



Product Information

1261-DB-001-0-00

February, 1994

DEFAULT SECURITY CODES

LEV.1 - 1
LEV.2 - 2
LEV.3 - 3
LEV.4 - 4
LEV.5 - 5

Series 10Q

1/4 DIN Process and Temperature Controller

Key Standard Features:

- 0.3% Accuracy
- 300 millisecond Control Response
- Universal TC, mVDC, VDC & mADC Input
- AT™ Self-Tune
- Auto Comp™ Sensor Break
- Designed to meet IEC IP65 Sealed Front
- Selectable °C or °F
- Loop Break
- Setpoint Ramp
- Selectable Decimal Point
- Pass Code Security
- 8 Large Tactile Feedback Keys
- Second Setpoint and Tuning Constant
- Indicator (no Control Output)



Position Statement

The 10Q is a modern low-cost controller with a short depth (4.2") case, ideal for OEM's, cost-sensitive placements and system upgrade applications.

Introduction

The 10Q is a versatile microprocessor-based 1/4 DIN controller which can be used to display and control temperature, pressure, level and flow variables. Front panel programming allows a single 10Q to meet a wide variety of plant and test facility applications. Thermocouple, mADC, mVDC and VDC inputs can be changed in the field without the addition of hardware or recalibration. Universal input including RTD is offered as an option. Selection of alarm types, scaling, °C or °F, setpoint limits, decimal point location and sensor break response is made from the keypad without having to locate hard-to-find internal jumpers or switches.

Typical applications include:

Furnaces
Ovens
Plastics processing machines
Packaging machinery
Food equipment
Solder lines
Printing equipment
Curing, baking and drying equipment

matic tuning. The new Barber-Colman AT™ Self Tune provides automatic tuning with completely hands-off, no-operator-involved PID tuning at startup. The yellow AT LED glows steadily to indicate that tuning is occurring. The LED turns off when tuning is complete or flashes if tuning is unsuccessful. The AT button can be pressed to cancel tuning depending on the autotuning status. Autotuning incorporates an adaptive tuning oscillation monitor that automatically retunes the controller should conditions change. The oscillation monitor can be turned off once the desired performance is achieved or it can be left on to provide continuous adaptive tuning.

The loop break function provides early warning that something in the control loop has failed. If the controller fails to progress toward setpoint, the LB (Loop Break) LED turns on. The loop break function can also be programmed to one of the optional alarms. The advanced Auto Comp™ sensor break function minimizes process upsets due to sensor break by providing for the selection of a preset manual percentage output or the last stable output when a sensor fails.

Barber-Colman pioneered control technology by introducing the first 1/4 DIN single-loop controller with auto-

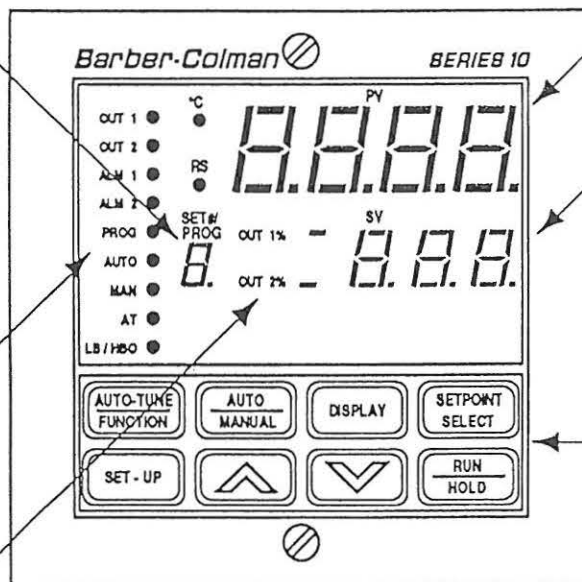
The second setpoint function saves setup time by providing a second setpoint and tuning constants stored in memory and available by pressing the setpoint select

One 7-segment LED (green) shows Tuning Set # (and setpoint) or Ramp Status

Eleven 3 mm diameter LED annunciators:

Out 1 (green)
Out 2 (green)
Alm 1 (red)
Alm 2 (red)
Prog (green)
Auto (green)
Man (yellow)
AT (yellow)
LB/HBO (red)
°C (green)
RS (green)

Out 1% (LED dash)
Out 2% (LED dash)



Four 7-segment LEDs (orange) for process value (PV) display

Four 7-segment LEDs (green) for setpoint value (SV) display

Eight Tactile Keys:
Auto-tune/Function
Auto/Manual
Display
Setpoint Select
Set Up
Up Arrow
Down Arrow
Run/Hold

button. The SET# (Tuning Set number) LED indicates which Tuning Set (and setpoint) is active. The second Tuning Set can also be selected remotely using the optional contact closure input function. Provided as a standard feature is a programmable setpoint ramp up and ramp down function which operates whenever the setpoint is changed. This is helpful in startups and applications where rapid changes cannot be tolerated. Powerup selections allow precise definition of the powerup process so that when power is applied the controller will powerup in either automatic control, a preset percentage or the last condition of automatic or manual control.

10Q options include dual outputs and dual alarms, auto/manual control, two contact closure inputs for remotely selecting controller states (auto/manual, second tuning set, toggle output action, sample and hold, freeze reset, and halt) and a hardware lock function.

Features/Benefits

Low Initial and Total Cost

The 10Q offers rugged construction, a front designed to be sealed to water and dust (IEC IP65), built-in noise immunity that is designed to meet IEC 801-2 for electrostatic discharge and IEC 801-4 for power line noise spikes and inputs and outputs.

Easy Installation

The 4.2 inch panel depth fits virtually all panel sizes. Adapter plates for non-1/4 DIN cutouts are available.

Fast Setup and Configuration

The 10Q is preconfigured by model number. Inputs, outputs and alarm types are preset, which saves valuable setup time. Final setup and configuration are done

from the front using a spreadsheet structure which allows rapid movement from function to function.

Human Engineered

Eight tactile feedback keys provide direct access to important functions such as auto/manual, autotuning, operating displays and setup.

Easy Setpoint Change

Pressing the Up or Down arrow key changes the setpoint.

Color Coded Displays

The dual seven-segment displays and the status LED's conform to IEC guidelines featuring red only for alarm indications.

Scaleable Control Functions

Programmable setpoint limits prevent unsafe changes to setpoints. Programmable output limits can be set from 0% to 100% (105% for analog outputs). All input ranges are scalable to useable high and low limits and DC analog inputs are programmable from -1999 to 9999 with up to 3 decimal places.

Load Line Function

The advanced load line function allows particular load requirements to be matched to the controller's load line setting in order to minimize overshoot at startup.

Flexible Bimodal Heat/Cool Control

Cooling outputs can be programmed for linear, fan or non-linear water cooling.

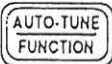
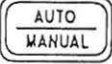
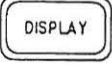
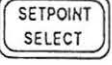
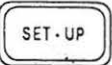
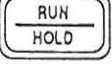
Pass Code Security Lock

The 10Q offers five levels of security using separate 4-digit pass codes. An optional hardware lock provides maximum security.

Status Annunciators

- OUT 1 ● Out 1 (green) is lit when Output 1 is ON
- OUT 2 ● Out 2 (green) is lit when Output 2 is ON
- ALM 1 ● Alm 1 (red) flashes (lit steadily if acknowledged) when Alarm 1 is ON
- ALM 2 ● Alm 2 (red) flashes (lit steadily if acknowledged) when Alarm 2 is ON
- PROG ● Prog (green) is lit when a Ramp/Soak program is running (not presently used)
- AUTO ● Auto (green) is lit when the controller is in the Automatic control mode
- MAN ● Man (yellow) is lit when the controller is in the manual (percent out) control mode
- AT ● AT (yellow) is lit while automatic tuning is taking place; flashes if tuning fails
- LB/HBO ● LB/HBO (red) flashes when a loop break or heater burnout occurs
- °C ● Degrees C (green) is lit when temperature is being displayed in Celsius
- RS ● RS (green) is lit when remote setpoint is functioning (not presently used)
- OUT 1% — Out1% (green dash) is lit when SV display is showing Output 1 percent out
- OUT 2% — Out2% (green dash) is lit when SV display is showing Output 2 percent out

Key Functions

KEYS	Operating Mode	Setup Mode	Configuration Mode
	Cancels "startup" automatic tuning constants. (Press again to re-initiate tuning).	Steps the display through a particular setup function. Once in the Setup mode, press the Setup key repeatedly to reach the proper setup function (e.g., "tun1"). Then use this key to step through the function.	Steps the display through a particular configuration function. Once in the Configuration mode, press the Setup key repeatedly to reach the proper configuration function (e.g., "SEC"). Then use this key to step through the function.
	Toggles the controller between Automatic and Manual (% Out) control.	Not Used.	In Calibration, initiates calibration of input signal.
	Steps through a loop of operating displays: Setpoint, % Out (heating and/or cooling), Second Setpoint and Deviation from Setpoint.	Returns the controller to the operating mode.	Returns the controller to the operating mode.
	Toggles the controller between Setpoint and Tuning Constants 1 (a "1" is displayed on the small 7-segment display) and Setpoint and Tuning Constants 2 (a "2" is displayed on the small 7-segment display).	Steps the display backward through a particular setup function (like the function key in reverse).	Steps the display backward through a particular configuration function (like the function key in reverse).
	Steps the controller through two different modes. Press (and release) and the controller goes to Setup (SETU) mode. Press (and hold 4 seconds) and the controller goes to Configuration (CONF) mode. Outputs are ON in Setup. Outputs are OFF in Configuration.	Steps the controller forward one Setup functional group.	Steps the controller forward one Configuration functional group.
	During Automatic control, pressing an arrow key increases or decreases the control setpoint. During Manual control, pressing an arrow key increases or decreases the percent output. With a numeric display, the longer an arrow key is pressed, the faster the rate of change.	Increases/decreases the Setup parameter on display or selects a mode of operation for a Setup parameter. With a numeric display, the longer an arrow key is pressed, the faster the rate of change.	Increases/decreases the Configuration parameter on display or selects a mode of operation for a Configuration parameter. With a numeric display, the longer an arrow key is pressed, the faster the rate of change.
	Not presently used.	Steps the controller backward one Setup functional group (like the Setup key in reverse).	Steps the controller backward one Configuration functional group (like the Setup key in reverse).

Optional Features

Outputs

Control output 1 can be either a form C relay, pulse non-contact DC voltage for solid state relays, 24/260 VAC solid state switching triac, 4-20 mADC current, or 0-10 VDC voltage. Control output 1 and 2 have the same selections except that the control output 2 relay is a form A. Any combination of the available types is allowable.

Output limits are settable from 0% to 100% (105% for analog outputs). DC output signal levels are scaleable in the field, meaning that the 0-10 VDC output can be set to 1-5 VDC out without recalibrating. The 4-20 mADC output is scaleable anywhere from 0-21 mADC.

The on/off hysteresis is adjustable for both outputs. Used with the spread adjustment, each output can be individually gapped or overlapped with respect to setpoint, providing advanced deadband settability.

Universal Inputs

The standard Series 10Q accepts eleven ANSI thermocouple types as well as the common DC mV, mA and voltage inputs. If an RTD input (or the capability to select universally in the field from RTD, thermocouple, DC mV, mA or voltage) is required, order the optional 100 DIN (0.00385 $\Omega/\Omega^{\circ}\text{C}$) RTD input. Changing inputs in the field involves selecting a menu item. Recalibration is not required. Field changing between thermocouple and RTD involves adding or removing the Balco resistor on the input terminals at the back of the case.

Auto/Manual

In automatic control, pressing the auto/manual key changes to manual control (the Auto LED goes out and the Man LED lights) while the setpoint is replaced with a bumpless transfer to a percent output indication. If Output 1 is active, the upper bar of the left-most seven segment display will be lit. If Output 2 is active, the lower bar of the left-most seven segment display will be lit.

Contact Inputs for Remote Switching

Two contact inputs are available for remote switching from automatic to manual control (selectable bumpless or preset percent out), second local setpoint and tuning constants, toggle output direction (e.g., reverse to direct), freeze reset, sample and hold, and halt (halt provides a preset safe manual percentage to shut down a process or bring it to a safe operating level).

Alarms

Up to two alarms are available. Alarm type can be configured in the field by changing a menu item. Choices include high deviation, low deviation, deviation band, deviation range, process low, process high and loop break. A unique standby function can be used to ignore an alarm (helpful with machine startups). The standby

function can be set from 0 to 100 minutes. After the time expires, the alarm functions normally.

Alarm outputs can be configured as non-latching or latching. Non-latching alarms deenergize when an alarm is acknowledged or when the condition clears. Latching alarms remain on after an alarm is acknowledged and turn off when the condition clears. If the condition clears before the alarm is acknowledged, the LED will continue to flash and the alarm will remain energized.

Specifications

Consult the Operator Manual for "as shipped" or "default" values of the variables listed here.

Control Modes

On/Off; Proportional; Proportional/Integral; Proportional/Integral/Derivative (all with Load Line); Proportional/Derivative with Manual Reset; None (for Indicator).

Proportional Band

0.1% to 200.0% of Input Scale (Input Low to High).

Integral (Reset)

0 to 3600 seconds in 1 second steps (0 indicates off).

Derivative (Rate)

0 to 2400 seconds in 1 second steps (0 indicates off).

Load Line

0% to 100% (of Demand) in 1% steps.

Cycle Time

0 to 120 seconds in 1 second steps.

Powerup Modes

Automatic; Manual; or Previous (can be Automatic or Manual depending on the mode when powered down). Manual powers up with a preset manual percent out.

Output On/Off Hysteresis

0 to 10% of Input Scale (Input Low to High) in steps of the Input Scale (depending on the location of the user programmed decimal point).

Output Limits

Minimum Power (0 Percent Out) to Maximum Power (100 Percent Out) (105% for analog outputs).

Control Action

Single Output – Reverse (Heating); Direct (Cooling).

Dual Output – Reverse (Output 1 Reverse acting; Output 2 Direct acting). Direct (Output 1 Direct acting; Output 2 Reverse acting).

Response Time

300 milliseconds.

Setpoint Limits

Minimum (Setpoint Low) and maximum (Setpoint High) limits can be set anywhere within Input Scale (Scale Low to Scale High).

Setpoint Ramp

0.1 to 9999 units per minute depending on decimal point location (separate entry for ramp up and ramp down). Operational whenever setpoints change (from front of instrument or contact closure). On powerup, the process reading is used as the initial setpoint.

DC Inputs

Current	4 to 20	mADC	-1999 to 9999
Voltage	0 to 5	VDC	-1999 to 9999
Voltage	1 to 5	VDC	-1999 to 9999
Voltage	0 to 10	VDC	-1999 to 9999
Voltage	0 to 100	mVDC	-1999 to 9999
Voltage	-10 to 10	mVDC	-1999 to 9999
Voltage	0 to 10	mVDC	-1999 to 9999

DC input levels can be assigned limits anywhere within a range of -10 to 100 mVDC; 0 to 20 mA; or 0 to 10 VDC.

Input Impedance

Millivolt, Volt, Thermocouple: 10 Megohm minimum.

Current: 250 ohms nominal.

Thermocouple and RTD Inputs

Type K,	-100 °F to 2400 °F;	-75 °C to 1320 °C
Type J,	-100 °F to 1600 °F;	-75 °C to 875 °C
Type E,	-100 °F to 1600 °F;	-75 °C to 875 °C
Type R,	0 °F to 3100 °F;	-20 °C to 1705 °C
Type S,	0 °F to 3100 °F;	-20 °C to 1705 °C
Type B,	100 °F to 3100 °F;	37 °C to 1817 °C
PL-II,	0 °F to 2500 °F;	-20 °C to 1375 °C
Type C,	0 °F to 4200 °F;	-20 °C to 2320 °C
Type N,	-100 °F to 2400 °F;	-75 °C to 1320 °C
Ni/Ni Mo	32 °F to 2500 °F;	0 °C to 1371 °C
Type T,	-350 °F to 700 °F;	-215 °C to 375 °C
RTD 385	-199.9 °F to 999.9 °F;	-199.9 °C to 850.0 °C

Accuracy not guaranteed for Type B below 200°C or for Types R and S below 100°C.

