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MIC 1422 MICROBASED CONTROLLER INSTRUCTION MANUAL

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SECTION 1: PRODUCT DESCRIPTION

1.1 General

This instrument is a microprocessor based single loop controller capable of measuring, displaying and controlling temperature, pressure, flow, and level from a variety of inputs. Most outputs are easily tuned using the instrument Pre-Tune and Auto-Tune, or RaPID (Response assisted PID) functions.

Control functions, alarm settings and other parameters are easily entered through the front keypad. E² Technology (100 year life) protects against data loss during AC power outages.

The input is user configurable to directly connect to either thermocouple, RTD, mVDC, VDC or mADC inputs. The instrument can operate from either a 90-264 VAC, 50/60 HZ power supply, or optional 24V AC/DC power supply.

Standard features include:

- Auto Tune
- Alarm Functions
- Auto/Manual Switching
- Process Retransmission
- Setpoint Retransmission
- Setpoint Ramp Rate
- Proportioning (Time or Current)/On-Off Control
- Single On-Off Control
- Single Time Proportioning Control
- Single Current Proportioning

Optional features include:

- Dual On-Off Control
- Dual Time Proportioning
- Dual Current Proportioning
- Dual Setpoint
- Remote Setpoint
- Digital Communications
- Alarm Outputs

1.2 Displays

Each instrument is provided with dual displays and status indicators as shown in Figure 1 -1. The upper display (RED) displays the value of the process variable. The lower display (GREEN) displays the setpoint value.

1.3 Control

The instrument can be programmed for on-off, time proportioning, or current proportioning control implementations depending on the model number. A second control output is an available option. Proportional control implementations are provided with fully programmable PID parameters.

1.4 Alarms

Alarm indication is standard on all instruments. Up to two alarm outputs are possible. Alarm type may be set as Process Direct or Reverse (high or low), Deviation Direct or Reverse (above or below setpoint), Deviation Band Type (closed or open within band), or Loop Reverse or Direct. Alarm status is indicated by LED. An Alarm Inhibit is provided to prevent, when activated, unwanted alarms during power-up.

FIGURE 1-1
Keys and Indicators



1.5 Process Variable/Setpoint Value Re-Transmission Output

If the instrument is specified with this option, this output may be scaled over any desired range and re-transmitted.

SECTION 2: INSTALLATION AND WIRING

2.1 Mounting

Electrical code requirements and safety standards should be observed and installation performed by qualified personnel.

The electronic components of the instrument may be removed from the housing during installation. To remove the components, grip the side edges of the front panel and pull the instrument forward. During re-installation, the vertically mounted circuit boards should be properly aligned in the housing.

Ensure that the instrument is correctly orientated. A stop will operate if an attempt is made to insert the instrument incorrectly.

Recommended panel opening sizes are illustrated in Figure 2-1. After the opening is properly cut, insert the instrument into the panel opening. Ensure that the panel gasket is not distorted and that the instrument is positioned squarely against the panel. Slide the mounting clamp into place on the instrument (see Figure 2-3) and push it forward until it is firmly in contact with the rear face of the mounting panel.

Note: The mounting clamp tongues may engage either on the sides or the top/bottom of the instrument housing, Therefore, when installing several instruments side-by-side in one cut out, use the ratchets on the top/bottom faces.

FIGURE 2-1
Panel Cut-Out Dimensions

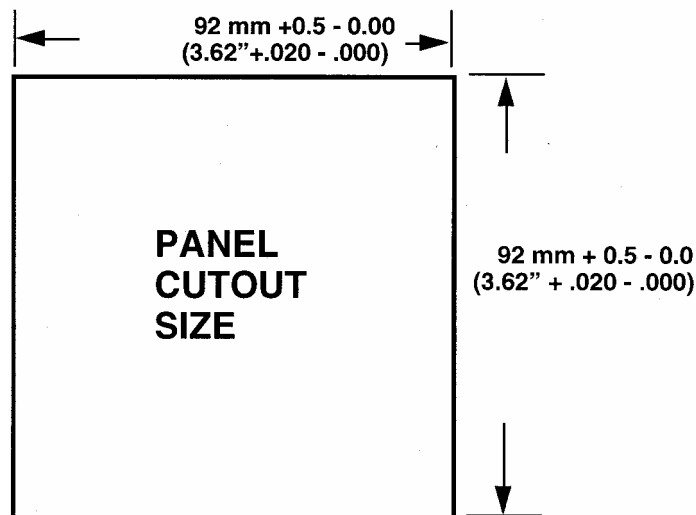


FIGURE 2-2
Main Dimensions

MIC1422

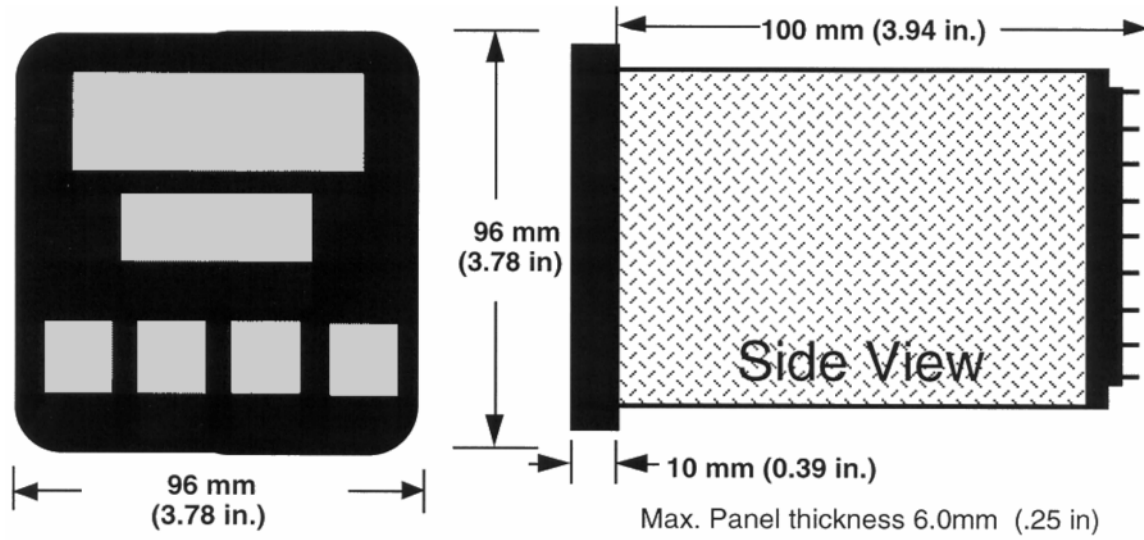
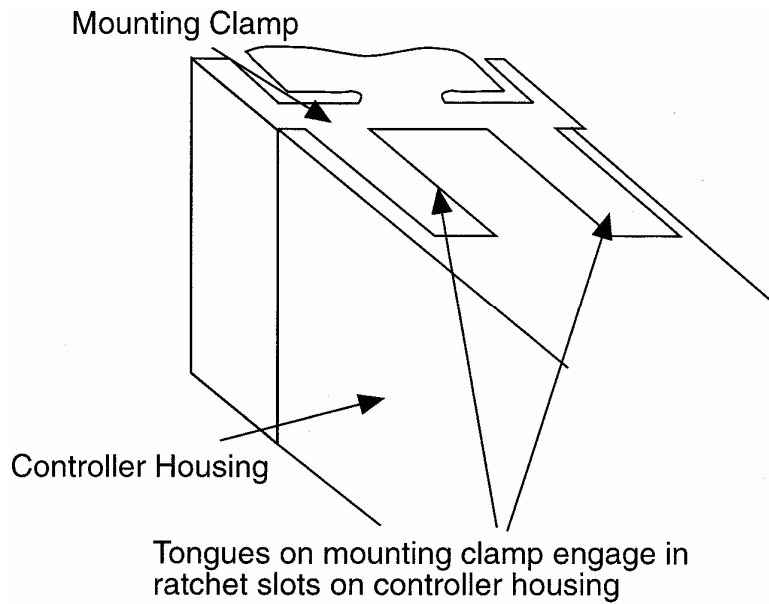


FIGURE 2-3
Panel Mounting the Controller



2.2 Wiring Guidelines

Electrical noise is a phenomenon typical of industrial environments. The following are guidelines that must be followed to minimize the effect of noise upon any instrumentation.

Installation Considerations

Listed below are some of the common sources of electrical noise in the industrial environment:

- Ignition Transformers
- Arc Welders
- Mechanical contact relay(s)
- Solenoids

Before using any instrument near the device listed, the instructions below should be followed:

1. If the instrument is to be mounted in the same panel as any of the listed devices, separate them by the largest distance possible. For maximum electrical noise reduction, the noise generating devices should be mounted in a separate enclosure.
2. If possible, eliminate mechanical contact relay(s) and replace with solid state relays. If a mechanical relay being powered by an instrument output device cannot be replaced, a solid state relay can be used to isolate the instrument.
3. A separate isolation transformer to feed only instrumentation should be considered. The transformer can isolate the instrument from noise found on the AC power input.
4. If the instrument is being installed on existing equipment, the wiring in the area should be checked to insure that good wiring practices have been followed.

AC Power Wiring

Neutral (For 115 VAC)

It is good practice to assure that the AC neutral is at or near ground potential. To verify this, a voltmeter check between neutral and ground should be done. On the AC range, the reading should not be more than 50 millivolts. If it is greater than this amount, the secondary of this AC transformer supplying the instrument should be checked by an electrician. A proper neutral will help ensure maximum performance from the instrument.

Wire Isolation

Four voltage levels of input and output wiring may be used with the unit:

- Analog input or output (i.e. thermocouple, RTD, VDC, MVDC, or mADC)
- SPDT Relays
- SSR driver outputs
- AC power

The only wires that should run together are those of the same category. If they need to be run parallel with any of the other lines, maintain a minimum 6 inch space between the wires. If wires must cross each other, do so at 90 degrees. This will minimize the contact with each other and reduces "cross talk". "Cross Talk" is due to the EMF (Electro Magnetic Flux) emitted by a wire as current passes through it. This EMF can be picked up by other wires running in the same bundle or conduit.

In applications where a High Voltage Transformer is used (i.e. ignition systems) the secondary of the transformer should be isolated from all other cables.

This instrument has been designed to operate in noisy environments, however, in some cases even with proper wiring it may be necessary to suppress the noise at its source.

Use Of Shielded Cable

Shielded cable helps eliminate electrical noise being induced on the wires. All analog signals should be run with shielded cable. Connection lead length should be kept as short as possible, keeping the wires protected by the shielding. The shield should be grounded at one end only. The preferred grounding location is the sensor, transmitter or transducer.

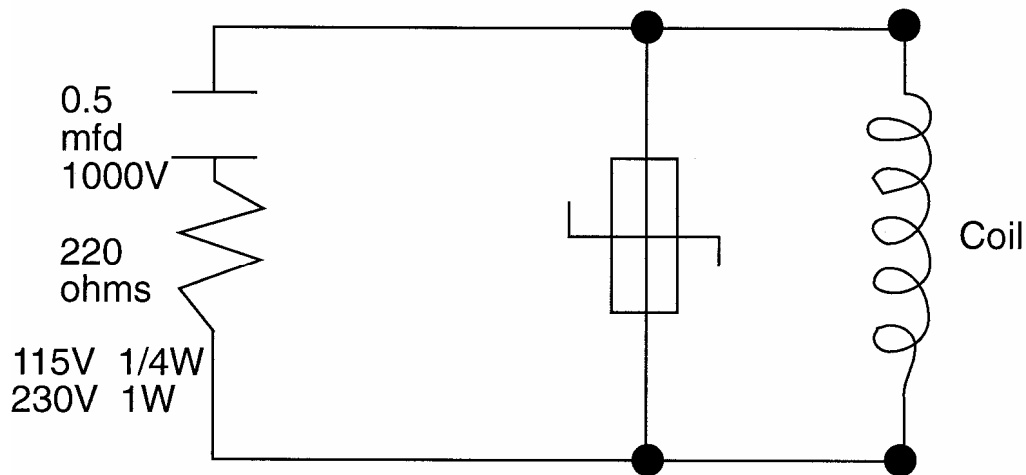
Noise Suppression At The Source

Usually when good wiring practices are followed no further noise protection is necessary. Sometimes in severe electrical environments, the amount of noise is so great that it has to be suppressed at the source. Many manufacturers of relays, contactors, etc. supply "surge suppressors" which mount on the noise source.

For those devices that do not have surge suppressors supplied, RC (resistance-capacitance) networks and/or MOV (metal oxide varistors) may be added.

Inductive Coils - MOV's are recommended for transient suppression in inductive coils connected in parallel and as close as possible to the coil. See Figure 2-4. Additional protection may be provided by adding an RC network across the MOV.

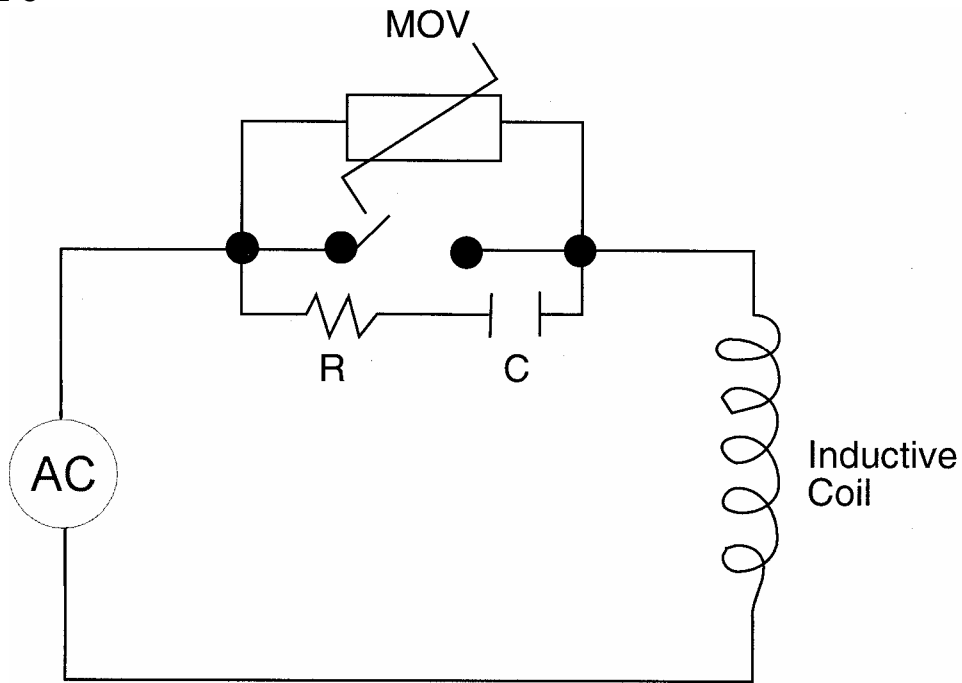
FIGURE 2-4



Contacts - Arcing may occur across contacts when the contact opens and closes. This results in electrical noise as well as damage to the contacts. Connecting a RC network properly sized can eliminate this arc.

For circuits up to 3 amps, a combination of a 47 ohm resistor and 0.1 microfarad capacitor(1000volts)is recommended. For circuits from 3 to 5 amps, connect 2 of these in parallel. See Figure 2-5, below.

FIGURE 2-5



2.3 Sensor Placement (Thermocouple or RTD)

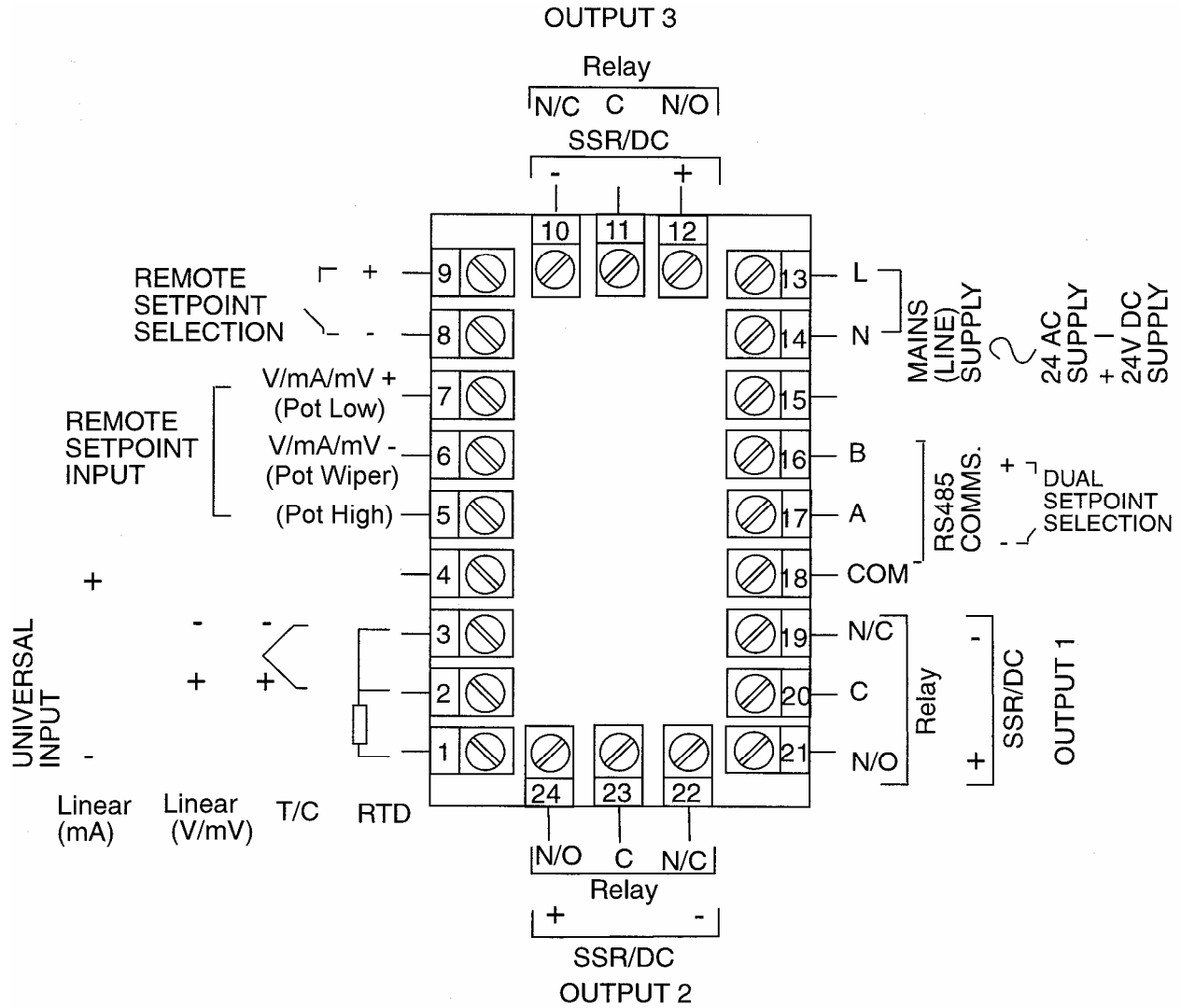
Two-wire RTDs should be used only with lead lengths less than 10 feet.

If the temperature probe is to be subjected to corrosive or abrasive conditions, it should be protected by the appropriate thermowell. The probe should be positioned to reflect true process temperature:

- In liquid media - the most agitated area
- In air - the best circulated area

FIGURE 2-6
Wiring Label

1/4
DIN



2.4 Input Connections

In general, all wiring connections are made to the instrument after it is installed. Avoid Electrical Shock. AC power wiring must not be connected to the source distribution panel until all wiring connection procedures are completed.

Caution: This equipment is designed for installation in an enclosure which provide adequate protection against electric shock. Local regulations regarding electrical installation should be rigidly observed. Consideration should be given to prevention of access to the power terminations by unauthorized authorized personnel. Power should be connected via a two pole isolating switch (preferably situated neat the equipment) and a 1 A fuse, as shown in Figure 2-7.

FIGURE 2-7
Main Supply

The instrument will operate on 90-264V AC 50/60 Hz line supply. The power consumption is approximately 4 VA. If the instrument has relay outputs in which the contacts are to carry line voltage, it is recommended that the relay contact line supply be switched and fused in a similar manner, but separate from the instrument line supply.

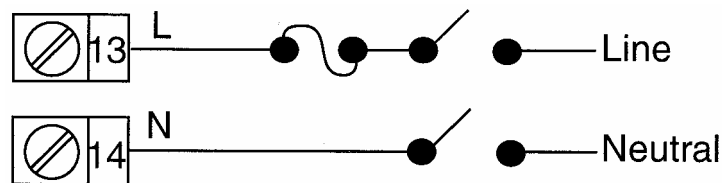


FIGURE 2-7A
24V Nominal AC/DC Supply

The supply connection for the 24V AC/DC option of the instrument are as shown below. Power should be connected via a two pole isolating switch and a 315 mA slow-blow (anti-surge type T) fuse. With the 24V AC/DC supply option fitted, these terminals will accept the following supply voltage ranges:

24V (nominal) AC 50/60 Hz -	20 - 50 V
24V (nominal) DC -	22 - 65 V

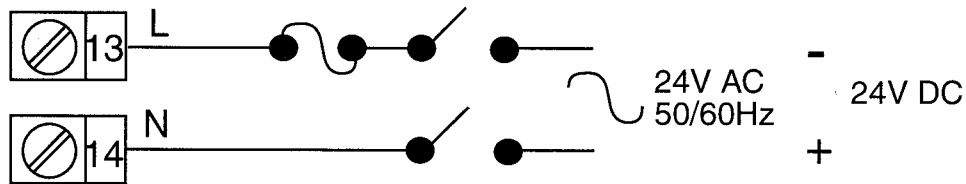


FIGURE 2-8
Thermocouple (T/C) Input

Make thermocouple connections as illustrated below. Connect the positive leg of the thermocouple to terminal 2 and the negative leg to terminal 3.

Note: Thermocouple must not be grounded! Damage to the cold junction in the control will result!

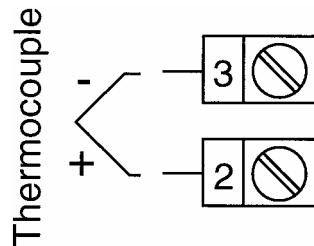


FIGURE 2-9
RTD Input

Make RTD connections as illustrated below. For a three wire RTD, connect the resistive leg of RTD to terminal 1 and the common legs to terminals 2 and 3. For a two wire RTD, connect one leg to terminal 2 and the other leg to terminal 3 as shown below. A jumper wire supplied by the customer must be installed between terminals 2 and 3. Input conditioning jumper must be positioned correctly (see Appendix B) and Hardware Definition Code must be correct (see Section 8, Configuration Mode).

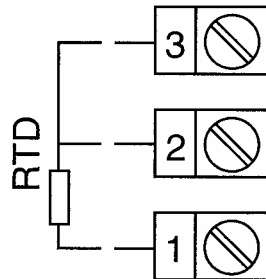


FIGURE 2-10
Volt, mV Input

Make volt and millivolt connections as shown below. Terminal 2 is positive and terminal 3 is negative. Input conditioning jumper must be positioned correctly (see Appendix A) and Hardware Definition Code must be correct (see Section 8, Configuration Mode).

mADC Input

Make mADC connections as shown below. Terminal 4 is positive and terminal 1 is negative. Input conditioning jumper must be positioned correctly (see Appendix A) and Hardware Definition Code must be correct (see Section 8, Configuration Mode).

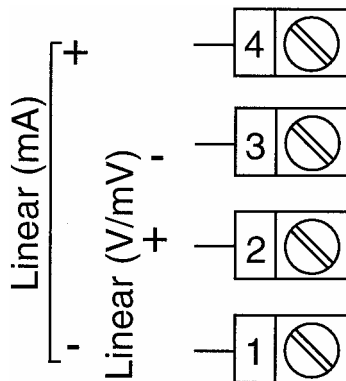


FIGURE 2-11
Remote Digital Communications - RS485

Make digital communication connections as illustrated below.

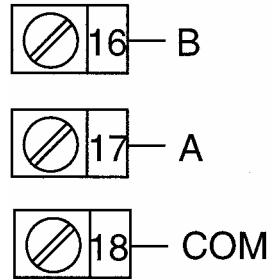


FIGURE 2-12
Remote Setpoint Input - V/mA/mV and Potentiometer

Connections are illustrated below. Terminal 6 is positive and terminal 7 is negative. The remote setpoint input can be configured for linear DC mv, linear DC mA, linear DC Volt or potentiometer. Make sure that the input selected matches the Second Input Usage selected in the Hardware Definition Mode and the Secondary Analog Input conditioning jumper is positioned correctly (see Appendix A.)

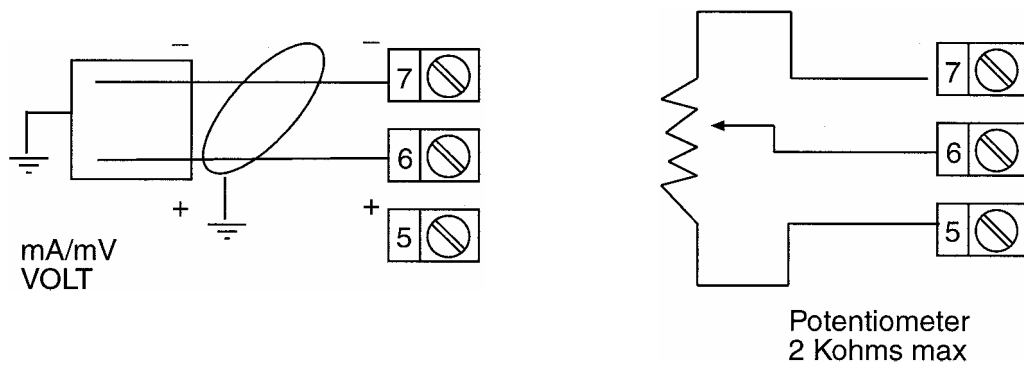


FIGURE 2-13
Remote Setpoint Selection

Connections are made as shown.

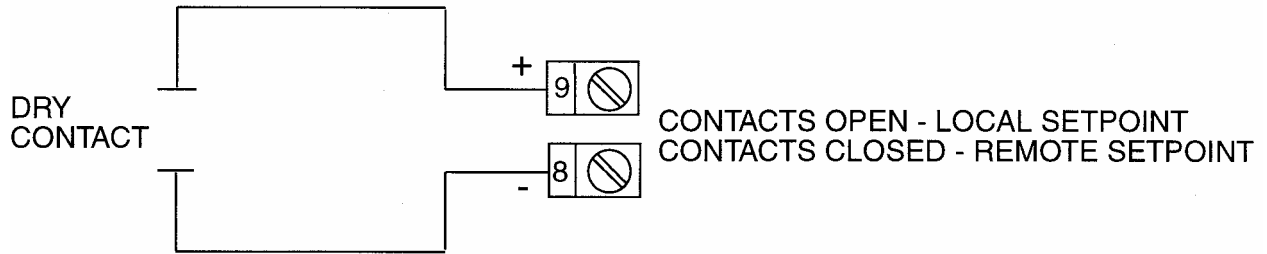
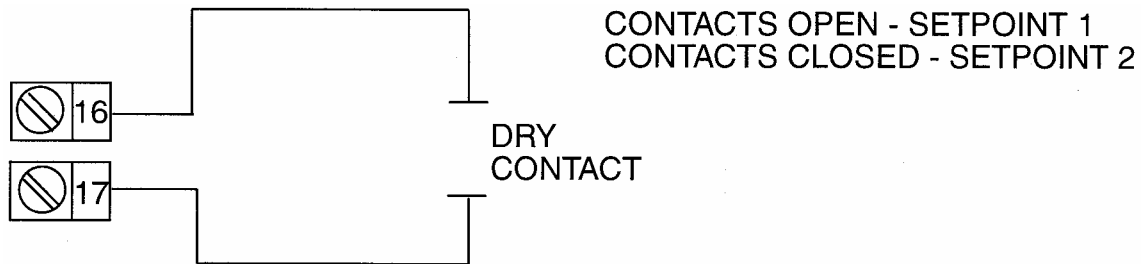


FIGURE 2-14
Dual Setpoint Selection

Connections are made as shown.



2.5 Output Connections

FIGURE 2-15
Relay Output 1 (Control Output 1)

Connections are made to Output 1 relay as illustrated below. The contacts are rated at 2 amp resistive, 120/240 VAC.

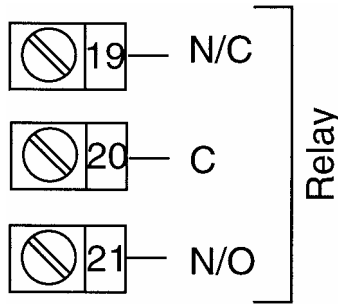


FIGURE 2-16
SSR Driver Output 1 (Control Output 1)

Connections are made to Output 1 SSR Driver as illustrated below. The solid state relay driver is a non-isolated 0-4 VDC nominal signal. Output impedance is 250 ohms.

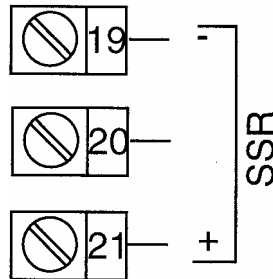


FIGURE 2-17
mADC Output 1 (Control Output 1)

Make connections for DC Output 1 as illustrated below.

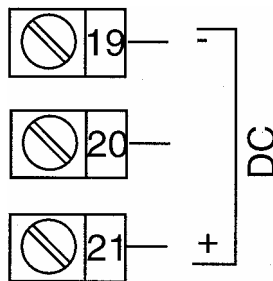


FIGURE 2-18
Relay Output 2 (Control Output 2 OR Alarm 2)

Connections are made to Output 2 relay as illustrated below. The contacts are rated at 2 amp resistive, 120/240 VAC.

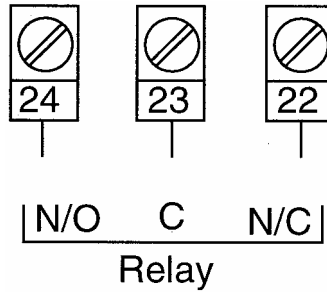


FIGURE 2-19
SSR Driver Output 2 (Control Output 2 OR Alarm 2)

Connections are made to Output 2 SSR Driver as illustrated below. The solid state relay driver is a non-isolated 0-4 VDC nominal signal. Output impedance is 250 ohms.

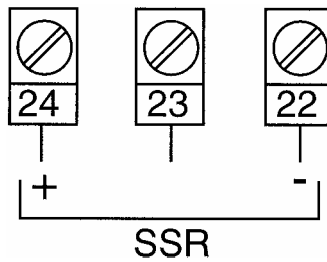


FIGURE 2-20
mADC Output 2 (Control Output 2)

Make connections for DC Output 2 as illustrated below.

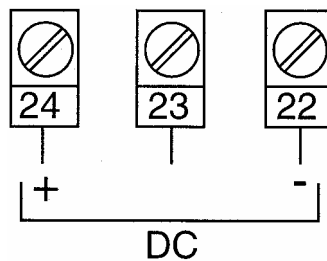


FIGURE 2-21
Relay Output 3 (Alarm 1)

Connections are made to Output 3 relay as illustrated below. The contacts are rated at 2 amp resistive, 120/240 VAC.

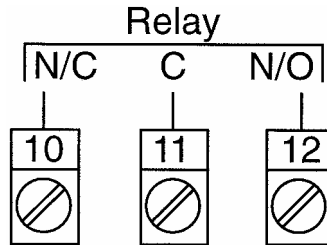


FIGURE 2-22
SSR Driver Output 3 (Alarm 1)

Connections are made to Output 3 SSR Driver as illustrated below. The solid state relay driver is a non-isolated 0-4 VDC nominal signal. Output impedance is 250 ohms.

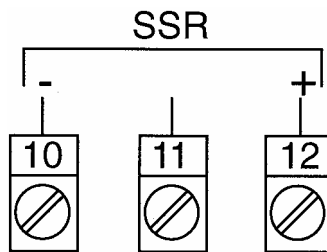
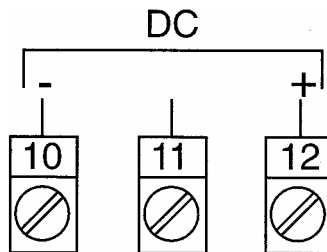


FIGURE 2-23
mADC Output 3 (Recorder Output Only)

Make connections for DC output 3 as illustrated below.



SECTION 3: OPERATION

3.1 Control Capability

The capabilities available in a specific unit are dependent upon the hardware options specified when the instrument is ordered. Refer to Appendix E for the decoding of the instrument model number. Current proportioning control cannot be implemented if a current output was not ordered. The available output types and quantity of each are as follows:

<u>Type of Output</u>	<u>Quantity Available</u>
• SPDT mechanical relay output	Up to three
• SSR Driver	Up to three
• mADC current output	Up to two

3.2 Control Responses

Each instrument may be configured to provide three mode proportional control. Proportional control is provided with Proportional Band, Integration, and Derivative responses. The PID parameters are defined as follows:

		Out 1	Out2
P (Proportional)	Proportional Band	Pb1	Pb2
I (integration)	Automatic Reset	ArSt	ArSt
D (Derivative)	Rate	rAtE	rAtE

Manual Reset is provided for use in lieu of, or in conjunction with automatic reset. A cycle time adjustment parameter is provided for use with each time proportioning control output.

3.3 Direct/Reverse Operation of Outputs

Direct operation is typically used with cooling applications. On-Off direct output(s) will turn on when the process variable exceeds setpoint. Proportional direct output(s) will increase the percentage of output as the process value increases within the proportional band.

Reverse operation is typically used with heating applications. On-Off reverse output(s) will turn off when the process variable exceeds setpoint. Proportional reverse output(s) will decrease the percentage of output as the process value increases within the proportional band.

Output 2 will be Direct when Output 1 is selected as Reverse, and Reverse when Output 1 is selected as Direct.

3.4 On-Off Control

On-Off control can be implemented with SPDT relay or SSR driver output(s) by setting the corresponding proportional band (Pb) to O.O. On-Off operation can be assigned to Output 1 only (Output 2 not present), Output 1 AND Output 2, or Output 2 only (Output 1 is time proportional or current proportional). A hysteresis adjustment is provided for On-Off outputs, "HySl " for Output 1 only, "HySt" for Output 1 AND Output 2, or "HyS2" for Output 2 only. This adjustment is in % of input span and defines the bandwidth of the hysteresis. Relay chatter can be eliminated by proper adjustment of this parameter. When operating in On-Off control, the output(s) will turn on or off depending upon the setpoint, the process value, and the hysteresis adjustment.

3.5 Time Proportioning Control

Time Proportioning control can be implemented with a SPDT relay or SSR driver. Time proportioning control can be selected for either Output 1 or Output 1 and Output 2, depending on hardware configuration. Time proportioning control is accomplished by cycling the output on and off during a prescribed period of time when the process variable is within the proportional band.

Ex: Calculated output % = 40%; Cycle time adjustment = 32 seconds
 Output on time = .4 x 32 = 12.8 seconds
 Output off time = .6 x 32 = 19.2 seconds

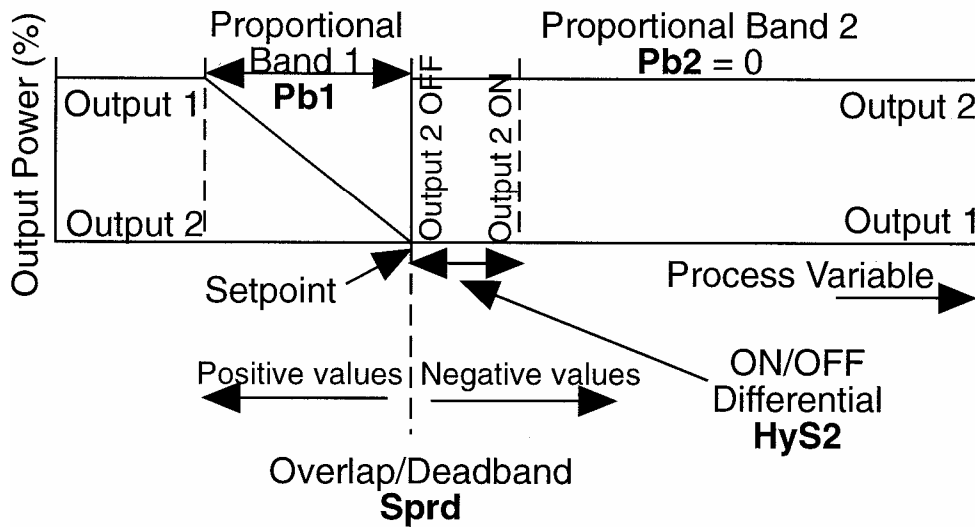
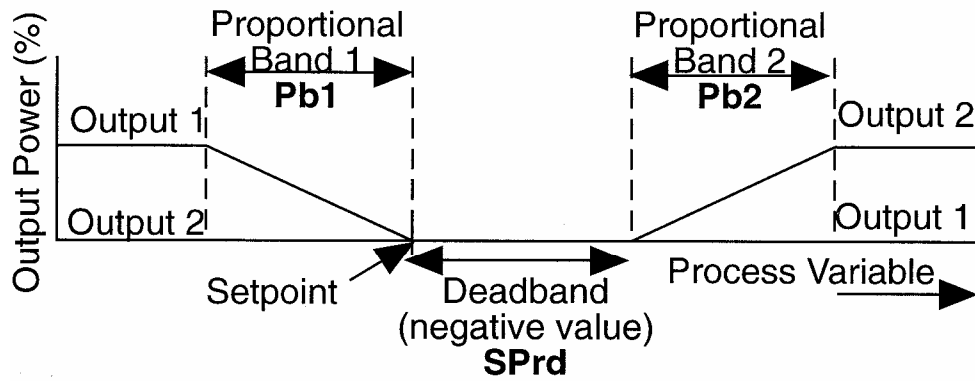
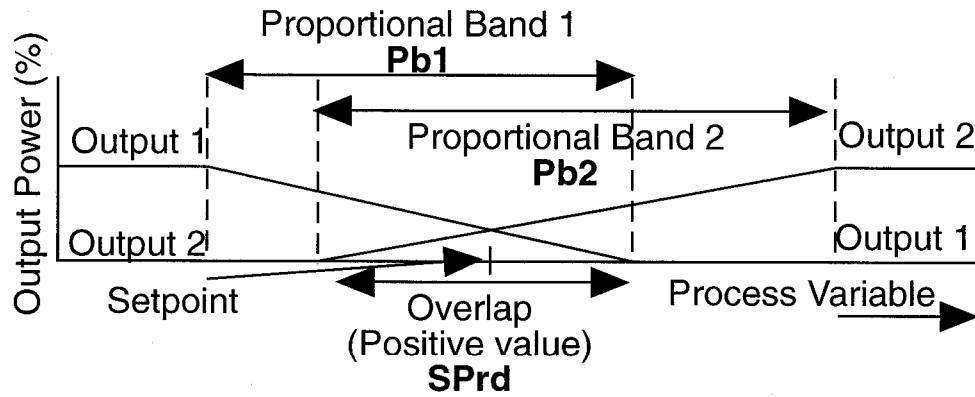
When the unit is operating in the Control Mode, the control algorithm determines the output % required to correct for any difference between the process value and the setpoint. The output calculation is affected by Tune Mode parameter adjustments. See Figure 3-1 for proportional bandwidth effect on the output.

3.6 Current Proportioning Control

Current Proportioning control can be implemented on units provided with mADC current output(s). Current Proportioning control provides a 4 to 20 mADC or 0-20 mADC output in response to process value and setpoint. As with Time proportioning, the calculated output % for Current proportioning is affected by the Tune Mode parameter adjustments.

See Figure 3-1 for proportional bandwidth effect on the output.

FIGURE 3-1
Proportional Band 1



3.7 Power Up Procedure

Verify all electrical connections have been properly made before applying power to the instrument.

If the instrument is being powered for the first time, it may be desirable to disconnect the controller output connections. The instrument will be into control following the power up sequence and the output(s) may turn ON. During power up, a self-test procedure is initiated during which all LED segments in the two front panel displays appear and all LED indicators are ON. When the self-test procedure is complete, the instrument reverts to normal operation.

Note: A delay of about 3 seconds, when power is first applied, will be seen before the displays light up

3.8 Keypad Operation



AUTO/MANUAL KEY



- Enter the Auto/Manual Mode and vice versa.
- Activate the Auto Tune Mode.
- Confirm a change in the Program Mode.

SCROLL KEY



- Select adjustment of the ramping setpoint, if enabled.
- Select a parameter to be viewed or adjusted.
- Display enabled modes of operation.
- Display a mode parameter value.
- Advance display from a parameter value to the next parameter code.
- Activate the Pre-tune Mode.
-  plus  to view the current Hardware Definition Code setting.



UP KEY



- Increase the displayed parameter value.
- Increase setpoint.

DOWN KEY



- Decrease the displayed parameter value.
- Decrease setpoint.
-  plus  to view the current Hardware Definition Code setting.

3.9 Front Panel Indicators

OP1 Indicates the state of the Output 1 relay or SSR driver. When the indicator is ON the relay is energized or the SSR driver is ON.

OP2 Indicates the state of the Output 2 relay or SSR driver. When the indicator is ON the relay is energized or the SSR driver is ON.

ALM When flashing, indicates an Alarm condition.

MAN Flashes when the Manual Mode has been entered

AT Indicates when the Pre-Tune, Auto-Tune or RaPID Mode has been selected; flashing RED for Pre-Tune, continuously on RED for Auto-Tune or flashing GREEN for RaPID activated.

SECTION 4: CONTROL MODE

4.1 Operation

After the instrument has performed its power up self test, the Control Mode is active with the setpoint in the lower display and the process variable in the upper display. To view the various parameters in the Control Mode, press the SCROLL key. The lower display shows the parameter name and the upper display shows the current setting of the parameter.

To change the setpoints, use the UP and DOWN keys. If the key is held for longer than 1 second, the value will change at an increasing rate.

Table 4-1 Control Mode Parameters

Parameter	Display	Description
Active Setpoint / Process Variable	(value) (value) ¹	Active setpoint value in lower display Current process variable value in upper display
Local Setpoint	LSP ^{5,3}	Local Setpoint of local setpoint operation
Setpoint 1	SP1 ²	First setpoint of a dual setpoint operation.
Setpoint 2	SP2 ²	Second setpoint of a dual setpoint operation
Remote Setpoint	rSP ³	Remote setpoint of remote setpoint operation
Ramping Setpoint	SPrP ⁶	Actual setpoint of the controller as it ramps to the active setpoint
Process Units	Unit ¹	Displays process variable units
Alarm Status	ALSt ^{1,4}	Displays current alarm status
Mode	Mod	Provides access to other controller setup modes.

1 Read-only display

2 This parameter is displayed only if dual setpoint is selected

3 This parameter is displayed only if remote setpoint is selected

4 This parameter is displayed only if an alarm is active

5 This parameter is not displayed if dual setpoint is selected.

6 This parameter is not displayed if SPrr in Tune Mode is set to OFF

4.2 Active Setpoint

To select which setpoint is currently active in dual setpoint operation, press the SCROLL key to view the desired setpoint (SP1 or SP2). Press the UP and DOWN keys simultaneously to make active the setpoint which is currently displayed.

The lower display uses the leftmost character to distinguish between the active and inactive setpoints in the following manner:

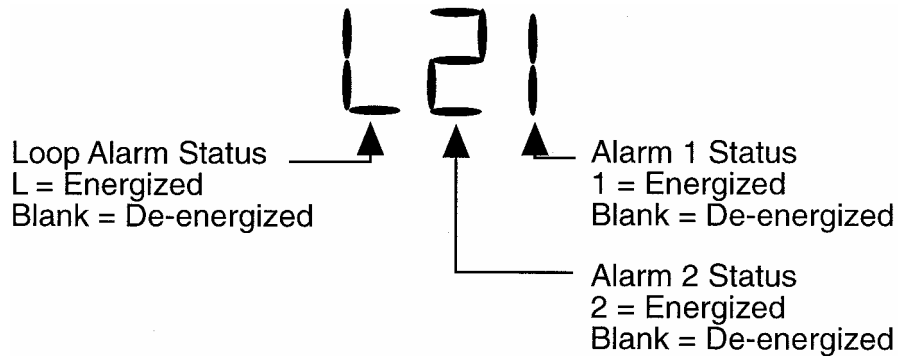
_SP2	≡SP2	SP2
Active Setpoint (selected via digital input)	Active Setpoint (selected via keypad override)	Inactive Setpoint

4.3 Override Feature

While the instrument is being used with either Dual Setpoint operation or Remote Setpoint operation, the Override feature is available. This enables the active setpoint selected by the digital input to be manually overridden from the keypad. To engage the Override feature, with the instrument displaying the desired setpoint, press the UP and DOWN keys simultaneously. This will cause the left-most character of the lower display to show a flashing "≡". This indicates that the display setpoint is now the active setpoint, regardless of the state of the digital input. To cancel an override condition, simply press the UP and DOWN keys again with this display shown.

4.4 Alarm Status Display

If any alarms are active, the user may view the alarm status by pressing the SCROLL key until the lower display shows the legend **ALSt**. The upper display will have the following format:



4.5 Over-Range / Under-Range Display

If the process variable attains a value higher than the input scale maximum limit, the upper display will show:

CHHO

If the process variable attains a value lower than the input scale minimum, the upper display will show:

CLLO

If a break is detected in the sensor circuit, the upper display will show:

SnSr

4.6 Manual Control (Percent Output)

Manual Control is not applicable if the Auto/Manual selection in Enable Mode is disabled.

If enabled, the Manual Mode may be entered by pressing the AUTO/MANUAL key. The Manual Mode status LED will begin to flash indicating that the Manual Mode is in use. Shifting from the Control to the Manual Mode is bumpless. The proportional output(s) will stay at the last value(s) calculated by the control algorithm. The upper display will show the current process value. The lower display will show the current value output power in the form PXXX where X is equal to the percentage of output power. The value of output power may be adjusted using the UP and DOWN keys, as required.

The output power value can be varied in the range 0% of 100% for instruments using Output 1 only, and -100% to +100 % for instruments with both Output 1 and Output 2.

To exit from the Manual Mode, press the Auto/Manual key. Shifting to the Control Mode is bumpless.

4.7 Setup Modes

The Setup Modes contain parameters which configure the instrument and affect how the control functions. To access the Setup Modes from the Control Mode, press the SCROLL key until the lower display reads **Mod**. Press the DOWN key, then press the SCROLL key to view the different modes available. The following sections contain instructions for accessing and using the various Setup Modes. To return to Control Mode, press the SCROLL key until **Ctrl** is displayed, then press the DOWN key.

If a mode is not enabled (see Section 10) it will not be displayed in the Setup Mode list.

Table 4-2 Setup Modes

MODE	DISPLAY	DESCRIPTION	MANUAL SECTION
Control	Ctrl	Return to Control Mode	4
Tune	tunE	Contains PID tuning parameters	5
Alarm	ALA	Contains alarm parameters	6
Test	tESt	Provides testing parameters for outputs	7
Configuration	ConF	Contains parameters which control inputs and outputs	8
Calibration	CAL	Contains instrument calibration parameters	9
Enable	EnAb	Controls access to the various modes	10
PreTune	Pre	Turns the Pre-tune facility off and on	11
AutoTune	Auto	Turns the Auto-tune facility off and on	12
RaPIDTune	rAP	Turns the RaPID tune facility off and on	13

SECTION 5: TUNE MODE

5.1 Tune Mode Description

The Tune Mode contains parameters concerning tuning of the instrument.

To access the Tune Mode from the Control Mode, press the SCROLL key until **Mod** is displayed. Press the DOWN key. This puts the control in Setup Mode. Press the SCROLL key until **tunE** is displayed. Press the DOWN key to access the Tune Mode.

A series of parameters is available by pressing the SCROLL key. The parameter tag name will appear the lower display with the upper display blank. Pressing the SCROLL key again will display the tag name in the lower display and the parameter value in the upper display. The value can then be edited by pressing the UP and DOWN keys. Once the proper value appears press the SCROLL key. The next parameter tag name will be displayed in the lower display with the upper display blank.

The mode list of parameters may be viewed quickly by pressing the DOWN key with the upper display blank. A subsequent press of the SCROLL key will show the parameter setting in the upper display.

To return to the Setup Mode, press the UP key with the upper display blank. To return to the Control Mode from the Setup Mode, press the SCROLL key until **Ctrl** is displayed, then press the DOWN key.

5.2 Manual Tuning Method

1. Cycle Time - Time Proportioning Outputs
 - A. Adjusting the cycle time affects instrument operation
 1. Shorter Cycle Time
 - a. More accurate control
 - b. Shorter life span of electromechanical components
2. Proportional Bandwidth
 - A. Proportional Bandwidth is the inverse of gain. Increased Bandwidth = Decreased Gain
 - B. Increase the Proportional Bandwidth if:
 1. The process overshoots excessively
 2. The process oscillates excessively
 - C. Decrease the Proportional Bandwidth if:
 1. The process responds slowly
 2. The process fails to reach setpoint
3. Automatic Reset
 - A. Increase the Automatic Reset (decrease the time) until the process becomes unstable, then decrease (increase the time) until stability is restored.
 - B. Be sure to allow sufficient time for the process and the instrument to react.
4. Rate Adjustment
 - A. Rate can cause process instability. Typically add Rate as 1 /10th of the automatic reset value.
 - B. Decrease Rate if:
 1. The process overshoots/undershoots
 2. If the process oscillates excessively
5. Manual Reset
 - A. After making all other adjustments, use if an offset exists between the setpoint and the process variable.
 - B. If the process is:
 1. Below setpoint use a positive Manual Reset value
 2. Above the setpoint use a negative Manual Reset value

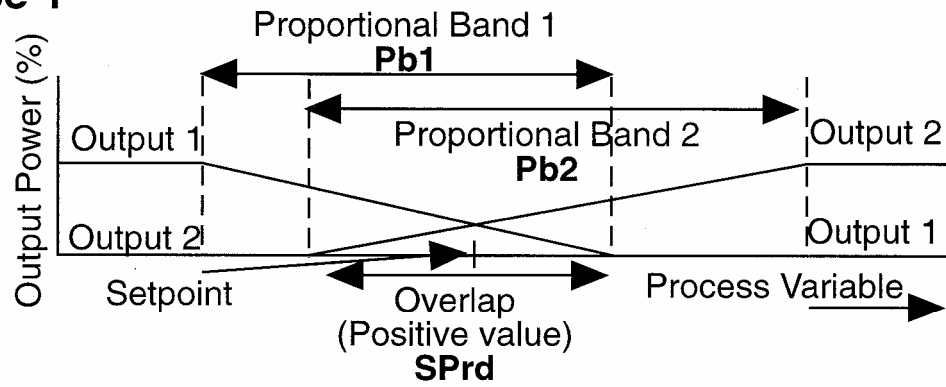
Table 5-1 Tune Mode Parameters

STEP	DESCRIPTION	DISPLAY CODE	AVAILABLE SETTINGS	FACTORY SETTING
1	Local Setpoint	LSP	+/- Setpoint Limits	Input range minimum
2	Remote Setpoint	rSP	+/- Setpoint Limits	Read Only
3	Setpoint 1 Value	SP1	+/- Setpoint Limits	Read Only
4	Setpoint 2 Value	SP2	+/- Setpoint Limits	Read Only
5	Input Correct	iCor	± Span	0
6	Output 1 %	Po1	0 to 100%	Read Only
7	Output 2%	Po2 ¹	0 to 100%	Read Only
8	1st Output Prop. Band	Pb1	0 to 999.9% of Input Span O%=On/OFF	5.0
9	2nd Output Prop. Band	Pb2 ¹	0 to 999.9% of Input Span O%=ON/OFF	5.0
10	Automatic Reset	ArSt ³	OFF to 99 mins. 59 secs/Repeat	OFF
11	Rate	rAtE ³	0 sec to 99 mins. 59 secs/Repeat	0 secs.
12	Manual Reset	rSEt ³	0 to 100% for output 1 -100 to 100% for output 2	25%
13	Hysteresis: Output 1 Output 2 Out 1 & Out 2	HyS1 ² HyS2 ^{1,2} HySt ^{1,2}	0.1 to 10.0% of span 0.1 to 10.0% of span 0.1 to 10.0% of span	0.5 0.5 0.5
14	Overlap/ Deadband	SPrd ¹	-20 to 20% of Pbl and Pb2	0%
15	Setpoint Ramp Rate	SPrr ⁵	1 to 9999 units/hour and OFF	OFF
16	Remote Setpoint Offset	rSPo ⁴	-1999 to 9999	0
17	Output 1 Cycle Time	Ct1 ³	.5, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512 (seconds)	32
18	Output 2 Cycle Time	Ct2 ^{1,3}	.5, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512 (seconds)	32

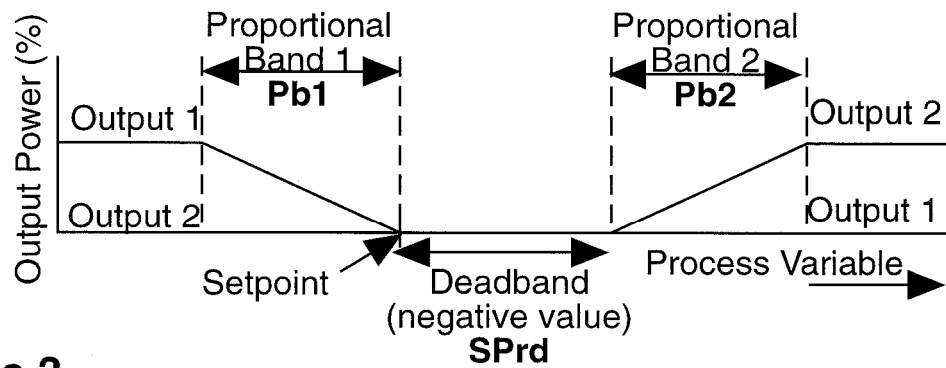
- 1 Does not appear unless output 2 has been selected
- 2 Does not appear unless instrument is configured for on-off control
- 3 Does not appear unless instrument is configured for proportional control
- 4 Does not appear unless remote setpoint has been selected
- 5 Does not appear unless ESPr is enabled in Enable Mode

FIGURE 5-1
Proportional Band & Deadband/Overlap

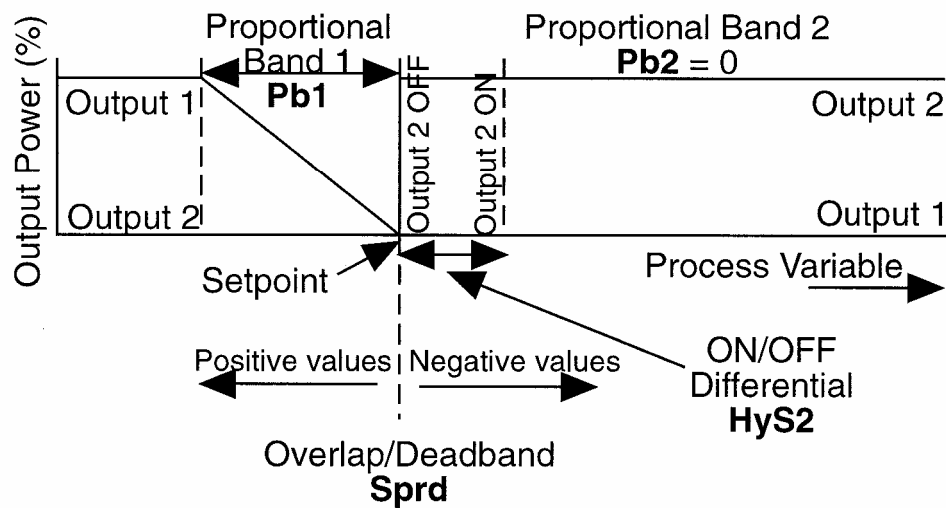
Case 1



Case 2



Case 3



SECTION 6: ALARM MODE

6.1 Alarm Mode Description

The Alarm Mode contains parameters concerning process alarms.

To access the Alarm Mode from the Control Mode, press the SCROLL key until **Mod** is displayed. Press the DOWN key. This puts the control in Setup Mode. Press the SCROLL key until **ALA** is displayed. Press the DOWN key to access the Alarm Mode.

A series of parameters is available by pressing the SCROLL key. The parameter tag name will appear in the lower display with the upper display blank. Pressing the SCROLL key again will display the tag name in the lower display and the parameter value in the upper display. The value can then be edited by pressing the UP and DOWN keys. Once the proper value appears press the SCROLL key. The next parameter tag name will be displayed in the lower display with the upper display blank.

The mode list of parameters may be viewed quickly by pressing the DOWN key with the upper display blank. A subsequent press of the SCROLL key will show the parameter setting in the upper display.

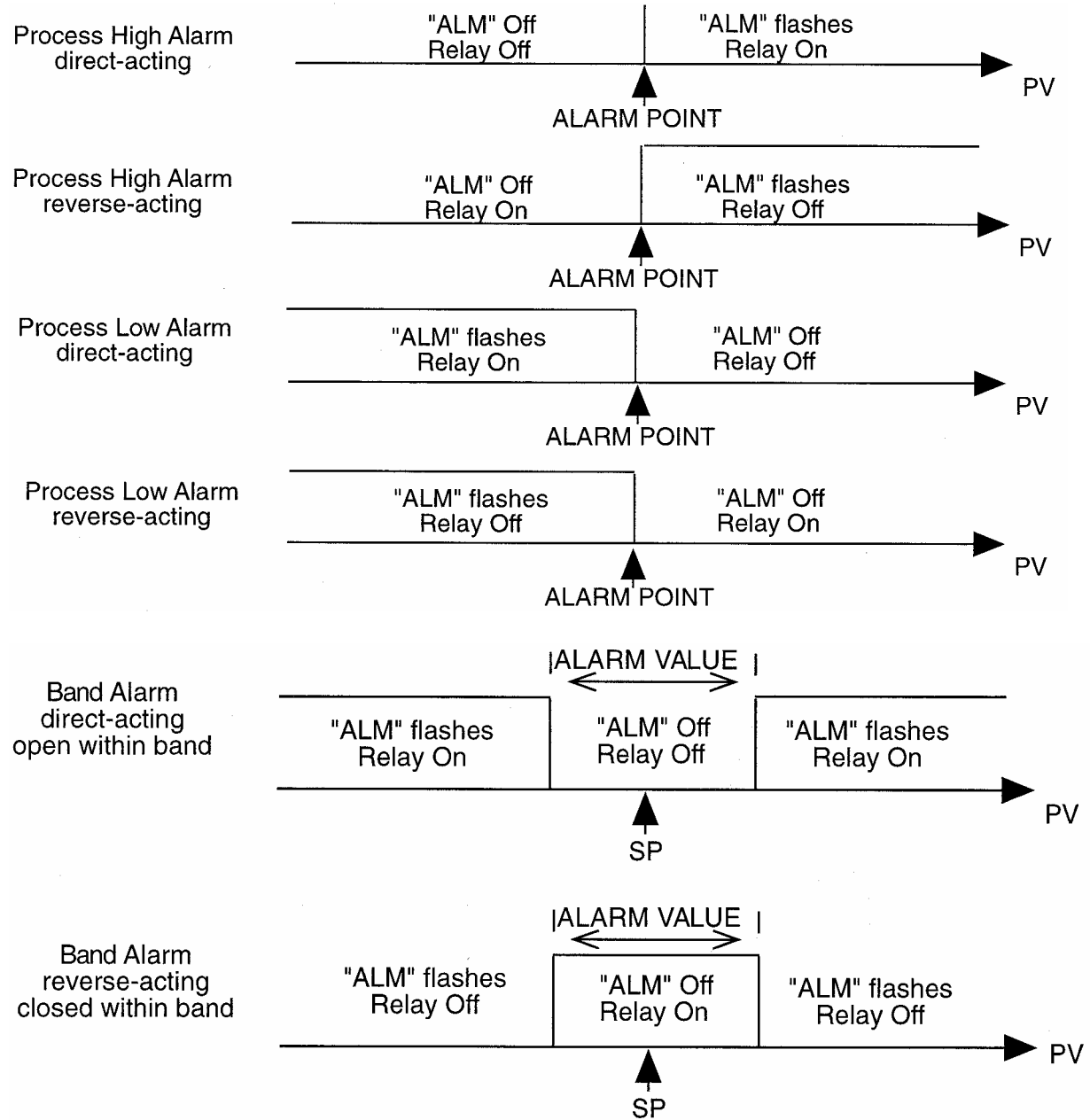
To return to the Setup Mode, press the UP key with the upper display blank. To return to the Control Mode from the Setup Mode, press the SCROLL key until **Ctrl** is displayed, then press the DOWN key.

Table 6-1 Alarm Mode Parameters

STEP	DESCRIPTION	DISPLAY CODE	AVAILABLE SETTINGS	FACTORY SETTING
1	Alarm 1 Type	ALA1	P-hi=Proc High nonE=No Alarm bAnd=Band dE=Deviation P-Lo=Proc Low	P_hi
2	Alarm 2 Type	ALA2	Same selection as ALA1	P_hi
3	Alarm Inhibit	Inhi	nonE=No Inhibit ALA1=Alarm1 Inhibited ALA2=Alarm2 Inhibited both=Both Inhibited	nonE
4a	Process High Alarm 1	PHA1 ²	± Span	Span Max.
4b	Process Low Alarm 1	PLA1 ²	± Span	Span Min.
4c	Band Alarm 1	bAL1 ²	0 to Span	5
4d	Deviation Alarm 1	dAL1 ²	± Span	5
5	Alarm Hysteresis	Ahy1 ²	1 LSD to 10% of span	1 LSD
6a	Process High Alarm 2	PHA2 ²	± Span	Span Max
6b	Process Low Alarm 2	PLA2 ²	± Span	Span Min.
6c	Band Alarm 2	bAL2 ²	0 to Span	5
6d	Deviation Alarm 2	dAL2 ²	± Span	5
7	Alarm 2 Hysteresis	AHy2 ²	1 LSD to 10% of span	1 LSD
8	Loop Alarm Enable	LAEn	diS = Disabled EnAb = Enabled	diS
9	Loop Alarm Time	LAti ¹	1 sec to 99 mins. 59 secs.	99 mins. 59 secs.

- 1 Only displayed when loop alarm is enabled and ON/OFF control is selected.
 2 Only displayed when alarm type is other than none. Only type selected is displayed.

FIGURE 6-1
Alarm Actuation



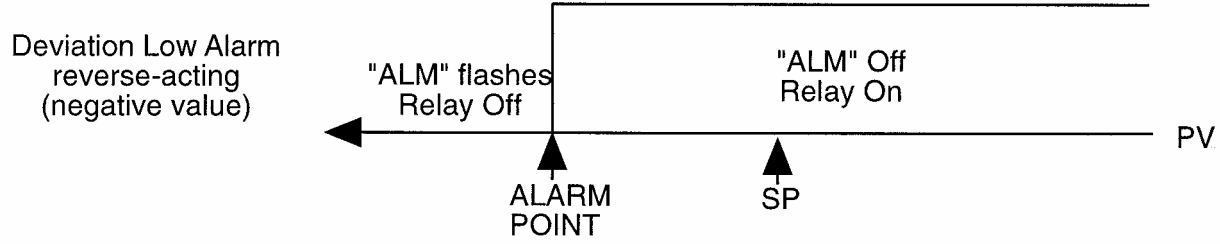
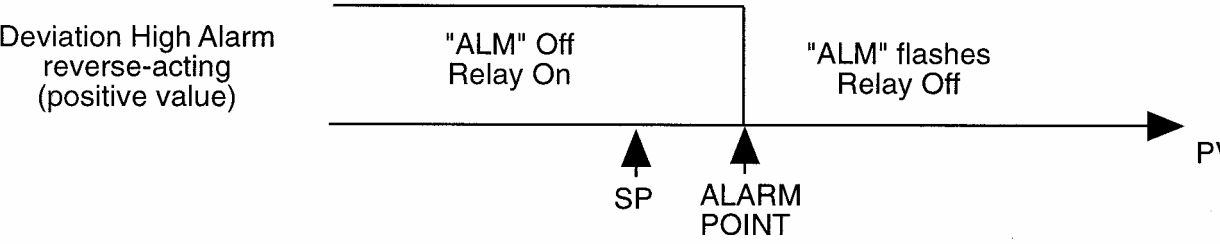
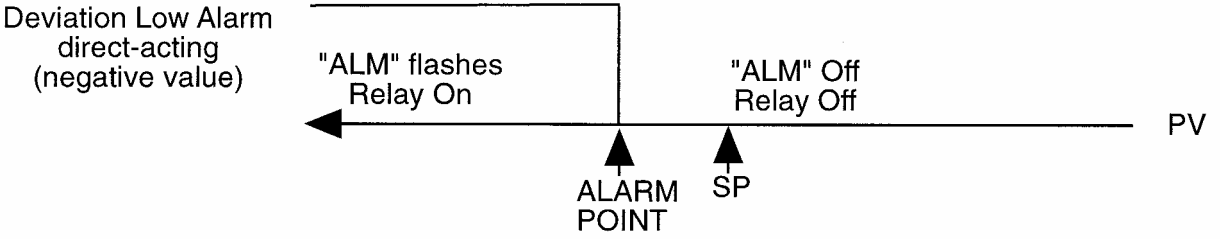
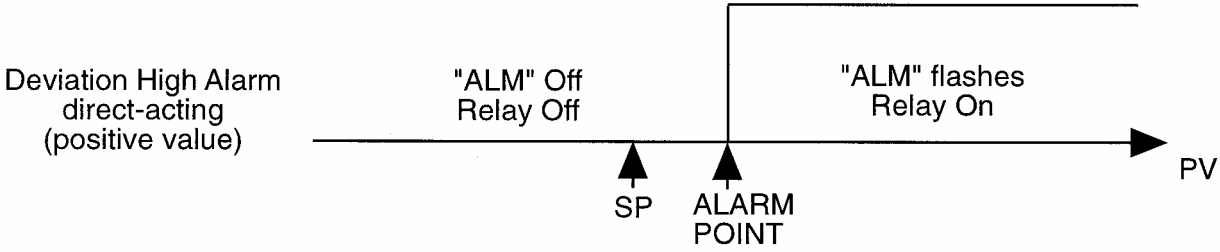
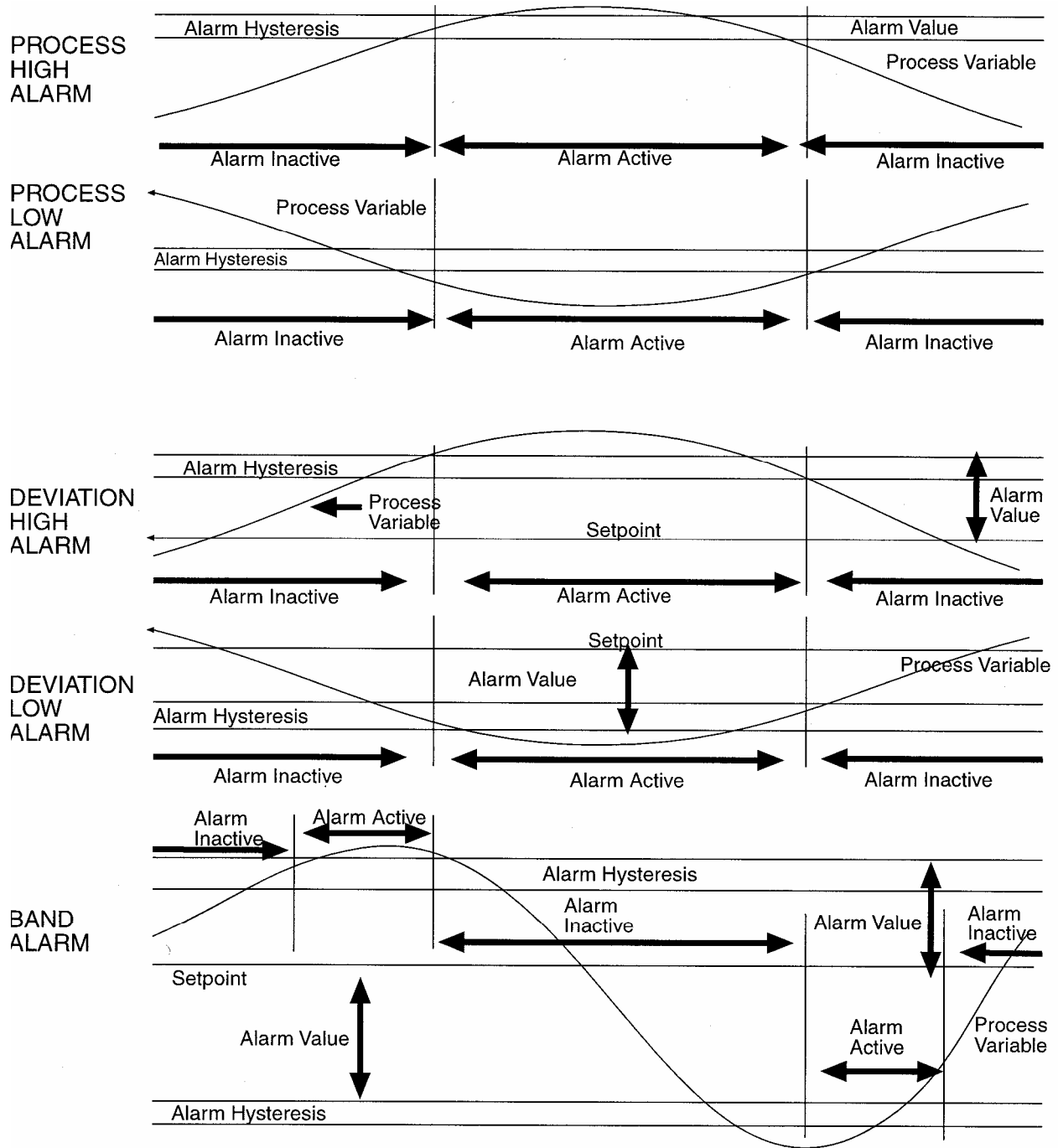


FIGURE 6-2
Alarm Hysteresis



6.2 Loop Alarm Enable

This parameter is the means by which the user can enable or disable the Loop Alarm. The Loop Alarm is a special alarm which detects faults in the control feedback loop by continuously monitoring process variable response to the control output(s).

The Loop Alarm, when enabled, repeatedly checks the control output(s) for being at the maximum or minimum limit. If an output is found to be at the limit, the Loop Alarm Mode starts a timer; thereafter, if the high output has not caused the process variable to be corrected by a predetermined amount V after a time T has elapsed, the Loop Alarm goes active. Subsequently, the Loop Alarm Mode repeatedly checks the process variable and the control output(s). When the process variable starts to change value in the correct sense or when the output comes below the limit, the Loop Alarm is deactivated.

For PID control, the Loop Alarm Time T is always set to twice the value of the Auto Reset parameter. For ON/OFF control, the user defined value of the Loop Alarm Time Set Up parameter is used.

The value of V is dependent upon the input type:

Deg C:	2°C or 2.0°C
Deg F:	3°F or 3.0°F
Linear Range:	10 least significant display units

For single output instruments, the limits are 0% and Out 1 Max %. For dual output instruments, the limits are -1 00% and Out 1 Max %.

Notes:

1. Correct operation of the Loop Alarm depends upon reasonably accurate PID tuning.
2. The Loop Alarm is automatically disabled during Manual Control Mode and during execution of the Pre-Tune Mode. Upon exit from Manual Mode or after completion of the Pre-Tune routine, the Loop Alarm is automatically re-enabled.

6.3 Loop Alarm Time

When full ON/OFF control is selected and Loop Alarm is enabled, this parameter determines the duration of the limit condition after which the Loop Alarm will be activated. It may be adjusted within the range of 1 second to 99 minutes 59 seconds. This parameter is omitted from the Tune Mode display sequence if ON/OFF control is not selected or Loop Alarm is disabled. The default setting 99:59. Display code is LAti.

6.4 Logical Combination of Alarms

Two alarms may be combined logically to create an AND/OR situation. They may be configured for Reverse-acting or Direct-acting. Either Output 2 or Output 3 may be assigned as Logical Outputs.

Example:

Logical OR of Alarm 1 with Alarm 2

Direct-Acting

AL1 OFF, AL2 OFF: Relay OFF

AL1 ON, AL2 OFF: Relay ON

AL1 OFF, AL2 ON: Relay ON

AL1 ON, AL2 ON: Relay ON

Reverse-Acting

AL1 OFF, AL2 OFF: Relay ON

AL1 ON, AL2 OFF: Relay OFF

AL1 OFF, AL2 ON: Relay OFF

AL1 ON, AL2 ON: Relay OFF

Logical AND of Alarm 1 with Alarm 2

Direct-Acting

AL1 OFF, AL2 OFF: Relay OFF

AL1 ON, AL2 OFF: Relay OFF

AL1 OFF, AL2 ON: Relay OFF

AL1 ON, AL2 ON: Relay ON

Reverse-Acting

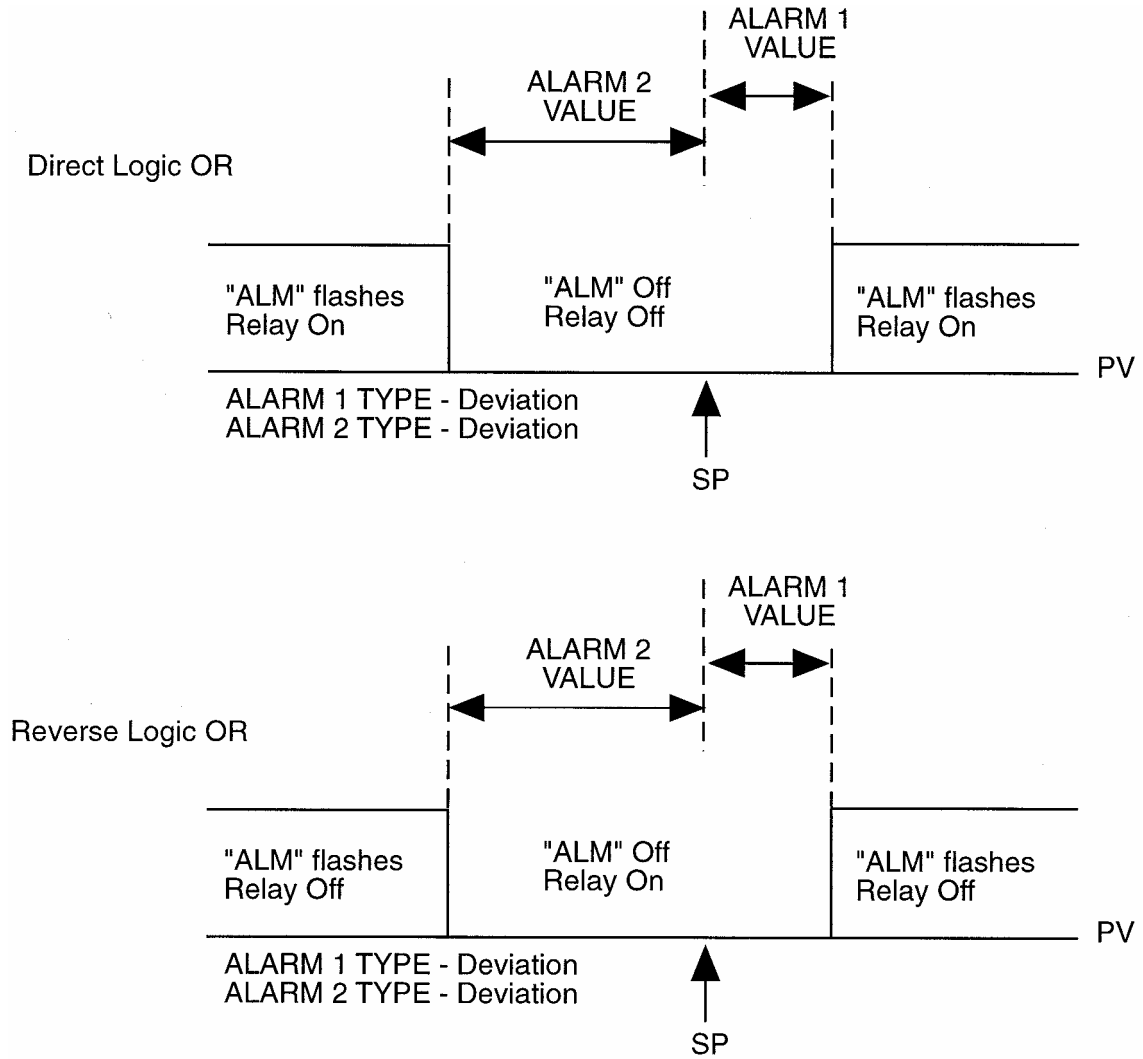
AL1 OFF, AL2 OFF: Relay ON

AL1 ON, AL2 OFF: Relay ON

AL1 OFF, AL2 ON: Relay ON

AL1 ON, AL2 ON: Relay OFF

FIGURE 6-3
Asymmetrical Band Alarm



SECTION 7: TEST MODE

7.1 Test Mode Description

The Test Mode allows manual control of the instrument outputs in order to test their operation.

To access the Test Mode from the Control Mode, press the SCROLL key until **Mod** is displayed. Press the DOWN key. This puts the control in Setup Mode. Press the SCROLL key until **tESt** is displayed. Press the DOWN key to access the Test Mode.

A series of parameters is available by pressing the SCROLL key. The parameter tag name will appear in the lower display with the upper display blank. Pressing the SCROLL key again will display the tag name in the lower display and the parameter value in the upper display. The value can then be edited by pressing the UP and DOWN keys. To activate an output, press the UP key. To deactivate an output press the DOWN key. Once the proper value appears press the SCROLL key. The next parameter tag name will be displayed in the lower display with the upper display blank.

To return to the Setup Mode, press the UP key with the upper display blank. To return to the Control Mode from the Setup Mode, press the SCROLL key until **Ctrl** is displayed, then press the DOWN key. Exiting the Test Mode will deactivate all outputs and revert control of the outputs back to the Control Mode.

Step	Description	Display Code	Available Settings
1	Test Output 1	tSt1	01 H 01 L
2	Test Output 2	tSt2	02 H 02 L
3	Test Output 3	tSt3	03 H 03 L
4	Test Communications	tSt4	OFF r485

SECTION 8: CONFIGURATION MODE

8.1 Configuration Mode Description

The Configuration Mode contains parameters concerning output functions of the instrument.

To access the Configuration Mode from the Control Mode, press the SCROLL key until **Mod** is displayed. Press the DOWN key. This puts the control in Setup Mode. Press the SCROLL key until **ConF** is displayed. Press the DOWN key to access the Configuration Mode.

A series of parameters is available by pressing the SCROLL key. The parameter tag name will appear in the lower display with the upper display blank. Pressing the SCROLL key again will display the tag name in the lower display and the parameter value in the upper display. The value can then be edited by pressing the UP and DOWN keys. Changing a parameter value will cause the upper display to flash. To verify the new value press the AUTO/MANUAL key. Once the proper value appears press the SCROLL key. The next parameter tag name will be displayed in the lower display with the upper display blank.

The mode list of parameters may be viewed quickly by pressing the DOWN key with the upper display blank. A subsequent press of the SCROLL key will show the parameter setting in the upper display.

To return to the Setup Mode, press the UP key with the upper display blank. To return to the Control Mode from the Setup Mode, press the SCROLL key until **Ctrl** is displayed, then press the DOWN key.

Table 8-1 Configuration Mode Parameters

STEP	DESCRIPTION	DISPLAY CODE	AVAILABLE SETTINGS	FACTORY SETTING
1	Input Select	inPS	See App. B*	1420
2	Input Filter	Filt	0.0 to 100.0 seconds in .5 sec. Increments	2.0
3	Remote Setpoint	rinP	See App. B	**
4	Output 1 Action	CtL1	rEv = Reverse Acting dir = Direct Acting	rEv

STEP	DESCRIPTION	DISPLAY CODE	AVAILABLE SETTINGS	FACTORY SETTING
5	Output 2 Usage	USE2	Out2=Control (opposite of Out1 action) Hy_r=Alm Hyst Rev Act** Hy_d=Alm Hyst Dir Act*** LP-r=Loop Reverse LP-d=Loop Direct Ad-r=Rev Logic AND Ad-d=Dir Logic AND Or-r=Rev Logic OR Or-d=Dir Logic OR A2_r=Alm 2 Rev A2_d=Alm2 Dir	Out2
6	Output 3 Usage	USE3	Al-d=Alm 1 Dir rEcP=Rcdr Out RV. rEcS=Rcdt Out S.R LP-r=Loop Reverse LP-d=Loop Direct Ad-r=Rev Logic AND Ad-d=Dir Logic AND Or-r=Rev Logic OR Or-d=Dir Logic OR Al-r=Alm 1 Rev Hy-d=Alm Hyst Dir Act*** Hy-r=Alm Hyst Rev Act***	A1_d
7	Com Bit Rate	CbS	1200, 2400, 4800, 9600	4800
8	Com Parity	CPAr	nonE, odd, EvEn	none
9	Com Address	CAd	1-255	1
10	CJC Enable	CJC	EnAb disA	EnAb
11	Decimal Position	dPoS	0, 1, 2, 3 (Linear Input Only)	1
12	Engineering Units Upper	Euu	-1999 to 9999	1000
13	Engineering Units Lower	EuL	-1999 to 9999	0
14	Setpoint Upper Limit	SPUL	Span Max.	Span Max.
15	Setpoint Lower Limit	SPLL	Span Min.	Span Min.
16	Remote Setpoint Maximum	rSPu	- 1999 to 9999	PV Range Maximum
17	Remote Setpoint Minimum	RSPL	- 1999 to 9999	PV Range Minimum
18	Output 1% Limit	o1PL	0 to 100%	100
19	Process Output Upper	Pou	- 1999 to 9999	Span Max.
20	Process Output Lower	PoL	-1999 to 9999	Span. Min.

- * The Hardware Definition Code and input jumper configuration may need to be changed. See Appendices A and B.
- ** If Remote Setpoint Input has been selected in the Hardware Definition Code, this parameter will appear in the normal Program Mode parameter sequence. The upper display shows a product code which defines the input range. The factory setting depends on code selected, see Appendix B.
- *** An Alarm Hysteresis output is made active only when both alarms become active; it subsequently becomes inactive only when both alarms are inactive. Thus, the status of an Alarm Hysteresis output only when one alarm is active depends upon the alarm status immediately prior to that alarm being activated.

8.2 Hardware Definition Code

The Hardware Definition Code is used to represent the hardware installed (input type, Output 1 type, Output 2 type and Output 3 type); this must be compatible with the hardware actually installed. It can be accessed, with the instrument in Configuration Mode (with a prompt inPS, etc. displayed), by simultaneously depressing the DOWN and SCROLL keys. The displays will show "XXXX" (where X represents any number) in the upper display and "dEFn" in the lower display, where:

the first (left-most) digit is input type:

- 1 = RTD/Linear mV
- 2 = Thermocouple
- 3 = Linear DC mA
- 4 = Linear DC V

the second digit is Output 1 type:

- 1 = Relay
- 2 = SSR
- 3 = DC 0-10 V
- 4 = DC 0-20 mA
- 5 = DC 0-5 V
- 7 = DC 4-20 mA

the third digit is Output 2 type:

- 0 = Output 2 not installed
- 1 = Relay (control or alarm 2)
- 2 = SSR (control or alarm 2)
- 3 = DC 0-10 V (control only)
- 4 = DC 0-20 mA (control only)
- 5 = DC 0-5 V (control only)
- 7 = DC 4-20 mA (control only)

the fourth digit is Output 3 type:

- 0 = Output 3 not installed
- 1 = Relay (alarm 1 only)
- 2 = SSR (alarm 1 only)
- 3 = DC 0-10 V (retransmit only)
- 4 = DC 0-20 mA (retransmit only)
- 5 = DC 0-5V (retransmit only)
- 7 = DC 4-20 mA (retransmit only)

The displayed code may be incremented/decremented using the UP/ DOWN keys as required. The maximum setting available is 4777. For example, the code for a thermocouple input, DC 4-20 mA Output 1 and relay Output 3 would be 2701. When the code is first altered, the code display will flash, until the desired value is displayed and confirmed by pressing the Auto/Manual key.

While the Hardware Definition Code is displayed, depressing the SCROLL key will cause the display to change to:

none	or	r485	or	duAL
OPtn		OPtn		OPtn

Where none indicates the absence of any option, r485 indicates the presence of the communications option, and duAL indicates the presence of the dual setpoint option. If selected, the plug-in digital input board used for selection of setpoint must be installed.

NOTE: The RS485 Serial Communications option and the plug-in Dual Setpoint option are mutually exclusive.

Another depression of the SCROLL key will cause the appearance of the Second Input Usage menu display, which may be one of the following:

none	or	rSP1	or	rSP3
2inP		2inP		2inP
OR				
rSP4		rSP9		duAL
2inP	or	2inP	or	2inP

Where nonE indicates Second Input not used, rSP1 indicates the use of the Second Input as a linear DC mV Remote Setpoint, rSP3 indicates the use of the second input as a linear DC mA Remote Setpoint, rSP4 indicates the use of the Second Input as linear DC Volt Remote Setpoint, rSP9 indicates the use of the Second Input as Potentiometer (up to 2K ohm) type Remote Setpoint, and duAL indicates Dual Setpoint switching capabilities.

Selection of Dual Setpoint switching allows the digital input part of the Remote Setpoint option to be used for dual setpoint switching, thus permitting the instrument to have Dual Setpoint operation and RS485 Serial Communications (the normal setpoint switching input and the RS485 Communications option are mutually exclusive).

NOTE: It is essential that this code is changed whenever there is a change to the instrument's hardware configuration (change of input/output type, alarm/retransmit output added/removed etc.). The instrument's software depends upon this code to ensure that the instrument operates correctly.

To exit from the Hardware Definition Code display, depress the DOWN and SCROLL keys simultaneously.

SECTION 9: CALIBRATION MODE

9.1 Entering Calibration Mode

To enter the Calibration Mode from Setup Mode:

1. Press the SCROLL key until CAL appears in the message display
2. Press the DOWN key to enter the Calibration Mode.

NOTE: Calibration should be attempted only on Controllers on which calibration errors have been encountered (see CALIBRATION CHECK).

9.2 Calibrating The Universal Input

Equipment Required

1. Input source with an accuracy better than +/- 0.05 of reading:
 - a. Thermocouple inputs - T/C simulator, "K" type with compensated leads
 - b. DC linear inputs - 0 - 50 mV, 0 - 10 V, or 0 - 20 mA
 - c. RTD inputs - decade resistance box with connections for three-wire input (or equivalent)
2. Case assembly, wired for appropriate input supply (90 - 264 VAC 50/60 Hz, 20 - 50 VAC 50/60 Hz or 22 - 65 VDC)

Calibration Procedure

1. Ensure that the Controller is powered-off and that the line power lead is disconnected. On the CPU PCB, fit the appropriate link jumpers for the input type to be calibrated (see Figure A-2 in Appendix A). Connect the appropriate input lead (see Table 9-1).
2. Connect the line power lead to the Controller. Power-up the Controller and leave switched on for five minutes (for RTD and DC Linear inputs) or 30 minutes (for thermocouple inputs).

3. Enter Calibration Mode (Section 9.1). The upper display will then show Input Type Number, in the form:

iP_I

and the lower display will show:

CAL

Using the UP/DOWN keys, change the input type number as required (see Table 9-1).

NOTE: If required, only one input type may be calibrated. Exception: If it is required to calibrate the thermocouple input (Input Type 5), it is necessary first to calibrate the DC 0 - 50 mV input (Input Type 1).

Table 9-1 Universal Input Type Selection

Input Type No.	Input Type	Calibration Input	Link Jumper 1	Link Jumper 2	Link Jumper 3
1	0 - 50 mVDC	50 mVDC	Parked	Parked	Parked
2	0 - 10 VDC	10 VDC	Fitted	Parked	Parked
3	0 - 20 mADC	20 mADC	Parked	Fitted	Parked
4	3-wire RTD	200 ohm	Parked	Parked	Parked
5	Thermocouple	0°C "K"	Parked	Parked	Fitted

4. Press the AUTO/MANUAL key to change the upper display to show:

- - - -

After a few seconds, the upper display will either (a) return to the initial Input Type Number display if calibration was successful, or (b) display:

FAIL

In the latter case, the link jumpers and wiring should be checked.

5. To calibrate all inputs, repeat Steps 1 to 4 for each of the other input types (see Table 9-1) until all desired input types have been successfully calibrated.

The universal input calibration procedure is now complete. Power down the control and ensure the jumpers on the CPU PCB are in the correct position according to input type, and according to Figure A-2.

9.3 Calibrating The Secondary Analog Input

Equipment Required

1. DC linear input source (0 - 5 V and 0 - 20 mA) with an accuracy better than +/- 0.05% of reading.
2. Case assembly, wired for appropriate input supply (90 - 264V AC 50/60 Hz, 20 - 50 VAC 50/60 HZ or 22-65 VDC).

Calibration Procedure

1. Ensure that the Controller is powered off and that the line power lead is disconnected. On the CPU PCB, configure link jumpers LJ10 and LJ11 (see Figure A-2). Connect the remote setpoint input lead and apply input signal.
2. Connect the line power lead to the Controller. Power-up the Controller and leave switched on for five minutes.
3. Enter Calibration Mode (Section 9.1). The upper display will then show Input Type Number, in the form:

iP_1

and the lower display will show:

CAL

4. Using the UP/DOWN keys, change the input type number as required (see Table 9-2).

NOTE: If required, only one input type may be calibrated.

5. Press the AUTO/MANUAL key to change the upper display to show:

After a few seconds, the upper display will either (a) return to the initial Input Type Number display if calibration was successful, or (b) display:

FAIL

In the latter case, the link jumpers and wiring should be checked.

- To calibrate all inputs, repeat Steps 1 to 4 for each of the other input types (see Table 9-2) until all three secondary analog input types have been successfully calibrated.

Table 9-2 Secondary Analog Input Type Selection

Input Type No.	Input Type	Calibration Input	Link Jumper 10	Link Jumper 11
7	Remote Setpoint, Linear DC mV	50 mV DC	Parked	Parked
8	Remote Setpoint, Linear DC V	10 VDC	Parked	Fitted
9	Remote Setpoint, Linear DC mA	20 mA DC	Fitted	Parked

NOTE: No calibration is required if the secondary analog input is to be used as a Remote Setpoint Potentiometer Input or for Dual Setpoint switching.

9.4 Exit From Calibration Mode

To exit from Calibration Mode, press the DOWN and SCROLL keys simultaneously.

NOTE: An automatic exit is made from Calibration Mode if there is no key activity for two minutes.

9.5 Calibration Check

- Set the Controller to the required configuration (using link jumpers and front panel entry) as described in the appropriate Site Manual.
- Power-up the Controller and leave it powered-up for at least five minutes (for RTD and DC linear inputs) or at least 30 minutes (for thermocouple inputs).
- After the appropriate delay for stabilization has elapsed, check the calibration by connecting the appropriate input source and checking a number of cardinal points.

SECTION 10: ENABLE MODE

10.1 Enable Mode Description

The Enable Mode controls access to the various modes available.

To access the Enable Mode from the Control Mode, press the SCROLL key until **Mod** is displayed. Press the DOWN key. This puts the control in Setup Mode. Press the SCROLL key until **EnAb** is displayed. Press and hold the DOWN key for five seconds. The lower display will read **PASS**. Use the UP and DOWN keys to change the upper display to the correct Pass Code. Press the SCROLL key.

If the proper Pass Code was entered, the first parameter will read **EPrE** in the lower display. If an improper Pass Code was entered, the control will return to the Setup Mode.

A series of parameters in the Enable Mode is available by pressing the SCROLL key. The parameter tag name will appear in the lower display with the upper display blank. Press the SCROLL key. The parameter tag name will appear in the lower display with the enable status in the upper display. Press the UP and DOWN keys to change the enable setting. Once the proper value appears, press the SCROLL key again to display the next tag name in the lower display with the upper display blank.

To return to the Setup Mode, press the UP key when the upper display is blank. Press the UP key again to return to Control Mode.

Table 10-1 Enable Mode Parameters

STEP	DESCRIPTION	DISPLAY CODE	AVAILABLE SETTINGS	FACTORY SETTING
1	Enable Setpoint Change	ESP	EnAb = Enable diS = Disable	EnAb
2	*Enable Pre Tune	EPre	EnAb = Enable diS = Disable	EnAb
3	Enable Auto Tune	EAut	EnAb = Enable diS = Disable	diS
4	Enable RaPID Tune	ErAP	EnAb = Enable diS = Disable	diS
5	Enable Power-Up PreTune	EPtn	EnAb = Enable diS = Disable	diS
6	Enable Tune Mode	Etun	EnAb = Enable diS = Disable	EnAb
7	Enable Alarm Mode	EALA	EnAb = Enable diS = Disable	EnAb
8	Enable Test Mode	EtSt	EnAb = Enable diS = Disable	diS
9	Enable Configuration Mode	ECon	EnAb = Enable diS = Disable	EnAb
10	Enable Calibration Mode	ECAL	EnAb = Enable diS = Disable	diS
11	Enable Manual Control	ESby	EnAb = Enable diS = Disable	diS
12	Setpoint Ramp Rate Enable	ESPr	EnAb = Enable diS = Disable	diS
13	Enable Communications	ECo	EnAb = Enable diS = Disable	EnAb
14	Password Change	CodE	0 - 9999	0

SECTION 11: PRE-TUNE MODE

11.1 Pre-Tune Mode Description

The Pre-Tune Mode may be used to set the instrument's PID parameters to values which are approximately correct, in order to provide a base from which the Auto Tune Mode may optimize tuning.

To engage the Pre-Tune Mode, with the instrument in Control Mode, press the SCROLL key until **Mod** is displayed. Press the DOWN key. Press the SCROLL key until **Pre** is displayed. Press the UP key until the AT LED flashes. To disengage the Pre-Tune Mode, press the DOWN key.

Note: Since the Pre-Tune Mode is a single-shot operation, it will automatically disengage itself once the operation is complete, If the Enable Pre-Tune parameter in the Tune Mode is enabled, then upon power interruption, the unit will first engage the Pre-Tune Mode prior to engaging the Auto-Tune Mode when power is restored.

Also note: The Pre-Tune Mode will not engage during setpoint ramping, Additionally, if the process variable is within 5% of input span from the setpoint, or if an incorrect key sequence is used, the Pre-Tune Mode will not be engaged.

To return to the Control Mode, press the SCROLL key until **Ctrl** is displayed, then press the DOWN key.

SECTION 12: AUTOTUNE MODE

12.1 AutoTune Mode and Description

The Auto-Tune Mode is used to optimize tuning while the instrument is operating.

To access the Auto-Tune Mode, with the instrument in Control Mode, enter the Setup Mode. Press the SCROLL key until Auto is displayed. To engage Auto-Tune, press the UP key. The AT LED will light red.

Note: If the Enable Pre-Tune parameter in the Tune Mode is enabled, then on power-up, the unit will automatically engage the Pre-Tune Mode prior to engaging the Auto-Tune Mode when power is restored.

To disengage the Auto-Tune Mode, access the Auto-Tune Mode. Press the DOWN key. The AT LED will turn off.

To return to Control Mode, press the SCROLL key until Ctrl is displayed, then press the DOWN key.

12.2 How Auto-Tune Works

This instrument uses a pattern recognition algorithm, which monitors the process error (deviation signal). Figure 12-1 shows a typical temperature application involving process start up, a setpoint change and a load disturbance. The deviance signal is shown shaded and overshoots have been exaggerated for clarity.

The auto-tuning algorithm observes one complete deviation oscillation before calculating a set of PID values. Successive deviation oscillations cause values to be recalculated so that the controller rapidly converges on optimal control.

When auto-tuning controllers are switched off, the final PID terms remain stored in the controller's nonvolatile memory, and are used as starting values at the next switch on.

The stored values are not always valid, if for instance, the controller is brand new or the application has changed. In these cases the user can utilize an extra facility on the auto-tuning controllers called "Pre-Tune". Figure 12-2 shows how the "Pre-Tune" facility artificially disturbs the start up pattern so that a first approximation of the PID values can be made prior to the setpoint being reached.

New instruments supplied by the factory contain PID terms set at "DEFAULT" values which have been found to give adequate and safe control over a wide range of applications. In the "Pre-Tune" mode of operation, the "default" PID terms are loaded and the controller demands 100% power until the process value has moved approximately halfway to the setpoint. At that point, power is removed thereby introducing a deviation oscillation. Once the oscillation peak has passed, the Pre-Tune algorithm can calculate its first approximation to the optimum PID values. The power is reapplied using new values. This technique limits possibility of setpoint overshoot when the instrument is new or the application has been changed.

FIGURE 12-1

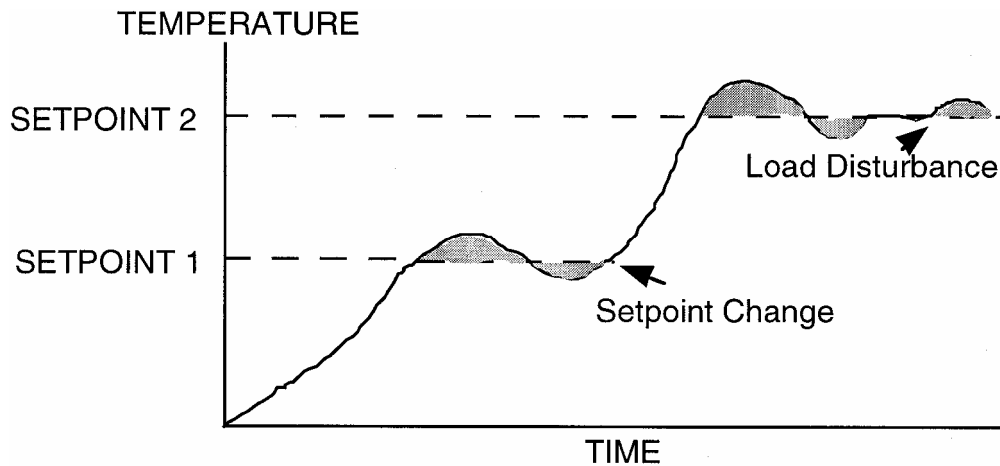
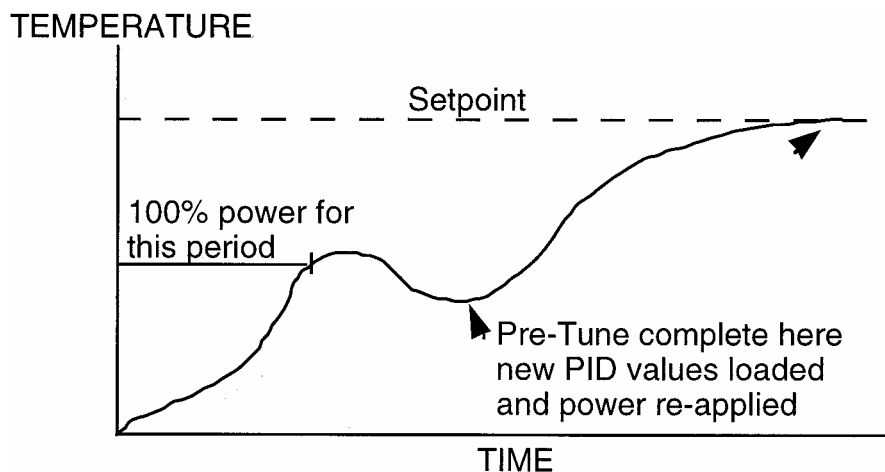


FIGURE 12-2



SECTION 13: RaPID FEATURE

13.1 RaPID Description

The RaPID (Response assisted PID) range of controllers have been designed with a unique "fuzzy" logic algorithm which dramatically reduces overshoot and improves settling times on start-up, setpoint changes and disturbances by 70%, without complicating set-up and usage.

The fuzzy logic based algorithm enhances the traditional PID function, continuously reblending the P, I and D control building blocks on line. Instead of learning from an event and reacting after it has happened (which is how all self-tuning PID controllers work,) the RaPID controllers can react as an event occurs, thereby improving the quality of control and speed of response in any application.

To access the RaPID Mode, access the Setup Mode. Press the SCROLL key until **rAP** is displayed.

To engage the RaPID feature, press the UP key. The AT light will turn green. To disengage the RaPID feature, access the RaPID Mode, and press the DOWN key. The AT light will turn off.

To return to Control Mode, press the SCROLL key until **CtrlL** is displayed, then press the DOWN key.

For a detailed description of the RaPID feature, refer to Appendix C.

NOTE: If either Pb1 or Pb2 is zero, the RaPID feature cannot be engaged.

APPENDIX A: BOARD LAYOUT - JUMPER POSITIONING

FIGURE A-1 OUTPUT 2, OUTPUT 3 REMOVAL

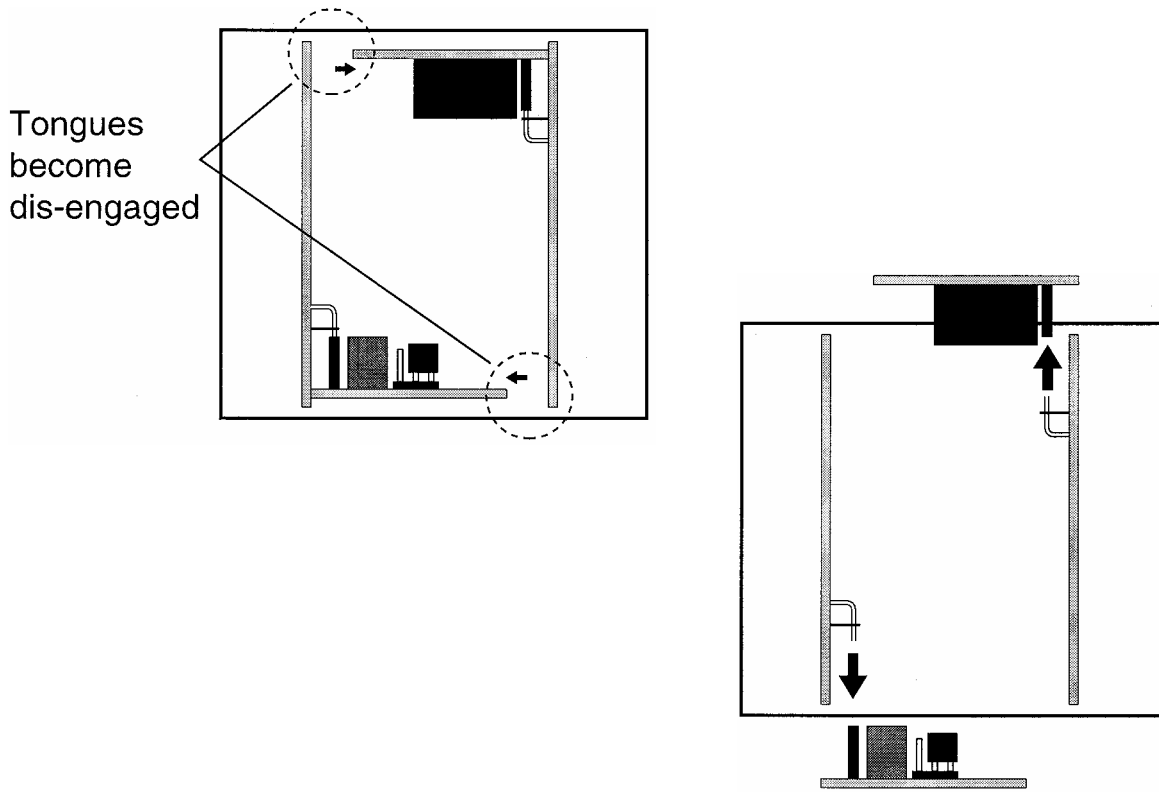
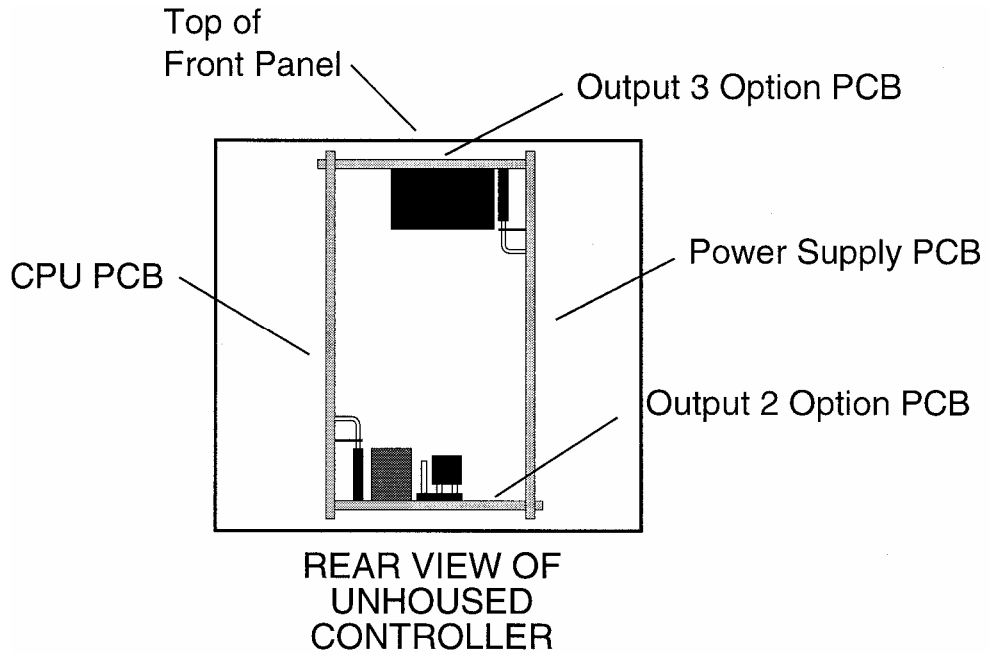
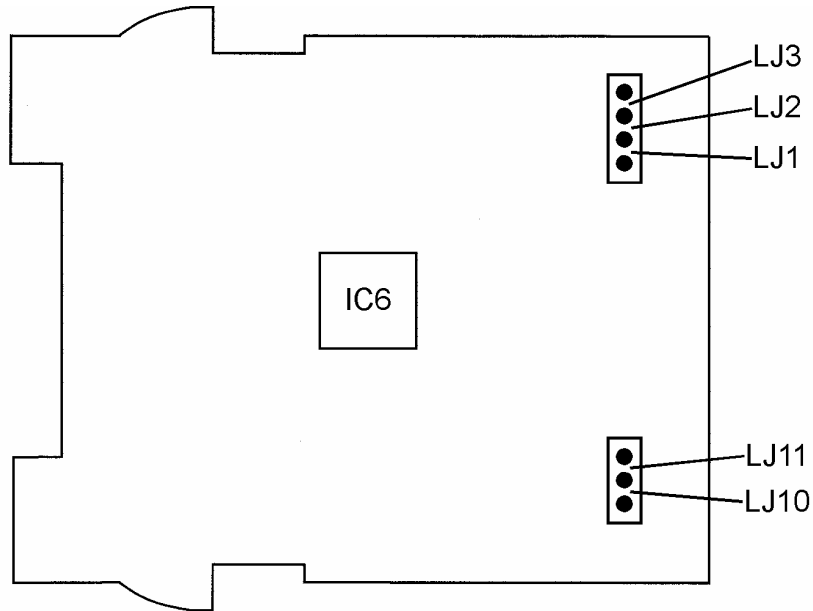


FIGURE A-2 CPU PWA










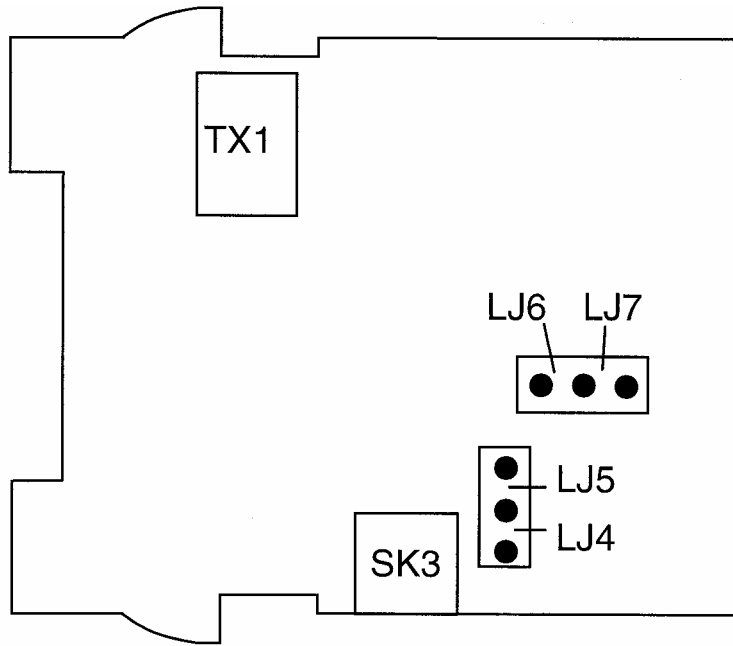
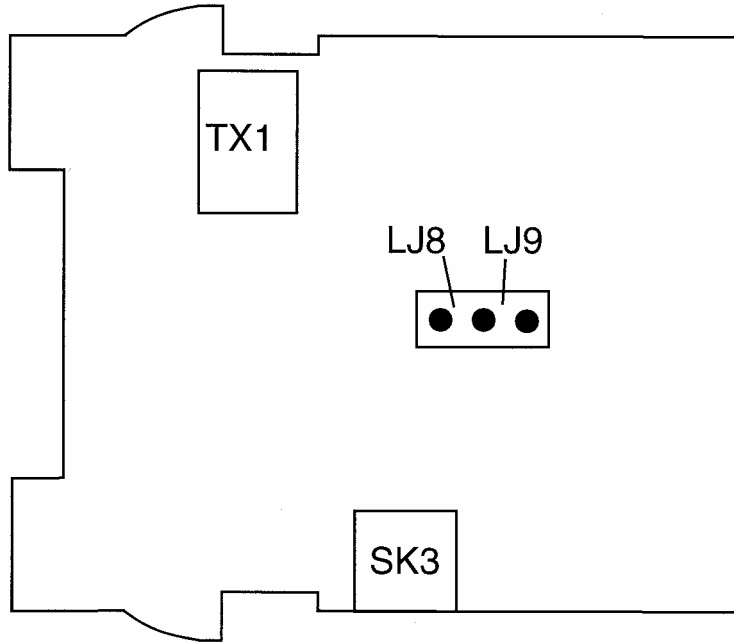
<u>Input Type</u>	<u>LJ1, LJ2, LJ3 Jumper Position</u>	<u>Remote Setpoint Input Type</u>	<u>LJ10, LJ11 Jumper Position</u>
RTD, DC (mV)	 None (parked)	mVDC	 None (parked)
T/C	 LJ3	VDC	 LJ11
DC (mA)	 LJ2	mADC	 LJ10
DC (V)	 LJ1		

FIGURE A-3 PSU PWA WITH RELAY OR SSR OUTPUT 1



<u>Output Type</u>	<u>LJ4, LJ5 Jumper Position</u>	<u>LJ6, LJ7 Jumper Position</u>
Relay	LJ5	LJ6
SSR	LJ4	LJ7

FIGURE A-4 PSU PWA WITH DC OUTPUT 1







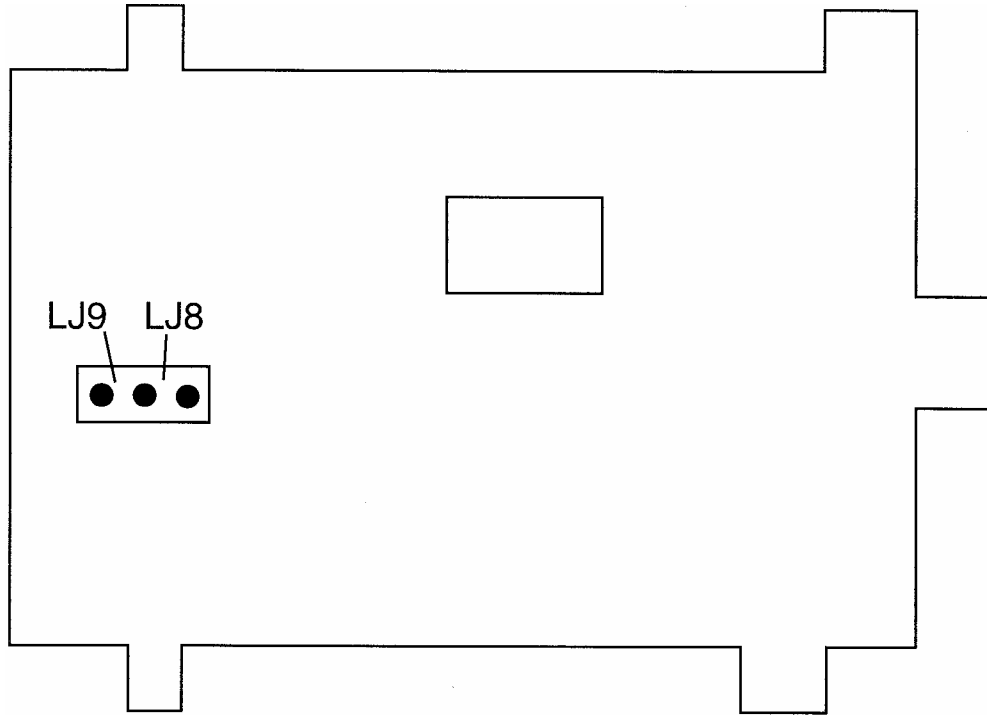
<u>Output Type</u>	<u>LJ8, LJ9 Jumper Position</u>
DC (0-10V)	 LJ8
DC (0-20mA)	 LJ9
DC (0-5V)	 LJ8
DC (4-20mA)	 LJ9

