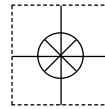


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The information contained in this document is believed to be correct, but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, patient-connected applications.

Table of Contents

Section 1 - General	Page
1.1 Product Description	1
Section 2 - Installation & Wiring	
2.1 Unpacking Procedure	3
2.2 Panel Mounting	3
2.3 Preparation for Wiring	5
2.4 Input Connections	12
2.5 Output Connections	15
Section 3 - Operation	
3.1 Power-up Procedure	23
3.2 Keypad Operation	23
3.3 Indicators	25
3.4 Displays	26
3.5 Alarm Status Indication	26
3.6 Viewing Operating Modes	27
3.7 Adjusting the Setpoint	27
3.8 Viewing Input Values	28
3.9 Base Mode/Off Mode Outputs	29
3.10 Viewing the Time and Day	29
3.11 Manual Control	29
3.12 Using the Pre-Tune Facility	30
3.13 Using the Self-Tune Facility	31
3.14 Enable Mode	32
Section 4 - Configuration	
4.1 Entry into Configuration	34
4.2 Hardware Definition Mode	35
4.3 Configuration Mode Parameters	38
4.4 Exit from Configuration Mode	43
Section 5 - Tune Mode	
5.1 Tune Parameters	45
5.2 Exiting Tune Mode	50
Section 6 - Alarm Mode	
6.1 Alarm Parameters	51
6.2 Alarm Inhibit	55
6.3 Loop Alarm and Loop Alarm Time	55

Section 7 - Profile Define Mode	
7.1 Entry into Profile Define	60
7.2 Parameters Common to All Profiles	61
7.3 Parameters which apply to a Specific Profile	64
7.4 Parameters in any/each Segment	68
7.5 Using Join, Repeat, and End Segments	71
7.6 Basic Rules to Remember	73
7.7 Exiting Program Define Mode	73
Section 8 - Programs	
8.1 Selecting and Running a Program	74
8.2 Changing Timebase	74
8.3 Holding Manually	74
8.4 Jumping to Next Segment	75
8.5 Viewing Program Status	75
8.6 Aborting a Program	76
8.7 End of Program Indication	76
8.8 Accessing Modes of the Controller	77
Section 9 - Test Mode	78
Section 10- Calibration Mode	
10.1 Calibration Procedure	79
10.2 Exit From Calibration	82
10.3 Calibration Check	82
Appendices	
A - Input Range Codes	83
B - Board Layout - Jumper positioning	85
Figure B-1 PCB Positions	85
Figure B-2 Output 2/Output 3 Removal	86
Figure B-3 CPU PWA	87
Figure B-4 PSU PWA with Relay or dc pulse Out.1	88
Figure B-5 PSU PWA with DC Output 1	89
Figure B-6 Option PWA DC Output 2/Output 3	90
C - Specifications	91
D - Model Number Hardware Matrix	100
E - Software Reference Sheet	101

Figures

Figure 1-1	Front Panel	2
Figure 2-1	Panel Cut-Out Dimensions	3
Figure 2-2	Main Dimensions	4
Figure 2-3	Panel Mounting the controller	5
Figure 2-4	Noise Suppression	8
Figure 2-5	Noise Suppression	8
Figure 2-6	Rear Terminal Connections	10
Figure 2-6A	Rear Terminal Connections	11
Figure 2-7	Main Supply	12
Figure 2-7A	24V Nominal AC/DC Supply	13
Figure 2-8	Thermocouple (T/C) Input	13
Figure 2-9	RTD Input	13
Figure 2-10	Volt, mV Input	14
Figure 2-11	mA DC Input	14
Figure 2-12	Remote Digital Communications	15
Figure 2-13	Relay Output 1	15
Figure 2-14	dc Pulse Output 1	15
Figure 2-15	mADC Output 1	16
Figure 2-16	Relay Output 2	16
Figure 2-17	dc Pulse Output 2	16
Figure 2-18	mADC Output 2	17
Figure 2-19	Transmitter Power Supply Out 2	17
Figure 2-20	Relay Output 3	17
Figure 2-21	dc Pulse Output 3	18
Figure 2-22	mADC Output 3	18
Figure 2-23	Transmitter Power Supply Out 3	18
Figure 2-24	End of Program Output	19
Figure 2-25	Event Outputs	19
Figure 2-26	Remote Program Output	20
Figure 2-27	Valve Motor Drive	21
Figure 2-28	VMD with Interlock	22
Figure 5-1	Proportional Band and Deadband/Overlap	49
Figure 6-1	Alarm Operation	57
Figure 6-2	Alarm Hysteresis Operation	59
Figure 7-1	Auto Hold Operation	67
Figure 10-1	Jumper Positions Calibration	81
Figure 10-2	Connections for Calibration	82

Section 1 - General

1.1 PRODUCT DESCRIPTION

This instrument is a powerful, easy-to-use 1/4 DIN setpoint programmer with full PID control capability (complete with Self-Tune and Pre-Tune capabilities).

Its standard features include:

- Up to eight programs of up to 16 free-format (e.i. dwell, ramp, join, or end) segments each.
- Facility to join programs to one another in any sequence (maximum program length 121 segments)
- User can change currently-running program segment.
- Delayed Start of Program facility
- End of Program relay output
- Universal input-thermocouple, RTD (PT100) or DC linear - user-selectable.
- Universal power supply (90 -264V AC 50/60 Hz)
- Configurable from front panel
- Comprehensive front panel displays
- Front panel sealing to NEMA 4 standard
- Behind-panel depth only 100mm (3.94 inches)
- Power Failure Recovery

Optional features include:

- Remote control and selection of program (plug-in option)
- Up to four Event relay outputs (plug-in option)
- Second control output
- Recorder output (setpoint or process variable)
- RS-485 serial communications
- User-definable program tag names
- Support software (Off-line Configurator, On-line Graphic Program Editor) - operates via RS-485 communications link.
- Real Time Clock

The Setpoint Programmer has numerous operating modes:

Base Mode: Day to day PID control operations with no program running. In this mode, a program may be selected to run.

Profile Run Mode: A selected program is running, held or waiting for a pre-defined delay before starting. In this mode, the operator can view status and program information.

Profile Define Mode: Used to view/create/edit programs. this mode is entered either from Base Mode (selected program may be edited/created) or from Program Run Mode (currently-running program may be edited).

Controller Define Mode: Used to define the controller characteristics.

Tune: Used to adjust tuning parameters

Alarm: Used to define and set alarms

Enable: Provides a means of enabling or disabling access to setpoint changes and each of the non-control modes.

FIGURE 1-1
Front Panel



Section 2 - Installation & Wiring

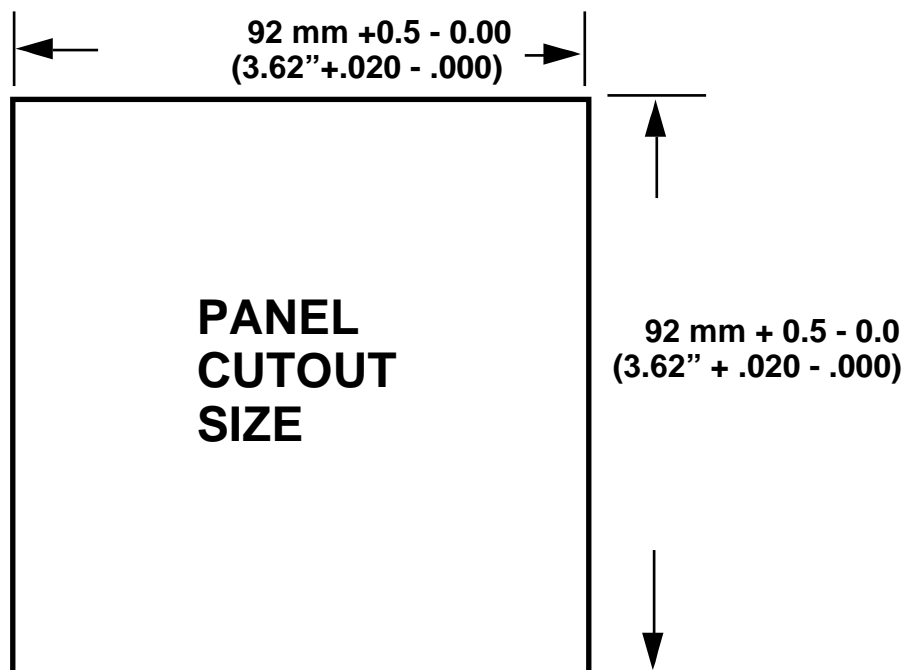
2.1 UNPACKING PROCEDURE

1. Remove the instrument from its packing. The instrument is supplied with a panel gasket and push-fit strap. Retain the packing for future use, should it be necessary to transport the instrument to a different site or return it to the factory for repair/testing.
2. Examine the delivered items for damage or deficiencies. If any is found, notify the carrier immediately. Check that the model number shown on the label affixed to the instrument housing corresponds to that ordered (see Appendix D).

2.2 PANEL-MOUNTING THE SETPOINT PROGRAMMER

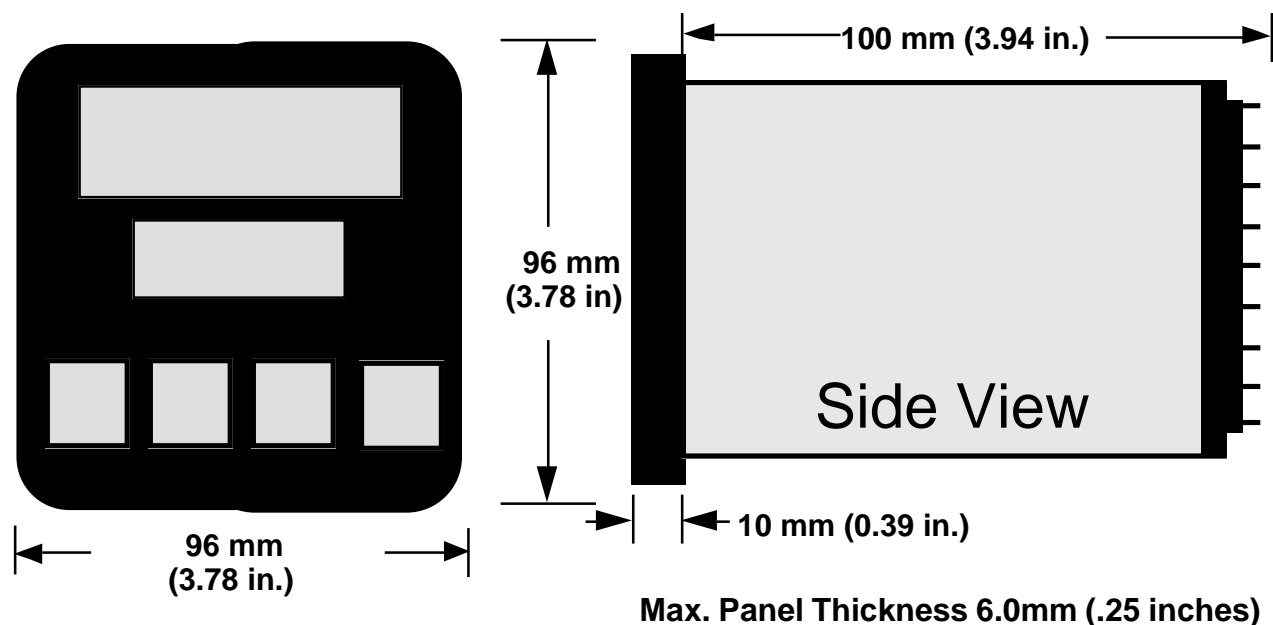
The panel on which the instrument is to be mounted must be rigid and may be up to 6.0 mm (.25 inches) thick. The cutout required for a single instrument is shown in Figure 2-1.

FIGURE 2-1
Cut-Out Dimensions



The main dimensions of the instrument are shown below.

FIGURE 2-2
Main Dimensions



To panel-mount the instrument:

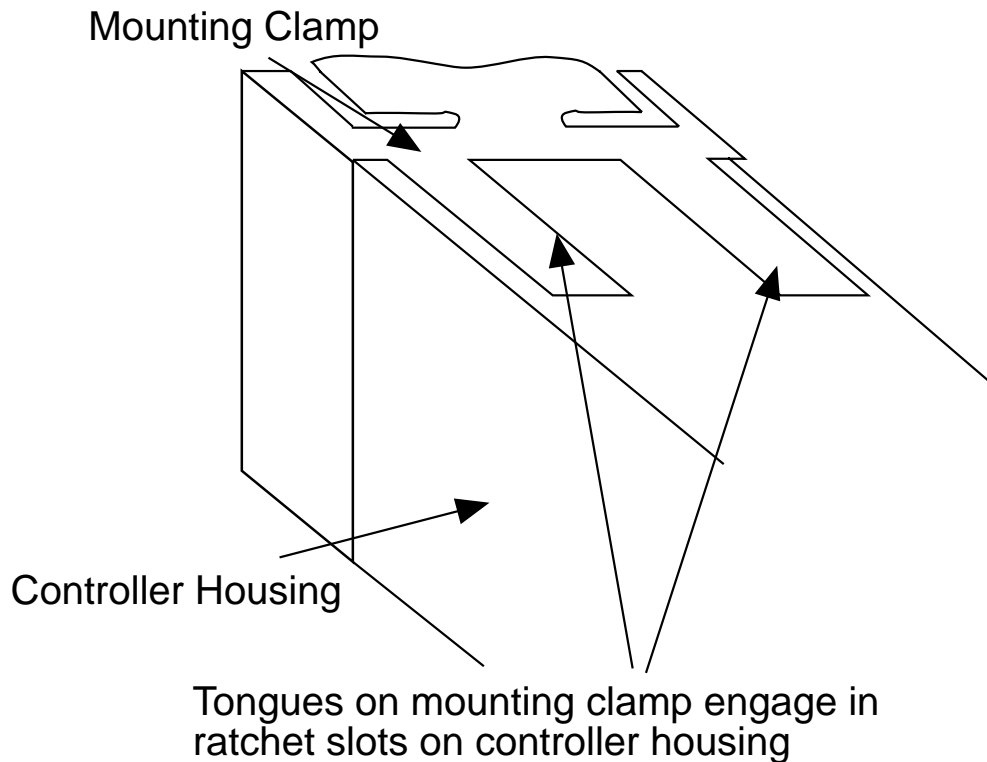
1. Insert the rear of the instrument housing through the cutout (from the front of the mounting panel) and hold the instrument lightly in position against the panel. Ensure that the panel gasket is not distorted and that the instrument is positioned squarely against the mounting panel. Apply pressure to the front panel bezel only.

Caution: Do not remove the panel gasket, as this may result in inadequate clamping of the instrument in the panel.

2. Slide the fixing strap in place (Figure 2-3) and push it forward until it is firmly in contact with the rear face of the mounting panel (the tongues on the strap should have engaged in matching ratchet positions on the instrument housing and the fixing strap springs should be pushing firmly against the mounting panel rear face).

Once the instrument is installed in its mounting panel, it may be subsequently removed from its housing, if necessary, as described in Appendix B.

FIGURE 2-3
Panel-Mounting the Instrument



2.3 PREPARATION FOR WIRING

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.

2.3.1 *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.

2.3.2 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.

2.3.3 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 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 the source.

2.3.4 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.

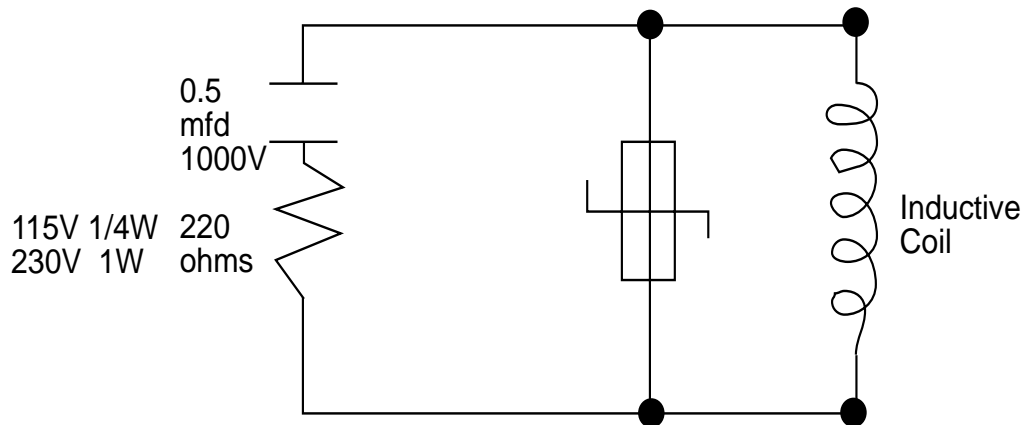
2.3.5 NOISE SUPPRESSION AT THE SOURCE

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.

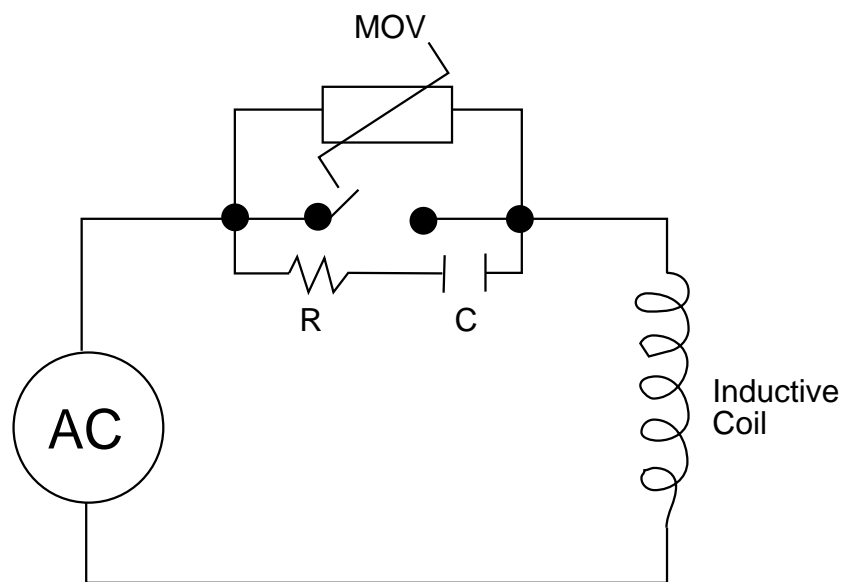
FIGURE 2-4



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 (1000 volts) is recommended. For circuits from 3 to 5 amps, connect 2 of these in parallel. See Figure 2-5, below.