RTD

3-wire Platinum, 100 Ω (0.00385 Ω /°C), per IEC 751 and DIN 43760.

Input Lead Resistance

200 Ω maximum (any control input).

Contact Closure Inputs

2 contacts, 1.5 mA max. current; 200 Ω max. resistance (leads and contacts); 500 msec. minimum closure.

Input Protection

Common Mode Rejection (Thermocouple & RTD only)
Common mode voltages from 0 to 240 VAC will not shift the control operating point more than 0.1% of span.

Common Mode Rejection (Analog Inputs)

Common mode voltages from -1 to 10 VDC will not shift the control operating point more than 0.5% of span.

Series Mode Rejection

60 db at 50 or 60 Hz for all input signals from 0 to 250 mVAC RMS.

Sensor Break Protection (Burn Mode)

On—Outputs go to the "on" condition (maximum percent out demand for PID and "on" for on/off).

Off—Outputs go to the "off" condition (minimum percent out demand for PID and "off" for on/off)(as shipped).

Safe—Outputs go to the safety out percent demand specified by the user.

AutoComp—Output is determined by the autocomp type chosen. If the autocomp type is "manual percent," then the output will go to the preset manual percent output entered by the user. If the autocomp type is "process" and the control output demand is stable, then the output will freeze at the present process demand percent output. If the "steady state" conditions have not been met the output will go to the preset manual percent output entered by the user.

Input Isolation to Ground

500 VDC.

Accuracy

$\pm 0.3\%$ of span typical (± 1 digit of display).

Input Resolution

Thermocouples—0.1 °C or °F (under 999 counts); 1 °C or °F (over 999 counts).

RTDs—0.1 °C or °F.

Analog—0.02% of full scale span.

Control Outputs

Output 1 Relay—Form C, SPDT. NO, NC and Common contacts. 120/240 VAC, 2 Amp, resistive load; 200 VA inductive load.

Output 2 Relay—Form A, SPST. NO and Common contacts. 120/240 VAC, 2 Amp, resistive load; 200 VA inductive load.

Triac Output—1.0 Amp continuous, 24 to 240 VAC, resistive, 8 Amp inrush. Minimum load 50 mA.

Non-Contact Voltage—On: 12 VDC; Off: 0.1 VDC or less, into 1K Ohm minimum load.

Current—0 to 21 mA (shipped 4 to 20 mA), isolated, short circuit protected both leads to ground. 600 Ohm

maximum load. 12 bit resolution for 0 to 20 mA. 0.2% accuracy at full scale at rated conditions.

Voltage – 0 to 10.5 VDC, isolated, short circuit protected at 30 mA both leads to ground. 1K Ohm minimum load. 12 bit resolution for 0 to 10 VDC. 0.2% accuracy at full scale at rated conditions.

Alarm Outputs

Up to 2 alarm relays available (see model number for limitations). Form A, SPST. NO and Common contacts are brought out to the rear terminals as standard. NC operation is jumper selectable. 120/240 VAC, 2 Amp, resistive load; 200 VA inductive load.

Displays

Process Value – 4 digit, 14.2mm (0.56 in.), 7 segment orange LEDs, from -1999 to 9999.

Set Value – 4 digit, 10.2mm (0.40 in.), 7 segment green LEDs, from -1999 to 9999.

SET#/PROG (Setpoint Number/Program) – 1 digit, 7.6mm (0.30 in.), 7 segment green LED, from 0 to 9. Indicates setpoint (and tuning set) number. Also used to indicate ramping setpoint.

Status Annunciators

OUT 1 (green LED); OUT 2 (green LED)
Lit when the output is on. For analog DC outputs, LED will turn off when demand equals minimum power.

ALM 1 (red LED); ALM 2 (red LED)
Flashes when alarm is on. A steadily lit alarm LED means the alarm has been acknowledged. On a non-latching alarm, the LED turns off when the alarm condition clears. On a latching alarm, the LED continues to flash when the alarm condition clears until acknowledged and then the LED turns off.

AUTO (green LED)
Lit when controller is in the automatic control mode (off when the controller is in the manual control mode).

MAN (yellow LED)
Lit when controller is in the manual control mode (off when the controller is in the automatic control mode).

AT (yellow LED)
Lit when controller is performing autotuning. Flashes if AT fails (press the AT button to clear the flashing LED).

LB/HBO (red LED)
Flashes when loop break alarm exists. Off when alarm condition clears. Loop break can be programmed to one of the alarm outputs.

°C (green LED)
Lit when Celsius (Degrees C) is displayed.

RS (green LED)
Lit when Remote Setpoint is in use (reserved for future function).

OUT1% (green LED dash)
The upper bar of the left-most 7 segment display is lit when the SV display is showing percent out for output 1.

OUT2% (green LED dash)
The lower bar of the left-most 7 segment display is lit when the SV display is showing percent out for output 2.

Security

Programmable 4 digit pass code.

Pass Code Levels

Level 1 Operating mode screens can be reached, but data cannot be changed.

Level 2 Same as Level 1, except setpoints (or percent out in manual mode) can be changed.

Level 3 Same as Level 2, except setpoint select, autotune and auto/manual can be used.

Level 4 Same as Level 3, except Setup can be changed.

Level 5 Same as Level 4, except Configuration data can be changed.

Hardware Lock

Internal jumper: "Total" locks entire keyboard; "Partial" allows setpoint changes only.

Loop Break Function

Settable from 0 to 10 minutes (0 = Off). If a maximum percent out demand signal is present and no progress is made toward setpoint within the time setting, the LB LED will begin flashing and the output will change to the preset percent out. If an alarm output has been assigned to the function, the alarm will energize.

Indicator

The 10Q can be ordered as an indicator (without control outputs) or it can be configured in the field as an indicator by setting the control algorithms to "none." Resident control outputs become inactive. The Setting Value and the Set# display will be blank in the operate mode; alarm will continue to operate (deviation alarms will look to the setpoint source and the local setpoint value in Setup).

Manual Station

The 10Q can be setup as a manual station only (without automatic control).

MODEL 1 0 - 0 - - -
 Field No. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Field 3. CONTROLLER SIZE

Q - Quarter DIN

Field 4. CONTROL OUTPUT 1

V - Indicator (No Output)

1 - Relay (Form C)

2 - Pulse Non-Contact Voltage for SSR (12 VDC)

3 - Current (4-20 mA)

4 - Voltage (0-10 VDC)

T - Triac (24-260 VAC, 1A)

Field 5. CONTROL OUTPUT 2*

0 - None

1 - Relay (Form A)

2 - Pulse Non-Contact Voltage for SSR (12 VDC)

3 - Current (4-20 mA)

4 - Voltage (0-10 VDC)

T - Triac (24-260 VAC, 1A)

*Control Output 2 is NOT available with a combination of Control Output 1 Form C Relay (Option 1) and Alarm 2.

Fields 6, 7. INPUT 1

Universal Input (field selectable) for TC, Current, Millivoltage and Voltage inputs. Ordering RTD input provides field selectable RTD, TC, Current, Millivoltage and Voltage inputs.

Thermocouple

(Decimal Point Programmable up to 1 digit)

KF - Type K, -100 °F to 2400 °F

KC - Type C, -75 °C to 1320 °C

JF - Type J, -100 °F to 1600 °F

JC - Type J, -75 °C to 875 °C

EF - Type E, -100 °F to 1600 °F

EC - Type E, -75 °C to 875 °C

RF - Type R, 0 °F to 3100 °F

RC - Type R, -20 °C to 1705 °C

SF - Type S, 0 °F to 3100 °F

SC - Type S, -20 °C to 1705 °C

BF - Type B, 100 °F to 3100 °F

BC - Type B, 37 °C to 1817 °C

PF - Type P, 0 °F to 2500 °F

PC - Type P, -20 °C to 1375 °C

CF - Type C, 0 °F to 4200 °F

CC - Type C, -20 °C to 2320 °C

NF - Type N, -100 °F to 2400 °F

NC - Type N, -75 °C to 1320 °C

MF - Ni/Ni Mo, 32 °F to 2500 °F

MC - Ni/Ni Mo, 0 °C to 1371 °C

TF - Type T, -350 °F to 700 °F*

TC - Type T, -215 °C to 375 °C*

*Decimal Point is NOT Programmable with Type T

Current and Voltage

(Decimal Point Programmable up to 3 digits)

C1 - Current 4 to 20 mADC -1999 to 9999

V1 - Voltage 0 to 5 VDC -1999 to 9999

V2 - Voltage 1 to 5 VDC -1999 to 9999

V3 - Voltage 0 to 10 VDC -1999 to 9999

V4 - Voltage 0 to 100 mVDC -1999 to 9999

V5 - Voltage -10 to 10 mVDC -1999 to 9999

V6 - Voltage 0 to 10 mVDC -1999 to 9999

Fields 6, 7. INPUT 1 (continued)

RTD

(Decimal Point Programmable up to 1 digit)

8F - PLT100 DIN (0.00385Ω/Ω°C) -199.9 °F to 999.9 °F

8C - PLT100 DIN (0.00385Ω/Ω°C) -199.9 °C to 850.0 °C

Field 9. ADVANCED OPTIONS

0 - None

1 - Auto/Manual

Field 10. CONTACT CLOSURES

0 - None

1 - Dual Contact Closure, programmable to Manual Select*, Second Local Setpoint and Tuning Constants, Toggle Output Action, Sample & Hold, Freeze Reset and Halt.

*Note that Auto/Manual option must be ordered for Manual Select.

Field 11. ALARM 2*

Form A Relay; shipped NO, field configurable to NO/NC; field configurable Standby and Latching function.

0 - None

1 - High Deviation

2 - Low Deviation

3 - Deviation Band (deenergized in the band)

4 - Deviation Range Band (energized in the band)

5 - Process High

6 - Process Low

B - Loop Break Relay

*Alarm 2 is NOT available with a combination of Control Output 1 Form C Relay (Option 1) and Control Output 2.

Field 12. POWER SUPPLY

0 - 85 to 264 VAC, 48/62 Hz

Field 13. ALARM 1

Form A Relay; shipped NO, field configurable to NO/NC; field configurable Standby and Latching function.

0 - None ..

1 - High Deviation

2 - Low Deviation

3 - Deviation Band (deenergized in the band)

4 - Deviation Range Band (energized in the band)

5 - Process High

6 - Process Low

B - Loop Break Relay

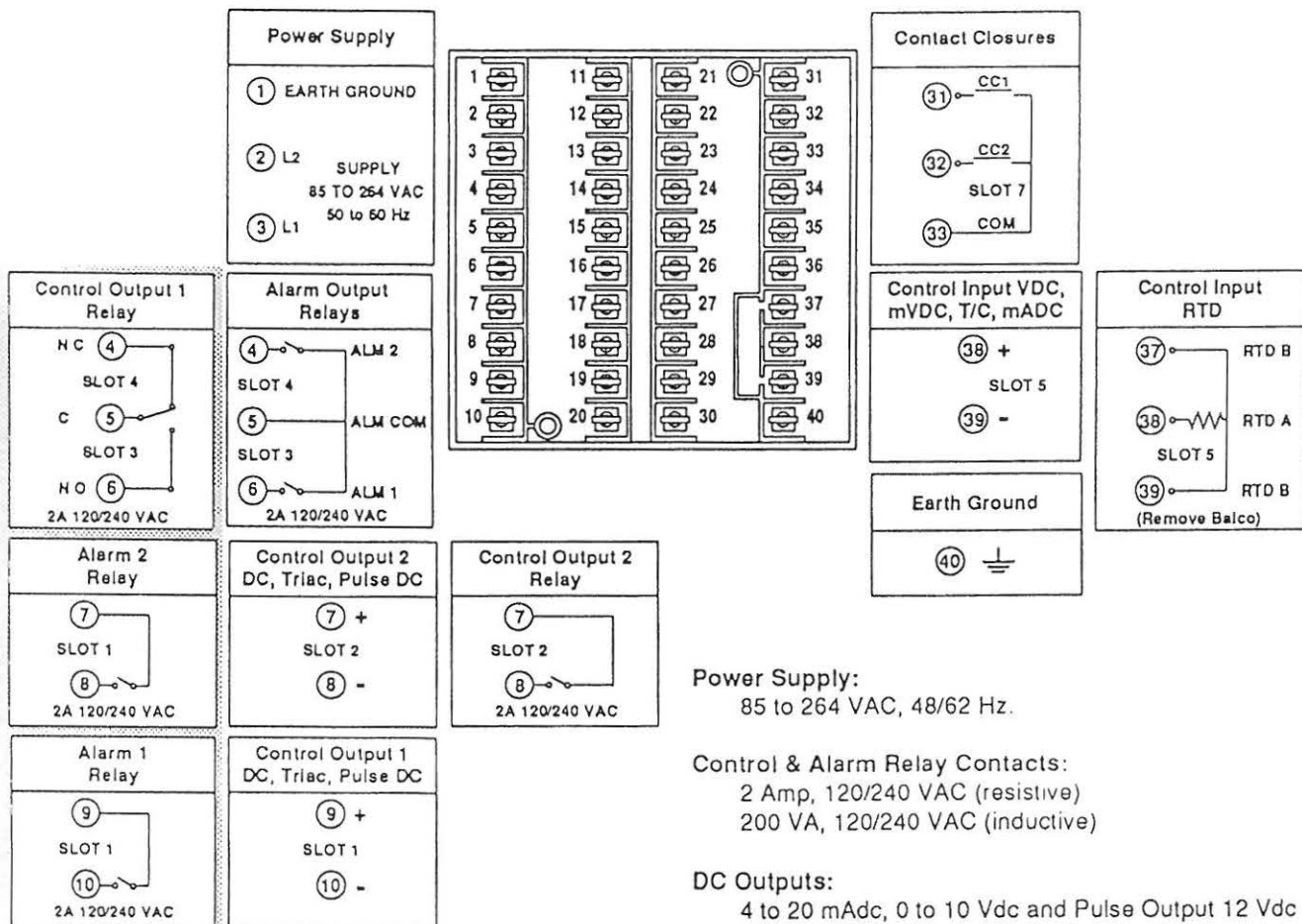
Fields 14, 15. SPECIALS

00 - None

01 - Shipped without Housing (order Housing separately)

02 - Hardware Security Lock

Controller Wiring Examples



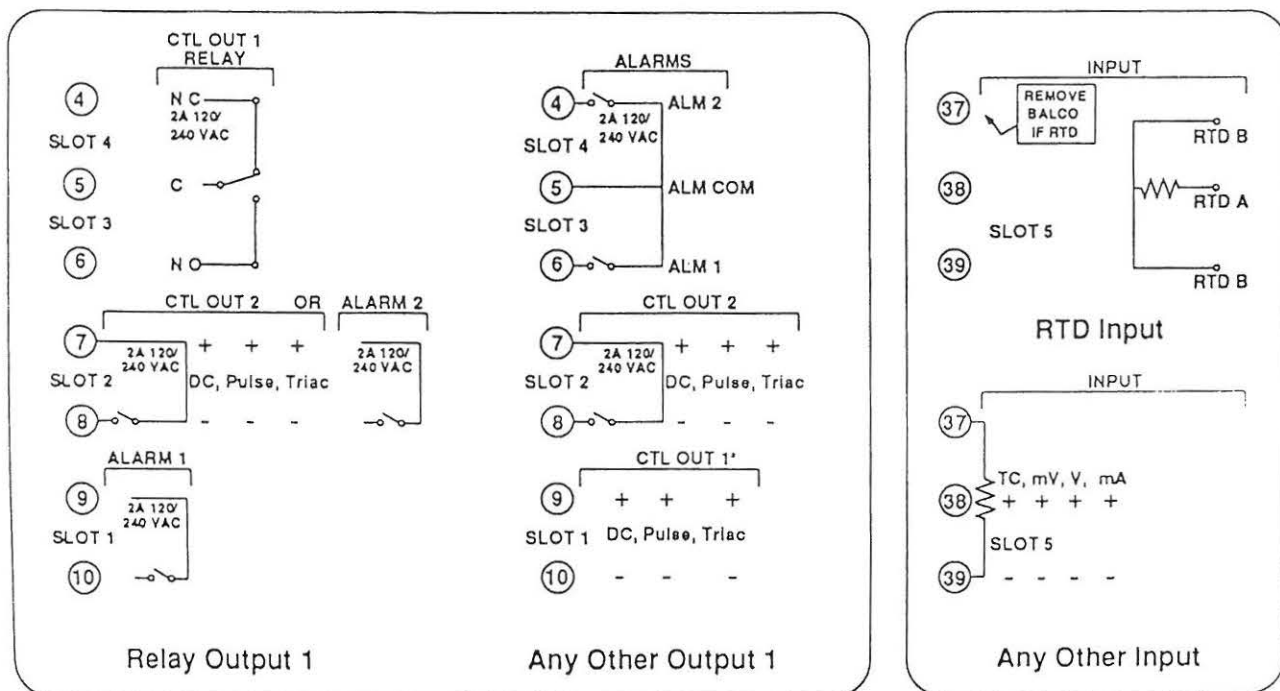
Power Supply:
85 to 264 VAC, 48/62 Hz.