FIGURE A-5 OPTION PWA DC OUTPUT 2/OUTPUT 3







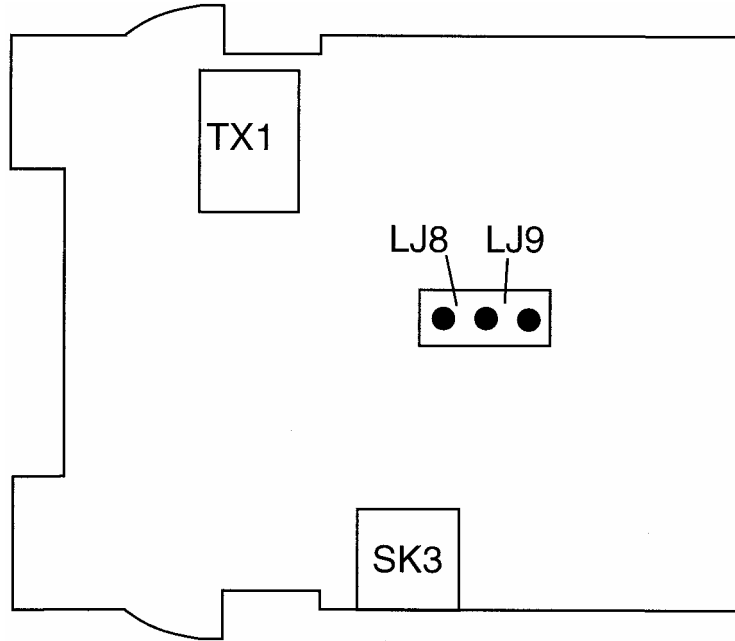




<u>Output Type</u>	<u>LJ8, LJ9 Jumper Position</u>
DC (0-10V)	 LJ8
DC (0-20mA)	 LJ9
DC (0-5V)	 LJ8
DC (4-20mA)	 LJ9

FIGURE A-6 JUMPER PLACEMENT FOR REMOTE INPUT TYPE



<u>Input Type</u>	<u>LJ8, LJ9 Jumper Position</u>
DC (0-10V)	 LJ8
DC (0-20mA)	 LJ9
DC (0-5V)	 LJ8
DC (4-20mA)	 LJ9

APPENDIX B: RANGE CODES

The input ranges available (selectable via the front panel) are:

For Thermocouple Inputs

TYPE	INPUT RANGE	DISPLAYED CODE
R	0 - 1650°C	1127
R	32 - 3002°F	1128
S	0 - 1649°C	1227
S	32 - 3000°F	1228
J	0.0 - 205.4°C	1415
J	32.0 - 401.7°F	1416
J	0 - 450°C	1417
J	32-842°F	1418
J	0 - 761°C	1419
J	32 - 1401 °F	1420
T	-200 - 262°C	1525
T	-328 - 503°F	1526
T	0.0 - 260.6°C	1541
T	32.0 - 501.0°F	1542
K	-200 - 760°C	6726

TYPE	INPUT RANGE	DISPLAYED CODE
K	-328 -1399°F	6727
K	-200 - 1373°C	6709
K	-328 - 2503°F	6710
L	0.0 - 205.7°C	1815
L	32.0 - 402.2°F	1816
L	0 - 450°C	1817
L	32 - 841°F	1818
L	0 - 762°C	1819
L	32 - 1403°F	1820
B	211 - 3315°F	1934
B	100 - 1824°C	1938
N	0 - 1399°C	5371
N	32 - 2550°F	5324

For RTD Inputs

Note: Input conditioning jumper LJ1, LJ2, or LJ3 needs to be changed, see Appendix A.

INPUT RANGE	DISPLAYED CODE
0 - 800°C	7220
32 - 1471 °F	7221
32 - 571 °F	2229
-100.9 - 100.0°C	2230
- 149.7 - 211.9°F	2231
0 - 300°C	2251

INPUT RANGE	DISPLAYED CODE
0.0 - 100.9°C	2295
32.0 - 213.6°F	2296
-200 - 206°C	2297
-328 - 402°F	2298
- 100.9 - 537.3°C	7222
- 149.7 - 999.1 °F	7223

For DC Inputs

Note: Input conditioning jumper LJ1, LJ2. or LJ3 needs to be changed, see Appendix A.

INPUT RANGE	DISPLAYED CODE
0-20mA	3413
4-20mA	3414
0-50mV	4443
10-50Mv	4499
0-100 mV	4412
0-5V	4445
1-5V	4434
0-10V	4446
2-10V	4450

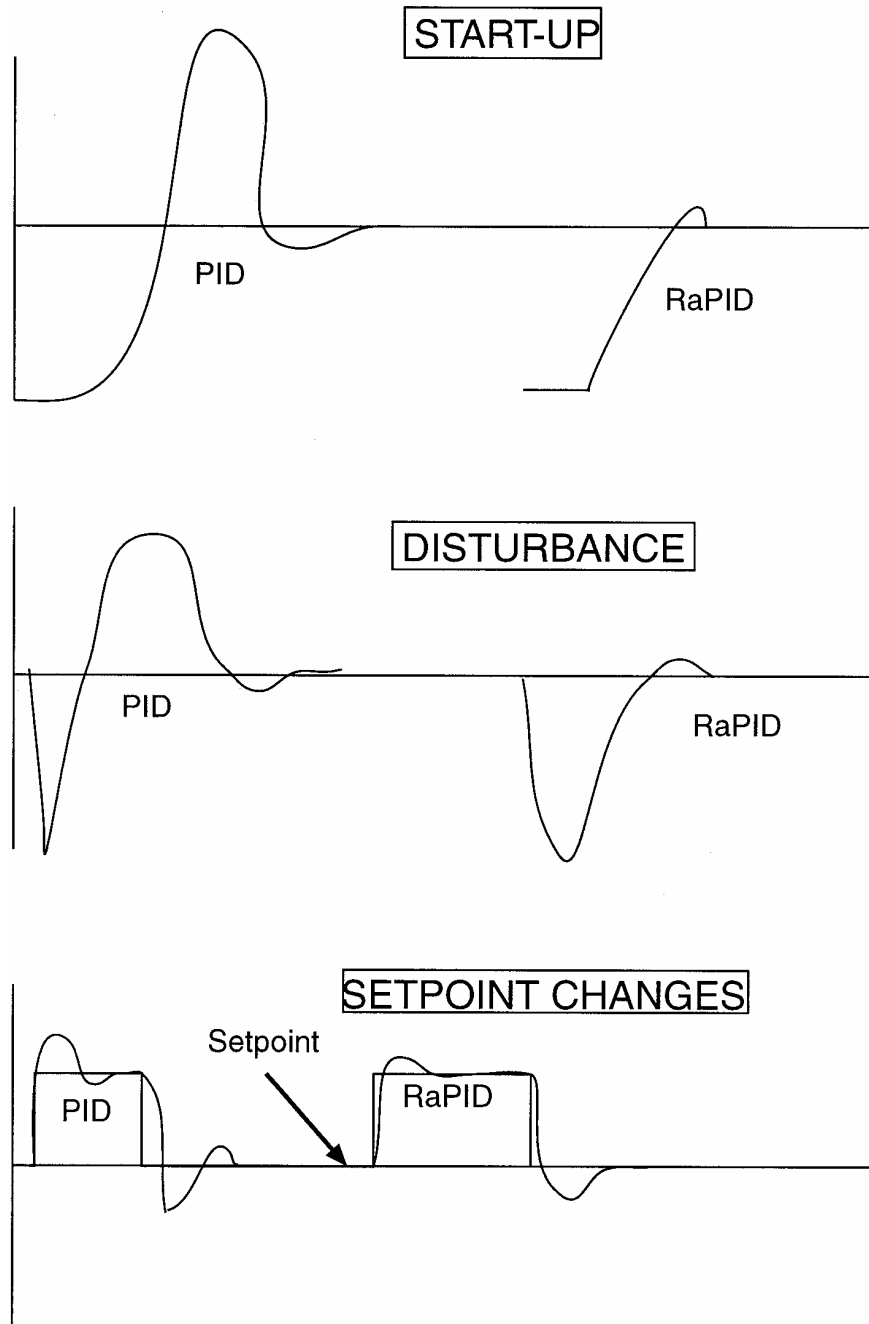
Remote Setpoint Input Ranges

SECOND INPUT RANGE	INPUT RANGE	DISPLAYED CODE
rSP1	0 - 50mV	4443
	10 - 50mV	4499
	0 - 100mv	4412
rSP3	0 - 20mA	3413
	4 - 20mA	3414
rSP4	0 - 5V	4445
	1 - 5V	4434
	0 - 10V	4446
	2 - 10V	4450

If the Second Input Usage is set to rSP9, the upper display will show the fixed legend Pot.

APPENDIX C: RaPID CONTROL FEATURE

The RaPID (Response - assisted PID) feature offers dramatic improvements in control quality compared with conventional PID techniques. It responds much more effectively than PID techniques to load conditions. With this feature, the instrument's response at start-up, during setpoint changes and during disturbances shows considerably reduced overshoot and much more shorter settling times (see below).



RaPID works best with well-tuned terms. It is therefore recommended, on newly installed instruments, that the Pre-Tune facility is run before RaPID is engaged.

Note: If Pre-Tune and RaPID are both engaged, Pre-Tune will run first. Once Pre-Tune (a single shot process) is automatically disengaged, RaPID will operate automatically.

In conditions of frequent change in load characteristics, it is recommended that the Auto-Tune facility is used.

Note: With Auto-Tune and RaPID engaged together, Auto-Tune is suspended until RaPID is disengaged, whereupon Auto-Tune will operate automatically.

The responses to RaPID being engaged are:

Pre-Tune	Auto-Tune	Response	Indication
Not operational	Not selected	RaPID activated	AT static green
Not operational	Selected	Auto-Tune suspended	AT flash green then static green
Operational	Not Selected	Pre-Tune completes operation, then Auto-Tune suspended and RaPID activated	AT flash green then static green
Operational	Selected	Pre-Tune completes operation, then Auto-Tune suspended and RaPID activated	AT flash green then static green

The responses to RaPID being disengaged are:

Pre-Tune	Auto-Tune	Response	Indication
Not Operational	Not Selected	RaPID deactivated	AT OFF
Not Operational	Selected	RaPID deactivated, Auto-Tune comes out of suspension	AT static red
Operational	Not selected	Pre-Tune completes operation, then RaPID deactivated and return made to normal control	AT flash red, then off
Operational	Selected	Pre-Tune completes operation, then RaPID deactivated and AutoTune comes into effect	AT flash red, then static red

APPENDIX D: SPECIFICATIONS

Input Specifications

General

Input Sample Rate:	Four per second
Input Resolution:	14 bits approximately
Input Impedance:	Greater than 100M ohm resistive (except for DC mA and V inputs)
Isolation:	Universal input isolated from all outputs except SSR at 240 VAC

Thermocouple Inputs

Thermocouple Types:	R, S, J, T, K, L, B and N Note: Thermocouple must not be grounded! Damage to the cold junction in the control will result!
Calibration:	Complies with BS 4937, NBS125 and IEC584.
Sensor Break Protection:	Break detected within 2 seconds. Control outputs set to OFF (0% power); alarms operate as if the process variable has gone over-range.

RTD and DC mV Inputs

Type and Connection:	Three-wire Pt100
Calibration:	Complies with BS1904 and DIN43760.
Lead Compensation:	Automatic
RTD Sensor Current:	200 mA (approximately)
Sensor Break Protection:	Break detected within 2 seconds. Control outputs set to OFF (0% power); alarms operate as if the process variable has gone under-range.

DC mA and DC V Inputs

Scale Range Maximum:	-1999 to 9999
Scale Range Minimum:	-1999 to 9999
Minimum Span:	1 display LSD
Sensor Break Protection:	Applicable to 4-20 mA, 1-5V, and 2-10V ranges only. Break detected within 2 seconds. Control outputs set to OFF (0% power); alarms operate as if the process variable has gone under-range.

Dual Setpoint Selection Input

Type: Voltage free or TTL compatible
Voltage Free Operations: Connections to contacts of external switch or relay; contacts open equal Setpoint 1 selected (minimum contact resistance = 5K ohms), contacts closed equal setpoint 2 selected (maximum contact resistance = 50 ohms)

TTL Levels: To select Setpoint 1: -0.6V to 0.8V
To select Setpoint 2: 2.0V to 24V

Remote Setpoint/Potentiometer Input

Types available: 4 - 20 mA, 0 - 20 mA
0 - 100 mV, 0 - 50 mV, 10 - 50 mV
0 - 10V, 2 - 10V, 0 - 5V, 1 - 5V
Potentiometer (up to 2K ohms)

Measurement accuracy under reference conditions: +/- 0.25% of input span +/- 1 LSD
Input sample rate: Four per second
Input resolution: 13 bits
Isolation: 240V ac isolation from all other outputs and inputs except Remote Setpoint Select

Sensor Break protection: For 4 - 20 mA and 1 - 5 ranges only
Remote Setpoint Scale Max.: -1999 to 9999, decimal point as for universal input
Remote Setpoint Scale Min.: -1999 to 9999, decimal point as for universal input
Remote Setpoint Offset: -1999 to 9999, decimal point as for universal input

Remote Setpoint Select Input

Type: Voltage free contact and TTL comparable. Selects Local/Remote Setpoint (or Setpoint 1/Setpoint 2, if Dual Setpoint operation is selected)

To Select Remote Setpoint/
Setpoint 2:
Maximum resistance (closure): 50 ohms
Maximum voltage (TTL) for "0": 0.8 (1 mA sink)
Minimum voltage for "0": -0.6V

To Select Remote Setpoint/

Setpoint 1:

Minimum contact resistance (open):	5K ohms
Minimum voltage for (TTL) for " 1 ":	2.0 V
Maximum voltage for "1":	24.0 V
Maximum input delay (OFF-ON):	0.5 seconds
Minimum input delay (ON-OFF):	0.5 seconds
Isolation:	240 VAC isolation from all setpoints and inputs except Remote Setpoint

Output Specifications

Output 1

General

Types Available: Relay (as standard), SSR Driver and DC as options.

Relay

Contact Type:	Single pole double throw SPDT
Rating:	2A resistive at 120/240V AC
Lifetime:	> 500,000 operations at rated voltage/current
Isolation:	Inherent

SSR Driver/TTL

Drive Capability:	SSRD>4.3V DC into 250 ohm minimum
Isolation:	Not isolated from input or other SSR outputs.
DC Resolution:	Eight bits in 250mS (10 bits in 1 second typical, >10 bits in >1 second typical).
Update Rate:	Every control algorithm execution
Ranges:	0 - 20 mA, 4 - 20 mA, 0 - 10V, and 0 - 5 V NOTE: Changes between V and mA ranges also require JU movement.
Load Impedance:	0-20 mA: 500 ohm maximum
4 - 20 mA:	500 ohm maximum
0 - 10 V:	500 ohm minimum
0 - 5V:	500 ohm minimum
Isolation:	Isolated from all other inputs and outputs.

Output 2

General

Types Available: Relay, SSR and DC

Relay

Contact Type: Single pole double throw (SPDT)
Rating: 2A resistive at 120/240V AC
Lifetime: > 500,000 operations at rated voltage/current
Isolation: Inherent

SSR Driver/TTL

Drive Capability: SSRD>4.3V DC into 250 ohm minimum
Isolation: Not isolated from input or other SSR outputs

DC

Resolution: Eight bits in 250 mS (10 bits in 1 second typical, >10 bits in >1 second typical)
Update Rate: Every control algorithm execution
Ranges: 0-20 mA, 4-20 mA, 0-10 V, and 0-5 V
NOTE: Changes between V and mA ranges also require jumper movement.
Load Impedance: 0 - 20 mA: 500 ohm maximum
4 - 20 mA: 500 ohm maximum
0 - 10 V: 500 ohm minimum
0 - 5 V: 500 ohm minimum
Isolation: Isolated from all other inputs and outputs
Transmitter Power Supply Rating: 24 VDC, 20 mA maximum

Output 3

General

Types Available: Relay, SSR Driver and DC linear (retransmit only)

Relay

Contact Type: Single Pole Double Throw (SPDT)
Rating: 2 A resistive at 120/240V AC
Lifetime: > 500,000 operations at rated voltage/current
Isolation: Inherent

SSR Driver/TTL

Drive Capability: SSRD>4.3 V DC into 250 K ohm minimum
Isolation: Not isolated from input or other SSR outputs

DC

Resolution:	Eight bits in 250 mS (10 bits in 1 second typical, >10 bits in >1 second typical).
Update Rate:	Four times per second
Ranges:	0-20 mA, 4-20 mA, 0-10 V, and 0-5 V NOTE: Changes between V and mA ranges also require jumper movement.
Load Impedance:	0 - 20 mA: 500 ohm maximum 4 - 20 mA: 500 ohm maximum 0 - 10 V: 500 ohm minimum 0 - 5V: 500 ohm minimum
Isolation:	Isolated from all other inputs and outputs.
Transmitter Power Supply Rating:	24 VDC, 20 mA maximum

Control Specifications

Control Types:	RaPID, PID, PID/On-OFF2, ON-OFF
Automatic Tuning	
Types:	Pre-Tune and Auto-Tune
Proportional Bands:	0 (OFF), 0.5% - 999.9% of input span @ 0.1% increments
Auto Reset:	1 s - 99 min 59 s/repeat and OFF
Rate:	0 (OFF) - 99 min 59 s
Manual Reset:	Adjustable in the range 0-100% of output power (single output) or -100% to +100% of output power(dual output)
Deadband/Overlap:	-20% to +20% of proportional band 1 + proportional band 2
ON/OFF Hysteresis:	0.1% to 10.0% of input span
Auto/Manual Control:	User-selectable with "bumpless" transfer into and out of Manual control.
Cycle Times:	Selectable for 0.5s to 512s in binary steps
Setpoint Range:	Limited by Setpoint Upper and Setpoint Lower limits
Setpoint Maximum:	Limited by Setpoint and Range Upper Limits
Setpoint Minimum:	Limited by Range and Setpoint Lower Limits
Setpoint Ramp:	Ramp rate selectable 1-9999 LSDs per hour and infinite. Number displayed is decimal point aligned with selected range.