FIGURE 2-5



2.3.5 SENSOR PLACEMENT (THERMOCOUPLE OR RTD)

Two wire RTD's 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
Rear Terminal Connections

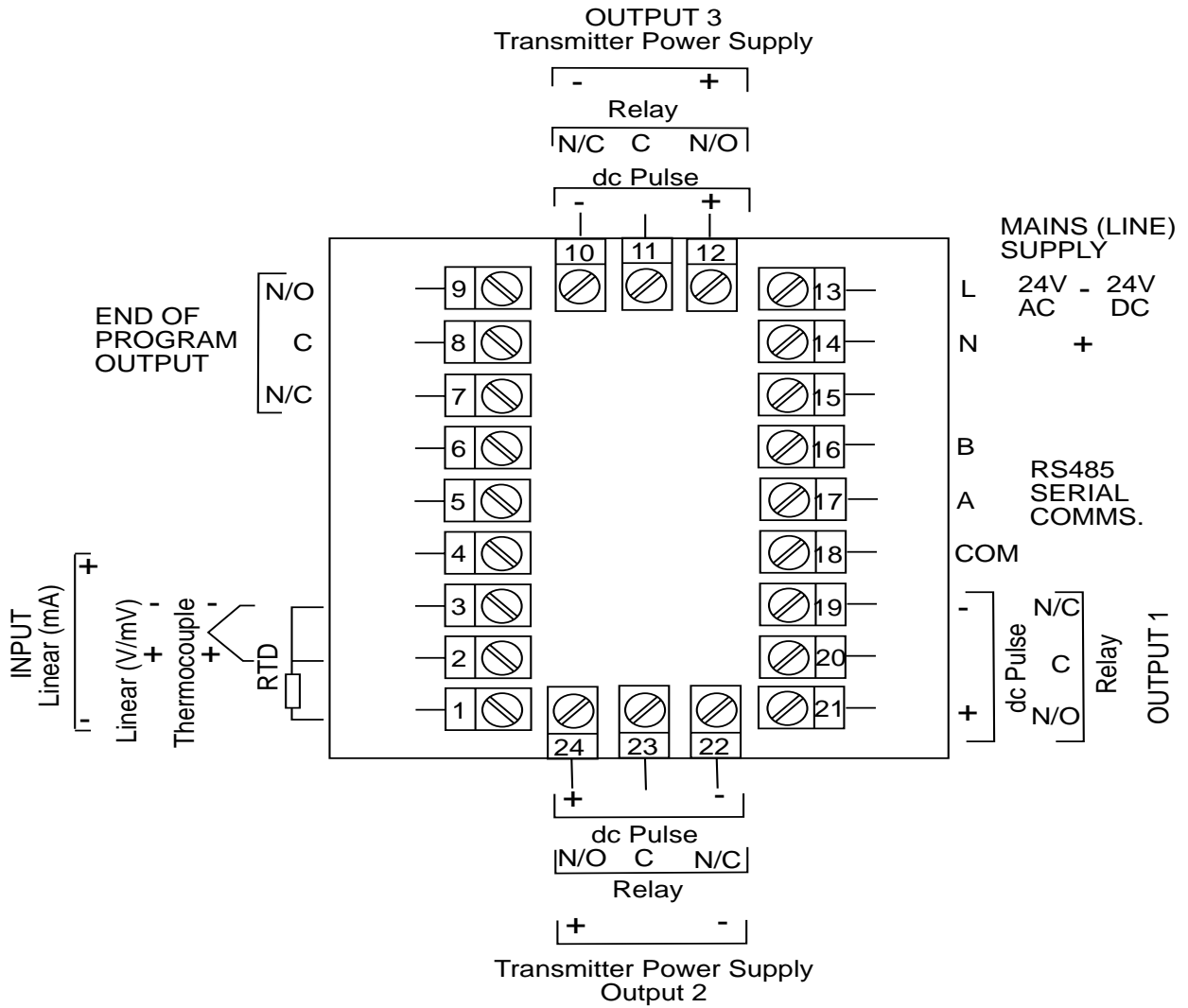
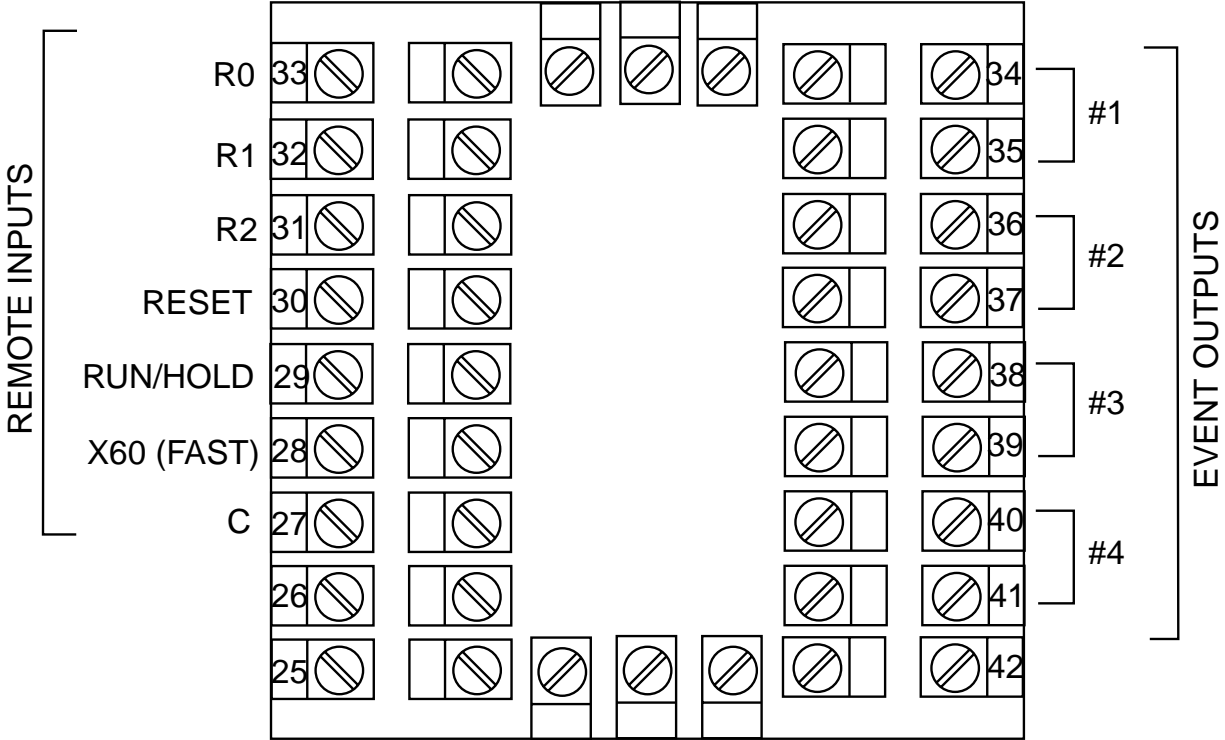


FIGURE 2-6A



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 personnel. Power should be connected via a two pole isolating switch (preferably situated near 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 mains (line) supply. The power consumption is approximately 4 VA. If the instrument has relay outputs in which the contacts are to carry mains (line) voltage, it is recommended that the relay contact mains (line) supply should be switched and fused in a similar manner but should be separate from the instrument mains (line) supply.

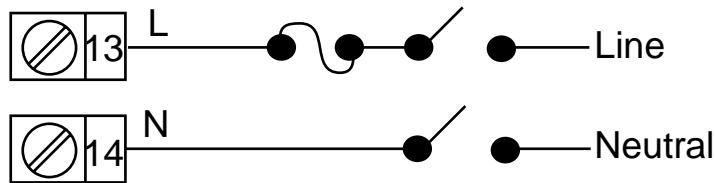


FIGURE 2-7A

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

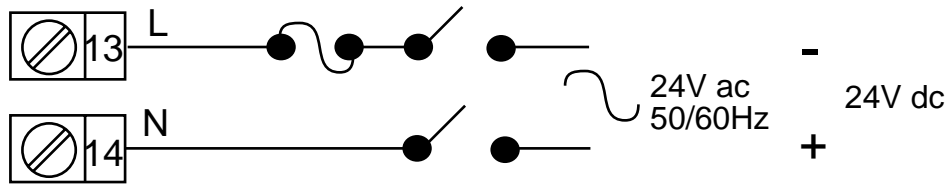


FIGURE 2-8

Thermocouple (T/C) Input

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

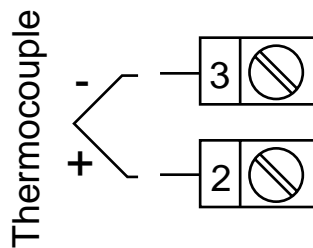


FIGURE 2-9

RTD Input

Make RTD connections as illustrated below. For a three wire RTD, connect the resistive leg of the 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. (Continued on next page)

Input conditioning jumper must be positioned correctly (see Appendix B) and Hardware Definition Code must be correct (see Appendix C).

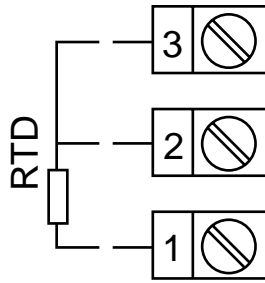


FIGURE 2-10

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 B) and Hardware Definition Code must be correct (see Appendix C).

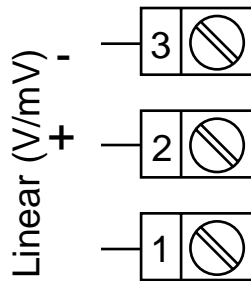


FIGURE 2-11

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 B) and Hardware Definition Code must be correct (see Appendix C).

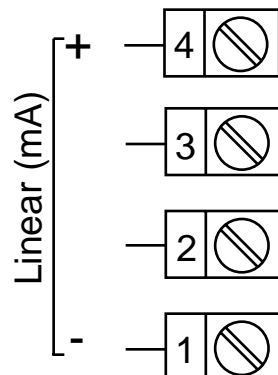
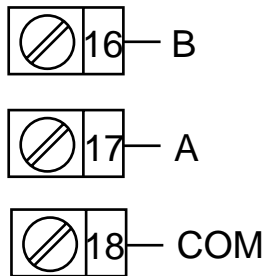


FIGURE 2-12

Remote Digital Communications - RS485

Make digital communication connections as illustrated below.



Output Connections 2.5

FIGURE 2-13

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 .

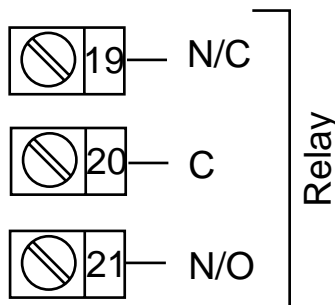


FIGURE 2-14

dc Pulse Output 1 (Control Output 1)

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

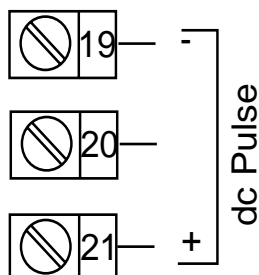


FIGURE 2-15

mAdc Output 1 (Control Output 1)

Make connections for analog dc Output 1 as illustrated below.

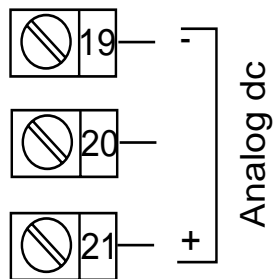


FIGURE 2-16

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.

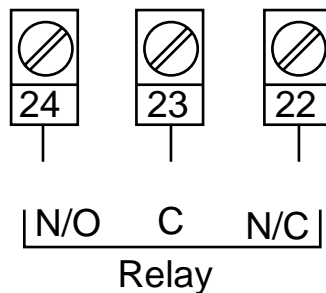


FIGURE 2-17

SSR Driver Output 2 (Control Output 2 OR Alarm 2)

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

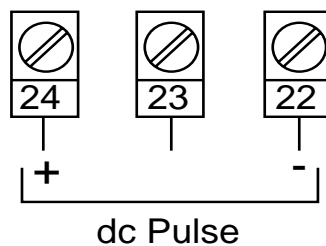


FIGURE 2-18

mAdc Output 2 (Control Output 2)

Make connections for analog dc Output 2 as illustrated below.

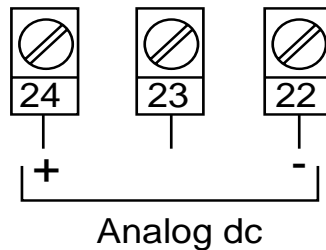


FIGURE 2-19

Transmitter Power Supply Out 2

Make connections for 24V dc transmitter power supply as illustrated below

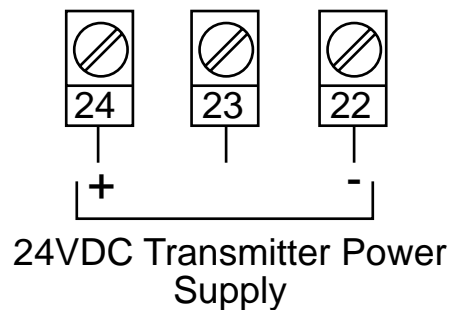


FIGURE 2-20

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.

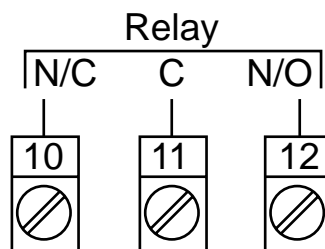


FIGURE 2-21

dc Pulse Output 3 (Alarm 1)

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

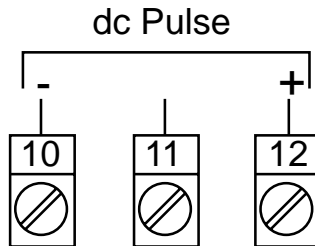


FIGURE 2-22

mAdc Output 3 (Recorder Output Only)

Make connections for dc output 3 as illustrated below.

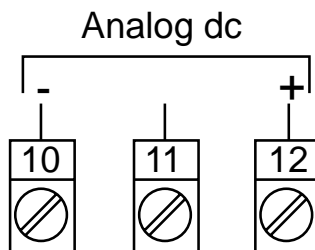


FIGURE 2-23

Transmitter Power Supply Out 3

Make connections for 24Vdc transmitter power supply as illustrated below.

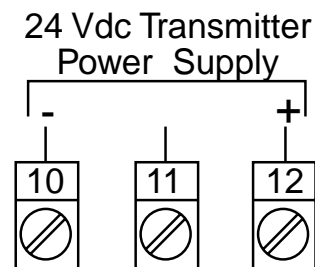


FIGURE 2-24

End of Program Output

Connections are made to End of Program Output as shown below. The contacts are rated at 5 amp resistive, 120/240 Vac.

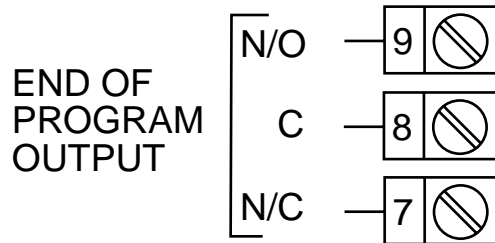


FIGURE 2-25

Event Outputs (optional)

If the Event Outputs have been specified and if the External Option parameter in Hardware Definition is set to either OUT or BOTH, Event Outputs are available. Make connections as shown on top of next page. The contacts are rated at 5 amps, 120/240 Vac.

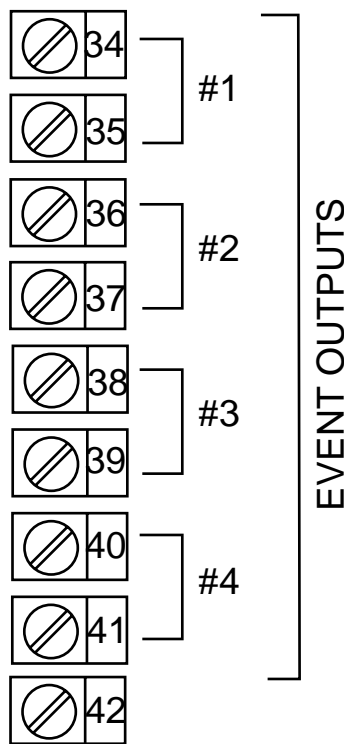


FIGURE 2-26

Remote Program Outputs (optional)

If the Remote Program Control Inputs has been specified, make connections as shown. These inputs can be either TTL or switch contact, selectable in Hardware Definition. The following applies:

Terminals 31 (R2) to 33 (RO) provide a binary-coded input which is used to select the program:

Digital Inputs=TTL Level				Digital Inputs=Contacts (switches)			
R0	R1	R2	Program Select	R0	R1	R2	Program Select
0	0	0	Program 1	Closed	Open	Open	Program 1
1	0	0	Program 2	Open	Closed	Open	Program 2
0	1	0	Program 3	Closed	Closed	Open	Program 3
1	1	0	Program 4	Open	Open	Closed	Program 4
0	0	1	Program 5	Closed	Open	Closed	Program 5
1	0	1	Program 6	Open	Closed	Closed	Program 6
0	1	1	Program 7	Closed	Closed	Closed	Program 7
1	1	1	Program 8	Open	Open	Open	Program 8

For the Program Control Inputs, the following convention has been adopted: for TTL inputs OFF=logic 0, ON=logic 1; for contacts (switch) inputs OFFG=open, ON=closed.

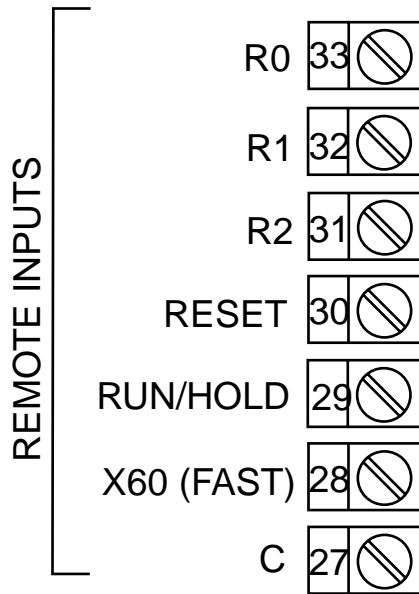
Terminal 30 is the Program Abort control. It is **EDGE SENSITIVE**; an OFF-ON transition at any time will cause an immediate Program Abort.

Terminal 29 provides the Remote Run/Hold Program control and has an identical effect to that of the Run/Hold key on the front panel. An OFF-ON transition will cause the currently selected program to be run (or to be resumed if it is currently held); AN ON-OFF transition will cause the currently running program to be held. Powering up the instrument with this terminal ON will not cause a program to run.

Terminal 28 provides the "x60" program time base selection. This terminal is **LEVEL SENSITIVE** (ON=minutes/seconds, OFF=hours/minutes). When the instrument is powered up, the initially powered time base will be according to the level on this terminal at power-up.

NOTE: All remote selection/control functions except the Abort function have

precedence over the corresponding front panel controls. The "x60" function will also take precedence over any present x60 parameter settings.

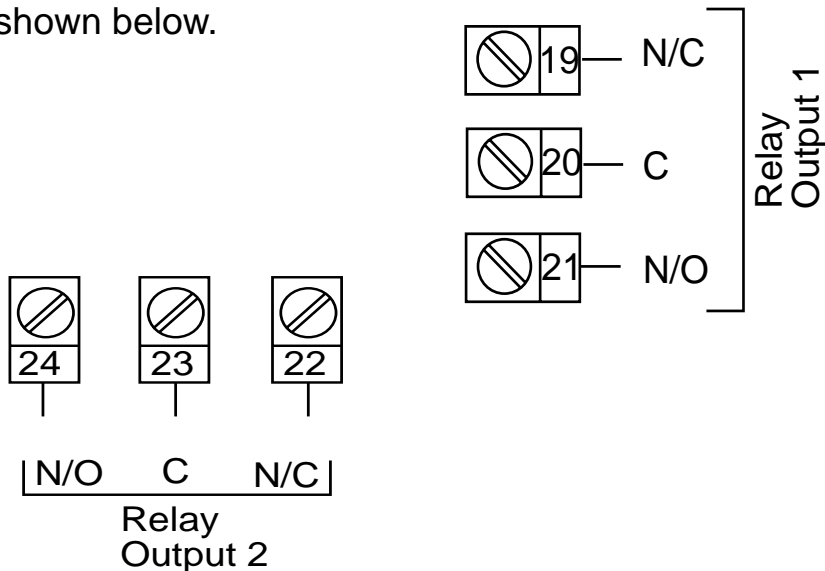


Note: Only one remote connection shown for clarity.

FIGURE 2-27

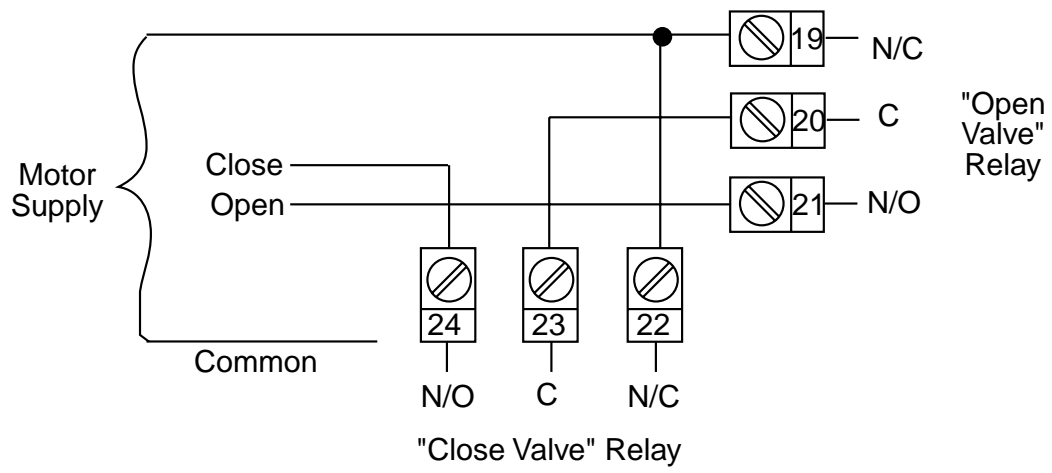
Valve Motor Drive (VMD) Control Relay Outputs 1 & 2

The contacts are rated at 2A resistive at 120V (motor drive). Connections are made as shown below.



NOTE: With VMD control, the controller is designed to switch on either Output 1 or Output 2 (to open or close the valve). However, under fault conditions, both Output 1 and Output 2 relays could be switched on simultaneously. For safety purposes, an interlock can be included which connects the supply to the motor via the "normally closed" relay contacts on the Output 1 and Output 2 relays (see Figure 2-26)

FIGURE 2-28



Section 3 - Operation

3.1 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.

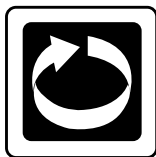
Note: When power is first applied, a delay of approx. 3 seconds will be seen before the displays light up.

3.2 KEYPAD OPERATION



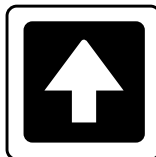
Mode Key

Cycles through modes available in the instrument.



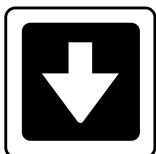
Scroll Key

Displays the next parameter in sequence (indicated by Message display).



Up Key

Increments displayed parameter value/cycles through options.



Down Key

Decrements displayed parameter value/cycles through options.



PROF Key
Cycles through Program (profile) numbers.



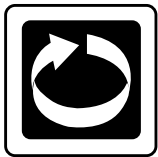
RUN/HOLD Key
Runs, holds or aborts current program (profile).



+



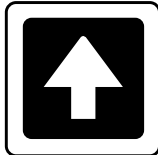
Jumps to next segment, when program is running.