Control & Alarm Relay Contacts:
2 Amp, 120/240 VAC (resistive)
200 VA, 120/240 VAC (inductive)

DC Outputs:
4 to 20 mA dc, 0 to 10 Vdc and Pulse Output 12 Vdc

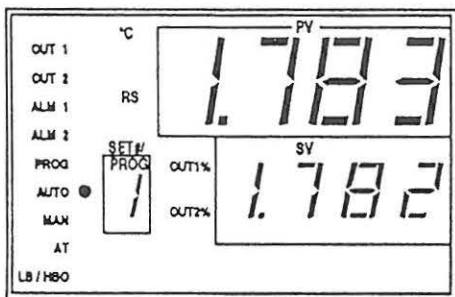
Control Output 1 Relay (a Form C Relay) requires locating Alarms on Terminals 7 & 8 and 9 & 10. In ALL other cases, Alarms are located on Terminals 4, 5 & 6.

Triac Output:
1 Amp, 24 to 240 VAC (50 mA minimum load)

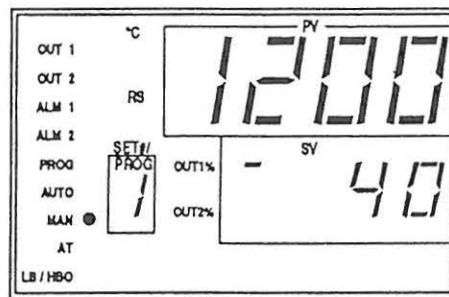


Display Screen Examples

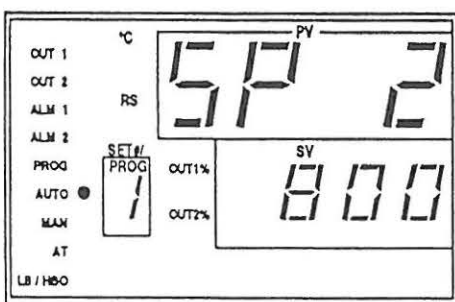
Operating Displays



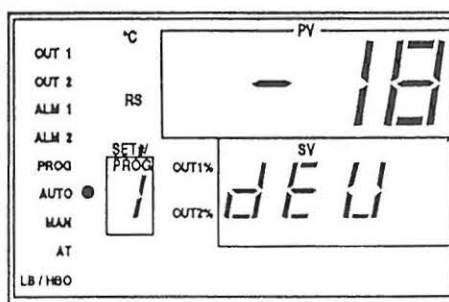
Process and Setpoint displayed with 3 decimal places



Controller In Manual Mode
(PV = 1200, Out 1 = 40%)

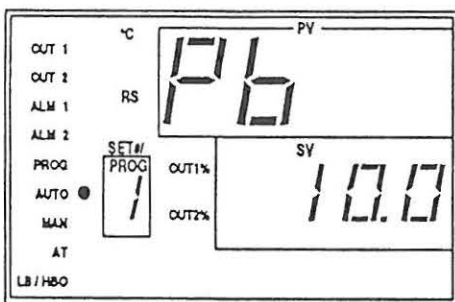


Screen for changing Setpoint 2

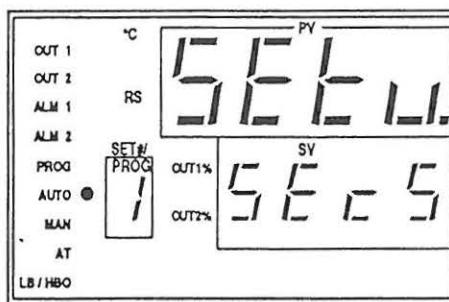


Screen showing deviation from Setpoint

Setup Displays

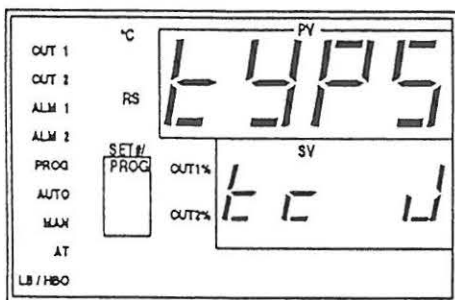


10.0% Proportional Band

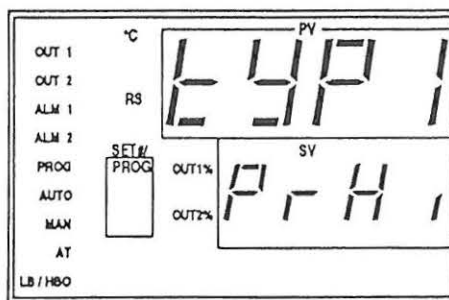


Security Level 5 active

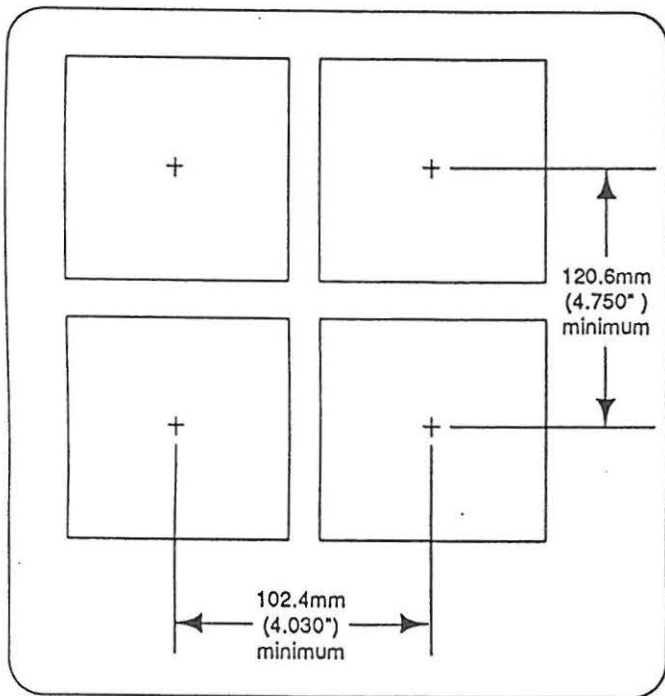
Configuration Displays



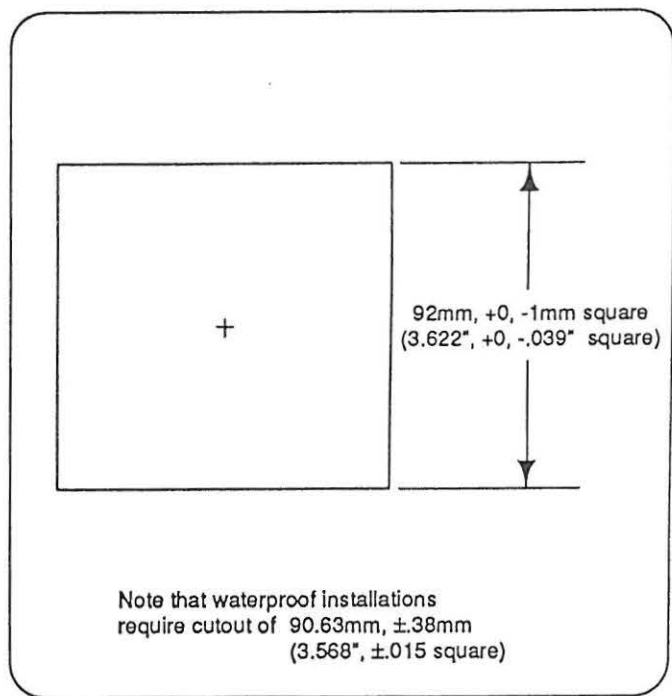
Type J Thermocouple selected



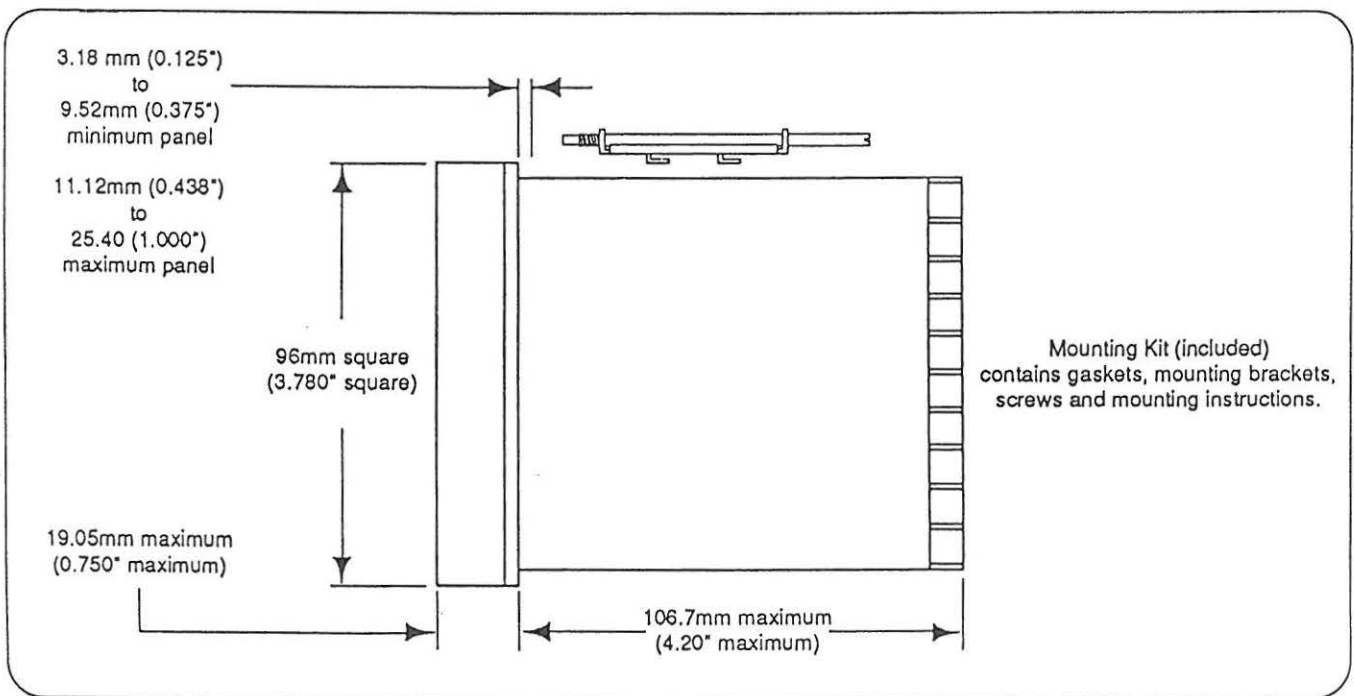
Process High selected as Alarm Type 1



Multiple Instruments Spacing



Single Instrument Cutout



Side View

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Environmental

Operating Conditions

Temperature:

0°C to 55°C (32°F to 131°F)

Humidity:

10% to 95% RH (non-condensing)

Storage Temperature:

-40°C to 85°C (-40°F to 185°F)

Temperature Stability:

±0.02% of reading per °C or 1 µvolt per °C

Front Panel:

Designed to be dust and water resistant
per IEC IP65.

Electrostatic Discharge:

Designed to meet IEC 801-2.

RF Protection:

Designed to meet IEC 801-3.

Operating Voltage:

85 to 264 VAC, 48/62 Hz (standard)

Power Consumption:

10 VA maximum

Transient/Burst (Noise immunity)

Designed to meet IEC 801-4.

Physical

Overall Size

Height:

96mm (3.78 in.)

Width:

96mm (3.78 in.)

Depth:

106.7mm (4.20 in.)

Weight:

1 lb. (.45 Kg)

Housing Materials

Front Lens:

Polycarbonate

Keypad:

Silicone Rubber

Front Bezel and Case:

Polyarylene Ether
Engineering Plastic

APPLIED INSTRUMENTS COMPANY

51760 GRAND RIVER AVE. • WIXOM, MI 48393

(810) 380-6500 • FAX: (810) 380-6510

TOLL FREE (800) 521-0612

WARRANTY

This product is warranted according to the General Warranty Statement that is part of the Terms and Conditions of Sale of the Industrial Instruments Division, Barber-Colman Company.

The warranty for this product is effective for TWO YEARS AFTER SHIPMENT from Barber-Colman Company.

Barber-Colman Company

INDUSTRIAL INSTRUMENTS DIVISION

1354 Clifford Avenue

Loves Park, IL U.S.A. 61132-2940

1-815-637-3000

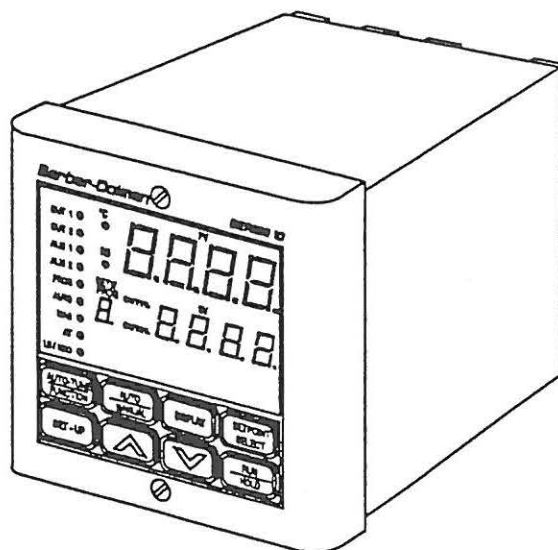


Instruction Manual

1261-IN-002-0-00

23 March, 1994

Series 10Q Reference Manual



PRELIMINARY

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1. Introduction

Before doing anything else, check the shipping carton for damage and report any obvious damage to the carrier who made the delivery.

Each controller will come equipped with an instruction sheet and a mounting kit. If multiple controllers have been purchased, check the carton carefully before discarding it (there may be instruction sheets or mounting kits under the inserts).

Check that the delivered items match the order for which they were intended. If not, contact the local Barber-Colman representative or the Barber-Colman factory.

Read "First Time Operation" before making changes to the controller. Before permanently installing this controller or connecting it to a load, be certain to:

READ THIS INSTRUCTION MANUAL CAREFULLY.

