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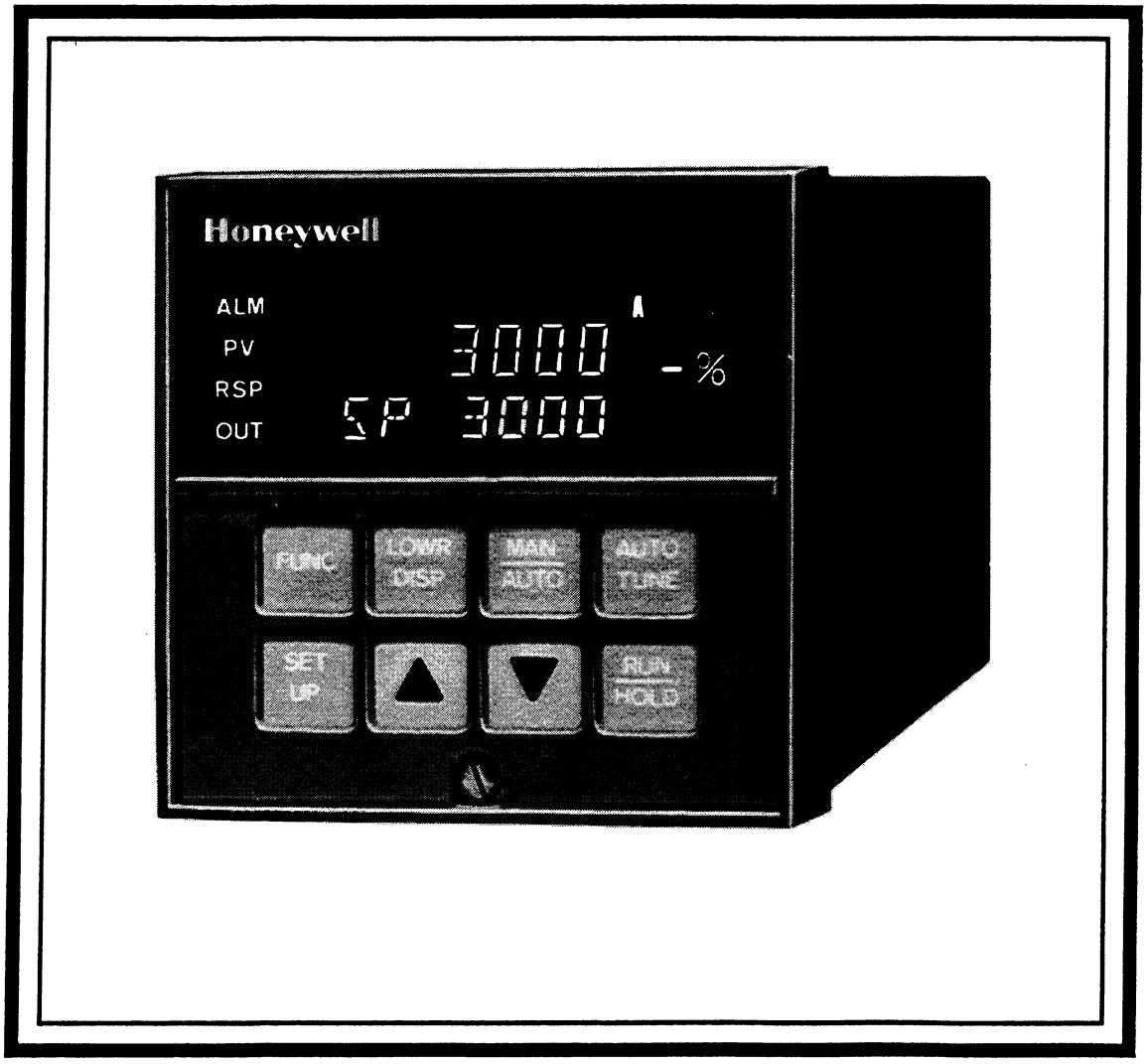
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Honeywell

51-51-25-07b

UDC 3000 Universal Digital Controller

Product Manual



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UDC 3000 Universal Digital Controller

10/91
Addendum to Product Manuals
51-51-25-07 b 3/91

Power-up Controller Mode Recall

On restart after power loss, the controller is able to power-up in the last mode it was in before power was lost. Please update your product manual to add the following selections:

CONFIGURATION

Page 3-12 Under **"Control Parameters Group"**

Lower Display = POWER UP

Upper Display = Selections should now read:

MANUAL	Manual, LSP
A.L S P	Automatic, LSP
A.R S P	Automatic, RSP
AM SP	Last Mode, Last SP
AM LSP	Last Mode, Last Local SP

OPERATION

Page 4-42 Under **"Restarting after Power Loss"**

Add the following conditions:

Last Mode, Last Set Point - at power-up, the controller will return to the last mode and the last set point displayed.

Last Mode, Last Local Set Point - at power-up, the controller will return to the last mode and the last *Local* set point displayed.

APPENDIX A

Page 8-15 Under **"Control Parameters Group"**

Please add the following to "POWER UP CONTROLLER MODE RECALL"

AM SP **LAST MODE, LAST SP** - At power-up, the controller will return to the last mode and the last set point displayed.

AM LSP **LAST MODE, LAST LOCAL SP** - At power-up, the controller will return to the last mode and the last *Local* set point displayed.

Communications Shed to Automatic Mode

If the controller "sheds" from the Communications link, it returns to stand alone operation. You can now enable it to go to Automatic Mode upon shed. Please update your product manual to add the following selection:

CONFIGURATION

Page 3-16 Under **"Communications Parameters Group"**

Lower Display = SHEdMOdE

Upper Display = Selections should now read:

LAST	Same Mode
TO MAN	Manual, Same Output
FSAFE	Manual, Failsafe
TO AUTO	Automatic Mode

APPENDIX A

Page 8-21 Under **"Communications Parameters Group"**

Please add the following to "SHED MODE"

TO AUTO To Automatic Mode

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Three Position Step Control Algorithm

Additions to the Product Manuals

Please make the following changes or additions to your product manual in the sections listed below:

OVERVIEW

Page 1-5 **Operator Interface Overview**

Lower Display Key - Change the parameter listed below to read as follows:

"POS" - Three Position Step Motor Position when slidewire is connected

"OUT" - Estimated Three Position Step Motor Position when no slidewire exists

OPERATING DATA

Page 4-6 **Monitoring Your Controller**

The Lower Display Key - change the following prompt:

*"OUT" - The controller output * in percent (%)*

or in the case of Three Position Step Control

Estimated Three Position Step Motor Position when no slidewire exists

Page 4-11 **Position Proportional Back-Up Mode**

Under this new heading add the following:

A new feature provides for a Position Proportional Model DC3004 to automatically change to a Three Position Step Algorithm if the slidewire input signal fails. this will maintain control of your process. "IN2 RNG" will flash in the lower display and "OUT". display will show estimated motor position without a decimal point.

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UDC 3000 START-UP MADE EASY

As owner of a UDC 3000 Versa-Pro, your tasks are to:

1. **"MOUNT"** the controller in a suitable location.
2. **"CONNECT FIELD WIRING"** from process sensors (thermocouples, transmitters, etc.), final control devices (motors, valves, heaters, etc.) and auxiliary equipment (recorders, alarms, etc).
3. **"CONFIGURE"** (Set Up) the UDC 3000 for the appropriate sensor input(s), control output(s), and process control parameters (PID, output and sensor limits, alarms, etc) required for your process.

To assist you in getting the UDC 3000 "UP and RUNNING", we have attached a Model Specific Index that provides a handy reference to the key product manual pages that apply to your UDC 3000 controller. The index is provided as a supplement to the general information applicable to all models.

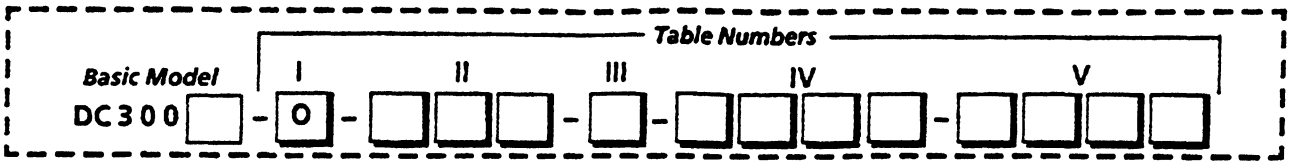
To use this Model Specific Index, copy the model number of your controller into the blocks provided at the top of the index page and into the blocks on the left side of the index. ***NOTE:*** *The model number is located on the side of the case.* Next, refer to the specific model number digit in the left hand column of the index to find the appropriate page number and/or product manual reference.

If you still have questions regarding configuration after reviewing this material, refer to Section 8 - Appendix A in the product manual for more detailed configuration information.

If you have read this material and still have questions, contact:

1. The local ***HONEYWELL SALES RESPONSE CENTER*** or your ***LOCAL HONEYWELL DISTRIBUTOR***.
2. The ***1 - 800 #, TECHNICAL ASSISTANCE CENTER(TAC)*** listed in the foreword section of the product manual. Please have your complete model, serial number, and configuration data available.

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3 0 0 ☐
BASIC MODEL NUMBER

3001 3002		3003		3004		
Install	*Configure*	*Install*	*Configure*	*Install*	*Configure*	*Calibrate*
P2-2 P2-3 P2-8 *NOT MODEL 3001	P8-6 P8-9 P8-22* P3-1 P3-3 P3-8 P3-12 P4-31* P3-17* P3-19*	P2-2 P2-3 P2-7	P8-6 P8-9 P8-22 P3-1 P3-3 P3-8 P3-12 P4-31 P3-17 P3-19	P2-2 P2-3 P2-9	P8-6 P8-9 P8-22 P3-1 P3-3 P3-8 P3-12 P4-31 P3-17 P3-19	P5-13 Note: This procedure must be done for Position Proportional to function properly

TABLE I — ☐ = O

Table Selection	Description	ALL MODELS Install	ALL MODELS Configure	Appendix (Definitions)	
0	*NONE*	-	-		
0 - -	*NONE*	-	-		
1 - -	*COMM RS422*	Product Manual 51-51-25-08	P3-15 plus Manual 51-51-25-08	P8-20	
2 - -	*AUX OUT*	P2-10	P3-14	P8-18	
3 - -	*DIGITAL INPUT*	P2-10	P4-28 P3-14	P8-19	
4 - -	*COMM DMCS*	P2-10 plus Gateway Section 85-50-10-23	P3-16 plus Gateway Section 85-50-10-23		

TABLE II

- 0 -	*NONE*	-	-		
- 1 -	*2nd INPUT 4 - 20 MA*	P2-7 P2-8	P3-8 P3-11	P8-12	Not for model 3004
- 2 -	*2nd INPUT 1 - 5 VDC*	P2-7 P2-8	P3-8 P3-11	P8-12	Not for model 3004
- - 0	*NONE*	-	-		
- - A	*AUTO TUNE*	-	P4-33 P3-7	P8-5	
- - B	*SP PROG and AUTOTUNE*	-	P4-18 P4-23 P4-33 P3-7 P3-17		

TABLE III

1	*1 - 5VDC, T/C, RTD, and MV*	P2-3 P2-7 P2-8 P2-9	P3-9 P3-10 P3-21 P3-22	P8-9
2	*4-20MAdc*	P2-3 P2-7 P2-8 P2-9	P3-9 P3-10 P3-21 P3-22	P8-9
3	*0-10 VDC*	P2-3 P2-7 P2-8 P2-9	P3-9 P3-10 P3-21 P3-22	P8-9

TABLES IV AND V DO NOT REQUIRE INSTALLATION, CONFIGURATION, OR CALIBRATION

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UDC 3000
Universal Digital Controller

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Foreword

Warranty

The device described herein has been manufactured and tested for correct operation and is warranted as follows:

The UDC 3000 Universal Digital Controller carries a two year warranty. This warranty includes immediate technical assistance via a toll free telephone number and complete replacement of the controller if necessary.

Technical Assistance

If you encounter a problem with your UDC 3000 controller, review all the configuration data under the SET UP groups to verify that your selections are consistent with your application; i.e. Inputs, Outputs, Alarms, Limits, etc. If the problem persists after checking the above, you can get technical assistance by dialing

1-800-423-9883

An engineer will discuss your problem with you. Please have your complete model number, serial number and configuration data available. The model and serial numbers can be found on the chassis nameplate. If it is determined that a hardware problem exists a replacement controller will be shipped with instructions for returning the defective unit.

Do not return your unit until the replacement has been received.

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Foreword

How This Manual Is Organized

The UDC 3000 Universal Digital Controller product manual consists of ten sections number 1 through 10.

To find a major category of information quickly, thumb through the manual to find the integral section tab located on the top of the page.

Page numbers include a section number prefix so you can readily access the described information. For example: P1-1 is Page 1 of Section 1.

SECTION 1.	OVERVIEW	Describing the controller
SECTION 2.	INSTALLATION	Installing the UDC
SECTION 3.	CONFIGURATION	Configuring your controller
SECTION 4.	OPERATION	Operating tips and procedures
SECTION 5.	CALIBRATION	Calibrating the unit
SECTION 6.	SERVICE	Troubleshooting/Service
SECTION 7.	PARTS LIST	Ordering replacement parts
SECTION 8.	APPENDIX A	Defining the configuration prompts
SECTION 9.	APPENDIX B	Tuning the controller manually
SECTION 10.	APPENDIX C	Eliminating electrical noise

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Overview Section 1

Function

The UDC 3000 Universal Digital Controller is a microprocessor-based stand alone controller. It combines the highest degree of functionality and operating simplicity offered in a 1/4 DIN size.

With a typical accuracy of ±0.20% of percent of span, the UDC 3000 is an ideal controller for regulating temperature and other process variables in numerous heating and cooling applications, in metal working, food, and pharmaceuticals, and testing and environmental work.

The dedicated vacuum fluorescent displays with English language prompts make the operator interface easy to read, understand, and operate. Programmed sequences of displays assure quick and accurate entry of all configurable parameters. Simple keystrokes let you select input and range configuration, set the operating parameters that meet your process control needs now, and change them later to meet new ones. The tactile keyboard provides positive operator feedback.

The UDC 3000 is environmentally hardened and can be mounted virtually anywhere in plant or factory; on the wall, in a panel, or even on the process machine. It withstands ambient temperatures up to 55°C and resists the effects of vibration and mechanical shock.

Self diagnostics, fault tolerant design and keyboard security provide maximum assurance of trouble-free operation.

Features and Benefits

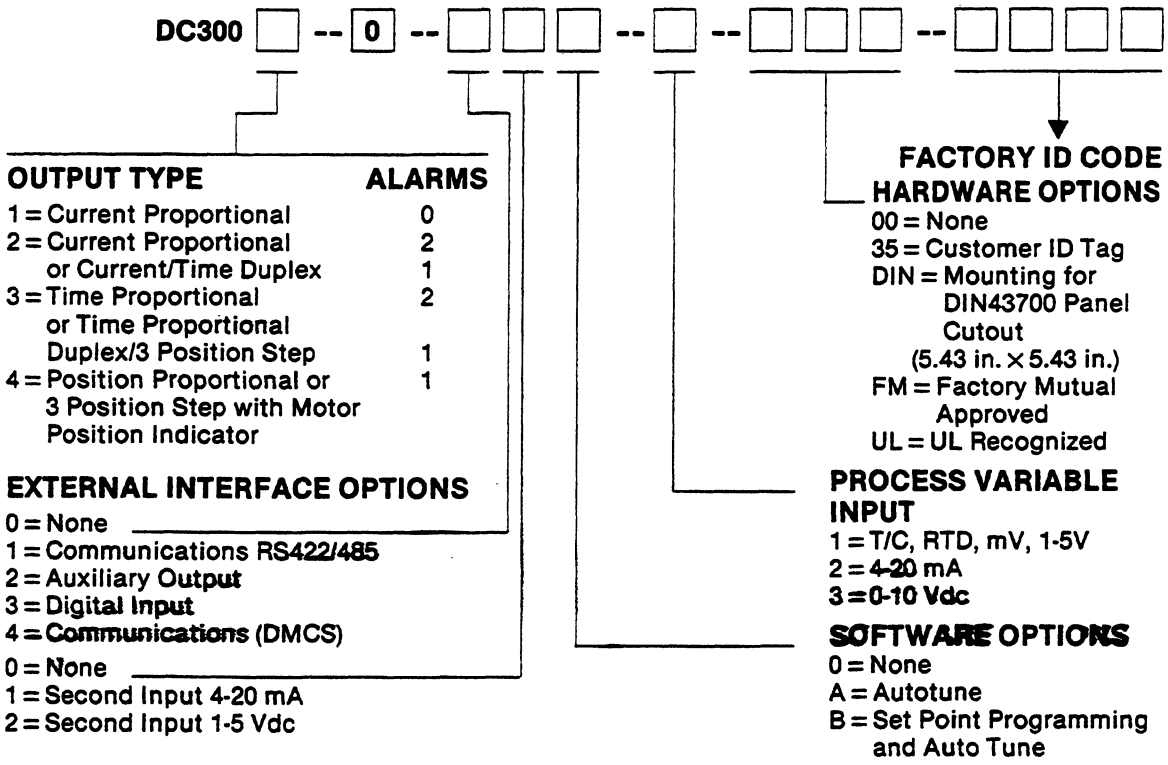
- **Dedicated Displays** — Vacuum fluorescent displays, with English language prompts, keep you informed of up-to-the-minute process conditions. A deviation bargraph indicates deviation (up to ±10% of span) between set point and process variable.
- **Universal Isolated Inputs** — Accepts thermocouple, RTD, mA, mV, and Volts input. All are configurable; no need to calibrate.
- **Thermocouple Failsafe** — Configurable upscale or downscale burnout and failsafe output level.
- **Easy Configuration** — English language prompts lead you through configuration in a logical sequence.
- **Manual/Automatic Modes** — Bumpless, balanceless transfer between control modes.
- **Control Algorithms** — The controller can be configured for ON-OFF, PID-A, PID-B, PD with Manual Reset, or Three Position Step Control.
- **Heat/Cool Capability** — Provides split range control with independent PID tuning constants; one for heating, one for cooling, plus mixed output forms.

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- **Control Outputs** — Time, Current, or Position Proportional; On-Off, Time or Current Proportional Duplex, or Current/Relay Duplex.
- **Two Local Set Points** — Available as keyboard selectable or optional remote switch selectable.
- **Alarm Selection** — One or two fully configurable alarms alert you to critical process conditions.
- **Set Point Ramp** — Provides a single programmable set point ramp of up to 255 minutes duration.
- **Set Point Ramp/Soak Programming** — enables you to program and store 6 ramp and 6 soak segments to be used in one program or multiple small programs.
- **Options** — Include AUTOTUNE which automatically calculates optimum tuning constants, 4-20 mA AUXILIARY OUTPUT scaleable to represent any parameter, COMMUNICATIONS link to a host computer (read only in FM approved units), SET POINT RAMP/SOAK PROGRAMMING with 6 ramp and 6 soak segments, DIGITAL INPUT allows remote selection of set points, control modes, controller action, Run/Hold of set point ramp, or Set Point Ramp/Soak Program.

Model Number Interpretation

The model number of the controller contains selection codes that identify the output type, input type, and optional features that may be included in your controller. The model number for your controller can be found on the nameplate on the controller chassis. The table below is an interpretation of the model selections.



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Condensed Specifications

Accuracy

±0.20% of Span typical (±1 digit for display)

Inputs

SENSOR TYPE	PV INPUT RANGE °F	°C
THERMOCOUPLES		
B*	105 to 3300	41 to 1815
E*	−454 to 1832	−270 to 1000
E (low)	−200 to 1100	−129 to 593
J	0 to 1600	− 18 to 871
J (low)	20 to 770	− 7 to 410
K	0 to 2400	− 18 to 1316
K (low)	− 20 to 1000	− 29 to 538
NNM NiNiMoly	32 to 2500	0 to 1371
NNM NiNiMoly (low)	32 to 1260	0 to 682
NIC Nicrosil Nisil	0 to 2372	−17.8 to 1300
R	0 to 3100	− 18 to 1704
S	0 to 3100	− 18 to 1704
T	−300 to 700	−184 to 371
T (low)	−200 to 600	−129 to 316
W_5W_{26}	0 to 4200	− 18 to 2316
W_5W_{26} (low)	0 to 2240	− 18 to 1227
RTD		
IEC Alpha + 0.00385		
100 Ohms	−300 to 900	−184 to 482
100 Ohms	0 to 300	− 18 to 149
500 Ohms	−300 to 900	−184 to 482
RADIAMATIC (RH)	1400 to 2100	760 to 1149
	2100 to 3400	1149 to 1871
LINEAR		
Milliamps	4 to 20 mA	
Millivolts	0 to 10 mV	
	10 to 50 mV	
Volts	1 to 5V	
	0 to 10V	

*Field calibration may be required to achieve rated accuracy below 1000°F for type B thermocouple, below −200°F for type E thermocouple and below 80°F for type T.

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Condensed Specifications (continued)

TUNING PARAMETERS

Gain or PB (%)	0.1 to 999.9
Rate	0.08 to 10.00 Minutes
Reset	0.02 to 50.00 Minutes/Repeat or Repeats/Minute

POWER REQUIREMENTS

120/240 Volts, 50 or 60 Hz

OPERATING CONDITIONS

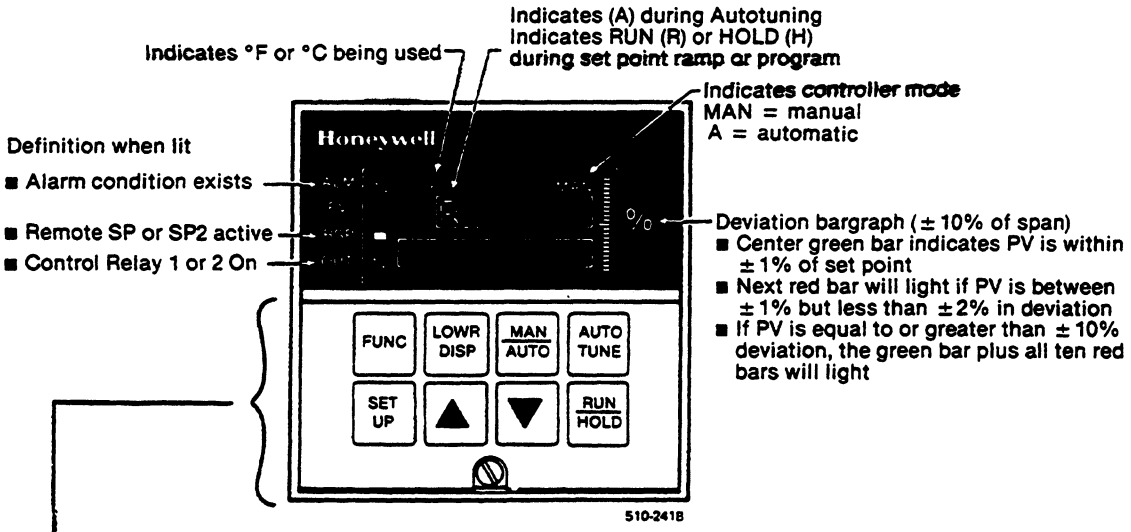
	REFERENCE CONDITIONS	RATED CONDITIONS	OPERATIVE LIMITS	TRANSPORTATION AND STORAGE
Ambient Temperature	22 ±3°C 72 +5°F	15 to 55°C 58 to 131°F	0 to 55°C 32 to 131°F	−40 to 66°C −40 to 151°F
Vibration				
Frequency (Hz)	0	0 to 70	0 to 200	0 to 200
Acceleration(g)	0	0.1	0.2	0.5
Mechanical Shock				
Accelleration (g)	0	1	5	20
Duration (ms)	0	30	30	30
Voltage (Vac)	120 ±1 240 ±2	102 to 132 204 to 264	102 to 132 204 to 264	——
Frequency (Hz)	50 ±0.2 60 ±0.2	49 to 51 59 to 61	48 to 52 58 to 62	—— ——

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Operator Interface Overview

Upper display—six characters
- Normal operation—four digits dedicated to display the process variable
- Configuration mode—displays parameter vaule or selection.

Lower display—eight characters
- Normal operation—displays operating parameters and values
- Configuration mode—displays function groups and parameters



SET UP — SET UP KEY

■ Places controller in Configuration Group select mode. Sequencially displays configuration groups and allows the [FUNC] key to display individual functions for each group.

FUNC — FUNCTION KEY

■ Used in conjunction with [SET UP] key to select the individual functions of a selected configuration group,

■ Used during field calibration procedure.

■ Alternately selects Local or Remote set point, or between two local set points.

LOWR DISP — LOWER DISPLAY KEY

■ Selects the operating parameters shown in the lower display:

"OUT"-Output "SP"-Set Point "2SP"-2nd Local Set Point
"RSP"-Remote Set Point "2IN"-Input 2 "CSP"-Computer set point
"DEV"-Deviation "1IN"-Input 1 "PIDSETX"-Tuning Parameters
"#RA"-Minutes remaining in the set point ramp.
"#SK"-Minutes remaining in the Set Point Soak
"RECYC"-Number of Recycles left in Ramp/Soak Program
"SAM"-Number of samples remaining in current Autotune window
"POS"-3 Position Step Motor Position when slidewire connected
"OUT"-Estimated 3 Position Step Motor Position when slidewire exists

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Operator Interface Overview (continued)

MAN / AUTO — MANUAL/AUTOMATIC KEY
- Alternately selects Manual or Automatic control mode

AUTO — lower display automatically indicates Set Point value in Engr. units

MAN — lower display automatically indicates Output value in percent (%)

▲ — RAISE KEY
- Increases the set point, output, or configuration values.

▼ — LOWER KEY
- Decreases the set point, output, or configuration values.

AUTO TUNE — AUTOTUNE KEY
- Starts the Auto Tune procedure. Key error appears if option is not present or disabled.

RUN / HOLD — RUN/HOLD KEY

SET POINT PROGRAM
- Alternate action switch which initiates the single set point ramp or set point Ramp/Soak program. While program is running, one press places the ramp or program in the HOLD mode; another press allows the ramp or program to continue. (RUN)

RESTORE ORIGINAL VALUE
- When you are using the [FUNC] key and [▲] [▼] keys to change a parameter value or selection and you decide you want to keep the original value that was displayed, press [RUN/HOLD] key, before entry, to recall the original value.

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Installation Section 2

Inspect For Shipping Damage and Check for Accessories

If the UDC 3000 has not been removed from its shipping carton, inspect the carton for damage, and remove the UDC. Inspect the UDC for any obvious shipping damage and report any damage due to transit to the carrier. Check that a bag containing mounting hardware is included in the carton with the controller.

Reviewing Data Before Installation

While installing the UDC is straightforward, we recommend that you review the following data before installation.

Operating Conditions

Temperature: 32 to 131°F (0–55°C)
Vibration: 0 to 0.2G
Power
voltage: 120 Vac or 240 Vac
frequency: 50/60 Hz ±2 Hz
consumption: 9 Va

Stray Rejection

Common Mode: AC (50 or 60 Hz) – 120 db
Normal Mode: AC (50 or 60 Hz) - 60 db
Weight: approximately 4 lbs (1.8 Kg)

Electrical Noise Protection

Electrical noise is unwanted electrical signals which produce undesirable effects in measurement and control circuits. Digital equipment is especially sensitive to the effects of electrical noise. Your UDC 3000 controller has built-in circuits to reduce the effects of electrical noise from various sources. To further reduce these effects:

- Separate External Wiring - separate connecting wires into bundles (see Table 2-1), and route the individual bundles through separate conduits or metal trays;
- Use Suppression Devices - for additional noise protection, you may want to add suppression devices at the external noise source. Appropriate suppression devices are commercially available.

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TABLE 2-1

PERMISSIBLE WIRE BUNDLING

Bundle No.	Wire Functions
1	a. Line power wiring b. Earth ground wiring c. Control relay output wiring d. Line voltage alarm wiring
2	Analog signal wire, such as a. Input signal wiring (thermocouple, 4-20 mA, etc.) b. 4-20 mA output signal wiring c. Slidewire feedback circuit wiring d. Digital input signals e. Communications
3	a. Low-voltage alarm relay output wiring b. Low-voltage wiring to solid state type control circuits.

NOTE: For further information concerning electrical noise, refer to **APPENDIX C** entitled **"HOW TO APPLY DIGITAL INSTRUMENTATION IN SEVERE ELECTRICAL NOISE ENVIRONMENTS".**

Preliminary Checks

Before you install the controller, you may want to make the following preliminary checks:

- Model number identification
- Operating Voltage selection
- Check the cold junction plug position

Check the Model Number

Make sure the model number shown on the nameplate on the side of the case agrees with what you have ordered. The model number interpretation is on page 2-6

Check the Operating Voltage

The UDC 3000 controller is shipped configured for use with 120 Vac. If you want to use 240 Vac, you will have to position a connector on the rear of the controller.

CAUTION: OPERATING A 120 VOLT CONTROLLER AT 240 VOLTS WILL DAMAGE THE UNIT.

- Make sure connector J4 at the back of the controller is positioned to agree with the operating voltage you are going to use.
  a. Loosen the screw on the front of the controller and pull the chassis out of the case.

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b. Position the J4 connector on the Power/Input printed wiring board (see Figure 2-1).
For 120 Vac — Position the J4 connector with top aligned with the line indicating 120V (plug and socket ends aligned).
For 240 Vac — Position the J4 connector with top aligned with the line indicating 240V (top pin exposed).
c. Return the chassis to the case and tighten the screw.

Check the Cold Junction Jumper Position

- The controller has been shipped configured for non-T/C actuations (W2). Position the cold junction assembly jumper on the Power/Input board for the input type you are using (Table 2-2). Make sure top of unit is as shown in Figure 2-1.

TABLE 2-2

Input Type	C/J Jumper Position
Thermocouple	W1
RTD	W2
4-20 mA, 1-5V, Radiamatic, 0-10 mV, 10-50 mV, 0-10 Vdc	W1 or W2

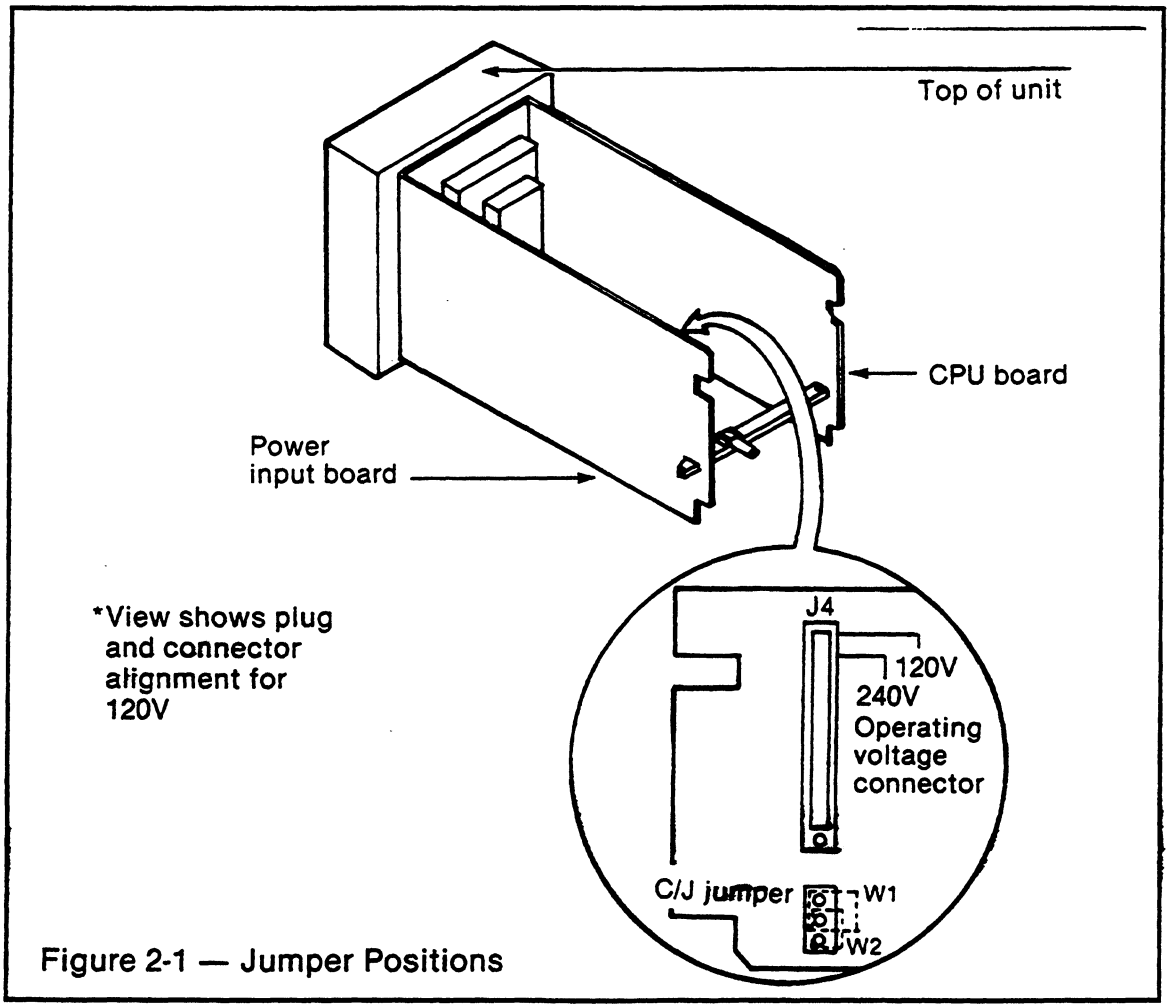


Figure 2-1 — Jumper Positions

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Mounting

Physical Considerations

The UDC 3000 controller can be mounted on either a vertical or tilted panel using the mounting kit supplied with the controller. Adequate access space must be available at the back of the panel for installation and servicing activities. The overall dimensions and panel cutout requirements for mounting the controller are shown on the dimension data drawing in Figure 2-2.

The enclosure into which the UDC 3000 controller is mounted must be grounded according to CSA standard C22.2 No. 0.4 or Factory Mutual Class No. 3820 paragraph 6.1.5.

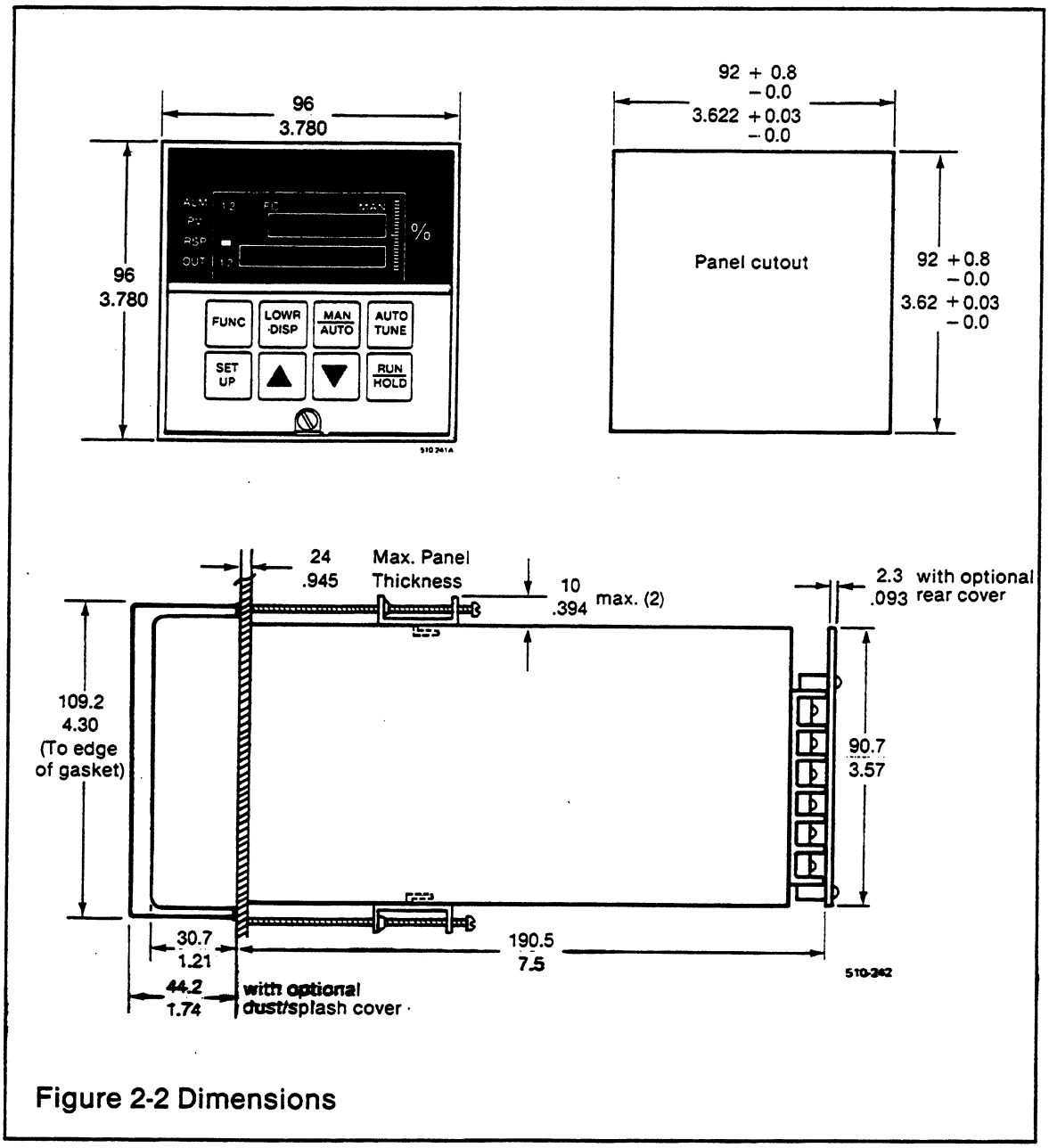


Figure 2-2 Dimensions

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Mounting (continued)

Mounting

Before mounting the controller, refer to the identification label (nameplate) on the side of the case, and make a note of the model number. It will help later when selecting the proper wiring diagram.

- Mark and cut out the controller mounting hole in the panel according to the dimensions specified on the dimension data drawing. (Figure 2-2).
- Loosen the screw on the front of the controller and pull the chassis from the case.
- Orient the case properly and slide it through the panel hole from the front.
- Remove the mounting kit from the shipping container, and install the kit as follows:
  a. Install the screws into the threaded holes of the clips.
  b. Insert the prongs of the clips into the two holes in the top and bottom of the case.
  c. Tighten both screws to secure the case against the panel. (See Figure 2-2)
  d. Carefully slide the chassis assembly into the case, press to close and tighten the screw.