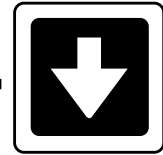
+



Selects/de-selects Manual Control



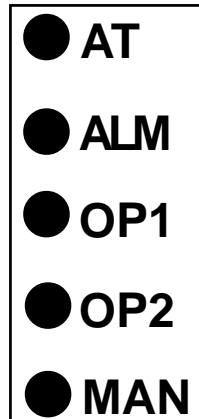
+



Sets a segment to Dwell when defining a program.

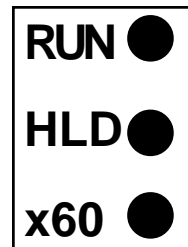
3.3 INDICATORS

Control Status Indicators



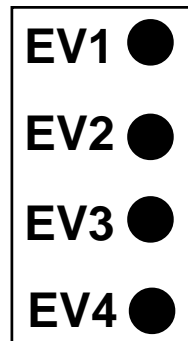
- AT - ON when Self-Tune is active; flashes when Pre-Tune is active.
- ALM - Flashes when any alarm is active.
- OP1 - ON when primary control output is active.
- OP2 - ON when secondary control output (if fitted) is active.
- MAN - ON when Manual Control is selected.

Run Status Indicators



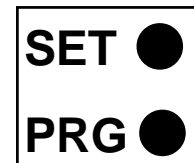
- RUN - ON - Program running or (if HLD ON also) held
Flashing - Program in Delayed state
- HLD - ON - Program held
Flashing - Program in Auto-Hold
- x60 - OFF - timebase = hours/minutes
ON - timebase = minutes/seconds

Event Indicators



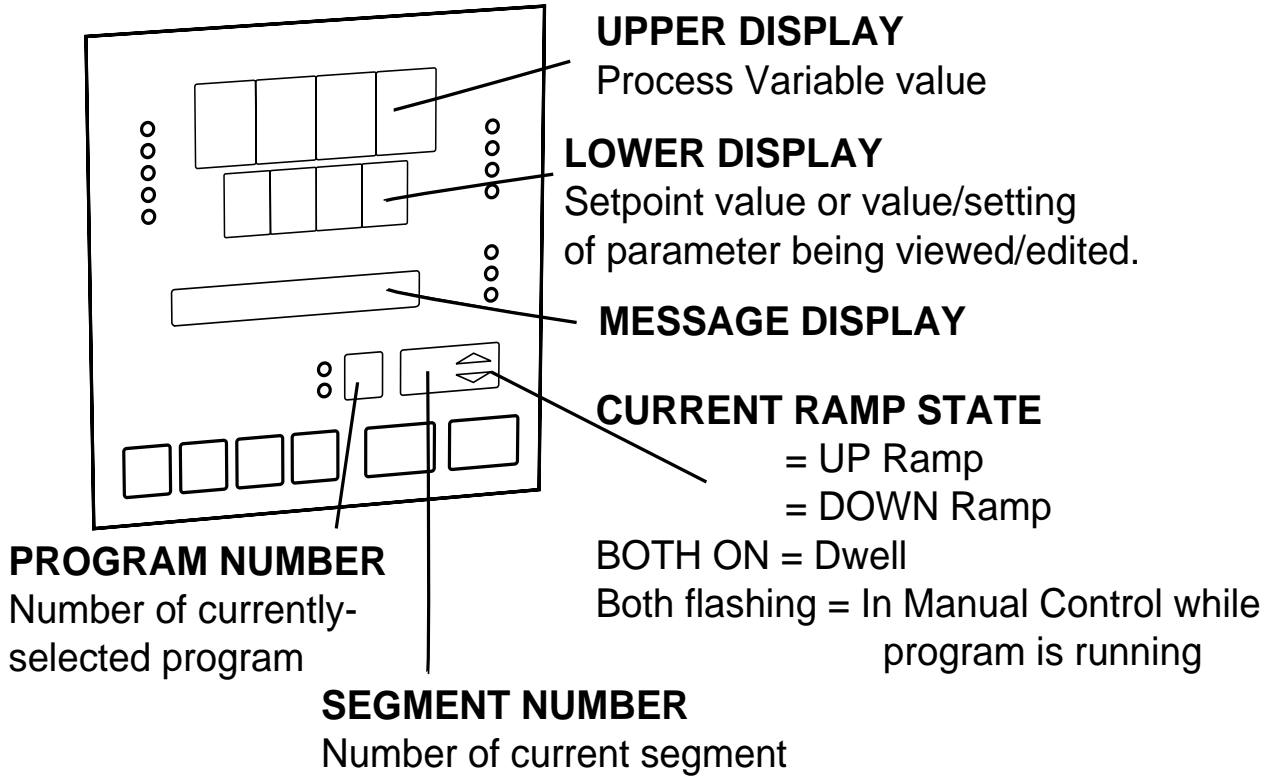
- Each indicates the status (active or inactive) of a user-defined event (OFF = inactive, ON = active)

Mode Indicators



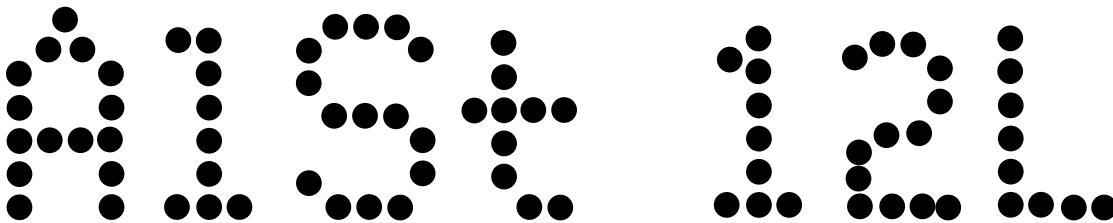
- SET - ON when any mode is entered; flashes when in Controller Parameter Mode.
- PRG - ON when Profile Set Mode is entered.

3.4 DISPLAYS



3.5 ALARM STATUS INDICATION

When any alarm is active, the **ALM** indicator will flash. To view the main status in the Message Display, press the SCROLL key until a display appears in the form:



Appears only if Alarm 1 is active

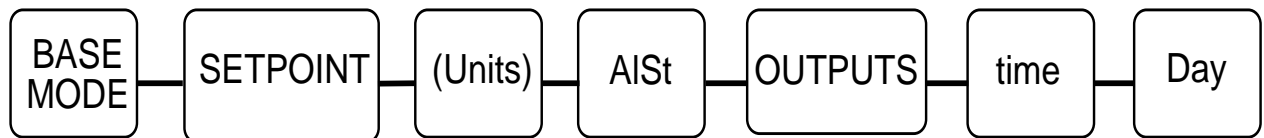
Appears only if Alarm 2 is active

Appears only if the Loop Alarm is active

3.6 VIEWING PROGRAM AND CONTROLLER PARAMETERS

In Base Mode (i.e. with no profile currently running or held), pressing the SCROLL key will cause the instrument to display various information. The operator may view and change the setpoint, view the units the instrument is using, whether the outputs are on or off, the alarm status, the present time and day (if the real time clock is fitted), and the percent output of the control instrument if operating in Manual Mode.

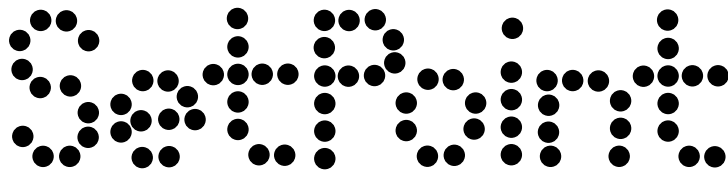
NOTE: If the SCROLL key is held for longer than two seconds, the instrument will automatically scroll through the displays.



3.7 ADJUSTING THE CONTROLLER SETPOINT

With the Setpoint Programmer in Base Mode (i.e. with the **RUN**, **HLD**, **SET**, **MAN** and **PRG** indicators OFF), the two main displays will show the process variable value (upper display) and the setpoint value (lower display - Read Only). To change the setpoint value:

1. Press the SCROLL key, the Message Area will display:



2. If Setpoint has been enabled in the Enable mode, use the UP and DOWN keys to change the setpoint value (in the lower display) as required.
3. When the setpoint value is set as desired, press the SCROLL key again to view other Base mode parameters.

3.8 VIEWING THE INPUT UNITS

To see what type of input the control is using press the SCROLL key until the Units display is shown. The Units display shows the temperature scale for thermocouple and RTD inputs <DEGF> or <DEGC> or unspecified engineering UNITS for other input types. This display can be deactivated, if desired.

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

If the CJC facility in the Configuration Mode is disabled, the initial display in Operator Mode will show:

— — — —
— — — —
— — — —

flashing in the lower display.

3.9 BASE MODE AND OFF MODE OUTPUTS

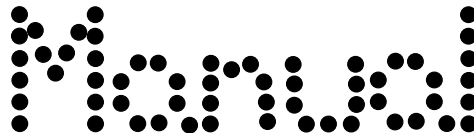
The Base Mode allows for the process and event outputs to be turned on or off. When all outputs are off, the Base Mode becomes Off Mode. In Base Mode the process output is adjusted by the controller based on the process input and setpoint. The event outputs for the Base Mode are set in the Configuration Mode. To view the present status of the outputs, press the SCROLL key until **OUTPUTS** is displayed in the message display. Use the UP and DOWN keys to turn the outputs **ON** or **OFF** (toggle between Base Mode and Off Mode).

3.10 VIEWING THE TIME AND DAY

If the real time clock option is fitted, the operator may view the present time and day. Press the SCROLL key until **HH:MM Tim** is displayed. This is the present time of day in hours and minutes. Press the SCROLL key again and **Day: XXX** is displayed with **XXX** being an abbreviation for the present day of the week. If **TIME BAD** is displayed, the time and day must be set in the Profile Mode (see sec. 6)

3.11 MANUAL CONTROL

In any mode except Configuration Mode, the operator may select manual control of the process by simultaneously pressing the SCROLL and MODE keys, provided Manual Mode is enabled in Controller Define Mode. The instrument will then enter Base Mode or (if a program is currently running) Program Run Mode with the program held. The Message Display will show:



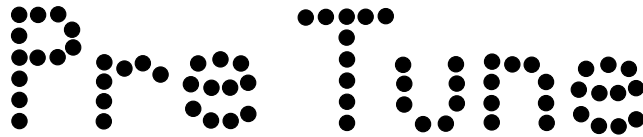
The lower Main Display will show the power output value, which may then be adjusted using the UP and DOWN keys and the MAN indicator will be lit. While manual control is being used, the power output display is included in the displays available in Base Mode and Program Run Mode.

To cancel manual control, press the SCROLL and MODE keys simultaneously, whereupon the power out value display and the Power message display will disappear and the Setpoint Controller will remain in whatever mode prevailed when manual control was cancelled (if this is Program Run Mode, the currently-running program will be resumed from the point at which it was held).

3.12 USING THE PRE-TUNE FACILITY

The Pre-Tune facility is used to set the instrument's PID control parameters to values which are approximately correct in order to provide a base from which the Self-Tune facility may subsequently optimize tuning. Pre-Tune may be activated as follows:

1. With the instrument in Base mode (with the **RUN** and **HLD** indicators OFF), press the MODE key until the Message Display shows:



and the lower Main Display shows:



2. Press the UP key to change the lower Main Display to:



indicating that the Pre-Tune facility is now activated. The **AT** indicator will flash.

NOTES:

1. If the process variable is within 5% of the input span from the setpoint, the Pre-Tune facility cannot be activated and any attempt to do so will have no effect.

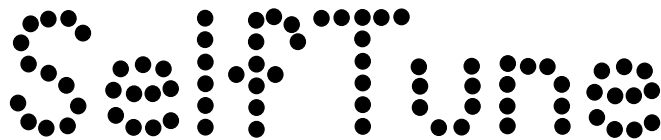
2. Since the Pre-Tune facility is a single-shot operation, it will automatically de-activate itself once the operation is complete.

To de-activate the Pre-Tune facility manually (with the instrument in Base Mode), press the MODE key to obtain the same Message Displays above; then press the DOWN key simultaneously to change the lower Main display from ON to OFF.

3.13 USING THE SELF-TUNE FACILITY

The Self-Tune facility is used to optimize tuning while the Controller part of the instrument is operating. Self Tune may be activated as follows:

1. With the instrument in Base Mode (with **RUN** and **HLD** indicators OFF), press the MODE key until the Message Display shows:

The image shows the text "Self Tune" rendered in a dot-matrix font. Each character is composed of a grid of small black dots on a white background.

and the lower Main Display shows:

The image shows the text "OFF" rendered in a seven-segment font. The characters are formed by black outlines of rectangular segments.

2. Press the UP key to change the lower Main Display to:

The image shows the text "On" rendered in a seven-segment font. The characters are formed by black outlines of rectangular segments.

indicating that the Self-Tune facility is now activated. The **AT** indicator is on continuously.

To de-activate the Self-Tune facility, press the MODE key to obtain the same Message Display as above; then press the DOWN key to change the lower Main Display from ON to OFF.

3.14 ENABLE MODE

The Enable Mode controls which modes are readily available to the operator. If a mode is disabled or off, it will not be displayed when the MODE key is pressed in Base Mode. If a mode is set to Read Only that mode is not available to be changed by the operator, such as the Setpoint Change and Auto Tune Settings.

To enter the Enable Mode from Base Mode:

1. Press the MODE key until Enable appears in the message display.
2. Press and hold the SCROLL key for (5) seconds to access the Enable Mode.
3. With PassCode displayed in the message display, use the UP and DOWN keys to set the pass code in the numerical display.
4. With the proper pass code displayed, press the SCROLL key.

If a proper pass code has been entered, the control will enter the Enable Mode, with EnAB shown in the lower display. If an improper pass code has been entered, the control will revert back to the enable prompt.

Once the Enable Mode has been accessed, if no key is pressed for more than one minute, the instrument will automatically revert to Base Mode.

Press the SCROLL key to step through the parameters. Press the UP or DOWN keys to change the parameter setting.

STEP	MODE	DISPLAY	AVAILABLE SETTINGS
1	Profile Parameters	Prof Par	Enable or Disable
2	Setpoint Change	Setpoint	Enable or Disable
3	Pre- Tune Facility	PreTune	Enable or Read Only or OFF
4	Auto – Tune Facility	AutoTune	Enable or Read Only or OFF
5	Alarm Parameters	Alarm	Enable or Disable
6	Tuning Parameters	TunePar	Enable or Disable
7	Configuration Parameters	ConfPar	Enable or Disable
8	Test	Test	Enable or Disable
9	Calibration	Calib	Enable or Disable
10	Manual control of output	Manual	Enable or Disable
11	Setpoint ramp rate	SPRate	Enable or Disable

STEP	MODE	DISPLAY	AVAILABLE SETTINGS
12	Communications Write	ComWrite	Enable or Disable
13	Auto Pre-Tune *	AutoPT	Enable or Disable
14	Units	Units	Enable or Disable
15	Password Change	PassCh	0 – 9999

* This setting does not determine access. It determines whether the Pre-tune facility is automatically activated when power is applied to the instrument.

To return to Base Mode:

1. Press the Mode key until Basemode appears in the message display.
2. Press the SCROLL key to return to Base Mode.

Section 4 - Configuration

4.1 ENTRY INTO CONFIGURATION MODE

To enter Configuration Mode:

1. Press the MODE Key until Conf Par appears in the message display.
2. Press the SCROLL Key to enter the Configuration Mode

The instrument will then enter Configuration Mode, whereupon the main display will initially be of the form:

14 19

showing the current input code selected, and the Message Display will show:

input

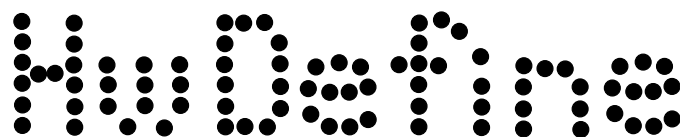
The user may then step through the Configuration Mode parameters using the SCROLL key. For each parameter, the Message Display will show a legend identifying that parameter and the lower main display will show the current setting of that parameter. The setting may be adjusted using the UP/DOWN keys. As soon as the setting is changed, the lower main display will flash, indicating that the new setting has yet to be confirmed. When the setting is as required, it may be confirmed by pressing the MODE key, whereupon the upper display will stop flashing.

NOTE: Changes to certain Configuration Mode parameters (i.e. input range, output use and type) will cause other mode parameters to be automatically set to their default values. Items affected include Tune Mode, and Pretune and Auto Tune Facilities. Until the Tune Mode setting have been verified by changing at least one parameter, the upper main display will show decimal points to indicate that the values are in their default condition.

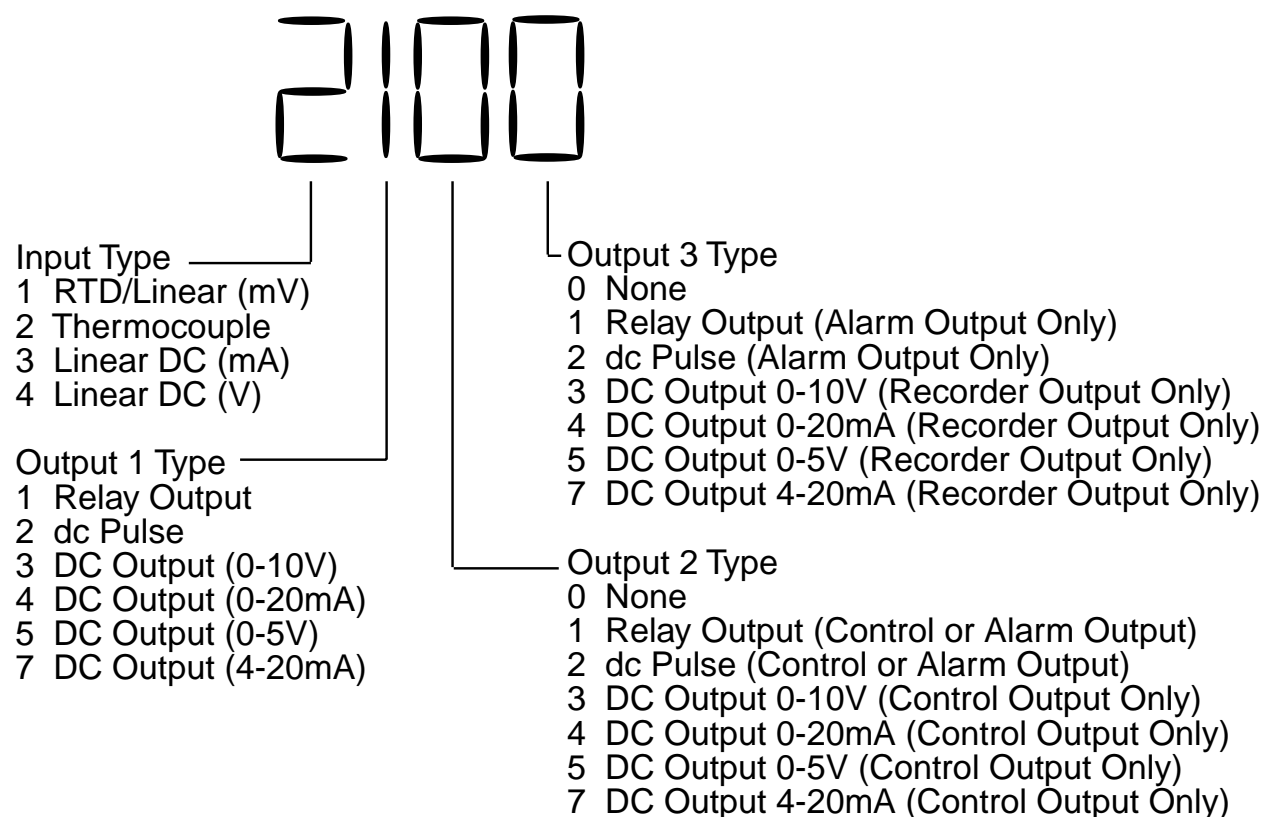
Changes to Configuration Mode parameters will not be accepted until they have been verified with the PROF key.

4.2 HARDWARE DEFINITION CODE

This parameter is a special facility in Configuration Mode, which is used to specify the hardware fitted (input type, output types, etc); this must be compatible with the hardware actually fitted. It can be accessed, with the instrument in Configuration Mode, by simultaneously pressing the DOWN and SCROLL keys. The Message Display will then show:



and lower main display will be of the form:

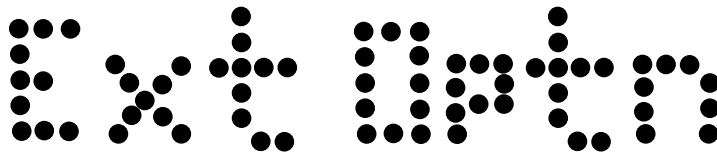


The displayed code may be incremented/decremented using the UP/DOWN keys as required. The maximum setting available for this code is 4777. For example, the code for a thermocouple input, 4-20mA DC primary output (Output 1) and relay Output 3 would be 2701. When the code is first altered, the code display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

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

Hardware Definitions may be viewed as Read Only displays in Base Mode by pressing the SCROLL and DOWN keys simultaneously.