The controller is preconfigured by model number. Inputs, outputs and alarm types are preset, which saves valuable setup time. Final setup and configuration are done from the front using a spreadsheet structure which allows rapid movement from function to function.

The controller has three basic modes (note that the manual is similarly divided):

- The Operating Mode
- The Setup Mode
- The Configuration Mode

The operating mode is used for "normal" day-to-day operation of the controller. The screens appearing in this mode depend on whether the controller is configured to operate as an automatic controller, a manual controller, or an indicator.

The setup mode is, in general, used to set or change settings associated with software, such as specific setpoints, tuning constants, alarm settings, etc. Control outputs remain active in the setup mode.

The configuration mode is, in general, used to set or change settings more closely associated with hardware, such as input type, output type, alarm type, etc. Control outputs turn OFF in the configuration mode.

This controller can be used to display and control temperature, pressure, level and flow variables. Front panel programming allows a single controller to meet a wide variety of plant and test facility applications. Thermocouple, mADC, mVDC and VDC inputs can be changed in the field without the addition of hardware or recalibration. A universal input including RTD is offered

as an option. Selection of alarm types, scaling, °C or °F, setpoint limits, decimal point location and sensor break response is made from the keypad.

Barber-Colman AT™ Self Tune provides automatic tuning with completely hands-off PID tuning at startup. An adaptive tuning oscillation monitor that automatically retunes the controller should conditions change is also available. The oscillation monitor can be turned off once the desired performance is achieved or it can be left on to provide continuous adaptive tuning.

The loop break function provides early warning that something in the control loop has failed. The loop break function can also be programmed to one of the optional alarms. The Auto Comp™ sensor break function minimizes process upsets due to sensor break by providing for the selection of a preset manual percentage output or the last stable output when a sensor fails.

The second setpoint function saves setup time by providing a second setpoint and tuning constants stored in memory and available by pressing the setpoint select button. The SET# (Tuning Set number) LED indicates which Tuning Set (and setpoint) is active. The second Tuning Set can also be selected remotely using the optional contact closure input function. Provided as a standard feature is a programmable setpoint ramp up and ramp down function which operates whenever the setpoint is changed. This is helpful in startups and applications where rapid changes cannot be tolerated. Powerup selections allow precise definition of the powerup process so that when power is applied the controller will powerup in either automatic control, manual control using a preset percentage, or the last condition of automatic or manual control.

Options include dual outputs and dual alarms, auto/manual control, two contact closure inputs for remotely selecting controller states (auto/manual, second tuning set, toggle control action, sample and hold, freeze reset, and halt) and a hardware lock function.

Eight tactile feedback keys provide direct access to important functions such as auto/manual, autotuning, operating displays and setup.

Programmable setpoint limits prevent unsafe changes to setpoints. Programmable output limits can be set from 0% to 100% (105% for analog outputs). All input ranges can be set to useable high and low limits and DC inputs are programmable from -1999 to 9999 with up to 3 decimal places.

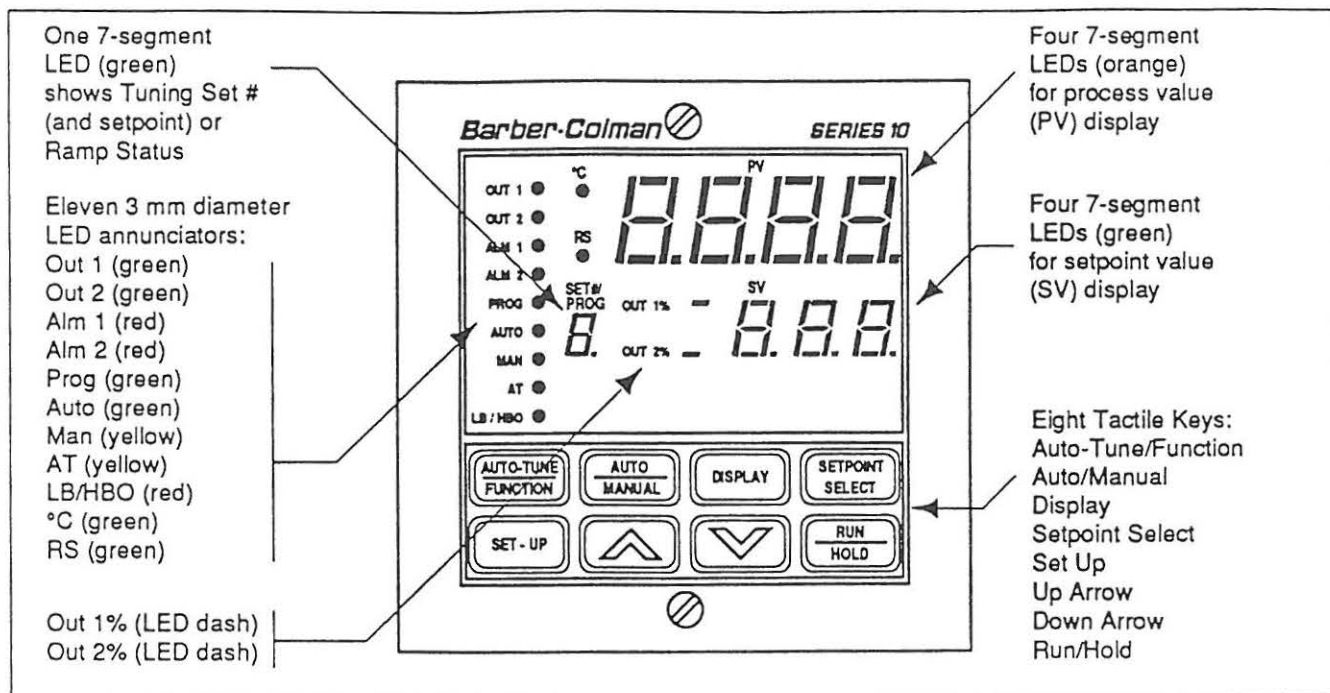


Figure 2.1 The Front of the Controller

2. First Time Operation

Before permanently installing this controller or connecting it to a load, proceed through this instruction manual in an orderly manner:

A. Go to the section of this manual labeled "Wiring the Controller." Follow the instructions given there for wiring the controller to a suitable power supply. **DO NOT** connect input wiring or output wiring at the present time.

Note that the controller will be shipped "as ordered" by the model number.

B. Go to the section of the manual labeled "Output Configuration." Follow the instructions given there for entering the Output Configuration mode. Check that the controller model number (on the side of the case and listed in the section "Controller Model Number") is in agreement with your application (Output Signal Low and High are the only changes possible).

C. Go to the section of the manual labeled "Input Configuration." Follow the instructions given there for entering the Input Configuration mode. Check that the controller model number (on the side of the case and listed in the section "Controller Model Number") is in agreement with your application.

D. Go to the section of the manual labeled "Alarm Configuration." Follow the instructions given there for entering the Alarm Configuration mode. Check that the controller model number (on the side of the case and listed in the section "Controller Model Number") is in agreement with your application.

E. Go to the section of the manual labeled "Control Configuration." Follow the instructions given there for entering the Control Configuration mode. Check that the controller model number (on the side of the case and listed in the section "Controller Model Number") is in agreement with your application.

F. Go to the section of the manual labeled "Loop Configuration." Follow the instructions given there for entering the Loop Configuration mode. Check that the controller model number (on the side of the case and listed in the section "Controller Model Number") is in agreement with your application.

G. Go to the section of the manual labeled "Input Setup." Follow the instructions given there for entering the Input Setup mode. Make any changes necessary for your application (pay attention to engineering units).

H. Go to the section of the manual labeled "Control Setup." Follow the instructions given there for entering the Control Setup mode. Make any changes or entries necessary for your application.

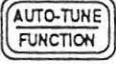
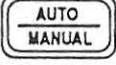
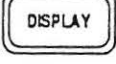
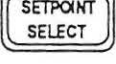
I. Go to the section of the manual labeled "Loop Setup." Follow the instructions given there for entering the Loop Setup mode. Make any changes or entries necessary for your application.

J. Go to the section of the manual labeled "Autotune Setup." Follow the instructions given there for entering the Autotune Setup mode. Make any changes or entries necessary for your application.

Table 2.1 Status Annunciators

OUT 1 ●	Out 1 (green) is lit when Output 1 is ON
OUT 2 ●	Out 2 (green) is lit when Output 2 is ON
ALM 1 ●	Alm 1 (red) flashes (lit steadily if acknowledged) when Alarm 1 is ON
ALM 2 ●	Alm 2 (red) flashes (lit steadily if acknowledged) when Alarm 2 is ON
PROG ●	Prog (green) is lit when a Ramp/Soak program is running (not presently used)
AUTO ●	Auto (green) is lit when the controller is in the Automatic control mode
MAN ●	Man (yellow) is lit (flashes if by Contact Input) when the controller is in the manual (% out) control mode
AT ●	AT (yellow) is lit while automatic tuning is taking place; flashes if tuning fails
LB/HBO ●	LB/HBO (red) flashes when a loop break or heater burnout occurs
°C ●	Degrees C (green) is lit when temperature is being displayed in Celsius
RS ●	RS (green) is lit when remote setpoint is functioning (not presently used)
OUT 1% —	Out1% (green dash) is lit when SV display is showing Output 1 percent out
OUT 2% —	Out2% (green dash) is lit when SV display is showing Output 2 percent out

Table 2.2 Key Functions

KEYS	Operating Mode	Setup Mode	Configuration Mode
	Cancels "startup" automatic tuning constants. (Press again to re-initiate tuning).	Steps the display through a particular setup function. Once in the Setup mode, press the Setup key repeatedly to reach the proper setup function (e.g., "tun1"). Then use this key to step through the function.	Steps the display through a particular configuration function. Once in the Configuration mode, press the Setup key repeatedly to reach the proper configuration function (e.g., "SEC"). Then use this key to step through the function.
	Toggles the controller between Automatic and Manual (% Out) control.	Not Used.	In Calibration, initiates calibration of input signal.
	Steps through a loop of operating displays: Setpoint, % Out (heating and/or cooling), Second Setpoint and Deviation from Setpoint.	Returns the controller to the operating mode.	Returns the controller to the operating mode.
	Toggles the controller between Setpoint and Tuning Constants 1 (a "1" is displayed on the small 7-segment display) and Setpoint and Tuning Constants 2 (a "2" is displayed on the small 7-segment display).	Steps the display backward through a particular setup function (like the function key in reverse).	Steps the display backward through a particular configuration function (like the function key in reverse).
	Steps the controller through two different modes. Press (and release) and the controller goes to Setup (SETU) mode. Press (and hold 4 seconds) and the controller goes to Configuration (CONF) mode. Outputs are ON in Setup. Outputs are OFF in Configuration.	Steps the controller forward one Setup functional group.	Steps the controller forward one Configuration functional group.
	During Automatic control, pressing an arrow key increases or decreases the control setpoint. During Manual control, pressing an arrow key increases or decreases the percent output. With a numeric display, the longer an arrow key is pressed, the faster the rate of change.	Increases/decreases the Setup parameter on display or selects a mode of operation for a Setup parameter. With a numeric display, the longer an arrow key is pressed, the faster the rate of change.	Increases/decreases the Configuration parameter on display or selects a mode of operation for a Configuration parameter. With a numeric display, the longer an arrow key is pressed, the faster the rate of change.
	Not presently used.	Steps the controller backward one Setup functional group (like the Setup key in reverse).	Steps the controller backward one Configuration functional group (like the Setup key in reverse).

K. Go to the section of the manual labeled "Tuning Set 1 and 2 Setup." Follow the instructions given there for entering the Tuning Set 1 (or 2) Setup mode. Make any changes or entries necessary for your application.

L. Go to the section of the manual labeled "Alarm Setup." Follow the instructions given there for entering the Alarm Setup mode. Make any changes or entries necessary for your application.

M. Go to the section of the manual labeled "Security Configuration." Follow the instructions given there for entering the Security Configuration mode. Make any changes or entries necessary for your specific needs.

N. Once the controller is configured and setup to your specific control needs, go to the section of the manual labeled "Installing the Controller" and prepare the panel for controller installation.

O. Return to the section of the manual labeled "Wiring the Controller" and complete whatever wiring is necessary for your specific needs.

P. Once the controller is connected to a load and power is applied, make certain to observe both the controller and the load until you are certain that the controller is operating properly and is indeed in control of the load.

3. Installing the Controller

The installation kit contains the following parts:

Qty.	Description	Part Number
1	Front Gasket	27-269
1	Rear Gasket	27-271
2	Mounting Brackets	13-5156-100
2	Mounting Screws	11-3906
1	Instruction Sheet	1261-MF-001-0-XX

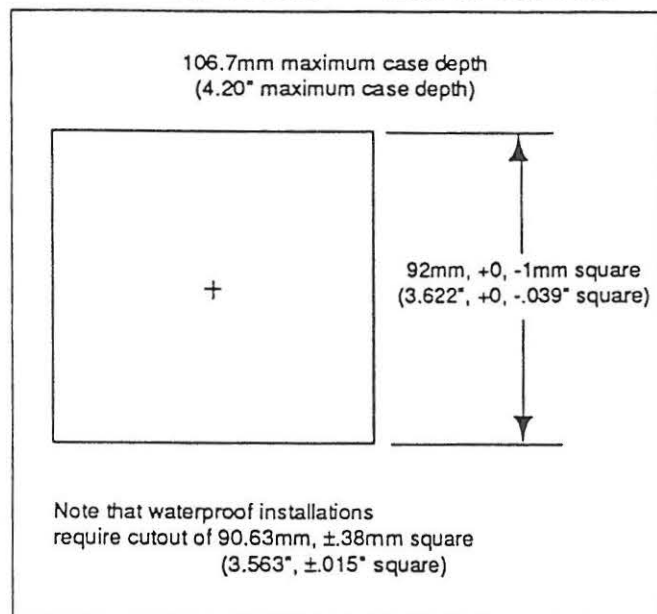


Figure 3.1 Single Instrument Cutout

Make certain that the surrounding environment conforms to the controller specifications regarding temperature (0°C to 55°C; 32°F to 131°F) and humidity (10% to 95% RH, non-condensing).

Follow all applicable local and national electrical codes during installation.

Cutouts

Make any cutouts as shown in Figure 3.1 and 3.2. Remove any sharp edges or burrs from the openings. To make the installation easy and to avoid heat buildup, allow as much room as possible between openings.

Installation

There are two gaskets included with this installation kit. One is meant to be installed between the controller and the case (the controller must first be removed from the case). The other is meant to be installed between the case and the panel.

In order for the controller to pass IEC IP65 dust and water protection specifications, both gaskets **MUST** be installed (in fact, it is recommended to install the gaskets even if they are not "required"). Follow this procedure:

1. Use a medium-sized, flat bladed screwdriver to loosen (until the threads disengage) the screw at the TOP of the controller face.
2. Use the screwdriver to rotate the screw at the BOTTOM of the face in a counterclockwise direction. This will cause the controller to be ejected from the case. Once the jackscrew is free (and the controller is clear of its contacts), remove the controller from the case.
3. Carefully remove the gaskets from their cardboard protector. The front gasket has an adhesive coating

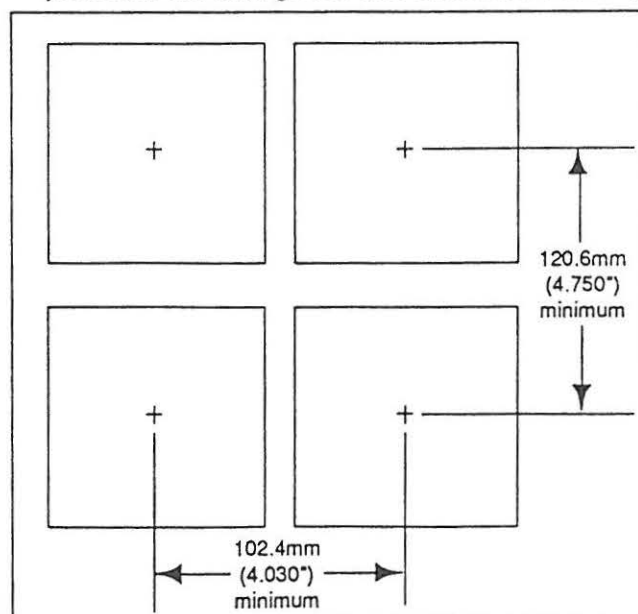


Figure 3.2 Multiple Instruments Spacing

that is protected by white paper. LEAVE THE PAPER IN PLACE MOMENTARILY!

