul>	<ul style="list-style-type: none"> <li>• Failsafe</li> <li>• PV Rate of Change</li> <li>• Digital Input 1 Actuated</li> <li>• Digital Input 2 Actuated</li> <li>• Loop Break (NOTE 3)</li> <li>• Thermocouple Warning (NOTE 4)</li> <li>• Thermocouple Fail (NOTE 5)</li> <li>• PV Hold</li> <li>• Process Variable - Loop 2</li> <li>• Deviation - Loop 2 (Note 1)</li> <li>• Output - Loop 2</li> <li>• Alarm on Manual Mode - Loop 2 (Note 2)</li> <li>• Remote Setpoint - Loop 2 (Note 6)</li> <li>• Alarm on Failsafe - Loop 2</li> <li>• PV Rate of Change - Loop 2</li> <li>• Loop Break - Loop 2 (Note 3)</li> <li>• PV Hold - Loop 2</li> </ul>
<p><b>Note 1:</b> This Deviation Alarm is based upon deviation from whichever SP is active.</p> <p><b>Note 2:</b> Alarm 1 is not available if the Timer is enabled because Alarm 1 is dedicated to Timer output.</p> <p><b>Note 3:</b> 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.</p> <p>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 ° in the</p>		

Function Prompt	Selections or Range of Setting	Parameter Definition
<p>desired direction in the time allowed. For the Degrees C configuration, the PV must move by 2 ° 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.</p> <p>Loop Break alarms do not have a HIGH/LOW State configuration, they are always assumed to be a HIGH state alarm.</p> <p><b>Note 4:</b> Thermocouple Warning means that the instrument has detected that the Thermocouple Input is starting to fail. Not valid for other input types.</p> <p><b>Note 5:</b> Thermocouple Failing means that the instrument has detected that the Thermocouple Input is in imminent danger of failing. Not valid for other input types.</p> <p><b>Note 6:</b> Alarm is triggered when the current SP is remote setpoint.</p> <p><b>Note 7:</b></p> <p><b>Event On:</b> Alarm is set to on when the alarm (event) condition is met.</p> <p><b>Event Off:</b> Alarm is set as off when the alarm (event) condition is met.</p> <div style="border: 1px solid blue; padding: 5px; margin: 10px 0;"> <p><b>NOTE:</b> The alarm will not be reset after the event is finished.</p> </div> <p><b>Note 8:</b> When the controller is configured for Three Position Step Control, alarms set for Output will not function.</p>		
<p>A1S1 Value</p>	<p>Value in engineering units</p>	<p>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 required for alarms configured for Communications SHED.</p> <div style="border: 1px solid orange; padding: 5px; margin: 10px 0;"> <p><b>ATTENTION:</b> For SP Programming the value is displayed as <b>PxSy</b> for which the event applies. PxSy = Program x, Segment y.</p> </div> <div style="border: 1px solid orange; padding: 5px; margin: 10px 0;"> <p><b>ATTENTION:</b> In Easysset app, the SP Programming value is displayed as <b>Px.Sy00</b>, for which the event applies.</p> </div>

Function Prompt	Selections or Range of Setting	Parameter Definition
		<div style="border: 1px solid orange; padding: 5px; margin-bottom: 10px;">                     Px.Sy00 = Program x. Segment y 00.                      For example, Program2. Segment300 (2.300).                 </div> 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  <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <b>ATTENTION:</b> Alarms configured for events will not operate on Setpoint Program segments of zero length.                 </div>
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	<p>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.</p> <p>Configure the hysteresis of the alarms based on Input signals as a % of input range span.</p> <p>Configure the hysteresis of the alarm based on Output signals as a % of the full scale output range.</p>
A1S2 Type	Same as A1S1 Type	<p>Alarm 1 Setpoint 2 Type —Select what you want Setpoint 2 of Alarm 1 to represent.</p> <p>The selections are the same as A1S1 Type.</p>
A1S2 Value	Value in engineering units	<p>Alarm 1 Setpoint 2 Value —This is the value at which you want the alarm type chosen in prompt A1S2 Type to actuate.</p> <p>The details are the same as A1S1 Value.</p>
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.

Function Prompt	Selections or Range of Setting	Parameter Definition
		<p>Configure the hysteresis of the alarms based on Input signals as a % of input range span.</p> <p>Configure the hysteresis of the alarm based on Output signals as a % of the full scale output range.</p>
A2S1 Type	Same as A1S1 Type	<p>Alarm 2 Setpoint 1 Type –Select what you want Setpoint 1 of Alarm 2 to represent.</p> <p>The selections are the same as A1S1 Type.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Not available with Relay Duplex or Position Proportional output types unless using Dual Relay PWA.</p> </div>
A2S1 Value	Value in engineering units	<p>Alarm 2 Setpoint 1 Value –This is the value at which you want the alarm type chosen in prompt A2S1 Type to actuate.</p> <p>The details are the same as A1S1 Value.</p>
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	<p>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.</p> <p>Configure the hysteresis of the alarms based on Input signals as a % of input range span.</p>

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.  <b>ATTENTION:</b> Not applicable with Relay Duplex or Position Proportional output types 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  <b>ATTENTION:</b> 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  <b>ATTENTION:</b> 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 4-18: 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
		<b>ATTENTION:</b> 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.
Decimal		This selection determines where the decimal point

Function Prompt	Selections or Range of Setting	Parameter Definition
Digits 2		appears in the display for Loop 2.
	None	No Decimal place - fixed, no auto - ranging
	One	One Place
	Two	Two Place
	Three	Three Place  <b>ATTENTION:</b> Auto - ranging will occur for selections of one, two or three places.
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

Function Prompt	Selections or Range of Setting	Parameter Definition
	Disable	Disable Diagnostic Messages
Theme	Dark	This selection applies the Dark theme to the UDC device.
	White	<p>This selection applies the White theme to the UDC device.</p> <p><b>NOTE:</b> After changing the theme, the UDC device must be restarted for the new theme to take effect.</p> <p><b>NOTE:</b> Theme change can not be done from Easyset app.</p>

# 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 for more information.

## Function Prompts

Table 4-19: Input1 Calib Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
TC Calibration method	TC Calibrator	Allows the user to calibrate the thermocouple input type using thermocouple source or Ice Bath.
	Millivolts Source	Allows the user to calibrate the thermocouple input type using millivolts source.
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 <a href="#">Voltage, Milliamp and Resistance Equivalents for Input Range Values</a> 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 <a href="#">Voltage, Milliamp and Resistance Equivalents for Input Range Values</a> for Voltage, Degrees, or Resistance equivalents

Function Prompt	Selections or Range of Setting	Parameter Definition
		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.

**NOTE:** TC Calibration method prompt is visible only when TC input is selected.

## 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 for more information.

### Function Prompts

Table 4-20: Input2 Calib Group Function Prompts

Function Prompt	Selections or Range of Setting	Parameter Definition
TC Calibration method	TC Calibrator	Allows the user to calibrate the thermocouple input type using thermocouple source or Ice Bath.
	Millivolts Source	Allows the user to calibrate the thermocouple input type using millivolts source.

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 <a href="#">Voltage, Milliamp and Resistance Equivalents for Input Range Values</a> 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 <a href="#">Voltage, Milliamp and Resistance Equivalents for Input Range Values</a> 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.

**NOTE:** TC Calibration method prompt is visible only when TC input is selected.

# Slidewire Calib Set Up Group

## Introduction

This group appears when **Input 2 Type** of the **Input 2** set up group is configured as **Slidewire**, and **Output Algorithm** of the **Output** set up group is **Position Proportion**. You can calibrate the controller output manually or let the controller calibrate the output automatically.

## Function Prompts

Table 4-21: Slidewire Group Function Prompts

Function Prompt	Selections or Range	Parameter Definition
Position Proportion	Disable	Disable the calibration.
	Do Auto	If the slidewire has never been calibrated, you must use Do Auto first, and the controller relays automatically move the motor in the proper direction.
	Do Manual	The motor does not move, you can change the value with the Increment key and Decrement key.
Zero Value	1~1023	Set 0% value
Span Value	1~1023	Set 100% value

**NOTE:** When the slide wire is in failsafe mode and a power cycle is closed, select the auto/manual or increment/decrement key to change to normal mode.

# 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 for more information.

## Function Prompts

Table 4-22: 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 for more information.

## Function Prompts

Table 4-23: 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	_____	0
	Lockout	_____	Calibration
	Auto/Man Key	_____	Enable
	Run/Hold Key	_____	Enable
	SP Select Key	_____	Enable
	Restore Settings	_____	Disable
	Restore*	_____	Disable
	Change Password	_____	- -

Group Prompt	Function Prompt	Value or Selection	Factory Setting
Tuning	Proportional Band 1	_____	--
	or		
	Gain 1	_____	1.000
	or		
	Rate Min	_____	0.00
	Reset Mins/Rpt 1	_____	1.00
	or		
	Reset Rpts/Min 1	_____	--
	Manual Reset	_____	0
	Proportional Band 2	_____	--
	or		
	Gain 2	_____	1.000
	Rate 2 Min	_____	0.00
	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	
Tuning 2	Proportional Band 5	_____	--
	or		
	Gain 5	_____	1.000
	or		
	Rate Min	_____	0.00
	Reset Mins/Rpt 5	_____	1.00
or	_____		



Group Prompt	Function Prompt	Value or Selection	Factory Setting
Accutune	Fuzzy Suppression	_____	Disable
	Accutune	_____	Disable
	Duplex Output	_____	Manual
	Accutune 2	_____	Disable
	Duplex Output 2	_____	Manual
	Error Status	Read Only	None
	Error Status 2	Read Only	None
Algorithms	Control Algorithm	_____	PID A
	PID Loops	_____	1 Loop
	Control Algorithm 2	_____	PID A
	Output Override	_____	Disable
	Timer Function	_____	Disable
	Period Hrs:Mins	_____	0.01
	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
	Output Algorithm 2	_____	None
	Output Range 2	_____	100 Percent
	Relay State 2	_____	1 Off 2 On
Current Output	_____	Disable	











# MONITORING AND OPERATING THE CONTROLLER

## What's in this section?

The following topics are covered in this section.

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# 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.

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.  <b>NOTE:</b> The three consecutive wrong password attempts, will lock the lockout function access for 1 minute.

# 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 for more information.

## Lockout levels

**NOTE:** In the EasySet app, lockout options appears under the security group only after entering the password.

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	<p>When <b>Control Algorithm</b> is NOT configured as <b>Three Position Step Control (TPSC)</b>, and Slidewire is connected. Output value is shown in percent with one decimal point.</p> <div style="border: 1px solid yellow; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> If <b>Output Algorithms</b> is configured as <b>Position Proportion</b>, and slidewire fails, the value is shown with no decimal point.</p> </div>
OUT XXX	<p>Output value is shown with no decimal point.</p> <p>When <b>Control Algorithm</b> is NOT configured as <b>Three Position Step Control (TPSC)</b>, <b>Output Algorithms</b> is configured as <b>Position Proportion</b>, and slidewire fails.</p> <p>or,</p>

Lower Display	Description
	When <b>Control Algorithm</b> is configured as <b>Three Position Step Control</b> (TPSC), and Slidewire is NOT connected.
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.
POS XXX	Slidewire Position—Used only with TPSC applications that use a slidewire input.
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: <ul style="list-style-type: none"> <li>• In the <b>Algorithms</b> set up group, configure <b>Control Algorithm</b> as ANY algorithm except Disable.</li> <li>• In the <b>Control</b> set up group, configure <b>Local SP Source</b> as 2/3/4 Local SPs.</li> </ul>
3SP XXXX.XXX	Local Setpoint #3, appears when the following two conditions are satisfied: <ul style="list-style-type: none"> <li>• In the <b>Algorithms</b> set up group, configure <b>Control Algorithm</b> as ANY algorithm except Disable.</li> <li>• In the <b>Control</b> set up group, configure <b>Local SP Source</b> as 3/4 Local SPs.</li> </ul>
4SP XXXX.XXX	Local Setpoint #4, appears when the following two conditions are satisfied: <ul style="list-style-type: none"> <li>• In the <b>Algorithms</b> set up group, configure <b>Control Algorithm</b> as ANY algorithm except Disable.</li> <li>• In the <b>Control</b> set up group, configure <b>Local SP Source</b> as 4 Local SPs.</li> </ul>
RSP XXXX.XXX	Remote Setpoint, appears when the following two conditions are satisfied:

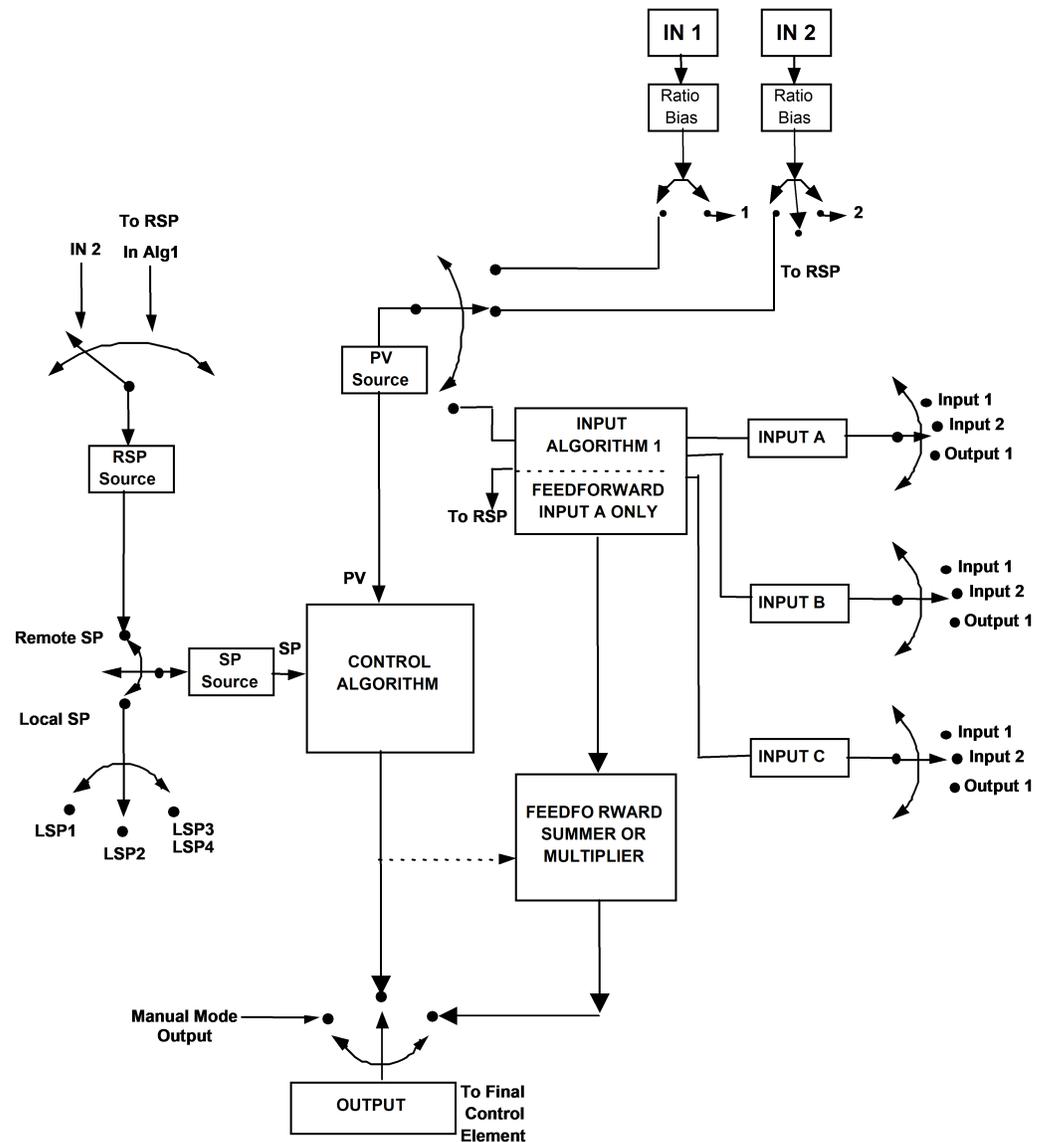
Lower Display	Description
	<ul style="list-style-type: none"> <li>In the <b>Algorithms</b> set up group, configure <b>Control Algorithm</b> as ANY algorithm except Disable.</li> <li>In the <b>Control</b> set up group, configure <b>Remote SP Source</b> as ANY selection except Disable.</li> </ul>
CSP XXXX.XXX	<p>Computer Setpoint—When SP is in override.</p> <ul style="list-style-type: none"> <li>In the <b>Algorithms</b> set up group, configure <b>Control Algorithm</b> as ANY algorithm except Disable.</li> <li>In the <b>Communication</b> set up group, enable <b>Shed Function</b>. And CSP is successfully override by SP override through Modbus.</li> </ul>
SPN XXXX.XXX	<p>Setpoint Now—Current Setpoint when SP Rate is enabled. The SP XXXX.XXX display shows the “target” or final setpoint value.</p> <p>SPN is not equal with the target SP.</p>
DEV XXX.X	Deviation
1IN XXXX.XXX	Input 1—Used only with combinational input algorithms.
2IN XXXX.XXX	Input 2
1PV	Process Variable 1—For Cascade or 2-loop applications.
2PV	Process Variable 2—For Cascade or 2-loop applications.
OUT1	Output of loop 1- For Cascade or 2-loop applications.
OUT2	Output of loop 2 - For Cascade or 2-loop applications.
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.
OTI XX.X	OUTPUT OVERRIDE (2 PID LOOPS ONLY)—Appears when internal loop 1 output value is displayed, this represents the internal output 1 value before override.
AUX XXX.X	Auxiliary Output—Displayed only when output algorithm is not Current Duplex.
TEL O XXH: XXM or, TEL O XXM: XXS	<p>Elapsed Time—Time that has elapsed on the Timer in Hours.Minutes, or Minutes:Seconds.</p> <p>The "O" is a clockwise running clock.</p>

Lower Display	Description
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 [Background 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](#).

For more information of interface displays, see "Function of displays" in *UDC2800 Product Manual*.

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.  <b>ATTENTION:</b> 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.

Step	Operation	Press	Result
			<p>Refer to Tuning Set Up group to ensure that the selections for Proportional Band or Gain, Rate Min, and Reset Mins/Rpt, or Reset Rpts/Min have been entered.</p> <p>Use Accutune to tune the controller. See Accutune III for more information.</p> <p>Use Accutune to tune the controller. See "Accutune III" in <i>UDC2800 Product Manual</i>.</p>

## Control Modes

### Mode Definitions

Table 5-3: Control Mode Definitions

Control Mode	Definitions
AUTOMATIC with LOCAL SETPOINT	<p>In automatic local mode, the controller operates from the local setpoints and automatically adjusts the output to maintain the PV at the desired value.</p> <p>In this mode you can adjust the setpoint.</p> <p>See Setpoints for more information.</p>
AUTOMATIC with REMOTE SETPOINT (optional)	<p>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 .</p> <p>See Input 1 Set Up Group for more information.</p> <p>See Input 2 Set Up Group for more information.</p>
MANUAL (optional)	<p>In the manual mode, the operator directly controls the controller output level. The process variable and the percent output are displayed. The 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).</p>

Control Mode	Definitions
MANUAL CASCADE	<p>In the manual cascade mode, both control loops are in manual although there is still only one output active. This mode is used to bring both loops into a reasonable operation area, at which point the unit is placed into the automatic cascade mode.</p> <p>If Loop 1 is placed in Manual control mode, then Loop 2, if in auto, is then placed in a pseudo-manual mode thereby eliminating output bumps when Loop 1 is returned to Automatic control mode.</p>
AUTOMATIC CASCADE	<p>In Automatic cascade mode, there are two control loops, where one loop's output acts as the setpoint for the second control loop. There is only one physical output in this mode.</p>

### What happens when you change modes

Table 5-4: Changing Control Modes

Control Mode	Definition
Manual to Automatic Local Setpoint	<p>The Local Setpoint is usually the value previously stored as the Local Setpoint. &gt;</p> <p>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.</p>
Manual or Auto Local to Automatic Remote SP	<p>The Remote Setpoint uses the stored ratio and bias to calculate the control setpoint.</p> <p>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</p> $\text{Bias} = \text{LSP} - (\text{RSP Input} \times \text{R}).$
Automatic Remote Setpoint to Manual or Auto Local Setpoint	<p>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.</p> <p>If LSP tracking is not configured, the local setpoint will not be altered when the transfer is made.</p>

# 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 for more information.

See "Control Set Up Group" in *UDC2800 Product Manual*.

## 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	<p>To switch between the four Local Setpoints and/or the Remote Setpoint.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> “KEY ERROR” will appear if:</p> <ul style="list-style-type: none"> <li>• the remote setpoint or additional local setpoints are not configured as a setpoint source.</li> <li>• you attempt to change the setpoint while a setpoint ramp/program is running.</li> <li>• you attempt to change the setpoint with the setpoint select function key disabled.</li> <li>• while a setpoint ramp/program is not terminated.</li> </ul> </div>

# 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 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 selected as TUNE. See Accutune Set Up Group 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. The SLOW selection may be useful for TPSC and Position Proportional applications, as it reduces “hunt” problems for the motor. 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 desirable to enable the FUZZY tune selection. See Fuzzy Overshoot Suppression 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 <b>SP</b> (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 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 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 <b>SP</b> (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 <b>2SP</b> (Local Setpoint 2) shows in the lower display.

Step	Operation	Press	Result
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 <b>SP</b> (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"	Man Auto key	Until "Auto" appears (on controllers with Manual option).

Step	Operation	Press	Result
	Mode		
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 <b>SP</b> (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

Step	Operation	Press	Result
			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 <b>2SP</b> (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

Step	Operation	Press	Result
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 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 Tuning 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 <b>Control</b> 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 <b>PID Sets</b>

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

Step	Operation	Press	Result
			<p>When the process variable or setpoint value is <b>LESS</b> 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.</p> <p>When the process variable or setpoint value is <b>GREATER</b> 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.</p> <p>Similarly, the controller switches between the other PID sets based upon the values configured for Switchover Value 2/3 and Switchover Value 3/4.</p>
5	Set Switchover Value for <b>2 Sets PV Switchover, 2 Sets SP Switchover, 4 Sets PV Switchover, or 4 Sets SP Switchover</b> selection	Function key  Increment key or Decrement key	Enter in the configuration prompt of Switchover Value.  Enter the switchover value. Press the Function key after enter the desired value.  It is highly recommended to configure Switchover Value as follows:  <b>Switchover Value 1/2 &lt; Switchover Value 2/3 &lt; Switchover Value 3/4</b>

## 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

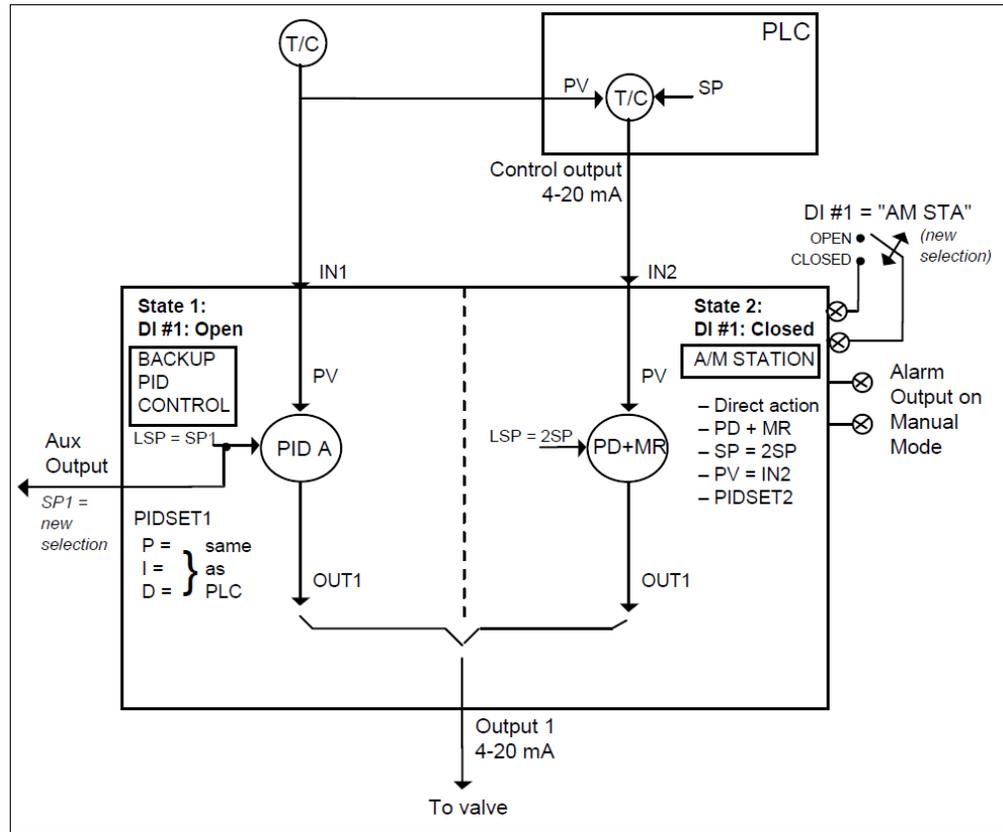
When you select "To Auto/Man Station" for one of the Digital Inputs, contact closure on the selected Digital Input causes the controller to switch to Auto/Manual Station mode. See Options Set Up Group for more information.

### 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 parameters 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  $(\text{Input 1 High Value} - \text{Input 1 Low Value}) / (\text{Input 2 High Value} - \text{Input 2 Low Value})$ .

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 <b>Algorithms</b> 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 <b>PD+Manual Reset</b> .
		Function key	Select the selection <b>PD+Manual Reset</b> .

Step	Operation	Press	Result
4	Select Control set up group	Setup key	Until you see <b>Control</b> 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 <b>PID Sets</b> . 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 <b>2 Sets Keyboard</b> .
		Function key	Select the selection <b>PD+Manual Reset</b> .
7	Select Local SP Source	Increment key or Decrement key	Until you see <b>Local SP Source</b> .
		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 <b>2 Local SPs</b> .
		Function key	Select the selection <b>2 Local SPs</b> .
9	Select SP Tracking	Increment key or Decrement key	Until you see <b>SP Tracking</b>
		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 <b>None</b>
		Function key	Select the selection <b>None</b> .
11	Select Tuning set up group	Setup key	Until you see <b>Tuning</b> 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 <b>Manual Reset</b> . Press the Function key to enter in the configuration prompt of <b>Manual Reset</b> .
13	Configure Manual Reset Value	Increment key or Decrement key	Configure 0 for <b>Manual Reset</b> . 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 <b>Algorithms</b> 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 <b>PID A</b> .
		Function key	Select the selection <b>PID A</b> . This is defining the back-up control algorithm.
17	Select Tuning set up group	Setup key	Until you see <b>Tuning</b> 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 <b>Gain 2</b> . 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:

Step	Operation	Press	Result
			<p><b>Input 1 Span</b> <b>Input 2 Span</b></p> <p>If "PB" is selected under the Control set up group function prompt "Gain" or "Proportional Band", then set the Proportional Band 2 to:</p> $100 \times \frac{\text{Input 2 Span}}{\text{Input 1 Span}}$
		Function key	Configure the Gain 2 value.
20	Select Rate 2 Min Value	Increment key or Decrement key	Until you see <b>Rate 2 Min.</b>
		Function key	Enter in the first configuration prompt of <b>Rate 2 Min.</b>
		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 <b>Options</b> 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 <b>DI 1 Function</b> or <b>DI 2 Function</b> . 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 <b>DI 1 Function</b> or <b>DI 2 Function</b> .
		Increment key or Decrement key	Until you see <b>To Auto/Man Station</b> .
		Function key	Select the selection <b>To Auto/Man Station</b> .

**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, or Three Position Step.
- 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.

These 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.

# Two Loops of Control

## Introduction

As an option, this instrument can operate using two independent loops of control or internal Cascade Control.

## Two Independent Loops

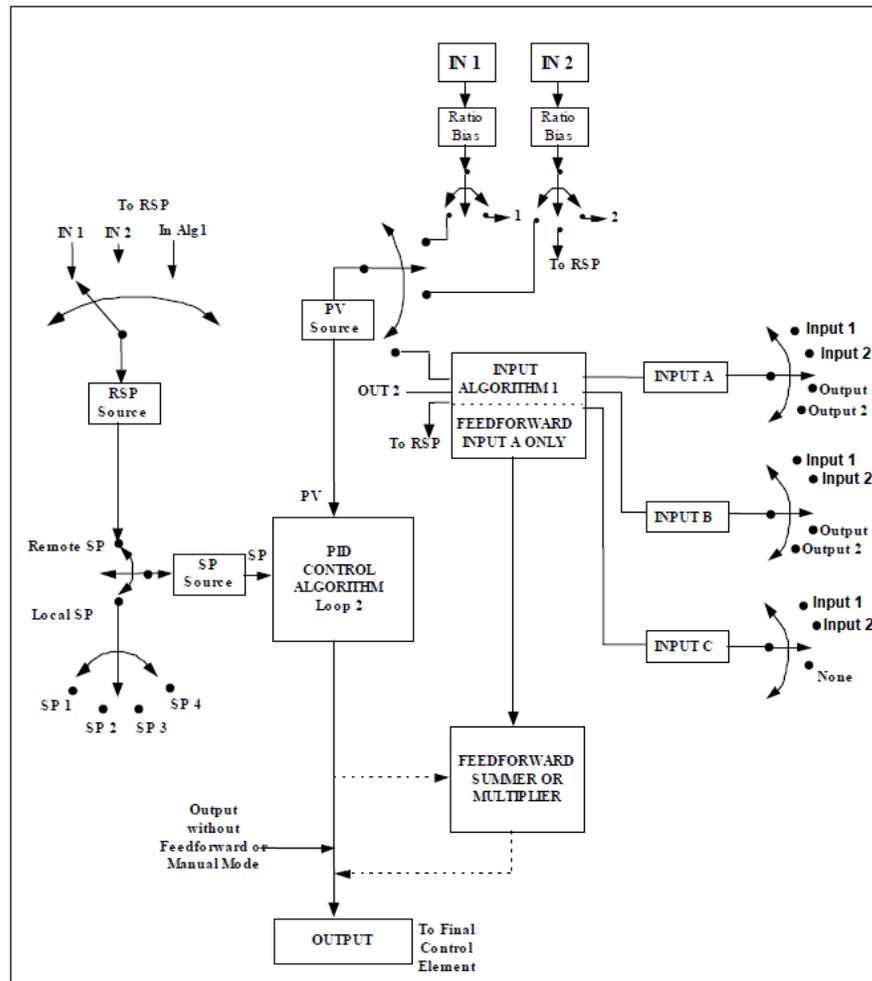
See Functional Overview Block Diagrams for Loop 1 and Loop 2 (Figure 4-3) for selections based on these diagrams.

The following rules apply for two independent loops:

- Control and Alarm Outputs are allocated per Table 3-6 and Table 3-7.

- Current output on Loop 2 requires Auxiliary Output to be installed.
- Loop 2 relay output is always dedicated to relay outputs 3 and 4.
- No Three Position Step output on Loop 2.

Figure 5-4: Functional Overview Block Diagram of a Single Loop (Loop #1) or Dual Loop Controller (Loop #1 and Loop #2)



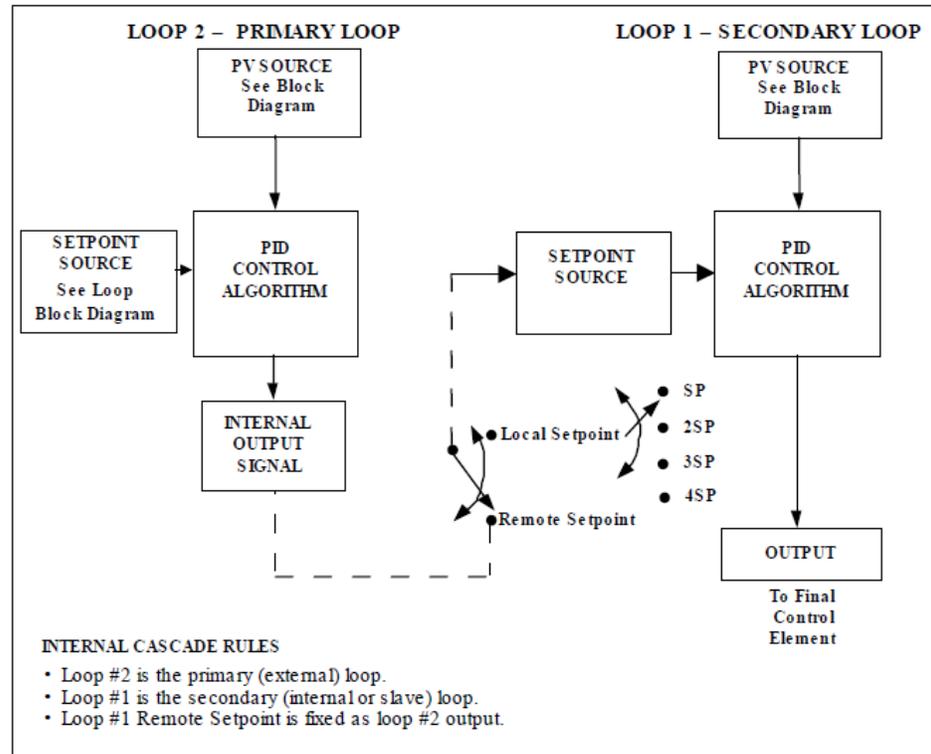
### Internal Cascade Control

See Functional Overview Block Diagram Figure 5-4 for selections based on these diagrams.