Mounting Accessories

In addition to the panel cutout described above, other aids for mounting the UDC 3000 controller include the following supplementary accessories and kits:

- A rear terminal cover kit, part number 30755052-001, that allows the wiring terminations to be covered.
- A splash cover, part number 24400107-001
- An adaptor kit for DIN 43700 Panel Cutout (5.43 in. × 5.43 in.) to fit DialaTrol, Barber-Colman 560, and Leeds & Northrup E Max V Cutout, part number 30755223-002
- An adaptor plate with hardware to cover UDC 300 Cutout 5.4" × 7.5" to cover 4.63" × 6.75" maximum cutout. Part number 24400104-002
- 1/4 DIN adaptor plates with mounting hardware:

DIMENSIONS				MAXIMUM CUTOUT				PART NUMBER
Inches		Centimeters		Inches		Centimeters		
Width	Height	Width	Height	Width	Height	Width	Height	
5.25	8.875	13.3	22.5	4.5	8.125	11.4	20.6	24400104-001
8.25	7.25	21.0	18.4	7.5	6.5	19.0	16.5	24400104-003
8.375	8.875	21.3	22.2	7.625	8.125	19.3	20.6	24400104-004
9.875	10.875	25.1	27.6	9.125	10.125	23.1	25.6	24400104-005

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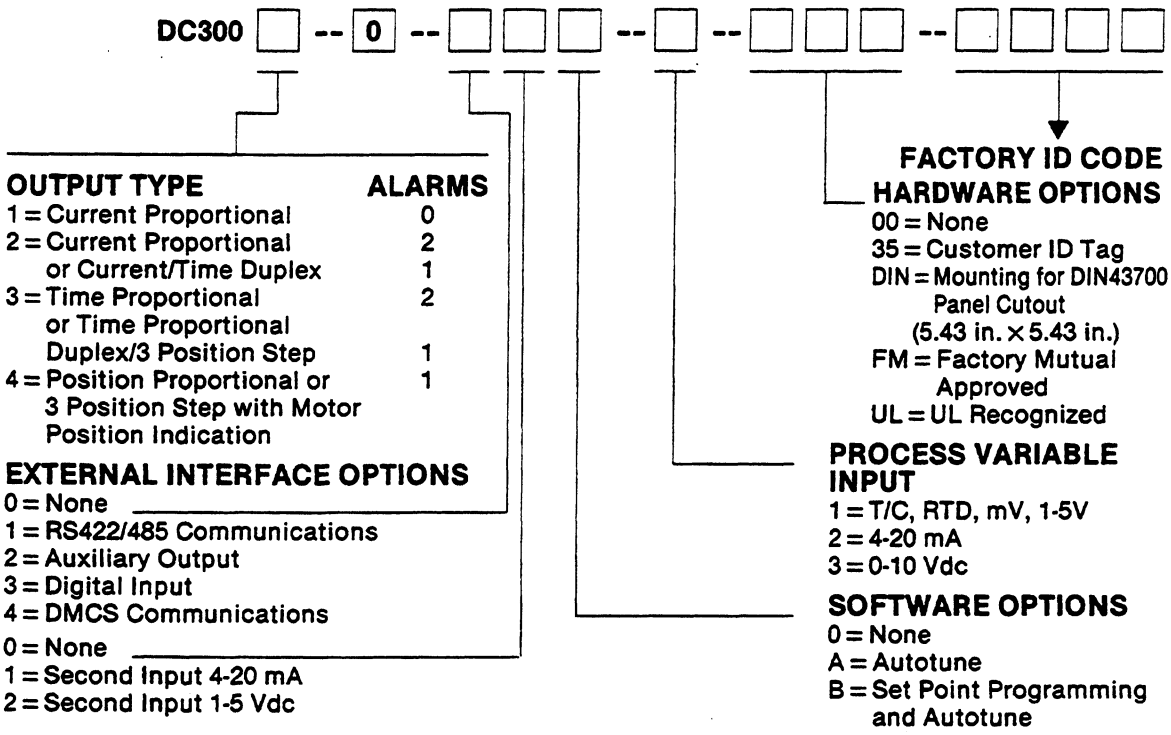
Wiring

To determine the appropriate diagrams for wiring your controller:

- Refer to the Model Number Interpretation shown below. The model number of the controller contains selection codes that identify the output type, input type, number of alarms and external interface options. The model number for your controller can be found on the side of the case.
- Using the information contained in the model number of the controller, select the appropriate wiring diagrams from the connection diagrams in Figure 2-3 through 2-6 and wire the controller accordingly.

Model Number Interpretation

The table below is an interpretation of the model number selections.

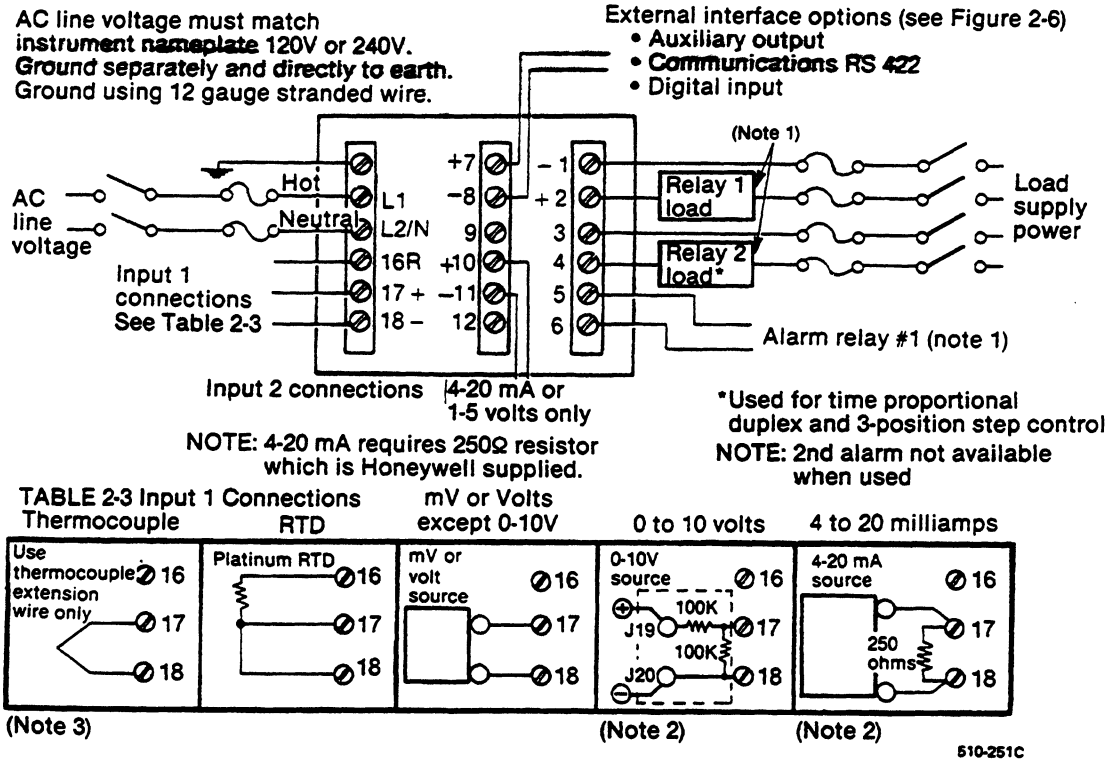


Wiring The Controller

Connections to the UDC 3000 are shown in Figure 2-3 through 2-6. Information is included in the individual figures to help guide you in connecting external equipment. Wiring connections are shown in the following figures

- Relay Output — Figure 2-3
- Current Output — Figure 2-4
- Position Proportional Output — Figure 2-5
- External Interface Options — **Figure 2-6**
  - **— Auxiliary Output**
  - — Digital Input
  - — Communications

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NOTE 1. Control relay 1 is shipped having N.O. contacts configured. Relay 2 is shipped as an alarm relay. It and alarm relay 1 are shipped with N.C. contacts configured. A N.O. or N.C. contact is selectable by means of a jumper on the controller board. See "Hardware Configuration" in the configuration section for details. Each alarm is a SPST relay, rated at 5 Amps for 120 Vac, and 2.5 amps at 240 Vac.

NOTE 2. The 4-20 mA load resistor and voltage divider are Honeywell supplied when input is specified.

NOTE 3. The reference junction resistor is Honeywell supplied and requires proper positioning by internal jumper. See "Hardware Configuration", Section 3.

NOTE 4. Electrical noise suppression may be required. See Page 2-1

Figure 2-3 External Wiring Diagram — Relay Output

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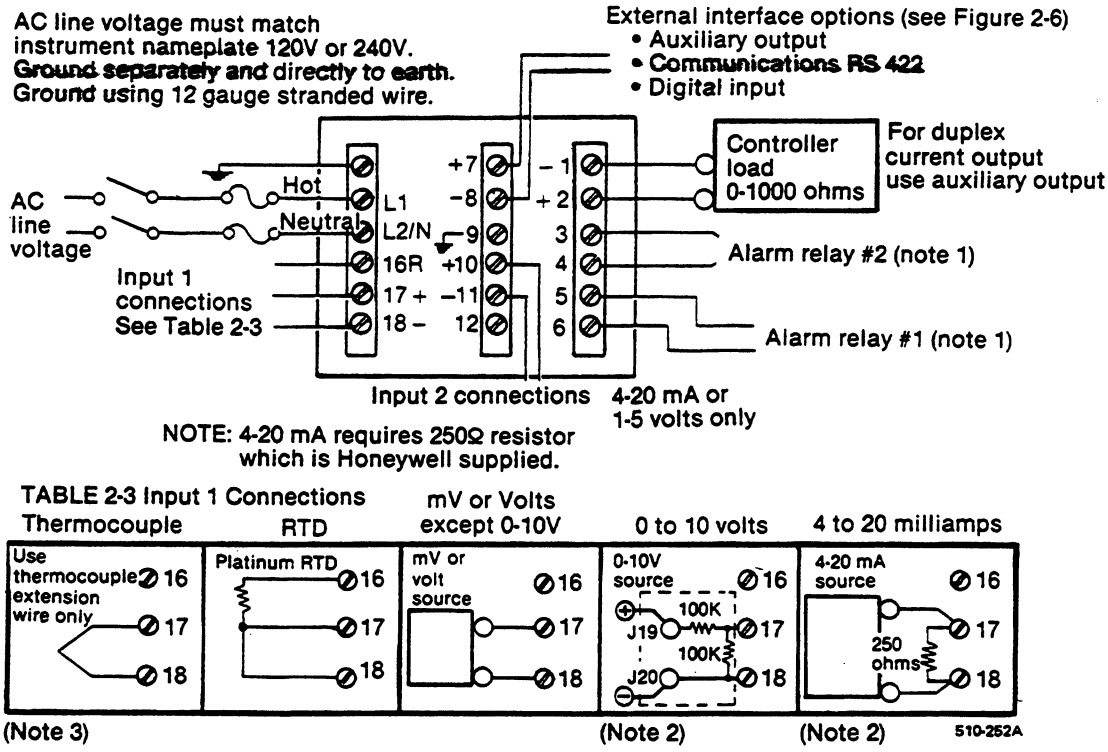


TABLE 2-3 Input 1 Connections

Thermocouple	RTD	mV or Volts except 0-10V	0 to 10 volts	4 to 20 milliamps
Use thermocouple extension wire only	Platinum RTD	mV or volt source	0-10V source	4-20 mA source
(Note 3)			(Note 2)	(Note 2)

NOTE 1. Relay 2 is shipped as an alarm relay. It and alarm relay 1 are shipped with the relays having N.C. contacts configured. A N.O. or N.C. contact is selectable by means of a jumper on the controller board. See "Hardware Configuration" in the configuration section for details. Each alarm is a SPST relay, rated at 5 Amps for 120 Vac, and 2.5 amps at 240 Vac.

NOTE 2. The 4-20 mA load resistor and voltage divider are Honeywell supplied when input is specified.

NOTE 3. The reference junction resistor is Honeywell supplied and requires proper positioning by internal jumper. See "Hardware Configuration", Section 3.

NOTE 4. Electrical noise suppression may be required. See Page 2-1.

Figure 2-4 External Wiring Diagram — 4-20 MA Current Output

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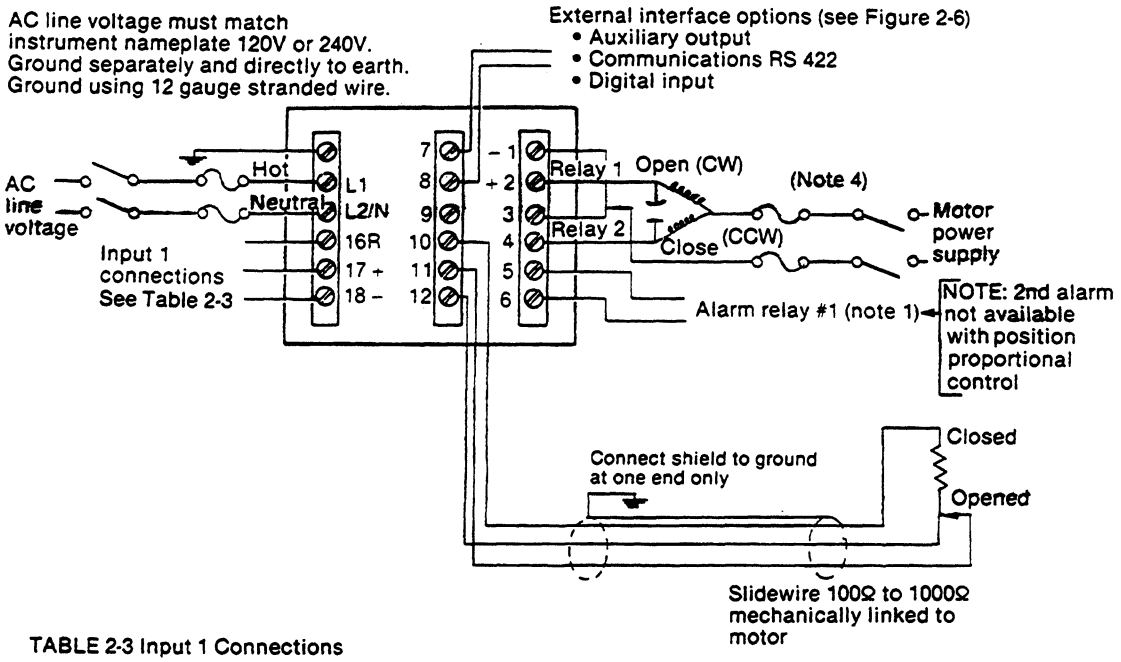
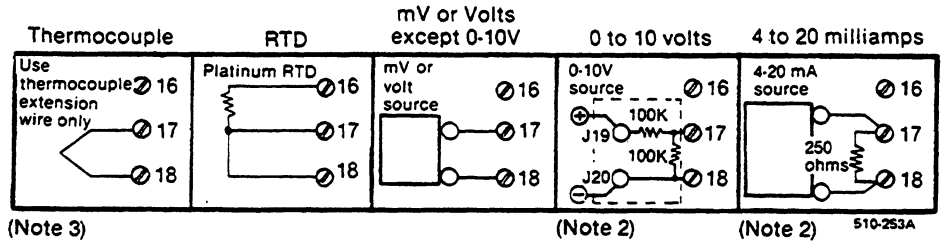


TABLE 2-3 Input 1 Connections



NOTE 1. Control relay 1 and relay 2 are shipped having N.O. contacts configured. Alarm relay 1 is shipped with N.C. contact configured. A N.O. or N.C. contact is selectable by means of a jumper on the controller board. See "Hardware Configuration" in the configuration section for details. Each alarm is a SPST relay, rated at 5 Amps for 120 Vac, and 2.5 amps at 240 Vac.

NOTE 2. The 4-20 mA load resistor and voltage divider are Honeywell supplied when input is specified.

NOTE 3. The reference junction resistor is Honeywell supplied and requires proper positioning by internal jumper. See "Hardware Configuration", Section 3.

NOTE 4. Electrical noise suppression may be required. See Page 2-1

Figure 2-5 External Wiring Diagram — Position Proportional Output

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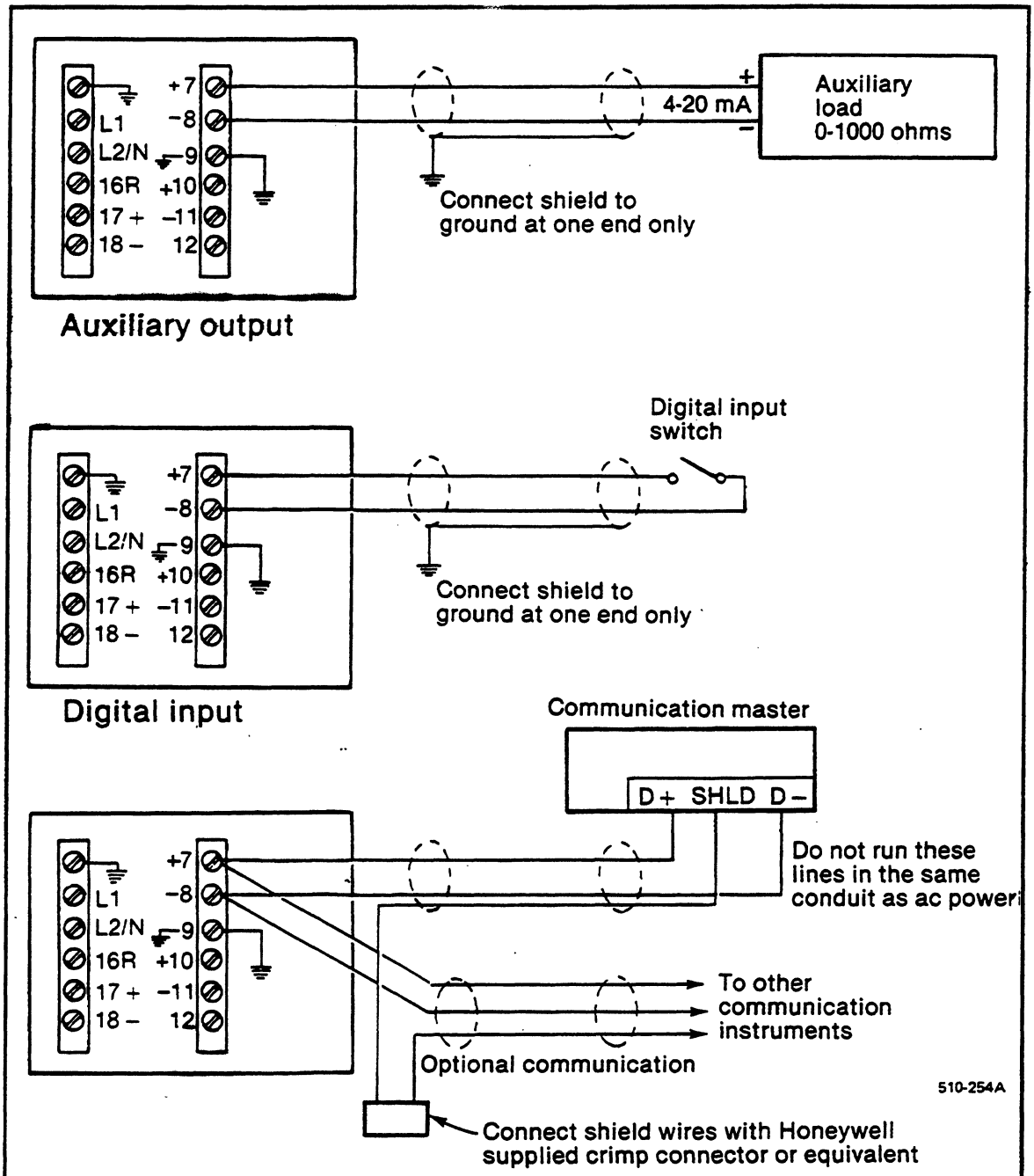


Figure 2-6 External Wiring Diagrams — External Interface Options

Calibration of Position Proportional Output

Note that the Position Proportional Output *or Three Position Step Models (DC3004)* must have the output calibrated per section 5 "Position Proportional Output Calibrations" to ensure the displayed output (slidewire position) agrees with the actual final control element position.
Model DC3003 - Three Position Step models only require that the Motor Time be entered per section 5. ***Calibration is not required.***

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Configuration Section 3

Types of Configuration

There are two types of configuration:

Software - entering the parameter values or selections into memory that are best suited for controlling your process. See below.

Hardware - positioning internal jumpers to select the normally open (NO) or normally closed (NC) contacts on the relays, cold junction assembly jumper position, and the operating voltage. See page 3-19.

Software Configuration

Introduction

Software configuration is a dedicated operation where you use straight-forward keystroke sequences to select and establish (configure) pertinent controller data best suited for your specific application.

Prompts

To assist you in this process, there are prompts which appear in the upper and lower displays. These prompts let you know what group of configuration data you are working with and also, the specific parameters associated with each group. Figure 3-1 shows an overview of these prompts. As you can see, the configuration data is divided into 10 main set up groups plus calibration and status.

TUNING	INPUT 2
AUTOTUNE	CONTROL
SET POINT RAMP/PROGRAM	OPTIONS
ALGORITHM	COMMUNICATIONS
INPUT 1	ALARMS

Within each of these groups are function prompts for associated parameters.

NOTE: This manual explains *all* the prompts that can appear in the UDC 3000 controller. Some of the prompts won't apply to your specific controller and therefore will not appear.

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
— not in set-up mode, press [SET UP] first
— Key malfunction, perform keyboard test to verify (see operating data)

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Software Configuration (continued)

How to Get Started

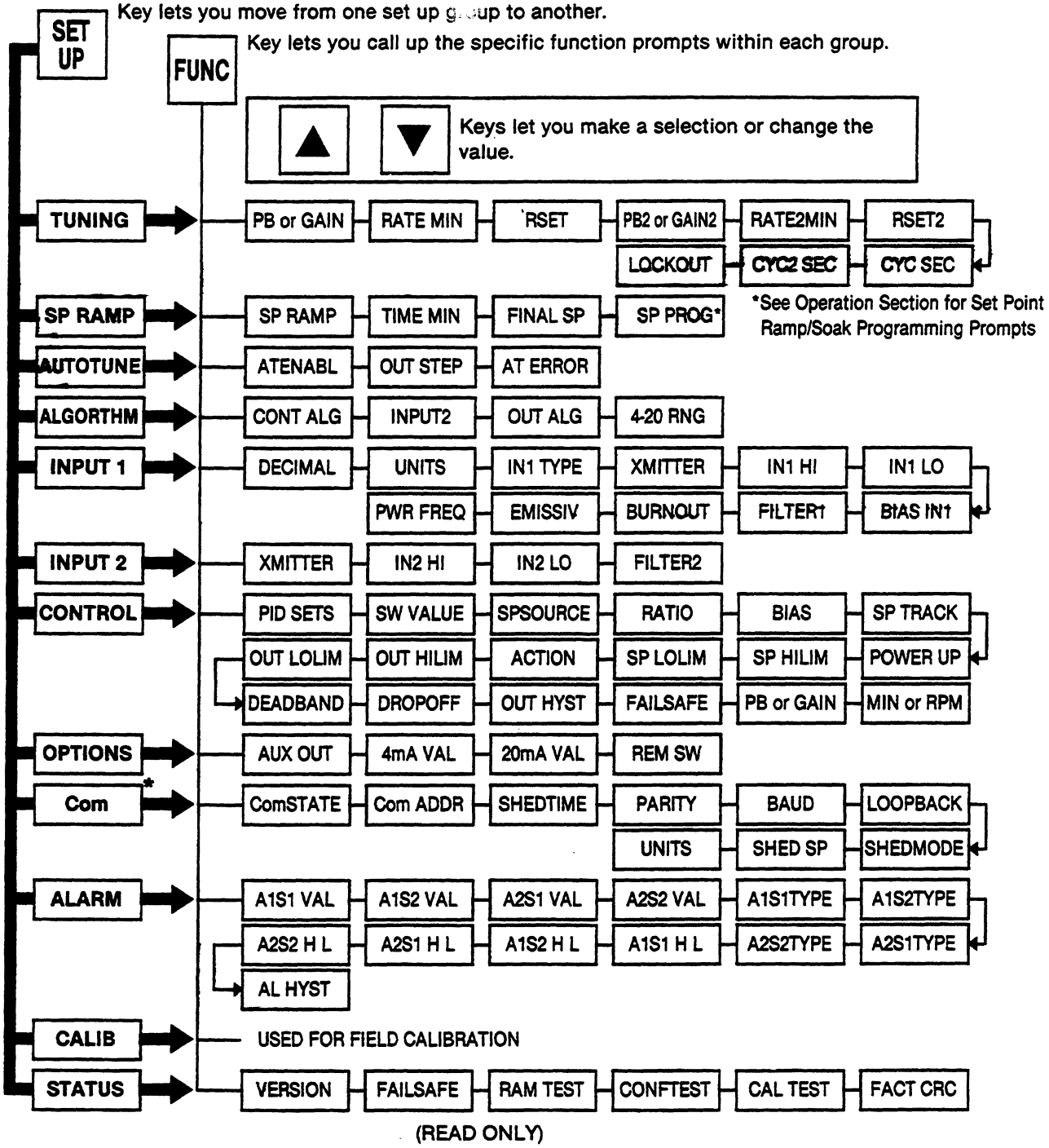
- Read the procedure (page 3-4) for accessing the groups and the parameters within each group to become familiar with the key sequences.
- Go to page 3-5 and read the configuration tips, then start to configure the controller for your application. The groups and parameters are all listed starting on page 3-6, along with the selections and range of settings available for each.
- If you need a detailed explanation of any prompt listed in this section, go to Section 8–Appendix A. This appendix lists the set up and function prompts, the selection or range of settings that you can make plus a detailed definition of each parameter.
- Record your selections on the Configuration Record Sheet, located in the back of this section, so you'll have a record of how the controller was configured.

The Prompt Hierarchy is listed on page 3-3.

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Software Configuration (continued)

Prompt Hierarchy



*Will show ComRS422 or ComDMCS.

Figure 3-1

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Software Configuration (continued)

How to Call Up and Change a Configuration Parameter

A list of "How the Controller was Configured at the Factory" appears on page 3-23. If you want to change any of these selections or values follow the procedure listed below.

This procedure gives you information about what keys to press to get you to the point where you can effectively use the prompts to start configuring your controller.

PROCEDURE

Select a Group	Press [SET UP]. The first group title is listed in the lower display, Lower Display [T][U][N][I][N][G][ ][ ] and the controller is in the configure mode. NOTE: SET UP appears in the upper display to let you know you're in the configure mode and a Set Up group title is being displayed. Successive presses of the [SET UP] key will sequentially display the other Set Up group titles as shown in the prompt hierarchy. (Page 3-3) (NOTE 1) Stop at the group title describing the group of parameters you want to configure then go to "Select a Function" for specific parameters. To exit the Set Up group prompts, press the [LOWR DISP] key and return to normal operation.
Select a Function	As shown in the prompt hierarchy, each of the groups listed contain specific prompts which deal with functions that are pertinent to that particular group. You access these functions by pressing the [FUNC] key. Press [FUNC]. UPPER DISPLAY = The current value or selection for each prompt is shown. LOWER DISPLAY = The individual function prompts within each group are shown. Successive presses of the [FUNC] key will sequentially display all the functions and their values or selections for that group. (NOTE 1)
Change Value or Selection	Press [▲] or [▼] keys to change the value or selection in the upper display. If the display blinks, you are trying to select an unacceptable value.
Enter Value or Selection	Press [FUNC] and go to another function prompt or, Press [SET UP] to go to the next Set Up group. The value or selection will be entered into the controller memory.
Exit Configuration	Press [LOWR DISP] to exit from configuration mode and return to normal operation. **NOTE 1. The prompting scrolls at the rate of 2/3 seconds when [SET UP] or [FUNC] keys are held in.**

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Configuration Tips

Listed below are a few procedures that will help you to easily and quickly accomplish the tasks at which you'll be working when you configure your controller.

Displaying Groups

Use the [SET UP] key to display the groups. The group titles (page 3-6) are listed in the order as they appear in the UDC 3000 controller.

Displaying Functions

Use the [FUNC] key to display individual parameters under each group. These prompts are listed in the order as they appear in each group.

Scrolling

To get a Set Up group or a Function parameter quickly,

Hold [FUNC] or [SET UP] key in

The display will scroll through the parameters.

Changing Values Quickly

When changing the value of a parameter, you can adjust a more significant digit in the upper display by holding in one key [▲] or [▼], and pressing the other [▲] or [▼] at the same time.
The adjustment will move one digit to the left. Press the key again and you will move another digit to the left.

Restoring to the Original Value

When you change the value or selection of a parameter while in [SET UP] mode and decide not to enter it,

Press [RUN / HOLD] once, the original value or selection will be recalled.

Exiting Set Up Mode

To exit [SET UP] mode,

Press [LOWR DISP]

This returns the display to the same state it was in immediately preceeding entry into the set up mode.

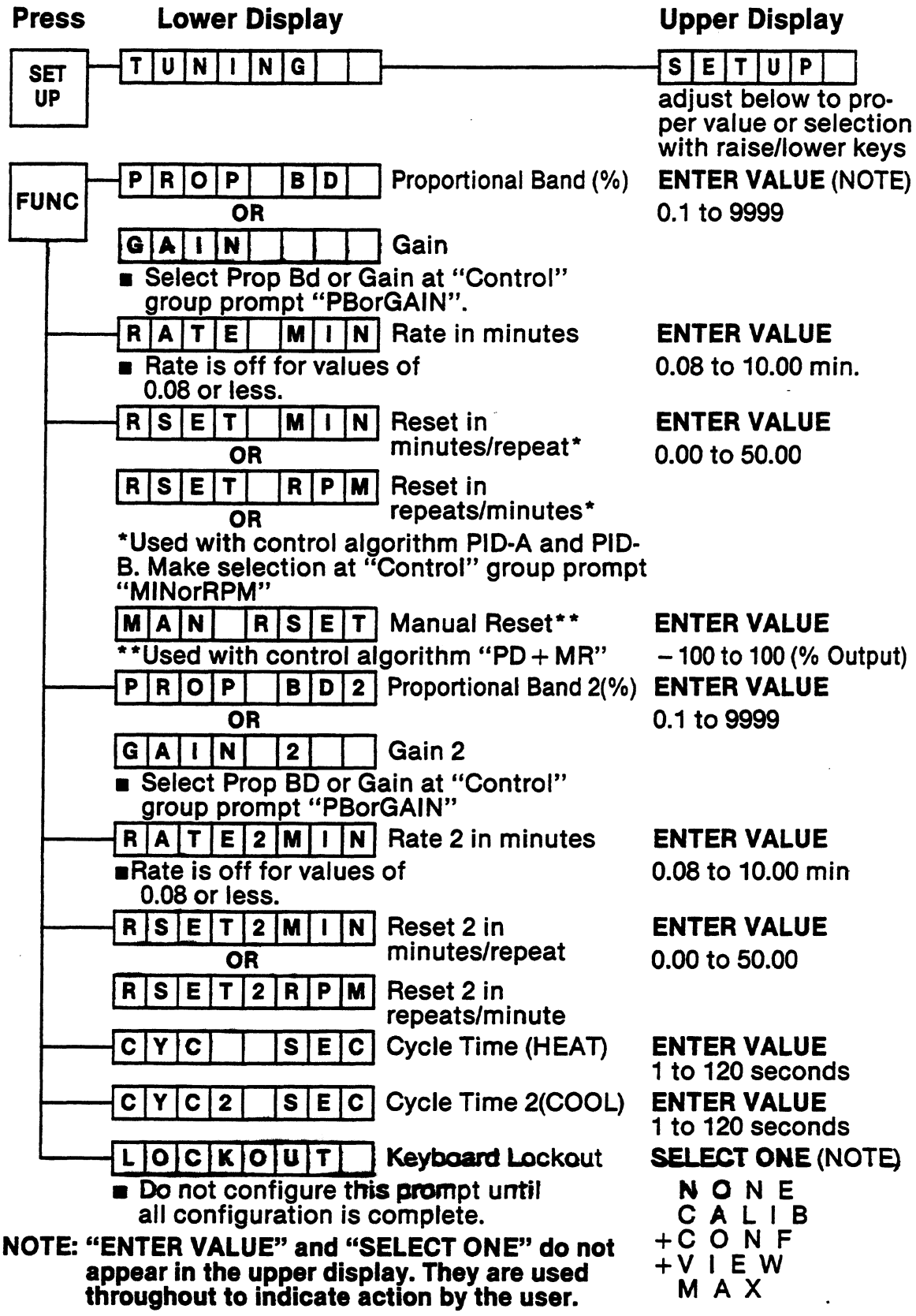
Timing Out from Set Up

If you are in [SET UP] mode and don't press any keys for one minute, the controller will time out and revert to the mode and display that was being used prior to entry into [SET UP] mode.

Refer to Appendix A for additional data about any prompt you're not sure how to configure.

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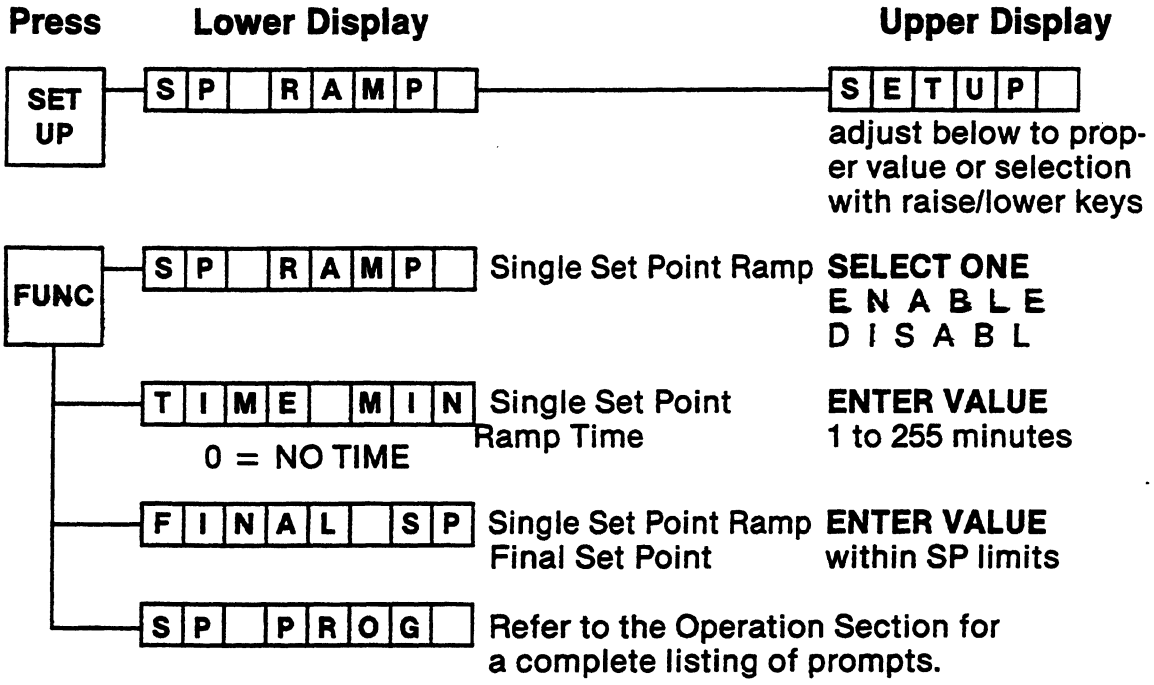
Tuning Parameter Group



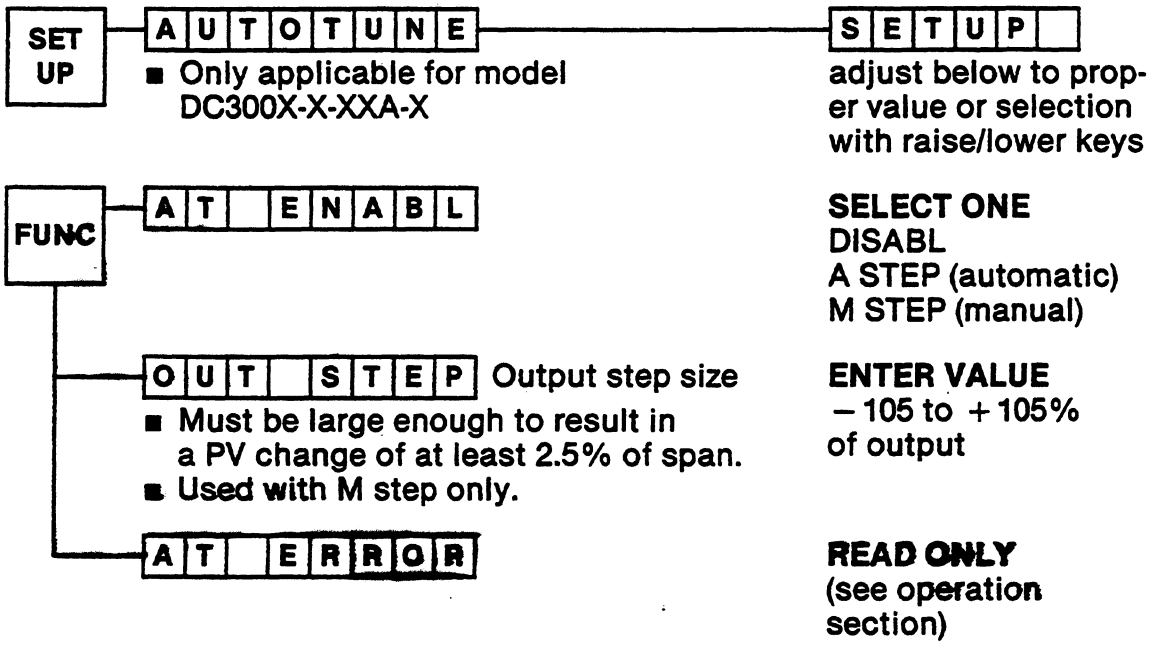
NOTE: "ENTER VALUE" and "SELECT ONE" do not appear in the upper display. They are used throughout to indicate action by the user.

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Set Point Ramp Or Set Point Ramp/Soak Program Group

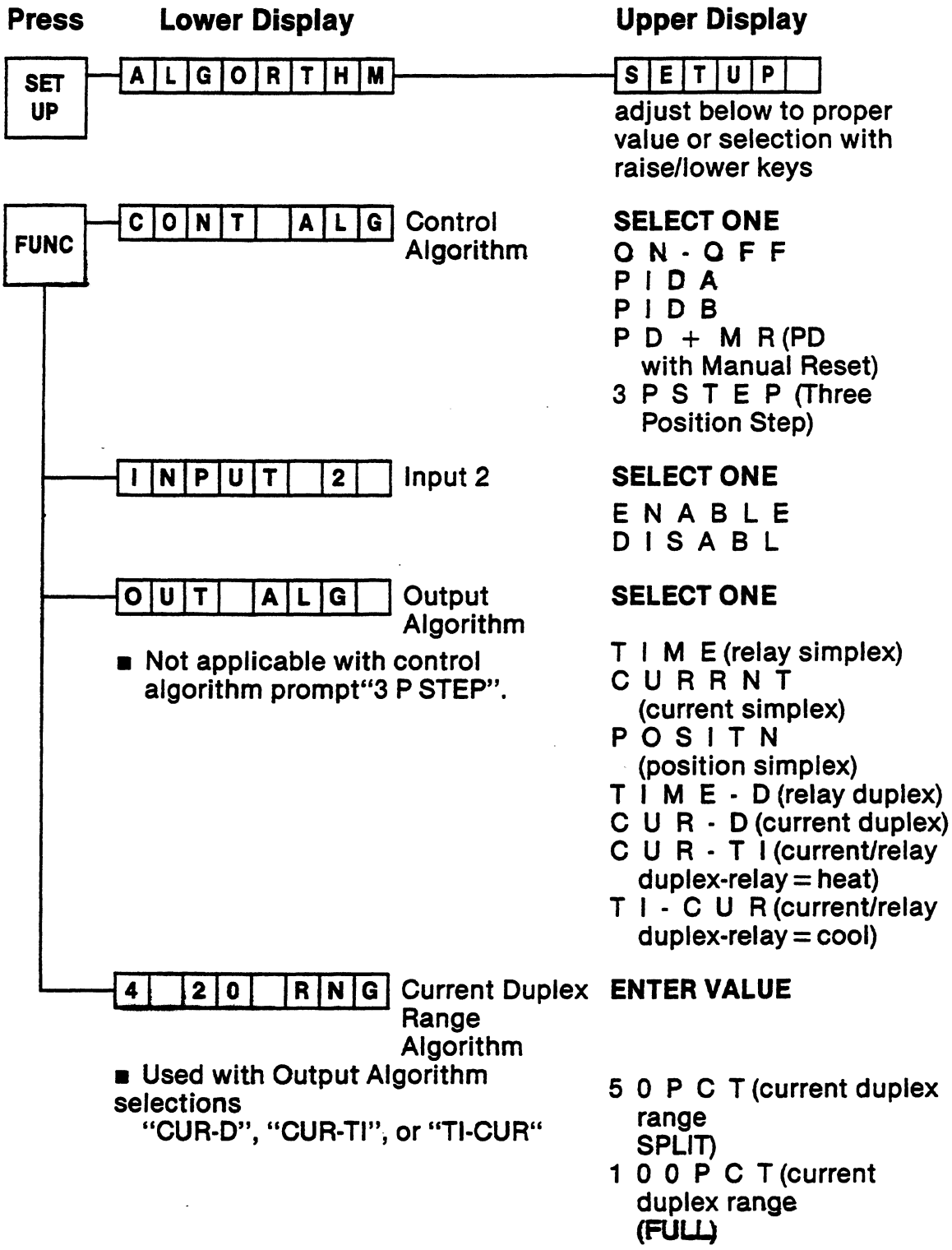


Autotune Parameters Group



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Algorithm Parameters Group



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Input 1 Parameters Group

Press | **Lower Display** | **Upper Display**

SET UP → `INPUT 1` → `SETUP`

adjust below to proper value or selection with raise/lower keys

FUNC

`DECIMAL` — Decimal Point Location

- Where the decimal point appears in the display

SELECT ONE

X X X X	None
X X X.X	One place
X X.X X	Two places

`UNITS` — Temperature Units

- Not applicable for linear inputs.