4. Place the larger of the gaskets (27-271; the one with no adhesive) over the rear of the case and slide it forward to the front of the case. Press the gasket firmly against the case flange.
5. Start the mounting screws in the mounting brackets as shown in Figure 3.3.
6. Insert the case through its opening in the panel and hook the mounting brackets in place. Note that three rectangular openings are provided for each of the mounting brackets. The two openings nearest the front of the case are used for panel thicknesses of 3.18mm to 9.52mm (.125" to .375"). The two openings nearest the back of the case are used for panel thicknesses of 11.12mm to 25.40mm (.438" to 1.000"). Hand tighten the mounting screws to temporarily
- hold the case in position, then return and tighten them firmly in place using a flat bladed screwdriver. BE CAREFUL NOT TO OVERTIGHTEN!
7. Remove the protective paper from the smaller remaining gasket (27-269) and press it carefully (adhesive side toward the flange) into the recess provided for it on the front of the case flange.
8. Insert the controller into the case and gently slide it forward until the contacts touch.
9. Use the flat bladed screwdriver to rotate the screw at the BOTTOM of the case in a clockwise direction. This will cause the controller to be pulled forward into the case and be seated on its contacts. Be careful not to overtighten this screw.
10. Tighten the screw at the TOP of the controller firmly in place. BE CAREFUL NOT TO OVERTIGHTEN!

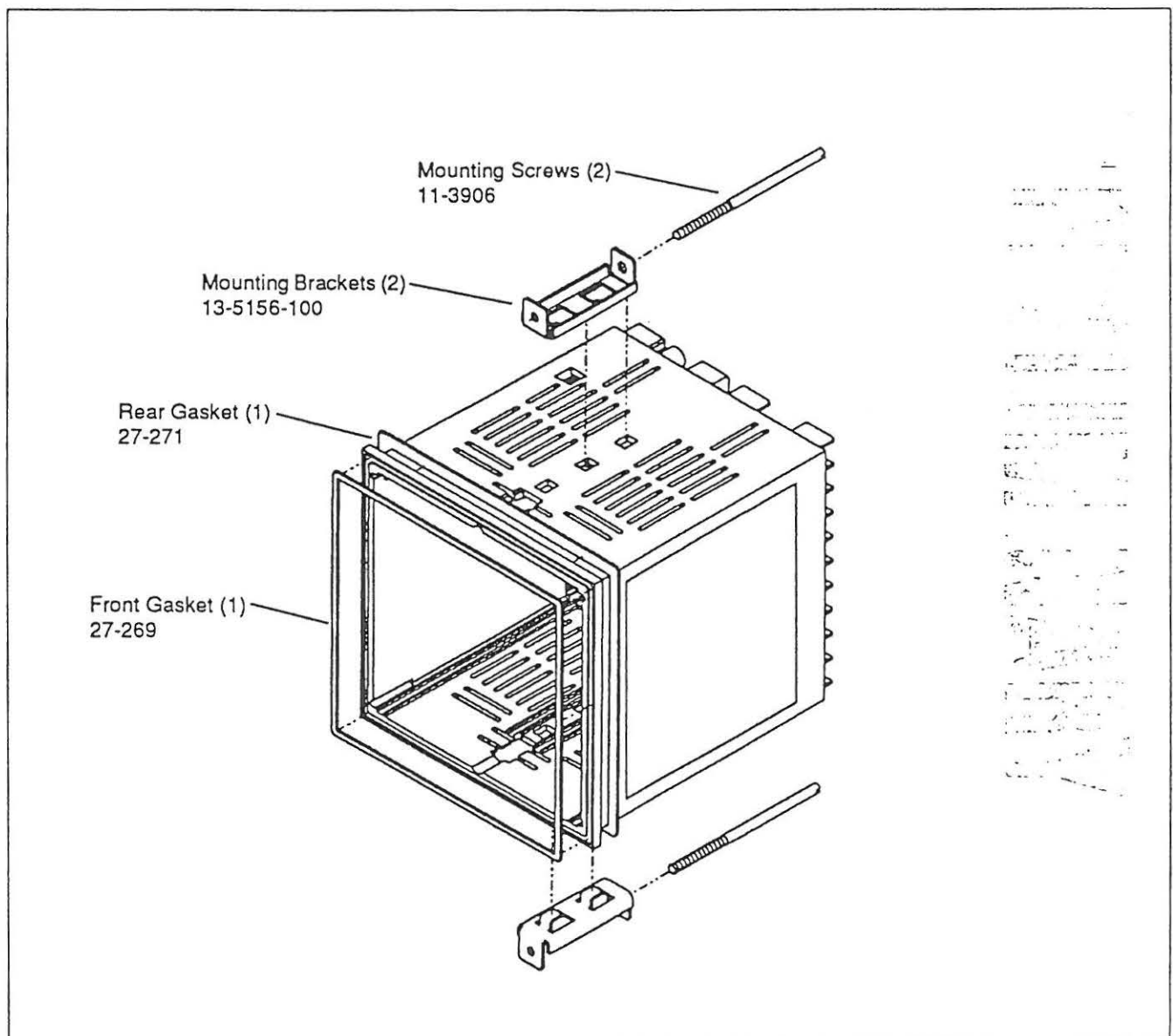


Figure 3.3 Mounting the Case

4. Wiring the Controller

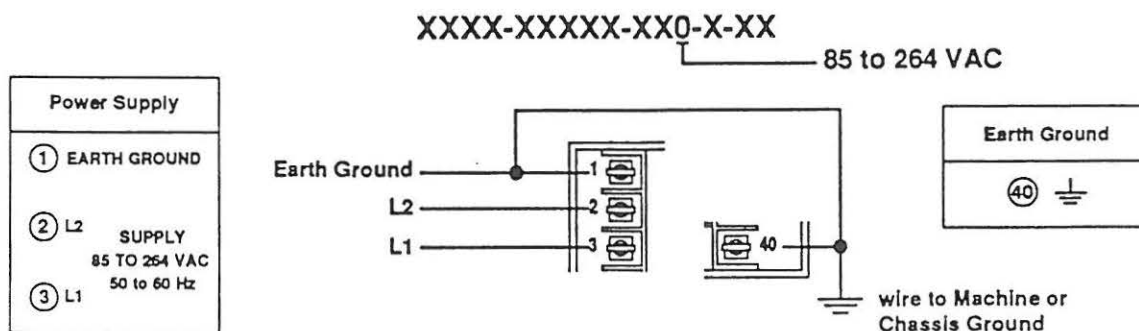
Observe all Local and National Wiring Codes.

Wire using #6 ring lugs and up to 14 AWG stranded wire maximum or wire using 16 AWG stranded wire maximum.

4.1 Power Supply Wiring

Check Field 12 of the 15-digit controller model number (see the label on the side of the case).

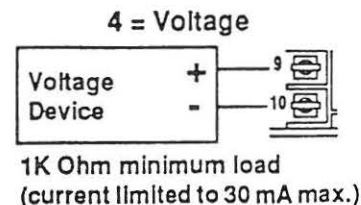
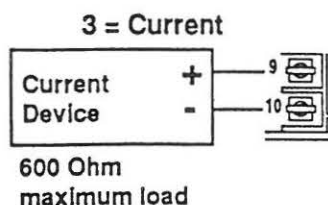
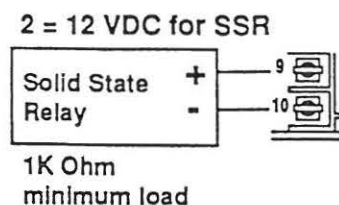
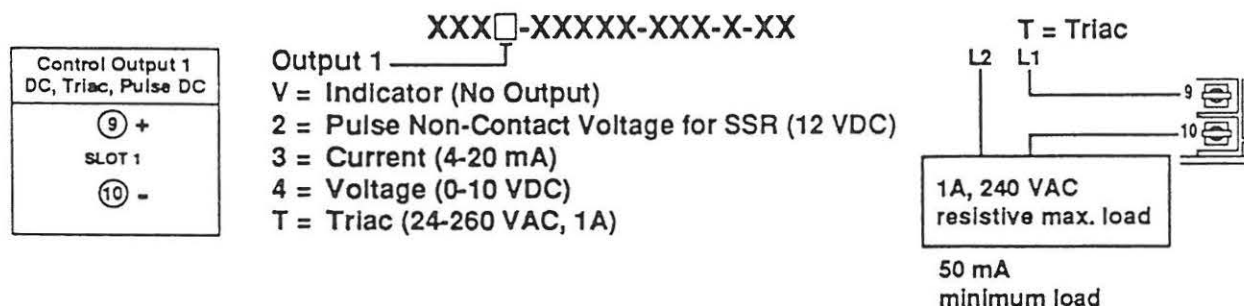
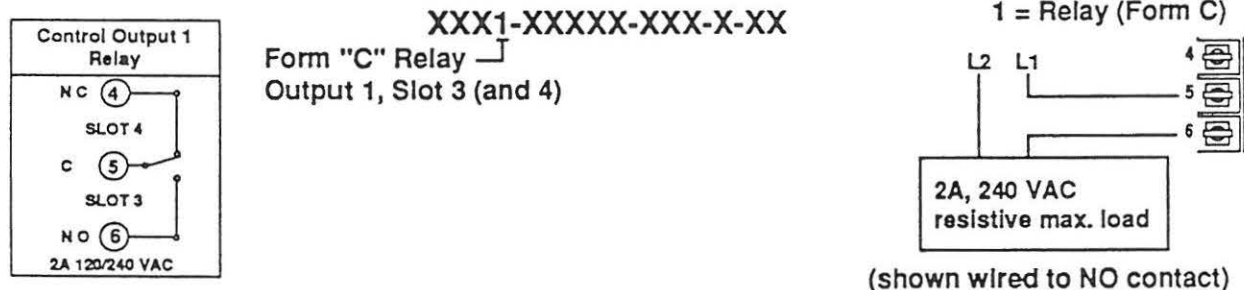
A "0" indicates the controller is equipped with the standard universal (85 to 264 VAC, 48/62 Hz) power supply.



4.2 Control Output 1 Wiring

Check Field 4 of the 15-digit controller model number (see the label on the side of the case).

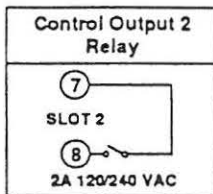
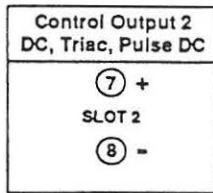
A "1" in Field 4 indicates the controller is equipped with a Form C Relay for Control Output 1. In this case, Output 1 occupies Slot 3 (and Slot 4) (Terminals 4, 5 and 6) of the controller. Any other kind of Control Output 1 would occupy Slot 1 (Terminals 9 and 10) of the controller.



4.3 Control Output 2 Wiring

Check Field 5 of the 15-digit controller model number (see the label on the side of the case).

A "0" in Field 5 indicates the controller is NOT equipped with a second Output. If an Output 2 exists, it will occupy Slot 2 (Terminals 7 and 8) of the controller.



XXXX-☐XXXX-XXX-X-XX

Output 2

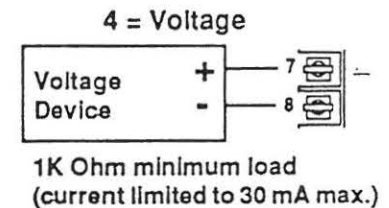
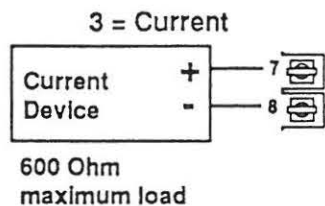
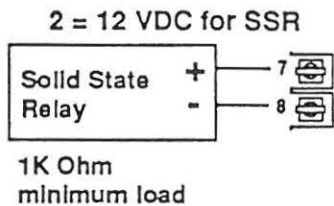
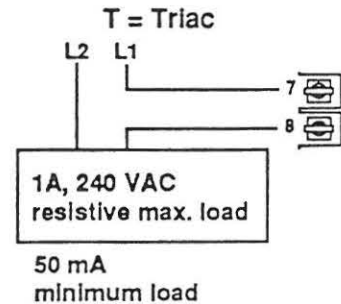
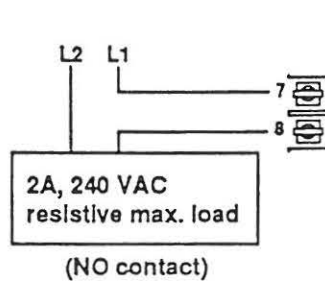
1 = Form A Relay

2 = Pulse Non-Contact Voltage for SSR (12 VDC)

3 = Current (4-20 mA)

4 = Voltage (0-10 VDC)

T = Triac (24-260 VAC, 1A)



4.4 Contact Input Wiring

Check Field 10 of the 15-digit controller model number (see the label on the side of the case).

A "0" in Field 10 indicates the controller is NOT equipped with the dual contact closure option.

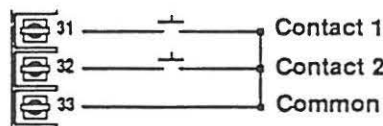
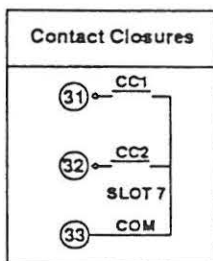
A "1" in Field 10 indicates the controller is equipped with the dual contact closure option.

The contact closure option always occupies Slot 7 (Terminals 31, 32 and 33) of the controller.

Refer to Input Configuration.

XXXX-XXXXX-1XX-X-XX

Contact Closure

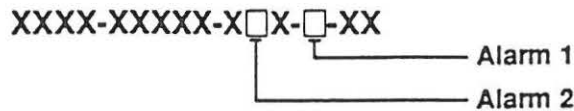


6.5 VDC nominal open circuit voltage between Common (Terminal 33) and Terminals 31 & 32. Maximum resistance (lead resistance plus contact) is 200 Ohms.

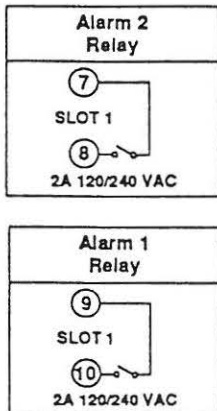
Note that contacts are assumed to be Normally Open, but opening or closing the contacts Initiates a change (see Input Configuration).

4.5 Alarm Wiring

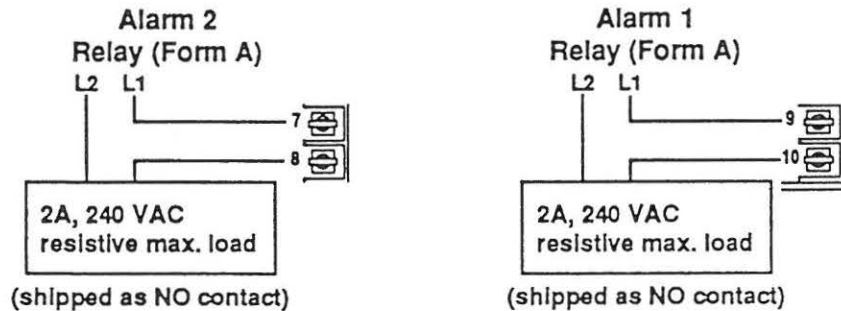
Check Fields 13 and 11 of the 15-digit controller model number (see the label on the side of the case). A "0" in Field 13 indicates the controller is NOT equipped with an Alarm 1. A "0" in Field 11 indicates the controller is NOT equipped with an Alarm 2.