The following rules apply for internal Cascade control:

- Loop 2 is the primary (external) loop.
- Loop 1 is the secondary (internal or slave) loop.
- Loop 1 Remote Setpoint is fixed as the Loop 2 output.

Figure 5-5: Functional Overview Block Diagram of Internal Cascade Controller



## Output Override

This instrument allows override of the Loop 1 output with the Loop 2 output based upon which is larger or smaller. This can be accomplished by configuration (See Section 4.9) or by Digital Input actuation (see Section 4.14).

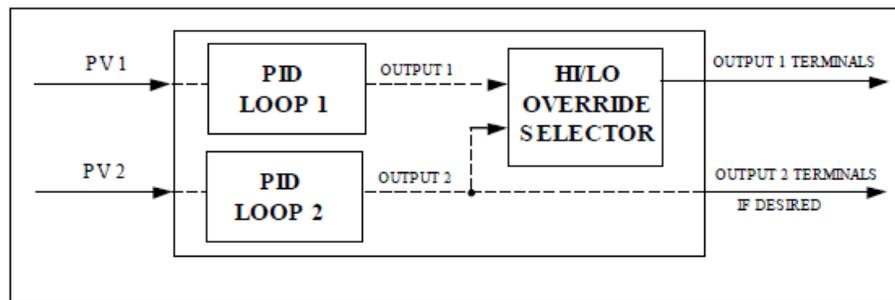
The following rules apply for high/low override:

- Only one physical output is required when override is enabled. It is the output from Loop 1 because Loop 2's internal output is routed through the selector.
- Loop 2 output can also be available at all times if desired.

- In Manual mode, the Output may be overridden.
- Does not apply for Three Position Step Control.
- OTI on bottom display shows value of the internal Loop 1 output before any override.

**ATTENTION:** The output of the unselected loop tracks the selected loop to within 5 % when in Auto mode to eliminate windup. This tracking is done in the direction opposite to the Override Select configuration; i.e., for High Select, the unselected output tracks within 5 % of the lower output, and vice versa for Low Select.

Figure 5-6: Hi/Lo Override Selector



## Configuring Two Loops of Control

### Introduction

This instrument can operate using two independent loops of control or internal Cascade control.

Table 5-17: Procedure for Selecting Two Loop Algorithm

Step	Operation	Press	Result
1	Select Algorithm Set-up Group	Setup Key and Increment or Decrement Key	Until you see Algorithm group.

Step	Operation	Press	Result
2	Select the PID Loops	Function key and Increment or Decrement Key	Until you see PID Loops function prompt.
3		Up or Down	To change selection.
4		Lower Display	To accept changes.

## Monitoring Two Loops of Control

### Introduction

Monitoring two individual loops of control or internal Cascade is similar as for a single loop with the following additions.

Table 5-18: Digital Display Indication - Two Loops

Indicator	Loop Indication	Definition
Loop 1 (two - loop) Cascade (Cascade)	Loop 1	<ul style="list-style-type: none"> <li>• Upper display shows the Process Variable (PV) for Loop 1</li> <li>• Lower display shows the Loop 1 parameters and the PV and Output for Loop 2</li> <li>• Controller setpoint annunciators show the setpoint currently being used for Loop 1</li> </ul>
Loop 2	Loop 2	<ul style="list-style-type: none"> <li>• Upper display shows the Process Variable (PV) for Loop 2</li> <li>• Lower display shows the Loop 2 parameters and the PV and Output for Loop 1</li> <li>• Controller setpoint annunciators show the setpoint currently being used for Loop 2</li> </ul>

### Loop Display

Display of Loop 1 or Loop 2 (if configured) is selected by toggling the Set-up+Lower display key combination.

## Viewing each Loop's Process Variable

Regardless of which loop is being displayed, 1 or 2, the process variable of the non-displayed loop can be shown in the lower display by repeated presses of the Lower Display key until 1PVXXXX or 2PVXXXX is displayed.

## Internal Cascade Indication

When internal Cascade has been configured, an "Cascade" will appear on the top of the upper display as long as Loop 1 is operating in the remote setpoint mode. Press the function key to set remote setpoint as working setpoint.

Switching between automatic and manual mode on either loop will not affect the internal Cascade indication.

# Operating Two Loops of Control

## Introduction

Operation of two individual loops of control is identical to operating a single loop of control except that TUNING 2 group applies to Loop 2 only and four PID sets, 5 through 8, are available. TUNING group applies to Loop 1 with PID sets 1 through 4 applicable.

## Operating modes and setpoint source

The rules for Auto/Manual modes and changing setpoint sources are the same as single loop operation.

## Keyboard operation

Note that the loop being displayed is the only loop affected by normal keyboard operation. However, either loop can be reconfigured when in the Set Up mode regardless of which is being displayed during normal operation.

## Accutune III

Two independent loops or cascaded loops can be tuned at the same time, if so configured.

## Setpoint Ramp or SP Programming

Either loop or both loops can be configured for a single setpoint ramp operation by enabling the desired loop or loops (see Section 3 – Configuration)

An “Hold” or “Run” will appear in the upper display when applicable, depending upon which loop is being displayed.

## Digital Inputs (remote mode switching)

Digital Input 1 is dedicated to Loop 1 when two loops or Cascade control is configured. The other digital inputs may be configured to work on either loop.

## Output Override Hi/Lo select

Output Override allows you to select the higher of Output 1 and Output 2 (Hi Select) or the lower of Output 1 and Output 2 (Lo Select) to appear at Output 1 terminals to drive the final control element. Refer to Section 5.12 for Override rules and block diagram.

Override prompts appear under the Algorithm Set Up group, function prompt OUTPUT OVERRIDE.

# 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 5-19: 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 Increment key or Decrement key	<p>Enter in the first function prompt A1S1 Type.</p> <p>Until you see the required Alarm setpoint.</p> <p>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</p> <p>To successively display the alarm setpoints and their values. Their order of appearance is shown below.</p> <p>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.</p> <p><b>NOTE:</b> With Three position step control, alarms set for “output” will not function.</p> <p><b>NOTE:</b> Manual, Remote Setpoint, and Failsafe selections do not have setpoint values.</p>

Step	Operation	Press	Result
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.
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.

## Three Position Step Control Algorithm

### Introduction

The Three Position Step Control algorithm allows the control of a valve (or other actuator) with an electric motor driven by two controller output relays; one to move the motor upscale, the other to move it downscale, without a feedback slidewire linked to the motor shaft.

### Estimated Motor Position

The Three Position Step control algorithm provides an output display which is an estimated motor position since there is no slidewire feedback.

- Although this output indication is only accurate to a few percent, it is corrected each time the controller drives the motor to one of its stops (0 % or 100 %).
- It avoids all the control problems associated with the feedback slidewire (wear, dirt, and noise).
- When operating in this algorithm, the output display is shown to the nearest percent (that is, no decimal).

See Output Set Up Group for more information.

## Motor Position Display

Table 5-20: Procedure for Displaying 3Pstep Motor Position

Step	Operation	Press	Result
1	Access the Displays	Lower Display	You will see OUT (The estimated motor position in %) in 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 5-21: 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.  Except Three Position Step, for Three Position Step: 0 Percent = motor goes to

Step	Operation	Press	Result
			closed position 100 Percent = motor goes to open position
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 5-22: 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:  <b>Latching:</b> Controller goes to manual and output goes to failsafe value  <b>No Latching :</b> Controller mode does not change and output goes to failsafe 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	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 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 for more information.)
- SP Program – a ramp/soak profile in a 12-segment program. (See Setpoint Ramp/Soak Programming for more information.)

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

### PV Hot Start

This is a standard feature. At power-up, the setpoint is set to the current PV value and the Rate or Ramp or Program then starts from this value.

### 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 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.

### Power outages

If power is lost before the “target” setpoint is reached, upon power recovery, the controller powers up with SPN = Current PV value and it automatically “Restarts” from SPN = current PV value up to the original “target” setpoint.

## 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 for more information.

### Operation

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

Table 5-23: 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	To set the start setpoint

Step	Operation	Press	Result
		key	
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: <ul style="list-style-type: none"> <li>time is up, and LSP1 will be changed to the final SP.</li> <li>or</li> <li>the final sp is reached, and the timer will be reset.</li> </ul>
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.  <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b> Before the final setpoint is reached, you can disable SP Ramp Function to end the SP Ramp.</p> </div>

### 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 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 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 5-24: 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: <ul style="list-style-type: none"> <li>• Disable: SP Program Function is disabled (so program value changed to Disable).</li> <li>• Hold: SP Program Function is not disabled.</li> </ul>
Program Termination	Program termination state	The program termination state function determines the status of the controller upon completion of the program.  The selections are: <ul style="list-style-type: none"> <li>• Last SP: controls to last setpoint</li> <li>• Failsafe: manual mode and failsafe output.</li> </ul>
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.

Associated Prompts	Contents	Definition
		When enabled, this selection allows you to reset the program via the keyboard to the beginning of the program.
	Rerun	<p>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.</p> <p>When enabled, this selection allows you to reset the program via the keyboard to the beginning of the current segment.</p>
Hot Start	Hot Start	<p>This function determines whether LSP1 or PV is used as the setpoint when the program is initially changed from HOLD to RUN.</p> <p>The selections are:</p> <p>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.</p> <p>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 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.</p>
Ramp Unit Segment x Ramp or Segment x Rate	Ramp time or rate segments	<p>A ramp segment is the time it will take to change the setpoint to the next setpoint value in the program.</p> <p>Ramps are odd number segments (1, 3, 5, 7).</p>

Associated Prompts	Contents	Definition
		<p>Segment #1 will be the initial ramp time.</p> <p>Ramp time is determined in either:</p> <p>TIME* - Hours.Minutes, Range = 0-99 hr.59 min.</p> <p>or</p> <p>RATE* - EU/MIN or EU/HR, Range = 0 to 999</p> <p>* This selection of time or rate is made at prompt "Ramp Unit".</p> <p>Set this prompt before entering any Ramp values.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;"> <p><b>ATTENTION:</b> Entering "0" implies an immediate step change in setpoint to the next soak.</p> </div>
<p>Segment x SP Segment x Time</p>	<p>Soak segments</p>	<p>A soak segment is a combination of soak setpoint (value) and a soak duration (time).</p> <ul style="list-style-type: none"> <li>• Soaks are even number segments (2, 4, 6, 8).</li> <li>• Segment 2 will be the initial soak value and soak time.</li> <li>• The soak setpoint range value must be within the setpoint high and low range limits in engineering units.</li> <li>• Soak time is the duration of the soak and is determined in:</li> </ul> <p>TIME - Hours:Minutes, Range = 0-99 hr:59 min.</p>
<p>Soak Deviation</p>	<p>Guaranteed soak</p>	<p>All soak segments can have a deviation value of from 0 to <math>\pm 99</math> (specified by SOK DEV) which guarantees the deviation value for that segment.</p> <p>Guaranteed soak deviation values greater than zero guarantee that the soak segment's process variable is within the <math>\pm</math> deviation value for the configured soak time. Whenever the <math>\pm</math> deviation value is exceeded, the soak timer stops until the process variable gets within the <math>\pm</math> deviation value.</p>

Associated Prompts	Contents	Definition
		<p>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).</p> <p>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 <math>\pm 99.XX</math>.</p> <p>The decimal location here corresponds decimal configuration chosen in the Display Set up group.</p>

### 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 5-7: Ramp/Soak Profile Example

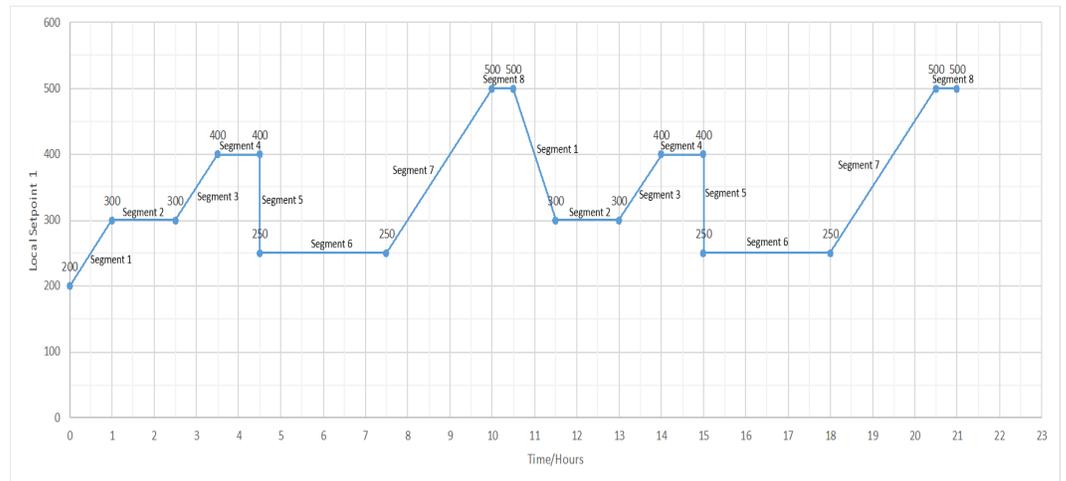


Table 5-25: Ramp/Soak Profile Example

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
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 5-26: 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		
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	

Prompt	Function	Segment	Value
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 5-27: 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)	Holds the setpoint program. “ Hold ” appears in the Middle Display indicating that

Function	Press	Result
	and Increment key)	<p>the program is in the HOLD state.</p> <p>The setpoint holds at the current setpoint.</p> <div style="border: 1px solid blue; padding: 5px;"> <p><b>NOTE:</b> When you place the SPP on HOLD with the SPP status in the display, the up and down keys increase or decrease the active segment.</p> </div>
External Hold		<p>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.</p> <p>The middle display will periodically show “Hold ” while the switch is closed.</p> <div style="border: 1px solid yellow; padding: 5px;"> <p><b>ATTENTION:</b> The keyboard takes priority over the external switch for the Run/Hold function.</p> </div> <p>Reopening the HOLD switch runs the program.</p>
Viewing the present ramp or soak segment number and time	Lower Display key	<p>In the Lower Display, until you see:</p> <p>PXSX RA XXH:XXM:XXS for Ramps: Program X(1-8) Segment X(1, 3, 5, 7) Ramp XXH:XXM:XXS remaining</p> <p>or,</p> <p>PXSX SK XXH:XXM:XXS for Soaks: Program X(1-8) Segment X(2, 4, 6, 8) Soak XXH:XXM:XXS remaining</p> <p>X and XX is current program or segment or time remaining</p>
Viewing the number of cycles left in the program	Lower Display key	<p>Until you see Recycle XX in the Lower Display.</p> <p>Number of cycles remaining in the setpoint program. XX = 0 to 99</p>
End Program		<p>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).</p> <p>The controller then either operates at the last setpoint</p>

Function	Press	Result
		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 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.

# 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.

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In this section:

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# 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.

**NOTE:** UDC2800 controller supports two methods of TC calibration.

1. Thermocouple Inputs using a Thermocouple Source or Ice Bath.
2. Thermocouple Inputs using a Millivolt Source.

**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 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 <a href="#">Voltage, Milliamp and Resistance Equivalents for Input Range Values</a> .
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 for more information.).
4	Follow the calibration procedure given for Input #1 or Input #2 (See Input 1 or 2 Calibration Procedure 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	44.555 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		4.00 mA	20.00 mA
	0 to 20 mA		0.00 mA	20.00 mA
Millivolts	0 to 10 mV		0.00 mV	10.00 mV
	0 to 50 mV		0.00 mV	50.00 mV
	0 to 100 mV		0.00 mV	100.00 mV
Volts	1 to 5 Volts		1.00 Volts	5.00 Volts
	0 to 5 Volts		0.00 Volts	5.00 Volts
	0 to 10 Volts		0.00 Volts	10.00 Volts
Carbon Oxygen	0 to 1250 mV		0.00 mV	1250.00 mV
	-30 to 510 mV		-30.00 mV	510.00 mV

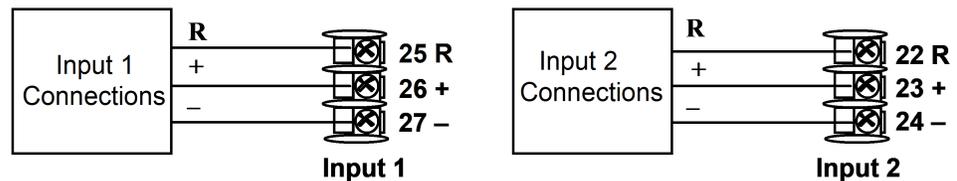
\*The Factory Calibrated millivolt values for the Thermocouple Differential Input are for a pair of J thermocouples at an ambient temperature mean of 450° F / 232 ° C. Other thermocouple types and ambient temperature means may be accomplished via Field Calibration of the input, with the range value limits 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 (Ice Bath )	<ul style="list-style-type: none"> <li>• A calibrating device with at least <math>\pm 0.02\%</math> accuracy for use as a signal source such as a millivolt source.</li> <li>• Thermocouple extension wire that corresponds with the type of thermocouple that will be used with the controller input.</li> <li>• Two insulated copper leads for connecting the thermocouple extension wire from the ice baths to the mV source.</li> <li>• Two containers of crushed ice or a commercially available ice bath.</li> </ul>
Thermocouple Input (Thermocouple Source)	<ul style="list-style-type: none"> <li>• A calibrating device with at least <math>\pm 0.02\%</math> accuracy for use as a signal source such as a millivolt source.</li> <li>• Thermocouple extension wire that corresponds with the type of thermocouple that will be used with the controller input.</li> </ul>
Thermocouple Inputs (Millivolt Source)	<ul style="list-style-type: none"> <li>• A calibrating device with at least <math>\pm 0.02\%</math> accuracy for use as a signal source such as a millivolt source.</li> <li>• Two insulated copper leads for connecting the thermocouple inputs to the millivolt source.</li> </ul>
RTD (Resistance Thermometer Device)	<ul style="list-style-type: none"> <li>• A decade box, with at least <math>\pm 0.02\%</math> accuracy, capable of providing stepped resistance values over a minimum range of 0 to 1650 ohms with a resolution of 0.001 ohm.</li> <li>• Three insulated copper leads of equal length for connecting the decade box to the controller.</li> </ul>
Milliampere, Millivolt and Volts	<ul style="list-style-type: none"> <li>• A calibrating device with at least <math>\pm 0.02\%</math> accuracy for use as a signal source.</li> <li>• Two insulated copper leads for connecting the calibrator to the controller.</li> <li>• Place current source at zero before switching ON.</li> <li>• Do not switch current sources OFF/ON while connected to</li> </ul>

Type of Input	Equipment Needed
	the UDC2800 input.

# Input 1 or 2 Set Up Wiring

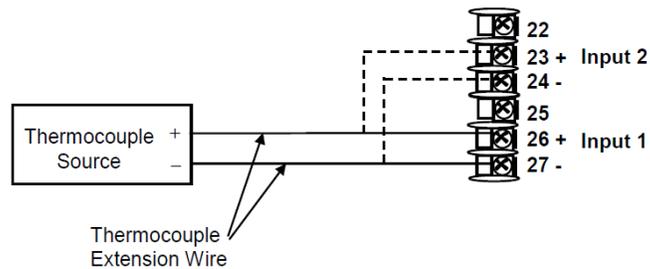
## Thermocouple Inputs using a Thermocouple Source

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

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

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

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



## Thermocouple Inputs using an ice bath

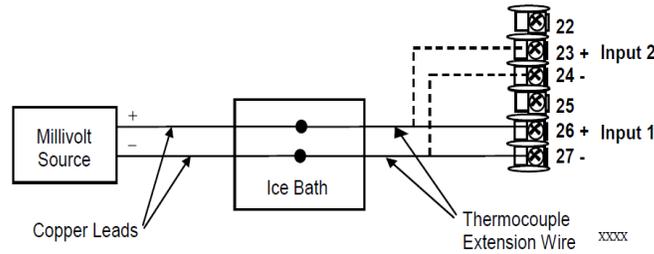
Refer to Figure "Wiring Connections for Thermocouple Inputs using an Ice Bath" and wire the controller according to the procedure given in Table "Set Up Wiring Procedure for Thermocouple Inputs using an Ice Bath".

Table 6-4: Set Up Wiring Procedure for Thermocouple Inputs using an Ice Bath

Step	Action
1	Connect the copper leads to the calibrator.
2	If using a physical Ice Bath: Connect a length of thermocouple extension wire to the end

Step	Action
	<p>of each copper lead and insert the junction points into the ice bath.</p> <p>If using a commercial Ice Bath:</p> <p>Connect a length of thermocouple extension wire to the output side of the Ice Bath. Connect the calibrator with copper wires to the input side of the Ice Bath.</p>
3	Connect the thermocouple extension wires to the terminals for the input to be calibrated.

Figure 6-3: Wiring Connections for Thermocouple Inputs using an Ice Bath



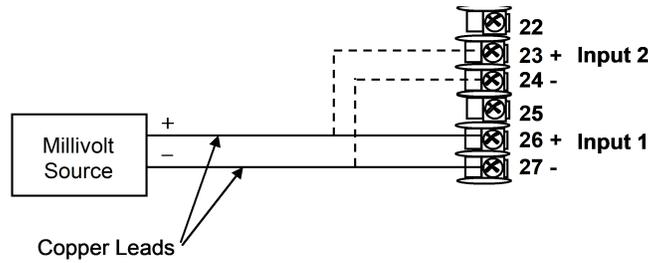
### Thermocouple Inputs using a Millivolt Source

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 6-5: 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 6-4: Wiring Connections for Thermocouple Inputs using a Millivolt Source



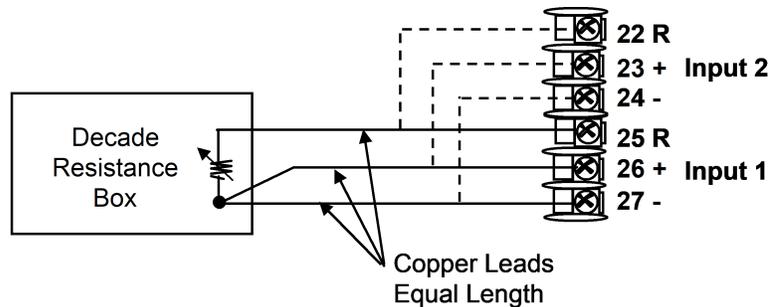
### RTD Inputs

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 6-6: 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 6-5: 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 6-6: Wiring Connections for Thermocouple Differential, Millivolts or Volts

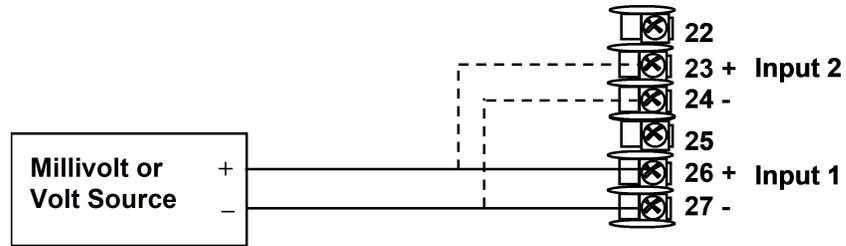


Table 6-7: Set Up Wiring Procedure for Millivolts, Volts or Thermocouple Differential Inputs

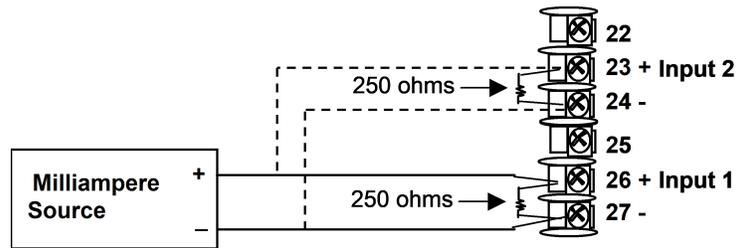
Step	Action
1	Connect the copper leads from the calibrator to the Input #1 terminals as shown in Figure "Wiring Connections for Thermocouple Differential, Millivolts or Volts".
2	Place current/voltage source at zero before switching on.
3	Do not switch current/voltage source ON/OFF while connected to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

### Milliamperes

Table 6-8: 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 6-7: 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 for more information.
- Make sure you have set Lock to NONE in the Security set up group. See Security Set Up Group 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 6-9: 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) If, <ul style="list-style-type: none"> <li>• You are using Thermocouple Input, go to step 2.</li> <li>• You are using other than Thermocouple Input, go to step 3.</li> </ul>
2	Choose TC Calibration Method	Function Key	Enter into the function prompt "TC Calibration Method" of the Input N Calib Set Up group. Press the function key again to enter the configuration prompt of TC Calibration method.
		Increment key or Decrement key	To see the options "mV Source" and "TC Calibrator".
		Function Key	Configured TC Calibration method will be applied for the Calibration procedure.
3	Enable Calibration function	Function key	Enter into the function prompt "Calibrate Input N" of the InputN Calib set up group. Press the Function key again to enter into the 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.

Step	Operation	Press	Result
4	Calibrate 0 %	Decrement key	<p>You will see Input N Zero (N=1 or 2)</p> <ul style="list-style-type: none"> <li>Adjust your calibration device to an output signal equal to the 0 % range value for your particular input sensor. See the table <a href="#">Voltage, Milliamp and Resistance Equivalents for Input Range Values</a> for Voltage, Degrees, or Resistance equivalents for 0 % range values.</li> <li>Wait 15 seconds and press the function key twice, then go to the next step.</li> </ul> <p><b>NOTE:</b> It is recommended to wait 15 seconds before pressing the function key for stable readings from the source.</p>
5	Calibrate 100 %	Decrement key	<p>You will see Input N Span (N=1 or 2)</p> <ul style="list-style-type: none"> <li>Adjust your calibration device to an output signal equal to the 100 % range value for your particular input sensor. See the table <a href="#">Voltage, Milliamp and Resistance Equivalents for Input Range Values</a> for Voltage, Degrees, or Resistance equivalents for 100 % range values.</li> <li>Press the function key twice, and if                             <ul style="list-style-type: none"> <li>you are calibrating a Thermocouple input, go to step 5.</li> <li>you are calibrating other than a Thermocouple input, go to step 6.</li> </ul> </li> </ul> <p><b>NOTE:</b> It is recommended to wait 15 seconds before pressing the function key for stable readings from the source.</p>
6	Check the Cold Junction Temperature	Decrement key	<p>The calculations for zero and span are now stored and you will see Cold Junction Temp N (N=1 or 2):</p> <p>The value is in tenths of a degree. It is the current</p>

Step	Operation	Press	Result
			<p>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 by pressing Function Key to configure the CJC value, then use Increment Key or Decrement Key for adjusting the value and press Function Key again to save the value.</p> <div style="border: 1px solid blue; padding: 5px;"> <p><b>NOTE:</b> Users must measure the temperature on the rear terminals before calibrating the Cold junction.</p> </div> <div style="border: 1px solid orange; padding: 5px;"> <p><b>CAUTION:</b> 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.</p> </div>
7	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 for more information.

Table 6-10: 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.

# OUTPUT CALIBRATION

## What's in this section?

The following topics are covered in this section.

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In this section:

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<i>Position Proportional and Three Position Step Output Calibration</i>	304
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# Overview

## Introduction

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

- Current Output
- Auxiliary Output
- Position Proportional Output and Three Position Step 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 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

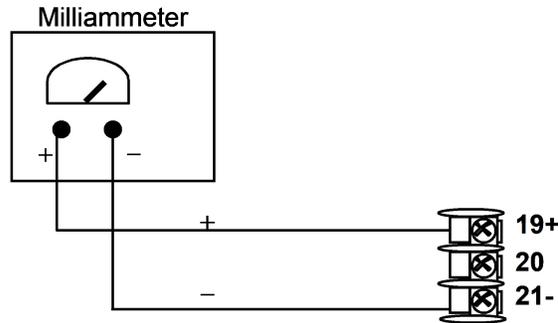


Table 7-1: Set Up Wiring Procedure for Current Output

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 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 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 for more information.

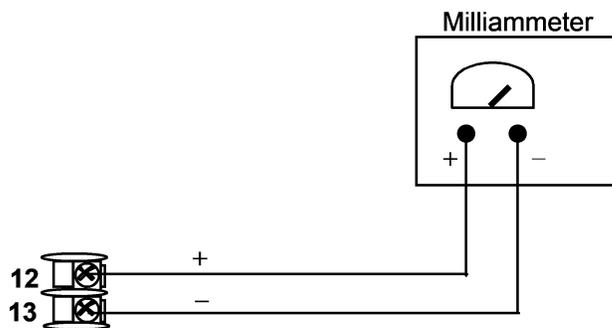
## Equipment Needed

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 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

Step	Operation	Press	Result
			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	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.

## Position Proportional and Three Position Step Output Calibration

### Position Proportional control

#### Position Proportional Control Output Models

This model must have its output calibrated per the entire procedure to ensure the displayed output (slidewire position) agrees with the final control element position.

### Three position step control

- Three Position Step Control Output Models not using slidewire feedback**  
 This model only requires that the "Motor Time" be entered as shown in Subsection "Output Set Up Group".

- Three Position Step Control Models using slidewire feedback**  
 This model must have its output calibrated per the entire procedure to ensure the displayed output (slidewire position) agrees with the final control element position.

### Equipment needed

None.

### Connections

Apply power and leave all field wiring connected to the rear terminals.

### Procedure

The procedure for calibrating the Three Position Step control output is listed in table below. For Three Position Step Control (3Pstep), these prompts only appear when “SLIDEW” is selected in the INPUT 2 Setup group. For Position Proportional Control, the Output algorithm must also be configured for “POSITON”.

Make sure LOCKOUT in Security Set Up group is set to NONE. See Security Set Up Group for more information.

**ATTENTION:** For Three Position Step Control (3Pstep), these prompts only appear when “SLIDEW” is selected in the INPUT 2 Setup group. For Position Proportional Control, the Output algorithm must also be configured for “POSITON”. The Motor Time must be entered in the Output Algorithm Group for both Position Proportional or for 3Pstep control. Output Set Up Group

Table 7-5: Position Proportional and Three Position Step 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 Slidewire Calib.

Step	Operation	Press	Result				
2	Select Automatic or Manual Calibration	Function key	<p>Enter into the first function prompt <b>Position Proportion</b> of the <b>Slidewire Calib</b> set up group. Press the Function key again to enter the configuration prompt of <b>Position Proportion</b>.</p> <p>You can calibrate the controller output manually or let the controller calibrate the output automatically.</p> <p>If the slidewire has never been calibrated, you must use Do Auto first. In the “Automatic Calibration Mode” (Do Auto), the controller relays automatically move the motor in the proper direction.</p> <p>If desired, however, the motor may be manually positioned to 0 % and 100 % positions. Disconnect the relay wires. Use Do Manual. In the “Manual Calibration Mode” (Do Manual), the motor does not move. Instead, the existing 0 % and 100 % values may be changed with the Increment key or Decrement key.</p>				
		Increment key or Decrement key	<p>Select automatic (<b>Do Auto</b>) or manual (<b>Do Manual</b>) calibration.</p> <table border="1"> <thead> <tr> <th>If you select...</th> <th>Then...</th> </tr> </thead> <tbody> <tr> <td>Do Auto</td> <td>go to Step 3</td> </tr> <tr> <td>Do Manual</td> <td>go to Step 5</td> </tr> </tbody> </table> <p><b>ATTENTION:</b> When calibration is terminated, this selection reverts to <b>Disable</b>.</p>	If you select...	Then...	Do Auto	go to Step 3
If you select...	Then...						
Do Auto	go to Step 3						
Do Manual	go to Step 5						
3	Do Auto Set 0 % value	Function key	Back to the configuration prompt Position Proportion.				
		Increment key or Decrement key	<p>Until you see <b>Zero Value</b>.</p> <p>The decrement relay is turned on to move the motor to 0 % position.</p>				

Step	Operation	Press	Result
			When the motor stops, the display should stop counting, then go to the next step.
4	Do Auto Set 100 % value	Function key	Back to the configuration prompt Position Proportion.
		Increment key or Decrement key	Until you see <b>Span Value</b> .  The increment relay is turned on to move the motor to 100 % position.  When the motor stops, the display should stop counting, then, go to Step 7.
5	Do Manual Set 0 % value	Function key	Back to the configuration prompt Position Proportion.
		Increment key or Decrement key	Until you see <b>Zero Value</b> .
		Function key	Enter into configuration prompt of <b>Zero Value</b> .
		Increment key or Decrement key	Change the value.
6	Do Manual Set 100 % value	Function key	Back to the configuration prompt Position Proportion.
		Increment key or Decrement key	Until you see <b>Span Value</b> , and press the function key to change the value.  For manual calibration, the motor does not move from its position prior to the start of Position Proportional calibration.
		Function key	Enter into configuration prompt of <b>Span Value</b> .
		Increment key or Decrement key	Change the value.

Step	Operation	Press	Result
7	Exit the Calibration Mode	Function key	The controller will store the 100 % 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 for more information.

Table 7-6: 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.
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.

# TROUBLESHOOTING/SERVICE

## What's in this section?

The following topics are covered in this section.

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In this section:

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# 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 for more information.
- When the Status Tests are requested. See Status Tests for more information.
- During continuous background tests while in normal operation. See Background Tests and Diagnostic 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 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, EEPROM test and Slidewire calibration 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 diagnostics display.