SELECT ONE

D E G F	°Fahrenheit
D E G C	°Celcius
N O N E	

`IN1 TYPE` — Input 1 Actuation Type

SELECT ONE (See Note)

B TC	B thermocouple	105 to 3300°F	41 to 1815°C
E TC H	E thermocouple high	−454 to 1832°F	−270 to 1000°C
E TC L	E thermocouple low	−200 to 1100°F	−129 to 593°C
J TC H	J thermocouple high	0 to 1600°F	−18 to 871°C
J TC L	J thermocouple low	20 to 770°F	−7 to 410°C
K TC H	K thermocouple high	0 to 2400°F	−18 to 1316°C
K TC L	K thermocouple low	−20 to 1000°F	−29 to 538°C
NNM TC H	NiNiMo thermocouple high*	32 to 2500°F	0 to 1371°C
NNM TC L	NiNiMo thermocouple low*	32 to 1260°F	0 to 682°C
NIC	Nicrosil-Nisil	0 to 2372°F	−17.8 to 1300°C
R TC	R thermocouple	0 to 3100°F	−18 to 1704°C
S TC	S thermocouple	0 to 3100°F	−18 to 1704°C
T TC H	T thermocouple high	−300 to 700°F	−184 to 371°C
T TC L	T thermocouple low	−200 to 600°F	−129 to 316°C
W TC H	W thermocouple high	0 to 4200°F	−18 to 2316°C
W TC L	W thermocouple low	0 to 2240°F	−18 to 1227°C
100 PT	100 Ohm-Pt Bulb	−300 to 900°F	−184 to 482°C
500 PT	500 Ohm-Pt Bulb	−300 to 900°F	−184 to 482°C
100 LO	100 Ohm RTD Low	0 to 300°F	−18 to 149°C
RADIAM	Radiamatic (RH)	1400 to 3400°F	760 to 1871°C
4-20mA	4 to 20 Milliamps		
0-10mV	0 to 10 Millivolts		
10-50m	10 to 50 Millivolts		
1-5 V	1 to 5 Volts		
0-10V	0 to 10 Volts		

NOTE: The controller has been shipped from the factory configured for non-t/c actuations. If you change to a T/C or RTD input refer to "Hardware Configuration—C/J Plug" for plug position.

(Continued)

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Input 1 Parameters Group (continued)

Press	Lower Display	Upper Display
FUNC	. . Continued	
	XMITTER	Transmitter Characterization ■ Appears only if Input 1 was set to Linear Range
	IN1 HI	Input 1 High Range Value ■ Set only with linear inputs.
	IN1 LO	Input 1 Low Range Value ■ Set only with linear inputs.
	BIAS IN1	Bias for Input 1
	FILTER 1	Filter for Input 1 ■ No filter = 0
	BURNOUT	Burnout Protection (sensor break) ■ No Burnout = Failsafe output applied for failed input.
	EMISSIV	Emissivity Value for Radiamatic Actuations
	PWR FREQ	Power Line Frequency

SELECT ONE

B TC	B thermocouple
E TC H	E thermocouple high
E TC L	E thermocouple low
J TC H	J thermocouple high
J TC L	J thermocouple low
K TC H	K thermocouple high
K TC L	K thermocouple low
NNM TC H	NiNiMo thermocouple high*
NNM TC L	NiNiMo thermocouple low*
NIC TC	Nicrosil Nisil thermocouple
R TC	R thermocouple
S TC	S thermocouple
T TC H	T thermocouple high
T TC L	T thermocouple low
W TC H	W thermocouple high
W TC L	W thermocouple low
100 PT	100 Ohm-Pt Bulb
500 PT	500 Ohm-Pt Bulb
100 LO	100 Ohm RTD Low
RADIAM	Radiamatic (RH)
LINEAR	Linear range
SQROOT	Square Root

*NNM = Ni Ni Moly

ENTER VALUE
−99.99 to 99.99
−999 to 9999
−999.9 to 999.9

ENTER VALUE
−99.99 to 99.99
−999 to 9999
−999.9 to 999.9

ENTER VALUE
−999.9 to 9999

ENTER VALUE
0 to 120 Seconds

SELECT ONE

NONE	No Burnout
UP	Upscale Burnout
DOWN	Downscale Burnout

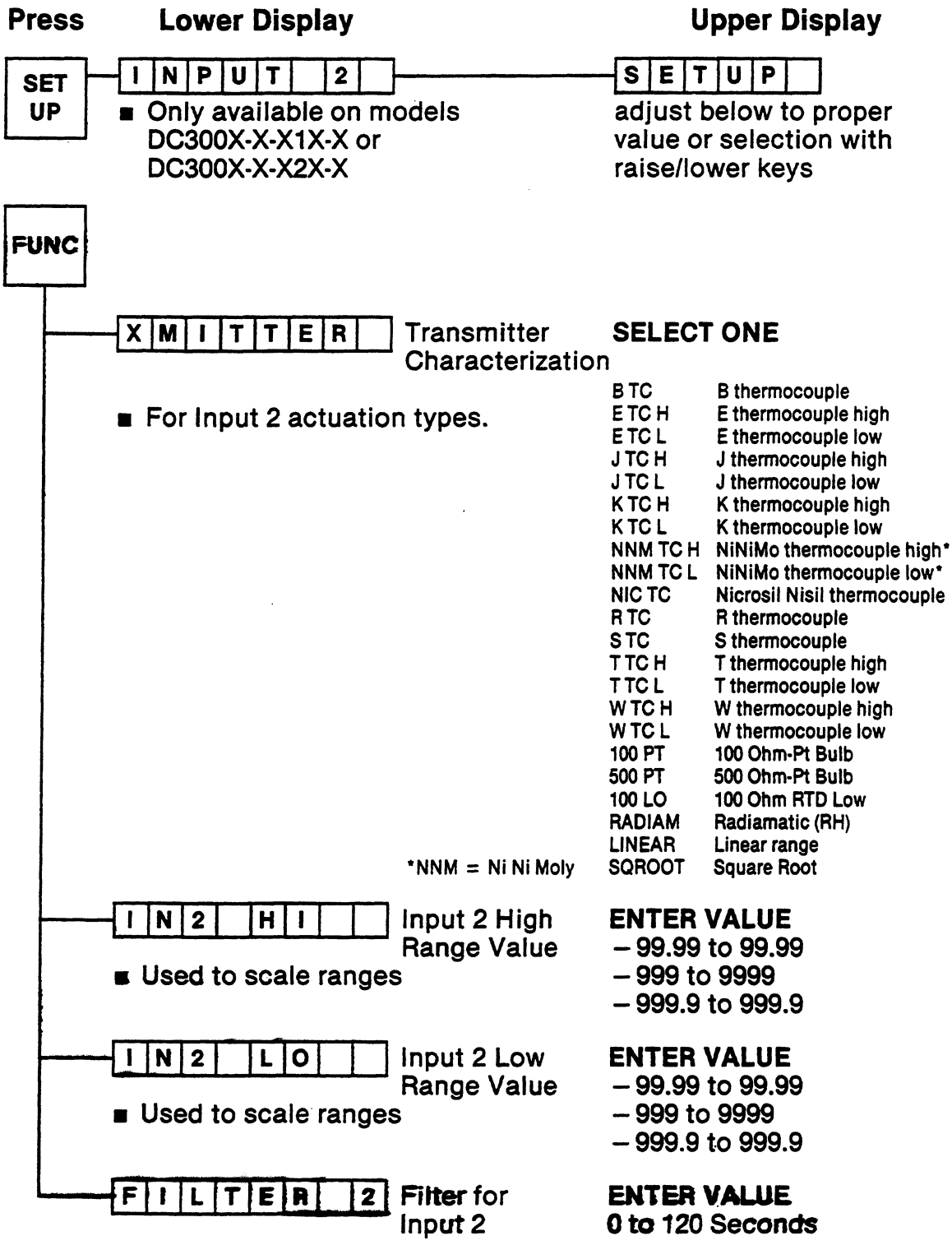
ENTER VALUE
0.01 to 1.00

SELECT ONE

60HZ	60 Hertz
50HZ	50 Hertz

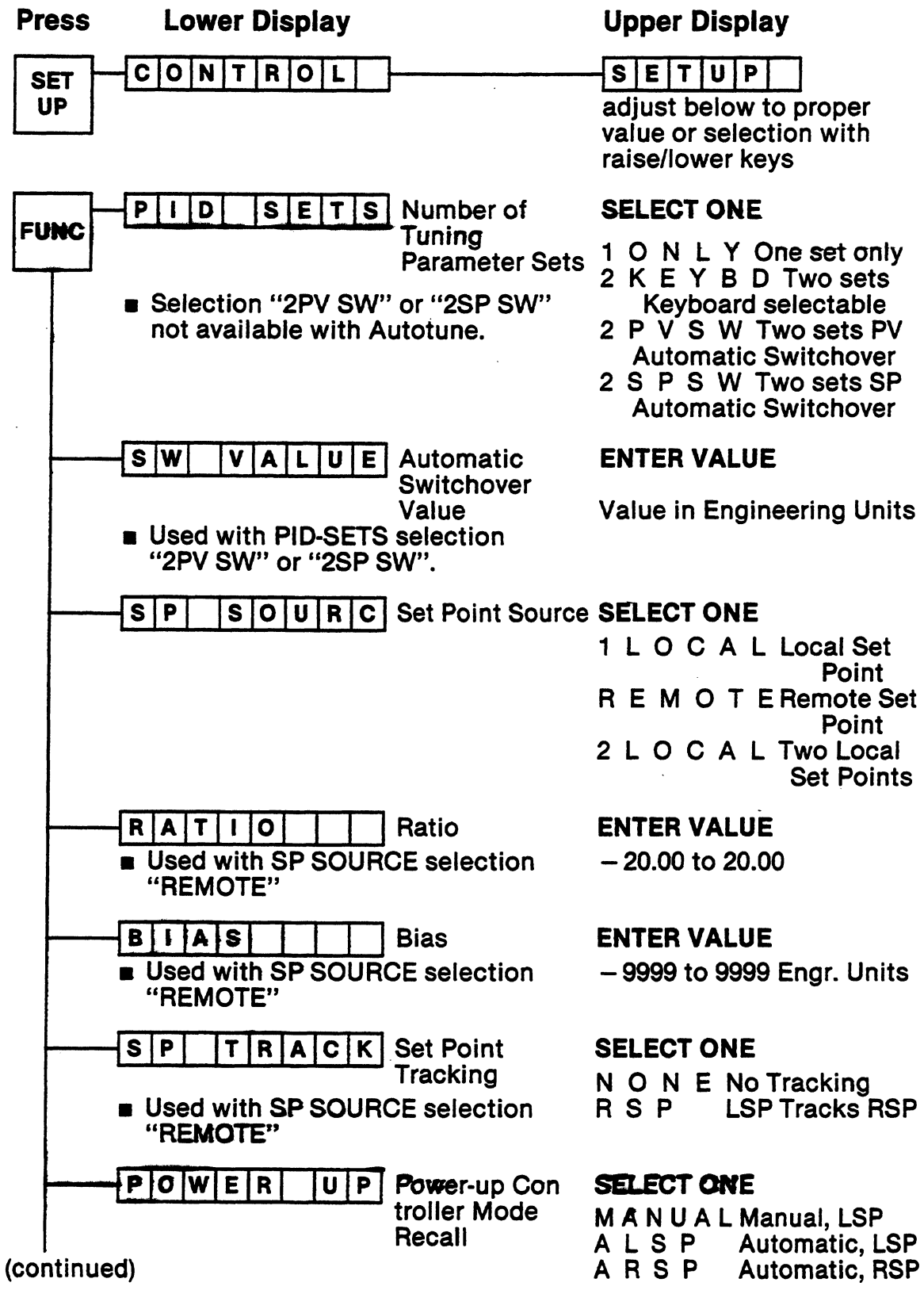
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Input 2 Parameters Group



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Control Parameters Group



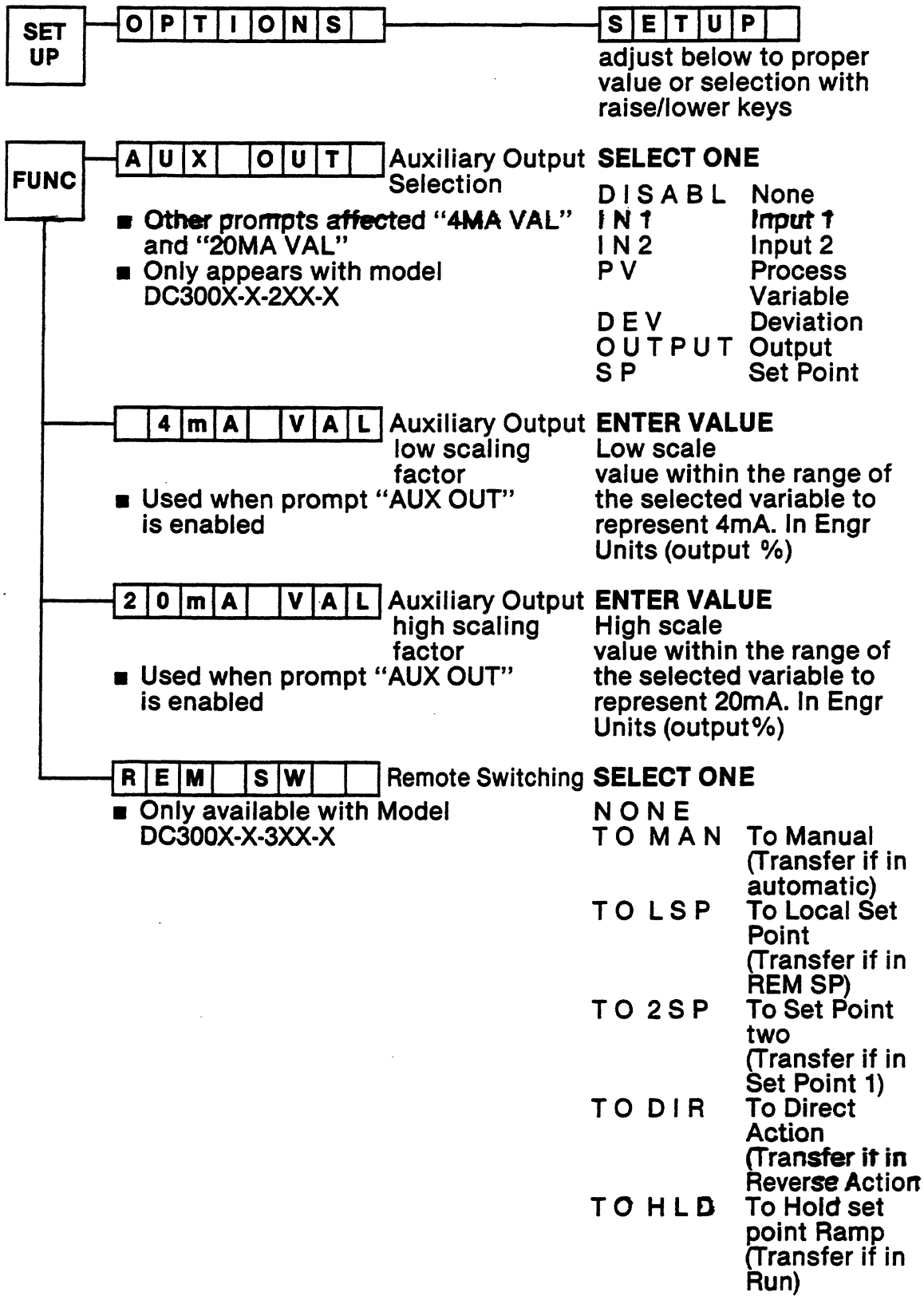
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Control Parameters Group (continued)

Press	Lower Display	Upper Display
FUNC	·· Continued	
	SP HILIM — High Set Point Limit ■ The Local set point will automatically adjust itself to be within this limit.	**ENTER VALUE** 0 to 100% of span in engineering units
	SP LOLIM — Low Set Point Limit ■ The Local set point will automatically adjust itself to be within this limit.	**ENTER VALUE** 0 to 100% of span in engineering units
	ACTION — Control Output Direction	**SELECT ONE** DIRECT Direct Acting Control REVRSE Reverse Acting Control
	OUTHILIM — High Output Limit	**ENTER VALUE** –5 to 105% of output
	OUTLOLIM — Low Output Limit	**ENTER VALUE** –5 to 105% of output
	DROPOFF — Controller Dropoff Value	**ENTER VALUE** –5 to 105% of output
	DEADBAND — Deadband ■ Only used with Duplex Relay output or Position Proportional Control	**ENTER VALUE** –5.0 to 25.0% of output 0.5 to 5.0% (Posit Prop)
	OUT HYST — Hysteresis (output relay only) ■ Used with ON-OFF or Position proportional control (fixed 0.0625%)	**ENTER VALUE** 0.0 to 5.0% of PV span (On/Off)
	FAILSAFE — Failsafe Output Value	**ENTER VALUE** Within the range of Output limits (%)
	PBorGAIN — Proportional Band Units ■ Selects Proportional Band or Gain for use with TUNING parameters group.	**SELECT ONE** PBPCT Proportional Band (%) GAIN Gain
	MINorRPM — Reset Units ■ Selects Minutes per Repeat or Repeats per Minute for use with TUNING parameters group.	**SELECT ONE** RPM Repeats per Minute MIN Minutes per Repeat

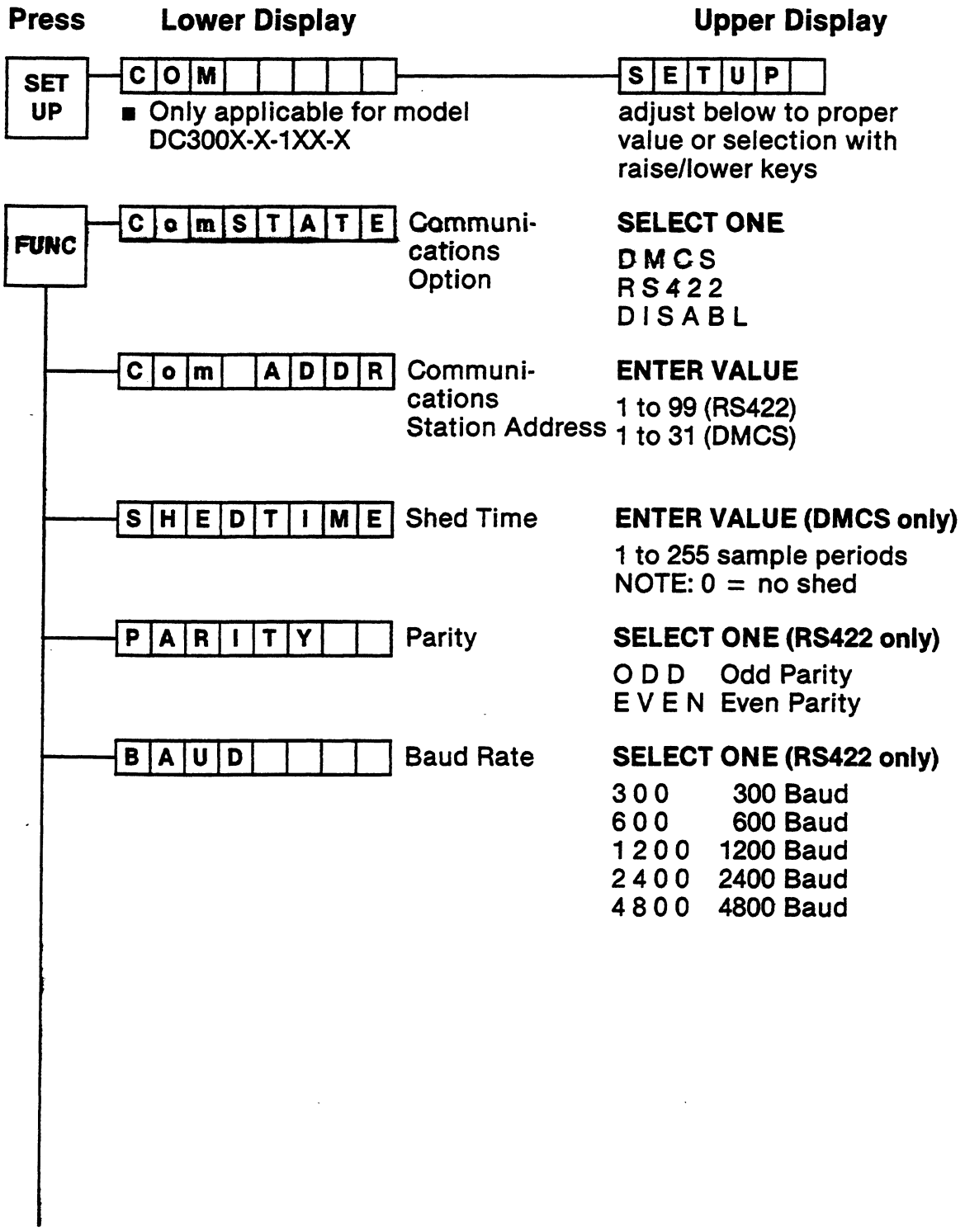
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Option Parameters Group



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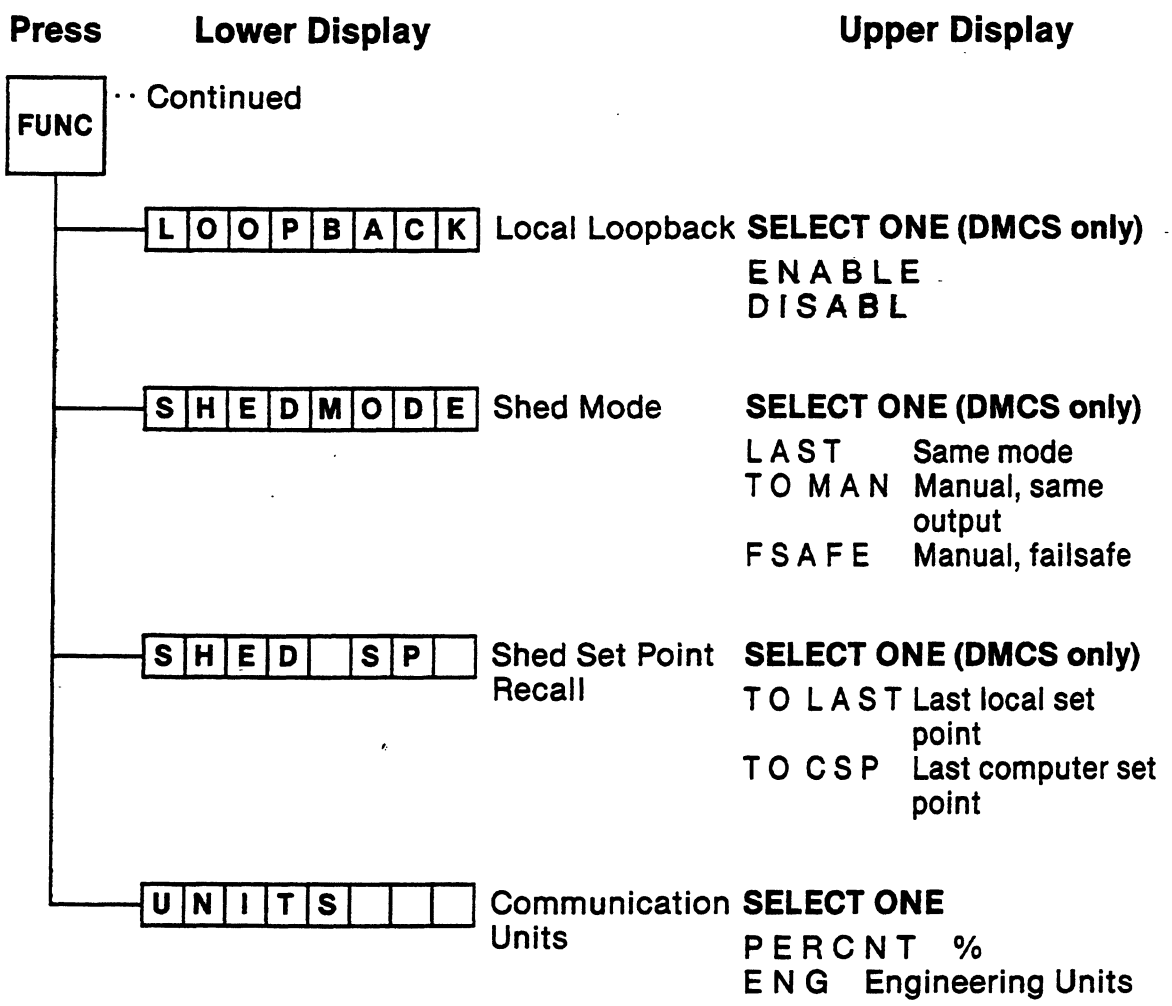
Communications Parameters Group



(continued)

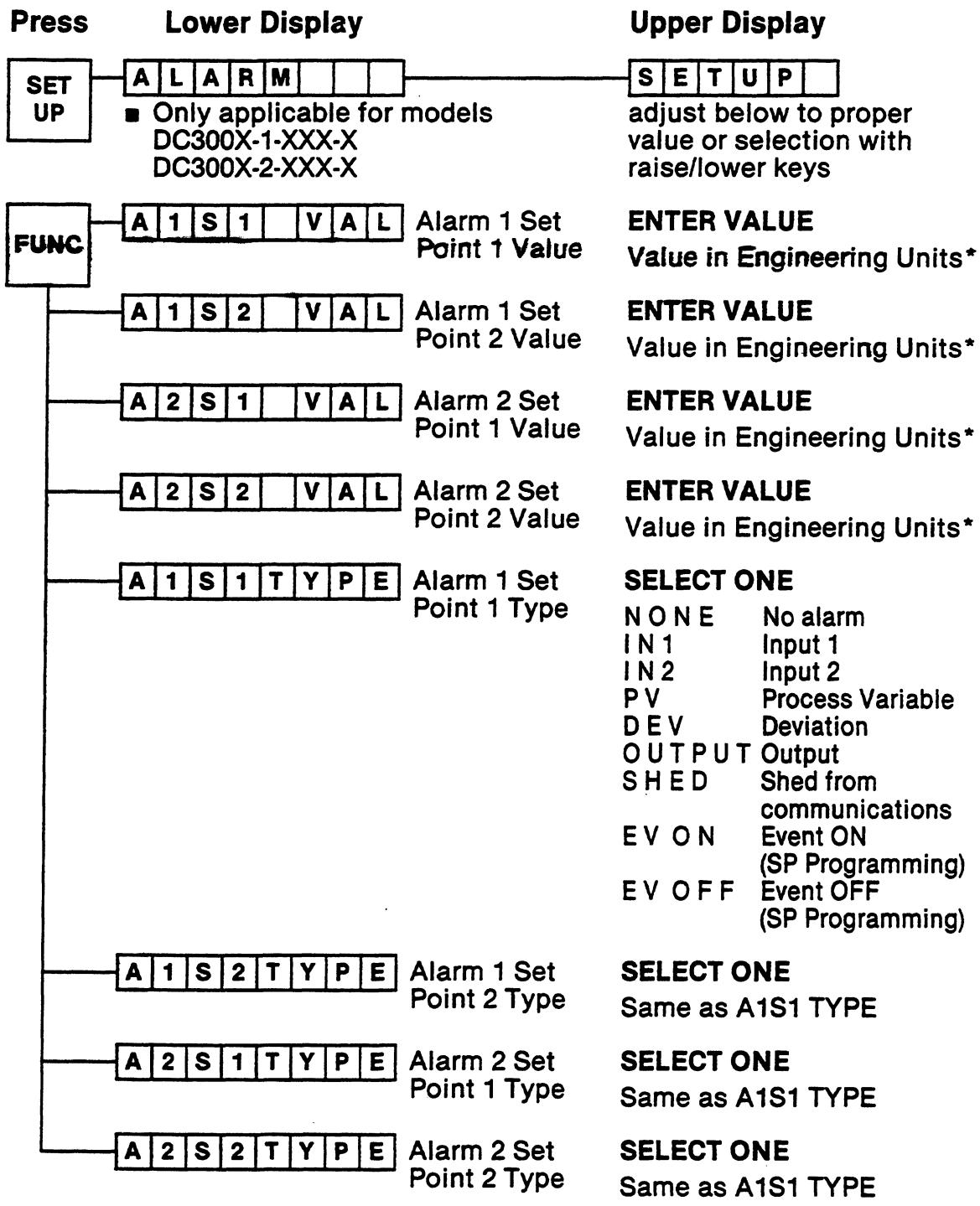
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Communications Parameters Group



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Alarm Parameters Group

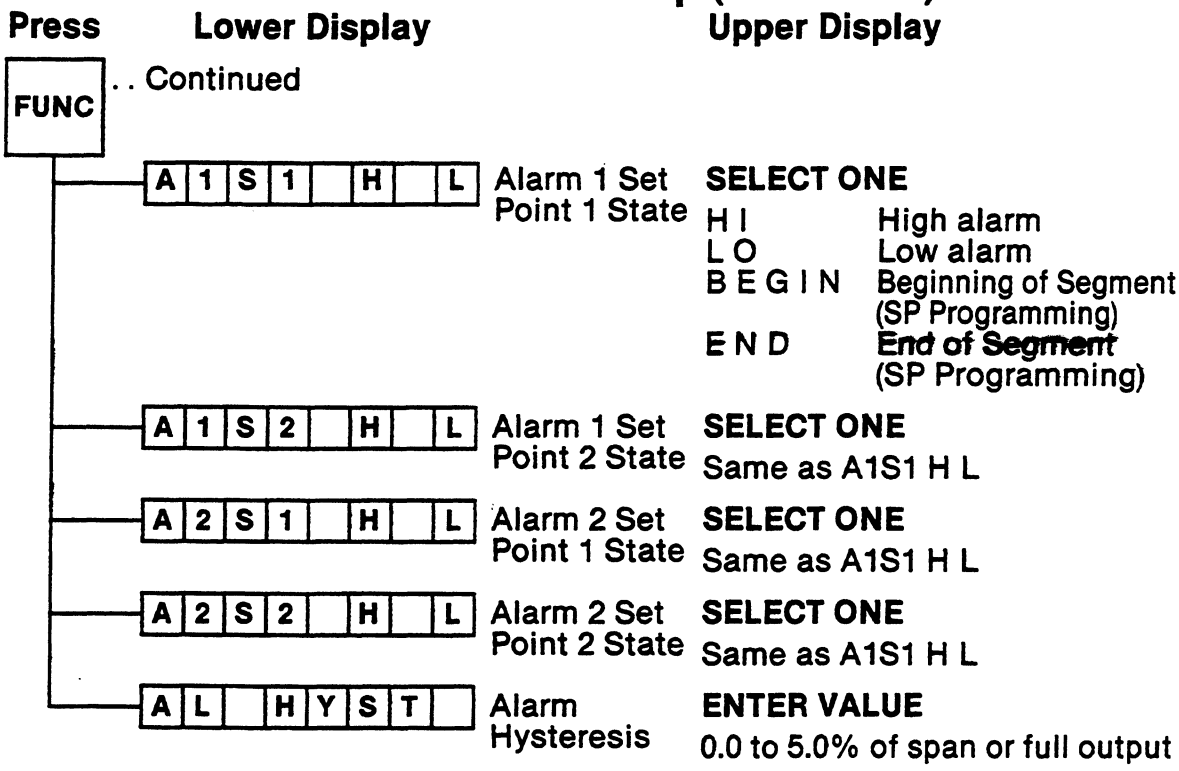


(continued)

*For SP Programming, Value = Segment Number

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Alarm Parameters Group (continued)

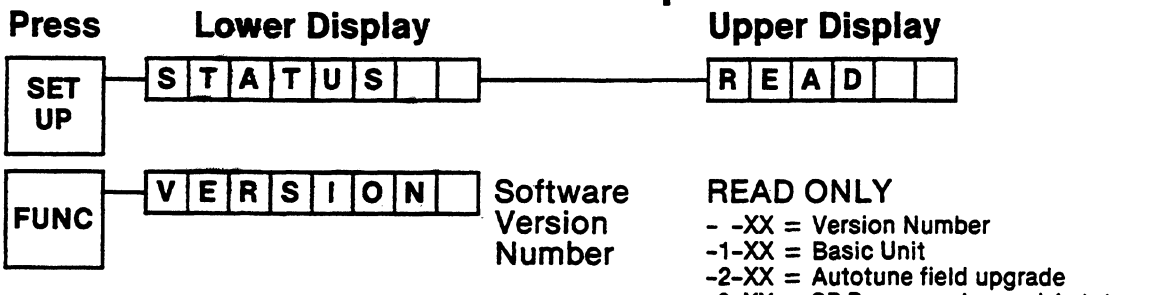


Calibration Prompts



■ Only used for field calibration
REFER TO THE CALIBRATION SECTION IN THIS MANUAL

Status Prompts



REFER TO THE TROUBLESHOOTING SECTION IN THIS MANUAL FOR DIAGNOSTIC TESTS STATUS

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Hardware Configuration

Hardware configuration consists of positioning jumpers for

- Control relay action (NO) (NC) for the alarm and control relays
- Cold junction compensation (T/C, RTD, 4-20 mA, 1-5V, 0-10 mV, 10-50 mV)
- Operating Voltage (120V or 240V)

Accessing the Jumpers

Remove the Chassis

1. Turn the screw on the front of the controller counter-clockwise until it is loose.
2. Pull the chassis all the way out of the case.
   NOTE: Remove the Interface/Posit. Prop/2nd Input (Refer to Service for procedure).
3. The jumpers used in the hardware configuration are all located in the rear of the chassis.
   The alarm and control relay jumpers are on the CPU board.
   The C/J and Operating Voltage jumpers are on the power/input board.

Position the Alarm and Control Relay Jumpers

Position the jumper (see Table 3-1) for N.O. (normally open) or N.C. (normally closed) relay action for the alarm and control relays. [See Figure 3-2 and Table 3-2 and 3-3 for relay contact information.] The controller has been shipped configured for normally open contacts.

The second control relay (Relay #2) can be used for:

- Time Proportional Duplex Output
- Position Proportional Output
- Optional Second Alarm (not available with time proportional duplex or position proportional outputs)

TABLE 3-1.

RELAY	JUMPER POSITION	RELAY ACTION
Control Relay #1	W3 =	N.O. Normally Open Contacts
	W4 =	N.C. Normally Closed Contacts
Control Relay #2 or Alarm Relay #2	W5 =	N.O. Normally Open Contacts
	W6 =	N.C. Normally Closed Contacts
Alarm Relay #1	W7 =	N.O. Normally Open Contacts
	W8 =	N.C. Normally Closed Contacts

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Hardware Configuration (continued)

Position the Alarm and Conrol Relay Jumpers (continued)

Table 3-2 Control Relay Contact Information Chart

UNIT POWER	CONTROL RELAY JUMPER	CONTROL RELAY CONTACT	#1 OR #2 OUTPUT INDICATOR STATUS
Off	N.O. N.C.	Open Closed	Off
On	N.O. N.C.	Open Closed Closed Open	Off On Off On

NOTE: *Control relays operate in the standard control mode. i.e., Energized when output state is on.*

Table 3-3 Alarm Relay Contact Information Chart

UNIT POWER	ALARM RELAY JUMPER	VARIABLE NOT IN ALARM		VARIABLE IN ALARM STATE	
		RELAY CONTACT	INDICATORS	RELAY CONTACT	INDICATORS
Off	N.O. N.C.	Open Closed	Off	Open Closed	Off
On	N.O. N.C.	Closed Open	Off	Open Closed	On

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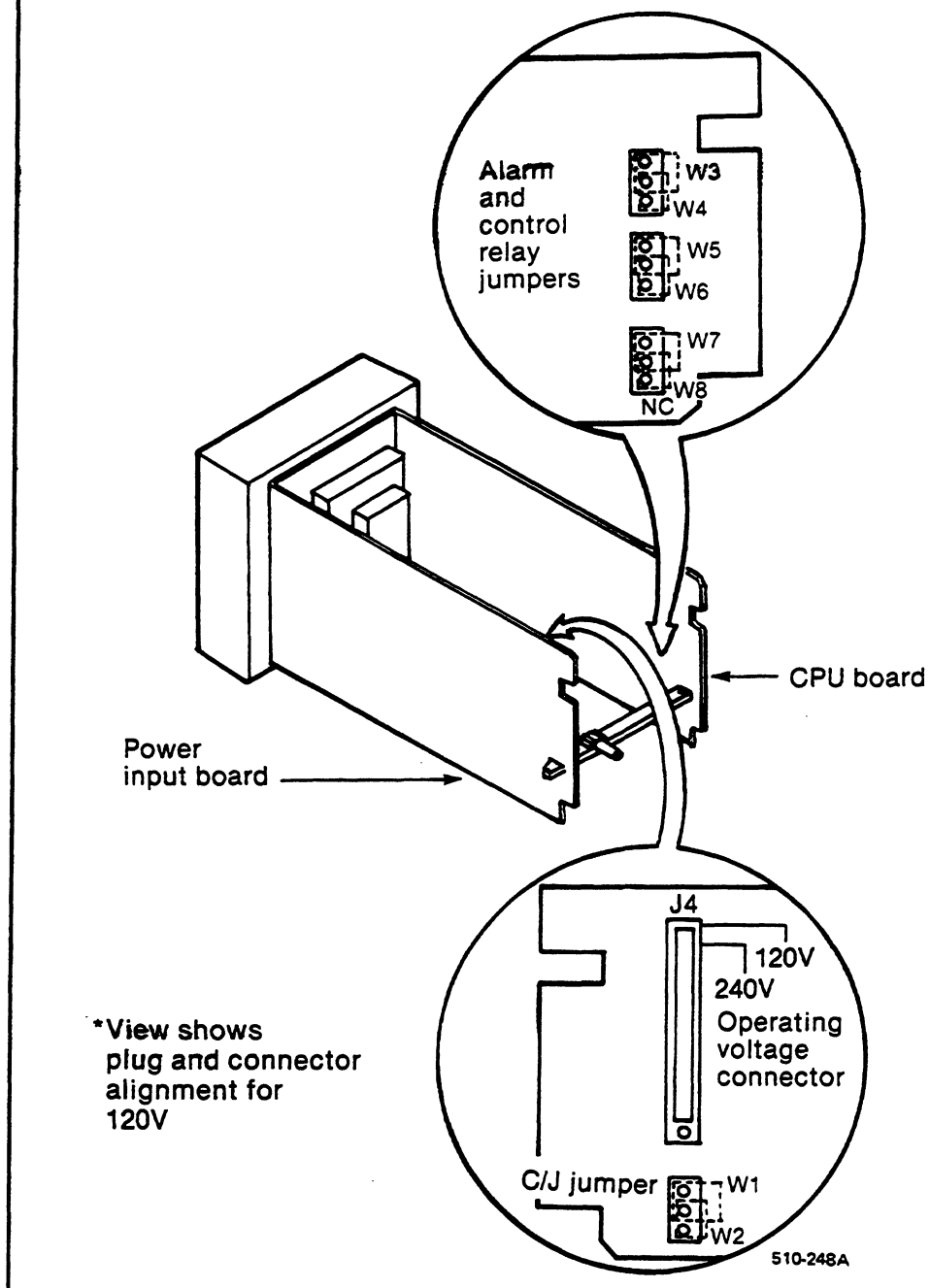


Figure 3-2. Jumper Locations

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Accessing the Jumpers (continued)

Position the Cold Junction Assembly Jumper

Position the cold junction assembly jumper W1/W2 for the input type you are using (Table 3-4). [Figure 3-2]
The controller has been shipped configured for non-T/C actuations (W2).