While the Hardware Definition Code is displayed, pressing the SCROLL key will cause the Message Display to change to:



and the lower main display to change to one of:



No option PCB fitted



Digital Input Option PCB fitted



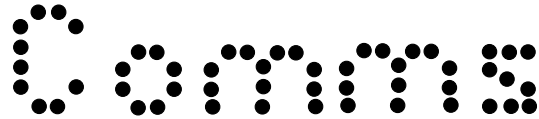
Event Output Option PCB fitted



Both Option PCBs fitted

The desired setting can be achieved using the UP/DOWN keys.


Press the SCROLL key to change the Message Display to:



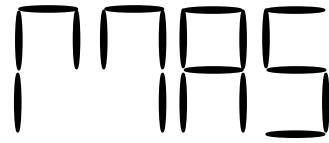
and the lower main display to one of:



RS485
Communications
Option PCB not
fitted



RS485
Communications
Option PCB fitted -
Programmer acting as
slave device



RS485
Communications
Option PCB fitted -
Programmer acting as
master device

The desired setting can be achieved using the UP/DOWN keys.

Pressing the SCROLL key again will display Inputs in the Message Display. Press the UP and DOWN keys to select from contact (cont) and low voltage (ttl) type inputs.

Pressing the SCROLL key again will display the desired function of the remote input wired to terminal 28 (see Sec. 2). Press the UP and DOWN keys to select from X60 timebase (60) or jump to next segment (SEGJ). This input can be used to remotely control the appropriate function in the Program Run Mode.

To exit from the Hardware Definition Code facility, press the DOWN and SCROLL keys simultaneously (which will cause a return to the normal Configuration Mode). Alternatively, either of the methods of exit from Configuration Mode may be used here.

4.3 CONFIGURATION MODE PARAMETERS

The Configuration Mode parameters are presented for view/edit in the following sequence: (Explanation of the following is in the Notes section on page 41)

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
1	Primary Input Range	Input	Code displayed defines input type/range (see App. A)	See App. A
2	Control Action	Control	Specifies control action of Output 1 ¹	dir - Direct Acting rEV- Reverse Acting *Mdr-Motor Drive Reverse *Mdd-Motor Drive Direct
* Not available if Output 1 AND Output 2 are Not Relay Outputs				
3	Output 2 Usage	Out2 Use	Specifies use of Output 2 ²	out2-Control Output A2_d-Alarm 1 (direct) A2_r-Alarm 2 (reverse) Or_d-Alarm 1 OR 2 (direct) Or_r-Alarm 1 OR 2 (reverse) Ad_d-Alarm 1 AND 2 (direct) Ad_r-Alarm 1 AND 2 (reverse)
NOTE: This parameter not available if Control Action is set to Mdr or Mdd-Output 2 automatically used as control output				

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTINGS
4	Output 3 Useage	Out3 Use	Specifies use of Output 3 ³	LP_d-Loop Alarm (direct) LP_r-Loop Alarm (reverse) Al_d-Alarm 1 (direct) Al_r-Alarm 1 (reverse) Or_d-Alarm 1 OR 2 (direct) Or_r-Alarm 1 OR 2 (reverse) Ad_d-Alarm 1 AND 2 (direct) Ad_r-Alarm 1 AND 2 (reverse) LP_d-Loop Alarm (direct) LP_r-Loop Alarm (reverse) rEcS-Rcdr Output (SP) rEcP-Rcdr Output (PV)

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTINGS
5	Segment Mode	Seg Mode	Defines parameter used to specify duration of each segment (along with final SP value)	ti- Time rA-Ramp Rate
6	Baud Rate ⁶	Baud Rate	Selects Baud Rate for RS485 Comms.	Numeric value: 1200, 2400, 4800 or 9600
7	Protocol ⁶	Protocol	Select protocol and parity for RS-485 Comms	Mbn-Modbus, no parity Mbo-Modbus, odd parity Mbe-Modbus, even parity WES-ASCII
8	Address ^{6,7}	Address	Selects RS485 comm. address	Numeric value in range 1-32
9	CJC ⁴ Enable/ Disabled	CJC	Enables/ disables cold junction comp.	EnAb-enabled diSA-disabled
10	Events ¹⁰	Events	Set event status in Base Mode	Binary with LSD=Event 1 0100=Event3 on, all other events off

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTINGS
11	Scale Range Decimal Point ⁹	DecPos	For Linear Inputs, defines decimal point position	0 XXXX 1 XXX.XDefault 2 XX.XX 3 X.XXX
12	Scale Range Maximum ⁹	EngU UP	For linear inputs ,defines the scaled input value when the process variable input is at its maximum value	-1999 to 9999 (decimal point as defined by Scale Range Decimal Point parameter)
13	Scale Range Minimum ⁹	EngU LO	For linear inputs ,defines the scaled input value when the process variable input is at its minimum value	-1999 to 9999 (decimal point as defined by Scale Range Decimal Point parameter)
14	Setpoint High Limit ⁸	SP High	The Maximum limit for setpoint adjustment. Should be set to a value which prevents setpoint values causing damage to the process	Current setpoint value to input range max.

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTINGS
15	Setpoint Low Limit ⁸	SP Low	The Minimum limit for setpoint adjustment. Should be set to a value which prevents setpoint values causing damage to the process	Current setpoint value to input range min.
16	Input Filter Time Constant	Filter	Defines time constant for input filter (removes extraneous impulse from the process variable input.)	0.0 seconds (filter OFF) to 100.0 sec. in 0.5 increments.
17	Output Power Limit	Out PL	Determines max output setting instrument will provide	0 to 100 (%)
18	Engineering Units ³	Units	Sets units to be displayed in base mode	Unit CEnt FAHr
19	End of Program	EOPrelay	Sets action of relay	End=relay active at end of profile run=relay active during profile Default=End

For Notes on Configuration Mode Parameters, see next page.

Notes on Configuration Mode Parameters

1. If the secondary output is chosen as Output 2 (COOL) control output, its action is always the compliment of the action of Output 1.
2. The default setting for Output 2 Usage is Alarm 2 hardware output, direct-acting (if relay/dc Pulse) or Output 2 - COOL (if DC output).
3. The default setting for Output 3 Usage is Alarm 1 hardware output, direct-acting (if relay/dc Pulse) or Process Variable Recorder Output (if DC output)
4. This parameter does not appear in the sequence if the input type selected is not thermocouple. If the CJC is disabled, the initial display in Operator Mode will show horizontal bars flashing in the lower display.
5. The primary input default setting is dependent upon the hardware fitted, as indicated in the Hardware Definition Code.
6. These parameters do not appear if the Hardware Definition Comms parameters is set to nonE.
7. This parameter does not appear if the Programmer communications option is set to operate in Master mode.
8. Internal software prevents (a) the Setpoint High Limit being given a value less than any setpoint value contained in currently-resident programs, and (b) the Setpoint Low Limit being given a value greater than any setpoint value contained in currently-resident programs.
9. These parameters are applicable only if a linear input is fitted.
10. These parameters do not appear if features are not fitted.
11. When X60 in Profile Set = OFF, Time = hours/minutes and Ramp Rate = LSD/hour
When X60 in Profile Set = ON, Time = minutes/seconds and Ramp Rate - LSD/minute

4.4 EXIT FROM CONFIGURATION MODE

To leave Configuration Mode, depress and hold the MODE key for five seconds.

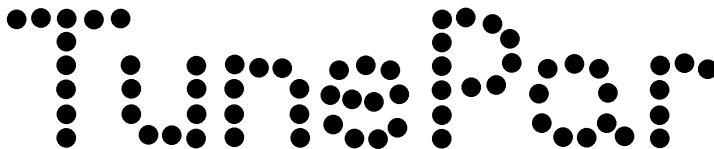
The exit is made via the power-up self-test routines which includes a lamp test.

Section 5 - Defining The Tune Parameters

Entry can be made into this mode from Program Define Mode, Program Run Mode or Base Mode.

To enter from Base Mode or Program Run Mode:

1. Press the MODE key until the Message Display will show:

The image shows the word "TunePar" rendered in a dot-matrix font. Each letter is composed of a grid of black dots on a white background. The 'T' is a vertical line of 5 dots with a horizontal bar of 4 dots at the top. The 'u' is a vertical line of 5 dots with a curved bottom. The 'n' is a vertical line of 5 dots with a curved top and bottom. The 'e' is a vertical line of 5 dots with a curved top and bottom. The 'P' is a vertical line of 5 dots with a curved top and bottom. The 'a' is a vertical line of 5 dots with a curved bottom. The 'r' is a vertical line of 5 dots with a curved bottom.

2. Press the SCROLL key.

The instrument is now in the Tune Mode.

Upon entry into the Tune Mode, the **SET** indicator will then come ON and the first of the Tune parameters (Input Correction) will be presented for editing/viewing. Using the SCROLL key, step through the sequence of Tune parameters, editing as required (using the UP/DOWN keys).

5.1 TUNE PARAMETERS

The Controller parameters appear in the following sequence:

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
1	Input Correction Offset	Inp Cor	Modifies Actual PV Value: Offset PV + Actual PV = PV Value Used	For linear input, limited by Scale Range Max. and Scale Range Min. Default = 0
2	Output 1 Power	Po1	Indicates current Output1 Power Level	Not Adjustable "Read Only"
3	Output 2 Power	Po2	Indicates current Output2 Power Level	Not Adjustable "Read Only"
4	Recorder Output Scale Maximum(5)	P Out HI	The Value of the process variables or setpoints (as applicable) for which the recorder output is a maximum	-1999 to 9999 (decimal point as for the process variable input range). Default = Input Range Max
5	Recorder Output Scale Minimum(5)	P Out Lo	The value of the process variable or setpoint(as applicable) for which the recorder output is a minimum	-1999 to 9999 (decimal point as for the process variable input range). Default = Input Range Min.

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
6	Proportional Band 1 (PB1)	P. Band 1	Defines Portion of input span in which the Output 1 power level is proportional to the (offset) process variable value	0.0% (ON/OFF control) to 999.9% of input span Default 10.0%
7	Proportional Band 2 (PB2)(2)	P. Band 2	Defines Portion of input span in which the Output 2 power level is proportional to the (offset) process variable value	0.0% (ON/OFF control) to 999.9% of input span Default 10.0%
8	AutoReset (3)	AutoRset	Integral Time Constant	1 second to 99 minutes 59 seconds per repeat Default 5.00 minutes
9	Rate (3)	Rate	Derivative Time Constant	00 seconds to 99 minutes 59 seconds Default 1.15 minutes
10	Spread (4)	Spread	Defines the portion of the proportional band (PB1 + PB2) over which both outputs are active (overlap) or neither output is active (deadband)	-20% to +20% (negative value = deadband, positive value = overlap) Default = 0%

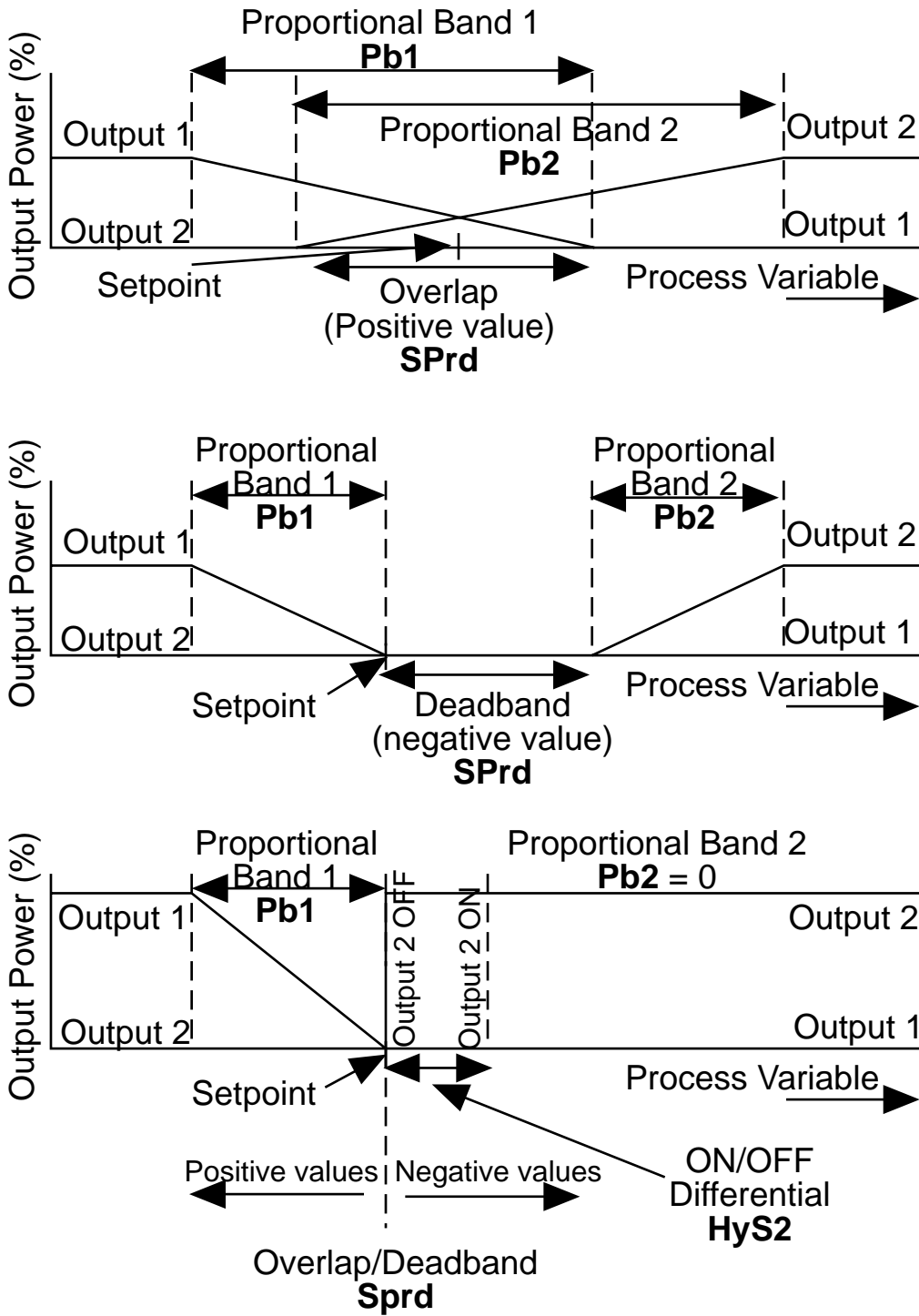
STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
11	Manual Reset (3) output power, expressed as a percentage of output power	Man Rset	Bias applied to (Output1 only) -100% to +100% (Output 1 & Output 2) Default 25%	0% to 100%
12	Hysteresis (7) below setpoint where output 1 will not transition	Hyst 1	Defines band input span Default 0.5% (=7°F for input type 1420)	0.1 to 10% of
13	Hysteresis (7,2) above setpoint where output 2 will not transition	Hyst 2	Defines band input span Default 0.5% (=7°F for input type 1420)	0.1 to 10% of
14	Setpoint Rate	SP Rate	Determines maximum rate of change for setpoint in units per hour	1 to 9999, INF Default = INF (infinite)
15	Output 1 Cycle Time (6) operation of output relay to maximize relay life	CycTime1	Limits frequency of 128, 256 or 512 seconds. Default = 1 second	0.5, 1, 2, 4, 8, 16, 32, 64,
16	Output 2 Cycle Time (6,2) operation of output relay to maximize relay life	CycTime2	Limits frequency of 128, 256 or 512 seconds. Default = 1 second	0.5, 1, 2, 4, 8, 16, 32, 64,
17	Motor Travel Time (8) from one end stop to the other	MT Time	Time Taken for value to travel Default = 1.00 Minute	5 seconds to 5 minutes

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
18	Minimum Motor OnTime(8)	MinDrive	Minimum drive effort required to initiate movement in a stationary valve	0.0 seconds to Motor Travel Time divided by 10 Default=1.0 second

NOTES ON TUNE PARAMETER MODE

1. The input Correction value should be chosen with care. Any adjustment to this parameter is, in effect, a calibration adjustment. Injudicious application of values to this parameter could lead to the displayed process variable value bearing no meaningful relationship to the actual process variable value. There is no front panel indication when this parameter is in effect (i.e. has been set to a non-zero value).
2. These parameters are applicable only if the secondary control (COOL) output is fitted.
3. These parameters are not applicable if Proportional Band 1 is set to 0 (i.e. ON/OFF control).
4. This parameter is not applicable if Proportional Band 1 is set to 0 or if Output 2 (COOL) is not fitted.
5. These parameters are not applicable if the Recorder Output option is not fitted.
6. Output 1 cycle Time is not applicable if Proportional Band 1 is set to 0 or if Output 1 is a DC linear output. Output 2 cycle Time is not applicable if Proportional Band 1 is set to 0, if Output 2 is not fitted or if Output 2 is a DC linear output.
7. These parameters only apply if the proportional band has been set to 0.
8. These parameters only apply if Control Action in configuration is Mdr or Mdd.

FIGURE 5-1



5.2 EXITING TUNE MODE

The operator may exit from Tune Mode by pressing the MODE key.

Section 6 - Alarm Mode

The Alarm Mode parameters control the type of alarms used and their settings.

To enter the Alarm Setting Mode from Base Mode:

1. Press the MODE key until **Alarm** appears in the message display
2. Press the SCROLL key to enter the alarm setting mode

To return to Base Mode:

1. Press the MODE key until, **Basemode** appears in the message display
2. Press the SCROLL key to return to Base Mode

6.1 ALARM PARAMETERS

Press the SCROLL key to step through the parameters. Press the UP and DOWN keys to change the parameter setting.

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
1	Alarm 1 Type	Alarm 1	Specifies Alarm 1 Operation	P_hi-Process High P_Lo-Process Low dE-Deviation bAnd-Band nonE-None
2	Alarm 2 Type	Alarm 2	Specifies Alarm 2 Operation	P_hi-Process High P_Lo-Process Low dE-Deviation bAnd-Band nonE-None

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
3	Alarm Inhibit	Inhibit	Specifies which alarms are inhibited	nonE-None ALA1-Alarm 1 ALA2-Alarm 2 both-Both Alarms
4a	Process High Alarm 1 value	HiAlarm 1	If Alarm 1 is a process high alarm, process variable at or above which Alarm 1 will be active	Input Range Max to input Range Min. Default=Input Range Max.
4b	Process Low Alarm 1 value	LoAlarm 1	If Alarm 1 is a process low alarm, process variable at or below which Alarm 1 will be active	Input Range Max to input Range Min. Default=Input Range Min.
4c	Band Alarm 1 Value	BaAlarm1	If Alarm 1 is a Band Alarm, the band of process variable values (centered on the setpoint) outside which the process variable will cause the alarm to be active	$\pm(\text{Input Span})$ From setpoint Default = five input units

4d	Deviation (High/Low) Alarm 1 Value	DeAlarm 1	If Alarm 1 is a Deviation High/Low alarm, gives a value above (positive value) or below (negative value) the setpoint. If the process variable deviates from the setpoint by a margin greater than this value, the alarm becomes active	\pm (input range) from setpoint. Default = five input range units
5	Alarm 1 Hysteresis value	Al1 Hyst	Value defines a hysteresis band on the "safe" side of the Alarm 1 value	1 unit to X units where X = 10% of input span.
6a	Process High Alarm 2 value	HiAlarm 2	If Alarm 2 is a process high alarm, process variable at or above which Alarm 2 will be active	Input Range Max to input Range Min. Default=Input Range Max.
6b	Process Low Alarm 2 value	LoAlarm 2	If Alarm 2 is a process low alarm, process variable at or below which Alarm 2 will be active	Input Range Max to input Range Min. Default=Input Range Min.

6c	Band Alarm 2 Value	BaAlarm2	If Alarm 2 is a Band Alarm, the band of process variable values outside which the process variable will cause the alarm to be active	$\pm(\text{Input Span})$ From setpoint Default = five input units (centered on the setpoint)
6d	Deviation (High/Low) Alarm 2 Value	DeAlarm 2	If Alarm 2 is a Deviation High/Low alarm, gives a value above (positive value) or below (negative value) the setpoint. If the process variable deviates from the setpoint by a margin greater than this value, the alarm becomes active	$\pm(\text{input range})$ from setpoint. Default = five input range units
7	Alarm 2 Hysteresis value	Al2 Hyst	A non-zero value defines a hysteresis band on the safe side of the Alarm 2 value	1 unit to X units where X = 10% of input span.
8	Loop Alarm Enable	Loop Alm	Enables/disables Loop Alarm	EnAb disA Default=disA

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
9	Loop Alarm Time	LpAtime	If ON/OFF control is selected, and loop alarm is enabled this defines the duration of the saturation condition after which the Loop Alarm is Activated.	1 second to 99 minutes 59 seconds. Default = 99 minutes 59 Seconds.

6.2 ALARM INHIBIT FACILITY

On Power-up, an "alarm" condition may occur, based on the alarm value, the process value and, if appropriate to the alarm type, the setpoint value. This would normally activate an alarm; however, if the pertinent alarm is inhibited, the alarm indication is suppressed and the alarm will remain inactive. This will prevail until the "alarm" condition returns to the "inactive" state, whereafter the alarm will operate normally.

6.3 LOOP ALARM AND LOOP ALARM TIME

The Loop Alarm is a special alarm which detects faults in the control feedback loop by continuously monitoring process response to the control output(s).