## Three Position Step test failures

For controller configured for Three Position Step Control with motor position indication and Auto-cal has never been done, the prompt CAL MTR will appear to suggest that the controller be calibrated. Position Proportional and Three Position Step Output Calibration

# 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.	<ol style="list-style-type: none"> <li>1. Run through STATUS check to determine the reason for the failure.</li> <li>2. Run through the STATUS check a second time to see if the error cleared.</li> <li>3. Power cycle the instrument. If the message reappears, replace the instrument.</li> </ol>
EEPROM Error	Unable to write to non-volatile memory. Anytime you change a parameter and it is not accepted, you will see EEPROM Error.	<ol style="list-style-type: none"> <li>1. Check the accuracy of the parameter and re-enter.</li> <li>2. Try to change something else in configuration.</li> <li>3. Run through Read STATUS tests to re-write to EEPROM.</li> <li>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.</li> </ol>

Lower Display	Reason for Failure	How to Correct the Problem
Calibration Test Error	Calibration test failed at start up.	<ol style="list-style-type: none"> <li>1. Run through STATUS check to determine the reason for the failure.</li> <li>2. Restore factory settings. See Restoring Factory Configuration for more information.</li> <li>3. Power cycle the instrument. If the message reappears, replace the instrument.</li> </ol>
Configuration Error	<p>It appears when one of the following conditions is happened:</p> <ul style="list-style-type: none"> <li>• PV low limit is &gt; PV high limit</li> <li>• SP low limit is &gt; SP high limit</li> <li>• Output low limit &gt; Output high limit</li> </ul>	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 or Failsafe Loop 2	<p>This error message shows whenever the controller goes into a failsafe mode of operation. This will happen if:</p> <ul style="list-style-type: none"> <li>• RAM test failed</li> <li>• Configuration test failed</li> <li>• Calibration test failed</li> <li>• Burnout is configured for none and the input failed.</li> </ul>	<ol style="list-style-type: none"> <li>1. Run through STATUS check to determine the reason for the failure.</li> <li>2. Press the Setup and Increment key until Status appears.</li> <li>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.</li> </ol>
Input 1 Range	Input 1 out of range. The	<ol style="list-style-type: none"> <li>1. Make sure the range and</li> </ol>

Lower Display	Reason for Failure	How to Correct the Problem
	process input is outside the range limits.	<p>actuation are configured properly.</p> <ol style="list-style-type: none"> <li>2. Check the input source.</li> <li>3. Restore the factory calibration. (See Restore Input Factory Calibration for more information.)</li> <li>4. Field calibrate. See Input Calibration for more information.</li> </ol>
Input 1 Fail	<p>Two consecutive failures of input 1 integration; i.e., cannot make analog to digital conversion. This will happen if:</p> <ul style="list-style-type: none"> <li>• Upscale or Downscale burnout is selected and the input is open</li> <li>• Input not configured correctly for the sensor being used</li> <li>• Calibration test failed</li> <li>• Input source is grossly out of range.</li> </ul>	<ol style="list-style-type: none"> <li>1. Make sure the actuation is configured correctly. See Configuration for more information.</li> <li>2. Make sure the input is correct and that it has not burned-out (opened).</li> <li>3. Check for gross over-ranging with a multimeter</li> <li>4. Restore factory calibration. See Restore Input Factory Calibration for more information.</li> </ol>
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	<p>PV in engineering unit (with ratio and bias) is out of limit.</p> <p>PV limit is same as burnout</p>	<ol style="list-style-type: none"> <li>1. Make sure the input signal is correct.</li> </ol>

Lower Display	Reason for Failure	How to Correct the Problem
	<p>high/low limit, Linear, &amp; TC/RTD <math>\pm 10\%</math>, Input Algorithm 0%.</p> <p>PV = Input 1 x Ratio 1 + Input 1 BIAS</p>	<ol style="list-style-type: none"> <li>2. Make sure the Ratio and Bias settings are correct.</li> <li>3. Recheck the calibration. Use Bias of 0.0.</li> </ol>
Remote SP Limit	<p>RSP in engineering unit (with ratio and bias) is out of limit.</p> <p>RSP limit is same as burnout high/low limit, Linear, &amp; TC/RTD <math>\pm 10\%</math>, Input Algorithm 0%.</p> <p>RSP limit shall not triggered when RSP Source choose None.</p> <p>RV = Input 2 x Ratio + BIAS</p>	<ol style="list-style-type: none"> <li>1. Make sure the input signal is correct.</li> <li>2. Make sure the Ratio2 and Bias2 settings are correct.</li> <li>3. Recheck the calibration. Use a Ratio2 of 1.0 and a Bias2 of 0.0.</li> </ol>
Segment Error	<p>Setpoint Program start segment number is less than ending segment number.</p> <p>Segment Error shall not triggered when Setpoint Program is disabled.</p>	<p>Check SP Program configuration. See SP Ramp/Program Set Up Group for more information.</p>
Slidewire Calib	<ol style="list-style-type: none"> <li>1. Input 2 Type is configured as Slidewire.</li> <li>2. Slidewire calibration never performed.</li> </ol>	<p>Field Calibrate the slidewire. See Position Proportional and Three Position Step Output Calibration for more information.</p>
Slidewire Fail	<ol style="list-style-type: none"> <li>1. Input 2 Type is configured as Slidewire.</li> <li>2. Position Proportional slidewire input failure.</li> </ol>	<p>See Troubleshooting Procedures for more information.</p>
Sooting	<p>Percent Carbon falls outside sooting boundary</p>	<p>Check process for correct operation.</p>
TC 1 Warning	<p>Thermocouple on Input 1 is starting to burn out.</p>	<p>This diagnostic message means that the controller has detected that the thermocouple is starting</p>

Lower Display	Reason for Failure	How to Correct the Problem
		to burn out. This error message may be created if the resistance of the wires used to connect the thermocouple to the instrument is above 1000 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 be created if the resistance of the wires used to connect the thermocouple to the instrument is above 1000 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 be generated if the resistance of the wires used to connect the thermocouple to the instrument is above 2000 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 be generated if the resistance of the wires used to connect the thermocouple to the instrument is above 2000 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
OK	Displayed Output disagrees with Controller Output	OK	Controller Output disagrees with Displayed Output	Position Proportional or TPSC Output	6
Display does not change when a key is pressed				Keyboard Malfunction	7

Upper Display	Lower Display	Indicators	Controller Output	Probable Cause	Troubleshooting Procedure
Controller fails to go into "Slave" operation during communications				Communications Failure	8
OK	Displayed Output disagrees with Auxiliary Output	OK	Controller Auxiliary Output disagrees with Displayed Auxiliary Output	Auxiliary Output	9

### 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.

**ATTENTION:** If the UDC display gets hanged on power up due to power fluctuations, then user needs to do power cycle again to recover from the hang stateS.

## 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 for more information.
2	Check the field wiring.	Output impedance must be less than or equal to 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 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 for more information.
2	Check the field wiring.	Make sure the NO or NC contact wiring is correct.  See Installation 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

Step	What to do	How to do it
		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 for more information.
2	Check the field wiring.	Make sure the NO or NC contact wiring selection is correct.  See Installation 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 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 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 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 Position Proportional Output failure symptoms.

*Table 8-10: Troubleshooting Position Proportional Output Failure*

Step	What to do	How to do it
1	Make certain that the controller is configured for Position Proportional output.	Make Output Set Up group function prompt Output Algorithms = Position Proportion.  See Output Set Up Group for more information.
2	Check the field wiring.	See Installation for more information.
3	Check the output.	Put the controller into Manual mode and change the output from 0 % to 100 %.
4	Check whether the motor drives in both directions. If it does go to Step 6.	See Position Proportional and Three Position Step Output Calibration for more information.
5	Check whether the motor drives in either direction. If the motor drives only in one direction, check the slidewire. If the motor does not drive in either direction, check the motor.	Refer to the motor instructions.
6	Check the output voltage to the slidewire (if used).	See the Input 2 wiring diagram for terminal designations in Section – Installation.  1) Measure between the R and the – terminals (across the entire slidewire). This voltage should be between 0.024 volts (for a 100 ohm slidewire) and 0.200 volts (for a 1000

Step	What to do	How to do it
		<p>ohm slidewire). This voltage should remain steady as the motor moves.</p> <p>2) Measure between the + and the – terminals (across just the wiper section). This voltage should be somewhere between 0.002 and 0.200 volts, depending upon the total slidewire resistance and the current position of the slidewire. This voltage should vary smoothly as the motor moves and the wiper travels across the slidewire. If the voltage jumps at a particular position while the motor is moving, this could indicate a “deadspot” and mean that the slidewire may be worn out and need replacing. Refer to the motor manufacturer’s instructions.</p>
7	<p>Make sure the output relays are actuating properly.</p>	<p>Put the controller into Manual mode. Vary the output above and below the present value. Observe “OUT” indicators and the output value (“OUT”) on the lower display. When the “OUT 1” indicator is on, the output value should be increasing. When the “OUT 2” indicator is on, the output value should be decreasing.</p> <p>If these are not working properly, check the field wiring, then go to Step 5.</p> <p>If they are, go to Step 8.</p>
8	<p>Recalibrate the controller.</p>	<p>See Output Calibration for more information.</p>
9	<p>Change the two Output Relays or the Dual Relay Board (depending upon unit)</p>	<p>Installation instructions supplied with the new relays or board.</p>

## Procedure #7

This table explains how to troubleshoot a Keyboard failure.

*Table 8-11: 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 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 #8

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

*Table 8-12: 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 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 #9**

This table explains how to troubleshoot an Ethernet Communications failure.

*Table 8-13: 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	The Ethernet symbol:

Step	What to do	How to do it
	Connection is active.	<ul style="list-style-type: none"> <li>• Is <b>red</b> when there is no Ethernet connection.</li> <li>• Is <b>solid White</b> when there is an Ethernet connection, but no data exchange.</li> <li>• Is <b>white and blinks once per second</b> when there is an Ethernet connection and data exchange.</li> </ul>
3	Change Ethernet Communications board.	Installation instructions provided with new board.
4	Change Controller	

### Procedure #10

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

Table 8-14: 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.	<p>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 Output and Digital Input 2 are mutually exclusive, you must choose which one of these features you wish to use.</p> <p>Make the Options Set UP group function prompt CO Range = 4–20 or 0–20 per your application.</p> <p>See Configuration for more information.</p>
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 for more information.

Step	What to do	How to do it
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 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 8-15: 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	<p>A dialog appears asking you are sure to restore the settings. Configuration will be restored in 5 seconds.</p> <p>You can press the Lower Display key to cancel the restore within 5 seconds.</p> <p>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 for more information.</p> <p>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.</p>

# PARTS LIST

## What's in this section?

The following topics are covered in this section.

---

In this section:

<i>Exploded View</i> .....	334
<i>Removing the chassis</i> .....	339

# Exploded View

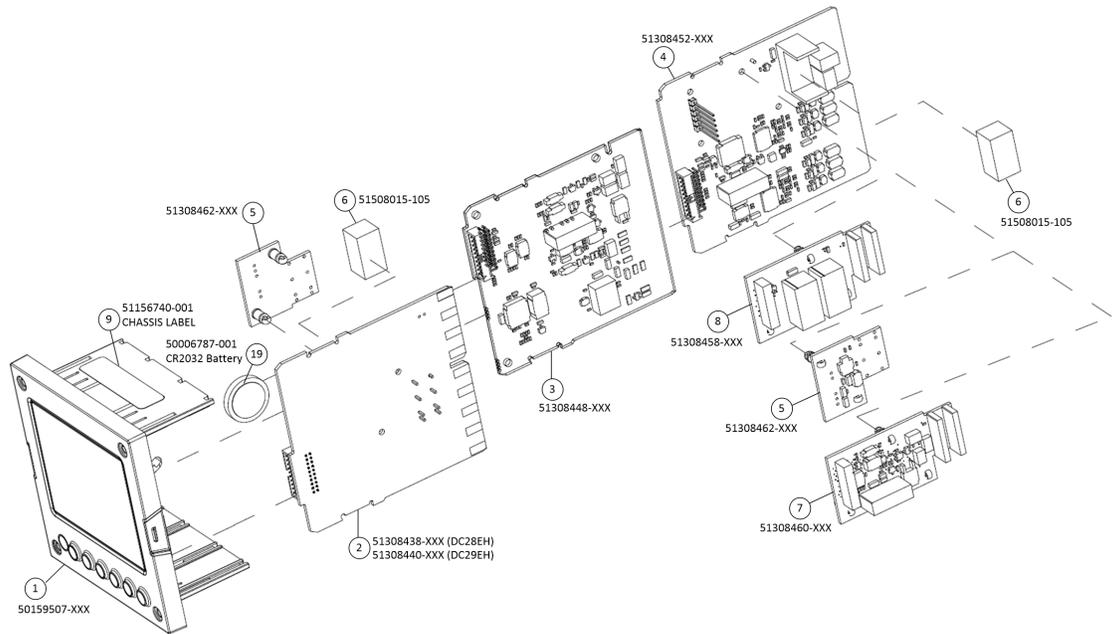
## Introduction

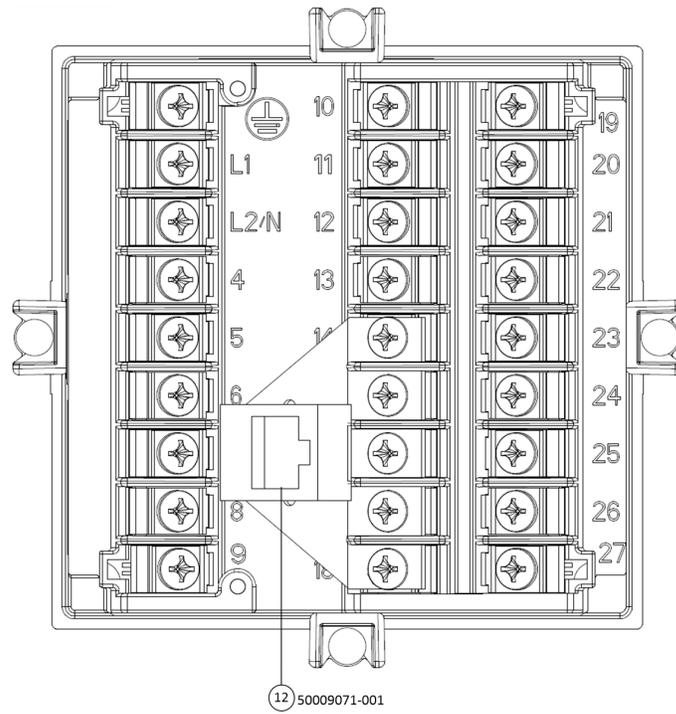
This figure shows an exploded view of the UDC2800 Controller. Each part is labeled with a key number. The part numbers are listed by key number in table [Parts Identification](#).

**NOTE:** Not all parts are standard.

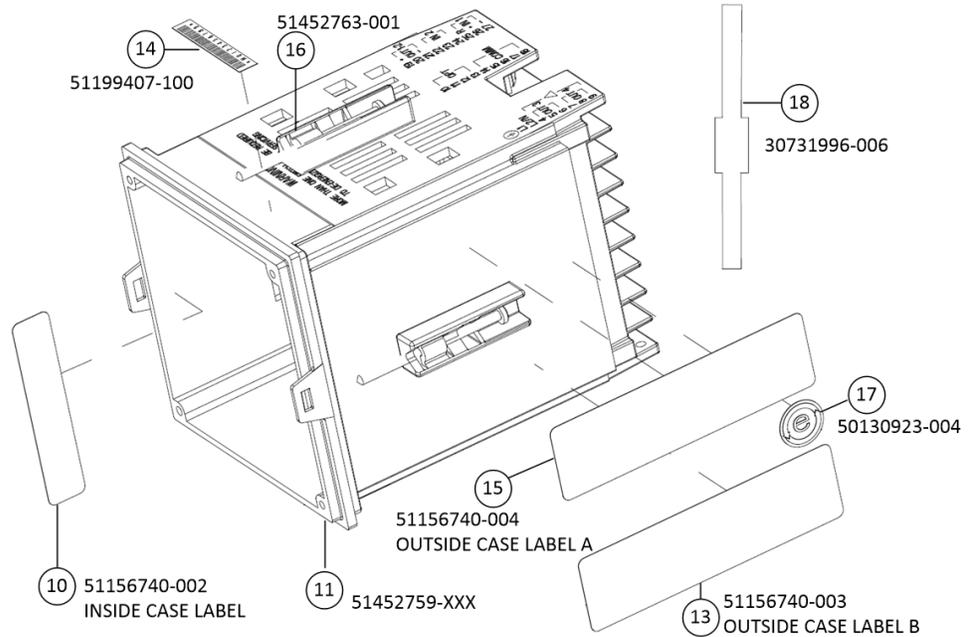
**ATTENTION:** Internal parts of the product must be replaced and maintained by Honeywell representative.

Figure 9-1: UDC2800 Exploded View





12 50009071-001



10 51156740-002  
INSIDE CASE LABEL

11 51452759-XXX

15 51156740-004  
OUTSIDE CASE LABEL A

13 51156740-003  
OUTSIDE CASE LABEL B

18 30731996-006

17 50130923-004

14 51199407-100

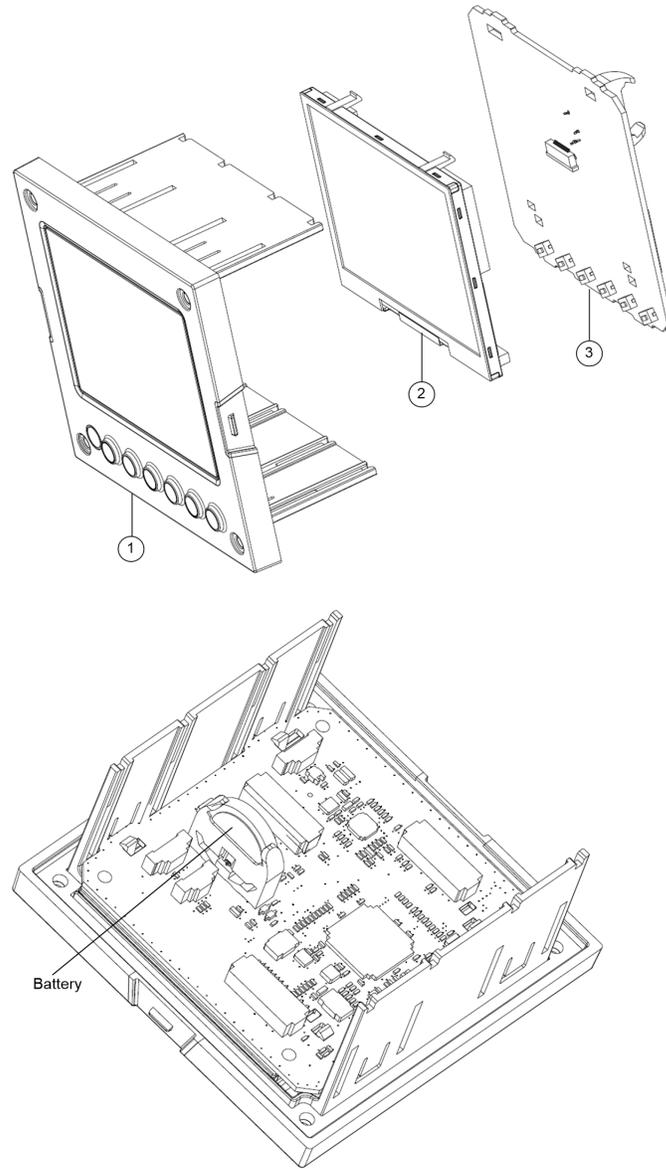
16 51452763-001

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)
17	50130923-004	China RoHS 2 Label, Compliant

Key Number	Part Number	Description
18	30731996-506	4-20 mA Input Resistor Assembly (250 ohm)
19	50006787-001	<p>CR2032 Battery.</p> <p>Battery is installed in MCU display. For more information, see the following figures.</p> <p><b>NOTE:</b> Battery is not used for the current release.</p>

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 for more information.

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

# CONFIGURATION VIA HONEYWELL EASYSET

## What's in this section?

The following topics are covered in this section.

---

In this section:

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<i>Upload Configuration</i> .....	349
<i>Offline Configuration</i> .....	351
<i>Download</i> .....	359
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<i>Maintenance Data</i> .....	364
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## Overview

Honeywell EasySet app lets users configure their instrument (Non-FM) 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 and Android 9 or higher operating system.

**ATTENTION:** Before using the EasySet app on an Android device, it is recommended to install and keep all Android security updates up-to-date.

**NOTE:** It is always recommended to update the existing Android or IOS version to the latest version.

**NOTE:** It is recommended to use the default keyboard when using the EasySet app on an Android device.

**NOTE:** It is recommended to use the Honeywell EasySet app on 5 inch and above screen size iOS mobiles for a better experience.

The configurations are accessed using icons introduced below.

Figure 10-1: Honeywell EasySet interface

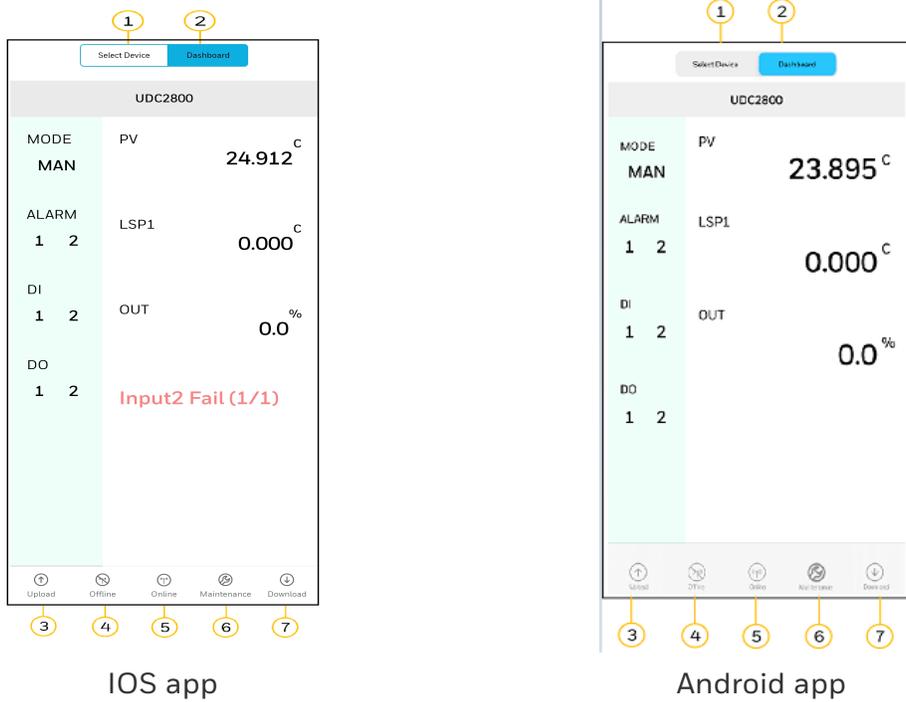


Table 10-1: Description of icons

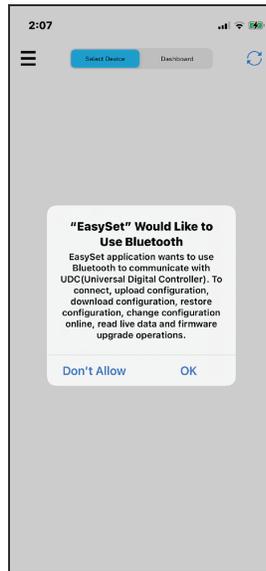
Item	Description
1	The Select Device Tab shows list of available UDC devices. It is used to set up communications before uploading or downloading instrument configurations. See Communications Setup for more information.
2	The Dashboard is used to configure & operate controllers and download/upload the complete configuration.  <b>NOTE:</b> The displayed data on the Dashboard page refreshes every 10 seconds.
3	The Upload tab is used to upload instrument configuration to Mobile Device. See Upload for more information.
4	The Offline tab is used to edit an instrument configuration for later downloading. See Offline Configuration for more information.

Item	Description
5	The Online tab is used to edit and download one instrument settings at a time. See Online Configuration for more information.
6	The Maintenance tab 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 for more information.
7	The Download tab is used to download an instrument configuration to an instrument. See Download for more information.

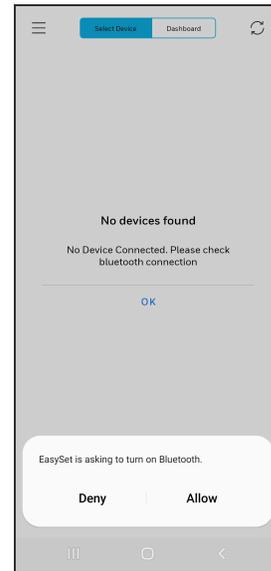
## Communications Setup

Before transferring the data between the EasySet app and instrument, the user must set up the mobile device communication parameters using following procedure.

1. Open the EasySet app. The Bluetooth permission pop-up appears.

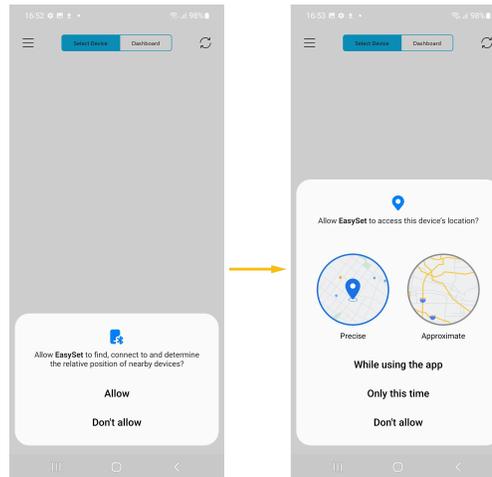


IOS app



Android app

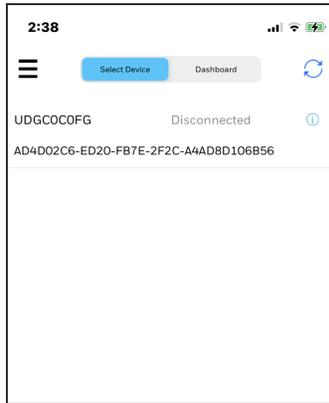
**NOTE:** In Android device, if the Easyset app opened for the first time, users need to allow **Location** access permission. It is recommended to choose Precise location for better results.



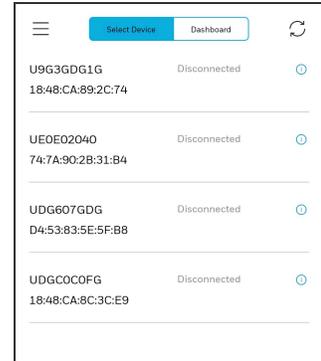
2. Perform the following:

- In IOS device, Click **OK**.
- In Android devices, Click **Allow**.

3. Click **Select Device**, all available controllers are detected and displayed with Bluetooth IDs.



IOS app

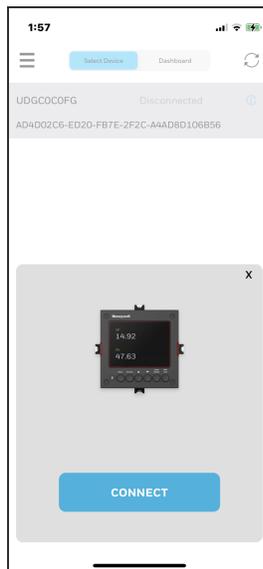


Android app

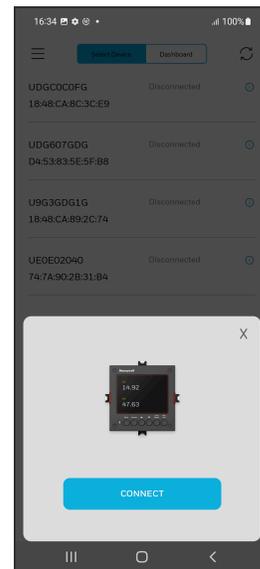
**NOTE:** The UDC device's **Bluetooth ID** appears in the communications group on the controller screen.

**NOTE:** If the required controller is not listed, click the **Refresh** icon to refresh the page.

4. Select the desired controller to connect, the connect dialog appears.



IOS app



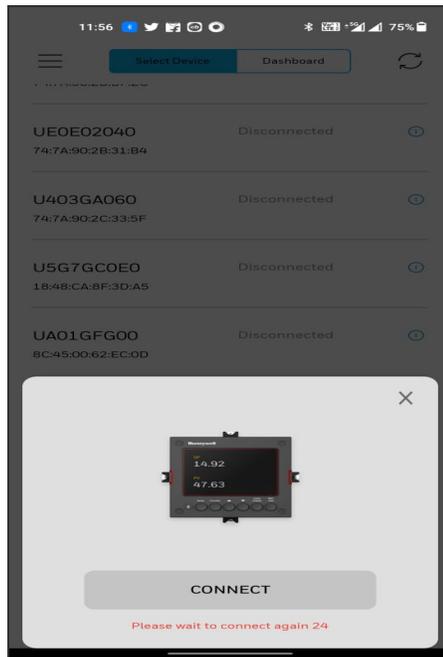
Android app

5. Click **CONNECT**, Bluetooth pairing request dialog appears.

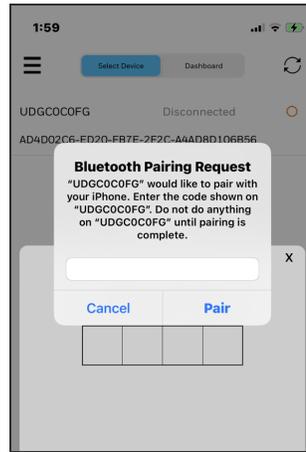
**NOTE:** The UDC device displays a pairing code. Record the code.

6. Enter the UDC device pairing code, and then click **Pair**.

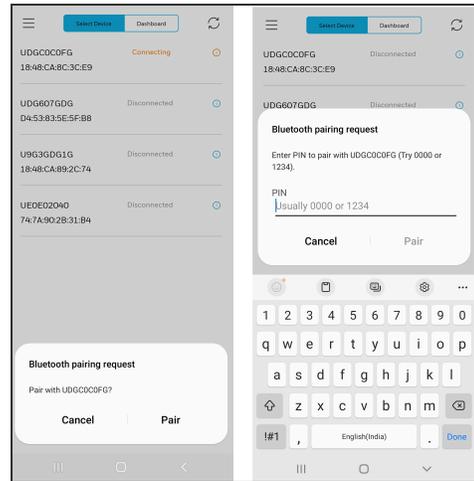
**ATTENTION:** If the user clicks cancel option while pairing with UDC device, at that point controller will still be in active state with phone for 30 seconds, to repair with the UDC device user needs to wait for 30 seconds.



**ATTENTION:** After clicking cancel option, if the user clicks on refresh button then the device name will disappear from the list.



IOS app



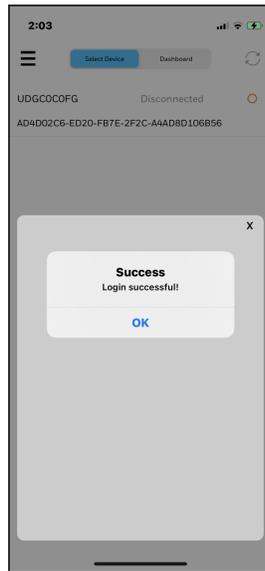
Android app

**ATTENTION:** In some Android devices If the wrong pairing code is entered, then the pairing code pop up will dismiss and again the user needs to connect from start.

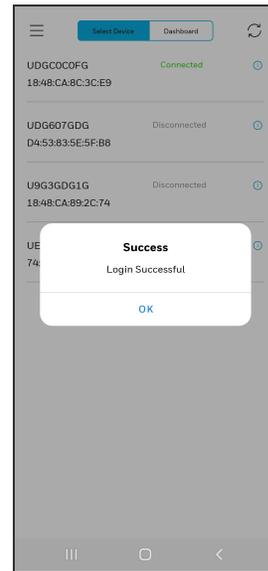
7. Once Bluetooth pair is success, enter a PIN dialog appears.
8. Enter the UDC device PIN.
  - The entered PIN is valid, and **Success** dialog appears.
  - The entered PIN is not valid, and **Login failed** dialog appears. Check the device password try again.

**ATTENTION:** Enter the four digit UDC device PIN in the EasySet app to login.

**ATTENTION:** The three consecutive wrong password attempts, will lock the login access for 1 minute.



IOS app

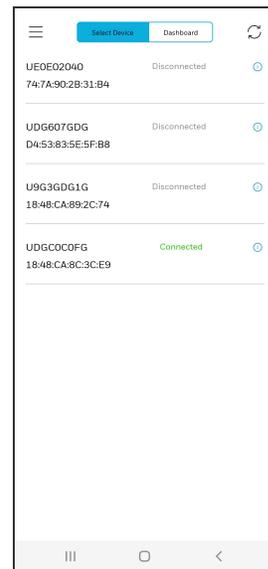


Android app

9. Click OK.



IOS app



Android app

**ATTENTION:** Once the UDC device is connected to the EasySet app through Bluetooth, do not disable or turn off the Bluetooth function in the UDC device.

**NOTE:** The user must disconnect the current device from the EasySet app before connecting to the new device.

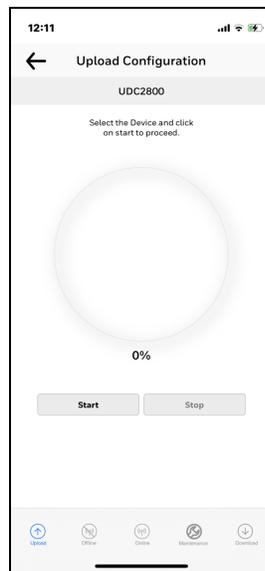
**NOTE:** If the Android app is unable to connect to the controller after retrying, user must turn On and Off their phone's bluetooth.

**ATTENTION:** The EasySet app does not allow the user to connect to new devices if a UDC device is paired with the app but the PIN is not entered. In this instance, the user must either close the app or enter the PIN to log in.