Table 3-4.

INPUT TYPE	JUMPER POSITION
Thermocouple	W1
RTD	W2
4-20 mA, 1-5V, Radiamatic, 0-10 mV, 10-50 mV, 0-10 Vdc	W1 or W2

Select the Operating Voltage

Position connector J4 to agree with the operating voltage you are using (Table 3-5). [Figure 3-2]
The controller is factory configured for 120 VAC

Table 3-5.

OPERATING VOLTAGE	CONNECTOR POSITION
120 Vac	Position the J4 Connector with top aligned with the line indicating 120V (plug and socket ends aligned)
240 Vac	Position the J4 connector with top aligned with the line indicating 240V (top pin exposed)

CAUTION: Applying 240 Volts to a controller selected for 120 Volts will damage the controller.

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UDC 3000 Configuration Record

Group Prompt	Function Prompt	Value or Selection
TUNING	PROP BD	
	or	
	GAIN	
	RATE MIN	
	RSET MIN	
	or	
	RSET RPM	
	or	
	MAN RSET	
	PROP BD2	
	or	
	GAIN 2	
	RATE2MIN	
	RSET2MIN	
	or	
	RSET2RPM	
	CYC SEC	
	CYC2SEC	
	LOCKOUT	
SP RAMP	SP RAMP	
	TIME MIN	
	FINAL SP	
AUTOTUNE	ATENABL	
	OUT STEP	
	AT ERROR	
ALGORITHM	CONT ALG	
	INPUT 2	
	OUT ALG	
	4-20 RNG	
INPUT 1	DECIMAL	
	UNITS	
	IN 1 TYPE	
	XMITTER	
	IN 1 HI	
	IN 1 LO	
	BIAS IN 1	
	FILTER 1	
	BURNOUT	
	EMISSIV	
	PWR FREQ	
INPUT 2	XMITTER	
	IN 2 HI	
	IN 2 LO	
	FILTER 2	

Group Prompt	Function Prompt	Value or Selection
CONTROL	PID SETS	
	SW VALUE	
	SP SOURCE	
	RATIO	
	BIAS	
	SP TRACK	
	POWER UP	
	SP HIL IM	
	SP LOL IM	
	ACTION	
	OUT HIL IM	
	OUT LOL IM	
	DROPOFF	
	DEADBAND	
	OUT HYST	
	FAILSAFE	
	PB or GAIN	
	MIN or RPM	
OPTIONS	AUX OUT	
	4MA VAL	
	20MA VAL	
	REM SW	
COM	ComSTATE	
	ComADDR	
	SHED TIME	
	PARITY*	
	BAUD*	
	LOOPBACK**	
	SHEDMODE	
	SHED SP	
	UNITS	
ALARMS	A1S1 VAL	
	A1S2 VAL	
	A2S1 VAL	
	A2S2 VAL	
	A1S1 TYPE	
	A1S2 TYPE	
	A2S1 TYPE	
	A2S2 TYPE	
	A1S1 H L	
	A1S2 H L	
	A2S1 H L	
	A2S2 H L	
	AL HYST	

*Not used in DMCS
**Not used in RS422

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UDC 3000 Factory Configuration

Group Prompt	Function Prompt	Value or Selection
TUNING	PROP BD	1.0
	or	
	GAIN	1.0
	RATE MIN	0.00
	RSET MIN	1.0
	or	
	RSET RPM	1.0
	or	
	MAN RSET	0.0
	PROP BD2	5.0
	or	
	GAIN 2	5.0
	RATE2MIN	0.0
	RSET2MIN	0.2
	or	
	RSET2RPM	0.2
	CYC SEC	20.0
	CYC2SEC	20.0
	LOCKOUT	CALIB
SP RAMP	SP RAMP	DISABL
	TIME MIN	3
	FINAL SP	448
AUTOTUNE	ATENABL	M STEP
	OUT STEP	20
	AT ERROR	READ ONLY
ALGORITHM	CONT ALG	PID A
	INPUT 2	DISABL
	OUT ALG	TIME
	4-20 RNG	50 PCT
INPUT 1	DECIMAL	NONE
	UNITS	NONE
	IN 1 TYPE	0-10 MV
	XMITTER	LINEAR
	IN 1 HI	1000
	IN 1 LO	0
	BIAS IN 1	0
	FILTER 1	0
	BURNOUT	NONE
	EMISSIV	0
	PWR FREQ	60 HZ
INPUT 2	XMITTER	LINEAR
	IN 2 HI	1000
	IN 2 LO	0
	FILTER 2	0

Group Prompt	Function Prompt	Value or Selection
CONTROL	PID SETS	1 ONLY
	SW VALUE	0.00
	SP SOURCE	1 LOCAL
	RATIO	1.0
	BIAS	0
	SP TRACK	NONE
	POWER UP	MANUAL
	SP HIL IM	1000
	SP LOL IM	0
	ACTION	REVERSE
	OUT HIL IM	100.0
	OUT LOL IM	0.0
	DROPOFF	0.0
	DEADBAND	2.0
	OUT HYST	0.5
	FAILSAFE	0.0
	PB or GAIN	GAIN
	MIN or RPM	MIN
OPTIONS	AUX OUT	DISABL
	4MA VAL	0
	20MA VAL	100
	REM SW	NONE
COM	ComSTATE	DISABL
	ComADDR	0
	SHED TIME	0
	PARITY*	ODD
	BAUD*	300
	LOOPBACK**	DISABL
	SHEDMODE	LAST
	SHED SP	TO LSP
	UNITS	PERCNT
ALARMS	A1S1 VAL	90
	A1S2 VAL	10
	A2S1 VAL	95
	A2S2 VAL	5
	A1S1 TYPE	NONE
	A1S2 TYPE	NONE
	A2S1 TYPE	NONE
	A2S2 TYPE	NONE
	A1S1 H L	HI
	A1S2 H L	LO
	A2S1 H L	HI
	A2S2 H L	LO
	AL HYST	0.1

*Not used in DMCS
**Not used in RS422

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Operating Data

Section 4

Operator Interface Overview

Figure 4-1 is an overview of the indicators, displays, and keys. See "Monitoring" or "Operating" your controller for detailed information.

CAUTION: The keys have tactile feedback. Damage can occur if you use a sharp object to press the keys.

Upper display—six characters
- Normal operation—four digits dedicated to display the process variable
- Configuration mode—displays parameter vaule or selection.

Lower display—eight characters
- Normal operation—displays operating parameters and values
- Configuration mode—displays function groups and parameters

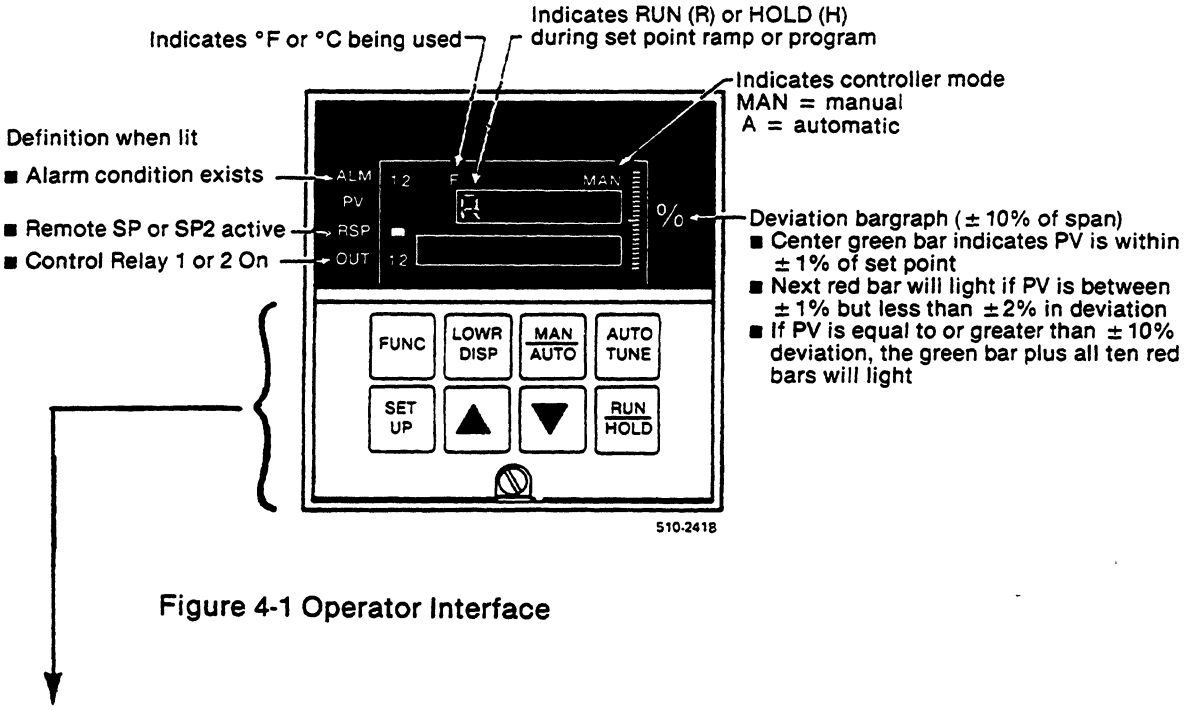


Figure 4-1 Operator Interface

SET UP

Set Up Key

- Places controller in Configuration Group select mode. Sequentially displays configuration groups and allows the [FUNC] key to display individual functions for each group.

FUNC

Function Key

- Used in conjunction with [SET UP] key to select the individual functions of a selected configuration group.
- Used during field calibration procedure.
- Alternately selects Local or Remote set point, or between two local set points.

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LOWR DISP

Lower Display Key

- Selects the operating parameter shown in the lower display:

"OUT"-Output
"RSP"-Remote Set Point
"DEV"-Deviation
"SAM"-Samples remaining in Autotune time window
"#RA"-Minutes remaining in the set point ramp
"#SK"-Minutes remaining in the set point soak.
"SP"-Set Point
"2IN"-Input 2
"1IN"-Input 1
"2SP"-2nd Local Set Point
"CSP"-Computer Set Point
"PIDSETX"-Tuning Parameter
"RECYC"-Number of cycles remaining in the program.
"POS"-3 Position Step Motor position when slidewire connected.

MAN / AUTO

Manual/Automatic Key

- Alternately selects Manual or Automatic control mode.

AUTO - lower display automatically indicates Set Point value in Engineering units.
MAN - lower display automatically indicates Output value in %.

▲

Raise Key

- Increases the set point, output, or configuration values.

▼

Lower Key

- Decreases the set point, output, or configuration values.

AUTO TUNE

Autotune Key

- Starts the Autotune procedure. "KEY ERROR" appears if option is not present or disabled.

RUN / HOLD

Run/Hold Key

Set Point Program

- Alternate action switch which initiates the SP Ramp or set point program. While program is running, one press places the Ramp or program in the HOLD mode; another press allows the Ramp or program to continue (RUN).

Restore Original Value

- When you are using the [FUNC] key and [▲] [▼] keys to change a parameter value or selection and you decide you want to keep the original value that was displayed, press [RUN/HOLD] key, before entry, to recall the original value.

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Powering Up the Controller

Apply Power

CAUTION: Be sure to check power jumper and voltage being applied. Damage can occur if power used does not agree with hardware jumper position. (See Installation.)

When power is applied, the controller will run 3 diagnostic tests:

RAM Test
Configuration Test
Calibration Test

All the displays will light and then the controller will go into automatic mode.

If one or more of these tests fail, the controller will go to FAILSAFE (blinking in the lower display). Refer to the Troubleshooting section (STATUS TESTS) in this manual to identify and correct the problem.

Checking the Displays and Keys

To run the Display and Key test

Press [SET UP] and *HOLD* in, then

Press [FUNC] at the same time.

The controller will run a display test. All the displays will light, then

UPPER DISPLAY = KEYS
LOWER DISPLAY = TRY ALL

Press each key to see if it works. When the key is pressed the lower display will indicate the name of the key pressed.

UPPER DISPLAY = KEYS
LOWER DISPLAY = FUNCTION
LWR DISP
AUTO-MAN
AUTOTUNE
SET UP
INCREMNT
DECREMNT
RUN-HOLD
INCRDECR (If you press ▲ ▼ simutaneously)

If no key is pressed for 20 seconds the test will time out, and the controller will go into control mode.

If any test fails, refer to the troubleshooting section in this manual.

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
- not in Set-Up mode—press [SET UP] first
- key malfunction—perform keyboard test to verify

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Monitoring Your Controller

The indicators and displays on the operator interface let you see what is happening to your process and how the controller is responding.

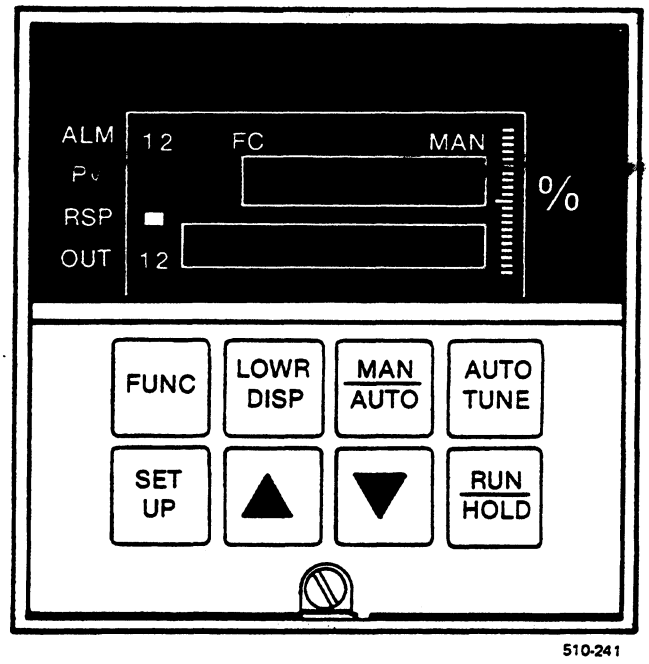


Figure 4-2—Operator interface

Indicators

During normal operation, the indicators will light for the following reasons:

Indicator	Definition When Lit
ALM 1 2	Alarm condition exists for alarm relay 1 or 2.
PV	Process Variable Display
RSP ■	Remote set point is active or 2nd set point is active.
OUT 1 2	Control relay 1 or 2 is ON.
A or MAN	Indicates the mode of the controller. A = Automatic MAN = Manual
F or C or Blank	Indicates the temperature units of PV. F = Fahrenheit C = Celcius
R or H or Blank	Indicates the state of the set point ramp if enabled. R = Run H = Hold Blank = Disabled

•.For other indications during Remote Switching (Digital Input) refer to page 4-26

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Monitoring Your Controller (continued)

Deviation Bargraph

In addition to the indicators described above, a Bargraph containing 21 bars will display Process Variable (PV) deviation from set point (see Figure 4-3).

The blue "On Control" bar will be on when the PV is within ±1% of set point.

The 10 red bars above the blue center bar will indicate a positive deviation to +10% and the 10 below will indicate −10% (% of span).

If the process deviation is greater than ±10% (% of span), the blue bar and the specific red bars will light.

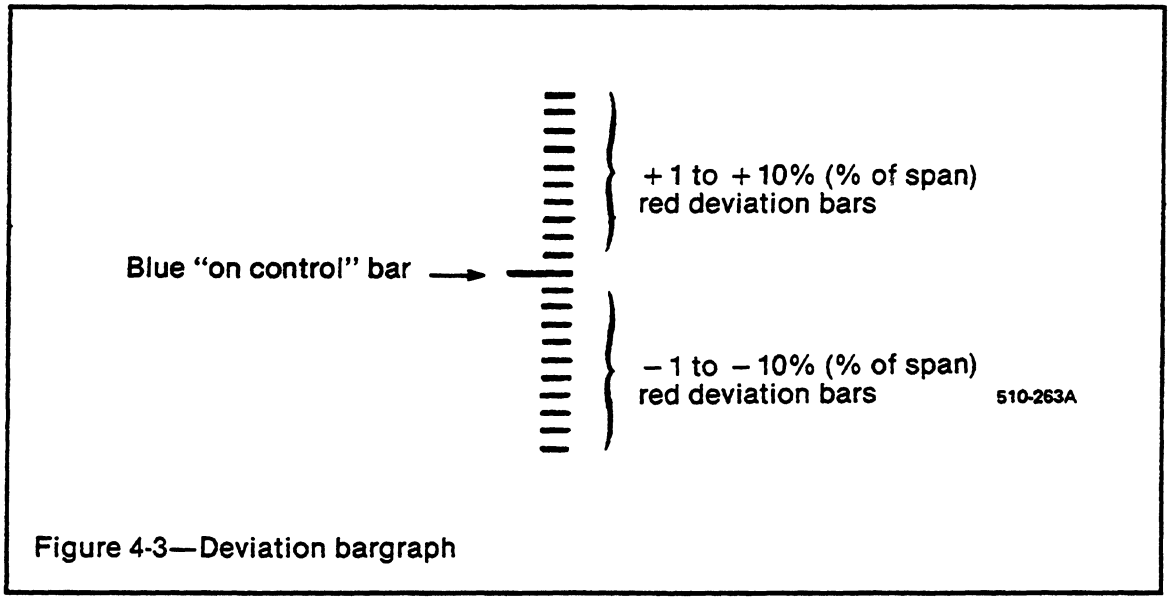


Figure 4-3—Deviation bargraph

Displays

The UPPER DISPLAY ☐☐☐☐☐☐ is a 6-character display, four of which show the value of the process variable during normal operation.

In the configuration (Set Up) mode, it displays parameter values or selections in English language prompts.

The LOWER DISPLAY ☐☐☐☐☐☐☐☐ is an 8-character display. During normal operation, it shows the operating information needed to monitor your controller. The [LOWR/DISP] key will successively display these parameters.

In the configuration (Set Up) mode, it displays parameter values or selections in English language prompts.

When no decimal place is configured, the right-most character is a blank.

When a single decimal position has been configured and values greater than 1000 are displayed, the right-most character is blank but the decimal point will be lit.

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Monitoring Your Controller (continued)

The LOWR DISP Key

Press [LOWR DISP] to scroll through the following operating parameters.

NOTE: The display will show only those that apply to your specific model and the way it is configured.
LOWER DISPLAY = The prompt and its value

Prompt	Definition
OUT	The controller Output* in percent (%)
SP	Local Set Point 1,* also current set point of set point ramp, or set point Ramp/Soak program
2SP	Local Set Point 2* (where remote set point does not apply)
RSP	Remote Set Point (when available)
2IN	Input 2
CSP	Computer Set Point (when set point is in override)
DEV	PV deviation from set point (±999.9 maximum)
SAM	The number of samples remaining in the current Autotune time window
1IN	Input 1
PIDSET X	Tuning Parameter Set* selected where X = 1 or 2
RAMP	The time (minutes) remaining in the set point ramp
# SK	The time (minutes) remaining in set point soak
# RA	The time (minutes) remaining in set point ramp.
RECYC	The number of recycles left in the ramp/soak program.
POS	3 Position Step Motor position when slidewire connected

*Press [▲] or [▼] to change the value of this parameter.

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Monitoring Your Controller (continued)

Diagnostic Error Messages

The UDC 3000 performs background tests to verify data and memory integrity. If there is a malfunction, an error message will be displayed. In the case of more than one simultaneous malfunctions, only the one with the highest priority will appear on the lower display.

Lower Display Prompt	Condition
EE FAIL	Unable to write to non-volatile memory
FAILSAFE	Failsafe
INP1FAIL	Two consecutive failures of input 1 integration
INP2FAIL	Two consecutive failures of input 2 integration
INP1 RNG	Input 1 out-of-range Linear: ± 10% out of range Characterized: ± 1% out of range
INP2 RNG	Input 2 ± 10% out of range
PV LIMIT	PV ± 10% out of range
RV LIMIT	Remote variable out-of-range NOTE: RV = (input 1 × ratio) + bias

IF ANY OF THESE ERROR MESSAGES OCCUR, REFER TO THE TROUBLESHOOTING SECTION IN THIS MANUAL.

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Start-Up

PROCEDURE

Select Manual Mode

Press MAN/AUTO until

"MAN" indicator is ON.
The controller is in manual mode.
UPPER DISPLAY = The PV value
LOWER DISPLAY = OUT and the output value in percent (%)

Press ▲ or ▼ to adjust the output and ensure that the final control element is functioning correctly.

Tune the Controller

Make sure the controller has been configured properly and all the values and selections have been recorded on the configuration record sheet.

Refer to "TUNING" group to ensure desired selections for "PB" or "GAIN," "RATE," and "RESET" have been entered.

For controllers with Auto Tune: See Auto Tune procedure on page 4-22, OR YOU CAN TUNE THE CONTROLLER MANUALLY.
For controllers without Auto Tune: See Appendix B—How to manually tune your controller

Enter Local Set Point

Press LOWR DISP once

UPPER DISPLAY = The PV value
LOWER DISPLAY = SP and the Local Set Point value

Press ▲ or ▼ to adjust the local set point to the value at which you want the process variable maintained.

NOTE: The Local Set Point cannot be adjusted if the Set Point Ramp function is enabled ("H" or "R" appears in the top display).

Select Automatic Mode

Press MAN/AUTO until

"A" indicator is ON.
The controller is in automatic mode.
UPPER DISPLAY = Process Variable Value
LOWER DISPLAY = SP and the set point value
The controller will automatically adjust the output to maintain the process variable at the set point, if the controller is properly configured and tuned.

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Operating the Controller

Operating Tips

Listed below are a few procedures that will help you to easily and quickly operate your controller.

Changing Values Quickly

When changing the value of a parameter, you can adjust a more significant digit in the upper display by holding in one key [▲] or [▼], and pressing the opposite key at the same time.

The adjustment will move one digit to the left.

Press the key again and you will move another digit to the left.

Returning to the Original Value

When you change the value or selection of a parameter while in [SET UP] mode and decide not to enter it,

Press [RUN / HOLD] once, the original value or selection will be recalled

Exiting Set Up Mode

To exit [SET UP] mode,

Press [LOWR DISP]

This returns the upper display to PV and the lower display to SP or OUT depending on the mode it was in immediately preceding entry into the set up mode.

Timing Out from Set Up

If you are in [SET UP] mode and don't press any keys for one minute, the controller will time out and revert to the mode and display that was being used prior to entry into Set Up mode and enter any change you made.

Scrolling

To get to a Set Up Group or a Function parameter quickly,

Hold [FUNC] or [SET UP] key *IN*

The display will scroll through the available parameters.

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Operating the Controller (continued)

Operating Modes

Press [MAN / AUTO] to alternately select Automatic or Manual mode.

Switching between manual and automatic will be bumpless, except when PD + MR algorithm is selected.

PROCEDURE

Selecting Automatic

The controller regulates its output to maintain the process variable at the desired set point.

Press [MAN / AUTO] until

"A" indicator is ON (automatic mode).
UPPER DISPLAY = the PV value
LOWER DISPLAY = SP and the set point value
The Deviation Bargraph indicates PV deviation from Set Point.

Selecting Manual

The controller holds its output at the last value used during automatic operation and stops adjusting the output for changes in set point or process variable.

Press [MAN / AUTO] until

"MAN" indicator is ON (manual mode).
UPPER DISPLAY = the PV value
LOWER DISPLAY = OUT and the output value in percent (%)
The Deviation Bargraph indicates PV deviation from Set Point.

Changing the Output

In manual mode,

Press [▲] or [▼] to change the output value shown in the lower display.

Press [MAN / AUTO] to return to automatic control mode.

"A" indicator will appear (automatic mode).

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REFER TO THE CONFIGURATION SECTION OF THIS MANUAL TO DISPLAY OR CHANGE THESE ASSOCIATED CONTROL PARAMETERS.

	Set Up Group Prompt	Function Prompt
OUTPUT DIRECTION	"CONTROL"	"ACTION"
OUTPUT LIMITS	"CONTROL"	"OUTLOLIM" and "OUTHILIM"
CONTROLLER DROPOFF VALUE	"CONTROL"	"DROPOFF"
FAILSAFE OUTPUT VALUE	"CONTROL"	"FAILSAFE"

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Set Points

Definitions

Local Set Point—entered from the keyboard.
Remote Set Point—The set point that input 2 supplies from a remote source (configurable).
2nd Local Set Point—entered at the keyboard (configurable).

PROCEDURE

Changing the Local Set Point

Press [MAN / AUTO] until
"A" indicator is ON.
UPPER DISPLAY = the PV value
LOWER DISPLAY = SP and the local set point value

Press [▲] or [▼] to change the local set point to the value at which you want the process variable maintained.

The Deviation Bargraph indicates PV deviation from Set Point.

Selecting Set Point Source

You can select what you want your two set points to be: A single local set point, or a Local Set Point and a Remote Set Point, or 2 Local Set Points.

Press [SET UP] until

UPPER DISPLAY = SET UP
LOWER DISPLAY = CONTROL

Press [FUNC] until

UPPER DISPLAY = The selected set point source:
1 LOCAL
REMOTE
2 LOCAL
LOWER DISPLAY = SP SOURCE

Press [▲] or [▼] to select the desired set point source in the upper display.

Press [LOWR DISP] to return to control.

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Set Points (continued)

PROCEDURE (continued)

Switching Between Local and Remote Set Points or Between 2 Local Set Points

Press [FUNC] to alternately select Local or Remote Set Points or switch between 2 Local Set Points (when configured).

NOTE: "KEY ERROR" will appear in the lower display if the remote set point or 2nd local set point is not configured as a set point source or if you attempt to change the set point while a set point ramp is enabled.

The table below shows how the indicators react, what the displays show, and whether or not you can change the value for each type of set point.

	Using Local Set Point	Using Remote Set Point	Using 2nd Local Set Point
RSP Indicator	OFF	ON	ON
Upper Display	PV	PV	PV
Lower Display	SP and Local Set Point value	RSP and Remote Set Point value	SP2 and 2nd Local Set Point value
To Change Set Point Value*	Press ▲ or ▼	Cannot change at keyboard	Press ▲ or ▼

Bargraph indicates PV deviation from Set Point.

*Display blinks if you attempt to enter set point values beyond the high or low set point limits.

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Set Points (continued)

REFER TO THE CONFIGURATION SECTION IN THIS MANUAL TO DISPLAY OR CHANGE THESE ASSOCIATED SET POINT PARAMETERS.

	Set Up Group Prompt	Function Prompt
SET POINT SOURCE	"CONTROL"	"SP SOURCE"
HI AND LO SET POINT LIMIT VALUES	"CONTROL"	"SP HILIM" and "SP LOLIM"
TRACKING (LSP TRACKS RSP)	"CONTROL"	"SP TRACK"

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Operating A Single Set Point Ramp

Configuring a Single Set Point Ramp

You can configure a single set point ramp to occur between the current local set point and a final local set point over a time interval of from 1 to 255 minutes. You can RUN or HOLD the ramp at any time.

PROCEDURE

Select SP RAMP Group

Press [SET UP] until

UPPER DISPLAY = SET UP
LOWER DISPLAY = SP RAMP

Enable SP RAMP Function

Press [FUNC]

UPPER DISPLAY = DISABL
LOWER DISPLAY = SP RAMP

Press [▲] to enable the set point ramp function

UPPER DISPLAY = ENABLE
LOWER DISPLAY = SP RAMP

NOTE: You cannot change the current local set point if the set point ramp has been enabled.

Set Ramp Time

Press [FUNC]

UPPER DISPLAY = The ramp time in minutes
LOWER DISPLAY = TIME MIN

Press [▲] or [▼] to change the upper display value to the number of minutes in which you want the final set point to be reached.

Setting Range = 1 to 255 minutes

NOTE: Entering 0 will imply an immediate step change in set point to the final set point.

Set FINAL SP Value

Press [FUNC]

UPPER DISPLAY = The final set point value
LOWER DISPLAY = FINAL SP

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Operating a Single Set Point Ramp (continued)

PROCEDURE (continued)

Press ▲ or ▼ to change the upper display value to the final desired set point for the ramp.

Setting Range = within the set point limits

Running a Single Set Point Ramp

PROCEDURE

Put the Controller into Automatic Mode

Press [MAN/AUTO] until "A" indicator ON.

UPPER DISPLAY = H (hold) and the PV value

LOWER DISPLAY = SP and the present set point value

Start Ramp

Press [RUN/HOLD]

UPPER DISPLAY = R (run) and the PV value

LOWER DISPLAY = SP and the set point value

NOTE: The value in the lower display will be increasing or decreasing toward the final set point value.

The PV value in the upper display will also change.

Hold Ramp at Current Value

Press [RUN/HOLD] to hold the ramp at the current set point value. Press again to continue run.

A "KEY ERROR" prompt will appear if [RUN/HOLD] key is pressed while "SP RAMP" is disabled.

View the Remaining Time for the Ramp

Press [LOWR DISP] until

UPPER DISPLAY = R or H and the PV value

LOWER DISPLAY = RAMP XXXM (time remaining)

End Ramp

When the final set point value is reached, the "R" changes to "H" in the upper display and the controller operates at the new set point.

NOTE: Any time the local set point is different from the Final Set Point value and the [RUN/HOLD] key is pressed — the ramp will start again.

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Running a Single Set Point Ramp (continued)

PROCEDURE (continued)

Disable SP RAMP Function

Press [SET UP] until

UPPER DISPLAY = SET UP
LOWER DISPLAY = SP RAMP

Press [FUNC]

UPPER DISPLAY = ENABLE
LOWER DISPLAY = SP RAMP

Press [▲] to disable the set point ramp function

UPPER DISPLAY = DISABL
LOWER DISPLAY = SP RAMP

Press [LOWR DISP] to return to normal display.

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Set Point Ramp/Soak Programming

Introduction

The term "Programming" is being used here to identify the process for selecting and entering the individual ramp and soak segment data needed to generate the required Set Point versus Time profile (also called a program).

A segment is a ramp or soak function which together make up a set point program. Set Point Ramp/Soak Programming lets you configure 6 ramp and 6 soak segments to be stored for use as one program or several small programs. You designate the beginning and end segments to determine where the program is to start and stop.

Each ramp segment can be configured to be run in hours and minutes or degrees per minute. 0 implies an immediate step change in set point to the next soak.

Each soak segment can have a guaranteed soak deviation which guarantees the value for each soak. This means that the timer will not start until the process variable (PV) is within the deviation limit (±) and then if the PV subsequently exceeds the deviation range, the timer holds until the PV enters the range.

Configuration

What you will configure

Basically, you will configure all the data that is relevant to each ramp and soak segment for a given set point versus time profile. The controller will prompt you through the sequence of segments and associated functions. These will include:

RAMP TIME or RATE

A ramp segment is the time it will take to change the set point to the next set point value in the program.

Ramps are odd number segments. Segment #1 will be the initial ramp time.

Ramp time is determined in either

TIME*	or	RATE*
Hours:Minutes		Degrees/Minute
Range 0-99 hrs:59 min		range 0 to 999
Enter value [ ][X][X][Y][Y][ ]		Enter Value [ ][ ][X][X][X][ ]
where XX = hours (0-99) YY = minutes (0-59)		where XXX = degrees/minute

*This selection of time or rate is made at prompt "RAMP UNIT."

NOTE: Entering 0 will imply an immediate step change in set point to the next soak.

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SOAK SET POINT RANGE VALUES AND DURATION TIME

A soak segment is a combination of soak set point (value) and a soak duration (time).

Soaks are even number segments.
Segment 2 will be the initial soak value and soak time.

The soak set point range value must be within the set point high and low range limits in engineering units.

SOAK TIME is the duration of the soak and is determined in

TIME
Hours:Minutes
Range 0-99hrs:59min

Enter value | | X | X | Y | Y | | where

XX = hours (0-99)
YY = minutes (0-59)

START SEGMENT NUMBER

This designates the number of the first segment.

The range is 1 to 11.

END SEGMENT NUMBER

This designates the number of the last segment. It must be a soak segment(even number).

The range is 2 to 12.

RECYCLE NUMBER

This number allows the program to recycle a specified number of times from beginning to end.

The range is 0 to 99.

GUARANTEED SOAK DEVIATION IN ENGINEERING UNITS

Each soak segment can have a deviation value of 0 to ±99 which guarantees the value for that segment.

Guaranteed soak segment values >0 guarantee that the segments process variable is within the ± deviation for the configured soak time. Whenever the ± deviation is exceeded, soak timing is frozen. There are no guaranteed soaks whenever the deviation value is configured to 0, i.e., soak segments start timing soak duration as soon as the soak set point is first reached, regardless of where the process variable remains relative to the soak segment.

The value is the number in engineering units, above or below the set point, outside of which the timer halts.

The decimal location corresponds to Input 1 decimal selection.

PROGRAM TERMINATION STATE

This function determines the status of the controller upon completion.

LAST SP = controls to last set point and last control mode.
F SAFE = Manual mode, Failsafe output

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PROGRAM STATE

This selection determines the program state after completion.

DISABL = Program is disabled
HOLD = Program on hold.

RAMP UNIT

This determines the engineering units for the ramp segments.

TIME = Hours:Minutes
RATE = Degrees/Minute

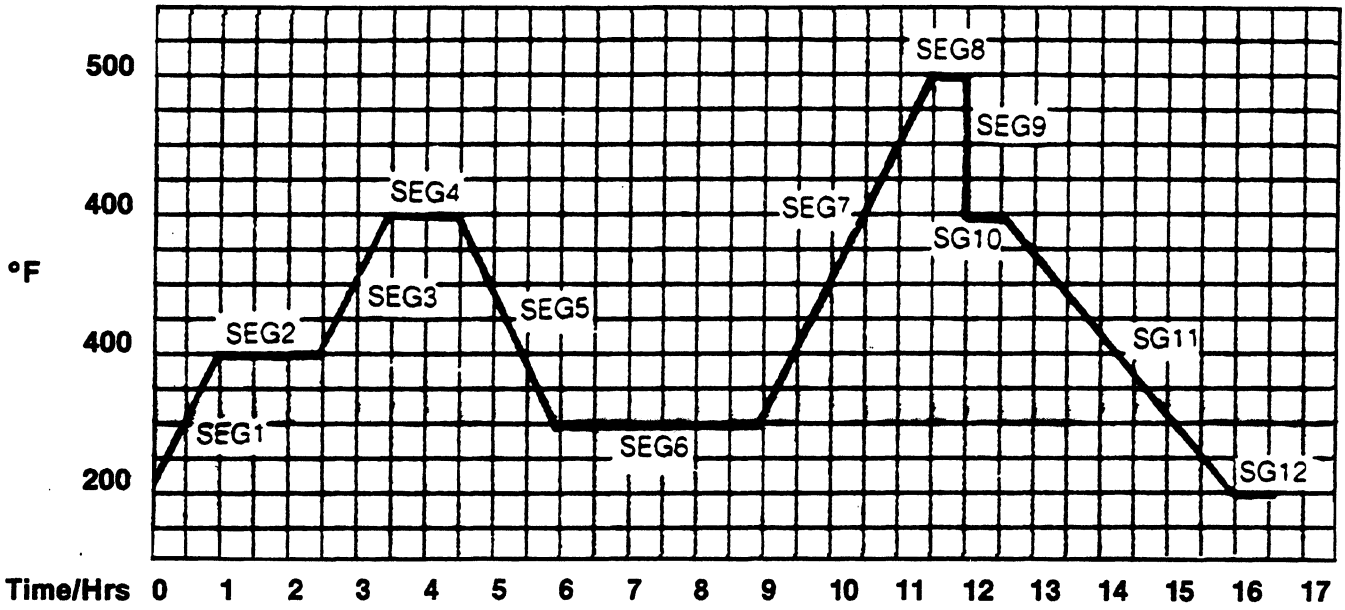
NOTE: If power is lost during a program, upon power-up the unit will be in hold and the SP value will be the SP value prior to the beginning of the set point program. The program is placed in hold.

Drawing a Ramp/Soak Profile

Before you do the actual configuration, we recommend that you draw a Ramp/Soak profile in the space provided on the Program Record Sheet (page 4-22) and fill in the associated information. An example of a Ramp/Soak profile is shown on page 4-21.

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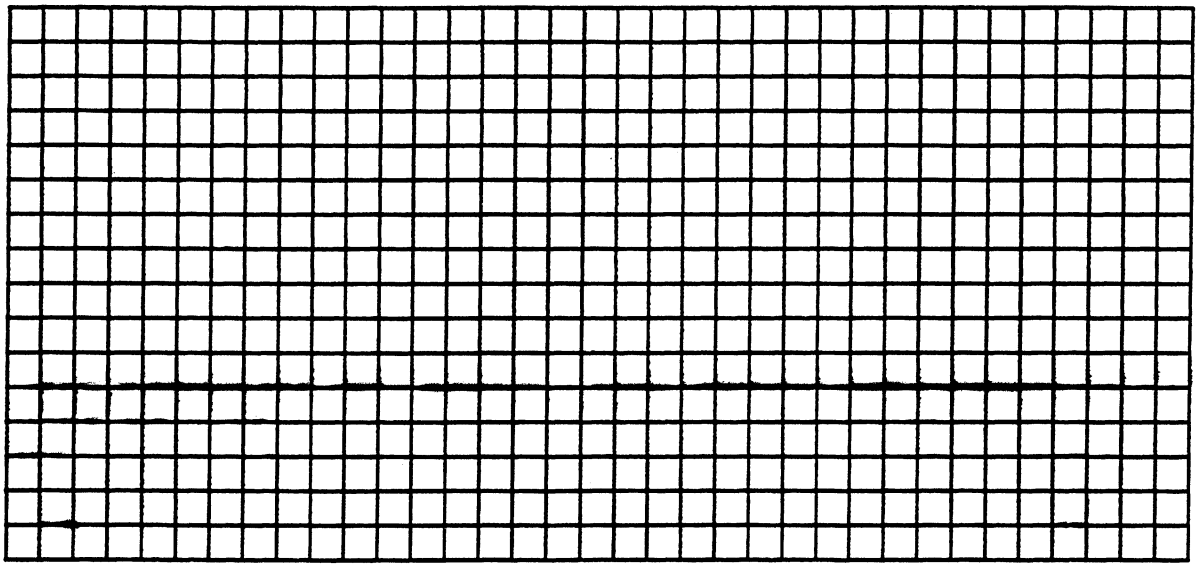
Ramp/Soak Profile Example



Prompt	Function	Segment	Value	Prompt	Function	Segment	Value
STRT SEG	Start Seg		1	SEG7RAMP	Ramp Time	7	2HR/30MN
END SEG	End Seg		12	SEG8 SP	Soak SP	8	500
RECYCLES	Number of Recycles		2	SEG8TIME	Soak Time	8	30 MIN
SOAK DEV	Deviation Value		0	SEG9RAMP	Ramp Time	9	0
SEG1RAMP	Ramp Time	1	1 HR	SG10 SP	Soak SP	10	400
SEG2 SP	Soak SP	2	300	SG10TIME	Soak Time	10	30 MIN
SEG2TIME	Soak Time	2	1HR/30MIN	SG11RAMP	Ramp Time	11	3HR/30MN
SEG3RAMP	Ramp Time	3	1 HR	SG12 SP	Soak SP	12	200
SEG4 SP	Soak SP	4	400	SG12TIME	Soak Time	12	30 MIN
SEG4TIME	Soak Time	4	1 HR	STATE	Program Controller State		LAST SP
SEG5RAMP	Ramp Time	5	1HR/30MIN	PROG END	Controller Status		HOLD
SEG6 SP	Soak SP	6	250	RAMPUNIT	Engr. Unit for Ramp		TIME
SEG6TIME	Soak Time	6	3 HRS				

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PROGRAM RECORD SHEET



Prompt	Function	Segment	Value	Prompt	Function	Segment	Value
STRT SEG	Start Seg			SEG7RAMP	Ramp Time	7	
END SEG	End Seg			SEG8 SP	Soak SP	8	
RECYCLES	Number of Recycles			SEG8TIME	Soak Time	8	
SOAK DEV	Deviation Value			SEG9RAMP	Ramp Time	9	
SEG1RAMP	Ramp Time	1		SG10 SP	Soak SP	10	
SEG2 SP	Soak SP	2		SG10TIME	Soak Time	10	
SEG2TIME	Soak Time	2		SG11RAMP	Ramp Time	11	
SEG3RAMP	Ramp Time	3		SG12 SP	Soak SP	12	
SEG4 SP	Soak SP	4		SG12TIME	Soak Time	12	
SEG4TIME	Soak Time	4		PROG END	Controller Status		
SEG5RAMP	Ramp Time	5		STATE	Program Controller State		
SEG6 SP	Soak SP	6		RAMPUNIT	Engr. Unit for Ramp		
SEG6TIME	Soak Time	6					

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Entering the Set Point Program Data

This procedure tells you what keys to press and what prompts you will see when entering the set point program data.