The Loop Alarm facility, when enabled, repeatedly checks the control output(s) for saturation i.e. either or both outputs being at the maximum or minimum limit. If an output is found to be in saturation, the Loop Alarm facility starts a timer; thereafter, if the saturated 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 facility 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 saturated output comes out of saturation, the Loop Alarm is deactivated.

For PID control, the Loop Alarm Time T is always set to twice the value of the Reset (Integral Time Constant) parameter. For On/Off control, the user defined value of the Loop Alarm Time parameter is used.

The value of V is dependent upon the input type:

°C ranges: 2°C or 2.0°C

°F ranges: 3° F or 3.0°F

Linear ranges: 10 least significant display units

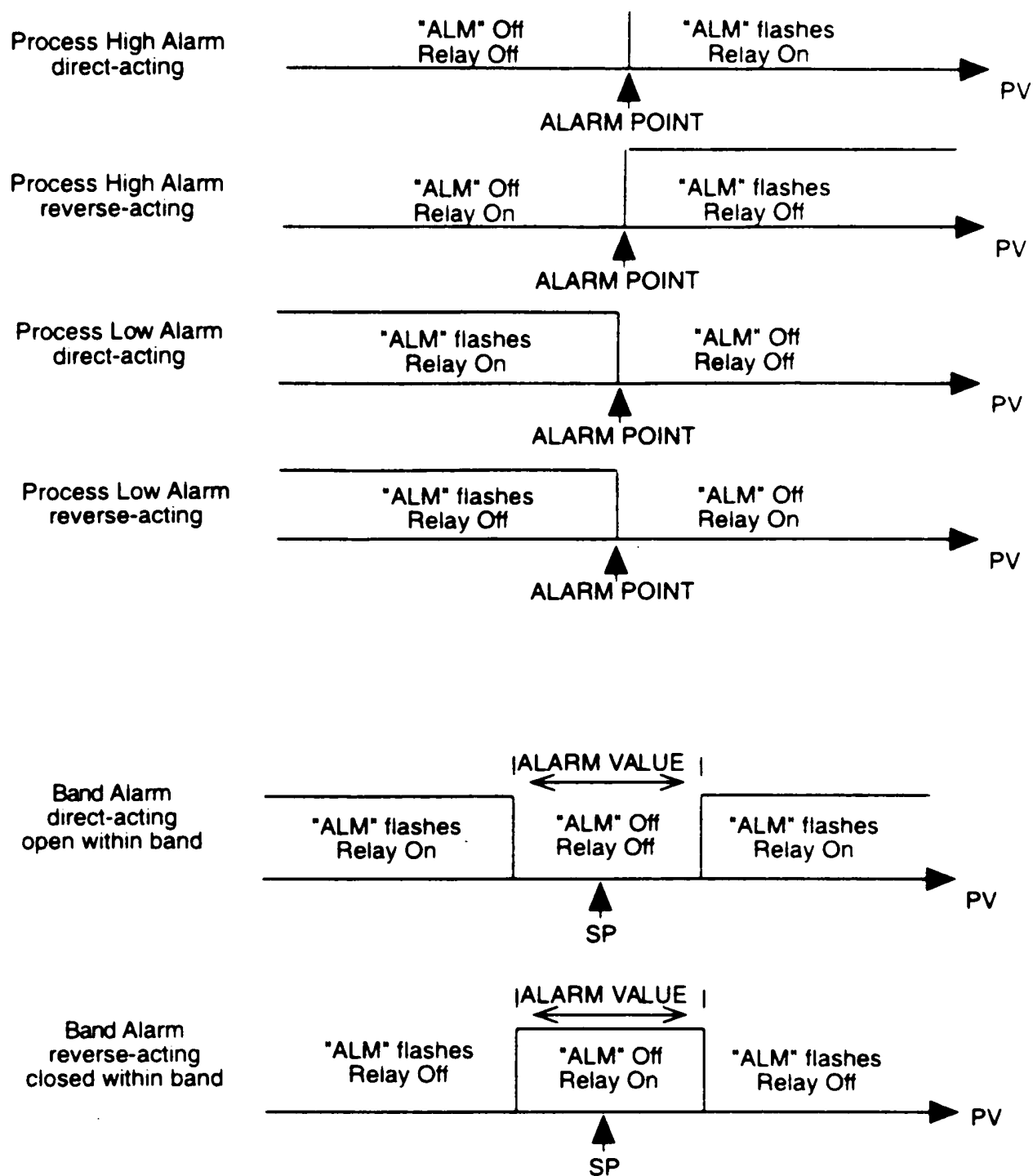
For single output controllers, the saturation limits are 0% and Output Power Limit. For dual output controllers, the saturation limits are - 100% and Output Power Limit.

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 facility. Upon exit from Manual Control Mode or after completion of the Pre-Tune routine, the Loop Alarm is automatically re-enabled.

When full ON/OFF control is selected (i.e. Proportional Band 1 is set to 0) and Loop Alarm is enabled, the Loop Alarm Time parameter determines the duration of the saturation condition after which the Loop alarm will be activated. It may be adjusted within the range 1 second to 99 minutes 59 seconds. This parameter is omitted from the display sequence if ON/Off control is not selected or Loop Alarm is disabled. The default setting is 99:59.

FIGURE 6-1



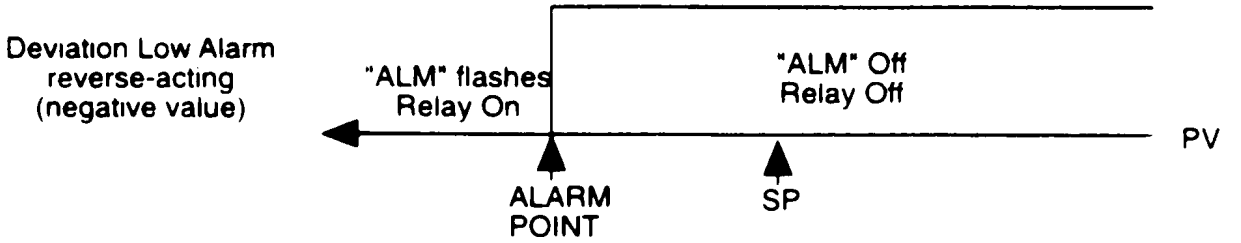
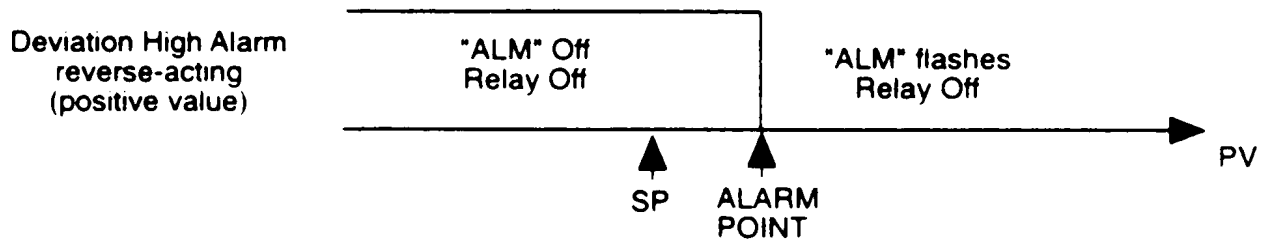
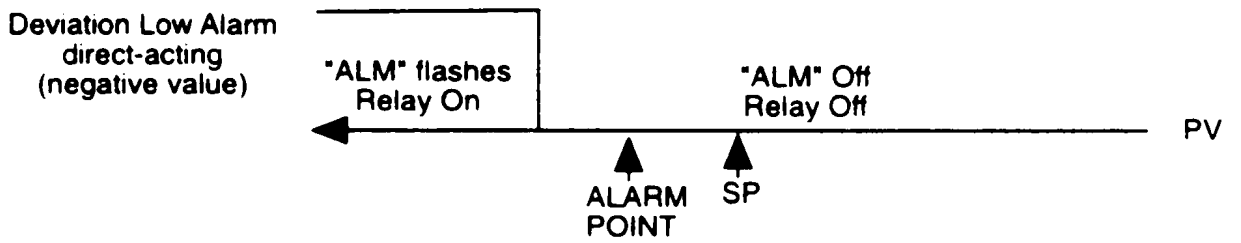
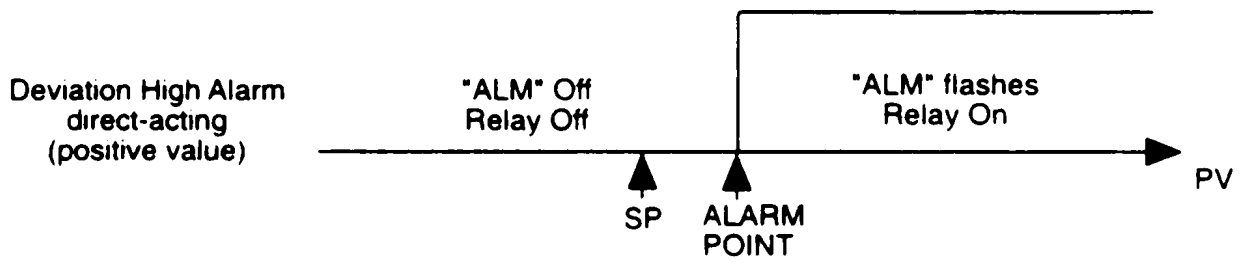
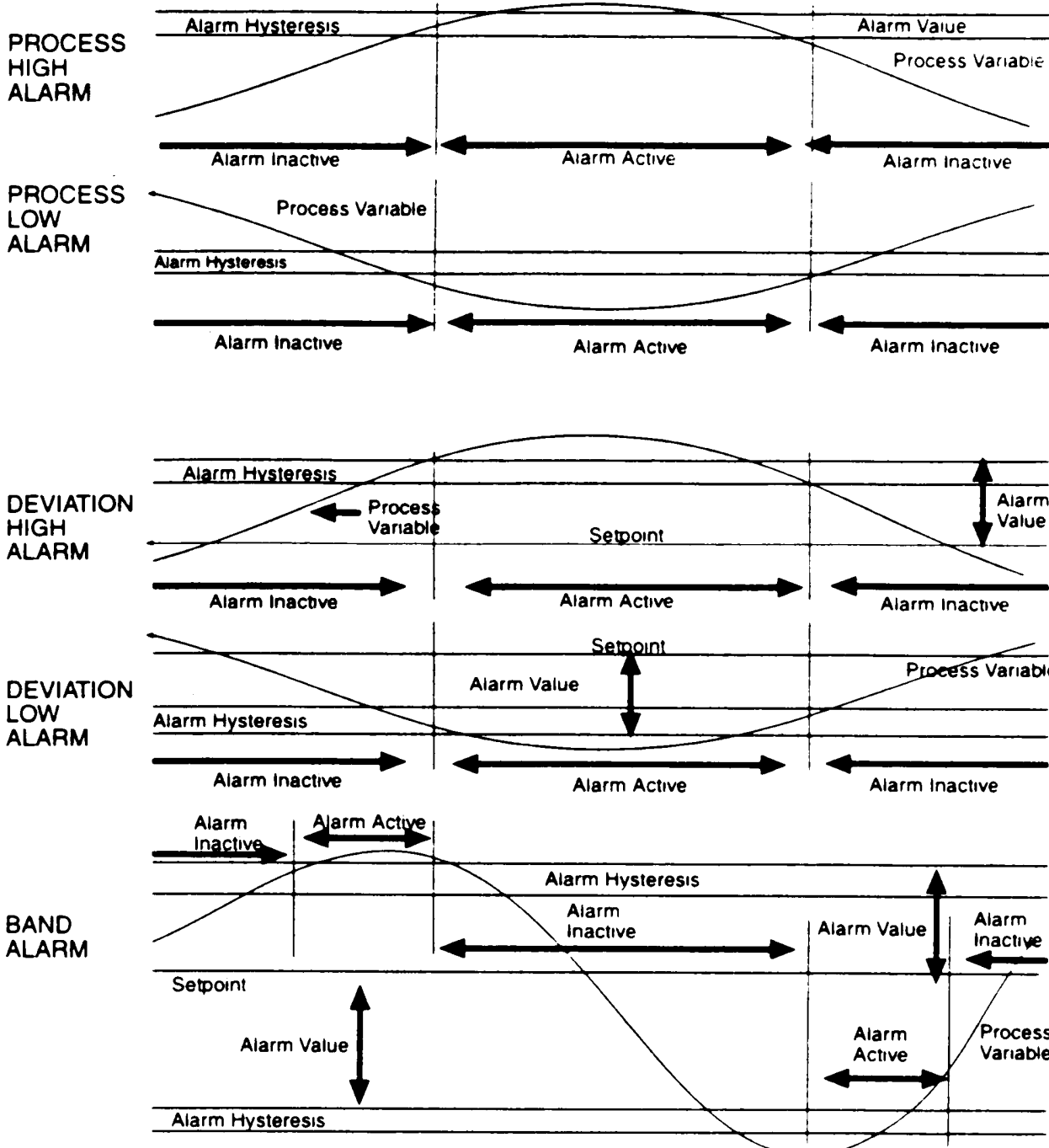


FIGURE 6.2

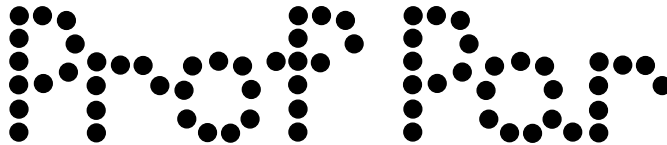


Section 7 - Defining and Viewing a Profile (Profile Set Mode)

The instrument may be put into Profile Set Mode from either Base Mode or Program Run Mode (i.e. with a program currently running).

7.1 ENTRY INTO PROFILE SET MODE

1. Press the MODE key until the Message Display shows:



2. Press the SCROLL key.

The instrument will enter Profile Set Mode, the **SET** and **PRG** indicators will go ON and the operator will be able to edit programs and segments.

To return to Base Mode, press the MODE key.

Program parameters are divided into three categories:

- (a) Those common to all programs - global parameters
- (b) Those which apply to a specific program as a whole
- (c) Those relevant to a specific segment in a specific program

In Profile Set mode, the operator will be presented with the first of a sequence of parameter displays. The operator may then step through the sequence, using the SCROLL key. The parameter setting (in the lower Main Display) may be changed using the UP/DOWN keys. The displayed Program Number may be changed using the PROF key and the displayed Segment Number may be changed using the RUN/HOLD key.

7.2 PARAMETERS COMMON TO ALL PROFILES (Program Number = A, Segment Number = Blank)

The parameters common to all programs (global parameters) are presented for edit/viewing in the following sequence:

To view the parameters in the Global category, press the PROF key until the Program Number shown is "A". Press the RUN/HOLD key until the segment Number shown is blank. Press the SCROLL key.

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
1	Start On	Start on	Defines setpoint value at start of each program	SEtP-Current Controller setpoint value Proc-Current Process variable value
2	Go To	Go To	Defines Basemode Status at end of each program	ON= Outputs are active OFF=Outputs are inactive
3	End On	End on	Defines setpoint value at end of each program	F_SP-End on Final SP value value* SEtP-End on Controller SP value

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
4	Delay Time	Delay	Defines delay (in hours/min) between initiating the program and actually starting	Numerical value, with the decimal point separating the two units (hours/min)
5	Program Lock	LockProg	Defines whether the operator is permitted to change program definitions while a program is running/held	On - No changes permitted OFF- changes permitted
6	Power Fail Recovery Period	Recovery	Defines length of power loss before automatic return to Base Mode after restoration of power, regardless of recovery type	1:00 - 24:59 NOTE: If the real time clock option has not been provided changing this value to 0.01 will allow selection of recovery type. Setting this to 0.00 will force a return to Base Mode.
7	Power Fail Recovery Type	Rec Type	Defines response to restoration of power after a power loss. This parameter	cont-Continue with mode of operation at time of power failure. rESt-Restart

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
			<p>does not appear if recovery is set to 0.00. These settings can be overridden by the recovery parameter</p>	<p>program running at time of power failure. If one was not running, return to Base Mode. PFH-Setpoint and event outputs are held at values at time of power loss. P.F. Hold is displayed until a key other than RUN/HOLD is pressed. Pressing the RUN/HOLD key will continue the profile if one was running. Holding this key for more than five seconds will abort the profile.</p>
8	Time of day	RTC Time**	Sets clock of real-time clock option	1:00 - 24:59
9	Day of the Week	RTC Day**	Sets day of real time clock option	Sun through Sat
10	External Selection	Ext.Sel***	Defines functions which may be	

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
			controlled externally	nonE=No external selection SEL=Program selection only run=Only Run Hold,Abort, and x60 functions both=All pro- gram selec- tion and run control func- tions

* The Final Setpoint value for the End Segment of each program.

** Only if real-time clock is fitted.

*** Only if external options are fitted.

7.3 PARAMETERS WHICH APPLY TO A SPECIFIC PROGRAM AS A WHOLE

Only the parameters relevant to the displayed program number (which can be changed using the PROG key) are presented. The parameter sequence is as follows:

To view parameters in the Program category, press the PROF key until the desired Program Number is displayed. Press the RUN/HOLD key until the Segment Number shown is blank.

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
1	Cycle Count	Cycles	Defines the number of times the program will be repeated	1 - 9999 Program will repeat the set number of of times

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
				inF = Program will repeat indefinitely
2	Deviation Hold	Dev. Hold	Selects operation of Deviation Hold facility (relative to setpoint)	<p>OFF = No Deviation Hold</p> <p>H_SP = Deviation Hold above setpoint only</p> <p>L_SP = Deviation Hold below setpoint only</p> <p>both = Deviation Hold above and below setpoint</p>
3*	Hold Band	HoldBand	Defines the width of the Hold Band	Numerical value (0.0 to span)
4*	Hold On	Hold on	Defines whether the Deviation Hold facility is used on ramps only, dwells only or both	<p>d_r = Deviation Hold on ramps and dwells</p> <p>___d = Deviation Hold on dwells only</p>

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
				___r = Devia- tion Hold on ramps only
5	Pre-x60	Pre-x60	Determines whether the timebase for the program is pre-selected to be hours/minutes or minutes/seconds	nonE = No pre-selection ON=minutes/seconds OFF=hours/minutes
6	Autostart time Enable	Timer	Selects Whether autostart is active for this profile	ON OFF
7	Start Time**	Strt-ti	Determines the automatic start time for the profile	1:00-24:59 OFF=manual start only
8	Start Day**	Strtday	Determines the day of the week when start time applies	ALL=7 days a week Mon=Monday tuE=Tuesday Wed= Wednesday thu=Thursday Fri=Friday SAt=Saturday Sun=Sunday 5dy=Mon-Fri 6dy=Mon-Sat

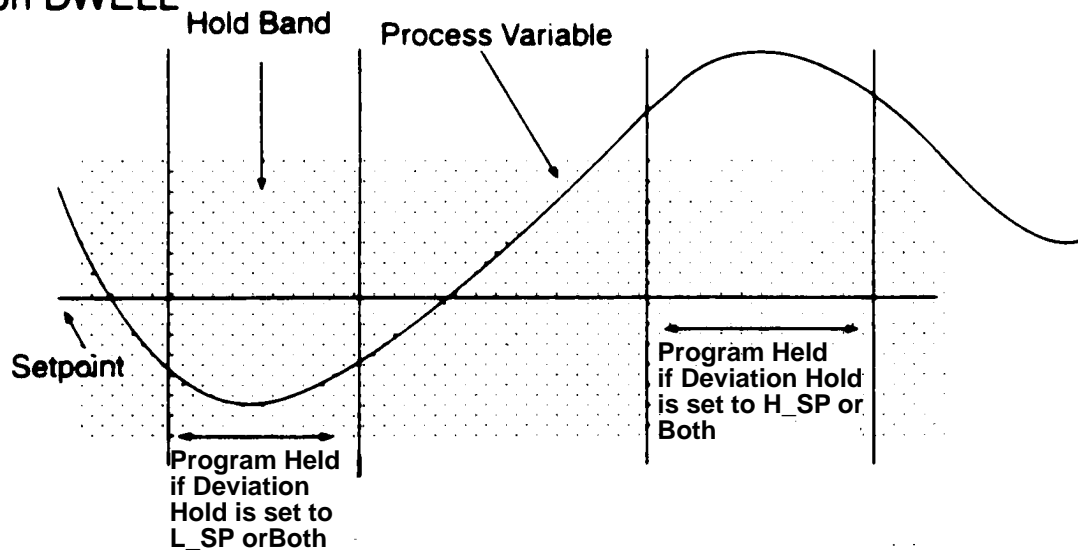
* Not displayed if deviation hold is off.