Alarms

Maximum Number:	Two "soft" alarms plus Loop Alarm*
Maximum # Outputs:	Up to 2 outputs can be used for alarm purposes
Combination Alarms:	Logical OR or AND of alarms to an individual hardware output is available.
Hysteresis:	1 LSD to 10% of span
Loop Alarm:	Detects faults in the control feedback loop by continuously monitoring process variable response to the control output(s)

Performance

Reference Conditions

Ambient Temperature:	20° C ± 2° C
Relative Humidity:	60 - 70%
Supply Voltage:	90 - 264 VAC 50 Hz ± 1 %
Source Resistance:	<10 ohm for T/C input
Lead Resistance:	<0.1 ohm/lead balanced (Pt100)

Performance Under Reference Conditions

Common Mode	
Rejection:	>120dB at 50/60Hz giving negligible effect at up to 264V, 50/60Hz
Series Mode	
Rejection:	>500% of span (at 50/60Hz) causes negligible effect
DC Linear Inputs	
Measurement Accuracy:	± 0.25% of span ± -1 LSD
Thermocouple Inputs	
Measurement Accuracy:	± 0.25% of span ± -1 LSD
	Note: Reduced performance with Type B T/C between 100-600° C (212 - 1112° F)
	Note: Thermocouple must not be grounded! Damage to the cold junction in the control will result!
Linearization Accuracy:	Better than ± 0.2° C any point, any 0.1° C range (± 0.05° C typical). Better than ± 0.5° C any point, any 1° C range.
Cold Junction	
Compensation:	Better than ± 0.7°C
RTD Inputs Measurement	
Accuracy:	± 0.25% of span ± 1 LSD
Linearization Accuracy:	Better than ± 0.2° C any point, any 0.1° C range (± 0.05°C typical). Better than ± 0.5°C any point, any 1°C range.

DC Outputs

Output 1 Accuracy:	mA: 0 - 20mA \pm 0.5% of span (20 mA) @250 ohm 4 - 20mA \pm 0.5% of span (16 mA) @ 250 ohm
	V: 0 - 10V \pm 0.5% of span (10 V) @ 2K ohm 0 - 5V \pm 0.5% of span (5 V) @ 2K ohm
Output 2 Accuracy:	mA: 0 - 20mA \pm 0.5% of span (16 mA) @250 ohm 4 - 20mA \pm 0.5% of span (16 mA) @ 250 ohm
	V: 0 - 10V \pm 0.5% of span (10 V) @ 2K ohm 0 - 5V \pm 0.5% of span (5 V) @ 2K ohm
Output 3 Accuracy: (Recorder Accuracy)	mA: 0 - 20mA \pm 0.5% of span (20 mA) @250 ohm 4 - 20mA \pm 0.5% of span (16 mA) @ 250 ohm
	V: 0 - 10V \pm 0.5% of span (10 V) @ 2K ohm 0 - 5V \pm 0.5% of span (5 V) @ 2K ohm

Operating Conditions

Ambient Operating Temperature:	0° to 55° C
Ambient Storage Temperature:	-20° to 80° C
Relative Humidity:	20% - 95% non-condensing
Supply Voltage:	90 - 264 VAC 50/60 Hz (standard) 20 - 50 VAC 50/60 Hz or 22 - 65 VDC (option)
Source Resistance:	1000 ohms maximum (thermocouple)
Lead Resistance:	50 ohms per lead maximum balanced (Pt100)

Performance Under Operating Conditions

Temperature Stability: Cold Junction Compensation (thermocouple only):	0.01 % of span /degree C change in ambient temperature Better than $\pm 1^{\circ}$ C Note: Thermocouple must not be grounded! Damage to the cold junction in the control will result!
Supply Voltage Influence:	Negligible
Relative Humidity Influence:	Negligible
Sensor Resistance Influence:	Thermocouple 100 ohm: <0.1 %of span error Thermocouple 1000 ohm: < 0.5% of span error RTD Pt100 50 ohm/lead: 0.5% of span error

Environmental

EMI Susceptibility:	Designed to meet EN50082 Part 2
EMI Emissions:	Designed to meet EN50081 Part 2
Safety Considerations:	Designed to comply with IEC 1010-1 in as far as it is applicable
Supply Voltage:	90 - 264V AC 50/60 Hz (standard) 20 - 50V AC 50/60 Hz or 22-65V DC (option)
Power Consumption:	4 watts approximately
Front Panel Sealing:	NEMA4
Agency Approvals:	UL Pending cUL certified for use in Canada pending

Physical

Dimensions:	1/4 DIN front panel: 96 mm x 96mm (3.78" x 3.78") 100mm deep (3.94 inches)
Mounting:	Panel cut-out: 92mm x 92mm (3.62" x 3.62")
Terminals:	Screw type (combination head)
Weight:	16 ounces maximum
Display Character Height:	Top - .53", Bottom - .39"

APPENDIX E: SOFTWARE REFERENCE SHEET

Tune Parameter	Setting
LSP	
rSP	
SP1	
SP2	
iCor	
Po1	
Po2	
Pb1	
Pb2	
ArSt	
rAtE	
rSEt	
HyS1	
HyS2	
SPrd	
SPrr	
rSPo	
Ct1	
Ct2	

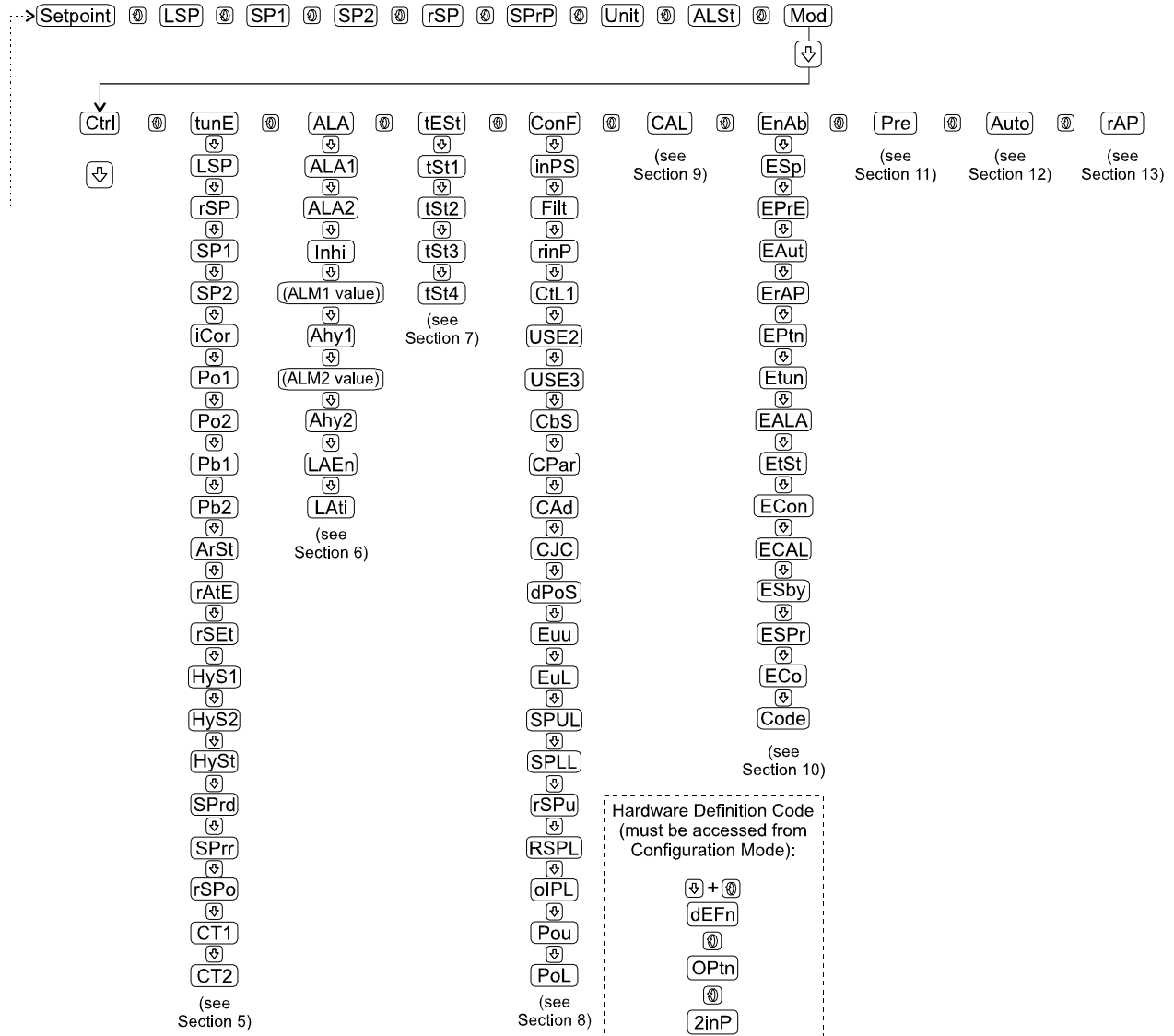
Alarm Parameter	Setting
ALA1	
ALA2	
Inhi	
(Alm 1 Value)	
AHy1	
(Alm 2 Value)	
AHy2	
LAEn	
LAti	


Enable Parameter	Setting
ESP	
EPrE	
EAut	
ErAP	
EPtn	
Etun	
EALA	
Etst	
ECon	
ECAL	
ESby	
ESPr	
ECo	
Code	


Configuration Parameter	Setting
InPS	
FiLt	
rinP	
CtL1	
USE2	
USE3	
CbS	
CPAr	
CAd	
CJC	
dPoS	
Euu	
EuL	
SPuL	
SPLL	
rSPu	
rSPL	
o1PL	
Pou	
PoL	

Hardware Definition	Setting
dEFn	
OPtn	
2inp	

APPENDIX F: FLOW CHART OF OPERATION



 = SCROLL key

 = DOWN key

Product Warranty

See separate warranty for Standard Products (Form BB7)

Parts, Materials and Labor

Seller warrants the equipment manufactured by Seller and not by others, to be free from defects in workmanship and material under normal use and service for a period of (1) year from the date of delivery or the period of two thousand (2,000) accumulated hours of use, whichever period is shorter. Use or service with corrosive or abrasive chemicals or materials is not deemed normal. The period of the forgoing warranty, in the case of furnaces, shall be ninety (90) days or five hundred twenty-five (525) accumulated hours of use, whichever period is shorter. Components manufactured by others including expendable items, are warranted only in accordance with the warranty, if any, issued by such other manufacturer.

Buyer shall give Seller written notice of any defects with 14 days after discovery thereof, specifying each particular defect discovered. If such notice is properly given, Seller will correct without charge any workmanship that is demonstrated to Seller's satisfaction to have been defective at the time of installation, and will repair or replace, at Seller's option, without charge, f.o.b. Seller's factory, parts covered by this warranty that upon inspection are found defective under normal use within the warranty period above stated. All work of removal and reinstallation, whether or not found defective, and shipping charges for defective or replacement parts shall be at the sole expense of Buyer.

The foregoing warranty shall not apply to (i) work done or materials furnished by others in connection with installation work performed without supervision by Seller's installation supervisors, or (ii) equipment repaired or altered by others unless such repairs or alterations were specifically agreed to in writing by an Officer of Seller. Seller shall not be liable for consequential damages of any kind which occur during the course of installation of equipment, or which result from the use or misuse by Buyer, its employees or others of the equipment supplied hereunder, and Buyer's sole and exclusive remedy against Seller for any breach of the foregoing warranty or otherwise shall be for the repair or replacement of the equipment of parts thereof affected by such breach.

The foregoing warranty shall be valid and binding upon Seller if and only if Buyer loads, operates and maintains the equipment supplied hereunder in accordance with the instruction manual to be provided upon delivery of the equipment. Seller does not guarantee the process of manufacture by Buyer or the quality of product to be produced by the equipment supplied hereunder, and Seller shall not be liable for prospective profits.

Despatch will repair or replace, at Despatch's option, FOB Despatch's factory, parts and materials covered by this warranty. Despatch is not responsible for parts or material failures resulting from misuse, abuse, inadequate preventative maintenance, acts of nature, or non-conforming utilities, including electrical, fuel supply, environmental and intake/exhaust provisions. This warranty also does not cover normal wear or routine maintenance parts and materials expressly designed as expendable/consumable and replaceable. (Note: Laboratory oven electric heaters are warranted for a period of five (5) years from date of shipment; three (3) years from date of shipment for Protocol Plus and DES 2000 temperature controllers).

Labor services for parts and materials replacement and repair to support this warranty are available at Despatch's normal service fees. This service is provided worldwide by a network of factory trained professionals.

Transportation Costs

All transportation costs to transport defective parts or materials to Despatch and to transport repaired or replacement parts or materials to Customer shall be the responsibility of the Customer.

Terms and Conditions

This Warranty shall be deemed valid and binding upon Despatch if and only if the Customer:

1. Installs, loads, operates and maintains the covered product supplied hereunder in accordance with the instruction manual provided upon delivery and product labeling affixed to the subject equipment;
2. If applicable, follows the Emergency Procedure set forth in this Warranty; and
3. Contacts Despatch's Helpline at 1-800-473-7373 for assistance in diagnosing and troubleshooting the problem immediately upon discovering any damage or malfunction. Despatch's reasonable determination as to whether a repair, replacement, or service is covered by this Warranty shall be final and binding.

Exclusions

This Warranty DOES NOT cover:

1. Damage or malfunctions, or expenses incurred in the process of diagnosing and/or repairing damage or malfunctions, resulting from any of the following: operator error, misuse, abuse, inadequate preventative maintenance, normal wear and tear, service or modifications by other than Despatch authorized technicians, use of the covered product that is inconsistent with the operation manual or labeling, acts of nature (including, without limitation, floods, fire, earthquake, or acts of war or civil emergency) internal or external corrosion, or non-conforming utilities (including, without limitation, electrical, fuel supply, environmental and intake/exhaust installations);
2. Repair or replacement of parts or materials designed and intended to be expendable or consumable; refrigerants, filters, lamps;
3. Routine maintenance; or
4. Labor costs incurred for troubleshooting, diagnostics or testing (except for testing required to verify that a covered defective part or material has been repaired).

Limitations of Liability

Despatch, shall not, in any event, be liable for indirect, special, consequential, incidental, or punitive damages or penalties of any kind, including, without limitation loss of revenue, profits or business opportunities resulting from interruption of process or production. In no event shall Despatch be liable for damages in excess of the amounts paid by Customer to Despatch with respect to the applicable product(s). This Warranty does not cover, and Despatch shall not be liable for any losses, costs, damages or expenses resulting from delays in diagnosing or repairing the products, supplying or obtaining replacement parts or materials, strikes, labor stoppages or shortages, fires, accidents, government acts or regulations, or any other causes beyond the control of Despatch.

Non-Compliance By Customer

Despatch reserves the right to suspend and withhold service under this Warranty in the event of non-compliance by the Customer to any terms and conditions of this Warranty or the applicable purchase order or invoice. Further, Despatch shall not be liable for any loss of production, expenses, and inconveniences incurred due to such suspension.

Customer Furnished Equipment Warranty Limitation

This Warranty does not cover diagnosis or repairs of defects in or caused by, lack of performance of, or fitness for purpose of customer-supplied parts or equipment unless specifically noted in the Despatch written order acceptance confirmation.

Performance Commitment

Despatch provides no guarantee of process performance or fitness for purpose, unless specifically noted otherwise in Despatch written order acceptance confirmation. Despatch is providing equipment with design parameters specific only to its equipment.

Procedure Upon Discovery of Defects and Emergencies

In the event Customer becomes aware of any defect in the applicable products, Customer must immediately: (a) shut off fuel or energy supply (gas and electricity), (b) call for emergency assistance, if needed, and (c) notify Despatch Service.

THE REPRESENTATION AND WARRANTIES SET FORTH HEREIN ARE EXCLUSIVE AND IN LIEU OF AND CUSTOMER HEREBY WAIVES AND DISCLAIMS RELIANCE UPON, ALL OTHER REPRESENTATIONS AND WARRANTIES OF EVERY KIND WHATSOEVER, WHETHER EXPRESS OR IMPLIED, OR ARISING BY OPERATION OF LAW OR IN EQUITY, OR BY COURSE OF PERFORMANCE OR DEALING OR USAGE OF TRADE, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

THIS WARRANTY IS PERSONAL TO THE CUSTOMER AND MAY NOT BE TRANSFERRED OR ASSIGNED. ALL LIMITATIONS HEREUNDER, HOWEVER, SHALL BE BINDING ON ALL SUCCESSORS AND ASSIGNS OF CUSTOMER.

Service
Worldwide Phone 952-469-8230; Worldwide Fax 952-469-8193; North American Phone 800-473-4373
e-mail service@despatch.com; www.despatch.com

Please see reverse side for other service offerings

Despatch Industries

Advantage Service Assurance Program (ASAP)

CONTACT: DESPATCH SERVICE AGREEMENTS SPECIALIST at 800-473-7373 or 952-469-8230
or e-mail: service@despatch.com

Despatch continues to deliver exceptional products backed by a strong sense of responsibility and drive for long term customer satisfaction. Your partnership with Despatch can offer even higher value through your subscription to one of Despatch's Advantage Service Assurance Program(ASAP).

Warranty

Despatch's exclusive, comprehensive service programs start with the 1 year parts only warranty which is described on the other side of this document. This warranty can be expanded immediately to meet your most stringent service needs. Despatch Service Products Group will be able to answer your service questions and provide a quotation for the immediate expansion of your product warranty. Call 800-473-7373 or 952-469-8230; or e-mail service@despatch.com.

Immediate Service Response

The key to an effective service program is response. Wherever your location, Despatch is only a phone call away. Our U.S. and Canadian customers can reach Despatch at 1-800-473-7373. Worldwide customers can call 1-952-469-8230 or FAX 1-952-469-8193. Our Customer Service Technicians have over 150 years combined experience and access to detailed design and manufacturing documentation specific to your Despatch unit(s). This exacting level of service is a benefit only Despatch can provide and means that you can expect speedy, accurate and the most cost effective response.

Field Service Network

A worldwide network of factory trained Service Professionals is available to support your Despatch equipment. From routine repair to certified instrument calibration, the Despatch service network is positioned to respond to your needs. As a manufacturer of custom equipment, our service programs are customized to meet your specific needs regarding:

1. Service scope
2. Response time
3. Preventive maintenance frequency and content
4. Payment method

Sustained Service Support

At Despatch, long term customer satisfaction means more than just responding quickly and effectively to our customers' service needs. It means offering comprehensive customer support well beyond the scope and duration of our initial warranty. Despatch offers two basic service packages which are customized to each individual customer's need. These service packages are titled Full Service and Preventive Maintenance Plus+ service agreement products. Each is unique in the industry and offer the following benefits:

1. Priority response for minimum production interruption
2. Preventive maintenance for longer product life
3. Discounts on parts and services
4. Various payment plans to ease budgeting and recording expenses
5. Reduce purchase ordering costs