Select SP Ramp Group

Press [SET UP] key until

Upper Display = SET UP

Lower Display = SP RAMP

Select the Functions

Press [FUNC] key to access the function prompts and enable the SP programming.

Upper Display = The current value or selection for each prompt is shown.

Lower Display = The individual function prompts within the set point program group are shown.

Successive presses of the [FUNC] key will sequentially display all the functions and their values or selections.

FOLLOW THE PROMPT HIERARCHY SHOWN ON THE NEXT PAGE.

Change Value/ Selection

Press [▲] [▼] keys to change the value or selection in the upper display. If the display blinks, you are trying to select an unacceptable value.

Enter Value/ Selection

Press [FUNC] key and go to another prompt.

Exit Configuration

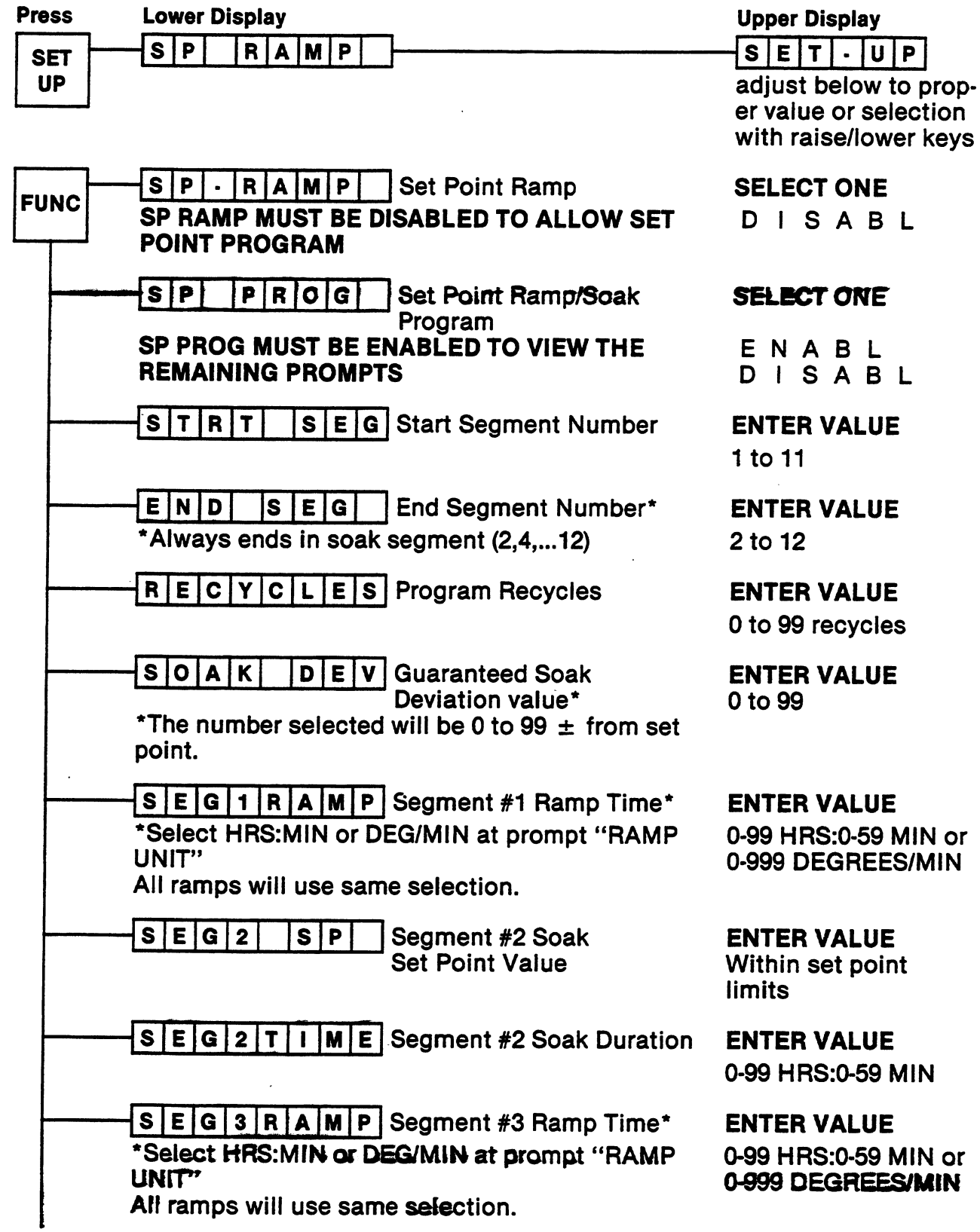
Press [LOWR DISP] key to exit from configuration mode.

Alarms on SP Program

You can configure an event to go ON or OFF at the beginning or end of any segment. Refer to the configuration section under "Alarm Parameters Group" for details.

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PROMPT HIERARCHY

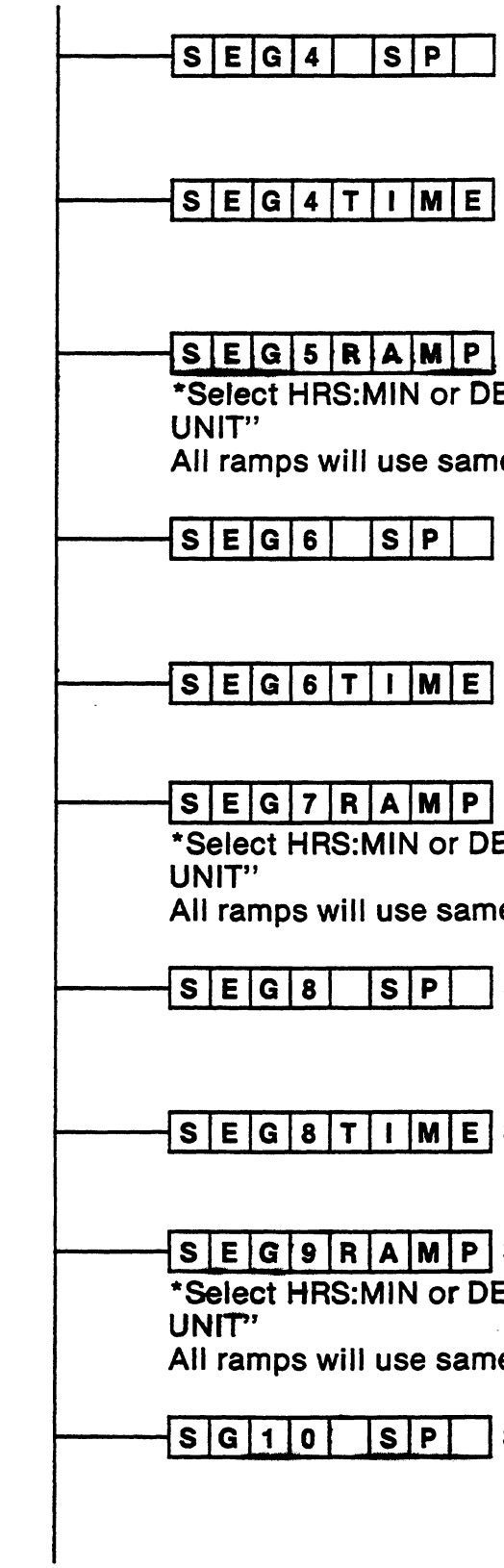


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PROMPT HIERARCHY

(continued from previous page)



SEG4 SP — Segment #4 Soak Set Point Value	**ENTER VALUE** Within set point limits
SEG4TIME — Segment #4 Soak Duration	**ENTER VALUE** 0-99 HRS:0-59 MINUTES
SEG5RAMP — Segment #5 Ramp Time*	**ENTER VALUE** 0-99 HRS:0-59 MIN or 0-999 DEGREES/MIN
SEG6 SP — Segment #6 Soak Set Point Value	**ENTER VALUE** Within set point limits
SEG6TIME — Segment #6 Soak Duration	**ENTER VALUE** 0-99 HRS:0-59 MIN
SEG7RAMP — Segment #7 Ramp Time*	**ENTER VALUE** 0-99 HRS:0-59 MIN or 0-999 DEGREES/MIN
SEG8 SP — Segment #8 Soak Set Point Value	**ENTER VALUE** Within set point limits
SEG8TIME — Segment #8 Soak Duration	**ENTER VALUE** 0-99 HRS:0-59 MIN
SEG9RAMP — Segment #9 Ramp Time*	**ENTER VALUE** 0-99 HRS:0-59 MIN or 0-999 DEGREES/MIN
SG10 SP — Segment #10 Soak Set Point Value	**ENTER VALUE** Within set point limits

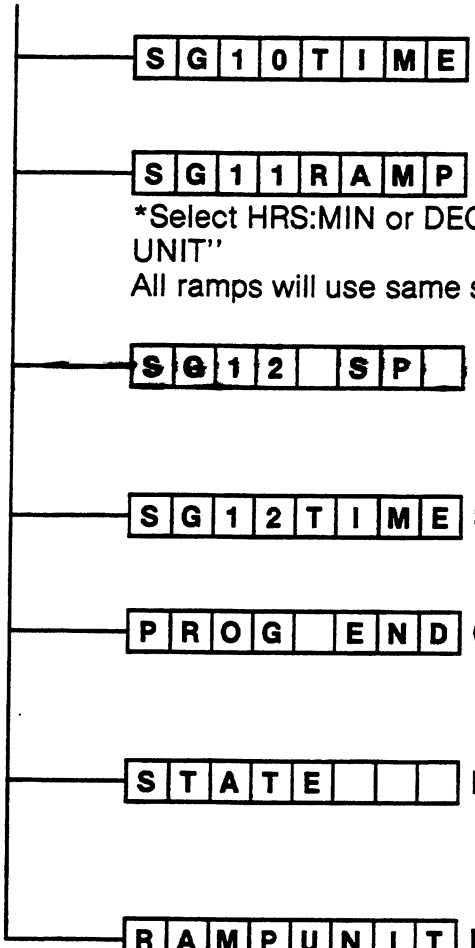
*Select HRS:MIN or DEG/MIN at prompt "RAMP UNIT"
All ramps will use same selection.

(continued next page)

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PROMPT HIERARCHY

(continued from previous page)



SG10TIME — Segment #10 Soak Duration

ENTER VALUE
0-99 HRS:0-59 MIN

SG11RAMP — Segment #11 Ramp Time

*Select HRS:MIN or DEG/MIN at prompt "RAMP UNIT"
All ramps will use same selection.

ENTER VALUE
0-99 HRS:059 MIN or
0-999 DEGREES/MIN

SG12 SP — Segment #12 Soak Set Point Value

ENTER VALUE
Within set point limits

SG12TIME — Segment #12 Soak Duration

ENTER VALUE
0-99 HRS:0-59 MIN

PROG END — Controller Status

SELECT ONE
LAST SP
F SAFE

STATE — Program Controller State

SELECT ONE
DISABL
HOLD

RAMPUNIT — Engineering units for Ramp Segments

SELECT ONE
TIME (Hrs:Min)
RATE (Deg/Min)

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RUNNING THE SET POINT RAMP/SOAK PROGRAM

Make sure all the "SP PROG" function prompts under the SET UP group "SP RAMP" have been configured with the required data.

An H will appear in the upper display indicating the program is in HOLD state.

Run State

Press RUN/HOLD to initiate the set point program

An "R" appears in the upper display indicating that the program is running.

Hold State

Press RUN/HOLD to hold the set point program

An "H" appears in the upper display indicating that the program is in HOLD state. The set point holds at the current set point.

External Hold

If Remote Switching (Digital Input Option) is present on your controller, contact closure places the controller in the HOLD state if the set point program is running.

The "H" in the upper display will BLINK. NOTE: The keyboard takes priority over external switch for the RUN/HOLD function.

Viewing the Present Ramp or Soak Number and Time

Press the [LOWR DISP] key until

Upper display = "R" and the PV value
Lower Display = # RA and the time for the ramp, or
SK and the time for the soak

Viewing the Number of Cycles Left in the Program

Press [LOWR DISP] until

Upper Display = "R" and the PV value
Lower Display = RECYC and the number of recycles remaining to be run in the program.

End Program

When the final segment is completed, the "R" in the upper display either changes to "H" if configured for HOLD state, or disappears if configured for disable of SP programming. The controller operates at the last set point in the program or will be in manual mode at the failsafe output value.

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Remote Switching (Digital Input Option)

The Remote Switching option detects the state of external contacts. On contact closure, the controller will respond according to how the controller has been configured for Remote Switching.

- Places the controller in manual mode if in automatic, or
- Goes to local set point if in remote set point, or
- Goes to second local set point if in set point 1, or
- Goes to direct controller action if in reverse action, or
- Places the controller in HOLD if running a set point ramp or a set point program.

Make your selection under OPTION Set Up group prompt "REM SW". (See the table below and the Configuration section in this manual).

The table below lists the "Action on Contact Closure", the "Display Indication" and what selection to make under configuration SET UP prompt "REM SW"

Action On Contact Closure	Display Indication	Selection Under "REM SW" Prompt
■ Places the controller in Manual mode. (transfer if in automatic)	■ Blinking MAN indicator	■ TO MAN
■ Switches out the Remote Set Point and selects the Local Set Point. (tansfer if in Remote set point)	■ Blinking RSP indicator	■ TO LSP
■ Switches out the first Local Set Point and selects the second Local Set Point. (transfer if in set point 1)	■ Blinking RSP indicator	■ TO 2SP
■ Places the controller in Direct controller action. (transfer if in reverse)	■ None	■ TO DIR
■ Places the controller in HOLD state if SP Ramp or SP Program is running. (transfer if in RUN) **NOTE: Keyboard takes priority over external switch for the RUN/HOLD function.**	■ Blinking "H" in the PV display	■ TO HOLD

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Two Sets of Tuning Constants

You can use two sets of tuning constants for single output types and choose the way the sets are to be switched.

The sets can be:

- Keyboard selected.
- Automatically switched when a predetermined Process Variable value is reached.
- Automatically switched when a predetermined Set Point value is reached.

PROCEDURE

Select Two Sets

Press [SET UP] until

UPPER DISPLAY = SET UP
LOWER DISPLAY = CONTROL

Press [FUNC] until

UPPER DISPLAY = Select one from below:
- 1 ONLY - 1 set of tuning constants or
- 2 KEYBD - 2 sets, keyboard selectable or,
- 2 PVSW - 2 sets, automatic switchover at PV value
- 2 SPSW - 2 sets, automatic switchover at SP value

LOWER DISPLAY = PIDSETS

Press [▲] or [▼] to select the type of PID SET

Set Switchover Value

If you select 2 PVSW or 2 SPSW, you must set the value at which the sets will switchover.

Press [FUNC] until

UPPER DISPLAY = the switchover value
LOWER DISPLAY = SW VALUE

Press [▲] or [▼] to set the switchover value

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Two Set of Tuning Constants (continued)

PROCEDURE (continued)

Set Tuning Constant Values for Each Set

Press [SET UP] until

UPPER DISPLAY = SET UP
LOWER DISPLAY = TUNING

Press [FUNC] to successively display the following constants:

UPPER DISPLAY = the tuning constant value
LOWER DISPLAY = PROP BD or GAIN
RATE ("MIN" or "RPM"*)
RSET
PROP BD2 or GAIN2
RATE2 ("MIN" or "RPM"*)
RSET2

*Select under "CONTROL" group.

Press [▲] or [▼] to change the value for any of the above lower display prompts.

*Switch between Two Sets via the Keyboard (without automatic switchover)***

Press [LOWR DISP] until

UPPER DISPLAY = the PV value
LOWER DISPLAY = PIDSET 1 or
PIDSET 2

Press [▲] or [▼] to change PID SET 1 to PID SET 2 or vice versa.

You can Auto Tune for both sets (see page 4-22).

**Only operational if 2 PID SETS was configured under "CONTROL" group.

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Alarm Set Points

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

The alarm is de-energized when the value goes into the allowed region by more than the hysteresis (Set Up Group — "ALARMS," Function Prompt "AL HYST").

The relay contacts can be configured for normally open (open with power off) or normally closed by jumper selection (see configuration section).

The alarm set point values are for each of the four alarm set points.

The type and state of each alarm was configured at Set Up Group Prompt "ALARMS," Function key prompts "AXSX H L" and "AXSXTYPE."

PROCEDURES

Displaying the Alarm Set Point Values

Press [SET UP] until

UPPER DISPLAY = SET UP
LOWER DISPLAY = ALARMS

Press [FUNC]

UPPER DISPLAY = the alarm set point value
LOWER DISPLAY = A1S1 VAL (alarm 1 set point 1)

Press [FUNC] three more times to successively display the other set points and their values.

UPPER DISPLAY = the alarm set point value
LOWER DISPLAY = A1S2 VAL (alarm 1, set point 2)
then,
A2S1 VAL (alarm 2, set point 1)
then,
A2S2 VAL (alarm 2, set point 2).

Changing the Value

Press [▲] or [▼] to change any alarm set point value in the upper display.

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Alarm Set Points (continued)

REFER TO THE CONFIGURATION SECTION IN THIS MANUAL TO DISPLAY OR CHANGE THESE ASSOCIATED ALARM SELECTIONS.

	Set Up Group Prompt	Function Prompt
Alarm Types	"ALARMS"	"A1S1TYPE" "A1S2TYPE" "A2S1TYPE" "A2S2TYPE"
Alarm State	"ALARMS"	"A1S1 H L" "A1S2 H L" "A2S1 H L" "A2S2 H L"
Alarm Hysteresis	"ALARMS"	"AL HYST"

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Autotune

Introduction

Autotune automatically calculates Gain (PB), Rate (Derivative), and Reset (Integral) Time (PID) tuning constants on demand. These tuning constants are calculated at the end of the Autotune procedure based on the output step introduced onto the process. An output step causing an approximate 4.0% change in PV will be automatically generated when autotune is performed using the Auto step approach. If you select the manual set approach, you must select a specific output step size in % that will be large enough to result in at least a 2.5% PV change. These constants, once calculated, are automatically entered into the controller memory in their normal locations.

Autotune provides the theoretical PID constants which results in little or no overshoot. This usually provides a conservative Gain value which results in a slower response to insure no overshoot. If faster response is desired and some overshoot can be tolerated, the calculated Gain value can be increased by a factor of 2 or perhaps more. Of course, the process loop must be checked for stability in the Automatic mode.

Alarm 1 is available to protect the process during Autotune. If alarm set point is exceeded during the sampling period Autotune will abort. This eliminates the need to continually monitor the Autotune sequence.

There is a SHORT TUNE feature that lets you obtain approximate tuning constants by prematurely implementing the Autotune calculation before the PV has fully lined out during the Autotune process. This typically results in a different Gain value. However, Rate and Reset Time will be relatively close to the optimum calculated. The only adjustment you may need make is Gain to achieve an acceptable response.

Autotune is most effective when implemented in the region of PV where you plan to operate. Don't Autotune at 900°F if you plan to operate at 1300°F. The process dynamics may be different at different energy levels.

In summary, Autotune and Short Tune can be used as a flexible tool to quickly identify Gain, Rate, and Reset time constants. Further tuning can then be done using these values as a starting point.

IMPORTANT: Autotune will function only when the controller is in a closed loop system. Attempts to Autotune open loop will result in "AT ABORT."

NOTE: • Autotune can be applied to Three Position Step Control.
• A step may be performed in Automatic mode.

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Configuring for Autotune

Before starting Autotune, you must
- enable the Autotune feature,
- select whether you want the controller to generate an output step automatically (A step) or whether you want to enter an output step size manually (M step).
- set alarm 1 to proper type and value to protect process if desired — otherwise set to *NONE* to avoid accidental abort.

PROCEDURE

Enter Configuration Mode

Press [SET UP] until

UPPER DISPLAY = SET UP
LOWER DISPLAY = AUTOTUNE

Enable Autotune and Select Output Step Type

Press [FUNC]

UPPER DISPLAY = DISABL
LOWER DISPLAY = AT ENABL

Press [▲] or [▼] to select the output step type.

UPPER DISPLAY = A STEP (Will generate the output step automatically) or
M STEP (Requires you to manually enter a step size value under prompt "OUT STEP")
LOWER DISPLAY = AT ENABL

Select Output Step Size for M STEP

Press [FUNC] (only if selection M STEP is made).

UPPER DISPLAY = the value of the controller output step size in %
LOWER DISPLAY = OUT STEP

Press [▲] or [▼] to choose an output step in percent that will be applied to the output of the controller when Autotune is initiated.

This step must be large enough to result in a PV change of at least 2.5% of span. This step can be verified by stroking the process in manual mode. Use as large a step as possible.

Range of Setting = −105 to 105% of output.

NOTE: The process can be tuned using either an upscale or downscale step change.

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Configuring for Autotune (continued)

PROCEDURE (continued)

Exit Configuration Mode

Press [LOWR DISP] once to exit configuration mode.

UPPER DISPLAY = the value of the process variable
LOWER DISPLAY = SP and the set point value

Starting Autotune

A Step

In order to start Autotune using A step, simply let the controller PV line out in Manual or Auto mode and press [AUTOTUNE] key. (See "Start Autotune.") If the controller is unable to complete the Autotune procedure in 6 time windows, A step will abort.

M Step

In order to start Autotune in manual step approach, you must

- put the controller into Manual Mode,
- adjust the output,
- adjust the set point to the desired value you want to control at after Autotune,
- press [AUTOTUNE] key (after PV lines out).

M STEP PROCEDURE

Put the Controller into Manual Mode

Press [MAN / AUTO] until "MAN" indicator is ON.

UPPER DISPLAY = the PV value
LOWER DISPLAY = OUT and the output value in percent

Adjust the Output

Press [▲] or [▼] to adjust the output value so that the step change will not take the output beyond the desired zone. This will move the PV (upper display) to a value near the lower end of the normal operating range. Depending on the response time of the process, you may have to wait a while to the PV value to line out. Watch the displays for a stable condition.

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Starting Autotune (continued)

M STEP PROCEDURE (continued)

Adjust the Set Point

Press [LOWR DISP] until

UPPER DISPLAY = the PV value
LOWER DISPLAY = SP and the Set Point value

Press [▲] or [▼] to adjust the set point to the desired PV that you plan to operate at after Autotune is complete.

Start Autotune

Press [AUTO TUNE]

The Autotune algorithm automatically introduces the output step change to the process.

"A" appears in the left side of the upper display to indicate that Autotune is in progress.

UPPER DISPLAY = A and the value of PV
LOWER DISPLAY = SP and the set point value

The algorithm samples the step response of the process until that response has lined out. The line out time depends on the process reaction time. Autotune will abort is no line-out has occurred after 48.54 hours of sampling.

In "Auto Step" if the resultant PV step is less than 2.5% the Auto Tune will abort.

Viewing the Remaining Samples

You can view the remaining number of samples left in the most recently initiated time window. (See next page.)

Press [LOWR DISP] until

UPPER DISPLAY = the current value of the PV
LOWER DISPLAY = SAM and the number of samples counting down in the current time window

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Step Response Sampling

Introduction

When Autotune is initiated, the controller output is stepped changed. The algorithm samples the step response of the process until the response has lined out (PV stabilized). The line-out time depends on the process reaction time.

Time Window

A time window is the time it takes for the algorithm to sample the step-response of the process for line out. The first time window takes 256 PV samples at a rate of one every 1/3 second. The lower display counts down from 256 until it reaches 0 (total time elapsed = 85-1/3 seconds) at which time the algorithm checks for line-out. If line-out has not occurred, another time window takes 128 samples at a rate of one every 2/3 second. The lower display counts down from 128 until it reaches 0 (total time elapsed for two windows = 170-2/3 seconds) and again checks for line-out. If there is no line-out, a third window of 128 samples, at 1-1/3 seconds each, is initiated. As long as there is no line-out, this time windowing will continue 9 more times, each time sampling at a lower rate. See Table 4-1 to determine what time window the controller is displaying. By determining how long one sample takes (column C in table), you can find out what time window the controller is displaying (column A) and how long the time window will last (column D).

For Example: If one sample takes 42-2/3 seconds then the Autotune algorithm is in the #8 time window and will take 91 minutes to complete. At the end of window #8 the total time elapsed for all windows is 3.03 hours. If line-out has not occurred after the 12th window (48.54 hours) the Autotune will abort.

TABLE 4-1—Time Windows

A	B	C	D	E
Window Number	**Total Samples***	**Sampling Time**	**Time for This Window**	**Total Time Window**
1	256	1/3 sec	85-1/3 sec	85-1/3 sec
2	128	2/3 sec	85-1/3 sec	170-2/3 sec
3	128	1-1/3 sec	170-2/3 sec	341-1/3 sec
4	128	2-2/3 sec	341-2/3 sec	11.4 min
5	128	5-1/3 sec	11-1/4 min	22.7 min
6	128	10-2/3 sec	22.7 min	45.5 min
7	128	21-1/3 sec	45.5 min	91.0 min
8	128	42-2/3 sec	91.0 min	3.03 hrs
9	128	85-1/3 sec	3.03 hrs	6.07 hrs
10	128	170-2/3 sec	6.07 hrs	12.14 hrs
11	128	341-1/3 sec	12.14 hrs	24.27 hrs
12	128	682-2/3 sec	24.27 hrs	48.54 hrs

*The lower display indicates the number of samples remaining in the present window number.

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"Short Tune" Feature

Introduction

This feature lets you obtain approximate tuning constants by prematurely implementing the Autotune calculation before the PV has fully lined-out during the Autotune process. This typically results in a different Gain value; however, Rate and Reset time will be relatively close to the optimum calculated value. You can then increase gain by a factor of 2 to 4 until an acceptable stable closed loop response is achieved — all in a short time — without prior process knowledge or trial and error guesswork.

Implementing Short Tune

After implementing the Autotune process, press [AUTO TUNE] key while the controller is sampling the process response. "A" in the upper display will start to blink acknowledging the short tune procedure.

At the end of the time window (when lower display = 0), the Autotune algorithm will calculate constants based on the PV response up to that time if the PV has changed by at least 2.5% span.

Autotune Error Codes

When an error is detected in the Autotune process, the message "AT ABORT" will appear in the lower display. Access function prompt "AT ERROR" to determine what is causing the error.

Refer to Table 4-2 for the definition of the error code and what action to take to correct it.

Access "AT ERROR"

To examine the autotune error code,

Press [SET UP] until

UPPER DISPLAY = SET UP
LOWER DISPLAY = AUTOTUNE

Press [FUNC] until

UPPER DISPLAY = See Table 4-2
LOWER DISPLAY = AT ERROR

Aborting Autotune

To abort Autotune and return to the last previous operation (SP or output level), press [MAN/AUTO] key to abort the Autotune process.

Autotune will abort automatically if alarm 1 set point is exceeded or if A-step requires more than 6 windows.

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TABLE 4-2—Error Codes

Error Code (Upper Display)	Definition	Action to Take
OUTLIM	OUTPUT GREATER THAN HIGH OUTPUT LIMIT OR LESS THAN LOW OUTPUT LIMIT	■ Check the output limits under "Control" function prompts "OUTHILIM" and "OUTLOLIM." See Configuration — Section 3. ■ If you are using a manual step change, reconfigure "OUTSTEP" prompt under AUTOTUNE group. ■ Restart Autotune procedure.
DUPLIM	OUTPUT GREATER OR LESS THAN THE HEAT/COOL LIMITS The step entered cool zone when tuning heat or the step entered heat zone when tuning cool.	■ Reconfigure the step size to fall only within heat or cool zone. Autotune function prompt "OUT STEP." ■ Restart Autotune procedure.
ALARM 1	ALARM 1 LIMIT EXCEEDED Alarm 1 error code will show if you have configured alarm 1 to activate at a value of a parameter such as PV or output and it is exceeded.	■ Check alarm type and limit under "ALARM" function prompts "A1S1VAL" and "A1S1TYPE." ■ Reconfigure smaller step size. ■ Restart Autotune procedure.
LOW PV	PV CHANGE NOT GREATER THAN 2.5% The algorithm has sampled the process step response for a period of time (48.54 hours max) and the Pv has lined out with less than a 2.5% change.	■ Reconfigure to MAN step and use a larger step size "AUTOTUNE" function prompt "OUT STEP." ■ Restart Autotune procedure.
ID FAIL	PROCESS IDENTIFICATION FAILURE Autotune has aborted due to either excessive noise or a step response interruption, or because the process cannot be tuned.	■ Excessive noise – reconfigure larger step size "AUTOTUNE" function prompt "OUT STEP." ■ Step response interruption – make sure interruption is not repeated. – restart Autotune procedure. ■ Untunable process — contact local application engineer.

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TABLE 4-2—Error Codes (continued)

Error Code (Upper Display)	Definition	Action to Take
-I-LIM	RESET LIMITS EXCEEDED The reset value has exceeded high or low limits. The unit will control at high or low limits. Low = 0.02 minutes High = 50.00 minutes	■ Increase or decrease PB or Gain to bring reset within the defined limits. ■ Check the final control element for proper application. ■ Untunable process — contact local application engineer.
-P-LIM	GAIN LIMITS EXCEEDED The Gain value has exceeded high or low limits. The unit will control at high or low limits. Low = 0.1 High = 9999	■ Increase or decrease Reset to bring Gain or PB to within defined limits. ■ Check the final control element for proper application. ■ Untunable process — contact local application engineer.
ABORT	MANUAL ABORT Autotune has been manually aborted.	■ Autotune will abort if the [MAN/AUTO] key is pressed during Autotune.
INPUT 1	INPUT 1 ERROR The process input is outside the 0 to 100% region.	■ Make sure the range and actuation are configured properly. ■ Check the input source.
RAMP	AUTOTUNE ILLEGAL DURING RAMP OR SET POINT PROGRAM	■ Wait until Ramp is complete and restart Autotune.
REM SW	AUTOTUNE IS ABORTED WHEN EXTERNAL SWITCH IS DETECTED	■ Restart Autotune — Do not interrupt with digital input contact closure.

Completing Autotune

When Autotune is complete,

- The calculated tuning parameters are stored in their proper memory location in the controller.
- The UDC 3000 controller will return to automatic mode ("A" indicator ON) and control at the local set point using the newly calculated tuning constants.

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Three Position Step Control Algorithm

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

The Three Position Step Control algorithm provides an output display ("OUT") which is an estimated motor position since the motor is not using any feedback. Although this output indication is only accurate to a few percent, it is "corrected" each time the controller drives the motor to one of its stops (0% or 100%). It avoids all the control problems associated with the feedback slidewire (wear, dirt, noise). When operating in this algorithm, the estimated "OUT" display is shown to the nearest percent (i.e. No Decimal).

In the event that an accurate and repeatable indication in motor position is required, Model 3004's slidewire input can be used to read the motor position and display it on the lower display as "POS" while still operating in the Three Position Step Control mode.

Use the Lower Display key to display the above mentioned parameters.

"POS" = Three Position Step Motor position when the slidewire is connected.

"OUT" = Estimated Three Position Step Motor position when no slidewire exists.

Three additional new features of the improved algorithm are:

1. The controller can use all three modes of control (PID) instead of PI only.
2. Autotune can now be used with Three Position Step control.
3. Three Position Step is an automatic back-up mode to Position Proportional Control if the feedback slidewire signal should fail.

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Restarting After Power Loss

The mode of operation and the set point assumed by the UDC 3000 controller on power-up after a power loss is configurable under "CONTROL" group.

If the power to the controller fails and power is reapplied, the controller goes through power-up tests, then starts up in one of the configurable conditions shown below:

Manual, Local Set Point — The controller returns to manual control mode with the **Local Set Point** displayed.

Automatic, Local Set Point — The controller returns to automatic control mode and will use the Local Set Point for control.

Automatic, Remote Set Point — The controller returns to automatic control mode and will use the Remote Set Point for control.

REFER TO THE CONFIGURATION SECTION IN THIS MANUAL TO SELECT ONE OF THESE CONDITIONS.

SET UP PROMPT	FUNCTION PROMPT
"CONTROL"	"POWER UP"

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Calibration Section 5

Input Calibration

NOTE: Calibrate with unit in case.

Introduction

This section describes the field calibration procedures for input 1 and 2. However, this procedure should only be implemented if the factory calibration of the desired input range is not within specifications. Note that every UDC 3000 controller contains all input actuation ranges fully factory calibrated and ready for configuration to the range by the user. It should not be necessary to recalibrate the controller.

Note: Thermocouple Ranges
In the event recalibration is deemed necessary, calibrate the cold junction first on thermocouple ranges. This may eliminate the error.

Recalibrate input 1 (T/C ranges) after the cold junction recalibration only if necessary.

Note also that the field calibration will be lost if a change in input type configuration is implemented at a later time. The original factory calibration data remains available for later use after a field calibration is performed.

Minimum and Maximum Range Values

Calibrate the UDC 3000 controller for the minimum (0%) and maximum (100%) range values for your particular sensor. If you have a two input controller, calibrate each input separately.

Select the voltage or resistance equivalent for 0% and 100% range values from Table 5-1. Use these values when calibrating the controller.

Table 5-1
Voltage and Resistance Equivalents for 0% and 100% Range Values

	PV Input Range		Range Value	
Sensor Type	**°F**	**°C**	**0%**	**100%**
Thermocouples				
B	105 to 3300	41 to 1815	0 mV	13.763 mV
E	-454 to 1832	-270 to 1000	-9.835 mV	76.358 mV
E (low)	-200 to 1100	-129 to 593	-6.471 mV	44.547 mV
J	0 to 1600	-18 to 871	-0.885 mV	50.059 mV
J (low)	20 to 770	-7 to 410	-0.334 mV	22.397 mV
K	0 to 2400	-18 to 1316	-0.692 mV	52.939 mV
K (low)	-20 to 1000	-29 to 538	-1.114 mV	22.251 mV

Table 5-1 continued next page

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TABLE 5-1 (Continued)
Voltage and Resistance Equivalents for 0% and 100% Range Values

	PV Input Range		Range Value	
Sensor Type	**°F**	**°C**	**0%**	**100%**
NNM NiNiMoly	32 to 2500	0 to 1371	-0.001 mV	71.330 mV
NNM NiNiMoly (low)	32 to 1260	0 to 682	-0.001 mV	31.820 mV
NIC Nicrosil-Nisil	0 to 2372	-17.8 to 1300	-0.461 mV	47.502 mV
R	0 to 3100	-18 to 1704	-0.089 mV	20.275 mV
S	0 to 3100	-18 to 1704	-0.092 mV	17.993 mV
T	-300 to 700	-184 to 371	-5.341 mV	19.095 mV
T (low)	-200 to 600	-129 to 316	-4.149 mV	15.769 mV
W5W26	0 to 4200	-18 to 2316	-0.234 mV	37.066 mV
W5W26 (low)	0 to 2240	-18 to 1227	-0.234 mV	22.277 mV
RTD IEC Alpha = 0.00385 100 ohms	-300 to 900	-184 to 482	25.18 Ω	274.96 Ω
100 ohms	0 to 300	– 18 to 149	93.03 Ω	156.90 Ω
500 ohms	– 300 to 900	– 184 to 482	125.90 Ω	1374.80 Ω
Radiamatic (RH)	1400 to 3400	760 to 1871	0.99 mV	57.12 mV
Linear Milliamps	4 to 20 mA		4 mA	20 mA
Millivolts	0 to 10 mV		0 mV	10 mV
	10 to 50 mV		10 mV	50 mV
Volts	1 to 5V		1V	5V
	0 to 10V		0V	10V

Preliminary Procedures

DISCONNECT FIELD WIRING

Depending on which input (#1 or #2) you are going to calibrate, tag and disconnect any field wiring connected to the input terminals on the rear of the controller.

Input #1 = Terminals 16, 17, and 18
Input #2 = Terminals 10, and 11

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Equipment Needed

- Screwdriver

THERMOCOUPLE INPUTS (ICE BATH)

- A calibrating device with ±0.02% accuracy for use as a signal source.
- Thermocouple extension wire that corresponds with the type of thermocouple that will be used with the controller input.
- Two insulated copper leads for connecting the thermocouple extension wire from the ice baths to the precision calibrator.
- Two containers of *crushed ice*.

THERMOCOUPLE INPUTS (PRECISION RESISTOR)

- A calibrating device with ±0.02% accuracy for use as a signal source.
- Two insulated copper leads for connecting the calibrator to the controller.
- A precision 2000Ω resistor ±0.1% connected across terminals 16(R) and 18(−).

RTD (RESISTANCE THERMOMETER DEVICE)

- A decade box, with ±0.02% accuracy, capable of providing stepped resistance values over a minimum range of 0 to 1400 ohms with a resolution of 0.1 ohm.
- Three insulated copper leads for connecting the decade box to the controller.

MILLIAMPERE, MILLIVOLT, VOLTS, AND RADIAMATIC

- A calibrating device with ±0.02% accuracy for use as a signal source.
- Two insulated copper leads for connecting the calibrator to the controller.
- Place current source at zero *before* switching ON.
- Do not switch current sources OFF/ON while connected to the UDC 3000 input.

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SET UP

THERMOCOUPLE INPUTS (ICE BATH)

- Connect the copper leads to the calibrator.
- Connect a length of thermocouple extension wire to the end of each copper lead and insert the junction points into the ice baths.
- Connect the thermocouple extension wires to the terminals for Input 1. (See Figure 5-1.)

THERMOCOUPLE INPUTS (PRECISION RESISTOR)

- Use the copper leads and connect the calibrator to the rear terminals (Figure 5-2).
- Disconnect the internal cold junction resistor.
- Install a 2000Ω precision resistor across terminals 16 (R) and 18 (—). (See Figure 5-2.)
- Subtract the millivolt value for 68°F (20°C) from the zero and span values for your range (see Table 5-1 for zero and span value) and use the adjusted value when calibrating.

RTD (RESISTANCE THERMOMETER DEVICE)

- Use the copper leads and connect the calibrator to the rear terminals of Input 1. (See Figure 5-3.)