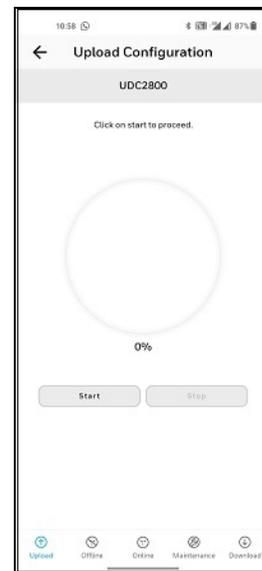
## Upload Configuration

Using Upload user can upload the instrument's configuration into the EasySet app, where user can save, edit, and download the configuration back to the instrument or other instruments.

1. Click **Dashboard**. The dashboard page appears.
2. Click **Upload**. The **Upload Configuration** page appears.

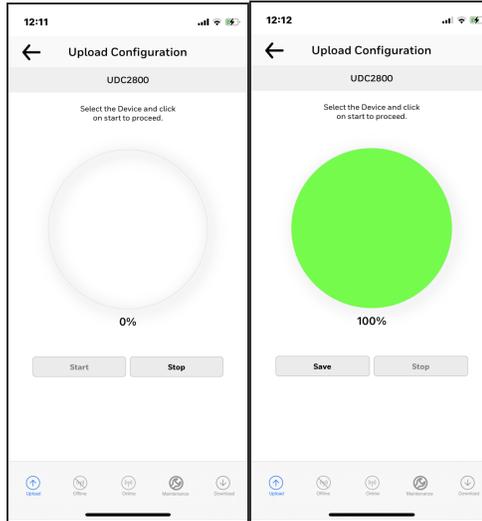


IOS app

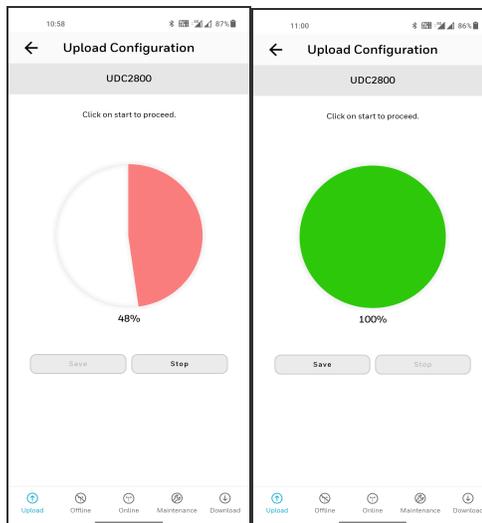


Android app

3. Click **Start** to begin upload. The status of upload (0% complete) is shown.



IOS app

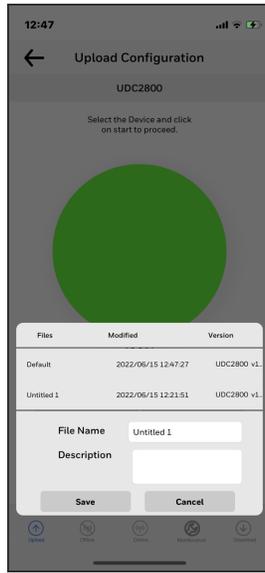


Android app

**NOTE:** To terminate upload, click **Stop**.

If upload is successful, Users can save the configuration.

4. Click **Save**, and enter the **File Name** and **Description**.



IOS app



Android app

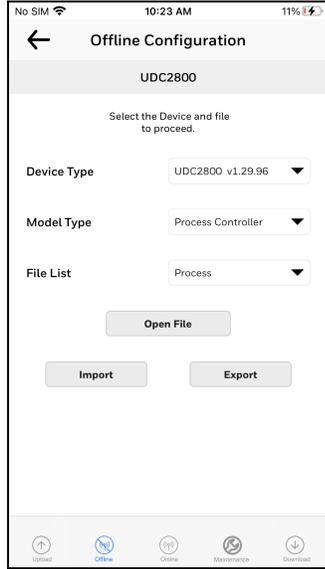
5. Click **Save**. The configuration is saved in the mobile device.

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

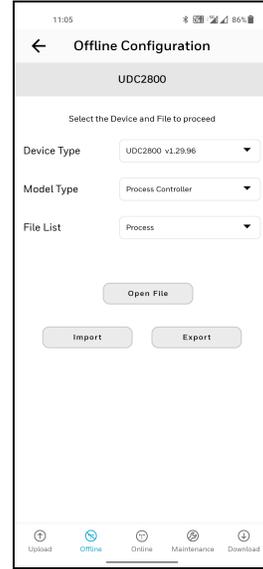
## Offline Configuration

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

1. Click **Dashboard**. The dashboard page appears.
2. Click **Offline**. The **Offline Configuration** page appears.



IOS app

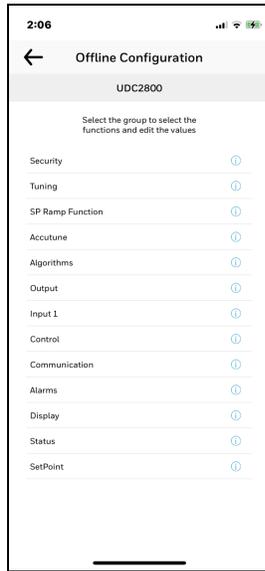


Android app

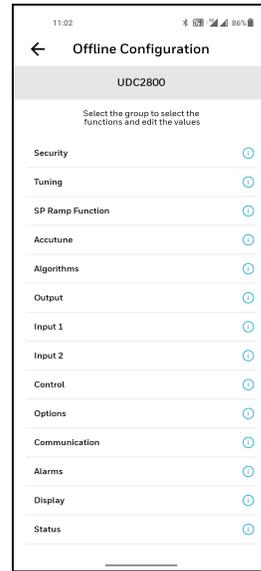
3. Select **Device Type** and **File List**.

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.
Model Type	Based on the device type model type can be selected.

4. Click **Open File**, the offline configuration page appears.



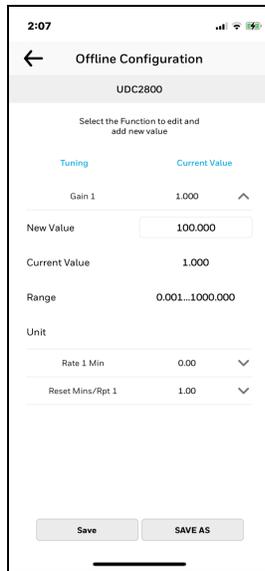
IOS app



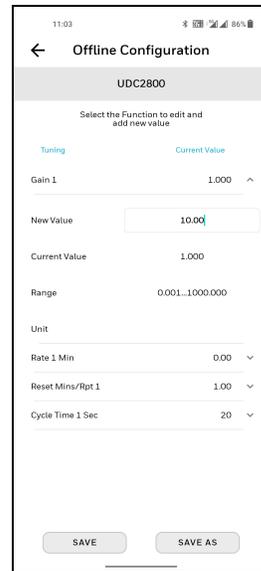
Android app

5. Select a group and edit configurations.

**NOTE:** The groups are organized exactly as on the instrument itself.



IOS app



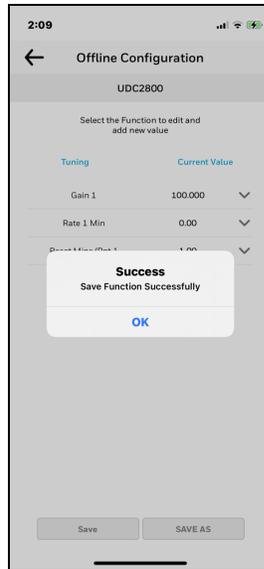
Android app

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.

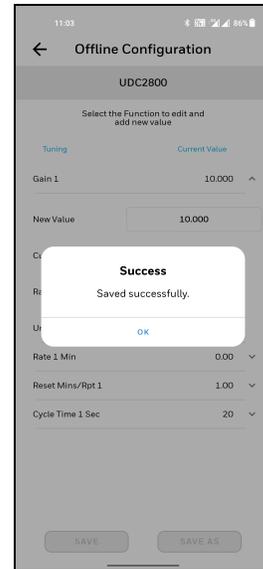
**NOTE:** Save or SAVE AS options are enabled only if any configuration changes happen.

After finishing the configuration:

- Click **Save**. The **Success** dialog appears, and then click **OK**.

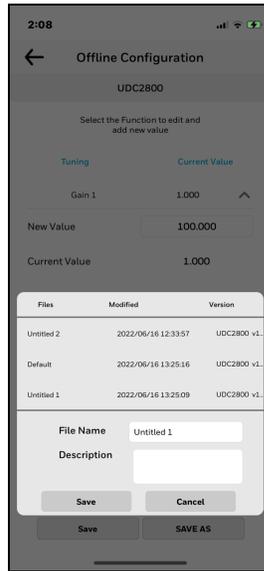


IOS app

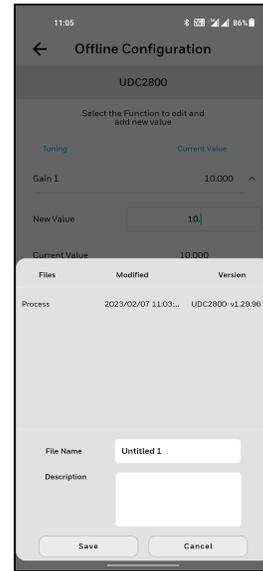


Android app

- If the user wants to save as a new configuration, click **SAVE AS**. Enter **File Name** and **Description** and then click **OK**



IOS app



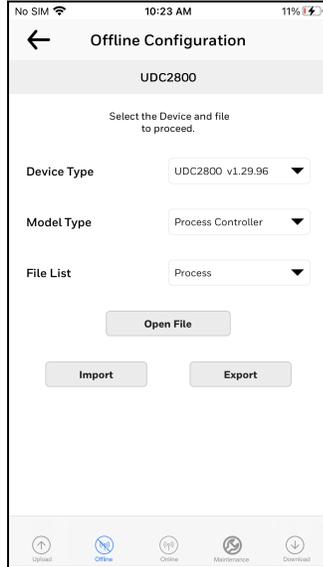
Android app

**ATTENTION:** Users must **Download** the offline configuration to reflect the changes in the UDC device. See Download.

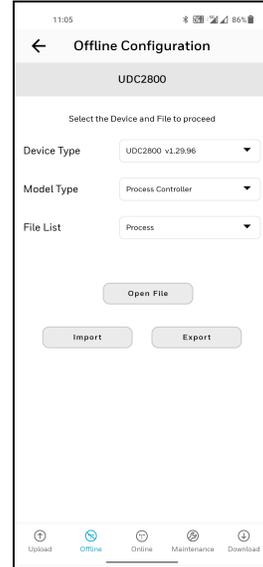
### Export configuration

Users can Export the UDC2800 offline configuration files to .cvt format using the Export option. The exported .cvt files can import to other UDC2800 devices.

1. Open the **EasySet** app.
2. Click **Dashboard**, and click **Offline**. The **Offline Configuration** dialog appears.

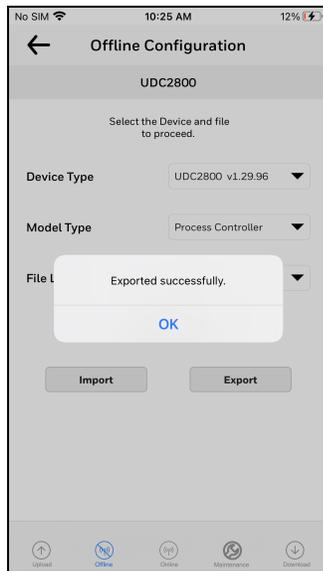


IOS app

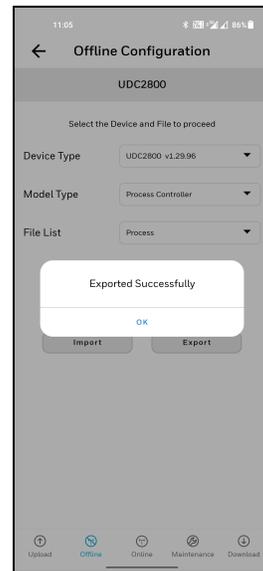


Android app

3. Configure the all parameters and Save the file.
4. Click **Export**. Export options appears.
5. Click **Save to Files** and select the location, and click **Save**. **Exported successfully** pop-up appears, click **OK**.



IOS app



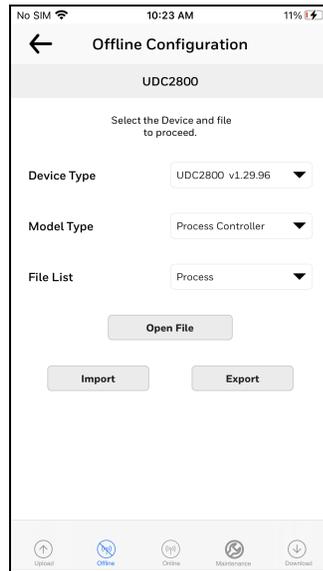
Android app

6. Exported .cvt file can be shared through email to import to the other UDC2800 devices.

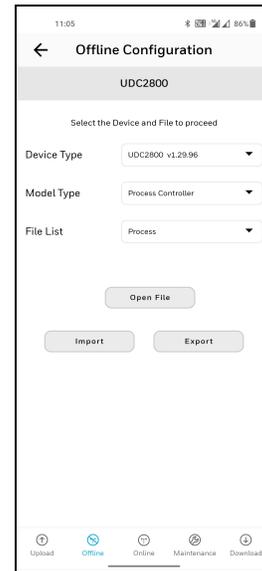
## Import configuration

Using the Import option, users can import the UDC2800 configuration files (.cvt) to the UDC device through the app.

1. Open the mail that contains configuration (.cvt) file. Download the file and save to the IOS mobile.
2. Open the **EasySet** app.
3. Click **Dashboard**, and click **Offline**. The **Offline Configuration** dialog appears.

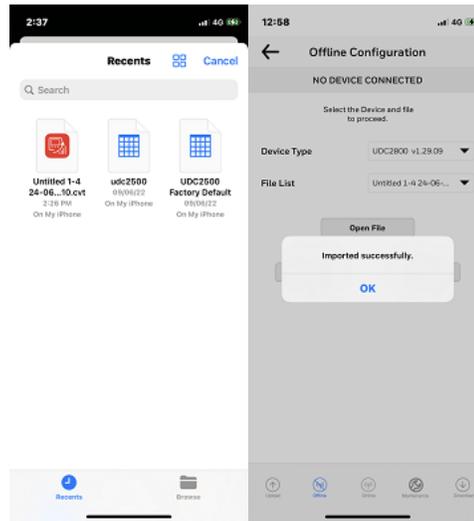


IOS app

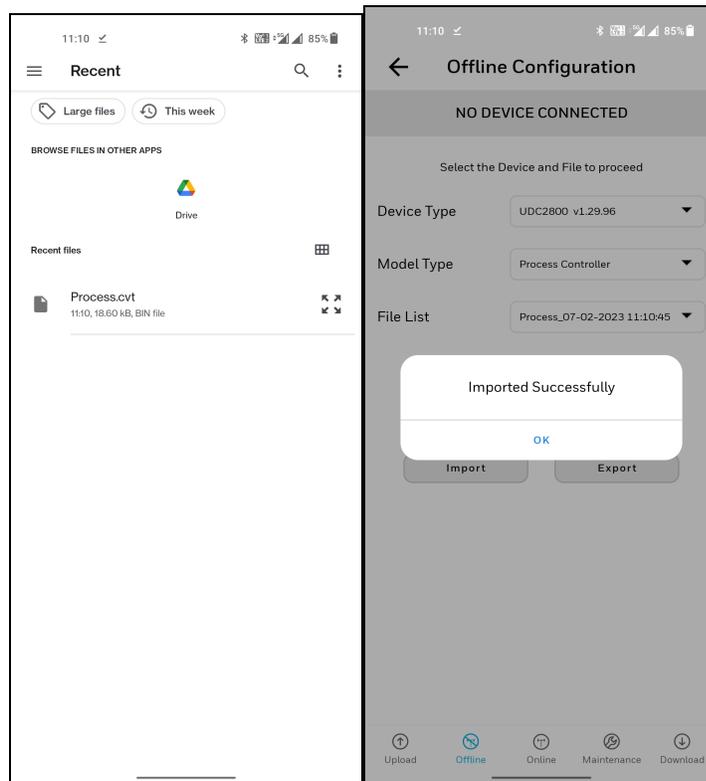


Android app

4. Click **Import**. The import window appears and select the configuration file from the storage. **Imported successfully** pop-up appears, click **OK**.



IOS app



Android app

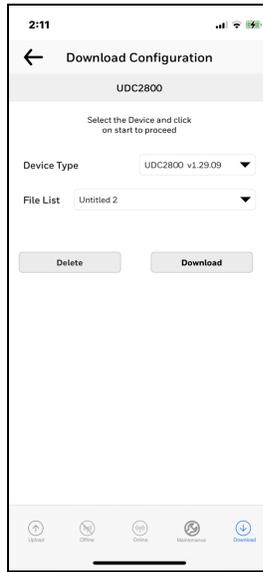
5. Click the arrow at the top left corner to return to the **Dashboard** page.

6. Click **Download**. See Download.

## Download

Using the Download option, users can download saved and offline configurations from the EasySet app to the instrument.

1. Click **Dashboard**. The dashboard page appears.
2. Click **Download**. The **Download Configuration** page appears.



IOS app



Android app

3. 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.

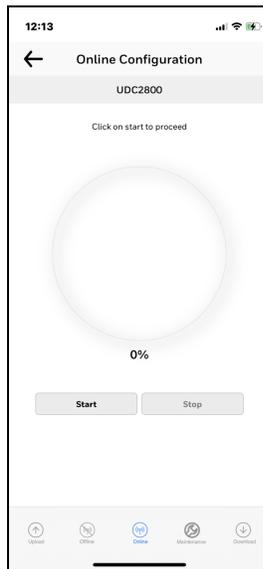
4. Click **Download**, and a dialog appears indicating that the configuration is downloaded successfully.
5. Click **OK**.

**NOTE:** If user want to delete the selected configuration file, click **Delete**. A confirmation dialog appears, and then click **OK**.

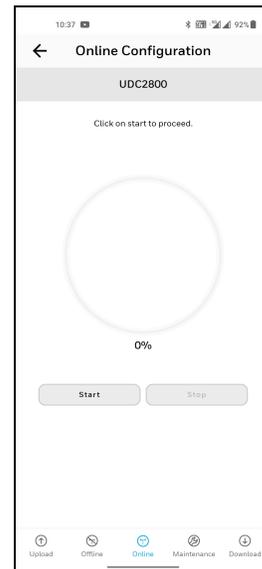
# Online Configuration

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

1. Click **Dashboard**. The dashboard page appears.
2. Click **Online Configuration**. The **Online Configuration** dialog appears.



IOS app

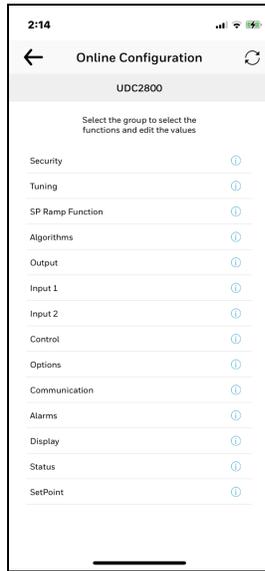


Android app

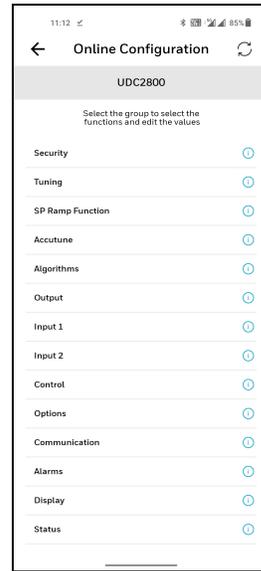
3. Click **Start** to begin upload. Status of upload (% complete) is shown.

**NOTE:** To terminate upload, click **Stop**.

If upload is successful, configurable groups appear.



IOS app

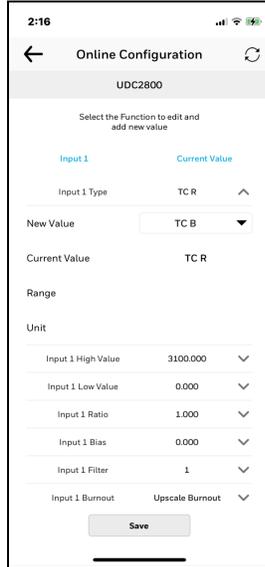


Android app

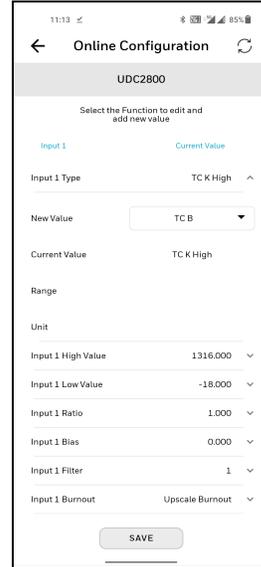
4. Select a group and edit configurations.

**NOTE:** The groups are organized exactly as on the instrument itself.

**NOTE:** In the Honeywell EasySet app for security group lockout parameter max all group parameter options are available for read only.



IOS app

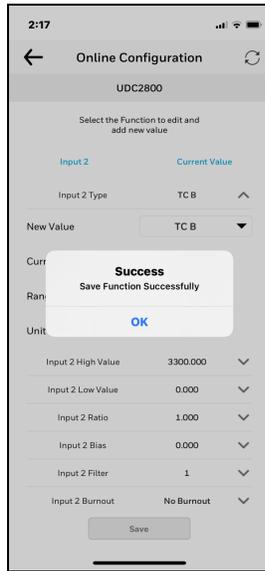


Android app

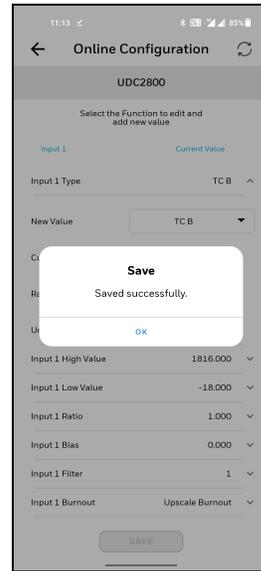
If an analog configuration is highlighted with red text or a digital configuration is shown blank, it means that the value read up from the instrument is now out of range, either because of previous changes to the instrument's configuration or because of incompatibilities with a downloaded configuration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

**ATTENTION:** In Easysset app, the SP Programming value is displayed as **Px.Sy00**, for which the event applies. Px.Sy00 = Program x. Segment y 00. For example, Program2. Segment300 (2.300).

5. Once the configuration is completed, click **Save**. The **Success** dialog appears. Click **OK**.

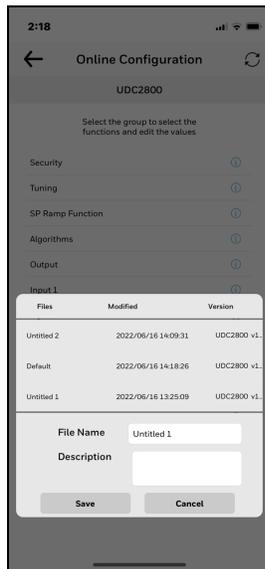


IOS app

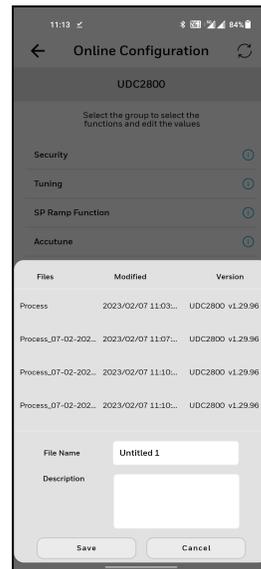


Android app

6. Click the arrow icon at the top left corner to return to the configurable groups page.
7. Click the arrow icon at the top left corner again, a dialog appears to ask you to save the changed configuration for later use in the mobile device.
8. Enter **File Name** and **Description**, and click **Save**.



IOS app



Android app

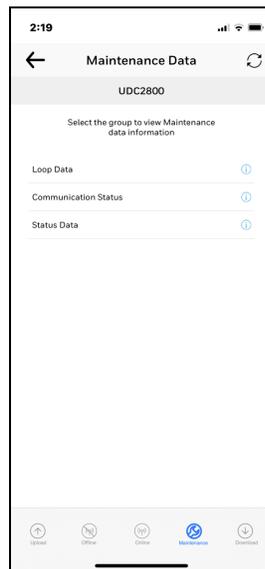
**NOTE:** If user do not want to save the configuration, click **Cancel**.

**NOTE:** Click the **Refresh** icon to reflect the UDC device's configured settings in the Honeywell EasySet app.

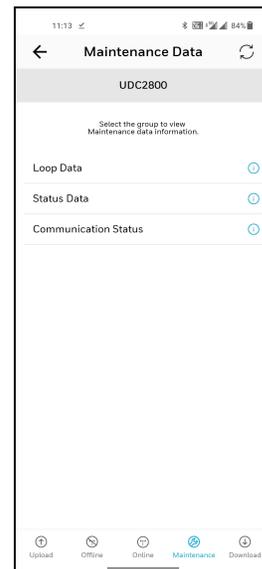
## Maintenance Data

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

1. Click **Dashboard**. The dashboard page appears.
2. Click **Maintenance**. The **Maintenance Data** page appears with **Loop Data**, **Communication Status**, and **Status Data**.

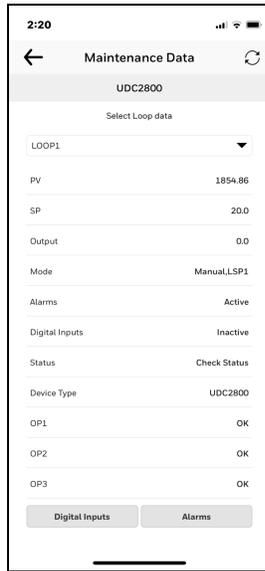


IOS app

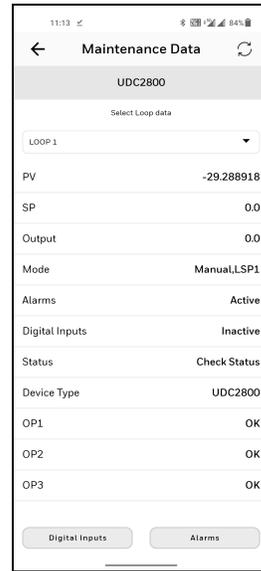


Android app

3. Click **Loop Data**. Loop data page appears.
4. Select the loop from the drop down list, the loop data appears.



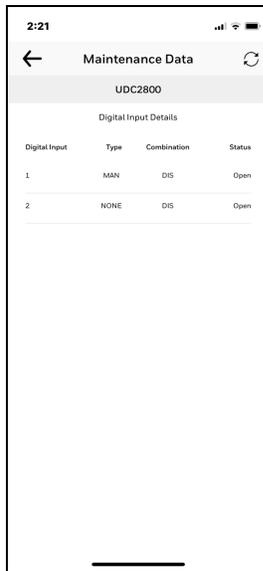
IOS app



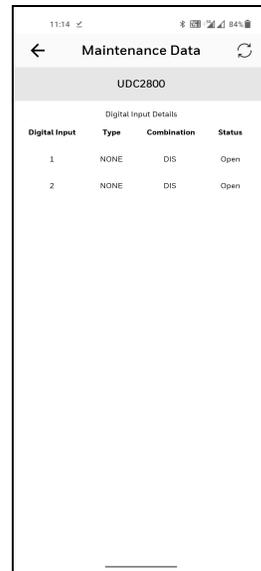
Android app

**NOTE:** To refresh the loop data, click the **Refresh** icon.

- Click **Digital Inputs**. The **Digital Inputs Details** page appears.



IOS app

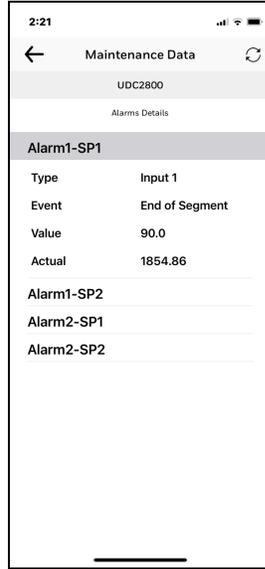


Android app

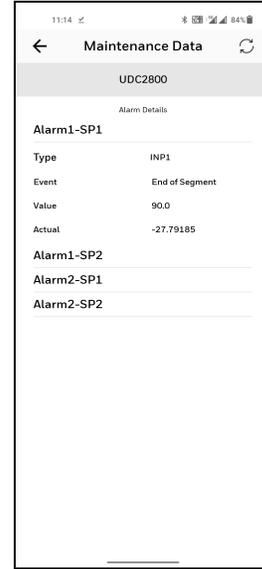
**NOTE:** To refresh Digital Input Details, click the **Refresh** icon.

Click the arrow icon at the top left corner to return to the loop data page.

- Click **Alarms**. The **Alarms Details** page appears.



IOS app

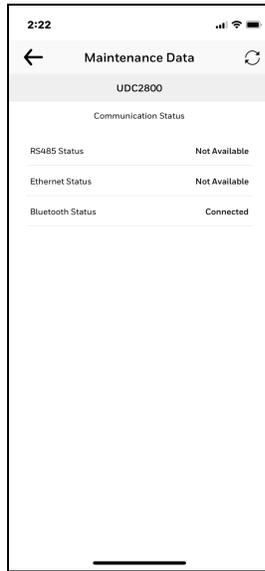


Android app

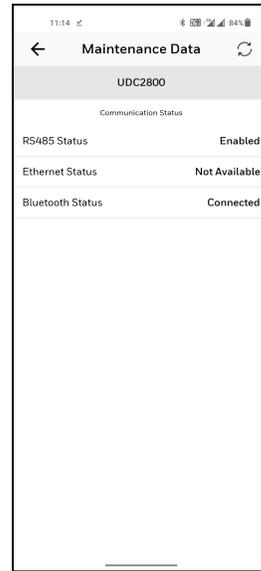
**NOTE:** To refresh Alarms Details, click the **Refresh** icon.

Click the arrow icon at the top left corner to return to the loop data page.

5. Click the arrow icon at the top left corner to return to the maintenance page.
6. Click **Communication Status**. The Communication status page appears.



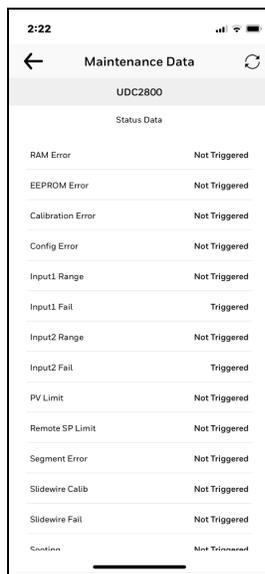
IOS app



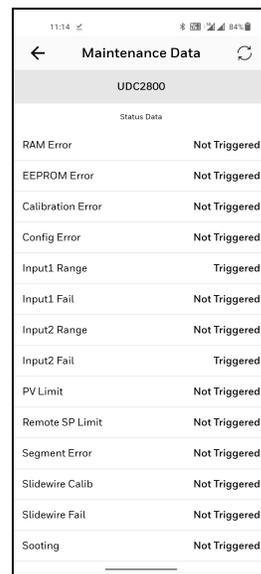
Android app

**NOTE:** The latest EasySet App supports only bluetooth communication.

- Click the arrow icon at the top left corner to return to the maintenance page and click **Status**. Status data page appears.



IOS app

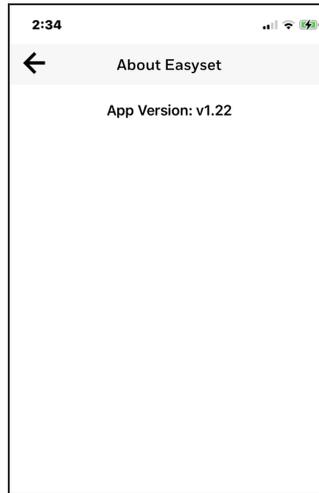


Android app

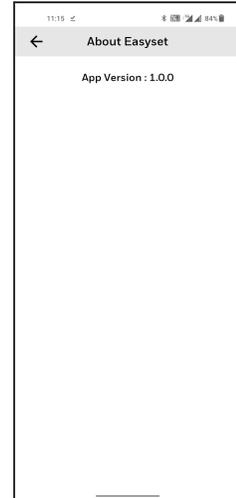
## About EasySet

The About EasySet page includes information about the app's release version.

Click **Menu**, and then click **About Easyset**.



IOS app



Android app

## Firmware update through Easyset App

Users can update the UDC2800 device firmware using Honeywell EasySet IOS app. This app can be installed on IOS 12.0 or Android 9 or higher operating system.

**NOTE:** It is always recommended to update the existing Android or IOS version to the latest version.

**NOTE:** The newly purchased UDC2800 device will have the latest firmware by default, If there is a patch release user needs to upgrade it through Easyset App.

**ATTENTION:** After a firmware update, the UDC device is reset to default factory settings and the user loses all configurations.

### **Prerequisites**

- Connect to the UDC2800 device. See Communications Setup for more information.

### **Download the firmware package**

1. Go to Honeywell Process Solutions website (<https://process.honeywell.com>).
2. Click **Sign In** at the top-right corner of the page.
3. If you are a new user, create a new account at this website. Click **Create an Account**, and follow the on-screen instructions.
4. If you are an existing user, Click **SIGN IN TO MYHPS** and type your **user name** and **password**, and then click **SIGN IN**.

