Information Guide 925-3
08/2005

Eclipse Universal Digital Controller

Model UDC3200

ECLIPSE®
Innovative Thermal Solutions

Notices and Trademarks

WARRANTY/REMEDY

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Contact your local sales office for warranty information. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace without charge those items it finds defective. The foregoing is Buyer's sole remedy and is **in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose**. Specifications may change without notice. The information we supply is believed to be accurate and reliable as of this printing. However, we assume no responsibility for its use.

While we provide application assistance personally, through our literature and the Honeywell web site, it is up to the customer to determine the suitability of the product in the application.

Contacts

World Wide Web

The following lists Honeywell's World Wide Web sites that will be of interest to our customers.

Honeywell Organization	WWW Address (URL)
Corporate	*http://www.honeywell.com*
Industrial Measurement and Control	*http://www.honeywell.com/imc*

Telephone

Contact us by telephone at the numbers listed below.

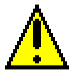
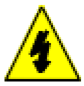
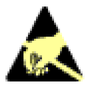
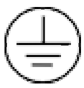
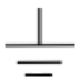
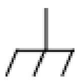
	Organization	Phone Number
United States and Canada	Honeywell	1-800-423-9883 Tech. Support 1-800-525-7439 Service Web http://content.honeywell.com/ipc/faq/

Industrial Measurement and Control

Honeywell
1100 Virginia Drive
Fort Washington, PA 19034

Symbol Definitions

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

Symbol	Definition
	This CAUTION symbol on the equipment refers the user to the Product Manual for additional information. This symbol appears next to required information in the manual.
	**WARNING** **PERSONAL INJURY:** Risk of electrical shock. This symbol warns the user of a potential shock hazard where HAZARDOUS LIVE voltages greater than 30 Vrms, 42.4 Vpeak, or 60 VDC may be accessible. **Failure to comply with these instructions could result in death or serious injury.**
	ATTENTION, Electrostatic Discharge (ESD) hazards. Observe precautions for handling electrostatic sensitive devices
	Protective Earth (PE) terminal. Provided for connection of the protective earth (green or green/yellow) supply system conductor.
	Functional earth terminal. Used for non-safety purposes such as noise immunity improvement. NOTE: This connection shall be bonded to protective earth at the source of supply in accordance with national local electrical code requirements.
	Earth Ground. Functional earth connection. NOTE: This connection shall be bonded to Protective earth at the source of supply in accordance with national and local electrical code requirements.
	Chassis Ground. Identifies a connection to the chassis or frame of the equipment shall be bonded to Protective Earth at the source of supply in accordance with national and local electrical code requirements.

Contents

1 Introduction

1.1 Operator Interface

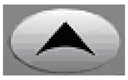
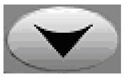
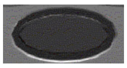
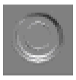
Figure 1-1 UDC3200 Operator Interface

1.2 Function of Displays and Keys

Table 1-1 Function of Displays and Keys

Display Indicators			
3200	Upper display with 4 large digits shows Process Variable value (normal operation) and special annunciator features. During Configuration, the upper display provides guidance for the operator through prompts (7 – characters)	OUT	Indicates Control Relay 1 and/or 2 on.
SP 3200	During normal operation, the 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 (4 digits). During configuration, the lower display provides guidance for the operator through prompts (8-characters).	F Or C	Indicates either degrees Fahrenheit or Centigrade.
ALM	Indicates Alarm 1 and/or Alarm 2 conditions exist.	MAN Or A	Indicates either Manual or Auto mode.
DI	Indicates Digital Input 1 and/or 2 on.	SP	Indicates Local Setpoint #1. Also, a bar is lighted when the setpoint being used is shown on the lower display.

Keys and Functions

Function	Selects functions within each configuration group.	Man Auto	Selects Manual or Auto mode.
Setup	Scrolls through the configuration groups.	SP Select	Hold key down to cycle through configured setpoints.
Lower Display	Returns Controller to normal display from Set Up mode. Toggles various operating parameters for display.	Run Hold	Enables Run/Hold of the SP Ramp or Program plus Timer start.
	Increases setpoint or output value. Increases the configuration values or changes functions in Configuration mode groups.		Decreases setpoint or output value. Decreases the configuration values or changes functions in Configuration mode groups.
	Infrared transceiver		NEMA4X and IP66 screw attachment (each corner)

1.3 CE Conformity (Europe)

This product is in conformity with the protection requirements of the following European Council Directives: **73/23/EEC**, the Low Voltage Directive, and **89/336/EEC**, the EMC Directive. 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)

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, emissions), Industrial Equipment (EN61326, immunity)

Method of EMC Assessment: Technical File (TF)

Declaration of Conformity: 51453663

Deviation from the installation conditions specified in this manual, and the special conditions for CE conformity in Subsection 2, 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.

2 Installation

2.1 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.

2.2 Model Number Interpretation

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.

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 (•) denotes availability.

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

KEY NUMBER - UDC3200 Single Loop Controller

Description	Selection	Availability	
Digital Controller for use with 90 to 264Vac Power	DC3200	↓	
Digital Controller for use with 24Vac/dc Power	DC3201		↓

TABLE I - Specify Control Output and/or Alarms

	Description	Selection		
Output #1	Current Output (4 to 20ma, 0 to 20 ma)	C _	•	•
	Electro Mechanical Relay (5 Amp Form C)	E _	•	•
	Solid State Relay (1 Amp)	A _	•	•
	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	•	•
	Solid State Relay (1 Amp) Plus Alarm 1 (5 Amp Form C Relay)	_ A	•	•
	Open Collector Plus Alarm 1 (5 Amp Form C Relay)	_ T	•	•

TABLE II - Communications and Software Selections

	Description	Selection		
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 Base-T Ethernet (Modbus RTU) Plus Auxiliary Output/Digital Inputs	3 _ _ _	•	•
Software Selections	Standard Functions, Includes Accutune	_ 0 _ _	•	•
	Math Option	_ A _ _	•	•
	Set Point Programming (1 Program, 12 Segments)	_ B _ _	•	•
	Set Point Programming Plus Math	_ C _ _	•	•
Reserved	No Selection	_ _ 0 _	•	•
Infrared interface	Infrared Interface Included (Can be used with a Pocket PC)	_ _ _ R	•	•

TABLE III - Input 1 can be changed in the field using external resistors

	Description	Selection		
Input 1	TC, RTD, mV, 0-5V, 1-5V	1 _ _	•	•
	TC, RTD, mV, 0-5V, 1-5V, 0-20mA, 4-20mA	2 _ _	•	•
	TC, RTD, mV, 0-5V, 1-5V, 0-20mA, 4-20mA, 0-10V	3 _ _	•	•
	Carbon, Oxygen or Dewpoint (Requires Input 2)	1 6 0	•	•
Input 2	None	_ 00	•	•
	TC, RTD, mV, 0-5V, 1-5V, 0-20mA, 4-20mA	_ 10	•	•
	TC, RTD, mV, 0-5V, 1-5V, 0-20mA, 4-20mA, 0-10V	_ 20	•	•
	Slidewire Input (Requires two Relay Outputs)	_ 40	•	•

TABLE IV - Options

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

TABLE V - Product Manuals

Manuals	Product Information on CD - All Languages	0 _	•	•
	English Manual	E _	•	•
	French Manual	F _	•	•
	German Manual	G _	•	•
	Italian Manual	I _	•	•
	Spanish Manual	S _	•	•
Certificate	None	_ 0	•	•
	Certificate of Conformance (F3391)	_ C	•	•

TABLE VI

No Selection	None	0 _	•	•

Figure 2-1 Model Number Interpretation

2.3 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 2-1 Control Relay Contact Information

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

Alarm Relays

ATTENTION

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

Table 2-2 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	

2.4 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.

- Overall dimensions and panel cutout requirements for mounting the controller are shown in Figure 2-2.
- 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.
- The front panel is moisture rated NEMA3 and IP55 rated and can be easily upgraded to NEMA4X and IP66.

Overall Dimensions

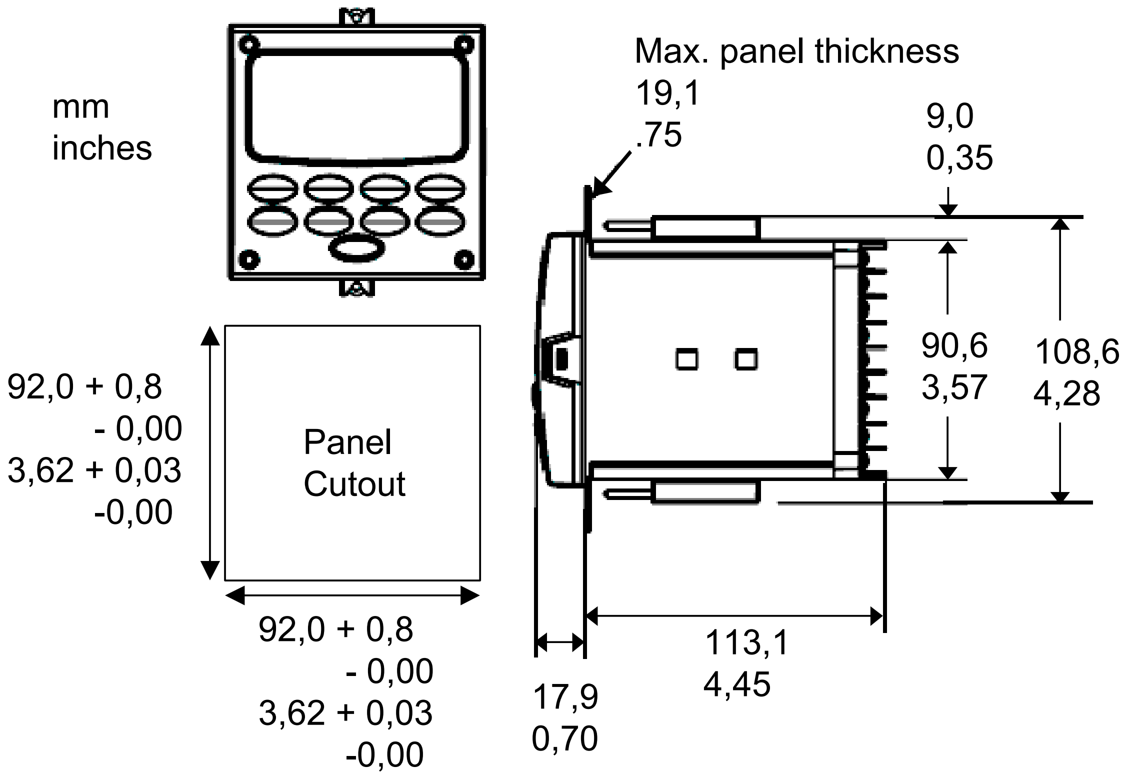


Figure 2-2 Mounting Dimensions (not to scale)

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.

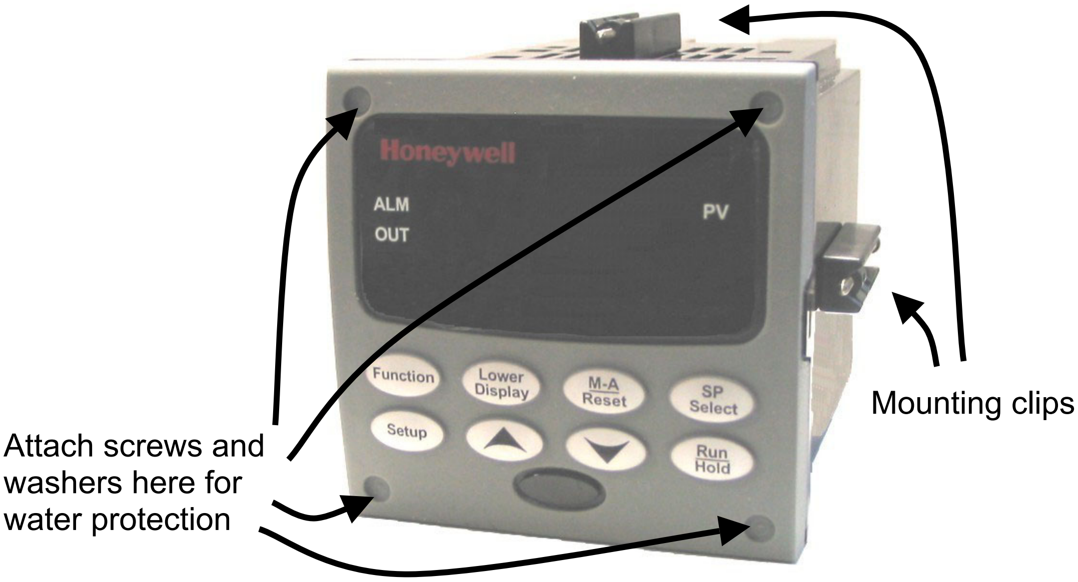


Figure 2-3 Mounting Methods

Mounting Procedure

Table 2-3 Mounting Procedure

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

2.5 Wiring

2.5.1 Electrical Considerations

Line voltage wiring

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

Mains Power Supply

This equipment is suitable for connection to 90 to 264 Vac or to 24 Vac/dc 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), 1/2A, 250V fuse(s), or circuit-breaker for 90-264 Vac applications; or 1 A, 125 V fuse or circuit breaker for 24 Vac/dc 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 90-264 Vac to an instrument rated for 24 Vac/dc will severely damage the instrument and is a fire and smoke hazard.

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 No. 12 (4 mm^2) 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, Table 2-4.

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 Permissible Wiring Bundling - Table 2-4) 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 2-4 Permissible Wiring Bundling

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

2.6 Wiring Diagrams

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 relays; or
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 2-5 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, Solid-State Relay or Open Collector Output.

Table 2-5 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% Current = COOL and HEAT	Single Relay	INU	Alarm 2	Alarm 1	Outputs 1 and 2
	Current Output	Outputs 1 and 2	Alarm 2	Alarm 1	Not Needed
	Dual Relay	INU	Alarm 2	Alarm 1	Outputs 1 and 2
Current Duplex 50% Current = HEAT Aux Out = COOL	Single Relay	N/A	N/A	N/A	N/A
	Current Output	Output 1	Alarm 2	Alarm 1	Output 2
	Dual Relay	N/A	N/A	N/A	N/A
Current/Time Current = COOL Time = HEAT	Single Relay *	Output 1	Output 2	Alarm 1	Output 2
	Current Output	Output 2	Output 2	Alarm 1	Not Needed
	Dual Relay *	Outputs 1 & 2	Alarm 2	Alarm 1	Output 2
Time/Current Time = COOL Current = HEAT	Single Relay *	Output 1	Output 2	Alarm 1	Output 1
	Current Output	Output 1	Output 2	Alarm 1	Not Needed
	Dual Relay *	Outputs 1 & 2	Alarm 2	Alarm 1	Output 1

TPSC = Three Position Step Control

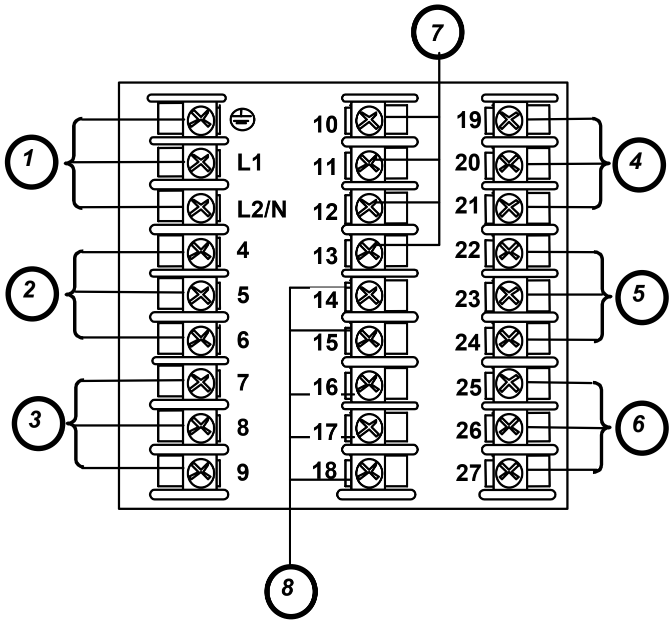
N/A = Not Available – This output algorithm type cannot be performed with this Output 1/2 option.

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

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

* To obtain this output algorithm type with these Output 1/2 Options: 1) Configure the OUTALG selection as “TIME D”; 2) Configure Auxiliary Output for “OUTPUT” and; 3) Scale the Auxiliary Output as necessary for the desired output algorithm type. For these selections, the Output 1 (HEAT) and Output 2 (COOL) signals will be present both on the Auxiliary Output and on the two relays normally used for Time Duplex.

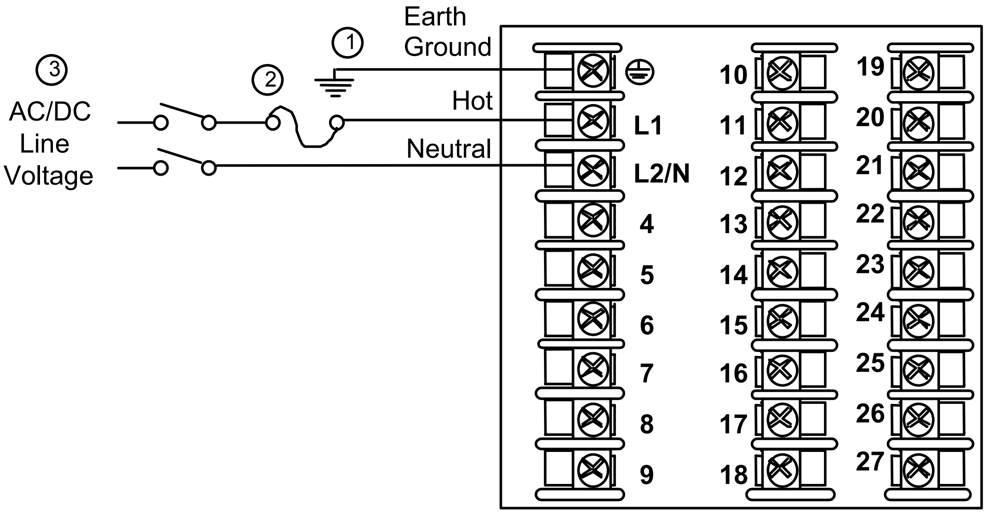
Wiring the Controller



See table for callout details

Figure 2-4 Composite Wiring Diagram

Callout	Details
1	AC/DC Line Voltage Terminals. See Figure 2-5.
2	Output 3 Terminals. See Figure 2-8 through Figure 2-14.
3	Output 4 Terminals. See Figure 2-8 through Figure 2-14.
4	Outputs 1 and 2 Terminals. See Figure 2-8 through Figure 2-14.
5	Input #2 Terminals. See Figure 2-7.
6	Input #1 Terminals. See Figure 2-6.
7	Aux. Output and Digital Inputs Terminals. See Figure 2-17.
8	Communications Terminals. See Figure 2-15 and Figure 2-16.