MILLIAMPERE, MILLIVOLT, VOLTS, AND RADIAMATIC

- Use the copper leads and connect the calibrator as shown to the rear terminals for Input 1.
  - Radiamatic, mV, or Volts except 0-10V — Figure 5-4
  - 0 to 10 Volts — Figure 5-5
  - 4 to 20 mA — Figure 5-6

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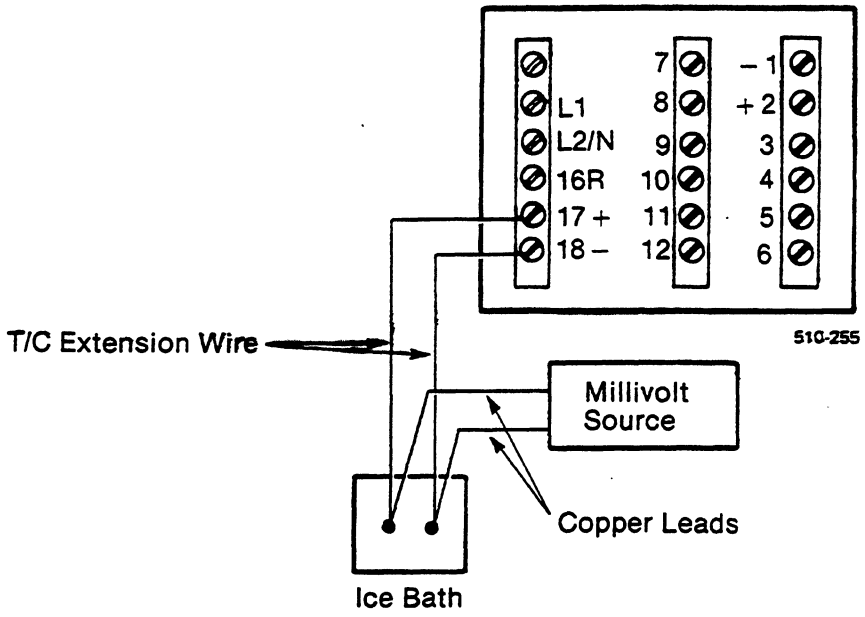


Figure 5-1 Thermocouple Using An Ice Bath

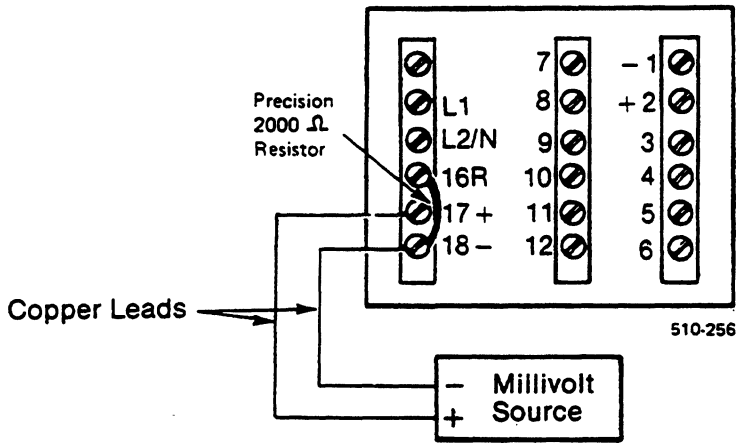


Figure 5-2 Thermocouple Using A Precision 2000Ω Resistor

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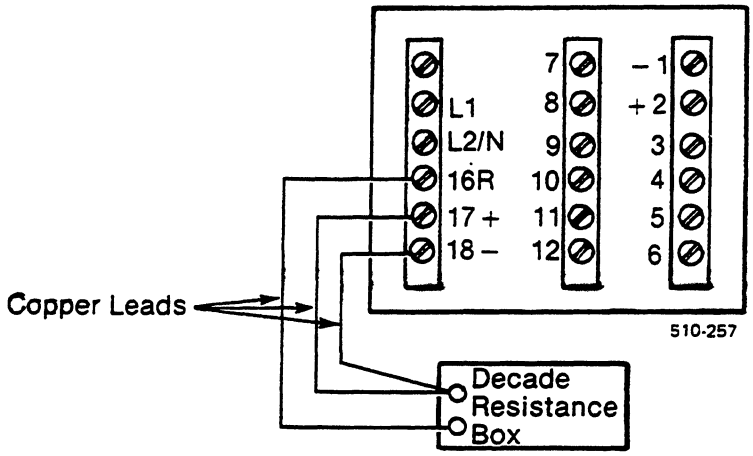


Figure 5-3 Resistance Thermometer Device (RTD)

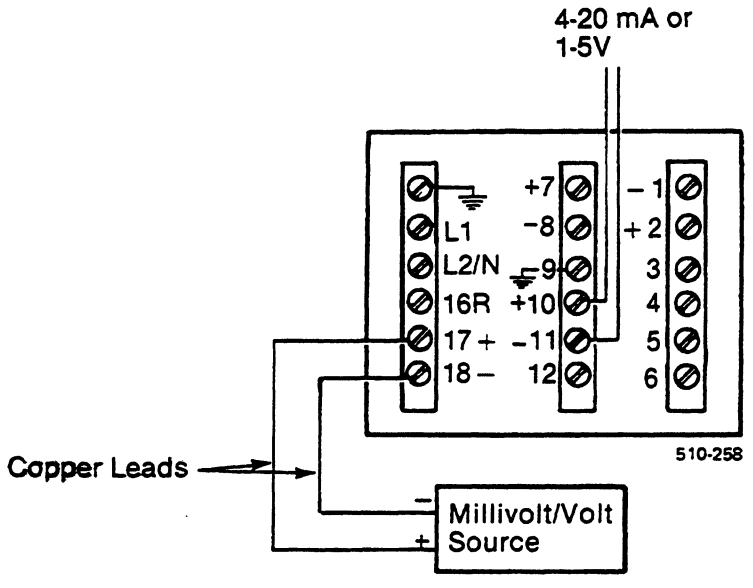


Figure 5-4 Radiamatic, mV, or Volts Except 0-10V

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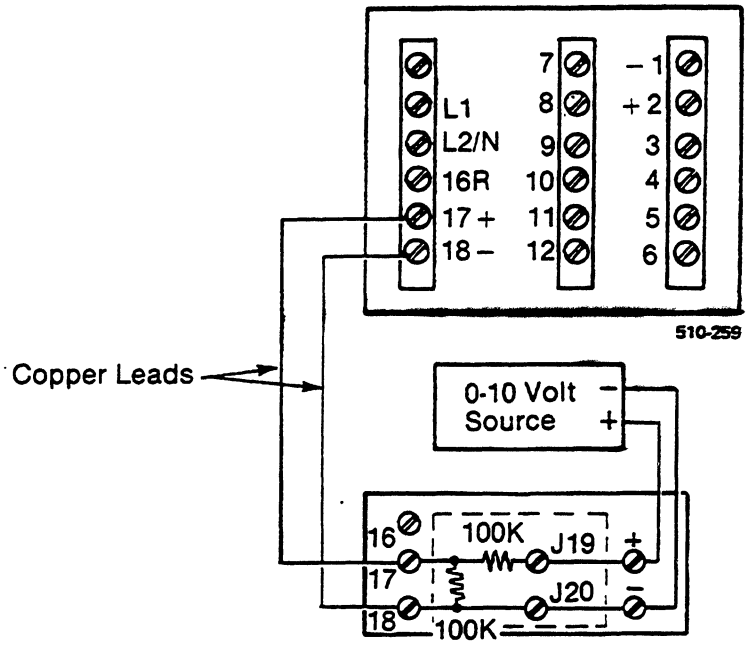


Figure 5-5 0 to 10 Volts Only

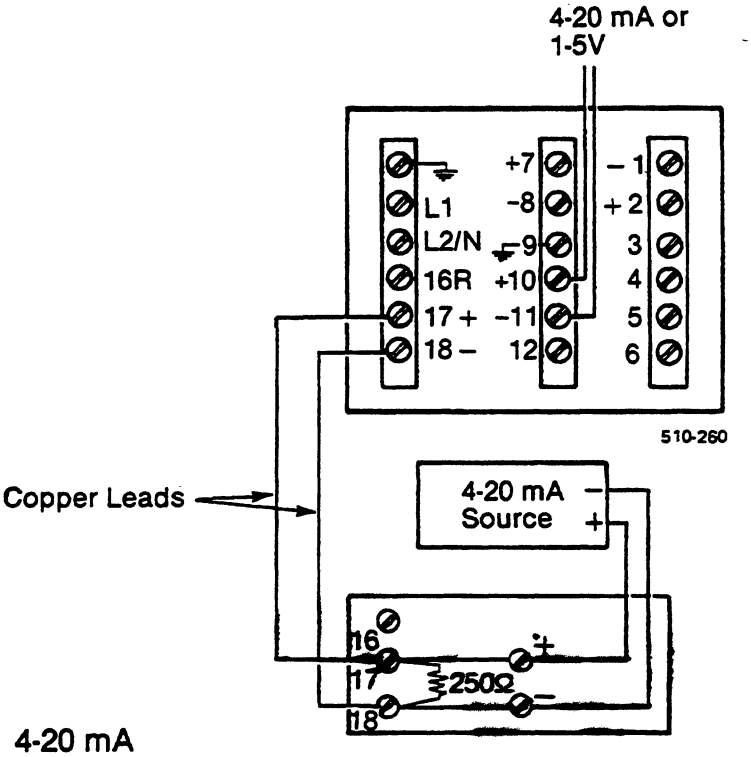


Figure 5-6 4-20 mA

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Input 1 Calibration Procedures

Apply power and allow the controller to warm up for 15 minutes before you calibrate.

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

Please read "SET UP" before beginning the procedure.

PROCEDURE

Enter Calibration Mode

Press [SET UP] until

Upper Display = CALIB
Lower Display = INPUT 1

Press [FUNC]

Upper Display = DISABL
Lower Display = CAL IN1

Press [▲]

Upper Display = BEGIN
Lower Display = CAL IN1

Calibrate 0%

Press [FUNC] until

Upper Display = APPLY
Lower Display = IN1 ZERO
Adjust your calibration device to an output signal equal to the 0% range value for your particular input sensor. (See Table 5-1 for Voltage or Resistance equivalent.)
Wait 30 seconds, then

Calibrate 100%

Press [FUNC] until

Upper Display = APPLY
Lower Display = IN1 SPAN
Adjust your calibration device to an output signal equal to the 100% range value for your particular input sensor. (See Table 5-1 for Voltage or Resistance equivalent.)
Wait 30 seconds, then

Press [FUNC]

The working calibration constants are stored and you go to the next calibration routine.

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Input 1 Calibration Procedures (continued)

Check the Cold Junction Temperature (Thermocouple ranges only)

Press **FUNC** until C-J Temp appears in the lower display

The cold junction temperature will appear only on units with thermocouple inputs.
Upper Display = the cold junction temperature at the rear terminals.
Lower Display = C-J TEMP
The value in the upper display is in tenths of a degree. It is the current reading of the temperature as measured at the thermocouple terminals and recognized by the controller. You can change this value, if it is in error, using the [▲] [▼] keys.

NOTE: When calibrating T/C inputs using a precision resistor, calibrate the cold junction as 68°F (20°C)

Exit Calibration Mode

Press **FUNC** to store the calibration constants and exit calibration mode.

Input 2 Calibration Procedures (Ranges 4 to 20 mA or 1 to 5V only)

Apply power and allow the controller to warm up for 15 minutes before you calibrate.

PROCEDURE

Enter Calibration Mode

Press **SET UP** until

Upper Display = CALIB
Lower Display = INPUT 2

Press **FUNC**

Upper Display = DISABL
Lower Display = CAL IN2

Press **▲**

Upper Display = BEGIN
Lower Display = CAL IN2

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Input 2 Calibration Procedures (continued)

Calibrate 0%

Press **FUNC**

Upper Display = APPLY
Lower Display = IN2 ZERO

Adjust your calibration device to an output signal equal to the 0% range value for your particular input sensor.

Wait 30 seconds, then

Calibrate 100%

Press **FUNC**

Upper Display = APPLY
Lower Display = IN2 SPAN

Adjust your calibration device to an output signal equal to the 100% range value for your particular input sensor.

Wait 30 seconds, then

Press **FUNC**

The working calibration constants are stored and you go to the next calibration routine.

Exit Calibration Mode

Press **FUNC** to store the calibration constants.

Press **LOWR DISP** or **SET UP** to store the calibration constants and exit calibration mode.

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Output Calibration

Current Proportional Output Calibration

INTRODUCTION

Calibrate the controller so that the output provides the proper amount of current over the desired range.

The controller can provide an output current range of 2 to 21 milliamperes and can be calibrated at 4 mA for 0% of output and 20 mA for 100% of output or any other values between 2 and 21 mA.

EQUIPMENT NEEDED

- A standard shop type milliammeter with whatever accuracy is required, capable of measuring 0 to 20 milliamps.

CONNECT CALIBRATOR

- Apply the power and allow the controller to warm up 15 minutes before you calibrate.
- Tag and disconnect the field wiring at the rear of the controller from the following terminals: (See Figure 5-7.)

  Terminals 2 (+) and 1 (−)
- Connect a milliammeter across these terminals.

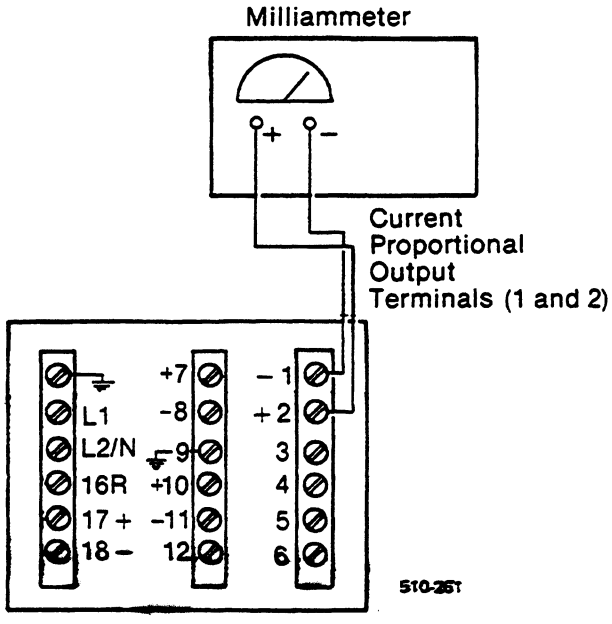


Figure 5-7—Test equipment connections for calibrating current proportional output

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Current Proportional Output (continued)

CALIBRATION PROCEDURE

Enter Calibration Mode

Press [SET UP] until

Upper Display = CALIB
Lower Display = CURRENT

Calibrate 0%

Press [FUNC] until

Upper Display = (a value)
Lower Display = ZERO VAL

Press [▲] or [▼] until

the desired 0% output is read on the milliammeter.
Use Table 1 to find the correct value.

Calibrate 100%

Press [FUNC] to store the minimum value and,

Upper Display = (a value)
Lower Display = SPAN VAL

Press [▲] or [▼] until

the desired 100% output is read on the milliammeter.
Use Table 1 to find the correct value.

Exit Calibration Mode

Press [FUNC] to store the span value.

Press [SET UP] or [LOWR DISP] to exit calibration mode.

Table 1

Reading	4-20 mA Direct	4-20 mA Reverse
0%	4 mA	20 mA
100%	20 mA	4 mA

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Position Proportional and 3 Position Step Output Calibration

INTRODUCTION

When the UDC 3000 controller has a Position Proportional control output, calibrate the controller so that the increase and decrease relays operate properly with respect to the position of the external feedback slidewire.

NOTE: Three Position Step models (DC3004) must have their output calibrated per this entire procedure to ensure the displayed Output (slidewire position) agrees with the actual Final Control Element position.
Three Position Step models (DC3003) only require that the "Motor Time" be entered as shown below. **CALIBRATION IS NOT REQUIRED.**

EQUIPMENT NEEDED

- None

CONNECTIONS

- Leave all field wiring connected to the rear terminals.
- Apply the power and allow the controller to warm up 15 minutes before you calibrate.

CALIBRATION PROCEDURE

Enter Calibration Mode

Press [SET UP] until

Upper Display = CALIB
Lower Display = POS PROP

Set Motor Traverse Time

This is the time it takes the motor to travel from 0 to 100%.

Press [FUNC] until

Upper Display = (a value)
Lower Display = MTR TIME

Press [▲] or [▼] until

the proper motor stroke time is reached (see motor spec or measure the time).

Range of Setting = 5 to 255 Seconds

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Position Proportional Output Calibration (continued)

Select Automatic or Manual Calibration

Select whether you want to calibrate the controller output manually or let the controller calibrate the output automatically.

In automatic calibration mode [i.e., DO AUTO], the controller relays automatically move the motor in the proper direction. If desired, however, the motor may be manually positioned to 0% and 100% positions but, relay wires must be disconnected. In the manual calibration mode [i.e., DO MAN] the motor does not move. Instead the existing 0% and 100% values may be manually changed with the [▲] [▼] keys.

Press [FUNC] until

Upper Display = DISABLE
Lower Display = POS PROP

Press [▲] or [▼] to select automatic or manual calibration

Upper Display = DO AUTO or
DO MAN
Lower Display = POS PROP

NOTE: When calibration is terminated, this selection reverts to DISABL.

DO AUTO

Set 0% Value

Press [FUNC] - Decrement relay turned on to move motor to 0% position

Upper Display = Counts of feedback slidewire (0 to 4095)
Lower Display = ZERO VAL

When the upper display stops counting

Set 100% Value

Press [FUNC] - Increment relay turns on to move motor to 100% position

Lower Display = Counts of feedback slidewire (0 to 4095)
Lower Display = SPAN VAL

When the upper display stops counting, exit the calibration mode by pushing [FUNC] key first, then [SET UP] OR [LOWR DISP] key.

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Position Proportional Output Calibration (continued)

DO MAN

Set 0% Value

Press [FUNC]

Upper Display = The existing zero calibration value in counts
Lower Display = ZERO VAL

Press [▲] or [▼] until

the desired Zero Value is reached in the upper display.

Set 100% Value

Press [FUNC] or

Upper Display = The existing span calibration value in counts
Lower Display = SPAN VAL

Press [▲] or [▼] until

the desired span value is reached in the upper display.

NOTE: For manual calibration, the motor does not move from its position prior to the start of Position Proportional calibration.

Exit Calibration Mode

Press [FUNC] to store the value.

Press [SET UP] or [LOWR DISP] to exit calibration mode

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Auxiliary Output Calibration

INTRODUCTION

Calibrate the controller so that the Auxiliary output provides the proper amount of current and the desired range.

The controller can provide an Auxiliary output current range of 0 to 21 milliamperes and can be calibrated at 4 mA for 0% of output and 20 mA for 100% of output or any other value between 0 and 21 mA.

EQUIPMENT NEEDED

- A standard shop type milliammeter, capable of measuring 0 to 20 milliamps.

CONNECT CALIBRATOR

- Apply the power and allow the controller to warm up one hour before you calibrate.
- Tag and disconnect the field wiring at the rear of the controller from the following terminals. (See Figure 5-8.)
  Terminals 7 (+) and 8 (–)
- Connect a milliammeter across these terminals.

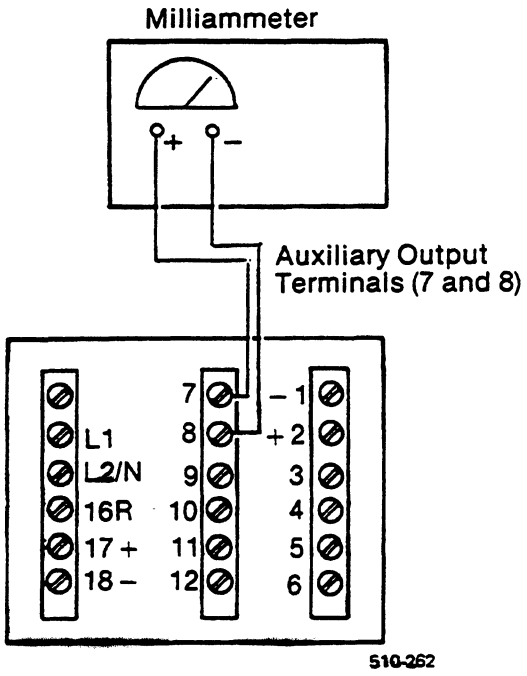


Figure 5-8—Test equipment connections for calibrating auxiliary output

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Auxiliary Output Calibration(continued)

CALIBRATION PROCEDURE

Enter Calibration Mode

Press [SET UP] until

Upper Display = CALIB
Lower Display = AUX OUT

Calibrate 0%

Press [FUNC] until

Upper Display = (a value)
Lower Display = ZERO VAL

Press [▲] or [▼] until

the desired 0% output is read on the milliammeter. (See NOTE.) Use Table 5-2 to find the correct value.

Calibrate 100%

Press [FUNC] to store the minimum value and,

Upper Display = (a value)
Lower Display = SPAN VAL

Press [▲] or [▼] until

the desired 100% output is read on the milliammeter. Use Table 5-2 to find the correct value.

Exit Calibration Mode

Press [FUNC] to store the span value and exit the calibration group.

Table 5-2

Reading	0-20 mA Direct	0-20 mA Reverse	4-20 mA Direct	4-20 mA Reverse
0%	0 mA	20 mA	4 mA	20 mA
100%	20 mA	0 mA	20 mA	4 mA

NOTE: When attempting to achieve 0 mA, always adjust the output to about 0.5 mA, and slowly decrease until the output just goes to zero. Further decrementing will not change the output current (since the circuit cannot produce negative current) but will affect the accuracy of the output by creating a dead zone where no current flows.

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Troubleshooting/Service Section 6

Introduction

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

- **Installation Related Problems —** Read the Installation section in this manual to make sure the UDC3000 has been properly installed. The installation section provides information on protection against electrical noise, connecting external equipment to the controller, and shielding and routing external wiring.

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

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

- **Application Related Problems —** Review the application of the controller; then, if necessary, direct your questions to the local sales office.

- **Hardware and Software Related Problems —** Use the troubleshooting error message prompts and controller failure symptoms to identify typical failures which may occur in the controller. Follow the troubleshooting procedures to correct them.

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Troubleshooting

Error Messages

An Error Message can occur

- at power-up
- during continuous background tests while in normal operation
- when the Status Tests are requested

Table 6-1 below lists all the error message prompts that you may see, the reason for the failure, and under what test group the prompt could appear.

TABLE 6-1 - ERROR MESSAGE PROMPTS

ERROR MESSAGE (Lower Display)	REASON FOR FAILURE	TEST GROUP
C A L T E S T	Calibration Test failure	Power-up or Status
C O N F T E S T	Configuration Test failure	Power-up or Status
E E F A I L	Unable to write to non-volatile memory	Background
F A C T C R C	Factory Calibration Cyclic Redundancy Test	Status
F A I L S A F E	Controller in Failsafe	Power-up, Background, or Status
I N P 1 F A I L	Input 1 unable to make the A/D conversion	Background
I N P 1 R N G	Input 1 Out-of-Range	Background
I N P 2 F A I L	Input 2 unable to make the A/D conversion	Background
I N P 2 R N G	Input 2 Out-of-Range	Background
R A M T E S T	RAM Test failed	Power-up or Status

Refer to tables (6-2, 6-3, or 6-4) under the particular test groups indicated. These tables list the tests, the reason for the failure, and how to correct the problem.

Controller Failure Symptoms

Other failures may occur that deal with the Power, Output, or Alarms. Refer to the controller failure symptoms table to determine what is wrong and the troubleshooting procedures to use to correct the problem.

Check Installation

If a set of symptoms still persists, refer to the installation section of the manual and ensure proper installation and proper use of the controller in the system.

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Customer Support

If you cannot solve the problem using the troubleshooting procedures listed in this section, get model number, serial number, and software version (see below), then

Call Customer Support Phone Number 1-800-423-9883

If it is determined that a hardware problem exists and the controller is within the two year warranty, a replacement controller will be shipped with instructions for returning the defective unit.

Determine the Software Version

Press [SET UP] and scroll through the software prompts until

Upper Display = READ
Lower Display = STATUS

Press [FUNC], you will see

Upper Display = (Software Version Number)
Lower Display = VERSION

Please give this number to the Customer Support person. It will indicate which version of UDC 3000 you have and help them determine a solution to your problem.

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Power-Up

When the controller is powered-up, three tests are run by the UDC3000 software to ensure memory integrity.

As the tests are run, the displays will appear as shown in Table 6-2.

TABLE 6-2

LOWER DISPLAY	UPPER DISPLAY
R A M T E S T	P A S S E D or F A I L E D
C O N F T E S T	P A S S E D or F A I L E D
C A L T E S T	P A S S E D or F A I L E D

If any of these first three tests fail, "FAILED" will appear momentarily in the upper display, then a display test is run, after which the controller will go into Manual mode and the

Upper Display = PV VALUE
Lower Display = FAILSAFE (blinking)

Refer to "Status Test" to determine which tests have failed and how to correct them.

Status Test

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

Press [SET UP] and scroll through software prompts until

Upper Display = READ
Lower Display = STATUS

Press [FUNC] and scroll through software prompts until

Upper Display = NO or YES (YES indicates a failure)
Lower Display = FAILSAFE

Each successive press of the [FUNC] key will display the results of the status tests in the order shown in Table 6-3.

Identify the failure and correct the problem as shown in Table 6-3.

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TABLE 6-3 - STATUS TESTS

Lower Display	Definition	Upper Display	Reason For Failure	How To Correct The Problem
FAIL SAFE	Failsafe Fault	NO YES	No failure Burnout configured for none and inputs fails. —RAM TEST failed —CONFTEST failed —CALTEST failed	1. Step through the rest of the STATUS check to identify the particular failure. See Table 6-4.
RAM TEST	RAM test run at power-up	PASS FAIL	No failure RAM failure	1. Power cycle to see if the error clears.
CONF-TEST	Configuration Checksum	PASS FAIL	No failure Configuration data in controller in error.	1. Step thru STATUS tests-the controller will recalculate the checksum. 2. Check all configuration prompts for accuracy. See the configuration section.
CAL TEST	Working Calibration Checksum	PASS FAIL	No failure Working calibration constants in controller in error.	1. If the controller has not been field calibrated—See the configuration section and change the input type to a different type. Enter it, loop thru status test then return input type to the original. 2. If the controller has been field calibrated — Recalibrate the controller.
FACT CRC	Factory Calibration Cyclic Redundancy Check	PASS FAIL	No Failure Factory set input constants have changed due to the change in input type.	1. Cycle thru STATUS to clear the error. 2. Check calibration — Make sure 0 and 100% are the correct values. See calibration section. 3. Recalibrate. If step 1 is unsatisfactory, always do step 3. — See calibration section.

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Background Tests

The UDC 3000 performs on-going background tests to verify data and memory integrity. If there is a malfunction, an error message will be displayed (blinking) in the lower display.

In the case of more than one simultaneous malfunction, only the one with the highest priority will appear in the lower display. Table 6-4 shows these background tests, their reason for failure, and how to correct the problem.

TABLE 6-4 - BACKGROUND TESTS

Lower Display	Reason For Failure	How To Correct The Problem
E E FAIL	Unable to write to non-volatile memory. Anytime you change a parameter and it is not accepted, you will see E E FAIL.	1. Check the accuracy of the parameter and reenter.
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. Press **[SET UP]** until STATUS appears in lower display. Press **[FUNC]** to see what tests pass or fail, then run through the STATUS codes a second time to see if the error was cleared. Correct according to recommendations given in Table 6-3.
INP1FAIL	Two consecutive failures of input one integration. i.e., cannot make analog to digital conversion.	1. Make sure the actuation is configured correctly. See the configuration section. 2. Make sure the input is correct. 3. Make sure the C/J is connected. 4. Check for gross overranging. 5. Replace the cold junction assembly.
INP2FAIL	Two consecutive failures of input two integration. ie. cannot make analog to digital conversion.	1. Make sure the actuation is configured correctly. See the configuration section. 2. Make sure the input is correct. 3. Check for gross overranging.

(TABLE 6-4 CONTINUED NEXT PAGE)

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TABLE 6-4 - BACKGROUND TESTS (continued)

Lower Display	Reason For Failure	How To Correct The Problem
INP1 RNG	Input 1—out of range The process input is outside the range limits: Out of Range criteria (see note): Linear range: ± 10% out of range Characterized range: ± 1% out of range NOTE: If the range goes outside the criteria listed above, the controller will switch to manual at the configured fail-safe output value.	1. Make sure the range and actuation are configured properly. 2. Check the input source. 3. Go to the configuration section and change the input type to a different type. Enter it, loop through STATUS test then return input to original. 4. Field calibrate—see Calibration.
INP2 RNG	Input 2—out of range The Remote input is outside the range criteria listed under input 1 above.	Same as input 1.
RV LIMIT	The result of the formula shown below is beyond the range of the remote variable. RV = INP2 x RATIO + BIAS	1. Go to "CONTROL" prompt "REMOTE SP SOURCE" and change to "LOCAL SET POINT SOURCE." 2. Use [LOWR DISP] key to view "IN2." 3. Check RV calculation to see if it is outside Input 2 limits. 4. Return to "REMOTE SP SOURCE" when testing is finished.

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Controller Failure Symptoms

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

Compare your symptoms with those shown in Table 6-5 and refer to the troubleshooting procedure indicated to correct the problem.

TABLE 6-5 - Controller Failure Symptoms

<table>
<tr><th>Upper Display</th><th>Lower Display</th><th>Indicators</th><th>Controller Output</th><th>Probable Cause</th><th>Troubleshoot Procedure</th></tr>
<tr><td>Blank</td><td>Blank</td><td>Off</td><td>None</td><td>Power Failure</td><td>1</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><td>2</td></tr>
<tr><td>OK</td><td>OK</td><td>Position Proportional Output</td><td>3</td></tr>
<tr><td>OK</td><td>OK</td><td>Time (Relay Proportional Output</td><td>4</td></tr>
<tr><td>OK</td><td>OK</td><td>Current/Time Proportional Output</td><td>5</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><td>6</td></tr>
<tr><td colspan="4">Display does not function when a key is pushed.</td><td>Keyboard Malfunction</td><td>7</td></tr>
</table>

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 symptoms still persist, refer to the installation section in this manual to ensure proper installation and proper use of the controller in your system.

Equipment Needed

- DC milliammeter xx.xx mA dc
- Calibration sources—T/C, mV, Volt, etc.
- Voltmeter

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Controller Failure Symptoms Troubleshooting Procedures

Procedure 1: Troubleshooting Power Failure Symptoms

What To Do	How To Do It Or Where To Find The Data
1. Check the AC line voltage	1. Use a voltmeter to measure the AC voltage across terminals L1 and L2 on the rear terminal panel of the controller.
2. Make sure the chassis plugs into the rear of the case properly.	2. Withdraw the chassis and visually inspect the controller board and inside of case.
3. Check the voltage selection.	3. See if the J4 connector on the power/input controller board is in the proper position for the voltage being used. See "Hardware Configuration" in the configuration section.
4. Check the system for Brown-outs, heavy load switching, etc.; and conformance to installation instructions.	4. Refer to the installation section.

Procedure 2: Troubleshooting Current Proportional Output Failure Symptoms

What To Do	How To Do It Or Where To Find The Data
1. Make sure the controller is configured for current output.	1. Make Set Up prompt "ALGORTHM", function prompt "OUT ALG" = selection "CURRENT" See the configuration section.
2. Check the field wiring.	2. Must be less than or equal to 1000 ohms.
3. Make sure all the configurable tuning constants, limits and configuration data stored in the controller are correct. Reconfigure if necessary.	3. See the configuration section in this manual to check tuning constant, limit and configuration data and to re-configure.
4. Check the output.	4. Put the controller in Manual mode and [▲][▼] the output from 0 to 100% (4-20mA). Use a DC milliammeter at the rear terminals to verify the output.
5. Recalibrate the current proportional output.	5. See the calibration section in this manual.

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Procedure 3:
Troubleshooting Position Proportional Output Failure Symptoms

What To Do	How To Do It Or Where To Find The Data
1. Make sure the controller has 3 relays and that the position proportional option board is installed.	1. Pull chassis from the case and visually check the boards.
2. Make sure the controller is configured for position proportional output.	2. Make Set Up prompt "ALGORTHM", function prompt "OUT ALG" = selection "POSITN". See the configuration section.
3. Check the field wiring.	3. See the installation section.
4. Check the output.	4. Put the controller in Manual mode and [▲][▼] the output from 0 to 100%.
5. Check whether the motor drives in both directions. If it does, go to step 7.	5. See Position Proportional calibration procedure in the Calibration section for motor slidewire calibration.
6. Check whether the motor drives in either direction. If the motor drives in one direction, check the slidewire. If the motor doesn't drive in either direction, check the motor.	6. See the motor instructions.
7. Check the output voltage to the slidewire.	7. Should equal 1.34 to 1.04 volts. See figure in the installation section for terminal designations. The feedback slidewire output voltage must vary with the valve position.
8. Make sure the output relays are actuating properly. If they aren't, check the field wiring then go to step 6. If they are, go to step 8.	8. Place the controller into manual mode. Vary the output above and below the present value. Listen for the click of the relays. One relay should click when the output is moved higher, and the other should click when the output is moved lower than the present setting. Observe OUT1 or 2 light on the front display.
9. Check the output (control) relay jumper position (W3 and W5).	9. See the configuration section in this manual.
10. Replace the Position Proportional Printed wiring board.	10. Refer to the "Replacement Procedures" portion of this section.
11. Recalibrate the controller.	11. See the calibration section in this manual.

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Procedure 4:
Troubleshooting Single Relay or Dual Relay Output Failure

What To Do	How To Do It Or Where to Find The Data
1. Make sure the controller has 3 relays and that it is configured for Relay output.	1. Make Set Up prompt "ALGORTHM", function prompt "OUT ALG" = selection "TIME" or "TIME D". See the configuration section.
2. Make sure all the configurable tuning constants, limits, and configuration data stored in the controller are correct. Reconfigure if necessary.	2. See the configuration section in this manual to check tuning constant, limit, and configuration data and to re-configure.
3. Check that the applicable output relay actuates properly. If it doesn't, go to step 5. If it does, go to step 4.	3. Place the controller into manual mode. Vary the output to raise and lower the PV around the set point. Listen for the click of the relay as the PV moves in either direction. Observe OUT1 or 2 light on the front display.
4. Check the output (control) relay jumper position.	4. See the configuration section.
5. Check the field wiring	5. See Installation Section for wiring diagrams

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Procedure 5: Troubleshooting Current/Time or Time/Current Proportional Output Failure

What To Do	How To Do It Or Where to Find The Data
1. Make sure the controller is configured for Current/Time or Time/Current output.	1. Make Set Up prompt "ALGORTHM", function prompt "OUT ALG" [5] selection "TI CUR" or "CUR TI". See the configuration section.
2. Make sure all the programmable tuning constants, limits, and configuration data stored in the controller are correct. Reconfigure if necessary.	2. See the configuration section in this manual to check tuning constant, limit and configuration data and re-configure.
3. Check the relay output. Make sure the output relay operates properly. If it does, go to step 4. If it doesn't, check the field wiring, then go to step 5.	3. Place the controller into manual mode. Vary the output to raise and lower the PV around the set point. Listen for the click of the relay as the output moves in either direction. Observe OUT1 or 2 light on the front display.
4. Check the output (control) relay #2 jumper position.	4. See the configuration section.
5. Check the current proportional output.	5. Put the controller into manual mode and [▲][▼] the output from 0 to 100% (4-20mA). Use a DC milliammeter at the rear terminals to verify the output.
6. Recalibrate the controller.	6. See the calibration section.

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Procedure 6: Troubleshooting Alarm Relay Output Failure

What To Do	How To Do It Or Where To Find The Data
1. Check the alarm configuration data. If it's correct, check the field wiring. Reconfigure if required.	1. See the configuration section.
2. Check the alarm relay jumper position.	2. See the configuration section.
3. Check that the applicable alarm relay actuates properly depending on what you have set at prompt "ALARM TYPE". If it does, check the field wiring.	3. If the alarm type is set for PV, place the controller in manual mode. Vary the input to raise and lower the PV around the set point. Listen for a click from the relay as the PV moves in either direction and note that the proper ALM1 or 2 is lit. If the alarm is set for OUTPUT, place the controller in manual mode. Raise or lower the output above or below the value you have set as the alarm set point.

Procedure 7: Troubleshooting Keyboard Failure Symptoms

What To Do	How To Do It Or Where To Find The Data
1. Make sure the keyboard cable is connected properly to the CPU board.	1. Withdraw the chassis from the case and visually inspect the connection.
2. Run the keyboard test.	2. Press [SET UP] and hold in, then press [FUNC] at the same time. The controller will run a display test, then UPPER DISPLAY = KEYS LOWER DISPLAY = TRY ALL Press each key. If it works, the key name will appear in the lower display.
3. Replace the keyboard if necessary.	3. See "Replacing the Keyboard" in this section.

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Replacement Procedures

Replacing The Keyboard (Figure 6-1)

Part No. 30754783-501

EQUIPMENT NEEDED - Flat-bladed screwdriver

PROCEDURE

1. Loosen the screw on the front of the case and pull the chassis out of the case.
2. Stand the chassis up on the front face and use both index fingers (one on each side) to remove the J2 connector from the CPU board.
3. Put a flat-bladed screwdriver into the slots (one at a time) at the rear of the bezel and push on the bracket of the lattice until the keyboard and lattice come off the front. Some upward force on the bottom edges of the lattice will help. (Use flat bladed screwdriver if necessary).
4. Remove the keyboard by slowly pulling the ribbon cable and connector out through the opening at the bottom of the bezel.
5. Thread the ribbon cable for the new keyboard through the hole in the bottom of the bezel and position the keyboard into the front of the bezel.
6. Position the lattice brackets into the bezel and push it until it clicks into place.
7. Connect the J2 connector to the CPU board.
8. Reinstall the chassis into the case and tighten the screw.

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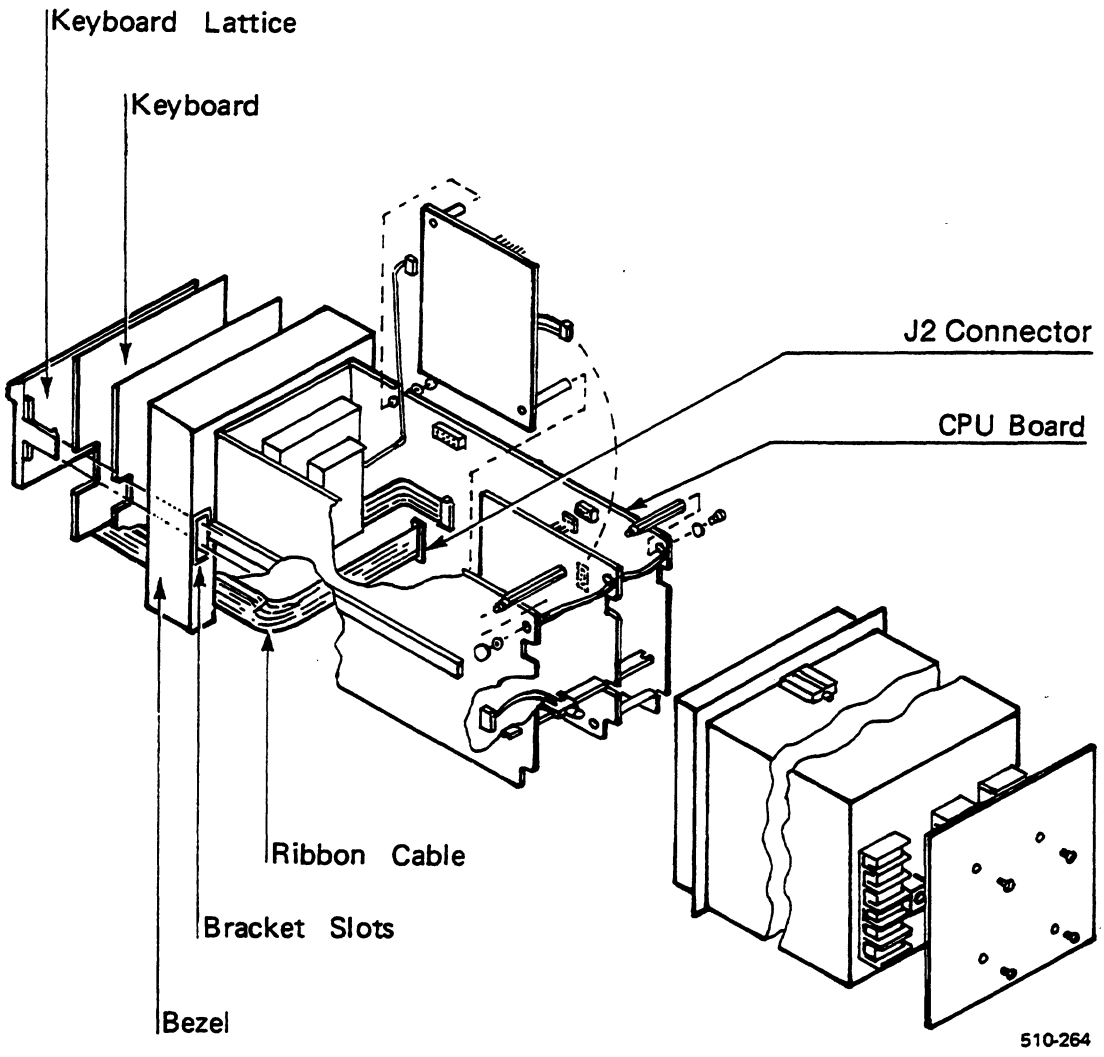


Figure 6-1—Replacing the keyboard

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Replacing The Cold Junction Assembly (Figure 6-2)

Part No. 30754949-501

EQUIPMENT NEEDED - Flat-bladed screwdriver

PROCEDURE

1. Loosen the screw on the front of the case and pull the chassis out of the case.
2. Disconnect the W1/W2 plug on the Input/Power supply printed wiring board and note its location.
3. Disconnect the ground strap at one side.
4. If an option board is present, remove the screw from the standoff on the left side of the rear of the chassis.
5. Separate the two main printed wiring boards and remove and replace the cold junction assembly by squeezing the end of the assembly with the thumb and index finger.
6. Replace the ground strap and the standoff.
7. Replace the plug at the position W1 or W2 as shown below:

INPUT TYPE	C/J PLUG POSITION
T/C	W1
RTD	W2
4-20mA, 1-5V, 0-10mV, 10-50mV, Radiamatic	W1 or W2

8. Reinstall the chassis into the case and tighten the screw.

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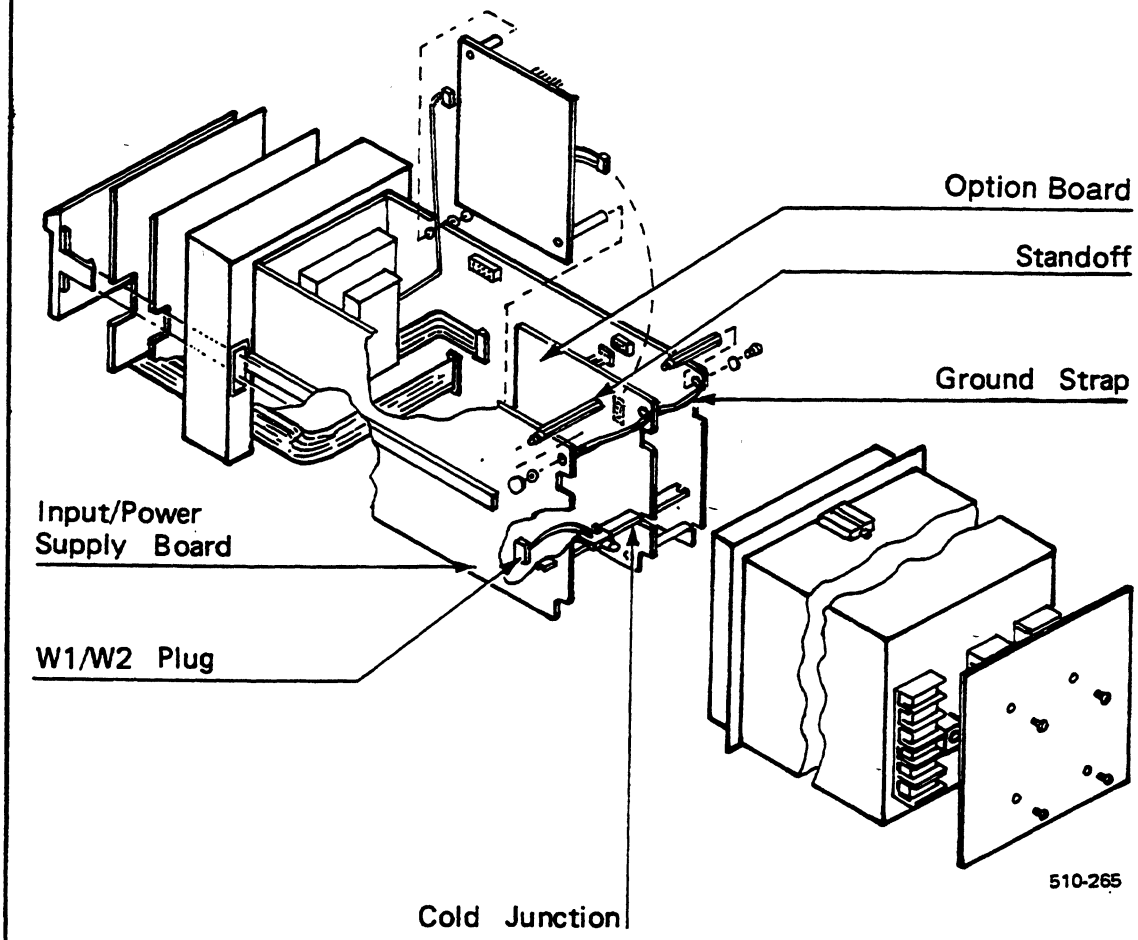


Figure 6-2—Replacing the cold junction assembly

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Replacement Procedures (continued)

Replacing The Position Proportional Output/2nd Input/Interface Board (Figure 6-3)

Part No. 30755161-501 Position Proportional Output Board
30755161-502 2nd Input Board
30755161-503 Interface Board

EQUIPMENT NEEDED - Flat-bladed screwdriver
Phillips head screwdriver

PROCEDURE

1. Loosen the screw on the front of the case and pull the chassis out of the case.
2. The printed wiring board is mounted on the rear of the controller between the CPU board and the power input board. Remove the three (3) screws that hold the board to the CPU board.
3. Unhook the ground strap from the CPU board to the power/input board at the power input board side connector.
4. Unhook the plastic cold junction assembly from the CPU board and Power/Input board.
5. Remove the standoffs that hold the interface board to both the CPU board and the power input board (unscrew the two standoffs from one another).
6. Pull the printed wiring board out of the P7 plug on the CPU board.
7. Remove the J1 (and J2 if there is a 2nd input board) connector from the old printed wiring board and connect it to the new board.
8. Position the new board and push the P7 connector plug on the CPU board.
9. Reassemble the standoffs that hold the interface board to the back of the CPU board and the power/input board (screw the two standoffs) to one another.
10. Replace the plastic cold junction assembly between the CPU board and the Power/Input board.
11. Assemble the standoffs to the CPU board with the three screws removed in Step 2.
12. Hook the ground strap from the CPU board to the power/input board.
13. Reinstall the chassis into the case and tighten the front screw.
14. Power-up and verify the configuration and operation.

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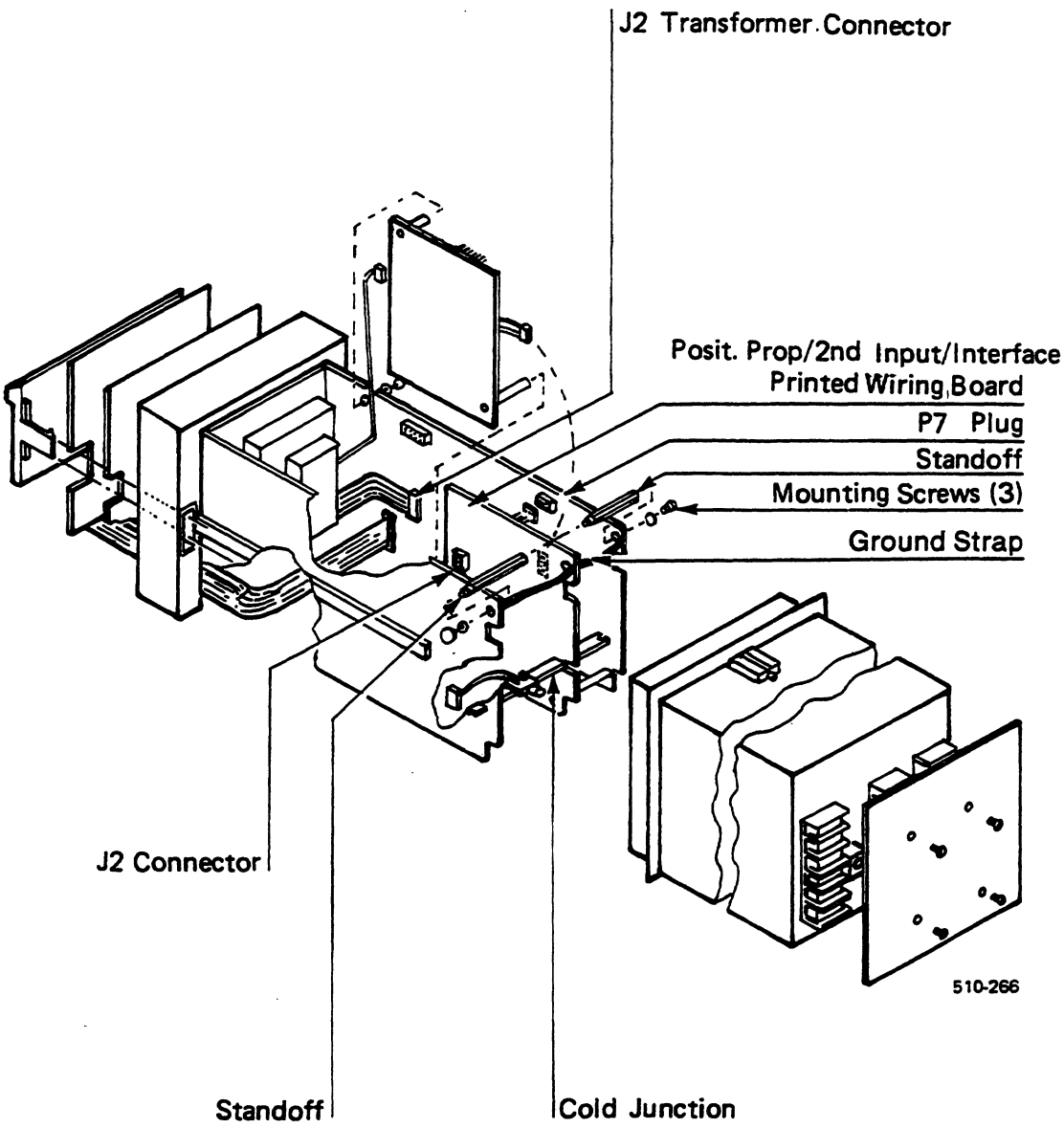


Figure 6-3—Replacing the position proportional output/2nd input/interface board

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Replacement Procedures (continued)

Replacing The Option Printed Wiring Board (Figure 6-4)

Part No. 30754962-501 Communications RS422
30754965-501 Digital Input
30754965-502 Auxiliary Output
30755385-501 Communications DMCS

EQUIPMENT NEEDED - Flat-bladed screwdriver

PROCEDURE

1. Loosen the screw on the front of the case and pull the chassis out of the case.
2. The option printed wiring board is mounted on the CPU board toward the front of the controller. Remove the connector from J1 on the Position Prop/2nd Input/Interface board.
3. Remove the two screws that hold the option board to the CPU board.
4. Pull the option board out of the connector on the CPU board.
5. Remove the transformer connector from J17 on the option board (yellow wire).
6. Reconnect the transformer lead to J17 (yellow wires) to the new board.
7. Push the new board into the connector on the CPU board.
8. Reconnect the plug to J1 of the pos prop/2nd input/interface board.
9. Replace the two screws that hold the option board to the CPU board.
10. Reinstall the chassis into the case and tighten the screw.
11. Power-up the controller and verify the option configuration and operation.

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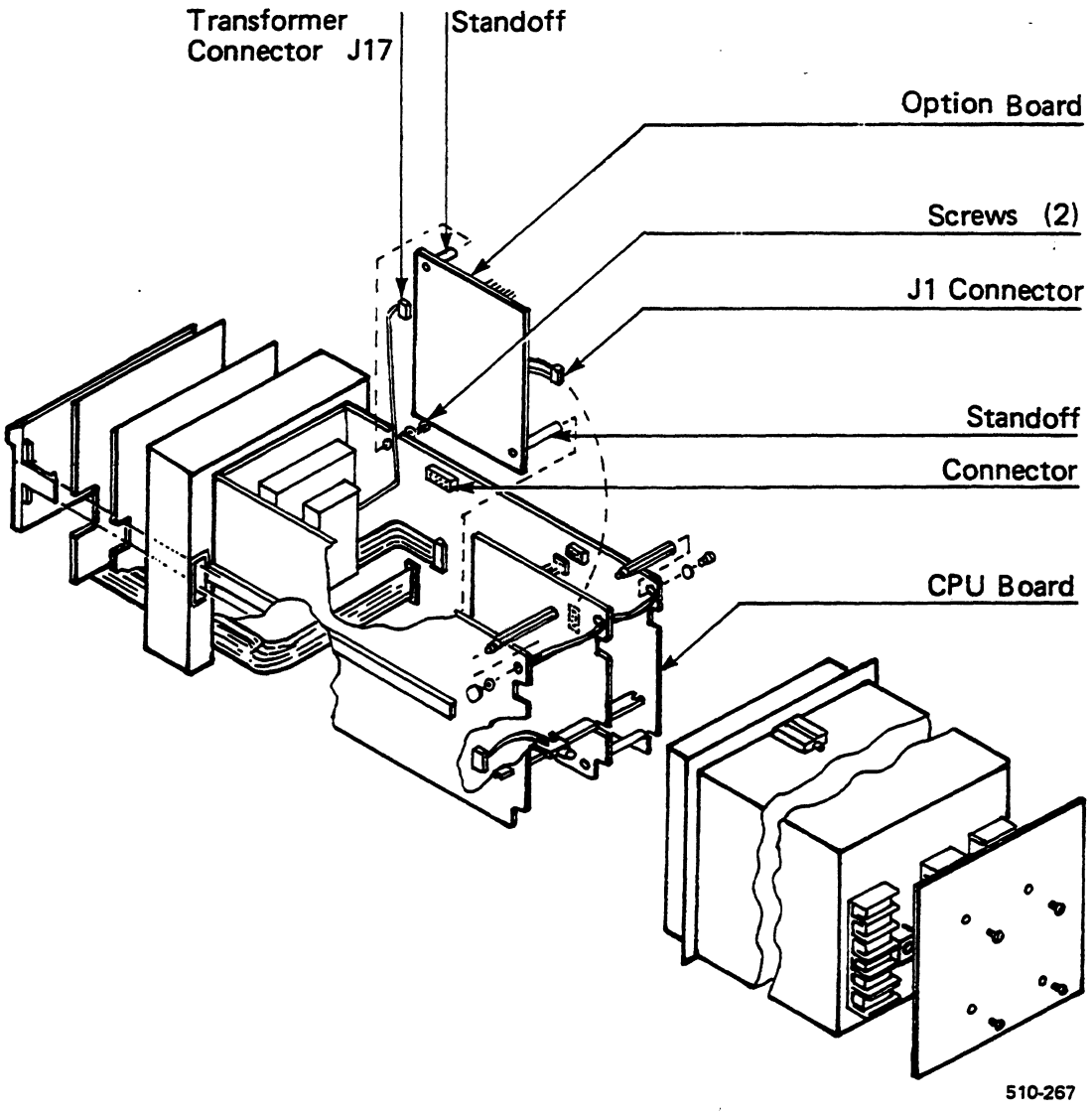


Figure 6-4—Replacing the option board

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Parts List

Section 7

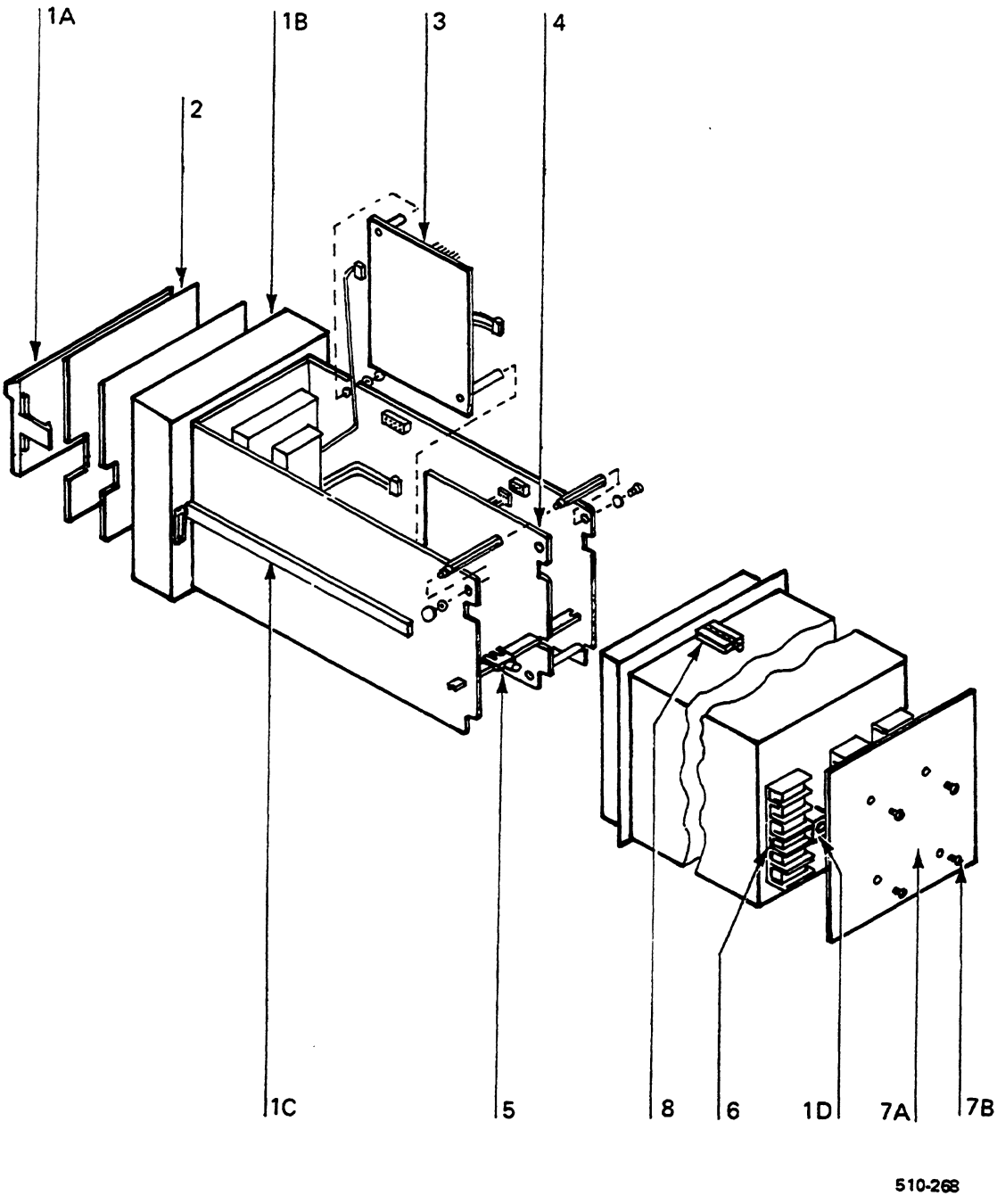


Figure 7-1—UDC 3000 Controller exploded view

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■ Some parts listed below have been grouped into kits. These parts are prefixed by a "K" and identified by the Kit Number.

Key No.	Part Number	Description	Quantity
1A	K30755246-001	Keyboard Lattice	1
1B		Bezel	1
1C		Guide Rail	2
1D		Cold Junction Receptacle	1
2	30754783-501	Keyboard	1
3		Option Printed Wiring Boards	1
	30754962-501	Communications RS422	
	30754965-501	Digital Input	
	30754965-502	Auxiliary Output	
	30755385-501 (see key 4 and 6)	Communications — DMCS	
4		Position Proportional/2nd Input/Interface Printed Wiring Board	1
	30755161-501	Position Proportional Board	
	30755161-502	2nd Input Board	
	30755161-503	Interface Board (required when adding or using any option printed wiring board if position proportional or 2nd input board is not present)	
5	30754949-501	Cold Junction Assembly	1
6	K30755313-001	Terminal Kit (required when adding position proportional, 2nd input, or interface printed wiring board)	1
7A	K30755052-001	Rear Cover Kit	1
7B		Screws for mounting rear cover	4
8	30755050-001	Panel mounting bracket kit (2 brackets)	1

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FIELD UPGRADE PROMS:

30755204-501	Add Autotune	1
30755205-501	Add Autotune and SP Prog.	

Parts Kits Not Shown

30755057-501	Display Assembly	1
30731996-006	4-20 mA Resistor Assembly (250 ohms)	1
30755090-001	0-10 Volt Input Resistor Assembly	1
24400071-001	Surface Mounting Bracket Kit	1
30732481-002	MOV Noise Suppressor (275 ac, 15 Joules)	1
30755223-002	Adaptor Kit for DIN43700 Panel Cutout (5.43" × 5.43") to fit DialaTrol, Barber Coleman 560, and Leeds and Northrup E MAX V cutout — includes mounting hardware.	1
(See Below)	1/4 DIN Adaptor Plates with mounting hardware	1

Part Number	Dimensions				Maximum Cutout			
	Inches		Centimeters		Inches		Centimeters	
	Width	Height	Width	Height	Width	Height	Width	Height
24400104-001	5.25	8.875	13.3	22.5	4.5	8.125	11.4	20.6
24400104-002*	5.4	7.5	13.7	19.0	4.63	6.75	11.7	17.1
24400104-003	8.25	7.25	21.0	18.4	7.5	6.5	19.0	16.5
24400104-004	8.375	8.875	21.3	22.2	7.625	8.125	19.3	20.6
24400104-005	9.875	10.875	25.1	27.6	9.125	10.125	23.1	25.6

*Used to cover UDC 3000 cutout.

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Appendix A Section 8

Introduction

This Appendix provides information for all the user configurable parameters listed in the configuration section. If you aren't familiar with these parameters, this appendix gives you the parameter prompt, the selection or range of setting that you can make, and a definition of how each parameter setting affects controller performance. It will also refer you to any other prompts that might be affected by your selection.

Parameter Groups and Prompts

As shown in the Table of Contents, the information is divided into 10 configuration groups which are accessed by pressing the SET UP key.

Each of these groups contain prompts, viewed in the lower display, which deal with functions that are pertinent to that particular group. These are accessed by pressing the FUNC key.

The selections or values are listed in the upper display. Refer to the Configuration section for step by step instructions.

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Tuning Data

Tuning consists of establishing the appropriate values for the tuning constants you are using so that your controller responds correctly to changes in process variable and set point. You can start with pre-determined values but you will have to watch the system to see how to modify them. Autotune feature automatically selects Gain, Rate, and Reset.

Lower Display	Upper Display
TUNING	SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
PROPORTIONAL BAND 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. $G = \frac{100\%}{PB\%}$ where PB is the proportional band (in %) If the PB is 20%, then the Gain is 5. Likewise, 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%. Defined as "HEAT" Gain on Duplex models for variations of Heat/Cool applications. The selection of Prop. Band or Gain is made in the control parameter group under Prompt "PBorGAIN".	PROP-BD* or GAIN*	0.1 to 999.9
RATE action affects the controller's output whenever the deviation is changing; and affects it more when the deviation is changing faster. Defined as "HEAT" Rate on Duplex models for variations of Heat/Cool applications.	RATE- MIN*	0.08 to 10.00 Minutes 0.08 or Less = Off
RESET adjusts the controller's output in accordance with both the size of the deviation (SP-PV) and the time 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/minute. Defined as "HEAT" Reset on Duplex models for variations of Heat/Cool applications. The selection of minutes per repeat or repeats per minute is made in the control parameters group under Prompt "MINorRPM." **MANUAL RESET** Only applicable if you have control algorithm PD WITH MANUAL RESET. Because a proportional controller will not necessarily line out at set point, there will be a deviation (offset) from set point. This eliminates the offset and lets the PV line out at set point.	RSET-MIN* or RSET-RPM* or MAN RSET**	0.02 to 50.00 0.02 to 50.00 – 100 to + 100 (in % output)

*Used with Control Algorithm "PID-A" or "PID-B"

**Used with Control Algorithm "PD + MR"

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Lower Display Upper Display

TUNING SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
PROPORTIONAL BAND 2 or GAIN 2, RATE 2, and RESET 2 are the same as previously described except that they refer to the cool zone tuning constants on duplex models or the second set of PID parameters, which ever is pertinent.	PROP-BD2* or GAIN 2*	0.1 to 999.9
	RATE2MIN*	0.08 to 10.00 Minutes 0.08 or less = Off
	RSET2MIN* or RST2RPM*	0.02 to 50.00
CYCLE TIME (HEAT) determines the length of one time proportional output relay cycle. Defined as "HEAT" cycle time for Heat/Cool applications.	CYC-SEC	1 to 120 Seconds
CYCLE TIME 2 (COOL) is the same as above except it applies to Duplex models as the cycle time in the "COOL" zone of Heat/Cool applications or for 2nd set of PID constants.	CYC2-SEC	1 to 120 Seconds
LOCKOUT applies to one of the functional groups: Configuration, Calibration, Tuning, or Auto Tune. DO NOT CONFIGURE UNTIL ALL CONFIGURATION IS COMPLETE.	LOCKOUT	
No Lockout—all groups read/write.		NONE
Calibration locked out.		CALIB
Tuning, SP Ramp, and Auto Tune are Read/Write. All other groups are Read only.		+CONF
Tuning and Set Point Ramp parameters are Read/Write. No other parameters are viewable.		+VIEW
Tuning and Set Point Ramp, parameters are available for read only.		MAX

*Used with Control Algorithm "PID-A" or "PID-B"

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Set Point Ramp

A single set point ramp can be configured to occur between the current local set point and a final local set point over a time interval of from 1 to 255 minutes. You can start and stop the ramp using the RUN/HOLD key.*

Lower Display	Upper Display
SP RAMP	SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
SET POINT RAMP - make selection to enable or disable the set point ramp function. Make sure you configure a ramp time and a final set point value.	SP-RAMP	
ENABLE SET POINT RAMP - Allows you to start the set point ramp (in automatic mode).		ENABLE
DISABLE SET POINT RAMP - Disables the set point ramp.		DISABL
SET POINT RAMP TIME - Enter the number of minutes desired to reach the final set point.	TIME-MIN	0 to 255 minutes
SET POINT RAMP FINAL SET POINT - Enter the value desired for the final set point.	FINAL-SP	Within SP limits
SET POINT RAMP/SOAK PROGRAM - Refer to the Operating Data section for definition of prompts.	SP-PROG	

*When you exit from [SET UP] mode, an "H" appears in the left most PV display. This indicates that the set point ramp is enabled but in "Hold". Make sure the controller is in automatic mode and press the [RUN/HOLD] key to change to Run mode and the ramp will begin.

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Auto Tune Data

When initiated on demand, the Auto Tune algorithm measures a process step response and automatically generates the PID tuning constants needed for your process for no overshoot. Perform Auto Tune in manual mode only.

Only applicable on models DC300X-X-XXA-X.

Lower Display	Upper Display
AUTOTUNE	SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
AUTOTUNE ENABLE - allows you to choose autotune disable, an automatic step change, or a manual step change for which you enter an output step size.	ATENABLE	
DISABLE AUTOTUNE - disables the Autotune Function.		DISABLE
AUTOMATIC STEP - lets you perform an Autotune with a step size automatically generated.		A STEP
MANUAL STEP - lets you choose an output step size in percent (%) that will be large enough to result in a PV change. The value of the output step size is selected under function prompt "OUT STEP".		M STEP
OUTPUT STEP SIZE - Choose an output step size in percent (%) that will be applied to the output of the controller when Auto Tune is initiated. This step must be large enough to result in a process variable (PV) change of at least 2.5% of span. This step can be verified by stroking the process in manual mode. Use as large a step as possible. NOTE:The process can be tuned using either an upscale or downscale step change.	OUT-STEP	-100 to +100% OF OUTPUT
AUTOTUNE ERROR - status when an error is detected in the Autotune Process an error prompt will appear.	ATERROR	
NO ERROR		NONE
OUTPUT GREATER OR LESS THAN OUTPUT LIMITS		OUT LIM
OUTPUT GREATER OR LESS THAN HEAT/COOL LIMITS		DUP LIM
ALARM 1 ERROR		ALARM 1
PV NOT GREATER THAN 2.5% AFTER 48 HOURS		LOW PV
IDENTIFICATION PROCESS FAILED		ID FAIL
CALCULATED RESET VALUE BEYOND RESET LIMITS		I LIM
CALCULATED GAIN BEYOND LIMITS OF UDC		P LIM
AUTOTUNE ABORTED VIA AUTO/MANUAL KEY		ABORT
INPUT 1 ERROR		INPUT 1
AUTOTUNE ILLEGAL DURING RAMP OR SP PROGRAM		SP RAMP
AUTOTUNE ABORTED AS EXTERNAL SWITCH DETECTED		REM SW

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Algorithm Data

This data deals with various algorithms in the controller: Control algorithm, Output algorithm, Enabling the second input, or the Current Duplex range.

Lower Display ALGORTHM **Upper Display** SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
The **CONTROL ALGORITHM** lets you select the type of control that is best for your process.	CONT-ALG	
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 set point (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. **DUPLEX ON/OFF** is an extension of this algorithm when the output is configured for Relay Duplex. It allows the operation of a second ON/OFF output. There is a deadband between the switching points of the relays and a hysteresis band for the on and off states of each relay. Both Deadband and Hysteresis are separately adjustable. With no relay action the controller will read 50%.		ON-OFF
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 Set Point). Integral (Reset)—regulates the controller's output proportional 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 A
PID B unlike the PID-A equation, the controller gives only an integral response to a set point 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.		PID B

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	Lower Display	Upper Display
	ALGORTHM	SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
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 not 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 and/or Reset Time to 0. Other prompts affected: "MAN RSET"	CONT-ALG (continued)	PD + MR
The **THREE POSITION STEP CONTROL** algorithm allows the control of a valve (or other actuator), with an electric motor driven by two controller output relays; one to move the motor upscale, the other downscale without a feedback slidewire linked to the motor shaft. The deadband and hysteresis are adjustable in the same manner as the duplex output algorithm. Refer to the Operation section for motor position displays.		3PSTEP
INPUT 2 algorithm allows you to enable or disable the second input.	INPUT 2	ENABLE DISABL
The output algorithm lets you select the type of output you want. Not applicable with Control Algorithm prompt "3 P STEP."	OUT-ALG	
RELAY SIMPLEX – Type of output using one SPDT relay. Its normally open (NO) or normally closed (NC) contacts are selected by positioning an internal jumper. Other prompts affected: "OUT HYST"		TIME
CURRENT SIMPLEX – Type of output using one 2 to 20 mA signal that can be fed into a positive or negative grounded load of 0 to 1000 Ohms. The signal can be recalibrated for any desired range from 2 to 20 mA for 0 to 100% output.		CURRNT
POSITION PROPORTIONAL SIMPLEX – Type of output using two SPDT relays and a motor which has a 100 to 1000 Ohm feedback slidewire. Other prompt affected: "DEADBAND"		POSITN

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Parameter Definition	Lower Display Prompt ALGORTHM	Upper Display Range of Setting or Selection SET-UP
RELAY DUPLEX – Type of output using two SPDT relays. Its normally open (NO) or normally closed (NC) contacts are selected by positioning an internal jumper for each relay. (See Hardware Configuration.) Other prompts affected: "DEADBAND" and "OUT HYST"	OUT-ALG (continued)	TIME D
CURRENT DUPLEX is similiar to current simplex but provides a second current output if Auxiliary output is used. 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. NOTE: Auxiliary Output must be configured for "OUTPUT"		CUR-D
CURRENT/RELAY DUPLEX (RELAY = HEAT) is a variation of duplex with current active for 0 to 50% output (tuning set 2) and relay active 50 to 100% output (tuning set 1) Other prompts affected: "OUT HYST", "4-20 RNG", "DEADBAND"		CUR-TI
CURRENT/RELAY DUPLEX (RELAY = COOL) is similiar to "CUR-TI" except that current is active for 50 to 100% and relay is active for 0 to 50% Other prompts affected: "OUT HYST", "4-20 RNG", "DEADBAND"		TI-CUR
CURRENT DUPLEX RANGE ALGORITHM – Used with Output Algorithm selections "CUR-D", "CUR-TI" or "TI-CUR".	4-20 RNG	
CURRENT DUPLEX RANGE (SPLIT) enables the normal control current output to provide its full 4-20 mA range for 50% output change. This current duplex requires that the Auxiliary output provides cool control. To enable this, the Auxiliary output must be selected for OUTPUT. Other prompts affected: "AUX OUT"		50 PCT
CURRENT DUPLEX RANGE (FULL) enables the normal control current output to provide duplex control over 0-100% of the controller output by providing cool control over 4-12 mA and heat control over 12-20 mA. Auxiliary output is not required for this type of duplex operation.		100 PCT

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Input 1 Data

These are the parameters required for input 1; temperature units, decimal location, actuation, transmitter characterization, high and low range values in engineering units, filter, burnout, and power line frequency.

Lower Display: INPUT 1 **Upper Display:** SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
DECIMAL POINT LOCATION - This selection determines where the decimal point appears in the display.	DECIMAL	
None		XXXX
One Place		XXX.X
Two Places		XX.XX
TEMPERATURE UNITS - This selection will affect the indicator. What display of temperature do you want. Not applicable for Linear or square root characterization.	UNITS	
Degrees Fahrenheit		DEG F
Degrees Celcius		DEG C
None		NONE
INPUT 1 ACTUATION TYPE - This selection determines what actuation you are going to use for input one.	IN1 TYPE	
B thermocouple 105 to 3300°F 41 to 1815°C		B TC
E thermocouple high -454 to 1832°F -270 to 1000°C		E TC H
E thermocouple low -200 to 1100°F -118 to 593°C		E TC L
J thermocouple high 0 to 1600°F -18 to 871°C		J TC H
J thermocouple low 20 to 770°F -7 to 410°C		J TC L
K thermocouple high 0 to 2400°F -18 to 1316°C		K TC H
K thermocouple low -20 to 1000°F -29 to 538°C		K TC L
NNM NiNiMo thermocouple high 32 to 2500°F 0 to 1371°C		NNM TC H
NNM NiNiMo thermocouple low 32 to 1260°F 0 to 682°C		NNM TC L
NIC Nicrosil-Nisil thermocouple 0 to 2372°F -17.8 to 1300°C		NIC TC
R thermocouple 0 to 3100°F -18 to 1704°C		R TC
S thermocouple 0 to 3100°F -18 to 1704°C		S TC
T thermocouple high -300 to 700°F -184 to 371°C		T TC H
T thermocouple low -200 to 600°F -129 to 316°C		T TC L
W thermocouple high 0 to 4200°F -18 to 2316°C		W TC H
W thermocouple low 0 to 2240°F -18 to 1227°C		W TC L
100 Ohm-RTD -300 to 900°F -184 to 482°C		100 PT
500 Ohm-RTD -300 to 900°F -184 to 482°C		500 PT
100 Ohm RTD Low 0 to 300°F -18 to 149°C		100 LO
Radiamatic (RH) 1400 to 3400°F 760 to 1871°C		RADIAM
4 to 20 Milliamps		4-20mA
0 to 10 Millivolts		0-10mV
10 to 50 Millivolts		10-50mV
1 to 5 Volts		1-5V
0 to 10 Volts		0-10V

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Lower Display **Upper Display**

INPUT 1 **SET-UP**

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
TRANSMITTER CHARACTERIZATION - This selection lets you instruct the controller to characterize a linear input to represent a non-linear one. For example: If input 1 is a 4 to 20 mA signal, but the signal represents a type "K" thermocouple; select "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).	XMITTER	
B Type Thermocouple		B TC
E Type Thermocouple High		E TC H
E Type Thermocouple Low		E TC L
J Type Thermocouple High		J TC H
J Type Thermocouple Low		J TC L
K Type Thermocouple High		K TC H
K Type Thermocouple Low		K TC L
NNM NiNiMo Type Thermocouple High		NNM TC H
NNM NiNiMo Type Thermocouple Low		NNM TC L
NIC Nicrosil Nisil Thermocouple		NIC TC
R Type Thermocouple		R TC
S Type Thermocouple		S TC
T Type Thermocouple High		T TC H
T Type Thermocouple Low		T TC L
W Type Thermocouple High		W TC H
W Type Thermocouple Low		W TC L
100 Ohm-RTD		100 PT
500 Ohm-RTD		500 PT
100 Ohm RTD low		100 LO
Radiamatic (RH)		RADIAM
Linear Range		LINEAR
Extracts Square Root		SQROOT
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%. Example: Actuation (Input) = 4 to 20 mA Process Variable = Flow Range of Flow = 0 to 250 Gal/Min High Range display value = 250 Then 20 mA = 250 Gal/Min The control set point will be limited by the range of units selected here.	IN1 HI	-999.9 to 9999

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	Lower Display	Upper Display
	INPUT 1	**SET-UP**

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
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 on previous page. The control set point for Input 1 will be limited by the range of units selected here.	IN1 LO	– 999.9 to 9999
BIAS ON INPUT 1 – Select the bias value you want on input one	BIAS IN1	– 999.9 to 9999
FILTER FOR INPUT ONE – 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 don't want filtering, enter 0.	FILTER 1	0 to 120 Seconds No Filter = 0
BURNOUT PROTECTION (SENSOR BREAK) provides all input types with upscale or downscale protection if the input fails.	BURNOUT	
NO BURNOUT – Failsafe output applied for failed input.		NONE
UPSCALE BURNOUT will make the indicated PV signal increase when a sensor fails, and flash the upper display.		UP
DOWNSCALE BURNOUT will make the indicated PV signal decrease when a sensor fails, and flash the upper display.		DOWN
NOTE: For no Burnout, i.e. "None," to function properly on a linear input, there must be a dropping resistor directly across the *input* terminals (i.e. not remote), then the unit can detect the "zero" voltage that occurs when the 4-20 mA line is opened. Conversely, for **UP** or **DOWNSCALE** burnout to function properly on linear inputs, there must be *no* dropping resistor *directly* on the *input* terminals. This then allows the internally generated burnout signal to drive the open circuited input in the correct direction.		
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.	EMISSIV	0.01 to 1.00
POWER LINE FREQUENCY – select whether your controller is operating at 60Hz or 50Hz.	PWR FREQ	
60 HERTZ		60HZ
50 HERTZ		50HZ

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Input 2 Data

These are the parameters required for input 2; actuation, transmitter characterization, high and low range values in engineering units, filter, and burnout. Only available on models DC300X-X-X1X-X or DC300X-X-X2X-X.

Lower Display: INPUT 2 **Upper Display:** SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
TRANSMITTER CHARACTERIZATION – This selection lets you instruct the controller to characterize a linear input to represent a non-linear one. For example: If input 2 is a 4 to 20 mA signal, but you want the signal to represent a type "K" thermocouple; select "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.	XMITTER	
B Type Thermocouple		B TC
E Type Thermocouple High		E TC H
E Type Thermocouple Low		E TC L
J Type Thermocouple High		J TC H
J Type Thermocouple Low		J TC L
K Type Thermocouple High		K TC H
K Type Thermocouple Low		K TC L
NNM NiNiMo Type Thermocouple High		NNM TC H
NNM NiNiMo Type Thermocouple Low		NNM TC L
NIC Nicrosil Nisil Thermocouple		NIC TC
R Type Thermocouple		R TC
S Type Thermocouple		S TC
T Type Thermocouple High		T TC H
T Type Thermocouple Low		T TC L
W Type Thermocouple High		W TC H
W Type Thermocouple Low		W TC L
100 Ohm – PT. Bulb		100 PT
500 Ohm – PT. Bulb		500 PT
100 Ohm RTD low		100 LO
Radiamatic (RH)		RADIAM
Linear Range		LINEAR
Square Root		SQROOT
INPUT 2 HIGH RANGE VALUE in engineering units is displayed for all inputs but can only be configured for linear or square root actuations only. Scale the #2 input signal to the display value you want for 100%. Example: Same as input one.	IN2 HI	–999.9 to 9999
INPUT 2 LOW RANGE VALUE in engineering units, for linear or Square Root characterization only. Scale the #2 input signal to the display value you want for 0%. Example: Same as input one.	IN2 LO	–999.9 to 9999.
FILTER FOR INPUT TWO – See description on input one.	FILTER 2	0 to 120 Seconds No Filter = 0

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Control Data

The functions listed in this group deal with how the UDC 3000 will control the process including: Number of tuning parameter sets, Set point source, Ratio, Bias, Tracking, Power-up recall, Set point limits, Output direction and limits, Deadband and Hysteresis.

Lower Display **Upper Display**

CONTROL **SET-UP**

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
NUMBER OF TUNING PARAMETER SETS - This selection lets you choose one or two sets of tuning constants (gain, rate, and reset)	PID SETS	
ONE SET ONLY - only one set of tuning parameters is available. Configure the values for: Gain (proportional band) Rate Reset Cycle (if time proportional is used)		1 ONLY
TWO SETS KEYBOARD SELECTABLE - Two sets of tuning parameters can be configured. Press [LOWR/DISP] key to prompt "TUN 1/2" to switch between sets. Configure the values for: Gain — Gain #2 Rate — Rate #2 Reset — Reset #2 Cycle — Cycle #2		2KEYBD
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. 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 Other Prompt affected - SW VALUE		2PV SW
TWO SETS SP AUTOMATIC SWITCHOVER - When the set point is *GREATER* than the value set at prompt "SW VALUE" (Switchover Value), the controller will use Gain, Rate, Reset, and Cycle. When the set point is *LESS* than the value set at prompt "SW VALUE," the controller will use Gain#2, Rate#2, Reset#2, and Cycle#2. Other Prompt affected - SW VALUE		2SP SW
AUTOMATIC SWITCHOVER VALUE - This is the value of Process Variable or Set Point at which the controller will switch from Tuning Constant Set#2 to Set#1.	SW VALUE	VALUE IN ENGINEERING UNITS

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Lower Display Upper Display

CONTROL SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
SET POINT SOURCE - This selection determines what your set point source will be; One local, Remote, or Two local-Key toggled.	SP SOURC	
LOCAL SET POINT - The set point entered from the keyboard.		1LOCAL
REMOTE SET POINT - A signal is brought in through the input 2 terminals and used as the control set point. Ratio and Bias can be applied to the remote set point. Other Prompts affected: RATIO, BIAS		REMOTE
TWO LOCAL SET POINTS - This selection lets you switch between two local set points.		2LOCAL
RATIO - Used when input 2 operates as a remote set point, prompt "REMOTE". This ratio value can be applied to the remote set point. It establishes the correct relationship between the remote set point and the input 2 signal applied according to the formula below . . .	RATIO	– 20.00 to 20.00
BIAS - Used when input 2 operates as a remote set point prompt "REMOTE". Bias, together with ratio, establishes the correct relationship between the remote set point and the input 2 signal applied according to the formula:	BIAS	– 9999 to 9999 Engr. Units

REMOTE SET POINT = (IN2 VALUE – IN2 LO) RATIO + IN2 LO + BIAS

NOTE: IN2 VALUE = Actual (engineering units)
IN2 LO = IN2 LO Scaling (engineering units)

All values must be within configured set point high and low limits.

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Lower Display Upper Display

CONTROL SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
SET POINT TRACKING – Select one of the following:	SP TRACK	
NO TRACKING – If local set point tracking is not configured, the LSP will not be altered when transfer from RSP to LSP is made.		NONE
LSP (LOCAL SET POINT) TRACKS RSP (REMOTE SET POINT) IN RSP – If configured, when the controller transfers out of remote set point, the last value of the remote set point (RSP) is inserted into the local set point.		RSP
POWER UP CONTROLLER MODE RECALL – Restart after power loss. Select one of the below:	POWER UP	
MANUAL, LSP – At power-up, the controller will use *manual* mode with the local set point displayed.		MANUAL
AUTOMATIC, LOCAL SET POINT – At power-up, the controller will return to the *automatic* mode and will use the local set point for control.		A LSP
AUTOMATIC, REMOTE SET POINT – At power-up, the controller will return to the *automatic* mode and will use the remote set point for control.		A RSP
SET POINT HIGH LIMIT* – This selection prevents the local and remote set points from going above the value selected here. The setting must be equal or less than the upper range of input 1 and input 2. Input 2, when configured for remote set point, will be restricted to this upper limit.	SP HILIM	0 to 100% of span Input in engineering units with decimal place
SET POINT LOW LIMIT* – This selection prevents the local and remote set points from going below the value selected here. The setting must be equal or greater than the lower range of input 1 and input 2. Input 2, when configured for remote set point, will be restricted to this lower limit.	SP LOLIM	0 to 100% of span Input in engineering units with decimal place
*The Local Set Point will automatically adjust itself to be within the set point limit range. For example, if SP = 1500 and the SP HI LIM is changed to 1200, the new Local Set Point will be 1200.		

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Lower Display Upper Display

CONTROL SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
CONTROL OUTPUT DIRECTION – What direction do you want the controller output to go when the process variable increases. **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.	ACTION	DIRECT REVRSE
HIGH OUTPUT LIMIT – This is the highest value of output beyond which you do not want the controller automatic output to exceed. Use 0 to 100% for time proportional output type.	OUTHILIM	–5.0 to 105.0% of output
LOW OUTPUT LIMIT – This is the lowest value of output below which you do not want the controller automatic output to exceed. Use 0 to 100% for time proportional output type.	OUTLOLIM	–5.0 to 105.0% of output
CONTROLLER DROPOFF VALUE – Select an output value that below which the controller output will dropoff to the low output limit value set in prompt "OUT LOLIM".	DROPOFF	–5.0 to 105.0% of output
DEADBAND is an adjustable gap between the operating ranges of output 1 and output 2. It is the difference between the nominal trip points of relay 1 and relay 2.	DEADBAND	–5.0 to 25.0% of output
HYSTERESIS (OUTPUT RELAY ONLY) is an adjustable overlap of the ON/OFF states of each relay. This is the difference between the value of the process variable at which the control relay(s) energize and the value at which they de-energize. Only applicable for Position Proportional and ON-OFF control.	OUT HYST	0.0 to 5.0% of PV span
FAILSAFE OUTPUT VALUE – Select the value you want the output to be when power is returned after a power-down. The value used here will also be the output level when you have Communications SHED or when No Burnout is configured and input 1 fails.	FAILSAFE	With the range of output limits

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Lower Display Upper Display

CONTROL SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
PROPORTIONAL BAND UNITS - Select one of the following:	PBorGAIN	
PROPORTIONAL BAND - selects units of percent proportional band for the P term of the PID algorithm.		PB PCT
GAIN selects the unitless term of gain for the P term of the PID algorithm.	PBorGAIN (continued)	GAIN
RESET UNITS - Selects units of minutes or repeat per minutes for the T term of the PID algorithm. 20 Repeats per Minute = 0.05 Minutes per Repeat.	MINorRPM	
REPEATS PER MINUTE - The number of times per minute that the proportional action is repeated by reset.		RPM
MINUTES PER REPEAT - The time between each repeat of the proportional action by Reset.		MIN

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Option Data

Remote Mode Switching and Auxiliary Output options are mutually exclusive. Configure the remote mode switch to a specific contact closure response, or configure the Auxiliary Output to be a specific selection with desired scaling.

	Lower Display	Upper Display
	OPTIONS	**SET-UP**

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
AUXILIARY OUTPUT SELECTION provides an mA output representing any of six control parameters. The display for auxiliary output viewing will be in engineering units for Input 1, Input 2, Process Variable, Deviation, and Set Point. Output will be displayed in percent. Other prompts affected by these selections: "4mA VAL" and "20mA VAL" Only available with Model DC300X-X-2XX-X.	AUX OUT	
NO AUXILIARY OUTPUT		DISABL
INPUT 1 - This represents the configured range of input 1. For example: Type "J" Thermocouple (0 to 1600°F) 0°F display = 0% output 1600°F display = 100% output.		IN 1
INPUT 2 represents the value of the configured range of input 2.		IN 2
PROCESS VARIABLE - Represents the value of the Process Variable.		PV
DEVIATION (PROCESS VARIABLE MINUS SET POINT) - Represents −100 to +100% of the selected PV span in engineering units. For example: Type "T" Thermocouple PV range = −300 to +700°F PV span = 1000°F Deviation Range = −1000 to +1000°F If PV = 500°F and SP = 650°F then Deviation Display = −150°F Auxiliary output = 42.5% NOTE: A deviation of 0°F yields an auxiliary output of 50%.		DEV
OUTPUT - Represents the displayed controller output in percent (%).		OUTPUT
SET POINT - Represents the value of the set point in units of PV.		SP

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Lower Display **Upper Display**

OPTIONS **SET-UP**

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
AUXILIARY OUTPUT LOW SCALING FACTOR - Use a value in engineering units for: Input 1, Input 2, Process Variable, and Set Point. Use value in percent (%) for Output. (Output can be between −5 and +105%.)	4mA VAL	Low Scale Value within the range of the selected variable to represent 4 mA
AUXILIARY OUTPUT HIGH SCALING FACTOR - Use a value in engineering units for: Input 1, Input 2, Process Variable, Deviation,* and Set Point. Use a value in percent (%) for Output. (Output can be between −5 and +105%.) *When Deviation is selected, only one operating parameter will be entered. This value represents the deviation level that will produce 20 mA output. Zero deviation will produce a center scale (12mA) output. A negative deviation equal in magnitude to the Auxiliary Output High Value will produce a low end (4mA) output.	20mA VAL	High Scale Value within the range of the selected variable to represent 20 mA
REMOTE SWITCHING (DIGITAL INPUT) enables remote selection of set point source (local/ remote), and (SP1/SP2), controller mode (manual/ automatic), controller action (direct/reverse). Only available with model DC300X-X-1XX-X.	REM SW	
NO REMOTE SWITCHING		NONE
TO MANUAL - Contact closure puts the controller into manual mode if in Automatic.		TO MAN
TO LOCAL SET POINT - Contact closure puts the controller into local set point if in Remote.		TO LSP
TO LOCAL SET POINT TWO - Contact closure selects set point 2 if in Set Point 1.		TO SP2
TO DIRECT ACTION - Contact closure selects Direct controller action if in Reverse action.		TO DIR
TO HOLD RAMP - Contact closure puts the set point ramp on hold if SP Ramp or SP Program is running. NOTE: Keyboard takes priority over external switch for the RUN/HOLD Function.		TO HOLD

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Communications Data

Lower Display	Upper Display
Com	SET-UP

This option allows the controller to be connected to a host computer via a RS422 or DMCS bus. Fifteen units can be configured over this link. The controller looks for messages from the computer at regular intervals. If these messages are not received within the configured shed time, the controller will SHED from the communications link and return to stand alone operation. The device address, parity, and baud rate are configurable. You can also set the SHED output mode and set point recall, and communication units.

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
RS422 - Allows RS422 communication prompts. **DMCS** - Allows DMCS communication prompts. **DISBAL** -Disables the communications function.	ComSTATE	RS422 DMCS DISABL
COMMUNICATIONS STATION ADDRESS - This is a number that is assigned to a controller that is to be used with the communications option.	Com ADDR	1 to 99 (RS422) 1-31 (DMCS)
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 = No shed. (DMCS only)	SHEDTIME	0 to 255
PARITY pertains to the use of a self-checking code employing binary digits in which the total number of ONE's (or ZERO's) in each permissible code expression is either ODD or EVEN (RS422 only).	PARITY	
ODD PARITY		ODD
EVEN PARITY		EVEN
BAUD RATE is the transmission speed in bits per second (RS422 only).	BAUD	
300 Baud		300
600 Baud		600
1200 Baud		1200
2400 Baud		2400
4800 Baud		4800

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Lower Display **Upper Display**

Com **SET-UP**

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
LOOPBACK (DMCS only) **ENABLE** - Allows loopback test.	LOOPBACK	ENABLE DISABL
SHED MODE - Mode of local control when COM is shed (DMCS only). **LAST** - Same mode as before shed. **TO MAN** - To manual mode. **F SAFE** - To failsafe mode.	SHEDMODE	LAST TO MAN F SAFE
SHED SP - Shed set point (DMCS only). **TO LAST** - Controller will use last SP used. **TO CSP** - Controller will use computer set point.	SHED SP	TO LAST TO CSP
COMMUNICATION UNITS - This selection determines how the controller values are expressed during communications. **PERCENT OF SPAN** **ENGINEERING UNITS**	UNITS	PERCNT ENG

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An alarm is an indication that an event that you have configured (for example—Process Variable) has exceeded one or more alarm limits. There are two alarms available. Each alarm has two set points. You can configure each of these two set points to alarm on one of six separate events. There are two alarm output selections, High and Low. You can configure each set point to alarm either High or Low. These are called single alarms. You can also configure the two set points to alarm on the same event and to alarm both high and low. A single adjustable Hysteresis of 0.0% to 5.0% is configurable for the alarm set point. Only available with models DC300X-1-XXX-X or DC300X-2-XXX-X.

Lower Display	Upper Display
ALARMS	SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
ALARM 1 SET POINT 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 set point has been configured to represent. NO set point is required for Communications SHED. For SP Programming the value is the segment number for which the event applies.	A1S1 VAL	Value in Engineering Units
ALARM 1 SET POINT 2 VALUE - This is the value at which you want the alarm type chosen in Prompt "A1S2TYPE" to actuate. The value depends on what the set point has been configured to represent. NO set point is required for Communications SHED. For SP Programming the value is the segment number for which the event applies.	A1S2 VAL	Value in Engineering Units
ALARM 2 SET POINT 1 VALUE - This is the value at which you want the alarm type chosen in Prompt "A2S1TYPE" to actuate. The value depends on what the set point has been configured to represent. NO set point is required for Communications SHED. For SP Programming the value is the segment number for which the event applies.	A2S1 VAL	Value in Engineering Units
ALARM 2 SET POINT 2 VALUE - This is the value at which you want the alarm type chosen in Prompt "A2S2TYPE" to actuate. The value depends on what the set point has been configured to represent. NO set point is required for Communications SHED. For SP Programming the value is the segment number for which the event applies.	A2S2 VAL	Value in Engineering Units
ALARM 1 SET POINT 1 TYPE - Select what you want Set Point 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 set point programming you can alarm when a segment goes ON or OFF.	A1S1TYPE	
NO ALARM		NONE
INPUT 1		IN1
INPUT 2		IN2
PROCESS VARIABLE		PV
DEVIATION		DEV
OUTPUT		OUTPUT
SHED FROM COMMUNICATIONS		SHED
EVENT ON (SP PROGRAMMING)		EV ON
EVENT OFF (SP PROGRAMMING)		EV OFF

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	Lower Display	Upper Display
	ALARMS	SET-UP

Parameter Definition	Lower Display Prompt	Upper Display Range of Setting or Selection
ALARM 1 SET POINT 2 TYPE - Select what you want Set Point 2 of Alarm 1 to represent. The selections are the same as A1S1TYPE.	A1S2TYPE	Same as A1S1 type
ALARM 2 SET POINT 1 TYPE - Select what you want Set Point 1 of Alarm 2 to represent. The selections are the same as A1S1TYPE. NOTE: Not applicable with Relay Duplex or Position Proportional outputs	A2S1TYPE	Same as A1S1 type
ALARM 2 SET POINT 2 TYPE - Select what you want Set Point 2 of Alarm 2 to represent. The selections are the same as A1S1TYPE. NOTE: Not applicable with Relay Duplex or Position Proportional outputs	A2S2TYPE	Same as A1S1 type
ALARM 1 SET POINT 1 STATE - Select whether you want the alarm type chosen in Prompt "A1S1TYPE" to alarm HIGH or LOW or the beginning or end of a segment in set point Ramp/Soak programming.		
HIGH ALARM	A1SI HL	HI
LOW ALARM	A1SI HL	LO
BEGIN (SP PROGRAMMING)	A1SI EV	HI
END (SP PROGRAMMING)	A1SI EV	LO
ALARM 1 SET POINT 2 STATE - Select whether you want the alarm type chosen in Prompt "A1S2TYPE" to alarm HIGH or LOW or the beginning or end of a segment in set point Ramp/Soak programming).		
HIGH ALARM	A1SI HL	HI
LOW ALARM	A1SI HL	LO
BEGIN (SP PROGRAMMING)	A1SI EV	HI
END (SP PROGRAMMING)	A1SI EV	LO
ALARM 2 SET POINT 1 STATE - Select whether you want the alarm type chosen in Prompt "A2S1TYPE" to alarm HIGH or LOW or the beginning or end of a segment in set point Ramp/Soak programming.		
HIGH ALARM	A2SI HL	HI
LOW ALARM	A2SI HL	LO
BEGIN (SP PROGRAMMING)	A2SI EV	HI
END (SP PROGRAMMING)	A2SI EV	LO
ALARM 2 SET POINT 2 STATE - Select whether you want the alarm type chosen in Prompt "A2S2TYPE" to alarm HIGH or LOW or the beginning or end of a segment in set point Ramp/Soak programming.		
HIGH ALARM	A2S2 HL	HI
LOW ALARM	A2S2 HL	LO
BEGIN (SP PROGRAMMING)	A2S2 EV	HI
END (SP PROGRAMMING)	A2S2 EV	LO
ALARM HYSTERESIS - A single adjustable hysteresis is provided on alarms such that when the alarm is OFF it activates at exactly the alarm set point; when the alarm is ON, it will not deactivate until the variable is 0.0% to 5.0% away from the alarm set point. Configure the hysteresis of the alarms based on INPUT signals as a % of input range span. Configure the hysteresis of the alarms based on OUTPUT signals as a % of the full scale output range.	AL HYST	0.0 to 5.0% of span or full output

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CALIBRATION PARAMETERS GROUP

Calibration Data

The prompts used here are for field calibration purposes. Refer to the Calibration section in this manual for complete information.

Lower Display	Upper Display
CALIB	SET-UP

STATUS GROUP

Status Test Data

The prompts used here are for determining the reason for a controller failure. Refer to the Troubleshooting section in this manual for complete information.

Lower Display	Upper Display
STATUS	READ

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Appendix B Manual Tuning

Section 9

Introduction

When you tune a controller, there are some things to consider:

- Process Characteristics - Gain, Time Constants, etc.
- Desired Response - Minimal overshoot

Basically, controller tuning consists of determining the appropriate values for the Gain, (PB) Rate (Derivative), and Reset (Integral) Time tuning parameters (control constants) that will give the control you want. Depending on the characteristics of the deviation of the process variable from the set point, the tuning parameters interact to alter the controller's output and produce changes in the value of the process variable. Since each parameter responds to a specific characteristic of the deviation, you may not need a combination of all three. It depends on the process characteristics and the desired control response.

You can estimate a starting point and the tuning parameters required to give the desired controller response and with some experience become proficient with this method.

An alternate approach is to rely on a tuning technique. In practice, tuning techniques usually do not give exactly the type of response desired; thus, some final adjustments to the tuning parameters must be made. However, you should at least obtain a reasonable starting point from which the desired response characteristics can be obtained.

The tuning method presented here requires finding the Gain (PB) of a proportional-only controller that will cause the loop to cycle indefinitely with a constant amplitude. This Gain (PB) is called the ultimate (measured) Gain (PB).

- Tune out all rate and reset action, and put the controller into automatic mode,
- Introduce an upset into the loop, and adjust the Gain (PB) until the loop cycles continuously,
- Record the value of Gain or PB and the period of time for one oscillation of the process variable (measured time),
- Determine the setting from the table of formulas given in the procedure.

Controller Tuning Procedures

There are three procedures for tuning the controller:

- Time, Position, or Current proportional simplex control,
- Duplex time or current proportional control
- Two sets of tuning constants for single output operation.

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The suggested procedures describe how to establish and store values of Gain (PB), Rate, and Reset time constants for your process. You must know the type of control and algorithm your controller has.

A graphic recorder (such as Honeywell model DPR, DR 4500, or VP131) connected to the process variable will make it easier to determine when the oscillations are constant and the time for one oscillation. If a recorder is not available, you can use a stop watch to time the oscillation of the process variable displayed on the controller.

Time, Position, or Current Proportional Simplex Control

Procedure

STEP 1

In Manual Mode, adjust the output to bring the PV (Process Variable) near the desired value.

STEP 2

Set Rate time to 0 minutes and set Reset Time to maximum value (50.00 minutes) or set repeats/min to minimum value to minimize Reset action.

If applicable, set CYCLE TIME to 4 seconds and DEADBAND to 0.5.

STEP 3

Increase GAIN (decrease PB) significantly. Try a factor of 10.

STEP 4

Adjust the local set point to equal PV and switch to automatic control mode.

STEP 5

Increase the Set Point by 5 or 10% and observe the process variable response.

STEP 6

If the PV oscillates, continue to the next step. If it doesn't oscillate, return to the original Set Point and increase GAIN (decrease PB) again by a factor of 2, and repeat step 5.

STEP 7

Compare the oscillations with Figure 9-1 shown below.

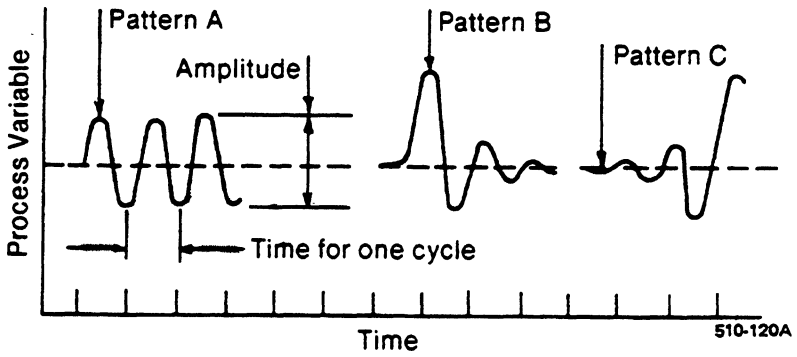


Figure 9-1

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STEP 7 (continued)

- If the oscillation matches pattern A, go to STEP 8.
- If the oscillation matches pattern B, increase GAIN (decrease PB) by a factor of 2 and repeat steps 4 to 6.
- If the oscillation matches pattern C, decrease GAIN (increase PB) by a factor of 0.8 and repeat steps 4 to 6.

  The amplitude of the cycle is immaterial, but all of the elements of the loop must be within the operating range (i.e., the valve must not go full open or full closed).

STEP 8

Record the current value of GAIN (or PB) and measure and record the value of time for one complete oscillation of PV.

STEP 9

Select the proper set of formulas from the Table 9-1. Use the values of GAIN (or PB) and time (in minutes) in the formulas to arrive at the controller's tuning parameters settings.

TABLE 9-1 FORMULAS

	Units	
	GAIN and RESET TIME in $\frac{\text{Minutes}}{\text{Repeat}}$	% PROPORTIONAL BAND and RESET ACTION in $\frac{\text{Repeats}}{\text{Minutes}}$
Proportional (P) only	GAIN = Measured Gain × 0.5 RESET TIME = 50.00 (minimum reset) RATE = 0	% PB = Measured PB × 2 RESET ACTION = 0.02 (repeats/minute) RATE = 0
Proportional + Reset (PI) (No Rate)	GAIN = Measured Gain × 0.45 RESET TIME = $\frac{\text{Measured Time}}{1.2}$ (M/R) RATE = 0	% PB = Measured PB × 2.2 RESET ACTION = $\frac{1.2}{\text{Measured Time}}$ (R/M) RATE = 0
Proportional + Reset + Rate (PID)	GAIN = Measured Gain × 0.6 RESET TIME = $\frac{\text{Measured Time}}{2}$ RATE = $\frac{\text{Measured Time}}{8}$	% PB = Measured PB × 1.7 RESET ACTION = $\frac{2}{\text{Measured Time}}$ RATE = $\frac{\text{Measured Time}}{8}$

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STEP 10
Enter the values of GAIN (or PB), RATE, and RESET in Minutes (or Repeats Per minute) into the UDC 3000 and verify that the PV response is adequate. Make additional trimming adjustments if necessary to fine tune the controller per the guide lines shown below:

TO REDUCE OVERSHOOT - Less Gain (More PB)
Perhaps longer Rate Time

TO INCREASE OVERSHOOT - More Gain (Less PB), perhaps shorter *Rate*
OR time
INCREASE SPEED OR RESPONSE

Time Proportional/Duplex or Current Proportional Duplex Control

For HEAT/COOL applications — When obtaining HEAT tuning parameters, the output must remain above 50%. To obtain COOL tuning parameters, the output must remain below 50%.

The "TUNING" function prompts for HEAT/COOL are:

HEAT	COOL
GAIN	GAIN2
RSETMIN	RSET2MIN
RATEMIN	RATE2MIN
CYCSEC	CYC2SEC

Two Sets of Tuning Parameters for Single Output Operation

You can use two sets of tuning constants for single output types and tune each set separately.

The "TUNING" function prompts for two sets are:

PID SET 1	PID SET 2
GAIN	GAIN2
RSETMIN	RSET2MIN
RATEMIN	RATE2MIN
CYCSEC	CYC2SEC

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Appendix C Section 10

How to Apply Digital Instrumentation In Severe Electrical Noise Environments

Introduction

Products which incorporate digital technology provide recognized performance advantages over conventional analog instrumentation used for process control. These advantages can result in better product uniformity and greater overall efficiency when used correctly.

There are, however, certain guidelines regarding installation and wiring which must be carefully followed in order to achieve this performance. In addition to the traditional precaution of the separation of signal and power wiring in separate conduits, other measures must be taken to minimize the effects of electromagnetic interference (EMI) and radio frequency interference (RFI) on the operation of the equipment. Otherwise, if high level, short duration, noise spikes are permitted to enter the digital equipment, the noise can be transferred into the system's logic networks and can be misinterpreted as signal data, resulting in erroneous system operation and other unpredictable responses.

Potential Noise Sources

Noise can enter electronic equipment via three methods of coupling, namely:

- capacitive (or electrostatic)
- inductive (or magnetic)
- impedance

Capacitive and inductive coupling have the same essential effect — they couple current or voltage, without any actual connection of the two circuits. Impedance coupling requires a connection between the two circuits.

Typical noise-generating sources that could affect electronic equipment through capacitive and inductive coupling include:

- Relay coils
- Solenoids
- AC power wires — particularly at or above 100 Vac
- Current carrying cables
- Thyristor field exciters
- Radio frequency transmissions

Impedance couple noise may enter by way of the lines used to power the digital equipment or by way of improper grounding. Most power lines, at typical industrial locations, are far from noise-free. The noise on them can be generated in many ways, but are nearly always associated with switching circuits of some nature.

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Potential Noise Sources (Continued)

These include:

- large relays
- contactors
- motor starters
- business and industrial machines
- power tools
- HID (High Intensity Discharge) lights
- Silicon Controlled Rectifiers (SRCs) that are phase angled fired.

These devices generate noise by lowering the line voltage during energization when large currents are drawn for short periods of time.

Prevention of Noise Interference

There are three ways to prevent electrical noise from interfering with the operation of the electronic digital equipment. One is to suppress the noise at its source. This is the most effective but also the most difficult because it is not easy to identify all of the potential noise sources in a typical industrial installation. Therefore "suppression" is usually a last resort for those extreme situations where the other methods are insufficient by themselves.

The second method is to prevent noise from getting on the signal and power lines that are connected to the equipment. This is achieved by proper separation and shielding of those lines. In some cases separate power lines or special power line regulation or filtering may be required for satisfactory electronic digital equipment operation. It is the responsibility of the installer to follow good wiring practices.

The third method is to design the digital equipment with a high degree of noise rejection built-in. This includes housing the equipment in a case that will provide shielding, liberal use of noise rejection filters and opto-isolators, and the use of noise suppressors on potential noise sources within the equipment itself. This, of course, is the responsibility of the manufacturer who usually performs extensive laboratory and field testing of newly designed digital equipment to insure the adequacy of its immunity to noise. As a minimum requirement, the equipment should be able to pass the tests outlined in the IEEE Standard 472-1974 (Surge Withstand Capacity Tests).

RECOMMENDED WIRING PRACTICES

- All wiring must conform to local codes and practices.
- Wires carrying similar types of signals (Table 10-1) may be bundled together, but bundles with different types of signals must be kept separated to prevent inductive or capacitive coupling.
- For distances over five (5) feet, and when shielding is recommended, use a separate metal tray or conduit for each bundle. Where conduits or trays are not practical, use twisted wires with a metal overbraid and provide physical separation of at least one foot.
- Tray covers must be in continuous contact with the side rails of the trays.
- When unlike signal levels must cross, either in trays or conduits, they should cross at a 90-degree angle and at a maximum spacing. Where it is not possible to provide spacing, a grounded steel barrier or grid should be placed between the unlike levels at the crossover points.

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RECOMMENDED WIRING PRACTICES (Continued)

- Trays containing low level wiring should have solid bottoms and sides. Tray covers must be used for complete shielding. Tray cover contact with side rails must be positive and continuous to avoid high reluctance air gaps, which impair shielding. Trays for low level cables should be metal and solidly grounded.
- Wires containing low level signals should not be routed near any of the following:
  - contactors
  - motors
  - generators
  - radio transmitters
  - wires carrying high current that is being switched on and off
- Use a 12-gage (or heavier) insulated stranded wire for the ground connection. Attach it firmly to a proven good earth ground such as a metal stake driven into the ground.
- All shields should be grounded at one end only — preferably the instrument end.

TABLE 10-1 - External Wiring

Wire Function No.	Type	Bundle No.	Are Shielded Twisted Wires Recommended?
	HIGH VOLTAGE	1	NO
1	Line Power		
2	Earth Ground		
3	Line Voltage		
	Digital I/O		
	ANALOG I/O	2	YES
4	Process Variable		
	RTD		
	Thermocouple		
	dc Millivolts		
5	Low Level (<100V)		
	4-20 mA dc		
	1-5 Vdc		
	DIGITAL I/O	3	YES
6	Low Voltage (<100V)		
7	Computer Interface		

POWER SOURCE

The AC power for the digital electronic equipment must be within the voltage and frequency limits specified for that equipment. Attempts to operate outside the specified limits will result in no performance. For those installations where the supply voltage will not stay within the specified limits; a ferro-resonant transformer, for voltage regulation, should be used.

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POWER SOURCE (Continued)

For protection against noise, the AC source for the digital electronic equipment should be independent of all other loads especially when switching loads are involved. For example, it should not provide power for air-conditioning, convenience outlets, lighting, motors, or similar noise generating devices. To obtain electrical isolation (Figure 10-1) a separate transformer is required to supply power to the digital equipment. For additional noise and transient rejection, shielded primary and secondary windings may be required. And if necessary, power line filters may be added to attenuate noise signals that have a higher frequency than the power line frequency.

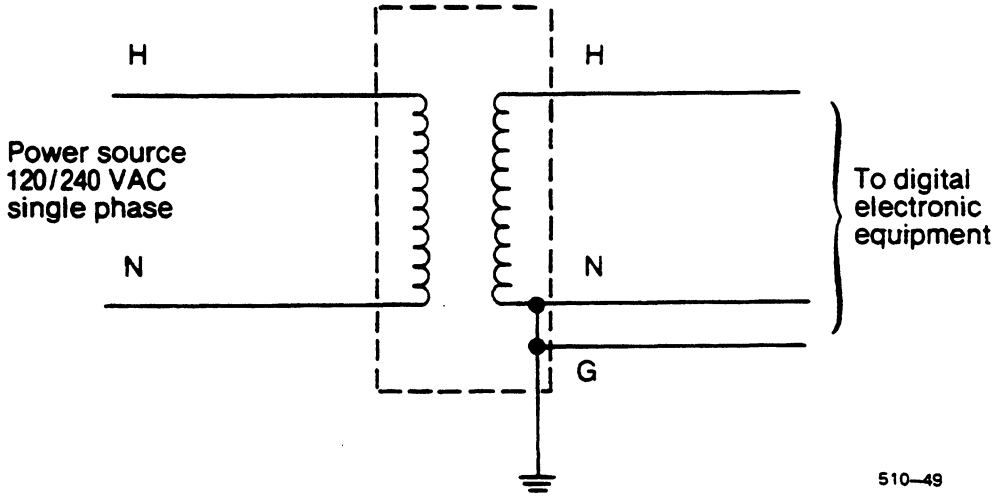


Figure 10-1—Transformer for digital equipment

NOISE SUPPRESSION AT THE SOURCE

Generally speaking, when good wiring practices are used with well designed digital electronic equipment, no further noise protection is necessary. However, in some severe electrical environments, the magnitude of the electrical noise is so great that it must be suppressed at the source. In most control cabinets, the main sources of noise are motor starters, contactors, relays, and switch gear. For this reason, many manufacturers of these devices supply "surge suppressors" which mount directly on the noise source, for example, on the coil of a control relay or motor starter.

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NOISE SUPPRESSION AT THE SOURCE (Continued)

For those devices that do not have accessory "surge suppressors," resistance-capacitance (RC) circuits and/or voltage limiters such as metal varistors may be added when and where needed. This can be broken down into two categories, namely inductive loads (e.g., a relay switch in series with a relay coil) and contacts.

- *Inductive Coils:* Metal Oxide Varistors (MOVs) are recommended for transient suppression in inductive coils. An MOV is connected in parallel with the coil and is as close as physically possible to the coil (Figure 10-2). MOV devices (Table 10-2) are recommended for general purpose applications.

TABLE 10-2 - MOV Devices

Honeywell Part Number	30732481-001	30732481-002
Maximum AC	130V	275V
Energy Pulse Rating	10 Joules	15 Joules
Supplier (General Electric)	V130LA10A	V275LA15A

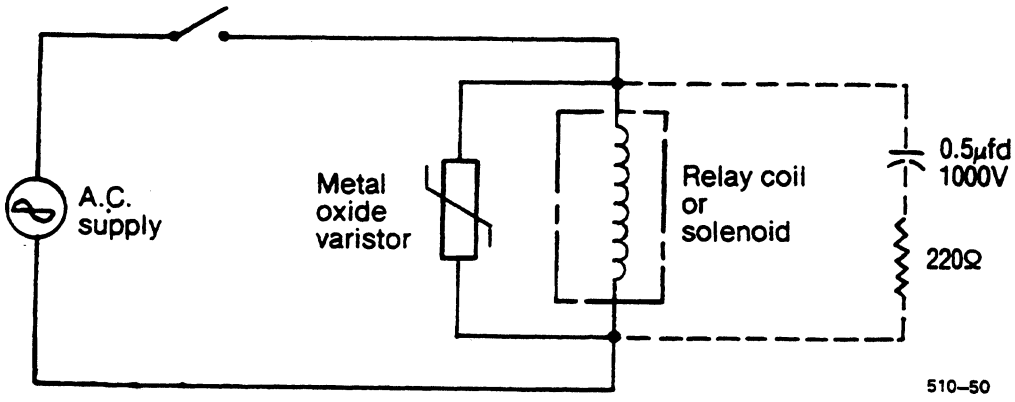


Figure 10-2—Transient suppression in inductive coils

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NOISE SUPPRESSION AT THE SOURCE (Continued)

Additional protection may be provided by adding an RC circuit in parallel with the MOV. This consists of a 220 ohm resistor in series with a 0.5 microfarad, 1000V capacitor. The power rating of the resistor will depend on the voltage rating of the coil (Table 10-3).

TABLE 10-3 - Coil Voltage vs Resistor Voltage Rating

Coil Voltage	Resistor Voltage Rating
115V	1/4 Watt
230V	1 Watt
460V	3 Watt
550V	5 Watt

- *Contacts:* When a contact interrupts an inductive load, a certain amount of energy is stored in the load. An MOV or RC circuit in parallel with the load provides a place where this energy may be dissipated. However, if there is no MOV or RC circuit, the energy may create a visible electrical arc across the open contacts. And this, in turn, results in electrical noise as well as damage to the contacts.

  One way to eliminate this arc is to connect a resistor and capacitor across the contacts (Figure 10-3). A combination of 47 ohms and 0.1 microfarads (1000 Vdc) is recommended for circuits up to 3 amps and 300 Vac. And for voltages above 2000 Vac, an MOV across the contact may be added for extra protection.

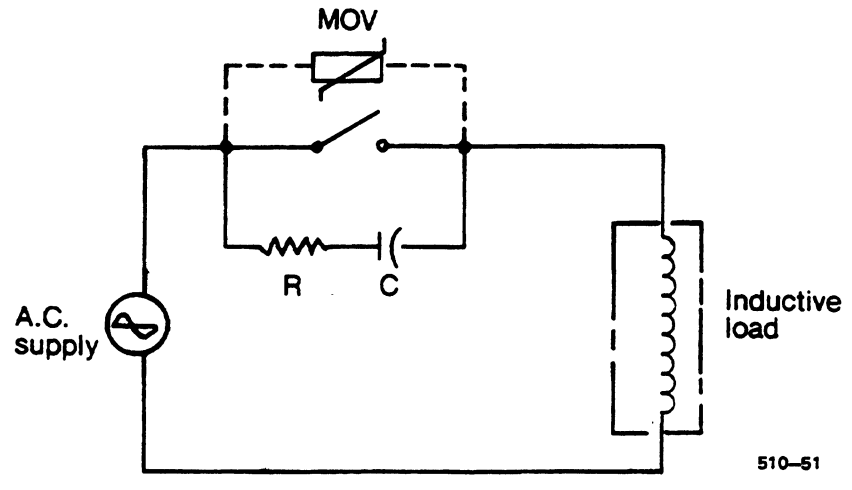


Figure 10-3—Contact noise suppression

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NOISE SUPPRESSION AT THE SOURCE (Continued)

For large load currents, a rule-of-thumb is to size the capacitor so that the number of microfarads equals the number of amperes in the load current, and the resistor is the same value as the load. This objective is to eliminate the visible arc.

Either discreet resistors and capacitors or packaged RC networks may be used. An RC network (47 ohms and 0.1 microfarad) is available from Honeywell as part number 30371852-001. Similar RC networks are available from Electrocube Inc. (part number RG1782-3) and from Industrial Condensor Corporation.

In DC circuits, the power dissipation under steady-state condition can be eliminated by placing a diode (in series with a resistor) in parallel with the load (Figure 10-4). The value of R should be less than or equal to the DC resistance of the inductive load.

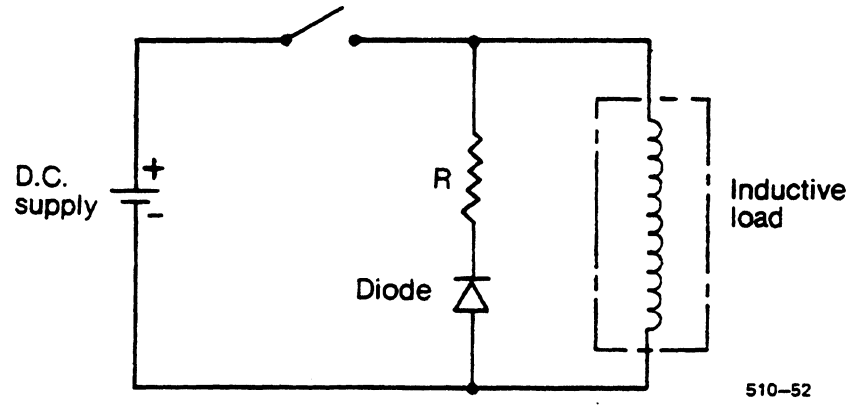


Figure 10-4—DC load noise suppression

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