After successful sign in, your account name appears at the top-right of the page.

5. Click **Support>Product Documents & Downloads**. The **Product Documents & Downloads** page appears.
6. In the **Search** box, enter **UDC2800 Firmware**, and then click **Search**.
7. Click the document link from the search results to download it.
8. Open the document and download the firmware file to the IOS or Android mobile.

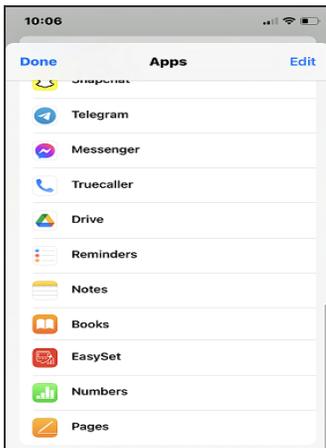
1. Open the firmware file on the IOS mobile.	1. Click the firmware file, and select open with EasySet app.
--	---



2. Click the share icon. Share options appear.
3. Click **More** and select **EasySet** app.



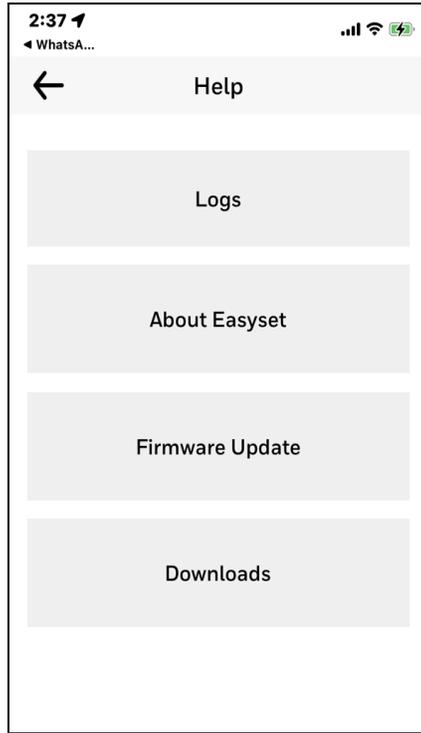
2. Firmware file is imported to the **EasySet** app.



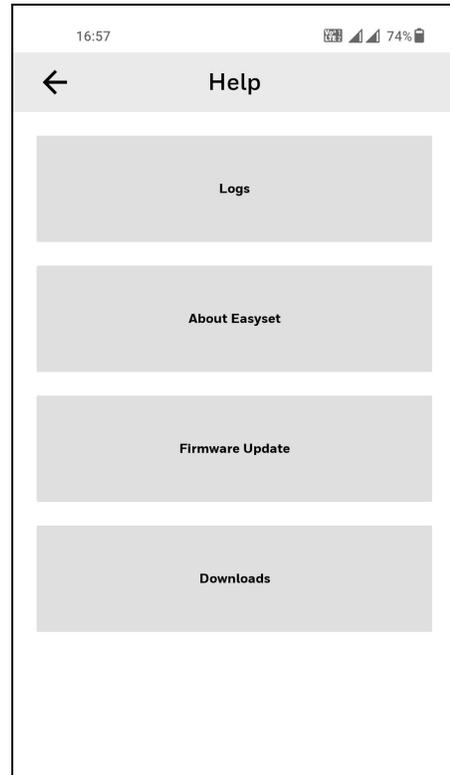
4. Firmware file is imported to the **EasySet** app.

## Update firmware package

1. Open the **EasySet** app.
2. Click **Menu**, the menu options page appears.

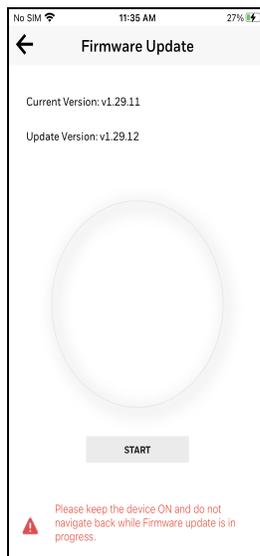


IOS app

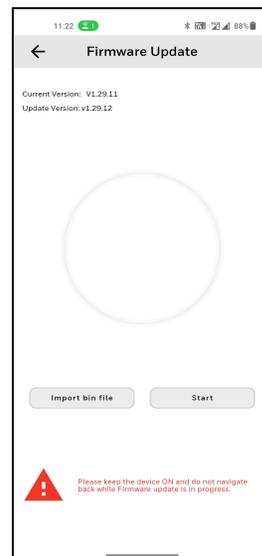


Android app

3. Click **Firmware Update** and then click **START**.

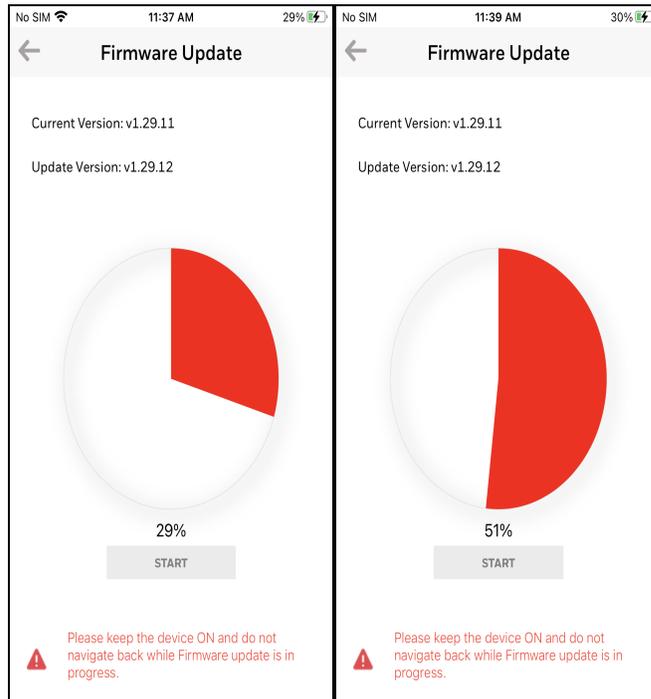


IOS app

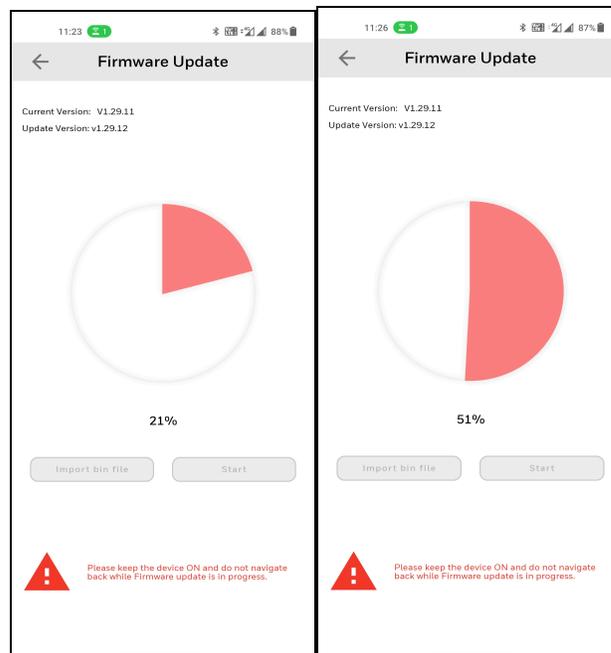


Android app

4. Firmware update process is started.



IOS app



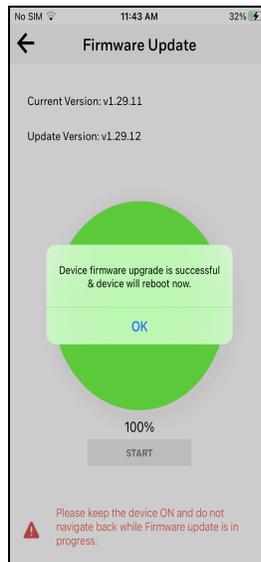
Android app

**ATTENTION:** Do not close or minimize the EasySet app during firmware update.

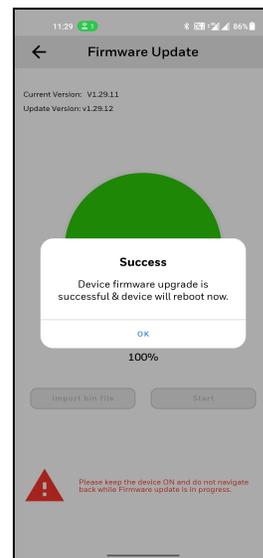
**ATTENTION:** Do not turn off the UDC device during firmware update.

**ATTENTION:** Keep the mobile and the UDC device in the Bluetooth range while updating the firmware.

5. When the firmware update is complete, a message appears that the UDC device is going to reboot. Click **OK** and wait for the device to restart.



IOS app



Android app

**ATTENTION:** The device takes some time to reboot. Do not turn off or stop the device.

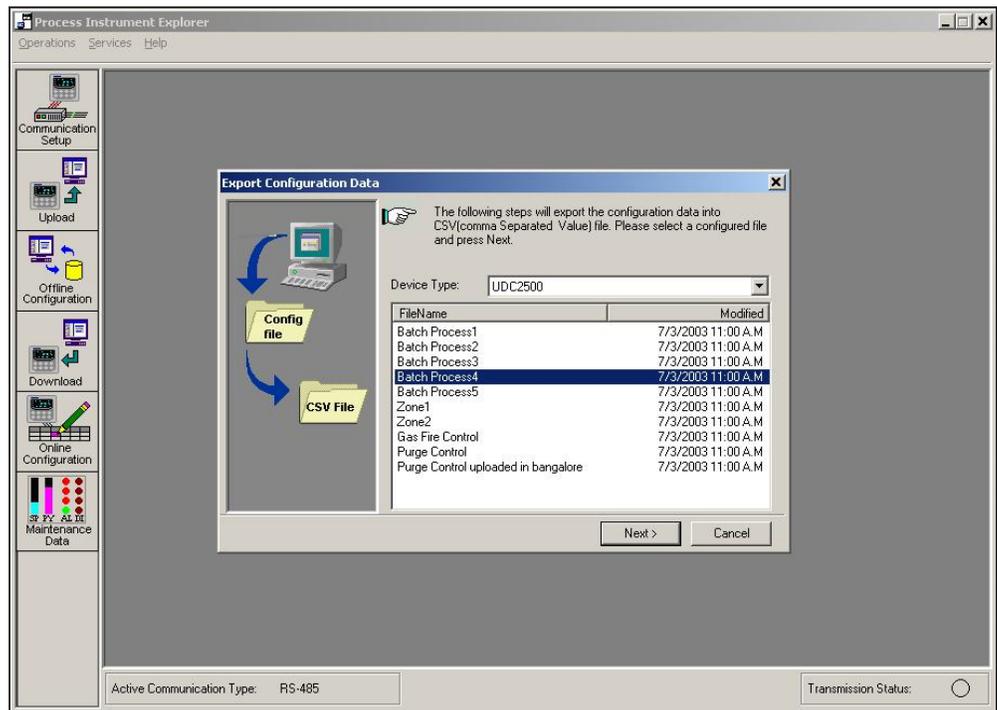
Once the device restarts, the new firmware is installed in the device.

**NOTE:** The default password for the UDC device is 1234. It is recommended to change the password after the first login.

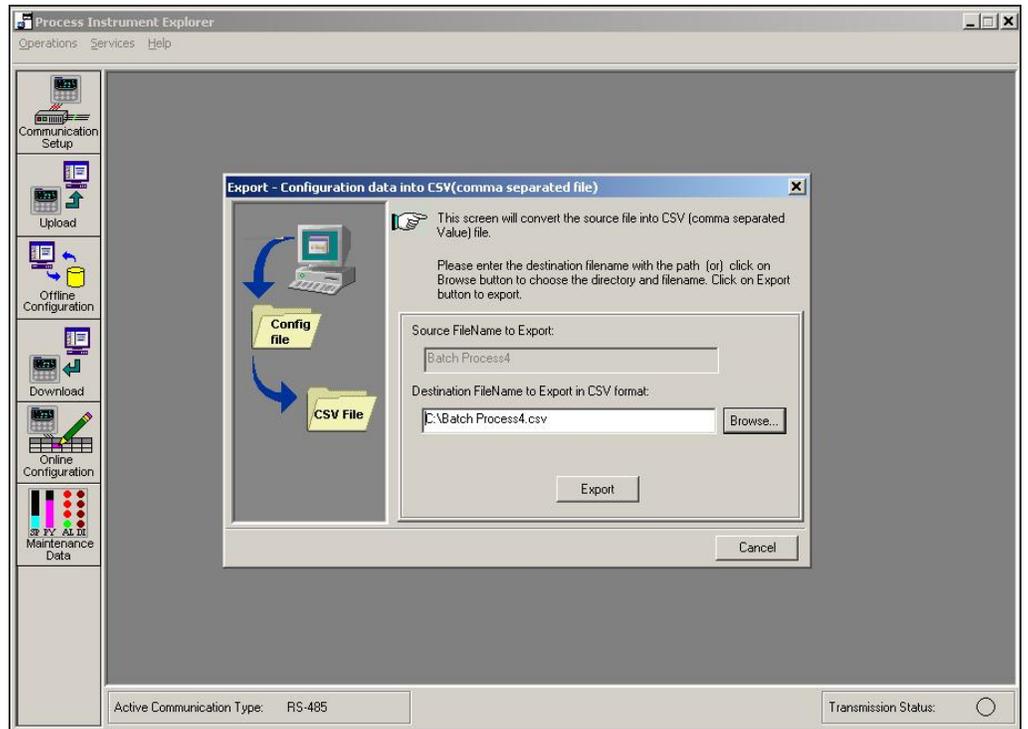
# Transfer configuration from the legacy device to the UDC2800

## *Export configuration from legacy device using PIE tool*

1. Open the PIE tool in the PC (Desktop or Laptop) or pocket PC.
2. Configure communication setup with PIE tool and UDC device.
3. Click **Services>Export Configuration**. A dialog box appears with configuration file information.



4. Select configuration file and click **Next**. A Dialog appears with the selected file for export .



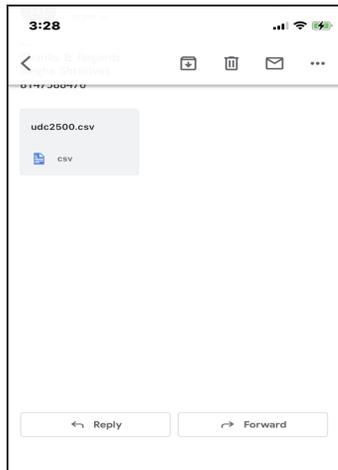
5. Click **Browse** and select the export file destination path . Click **OK**
6. Click **Export**. A confirmation dialog box appears.

The configuration file is exported in .csv format . Send .csv file through mail to import configuration in UDC 2800 device.

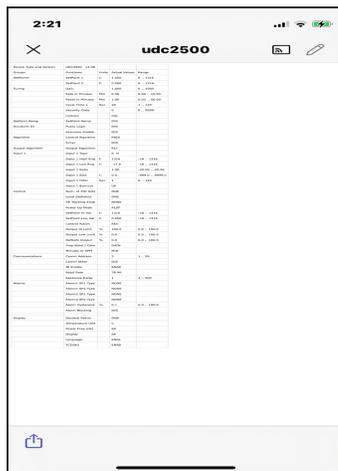
## Import configuration to the UDC 2800 using Easy Set app

Set up communications before uploading or downloading instrument configurations. See Communications Setup for more information.

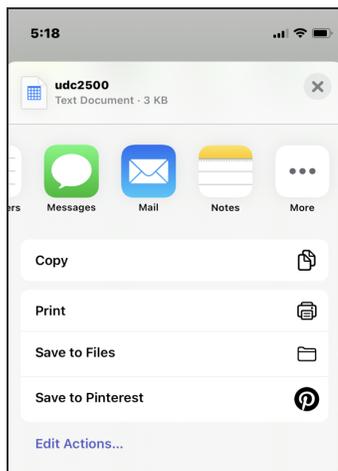
1. Open the mail that contains legacy instrument configuration (.csv) file .



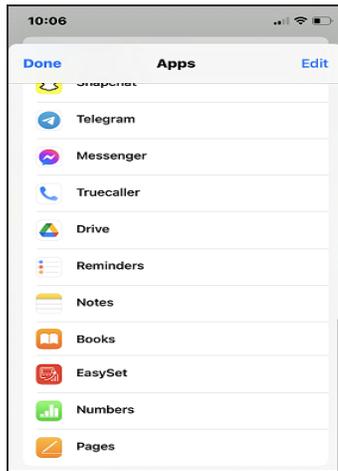
2. Open the .csv file.



3. Click the share icon. Share options are appear.



4. Click **More** and select **EasySet** app.

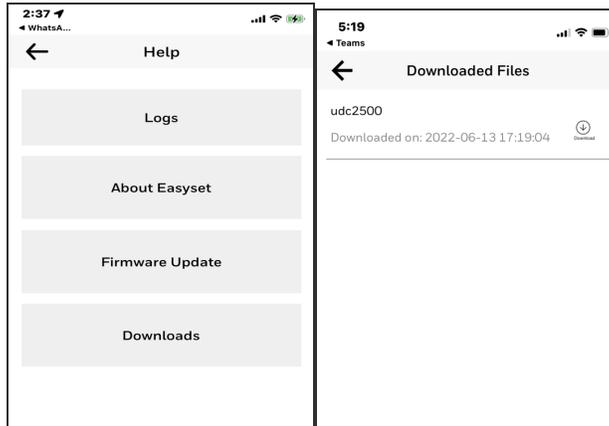


5. Configuration file is uploaded to the app.

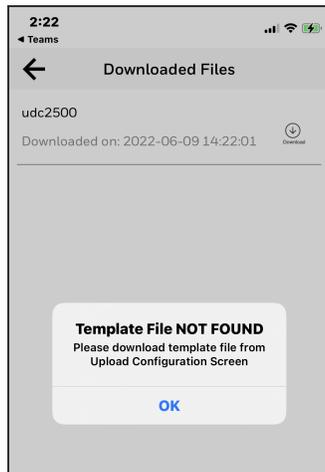


6. Open the **EasySet** app.

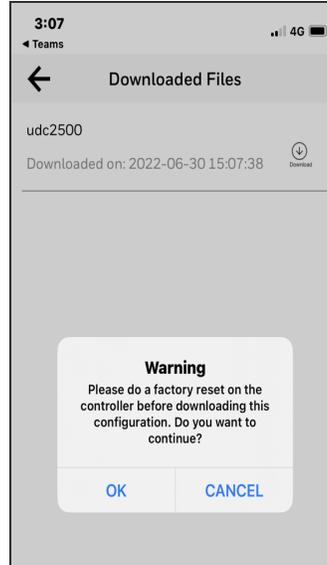
7. Click **Menu >Downloads**. The Download Files page appears



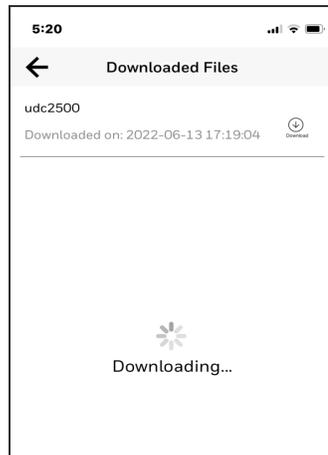
**NOTE:** The **Template file NOT FOUND** pop-up appears on the download page if the configuration file is not uploaded to the app even once.



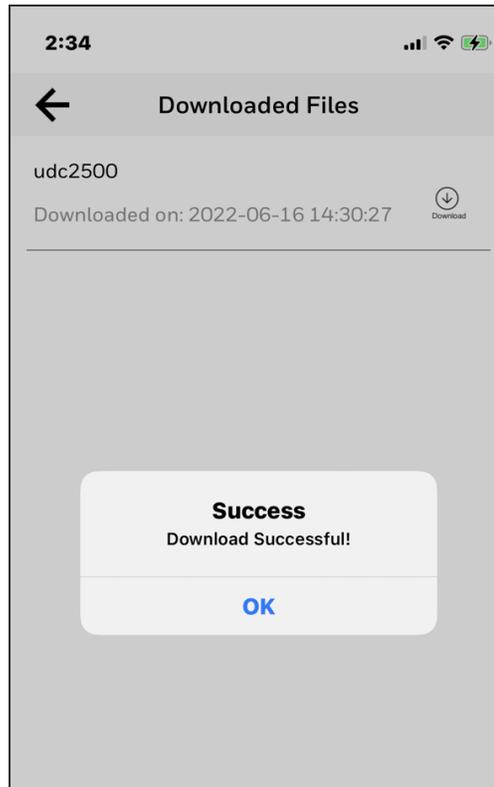
**ATTENTION:** The UDC device must Factory reset from the controller side before downloading any configuration (.csv) file.



8. Click the **Download** icon to download configuration.



9. The **Success** dialog appears. Click **OK**.



**ATTENTION:** As the menu layout for the UDC 2800 changes, the old device SPP, Ethernet and some of the communication group functions do not migrate. The user must configure the settings manually for the first time.

Legacy UDC device configuration is successfully imported to the UDC 2800 device.

# MODBUS RTU FUNCTION CODES 20&21

This section describes the function codes needed to upload and download the configuration from a host computer into the instrument.

**NOTE:** The UDC 2800 MODBUS addresses are different with legacy UDC modules.

Table 11-1: Modbus Function Codes 20&21 Definitions

Function Code	Name	Usage
20 (14h)	Read General Reference	Used to Read or upload the instrument's configuration into the host device.  See Function Code 20 (14h) - Read Configuration Reference Data for more information.
21 (15h)	Write General Reference	Used to Write or download an instrument's configuration into the instrument from a host device.  See Function Code 21 (15h) - Write Configuration Reference Data for more information.

## General Information

This instrument uses a subset of the standard Modbus RTU function codes to provide access to process-related information. Several MODICON function codes are implemented too. It is appropriate to define instrument-specific "user-defined" function codes. Where differences occur between the two protocols it will be noted. Several standard Modbus RTU function codes are supported, see Standard Modbus Read, Write and Override Parameters for more information.

## Configuration ID Tags

Function codes 20 and 21 use the RS485 tag IDs for accessing configuration and process-related data. These tags are fully explained in Section Modbus Read, Write and Override Parameters.

The tag IDs represent the register addresses used in the Request Message.

## Register Address Structure

Table 11-2: Integer Parameter Type

Register Numbers (Dec)	Name	Access	Notes
1	Type = 1	NOT SUPPORTED	16-bit Unsigned Integer
2	Attribute	NOT SUPPORTED	1 = Read Only, 2 = Read/Write
3	Value (16 bit integer)	Read / Write	
4	Not Used	NOT SUPPORTED	
5	Low Range (16 bit integer)	NOT SUPPORTED	
6	Not Used	NOT SUPPORTED	
7	High Range (16 bit Integer)	NOT SUPPORTED	
8	Not Used	NOT SUPPORTED	
9 to 13	Description Text (ASCII string)	NOT SUPPORTED	

Table 11-3: Floating Point Parameter Type

Register Numbers (Dec)	Name	Access	Notes
1	Type = 2	NOT	IEEE Floating

Register Numbers (Dec)	Name	Access	Notes
		SUPPORTED	Point
2	Attribute	NOT SUPPORTED	1 = Read Only, 2 = Read/Write
3	Value (float high word)	Read / Write	
4	Value (float low word)	NOT SUPPORTED	
5	Low Range (float high word)	NOT SUPPORTED	
6	Low Range (float low word)	NOT SUPPORTED	
7	High Range (float high word)	NOT SUPPORTED	
8	High Range (float low word)	NOT SUPPORTED	
9 to 13	Description Text (ASCII string)	NOT SUPPORTED	

## Register Count

The register count depends on the data format of the registers being read or written.

Integer data is represented in sixteen bits and is transferred high byte first.

Floating point data is transferred in IEEE 32-bit format.

The register count definitions are:

0001 = Integer Data

0002 = Floating Point Data

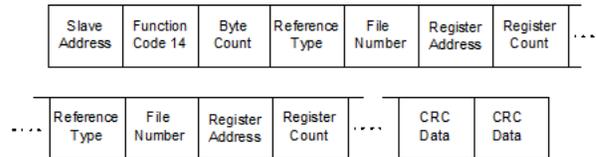
# Function Code 20 (14h) - Read Configuration Reference Data

Function code 20 (14 Hex) is used in this instrument to read information stored in its configuration database. Each configuration item is explicitly addressed by a file number and register address. IEEE 32-bit floating point and 16-bit integer formats are supported.

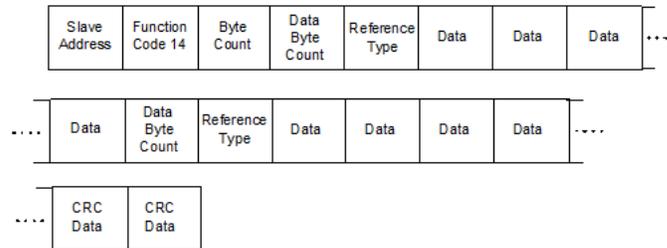
## Request and Response Formats

The Request and Response formats for Function code 20 (14 Hex) are shown below. Details for each block reference follow.

### Request Message Format



### Response Message Format



### Byte Count

The Byte Count equals the number of bytes transmitted in either the request or response message and will be the minimum number required to transmit all requested data.

### Data Byte Count

The Data Byte Count is the number of data bytes of the sub response including the Reference Type but not including itself. A floating point sub response has four bytes of data and one byte representing the reference type making the data byte count equal to five.

## Reference Type Definitions

The Reference Type definition is always 06.

See Read Configuration Examples for more information.

## File Number

The file number word contains the register number from [Register Address Structure](#). Although the register address structure tables indicate up to 13 data registers are available for access, only register address 3 is currently supported.

## Register Address

The register address word represents the tag ID number for the parameter(s) being accessed. The register address word is made up of two bytes—the MSB = 00 always. The LSB contains the tag ID number. The tag ID numbers represent the parameter's register address(es). See Configuration for more information.

Table 11-4: Register Address Format for Function Code 20

Register Address(es) (Decimal)	Register Address(es) (Hex)	Format
1 to 2048	1 to 800	analog formatted data (2 registers – IEEE 32-bit floating point)
2049 to 4096	801 to 1000	integer formatted data (1 register – 16-bit integer)

## Read Configuration Examples

### Example #1

The following is an example of a request to read the Gain 1 value using Function code 20.

**Request Message** (Read (Gain 1) = ID Tag  
001)02 14 07 06 00 03 00 01 00 02 (CRC16)

Where:

02 = Address

14 =Function Code 20 (14 hex)

07 = Byte Count

06 = Reference Type

00,03 = File Number (Access Data Value)

00,01 = Register Address (Standard Access Gain 1 - Tag ID #1)

00 02 = Register Count (Floating Point Data)

(CRC16)

This is the response to the above request.

**Response Message**

02 14 06 05 06 3F C0 00 00 (CRC16)

Where:

02 = Address

14 = Function Code 20 (14 Hex)

06 = Byte Count

05 = Sub Message Length

06 = Reference Type (IEEE Floating Point)

3F C0 00 00 = 1.50 (Value of Proportional Band)

(CRC16)

**Example #2**

The following is another example of a request and response message using Function code 20.

**Request Message** (Read LSP #1 = ID Tag 39 and LSP #2 = ID Tag 53)

02 14 0E 06 00 03 00 27 00 02 (CRC16)

Where:

02 = Address

14 = Function Code 20 (14 Hex)

07 = Byte Count

06 = Reference Type (IEEE Floating Point)

00,03 = File Number (Access Data Value)

00,27 = Register Address (Standard Access LSP #1 - ID Tag 39)

00,02 = Register Count to read (Floating Point Data)

(CRC16)

This is the response to the above request.

#### Response Message

02 14 0C 05 06 43 C8 00 00 (CRC16)

Where:

02 = Address

14 = Function Code 20 (14 Hex)

0C = Byte Count

05 = Data Byte Count (Sub Message Length)

06 = Reference Type (IEEE Floating Point)

43 C8 00 00 = 400.0 (Value of Local Setpoint #1)

(CRC16)

## Function Code 21 (15h) - Write Configuration Reference Data

Function Code 21 (15 Hex) is used in this instrument to allow writes of integer and floating point values to the configuration database and override values.

The configuration database of this instrument is located in EEROM. The override values are stored in RAM.

Integer format is used to write to “Digital” configuration items. Floating Point format is used to write to “Analog” configuration items as defined by the configuration ID tags.

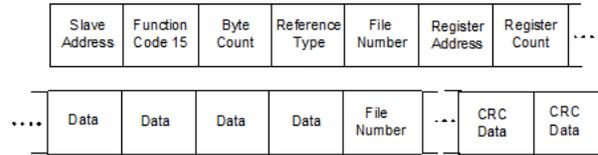
### Write Restrictions

Care should be taken not to exceed the 100,000 write limit of the EEROM.

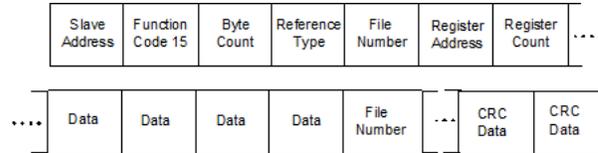
### Request and Response Formats

The Request and Response formats for Function code 21 (15 Hex) are shown below. Details for each block reference follow.

## Request Message Format



## Response Message Format (echo back of request)



The register address is interpreted by this instrument as the tag ID configuration number.

## Reference Type Definitions

The Reference Type definition is always 06.

See Write Configuration Examples for more information.

## File Number

The file number word contains the register number from the register address structure shown in table Integer Parameter Type and table Floating Point Parameter Type. Although the register address structure tables indicate up to 13 data registers are available for access, only register address 3 is currently supported.

## Register Address

The register address is used to designate the tag ID number for the parameter being accessed. The register address is made up of two bytes—the MSB = 00 always. The LSB contains the tag ID number. The tag ID numbers represent the parameter’s register address (es). See Modbus Read, Write and Override Parameters for more information.

Table 11-5: Register Address Format for Function Code 21

Register Address(es) (Dec)	Register Address(es) (Hex)	Format
1 to 2048	1 to 800	analog formatted data

Register Address(es) (Dec)	Register Address(es) (Hex)	Format
		(2 registers – IEEE 32-bit floating point)
2049 to 4096	801 to 1000	integer formatted data (1 register – 16-bit integer)

## Unrestricted Registers

As mentioned previously, all register data is stored in the EEROM of this instrument with some exceptions. These exceptions were made to allow write access to override information. The registers, which are designated as Override values, are listed below. These registers do not have restrictions on the number of writes.

ID Tag	Register Number	UDC Usage
263	107 (Hex)	Computer Setpoint Loop 1
343	157 (Hex)	Computer Setpoint Loop 2

## Restrictions on Parameter Numbers in One Message

The maximum number of writable parameters per write request is 1.

## Write Configuration Examples

### Example #1

The following is an example of a request to write the Gain 1 value using Function code 21 (15 Hex).

**Request Message** (Write Gain 1= 1.5 "ID Tag 1")

02 15 0B 06 00 03 00 01 00 02 3F C0 00 00 (CRC16)

Where:

02 = Address

15 =Function Code 21 (15 hex)

0B = Byte Count

06 = Reference Type (IEEE Floating Point)

00 03 = File Number (Access Data Value)  
00 01 = Register Address (Standard Access - Gain 1 - ID Tag 1)  
00 02 = Register Count (Floating Point Data)  
3F C0 00 00 = 1.50  
(CRC16)

This is the response to the above request.

**Response Message** (The response is an echo of the request)

02 15 0B 06 00 01 00 02 00 02 3F C0 00 00 (CRC16)

## Modbus Read, Write and Override Parameters

This section contains information concerning Reading, Writing, and Overriding parameters in UDC2800 Process Controller. There are two types of parameters:

- **Data Transfer** - These parameters include reading control data, option status, and reading or changing setpoints.
- **Configuration Data** - All the configuration data is listed in the order in which it appears in the controller.

Each type of parameter has the identifying codes listed with it.

### General Information

#### Analog Parameters

Whenever analog register addresses (those that can be changed via communications) are changed, a Write cycle occurs after receipt of the message and the response is returned.

#### Override Parameters

Override analog register address 107 (computer setpoint) is not stored in non-volatile memory. It can be changed as frequently as desired with no effect on non-volatile memory retentivity, but the controller must remain in the slave mode.

#### Digital Parameters

Whenever digital configuration register addresses are updated via communications, the non-volatile memory is updated as soon as the message is received.

#### Communications Transfer Rates

Reads minimum 20mS and writes minimum 200mS.

#### Supported Function Codes

- Bluetooth port 20 and 21
- RS485 and Ethernet ports 1, 2, 3, 4, 6, 8, 16, 17, 20, 21

#### Communications Modes of Operation

When the Shed Timer is enabled and a write or override occurs the controller will enter Slave Mode. The keypad is locked from the operator. The purpose of this mode is that if communications is lost and the shed timer times out then the controller will enter a known state of operation. The configuration of the “Shed Mode and Output” and Shed Setpoint Recall are used to configure the controller’s shed state. While in Slave Mode pushing the Man Auto key enters Emergency Manual mode. The local operator then has control of the output. The controller is in Monitor Mode if the Shed timer is disabled.

#### Reading Control Data

The following control data can be read from the controller:

- Input 1
- Input 2
- PV, SP, Output for each loop

#### Register Addresses

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 11-6: Control Data Parameters*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input #1	190	400	FP	RD	In Engineering Units or Percentage
Input #2	191	401	FP	RD	In Engineering Units or Percentage

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
PV, SP, Output Loop 1	192	402	FP	RD	In Engineering Units or Percentage
PV, SP, Output Loop 2	193	403	FP	RD	In Engineering Units or Percentage

### Read Software Options Status

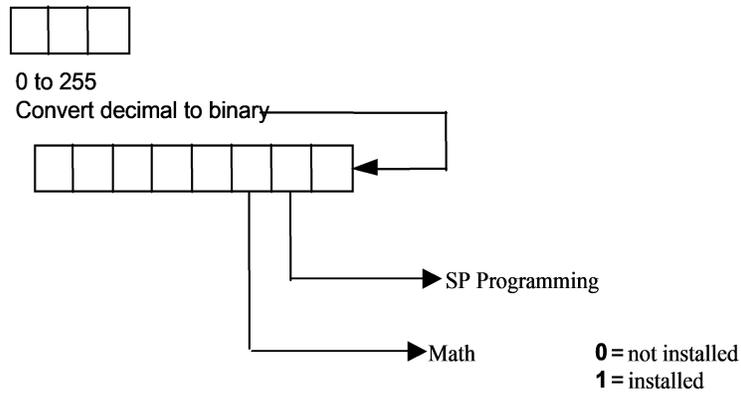
Doing a Read of register address 9C4 listed in the following table will tell you which of the available options are enabled / installed or disabled / not installed.

Table 11-7: Option Status

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Software Option Status	9C4	2500	INT	RD	See figure below

The data field in the response message will be a decimal number from 0 to 255. Convert the decimal number to binary as shown in the figure below to determine which options are or are not active.

Figure 11-1: Software Option Status Information



**EXAMPLE: 2**

Binary 

0	0	0	0	0	0	1	0
---	---	---	---	---	---	---	---

 SP Programming – installed

## Miscellaneous Read Onlys

### *Register Addresses for Read Only*

The identifying register addresses listed in this table represent some information that is Read only. No Writes allowed.

*Table 11-8: Miscellaneous Read Only*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Software Type	9C5	2501	INT	RD	0 ~ 65535
Software Version	9C6	2502	INT	RD	0 ~ 65535

### *SetPoint Program Read Only Information*

The identifying register addresses listed this table represent some information for Setpoint Programming that is Read only. No Writes allowed.

*Table 11-9: Miscellaneous Read Onlys*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Present SPP Segment Number	9C8	2504	INT	RD	1 ~ 8
Segment Time Remaining in Minutes	9C9	2505	INT	RD	0 ~ 59 Minutes
Segment Time Remaining in Hours	9CA	2506	INT	RD	0 ~ 99 Hours
Cycles Remaining	9CB	2507	INT	RD	0 ~ 99
Current Cycle Number	9CC	2508	INT	RD	0 ~ 99

## Setpoints

You can use two separate local setpoints in the controller. The identifying register addresses listed in the following table allow you to select which setpoint you want to use and to enter a value in Engineering Units (whichever is selected at register address 8D7 (Hex)) for that setpoint via communications.

## Register Address

Make your selection using register address 8A5 (Hex) and enter the value for the setpoint chosen using register address in table below.

Table 11-10: Setpoint Code Selections

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Local Setpoint #1 Loop 1	123	291	FP	R/W	Value within the setpoint range limits
Local Setpoint #2 Loop 1	124	292	FP	R/W	Value within the setpoint range limits
Local Setpoint #3 Loop 1	125	293	FP	R/W	Value within the setpoint range limits
Local Setpoint #4 Loop 1	126	294	FP	R/W	Value within the setpoint range limits
Number of Local Setpoints Loop 1	8A5	2213	INT	R/W	00 = Local Setpoint #1 only 01 = 2nd Local Setpoint via keyboard or communications 02 = 3rd Local Setpoint via keyboard or communications 03 = 4th Local Setpoint via keyboard or communications
Local Setpoint #1 Loop 2	15A	346	FP	R/W	Value within the setpoint range limits
Local Setpoint #2	15B	347	FP	R/W	Value within the setpoint

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Loop 2					range limits
Local Setpoint #3 Loop 2	15C	348	FP	R/W	Value within the setpoint range limits
Local Setpoint #4 Loop 2	15D	349	FP	R/W	Value within the setpoint range limits
Number of Local Setpoints Loop 2	912	2322	INT	R/W	00 = Local Setpoint #1 only 01 = 2nd Local Setpoint via keyboard or communications 02 = 3rd Local Setpoint via keyboard or communications 03 = 4th Local Setpoint via keyboard or communications

## Associated Parameters

Refer to table below to display or change any of the parameters associated with the setpoint.

*Table 11-11: Setpoint Associated Parameters*

Parameter	Register Address	
	Hex	Decimal
Setpoint Limits Loop 1	E5, E6	229, 230
Setpoint Limits Loop 2	149, 14A	329, 330
Computer Setpoint Loop 1	107	263
Computer Setpoint Loop 2	157	343

## Using a Computer Setpoint (Overriding Controller Setpoint)

You can use a setpoint generated from the computer to override the setpoint being used by the controller. The value generated by the computer will have ratio and bias applied by the controller.

## Register Address

Use the identifying code in table below to enter the computer setpoint.

*Table 11-12: Computer Setpoint Selection*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Computer Setpoint Loop 1	107	263	FP	R/W	Value from computer with Ratio and Bias applied by the controller. Within the Setpoint Range Limits in Engineering Units or Percent.
Computer Setpoint Loop 2	157	343	FP	R/W	Value from computer with Ratio and Bias applied by the controller. Within the Setpoint Range Limits in Engineering Units or Percent.

## Shed

The computer setpoint override will continue until SHED from communications occurs or the controller is placed into monitor mode through communications. Doing periodic SLAVE READS within the shed time will allow the override to continue until communication is stopped and shed time elapses. Does not apply to Bluetooth communications.

**ATTENTION:** 0 Shed (code 8D4 (Hex)) allows the override to continue indefinitely or until the reset shed timer register address 1B90 is written using function code 6 or register address 199 (Hex) using function code 21. Any data value can be written because it is ignored.

When SP is overridden, the middle display shows the CSP value as CSP XXXX.

Table 11-13: Shed Timer Reset

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Shed Time Reset Loop 1	199	409	FP	W	Exit Slave Mode Loop 1
Shed Time Reset Loop 2	19A	410	FP	W	Exit Slave Mode Loop2

## Associated Parameters

Refer to table below for the codes to display or change any of the parameters associated with the computer setpoint on **Loop 1**.

Parameter	Register Address	
	Hex	Decimal
Setpoint Limits	E5, E6	229, 230
Local Setpoint #1	123	291
Local Setpoint #2	124	292
Local Setpoint #3	125	293

Parameter	Register Address	
	Hex	Decimal
Local Setpoint #4	126	294
Local Setpoint Selection	8A5	2213
Computer Setpoint Ratio	105	261
Computer Setpoint Bias	106	262
Shed Timer Reset	199	409

Refer to table below for the codes to display or change any of the parameters associated with the computer setpoint on **Loop 2**.

Parameter	Register Address	
	Hex	Decimal
Setpoint Limits	149, 14A	329,330
Local Setpoint #1	15A	346
Local Setpoint #2	15B	347
Local Setpoint #3	15C	348
Local Setpoint #4	15D	349
Local Setpoint Selection	912	2322
Computer Setpoint Ratio	155	341
Computer Setpoint Bias	156	342
Shed Timer Reset	19A	410

## 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 11-14: Set-up Group – Security

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Lockout (keyboard only)  Changes to data are always possible via communications regardless of this configuration.	801	2049	INT	R/W	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 available  4 = Maximum Lockout
Man/Auto Key Lockout	802	2050	INT	R/W	0 = Disable  1 = Enable
Run/Hold Key Lockout	803	2051	INT	R/W	0 = Disable  1 = Enable
Setpoint Key Lockout	804	2052	INT	R/W	0 = Disable  1 = Enable

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Restore Settings	805	2053	INT	R/W	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 11-15: Set-up Group – Tuning*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Gain 1 See Note 1	1	1	FP	R/W	0.01 to 1000 Gain
Proportional Band 1 See Note 1	2	2	FP	R/W	0.1 to 1000 Proportional Band
Rate 1 Min See Note 1	3	3	FP	R/W	0.00 to 10.00
Reset Mins/Rpt 1 See Note 1	4	4	FP	R/W	0.02 to 50.00
Reset Rpts/Min 1 See Note 1	5	5	FP	R/W	0.02 to 50.00
Manual Reset	6	6	FP	R/W	-100 to +100
Gain 2 See Note 1	7	7	FP	R/W	0.01 to 1000 Gain
Proportional Band 2	8	8	FP	R/W	0.1 to 1000 Proportional Band

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
See Note 1					
Rate 2 Min See Note 1	9	9	FP	R/W	0.00 to 10.00
Reset Mins/Rpt 2 See Note 1	A	10	FP	R/W	0.02 to 50.00
Reset Rpts/Min 2 See Note 1	B	11	FP	R/W	0.02 to 50.00
Gain 3 See Note 1	C	12	FP	R/W	0.01 to 1000 Gain
Proportional Band 3 See Note 1	D	13	FP	R/W	0.1 to 1000 Proportional Band
Rate 3 Min See Note 1	E	14	FP	R/W	0.00 to 10.00
Reset Mins/Rpt 3 See Note 1	F	15	FP	R/W	0.02 to 50.00
Reset Rpts/Min 3 See Note 1	10	16	FP	R/W	0.02 to 50.00
Gain 4 See Note 1	11	17	FP	R/W	0.01 to 1000 Gain
Proportional Band 4 See Note 1	12	18	FP	R/W	0.1 to 1000 Proportional Band

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Rate 4 Min See Note 1	13	19	FP	R/W	0.00 to 10.00
Reset Mins/Rpt 4 See Note 1	14	20	FP	R/W	0.02 to 50.00
Reset Rpts/Min 4 See Note 1	15	21	FP	R/W	0.02 to 50.00
Cycle Time 1 Sec	80B	2059	INT16	R/W	1 to 120 seconds
Cycle Time 2 Sec	80C	2060	INT16	R/W	1 to 120 seconds
<b>Note 1:</b> Writes to these locations are not available when Accutune is enabled.					

## Tuning 2

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

Table 11-16: Set-up Group – Tuning

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Gain 5	12F	303	FP	R/W	0.01 to 1000 Gain
Proportional Band 5	130	304	FP	R/W	0.1 to 1000 Proportional Band
Rate 5 Min	131	305	FP	R/W	0.00 to 10.00
Reset Mins/Rpt 5	132	306	FP	R/W	0.02 to 50.00
Reset Rpts/Min 5	133	307	FP	R/W	0.02 to 50.00
Manual Reset 5	134	308	FP	R/W	-100 to +100
Gain 6	135	309	FP	R/W	0.01 to 1000 Gain
Proportional Band 6	136	310	FP	R/W	0.1 to 1000 Proportional Band
Rate 6 Min	137	311	FP	R/W	0.00 to 10.00
Reset Mins/Rpt 6	138	312	FP	R/W	0.02 to 50.00
Reset Rpts/Min 6	139	313	FP	R/W	0.02 to 50.00
Gain 7	13A	314	FP	R/W	0.01 to 1000 Gain
Proportional Band 7	13B	315	FP	R/W	0.1 to 1000 Proportional Band
Rate 7 Min	13C	316	FP	R/W	0.00 to 10.00
Reset Mins/Rpt 7	13D	317	FP	R/W	0.02 to 50.00
Reset Rpts/Min 7	13E	318	FP	R/W	0.02 to 50.00
Gain 8	13F	319	FP	R/W	0.01 to 1000 Gain
Proportional Band 8	140	320	FP	R/W	0.1 to 1000 Proportional Band
Rate 8 Min	141	321	FP	R/W	0.00 to 10.00

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Reset Mins/Rpt 8	142	322	FP	R/W	0.02 to 50.00
Reset Rpts/Min 8	143	323	FP	R/W	0.02 to 50.00
Cycle Time 5 Sec	904	2308	INT	R/W	1 to 120 seconds
Cycle Time 6 Sec	905	2309	INT	R/W	1 to 120 seconds

**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 11-17: Set-up Group – Setpoint Ramp/Program*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Ramp Function	815	2069	INT	R/W	0 = Disabled 1 = Enabled 2 = Enabled 2 3 = Enabled 1 & 2
Ramp Time Min	20	32	FP	R/W	0 to 255 (minutes)
Ramp Final SP	1F	31	FP	R/W	SP High/Low limit in Control setup group.
SP Rate Function	816	2070	INT	R/W	0 = Disabled 1 = Enabled 2 = Enabled 2 3 = Enabled 1 & 2
Rate Up EU/Hr	21	33	FP	R/W	0 to 9999
Rate Down EU/Hr	22	34	FP	R/W	0 to 9999
Rate Up EU/Hr Loop 2	15E	350	FP	R/W	0 to 9999

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Rate Down EU/Hr Loop 2	15F	351	FP	R/W	0 to 9999
SP Program Function	817	2071	INT	R/W	0 = Disabled 1 = Enabled
Soak Deviation	23	35	FP	R/W	0 to 99.9 0 = disable soak deviation function
Program Termination	818	2072	INT	R/W	0 = Last Setpoint and Mode 1 = Manual, Failsafe Output
Program End State	819	2073	INT	R/W	0 = Disable SP Program 1 = Hold at Program End
Key Reset/Rerun	81A	2074	INT	R/W	0 = Disable 1 = To Begin 2 = Rerun
Hot Start	81B	2075	INT	R/W	0 = Disabled 1 = Enabled
SP Program 1	81C	2076	INT	R/W	0 = Disabled 1 = Enabled
Start Segment	81D	2077	INT	R/W	Ramp segment 1 to 8
End Segment	81E	2078	INT	R/W	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	81F	2079	INT	R/W	0 = Time Hrs:Mins 1 = Rate EU/Min 2 = Rate EU/Hr
Recycles	820	2080	INT	R/W	0 to 100

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Segment 1 Ramp	24	36	FP	R/W	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	25	37	FP	R/W	Within Setpoint Limits
Segment 2 Time	26	38	FP	R/W	00:00 ~ 99.59 (0-99 Hrs:0 -59 Mins)
Segment 3 Ramp	27	39	FP	R/W	00:00 ~ 99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (EU/Min) or 0 to 999 (EU/Hr)
Segment 4 SP	28	40	FP	R/W	Within Setpoint Limits
Segment 4 Time	29	41	FP	R/W	00:00 ~ 99.59 (0-99 Hrs:0 -59 Mins)
Segment 5 Ramp	2A	42	FP	R/W	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	2B	43	FP	R/W	Within Setpoint Limits
Segment 6 Time	2C	44	FP	R/W	00:00 ~ 99.59 (0-99 Hrs:0 -59 Mins)
Segment 7 Ramp	2D	45	FP	R/W	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	2E	46	FP	R/W	Within Setpoint Limits
Segment 8 Time	2F	47	FP	R/W	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 11-18: Set-up Group – Setpoint Program 2

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 2	829	2089	INT	R/W	0 = Disabled 1 = Enabled
Start Segment	82A	2090	INT	R/W	Ramp segment 1 to 8
End Segment	82B	2091	INT	R/W	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	82C	2092	INT	R/W	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	82D	2093	INT	R/W	0 to 100
Segment 1 Ramp	33	51	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	34	52	FP	R/W	Within Setpoint Limits
Segment 2 Time	35	53	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 3 Ramp	36	54	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	37	55	FP	R/W	Within Setpoint Limits
Segment 4 Time	38	56	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 5 Ramp	39	57	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	3A	58	FP	R/W	Within Setpoint Limits

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Segment 6 Time	3B	59	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	3C	60	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	3D	61	FP	R/W	Within Setpoint Limits
Segment 8 Time	3E	62	FP	R/W	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 3.

Table 11-19: Set-up Group – Setpoint Program 3

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 3	833	2099	INT	R/W	0 = Disabled 1 = Enabled
Start Segment	834	2100	INT	R/W	Ramp segment 1 to 8
End Segment	835	2101	INT	R/W	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	836	2102	INT	R/W	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	837	2103	INT	R/W	0 to 100
Segment 1 Ramp	47	71	FP	R/W	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	48	72	FP	R/W	Within Setpoint Limits
Segment 2 Time	49	73	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 3 Ramp	4A	74	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	4B	75	FP	R/W	Within Setpoint Limits
Segment 4 Time	4C	76	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 5 Ramp	4D	77	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	4E	78	FP	R/W	Within Setpoint Limits
Segment 6 Time	4F	79	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	50	80	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	51	81	FP	R/W	Within Setpoint Limits
Segment 8 Time	52	82	FP	R/W	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 11-20: Set-up Group – Setpoint Program 4

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 4	83D	2109	INT	R/W	0 = Disabled  1 = Enabled

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Start Segment	83E	2110	INT	R/W	Ramp segment 1 to 8
End Segment	83F	2111	INT	R/W	Soak segment  0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	840	2112	INT	R/W	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	841	2113	INT	R/W	0 to 100
Segment 1 Ramp	5B	91	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	5C	92	FP	R/W	Within Setpoint Limits
Segment 2 Time	5D	93	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment 3 Ramp	5E	94	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	5F	95	FP	R/W	Within Setpoint Limits
Segment 4 Time	60	96	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment 5 Ramp	61	97	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	62	98	FP	R/W	Within Setpoint Limits

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Segment 6 Time	63	99	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	64	100	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	65	101	FP	R/W	Within Setpoint Limits
Segment 8 Time	66	102	FP	R/W	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 11-21: Set-up Group – Setpoint Program 5*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 5	847	2119	INT	R/W	0 = Disabled 1 = Enabled
Start Segment	848	2120	INT	R/W	Ramp segment 1 to 8
End Segment	849	2121	INT	R/W	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	84A	2122	INT	R/W	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Recycles	84B	2123	INT	R/W	0 to 100
Segment 1 Ramp	6F	111	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	70	112	FP	R/W	Within Setpoint Limits
Segment 2 Time	71	113	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment 3 Ramp	72	114	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	73	115	FP	R/W	Within Setpoint Limits
Segment 4 Time	74	116	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment 5 Ramp	75	117	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	76	118	FP	R/W	Within Setpoint Limits
Segment 6 Time	77	119	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment 7 Ramp	78	120	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	79	121	FP	R/W	Within Setpoint Limits
Segment 8 Time	7A	122	FP	R/W	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 11-22: Set-up Group – Setpoint Program 6

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 6	851	2129	INT	R/W	0 = Disabled 1 = Enabled
Start Segment	852	2130	INT	R/W	Ramp segment 1 to 8
End Segment	853	2131	INT	R/W	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	854	2132	INT	R/W	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	855	2133	INT	R/W	0 to 100
Segment 1 Ramp	83	131	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	84	132	FP	R/W	Within Setpoint Limits
Segment 2 Time	85	133	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment 3 Ramp	86	134	FP	R/W	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 4 SP	87	135	FP	R/W	Within Setpoint Limits
Segment 4 Time	88	136	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 5 Ramp	89	137	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	8A	138	FP	R/W	Within Setpoint Limits
Segment 6 Time	8B	139	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	8C	140	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	8D	141	FP	R/W	Within Setpoint Limits
Segment 8 Time	8E	142	FP	R/W	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 11-23: Set-up Group – Setpoint Program 7*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 7	85B	2139	INT	R/W	0 = Disabled 1 = Enabled
Start Segment	85C	2140	INT	R/W	Ramp segment

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					1 to 8
End Segment	85D	2141	INT	R/W	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	85E	2142	INT	R/W	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	85F	2143	INT	R/W	0 to 100
Segment 1 Ramp	97	151	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	98	152	FP	R/W	Within Setpoint Limits
Segment 2 Time	99	153	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment 3 Ramp	9A	154	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	9B	155	FP	R/W	Within Setpoint Limits
Segment 4 Time	9C	156	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment 5 Ramp	9D	157	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	9E	158	FP	R/W	Within Setpoint

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					Limits
Segment 6 Time	9F	159	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	A0	160	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	A1	161	FP	R/W	Within Setpoint Limits
Segment 8 Time	A2	162	FP	R/W	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 11-24: Set-up Group – Setpoint Program 8

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
SP Program 8	865	2149	INT	R/W	0 = Disabled 1 = Enabled
Start Segment	866	2150	INT	R/W	Ramp segment 1 to 8
End Segment	867	2151	INT	R/W	Soak segment 0 = Soak 8 1 = Soak 6 2 = Soak 4 3 = Soak 2
Ramp Unit	868	2152	INT	R/W	0 = Time Hrs:Mins 1 = Rate EU/Mins 2 = Rate EU/Hrs
Recycles	869	2153	INT	R/W	0 to 100
Segment 1 Ramp	AB	171	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 2 SP	AC	172	FP	R/W	Within Setpoint Limits
Segment 2 Time	AD	173	FP	R/W	99.59 (0-99 Hrs:0-59 Min)
Segment 3 Ramp	AE	174	FP	R/W	99.59 (0-99 Hrs:0-59 Min) or 0 to 999 (Degrees/Minute)
Segment 4 SP	AF	175	FP	R/W	Within Setpoint Limits

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Segment 4 Time	B0	176	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 5 Ramp	B1	177	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 6 SP	B2	178	FP	R/W	Within Setpoint Limits
Segment 6 Time	B3	179	FP	R/W	99.59 (0-99 Hrs:0 -59 Min)
Segment 7 Ramp	B4	180	FP	R/W	99.59 (0-99 Hrs:0 -59 Min) or 0 to 999 (Degrees/Minute)
Segment 8 SP	B5	181	FP	R/W	Within Setpoint Limits
Segment 8 Time	B6	182	FP	R/W	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 11-25: Set-up Group – Accutune*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Fuzzy Overshoot Suppression	86F	2159	INT	R/W	0 = Disabled 1 = Enabled 2 = Enabled 2 3 = Enabled 1 & 2
Accutune Enable	870	2160	INT	R/W	0 = Accutune Disabled

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					1 = Tune
Accutune Duplex selection	871	2161	INT	R/W	0 = Manual 1 = Auto 2 = Disable (blend)
Accutune 2	906	2310	INT	R/W	0 = Accutune Disabled 1 = Tune
Accutune Duplex Output 2	907	2311	INT	R/W	0 = Manual 1 = Auto 2 = Disable (blend)
Accutune Error Status (Read only)	872	2162	INT	R	0 = None 1 = Running 2 = Abort 3 = SP Error
Accutune 2 Error Status (Read only)	908	2312	INT	R	0 = None 1 = Running 2 = 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 11-26: Set-up Group – Algorithm*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Control Algorithm Selection (Selection)	87B	2171	INT	R/W	0 = Disable 1 = On-Off

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
here will affect ID code 39 in Output Algorithms.)					2 = PID A 3 = PID B 4 = PD-A with Manual Reset 5 = Three Position Step
Timer Function	87C	2172	INT	R/W	0 = Disable 1 = Enable
Period Hrs:Mins	BF	191	FP	R/W	00.00 TO 99.59
Start Trigger	87D	2173	INT	R/W	0 = Keyboard (Run/Hold by pressing Setup and Increment keys) 1 = Alarm 2
Lower Display	87E	2174	INT	R/W	0 = Time Remaining 1 = Elapsed Time
Reset Trigger	87F	2175	INT	R/W	0 = Keyboard (Run/Hold Key) 1 = Alarm1 (Alarm 1 or Key)
PID Loops	909	2313	INT	R/W	0 = 1 Loop 1 = 2 Loops 2 = Cascade
Control Algorithm 2	90A	2314	INT	R/W	0 = PID A 1 = PID B 3 = PD - A with Manual Reset
Output Override	90B	2315	INT	R/W	0 = Disable

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					1 = High Select 2 = Low Select
Timer increment	880	2176	INT	R/W	0 = Minutes (Counts hr/minute) 1 = Seconds (Counts min/second)
Input Algorithm 1 Input source selected via ID 417, 418, 419.	881	2177	INT	R/W	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 (Multiplier Divider) 10 = General Math D (Multiplier) 11 = Carbon A

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					12 = Carbon B 13 = Carbon C 14 = Carbon D 15 = Carbon FCC 16 = Dewpoint 17 = Oxygen 18 = A - B
Math K	C0	192	FP	R/W	0.001 to 1000
Calculated High	C1	193	FP	R/W	-999.0 to +9999 in Engineering Units
Calculated Low	C2	194	FP	R/W	-999.0 to +9999 in Engineering Units
Input Algorithm 1 Input A Selection (used with ID 326 math calculations)	882	2178	INT	R/W	0 = Input 1 1 = Input 2 2 = Output 3 = Output 2
Input Algorithm 1 Input B Selection (used with ID 326 math calculations)	883	2179	INT	R/W	0 = Input 1 1 = Input 2 2 = Output 3 = Output 2
Input Algorithm 1 Input C Selection (used with ID 326 math calculations)	884	2180	INT	R/W	0 = Input 1 1 = Input 2 2 = Output 3 = Output 2 4 = None
Algorithm 1 Bias	C4	196	FP	R/W	-999.0 to 9999 in

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					Engineering Units
Percent Carbon Value	C3	195	FP	R/W	0.02 to 0.350
Percent Hydrogen	C5	197	FP	R/W	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 11-27: Set-up Group – Output

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Output Algorithms	88F	2191	INT	R/W	0 = Time Simplex 1 = Current Simplex 2 = Three Position Step or Position Proportioning 3 = Time Duplex 4 = Current Duplex 5 = Current Time Duplex 6 = Time Current Duplex
Output Range	890	2192	INT	R/W	0 = Split (50%) 1 = Full (100%)
Relay State	891	2193	INT	R/W	0 = 1 Off 2 Off 1 = 1 On 2 Off 2 = 1 Off 2 On

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					3 = 1 On 2 On
Relay Type	892	2194	INT	R/W	Electromechanical
Output Algorithm 2	90C	2316	INT	R/W	0 = None 1 = Time Simplex 2 = Current Simplex 3 = Time Duplex 4 = Current Duplex 5 = Current Time Duplex 6 = Time Current Duplex
Output Range 2	90D	2317	INT	R/W	0 = Split (50%) 1 = Full (100%)
Output State 2	90E	2318	INT	R/W	0 = 1 off 2 off 1 = 1 On 2 Off 2 = 1 Off 2 On 3 = 1 On 2 On
Motor Time for Positional Proportional	893	2195	INT	R/W	5 to 1800 seconds
Current Output (Auxiliary Output Mode)	894	2196	INT	R/W	0 = Disable 1 = Input 1 2 = Input 2 3 = PV 4 = Deviation 5 = Output 6 = SP

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					7 = Local SP 1 8 = Local SP 2 9 = Local SP 3 10 = Local SP 4 11 = Remote SP 12 = Input Algorithm 1 13 = PV 2 14 = Deviation 2 15 = Output 2 16 = SP Loop 2 17 = LSP1 Loop 2 18 = LSP2 Loop 2 19 = LSP3 Loop 2 20 = LSP4 Loop 2 21 = RSP Loop 2
CO Low Value	C9	201	FP	R/W	Within the range of the selected variable in ID 242
CO High Value	CA	202	FP	R/W	Within the range of the selected variable in ID 242
CO Range	895	2197	INT	R/W	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 11-28: Set-up Group – Input 1

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input 1 Type	899	2201	INT	R/W	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 20 = TC PR40-PR20 21 = Thermocouple Differential 22 = RTD Pt100

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					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
	<div style="border: 2px solid orange; padding: 5px;"> <b>ATTENTION:</b> Changing the Input Type will result in the loss of Field Calibration values and will restore the Factory Calibration values.                 </div>				
Input 1 Transmitter Characterization	89A	2202	INT	R/W	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

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					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	CE	206	FP	R/W	-999. to 9999. Engineering Units (Linear types only)
Input 1 Low Value	CF	207	FP	R/W	-999 to 9999. Engineering Units (Linear types only)
Input 1 Ratio	DO	208	FP	R/W	-20.00 to 20.00

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input 1 Bias	D1	209	FP	R/W	-999 to 9999. Engineering Units
Input 1 Filter	D2	210	FP	R/W	0 to 120 seconds
Input 1 Burnout (Open Circuit Detection)	89B	2203	INT	R/W	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 11-29: Set-up Group – Input 2*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Input 2 Type	89E	2206	INT	R/W	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

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					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
					32 = 0-5 Vdc
					33 = 0-10 Vdc

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					34 = Slidewire
<div style="border: 1px solid orange; padding: 5px;"> <b>ATTENTION:</b> Changing the Input Type will result in the loss of Field Calibration values and will restore the Factory Calibration values.                 </div>					
Input 2 Transmitter Characterization	89F	2207	INT	R/W	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	D8	216	FP	R/W	-999. to 9999. Engineering Units
Input 2 Low Value	D9	217	FP	R/W	-999 to 9999. Engineering Units
Input 2 Ratio	DA	218	FP	R/W	-20.00 to 20.00
Input 2 Bias	DB	219	FP	R/W	-999 to 9999. Engineering Units
Input 2 Filter	DC	220	FP	R/W	0 to 120 seconds
Input 2 Burnout	8A0	2208	INT	R/W	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 11-30: Set-up Group – Control*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
PV Source	8A3	2211	INT	R/W	0 = Input 1

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					1 = Input 2 2 = Input Algorithm 1
PID Sets	8A4	2212	INT	R/W	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 8A4 selection 2 or 3)	E2	226	FP	R/W	Within the PV Range in engineering units
Automatic Switchover Value 2/3 (used with 8A4 selection 5 or 6)	E3	227	FP	R/W	Within the PV Range in engineering units
Automatic Switchover Value 3/4 (used with 8A4 selection 5 or 6)	E4	228	FP	R/W	Within the PV Range in engineering units
Local Setpoint	8A5	2213	INT	R/W	0 = One Local Setpoint

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Source (Number of LSPs)					1 = Two Local Setpoints 2 = Three Local Setpoints 3 = Four Local Setpoints
RSP Source	8A6	2214	INT	R/W	0 = None 1 = Input 2 2 = Input Algorithm 1
Autobias	8A7	2215	INT	R/W	0 = Disable 1 = Enable
Setpoint Tracking	8A8	2216	INT	R/W	0 = None 1 = LSP = PV (when in Manual) 2 = LSP = RSP (when switched)
Power Up Mode	8A9	2217	INT	R/W	0 = Manual/Local SP 1 = Auto/Local SP 2 = Auto/Remote SP 3 = Last Mode/Last SP 4 = Last Mode/Local SP
TPSC Power Output	8AA	2218	INT	R/W	0 = Last 1 = Failsafe
Control Setpoint High Limit	E5	229	FP	R/W	0 to 100% of PV (engineering units)
Control Setpoint Low Limit	E6	230	FP	R/W	0 to 100% of PV (engineering units)
Control Action Direction	8AB	2219	INT	R/W	0 = Direct 1 = Reverse

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Output Rate Enable	8AC	2220	INT	R/W	0 = Disable 1 = Enable
Output Rate Up	902	2306	INT	R/W	0 to 9999% per minute
Output Rate Down	903	2307	INT	R/W	0 to 9999% per minute
High Output Limit	E9	233	FP	R/W	-5 to 105% of output
Low Output Limit	EA	234	FP	R/W	-5 to 105% of output
High Integral Limit	EB	235	FP	R/W	-5 to 105%
Low Integral Limit	EC	236	FP	R/W	-5 to 105%
Output Drop Off Limit	ED	237	FP	R/W	-5 to 105%
Deadband	EE	238	FP	R/W	-5 to +25.0%
Output Hysteresis	EF	239	FP	R/W	0.0 to 100.0% of PV
Failsafe Mode	8AD	2221	INT	R/W	0 = Non latching 1 = Latching
Failsafe Output Level	F0	240	FP	R/W	0 to 100%
SW Failsafe Value	8AE	2222	INT	R/W	0 = 0 Percent 1 = 100 Percent
Preset Manual Output	F1	241	FP	R/W	0.0 to 100.0% of Output
Preset Auto Output	F2	242	FP	R/W	0.0 to 100.0% of Output
Proportion Unit	8AF	2223	INT	R/W	0 = Proportional Band

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					1 = Gain
Reset Unit	8B0	2224	INT	R/W	0 = Repeats/Minute 1 = Minutes/Repeat

**Control 2**

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

*Table 11-31: Set-up Group – Control*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
PV2 Source	90F	2319	INT	R/W	0 = Input 1 1 = Input 2 2 = Input Algorithm 1
Link Loops	910	2320	INT	R/W	0 = Disable 1 = Link Modes 2 = Link LSP1 3 = Link Modes & LSP
PID Sets	911	2321	INT	R/W	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

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					6 = 4 sets with SP automatic switchover
Automatic Switchover Value 1/2	146	326	FP	R/W	Within the PV Range in engineering units
Automatic Switchover Value 2/3	147	327	FP	R/W	Within the PV Range in engineering units
Automatic Switchover Value 3/4	148	328	FP	R/W	Within the PV Range in engineering units
Local Setpoint Source	912	2322	INT	R/W	0 = One Local Setpoint 1 = Two Local Setpoints 2 = Three Local Setpoints 3 = Four Local Setpoints
RSP Source	913	2323	INT	R/W	0 = None 1 = Input 2 2 = Input Algorithm 1
Autobias	914	2324	INT	R/W	0 = Disable 1 = Enable
Setpoint Tracking	915	2325	INT	R/W	0 = None 1 = LSP = PV (when in Manual) 2 = LSP = RSP (when switched)
Power Up Mode	916	2326	INT	R/W	0 = Manual/Local SP 1 = Auto/Local SP 2 = Auto/Remote SP

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					3 = Last Mode/Last SP 4 = Last Mode/Local SP
Setpoint High Limit	149	329	FP	R/W	0 to 100% of PV (engineering units)
Setpoint Low Limit	14A	330	FP	R/W	0 to 100% of PV (engineering units)
Action Direction	917	2327	INT	R/W	0 = Direct 1 = Reverse
Output Rate Enable	918	2328	INT	R/W	0 = Disable 1 = Enable
Rate Up Percent/Min	919	2329	FP	R/W	0.00 to 9999% per minute
Rate Down Percent/Min	91A	2330	FP	R/W	0.00 to 9999% per minute
High Output Limit	14B	331	FP	R/W	-5 to 105% of output
Low Output Limit	14C	332	FP	R/W	-5 to 105% of output
High Integral Limit	14D	333	FP	R/W	-5 to 105%
Low Integral Limit	14E	334	FP	R/W	-5 to 105%
Output Drop Off Limit	14F	335	FP	R/W	-5 to 105%
Deadband	150	336	FP	R/W	-5 to +25.0%
Failsafe Mode	91B	2331	INT	R/W	0 = Non latching 1 = Latching
Failsafe Value	151	337	FP	R/W	0 to 100%

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Preset Manual Output	152	338	FP	R/W	0.0 to 100.0% of Output
Preset Auto Output	153	339	FP	R/W	0.0 to 100.0% of Output
Proportion Unit	91C	2332	INT	R/W	0 = Proportional Band 1 = Gain
Reset Unit	91D	2333	INT	R/W	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 11-32: Set-up Group – Options

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Auxiliary Output *	8B7	2231	INT	R/W	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

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					10 = Local SP 4 11 = Remote SP 12 = Input Algorithm 1 13 = PV 2 14 = Deviation 2 15 = Output 2 16 = SP Loop 2 17 = LSP1 Loop 2 18 = LSP2 Loop 2 19 = LSP3 Loop 2 20 = LSP4 Loop 2 21 = RSP Loop 2
CO Low Value	FB	251	FP	R/W	Within the range of the selected variable in ID 134
CO High Value	FC	252	FP	R/W	Within the range of the selected variable in ID 134
CO Range	8B8	2232	INT	R/W	0 = 4-20 mA 1 = 0-20 mA
Digital Input 1 Function	8B9	2233	INT	R/W	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

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					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 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

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					27 = To Low Fire 28 = Manual Latching 29 = PV Hold 30 = Loop Display 31 = Output 2 Track Input 2 33 = To Output 2
Digital Input 1 Combinations	8BA	2234	INT	R/W	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
Digital Input 2 Function *	8BB	2235	INT	R/W	Same as Digital Input 1 Function
Digital Input 2 Combinations	8BC	2236	INT	R/W	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

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					7 = + To Local SP 3 8 = + To Local SP 4
DI on Loop 2	91E	2334	INT	R/W	0 = Disable 1 = Digital Input 2
* 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 11-33: Set-up Group – Communications

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Bluetooth Function	8C1	2241	INT	R/W	0 = Disable 1 = Enable
Communications Type	8C2	2242	INT	R/W	0 = Disable 1 = RS-485 Modbus 2 = Ethernet
Modbus Address	8C3	2243	FP	R/W	1 - 99
Baud Rate	8C4	2244	INT	R/W	0 = 4800 1 = 9600 2 = 19200 3 = 38400
Response Delay	8C5	2245	FP	R/W	Response Delay in ms (1 to 500) + 6ms

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Word Oder for Float	8C6	2246	INT	R/W	0 = FP B 0123 1 = FP BB 1032 2 = FP L 3210 3 = FP LB 2301
Ethernet Address 1	8C7	2247	INT	R/W	Ethernet Address = Add1.Add2.Add3.Add4 Ranges: 0~255
Ethernet Address 2	8C8	2248	INT	R/W	
Ethernet Address 3	8C9	2249	INT	R/W	
Ethernet Address 4	8CA	2250	INT	R/W	
Subnet Mask Address 1	8CB	2251	INT	R/W	Subnet Mask Address = Add1.Add2.Add3.Add4 Ranges: 0~255
Subnet Mask Address 2	8CC	2252	INT	R/W	
Subnet Mask Address 3	8CD	2253	INT	R/W	
Subnet Mask Address 4	8CE	2254	INT	R/W	
Default Gateway 1	8CF	2255	INT	R/W	Default Gateway = Gateway1.Gateway2.Gateway3.Gateway4 Ranges: 0~255
Default Gateway 2	8D0	2256	INT	R/W	
Default Gateway 3	8D1	2257	INT	R/W	
Default Gateway 4	8D2	2258	INT	R/W	
Shed Function	8D3	2259	INT	R/W	0 = Enable 1 = Disable

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Shed Time	8D4	2260	INT	R/W	0~255 Unit: 1/3 second
Shed Mode	8D5	2261	INT	R/W	0 = Last Mode 1 = Manual Mode 2 = Failsafe 3 = Auto Mode
Shed Setpoint Recall	8D6	2262	INT	R/W	0 = To Last Local Setpoint used 1 = To Computer SP
Computer Setpoint Units	8D7	2263	INT	R/W	0 = Engineering Units 1 = Percent
Computer Setpoint Ratio	105	261	FP	R/W	-20.00 to 20.00
Computer Setpoint Bias	106	262	FP	R/W	-999 to 9999.
Computer SP Ratio 2	155	341	FP	R/W	-20.00 to 20.00
Computer SP Bias 2	156	342	FP	R/W	-999 to 9999
Local Loopback	8D8	2264	INT	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 11-34: Set-up Group – Alarms

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Alarm 1 Setpoint 1 Type	8DF	2271	INT	R/W	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 19 = PV 2 20 = Deviation 2 21 = Output 2

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					22 = Manual 2 23 = Remote SP 2 24 = Failsafe 2 25 = PV Rate of Change 2 26 = Loop Break 2 27 = PV Hold 2
Alarm 1 Setpoint 1 Value	10F	271	FP	R/W	Within the range of selected parameter or PV span for deviation alarm
Alarm 1 Setpoint 1 State	8E0	2272	INT	R/W	0 = High Alarm 1 = Low Alarm
Alarm 1 Setpoint 1 Event	8E1	2273	INT	R/W	0 = Begin of Segment 1 = End of Segment
Alarm 1 Setpoint 1 Delay	8E2	2274	FP	R	0~30 seconds
Alarm 1 Setpoint 1 Hysteresis	110	272	FP	R/W	0.0 to 100% of output or span
Alarm 1 Setpoint 2 Type	8E3	2275	INT	R	Same as 8DF
Alarm 1 Setpoint 2 Value	111	273	FP	R/W	Within the range of selected parameter or PV span for deviation alarm
Alarm 1 Setpoint 2 State	8E4	2276	INT	R/W	0 = High Alarm 1 = Low Alarm
Alarm 1 Setpoint 2 Event	8E5	2277	INT	R/W	0 = Begin of Segment 1 = End of Segment

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Alarm 1 Setpoint 2 Delay	8E6	2278	FP	R/W	0~30 seconds
Alarm 1 Setpoint 2 Hysteresis	112	274	FP	R/W	0.0 to 100% of output or span
Alarm 2 Setpoint 1 Type	8E7	2279	INT	R	Same as 8DF
Alarm 2 Setpoint 1 Value	113	275	FP	R/W	Within the range of selected parameter or PV span for deviation alarm
Alarm 2 Setpoint 1 State	8E8	2280	INT	R/W	0 = High Alarm 1 = Low Alarm
Alarm 2 Setpoint 1 Event	8E9	2281	INT	R/W	0 = Begin of Segment 1 = End of Segment
Alarm 2 Setpoint 1 Delay	8EA	2282	FP	R/W	0~30 seconds
Alarm 2 Setpoint 1 Hysteresis	114	276	FP	R/W	0.0 to 100% of output or span
Alarm 2 Setpoint 2 Type	8EB	2283	INT	R/W	Same as 8DF
Alarm 2 Setpoint 2 Value	115	277	FP	R/W	Within the range of selected parameter or PV span for deviation alarm
Alarm 2 Setpoint 2 State	8EC	2284	INT	R/W	0 = High Alarm 1 = Low Alarm
Alarm 2 Setpoint 2 Event	8ED	2285	INT	R/W	0 = Begin of Segment 1 = End of Segment
Alarm 2 Setpoint 2 Delay	8EE	2286	FP	R/W	0~30 seconds
Alarm 2 Setpoint 2	116	278	FP	R/W	0.0 to 100% of output

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Hysteresis					or span
Alarm Latching for Output 1	8EF	2287	INT	R/W	0 = Non Latching 1 = Latching
Alarm Blocking	8F0	2288	INT	R/W	0 = Disable 1 = Alarm 1 2 = Alarm 2 3 = Alarm 1&2
AO/CO Diagnostic Alarm	8F1	2289	INT	R/W	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 11-35: Set-up Group – Display*

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
Decimal Point Location	8FD	2301	INT	R/W	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
Decimal Digits 2	91F	2335	INT	R/W	0 = None 1 = One Digit

Parameter Description	Register Address		Data Type	Access	Data Range or Enumerated Selection
	Hex	Decimal			
					2 = Two Digits 3 = Three Digits
Temperature Units	8FE	2302	INT	R/W	0 = °F 1 = °C 2 = None
Language	900	2304	INT	R/W	0 = English
Input 2 Ratio	8FF	2303	INT	R/W	0 = Disable 1 = Enable
TC Diagnostics	901	2305	INT	R/W	0 = Disable 1 = Enable

# STANDARD MODBUS READ, WRITE AND OVERRIDE PARAMETERS

## What's in this section?

The following topics are covered in this section.

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# Modbus RTU Message Format

For more information, see "Modbus RTU Message Format" of 51-52-25-66 *Modbus RTU Serial Communications User Manual*, which is available at [Honeywellprocess.com](http://Honeywellprocess.com).

Table 12-1: Modbus RTU Message Formats

<b>Coding system</b>	8 bit binary
<b>Number of data bits per character</b>	10 Bits  start bits - 1 data bits - 8 parity bits - 0 stop bits - 1
<b>Parity</b>	Not used
<b>Bit transfer rate</b>	300, 600, 1200, 2400, 4800, 9600, 19200, 38400 Selectable  NOTE: Not all instruments support all Baud Rates.
<b>Duplex</b>	Half duplex Transceiver or TX/RX
<b>Error checking</b>	CRC (cyclic redundancy check)
<b>Polynomial</b>	(CRC-16 10100000000001)
<b>Bit transfer order</b>	LSB first
<b>End of message</b>	Idle line for 3.5 or more characters (>1.82 msec for 19200).

## Modbus RTU Function Codes

The Honeywell Universal Modbus RTU protocol uses a subset of the standard Modbus RTU function codes to provide access to process-related information. Several MODICON function codes are employed. It is appropriate to define instrument-specific "user-defined" function codes. Several standard Modbus RTU function codes are supported. These standard function codes provide basic support for IEEE 32-bit floating point numbers and 16-bit integer register representation of instrument's process data.

Repolling of data is not supported by these instruments.

Table 12-2: Modbus RTU Function Codes Definitions

Function Code	Name	Usage
01	Read Coil Status	Read the State of a Digital Output
02	Read Input Status	Read the State of a Digital Input
03	Read Holding Registers	Read Data in 16 bit Register Format (high/low). Used to read integer or floating point process data. Registers are consecutive and are imaged from the instrument to the host.
04	Read Input Registers	
06	Preset Single Register	Write Data in 16-bit Integer Format (high/low) ONLY.
08	Loopback Test	Used for diagnostic testing of the communications port.
16 (10h)	Preset Multiple Registers	Write Data in 16-bit Format (high/low). Used to write integer and floating point override data. Registers are consecutive and are imaged from the host to the instrument.  Note: UDC will write floating point data using this Function Code.
17 (11h)	Report Device ID	Read instrument ID and connection information, ROM version, etc.

For more information, see "Modbus RTU Function Codes" of 51-52-25-66 *Modbus RTU Serial Communications User Manual*, which is available at [Honeywellprocess.com](http://Honeywellprocess.com).

## Digital Output Register Map

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 12-3: Digital Output Parameters

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
Output 1	0x00	1	Float	R	0: No output 1: Hardware channel Output 1
Output 2	0x01	2	INT16	R	0: No output 1: Hardware channel Output 2
Alarm Relay 2 / Output 2	0x02	3	Coil	R	0: No output 1: Hardware channel Output 3
Alarm Relay 1	0x03	4	Coil	R	0: No output 1: Hardware channel Output 4

## Digital Input Register Map

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 12-4: Digital Input Parameters

Parameter Description	Register Address		Data Type	Access	Description
	Hex	Decimal			
Digital Input 1	0x0000	10001	Coil	R	0: No input 1: Digital Input 1
Digital Input 2	0x0001	10002	Coil	R	0: No input 1: Digital Input 2

## Loop Value Integer Register Map

Table 12-5: Loop Value Integer Register Map

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
PV	0000	40001	R	Signed 16 bit integer, prescale * 10 (Note 1)
RV; Remote Set Point; SP2	0001	40002	R	Signed 16 bit integer, prescale *10
Working Set Point	0002	40003	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
Output	0003	40004	R/W	Signed 16 bit integer, prescale * 10
Input #1	0004	40005	R	Signed 16 bit

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				integer, prescale * 10
Input #2	0005	40006	R	Signed 16 bit integer, prescale * 10
Gain #1 (Prop Band #1 if active)	0006	40007	R/W	Signed 16 bit integer, prescale * 10
Direction	0007	40008	R	Signed 16 bit integer, prescale *1 Bit 0: 1 = Reverse, 0 = Direct
Reset #1	0008	40009	R/W	Signed 16 bit integer, prescale *100
Rate #1	0009	40010	R/W	Signed 16 bit integer, prescale *100
Cycle Time #1	000A	40011	R/W	Signed 16 bit integer, prescale *1
PV Low Range	000B	40012	R	Signed 16 bit integer, prescale * 10
PV High Range	000C	40013	R	Signed 16 bit integer, prescale * 10
Alarm #1 SP #1	000D	40014	R/W	Signed 16 bit integer, prescale * 10
Alarm #1 SP #2	000E	40015	R/W	Signed 16 bit integer, prescale * 10
Alarm #1 Action	000F	40016	R	Signed 16 bit integer, prescale *1

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Bit 0: 1 = Alarm 1 SP 1 State is High, or Event is End; 0 = State is Low, or Event is Begin  Bit 1: 1 = Alarm 1 SP 2 State is High, or Event is End; 0 = State is Low, or Event is Begin
Gain #2 (Prop Band #2 if active)	0010	40017	R/W	Signed 16 bit integer, prescale * 10
Deadband	0011	40018	R/W	Signed 16 bit integer, prescale * 10
Reset #2	0012	40019	R/W	Signed 16 bit integer, prescale *100
Rate #2	0013	40020	R/W	Signed 16 bit integer, prescale *100
Cycle Time #2	0014	40021	R/W	Signed 16 bit integer, prescale *1
SP1; LSP #1	0015	40022	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
LSP #2	0016	40023	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
Alarm #2 SP #1	0017	40024	R/W	Signed 16 bit integer, prescale * 10
Alarm #2 SP #2	0018	40025	R/W	Signed 16 bit integer, prescale *

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				10
Alarm #2 Action	0019	40026	R	Signed 16 bit integer, prescale *1  Bit 0: 1 = Alarm 2 SP 1 State is High, or Event is End; 0 = State is Low, or Event is Begin  Bit 1: 1 = Alarm 2 SP 2 State is High, or Event is End; 0 = State is Low, or Event is Begin
SP Low Limit	001A	40027	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
SP High Limit	001B	40028	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
Working Set Point	001C	40029	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
Output Low Limit	001D	40030	R/W	Signed 16 bit integer, prescale * 10
Output High Limit	001E	40031	R/W	Signed 16 bit integer, prescale * 10
Output Working Value	001F	40032	R/W	Signed 16 bit integer, prescale * 10
PV Override Value	0020	40033	R/W	Signed 16 bit integer, prescale * 10
SP Override Value	0021	40034	R/W	Signed 16 bit

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				integer, prescale * 10 (Note 1)
Output Override Value	0022	40035	R/W	Signed 16 bit integer, prescale * 10
Ratio, CSP parameters	0023	40036	R/W	Signed 16 bit integer, prescale * 10
Bias, CSP parameters	0024	40037	R/W	Signed 16 bit integer, prescale * 10
Deviation	0025	40038	R	Signed 16 bit integer, prescale * 10
LSP #3	0026	40039	R/W	Signed 16 bit integer, prescale * 10
Percent Carbon Monoxide - CO	0027	40040	R/W	Signed 16 bit integer, prescale *1000
Decimal Point	0028	40041	R/W	Signed 16 bit integer, prescale *1
Alg1 Bias	0029	40042	R/W	Signed 16 bit integer, prescale *10 (Note 2)
LSP #4	002B	40044	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
Current Output #2	002C	40045	R	Signed 16 bit integer, prescale * 10 (Note 1)
Fuzzy Enable	0038	40057	R/W	Unsigned 16 bit integer 0=Disable

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				1=Enable
Shed Enable	0039	40058	R/W	Bit Packed Bit 0: 0: Disable 1: Enable
Auto/Manual State	003A	40059	R/W	Bit Packed Bit 0: 0: Manual; 1: Auto Bit 1-15: Unused
Set Point State	003B	40060	R/W	Unsigned 16 bit integer 0=LSP1 1=LSP2 2=LSP3 3=CSP 4=LSP4 5=RSP
Remote/Local Set Point State	003C	40061	R/W	Bit Packed Bit 0: 0: LSP; 1: RSP Bit 1-15: Unused
Tune Set State	003D	40062	R/W	Unsigned 16 bit integer 0=Tune Set #1 1=Tune Set #2 2=Tune Set #3 3=Tune Set #4
Loop Status	003E	40063	R	Bit Packed Bit 0: Mode: 0:

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Manual; 1: Auto  Bit 1: Set Point: 0: SP1; 1: SP2  Bit 2: Remote/Local: 0: LSP; 1: RSP  Bit 3: Tune Set: 0: Set #1; 1: Set #2  Bit 4: LSP#3  Bit 5: LSP#4  Bit 6: CSP  Bit 7: 1 = Tune Set #1  Bit 8: 1 = Tune Set #3  Bit 9: 1 = Tune Set #4  Bit 10: Unused  Bit 11: 1 = Run Status, 0 = Hold Status  Bit 12: 1 = Any Digital Input Active  Bit 13: 1 = Any Alarm Active  Bit 14: Unused  Bit 15: 1 = Guaranteed Soak Deviation (Out of Limit), soak segment is stuck

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Device Status	003F	40064	R/W	1) Bit 0: Emergency Manual Bit 1: Failsafe Bit 2: Working Calibration Checksum Error Bit 3: Configuration Checksum Error Bit 4: Factory Calibration Error Bit 5: Hardware Failure Bit 6: Restart After Shed Bit 7: Configuration/ Calibration Memory Changed 2) Writing any value to this register via Function Code 6 clears bits 6 and 7 only
<p>Note 1: If the input type is configured as Carbon and the input algorithm is configured for one of the carbon selections, the prescale value is derived from the configured decimal point.</p> <p>Note 2: If the Algorithm 1 type is configured for weighted average, RH, Summer, Sq. Root Mult-Div, Sq Root Mult, Mult-Div, Mult, Carbon A-D, FCC, Dew Point, or Oxygen, the prescale value is derived from the configured decimal point.</p>				

## Loop 2 Value Integer Register Map

Table 12-6: Loop Value Integer Register Map

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
PV Loop 2	0FF	40256	R	Signed 16 bit integer, prescale * 10 ( Note 1)
Remote Setpoint Loop 2	100	40257	R	Signed 16 bit integer, prescale *10
Working SetPoint Loop 2	101	40258	R/W	Signed 16 bit integer, prescale * 10 ( Note 1)
Output Loop 2	102	40259	R/W	Signed 16 bit integer, prescale * 10
Gain 5	103	40260	R/W	Signed 16 bit integer, prescale * 10
Direction	104	40261	R	Signed 16 bit integer, prescale *1 Bit 0: 1 = Reverse, 0 = Direct
Reset 5	105	40262	R/W	Signed 16 bit integer, prescale *100
Rate 5	106	40263	R/W	Signed 16 bit integer, prescale *100
Cycle time 5	107	40264	R/W	Signed 16 bit integer, prescale *1
PV 2 Low limit	108	40265	R	Signed 16 bit integer, prescale * 10

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
PV 2 High limit	109	40266	R	Signed 16 bit integer, prescale * 10
Gain 6	10A	40267	R/W	Signed 16 bit integer, prescale * 10
Deadband Loop 2	10B	40268	R/W	Signed 16 bit integer, prescale * 10
Reset 6	10C	40269	R/W	Signed 16 bit integer, prescale *100
Rate 6	10D	40270	R/W	Signed 16 bit integer, prescale *100
Cycle time 6	10E	40271	R/W	Signed 16 bit integer, prescale *1
LSP 1 Loop2	10F	40272	R/W	Signed 16 bit integer, prescale * 10 ( Note 1)
LSP 2 Loop2	110	40273	R/W	Signed 16 bit integer, prescale * 10 ( Note 1)
SP Low limit Loop 2	111	40274	R/W	Signed 16 bit integer, prescale * 10 ( Note 1)
SP High limit Loop 2	112	40275	R/W	Signed 16 bit integer, prescale * 10 ( Note 1)
Working SetPoint Loop 2	113	40276	R/W	Signed 16 bit integer, prescale * 10 ( Note 1)
Output 2 Low limit	114	40277	R/W	Signed 16 bit

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				integer, prescale *10
Output 2 High Limit	115	40278	R/W	Signed 16 bit integer, prescale *10
Output 2 Working value	116	40279	R/W	Signed 16 bit integer, prescale *10
PV Loop 2 Override value	117	40280	R/W	Signed 16 bit integer, prescale *10
SP Loop 2 Override value	118	40281	R/W	Signed 16 bit integer, prescale * 10 ( Note 1)
Output Loop 2 Override value	119	40282	R/W	Signed 16 bit integer, prescale *10
CSP Loop 2 ratio	11A	40283	R/W	Signed 16 bit integer, prescale *10
CSP Loop 2 Bias	11B	40284	R/W	Signed 16 bit integer, prescale *10
Deviation Loop 2	11C	40285	R	Signed 16 bit integer, prescale *10
LSP 3 Loop2	11D	40286	R/W	Signed 16 bit integer, prescale *10
LSP 4 Loop 2	11F	40288	R/W	Signed 16 bit integer, prescale *10
Decimal Point Loop 2	120	40289	R/W	Signed 16 bit integer, prescale *1
Auto/Manual State Loop 2	121	40290	R/W	Bit Packed Bit 0: 0: Manual; 1:Auto Bit 1-15: Unused
SP State Loop 2	122	40291	R/W	Unsigned 16 bit integer

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				0=LSP1 1=LSP2 2=LSP3 3=CSP 4=LSP4 5=RSP
Remote/Local Set Point state Loop 2	123	40292	R/W	Bit Packed Bit 0: 0: LSP; 1: RSP Bit 1-15: Unused
Tune 2 Set State	124	40293	R/W	Unsigned 16 bit integer 0=Tune Set #1 1=Tune Set #2 2=Tune Set #3 3=Tune Set #4
Loop status	125	40294	R	Bit Packed Bit 0: Mode: 0: Manual; 1: Auto Bit 1: Set Point: 0: SP1; 1: SP2 Bit 2: Remote/Local: 0: LSP; 1: RSP Bit 3: Tune Set: 0: Set #1; 1: Set #2 Bit 4: LSP#3 Bit 5: LSP#4 Bit 6: CSP

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Bit 7: 1 = Tune Set #1 Bit 8: 1 = Tune Set #3 Bit 9: 1 = Tune Set #4 Bit 10: Unused Bit 11: 1 = Run Status, 0 = Hold Status Bit 12: 1 = Any Digital Input Active Bit 13: 1 = Any Alarm Active Bit 14: Unused Bit 15: 1 = Guaranteed Soak Deviation (Out of Limit), soak segment is stuck
<p>Note 1: If the input type is configured as Carbon and the input algorithm is configured for one of the carbon selections, the prescale value is derived from the configured decimal point.</p> <p>Note 2: If the Algorithm 1 type is configured for weighted average, RH, Summer, Sq. Root Mult-Div, Sq Root Mult, Mult-Div, Mult, Carbon A-D, FCC, Dew Point, or Oxygen, the prescale value is derived from the configured decimal point.</p>				

## Loop Value Register Map

Table 12-7: Loop Value Integer Register Map

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
PV	0000	40001	R	Signed 16 bit integer, prescale * 10 (Note 1)
RV; Remote Set Point; SP2	0001	40002	R	Signed 16 bit integer, prescale *10
Working Set Point	0002	40003	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
Output	0003	40004	R/W	Signed 16 bit integer, prescale * 10
Input #1	0004	40005	R	Signed 16 bit integer, prescale * 10
Input #2	0005	40006	R	Signed 16 bit integer, prescale * 10
Gain #1 (Prop Band #1 if active)	0006	40007	R/W	Signed 16 bit integer, prescale * 10
Direction	0007	40008	R	Signed 16 bit integer, prescale *1 Bit 0: 1 = Reverse, 0 = Direct
Reset #1	0008	40009	R/W	Signed 16 bit integer, prescale *100
Rate #1	0009	40010	R/W	Signed 16 bit integer, prescale *100
Cycle Time #1	000A	40011	R/W	Signed 16 bit

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				integer, prescale *1
PV Low Range	000B	40012	R	Signed 16 bit integer, prescale * 10
PV High Range	000C	40013	R	Signed 16 bit integer, prescale * 10
Alarm #1 SP #1	000D	40014	R/W	Signed 16 bit integer, prescale * 10
Alarm #1 SP #2	000E	40015	R/W	Signed 16 bit integer, prescale * 10
Alarm #1 Action	000F	40016	R	<p>Signed 16 bit integer, prescale *1</p> <p>Bit 0: 1 = Alarm 1 SP 1 State is High, or Event is End; 0 = State is Low, or Event is Begin</p> <p>Bit 1: 1 = Alarm 1 SP 2 State is High, or Event is End; 0 = State is Low, or Event is Begin</p>
Gain #2 (Prop Band #2 if active)	0010	40017	R/W	Signed 16 bit integer, prescale * 10
Deadband	0011	40018	R/W	Signed 16 bit integer, prescale * 10
Reset #2	0012	40019	R/W	Signed 16 bit integer, prescale *100

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Rate #2	0013	40020	R/W	Signed 16 bit integer, prescale *100
Cycle Time #2	0014	40021	R/W	Signed 16 bit integer, prescale *1
SP1; LSP #1	0015	40022	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
LSP #2	0016	40023	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
Alarm #2 SP #1	0017	40024	R/W	Signed 16 bit integer, prescale * 10
Alarm #2 SP #2	0018	40025	R/W	Signed 16 bit integer, prescale * 10
Alarm #2 Action	0019	40026	R	<p>Signed 16 bit integer, prescale *1</p> <p>Bit 0: 1 = Alarm 2 SP 1 State is High, or Event is End; 0 = State is Low, or Event is Begin</p> <p>Bit 1: 1 = Alarm 2 SP 2 State is High, or Event is End; 0 = State is Low, or Event is Begin</p>
SP Low Limit	001A	40027	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
SP High Limit	001B	40028	R/W	Signed 16 bit integer, prescale * 10 (Note 1)

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Working Set Point	001C	40029	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
Output Low Limit	001D	40030	R/W	Signed 16 bit integer, prescale * 10
Output High Limit	001E	40031	R/W	Signed 16 bit integer, prescale * 10
Output Working Value	001F	40032	R/W	Signed 16 bit integer, prescale * 10
PV Override Value	0020	40033	R/W	Signed 16 bit integer, prescale * 10
SP Override Value	0021	40034	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
Output Override Value	0022	40035	R/W	Signed 16 bit integer, prescale * 10
Ratio, CSP parameters	0023	40036	R/W	Signed 16 bit integer, prescale * 10
Bias, CSP parameters	0024	40037	R/W	Signed 16 bit integer, prescale * 10
Deviation	0025	40038	R	Signed 16 bit integer, prescale * 10
LSP #3	0026	40039	R/W	Signed 16 bit integer, prescale * 10
Percent Carbon Monoxide	0027	40040	R/W	Signed 16 bit

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
- CO				integer, prescale *1000
Decimal Point	0028	40041	R/W	Signed 16 bit integer, prescale *1
Alg1 Bias	0029	40042	R/W	Signed 16 bit integer, prescale *10 (Note 2)
LSP #4	002B	40044	R/W	Signed 16 bit integer, prescale * 10 (Note 1)
Current Output #2	002C	40045	R	Signed 16 bit integer, prescale * 10 (Note 1)
Fuzzy Enable	0038	40057	R/W	Unsigned 16 bit integer 0=Disable 1=Enable
Shed Enable	0039	40058	R/W	Bit Packed Bit 0: 0: Disable 1: Enable
Auto/Manual State	003A	40059	R/W	Bit Packed Bit 0: 0: Manual; 1: Auto Bit 1-15: Unused
Set Point State	003B	40060	R/W	Unsigned 16 bit integer 0=LSP1 1=LSP2 2=LSP3 3=CSP

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				4=LSP4 5=RSP
Remote/Local Set Point State	003C	40061	R/W	Bit Packed Bit 0: 0: LSP; 1: RSP Bit 1-15: Unused
Tune Set State	003D	40062	R/W	Unsigned 16 bit integer 0=Tune Set #1 1=Tune Set #2 2=Tune Set #3 3=Tune Set #4
Loop Status	003E	40063	R	Bit Packed Bit 0: Mode: 0: Manual; 1: Auto Bit 1: Set Point: 0: SP1; 1: SP2 Bit 2: Remote/Local: 0: LSP; 1: RSP Bit 3: Tune Set: 0: Set #1; 1: Set #2 Bit 4: LSP#3 Bit 5: LSP#4 Bit 6: CSP Bit 7: 1 = Tune Set #1 Bit 8: 1 = Tune Set #3

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Bit 9: 1 = Tune Set #4  Bit 10: Unused  Bit 11: 1 = Run Status, 0 = Hold Status  Bit 12: 1 = Any Digital Input Active  Bit 13: 1 = Any Alarm Active  Bit 14: Unused  Bit 15: 1 = Guaranteed Soak Deviation (Out of Limit), soak segment is stuck
Device Status	003F	40064	R/W	1) Bit 0: Emergency Manual  Bit 1: Failsafe  Bit 2: Working Calibration Checksum Error  Bit 3: Configuration Checksum Error  Bit 4: Factory Calibration Error  Bit 5: Hardware Failure  Bit 6: Restart After Shed  Bit 7: Configuration/ Calibration Memory

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Changed  2) Writing any value to this register via Function Code 6 clears bits 6 and 7 only
Note 1: If the input type is configured as Carbon and the input algorithm is configured for one of the carbon selections, the prescale value is derived from the configured decimal point.				
Note 2: If the Algorithm 1 type is configured for weighted average, RH, Summer, Sq. Root Mult-Div, Sq Root Mult, Mult-Div, Mult, Carbon A-D, FCC, Dew Point, or Oxygen, the prescale value is derived from the configured decimal point.				

## Loop 2 Value Register Map

Table 12-8: Loop Value Integer Register Map

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
PV Loop 2	126	40295	R	Floating Point in Engineering Units.
Remote Setpoint Loop 2	128	40297	R	Floating Point in Engineering Units.
Working SetPoint Loop 2	12A	40299	R	Floating Point in Engineering Units.
Output Loop 2	12E	40303	R	Floating Point in Engineering Units.
Gain 5	130	40305	R/W	Floating Point in Engineering Units.
Direction	132	40307	R	Floating Point 0.0=Direct; 1.0=Reverse

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Reset 5	134	40309	R/W	Floating Point in Repeats/Minute or Minutes/Repeat.
Rate 5	136	40311	R/W	Floating Point in Minutes
Cycle time 5	138	40313	R/W	Floating Point in Seconds.
PV 2 Low limit	13A	40315	R	Floating Point in Engineering Units.
PV 2 High limit	13C	40317	R	Floating Point in Engineering Units.
Gain 6	13E	40319	R/W	Floating Point in Engineering Units.
Deadband Loop 2	140	40321	R/W	Floating Point
Reset 6	142	40323	R/W	Floating Point in Repeats/Minute or Minutes/Repeat.
Rate 6	144	40325	R/W	Floating Point in Minutes
Cycle time 6	148	40329	R/W	Floating Point in Seconds.
LSP 1 Loop2	14A	40331	R/W	Floating Point in Engineering Units.
LSP 2 Loop2	14C	40333	R/W	Floating Point in Engineering Units.
SP Low limit Loop 2	14E	40335	R/W	Floating Point in Engineering Units.
SP High limit Loop 2	150	40337	R/W	Floating Point in Engineering Units.
Working SetPoint Loop 2	152	40339	R/W	Floating Point in Engineering Units.

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Output 2 Low limit	154	40341	R/W	Floating Point in Engineering Units.
Output 2 High Limit	156	40343	R/W	Floating Point in Engineering Units.
Output Loop 2 Working value	158	40345	R/W	Floating Point in Engineering Units.
PV Loop 2 Override value	15A	40347	R/W	Floating Point in Engineering Units.
SP Loop 2 Override value	15C	40349	R/W	Floating Point in Engineering Units.
Output Loop 2 Override value	15E	40351	R/W	Floating Point in Engineering Units.
CSP Loop 2 ratio	160	40353	R/W	Floating Point in Engineering Units.
CSP Loop 2 Bias	162	40355	R/W	Floating Point in Engineering Units.
Deviation Loop 2	164	40357	R	Floating Point in Engineering Units.
LSP 3 Loop2	166	40359	R/W	Floating Point in Engineering Units.
LSP 4 Loop 2	168	40361	R/W	Floating Point in Engineering Units.
Gain 7	16A	40363	R/W	Floating Point in Engineering Units.
Reset 7	16C	40365	R/W	Floating Point in Repeats/Minute or Minutes/Repeat.
Rate 7	16E	40367	R/W	Floating Point in Minutes
Gain 8	170	40369	R/W	Floating Point in Engineering Units.

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Reset 8	172	40371	R/W	Floating Point in Repeats/Minute or Minutes/Repeat.
Rate 8	176	40375	R/W	Floating Point in Minutes
PV/SP switch 3 to 4 Loop 2	178	40377	R/W	Floating Point in Engineering Units.
SP/PV Switch 1 to 2 Loop 2	17A	40379	R/W	Floating Point in Engineering Units.
SP/PV Switch 2 to 3 Loop 2	17C	40381	R/W	Floating Point in Engineering Units.
Loop2 Current output	17E	40383	R	Floating Point in Engineering Units.
Auto/Manual State Loop 2	180	40385	R/W	Bit Packed Bit 0: 0: Manual; 1: Auto Bit 1-15: Unused
Set Point State Loop 2	181	40386	R/W	Unsigned 16 bit integer 0=LSP1 1=LSP2 2=LSP3 3=CSP 4=LSP4 5=RSP
"Remote/Local Set Point State Loop 2"	182	40387	R/W	Bit Packed Bit 0: 0: LSP; 1: RSP Bit 1-15: Unused
Tune Set State Loop 2	183	40388	R/W	Unsigned 16 bit

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				integer 0=Tune Set #1 1=Tune Set #2 2=Tune Set #3 3=Tune Set #4
Loop status	184	40389	R	Bit Packed Bit 0: Mode: 0: Manual; 1: Auto Bit 1: Set Point: 0: SP1; 1: SP2 Bit 2: Remote/Local: 0: LSP; 1: RSP Bit 3: Tune Set: 0: Set #1; 1: Set #2 Bit 4: LSP#3 Bit 5: LSP#4 Bit 6: CSP Bit 7: 1 = Tune Set #1 Bit 8: 1 = Tune Set #3 Bit 9: 1 = Tune Set #4 Bit 10: Unused Bit 11: 1 = Run Status, 0 = Hold Status Bit 12: 1 = Any Digital Input Active Bit 13: 1 = Any Alarm Active Bit 14: Unused

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Bit 15: 1 = Guaranteed Soak Deviation (Out of Limit), soak segment is stuck
<p>Note 1: If the input type is configured as Carbon and the input algorithm is configured for one of the carbon selections, the prescale value is derived from the configured decimal point.</p> <p>Note 2: If the Algorithm 1 type is configured for weighted average, RH, Summer, Sq. Root Mult-Div, Sq Root Mult, Mult-Div, Mult, Carbon A-D, FCC, Dew Point, or Oxygen, the prescale value is derived from the configured decimal point.</p>				

## Analog Input Register Map

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 12-9: Analog Input Parameters

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Analog Input 1	1800	46145	R	Floating Point in Engineering Units.
Analog Input 2	1802	46147	R	Floating Point in Engineering Units.

## Math, Calculated Value, or Variable Register Map

Table 12-10: Math, Calculated Value, or Variable Register Map

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Math Value #1	18C0	46337	R	Floating Point in Engineering Units.

## Math or Calculated Value Status Register Map

Table 12-11: Math or Calculated Value Status Register Map

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Math Status #1 ~ #16	1AC0	46849	R	Bit Packed: Bit 0: Math #1 Status ⋮ Bit 15: Math #16 Status 0: Math OFF 1: Math ON

## Shed Timer Reset Register Map

Table 12-12: Shed Timer Reset Register Map

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Shed Timer Reset Loop 1	1B90	47057	W	Signed 16 bit integer Write this address to

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				clear an infinite shed condition. (Shed time = 0) Data is ignored.
Shed Timer Reset Loop 2	1B91	47058	W	Signed 16 bit integer  Write this address to clear an infinite shed condition. (Shed time = 0) Data is ignored.

## Alarm Status Register Map

Table 12-13: Alarm Status

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Alarm Status #1 ~ #16	1BF0	47153	R	Bit Packed:  Bit 0: Alarm #1 Status  ⋮  Bit 15: Alarm #16 Status  0: Alarm OFF  1: Alarm ON

## Alarm Set Point Value Register Map

Table 12-14: Alarm Set Point Value Register Map

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Alarm Set Point Value #1	1C00	47169	R/W	Floating Point in Engineering Units: Alarm

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				#1 Set Point 1.
Alarm Set Point Value #2	1C02	47171	R/W	Floating Point in Engineering Units: Alarm #1 Set Point 2.
Alarm Set Point Value #3	1C04	47173	R/W	Floating Point in Engineering Units: Alarm 2 Set Point 1.
Alarm Set Point Value #4	1C06	47175	R/W	Floating Point in Engineering Units: Alarm #2 Set Point 2.

## Set Point Program Value Register Map

Table 12-15: SP Program Value Register Map

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
SP Program Output	1E00	47681	R	Setpoint Program output value (engineering unit)
Current Segment Number	1E02	47683	R	Floating Point; 1...Max Segment # A write changes

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				the segment number
Segment Time Remaining	1E08	47689	R	Floating Point in Minutes or Time Units
Status	1E0B	47692	R	Bit 0: 1=Ready 1: 1=Run 2: 1=Hold 3: 1=End 4: 1=Time Units in Seconds 5: 1=Time Units in Minutes 6: 1=Time Units in Hours 7: Ramp Units <ul style="list-style-type: none"> <li>• 0: Time</li> <li>• 1: Rate</li> </ul> 8: If bit 7 Set <ul style="list-style-type: none"> <li>• 0: EU/Hour</li> <li>• 1: EU/Minute</li> </ul> 9: Guaranteed Soak State
Start	1EOC	47693	W	Signed 16 bit integer  Write to location Starts Profile;

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Data ignored
Hold	1E0D	47694	W	Signed 16 bit integer  Write to location Holds Profile;  Data ignored

## SP Program 2

Table 12-16: Setpoint Program 2

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
SP Program Output	1E10	47697	R	Setpoint Program output value (engineering unit)
Current Segment Number	1E12	47699	R	Floating Point; 1...Max Segment #  A write changes the segment number
Segment Time Remaining	1E18	47705	R	Floating Point in Minutes or Time Units
Status	1E1B	47708	R	Bit 0: 1=Ready  1: 1=Run  2: 1=Hold  3: 1=End

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				4: 1=Time Units in Seconds 5: 1=Time Units in Minutes 6: 1=Time Units in Hours 7: Ramp Units <ul style="list-style-type: none"> <li>• 0: Time</li> <li>• 1: Rate</li> </ul> 8: If bit 7 Set <ul style="list-style-type: none"> <li>• 0: EU/Hour</li> <li>• 1: EU/Minute</li> </ul> 9: Guaranteed Soak State
Start	1E1C	47709	W	Signed 16 bit integer Write to location Starts Profile; Data ignored
Hold	1E1D	47710	W	Signed 16 bit integer Write to location Holds Profile; Data ignored

### SP Program 3

Table 12-17: Setpoint Program 3

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
SP Program Output	1E20	47713	R	Setpoint Program output value (engineering unit)
Current Segment Number	1E22	47715	R	Floating Point; 1...Max Segment #  A write changes the segment number
Segment Time Remaining	1E28	47721	R	Floating Point in Minutes or Time Units
Status	1E2B	47724	R	Bit 0: 1=Ready  1: 1=Run  2: 1=Hold  3: 1=End  4: 1=Time Units in Seconds  5: 1=Time Units in Minutes  6: 1=Time Units in Hours  7: Ramp Units  • 0: Time  • 1: Rate

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				8: If bit 7 Set <ul style="list-style-type: none"> <li>• 0: EU/Hour</li> <li>• 1: EU/Minute</li> </ul> 9: Guaranteed Soak State
Start	1E2C	47725	W	Signed 16 bit integer  Write to location Starts Profile;  Data ignored
Hold	1E2D	47726	W	Signed 16 bit integer  Write to location Holds Profile;  Data ignored

### SP Program 4

Table 12-18: Setpoint Program 4

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
SP Program Output	1E30	47729	R	Setpoint Program output value (engineering unit)
Current Segment Number	1E32	47731	R	Floating Point; 1...Max

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Segment # A write changes the segment number
Segment Time Remaining	1E38	47737	R	Floating Point in Minutes or Time Units
Status	1E3B	47740	R	Bit 0: 1=Ready 1: 1=Run 2: 1=Hold 3: 1=End 4: 1=Time Units in Seconds 5: 1=Time Units in Minutes 6: 1=Time Units in Hours 7: Ramp Units • 0: Time • 1: Rate 8: If bit 7 Set • 0: EU/Hour • 1: EU/Minute 9: Guaranteed Soak State
Start	1E3C	47741	W	Signed 16 bit integer

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Write to location Starts Profile;  Data ignored
Hold	1E3D	47742	W	Signed 16 bit integer  Write to location Holds Profile;  Data ignored

### SP Program 5

Table 12-19: Setpoint Program 5

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
SP Program Output	1E40	47745	R	Setpoint Program output value (engineering unit)
Current Segment Number	1E42	47747	R	Floating Point; 1...Max Segment #  A write changes the segment number
Segment Time Remaining	1E48	47753	R	Floating Point in Minutes or Time Units
Status	1E4B	47756	R	Bit 0: 1=Ready  1: 1=Run

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				2: 1=Hold 3: 1=End 4: 1=Time Units in Seconds 5: 1=Time Units in Minutes 6: 1=Time Units in Hours 7: Ramp Units <ul style="list-style-type: none"> <li>• 0: Time</li> <li>• 1: Rate</li> </ul> 8: If bit 7 Set <ul style="list-style-type: none"> <li>• 0: EU/Hour</li> <li>• 1: EU/Minute</li> </ul> 9: Guaranteed Soak State
Start	1E4C	47757	W	Signed 16 bit integer Write to location Starts Profile; Data ignored
Hold	1E4D	47758	W	Signed 16 bit integer Write to location Holds Profile;

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Data ignored

### SP Program 6

Table 12-20: Setpoint Program 6

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
SP Program Output	1E50	47761	R	Setpoint Program output value (engineering unit)
Current Segment Number	1E52	47763	R	Floating Point; 1...Max Segment #  A write changes the segment number
Segment Time Remaining	1E58	47769	R	Floating Point in Minutes or Time Units
Status	1E5B	47772	R	Bit 0: 1=Ready  1: 1=Run  2: 1=Hold  3: 1=End  4: 1=Time Units in Seconds  5: 1=Time Units in Minutes  6: 1=Time Units in Hours

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				7: Ramp Units <ul style="list-style-type: none"> <li>• 0: Time</li> <li>• 1: Rate</li> </ul> 8: If bit 7 Set <ul style="list-style-type: none"> <li>• 0: EU/Hour</li> <li>• 1: EU/Minute</li> </ul> 9: Guaranteed Soak State
Start	1E5C	47773	W	Signed 16 bit integer  Write to location Starts Profile;  Data ignored
Hold	1E5D	47774	W	Signed 16 bit integer  Write to location Holds Profile;  Data ignored

### SP Program 7

Table 12-21: Setpoint Program 7

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
SP Program Output	1E60	47777	R	Setpoint Program output

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				value (engineering unit)
Current Segment Number	1E62	47779	R	Floating Point; 1...Max Segment #  A write changes the segment number
Segment Time Remaining	1E68	47785	R	Floating Point in Minutes or Time Units
Status	1E6B	47788	R	Bit 0: 1=Ready  1: 1=Run  2: 1=Hold  3: 1=End  4: 1=Time Units in Seconds  5: 1=Time Units in Minutes  6: 1=Time Units in Hours  7: Ramp Units  • 0: Time  • 1: Rate  8: If bit 7 Set  • 0: EU/Hour  • 1: EU/Minute

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				9: Guaranteed Soak State
Start	1E6C	47789	W	Signed 16 bit integer  Write to location Starts Profile;  Data ignored
Hold	1E6D	47790	W	Signed 16 bit integer  Write to location Holds Profile;  Data ignored

### SP Program 8

Table 12-22: Setpoint Program 8

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
SP Program Output	1E70	47793	R	Setpoint Program output value (engineering unit)
Current Segment Number	1E72	47795	R	Floating Point; 1...Max Segment #  A write changes the segment number
Segment Time Remaining	1E78	47801	R	Floating Point

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				in Minutes or Time Units
Status	1E7B	47804	R	Bit 0: 1=Ready 1: 1=Run 2: 1=Hold 3: 1=End 4: 1=Time Units in Seconds 5: 1=Time Units in Minutes 6: 1=Time Units in Hours 7: Ramp Units <ul style="list-style-type: none"> <li>• 0: Time</li> <li>• 1: Rate</li> </ul> 8: If bit 7 Set <ul style="list-style-type: none"> <li>• 0: EU/Hour</li> <li>• 1: EU/Minute</li> </ul> 9: Guaranteed Soak State
Start	1E7C	47805	W	Signed 16 bit integer Write to location Starts Profile; Data ignored
Hold	1E7D	47806	W	Signed 16 bit

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				integer Write to location Holds Profile; Data ignored

## Set Point Program Additional Values Register Map

Table 12-23: SP Program Additional Values Register Map

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Time Units	1F3A	47995	R	Bit Packed Bit 0: seconds 1: minutes 2: hours 3-15: Unused  <b>NOTE:</b> UDC2800 does not support seconds
Ramp Units	1F3B	47996	R	Bit Packed Bit 0:0: Time; 1: Rate Bit 1-15: Unused
Program End Segment (Program 1 only)	1F3D	47998	R/W	Bit Packed

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Bit 0: 1: 2 1: 1: 4 2: 1: 6 3: 1: 8
Program Termination State	1F3E	47999	R/W	Bit Packed Bit 0: 0: Last SP (Hold at last SP in program) 1: F'SAFE (Manual mode, failsafe output) 1-15: Unused
Program State at Program End	1F3F	48000	R/W	Bit Packed Bit 0: 0: Disable; 1: Hold 1-15: Unused
Engineering Units for Ramp Segments	1F40	48001	R/W	Bit Packed Bit 0: 0: Hrs:Mins 0: 1: Degrees/Min 1: 1: Degrees/Hour 2-15: Unused
Program Start Segment 1 ~ 8	1F41	48002	R/W	Bit Packed Bit 0: 1= Start Segment 1 1: 1= Start Segment 2 ⋮ 7: 1= Start Segment

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				8
Program Recycles	1F42	48003	R/W	Unsigned 16 bit integer 0 ~ 99

## SP Program 2

Table 12-24: Setpoint Program 2

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Time Units	1F7A	48059	R	Bit Packed Bit 0: seconds 1: minutes 2: hours 3-15: Unused  <b>NOTE:</b> UDC2800 does not support seconds
Ramp Units	1F7B	48060	R	Bit Packed Bit 0:0: Time; 1: Rate Bit 1-15: Unused
Program End Segment (Program 1 only)	1F7D	48062	R/W	Bit Packed Bit 0: 1: 2 1: 1: 4

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				2: 1: 6 3: 1: 8
Program Termination State	1F7E	48063	R/W	Bit Packed Bit 0: 0: Last SP (Hold at last SP in program) 1: F'SAFE (Manual mode, failsafe output) 1-15: Unused
Program State at Program End	1F7F	48064	R/W	Bit Packed Bit 0: 0: Disable; 1: Hold 1-15: Unused
Engineering Units for Ramp Segments	1F80	48065	R/W	Bit Packed Bit 0: 0: Hrs:Mins 0: 1: Degrees/Min 1: 1: Degrees/Hour 2-15: Unused
Program Start Segment 1 ~ 8	1F81	48066	R/W	Bit Packed Bit 0: 1= Start Segment 1 1: 1= Start Segment 2 ⋮ 7: 1= Start Segment 8
Program Recycles	1F82	48067	R/W	Unsigned 16 bit integer

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				0 ~ 99

### SP Program 3

Table 12-25: Setpoint Program 3

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Time Units	1FBA	48123	R	Bit Packed Bit 0: seconds 1: minutes 2: hours 3-15: Unused <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <b>NOTE:</b>                          UDC2800                          does not                          support                          seconds                     </div>
Ramp Units	1FBB	48124	R	Bit Packed Bit 0:0: Time; 1: Rate Bit 1-15: Unused
Program End Segment (Program 1 only)	1FBD	48126	R/W	Bit Packed Bit 0: 1: 2 1: 1: 4 2: 1: 6 3: 1: 8
Program Termination State	1FBE	48127	R/W	Bit Packed

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				Bit 0: 0: Last SP (Hold at last SP in program) 1: F'SAFE (Manual mode, failsafe output) 1-15: Unused
Program State at Program End	1FBF	48128	R/W	Bit Packed Bit 0: 0: Disable; 1: Hold 1-15: Unused
Engineering Units for Ramp Segments	1FC0	48129	R/W	Bit Packed Bit 0: 0: Hrs:Mins 0: 1: Degrees/Min 1: 1: Degrees/Hour 2-15: Unused
Program Start Segment 1 ~ 8	1FC1	48130	R/W	Bit Packed Bit 0: 1= Start Segment 1 1: 1= Start Segment 2 ⋮ 7: 1= Start Segment 8
Program Recycles	1FC2	48131	R/W	Unsigned 16 bit integer 0 ~ 99

## SP Program 4

Table 12-26: Setpoint Program 4

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Time Units	1FFA	48187	R	Bit Packed Bit 0: seconds 1: minutes 2: hours 3-15: Unused <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <b>NOTE:</b>                          UDC2800                          does not                          support                          seconds                     </div>
Ramp Units	1FFB	48188	R	Bit Packed Bit 0:0: Time; 1: Rate Bit 1-15: Unused
Program End Segment (Program 1 only)	1FFD	48190	R/W	Bit Packed Bit 0: 1: 2 1: 1: 4 2: 1: 6 3: 1: 8
Program Termination State	1FFE	48191	R/W	Bit Packed Bit 0: 0: Last SP (Hold at last SP in program) 1: F'SAFE (Manual mode, failsafe)

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				output) 1-15: Unused
Program State at Program End	1FFF	48192	R/W	Bit Packed Bit 0: 0: Disable; 1: Hold 1-15: Unused
Engineering Units for Ramp Segments	2000	48193	R/W	Bit Packed Bit 0: 0: Hrs:Mins 0: 1: Degrees/Min 1: 1: Degrees/Hour 2-15: Unused
Program Start Segment 1 ~ 8	2001	48194	R/W	Bit Packed Bit 0: 1= Start Segment 1 1: 1= Start Segment 2 ⋮ 7: 1= Start Segment 8
Program Recycles	2002	48195	R/W	Unsigned 16 bit integer 0 ~ 99

## SP Program 5

Table 12-27: Setpoint Program 5

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Time Units	203A	48251	R	Bit Packed Bit 0: seconds 1: minutes 2: hours 3-15: Unused <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <b>NOTE:</b>                          UDC2800                          does not                          support                          seconds                     </div>
Ramp Units	203B	48252	R	Bit Packed Bit 0:0: Time; 1: Rate Bit 1-15: Unused
Program End Segment (Program 1 only)	203D	48254	R/W	Bit Packed Bit 0: 1: 2 1: 1: 4 2: 1: 6 3: 1: 8
Program Termination State	203E	48255	R/W	Bit Packed Bit 0: 0: Last SP (Hold at last SP in program) 1: F'SAFE (Manual mode, failsafe)

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				output) 1-15: Unused
Program State at Program End	203F	48256	R/W	Bit Packed Bit 0: 0: Disable; 1: Hold 1-15: Unused
Engineering Units for Ramp Segments	2040	48257	R/W	Bit Packed Bit 0: 0: Hrs:Mins 0: 1: Degrees/Min 1: 1: Degrees/Hour 2-15: Unused
Program Start Segment 1 ~ 8	2041	48258	R/W	Bit Packed Bit 0: 1= Start Segment 1 1: 1= Start Segment 2 ⋮ 7: 1= Start Segment 8
Program Recycles	2042	48259	R/W	Unsigned 16 bit integer 0 ~ 99

## SP Program 6

Table 12-28: Setpoint Program 6

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Time Units	207A	48315	R	Bit Packed Bit 0: seconds 1: minutes 2: hours 3-15: Unused <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <b>NOTE:</b>                          UDC2800                          does not                          support                          seconds                     </div>
Ramp Units	207B	48316	R	Bit Packed Bit 0:0: Time; 1: Rate Bit 1-15: Unused
Program End Segment (Program 1 only)	207D	48318	R/W	Bit Packed Bit 0: 1: 2 1: 1: 4 2: 1: 6 3: 1: 8
Program Termination State	207E	48319	R/W	Bit Packed Bit 0: 0: Last SP (Hold at last SP in program) 1: F'SAFE (Manual mode, failsafe)

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				output) 1-15: Unused
Program State at Program End	207F	48320	R/W	Bit Packed Bit 0: 0: Disable; 1: Hold 1-15: Unused
Engineering Units for Ramp Segments	2080	48321	R/W	Bit Packed Bit 0: 0: Hrs:Mins 0: 1: Degrees/Min 1: 1: Degrees/Hour 2-15: Unused
Program Start Segment 1 ~ 8	2081	48322	R/W	Bit Packed Bit 0: 1= Start Segment 1 1: 1= Start Segment 2 ⋮ 7: 1= Start Segment 8
Program Recycles	2082	48323	R/W	Unsigned 16 bit integer 0 ~ 99

## SP Program 7

Table 12-29: Setpoint Program 7

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Time Units	20BA	48379	R	Bit Packed Bit 0: seconds 1: minutes 2: hours 3-15: Unused <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <b>NOTE:</b>                          UDC2800                          does not                          support                          seconds                     </div>
Ramp Units	20BB	48380	R	Bit Packed Bit 0:0: Time; 1: Rate Bit 1-15: Unused
Program End Segment (Program 1 only)	20BD	48382	R/W	Bit Packed Bit 0: 1: 2 1: 1: 4 2: 1: 6 3: 1: 8
Program Termination State	20BE	48383	R/W	Bit Packed Bit 0: 0: Last SP (Hold at last SP in program) 1: F'SAFE (Manual mode, failsafe)

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				output) 1-15: Unused
Program State at Program End	20BF	48384	R/W	Bit Packed Bit 0: 0: Disable; 1: Hold 1-15: Unused
Engineering Units for Ramp Segments	20C0	48385	R/W	Bit Packed Bit 0: 0: Hrs:Mins 0: 1: Degrees/Min 1: 1: Degrees/Hour 2-15: Unused
Program Start Segment 1 ~ 8	20C1	48386	R/W	Bit Packed Bit 0: 1= Start Segment 1 1: 1= Start Segment 2 ⋮ 7: 1= Start Segment 8
Program Recycles	20C2	48387	R/W	Unsigned 16 bit integer 0 ~ 99

## SP Program 8

Table 12-30: Setpoint Program 8

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
Time Units	20FA	48443	R	Bit Packed Bit 0: seconds 1: minutes 2: hours 3-15: Unused <div style="border: 1px solid blue; padding: 5px; margin-top: 10px;"> <b>NOTE:</b>                          UDC2800                          does not                          support                          seconds                     </div>
Ramp Units	20FB	48444	R	Bit Packed Bit 0:0: Time; 1: Rate Bit 1-15: Unused
Program End Segment (Program 1 only)	20FD	48446	R/W	Bit Packed Bit 0: 1: 2 1: 1: 4 2: 1: 6 3: 1: 8
Program Termination State	20FE	48447	R/W	Bit Packed Bit 0: 0: Last SP (Hold at last SP in program) 1: F'SAFE (Manual mode, failsafe)

Parameter Description	Register Address		Access	Description
	Hex	Decimal		
				output) 1-15: Unused
Program State at Program End	20FF	48448	R/W	Bit Packed Bit 0: 0: Disable; 1: Hold 1-15: Unused
Engineering Units for Ramp Segments	2100	48449	R/W	Bit Packed Bit 0: 0: Hrs:Mins 0: 1: Degrees/Min 1: 1: Degrees/Hour 2-15: Unused
Program Start Segment 1 ~ 8	2101	48450	R/W	Bit Packed Bit 0: 1= Start Segment 1 1: 1= Start Segment 2 ⋮ 7: 1= Start Segment 8
Program Recycles	2102	48451	R/W	Unsigned 16 bit integer 0 ~ 99

## Set Point Program Segment Map

A profile can contain up to 64 segments depending on the instrument. Each segment is made up of 8 registers. The segment mapping for setpoint programmer #1~8 is shown below.

Table 12-31: Set Point Program Segment Map

Start Address	End Address	Description
2800	2807	Set Point Programmer #1 Segment 1
2808	280F	Set Point Programmer #1 Segment 2
2810	2817	Set Point Programmer #1 Segment 3
2818	281F	Set Point Programmer #1 Segment 4
2820	2827	Set Point Programmer #1 Segment 5
2828	282F	Set Point Programmer #1 Segment 6
2830	2837	Set Point Programmer #1 Segment 7
2838	283F	Set Point Programmer #1 Segment 8
2A00	2A07	Set Point Programmer #2 Segment 1
2A08	2A0F	Set Point Programmer #2 Segment 2
2A10	2A17	Set Point Programmer #2 Segment 3
2A18	2A1F	Set Point Programmer #2 Segment 4
2A20	2A27	Set Point Programmer #2 Segment 5
2A28	2A2F	Set Point Programmer #2 Segment 6
2A30	2A37	Set Point Programmer #2 Segment 7
2A38	2A3F	Set Point Programmer #2 Segment 8
2C00	2C07	Set Point Programmer #3 Segment 1
2C08	2C0F	Set Point Programmer #3 Segment 2
2C10	2C17	Set Point Programmer #3 Segment 3
2C18	2C1F	Set Point Programmer #3 Segment 4
2C20	2C27	Set Point Programmer #3 Segment 5
2C28	2C2F	Set Point Programmer #3 Segment 6
2C30	2C37	Set Point Programmer #3 Segment 7
2C38	2C3F	Set Point Programmer #3 Segment 8
2E00	2E07	Set Point Programmer #4 Segment 1
2E08	2E0F	Set Point Programmer #4 Segment 2

Start Address	End Address	Description
2E10	2E17	Set Point Programmer #4 Segment 3
2E18	2E1F	Set Point Programmer #4 Segment 4
2E20	2E27	Set Point Programmer #4 Segment 5
2E28	2E2F	Set Point Programmer #4 Segment 6
2E30	2E37	Set Point Programmer #4 Segment 7
2E38	2E3F	Set Point Programmer #4 Segment 8
3000	3007	Set Point Programmer #5 Segment 1
3008	300F	Set Point Programmer #5 Segment 2
3010	3017	Set Point Programmer #5 Segment 3
3018	301F	Set Point Programmer #5 Segment 4
3020	3027	Set Point Programmer #5 Segment 5
3028	302F	Set Point Programmer #5 Segment 6
3030	3037	Set Point Programmer #5 Segment 7
3038	303F	Set Point Programmer #5 Segment 8
3200	3207	Set Point Programmer #6 Segment 1
3208	320F	Set Point Programmer #6 Segment 2
3210	3217	Set Point Programmer #6 Segment 3
3218	321F	Set Point Programmer #6 Segment 4
3220	3227	Set Point Programmer #6 Segment 5
3228	322F	Set Point Programmer #6 Segment 6
3230	3237	Set Point Programmer #6 Segment 7
3238	323F	Set Point Programmer #6 Segment 8
3400	3407	Set Point Programmer #7 Segment 1
3408	340F	Set Point Programmer #7 Segment 2
3410	3417	Set Point Programmer #7 Segment 3
3418	341F	Set Point Programmer #7 Segment 4
3420	3427	Set Point Programmer #7 Segment 5

Start Address	End Address	Description
3428	342F	Set Point Programmer #7 Segment 6
3430	3437	Set Point Programmer #7 Segment 7
3438	343F	Set Point Programmer #7 Segment 8
3600	3607	Set Point Programmer #8 Segment 1
3608	360F	Set Point Programmer #8 Segment 2
3610	3617	Set Point Programmer #8 Segment 3
3618	361F	Set Point Programmer #8 Segment 4
3620	3627	Set Point Programmer #8 Segment 5
3628	362F	Set Point Programmer #8 Segment 6
3630	3637	Set Point Programmer #8 Segment 7
3638	363F	Set Point Programmer #8 Segment 8

### Segment Register Map

The table below describes the registers that are part of a setpoint programmer segment. To determine the actual register address for a parameter within a segment, add the register offset to the start address of the segment.

Table 12-32: Segment Register Map

Parameter Name	Register Offset within Segment	Access	Description
Ramp Segment	0	R	Bit Packed Bit 0:1 = ramp segment; 0= soak segment Bit 1:1 = guaranteed soak enabled; 0 = guaranteed soak disabled
Time or Rate	2	R/W	Floating Point in time units

Parameter Name	Register Offset within Segment	Access	Description
			configured for the set point programmer.  Writing to this register is not permissible in the run mode.
Ramp or Soak value	4	R/W	Floating Point  Writing to this register is not permissible in the run mode.  ONLY for Soak Segment

### Example for Determining a Segment Register

To change the ramp value in segment #8 of setpoint programmer #2, the register address is determined as follows.

1. Use Table Set Point Program Segment Map to determine the start address for setpoint program #2 profile. The value is 2A00 Hex.
2. Calculate the offset address for segment 8 in a profile. This is calculated as:  
Segment #8 offset address:  

$$= (\text{segment number} - 1) * 8$$

$$= (8-1) * 8$$

$$= 56 \text{ or } 38 \text{ Hex}$$
3. Use Table Segment Register Map to determine the register offset for the ramp value. The value is 4.
4. Calculate the address by adding the results of steps 1, 2, and 3 to determine the register address.

Register address:

= Setpoint program #2 profile base address +  
Segment 8 offset address + Ramp value register  
offset

= 2A00 + 38 + 4

= 2A3C

# MODBUS COMMUNICATION 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 13-1: 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.

**Security Considerations**

Modbus protocol is supported by UDC device for communications over Ethernet/Serial line.

When creating a network environment, the low level of security of these protocols must be taken into consideration.

For Ethernet/serial connections with an insecure protocol enabled (For Example: unencrypted), additional security controls must be applied in addition to the ones listed in the security section. The data traveling across the Ethernet/serial line is not encrypted when Modbus-TCP/Serial is enabled.

This implies that anyone with access to any network point, such as a switch, router, or PC, can listen to this communication and possibly generate new packets with commands. Such packets may interfere with or entirely prevent a device from operating normally.

**NOTE:** If a customer is not using the serial line, they should unplug it. The vendor should set up a secure network environment and give the required individuals access to the controller.

### ***Physical Security***

It is essential to understand that any unauthorized access to physical device and the wiring carrying Modbus can allow malicious personnel to modify the communication by intercepting it inserting their own content (Man-in-the-middle) or to sniff data content. Any of these actions could affect behavior of the system in an undesirable way including system malfunction, incorrect behavior of network nodes, etc. Care must be taken with cable wiring per the physical protection recommendations to mitigate this security concern.

### ***Physical Device Protection***

When installing a device, always select a physical location with limited or even restricted access. It is recommended to lock the device in an enclosed cabinet with access allowed only to approved and trained personnel. Also, it is strongly advised to keep all the wiring of device physically secure.

# ETHERNET TCP/IP

## What's in this section?

The following topics are covered in this section.

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In this section:

*Overview* ..... 522

# 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 14-1: Private network

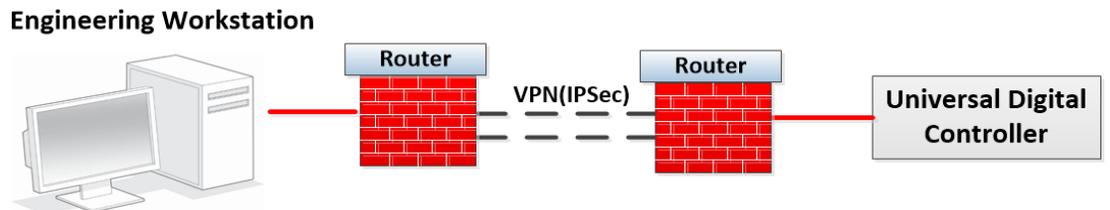
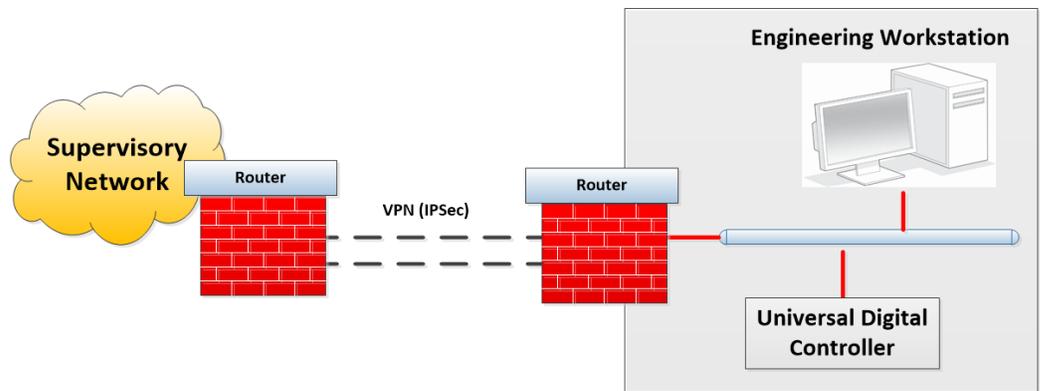


Figure 14-2: Public network



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## 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.

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