** Only displayed when real-time clock is fitted, or if timer is set to On.

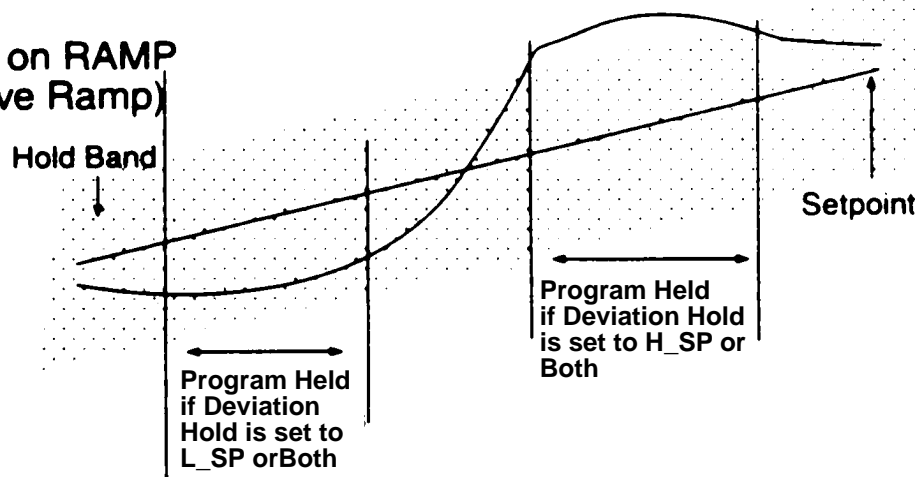
This parameter sequence may be viewed/edited for any program by simply changing the Program Number as required, using the PROF key, then stepping through the parameters with the SCROLL key.

FIGURE 7-1

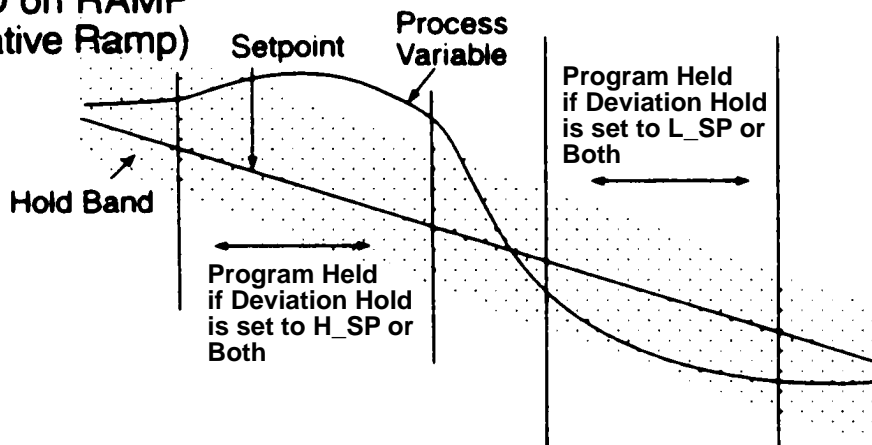
HOLD on DWELL



HOLD on RAMP (Positive Ramp)



HOLD on RAMP (Negative Ramp)



7.4 EDITING/VIEWING PARAMETERS IN ANY/EACH SEGMENT IN A SPECIFIC PROFILE

(Program Number = 1 to 8, Segment Number = 1-16)

Adjust the Program Number (using the PROF key) and the Segment Number (using the RUN/HOLD key) as required. The parameters presented will be those relevant to the program and segment whose numbers are displayed. The parameters sequence for each segment is as follows:

To view parameters in the Segment category, press the PROF key until the desired Program Number is displayed. Press the RUN/HOLD key until the desired Segment Number is displayed.

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
1	Final Setpoint Value	Final SP	Defines the final value of the setpoint for this segment, selects a dwell segment or indicates a Join, Repeat, or End Program segment	Numeric value (limited by SPHi and SPLo) or (by pressing the UP/DOWN keys simultaneously) indicates a dwell with: <p style="text-align: center;">- - - -</p> or, if the segment is already a Join, Repeat, or End Program segment, as shown below

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
2	Segment Time or Ramp Rate as selected in Configuration Mode	Time or RampRate	Defines the duration/ramp rate of the of the segment or whether this is a Join, Repeat or End Program segment*	Four-digit number in the form nn.nn (hours. minutes or seconds) or negative values as follows: J01 - Join to Program 1 J02 - Join to Program 2 J03 - Join to Program 3 J04 - Join to Program 4 J05 - Join to Program 5 J06 - Join to Program 6 J07 - Join to Program 7 J08 - Join to Program 8 rEP - Repeat Segment End - End Program

STEP	DESCRIPTION	MESSAGE DISPLAY	FUNCTION	AVAILABLE SETTING
3	Event †	Event	Defines the states of the four event outputs for this segment	Four-bit binary number (0=inactive, 1=active)

* If a segment is set to be a Join segment, a repeat segment or an End Program segment, the next depression of the SCROLL key will set the Segment Number to A and the parameter displayed will be the first in the sequence of parameters common to the whole program - Cycle Count. Otherwise, the next depression of the SCROLL key will display the next segment parameter - Event (for the current segment) if the Event Output hardware is fitted.

† This parameter appears in the sequence only if the Event Output hardware is fitted, in which case this parameter will be followed by the Final Setpoint Value parameter for the next segment. If this hardware is not fitted, this parameter will be omitted from the sequence and the segment number will be advanced, causing the Final Setpoint Value parameter for the next segment to appear immediately.

CANCELLING JOIN, REPEAT OR END PROGRAM SEGMENTS

This can be achieved:

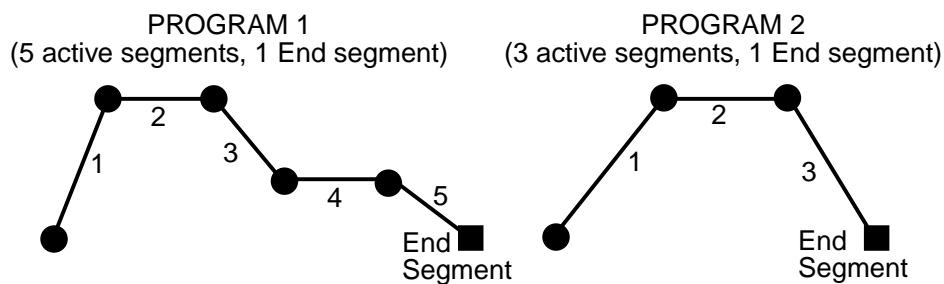
- (a) at the Final Setpoint Value parameter, by simultaneously pressing the UP/DOWN keys to produce a Dwell segment, or
- (b) at the Segment Time/Ramp Rate parameter, by incrementing the value to 0 or a positive value.

7.5 USING JOIN, REPEAT AND END SEGMENTS AND CYCLING PROGRAMS

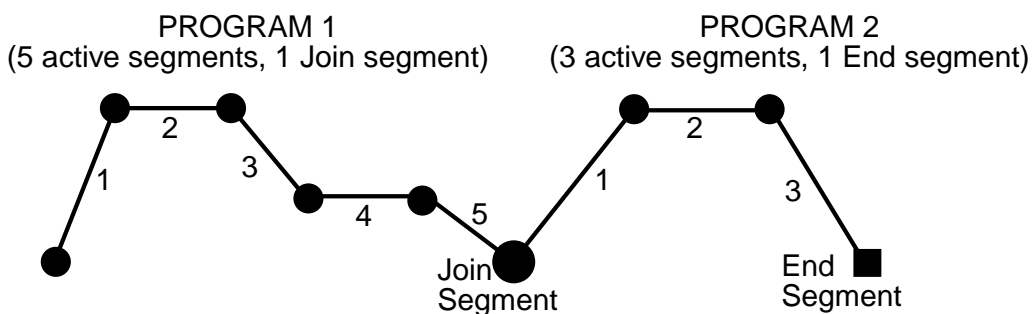
By default, the instrument has eight programs, each 16 segments long (all 16 segments are active and, at the end of Segment 16 is an implicit End Segment). These programs can be made shorter (using End segments) or longer (by creating program sequences with Join, Repeat and End segments). The only limit to the size of a program sequence is a maximum length of 121 active segments plus seven Join segments plus one End segment (i.e. all eight programs joined to make one program sequence).

Segments follow a free format in that ramp or dwell can be followed by dwell or ramp, completely as desired.

Consider two example programs:

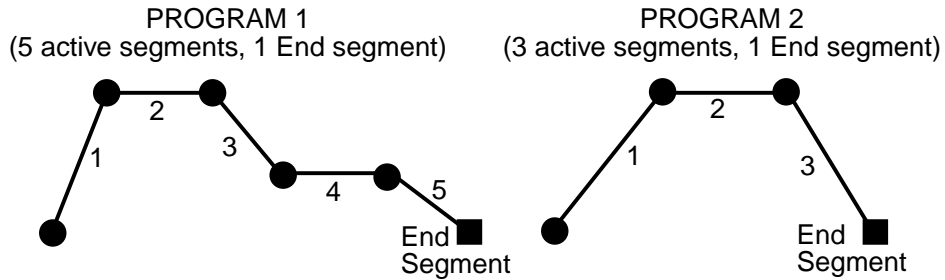


To join the two programs to form a program sequence, change the End segment of Program 1 to a Join segment (Segment Time or Ramp Rate set to J02 - Join Program 2):

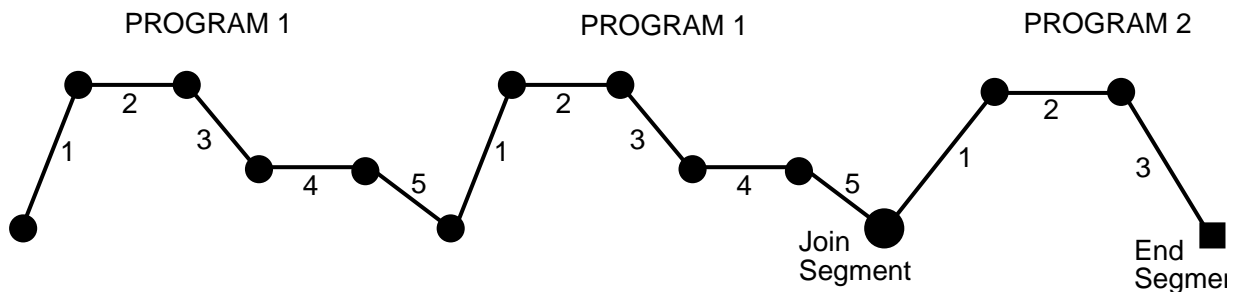


There are no restrictions on joining programs; several programs can be joined to one program (i.e. to provide user-selectable warm-up programs, depending upon which program is run first).

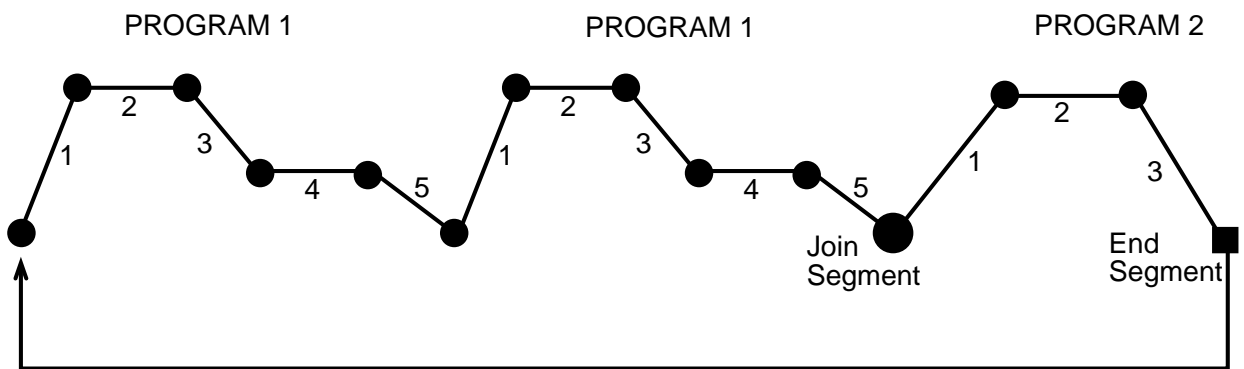
The Cycle feature can be used to make more complex program sequences. Consider the two simple example programs previously described:



and consider the case where Program 1 is set to perform two cycles and Program 1 is joined to Program 2. When Program 1 is run, the result would be:

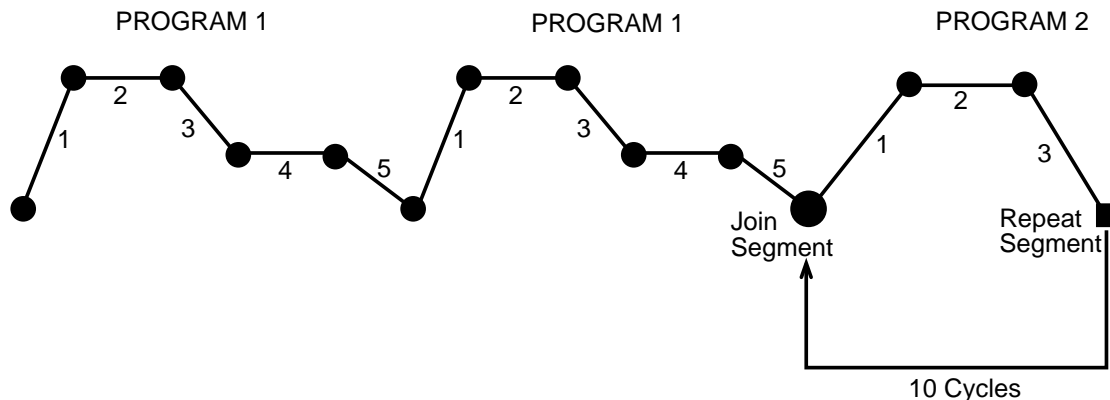


If Program 2 were now set to perform ten cycles, the result would be:



Now, with Program 2 set to perform 10 cycles, change its last segment to a

Repeat segment (Segment Time or Ramp Rate set to REP); the result would be:



At the end of the tenth cycle of Program 2, the program sequence would end.

7.6 BASIC RULES TO REMEMBER

In any program sequence:

- A program ending in a Join segment will perform the required number of cycles of *itself* before joining the new program.
- A program ending in a Repeat segment (hence, by definition, the last program in the sequence) will perform the required number of cycles of *itself* before ending the sequence.
- A program ending in an End segment (hence, by definition, the last program in the sequence) will perform its cycle on the *entire program sequence* before ending that sequence.

7.7 EXITING PROFILE SET MODE

The operator may exit from Profile Set Mode by pressing the MODE key, then pressing the SCROLL key, which will cause a return to the Base Mode.

Section 8 - Programs

8.1 SELECTING AND RUNNING A PROGRAM

When no program is running, the instrument is in Base Mode and the RUN and HLD indicators are OFF. In this mode, select a program as follows:

1. Hold down the PROF key until the required program number is displayed.
2. Press the RUN/HOLD key once to start the program. The **RUN** indicator will then go ON or flash if a delayed start has been programmed. The instrument is now in Program Run Mode.

8.2 CHANGING THE PROGRAM TIMEBASE

While a program is running, the normal timebase is hours/minutes. To change to a timebase of minutes/seconds (i.e. select the x60 facility) press the UP key for more than five seconds, whereupon the **x60** indicator will go ON. To cancel operation on the **x60** timebase, press the DOWN key for more than five seconds, whereupon the **x60** indicator will go OFF.

8.3 HOLDING A PROGRAM MANUALLY

The operator may hold or freeze a program by momentarily pressing the RUN/HOLD key. The **HLD** indicator will then go ON (the **RUN** indicator staying ON) and the program will stop execution. The program may subsequently be restarted by momentarily pressing the RUN/HOLD key again.

HLD INDICATOR FLASHING: If before the operator holds the program manually, the **HLD** indicator start flashing, this indicates that the program is currently subject to an Auto-Hold. If the RUN/HOLD key is pressed (for a manual Hold), the **HLD** indicator will go ON continuously. When the operator removes the manual Hold (by pressing the RUN/HOLD key again), the **HLD** indicator will either flash (indicating that the Auto-Hold conditions still prevail) or go OFF (indicating that the Auto-Hold conditions no longer prevail).

RUN INDICATOR FLASHING: This indicates that the program is in a Delay state i.e. is timed to start after a user-defined delay has elapsed. When the delay period has elapsed, the program will run and the **RUN** indicator will come on continuously.

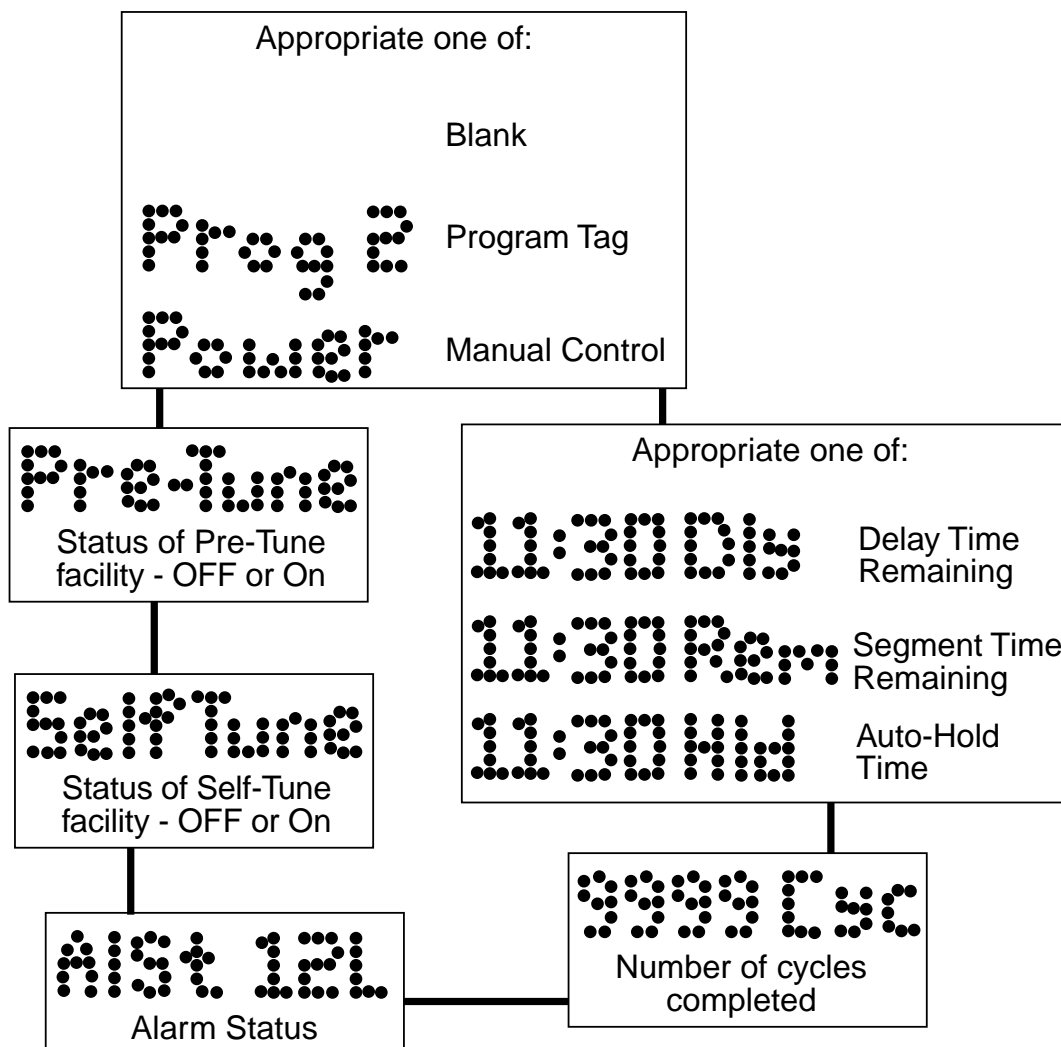
8.4 JUMPING TO THE NEXT SEGMENT

At any time during a program's execution, the operator may jump forward to the next segment by simultaneously pressing the PROF and UP keys.

Note that, since programs may be joined or set to cycle, jumping past the last segment in a program may result in changes in the Program Number and Cycle Count.

8.5 VIEWING PROGRAM PROGRESS/STATUS

In Program Run Mode, a number of displays are made available to the operator (in the Message Display area) which indicate program progress/status. While the current program is running, held or delayed, press the SCROLL key to cycle through a sequence of program status displays with the following legends in the Message Display:



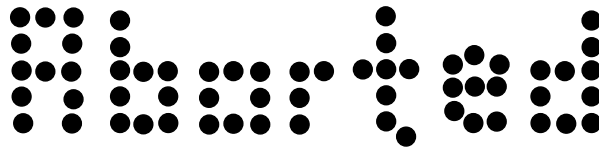
In the case of Segment Time Remaining or Auto-Hold Time display, the time is in hours/minutes (if the **x60** indicator is OFF) or minutes/seconds (if the **x60** indicator is ON). The Delay Time display is always in hours/minutes.

Note: If the SCROLL key is held for two seconds or longer, the instrument will auto-scroll through the above display cycle (with the exception of the Self-Tune and Pre-Tune displays). The auto-scroll can be stopped by pressing any key other than the SCROLL key.

The auto-scroll can be stopped by pressing any key other than the SCROLL key.

8.6 ABORTING A PROGRAM

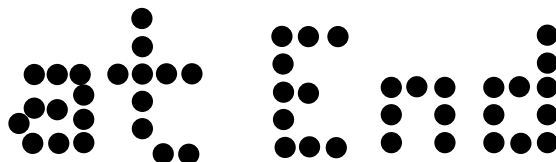
The operator may abort (i.e. terminate) the current program by holding down the RUN/HOLD key for more than five seconds. When the program is aborted, a return is made to the Base Mode and the Message area will show:



This message will be removed by the next key press.