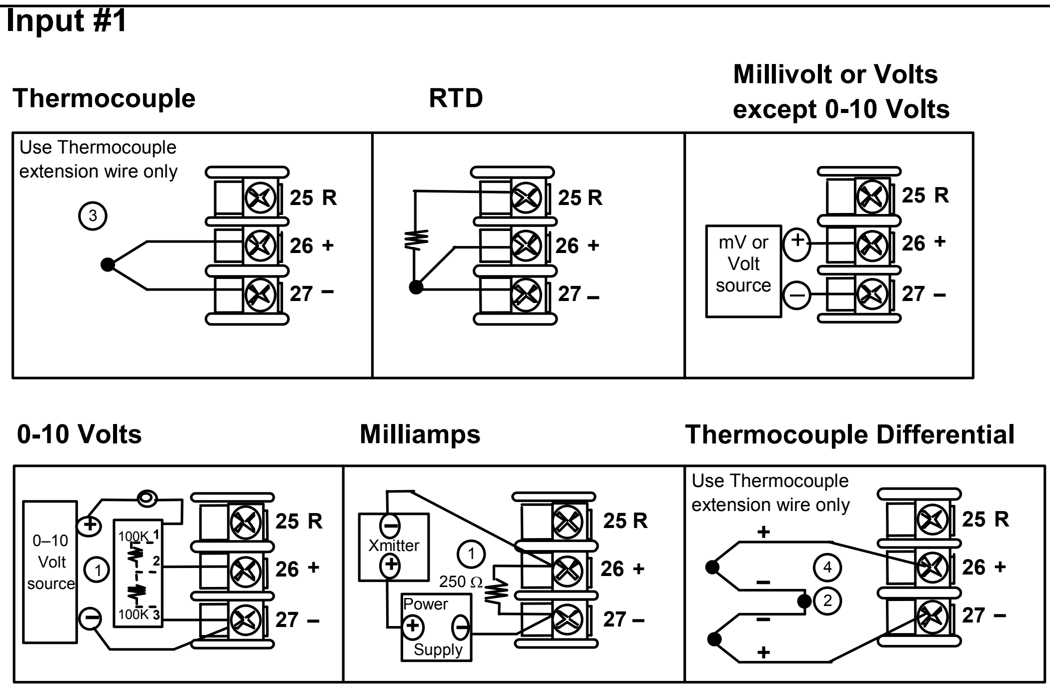


1 PROTECTIVE BONDING (grounding) of this controller and the enclosure in which it is installed, shall be in accordance with National and local electrical codes. To minimize electrical noise and transients that may adversely affect the system, supplementary bonding of the controller enclosure to local ground using a No. 12 (4 mm^2) copper conductor is recommended. Before powering the controller, see "Prelimnary Checks" in this section of the Product Manual.

2 It is the user's responsibility to provide a switch and non-time delay (North America), quick-acting, high breaking capacity, Type F (Europe), 1/2A, 250V fuse(s), or circuit-breaker for 90-264 Vac applications; or 1 A, 125 V fuse or circuit breaker for 24 Vac/dc applications, as part of the installation.

3 **CAUTION** Applying 90-264 Vac to an instrument rated for 24 Vac/dc will severely damage the instrument and is a fire and smoke hazard.

Figure 2-5 Mains Power Supply



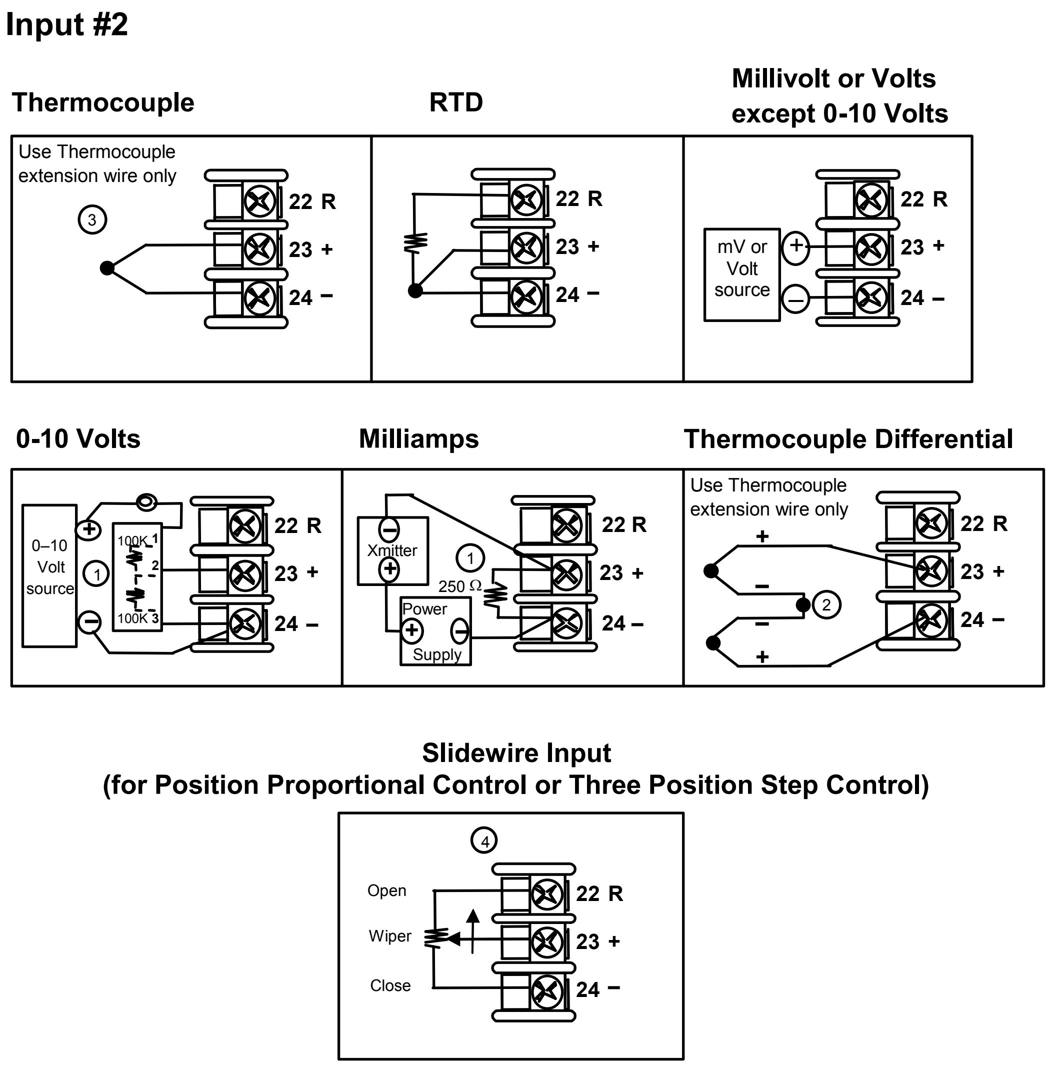
1. The 250 ohm resistor for milliamp inputs or the voltage divider for 0-10 Volt inputs are supplied with the controller when those inputs are specified. These items must be installed prior to start up when the controller is wired. For 0-20 mA applications, the resistor should be located at the transmitter 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 2-6 Input 1 Connections



1. The 250 ohm resistor for milliamp inputs or the voltage divider for 0-10 Volt inputs are 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 theother instrument to also drive this controller.
4. Input 2 is used to measure the Slidewire Input for Position Proportional Control.

xxxx

Figure 2-7 Input 2 Connections

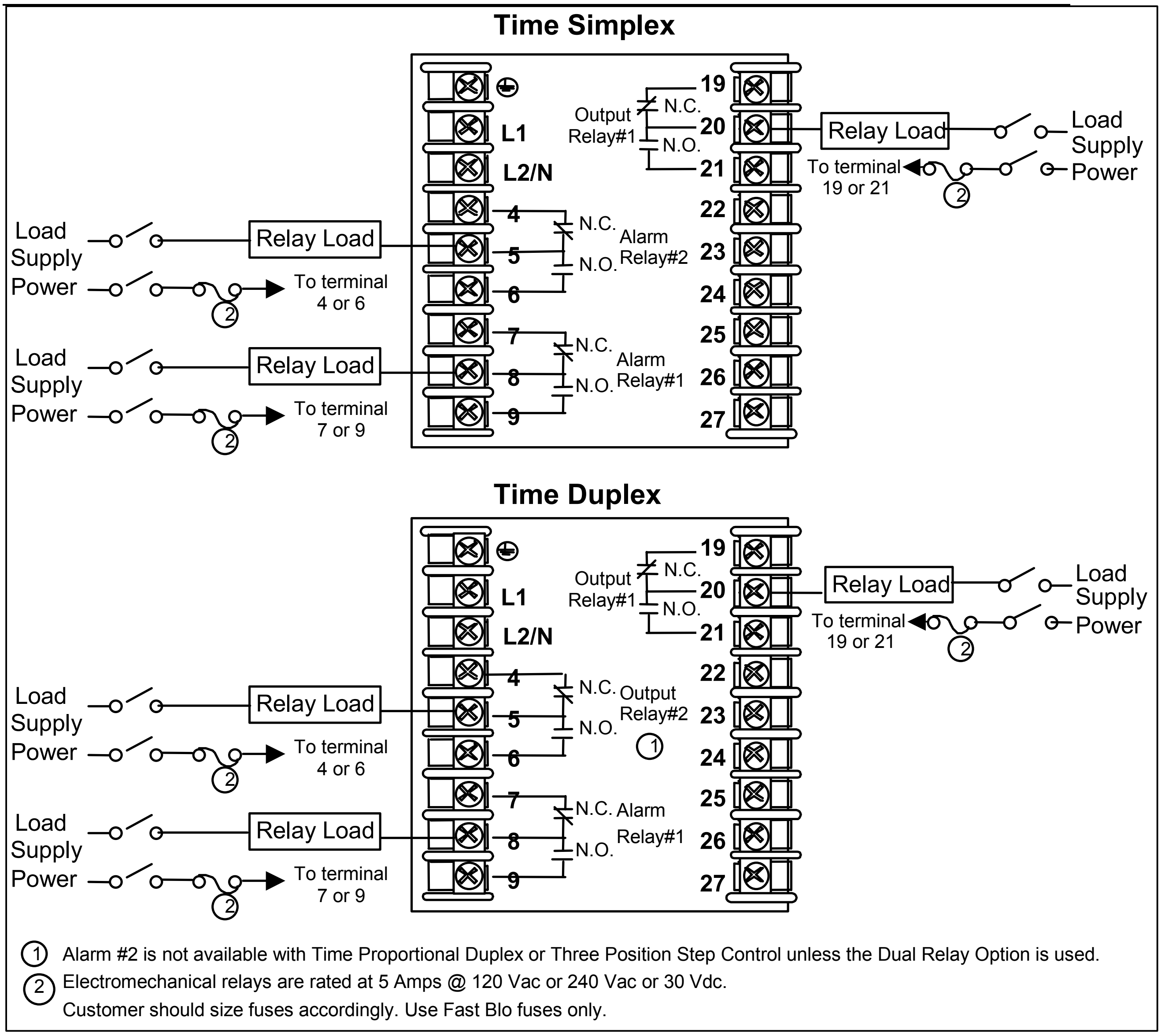
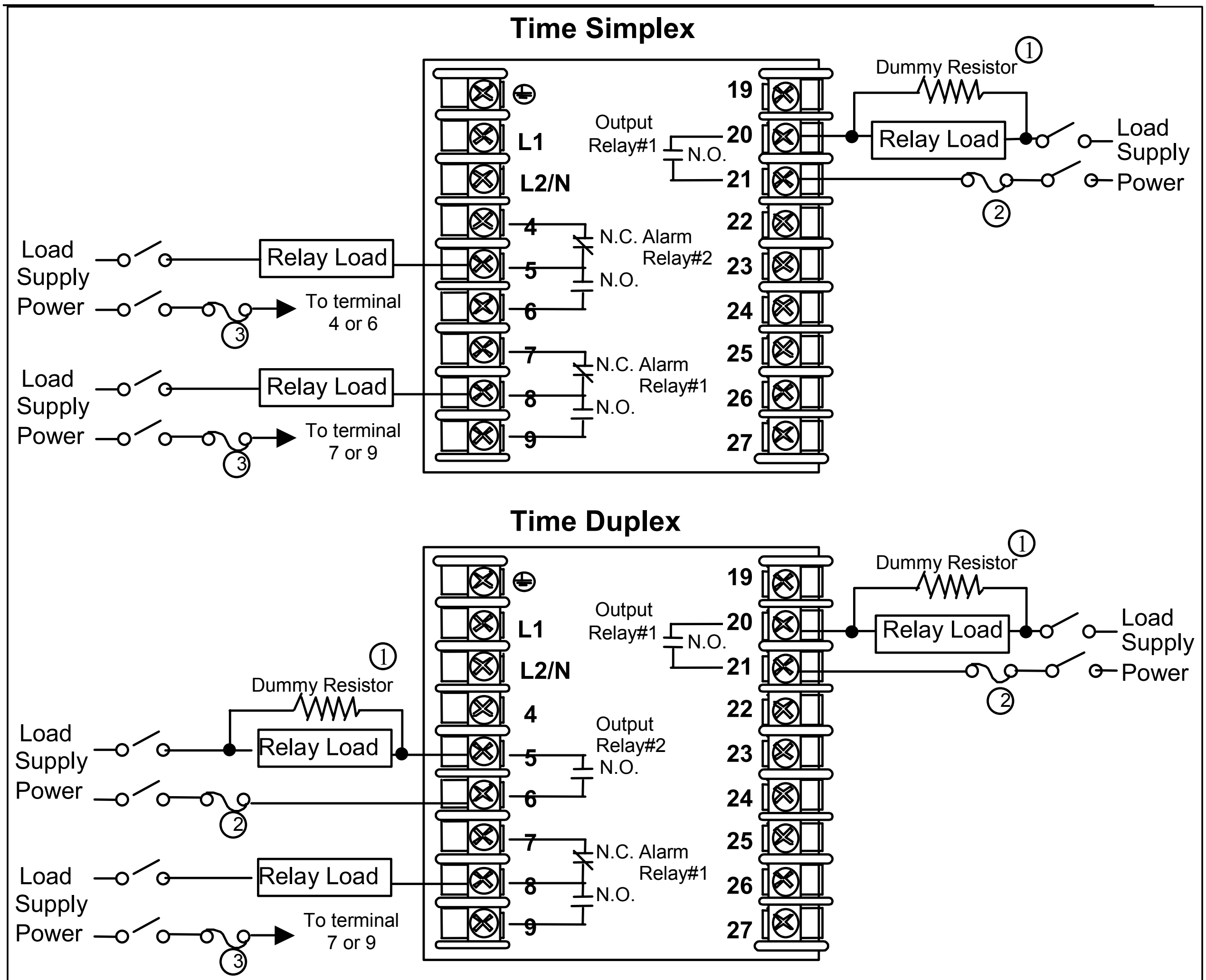


Figure 2-8 Electromechanical Relay Output

See Table 2-5 for relay terminal connections for other Output Algorithm Types.



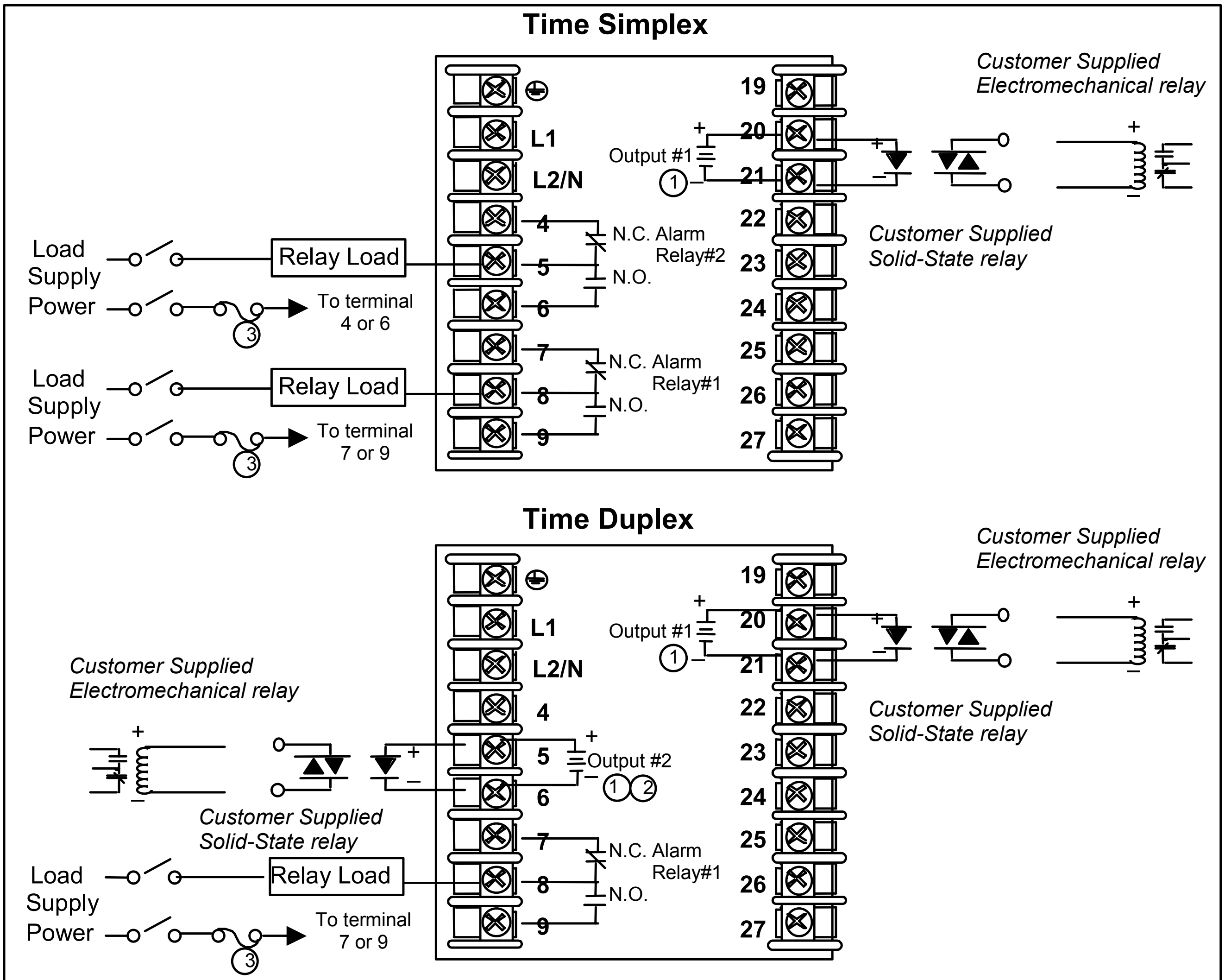
1. If the load current is less than the minimum rated value of 20 mA, then there may be residual voltage across both ends of the load even if the relay is turned off. Use a dummy resistor as shown to counteract this. The total current through the resistor and the the load must exceed 20 mA. Solid State Relays are zero-crossing type.

2. Solid State relays are rated at 1 Amp at 25°C and derated linearly to 0.5 Amp at 55°C. Customer should size fuse accordingly. Use Fast Blo fuses only.

3. Electromechanical relays are rated at 5 Amps @ 120 Vac or 240 Vac or 30 Vdc. Customer should size fuses accordingly. Use Fast Blo fuses only.

Figure 2-9 Solid State Relay Output

See Table 2-5 for relay terminal connections for other Output Algorithm Types.