If the controller is equipped with an Output 1 Relay (Form C), Alarm 1 (if it exists) will occupy Slot 1 (Terminals 9 and 10) and Alarm 2 (if it exists) will occupy Slot 2 (Terminals 7 and 8).



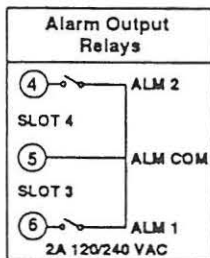
Alarm Wiring IF controller is equipped with Relay Output 1



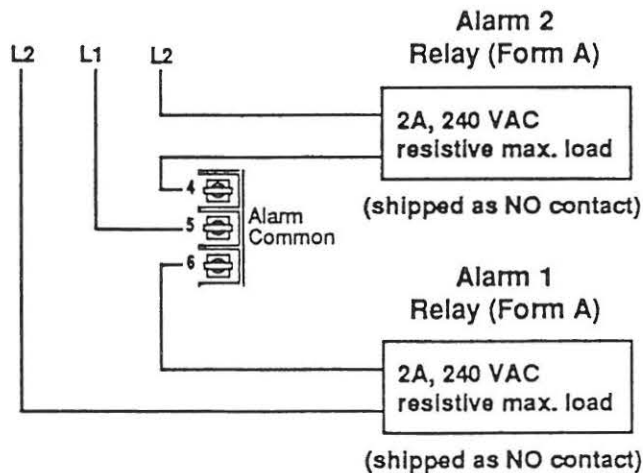
Note that Alarms occupying these positions (Slot 1 & 2) can be field configured to NO or NC. (See "Relay Contacts")

Alarm Wiring (continued)

If the controller is equipped with any Output 1 OTHER THAN Relay (Form C), Alarm 1 (if it exists) will occupy Slot 3 (Terminals 5 and 6) and Alarm 2 (if it exists) will occupy Slot 4 (Terminals 4 and 5).



Alarm Wiring IF controller is NOT equipped with Relay Output 1



Note that Alarm Relays occupying these positions (Slot 3 & 4) can be field configured to NO or NC. (See "Relay Contacts")

4.6 Control Input Wiring

Check Fields 6 and 7 of the 15-digit controller model number (see the label on the side of the case). An "8F" or "8C" in these two fields indicates the controller is equipped with the optional universal input which includes RTD input (and has been shipped from the factory configured for an RTD input). Note that with an "8F" or "8C" in Fields 6 and 7, the input type is field selectable to thermocouple, current, voltage, millivoltage or RTD (see Input Configuration). If anything other than "8F" or "8C" appears in Fields 6 and 7, the input type is field selectable to any input except RTD.

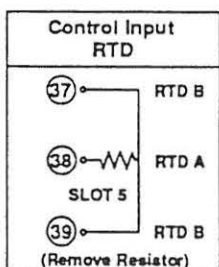
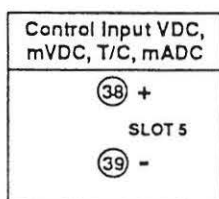
Input 1 always occupies Slot 5 (Terminals 37, 38 and 39) of the controller.

XXXX-X□□XX-XXX-X-XX

Control Input 1

RTD

8F - PLT100 DIN, °F
8C - PLT100 DIN, °C



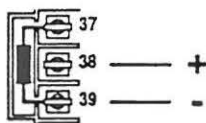
Current and Voltage

C1 - Current (4 to 20 mA)
V1 - Voltage (0 to 5 VDC)
V2 - Voltage (1 to 5 VDC)
V3 - Voltage (0 to 10 VDC)
V4 - Voltage (0 to 100 mVDC)
V5 - Voltage (-10 to 10 mVDC)
V6 - Voltage (0 to 10 mVDC)

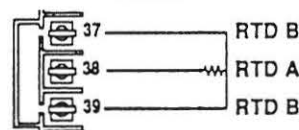
Thermocouple

KF - Type K, °F
KC - Type K, °C
JF - Type J, °F
JC - Type J, °C
EF - Type E, °F
EC - Type E, °C
RF - Type R, °F
RC - Type R, °C
SF - Type S, °F
SC - Type S, °C
BF - Type B, °F
BC - Type B, °C
PF - PL-II, °F
PC - PL-II, °C
CF - Type C, °F
CC - Type C, °C
NF - Type N, °F
NC - Type N, °C
MF - Ni/Ni Mo, °F
MC - Ni/Ni Mo, °C
TF - Type T, °F
TC - Type T, °C

ALL Inputs EXCEPT RTD



RTD ONLY



(Remove compensating resistor)

Note that the controller comes equipped with a temperature compensation resistor connected across Terminals 37 and 39.

This resistor should be left in place for all input types (including volts, millivolts and current) EXCEPT RTDs.

Keep ALL Thermocouple Wiring (or Input Sensor Wiring) Physically Separated from ALL other Wiring.

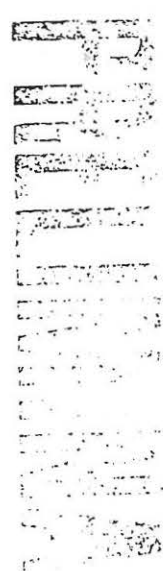
Although normal electrical interference on the sensor leads is effectively eliminated by internal filters, high voltage spikes and inductive transients coupled over into the sensor circuit may bypass the filter system.

WARNING!

Hazardous Extraneous Voltage Capable of Causing Severe Injury or Death may exist between Thermocouple Leads and Ground. Disconnecting the Instrument Power Source may not remove this Voltage. Measure for the presence of Voltage between each Sensor Lead and Ground Before Servicing.

Do NOT place power wiring and sensor wiring in either the same conduit or wiring trough.

If shielded thermocouple leads are used, the shields must be insulated electrically and terminated at one location, preferably the chassis of the controller (Terminal #40).



100

100

5.1 Hardware Security

Check Fields 14 and 15 of the controller model number (see the label on the side of the case). An "02" in Fields 14 and 15 indicates the controller is equipped with the hardware security option. If the hardware security option has been installed, the controller will have a switch (SW1) located on the "Input/CPU" board (see Figure 5.1).

XXXX-XXXX-XXX-X-02

└ Hardware Security Option

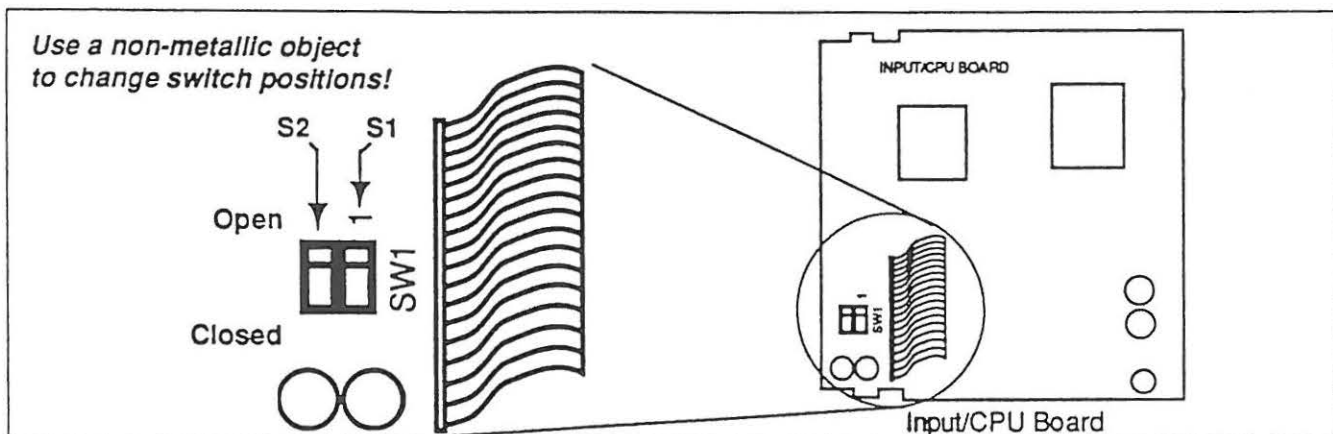


Figure 5.1 Hardware Security Switch Location

S2	S1	Action
Open	Open	Software Lock Only (as shipped)
Open	Closed	Partial Hardware Lock (arrow keys function)
Closed	Open	Total Hardware Lock (keypad totally disabled)
Closed	Closed	Software & Hardware Lock both OFF (no security)

Table 5.1 Hardware Security Switch Positions

5.2 Relay Contacts

Check Field 4 of the 15-digit controller model number (see the label on the side of the case).

A "1" in Field 4 indicates the controller is equipped with a Form C Relay for Control Output 1. In this case, Alarm 1 (if present) occupies Slot 1 (Terminals 9 and 10) of the controller. Output 2 (if present) or Alarm 2 (if present) occupies Slot 2 (Terminals 7 and 8). Note that the controller can NOT have a Form C Relay Output 1 and both an Output 2 (of any kind) and an Alarm 2. Alarm 1 and/or Alarm 2 can be switched from NO to NC. Note that if Relay Output 2 occupies Slot 2 it can NOT be changed from NO to NC (shipped NO).

(continued next page)

Form "C" Relay Output 1 XXX1-XXXXX-XXX-X-XX

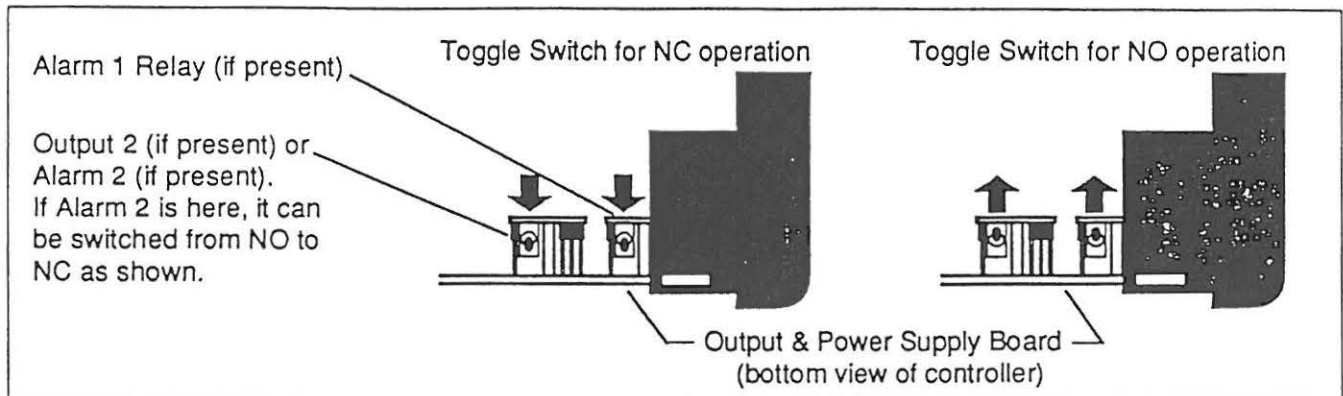


Figure 5.2 Relay Switch Positions

Relay Contacts (continued)

If Field 4 has any character other than a "1" (Form C Relay), Alarm 1 (if it exists) will occupy Slot 3 (Terminals 5 and 6) and Alarm 2 (if it exists) will occupy Slot 4 (Terminals 4 and 5). Alarm 1 and/or Alarm 2 can be switched from NO to NC by relocating the jumpers shown in Figure 5.3 below.

Any Character except "1" XXX-XXXXX-XXX-X-XX

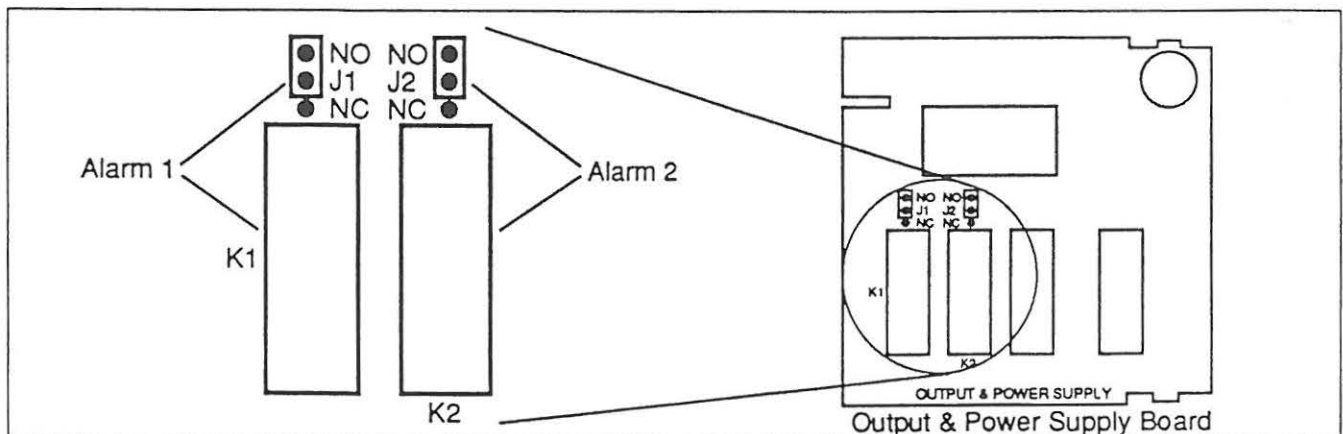
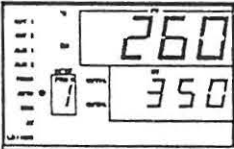
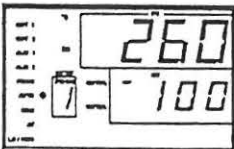


Figure 5.3 Alarm Relay Jumper Locations

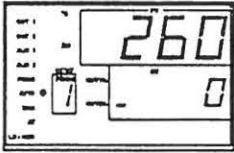
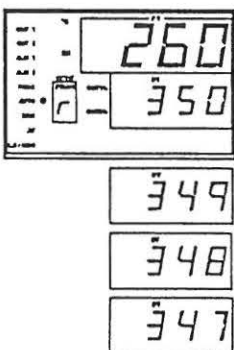
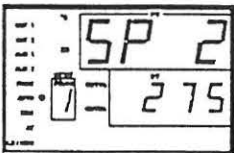
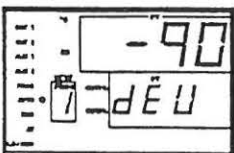
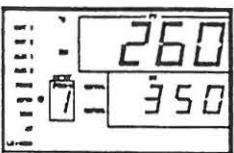
6. The Operating Mode

6.1 Automatic Operation

Display	Key	Description
		The controller will normally power up in the Operating mode. The displays available in the Operating mode will depend on the setup and configuration of the controller. Make certain to go through the "first time operation" procedure before attempting to examine the Operating screens. Note that during automatic (Pid or Pd-r) control, the controller will power up with the process value displayed in the upper (larger) display and the setpoint (if one has been entered) displayed in the lower display. In the automatic control mode, this is the "home" display of the controller. After a "no keystroke" timeout in either the Operating mode or the Setup mode, the controller returns to this display (the exception is that if the controller is left on a screen which shows the process value, it will remain on that screen without timing out).
	 	The control setpoint value can be changed (if the security setting allows) using the Arrow keys.
		The setpoint (and tuning set) can be toggled between "1" and "2" (if security allows and if Setup and Configuration allow) using the Setpoint Select key.
		Manual control can be selected (if security allows and if Setup and Configuration allow) using the Auto/Manual key. The present Pid (or Pd-r) output is converted to a percent out for a "bumpless" transfer.
		Power up autotuning can be cancelled using the Auto-Tune key. Tuning can also be re-initiated (if security allows and if Setup and Configuration allow) using the Auto-Tune key (see the explanation of autotuning).
		The Setup mode can be accessed (if security allows) by pressing (and releasing) the Setup key. Note that in order to allow changes to the software security level, Security Setup is <i>always</i> accessible (see Security Setup).
		The Configuration mode can be accessed (if security allows) by pressing (and holding for 4 seconds) the Setup key.
		Press the Display key to bring up the Output 1 Percent Out display.
		Press the Display key to bring up the Output 2 Percent Out display.