8.7 "END OF PROGRAM" INDICATION

When the program has completed its End Segment (i.e. the last segment to be performed), the message display shows:



and a return is made to the Base Mode.

8.8 ACCESSING MODES OF THE CONTROLLER

The controller has various modes in which the control parameters can be viewed or changed. A list of available modes is shown along with a brief description of their purpose.

To access a mode, press the MODE key until the desired mode appears in the message display. Press the SCROLL key to enter the mode. Refer to other sections of this manual for detailed information on each mode. Any mode which has been disabled in the Enable Mode will not be displayed, and may not be accessed.

MODE	USAGE
PreTune	Preset the PID control parameters to provide a base for the SelfTune facility
AutoTune	Activate/Deactivate Auto Tune
ProfPar	Create or edit program profile
TunePar	Adjusts the instrument PID parameters
Alarm	Set up the instrument alarm parameters
Enable	Allow access to various modes of the control
ConfPar	Adjust the control input, output and communications parameters
Test	Test the instrument outputs
Calib	Calibrate the control instrument
BaseMode	Return to Base Mode

Section 9 - Test Mode

The Test Mode permits turning on and off the instrument outputs in order to determine proper operation.

To enter the Test Mode from Base Mode:

1. Press the MODE key until **Test** appears in the message display.
2. Press the SCROLL key to enter the Test Mode.

To return to Base Mode:

1. Press the MODE key until **Basemode** appears in the message display.
2. Press the SCROLL key to return to Base Mode

Exiting the Test Mode will turn all outputs off and terminate communications. Control of outputs and communications will return to the mode from which access to the Test Mode was gained. Press the SCROLL key to step through the parameters. Use the UP and DOWN keys to change the parameter setting

<u>STEP</u>	<u>DISPLAY</u>	<u>SETTING</u>
1	Output 1 ¹	On/OFF
2	Output 2 ^{1,2}	On/OFF
3	Output 3 ^{1,2}	On/OFF
4	EOPrelay	ON/OFF
5	Event1 ¹	ON/OFF
6	Event2 ¹	ON/OFF
7	Event3 ¹	ON/OFF
8	Event4 ¹	ON/OFF
9	Comms	Send/Stop

Notes:

1. Only appears if presence has been registered in Hardware Define (Configuration Mode)
2. Driven to 100% when turned on.

Section 10 - Calibration Mode

To enter the Calibration Mode from Base Mode:

1. Press the MODE key until **Calib** appears in the message display.
2. Press the SCROLL key to enter the Calibration Mode.

To return to Base Mode, cycle power to the control.

10.1 CALIBRATION PROCEDURE

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

CALIBRATING THE UNIVERSAL INPUT

Equipment Required:

1. Input source with an accuracy better than $\pm 0.05\%$ of reading:
 - a) Thermocouple inputs: Thermocouple simulator, "K" type with compensated leads.
 - b) DC Linear inputs: 0-50mV, 0-10V or 0-20mA
 - 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 50/60Hz, 20-50 VAC 50/60 Hz or 22-65 VDC)

Calibration Procedure:

1. Ensure that the controller is powered off and that the mains (line) lead is disconnected. On the CPU PCB, fit the appropriate jumpers (see Figure 10.1, Table 10.1). Connect the appropriate input lead (see Figure 10.2)
2. Connect the mains (line) 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. The lower main display will then show Input Type Number in the form:

iP_I

and the message display will show:

Calib

Using the UP/DOWN keys, change the input type number as required (see Table 10.1).

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 0-50mV input (Input Type 1).

4. Press the PROF key to change the lower main display to show: _ _ _ _

After a few seconds, the lower main 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 jumpers and wiring should be checked.

5. To calibrate inputs, repeat Steps 1 to 4 for each of the other input types (see Table 10.1) until all five input types have been successfully calibrated.

The universal input calibration procedure is now complete.

TABLE 10.1 Universal Input Type Selection

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

FIGURE 10-1

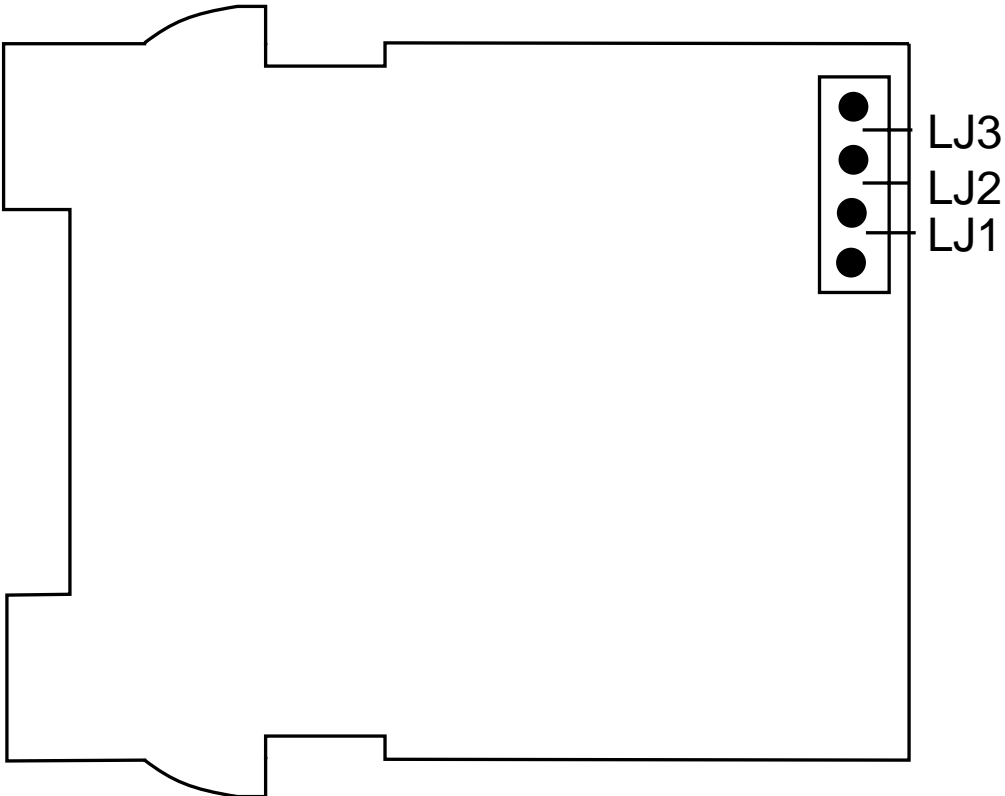
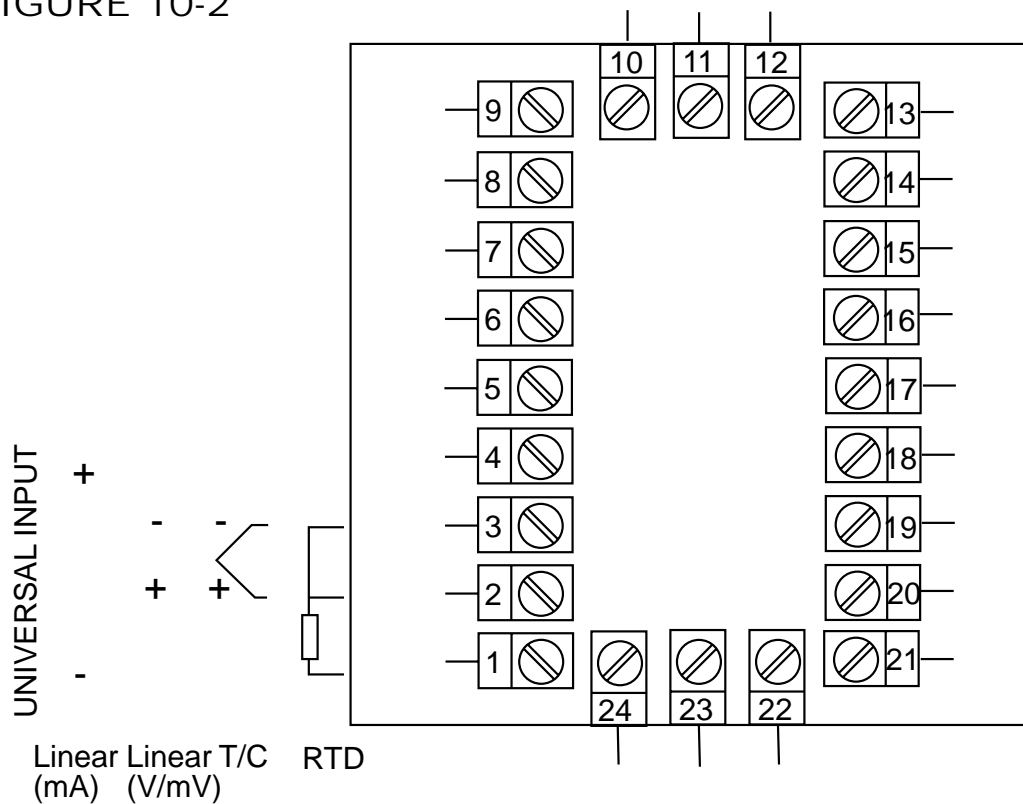


FIGURE 10-2



10.2 EXIT FROM CALIBRATION MODE

To exit from Calibration Mode, cycle power to the instrument.

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

10.3 CALIBRATION CHECK

1. Set the Controller to the required configuration (using link jumpers and front panel entry) as described in the appropriate site manual.
2. 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).
3. After the appropriate delay for stabilization has elapsed, check the calibration by connecting the appropriate input source and checking a number of cardinal points.

Appendix A - Range Codes

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

For Thermocouple Inputs

TYPE	INPUT RANGE	DISPLAYED CODE	TYPE	INPUT RANGE	DISPLAYED CODE
R	0 - 1650°C	1127	K	-200 - 760°C	6726
R	32 - 3002°F	1128	K	-328 - 1399°F	6727
S	0 - 1649°C	1227	K	-200 - 1373°C	6709
S	32 - 3000°F	1228	K	-328 - 2503°F	6710
J	0.0 - 205.4°C	1415	L	0.0 - 205.7°C	1815
J	32.0 - 401.7°F	1416	L	32.0 - 402.2°F	1816
J	0 - 450°C	1417	L	0 - 450°C	1817
J	32 - 842°F	1418	L	32 - 841°F	1818
J	0 - 761°C	1419	L	0 - 762°C	1819
J	32 - 1401°F	1420	L	32 - 1403°F	1820
T	-200 - 262°C	1525	B	211 - 3315°F	1934
T	-328 - 503°F	1526	B	100 - 1824°C	1938
T	0.0 - 260.0°C	1541	N	0 - 1399°C	5371
T	32.0 - 501.0°F	1542	N	32 - 2550°F	5324

For RTD Inputs

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

INPUT RANGE	DISPLAYED CODE	INPUT RANGE	DISPLAYED CODE
0 - 800°C	7220	0.0 - 100.9°C	2295
32 - 1471°F	7221	32.0 - 213.6°F	2296
32 - 571°F	2229	-200 - 206°C	2297
-100.9 - 100.0°C	2230	-328 - 402°F	2298
-149.7 - 211.9°F	2231	-100.9 - 537.3°C	7222
0 - 300°C	2251	-149.7 - 999.1°F	7223

For DC Inputs

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

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

Appendix B - Board Layout, Jumper Positioning

FIGURE B-1 PCB POSITIONS

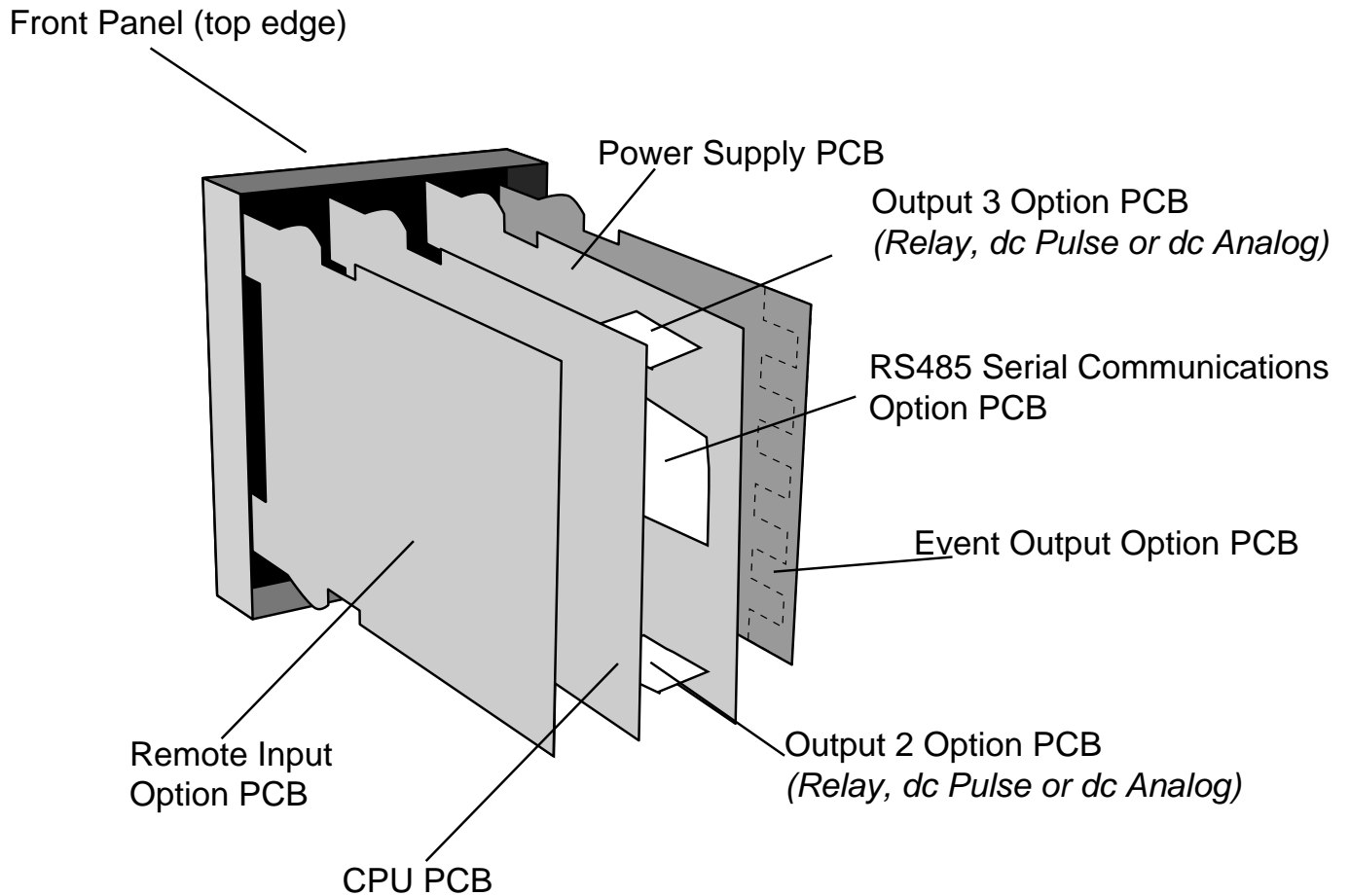


FIGURE B-2 OUTPUT 2, OUTPUT 3 REMOVAL

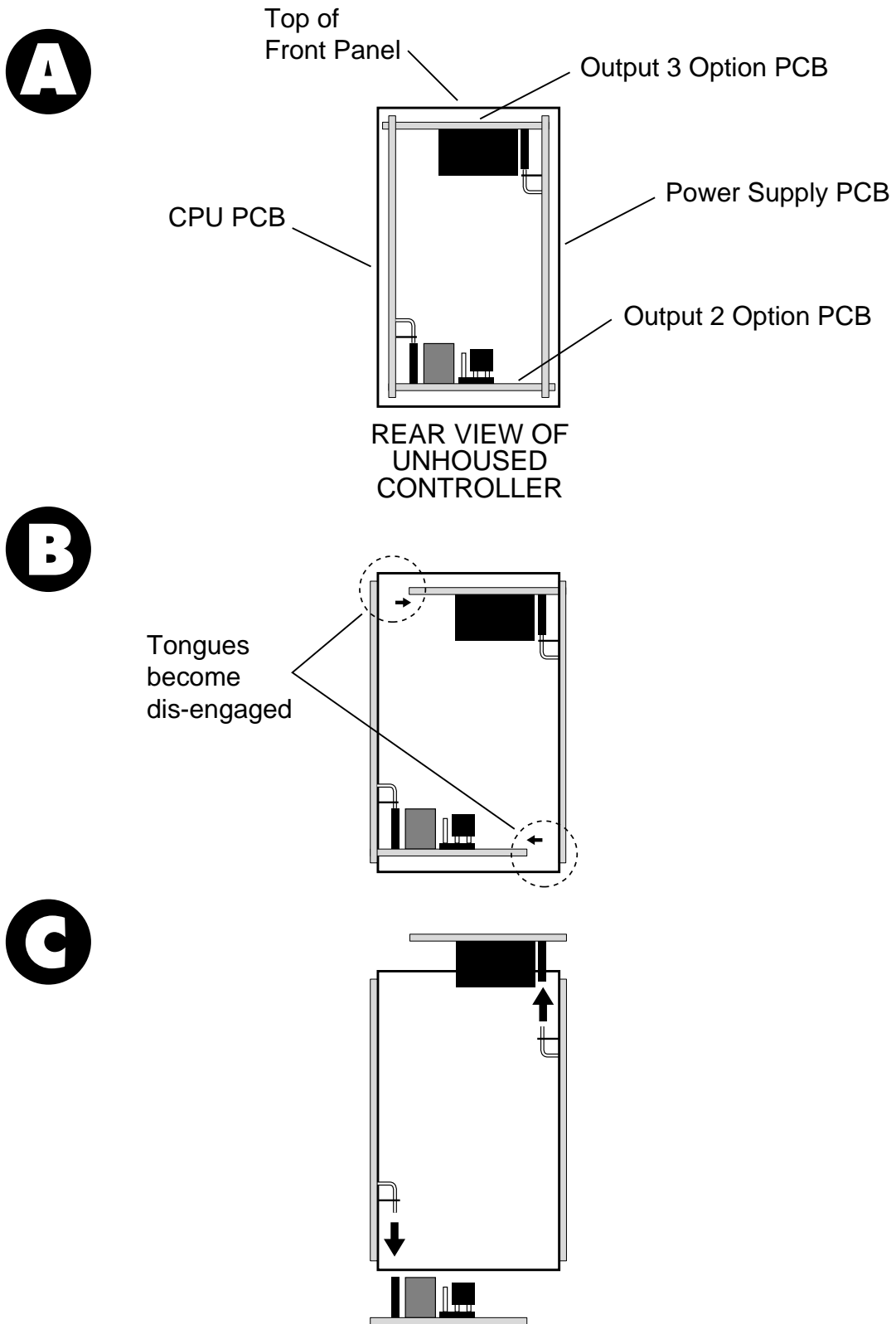
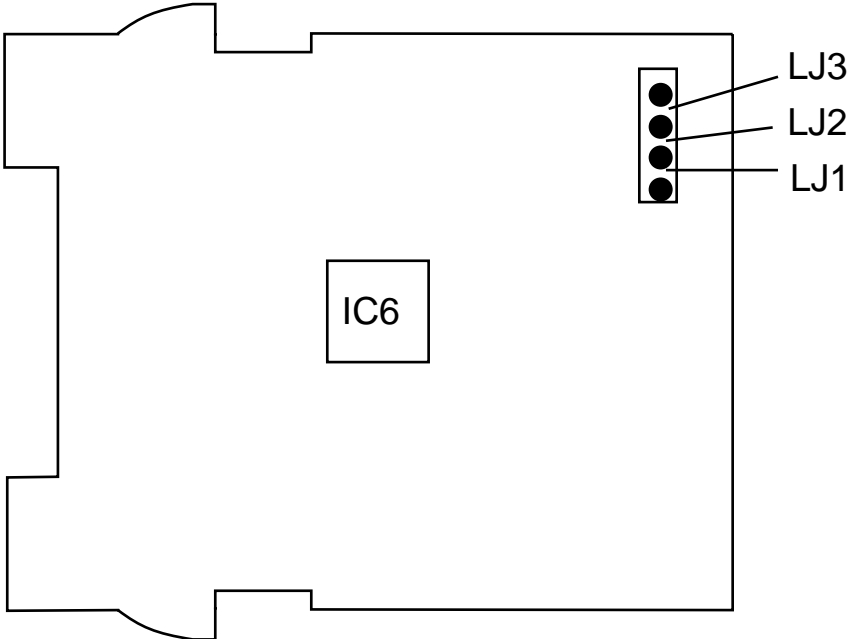
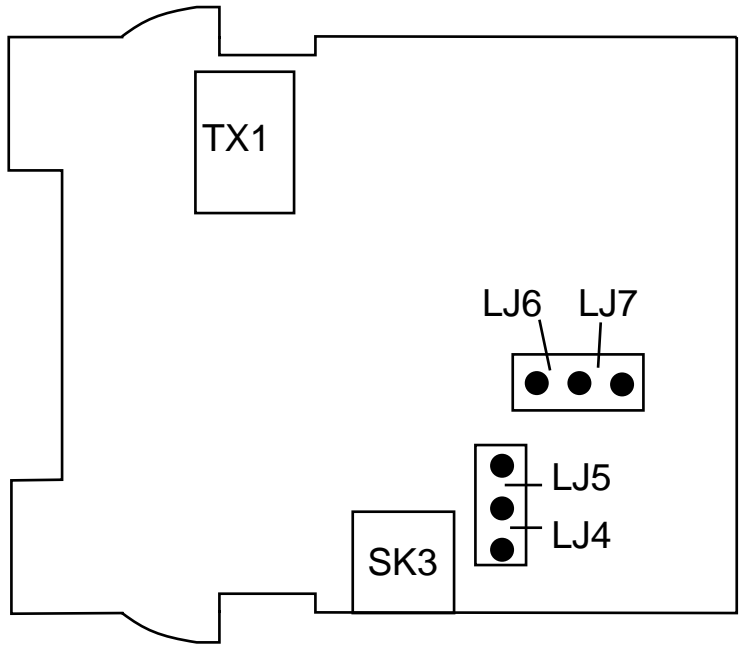