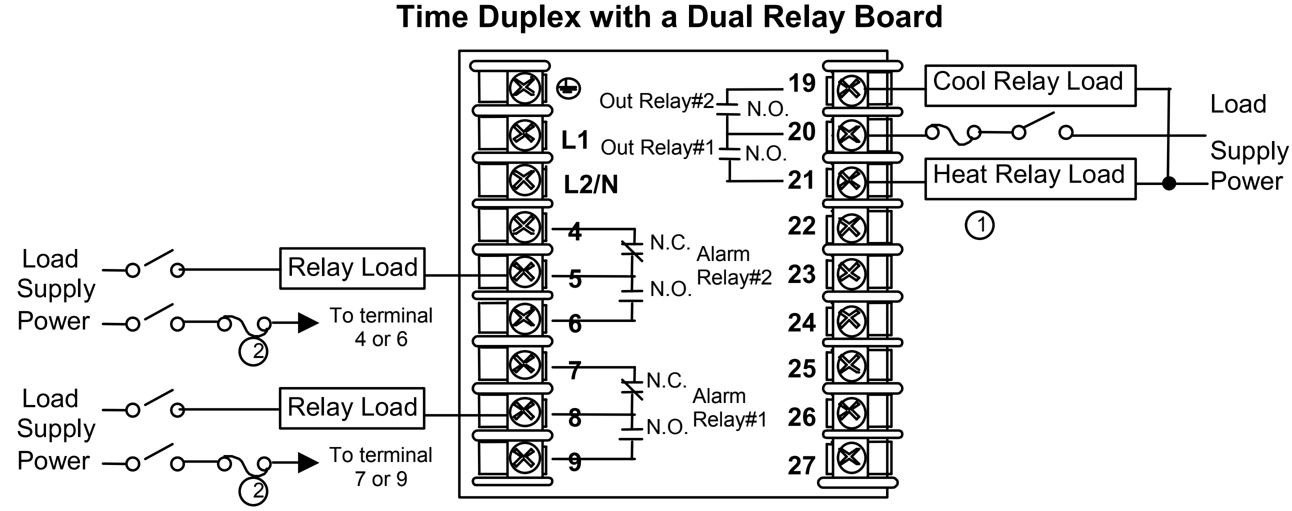
① **CAUTION** Open collector outputs are internally powered at +30 Vdc. Connecting an external power supply will damage the controller.

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 @ 120 Vac or 240 Vac or 30 Vdc. Customer should size fuses accordingly. Use Fast Blo fuses only.

Figure 2-10 Open Collector Output

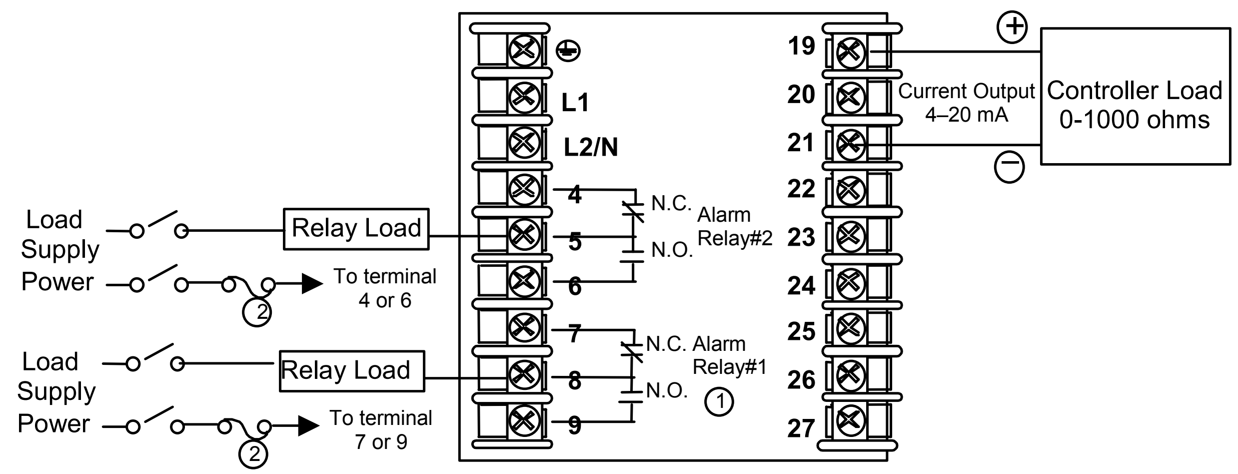
See Table 2-5 for relay terminal connections for other Output Algorithm Types.



1. Dual Electromechanical relays are rated at 2 Amps @120 Vac or 240 Vac or 30 Vdc. Customer should size fuses accordingly. Use Fast Blo fuses only.
2. Electromechanical relays are rated at 5 Amps @120 Vac or 240 Vac or 30 Vdc. Customer should size fuses accordingly. Use Fast Blo fuses only.

Figure 2-11 Dual Electromechanical Relay Option Output

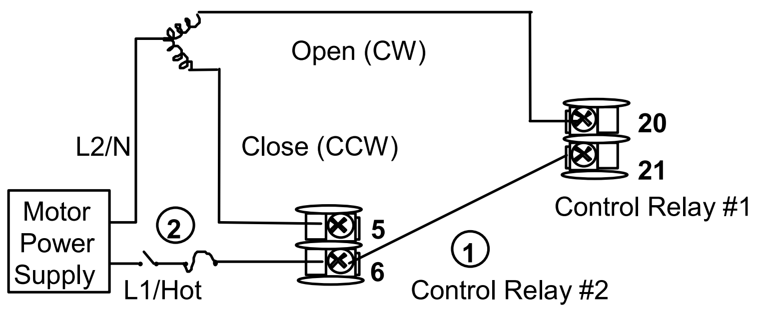
See Table 2-5 for relay terminal connections for other Output Algorithm Types.



1. When the instrument has the Current Output as shown, no Alarms are available when using the Time Proportional Duplex or Three Position Step Control Output Algorithms, as these outputs require both available relays.
2. Electromechanical relays are rated at 5 Amps @120 Vac or 240 Vac or 30 Vdc Customer should size fuses accordingly. Use Fast Blo fuses only.

Figure 2-12 Current Output

See Table 2-5 for relay terminal connections for other Output Algorithm Types.



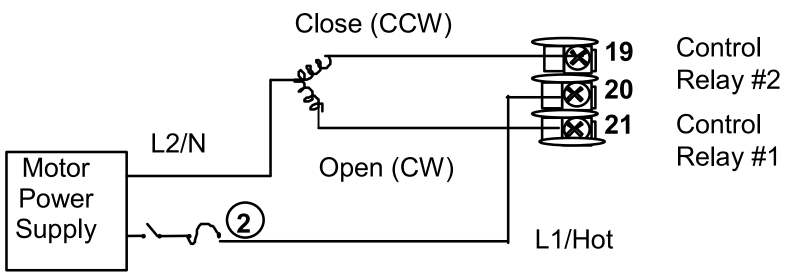
1 Alarm #2 is not available with this configuration.

2 Electromechanical Relays are rated at 5 amps at 120 Vac or 240 Vac or 24 Vdc. Solid State Relays are rated at 1 Amp at 25°C and derated linearly to 0.5 Amps at 55°C. Customer should size fuses accordingly. Use Fast Blo fuses only.

3 See Input 2 Wiring Diagram for Slidewire Connections.

xxxx

Figure 2-13 Position Proportional or Three Position Step Control Connections w/o Dual Relay Option



1 Alarm #2 is available with with this configuration.

2 Dual Electromechanical relays are rated at 2 Amps @120 Vac or 240 Vac or 30 Vdc. Customer should size fuses accordingly. Use Fast Blo fuses only.

3 See Input 2 Wiring Diagram for Slidewire Connections.

xxxx

Figure 2-14 Position Proportional or Three Position Step Control Connections with Dual Relay Option

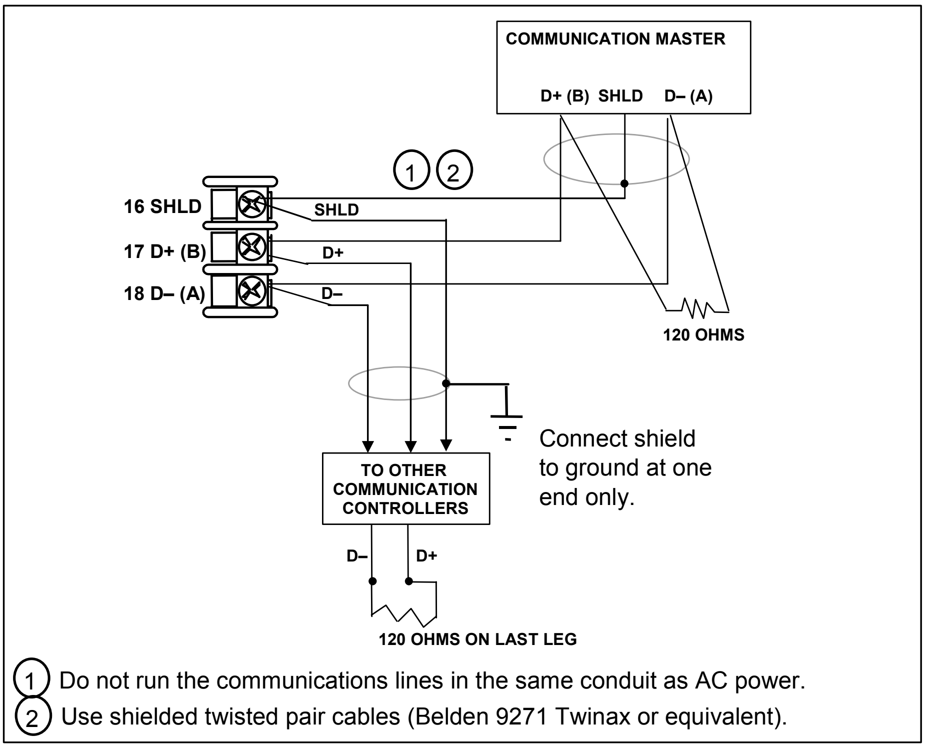


Figure 2-15 RS-422/485 Communications Option Connections

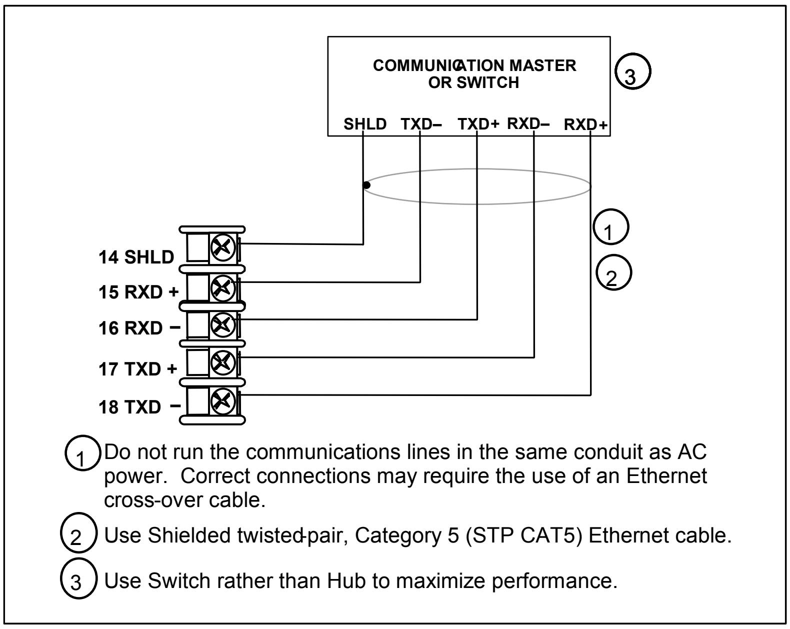


Figure 2-16 Ethernet Communications Option Connections

Figure 2-16 and Table 2-6 shows how to connect a UDC to a MDI Compliant Hub or Switch utilizing a **straight-through cable** or for connecting a UDC to a PC utilizing a **crossover cable**.

Table 2-6 Terminals for connecting a UDC to a MDI Compliant Hub or Switch

UDC Terminal	UDC Signal Name	RJ45 Socket Pin #	Switch Signal Name
Position 14	Shield	Shield	Shield
Position 15	RXD-	6	TXD-
Position 16	RXD+	3	TXD+
Position 17	TXD-	2	RXD-
Position 18	TXD+	1	RXD+

Table 2-7 shows how to connect a UDC directly to a PC utilizing a straight-through cable (wiring the UDC cable this way makes the necessary cross-over connections)

Table 2-7 Terminals for connecting a UDC directly to a PC utilizing a straight-through cable

UDC Terminal	UDC Signal Name	RJ45 Socket Pin #	PC Signal Name
Position 14	Shield	Shield	Shield
Position 15	RXD-	2	TXD-
Position 16	RXD+	1	TXD+
Position 17	TXD-	6	RXD-
Position 18	TXD+	3	RXD+

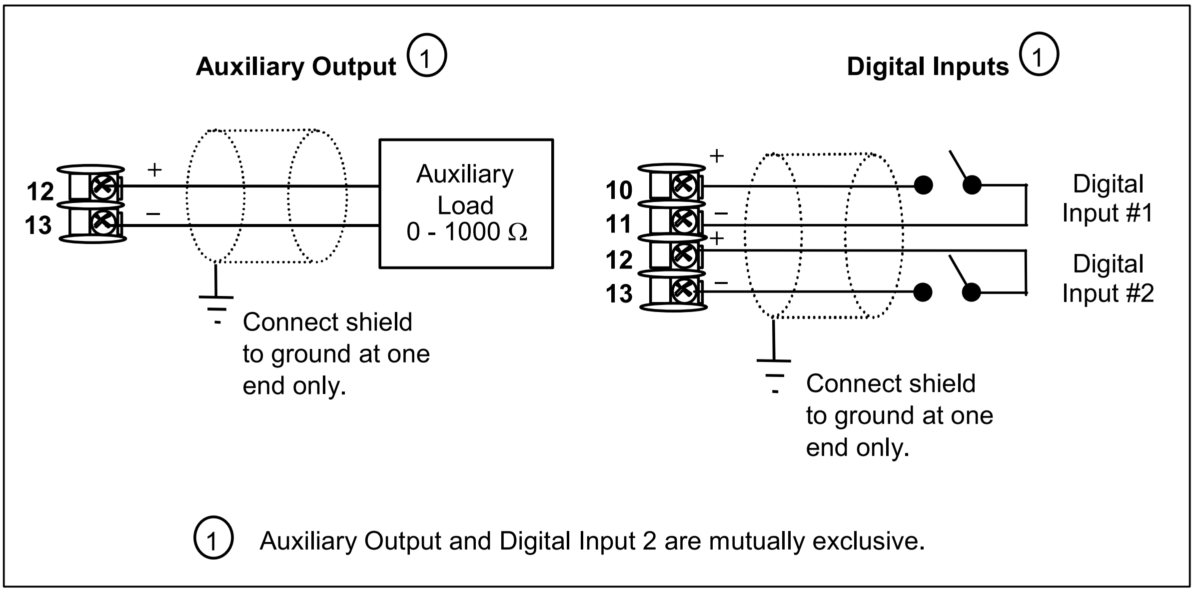


Figure 2-17 Auxiliary Output and Digital Inputs Option Connections

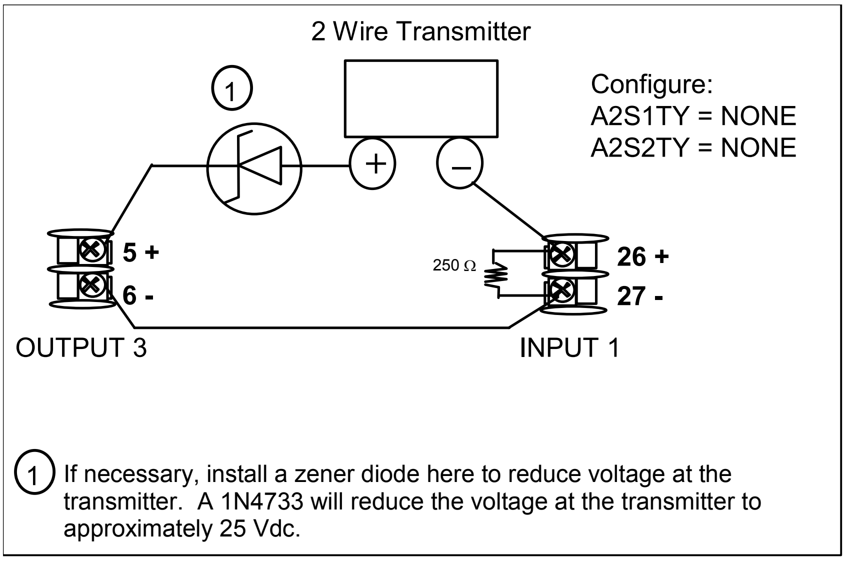


Figure 2-18 Transmitter Power for 4-20 mA — 2 wire Transmitter Using Open Collector Alarm 2 Output

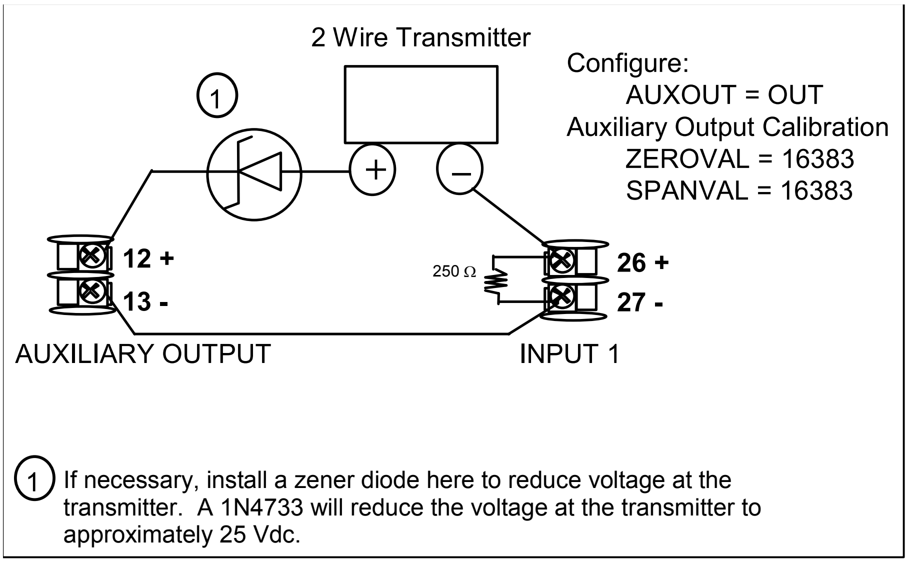


Figure 2-19 Transmitter Power for 4-20 mA — 2 Wire Transmitter Using Auxiliary Output

3 Configuration

3.1 Configuration Prompt Hierarchy

Set Up Group	Function Prompts							
TUNING	PROP BD or GAIN	GAINVALn	RATE MIN	RSET MIN or RSET RPM	MAN RSET	PROPBD2 or GAIN 2	RATE2MIN	RSET2MIN or RSET2RPM
	CYC SEC or CYC SX3	CYC2 SEC or CYC2 SX3	SECURITY	LOCKOUT	AUTO MAN	SP SEL	RUN HOLD	
SPRAMP	SP RAMP	TIME MIN	FINAL SP	SP RATE	EU/HR UP	EU/HR DN	EUHRUP2	EUHRDN2
	SP PROG	STRT SEG	END SEG	RAMPUNIT	RECYCLES	SOAK DEV	PROG END	STATE
	KEYRESET	HOTSTART	SEGxRAMP or SEGxRATE	SEGx SP*	* x = 1 to 12. Program concludes after segment 12			
ACCUTUNE	FUZZY	ACCUTUNE	DUPLEX	AT ERROR				
ALGORTHM	CONT ALG	TIMER	PERIOD	START	LOW DISP	INP ALG1	MATH K	CALC HI
	CALC LO	ALG1 INA	ALG1 INB	ALG1 INC	PCT CO	PCT H2	ALG1BIAS	
OUT ALG	OUT ALG	RLYSTATE	RLY TYPE	CUR OUT	LOW VAL	HIGH VAL	CO RANGE	MOTOR TI
INPUT1	IN1 TYPE	XMITTER1	IN1 HIGH	IN1 LOW	RATIO 1	BIAS IN1	FILTER 1	BURNOUT1
	EMISSIV1							
INPUT2	IN2 TYPE	XMITTER2	IN2 HIGH	IN2 LOW	RATIO 2	BIAS IN2	FILTER 2	BURNOUT2
	EMISSIV2							
CONTRL	PV SOURC	PID SETS	SW VALUE	LSP'S	RSP SRC	AUTOBIAS	SP TRACK	PWR MODE
	PWR OUT	SP HiLIM	SP LoLIM	ACTION	OUT RATE	PCT/M UP	PCT/M DN	OUTHiLIM
	OUTLoLIM	I Hi LIM	I Lo LIM	DROPOFF	DEADBAND	OUT HYST	FAILSAFE	FAILMODE
	MAN OUT	AUTO OUT	PBorGAIN	MINorRPM				
OPTIONS	AUX OUT	LOW VAL	HIGH VAL	CORANGE	DIG1 INP	DIG1 COM	DIG2 INP	DIG2 COM
COM	Com ADDR	ComSTATE	IR ENABLE	BAUD	TX DELAY	WSFLOAT	SHEDENAB	SHEDTIME
	SHEDMODE	SHEDSP	UNITS	CSP RATO	CSP BIAS	LOOPBACK		
ALARMS	A1S1TYPE	A1S1 VAL	A1S1 H L	A1S1 EV	A1S2 TYPE	A1S2 VAL	A1S2 H L	A1S2 EV
	A2S1TYPE	A2S1 VAL	A2S1 H L	A2S1 EV	A2S2TYPE	A2S2 VAL	A2S2 H L	A2S2 EV
	AL HYST	ALM OUT1	BLOCK	DIAGNOST				
DISPLAY	DECIMAL	TEMPUNIT	PWR FREQ	RATIO 2	LANGUAGE			
CALIB	USED FOR FIELD CALIBRATION							

3.2 Configuration Procedure

Introduction

Each of the Set Up groups and their functions are pre-configured at the factory. If you want to change any of these selections or values, follow the procedure in Table 3-1. This procedure tells you the keys to press to get to any Set Up group and any associated Function parameter prompt.

Procedure

ATTENTION

The prompting scrolls at a rate of 2/3 seconds when the **SET UP** or **FUNCTION** key is held in. Also, ▲ or ▼ keys will move group prompts forward or backward at a rate twice as fast.

Table 3-1 Configuration Procedure

Step	Operation	Press	Result
1	Enter Set Up Mode	Setup	*Upper Display* = **SETUP** *Lower Display* = **TUNING** (This is the first Set Up Group title)
2	Select any Set Up Group	Setup	Sequentially displays the other Set Up group titles. You can also use the ▲ or ▼ 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.
3	Select a Function Parameter	Function	*Upper Display* = the current value or selection for the first function prompt of the selected Set Up group. *Lower Display* = the first Function prompt within that Set Up group. Sequentially displays the other function prompts of the Set Up group you have selected. Stop at the function prompt that you want to change, then proceed to the next step.
4	Change the Value or Selection	▲ or ▼	Increments or decrements the value or selection that appears for the selected function prompt. If you change the value or selection of a parameter while in Set Up mode but then decide not to enter it, press the **MAN/AUTO** key once. This will recall the original configuration. This “recall” procedure does not work for a Field Calibration process. Field Calibration is a one-way operation.
5	Enter the Value or Selection	Function	Enters value or selection made into memory after another key is pressed.
6	Exit Configuration	Lower Display	Exits configuration mode and returns controller to the same state it was in immediately preceding entry into the Set Up mode. It stores any changes you have made. If you do not press any keys for 30 seconds, the controller times out and reverts to the mode and associated display used prior to entry into Set Up mode.

3.3 Tuning Set Up Group

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
PROP BD or **GAIN**	0.1 to 9999 % or 0.001 to 1000	**PROPORTIONAL BAND** (simplex) is the percent of the range of the measured variable for which a proportional controller will produce a 100 % change in its output. **GAIN** is the ratio of output change (%) over the measured variable change (%) that caused it. G = 100 / %PB where PB is the proportional band(in %) If the PB is 20 %, then the Gain is 5. And, at those settings, a 3 % change in the error signal (SP-PV) will result in a 15 % change in the controller's output due to proportional action. If the Gain is 2, then the PB is 50 %. Also defined as "HEAT" Gain on Duplex models for variations of Heat/Cool applications. *The selection of Proportional Band or Gain is made in the CONTROL parameter group under prompt PBorGAIN.*
RATE 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.
RSET MIN or **RSET RPM**	0.02 to 50.00	**RSET MIN** = Reset in Minutes per Repeat **RSET RPM** = Reset in Repeats per Minute **RESET** (or **Integral Time**) adjusts the controller's output in accordance with both the size of the deviation (SP–PV) and the time that it lasts. The amount of the corrective action depends on the value of Gain. The Reset adjustment is measured as how many times proportional action is repeated per minute or how many minutes before one repeat of the proportional action occurs. Used with control algorithm PID-A or PID-B. Also defined as "HEAT" Reset on Duplex models for variations of Heat/Cool applications. **ATTENTION** The selection of whether Minutes per Repeat or Repeats per Minute is used is made in the CONTROL parameters group under the prompt **MINorRPM**.
MAN RSET	–100 to +100 (in % output)	**MANUAL RESET** is only applicable if you use control algorithm PD WITH MANUAL RESET in the Algorithm Set Up group. Because a proportional controller will not necessarily line out at setpoint, there will be a deviation (offset) from setpoint. This eliminates the offset and lets the PV line out at setpoint. **ATTENTION** Bias is shown on the lower display.
PROPBD2 or **GAIN 2**	0.1 to 9999 % or 0.001 to 1000	**PROPORTIONAL BAND 2** or **GAIN 2**, **RATE 2**, and **RESET 2** parameters are the same as previously described for “Heat” except that they refer to the **cool** zone tuning constants on duplex models or the second set of PID constants, whichever is pertinent.
RATE2MIN	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.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
RSET2MIN **RSET2RPM**	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.
CYC SEC or **CYC SX3**	1 to 120	**CYCLE TIME (HEAT)** determines the length of one time proportional output relay cycle. Defined as "HEAT" cycle time for Heat/Cool applications. **CYC SEC**—Electromechanical relays **CYC SX3**—Solid state relays ATTENTION *Cycle times are in either second or 1/3-second increments depending upon the configuration of RLY TYPE in the Output Algorithm Set Up group.*
CYC2 SEC or **CYC2 SX3**	1 to 120	**CYCLE TIME 2 (COOL)** 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. **CYC2 SEC**—Electromechanical relays **CYC2 SX3**—Solid state relays ATTENTION *Cycle times are in either second or 1/3-second increments depending upon the configuration of RLY TYPE in the Output Algorithm Set Up group.*
SECURITY	0 to 9999	**SECURITY CODE**—The level of keyboard lockout may be changed in the Set Up mode. Knowledge of a security code may be required to change from one level to another. This configuration should be copied and kept in a secure location. NOTE: The Security Code is for keyboard entry only and is not available via communications. ATTENTION *Can only be changed if LOCKOUT selection is NONE.*
LOCKOUT		**LOCKOUT** applies to one of the functional groups: Configuration, Calibration, Tuning, Accutune. **DO NOT CONFIGURE UNTIL ALL CONFIGURATION IS COMPLETE.**
	NONE	**NONE**—No lockout; all groups are read/write.
	CALIB	**CALIB**—All groups are available for read/write except for the Calibration and Keyboard Lockout groups.
	+ CONF	**+ CONF**—Tuning, SP Ramp, and Accutune groups are read/write. All other groups are read only. Calibration and Keyboard Lockout groups are not available.
	+ VIEW	**+ VIEW**—Tuning and Setpoint Ramp parameters are read/write. No other parameters are viewable.
	MAX	**MAX**—Tuning and Setpoint Ramp parameters are available for read only. No other parameters are viewable.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
AUTO MAN	DISABLE ENABLE	**MANUAL/AUTO KEY LOCKOUT**—Allows you to disable the Manual/Auto key **DISABLE** **ENABLE** **ATTENTION** *Can only be viewed if LOCKOUT is configured for NONE.*
RUN HOLD	DISABLE ENABLE	**RUN/HOLD KEY LOCKOUT**—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** **ENABLE** **ATTENTION** *Can only be viewed if LOCKOUT is configured for NONE.*
SP SEL	DISABLE ENABLE	**SETPOINT SELECT KEY LOCKOUT**—Allows you to disable the Setpoint Select key **DISABLE** **ENABLE** **ATTENTION** *Can only be viewed if LOCKOUT is configured for NONE.*

3.4 SP Ramp Set Up Group

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
SP RAMP *SP Program must be disabled for SP Ramp prompts to appear*		**SINGLE SETPOINT RAMP**—Make a selection to enable or disable the setpoint ramp function. Make sure you configure a ramp time and a final setpoint value. *SP Programming must be disabled.*
	DISABLE	**DISABLE SETPOINT RAMP**—Disables the setpoint ramp option.
	ENABLE	**ENABLE SETPOINT RAMP**—Allows the single setpoint ramp prompts to be shown.
TIME MIN	0 to 255 minutes	**SETPOINT RAMP TIME**—Enter the number of minutes desired to reach the final setpoint. A ramp time of "0" implies an immediate change of setpoint.
FINAL SP	Within setpoint limits	**SETPOINT RAMP FINAL SETPOINT**—Enter the value desired for the final setpoint. The controller will operate at the setpoint set here when ramp is ended. **ATTENTION** If the ramp is on HOLD, the held setpoint can be changed by the ▲ and ▼ keys. 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. **ATTENTION** SP RAMP and SP RATE will cause the SP portion of Accutune to abort. PV Tune will continue to function normally. Ramp is placed into HOLD while tuning (TUNE configuration).
HOTSTART	DISABLE ENABLE	**DISABLE**—LSP1 is used as the initial ramp setpoint. **ENABLE**—Current PV value is used as the initial ramp setpoint.
SP RATE		**SETPOINT RATE**—Lets you configure a specific rate of change for any local setpoint change.
	DISABLE	**DISABLE SETPOINT RATE**—Disables the setpoint rate option.
	ENABLE	**ENABLE SETPOINT RATE**—Allows the SP rate feature. *SP Rate operates only when both SP Ramp and SP Programing are in HOLD mode or when both SP Ramp and SP Programming are disabled.*
EU/HR UP	0 to 9999 in engineering units per hour	**RATE UP**—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).

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
EU/HR DN	0 to 9999 in engineering units per hour	**RATE DOWN**—Rate down value. When making a setpoint change, this is the rate at which the controller will change from the original setpoint down to the new one. The ramping (current) setpoint can be viewed as SPn in the lower display. Entering a 0 will imply an immediate step change in Setpoint (i.e., no rate applies).
SP PROG (optional feature)	 DISABLE ENABLE	**SETPOINT RAMP/SOAK PROGRAM**—Available only with controllers that contain this option. *SP RAMP must be disabled.* **DISABLE**—Disables setpoint programming. **ENABLE**—Enables setpoint programming. *SP Ramp must be disabled for SP Program prompts to appear. If SP Rate is enabled, it does not operate while an SP Program is running*
STRT SEG	1 to 11	Start Segment Number
END SEG	2 to 12 even numbers	End Segment Number, always end in a soak segment (2, 4, ... 12)
RAMPUNIT	 TIME EU/MIN EU/HR	**RAMPUNIT**—Engineering Units for Ramp Segments **TIME** in hours: minutes **RATE** in Enineering units per minute **RATE** in Enineering units per hour
RECYCLES	0 to 99 recycles	Number of Program Recycles
SOAK DEV	0 to 99	Guaranteed Soak Deviation Value The number selected will be the PV value (in engineering units) above or below the setpoint outside of which the timer halts.
PROG END	 LASTSP F SAFE	Program Termination State Hold at last setpoint in the program Manual mode/Failsafe output
STATE	DISABLE HOLD	Program State at Program End
KEYRESET	DISABLE ToBEGIN RERUN	Reset/Rerun SP Program
HOTSTART	DISABLE ENABLE	Hot Start
SEG1RAMP or **SEG1RATE**	0-99 hours.0-59 minutes Engineering units/minute or Engineering units/hour	Segment #1 Ramp Time or Segment #1 Ramp Rate **Select TIME, EU/MIN, or EU/HR at prompt RAMPUNIT. All ramps will use the same selection.**
SEG2 SP	Within the Setpoint limits	Segment #2 Soak Setpoint Value

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
SEG2TIME	0-99 hours.0-59 minutes	Segment #2 Soak Duration
SEG3RAMP or **SEG3RATE** **SEG4 SP** **SEG4TIME** **SEG5RAMP** or **SEG5RATE** **SEG6 SP** **SEG6TIME** **SEG7RAMP** or **SEG7RATE** **SEG8 SP** **SEG8TIME** **SEG9RAMP** or **SEG9RATE** **SG10 SP** **SG10TIME** **SG11RAMP** or **SG11RATE** **SG12 SP** **SG12TIME**	Selections are same as above.	Same as above

3.5 Accutune Set Up Group

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
FUZZY		**FUZZY OVERSHOOT SUPPRESSION**—Can be enabled or disabled independently of whether Demand Tuning or SP Tuning is enabled or disabled.
	DISABLE	**DISABLE**—Disables Fuzzy Overshoot Suppression.
	ENABLE	**ENABLE**—The instrument uses Fuzzy Logic to suppress or minimize any overshoot that may occur when PV approaches SP. It will not recalculate any new tuning parameters.
ACCUTUNE		**ACCUTUNE III**
	DISABLE	**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 *This prompt only appears when a Duplex Control Algorithm has been configured*		**DUPLEX ACCUTUNING III** – These prompts only appear when a duplex output type has been configured.
	MANUAL	**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	**AUTOMATIC** – 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	**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).
AT ERROR (Read Only)		**ACCUTUNE ERROR STATUS**—When an error is detected in the Accutune process, an error prompt will appear.
	NONE	**NONE**—No errors occurred during last Accutune procedure.
	RUNNING	**RUNNING**—An Accutune process is still active checking process gain, even though “T” is not lit. It does not affect keyboard operation.
	ABORT	**CURRENT ACCUTUNE PROCESS ABORTED**—Caused by one of the following conditions: changing to manual mode, digital input detected, in heat region of output but a cool output was calculated, or vice versa.
	SP2	**SP2**—LSP2 not configured or a Setpoint other than LSP1 or LSP2 is in use.

3.6 Algorithm Set Up Group

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
CONT ALG		The **CONTROL ALGORITHM** lets you select the type of control that is best for your process.
	ON-OFF	**ON/OFF** is the simplest control type. The output can be either ON (100 %) or OFF (0 %). The Process Variable (PV) is compared with the setpoint (SP) to determine the sign of the error (ERROR = PV–SP). The ON/OFF algorithm operates on the sign of the error signal. In Direct Acting Control, when the error signal is positive, the output is 100 %; and when the error signal is negative, the output is 0 %. If the control action is reverse, the opposite is true. An adjustable overlap (Hysteresis Band) is provided between the on and off states. **ATTENTION** *Other prompts affected: OUT HYST* **DUPLEX ON/OFF** is an extension of this algorithm when the output is configured for a Duplex control algorithm. It allows the operation of a second ON/OFF output. There is a deadband between the operating ranges of the two inputs and an adjustable overlap (hysteresis) of the on and off states of each output. Both Deadband and Hysteresis are separately adjustable. With no relay action the controller will read 50 %. **ATTENTION** *Other prompts affected: OUT HYST and DEADBAND*
	PID A **ATTENTION** PID A should not be used for Proportional only action; i.e., no integral (reset) action. Instead, use PD+MR with rate set to 0.	**PID A** is normally used for three-mode control. This means that the output can be adjusted somewhere between 100 % and 0 %. It applies all three control actions—Proportional (P), Integral (I), and Derivative (D)—to the error signal. **Proportional (Gain)**—Regulates the controller's output in proportion to the error signal (the difference between Process Variable and Setpoint). **Integral (Reset)**—Regulates the controller's output to the size of the error and the time the error has existed. (The amount of corrective action depends on the value of proportional Gain.) **Derivative (Rate)**—Regulates the controller's output in proportion to the rate of change of the error. (The amount of corrective action depends on the value of proportional Gain.)
	PID B	**PID B**—Unlike the PID A equation, the controller gives only an integral response to a setpoint change, with no effect on the output due to the gain or rate action, and it gives full response to PV changes. Otherwise controller action is as described for the PID A equation. See note on PID A.

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
CONT ALG (continued)	PD+MR	**PD WITH MANUAL RESET** is used whenever integral action is not wanted for automatic control. The equation is computed with no integral contribution. The MANUAL RESET, which is operator adjustable, is then added to the present output to form the controller output. Switching between manual and automatic mode will be bumpless. If you select PD with Manual Reset you can also configure the following variations: • PD (Two Mode) control, • P (Single Mode) control. Set Rate (D) to 0. ATTENTION *Other prompts affected: MAN RSET in the Tuning Set Up group*
	3PSTEP	**THREE POSITION STEP**—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. 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 "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". Refer to the *Operation* section for motor position displays. 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. ATTENTION *Other prompts affected: DEADBAND*
TIMER	DISABLE ENABLE	**TIMER** allows you to enable or disable the timer option. The timer option allows you to configure a timeout period and to select timer start by either the keyboard (RUN/HOLD key) or Alarm 2. A digital input can also be configured to start the timer. When the timer is enabled, it has exclusive control of the alarm 1 relay; any previous alarm configuration is ignored. At timeout, the timer is ready to be re-activated by whatever action has been configured. Alarm 1 is activated at the end of the timeout period.

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
PERIOD	0:00 to 99:59	**PERIOD** allows you to configure the length of timeout period (from 0 to 99 hours: 59 minutes).
START	KEY ALARM 2	**START** allows you to select whether the timer starts with the keyboard (Run/Hold key) or Alarm 2.
LOW DISP	TI REM E TIME	**LOW DISP** allows you to select whether time remaining (TI REM) or elapsed time (E TIME) is displayed for the timer option. The time is shown on the lower display in HH:MM format along with a rotating “clock” character. • If the “clock” rotation is *clockwise,* elapsed time is indicated. • If the “clock” rotation is *counterclockwise,* time remaining is indicated.
INPUT MATH ALGORITHMS—Controllers with two inputs are provided with one input algorithm. Unless otherwise noted, these selections are provided only as part of the Math Options package. Each algorithm can be configured to provide a derived (calculated) PV or a derived Remote Setpoint. Up to three inputs may be applied to the calculation. See Inputs A, B, and C for definitions per equation. All algorithms operate in engineering units except Feedforward (F FWRD) which operates in percent of output units. **ATTENTION** When the Input C configuration is set to NONE, the value of Input C used in the functions is automatically set to 1.0, except for the Summer algorithm, where it is set to 0.0.		
INP ALG1	NONE	**INPUT ALGORITHM 1** has the following selections from which to choose: **NONE**—No algorithm configured
	W AVG (See Note 2) (Standard feature on controllers with two analog inputs)	**WEIGHTED AVERAGE**—When you configure for Weighted Average, the controller will compute a PV or SP for the control algorithm from the following equation:
	Alg1 = [(InpA x Ratio A + Bias A) + (K x InpB x Ratio B + Bias B)] / (1 + K)] + Alg1Bias	
	F FWRD (Standard feature on controllers with two analog inputs)	**FEEDFORWARD SUMMER**—Feedforward uses Input A, following a Ratio and Bias calculation as a value summed directly with the PID computed output value and sent, as an output value, to the final control element. This algorithm will only function in automatic mode and is not used for Three Position Step Control applications. The following formula applies:
	Controller Output = PID Output + (Input A x Ratio A + Bias A) x (100 / Input A Range)	
	FFWDMu (Standard feature on controllers with two analog inputs)	**FEEDFORWARD MULTIPLIER**—Feedforward uses Input A, following a Ratio and Bias calculation as a value multiplied directly with the PID computed output value and sent, as an output value, to the final control element. This algorithm will only function in automatic mode and cannot be used for Three Position Step Control applications. The following formula applies:
	Controller Output = PID Output x (Input A x Ratio A + Bias A) / Input A Range	

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
	SUMMER (See Note 2)	**SUMMER WITH RATIO AND BIAS**—The following formula applies:
		Alg1=(InpAxRatioA+BiasA)+(InpBxRatioB+BiasB)+(InpCxRatioC+BiasC)+Alg1Bias
	HI SEL (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)
	LO SEL (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)
	√MuDIV (See Note 1)	**MULTIPLIER DIVIDER WITH SQUARE ROOT**—The following formula applies:
		Alg1=K*SqRt{(InpAxRatioA+BiasA)x(InpCxRatioC+BiasC)/(InpB*RatioB+BiasB)} x (CalcHi-CalcLo)+Alg1Bias
	√MULT (See Note 1)	**MULTIPLIER WITH SQUARE ROOT**—The following formula applies:
		Alg1 =K x Sq.Rt.{(InputA x Ratio A + Bias A) x (InputB x Ratio B + Bias B) x (InputC x Ratio C + Bias C)} x (Calc Hi – Calc Lo) + Alg1Bias
	MuDIV (See Note 1)	**MULTIPLIER DIVIDER—**The following formula applies:
		Alg1 = K x [{(Input A x Ratio A + Bias A) x (Input C x Ratio C + Bias C)} / (Input B x Ratio B + Bias B)] x (Calc Hi – Calc Lo) + Alg1Bias
	MULT (See Note 1)	**MULTIPLIER**—The following formula applies:
		Alg1 = K x [(Input A x Ratio A + Bias A) x (Input C x Ratio C + Bias C) x (Input B x Ratio B + Bias B)] x (Calc Hi – Calc Lo) + Alg1Bias
	CARB A	**CARBON POTENTIAL A**—Make this selection if you have a Cambridge or Marathon monitor type Zirconium Oxide sensor. See Note 3.
	CARB 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.
	CARB 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.
	CARB 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 2000°F. See Note 3.

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
	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.
	DEW PT	**DEWPOINT OF CARBONIZING ATMOSPHERE**—Use this selection if you are using any Zirconium Oxide Carbon Probe and you want to measure the atmosphere in terms of Dewpoint. The range is –50 °F to 100 °F or –48 °C to 38 °C. This algorithm requires a temperature range within the region of 1000 °F to 2200 °F and a minimum carbon probe value of 800 millivolts.
	OXYGEN	**PERCENT OXYGEN RANGE**—Make this selection if you are using a Zirconium Oxide Oxygen Probe to measure Percent of Oxygen in a range of 0 to 40 % O_2. This algorithm requires a temperature range within the region of 800 °F to 3000 °F.
ATTENTION The Carbon and Dewpoint selections will automatically set the first input actuation to Carbon. The Oxygen selection will automatically set the first input actuation to Oxygen. Input 2 can be any input actuation, but it is normally a type K, R or S thermocouple input, depending upon the probe type selected. All calculations are performed by the Controller with Percent Carbon shown as the PV display. The actual value of each analog input may be viewed on the lower display. For all Carbon Types, if the value of Percent Carbon falls below 0.1% - such as can happen when the Carbon Probe voltage output falls below 900 mVdc – then the Controller will continue to update the PV display, but the accuracy is unspecified. Likewise, if the measured temperature falls outside of the specified ranges as noted above for the Carbon, Oxygen and Dewpoint input types, then the Controller will continue to update the PV display, but the accuracy is unspecified. For the Dewpoint algorithm, if the Carbon Sensor voltage falls below 800 mVdc, then the Dew Point is calculated as if the sensor voltage was at 800 mVdc.		
MATH K	0.001 to 1000 floating	**WEIGHTED AVERAGE RATIO OR MASS FLOW ORIFICE CONSTANT (K) FOR MATH SELECTIONS**—Only applicable for algorithms W AVG or General Math selections √MuDIV, √MULT, MuDIV, or MULT.
CALC HI	–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.
CALC LO	–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.
ALG1 INA	 INPUT 1 INPUT 2 OUTPUT	**ALGORITHM 1, INPUT A SELECTION** will represent one of the available selections. **Input 1** **Input 2** **Output** – Should not be used for Three Position Step Control applications)

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
ALG1 INB	 INPUT 1 INPUT 2 OUTPUT	**ALGORITHM 1, INPUT B SELECTION** will represent one of the available selections. **Input 1** **Input 2** **Output** – Should not be used for Three Position Step Control applications)
ALG1 INC	 NONE INPUT 1 INPUT 2 OUTPUT	**ALGORITHM 1, INPUT C SELECTION** will represent one of the available selections. **None** **Input 1** **Input 2** **Output** – Should not be used for Three Position Step Control applications)
PCT CO	0.020 to 0.350 (fractional percent of CO)	**PERCENT CARBON** is only applicable when Carbon Potential is selected. Enter the value in percent carbon monoxide that is applicable for the enriching gas used in fractional form. FOR EXAMPLE: Natural Gas = 20.0 % CO, then setting is 0.200 Propane Gas = 23.0 % CO, setting is 0.230
ALG1 BIAS	-999 to 9999 floating (in engineering units)	**INPUT ALGORITHM 1 BIAS—**Does not apply to selections: FFWRD, FFWDMU, HISEL or LOSEL.
PCT H2	1.0 to 99.0 (% H_2)	**HYDROGEN CONTENT FOR DEWPOINT** is only applicable when Dewpoint is selected. Enter a value for the percentage of Hydrogen content that is applicable.

Math Algorithm Notes:

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

3.7 Output Set Up Group

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
OUT ALG		The **OUTPUT ALGORITHM** lets you select the type of output you want. **Not applicable with Control algorithm prompt 3PSTEP.** Selections are hardware dependent. ATTENTION For all Duplex Output forms, PID heat parameters apply for controller output greater than 50 %; PID cool parameters apply for controller output less than 50 %.
	TIME	**TIME SIMPLEX**—This output algorithm uses Digital Output 1 for Time Proportional Control. The output is updated per the Loop sampling rate selection. Time Proportional Output has a resolution of 4.44 msec. Cycle Time is adjustable from 1 to 120 seconds.
	CURRENT	**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.
	POSITON	**POSITION PROPORTIONAL**—Type of output using two relays and a motor that has a 100 to 1000 ohms feedback slidewire. This output algorithm selection forces Input 2 to the SLIDEW selection when the Control Algorithm is any selection other than 3PSTEP. ATTENTION *Other prompts affected: DEADBAND, IN2 TYPE*
	TIME D	**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 4.44 msec. Cycle Time is adjustable from 1 second to 120 seconds.
	CUR D	**CURRENT DUPLEX** is similar to current simplex but uses a second current output. The second output is usually scaled so that zero and span correspond with 0 % and 50 % output (cool zone). When the output is 0 % to 50 %, the controller uses tuning parameter set #2, when the output is 50 % to 100 % it uses set #1. ATTENTION *Other prompts affected: OUT RNG*
	CUR TI	**CURRENT/TIME DUPLEX** is a variation of duplex with current active for 0 % to 50 % output (tuning set 2) and time is active 50 % to 100 % output (tuning set 1). Relay controls heat, current controls cool. ATTENTION *Other prompts affected: OUT RNG*
	TI CUR	**TIME CURRENT DUPLEX** is similar to CUR TI except that current is active for 50 % to 100 % and time is active for 0 % to 50 %. Relay controls cool, current controls heat. ATTENTION *Other prompts affected: OUT RNG*
OUT RNG		**CURRENT DUPLEX RANGE ALGORITHM** — Used with Output Algorithm selections CUR D, CUR TI, or TI CUR.
	50 PCT	**CURRENT DUPLEX RANGE (SPLIT)**—This setting should be

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
		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: • AUX OUT in the Options Set Up group must be selected for Output. • The Auxiliary Current Output is scaled as desired for 0-50 % controller output. • Deadband for this configuration only applies to the Current Output. The Auxiliary Output must have the Deadband scaled in. FOR EXAMPLE: If a 2 % Deadband is desired, then enter **2.0** for the Deadband selection in the Control Algorithm group. This will apply Deadband to the Current Output. In the Options group, set the Auxiliary Output LOW VAL selection to **49.0** and the HIGH VAL selection to **0.0**.
	100PCT	**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.
RLYSTATE		**DIGITAL OUTPUT STATUS AT 0 % OUTPUT** allows the following selections:
	1OF 2OF	1OF 2OF Output 1 de-energized Output 2 de-energized
	1ON 2OF	1ON 2OF Output 1 energized Output 2 de-energized
	1OF 2ON	1OF 2ON Output 1 de-energized Output 2 energized
	1ON 2ON	1ON 2ON Output 1 energized Output 2 energized
RLY 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.
	MECHAN	**ELECTROMECHANICAL RELAY**—Cycle time in one-second increments.
	SOL ST	**SOLID STATE RELAY**—Cycle time in 1/3 second increments. This is useful for solid state relay applications that require shorter cycle times. DO NOT use this setting unless cycle times of less than 1 second are required. **ATTENTION** The Lockout selection must be set to NONE in order to view this selection.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
MOTOR TI	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.
CUR OUT	 DISABLE INPUT 1 INPUT 2 PV DEV OUTPUT SP LSP RSP IN ALG 1	**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 INPUT 1 INPUT 2 PV (Process Variable) DEVIATION OUTPUT SETPOINT LOCAL SETPOINT REMOTE INPUT ALGORITHM 1
LOW VAL	Low Scale Value within the range of the selected variable to represent the minimun output (0 or 4 mA)	**CURRENT OUTPUT LOW SCALING FACTOR**—Used only when CUR OUT is any selection other than DISABLE. This is a value in engineering units used to represent all CUR OUT parameters except Output. For Output, this is a value in percent and can be any value between –5 % and +105 %. However, keep in mind that relay output types can only be scaled 0 % to 100 %.
HIGH VAL	High Scale Value within the range of the selected variable to represent the maximum output (20 mA)	**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. For Output, this is a value in percent and can be any value between –5 % and +105 %. However, keep in mind that relay output types can only be scaled 0 % to 100 %.
CO RANGE	4-20mA 0-20mA	**CURRENT OUTPUT RANGE** allows the user to easily select 4-20 mA output or 0-20 mA output operation without the need for recalibration of the instrument. **ATTENTION** Changing the Current Output Range will result in the loss of Field Calibration values and will restore Factory Calibration values.

3.8 Input 1 Set Up Group

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
IN1 TYPE		**INPUT 1 ACTUATION TYPE** – This selection determines what actuation you are going to use for Input 1.
ATTENTION Changing the input type will result in the loss of Field Calibration values and will restore Factory Calibration values.	DISABLE	**DISABLE**—Disables Input.
	B TC	**B TC**—B Thermocouple
	E TC H	**E TC H**—E Thermocouple High
	E TC L	**E TC L**—E Thermocouple Low
	J TC H	**J TC H**—J Thermocouple High
	J TC M	**J TC M**—J Thermocouple Med
	J TC L	**J TC L**—J Thermocouple Low
	K TC H	**K TC H**—K Thermocouple High
	K TC M	**K TC M**—K Thermocouple Med
	K TC L	**K TC L**—K Thermocouple Low
	NNM H	**NNM H**—Ni-Ni-Moly Thermocouple High
	NNM L	**NNM L**—Ni-Ni-Moly Thermocouple Low
	NIC H	**NIC H**—Nicrosil-Nisil Thermocouple High
	NIC L	**NIC L**—Nicrosil-Nisil Thermocouple Low
	R TC	**R TC**—R Thermocouple
	S TC	**S TC**—S Thermocouple
	T TC H	**T TC H**—T Thermocouple High
	T TC L	**T TC L**—T Thermocouple Low
	W TC H	**W TC H**—W5W26 Thermocouple High
	W TC L	**W TC L**—W5W26 Thermocouple Low
	100 PT	**100 PT**—100 Ohm RTD High
	100 LO	**100 LO**—100 Ohm RTD Low
	200 PT	**200 PT**—200 Ohm RTD
	500 PT	**500 PT**—500 Ohm RTD
	RAD RH	**RAD RH**—Radiamatic RH
	RAD RI	**RAD RI**—Radiamatic RI
	0-20mA	**0-20mA**—0 to 20 Milliamperes
	4-20mA	**4-20mA**—4 to 20 Milliamperes
	0-10mV	**0-10mV**—0 to 10 Millivolts
	0-50mV	**0-50mV**—0 to 50 Millivolts
	0-100mV	**0-100mV**—0 to 100 Millivolts
	0-5 V	**0-5 V**—0 to 5 Volts
	1-5 V	**1-5 V**—1 to 5 Volts
	0-10 V	**0-10 V**—0 to 10 Volts
	TC DIFF	**TC DIFF**—Thermocouple Differential
	CARBON	**Carbon**—Carbon Probe Input
	OXYGEN	**Oxygen**—Oxygen Probe Input

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
XMITTER	B TC E TC H E TC L J TC H J TC M J TC L K TC H K TC M K TC L NNM H NNM L NIC H NIC L R TC S TC T TC H T TC L W TC H W TC L 100 PT 100 LO 200 PT 500 PT RAD RH RAD RI LINEAR SQROOT	**TRANSMITTER CHARACTERIZATION**—This selection lets you instruct the controller to characterize a linear input to represent a non-linear one. If characterization is performed by the transmitter itself, then select LINEAR. **ATTENTION** Prompt only appears when a linear actuation is selected at prompt IN1 TYPE. FOR EXAMPLE: If input 1 is a 4 to 20 mA signal, but the signal represents a type K H thermocouple, then configure **K TC H** and the controller will characterize the 4 to 20 mA signal so that it is treated as a type K thermocouple input (high range). Parameter definitions are the same as in IN1 TYPE.
IN1 HIGH	–999. To 9999. Floating (in engineering units)	**INPUT 1 HIGH RANGE VALUE** in engineering units is displayed for all inputs but can only be configured for linear or square root transmitter characterization. Scale the #1 input signal to the display value you want for 100 %. **ATTENTION** The control setpoint will be limited by the range of units selected here.
IN1 LOW	–999. To 9999. Floating (in engineering units)	**INPUT 1 LOW RANGE VALUE** in engineering units is displayed for all inputs but can only be configured for linear or square root transmitter characterization. Scale the #1 input signal to the display value you want for 0 %. See example above. **ATTENTION** The control setpoint will be limited by the range of units selected here.
RATIO 1	–20.00 to 20.00 Floats to 3 decimal places	**RATIO ON INPUT 1**—Select the Ratio value you want on Input 1.
BIAS IN1	–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.
FILTER 1	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.

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
BURNOUT		**BURNOUT PROTECTION (SENSOR BREAK)** provides most input types with upscale or downscale protection if the input fails.
	NONE	**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.
	UP	**UPSCALE BURNOUT** 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.
	DOWN	**DOWNSCALE BURNOUT** will force the Input 1 signal to the lower range 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 lower range Input 1 signal developed by the Burnout circuitry.
	NO FS	**NO FAILSAFE**— This selection does not provide input failure detection and should only be used when a thermocouple input is connected to another instrument which supplies the Burnout current. (For this selection, no burnout signal is sent to the sensor.) **ATTENTION** For Burnout to function properly on a 0-20 mA input type (or a 0-5V type that uses a dropping resistor), the dropping resistor must be remotely located (across the transmitter terminals). Otherwise, the input at the instrument terminals will always be 0 mA (i.e., within the normal operating range) when the 0-20 mA line is opened.
EMISSIV1	0.01 to 1.00	**EMISSIVITY** is a correction factor applied to the Radiamatic input signal that is the ratio of the actual energy emitted from the target to the energy which would be emitted if the target were a perfect radiator. Available only for Radiamatic inputs.

3.9 Input 2 Set Up Group

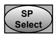
Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
IN2 TYPE **ATTENTION** Changing the input type will result in the loss of Field Calibration values and will restore Factory Calibration values. Selecting Position Proportional Control in the Output Setup Group forces Input 2 to the Slidewire Selection.	DISABLE B TC E TC H E TC L J TC H J TC M J TC L K TC H K TC M K TC L NNM H NNM L NIC H NIC L R TC S TC T TC H T TC L W TC H W TC L 100 PT 100 LO 200 PT 500 PT RAD RH RAD RI 0-20mA 4-20mA 0-10mV 0-50mV 0-100mV 0-5 V 1-5 V 0-10 V TC DIFF SLIDEW	**INPUT 2 ACTUATION TYPE** – This selection determines what actuation you are going to use for Input 2. **DISABLE**—Disables Input. **B TC**—B Thermocouple **E TC H**—E Thermocouple High **E TC L**—E Thermocouple Low **J TC H**—J Thermocouple High **J TC M**—J Thermocouple Med **J TC L**—J Thermocouple Low **K TC H**—K Thermocouple High **K TC M**—K Thermocouple Med **K TC L**—K Thermocouple Low **NNM H**—Ni-Ni-Moly Thermocouple High **NNM L**—Ni-Ni-Moly Thermocouple Low **NIC H**—Nicrosil-Nisil Thermocouple High **NIC L**—Nicrosil-Nisil Thermocouple Low **R TC**—R Thermocouple **S TC**—S Thermocouple **T TC H**—T Thermocouple High **T TC L**—T Thermocouple Low **W TC H**—W5W26 Thermocouple High **W TC L**—W5W26 Thermocouple Low **100 PT**—100 Ohm RTD High **100 LO**—100 Ohm RTD Low **200 PT**—200 Ohm RTD **500 PT**—500 Ohm RTD **RAD RH**—Radiamatic RH **RAD RI**—Radiamatic RI **0-20mA**—0 to 20 Milliamperes **4-20mA**—4 to 20 Milliamperes **0-10mV**—0 to 10 Millivolts **0-50mV**—0 to 50 Millivolts **0-100mV**—0 to 100 Millivolts **0-5 V**—0 to 5 Volts **1-5 V**—1 to 5 Volts **0-10 V**—0 to 10 Volts **TC DIFF**—Thermocouple Differential **SLIDEW**—Slidewire (For Position Proportional Applications)
XMITTER2	B TC E TC H E TC L J TC H J TC M J TC L K TC H K TC M K TC L NNM H NNM L NIC H NIC L R TC S TC T TC H T TC L W TC H W TC L 100 PT 100 LO 200 PT 500 PT RAD RH RAD RI LINEAR SQROOT	**TRANSMITTER CHARACTERIZATION**—This selection lets you instruct the controller to characterize a linear input to represent a non-linear one. **ATTENTION** Prompt only appears when a linear actuation is selected at prompt IN2 TYPE. Parameter definitions are the same as in IN2 TYPE.

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
IN2 HIGH	–999. To 9999. Floating (in engineering units)	**INPUT 2 HIGH RANGE VALUE** in engineering units is displayed for all inputs but can only be configured for linear or square root transmitter characterization See the example in IN1 HI.
IN2 LOW	–999. To 9999. Floating (in engineering units)	**INPUT 2 LOW RANGE VALUE** in engineering units is displayed for all inputs but can only be configured for linear or square root transmitter characterization. See the example in IN1 HI
RATIO 2	–20.00 to 20.00 Floats to 3 decimal places	**RATIO ON INPUT 2**—Select the Ratio value you want on Input 1.
BIAS IN2	–999. to 9999. (in engineering units)	**BIAS ON INPUT 2** — Bias is used to compensate the input for drift of an input value due to deterioration of a sensor, or some other cause. Select the bias value you want on Input 1.
FILTER 2	0 to 120 seconds No filter = 0	**FILTER FOR INPUT 2**—A software digital filter is provided for Input 1 to smooth the input signal. You can configure the first order lag time constant from 1 to 120 seconds. If you do not want filtering, enter 0.
BURNOUT		**BURNOUT PROTECTION (SENSOR BREAK)** provides most input types with upscale or downscale protection if the input fails.
	NONE	**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.
	UP	**UPSCALE BURNOUT** will force the Input 2 signal to the full scale value when the sensor fails. Diagnostic message IN2 FAIL intermittently flashed on the lower display. The controller remains in Automatic control mode and adjusts the controller output signal in response to the full scale Input 2 signal developed by the Burnout circuitry.
	DOWN	**DOWNSCALE BURNOUT** 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. 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.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
	NO FS	**NO FAILSAFE**—This selection does not provide input failure detection and should only be used when a thermocouple input is connected to another instrument which supplies the Burnout current. (For this selection, no burnout signal is sent to the sensor.) **ATTENTION** For Burnout to function properly on a 0-20 mA input type (or a 0-5V type that uses a dropping resistor), the dropping resistor must be remotely located (across the transmitter terminals). Otherwise, the input at the instrument terminals will always be 0 mA (i.e., within the normal operating range) when the 0-20 mA line is opened.
EMISSIV2	0.01 to 1.00	**EMISSIVITY** is a correction factor applied to the Radiamatic input signal that is the ratio of the actual energy emitted from the target to the energy which would be emitted if the target were a perfect radiator. Available only for Radiamatic inputs.

3.10 Control Set Up Group

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
PV SOURCE		**PROCESS VARIABLE SOURCE** —Selects the source of the Process Variable.
	INPUT 1 INPUT 2 IN ALG1	**INPUT 1** **INPUT 2** **INPUT ALGORITHM 1**
PID SETS		**NUMBER OF TUNING PARAMETER SETS**—This selection lets you choose one or two sets of tuning constants (gain, rate, and reset). NOTE: The Tuning Group is automatically configured to have two PID sets when a Duplex Control Algorithm is configured.
	1 ONLY	**ONE SET ONLY**—Only one set of tuning parameters is available. Configure the values for: Gain (proportional band), Rate, Reset Time, and Cycle Time (if time proportional is used).
	2KEYBD	**TWO SETS KEYBOARD SELECTABLE**—Two sets of tuning parameters can be configured and can be selected at the operator interface or by using the Digital Inputs.
	Lower Display	Press this key until you see PID SET1 or PID SET2 then press or to switch between sets. Configure the values for: Gain, Rate, Reset, Cycle Time, Gain #2, Rate #2, Reset #2, Cycle #2 Time
PID SETS (continued)	2PV SW	**TWO SETS PV AUTOMATIC SWITCHOVER**—When the process variable is *GREATER* than the value set at prompt SW VALUE (Switchover Value), the controller will use Gain, Rate, Reset, and Cycle Time. The active PID SET can be read in the lower display. When the process variable is *LESS* than the value set at prompt SW VALUE, the controller will use Gain#2, Rate#2, Reset#2, and Cycle#2 Time. The active PID SET can be read in the lower display.
	2SP SW	**TWO SETS SP AUTOMATIC SWITCHOVER**—When the setpoint is *GREATER* than the value set at prompt SW VALUE (Switchover Value), the controller will use Gain, Rate, Reset, and Cycle. When the setpoint is *LESS* than the value set at prompt SW VALUE, the controller will use Gain #2, Rate #2, Reset #2, and Cycle #2. **ATTENTION** *Other prompts affected: SW VALUE*
SW VALUE	Value in engineering units within PV or SP range limits	**AUTOMATIC SWITCHOVER VALUE**—This is the value of Process Variable or Setpoint at which the controller will switch from Tuning Constant Set #2 to Set #1.
LSP'S		**LOCAL SETPOINT SOURCE**—This selection determines what your local setpoint source will be.
	1 ONLY	**LOCAL SETPOINT**—The setpoint entered from the keyboard.
	TWO	**TWO LOCAL SETPOINTS**—This selection lets you switch between two local setpoints using the SP Select key.
	THREE	**THREE LOCAL SETPOINTS**—This selection lets you switch between three local setpoints using the SP Select key

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
RSP SRC	 NONE INPUT 2 IN ALG1	**REMOTE SETPOINT SOURCE**—This selection determines what your remote setpoint source will be when toggled by the **SP Select** key or Digital Input. **NONE**—No remote setpoint. **INPUT 2**—Remote Setpoint is Input 2. **IN AL1**—Remote Setpoint using Input 1 algorithm. **ATTENTION** To cycle through the available local setpoints and remote setpoint, press and hold in the key. When the key is released, the setpoint selection currently displayed will be the new setpoint selection.
AUTOBIAS	 DISABLE ENABLE	**AUTOBIAS** is used for bumpless transfer when transferring from local setpoint to remote setpoint. Auto Bias calculates and adds a bias to remote setpoint input each time a transfer is made. Only available if no tracking is selected. **DISABLE**—Disables auto bias. **ENABLE**—Enables auto bias.
SP TRACK	 NONE PV RSP	**SETPOINT TRACKING**—The local setpoint can be configured to track either PV or RSP as listed below. Not configurable when Auto Bias is set. **ATTENTION** For selections other than NONE, LSP is stored in nonvolatile memory only when there is a mode change; i.e., when switching from RSP to LSP or from Manual to Automatic. If power is lost, then the current LSP value is also lost. **NO TRACKING**—If local setpoint tracking is not configured, the LSP will not be altered when transfer from RSP to LSP is made. **PV**—Local setpoint tracks the PV when in manual. **RSP**—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.
PWR MODE	 MANUAL A LSP A RSP AM SP AM LSP	**POWER UP CONTROLLER MODE RECALL**—This selection determines which mode and setpoint the controller will use when the controller restarts after a power loss. **MANUAL, LSP**—At power-up, the controller will use manual mode with the local setpoint displayed. **AUTOMATIC MODE, LAST LSP**—At power-up, the controller will use automatic mode with the last local setpoint used before power down displayed. **AUTOMATIC MODE, LAST RSP**—At power-up, the controller will use automatic mode with the last remote setpoint used before power down displayed. **LAST MODE/LAST SETPOINT** used before power down. **LAST MODE/LAST LOCAL SETPOINT** on power down.
PWR OUT **For Three Position Step Control Only**		**THREE POSITION CONTROL STEP OUTPUT START-UP MODE**—This selection determines what position the motor will be in when powered up or in the failsafe position.

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
(Note 3)	LAST F'SAFE	**LAST OUTPUT**—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 OUTPUT**—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 Burnout/None, when the unit goes into FAILSAFE, it will go to manual mode; motor will be driven to the configured failsafe position.
SP HiLIM **(Note 4)**	0 to 100 % of PV span in engineering units	**SETPOINT HIGH LIMIT**—This selection prevents the local and remote setpoints from going above the value selected here. The setting must be equal or less than the upper range of the PV.
SP LoLIM **(Note 4)**	0 to 100 % of PV span in engineering units	**SET POINT LOW LIMIT**—This selection prevents the local and remote setpoints from going below the value selected here. The setting must be equal or greater than the lower range of the PV.
ACTION	 DIRECT REVERSE	**CONTROL OUTPUT DIRECTION**—Select direct or reverse output action. **DIRECT ACTING CONTROL**—The controller's output *increases* as the process variable increases. **REVERSE ACTING CONTROL**—The controller's output *decreases* as the process variable increases.
OUT RATE	 ENABLE DISABLE	**OUTPUT CHANGE RATE**—Enables or disables the Output Change Rate. The maximum rate is set at prompt PCT/M UP or PCT/M DN. Only available for PID-A, PID-B, PD+MR control algorithms. **ENABLE**—Allows output rate. **DISABLE**—Disables output rate.
PCT/M UP	0 to 9999 % per minute	**OUTPUT RATE UP VALUE**—This selection limits the rate at which the output can change upward. Enter a value in percent per minute. Appears only if OUT RATE is enabled. "0" means no output rate applied.
PCT/M DN	0 to 9999 % per minute	**OUTPUT RATE DOWN VALUE**—This selection limits the rate at which the output can change downward. Enter a value in percent per minute. Appears only if OUT RATE is enabled. "0" means no output rate.
OUTHiLIM	 0 % to 100 % –5 % to 105 %	**HIGH OUTPUT LIMIT**—This is the highest value of output beyond which you do not want the controller automatic output to exceed. For relay output types. For current output types.
OUTLoLIM	 0 % to 100 % –5 % to 105 %	**LOW OUTPUT LIMIT**—This is the lowest value of output below which you do not want the controller automatic output to exceed. For relay output types. For current output types.
I Hi LIM **(Note 5)**	Within the range of the output limits	**HIGH RESET LIMIT**—This is the highest value of output beyond which you do not want reset action to occur
I Lo LIM **(Note 5)**	Within the range of the output limits	**LOW RESET LIMIT**—This is the lowest value of output beyond which you do not want reset action to occur.
DROPOFF **(Note 5)**	–5 to 105 % of output	**CONTROLLER DROPOFF VALUE**—Output value below which the controller output will drop off to the low output limit value set in prompt OUTLoLIM.

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
DEADBAND	 –5.0 to 25.0 % 0.0 to 25.0 % 0.5 to 5.0 %	**DEADBAND** is an adjustable gap between the operating ranges of output 1 and output 2 in which neither output operates (positive value) or both outputs operate (negative value). Time Duplex On-Off Duplex Position Proportional and Three Position Step
OUT HYST	0.0 to 100.0 % of PV span	**HYSTERESIS (OUTPUT RELAY)** is an adjustable overlap of the ON/OFF states of each control output. This is the difference between the value of the process variable at which the control outputs energize and the value at which they de-energize. Only applicable for ON/OFF control.
FAILMODE	 NoLATCH LATCH	**FAILSAFE MODE** **NON LATCHING**—Controller stays in last mode that was being used (automatic or manual); If unit was in Automatic mode, then the output goes to the failsafe value. (NOTE 1, 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	0 to 100 % 0 PCT 100 PCT	**FAILSAFE OUTPUT VALUE**—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. **ATTENTION** Applies for all output types *except* Three Position Step Control. **THREE POSITION STEP FAILSAFE OUTPUT** **0 PCT**—Motor goes to closed position. **100 PCT**—Motor goes to open position.
SW FAIL	 0 PCT 100 PCT	Position Proportional motor position when slidewire fails. **0 PCT**—Motor goes to closed position. **100 PCT**—Motor goes to open position. **ATTENTION** PWR OUT must be configured for FSAFE.
MAN OUT	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. (NOTE 1)
AUTO OUT	0 to 100 %	**POWER-UP PRESET AUTOMATIC OUTPUT**—At power-up, the controller will begin its automatic control at the output value set here. (NOTE 1)
PBorGAIN	 PB PCT GAIN	**PROPORTIONAL BAND UNITS**—Select one of the following for the Proportional (P) term of the PID algorithm: **PROPORTIONAL BAND** selects units of percent proportional band for the P term of the PID algorithm. *Where:* PB % = $\frac{100\ \%\ FS}{GAIN}$ **GAIN** selects the unitless term of gain for the P term of the PID algorithm. *Where:* GAIN = $\frac{100\ \%\ FS}{PB\%}$

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
MINUTESorRPM		**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.
	RPM	**REPEATS PER MINUTE**—The number of times per minute that the proportional action is repeated by reset.
	MINUTES	**MINUTES PER REPEAT**—The time between each repeat of the proportional action by reset.

NOTE 1: Does not apply to Three Position Step Control.

NOTE 2: If controller is in Manual mode when a failure occurs, then the output will maintain its value.

NOTE 3:These selections appear when:

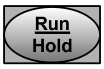
A) Control Algorithm is selected for 3PSTEP.
B) Control Algorithm is selected for PD+MR and Output Algorithm is selected for Position Proportional.

NOTE 4: 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.

NOTE 5: Reset limits and Dropoff are not displayed when Three Position Step Control is configured.

3.11 Options Group

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
AUX OUT ATTENTION Prompts for the Auxiliary Output Selection appear only if one of the Auxiliary Output boards is installed.		**AUXILIARY OUTPUT SELECTION** 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. ATTENTION *Other prompts affected by these selections: 4mA VAL and 20mA VAL.* ATTENTION Output cannot be configured when Three Position Step Control is used.
	DISABLE	**NO AUXILIARY OUTPUT**
	INPUT 1	**INPUT 1**—This represents the configured range of input 1.
	INPUT 2	**INPUT 2** represents the value of the configured range of input 2.
	PV	**PROCESS VARIABLE**—Represents the value of the Process Variable. PV = Input XxRatioX + BiasX
	DEV	**DEVIATION (PROCESS VARIABLE MINUS SETPOINT)**—Represents –100 % to +100 % of the selected PV span in engineering units. Zero deviation will produce a center scale (12 mA or 50 %) output. A negative deviation equal in magnitude to the Auxiliary Output High Scaling Factor will produce a low end output (4 mA or 0 %) output. A positive deviation equal in magnitude to the Auxiliary Output Low Scaling Factor will produce a high end output (20 mA or 100 %).
	OUTPUT	**OUTPUT**—Represents the displayed controller output in percent (%). Cannot be used with Three Position Step Control.
	SP	**SETPOINT**—Represents the value of the setpoint currently in use (LSP1, LSP2, LSP3, RSP or CSP) and is shown in the same units as those used by the PV.
	LSP 1	**LOCAL SETPOINT ONE**—Auxiliary output represents Local Setpoint 1 regardless of active setpoint.
	RSP	**REMOTE SETPOINT** – Represents the configured RSP regardless of the active SetPoint.
	IN ALG1	**INPUT ALGORITHM 1 OUTPUT**—Represents the output from input algorithm 1.
CO RANGE	4-20mA 0-20mA	**AUXILIARY CURRENT OUTPUT** RANGE—Allows the user to easily select 4-20mA output or 0-20mA output operation without the need for recalibration of the instrument. ATTENTION Changing the Auxiliary Current Output Range will result in the loss of Field Calibration values and will restore Factory Calibration values.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
LOW VAL	Low Scale Value within the range of the selected variable to represent the minimun output (0 or 4 mA)	**AUXILIARY OUTPUT LOW SCALING FACTOR**— This is a value in engineering units used to represent all AUX OUT parameters except Output. For Output, this is a value in percent and can be any value between –5 % and +105 %. However, keep in mind that relay output types can only be scaled 0 % to 100 %.
HIGH VAL	High Scale Value within the range of the selected variable to represent the maximum output (20 mA)	**AUXILIARY OUTPUT HIGH SCALING FACTOR**— This is a value in engineering units used to represent all AUX OUT parameters except Output. For Output, this is a value in percent and can be any value between –5 % and +105 %. However, keep in mind that relay output types can only be scaled 0 % to 100 %.
DIG INP1		**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 MAN	**TO MANUAL**—Contact closure puts the affected loop into manual mode. Contact open returns controller to former mode.
	TO LSP	**TO LOCAL SETPOINT**—When a remote setpoint is configured, contact closure puts the controller into local setpoint 1. When contact opens, the controller returns to former operation—local or remote setpoint—unless **SP Select** key is pressed while digital input is active. If this happens, the controller will stay in the local setpoint mode when contact opens.
	TO 2SP	**TO LOCAL SETPOINT TWO**—Contact closure puts the controller into local setpoint 2.
	TO 3SP	**TO LOCAL SETPOINT THREE**—Contact closure puts the controller into local setpoint 3.
	TO DIR	**TO DIRECT ACTION**—Contact closure selects direct controller action.
	TO HOLD	**TO HOLD**—Contact closure suspends Setpoint Program or Setpoint Ramp. When contact reopens, the controller starts from the Hold point of the Ramp/Program unless the Ramp/Program was not previously started via the  key. This selection applies to either loop.
	TO PID2	**TO PID2**—Contact closure selects PID Set 2.
	PV 2IN	**PV=INPUT 2**—Contact closure selects PV = Input 2.
	RERUN	**RERUN--**Allows the Setpoint Programmer to be reset to the initial segment of its current cycle, unit stays in previous mode.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
	TO RUN	**RUN**—Contact closure starts a stopped SP Ramp or Program. Upper left character blinks “R”. Reopening the contact puts controller in HOLD mode. This selection applies to either loop.
	ToBEGIN	**EXTERNAL SP PROGRAM RESET**—Contact closure resets SP Program back to the beginning of the first segment in the program and places the program in the HOLD mode. Program cycle number is not affected. Reopening switch has no effect. This selection applies to either loop. **ATTENTION** Once the last segment of the setpoint program has timed out, the controller enters the mode of action specified in the configuration data and the program cannot be reset to the beginning of the first segment by digital input closure.
	STOP I	**INHIBIT INTEGRAL (RESET)**—Contact closure disables PID Integral (Reset) action.
	MAN FS	**MANUAL FAILSAFE OUTPUT**—Controller goes to Manual mode, output goes to the Failsafe value. **ATTENTION** This will cause a bump in the output when switching from Automatic to Manual. The switch back from Manual to Automatic is bumpless. When the switch is closed, the output can be adjusted from the keyboard.
	TO LOCK	**KEYBOARD LOCKOUT**—Contact closure disables all keys. Lower display shows LOCKED if a key is pressed.
	TO Aout	**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. **ATTENTION** Does not apply to Three Position Step Control.
	TIMER	**TIMER**—Contact closure starts timer, if enabled. Reopening the switch has no effect.
	AM STA	**TO AUTO/MANUAL STATION**—Contact closure causes the control loop to perform as follows: PV = Input 2 Action = Direct Control algorithm = PD+MR PID SET = 2 SP = LSP 2
	TO TUNE	**INITIATE LIMIT CYCLE TUNING**—Contact closure starts the tuning process. The lower display shows TUNE ON. Opening the contact has no effect.
	SP Init	**SETPOINT INITIALIZATION**—Contact closure forces the setpoint to the current PV value. Opening the contact has no effect.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
	TRACK	**OUTPUT TRACKS 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 RSP	**TO REMOTE SETPOINT**—Contact closure selects the Remote setpoint.
	RST FB	**EXTERNAL RESET FEEDBACK**—Contact closure allows Input 2 to override the internal reset value.
	To PURGE	**TO PURGE**—Contact closure forces the loop to Manual mode with the output set to the Output High Limit configuration. MAN lights and the Output value is shown on the lower display. Opening the switch has no effect. **ATTENTION** Does not apply to Three Position Step Control.
	Lo FIRE	**LOW FIRE**—Contact closure forces the loop to Manual mode with the output set to the Output Low Limit configuration. MAN lights and the Output value is shown on the lower display. Opening the switch has no effect. **ATTENTION** Does not apply to Three Position Step Control.
	MAN LAT	**MANUAL LATCHING**—Contact closure transition forces the loop to Manual mode. Opening the switch has no effect. If the MAN/AUTO key is pressed while the switch is closed, the loop will return to Automatic mode.
	PV Hold	**PROCESS VARIABLE HOLD**—when the switch is closed, PV is frozen at last value. When switch opens, PV resumes.
DIG 1COMB		**DIGITAL INPUT 1 COMBINATION SELECTIONS** —This selection allows the specified function to occur in addition to the one chosen for DIG IN 1.
	DISABLE	**DISABLE**—Disables combination function.
	+PID2	**PLUS PID2**—Contact closure selects PID Set 2.
	+TO DIR	**PLUS DIRECT ACTION**—Contact closure selects direct controller action.
	+TO SP2	**PLUS SETPOINT 2**—Contact closure puts the controller into SP2.
	+DIS AT	**PLUS DISABLE ADAPTIVE TUNE**—Contact closure disables Accutune process.
	+TO SP1	**PLUS SETPOINT 1**—Contact closure puts the controller into SP1.
	+RUN	**PLUS RUN SETPOINT PROGRAM/RAMP**—Contact closure starts SP Program/Ramp if enabled.
DIG INP2	Same selections as for Digital Inp 1	**DIGITAL INPUT 2 SELECTIONS**
DIG2COMB	Same selections as Digital Input 1 Combinations	**DIGITAL INPUT 2 COMBINATIONS**

3.12 Communications Group

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
Com ADDR	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.
ComSTATE	 DISABLE MODBUS	**COMMUNICATIONS SELECTION** **DISABLE**—Disables RS-485 communications option. **MODBUS**—Enables RS-485 Modbus RTU communication port.
IR ENABLE	DISABLE ENABLE	**IR ENABLE**–Disable/Enables IR communications port. **ATTENTION** If there are no IR communications transactions for four minutes, then the IR port automatically shuts down. It can be re-enabled by pressing any key on the front panel.
BAUD	 4800 9600 19200 38400	**BAUD RATE** is the transmission speed in bits per second. This value is used for both RS-485 and IR Communications, but for IR Communications, values below 19200 baud are interpreted as being 19200 baud. **4800 BAUD** **9600 BAUD** **19200 BAUD** **38400 BAUD**
TX DELAY	1 to 500 milliseconds	**TX 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.
WS FLOAT	 FP_B FP_BB FP_L FP_LB	Defines word/byte order of floating point data for communications. Byte values: 0 1 2 3 seeeeeee emmmmmmm mmmmmmmm mmmmmmmm Where: s = sign, e = exponent, m = mantissa bit 0 1 2 3 1 0 3 2 3 2 1 0 2 3 0 1
SHED ENAB	DISABLE ENABLE	**SHED ENABLE**—Disables/enables shed functionaliy. Applies to Modbus protocol only.
SHEDTIME	0 to 255	**SHED TIME**—The number that represents how many sample periods there will be before the controller sheds from communications. Each period equals 1/3 seconds; 0 equals No shed. Note: If ComSTATE is set to MODBUS or MB3K and if SHEDENAB is set to DISABL, Shed Time will not be configurable.
SHEDMODE		**SHED CONTROLLER MODE AND OUTPUT LEVEL**—Determines the mode of local control you want when the controller is shed from the communications link.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
	LAST TO MAN FSAFE TO AUTO	**LAST**—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 MAN**—MANUAL MODE, SAME OUTPUT—The controller will return to manual mode at the same output level that it had before shed. **FSAFE**—MANUAL MODE, FAILSAFE OUTPUT—The controller will return to manual mode at the output value selected at Control prompt FAILSAFE. **TO AUTO**—AUTOMATIC MODE, LAST SP—The controller will return to the automatic mode and the last setpoint used before shed.
SHED SP	 TO LSP TO CSP	**SHED SETPOINT RECALL** Note: If SHEDENAB=DISABLE, this prompt will not be configurable. **TO LSP**—Controller will use last local or remote setpoint used. **TO CSP**—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.
UNITS	 ENG PERCENT	**COMPUTER SETPOINT UNITS** **ENG** — Engineering units **PERCENT** — Percent of PV range
CSP RATO	–20.0 to 20.0	**COMPUTER SETPOINT RATIO**—Computer setpoint ratio.
CSP BIAS	–999. to 9999. (engineering units)	**COMPUTER SETPOINT BIAS**—Computer setpoint bias in Engineering Units.
LOOPBACK	 DISABLE ENABLE	**LOCAL LOOPBACK** tests the RS-485 communications port. It is not used for any other communications port. **DISABLE**—Disables the Loopback test. **ENABLE**—Allows loopback test. The instrument goes into Loopback mode in which it sends and receives its own message. The instrument displays PASS or FAIL status in the upper display and LOOPBACK in the lower display while the test is running. The instrument will go into manual mode when LOOPBACK is enabled with the output at the Failsafe value. The test will run until the operator disables it here, or until power is turned off and on. **ATTENTION** The instrument does not have to be connected to the external communications link in order to perform this test. If it is connected, only one instrument should run the loopback test at a time. The host computer should not be transmitting on the link while the loopback test is active.

3.13 Alarms Set Up Group

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
A1S1 VAL	Value in engineering units	**ALARM 1 SETPOINT 1 VALUE**—This is the value at which you want the alarm type chosen in prompt A1S1TYPE to actuate. The value depends on what the setpoint has been configured to represent. No setpoint is required for alarms configured for Communications SHED. For SP Programming the value is the segment number for which the event applies. This prompt does not appear for “Alarm on Manual” type alarm. For example: A1S1TYPE = MANUAL.
A1S2 VAL	Value in engineering units	**ALARM 1 SETPOINT 2 VALUE**—This is the value at which you want the alarm type chosen in prompt A1S2TYPE to actuate. The details are the same as A1S1 VAL.
A2S1 VAL	Value in engineering units	**ALARM 2 SETPOINT 1 VALUE**—This is the value at which you want the alarm type chosen in prompt A2S1TYPE to actuate. The details are the same as A1S1 VAL.
A2S2 VAL	Value in engineering units	**ALARM 2 SETPOINT 2 VALUE**—This is the value at which you want the alarm type chosen in prompt A2S2TYPE to actuate. The details are the same as A1S1 VAL.
A1S1TYPE	 NONE INPUT 1 INPUT 2 PV DEV OUTPUT SHED EV ON EV OFF MANUAL REM SP F SAFE PV RATE DIG INP 1 DIG INP 2 DEV 2 BREAK TCWARN TCFAIL PVHOLD	**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. **NO ALARM** **INPUT 1** **INPUT 2** **PROCESS VARIABLE** **DEVIATION** **OUTPUT** (NOTE 1) **SHED FROM COMMUNICATIONS** **EVENT ON (SP PROGRAMMING)** **EVENT OFF (SP PROGRAMMING)** **ALARM ON MANUAL MODE** (NOTE 2) **REMOTE SETPOINT** **FAILSAFE** **PV RATE OF CHANGE** **DIGITAL INPUT 1 ACTUATED** (NOTE 7) **DIGITAL INPUT 2 ACTUATED** (NOTE 7) **DEVIATION FROM LSP 2** (NOTE 3) **LOOP BREAK** (NOTE 4) **THERMOCOUPLE WARNING (NOTE 5)** **THERMOCOUPLE FAIL (NOTE 6)** **PV HOLD**

ATTENTION

NOTE 1. When the controller is configured for Three Position Step Control, alarms set for Output will not function.

NOTE 2. Alarm 1 is not available if the Timer is enabled because Alarm 1 is dedicated to Timer output.

NOTE 3. This Deviation Alarm is based upon deviation from the 2nd Local Setpoint or Remote SP

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
regardless of whichever SP is active.		
A1S1 H L	HIGH LOW	***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 A1S1TYPE to alarm High or Low. **HIGH ALARM** **LOW ALARM**
A1S1 EV	BEGIN END	***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 A1S1TYPE to alarm the beginning or end of a segment in setpoint Ramp/Soak programming. **BEGINNING OF SEGMENT** **END OF SEGMENT** **ATTENTION** Alarms configured for events will not operate on Setpoint Program segments of zero length.
A1S2TYPE	Same as A1S1 TYPE	**ALARM 1 SETPOINT 2 TYPE**—Select what you want Setpoint 2 of Alarm 1 to represent. The selections are the same as A1S1TYPE.
A1S2 H L	HIGH LOW	**ALARM 1 SETPOINT 2 STATE**—Same as A1S1 H L.
A1S2 EV	BEGIN END	**ALARM 1 SEGMENT EVENT 2**—Same as A1S1 EV.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
A2S1TYPE	Same as A1S1 TYPE	**ALARM 2 SETPOINT 1 TYPE**—Select what you want Setpoint 1 of Alarm 2 to represent. The selections are the same as A1S1TYPE. **ATTENTION** Not available with Relay Duplex or Position Proportional output types unless using Dual Relay PWA.
A2S1 H L **A2S1 EV**	HIGH LOW BEGIN END	**ALARM 2 SETPOINT 1 STATE**—Same as A1S1 H L. **ALARM 2 SEGMENT EVENT 1**—Same as A1S1 EV.
A2S2TYPE	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 A1S1TYPE. **ATTENTION** Not applicable with Relay Duplex or Position Proportional output types unless using Dual Relay PWA.
A2S2 H L **A2S2 EV**	HIGH LOW BEGIN END	**ALARM 2 SETPOINT 2 STATE**—Same as A1S1 H L. **ALARM 2 SEGMENT EVENT 2**—Same as A1S1 EV.
ALHYST	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.
ALM OUT1	 NoLATCH LATCH	**LATCHING ALARM OUTPUT 1**—Alarm output 1 can be configured to be Latching or Non-latching. NoLATCH —Non-latching **LATCH**—Latching **ATTENTION** When configured for latching, the alarm will stay active after the alarm condition ends until the RUN/HOLD key is pressed.
BLOCK		**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.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
	DISABLE ALARM 1 ALARM 2 ALARM12	**DISABLE**—Disables blocking **ALARM 1**—Blocks alarm 1 only **ALARM 2**—Blocks alarm 2 only **ALARM12**—Blocks both alarms **ATTENTION** When enabled on power up or initial enabling via configuration, the alarm will not activate unless the parameter being monitored has not been in an alarm condition for a minimum of one control cycle (167 ms).
DIAGNOST	 DISABLE ALARM 1 ALARM 2	**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 **ALARM 2**—Alarm 2 is diagnostic alarm

3.14 Display Set Up Group

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
DECIMAL	 NONE ONE TWO THREE	**DECIMAL POINT LOCATION**—This selection determines where the decimal point appears in the display. **NONE**—No Decimal Place—fixed, no auto-ranging **ONE**—One Place **TWO**—Two Places **THREE**—Three Places **ATTENTION** Auto-ranging will occur for selections of one, two or three decimal places. For example, should the instrument be configured for two decimal places and the PV exceeds 99.99, then the display will change to a single decimal place so that values of 100.0 and above can be shown.
TEMP UNIT	 DEG F DEG C NONE	**TEMPERATURE UNITS**—This selection will affect the indication and operation. **DEG F**—Degrees Fahrenheit – Degrees F Annunciator lighted **DEG C**—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.
PWR FREQ	60 HZ 50 HZ	**POWER LINE FREQUENCY**—Select whether your controller is operating at 50 or 60 Hertz. **ATTENTION** For controllers powered by +24 Vdc, this configuration should be set to the AC line frequency used to produce the +24 Vdc supply. Incorrect setting of this parameter may cause normal mode noise problems in the input readings.
RATIO 2	 DISABLE ENABLE	**INPUT 2 RATIO**—This enables the Ratio for Input 2 to be set from the front panel. 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 FRENCH GERMAN SPANISH ITALIAN	**LANGUAGE**—This selection designates the prompt language. **ENGLISH** **FRENCH** **GERMAN** **SPANISH** **ITALIAN**

4 Monitoring and Operating the Controller

4.1 Operator Interface

Introduction

Figure 4-1 is a view of the Operator Interface.

Figure 4-1 Operator Interface

4.2 Entering a Security Code

Introduction

The level of keyboard lockout may be changed in the Set Up 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 0 which permits changing from one lockout level to another without entering any other code number.

Procedure

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

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

Table 4-1 Procedure to Enter a Security Code

Step	Operation	Press	Result
1	Enter Set Up Mode	Setup	*Upper Display* = **SET UP** *Lower Display* = **TUNING**
2	Select any Set Up Group	Function	*Upper Display* = **0** *Lower Display* = **SECUR**
3	Security Code Entry	▲ or ▼	To enter a four digit number in the upper display (0001 to 9999) This will be your security code.

4.3 Individual key lockout

There are three keys that can be disabled to prevent unauthorized changes to the parameters associated with these keys. *First set the "Lock" prompt to NONE.*

These keys are:

Run/Hold Key - you can disable the Run/Hold key for Set Point Programming at configuration Set Up group prompt "Tuning," function prompt "RN HLD."

Man/Auto Key - you can disable the Auto/Manual key at configuration Set Up, group prompt "Tuning", function prompt "AUTOMA"

SP Select Key - you can disable the Set Point Select function key at configuration Set Up group prompt "Tuning," function prompt "SP SEL."

See *Subsection 3.3 - Tuning Parameters Set Up Group* prompts to enable or disable these keys.

Key error

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

- Parameter not available or locked out
- Not in setup mode, press **SET UP** key first
- Individual key locked out.

4.4 Monitoring Your Controller

4.4.1 Annunciators

The following annunciator functions have been provided to help monitor the controller:

Table 4-2 Annunciators

Annunciator	Indication
ALM 1 2	*A visual indication of each alarm* Blinking 1 indicates an alarm latched condition. The blinking will continue even after the alarm condition ends until it is acknowledged by pressing the RUN/HOLD key.
OUT 1 2	*A visual indication of the control relays*
DI 1 2	*A visual indication of each Digital Input*
A or **MAN**	*A visual indication of the mode of the controller)* **A**—Automatic Mode **MAN**—Manual Mode
[None], F or **C**	*A visual indication of the temperature units* **[None]**—No temperature unit annunciator **F**—Degrees Fahrenheit **C**—Degrees Celsius
■	*A visual Lamp to indicate when the lower display is showing the Active Setpoint (Local 1, Local 2, Local 3, Remote Setpoint or Computer Setpoint)* *The upper left digit of the display is used to show other annunciator functions* **T**—Accutuning in process **C**—Computer overide active **O**—Output override active

4.4.2 Viewing the operating parameters

Press the **LOWER DISPLAY** key to scroll through the operating parameters. The lower display will show only those parameters and their values that apply to your specific model.

Table 4-3 Lower Display Key Parameter Prompts

Lower Display	Description
OUT XX.X	OUTPUT—Output value is shown in percent with one decimal point for all output types except Three Position Step Control (TPSC). For TPSC, when no slidewire is connected, this display is an estimated motor position and is shown with no decimal point. For Position Proportional Control, if the slidewire fails, then the instrument automatically switches over to TPSC and the OUT display changes with it.
SP XXXX	LOCAL SETPOINT #1—Also current setpoint when using SP Ramp.
2SP XXXX	LOCAL SETPOINT #2
3SP XXXX	LOCAL SETPOINT #3
RSP XXXX	REMOTE SETPOINT
1IN XXXX	INPUT 1—Used only with combinational input algorithms.
2IN XXXX	INPUT 2
POS XX	SLIDEWIRE POSITION—Used only with TPSC applications that use a slidewire input.
CSP XXXX	COMPUTER SETPOINT—When SP is in override.
DEV XXXX	DEVIATION—Maximum negative display is –999.9.
PIDSET X	TUNING PARAMETER —where X is either 1 or 2.
ET HR.MN	ELAPSED TIME—Time that has elapsed on the Timer in Hours.Minutes.
OTR HR.MN	TIME REMAINING—Time remaining on the Timer in Hours.Minutes. The “O” is a rotating clock face.
RAMPXXXM	SETPOINT RAMP TIME—Time remaining in the Setpoint Ramp in minutes.
SPN XXXX	SETPOINT NOW—Current Setpoint when SP Rate is enabled. The **SP XXXX** display shows the “target” or final setpoint value.
XXRAHR.MN	RAMP SEGMENT NUMBER AND TIME REMAINING—Set Point Programming display. XX is the current segment number and **HR.MN** is the time remaining for this segment in Hours.Minutes.
XXSKHR.MN	SOAK SEGMENT NUMBER AND TIME REMAINING— Set Point Programming display. XX is the current segment number and **HR.MN** is the time remaining for this segment in Hours.Minutes.
RECYC 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
AUX XXXX	AUXILIARY OUTPUT—Displayed only when output algorithm is not Current Duplex.
BIA XXXX	BIAS—Displays the manual reset value for algorithm PD+MR.
TUNE OFF	LIMIT CYCLE TUNING NOT RUNNING—Appears when Accutune is enabled but not operating.
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.
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.

4.4.3 Diagnostic Messages

The UDC3200 performs background tests to verify data and memory integrity. If there is a malfunction, a diagnostic message will be shown on the lower display. In the case of more than one simultaneous malfunction, only the highest priority diagnostic message will be displayed. Table 4-4 shows the error messages in order by priority.

Table 4-4 Diagnostic Messages

Prompt	Description
EE FAIL	Unable to write to nonvolatile memory. A subsequent successful write to nonvolatile memory removes this message.
FAILSAFE	This error message appears whenever the controller goes into a failsafe mode of operation. Failsafe operation occurs when an analog input fails or when configuration is corrupted.
INP1FAIL	Two consecutive failures of input 1 integration or input value is outside of Out-of-Range limits.
INP2FAIL	Two consecutive failures of input 2 integration or input value is outside of Out-of-Range limits.
SW FAIL	Slidewire input failure. Position Proportional Control automatically switched to Three Position Step Control.
CONF ERR	Configuration Errors—Low limit greater than high limit for PV, SP, Reset, or Output.
SOOTING	Carbon Potential Problem—Percent Carbon outside of “sooting boundary.”
IN1 RNG	Input 1 Out-of-Range—Input is outside of the High or Low Limits. Out-of-range criteria: Linear range: ± 10 % Characterized range: ± 1 %
IN2 RNG	Input 2 Out-of-Range—Same criteria as Input 1.
PV LIMIT	PV beyond limits—PV outside of PV Hi/Low Limits. PV = (PV source x PV source ratio) + PV source bias
FAILSAFE	Failsafe—Check inputs or configuration.
RV LIMIT	Remote Variable beyond limits—RSP outside of SP Hi/Low Limits. RV = (RV source x RV source ratio) + RV source bias
SEG ERR	Segment Error—SP Program starting segment number is less than ending segment number.
CAL MTR	Slidewire not calibrated. Perform Slidewire calibration.
SW FAIL	Position Proportional slidewire input failure.
TC1 WARN	The Thermocouple on Input 1 is starting to burnout.
TC2 WARN	The Thermocouple on Input 2 is starting to burnout.
TC1 FAIL	Thermocouple on Input 1 is in imminent danger of burning out.
TC2 FAIL	Thermocouple on Input 2 is in imminent danger of burning out.
OUT1FAIL	Current Output is less than 3.5 mA.
OUT2FAIL	Current Output 2 is less than 3.5 mA.

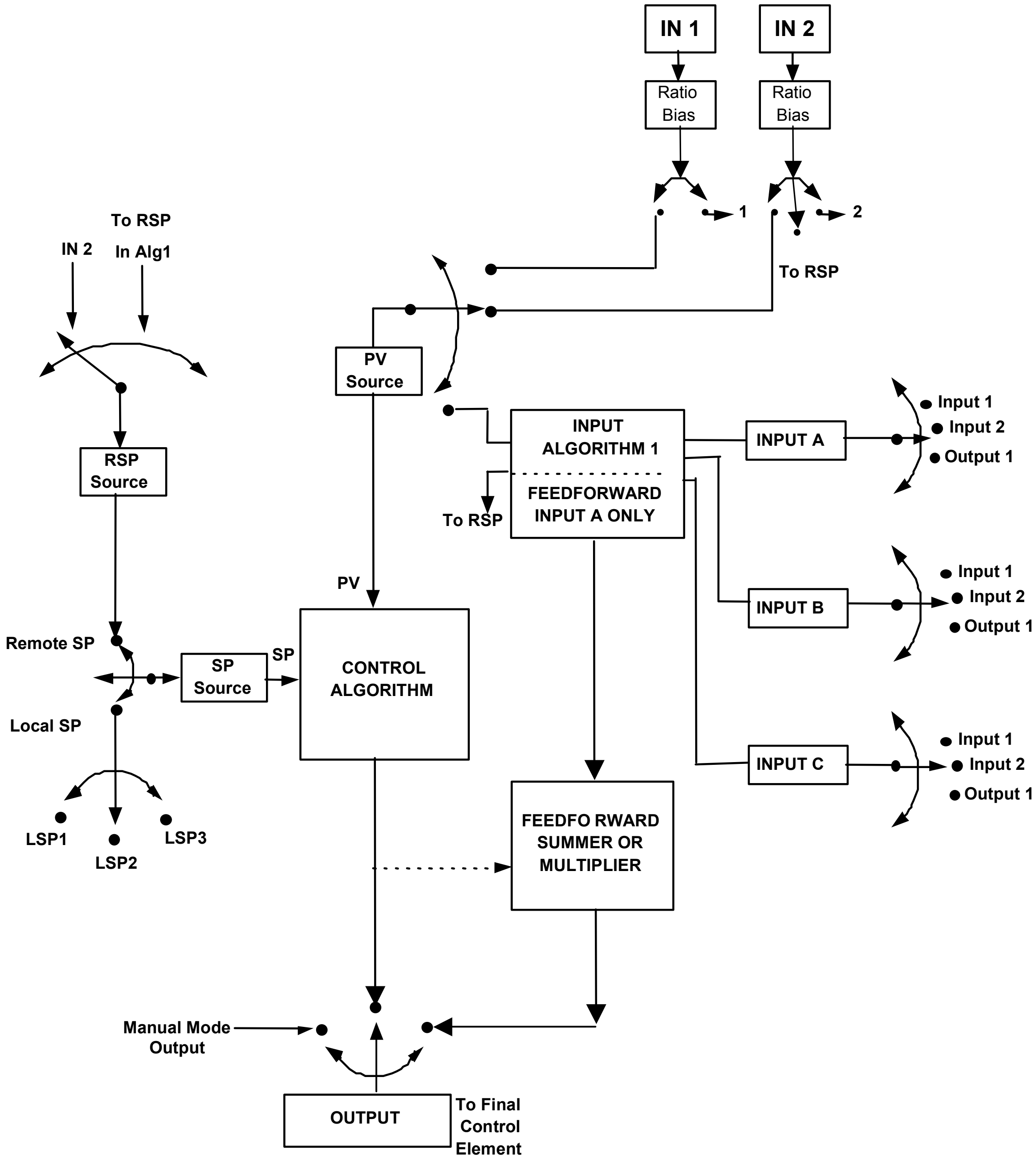


Figure 4-2 Functional Overview Block Diagram of the UDC3200 Controller

4.5 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:

- TUNE has been enabled see to *Subsection 3.5 - Accutune Set Up Group* for details.

Tuning indicators

A "T" will show in the leftmost alphanumeric of the upper 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 desireable to enable the FUZZY tune selection. See Section 4.6. 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.

4.5.1 Tune for Simplex Outputs

After “TUNE” has been enabled, you can start Accutune as shown in Table 4-5.

Table 4-5 Procedure for Starting “TUNE”

Step	Operation	Press	Result
1	Configure LSP1	Lower Display	Until **SP** (Local Setpoint 1) shows in the lower display.
2		▲ or ▼	Until LSP1 is to the desired value.
3	Switch to “Automatic” Mode	Man Auto	Until the “A” indicator is lighted (on controllers with Manual option).
4	Show Tuning Prompt	Lower Display	Until “TUNE OFF” is shown on lower display.

5	Initiate Tuning		Select “DO SLOW” or “DO FAST” in lower display.
6	Tuning in operation	Lower Display	Upper display will show a “T” as long as ACCUTUNE process is operating. When process completes, tuning parameters are calculated and lower display will show “NO TUNE” prompt.

ATTENTION

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

4.5.2 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). 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 *Subsection 3.5 - Accutune Set Up Group* for details.

Make sure:

- TUNE has been enabled
- DUPLEX has been configured to Manual, Automatic or Disabled

4.5.3 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 4-6 Procedure for Using AUTOMATIC TUNE at Start-up for Duplex Control

Step	Operation	Press	Result
1	Configure LSP1	Lower Display	Until **SP** (Local Setpoint 1) shows in the lower display.
2		▲ or ▼	Until LSP1 is a value within the **Heat** Zone (output above 50%).
3	Configure LSP2	Lower Display	Until **2SP** (Local Setpoint 2) shows in the lower display.
4		▲ or ▼	Until LSP2 is a value within the **Cool** Zone (output below 50%).
5	Switch to “Automatic” Mode	Man Auto	Until the “A” indicator is lighted (on controllers with Manual option).
6	Show Tuning Prompt	Lower Display	Until “TUNE OFF” is shown on lower display.
7	Initiate Tuning	▲	Select “DO SLOW” or “DO FAST” in lower display.
	Tuning in operation	Lower Display	Upper display will show a “T” as long as ACCUTUNE process is operating. When process completes, tuning parameters are calculated and lower display will show “NO TUNE” prompt.

4.5.4 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 4-7 Procedure for Using BLENDED TUNE at Start-up for Duplex Control

Step	Operation	Press	Result
1	Configure LSP1	Lower Display	Until **SP** (Local Setpoint 1) shows in the lower display.
2		▲ or ▼	Until the Setpoint is to the desired value.
3	Switch to "Automatic" Mode	Man Auto	Until the "A" indicator is lighted (on controllers with Manual option).
4	Show Tuning Prompt	Lower Display	Until "TUNE OFF" is shown on lower display.
5	Initiate Tuning	▲	Select "DO SLOW" or "DO FAST" in lower display.
6	Tuning in operation	Lower Display	Upper display will show a "T" as long as ACCUTUNE process is operating. When process completes, tuning parameters are calculated and lower display will show "NO TUNE" prompt.

4.5.5 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 4-8 Procedure for Using MANUAL TUNE for Heat side of Duplex Control

Step	Operation	Press	Result
1	Configure LSP1	Lower Display	Until **SP** (Local Setpoint 1) shows in the lower display.
2		▲ or ▼	Until LSP1 is a value within the **Heat** Zone (output above 50%).
3	Switch to "Automatic" Mode	Man Auto	Until the "A" indicator is lighted (on controllers with Manual option).

Step	Operation	Press	Result
4	Show Tuning Prompt	Lower Display	Until "TUNE OFF" is shown on lower display.
5	Initiate Tuning	▲	Select "DO SLOW" or "DO FAST" in lower display.
6	Tuning in operation	Lower Display	Upper display will show a "T" as long as ACCUTUNE process is operating. When process completes, tuning parameters are calculated and lower display will show "NO TUNE" prompt.

Table 4-9 Procedure for Using MANUAL TUNE for Cool side of Duplex Control

Step	Operation	Press	Result
1	Configure LSP2	Lower Display	Until **2SP** (Local Setpoint 2) shows in the lower display.
2		▲ or ▼	Until LSP2 is a value within the **Cool** Zone (output below 50%).
3	Switch to "Automatic" Mode	Man Auto	Until the "A" indicator is lighted (on controllers with Manual option).
4	Show Tuning Prompt	Lower Display	Until "TUNE OFF" is shown on lower display.
5	Initiate Tuning	▲	Select "DO SLOW" or "DO FAST" in lower display.
6	Tuning in operation	Lower Display	Upper display will show a "T" as long as ACCUTUNE process is operating. When process completes, tuning parameters are calculated and lower display will show "NO TUNE" prompt.

4.5.6 Error Codes

Table 4-10 Procedure for Accessing Accutune Error Codes

Step	Operation	Press	Result
1	Select Accutune Set-up Group	Setup	*Upper Display* = **SETUP** *Lower Display* = **ACCUTUNE**
2	Go to Error Code Prompt	Function	*Upper Display* = **(an error code)** *Lower Display* = **AT ERROR** **Table 4-11 lists all the error codes, definitions, and fixes.**

Table 4-11 Accutune Error Codes

Error Code (Upper Display)	Definition	Fix
RUNNING	ACCUTUNE RUNNING	The Accutune process is still active (Read Only)
NONE	NO ERRORS OCCURRED DURING LAST ACCUTUNE PROCEDURE	None
ID FAIL	PROCESS IDENTIFICATION FAILURE Autotune has aborted because an illegal value of GAIN, RATE, or reset was calculated.	• Illegal Values – try Accutune again. • untunable process -- contact local application engineer.
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
SP2	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.

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 “DO SLOW” or “DO 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.

4.6 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 Section 3 - Configuration:

Set Up Group "**ACCUTUNE**"
Function Prompt "**FUZZY**"
Select "**ENABLE**" or "**DISABLE**" - Use ▲ or ▼.

5 Troubleshooting/Service

5.1 Background Tests

The UDC3200 performs ongoing background tests to verify data and memory integrity. If there is a malfunction, a diagnostic message will be displayed (blinking) in the lower display. In the case of simultaneous malfunctions, the messages will appear in sequence in the lower display.

Diagnostic messages may be suppressed (stop the blinking) by pressing the RUN/HOLD key. The messages will still be available for viewing by pressing the LOWER DISPLAY key.

Table 5-1 Background Tests

Lower Display	Reason for Failure	How to Correct the Problem
EE FAIL	Unable to write to non-volatile memory. Anytime you change a parameter and it is not accepted, you will see E FAIL.	1. Check the accuracy of the parameter and re-enter. 2. Try to change something in configuration. 3. Run through Read STATUS tests to re-write to EEPROM.
FAILSAFE	This error message shows whenever the controller goes into a failsafe mode of operation. This will happen if: • RAM test failed • Configuration test failed • Calibration test failed • Burnout configured for none and the input failed.	1. Run through STATUS check to determine the reason for the failure. 2. Press the **SET UP** key until STATUS appears in the lower display. 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.
INP1 RNG	Input 1 out of range. The process input is outside the range limits.	1. Make sure the range and actuation are configured properly. 2. Check the input source. 3. Restore the factory calibration. 4. Field calibrate.
INP1FAIL	Two consecutive failures of input 1 integration; i.e., cannot make analog to digital conversion. This will happen if: • Upscale or Downscale burnout is selected and the input is open • Input not configured correctly for the sensor being used • Input source is grossly out of range.	1. Make sure the actuation is configured correctly. See *Section 3 - Configuration*. 2. Make sure the input is correct and that it has not burned-out (opened). 3. Check for gross over-ranging with a multimeter. 4. Restore factory calibration.
INP2 RNG	Input 2 out of range. The remote input is outside the range limits.	Same as INP1RNG above.
INP2FAIL	Two consecutive failures of input 2 integration. i.e., cannot make analog to digital conversion.	Same as INP1FAIL above.
CONF ERR	• PV low limit is > PV high limit • SP low limit is > SP high limit • Output low limit > Output high limit	1. Check the configuration for each item and reconfigure if necessary.

Lower Display	Reason for Failure	How to Correct the Problem
PV LIMIT	PV out of range. PV = INP1 x RATIO1+ INP1 BIAS	1. Make sure the input signal is correct. 2. Make sure the Ratio and Bias settings are correct. 3. Recheck the calibration. Use Bias of 0.0
RV LIMIT	The result of the formula shown below is beyond the range of the remote variable. RV = INP2 X RATIO + BIAS	1. Make sure the input signal is correct. 2. Make sure the Ratio2 and Bias2 settings are correct. 3. Recheck the calibration. Use a Ratio2 of 1.0 and a Bias2 of 0.0.
SEGERR	Setpoint Program start segment number is less than ending segment number.	Check SP Program configuration, subsection 3.4 Set up Group SPPROG function prompts “STRSEG” and “ENDSEG”.
CAL MTR	Slidewire calibration never performed.	Field Calibrate the slidewire.
SW FAIL	Position Proportional slidewire input failure.	Check the slidewire.
SOOTING	Percent Carbon falls outside sooting boundary	Check process for correct operation.
TCx WARN	Thermocouple on Input x (1 or 2) is starting to burnout.	This diagnostic message means that the controller has detected that the thermocouple is starting to burnout. This error message may also be created if the resistance of the wires used to connect the thermocouple to the instrument is above 100 ohms.
TCxFAIL	The Thermocouple on Input x (1 or 2) is in imminent danger of burning out.	This diagnostic message means that the controller has detected that the thermocouple will soon fail. User should consider replacing the thermocouple as soon as possible. This message will also be generated if the resistance of the wires used to connect the thermocouple to the instrument is above 180 ohms.
CURFAIL	Current Output is less than 3.5 mA.	The current output is open circuit. Check the field wiring.
AXFAIL	Auxiliary Output is less than 3.5 mA.	The auxiliary output is open circuit. Check the field wiring.

5.2 Controller Failure Symptoms

<table>
<tr><th>Upper Display</th><th>Lower Display</th><th>Indicators</th><th>Controller Output</th><th>Probable Cause</th></tr>
<tr><td>Blank</td><td>Blank</td><td>Off</td><td>None</td><td>Power Failure</td></tr>
<tr><td>OK</td><td rowspan="4">Displayed Output disagrees with Controller Output</td><td>OK</td><td rowspan="4">Controller Output disagrees with Displayed Output</td><td>Current Proportional Output</td></tr>
<tr><td>OK</td><td>OK</td><td>Position Proportional or TPSC Output</td></tr>
<tr><td>OK</td><td>OK</td><td>Time Proportional Output</td></tr>
<tr><td>OK</td><td>OK</td><td>Current/Time Proportional Output</td></tr>
<tr><td>OK</td><td>OK</td><td>OK</td><td>External Alarm function does not operate properly</td><td>Malfunction in alarm output</td></tr>
<tr><td colspan="4">Display does not change when a key is pressed</td><td>Keyboard Malfunction</td></tr>
<tr><td colspan="4">Controller fails to go into “Slave” operation during communications</td><td>Communications Failure</td></tr>
<tr><td>OK</td><td>Displayed Output disagrees with Auxiliary Output</td><td>OK</td><td>Controller Auxiliary Output disagrees with Displayed Auxiliary Output</td><td>Auxiliary Output</td></tr>
</table>

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.

6 Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

ARGENTINA
Honeywell S.A.I.C.
Belgrano 1156
Buenos Aires
Argentina
Tel. : 54 1 383 9290

ASIA PACIFIC
Honeywell Asia
Pacific Inc.
Room 3213-3225
Sun Kung Kai Centre
N° 30 Harbour Road
Wanchai
Hong Kong
Tel. : 852 829 82 98

AUSTRALIA
Honeywell Limited
5 Thomas Holt Drive
North Ryde Sydney
Nsw Australia 2113
Tel. : 61 2 353 7000

AUSTRIA
Honeywell Austria
G.M.B.H.
Handelskai 388
A1020 Vienna
Austria
Tel. : 43 1 727 800

BELGIUM
Honeywell S.A.
3 Avenue De Bourget
B-1140 Brussels
Belgium
Tel. : 32 2 728 27 11

BRAZIL
HONEYWELL DO
Brazil
And Cia
Rua Jose Alves Da
Chunha
Lima 172
Butanta
05360.050 Sao Paulo
Sp
Brazil
Tel. : 55 11 819 3755

BULGARIA
HONEYWELL EOOD
14, Iskarsko Chausse
POB 79
BG- 1592 Sofia
BULGARIA
Tel : 359-791512/
794027/ 792198
CANADA
Honeywell Limited
The Honeywell Centre
300 Yorkland Blvd.
Toronto, Ontario
M2j 1s1
Canada
Tel.: 800 461 0013
Fax:: 416 502 5001

CZECH REPUBLIC
HONEYWELL,
Spol.S.R.O.
Budejovicka 1
140 21 Prague 4
Czech Republic
Tel. : 42 2 6112 3434

DENMARK
HONEYWELL A/S
Automatikvej 1
DK 2860 Soeborg
DENMARK
Tel. : 45 39 55 56 58

FINLAND
HONEYWELL OY
Ruukintie 8
FIN-02320 ESPOO 32
FINLAND
Tel. : 358 0 3480101

FRANCE
HONEYWELL S.A.
Bâtiment « le Mercury »
Parc Technologique de St
Aubin
Route de l'Orme
(CD 128)
91190 SAINT-AUBIN
FRANCE
Tel. from France:
01 60 19 80 00
From other countries:
33 1 60 19 80 00

GERMANY
HONEYWELL AG
Kaiserleistrasse 39
D-63067 OFFENBACH
GERMANY
Tel. : 49 69 80 64444

HUNGARY
HONEYWELL Kft
Gogol u 13
H-1133 BUDAPEST
HUNGARY
Tel. : 36 1 451 43 00

ICELAND
HONEYWELL
Hataekni .hf
Armuli 26
PO Box 8336
128 reykjavik
Iceland
Tel : 354 588 5000

ITALY
HONEYWELL S.p.A.
Via P. Gobetti, 2/b
20063 Cernusco Sul
Naviglio
ITALY
Tel. : 39 02 92146 1

MEXICO
HONEYWELL S.A. DE
CV
AV. CONSTITUYENTES
900
COL. LOMAS ALTAS
11950 MEXICO CITY
MEXICO
Tel : 52 5 259 1966

THE NETHERLANDS
HONEYWELL BV
Laaderhoogtweg 18
1101 EA AMSTERDAM
ZO
THE NETHERLANDS
Tel : 31 20 56 56 911

NORWAY
HONEYWELL A/S
Askerveien 61
PO Box 263
N-1371 ASKER
NORWAY
Tel. : 47 66 76 20 00

POLAND
HONEYWELL Sp.z.o.o
UI Domaniewksa 41
02-672 WARSAW
POLAND
Tel. : 48 22 606 09 00

PORTUGAL
HONEYWELL
PORTUGAL LDA
Edificio Suecia II
Av. do Forte nr 3 - Piso 3
2795 CARNAXIDE
PORTUGAL
Tel. : 351 1 424 50 00

REPUBLIC OF IRELAND
HONEYWELL
Unit 1
Robinhood Business
Park
Robinhood Road
DUBLIN 22
Republic of Ireland
Tel. : 353 1 4565944

REPUBLIC OF SINGAPORE
HONEYWELL PTE LTD
BLOCK 750E CHAI
CHEE ROAD
06-01 CHAI CHEE IND.PARK
1646 SINGAPORE
REP. OF SINGAPORE
Tel. : 65 2490 100

REPUBLIC OF SOUTH AFRICA
HONEYWELL
Southern Africa
PO BOX 138
Milnerton 7435
REPUBLIC OF SOUTH
AFRICA
Tel. : 27 11 805 12 01

ROMANIA
HONEYWELL Office
Bucharest
147 Aurel Vlaicu Str.,
Sc.Z.,
Apt 61/62
R-72921 Bucharest
ROMANIA
Tel : 40-1 211 00 76/
211 79

RUSSIA
HONEYWELL INC
4 th Floor Administrative
Builiding of AO "Luzhniki"
Management
24 Luzhniki
119048 Moscow
RUSSIA
Tel : 7 095 796 98 00/01

SLOVAKIA
HONEYWELL Ltd
Mlynske nivy 73
PO Box 75
820 07 BRATISLAVA 27
SLOVAKIA
Tel. : 421 7 52 47 400/425

SPAIN
HONEYWELL S.A
Factory
Josefa Valcarcel, 24
28027 MADRID
SPAIN
Tel. : 34 91 31 3 61 00

SWEDEN
HONEYWELL A.B.
S-127 86 Skarholmen
STOCKHOLM
SWEDEN
Tel. : 46 8 775 55 00

SWITZERLAND
HONEYWELL A.G.
Hertistrasse 2
8304 WALLISELLEN
SWITZERLAND
Tel. : 41 1 831 02 71

TURKEY
HONEYWELL A.S.
Caryiryolu Sok No. 7
Ucgen Plaza, Kat 5-6-7
Icerenkoy 81120 Instanbul
Turkey
Tel (90-216) 575 66 00

UNITED KINGDOM
HONEYWELL
Honeywell House
Arlington Business Park
Bracknell,
Berkshire
RG12 1EB
Tel: +44 (0) 1344 656000

U.S.A.
HONEYWELL INC.
INDUSTRIAL PROCESS
CONTROLS
1100 VIRGINIA DRIVE
PA 19034-3260
FT. WASHINGTON
U.S.A.
Tel. : 1-800-343-0228

VENEZUELA
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VENEZUELA
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