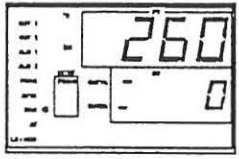
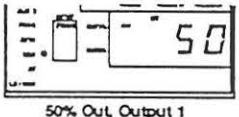
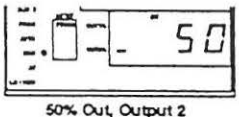
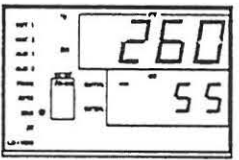
The Operating Mode (continued)

Automatic Operation (continued)

Display	Key	Description
		The Output 2 Percent Out screen is a "read only" screen while the controller is in automatic control. This display will only appear if the controller is equipped with the optional Output 2. The process value remains displayed in the upper display. The percent output of Output 2 (in whole numbers) will be displayed in the lower display. Press the Display key to bring up the Setpoint Ramp display.
		The Setpoint Ramp screen appears only if the Setpoint Ramp function has been enabled (see Loop Setup). The upper display will show the process value and the lower display will show the setpoint as it ramps either up or down according to the ramp rate settings (see Loop Setup). The Set# display will show an "r." Note that if the setpoint is not currently ramping to a different setting, the present setpoint will appear on the lower display. Note also that on power up, this display will ramp from the process value to the present setpoint. Press the Display key to bring up the Setpoint display.
	  	The Setpoint screen is used to display the "other" local setpoint. If Setpoint (and Tuning Set) 1 is in control (a "1" showing in the Set# display), then Setpoint 2 will be displayed here. If Setpoint (and Tuning Set) 2 is in control (a "2" showing in the Set# display), then Setpoint 1 will be displayed here. The arrow keys can be used to increase or decrease whichever setpoint is displayed. Press the Display key to bring up the Deviation display.
		The Deviation screen is a "read only" screen used to display the difference (in engineering units) between the process value and setpoint. A negative number indicates that the process value is below setpoint by the amount displayed. A positive number (no sign) indicates that the process value is above setpoint by the amount displayed. Press the Display key to return to the normal automatic control screen.
		This screen will remain on display during normal operation as an automatic controller.

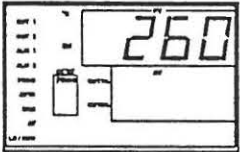
The Operating Mode (continued)

6.2 Manual Operation

Display	Key	Description
 Single Output at power up  Dual Output at power up 		The controller will normally power up in the Operating mode. The displays available in the Operating mode will depend on the setup and configuration of the controller. Make certain to go through the "first time operation" procedure before attempting to examine the Operating screens. Note that during manual (percent out) control, the controller will power up with the process value displayed in the upper (larger) display and the percent out displayed in the lower display. The percent output at power up is determined by the manual percent preset setting. Note that switching outputs (relays, triacs or SSR's) will be converted to time proportioning based on the manual percent out set here and the Cycle Time setting (default cycle time is 30 seconds – see Tuning Set 1 & 2 Setup).
 50% Out, Output 1	 	The percent output can be changed (if the security setting allows) using the Arrow keys. Note that if manual control has been initiated by means of the optional contact input function, it will NOT be possible to change the percent output using the Arrow keys.
 50% Out, Output 2		Automatic control can be selected (if security allows and if Setup and Configuration allow) using the Auto/Manual key. Note that if manual control has been initiated by means of the optional contact input function, it will NOT be possible to switch to automatic control using the Auto/Manual key.
		The Setup mode can be accessed (if security allows) by pressing (and releasing) the Setup key. Note that in order to allow changes to the software security level, Security Setup is <i>always</i> accessible (see Security Setup). The Configuration mode can be accessed (if security allows) by pressing (and holding for 4 seconds) the Setup key. This screen will remain on display during normal operation as a manual controller.

The Operating Mode (continued)

6.3 Indicator Operation

Display	Key	Description
		The controller will normally power up in the Operating mode. The displays available in the Operating mode will depend on the setup and configuration of the controller. Make certain to go through the "first time operation" procedure before attempting to examine the Operating screens. Note that during indicator operation, the controller will power up with the process value displayed in the upper (larger) display and nothing displayed in the lower display. The single seven segment display will also be blank. The Setup mode can be accessed (if security allows) by pressing (and releasing) the Setup key. Note that in order to allow changes to the software security level, Security Setup is <i>always</i> accessible (see Security Setup). The Configuration mode can be accessed (if security allows) by pressing (and holding for 4 seconds) the Setup key. Note that the controller can be purchased as an indicator only (with no outputs) or the control algorithms can both be set to "none" (see Control Configuration). As an indicator, any control outputs will be set to the "off" condition. Every key on the keypad is disabled in the Operating mode except for the Setup key. Any currently configured process alarms will continue to operate. Any currently configured deviation alarms will cease to exist (since there are no control setpoints from which to deviate). Any currently configured loop break alarms will cease to exist (since there are no control loops to be broken). This screen will remain on display during normal operation as an indicator.

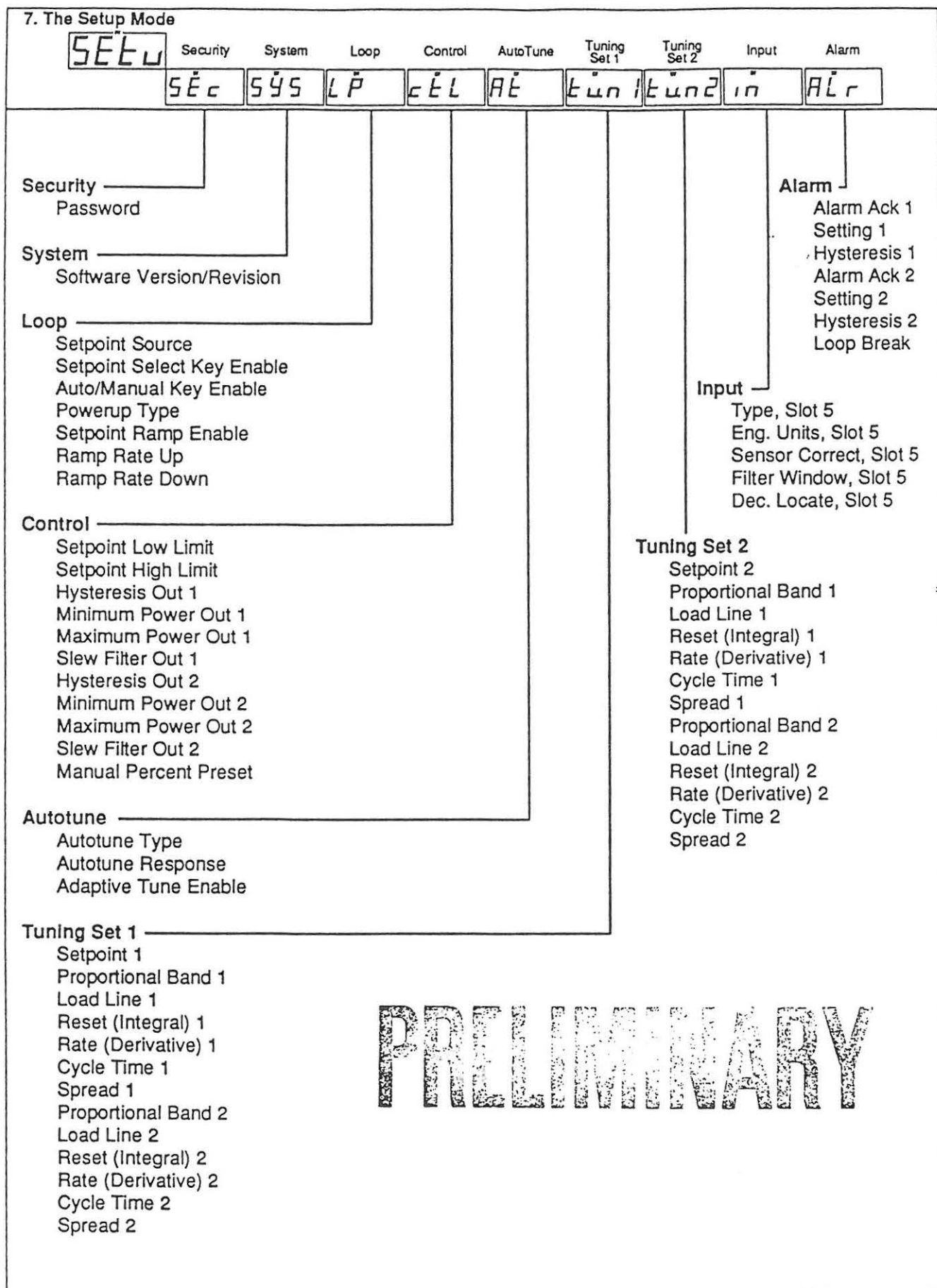
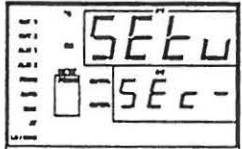
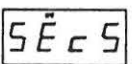
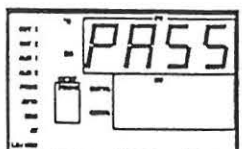


Figure 7.1 The Setup Loop

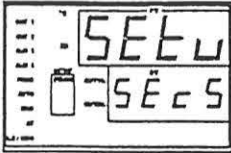
Setup	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEtU	SEc	595	LP	CEL	AE	Ln1	Ln2	in	ALr

7.1 Security Setup

Display	Key	Description
		From the Operating mode, press and release the Setup key and the Security Setup Header screen will appear.
 		If the Security screen appears with a dash in the first position, no software security is in effect. Unless the controller is equipped with the optional hardware security function, ALL Operating, Setup and Configuration screens will be accessible to the operator. If desired, go to the Security Configuration section to enable the software security function. If the Security screen appears with a number in the first position, software security is in effect and the number indicates the security level. The security level determines which Operating, Setup and Configuration screens are available to the user as follows: - Level 1 Operating mode screens can be viewed, but data cannot be changed. For software security, this is the default level. - Level 2 Same as Level 1, except setpoints (or percent out in manual mode) can be changed. - Level 3 Same as Level 2, except setpoint select, autotune and auto/manual can be used. - Level 4 Same as Level 3, except Setup is accessible. - Level 5 Same as Level 4, except Configuration is accessible. Note that the controller will power up at the same security level at which it was powered down. Note that in order to allow changes to the software security level, Security Setup is <i>always</i> accessible. Press the Function key to bring up the Password Enter display.
	  	7.1.1 Password Enter Use the Arrow keys to select a passcode. Pressing the Function key (or any key other than an Arrow key) will cause the code to be entered and the new security level to appear. After 3 successive wrong passcodes, the controller will set itself to Security Level 1. See Security Configuration to change the passcodes (note that the controller must be at Security Level 5). If identical codes are used for two or more levels, the first time the code is entered the controller will go to the lowest level for that code. If the same code is entered again (from that level), the controller will go to the next level that uses that code...etc. (note that doing this successively can cause the controller to "wrap around" to the lower security level). Press the Function key to bring up the Security Setup Header screen.

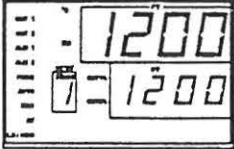
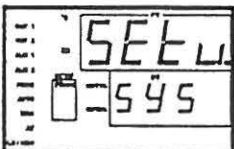
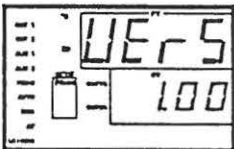
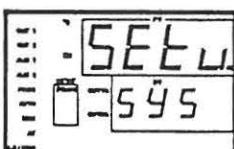
Setup									
SEtU	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEc	SYS	LP	CEL	AE	tun1	tun2	in	ALr	

Security Setup (continued)

Display	Key	Description
	DISPLAY SET - UP RUN HOLD	Press the Display key to return to the Operating mode or press the Setup key to continue through the Setup mode (or press the Run/Hold key to go backwards through the Setup mode). After 4 minutes without a key press the display will return to the Operating mode.

Setup	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEtL	SEc	SYS	LP	CEL	AE	Tun1	Tun2	in	ALr

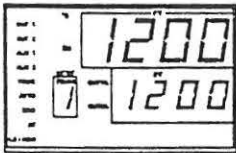
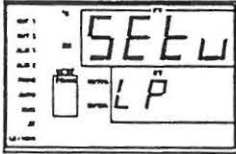
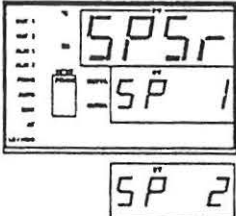
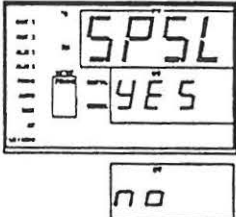
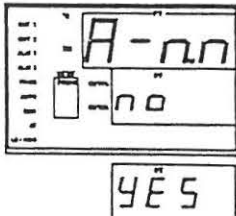
7.2 System Setup

Display	Key	Description
		From the Operating mode, press and release the Setup key. Press the Setup key a second time and the System Setup Header screen will appear.
		Note that there are presently no System Setup functions available to the user. System Setup does contain a "read only" Software Version screen. Press the Function key to bring up the Software Version screen.
		7.2.1 Software Version/Revision The Software Version screen displays the version and revision level of the software included with the controller (in the format VV.RR, where "VV" is the Version number and "RR" is the revision level of the Version). Press the Function key to bring up the System Setup Header screen.
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Setup mode (or press the Run/Hold key to go backwards through the Setup mode). After 4 minutes without a key press the display will return to the Operating mode.

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED

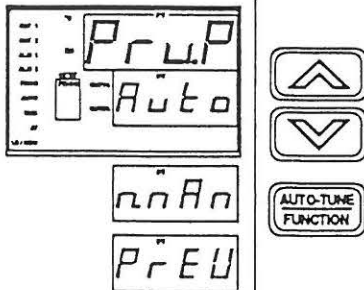
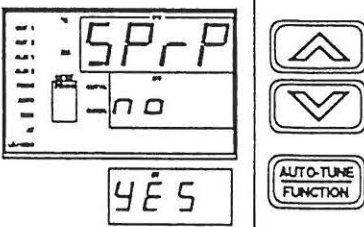
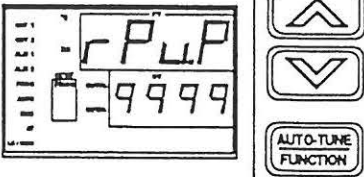
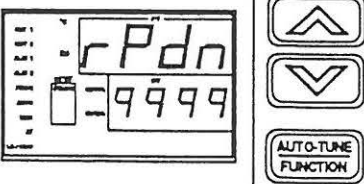
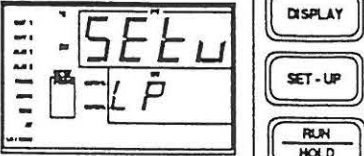
Setup	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEtU	SEc	SYs	LP	CEL	AE	tun1	tun2	in	ALr

7.3 Loop Setup

Display	Key	Description
		From the Operating mode, press and release the Setup key. Press the Setup key two more times and the Loop Setup Header screen will appear.
		Loop functions include setpoint (tuning set) source, setpoint (tuning set) select key enable, auto/manual select key enable, power up type, setpoint ramp enable, ramp up setpoint, and ramp down setpoint. Press the Function key to bring up the Setpoint Source display.
	  	7.3.1 Setpoint Source The Setpoint Source determines the controlling setpoint AND tuning constants. SP 1 is the default setting. Currently, the only choices are SP 1 and SP 2. Choosing SP 1 causes the controller to use the setpoint and constants entered in Tuning Set 1 ("tun 1"). Choosing SP 2 causes the controller to use the setpoint and constants entered in Tuning Set 2 ("tun 2"). Note that changing from SP 1 to SP 2 and vice-versa can also be accomplished from the Operating mode (if setpoint select below is enabled). Note that the contact input function has priority over the Setpoint Source (see Input Configuration). Note that Tuning Set Limit may limit this function (see Loop Configuration). Press the Function key to bring up the Setpoint Select Enable screen.
	  	7.3.2 Setpoint Select Key Enable The Setpoint Select Key Enable screen determines whether or not the controller can be switched between SP 1 and SP 2 from the Operating mode. "Yes" is the default setting. Choosing "Yes" causes the Setpoint Select key to function. Choosing "No" causes the Setpoint Select key to not function. In the Operating mode, with Setpoint Select enabled, pressing the Setpoint Select key will cause the controller to toggle between Tuning Set 1 and Tuning Set 2. Note that Tuning Set Limit may limit this function (see Loop Configuration). Press the Function key to bring up the Auto/Manual Key Enable screen.
(option) 	  	7.3.3 Auto/Manual Key Enable The Auto/Manual Key Enable screen determines whether or not the Auto/Manual key functions. This screen will not appear unless the option has been purchased. "No" is the default setting. Choosing "no" causes the Auto/Manual key to not function. Choosing "yes" allows the Auto/Manual key to function. In the Operating mode, with the Auto/Manual key enabled, pressing the Auto/Manual key will cause the controller to toggle between automatic (PID type) and manual (Percent Out) control. Individual LEDs on the controller front will indicate the type of control. Pressing the Up or Down Arrow keys when in the manual mode will change the Percent Output of the controller (refer to the Operating mode). Note that the contact input function has priority over the Auto/Manual key (see Input Configuration). Press the Function key to bring up the Powerup Type screen.

Setup	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEtU	SEc	SYS	LP	CEL	AE	tun1	tun2	in	ALr

Loop Setup (continued)

Display	Key	Description
	  	7.3.4 Powerup Type The Powerup Type screen determines the powerup mode of the controller. "Auto" is the default setting. Choosing "auto" causes the controller to power up in automatic (PID type) control. Choosing "man" causes the controller to power up in the manual (Percent Out) mode (using the Manual Percent Preset setting – see Control Setup). Choosing "prev" causes the controller to power up in the mode in which it was powered down (either automatic or manual). Note that if the controller is powered down in the Configuration mode, it will then power up in the Configuration mode. Once the controller is put in the Operating mode, it will be in the "proper" type as determined by this variable. Press the Function key to bring up the Setpoint Ramp Enable screen.
	  	7.3.5 Setpoint Ramp Enable The Setpoint Ramp Enable screen determines whether or not the setpoint ramp function will execute when the control setpoint is changed. "No" is the default setting. Choosing "no" causes the ramp function not to execute. Any setpoint change will be implemented as a "step" change. Choosing "yes" causes the ramp function to execute. Setpoint changes will occur according to the Ramp Up or Ramp Down settings below. Press the Function key to bring up the Ramp Rate Up setting screen.
	  	7.3.6 Ramp Rate Up The Ramp Rate Up setting determines the rate at which the control setpoint will move from the present setpoint to a higher setpoint. Entry is in engineering units per minute. 9999 is the default setting. The range of the setting is from 1 to 9999 units per minute. Press the Function key to bring up the Ramp Rate Down setting screen.
	  	7.3.7 Ramp Rate Down The Ramp Rate Down setting determines the rate at which the control setpoint will move from the present setpoint to a lower setpoint. Entry is in engineering units per minute. 9999 is the default setting. The range of the setting is from 1 to 9999 units per minute. Press the Function key to bring up the Loop Setup Header screen.
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Setup mode (or press the Run/Hold key to go backwards through the Setup mode). After 4 minutes without a key press the display will return to the Operating mode.

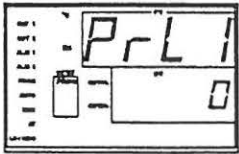
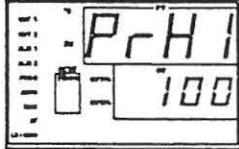
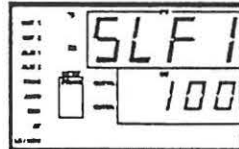
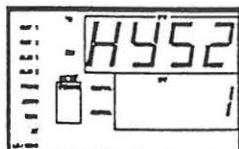
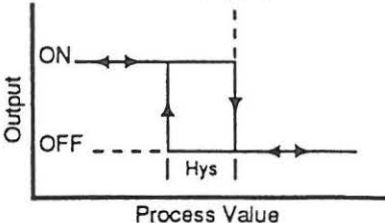
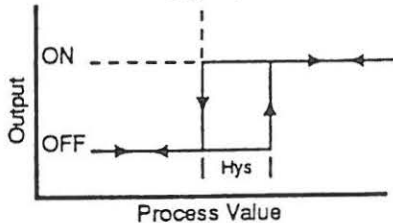
Setup	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEtL	SEc	SYS	LP	CEL	AE	tun1	tun2	in	ALr

7.4 Control Setup

Display	Key	Description
		From the Operating mode, press and release the Setup key. Press the Setup repeatedly until the Control Setup Header screen appears.
		The Control settings include setpoint low and high, Output 1 hysteresis, Output 1 minimum and maximum power, Output 2 hysteresis, Output 2 minimum and maximum power, and manual percent preset output. Press the Function key to bring up the Setpoint Low Limit screen.
	 	7.4.1 Setpoint Low Limit The Setpoint Low Limit screen determines the lowest setting the control setpoint can assume. The default setting will be the Input Scale Low setting. The range will be from the Input Scale Low setting to the Setpoint High Limit. Note that whenever the Input type is changed, this setting changes to match the Input Scale Low setting of whichever input has been chosen (see Input Configuration). Press the Function key to bring up the Setpoint High Limit screen.
	 	7.4.2 Setpoint High Limit The Setpoint High Limit screen determines the highest setting the control setpoint can assume. The default setting will be the Input Scale High setting. The range will be from the Setpoint Low Limit to the Input Scale High setting. Note that whenever the Input type is changed, this setting changes to match the Input Scale High setting of whichever input has been chosen (see Input Configuration). Press the Function key to bring up the Output 1 Hysteresis screen.
	 	7.4.3 Output 1 Hysteresis The Output 1 Hysteresis setting determines the hysteresis applied to a switching Output 1. This screen appears only if Control Algorithm 1 is "on/off." The default setting is one (engineering unit). The range is 10% of the Input Scale (Input Scale High - Input Scale Low). Hysteresis (Reverse Acting Output) Setpoint Output Process Value Hysteresis (Direct Acting Output) Setpoint Output Process Value Press the Function key to bring up the Output 1 Minimum Power screen.

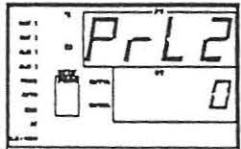
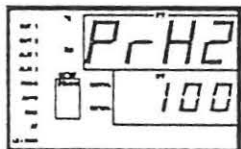
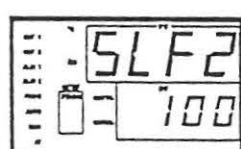
Setup									
SEtup	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
	SEc	SYS	LP	CEL	AE	Tun1	Tun2	in	ALr

Control Setup (continued)

Display	Key	Description
	  	7.4.4 Output 1 Minimum Power The Output 1 Minimum Power setting determines the minimum demand percent allowed at Output 1 <i>when using Pid or Pd-r control</i>. If Control Algorithm 1 calls for a demand of less than this setting, this setting will be used as the output. This screen will not appear unless Control Algorithm 1 is Pid or Pd-r (see Control Configuration). If the Pid type for Control Algorithm 1 is FAN, the default setting is 20%; otherwise the default is 0%. The range is from 0% to the Output 1 Maximum Power setting. Press the Function key to bring up the Maximum Power 1 screen.
	  	7.4.5 Output 1 Maximum Power The Output 1 Maximum Power setting determines the maximum demand percent allowed at Output 1 <i>when using Pid or Pd-r control</i>. If Control Algorithm 1 calls for a demand of more than this setting, this setting will be used as the output. This screen will not appear unless Control Algorithm 1 is Pid or Pd-r (see Control Configuration). The default setting is 100%. The range is from Output 1 Minimum Power to 100% (105% for an analog output). Press the Function key to bring up the Output 1 Slew Filter screen.
	  	7.4.6 Output 1 Slew Filter The Output 1 Slew Filter setting limits the maximum change in demand from one update to the next. This screen will not appear unless Control Algorithm 1 is Pid or Pd-r (see Control Configuration). The default setting is 100%. The range is from 1% to 100%. Note that the controller update time is approximately 150 milliseconds (so that a setting of 10% for the slew filter would cause a change in demand to be spread over 1.5 seconds). Press the Function key to bring up the Output 2 Hysteresis screen.
	  	7.4.7 Output 2 Hysteresis The Output 2 Hysteresis setting determines the hysteresis applied to a switching Output 2. This screen appears only if Control Algorithm 2 is "on/off." The default setting is one (engineering unit). The range is 10% of the Input Scale (Input Scale High - Input Scale Low). Hysteresis (Reverse Acting Output) Setpoint  Process Value Hysteresis (Direct Acting Output) Setpoint  Process Value Press the Function key to bring up the Output 2 Minimum Power screen.

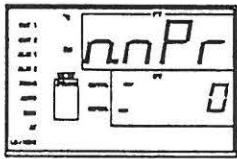
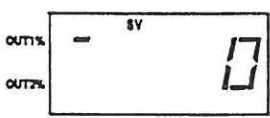
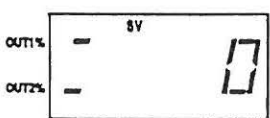
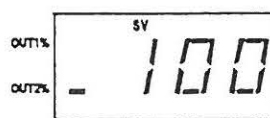
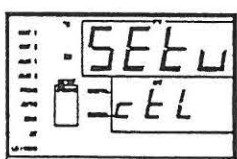
Setup									
SEtU	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEc	SYs	LP	CEL	AE	tun1	tun2	in	ALr	

Control Setup (continued)

Display	Key	Description
	  	7.4.8 Output 2 Minimum Power The Output 2 Minimum Power setting determines the minimum demand percent allowed at Output 2 <i>when using Pid or Pd-r control</i>. If Control Algorithm 2 calls for a demand of less than this setting, this setting will be used as the output. This screen will not appear unless the controller is equipped with a second (optional) output and Control Algorithm 2 is either Pid or Pd-r (see Control Configuration). If the Pid type for Control Algorithm 2 is FAN, the default setting is 20%; otherwise the default is 0%. The range is from 0% to the Maximum Power 2 setting. Press the Function key to bring up the Output 2 Maximum Power screen.
	  	7.4.9 Output 2 Maximum Power The Output 2 Maximum Power setting determines the maximum demand percent allowed at Output 2 <i>when using Pid or Pd-r control</i>. If the Control Algorithm 2 calls for a demand of more than this setting, this setting will be used as the output. This screen will not appear unless the controller is equipped with a second (optional) output and Control Algorithm 2 is either Pid or Pd-r (see Control Configuration). The default setting is 100%. The range is from Minimum Power 2 to 100% (105% for an analog output). Press the Function key to bring up the Output 2 Slew Filter screen.
	  	7.4.10 Output 2 Slew Filter The Output 2 Slew Filter setting limits the maximum change in demand from one update to the next. This screen will not appear unless Control Algorithm 2 is Pid or Pd-r (see Control Configuration). The default setting is 100%. The range is from 1% to 100%. Note that the controller update time is approximately 150 milliseconds (so that a setting of 10% for the slew filter would cause a change in demand to be spread over 1.5 seconds). Press the Function key to bring up the Manual Percent Preset screen.

Setup									
SEtL	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEt	SYs	LP	CEL	AE	ELn 1	ELn 2	in	ALr	

Control Setup (continued)

Display	Key	Description
	  	7.4.11 Manual Percent Preset The Manual Percent Preset setting determines output demand if the Manual Mode is selected in any of the following ways: 1. "Manual" is selected as a Contact Input (see Input Configuration) AND the Auto/Manual Transfer type is "Manual Percent" (see Loop Configuration). 2. The controller powers up in the Manual Mode because the power up type was set to "Manual" (or "Previous" and the previous setting was manual – see Loop Setup). 3. A sensor break occurs and the sensor break action is set to "Autocomp" (see Loop Configuration) AND the autocompensation type is set to "Manual Percent" (see Loop Configuration). The default setting is 0%. The range for a controller with a single output is 0% to 100% (105% for analog outputs). The range for a controller with two outputs is from 100% Output 1 to 100% Output 2 (105% for analog outputs).  0% Out, Single Output  100% Out, Output 1  0% Out, Dual Output  100% Out, Output 2 Press the Function key to bring up the Control Header screen.
	  	Press the Display key to return to the Operating mode or press the Setup key to continue through the Setup mode (or press the Run/Hold key to go backwards through the Setup mode). After 4 minutes without a key press the display will return to the Operating mode.

PRELIMINARY

Setup	Security	System	Loop	Control	AutoTune	Tuning Set 1	Tuning Set 2	Input	Alarm
SEtU	SEc	SYS	LP	CEL	AE	TUN1	TUN2	IN	ALr

7.5 Autotune Setup

Display	Key	Description
		From the Operating mode, press and release the Setup key. Press the Setup key repeatedly until the Autotune Setup Header screen appears. Note that in order for the AT Setup Header screen to appear, at least one Algorithm must be set to "Pid" or "Pd-r" (see Control Configuration) and the corresponding control action must be set to "rEV" (see also Control Configuration).
		The Autotune settings include autotune type, autotune response, and adaptive tune enable. Press the Function key to bring up the Autotune Type screen.
	 	7.5.1 Autotune Type The Autotune Type setting determines whether or not automatic tuning will be active. "nonE" is the default setting. Choosing "nonE" disables autotuning. Choosing "powerup" will cause automatic (Pid or Pd-r) tuning to occur at startup (it is not necessary to press the Autotune key). <i>Note that the tuning constants will be stored in whichever Tuning Set is active at the time tuning is performed. Refer to the section "How Autotuning Works."</i> Press the Function key to bring up the Autotune Response setting.
	 	7.5.2 Autotune Response The Autotune Response setting determines the type of damping that the autotuning routines will attempt to accomplish. In order for this display to appear, the Autotune Type must be something other than "nonE." "1.0" (critically damped) is the default setting. The range is from "0.5" (overdamped) to "1.5" (underdamped). If the autotuning constants cause "ringing" in the process, decrease this setting and redo autotuning. If the autotuning constants cause the process to come up to temperature too slowly, increase this setting and redo autotuning. Press the Function key to bring up the Adaptive Tune Enable screen.
	 	7.5.3 Adaptive Tune Enable The Adaptive Tune Enable setting determines whether or not adaptive tuning (the oscillation monitor) is active. "No" is the default setting. Choosing "no" disables the oscillation monitor and leaves the autotuning constants intact. Choosing "yes" enables the oscillation monitor, which will then be used to try to eliminate cyclical oscillations of the process by adjusting the tuning constants. Refer to the section "How Adaptive Tuning Works." Press the Function key to bring up the AT Setup Header screen.
	 	Press the Display key to return to the Operating mode or press the Setup key to continue through the Setup mode (or press the Run/Hold key to go backwards through the Setup mode). After 4 minutes without a key press the display will return to the Operating mode.