FIGURE B-3 CPU PWA



<u>Input Type</u>	<u>LJ1, LJ2, LJ3 Jumper Position</u>
RTD, DC (mV)	None (parked)
T/C	LJ3
DC (mA)	LJ2
DC (V)	LJ1

FIGURE B-4 PS PWA WITH RELAY OR DC PULSE OUTPUT 1



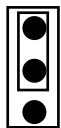


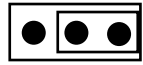
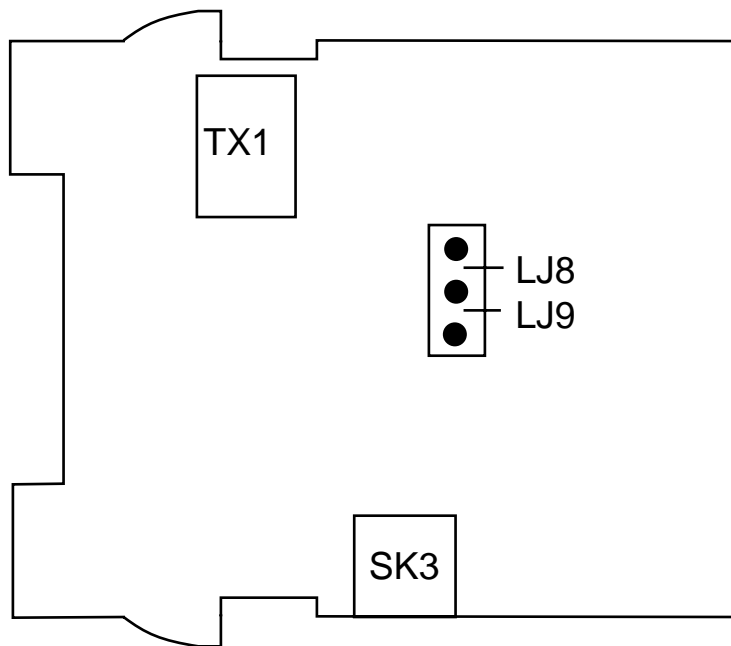
<u>Output Type</u>	<u>LJ4, LJ5 Jumper Position</u>	<u>LJ6, LJ7 Jumper Position</u>
Relay	 LJ5	 LJ6
dc Pulse	 LJ4	 LJ7

FIGURE B-5 PWA WITH DC OUTPUT 1



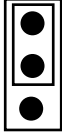

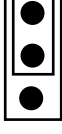
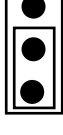
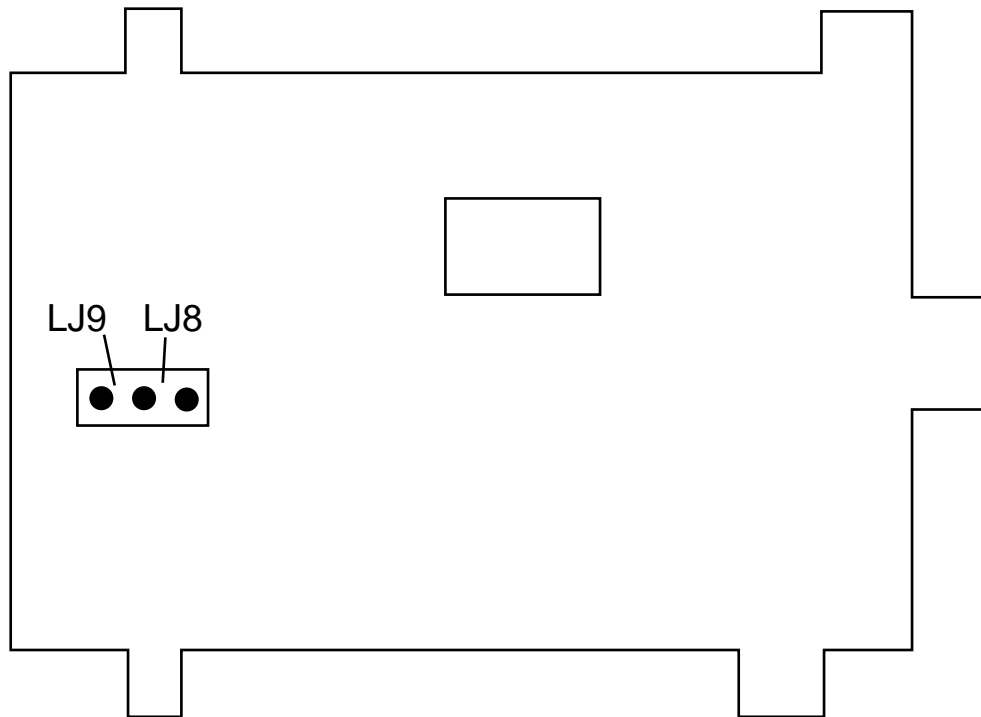




<u>Output Type</u>	<u>LJ8, LJ9 Jumper Position</u>
Analog DC (0-10V)	 LJ8
Analog DC (0-20mA)	 LJ9
Analog DC (0-5V)	 LJ8
Analog DC (4-20mA)	 LJ9

FIGURE B-6 OPTION PWA DC OUTPUT 2/OUTPUT 3



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

Appendix C - 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 dc Pulse at 240 VAC.

Thermocouple

Types:	R, S, J, T, K, L, B, and N
Calibration:	Complies with BS4937, 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

Type and Connection:	Three-wire Pt100
Calibration:	Complies with BS1904 and DIN43760.
Lead Compensation:	Automatic
RTD Current:	150uA (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

Scale Range Maximum:	-1999 to 9999
Scale Range Minimum:	-1999 to 9999
Minimum Span:	1 display LSD
Sensor Break Protection:	Applicable to 4-20mA, 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.

OUTPUT SPECIFICATIONS

Output 1

General

Types Available: Relay (standard), dc Pulse and Analog DC as options.

Relay

Contact Type:

SPDT

Rating:

2A resistive at 120/240V AC, 0.5A inductive @230VAC

Lifetime:

> 500,000 operations at rated voltage/current

Isolation:

Inherent

dc Pulse/TTL

Drive Capability:

dc Pulse>4.2V DC into 1K ohm minimum

Isolation:

Not isolated from input or other dc Pulse outputs.

Analog

Resolution:

Eight bits in 250mS (10 bits in 1 second typical, >10 bits in >1 second typical).

Update Rate:

Four times per second

Ranges:

* 0-20mA, 4-20mA, 0-10V, and 0-5V

Load Impedance:

0-20mA: 500 ohm maximum

4-20mA: 500 ohm maximum

0-10V: 500 ohm minimum

0-5V: 500 ohm minimum

Isolation:

Isolated from all other inputs and outputs.

*Changes between V and mA ranges also require jumper movement.

OUTPUT 2

General

Types Available:

Relay, dc Pulse , DC Analog, and Transmitter Power Supply

Relay

Contact Type:

SPDT

Rating:

2A resistive at 120/240V AC; 0.5A inductive @ 230VAC

Lifetime:

> 500,000 operations at rated voltage/current

Isolation:

Inherent

dc Pulse/TTL

Drive Capability: dc Pulse > 4.2V dc into 1K ohm minimum
Isolation: Not isolated from input or other dc Pulse outputs

Analog

Resolution: Eight bits in 250mS (10 bits in 1 second typical, >10 bits in >1 second typical)
Update Rate: Four times per second
Ranges: * 0-20mA, 4-20mA, 0-10V, and 0-5V
Load Impedance: 0-20mA: 500 ohm maximum
4-20mA: 500 ohm maximum
0-10V: 500 ohm minimum
0-5V: 500 ohm minimum
Isolation: Isolated from all other inputs and outputs

*Changes between V and mA ranges also require jumper movement.

TRANSMITTER POWER SUPPLY

Output: 20-28VDC (24VDC nominal)
Min. Load Impedance: 910 ohm (22mA @ 20Vdc)

OUTPUT 3

General

Types Available: Relay, dc Pulse, DC Analog (retransmit only), and Transmitter Power Supply

Relay

Contact Type: SPDT
Rating: 2A resistive at 120/240V AC; 0.5A inductive @ 230VAC
Lifetime: > 500,000 operations at rated voltage/current
Isolation: Inherent

dc Pulse/TTL

Drive Capability: dc Pulse > 4.2V DC into 1K ohm minimum
Isolation: Not isolated from input or other dc Pulse outputs

Analog

Resolution:	Eight bits in 250mS (10 bits in 1 second typical, >10 bits in >1 second typical).
Update Rate:	Four times per second
Ranges:	* 0-20mA, 4-20mA, 0-10V, and 0-5V
Load Impedance:	0-20mA: 500 ohm maximum 4-20mA: 500 ohm maximum 0-10V: 500 ohm minimum 0-5V: 500 ohm minimum
Isolation:	Isolated from all other inputs and outputs.

* Changes between V and mA ranges also require jumper movement.

TRANSMITTER POWER SUPPLY

Output:	20-28VDC (24VDC nominal)
Min. Load Impedance:	910 ohm (22mA @ 20VDC)

CONTROL SPECIFICATIONS

Control Types:	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:	1s-99min 59sec/repeat and OFF
Rate:	0 (OFF) - 99min 59sec
Manual Reset (Bias):	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 from 0.5sec to 512sec in binary steps
Setpoint Range:	Limited by Setpoint Maximum and Setpoint Minimum.
Setpoint Maximum:	Limited by Setpoint and Range Maximum.
Setpoint Minimum:	Limited by Range Minimum and Setpoint.

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).

PROGRAM SPECIFICATIONS

Programs:	Eight, each with free-form segments
Length of Programs:	Adjustable in the range 1 to 16 segments; programs cascadable - maximum length 121 segments.
Segment Types:	Ramp, Dwell, Join, Repeat, or End.
Program Cycling:	Range 1 to 9999, infinite.
Delayed Start:	May be set in the range 0 to 99:59 (hours:minutes). One setting applies to all programs.
Control:	Run, Hold, Abort, Time Base x60 (local or remote); Select Program (local or remote); Jump to next Segment.
Start From:	Either current process variable value or controller setpoint value.
Go To:	Base Mode or Off Mode
End On:	Final Value or controller setpoint.
Deviation/Hold:	Off, below setpoint only, above setpoint only or above and below setpoint. On ramps only, on dwells only, or on both ramps and dwells. Auto/ Hold band may be set from 0 to input span.
Time Base:	Either hours:minutes or minutes:secs (x60) pre-programmable or may be set during Program Run.
Segment Time:	May be set in the range 0 to 99:59 (hours:minutes or minutes:seconds).
Ramp Rate:	0 to 9999 least significant digits per hour or minute.

End of Program Output

Type: Relay
Contact Type: SPDT
Rating: 5A resistive @ 120/240V AC
Lifetime: >100,000 operations @ rated voltage/current
Isolation: Inherent

Event Outputs - Option

Type: Relay (4)
Contact Type: SPST
Rating: 5A resistive @ 120/240V AC
Lifetime: >100,000 operations @ rated voltage/current.
Isolation: Inherent
Programmability: Each event is programmable to either OFF or ON for each segment.

Digital (Remote Program Control) Inputs, Outputs

Type: Voltage-free contact and TTL compatible
Number available: Six: Run/Hold, Time Base x60, Abort Three (binary-coded) Program Select.
Active State: Max. Contact Resistance (closed) = 50 ohms
Max. Voltage (TTL) for "0" = 0.8V
Min. Voltage for "0" = -0.6V
Non-Active State: Min. Contact Resistance (open) = 5,000 ohms
Min. Voltage (TTL) for "1" = 2.0V
Max. Voltage for "1" = 24.0V
Max. Input Delay (OFF-ON): 0.25 seconds
Min. Input Delay (ON-OFF): 0.25 seconds

PERFORMANCE

Reference Conditions

Ambient Temperature: 20°C ± 2°C
Relative Humidity: 60-70%
Supply Voltage: 90-264V AC 50Hz ±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: $\pm 0.25\%$ of span ± 1 LSD

Thermocouple Inputs

Measurement Accuracy: $\pm 0.25\%$ of span ± 1 LSD
(Note: Reduced performance with Type B T/C between 100-600 °C (212 - 1112 °F))
Linearization Accuracy: Better than $\pm 0.2^\circ\text{C}$ any point, any 0.1°C range ($\pm 0.05^\circ\text{C}$ typical). Better than $\pm 0.5^\circ\text{C}$ any point, any 1°C range.
Cold Junction Comp: Better than $\pm 0.7^\circ\text{C}$

RTD Inputs

Measurement Accuracy: $\pm 0.25\%$ of span ± 1 LSD
Linearization Accuracy: Better than $\pm 0.2^\circ\text{C}$ any point, any 0.1°C range ($\pm 0.05^\circ\text{C}$ typical). Better than $\pm 0.5^\circ\text{C}$ any point, any 1°C range.

DC Outputs

Output 1 Accuracy: mA: 0-20mA $\pm 0.5\%$ of span (20mA) @ 250 ohm
4-20mA $\pm 0.5\%$ of span (16mA) @ 250 ohm
V: 0-10 $\pm 0.5\%$ of span (10V) @ 2K ohm
0-5V $\pm 0.5\%$ of span (5V) @ 2K ohm
Output 2 Accuracy: mA: 0-20mA $\pm 0.5\%$ of span (20mA) @ 250 ohm
4-20mA $\pm 0.5\%$ of span (16mA) @ 250 ohm
V: 0-10V $\pm 0.5\%$ of span (10V) @ 2K ohm
0-5V $\pm 0.5\%$ of span (5V) @ 2K ohm
Output 3 Accuracy: mA: 0-20mA $\pm 0.25\%$ of span (20mA) @ 250 ohm
(Recorder Accuracy) 4-20mA $\pm 0.25\%$ of span (16mA) @ 250 ohm
V: 0-10V $\pm 0.25\%$ of span (10V) @ 2K ohm
0-5V $\pm 0.25\%$ of span (5V) @ 2K ohm

OPERATING CONDITIONS

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

Performance Under Operating Conditions

Temperature Stability:	0.01% of span/°C change in ambient temperature
Cold Junction Compensation:	Better than $\pm 1^{\circ}\text{C}$ (thermocouple only)
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 50ohm/lead: < 0.5% of span error
Radiated RF Field Influence:	Degradation of Output 1 accuracy to 3% at spot frequencies in the range 80 - 350MHz at field strength of 10V/m.

ENVIRONMENTAL

EMI Susceptibility:	Designed to meet EN50082-1:1992 and EN50082-2: 1995
EMI Emissions:	Designed to meet EN50081-1:1992 and EN50081-2:1994
Safety Considerations:	Designed to comply with EN61010-1:1993
Supply Voltage:	90-264 AC 50/60Hz (standard) 20-50V AC 50/60Hz or 22-65V DC (optional)
Power Consumption:	4 watts approximately
Front Panel Sealing:	NEMA4
Agency Approvals:	UL Listed pending cUL certified for use in Canada pending

PHYSICAL

Dimensions:	1/4 DIN front panel 96mm x 96mm (3.78" x 3.78") 100mm deep (3.94")
Mounting:	Plug-in with panel mounting fixing strap. Panel cutout 92mm x 92mm (3.62" x 3.62")
Terminals:	Screw type (combination head)
Weight:	16 ounces maximum
Display Character Height:	Top : .4" Bottom: .36" Message: .19" Profile/Segment No.: .25"

Appendix D - Model Number Hardware Matrix

Features

- ✔ **Universal Sensor Inputs:**
Thermocouple, 3-Wire
RTD or DC Linear
(mA, mV or V)
- ✔ **Autotune on Soaks and
Basic Process Control**
- ✔ **Remote and Local
Program Number Select,
Run, Hold, and Abort**
- ✔ **90 to 264 Vac
Power Supply**
- ✔ **Dual 4-Digit
Programmable Display
and Alphanumeric
Message Display**
- ✔ **End of Program
Relay Output**
- ✔ **Eight Programs,
16 Segments with
Program Joining**
- ✔ **Readable Run
Time Messages**
- ✔ **Assured Soak**
- ✔ **NEMA-4/IP65
Sealed Front Panel**

Optional Features

- ✔ **Low Voltage Power
Supply: 20 to 50 Vac/
22 to 65 Vdc**
- ✔ **RS-485 Communications**
- ✔ **Remote Inputs, Event
Outputs**
- ✔ **Real Time Clock**

To Order (Specify Model Number)	
Model Number	Description
CN1462-R1	Single relay output profile controller
CN1462-DC1	Single dc pulse output profile controller
CN1462-F1	Single analog output profile controller

*Note: The single output models are standard. To order two or three outputs, specify output suffix from the **Second** and **Third Output Options** tables.*

OMEGACARESM extended warranty program is available for models shown on this page. Ask your sales representative for full details when placing an order.

Ordering Example: CN1462-R1-XP2-F3, ¼ DIN single relay output profile controller with trans. power supply and analog retransmission output.

Second Output Options

Output No. 2 Suffix	Description
-R2	Relay
-DC2	dc pulse
-F2	Analog (control only)
-XP2*	Trans. power supply

Third Output Options

Output No. 3 Suffix	Description
-R3	Relay
-DC3	dc pulse
-F3	Analog (retransmission only)
-XP3*	Trans. power supply

**Only one transmitter power supply can be ordered per unit*

Low Voltage Power Supply Option

Ordering Suffix	Description
-LV	20 to 50 Vac / 22 to 65 Vdc

RS-485 Communications Option

Ordering Suffix	Description
-C4	RS-485 communications

Additional Options (Only 1 option available per unit)

Ordering Suffix	Description
-1	4 event outputs
-2	6 remote profile control inputs
-3	4 event outputs, 6 remote profile control inputs
-4	Real time clock
-5	Real time clock and event outputs
-6	Real time clock and event inputs
-7	Real time clock and event outputs and remote inputs

Field Installable Plug-in Boards & Accessories

Model No.	Description
BD1600-R	2 A Relay
BD1600-DC	dc Pulse
BD1600-F	Analog
Note: Options above are for Outputs 2 and 3 only	
BD1600-C4	RS-485 Communication
BD1462-SOFT	Software & Cable for the Configuration Port

Appendix E - Software Reference Sheet

HDW DEF	
OPTION	

Configuration Parameters
Input
Control
Out2 Use
Out3 Use
Seg. Mode
Baud Rate
Protocol
Address
CJC
Events

Enable Mode				
Prof Par			EnAb	diSA
Setpoint		rEAd	EnAb	
Pretune	OFF	rEAd	EnAb	
Autotune	OFF	rEAd	EnAb	
Alarm			EnAb	diSA
Tune Par			EnAb	diSA
Conf Par			EnAb	diSA
Test			EnAb	diSA
Calib.			EnAb	diSA
Manual			EnAb	diSA
Sprate			EnAb	diSA
ComWrite			EnAb	diSA
Auto PT			EnAb	diSA
Units			EnAb	diSA
Passch				

Tune Mode	
Inp Cor	
Po1	Read Only
Po2	Read Only
P. Out HI	
P. Out LO	
P.Band 1	
P.Band 2	
AutoReset	
Rate	
Spread	
Man Reset	
Hyst 1	
Hyst 2	
SP Rate	
CycTime1	
CycTime2	

Alarm Mode
Alarm1
Alarm2
Inhibit
HiAlarm1
LoAlarm1
BaAlarm1
DeAlarm1
AI1 Hyst
HiAlarm2
LoAlarm2
BaAlarm2
DeAlarm2
AI2 Hyst
Loop Alm
LpAtime

Program Define Mode
(All Programs)
Start on
Go To
End on
Delay
ProgLock
Recovery
Rec Type
RTC Time
RTC Day
Ext. Sel

Specific Program as a
Whole
Cycles
DeviationHold
HoldBand
Hold on
Pre-x60
Timer
Strt-ti
Strt-day

Each Segment in a Specific Program

Final SP

Time

RampRate

Event

Notes

Notes

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of 37 months from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal three (3) year product warranty to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear are not warranted, including but not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

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RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR WARRANTY RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR NON-WARRANTY REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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- Displacement Transducers
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- Air Velocity Indicators
- Turbine/Paddlewheel Systems
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- Data Acquisition & Engineering Software
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- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments